



**PART 2**

**REPORT  
OF THE  
WORKING GROUP  
ON  
ASSESSMENT  
OF  
PELAGIC  
STOCKS  
IN  
THE  
BALTIC**

Copenhagen 10-20 April 1989

---

This document is a report of a Working Group of the International Council for the Exploration of the Sea and does not necessarily represent the views of the Council. Therefore,

**it should not be quoted without consultation with:**

the General Secretary  
ICES  
Palægade 2-4  
DK-1261 Copenhagen K  
Denmark

Table 3.8.1 SUM OF PRODUCTS CHECK

HERRING IN THE GULF OF FINLAND (FISHING AREA 32)  
 CATEGORY: TOTAL

CATCH IN NUMBERS	UNIT: millions											
-----	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
0	0	17	7	14	23	24	11	19	78	36	62	57
1	166	673	147	237	334	120	670	223	285	122	379	350
2	191	256	742	450	507	359	267	921	177	287	325	658
3	1114	187	224	957	357	259	308	211	630	166	254	202
4	183	654	141	140	613	200	197	154	108	392	78	120
5	80	79	221	82	69	334	95	84	85	67	179	35
6	133	51	25	99	41	31	246	107	74	41	24	80
7	17	74	14	14	87	20	21	56	35	30	20	12
8	27	18	47	4	7	52	16	12	90	20	26	16
9	17	15	6	8	8	6	34	10	8	41	3	9
10+	5	21	7	3	21	8	12	31	24	18	36	22
TOTAL	1933	2045	1581	2008	2067	1413	1877	1828	1594	1220	1386	1561
	1982	1983	1984	1985	1986	1987	1988					
0	65	28	58	26	43	9	37					
1	404	243	353	518	111	469	47					
2	724	759	495	926	675	148	1075					
3	145	512	411	253	650	304	138					
4	64	191	314	142	170	266	159					
5	43	36	105	118	92	94	126					
6	8	18	28	36	67	67	38					
7	26	8	16	10	19	53	33					
8	2	15	8	5	7	17	18					
9	3	2	13	3	5	7	9					
10+	9	8	7	12	3	7	10					
TOTAL	1493	1820	1808	2049	1842	1441	1690					

Table 3.8.2 SUM OF PRODUCTS CHECK

HERRING IN THE GULF OF FINLAND (FISHING AREA 32)  
 CATEGORY: TOTAL

	MEAN WEIGHT AT AGE IN THE CATCH											UNIT: gram
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
0	7.3	7.3	7.3	7.3	7.3	7.3	6.5	6.1	5.4	5.0	7.4	6.7
1	11.9	11.9	11.9	11.9	11.9	11.9	10.8	13.6	15.9	14.8	15.9	13.5
2	19.5	19.5	19.5	19.5	19.5	19.5	19.4	20.3	23.0	24.9	24.3	23.3
3	23.7	23.7	23.7	23.7	23.7	23.7	24.2	28.3	29.7	30.7	32.9	31.2
4	27.5	27.5	27.5	27.5	27.5	27.5	30.0	32.7	34.5	38.6	40.8	41.5
5	32.2	32.2	32.2	32.2	32.2	32.2	32.1	36.9	40.2	42.9	46.5	53.4
6	36.5	36.5	36.5	36.5	36.5	36.5	38.8	41.0	41.7	44.8	51.2	60.0
7	42.5	42.5	42.5	42.5	42.5	42.5	43.7	44.2	44.0	45.9	53.0	70.7
8	44.6	44.6	44.6	44.6	44.6	44.6	47.9	49.9	54.1	53.9	61.0	68.5
9	48.2	48.2	48.2	48.2	48.2	48.2	54.8	48.6	53.8	58.8	64.1	75.7
10+	52.2	52.2	52.2	52.2	52.2	52.2	51.6	67.9	62.7	67.8	78.3	79.9
	1982	1983	1984	1985	1986	1987	1988					
0	6.1	6.6	7.1	5.9	6.2	5.7	6.4					
1	16.9	15.2	13.4	14.0	14.0	12.5	12.2					
2	21.4	21.9	19.1	16.4	17.9	20.5	16.5					
3	30.4	33.1	29.3	22.9	22.4	25.9	25.5					
4	41.4	41.1	40.4	34.5	29.5	31.1	32.3					
5	48.9	53.0	42.6	46.0	39.6	41.2	37.1					
6	66.4	59.5	54.1	57.7	55.9	53.2	45.8					
7	60.5	73.7	72.5	63.3	63.4	69.6	59.5					
8	70.6	71.7	75.2	75.9	82.0	74.8	72.6					
9	97.9	65.7	83.4	79.7	83.8	90.5	66.7					
10+	80.2	110.3	70.4	93.8	100.1	106.7	103.6					

Table 3.3.3 Herring in Sub-division 32 (Gulf of Finland)

FILE:LINING

195  
USCP, Pelagic trawl  
1972, 1988  
1,1  
0, 9  
4655,15,269,427,197,28,17,3,6,1,2  
4045,13,130,494,271,109,16,3,2,6,1  
3944,16,201,321,250,84,47,1,3,1,4  
4332,14,348,657,177,63,28,8,1,1,1  
4185,23,78,423,416,99,50,17,7,2,2  
4149,2,772,91,186,141,37,37,13,8,1  
3785,13,34,803,84,94,47,13,12,3,3  
USCP, trawnet  
1978, 1988  
1,1  
1, 8  
283,3,96,3,6,2  
258,13,3,42,1,1  
243,4,7,2,11,1  
196,20,6,4,1,15  
120,5,11,2,2,4  
135,25,7,26,3,1  
122,5,17,30,9,4  
123,36,22,12,4,2  
118,48,28,8,6,2  
127,5,18,13,6,7  
130,17,6,14,11,5  
SF trawnet  
1974, 1988  
1,1  
1, 10  
300,0,5,20,9,33,7,69,7,10,4,9,0,13,4,3,9,3,2,1,5  
191,0,1,2,3,18,2,24,7,20,4,7,6,9,7,10,2,5,9,4,8  
400,0,2,14,8,21,1,35,7,41,4,28,4,10,1,14,6,12,0,7,1  
332,1,2,5,0,19,2,13,6,22,0,26,6,16,9,7,5,8,3,7,2  
376,0,0,6,2,31,7,28,6,19,0,22,2,20,3,20,6,7,8,6,5  
385,13,3,19,3,31,1,46,0,27,9,14,7,16,6,14,7,12,4,4,6  
429,0,0,6,0,16,9,22,5,38,1,16,9,17,8,14,9,10,7,7,6  
422,0,5,6,9,9,7,24,1,26,8,41,7,19,0,11,1,13,0,6,9  
456,1,3,25,4,35,4,20,4,23,2,21,1,29,9,10,4,6,5,4,5  
454,0,6,18,6,47,2,26,7,14,5,18,2,15,3,20,5,7,6,6,0  
439,0,1,7,5,33,5,34,6,13,6,10,9,13,3,11,9,10,9,3,5  
452,0,2,14,7,26,8,31,8,28,3,15,1,11,7,11,7,7,0,7,4  
477,0,4,13,0,65,2,37,5,24,2,14,7,4,9,7,3,5,0,2,6  
315,0,0,9,8,40,7,50,9,22,9,15,3,9,5,7,1,2,2,4,6  
277,0,9,2,16,3,30,3,26,3,13,4,11,1,11,0,2,1,1,3  
SF Botton trawl  
1974, 1988  
1,1  
0, 10  
4077,0,0,2,4,89,4,86,4,60,6,23,6,14,5,9,1,5,5,6,1,3,9  
3302,4,5,43,1,45,1,52,1,34,0,22,0,6,6,8,2,4,3,3,9,1,1  
1673,0,3,27,0,24,2,15,8,18,0,8,0,6,9,3,5,3,2,2,1,1,7  
1574,0,1,6,6,29,0,15,6,10,0,11,8,8,8,4,0,3,6,1,7,2,0  
1114,0,0,16,8,18,7,20,2,9,6,6,8,4,6,2,5,1,9,1,1,0,5  
378,0,0,0,6,1,6,2,5,3,2,0,9,1,7,1,2,0,6,0,6,0,3  
183,0,4,1,3,1,1,1,0,0,5,0,5,0,1,0,1,0,1,6,1,0,0  
491,0,9,2,11,0,9,1,5,2,7,1,4,2,0,0,5,6,6,0,6,0,2  
375,0,1,2,5,2,6,2,3,1,0,1,1,0,9,1,2,0,4,0,2,0,5  
154,0,0,22,3,6,2,2,4,2,1,0,3,0,1,0,0,0,0,0,3,0,0  
480,0,4,2,2,1,8,1,7,1,3,6,5,0,3,0,4,0,2,0,5,0,1  
226,0,9,3,7,6,7,2,0,1,9,2,4,0,7,0,1,0,2,0,2,0,1  
149,0,0,0,0,10,1,5,3,2,1,1,0,1,1,0,2,0,3,0,1,0,2  
260,0,2,5,1,3,2,0,0,5,8,2,9,0,6,0,5,0,1,0,0,0,2  
229,0,0,3,6,6,2,7,2,8,4,5,1,5,1,4,0,6,6,3,0,1  
SF Pelagic trawl  
1974, 1988  
1,1  
0, 10  
1431,2,3,17,9,34,1,17,9,12,3,3,2,2,1,1,4,0,7,0,3,0,5  
971,0,0,1,5,4,9,8,9,8,4,5,3,3,3,3,1,6,7,1,1,1  
2125,1,1,15,7,9,3,7,8,12,8,10,2,11,4,5,0,4,8,2,1,1,7  
2572,0,0,19,8,19,8,11,7,10,3,26,0,7,0,6,5,7,6,3,2,1,6  
2437,1,6,11,0,7,0,14,9,10,5,14,2,19,1,8,6,7,8,8,5,3,8  
3440,3,8,9,15,2,15,4,18,8,7,9,7,6,10,2,4,6,4,4,1,5  
3585,3,2,9,4,7,5,7,2,8,7,14,0,5,5,9,8,10,5,4,6,4,5  
3157,11,3,17,8,26,9,13,9,10,1,8,4,12,5,4,1,5,8,8,5,2,2  
3979,6,8,25,4,47,6,17,9,12,3,9,2,9,4,14,6,5,2,7,8,6,4  
4625,8,6,58,5,44,1,76,9,30,3,11,6,19,8,17,6,19,3,4,4,3,7  
4028,24,0,70,0,46,7,46,7,58,7,15,9,6,2,17,5,15,6,6,4,6,5  
4142,7,2,31,1,15,1,5,7,0,23,9,43,0,8,0,0,0,9,9,3,2,8  
2823,10,9,20,3,25,0,9,9,29,6,20,3,26,9,5,2,2,6,4,5,3,2  
2949,9,0,27,0,24,5,8,8,28,3,37,4,17,0,13,9,3,7,1,9,9  
2178,40,5,23,8,137,1,25,5,36,3,40,6,7,3,5,7,1,4,1,7,2,2,2



Table 3.8.3 cont'd.

Age 2 Fleet	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88
1									-10.00	-9.60	-9.75	-9.79	-9.79	-10.51	-9.86
2					-10.92	-10.04	10.75	-9.63	-10.84	-9.18	-10.44	-9.13	-8.40	-9.93	-10.25
3	9.88	11.47	-9.97	-12.04	-10.48	-9.78	10.91	-11.29	-10.55	-10.69	11.31	-11.33	-11.10	-10.16	-11.72
4	-11.02	-11.34	-10.91	11.34	10.46	-12.35	-11.75	-13.48	-12.63	-10.71	-11.85	-11.42	-10.19	-11.09	-11.86
5	-10.94	-12.34	-12.10	-12.72	-12.23	-12.14	-12.81	-11.95	-12.09	-12.15	-11.71	-10.93	-10.92	-11.29	-10.72

## SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial, F	Raised, F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-9.91	.320	.1383	.2570	.000E+00	.000E+00	-9.909	.113
2	-1.95	.353	.0962	.3933	.000E+00	.000E+00	-9.947	.246
3	-10.84	.725	.0954	.6318	.000E+00	.000E+00	-10.844	.181
4	-11.57	.889	.0023	.3703	.000E+00	.000E+00	-11.520	.222
5	-11.60	.703	.0163	.0890	.000E+00	.000E+00	-11.802	.176
Fbar								
	.264			.254				1.057

Age 3 Fleet	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88
1									-9.78	-9.98	-9.63	-10.24	-9.63	-10.07	-10.08
2					-8.71	-10.73	-9.71	-9.46	-9.00	-10.04	-8.84	-8.43	-8.75	-8.92	-9.35
3	-8.93	-9.05	-9.44	-8.91	-9.72	-8.29	-9.40	-9.75	-9.17	-9.34	-9.45	-9.54	-9.31	-9.02	-9.10
4	-10.60	-10.85	-11.16	-10.68	-11.26	-10.79	-11.38	-11.77	-11.71	-11.24	-11.54	-11.43	-10.65	-16.44	-10.71
5	-11.13	-11.39	-12.10	-11.46	-12.35	-11.19	-12.38	-11.41	-12.02	-11.18	-11.34	-10.87	-10.71	-10.38	-10.72

## SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial, F	Raised, F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-9.92	.255	.1870	.3079	.000E+00	.000E+00	-9.915	.090
2	-9.22	.609	.0128	.2960	.000E+00	.000E+00	-9.223	.176
3	-9.23	.382	.0272	.2309	.000E+00	.000E+00	-9.228	.095
4	-11.48	1.474	.0024	.1212	.000E+00	.000E+00	-11.480	.369
5	-11.37	.677	.0250	.1357	.000E+00	.000E+00	-11.374	.157
Fbar								
	.261			.189				.482

Age 4 Fleet	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88
1									-10.48	-9.73	-10.26	-10.56	-9.92	-10.12	-10.31
2					-9.97	-8.37	-9.87	-9.33	-9.45	-7.76	-7.81	-8.65	-8.87	-9.02	-8.73
3	-8.78	-8.23	-8.58	-9.03	-7.94	-8.67	-8.02	-8.30	-8.46	-8.95	-8.95	-8.98	-8.72	-8.56	-8.72
4	-11.53	-10.76	-10.69	-10.90	-10.12	-11.32	-10.97	-10.85	-11.28	-10.41	-11.34	-11.11	-10.44	-10.54	-10.91
5	-12.07	-11.20	-11.27	-11.36	-10.82	-11.76	-11.09	-11.18	-11.13	-11.15	-10.65	-11.21	-10.47	-10.39	-10.63

## SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial, F	Raised, F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-10.20	.317	.1412	.2676	.000E+00	.000E+00	-10.197	.112
2	-8.89	.762	.0179	.2038	.000E+00	.000E+00	-8.889	.220
3	-8.59	.355	.0514	.2699	.000E+00	.000E+00	-8.593	.089
4	-10.88	.410	.0043	.2457	.000E+00	.000E+00	-10.878	.102
5	-11.09	.473	.0332	.1496	.000E+00	.000E+00	-11.092	.118
Fbar								
	.238			.163				.319

Age 5 Fleet	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88
1									-10.41	-10.40	-9.92	-10.80	-10.30	-10.35	-10.64
2					-9.61	-10.14	-7.86	-9.89	-8.80	-9.68	-8.09	-9.18	-8.85	-8.68	-8.73
3	8.41	9.01	7.90	-6.31	-8.10	-7.22	-6.22	-7.17	-7.77	-6.31	-8.96	-8.53	-8.85	-8.25	-8.61
4	-10.20	-11.78	-10.97	-10.49	-10.28	-10.63	-11.70	-10.27	-10.62	-11.11	-11.37	-10.30	-10.87	-10.13	-10.19
5	-11.15	-11.89	-10.97	-10.45	-10.32	-10.67	-11.35	-10.35	-10.86	-10.91	-11.03	-10.05	-10.83	-10.07	-10.25

## SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial, F	Raised, F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-10.40	.298	.1149	.3069	.000E+00	.000E+00	-10.402	.105
2	-8.93	.609	.0172	.1965	.000E+00	.000E+00	-8.929	.193
3	8.24	.324	.0723	.3877	.000E+00	.000E+00	-8.245	.143
4	-10.73	.573	.0050	.1901	.000E+00	.000E+00	-10.727	.143
5	-10.74	.527	.0170	.1476	.000E+00	.000E+00	-10.743	.132
Fbar								
	.274			.177				.730

Table 3.8.3

cont'd.

Age 6 Fleet.	74.	75.	76.	77.	78.	79.	80.	81.	82.	83.	84.	85.	86.	87.	88
1					-9.99	-10.07	-9.75	-7.65	8.69	9.19	-7.77	-9.05	-9.26	-8.29	-8.41
3	-8.22	-7.72	-8.80	-7.41	-7.83	7.78	-6.99	-7.39	-6.98	-7.50	-8.04	-8.33	-8.73	-8.38	-8.18
4	-10.36	-10.71	-11.65	-10.07	-10.89	-10.70	-11.27	-10.58	-9.94	-10.52	-10.75	-10.71	-10.09	-11.17	-10.18
5	-11.24	-10.18	-11.53	-10.79	-9.85	-10.63	-10.24	-10.62	-9.95	-9.97	-10.84	-10.91	-10.11	-10.37	-10.81

SUMMARY STATISTICS												
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE				
q		F	F	F		Slope		Intrcpt				
1	-10.78	.391	.0790	.2328	.000E+00	.000E+00	-10.777	.138				
2	8.87	.831	.0183	.1400	.000E+00	.000E+00	-8.870	.240				
3	-7.89	.580	.1042	.2978	.000E+00	.000E+00	-7.886	.146				
4	-10.58	.499	.0058	.1462	.000E+00	.000E+00	-10.583	.125				
5	-10.53	.470	.0584	.2945	.000E+00	.000E+00	-10.526	.122				
Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio								
	.223	.229	.143	.229								

Age 7 Fleet.	74.	75.	76.	77.	78.	79.	80.	81.	82.	83.	84.	85.	86.	87.	88
1									-11.13	-11.12	-10.96	-12.23	-10.89	-10.26	-10.67
2	No data for this fleet at this age														
3	-8.59	-7.22	-7.63	-8.55	-8.84	7.49	-7.06	-6.08	-7.20	-6.90	-7.27	-7.51	-9.07	-8.02	-8.13
4	-11.59	-10.23	-10.13	-11.55	-10.62	-10.10	-11.39	-9.87	-10.22	-12.46	-9.89	-11.58	-11.11	-10.77	-10.01
5	-12.41	-9.97	-10.61	-11.55	-9.57	-10.17	-9.78	-9.64	-10.08	-9.41	-9.58	-10.12	-10.61	-9.63	-11.05

SUMMARY STATISTICS															
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE							
q		F	F	F		Slope		Intrcpt							
1	-11.03	.644	.0657	.1650	.000E+00	.000E+00	-11.040	.228							
2	No data for this fleet at this age														
3	-7.57	.510	.1428	.4193	.000E+00	.000E+00	-7.570	.202							
4	-10.73	.447	.0050	.1171	.000E+00	.000E+00	-10.726	.212							
5	-10.25	.579	.0771	.5349	.000E+00	.000E+00	-10.249	.220							
Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio											
	.239	.398	.345	.388											

Age 8 Fleet.	74.	75.	76.	77.	78.	79.	80.	81.	82.	83.	84.	85.	86.	87.	88
1									-10.81	-10.50	-11.27	-11.67	-11.08	-10.29	-10.96
2	No data for this fleet at this age														
3	-7.62	-7.90	-7.04	-7.13	-7.68	6.10	-6.99	-6.78	-6.14	-7.08	-6.60	-6.95	-7.59	-7.83	-7.05
4	-9.85	-11.01	-8.79	-9.12	-11.35	-9.28	-11.14	-9.85	-9.20	-12.93	-9.80	-10.33	-9.65	-11.91	-9.48
5	-10.90	-10.74	-9.64	-11.72	-10.72	-9.45	-9.46	-9.45	-9.00	-9.46	-8.56	-9.63	-10.45	-10.69	-10.29

SUMMARY STATISTICS															
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE							
q		F	F	F		Slope		Intrcpt							
1	-10.34	.497	.0670	.1310	.000E+00	.000E+00	-10.941	.176							
2	No data for this fleet at this age														
3	-7.14	.597	.2259	.5584	.000E+00	.000E+00	-7.112	.148							
4	-10.39	1.104	.0671	.5544	.000E+00	.000E+00	-10.387	.291							
5	-9.65	.754	.1742	.5576	.000E+00	.000E+00	-9.893	.188							
Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio											
	.183	.325	.184	.326											





Table 3.8.5 VIRTUAL POPULATION ANALYSIS

HERRING IN THE GULF OF FINLAND (FISHING AREA 32)

	FISHING MORTALITY COEFFICIENT					VARIABLE NATURAL MORTALITY COEFFICIENT						
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	.127	.120	.069	.115	.187	.102	.162	.230	.198	.097	.162	.096
2	.210	.276	.178	.295	.361	.296	.331	.348	.288	.314	.403	.465
3	.462	.308	.390	.344	.379	.299	.432	.475	.426	.481	.506	.471
4	.566	.512	.379	.425	.365	.357	.378	.400	.478	.516	.438	.479
5	.423	.482	.305	.373	.362	.327	.277	.274	.403	.622	.473	.359
6	.363	.494	.259	.206	.305	.259	.413	.575	.412	.346	.476	.402
7	.230	.333	.228	.214	.265	.226	.272	.154	.374	.292	.283	.466
8	.299	.382	.345	.089	.149	.237	.275	.246	.394	.380	.443	.385
9	.273	.255	.199	.085	.244	.175	.233	.277	.258	.314	.089	.270
10+	.273	.255	.199	.085	.244	.175	.233	.277	.258	.314	.089	.270
( 2- 5)U	.415	.394	.313	.359	.367	.320	.354	.374	.399	.483	.455	.443
	1982	1983	1984	1985	1986	1987	1988	1982-86				
1	.134	.106	.082	.169	.111	.084	.087	.120				
2	.292	.396	.324	.317	.347	.212	.281	.335				
3	.174	.346	.387	.273	.385	.259	.313	.313				
4	.266	.364	.370	.223	.298	.268	.210	.304				
5	.314	.236	.350	.230	.220	.268	.196	.270				
6	.129	.209	.290	.193	.198	.247	.166	.204				
7	.219	.184	.291	.159	.148	.238	.183	.200				
8	.129	.190	.282	.138	.160	.192	.115	.180				
9	.114	.185	.250	.162	.200	.237	.152	.182				
10+	.114	.185	.250	.162	.200	.237	.152	.182				
( 2- 5)U	.262	.335	.358	.261	.313	.252	.250					

Table 3.8.6 VIRTUAL POPULATION ANALYSIS

HERRING IN THE GULF OF FINLAND (FISHING AREA 32)

STOCK SIZE IN NUMBERS UNIT: millions

BIOMASS TOTALS UNIT: tonnes

ALL VALUES, EXCEPT THOSE REFERRING TO THE SPAWNING STOCK ARE GIVEN FOR 1 JANUARY; THE SPAWNING STOCK DATA REFLECT THE STOCK SITUATION AT SPAWNING TIME, WHEREBY THE FOLLOWING VALUES ARE USED: PROPORTION OF ANNUAL F BEFORE SPAWNING: .200  
PROPORTION OF ANNUAL M BEFORE SPAWNING: .300

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	1500	6404	2357	2338	2106	1336	4939	1193	1742	1447	2785	4224
2	1085	1138	4889	1893	1793	1504	1039	3440	776	1170	1075	1939
3	3223	758	743	3522	1213	1076	963	611	1989	476	700	588
4	453	1748	479	433	2148	715	687	512	311	1063	241	345
5	248	221	902	282	243	1283	431	385	281	158	520	127
6	468	140	118	572	167	146	796	267	240	154	69	265
7	89	280	74	78	401	106	97	431	123	130	89	35
8	112	61	173	50	54	265	73	60	303	69	80	55
9	76	72	36	105	40	40	180	45	39	167	39	42
10+	22	100	42	40	104	54	63	141	116	73	466	102
TOTAL NO	7278	10921	9812	9314	8271	6525	9267	7086	5919	4908	6063	7723
SPS NO	4137	3445	4867	4948	4638	3931	3259	3858	3018	2505	2364	2246
TOT. BIOM	166573	199953	202242	202797	188627	158096	182981	179095	167798	144364	179519	175171
SPS BIOM	110094	97987	120242	129094	128408	112830	102558	115671	105422	93657	105965	83417
	1982	1983	1984	1985	1986	1987	1988	1989	1978-86			
1	3555	2664	4954	3657	1163	6405	627	0	2910			
2	3143	2547	1962	3738	2527	852	4821	471	2097			
3	997	1922	1404	1162	2228	1463	564	2981	1274			
4	301	686	1114	781	724	1241	924	338	618			
5	175	189	390	630	511	440	777	613	331			
6	73	105	122	225	410	336	275	523	185			
7	145	52	70	75	152	275	215	191	97			
8	18	95	36	43	52	107	178	146	83			
9	31	13	65	22	30	36	72	130	50			
10+	92	52	35	88	18	36	75	104	116			
TOTAL NO	8530	8326	10151	10420	7816	11191	8528					
SPS NO	3151	3739	3626	4492	4591	3719	5599					
TOT. BIOM	203919	221637	228797	226001	194203	244338	211122					
SPS BIOM	99653	128861	127248	130	133238	134104	158600					

Table 3.8.7

List of input variables for the ICES prediction program.

HERRING SUBAREA 32 (GULF OF FINLAND)

The reference F is the mean F for the age group range from 2 to 5

The number of recruits per year is as follows:

Year	Recruitment
1989	2910.0
1990	2910.0
1991	2910.0

Proportion of F (fishing mortality) effective before spawning: .2000

Proportion of M (natural mortality) effective before spawning: .3000

Data are printed in the following units:

Number of fish: millions  
 Weight by age group in the catch: gram  
 Weight by age group in the stock: gram  
 Stock biomass: tonnes  
 Catch weight: tonnes

age	stock size	fishing pattern	natural mortality	maturity ogive	weight in the catch	weight in the stock
1	2910.0	.09	.20	.00	12.350	12.350
2	540.0	.28	.20	.66	18.500	18.500
3	2981.0	.31	.20	.97	25.700	25.700
4	338.0	.21	.20	1.00	31.700	31.700
5	613.0	.20	.20	1.00	39.150	39.150
6	523.0	.17	.20	1.00	49.500	49.500
7	191.0	.17	.20	1.00	64.550	64.550
8	146.0	.16	.20	1.00	73.700	73.700
9	130.0	.15	.20	1.00	78.600	78.600
10+	104.0	.15	.20	1.00	105.150	105.150

Table 3.8.8

Effects of different levels of fishing mortality on catch, stock biomass and spawning stock biomass.

HERRING SUBAREA 32 (GULF OF FINLAND)

Year 1989					Year 1990					Year 1991	
fac- tor	ref. F	stock biomass	sp.stock biomass	catch	fac- tor	ref. F	stock biomass	sp.stock biomass	catch	stock biomass	sp.stock biomass
1.0	.25	227	167	39	.0	.00	229	169	0	276	211
					.1	.02		168	4	271	206
					.2	.05		167	8	267	201
					.4	.10		166	15	258	191
					.6	.15		165	22	250	183
					.8	.20		163	29	242	174
					1.0	.25		162	36	235	166
					1.2	.30		161	42	228	159
					1.4	.35		159	48	221	151
					1.6	.40		158	54	214	144
					1.8	.45		157	60	208	138
					2.0	.50		156	65	202	132

The data unit of the biomass and the catch is 1000 tonnes.

The spawning stock biomass is given for the time of spawning.

The spawning stock biomass for 1991 has been calculated with the same fishing mortality as for 1990.

The reference F is the mean F for the age group range from 2 to 5

Table 3.8.9

13.57.79 23 APRIL 1989  
SERPENT GABBARA 32 (GOLF OF FICARD)

Year 1989, F-factor 1.000 and reference F .2500

age	absolute F	catch in numbers	catch in weight	stock size	stock biomass	at 1 January		at spawning time	
						sp.stock size	sp.stock biomass	sp.stock size	sp.stock biomass
1	.0900	277.34	2807.7	2910.00	35938	.00	0	.00	0
2	.2800	120.08	2221.5	540.00	9690	356.46	6593	317.37	5871
3	.3100	733.89	18604.1	2981.00	7611	2091.57	74313	2559.47	65778
4	.2100	58.23	1845.9	338.00	10714	338.00	10714	305.27	9675
5	.7000	101.05	3956.0	613.00	23998	613.00	23998	554.67	21715
6	.1700	74.32	3578.6	521.00	25888	521.00	25888	476.08	23565
7	.1700	27.14	1751.9	191.00	12328	191.00	12328	173.86	11222
8	.1600	19.62	1445.8	146.00	10760	146.00	10760	133.17	9814
9	.1500	16.45	1293.2	130.00	10218	130.00	10218	118.81	9338
10	.1500	13.16	1334.0	104.00	10935	104.00	10935	95.05	9994
Total		1381.27	38983.7	8476.00	227385	5292.97	185751	4733.69	166976

Year 1990, F-factor 1.000 and reference F .2500

age	absolute F	catch in numbers	catch in weight	stock size	stock biomass	at 1 January		at spawning time	
						sp.stock size	sp.stock biomass	sp.stock size	sp.stock biomass
1	.0900	227.34	2807.7	2910.00	35938	.00	0	.00	0
2	.2800	484.21	8957.9	2177.45	40282	1437.12	26586	1279.72	23674
3	.3100	81.14	2085.3	334.14	8329	324.12	8329	286.89	7373
4	.2100	308.39	9775.9	1798.08	56745	1790.08	56745	1616.49	51242
5	.7000	36.98	1447.6	224.31	8781	224.31	8781	202.97	7946
6	.1700	58.39	2890.2	410.91	20339	410.91	20339	374.04	18515
7	.1700	51.33	3313.5	501.25	23318	501.25	23318	328.84	21226
8	.1600	17.73	1306.5	131.93	9723	131.93	9723	120.33	8868
9	.1500	12.89	1013.3	101.86	8006	101.86	8006	93.09	7317
10	.1500	20.87	2194.5	164.90	17338	164.90	17338	150.70	15846
Total		1299.27	35792.4	8606.83	229063	4946.47	179171	4453.08	162011

Year 1991, F factor 1.000 and reference F .2500

age	absolute F	catch in numbers	catch in weight	stock size	stock biomass	at 1 January		at spawning time	
						sp.stock size	sp.stock biomass	sp.stock size	sp.stock biomass
1	.0900	227.34	2807.7	2910.00	35938	.00	0	.00	0
2	.2800	434.21	8957.9	2177.45	40282	1437.12	26586	1279.72	23674
3	.3100	327.19	8408.8	1347.37	34627	1306.95	33588	1156.84	29730
4	.2100	34.57	1095.8	200.65	6360	200.65	6360	181.19	5743
5	.7000	195.83	7666.6	1187.99	46509	1187.99	46509	1074.83	42083
6	.1700	21.37	1357.6	150.36	7042	150.36	7042	135.87	6775
7	.1700	40.35	2603.3	263.83	18321	263.83	18321	258.36	16677
8	.1600	33.53	2471.0	249.53	18390	249.53	18390	227.60	16773
9	.1500	11.65	915.6	92.04	7234	92.04	7234	84.12	6612
10	.1500	33.79	2501.7	187.30	19766	187.98	19766	171.80	18064
Total		1199.81	36486.1	8387.20	234874	5096.45	184200	4571.44	166136



Table 3.9.2 SUM OF PRODUCTS CHECK

HERRING IN THE BALTIC AREAS 25 TO 29  
 CATEGORY: TOTAL

	MEAN WEIGHT AT AGE IN THE CATCH										UNIT: gram	
	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1	31.9	31.3	29.2	31.6	29.9	27.2	27.7	30.5	24.7	20.4	18.9	16.9
2	42.1	39.8	44.5	41.0	46.8	47.7	43.4	44.1	47.0	39.2	37.0	26.6
3	51.8	57.9	58.9	58.7	51.5	65.6	64.4	63.3	57.4	64.3	53.1	48.7
4	61.4	60.2	67.7	66.9	63.0	60.5	73.3	77.3	70.6	66.7	73.4	62.1
5	78.3	68.2	64.6	74.2	68.5	72.0	69.5	81.7	78.8	80.8	76.7	72.2
6	84.2	82.7	71.7	69.8	80.6	77.7	81.1	80.2	84.9	89.2	88.1	78.0
7	89.6	80.5	82.9	78.8	79.1	81.0	83.1	86.5	82.3	91.7	90.9	86.9
8	76.9	88.7	74.8	91.1	79.6	87.0	90.5	91.1	90.7	90.6	93.2	95.0
9	76.1	71.9	95.4	94.9	98.1	87.1	94.6	99.3	99.2	106.3	97.2	101.2
10+	84.8	76.6	69.7	97.8	95.5	100.0	106.5	110.2	106.9	115.6	113.5	109.1
	1986	1987	1988									
1	19.6	18.1	20.5									
2	30.7	36.7	34.3									
3	39.3	41.7	51.9									
4	56.0	48.6	54.5									
5	66.9	62.1	56.2									
6	72.0	65.9	67.3									
7	81.9	71.2	72.9									
8	95.5	84.8	87.8									
9	98.0	93.0	92.7									
10+	104.5	102.0	97.2									

Table 3.9.3 Herring in the Baltic Proper, Sub-divisions 25-29

HERRING 75-296 TUNING DATA: Acoustical Surveys  
 192  
 Intern Acoustical 75-296  
 1983, 1988  
 1, 1  
 2, 9  
 1, 4594, 6383, 7316, 1344, 1400, 994, 590, 374  
 1, 3023, 4842, 4986, 2175, 1392, 1211, 1663, 670  
 1, 5341, 4922, 5042, 2979, 1805, 844, 676, 326  
 1, 3897, 6556, 3542, 2987, 1071, 470, 600, 202  
 1, 3305, 7493, 8223, 3727, 2411, 830, 417, 205  
 1, 5287, 2699, 4412, 4755, 1736, 1033, 321, 101  
 USSR 26-28 Surveys  
 1966, 1988  
 1, 1  
 2, 9  
 1, 361, 2305, 844, 1157, 502, 175, 165, 143  
 1, 109, 202, 330, 304, 415, 333, 205, 129  
 1, 1977, 405, 794, 1624, 707, 1100, 466, 344

Model: run at 15.50.17 28 APRIL 1989

DISAGGREGATED Qs

LOG TRANSFORMATION

NO explanatory variate (been used)

Fleet 1, Intern Acoustical 25, has terminal q estimated as the mean

Fleet 2, USSR 26,28 Surveys, has terminal q estimated as the mean

FLEETS COMBINED BY " VARIANCE "

Terminal populations from weighted Separable populations

Regression weights

, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000,

Oldest age F = 1.000 average of 5 younger ages. Fleets combined by variance of predictions

Fishing mortalities

Age,	83,	84,	85,	86,	87,	88,
1,	.061,	.043,	.081,	.109,	.037,	.102,
2,	.149,	.110,	.146,	.158,	.219,	.168,
3,	.311,	.201,	.187,	.212,	.264,	.377,
4,	.785,	.317,	.256,	.254,	.267,	.322,
5,	.248,	.287,	.389,	.332,	.263,	.326,
6,	.289,	.273,	.367,	.326,	.398,	.293,
7,	.273,	.314,	.413,	.335,	.369,	.410,
8,	.290,	.350,	.396,	.497,	.399,	.319,
9,	.277,	.308,	.364,	.349,	.343,	.332,

Log catchability estimates

Age 2	Fleet	83,	84,	85,	86,	87,	88
1,		-.32,	-.72,	-.43,	-.81,	-.23,	-.58
2,					-.245,	-3.18,	-1.56

SUMMARY STATISTICS									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	-.44	.402	.6459	.1211	.000E+00	.000E+00	-.437	.152	
2	-2.40	.939	.0909	.0467	.000E+00	.000E+00	-2.398	.469	
	Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio				
	.107	.370	.354	.370			.916		

cont'd.



Table 3.9.3 cont'd.

Age 3						
Fleet	83	84	85	86	87	88
1	.47	.47	.47	.45	.55	.77
2				.85	1.06	-1.35

SUMMARY STATISTICS								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	.26	.189	1.2089	.3761	.000E+00	.000E+00	.262	.071
2	1.78	1.315	1.1889	.2534	.000E+00	.000E+00	-1.779	.657
Fbar	SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio	
	.373	.187		.555E-01	.187		.088	

Age 4						
Fleet	83	84	85	86	87	88
1	.47	.64	.50	.20	.87	.51
2				-1.23	-2.40	-1.00

SUMMARY STATISTICS								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	.53	.275	1.6956	.3269	.000E+00	.000E+00	.528	.085
2	-1.61	.758	1.1986	.2139	.000E+00	.000E+00	-1.611	.394
Fbar	SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio	
	.317	.710		.112	.215		.268	

Age 5						
Fleet	83	84	85	86	87	88
1	.52	.84	.97	.54	.72	.72
2				-.40	-2.18	-.31

SUMMARY STATISTICS								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	.72	.185	2.0527	.3260	.000E+00	.000E+00	.719	.070
2	-.97	1.218	.3804	.1694	.000E+00	.000E+00	-.966	.609
Fbar	SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio	
	.321	.183		.971E-01	.183		.262	

cont'd.

Table 3.9.3

cont'd.

Age 6						
Fleet,	83,	84,	85,	86,	87,	88
1,	.50,	1.02,	.99,	.87,	.97,	.84
2,	,	,	,	.54,	.87,	.96

SUMMARY STATISTICS							
Fleet	Pred.	SE(q)	Partial	Raised,	SLOPE	SE	
q			F	F		Slope	
							INTRCPT, SE
							Intrcpt
1,	.67	.375	1.9479	.3546,	.000E+00,	.000E+00,	.667, .142
2,	.62	.249,	.5365,	.2393,	.000E+00,	.000E+00,	-.623, .125
Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio			
.270	.268	.180	.208	.755			

Age 7						
Fleet,	83,	84,	85,	86,	87,	88
1,	.56,	.93,	1.06,	.38,	.51,	.63
2,	,	,	,	-.94,	-.41,	.71

SUMMARY STATISTICS							
Fleet	Pred.	SE(q)	Partial	Raised,	SLOPE	SE	
q			F	F		Slope	
							INTRCPT, SE
							Intrcpt
1,	.68	.281	1.9716	.4307,	.000E+00,	.000E+00,	.679, .106
2,	-.21	.973,	.8689,	.1627,	.000E+00,	.000E+00,	-.212, .487
Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio			
.400	.270	.260	.270	.923			

Age 8						
Fleet,	83,	84,	85,	86,	87,	88
1,	.04,	1.14,	.74,	.86,	.63,	.10
2,	,	,	,	.68,	.12,	.47

SUMMARY STATISTICS							
Fleet	Pred.	SE(q)	Partial	Raised,	SLOPE	SE	
q			F	F		Slope	
							INTRCPT, SE
							Intrcpt
1,	.59	.467	1.7957	.5180,	.000E+00,	.000E+00,	.585, .176
2,	.23	.251	1.2525	.2489,	.000E+00,	.000E+00,	.225, .126
Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio			
.293	.221	.306	.306	1.912			

Table 3.9.4 VIRTUAL POPULATION ANALYSIS

HERRING IN THE BALTIC AREAS 25 TO 29

	FISHING MORTALITY COEFFICIENT											UNIT: Year-1	NATURAL MORTALITY COEFFICIENT = .20	
	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985		
1	.25	.26	.14	.15	.12	.07	.12	.10	.05	.06	.04	.08		
2	.12	.15	.19	.13	.23	.20	.20	.23	.22	.15	.11	.14		
3	.15	.18	.18	.19	.19	.23	.24	.25	.27	.31	.20	.18		
4	.18	.19	.16	.17	.16	.23	.22	.26	.22	.28	.31	.25		
5	.13	.19	.17	.18	.14	.20	.22	.23	.22	.25	.29	.38		
6	.16	.15	.16	.17	.14	.18	.17	.25	.21	.29	.27	.37		
7	.18	.19	.15	.17	.14	.17	.20	.21	.25	.27	.31	.41		
8	.16	.15	.13	.19	.15	.21	.20	.18	.22	.29	.35	.40		
9	.16	.18	.16	.18	.15	.20	.20	.23	.22	.28	.31	.36		
10+	.16	.18	.16	.18	.15	.20	.20	.23	.22	.28	.31	.36		
( 2- 8)U	.15	.17	.16	.17	.17	.20	.21	.23	.23	.26	.26	.31		
	1986	1987	1988											
1	.11	.04	.01											
2	.16	.22	.11											
3	.21	.26	.37											
4	.25	.26	.32											
5	.33	.27	.32											
6	.31	.39	.27											
7	.33	.35	.40											
8	.50	.40	.29											
9	.35	.34	.33											
10+	.35	.34	.33											
( 2- 8)U	.30	.31	.30											

Table 3.9.5 VIRTUAL POPULATION ANALYSIS

DURING IN THE MALE AGEAS 25 TO 29

STOCK SIZE IN NUMBERS UNIT: millions

BIOMASS TOTALS UNIT: tonnes

ALL VALUES, EXCEPT THOSE REFERRING TO THE SPANNING STOCK ARE GIVEN FOR 1 JANUARY; THE SPANNING STOCK DATA REFLECT THE STOCK SITUATION AT SPANNING TIME, WHEREBY THE FOLLOWING VALUES ARE USED: PROPORTION OF ANNUAL F BEFORE SPANNING: .150  
PROPORTION OF ANNUAL M BEFORE SPANNING: .200

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1	10628	8391	11784	8348	7558	4610	6490	11631	9680	9525	17457	10309
2	10471	8411	5303	8348	5902	5536	3519	4713	8643	7508	7346	9775
3	5640	7847	4797	5528	6019	3823	3715	2357	3080	5879	5300	5399
4	4958	3956	5146	3270	2423	4077	2493	2391	1500	1924	3423	3554
5	3673	3393	3677	3574	2268	1687	2648	1639	1512	985	1185	2055
6	2268	2593	2298	1643	2441	1613	1136	1740	1064	996	629	728
7	7597	1565	1323	1600	1277	1731	1107	768	1104	709	611	392
8	678	2466	1068	1290	1105	908	1191	740	524	702	442	365
9	585	475	1731	766	872	776	601	797	504	345	430	255
10*	600	617	659	1197	840	696	1123	1185	1212	776	699	524
TOTAL NO	42949	37839	37255	33915	30744	25458	24014	27980	28823	29148	32522	33357
SPS NO	26376	24450	21506	20770	19054	17168	14691	13362	14777	15253	15798	17823
TOT. BIOM	2316770	2082795	1989549	1862117	1672767	1490192	1406832	1515353	1455414	1405540	1404084	1274809
SPS BIOM	1672596	1555101	1421080	1353961	1227774	1151002	1055894	984810	979775	983810	961375	902242

	1985	1987	1988	1989
1	4420	14003	47285	0
2	7791	3249	11058	38328
3	6924	5454	2140	8137
4	3679	4596	3440	1707
5	2258	2353	2890	2052
6	1154	1331	1465	1716
7	413	691	736	915
8	212	242	300	404
9	201	106	133	244
10*	305	234	177	192
TOTAL NO	27356	32258	69723	
SPS NO	18111	15123	17108	
TOT. BIOM	1143750	1180707	2025953	
SPS BIOM	868668	785902	844033	

Table 3.9.6

Title : HERRING IN THE BALTIC AREAS 25 TO 29  
 At 15.36.33 28 APRIL 1969  
 from 74 to 88 on ages 1 to 9  
 with terminal F of .350 on age 4 and terminal S of 1.000

Initial sum of squared residuals was 20.996 and  
 final sum of squared residuals is 3.052 after 92 iterations

## Matrix of Residuals

Years Ages	74/75	75/76	76/77	77/78									
1/ 2	1.500	1.198	1.001	.305									
2/ 3	.035	.000	.400	-.213									
3/ 4	-.091	-.002	.162	.070									
4/ 5	.074	-.023	.075	.008									
5/ 6	-.115	-.025	-.004	-.039									
6/ 7	-.142	-.154	.060	-.004									
7/ 8	.195	.206	-.282	-.067									
8/ 9	-.214	-.343	-.448	-.046									
	.000	.000	.000	.000									
WTS	.010	.010	.010	.010									
Years Ages	78/79	79/80	80/81	81/82	82/83	84/84	84/85	85/86	86/87	87/88	WTS		
1/ 2	.518	-.215	.304	-.041	-.061	.205	-.246	.146	.227	-.276	.000	.176	
2/ 3	.606	.174	.213	.127	.217	.024	-.067	-.078	-.124	-.111	.000	.424	
3/ 4	.058	.105	.095	.134	.215	.140	-.001	-.279	-.126	-.086	.000	.706	
4/ 5	-.004	.078	.040	.127	.059	.078	.112	-.215	-.024	-.137	.000	1.000	
5/ 6	-.111	.101	-.082	-.014	-.135	-.081	-.001	.246	-.047	.006	.000	.955	
6/ 7	-.047	-.163	-.193	-.041	-.122	-.004	-.132	.176	.015	.118	.000	.882	
7/ 8	-.261	-.185	.135	-.134	.050	-.167	.060	-.009	-.026	.228	.000	.554	
8/ 9	-.239	-.100	-.203	-.444	-.219	-.129	.118	.089	.448	.153	.000	.384	
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	3.277		
WTS	.010	.010	.010	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Fishing Mortalities (F)													
F-values	74	75	76	77	78								
	.2188	.2425	.2122	.2174	.1877								
F-values	79	80	81	82	83	84	85	86	87	88			
	.2229	.2195	.2328	.2110	.2405	.2412	.2933	.2974	.3263	.3500			
Selection-at-age (S)													
S-values	1	2	3	4	5	6	7	8	9				
	.2908	.6634	.9281	1.0000	1.0433	1.0477	1.0797	1.1198	1.0000				



**Table 3.9.8** VIRTUAL POPULATION ANALYSIS

SYSTEM: 101.810M (SPL) 25.10.79

SPAWNING PERIOD: 1974-1989

INITIAL POPULATION: 100000

ALL VALUES, EXCEPT THOSE RELATING TO THE SPARKING STOCK ARE GIVEN FOR 1 JANUARY; THE SPARKING STOCK DATA RELATE TO STOCK SITUATION AT SPARKING LEVEL. MEMBERSHIP THE FOLLOWING VALUES ARE GIVEN: PROPORTION OF ANNUAL F BEFORE SPAWNING: 0.150  
PROPORTION OF ANNUAL F BEFORE SPAWNING: 0.500

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1	10000	9350	12100	8530	4327	4775	6609	11761	9765	8443	11200	9556
2	10120	9625	5240	3631	2041	5724	3674	4818	8756	7577	6461	8746
3	5680	7341	4641	3551	6250	3944	4849	2467	3166	5766	5357	4674
4	4346	1948	4978	3146	2400	4266	2983	2517	1590	1994	3495	3600
5	2682	2896	3297	3436	2167	1659	2803	1721	1615	1059	1242	2113
6	1781	1904	1863	1937	2329	1541	1121	1866	1131	1080	690	775
7	7730	1189	1350	1260	1626	1639	1639	776	1208	764	679	441
8	497	1545	564	862	327	703	1116	685	514	787	487	421
9	442	327	1137	561	521	548	433	735	459	337	500	292
10*	454	425	433	783	502	492	809	1093	1103	758	812	599
TOTAL 80	38669	34340	34790	32236	29991	25491	24045	28439	29300	28565	30921	31219
SFS 80	22674	21256	18877	19029	17978	16769	14546	13632	15109	15696	15722	16878
TOT. 810M	2013265	1875455	1731802	1706465	1572538	1449732	1386995	1535126	1479104	1419682	1395489	1231709
SFS 810M	1398661	1316540	1210643	1198364	1118623	105218	1025682	997779	998285	1016758	984839	884838

	1986	1987	1988	1989
1	4789	6580	4857	0
2	7174	7552	6981	3592
3	6062	4950	2468	3164
4	3086	3067	3627	1408
5	2296	1868	2326	1715
6	1201	1362	1069	1256
7	451	730	762	592
8	253	773	412	475
9	247	139	159	270
10*	375	307	211	231
TOTAL 80	25055	25685	26211	
SFS 80	16082	13378	12125	
TOT. 810M	1098541	976846	890952	
SFS 810M	820105	712165	650471	

Table 3.9.9

List of input variables for the ICES prediction program.

HERRING IN THE BALTIC PROPER

The reference F is the mean F for the age group range from 2 to 8

The number of recruits per year is as follows:

Year	Recruitment
1989	8778.0
1990	8778.0
1991	8778.0

Proportion of F (fishing mortality) effective before spawning: .1500

Proportion of M (natural mortality) effective before spawning: .3000

Data are printed in the following units:

Number of fish: millions  
 Weight by age group in the catch: gram  
 Weight by age group in the stock: gram  
 Stock biomass: tonnes  
 Catch weight: tonnes

age	stock size	fishing pattern	natural mortality	maturity ogive	weight in the catch	weight in the stock
1	8778.0	.10	.20	.00	19.295	19.295
2	3592.0	.25	.20	.70	35.500	35.500
3	3164.0	.33	.20	.90	46.790	46.790
4	1409.0	.37	.20	1.00	51.540	51.540
5	1715.0	.42	.20	1.00	59.155	59.155
6	1256.0	.39	.20	1.00	66.605	66.605
7	592.0	.38	.20	1.00	72.075	72.075
8	425.0	.27	.20	1.00	86.275	86.275
9	270.0	.27	.20	1.00	92.855	92.855
10+	231.0	.27	.20	1.00	99.610	99.610



Table 3.9.10

Effects of different levels of fishing mortality on catch, stock biomass and spawning stock biomass.

HERRING IN THE BALTIC PROPER

Year 1989					Year 1990					Year 1991		
fac- tor	ref. F	stock biomass	sp.stock biomass	catch	fac- tor	ref. F	stock biomass	sp.stock biomass	catch	stock biomass	sp.stock biomass	
1.0	.34	830	544	186	.0	.00	847	562	0	1080	762	
					.1	.03		560	21	1057	738	
					.2	.07		557	41	1035	715	
					.4	.14		552	79	993	672	
					.6	.21		546	115	953	632	
					.8	.28		541	149	916	594	
					1.0	.34		536	181	880	559	
					1.2	.41		531	211	847	526	
					1.4	.48		526	240	816	495	
					1.6	.55		520	267	786	467	
					1.8	.62		515	292	758	440	
					2.0	.69		510	316	731	415	

The data unit of the biomass and the catch is 1000 tonnes.

The spawning stock biomass is given for the time of spawning.

The spawning stock biomass for 1991 has been calculated with the same fishing mortality as for 1990.

The reference F is the mean F for the age group range from 2 to 8

Table 3.9.11

HERRING IN THE BALTIC PROPER

Year 1989, F-factor 1.000 and reference F .3443

age	absolute F	catch in numbers	catch in weight	stock size	stock biomass	at 1 January		at spawning time	
						sp. stock size	sp. stock biomass	sp. stock size	sp. stock biomass
1	.1000	758.37	14632	8778.0	169371	.0	0	.0	0
2	.2500	723.13	25671	3592.0	127518	2511.4	89261	2380.8	80969
3	.3300	810.46	37921	3164.0	148043	2847.6	133239	2552.3	119419
4	.3700	397.38	20480	1409.0	72619	1409.0	72619	1255.3	64698
5	.4200	536.80	31754	1715.0	101450	1715.0	101450	1516.5	89709
6	.3900	379.01	24644	1256.0	83655	1256.0	83655	1115.6	74307
7	.3800	170.70	12303	592.0	42668	592.0	42668	526.6	37957
8	.2700	91.56	7898	425.0	36666	425.0	36666	384.4	33160
9	.2700	58.16	5400	270.0	25070	270.0	25070	244.2	22673
10	.2700	49.76	4956	231.0	23009	231.0	23009	208.9	20809
Total		3966.34	185665	21432.0	830073	11260.0	607643	10084.6	543705

Year 1990, F-factor 1.000 and reference F .3443

age	absolute F	catch in numbers	catch in weight	stock size	stock biomass	at 1 January		at spawning time	
						sp. stock size	sp. stock biomass	sp. stock size	sp. stock biomass
1	.1000	758.37	14632	8778.0	169371	.0	0	.0	0
2	.2500	1309.15	46474	6502.9	230853	4552.0	161597	4129.2	146585
3	.3300	586.68	27450	2290.4	107165	2061.3	96449	1847.5	86445
4	.3700	525.23	27070	1862.3	95985	1862.3	95985	1659.2	85515
5	.4200	249.41	14753	796.8	47136	796.8	47136	704.6	41680
6	.3900	271.79	18102	922.6	61448	922.6	61448	819.5	54581
7	.3800	200.75	14659	696.2	50181	696.2	50181	619.4	44640
8	.2700	71.40	6160	331.5	28596	331.5	28596	299.8	25862
9	.2700	57.22	5313	265.6	24664	265.6	24664	240.2	22306
10	.2700	67.45	6719	313.1	31190	313.1	31190	283.2	28208
Total		4097.46	181147	22759.5	846593	11801.5	597249	10602.5	535825

Year 1991, F-factor 1.000 and reference F .3443

age	absolute F	catch in numbers	catch in weight	stock size	stock biomass	at 1 January		at spawning time	
						sp. stock size	sp. stock biomass	sp. stock size	sp. stock biomass
1	.1000	758.37	14632	8778.0	169371	.0	0	.0	0
2	.2500	1309.15	46474	6502.9	230853	4552.0	161597	4129.2	146585
3	.3300	1062.12	48696	4146.4	194011	3731.8	174610	3344.7	156500
4	.3700	380.21	19595	1348.1	69481	1348.1	69481	1201.1	61902
5	.4200	329.66	19500	1053.2	62302	1053.2	62302	931.3	55091
6	.3900	126.28	8410	428.6	28550	428.6	26550	380.7	25359
7	.3800	147.46	10628	511.4	36859	511.4	36859	454.9	32789
8	.2700	83.98	7245	389.8	33631	389.8	33631	352.5	30416
9	.2700	44.63	4143	207.2	19236	207.2	19236	187.4	17396
10	.2700	77.92	7761	361.7	36031	361.7	36031	327.1	32585
Total		4319.76	188090	23277.4	860325	12583.9	622300	11309.0	558628

**Table 4.1** SPRAT catches in the Baltic Sea by country and sub-division, 1987 and 1988 (t). By-catch of herring in directed sprat fisheries excluded and by-catch of sprat in herring fisheries included.

Year and country	Total catch	Sub-division										
		22	23	24	25	26	27	28	29	30	31	32
<b>1987</b>												
Denmark	2,593	2,456	-	-	137	-	-	-	-	-	-	-
Finland	2,817	-	-	-	-	-	-	21	1,776	4	-	1,016
German Dem. Rep.	1,307	4	-	1,303	-	-	-	-	-	-	-	-
Germany, Fed.Rep.	1,125	1,123	-	2	-	-	-	-	-	-	-	-
Poland	32,003	-	-	90	15,398	16,515	-	-	-	-	-	-
Sweden	3,453	-	-	242	481	727	46	1,957	-	-	-	-
USSR	44,888	-	-	-	-	25,602	-	11,824	5,693	-	-	1,769
<b>Total</b>	<b>88,186</b>	<b>3,583</b>	<b>-</b>	<b>1,637</b>	<b>16,016</b>	<b>42,844</b>	<b>46</b>	<b>13,802</b>	<b>7,855</b>	<b>3</b>	<b>-</b>	<b>2,785</b>
<b>1988<sup>1</sup></b>												
Denmark	1,972	6	-	983	-	-	-	-	-	-	-	-
Finland	2,996	-	-	-	-	-	-	11	1,975	3	-	1,007
German Dem. Rep.	1,234	-	-	1,234	-	-	-	-	-	-	-	-
Germany, Fed.Rep.	320	320	-	-	-	-	-	-	-	-	-	-
Poland	22,236	-	-	284	10,648	11,304	-	-	-	-	-	-
Sweden	7,345	-	-	439	791	616	2,194	3,305	-	-	-	-
USSR	44,181	-	-	-	-	23,205	-	13,368	4,330	-	-	3,278
<b>Total</b>	<b>80,294</b>	<b>326</b>	<b>-</b>	<b>2,940</b>	<b>12,422</b>	<b>35,125</b>	<b>2,194</b>	<b>16,684</b>	<b>6,305</b>	<b>3</b>	<b>-</b>	<b>4,285</b>

<sup>1</sup>Preliminary data.

<sup>2</sup>Sub-division 24 included.

Table 4.2.1 SUM OF PRODUCTS CHECK

SPRAT IN FISHING AREAS 22 TO 25  
 CATEGORY: TOTAL

CATCH IN NUMBERS	UNIT: millions											
-----	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
0	3	3	7	5	0	32	33	27	4	2	0	6
1	110	11	142	390	188	68	1071	961	315	559	91	508
2	28	75	46	207	688	308	105	1698	726	360	408	470
3	250	69	120	167	346	537	354	273	386	212	183	120
4	149	304	189	168	202	257	425	325	6	85	83	29
5	26	159	410	202	155	187	148	199	45	45	69	2
6	21	49	117	82	134	73	97	31	33	22	22	1
7	2	13	10	11	68	35	33	21	9	10	5	1
8+	1	1	1	1	1	1	1	1	1	1	1	1
TOTAL	590	684	1042	1233	1782	1498	2267	3536	1524	1295	863	1138
	1982	1983	1984	1985	1986	1987	1988					
0	11	21	23	40	19	4	42					
1	211	700	339	143	277	84	41					
2	506	139	236	394	230	90	188					
3	149	231	103	365	409	207	167					
4	55	32	49	102	508	484	247					
5	18	10	7	25	113	372	247					
6	9	2	1	1	35	77	179					
7	4	1	0	1	1	13	36					
8+	2	1	1	1	1	0	9					
TOTAL	965	1137	759	1072	1593	1332	1157					

Table 4.2.2. SUM OF PRODUCTS CHECK

SPRAT IN FISHING AREAS 22 TO 25

CATEGORY: TOTAL

MEAN WEIGHT AT AGE IN THE CATCH      UNIT: gram

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
0	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.800
1	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	6.000	4.800
2	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	15.900
3	16.000	16.000	16.000	16.000	16.000	16.000	16.000	16.000	16.000	16.000	16.000	19.000
4	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000	22.500
5	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000	27.000
6	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	.000
7	20.000	20.000	20.000	20.000	20.000	20.000	20.000	20.000	20.000	20.000	20.000	.000
8+	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

	1982	1983	1984	1985	1986	1987	1988
0	4.700	4.800	4.400	3.000	4.700	3.800	4.600
1	10.300	9.900	12.900	13.000	9.400	7.200	5.100
2	15.300	16.500	15.300	15.000	16.100	12.800	11.400
3	19.000	18.100	18.500	16.000	14.900	15.100	11.900
4	18.900	18.900	20.000	17.000	15.400	16.200	13.700
5	18.300	19.200	21.800	18.000	16.400	16.700	16.200
6	19.100	19.400	19.900	18.000	17.500	17.300	16.100
7	19.600	20.000	20.800	.000	26.000	18.100	16.600
8+	21.100	20.000	.000	.000	22.900	23.400	17.000



Table 4.2.4

Title : SPRAT IN FISHING AREAS 22 TO 25  
 At 18.12.19 18 APRIL 1989  
 from 70 to 88 on ages 1 to 5  
 with Terminal F of .387 on age 3 and Terminal S of 1.400

Initial sum of squared residuals was 93.431 and  
 final sum of squared residuals is 35.904 after 92 iterations

Matrix of Residuals

Years	70/71	71/72	72/73	73/74	74/75	75/76	76/77	77/78				
Ages												
1/ 2	.700	-.605	.297	-.146	-.471	-.286	.236	-1.282				
2/ 3	-.392	.540	-.451	.042	.383	.087	-.378	-.195				
3/ 4	.046	-.275	.202	.030	.060	.050	.092	1.342				
4/ 5	-.081	.173	.202	.013	-.473	.039	.384	-1.236				
	.000	.000	.000	.000	.000	.000	.000	.000				
WTS	.100	.100	.100	.100	.100	.100	.100	.100				
Years	78/79	79/80	80/81	81/82	82/83	83/84	84/85	85/86	86/87	87/88		WTS
Ages												
1/ 2	-.441	.051	-2.543	-.478	-.524	.118	-.022	-.176	.988	-.358	.000	.522
2/ 3	.914	.371	.324	.719	-.051	-.512	-.143	.410	.111	-.057	.000	.968
3/ 4	.656	.053	.358	-.126	.286	.406	-.001	-.204	-.499	.021	.000	1.000
4/ 5	-3.344	-1.119	1.671	-.818	.094	.073	.386	-.259	-.316	.565	.000	.392
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	-4.769	
WTS	.100	.100	.100	.100	.100	1.000	1.000	1.000	1.000	1.000		
Fishing Mortalities (F)												
F-values	70	71	72	73	74	75	76	77	78			
	.0196	.0285	.0700	.1519	.2689	.3333	.4954	1.8002	.7145			
F-values	79	80	81	82	83	84	85	86	87	88		
	.7879	.9651	.5953	.5001	.2429	.1046	.1318	.2019	.2037	.3870		
Selection-at-age (S)												
S-values	1	2	3	4	5							
	.4030	.5743	1.0000	1.3428	1.4000							

Table 4.2.5 VIRTUAL POPULATION ANALYSIS

SPRAT IN FISHING AREAS 22 TO 25

FISHING MORTALITY COEFFICIENT		UNIT: Year-1		NATURAL MORTALITY COEFFICIENT = .40								
-----												
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	.0250	.0039	.0400	.0796	.0717	.0659	.2367	.4179	.2381	.3735	.0633	.1852
2	.0074	.0261	.0246	.0929	.2443	.1995	.1701	.9601	.8593	.6032	.6717	.6836
3	.0210	.0279	.0651	.1441	.2760	.3868	.4704	1.1913	.7965	.8992	.9696	.5474
4	.0255	.0393	.1222	.1509	.3258	.4314	.7991	1.5837	.0768	.5167	1.7688	.4964
5	.0275	.0420	.0839	.2313	.2530	.7437	.6175	1.7729	1.5752	2.1643	1.5940	.2250
6+	.0275	.0420	.0839	.2313	.2530	.7437	.6175	1.7729	1.5752	2.1643	1.5940	.2250
( 1- 5)U	.0213	.0278	.0672	.1398	.2342	.3655	.4587	1.1852	.7092	.9114	1.0135	.4275
	1982	1983	1984	1985	1986	1987	1988	1970-86				
1	.0789	.0814	.0500	.0490	.1736	.0649	.1557	.1314				
2	.3578	.0841	.0436	.0929	.1279	.0968	.2523	.3088				
3	.6252	.3468	.1020	.1083	.1630	.2023	.3266	.4200				
4	.6853	.3299	.1417	.1722	.2696	.3719	.5008	.4668				
5	.8910	.3150	.1373	.1232	.3691	.4105	.4196	.6568				
6+	.8910	.3150	.1373	.1232	.3691	.4105	.4196	.6568				
( 1- 5)U	.5276	.2314	.0949	.1091	.2206	.2293	.3310					



Table 4.2-6 VIRTUAL POPULATION ANALYSIS

SPRAT IN FISHING AREAS 22 TO 25

STOCK SIZE IN NUMBERS UNIT: millions

-----  
BIOMASS TOTALS UNIT: tonnes

ALL VALUES, EXCEPT THOSE REFERRING TO THE SPAWNING STOCK ARE GIVEN FOR 1 JANUARY; THE SPAWNING STOCK DATA REFLECT THE STOCK SITUATION AT SPAWNING TIME, WHEREBY THE FOLLOWING VALUES ARE USED: PROPORTION OF ANNUAL F BEFORE SPAWNING: .400  
PROPORTION OF ANNUAL M BEFORE SPAWNING: .400

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	5399	3441	4384	6170	3290	1290	6116	3367	1790	2147	1790	3621
2	4577	3529	2297	2823	3820	2053	810	3236	1486	946	991	1126
3	14577	3045	2305	1503	1725	2005	1127	458	830	422	347	339
4	7162	9568	1985	1448	872	877	913	472	93	251	115	88
5	1163	4680	6167	1178	834	422	382	275	65	58	100	13
6+	1051	1840	1918	545	1090	245	337	73	62	42	41	18
TOTAL NO	33930	26103	19056	13666	11631	6892	9685	7880	4326	3865	3383	5206
SPS NO	26392	20496	13963	8573	7764	4665	4855	3693	2240	1881	1701	2767
TOT. BIOM	488744	403319	269752	145860	145656	94023	83544	80924	45272	34929	34809	45083
SPS BIOM	403864	332935	215604	107395	107090	67248	50248	41522	26028	19817	18736	25809

	1982	1983	1984	1985	1986	1987	1988	1989	1970-86
1	3365	10837	8424	3626	2097	1615	346	0	4186
2	2017	2085	6697	5372	2314	1182	1014	199	2716
3	381	945	1285	4297	3281	1365	719	528	2287
4	132	137	448	778	2585	1869	747	348	1643
5	36	44	66	261	439	1323	864	304	952
6+	30	16	15	31	144	322	783	726	441
TOTAL NO	5961	14064	16935	14364	10860	7675	4474		
SPS NO	3534	7930	11307	10590	7899	5408	3193		
TOT. BIOM	54861	110266	176426	185934	136593	100034	57222		
SPS BIOM	33810	69603	131411	146129	104150	73460	41370		

Table 4.2.7.

Analysis by RCRTINX2 of data from file RECBAL  
 SW Bal Sprat as 1-group post 1983, 0,1 and 2 group data

Data for 3 surveys over 6 years  
 REGRESSION TYPE = C  
 TAPERED TIME WEIGHTING NOT APPLIED  
 PRIOR WEIGHTING NOT APPLIED  
 FINAL ESTIMATES SHRUNK TOWARDS MEAN  
 ESTIMATES WITH S.E.'S GREATER THAN THAT OF MEAN INCLUDED  
 MINIMUM S.E. FOR ANY SURVEY TAKEN AS .00  
 MINIMUM OF 4 POINTS USED FOR REGRESSION

Yearclass = 1987

Survey/ Series	Index Value	Slope	Inter- cept	Rsquare	No. Pts	Predicted Value	Sigma	Standard Error	Weight
GDR 0	7.4530	2.303	-12.320	.8137	4	4.8427	.34189	1.15424	.08870
GDR 1	6.9875	.724	3.084	.7606	4	8.1398	.40076	.45775	.56399
GDR 2									
MEAN						8.4107	.58332	.58332	.34731

Yearclass = 1988

Survey/ Series	Index Value	Slope	Inter- cept	Rsquare	No. Pts	Predicted Value	Sigma	Standard Error	Weight
GDR 0	8.5122	*****	348.022	.0003	5	15.5324	33.11714	36.50526	.00021
GDR 1									
GDR 2									
MEAN						8.4869	.53314	.53314	.99979

Yearclass	Weighted Average Prediction	Internal Standard Error	External Standard Error	Virtual Population Analysis	Ext.SE/ Int.SE
1987	7.94	2811.41	.34	.69	8.79 6580.00
1988	8.49	4858.15	.53	.10	2.01 .19

Table 4.2.8

List of input variables for the ICES prediction program.

PREDICTION SPRAT 22T0 25

The reference F is the mean F for the age group range from 1 to 5

The number of recruits per year is as follows:

Year	Recruitment
1989	4668.0
1990	4186.0
1991	4186.0

Proportion of F (fishing mortality) effective before spawning: .4000  
 Proportion of M (natural mortality) effective before spawning: .4000

Data are printed in the following units:

Number of fish: millions  
 Weight by age group in the catch: gram  
 Weight by age group in the stock: gram  
 Stock biomass: tonnes  
 Catch weight: tonnes

age	stock size	fishing pattern	natural mortality	maturity ogive	weight in the catch	weight in the stock
1	4668.0	.11	.40	.60	6.242	4.763
2	3096.0	.26	.40	1.00	14.332	13.716
3	528.0	.35	.40	1.00	16.237	15.589
4	348.0	.39	.40	1.00	17.926	17.337
5	304.0	.55	.40	1.00	18.505	17.784
6+	726.0	.55	.40	1.00	18.683	18.584

Table 4.2.9

## Results

12.08.57 20 APRIL 1989  
 PREDICTION SPRAT 2220 25

.....  
 \* Year 1989, F-factor 1.000 and reference F .3320 \*

age	absolute F	catch in numbers	catch in weight	stock size	stock biomass	at 1 January		at spawning time	
						sp.stock size	sp.stock biomass	sp.stock size	sp.stock biomass
1	.1100	402.23	2510.8	4668.00	22234.4	2800.80	13340.7	2283.95	10878.8
2	.2600	589.27	8445.1	3096.00	42464.1	3096.00	42464.1	2377.65	32611.3
3	.3500	130.01	2110.9	528.00	8231.2	528.00	8231.2	391.15	6097.9
4	.3900	93.83	1682.0	348.00	6033.2	348.00	6033.2	253.71	4398.6
5	.5500	107.93	1997.3	304.00	5406.4	304.00	5406.4	207.89	3697.2
6+	.5500	257.76	4815.9	726.00	13492.1	726.00	13492.1	496.48	9226.8
Total		1581.03	21562.0	9670.00	97861.5	7802.80	88967.7	6010.84	66910.5

.....  
 \* Year 1990, F-factor 1.000 and reference F .3320 \*

age	absolute F	catch in numbers	catch in weight	stock size	stock biomass	at 1 January		at spawning time	
						sp.stock size	sp.stock biomass	sp.stock size	sp.stock biomass
1	.1100	360.70	2251.5	4186.00	19938.6	2511.60	11963.1	2048.12	9755.5
2	.2600	533.52	7646.2	2803.11	38446.9	2803.11	38446.9	2152.72	29526.2
3	.3500	394.01	6397.5	1600.17	24945.8	1600.17	24945.8	1185.44	18480.3
4	.3900	67.25	1205.5	249.41	4324.0	249.41	4324.0	181.83	3152.4
5	.5500	56.08	1037.7	157.94	2808.8	157.94	2808.8	108.01	1920.8
6+	.5500	141.43	2642.4	398.34	7402.9	398.34	7402.9	272.41	5062.6
Total		1552.98	21180.7	9394.98	97867.0	7720.58	89891.5	5948.52	67897.9

.....  
 \* Year 1991, F-factor 1.000 and reference F .3320 \*

age	absolute F	catch in numbers	catch in weight	stock size	stock biomass	at 1 January		at spawning time	
						sp.stock size	sp.stock biomass	sp.stock size	sp.stock biomass
1	.1100	360.70	2251.5	4186.00	19938.6	2511.60	11963.1	2048.12	9755.5
2	.2600	478.43	6856.7	2513.67	34477.0	2513.67	34477.0	1930.44	26477.4
3	.3500	356.73	5792.2	1448.79	22585.9	1448.79	22585.9	1073.29	16732.1
4	.3900	203.80	3653.3	755.87	13104.4	755.87	13104.4	551.07	9553.9
5	.5500	40.19	743.7	113.19	2013.1	113.19	2013.1	77.41	1376.6
6+	.5500	76.38	1427.1	215.14	3998.1	215.14	3998.1	147.12	2734.2
Total		1516.23	20724.6	9232.66	96117.1	7558.26	88141.6	5827.45	66629.7

Table 4.2.10

Effects of different levels of fishing mortality on catch, stock biomass and spawning stock biomass.

PREDICTION SPRAT 22T0 25

Year 1989					Year 1990					Year 1991		
fac- tor	ref. F	stock biomass	sp.stock biomass	catch	fac- tor	ref. F	stock biomass	sp.stock biomass	catch	stock biomass	sp.stock biomass	
1.0	.33	98	67	22	.0	.00	98	77	0	116	92	
					.1	.03		76	2	114	89	
					.2	.07		75	5	112	86	
					.4	.13		73	9	107	81	
					.6	.20		71	13	103	76	
					.8	.27		70	17	100	71	
					1.0	.33		68	21	96	67	
					1.2	.40		66	25	93	63	
					1.4	.46		65	28	90	59	
					1.6	.53		63	31	87	56	
					1.8	.60		62	34	84	53	
					2.0	.66		60	37	81	50	

The data unit of the biomass and the catch is 1000 tonnes.

The spawning stock biomass is given for the time of spawning.

The spawning stock biomass for 1991 has been calculated with the same fishing mortality as for 1990.

The reference F is the mean F for the age group range from 1 to 5

Table 4.3.1 VIRTUAL POPULATION ANALYSIS

SPRAT IN FISHING AREAS 26 AND 28

CATCH IN NUMBERS	UNIT: millions									
	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
0	90	29	17	8	84	9	24	9	0	70
1	706	146	1400	117	1029	539	227	198	525	34
2	188	940	219	1605	95	1805	1163	645	265	2245
3	696	139	162	192	110	226	1850	934	866	540
4	926	318	45	121	26	277	321	1351	1236	666
5	77	509	42	39	8	50	149	210	1205	462
6	64	25	121	28	2	27	14	97	127	428
7	84	27	6	18	3	4	7	7	80	17
8 <sup>1</sup>	33	51	25	14	7	16	4	11	25	21
TOTAL	2814	2184	2031	2141	1364	2951	3758	3462	4329	4483

Table 4.3.2 SUM OF PRODUCTS CHECK

SPRAT IN FISHING AREAS 26 AND 28  
 CATEGORY: TOTAL

	MEAN WEIGHT AT AGE IN THE CATCH										UNIT: gram
	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	
0	4.000	4.000	4.000	4.000	4.700	3.700	4.190	4.400	4.300	3.740	
1	6.000	6.000	6.000	5.700	9.000	8.000	8.170	5.500	8.200	5.750	
2	10.000	10.000	11.800	10.400	12.800	10.300	10.130	10.600	11.200	9.860	
3	12.000	12.000	15.000	14.200	14.500	13.100	11.980	11.900	12.600	12.150	
4	13.000	13.000	16.500	15.300	16.600	14.500	12.890	13.300	13.800	13.860	
5	14.000	14.000	16.700	16.000	17.200	14.900	16.100	13.900	14.600	14.570	
6	16.000	16.000	16.200	15.600	16.800	16.200	18.350	15.900	15.800	14.520	
7	17.000	17.000	17.600	18.000	17.700	17.500	19.370	16.600	17.000	16.160	
8	18.000	18.000	18.000	19.400	18.200	18.300	18.810	17.000	18.100	17.020	

Table 4.3.3. VIRTUAL POPULATION ANALYSIS

SPRAT IN FISHING AREAS 26 AND 28

MEAN WEIGHT AT AGE OF THE STOCK

UNIT: gram

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
0	4.000	4.000	4.000	3.000	4.000	3.600	4.190	4.400	4.310	3.740
1	6.000	6.000	6.000	6.000	4.100	3.800	8.170	5.500	4.610	5.750
2	17.000	12.000	10.000	10.000	11.600	9.100	10.130	10.600	11.200	9.860
3	15.000	15.000	12.000	13.400	13.800	12.200	11.980	11.900	12.800	12.150
4	16.000	16.000	13.000	15.000	15.500	14.100	12.890	13.300	14.100	13.860
5	17.000	17.000	14.000	16.400	16.000	14.600	16.100	13.900	14.600	14.570
6	17.000	17.000	16.000	17.000	17.000	16.600	18.350	15.900	15.600	14.520
7	18.000	18.000	17.000	18.000	17.100	17.500	19.370	16.600	17.000	16.160
8*	18.000	18.000	20.000	19.800	18.000	18.300	18.810	17.000	18.000	17.020



Table 4.3.4.

SUM OF PRODUCTS CHECK

SERIAL IN FISHING AREAS 26 AND 28  
CATEGORY: TOTAL

CATCH WEIGHT AND SUP CHECK

SUM OF PRODUCTS UNIT: tonnes  
NOMINAL CATCH UNIT: tonnes

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
0	162	117	47	33	395	33	99	40	0	263
1	4237	877	8397	665	9261	4309	1852	1089	4303	193
2	380	9404	2589	16691	1216	13590	11786	6834	2968	22136
3	8557	1677	7427	2719	1595	2954	22165	11115	10913	6561
4	1062	4133	749	1847	432	4017	4136	17965	17054	9235
5	1072	7123	701	626	138	739	2396	2922	17594	6731
6	1624	392	1960	436	34	429	255	1549	2008	6215
7	1426	456	97	324	53	74	134	111	1357	274
8	67	1027	445	272	127	295	77	132	449	363
9	5092	25196	17717	23612	14250	31439	42899	41607	56646	51969
10	0	25529	11110	3508	13476	31149	42973	41962	56646	51853
11	0	101	102	100	102	99	100	100	100	100

Table 4.3.5 Sprat in Sub-divisions 26 and 28.  
Tuning data file.

BALTIC SPRAT Tuning Data: Acoustical Surveys  
102  
Internat. Surveys 24-29  
1984, 1988  
1, 1  
2, 8  
1, 17621, 4897, 3547, 711, 110, 79, 91  
1, 9949, 9626, 2110, 535, 54, 9, 23  
1, 1393, 4174, 2639, 355, 33, 4, 26  
1, 891, 4128, 3258, 509, 73, 8, 3  
1, 7327, 1369, 1927, 511, 69, 9, 1  
USSR Surveys 26+28  
1984, 1988  
1, 1  
2, 8  
1, 21087, 2066, 1938, 501, 166, 20, 69  
1, 16531, 12765, 981, 441, 61, 0, 0  
1, 9752, 7748, 7174, 663, 357, 37, 58  
1, 5604, 5351, 5283, 4693, 107, 175, 19  
1, 23035, 2246, 2992, 2489, 2341, 110, 81

**Table 4.3.6** Sprat in Sub-divisions 26 and 28. Assessment 1.  
Tuning run.

Module run at 15.19.52 14 APRIL 1989

DISAGGREGATED 0s

LOG TRANSFORMATION

NO explanatory variate (Mean used)

Fleet 1 ,Internat. Surveys 24, has terminal q estimated as the mean

Fleet 2 ,USSR Surveys 26+28 , has terminal q estimated as the mean

FLEETS COMBINED BY \*\* VARIANCE \*\*

Regression weights

, 1.000, 1.000, 1.000, 1.000, 1.000,

Oldest age F = 1.000' average of 5 younger ages. Fleets combined by variance of predictions

Fishing mortalities

Age,	84,	85,	86,	87,	88,
1,	.021,	.012,	.024,	.013,	.070,
2,	.058,	.080,	.058,	.055,	.094,
3,	.091,	.105,	.117,	.142,	.210,
4,	.129,	.252,	.143,	.312,	.215,
5,	.302,	.130,	.368,	.255,	.257,
6,	.278,	.179,	.162,	.579,	.187,
7,	.172,	.149,	.170,	.269,	.193,

Log catchability estimates

Age 2 Fleet,	84,	85,	86,	87,	88
1,	-.58,	-.38,	-2.07,	-1.68,	-1.18
2,	-.40,	.13,	-.12,	.16,	-.04

SUMMARY STATISTICS						
Fleet	Pred.	SE(q)	Partial, Raised,	SLOPE	SE	INTRCPT, SE
q	F	F	F	Slope	Intrcpt	Intrcpt
1	-.18	.785	.3079	.0944	.000E+00	.000E+00, -1.178, .320
2	-.05	.245	.9471	.0923	.000E+00	.000E+00, -.054, .100
Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio		
.092	.234	.624E-02	.234	.001		

Age 3 Fleet,	84,	85,	86,	87,	88
1,	.68,	-.60,	-.65,	-.39,	-.63
2,	-.18,	-.32,	-.03,	-.13,	-.13

SUMMARY STATISTICS						
Fleet	Pred.	SE(q)	Partial, Raised,	SLOPE	SE	INTRCPT, SE
q	F	F	F	Slope	Intrcpt	Intrcpt
1	-.32	.623	.7283	.2873	.000E+00	.000E+00, -.317, .254
2	-.16	.115	.8534	.2052	.000E+00	.000E+00, -.159, .047
Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio		
.207	.113	.600E-01	.113	.282		

Age 4 Fleet,	84,	85,	86,	87,	88
1,	.50,	.50,	-1.27,	-.19,	-.48
2,	-.11,	-.26,	-.27,	.29,	-.04

SUMMARY STATISTICS						
Fleet	Pred.	SE(q)	Partial, Raised,	SLOPE	SE	INTRCPT, SE
q	F	F	F	Slope	Intrcpt	Intrcpt
1	-.19	.815	.8284	.2865	.000E+00	.000E+00, -.188, .333
2	-.08	.250	.9253	.2061	.000E+00	.000E+00, -.078, .102
Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio		
.212	.239	.925E-01	.239	.149		

cont'd.

Table 4.3.6 cont'd.

Age 5 Fleet,	84,	85,	86,	87,	88
1 ,	1.47,	-.76,	-.48,	-2.23,	-1.26
2 ,	1.12,	-.96,	.15,	-.01,	.32

SUMMARY STATISTICS								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
, q	, F	, F	, F	, F	, Slope	, Slope	, Intrcpt	, Intrcpt
1	-.65	1.488	.5210	.4710	.000E+00	.000E+00	-.652	.607
2	.13	.814	1.1334	.2104	.000E+00	.000E+00	.125	.332
Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio				
.253	.714	.339	.714	.226				

Age 6 Fleet,	84,	85,	86,	87,	88
1 ,	.14,	-.36,	-2.91,	-1.10,	-3.50
2 ,	.56,	-.24,	-.52,	-.72,	.02

SUMMARY STATISTICS								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
, q	, F	, F	, F	, F	, Slope	, Slope	, Intrcpt	, Intrcpt
1	-1.55	1.742	.2133	1.3232	.000E+00	.000E+00	-1.545	.711
2	-.18	.547	.8346	.1526	.000E+00	.000E+00	-.181	.223
Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio				
.185	.522	.617	.617	1.399				

**Table 4.3.7 Assessment 1**

Title : SPRAT IN FISHING AREAS 26 AND 28  
 At 15.36.34 16 APRIL 1989  
 from 70 to 88 on ages 1 to 7  
 with Terminal F of .200 on age 4 and Terminal S of 1.250

Initial sum of squared residuals was 117.581 and  
 Final sum of squared residuals is 27.740 after 111 iterations

Matrix of Residuals

Years	70/71	71/72	72/73	73/74	74/75	75/76	76/77	77/78				
Ages												
1/ 2	-.773	-.545	.101	-.589	1.221	-.235	-.050	.145				
2/ 3	-1.354	-.851	-.947	-.879	-.490	-.475	.323	-.269				
3/ 4	-.373	-.150	-.090	-.076	-.116	-.174	-.172	-.138				
4/ 5	-.509	-.232	-.177	.206	-.055	-.078	.012	-.240				
5/ 6	.893	.676	.909	.001	-.065	.094	.159	-.193				
6/ 7	1.019	.489	.294	.015	-.116	-.215	-.011	.909				
	.000	.000	.000	.000	.000	.000	.000	.000				
WTS	.001	.001	.001	.001	.001	.001	.001	.001				
Years	78/79	79/80	80/81	81/82	82/83	83/84	84/85	85/86	86/87	87/88	WTS	
Ages												
1/ 2	-.153	.420	-.478	.603	-1.020	1.165	-.119	-.365	.686	-.952	.000	.322
2/ 3	.520	.143	.851	.089	.703	.147	-.104	.170	-.053	-.949	.000	.333
3/ 4	.123	.430	.071	-.154	-.004	.091	-.443	.256	-.059	.004	.000	1.000
4/ 5	-.045	-.381	.358	-.496	.240	-.018	.115	-.050	-.085	.295	.000	.845
5/ 6	.312	-.119	-.501	-.425	.324	-.692	.625	-.189	.160	.195	.000	.470
6/ 7	-1.095	-.722	-.823	.742	-.790	-.538	.383	-.198	-.453	.854	.000	.325
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.066	
WTS	.001	.001	.001	1.000	1.000	1.000	1.000	1.000	1.000	1.000		
<b>Fishing Mortalities (F)</b>												
F-values	70	71	72	73	74	75	76	77	78			
	.2539	.3502	.4928	.5241	.6813	.5725	.5322	.7522	1.0545			
F-values	79	80	81	82	83	84	85	86	87	88		
	.7288	.8352	.4162	.4600	.0675	.1892	.1817	.1794	.2406	.2000		
<b>Selection-at-age (S)</b>												
S-values	1	2	3	4	5	6	7					
	.0946	.3230	.5544	1.0000	1.2741	1.4752	1.2500					

Table 4.3.8 VIRTUAL POPULATION ANALYSIS (Assessment 1)

SPRAT IN FISHING AREAS 26 AND 28

FISHING MORTALITY COEFFICIENT      UNIT: Year-1      NATURAL MORTALITY COEFFICIENT = .50

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	.01	.02	.02	.06	.12	.08	.06	.13	.08	.18	.06	.12
2	.02	.05	.06	.07	.15	.10	.20	.29	.63	.23	.56	.16
3	.21	.15	.27	.27	.36	.33	.23	.34	.53	.57	.38	.24
4	.22	.38	.43	.59	.68	.61	.46	.64	.90	.52	.84	.29
5	.64	.71	1.03	.67	.82	.78	.85	.71	1.39	.69	.92	.35
6	.61	.51	.73	.61	1.02	.81	.79	1.56	.99	.73	.73	.90
7	.32	.27	.32	.45	.52	.89	.83	.96	.83	1.48	1.31	.52
8+	.32	.27	.32	.45	.52	.89	.83	.96	.83	1.48	1.31	.52
( 2- 6)U	.34	.36	.50	.44	.60	.53	.51	.71	.89	.55	.69	.39
	1982	1983	1984	1985	1986	1987	1988	1979-86				
1	.01	.02	.02	.01	.02	.01	.02	.06				
2	.26	.02	.06	.07	.06	.04	.10	.18				
3	.30	.04	.08	.12	.10	.14	.15	.23				
4	.41	.08	.16	.22	.16	.27	.21	.34				
5	.62	.06	.30	.17	.32	.29	.21	.43				
6	.59	.08	.39	.18	.22	.46	.22	.48				
7	.46	.16	.32	.23	.17	.39	.14	.58				
8+	.46	.16	.32	.23	.17	.39	.14	.58				
( 2- 6)U	.44	.05	.20	.15	.17	.24	.18					

Table 4.3.9 VIRTUAL POPULATION ANALYSIS (Assessment 1)

SPRAT IN FISHING AREAS 26 AND 28

STOCK SIZE IN NUMBERS UNIT: millions

BIOMASS TOTALS UNIT: tonnes

ALL VALUES, EXCEPT THOSE REFERRING TO THE SPAWNING STOCK ARE GIVEN FOR 1 JANUARY; THE SPAWNING STOCK DATA REFLECT THE STOCK SITUATION AT SPAWNING TIME, WHEREBY THE FOLLOWING VALUES ARE USED: PROPORTION OF ANNUAL F BEFORE SPAWNING: .500  
PROPORTION OF ANNUAL M BEFORE SPAWNING: .500

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	37612	21903	30051	39065	21949	6440	30573	11657	2059	5364	3198	16095
2	22798	22696	12982	17816	22290	11859	3616	17545	6202	1147	2713	1827
3	27648	13586	13092	7406	10068	11677	6529	1798	7987	1995	552	937
4	6118	13560	7068	6035	3425	4274	5074	3146	774	2856	686	229
5	2444	2970	5616	2787	2023	1056	1410	1942	1003	190	1033	179
6	987	778	882	1220	862	542	294	364	577	152	58	249
7	274	326	285	258	403	188	146	81	47	130	44	17
8+	75	132	108	114	52	44	83	172	58	51	84	76
TOTAL NO	97954	75951	70084	74700	61073	36080	47724	36705	18706	11886	8369	19610
SPS NO	39002	33855	24036	21058	22284	17706	10572	13146	8517	3739	2493	2080
TOT. BIOM	1076441	896476	763104	730635	662240	455824	439031	401555	247706	130650	91865	137369
SPS BIOM	554288	482871	349891	294420	303582	250268	158081	175069	121709	56588	35386	24292
	1982	1983	1984	1985	1986	1987	1988	1989	1979-86			
1	10137	62950	36210	24364	14413	49268	2272	0	21591			
2	8689	6059	37388	21548	14603	8590	29478	1352	11747			
3	940	4047	3602	21290	12175	8362	5006	16157	5692			
4	445	424	2370	2011	11494	6668	4408	2623	2564			
5	104	179	237	1225	975	5937	3102	2164	515			
6	77	34	102	106	629	431	2683	1529	176			
7	61	26	19	42	54	307	166	1301	49			
8+	48	60	73	25	86	95	208	197	63			
TOTAL NO	20501	73778	80002	70611	54429	79658	47323					
SPS NO	5532	7140	25841	30191	26747	20053	27397					
TOT. BIOM	172048	395752	562020	721265	557730	624726	516011					
SPS BIOM	60163	91983	253929	344918	322625	263803	311587					

Table 4.3.10 Assessment 1

-----  
 List of input variables for the ICES prediction program.

SPRAT SD 26+28. ASSESSMENT BASED ON AD HOC TUNING WITH 140 ACOUSTIC SURVEYS.  
 The reference F is the mean F for the age group range from 2 to 6

The number of recruits per year is as follows:

Year	Recruitment
1989	47760.0
1990	21600.0
1991	21600.0

Proportion of F (fishing mortality) effective before spawning: .5000  
 Proportion of M (natural mortality) effective before spawning: .5000

Data are printed in the following units:

Number of fish: millions  
 Weight by age group in the catch: gram  
 Weight by age group in the stock: gram  
 Stock biomass: tonnes  
 Catch weight: tonnes

age	stock size	fishing pattern	natural mortality	maturity ogive	weight in the catch	weight in the stock
1	47760.0	.02	.50	.00	6.905	6.007
2	1352.0	.10	.50	.75	10.448	10.448
3	16157.0	.15	.50	1.00	12.157	12.207
4	2623.0	.21	.50	1.00	13.462	13.538
5	2164.0	.21	.50	1.00	14.792	14.792
6	1529.0	.22	.50	1.00	16.143	16.092
7	1301.0	.14	.50	1.00	17.283	17.283
8+	197.0	.14	.50	1.00	17.732	17.708



Table 4.3.11 Assessment 1

Effects of different levels of fishing mortality on catch, stock biomass and spawning stock biomass.

SPRAT SD 26+28. ASSESSMENT BASED ON AD HOC TUNING WITH TWO ACOUSTIC SURVEYS.

Year 1989					Year 1990					Year 1991	
fac- tor	ref. F	stock biomass	sp.stock biomass	catch	fac- tor	ref. F	stock biomass	sp.stock biomass	catch	stock biomass	sp.stock biomass
1.0	.18	616	234	45	.0	.00	613	318	0	599	339
					.1	.02		316	5	594	333
					.2	.04		314	11	589	326
					.4	.07		309	21	580	315
					.6	.11		305	31	571	304
					.8	.14		301	41	563	293
					1.0	.18		296	51	554	283
					1.2	.21		292	60	546	273
					1.4	.25		288	70	538	263
					1.6	.28		284	79	530	254
					1.8	.32		280	87	523	246
					2.0	.36		276	96	516	238

The data unit of the biomass and the catch is 1000 tonnes.

The spawning stock biomass is given for the time of spawning.

The spawning stock biomass for 1991 has been calculated with the same fishing mortality as for 1990.

The reference F is the mean F for the age group range from 2 to 6

Table 4.3.12 Detailed Prediction for SPRAT in Sub-divisions 26 and 28. Assessment 1.

## Results

09.58.35 20 April 1989

SPRAT SD 26+28. ASSESSM BASED ON AD HOC TUNING WITH TWO SURVEYS

```
*****
* Year 1939. F-factor 1.000 and reference F .1780 *
*****
```

age	absolute F	catch in numbers	catch in weight	stock size	stock biomass	at 1 January		at spawning time	
						sp.stock size	sp.stock biomass	sp.stock size	sp.stock biomass
1	.0200	744.83	5145.1	47760.6	286918	.0	.0	.0	.0
2	.1000	101.67	1062.2	1352.0	14125	1014.0	10593	751.2	7848
3	.1500	1782.07	21665.5	16157.0	197236	16157.0	197236	11673.9	142508
4	.2100	394.39	5509.5	2625.0	35508	2623.0	35508	1839.2	24897
5	.2100	325.38	4813.1	2164.0	32010	2164.0	32010	1517.3	22445
6	.2200	239.79	3870.8	1529.0	24605	1529.0	24605	1066.7	17166
7	.1400	134.53	2325.0	1301.0	22484	1301.0	22484	944.7	16327
8+	.1400	20.37	361.2	197.0	3498	197.0	3498	143.1	2533
Total		3745.03	46550.4	73083.0	616377	24985.0	325928	17936.1	233726

```
*****
* Year 1970. F-factor 1.000 and reference F .1780 *
*****
```

age	absolute F	catch in numbers	catch in weight	stock size	stock biomass	at 1 January		at spawning time	
						sp.stock size	sp.stock biomass	sp.stock size	sp.stock biomass
1	.0200	536.86	2326.0	21600.0	129762	.0	.0	.0	.0
2	.1000	2135.20	22307.5	28394.3	296649	21295.7	222437	15776.3	164822
3	.1500	81.84	995.0	742.0	9057	742.0	9057	536.1	6544
4	.2100	1268.23	17035.6	8434.7	114784	8434.7	114784	5914.2	80063
5	.2100	193.90	2668.3	1289.6	19076	1289.6	19076	904.2	13375
6	.2200	166.85	2693.4	1063.9	17121	1063.9	17121	742.3	11944
7	.1400	76.96	1350.0	744.2	12862	744.2	12862	540.4	9340
8+	.1400	81.68	1448.4	789.9	13986	789.9	13986	573.6	10156
Total		4361.51	51042.0	63058.6	612700	34360.0	408776	24987.1	296247

```
*****
* Year 1971. F-factor 1.000 and reference F .1780 *
*****
```

age	absolute F	catch in numbers	catch in weight	stock size	stock biomass	at 1 January		at spawning time	
						sp.stock size	sp.stock biomass	sp.stock size	sp.stock biomass
1	.0200	336.86	2326.0	21600.0	129762	.0	.0	.0	.0
2	.1000	965.67	10088.8	12841.6	134163	9631.2	100622	7135.0	74542
3	.1500	1718.77	20896.0	15583.1	190230	15583.1	190230	11259.2	137447
4	.2100	58.24	784.1	387.4	5243	387.4	5243	271.6	3676
5	.2100	623.52	9225.4	4146.9	61342	4146.9	61342	2907.7	43011
6	.2200	99.43	1605.0	634.0	10202	634.0	10202	442.3	7118
7	.1400	53.55	925.5	517.9	8949	517.9	8949	376.0	6499
8+	.1400	83.65	1483.3	808.9	14324	808.9	14324	587.4	10401
Total		5939.69	47332.1	56519.8	554219	31709.4	390916	22979.3	282697

**Table 4.3.13** VIRTUAL POPULATION ANALYSIS (Assessment 2)

SPRAT IN FISHING AREAS 26 AND 28

NATURAL MORTALITY COEFFICIENT UNIT: Year<sup>-1</sup>

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
0	.500	.500	.500	.500	.500	.500	.550	.550	.400	.500
1	.500	.500	.500	.500	.500	.500	.500	.500	.400	.480
2	.500	.500	.500	.500	.500	.450	.400	.350	.400	.340
3	.500	.500	.500	.500	.500	.300	.300	.250	.310	.260
4	.500	.500	.500	.500	.500	.300	.300	.190	.370	.240
5	.500	.500	.500	.500	.500	.350	.350	.200	.310	.290
6	.500	.500	.500	.500	.500	.400	.350	.300	.350	.350
7	.500	.500	.500	.500	.500	.400	.400	.350	.400	.390
8)	.500	.500	.500	.500	.500	.400	.400	.400	.400	.490

Table 4.3.14 VIRTUAL POPULATION ANALYSIS (Assessment 2)

SPRAT IN FISHING AREAS 26 AND 28

	FISHING MORTALITY COEFFICIENT					UNIT: Year <sup>-1</sup>		VARIABLE NATURAL MORTALITY COEFFICIENT				
	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1979-86	
0	.010	.001	.002	.000	.003	.001	.003	.000	.000	.001	.003	
1	.158	.064	.125	.026	.038	.033	.023	.042	.020	.013	.064	
2	.164	.462	.176	.287	.039	.115	.120	.108	.095	.130	.184	
3	.348	.290	.185	.322	.039	.154	.202	.154	.239	.330	.206	
4	.569	.375	.161	.285	.090	.161	.384	.235	.352	.320	.280	
5	.961	1.046	.106	.284	.037	.320	.139	.503	.359	.250	.365	
6	.419	.496	1.767	.129	.028	.218	.164	.146	.718	.240	.333	
7	.300	.303	.200	1.060	.025	.100	.100	.130	.200	.230	.282	
8+	.406	.300	.200	1.000	.025	.100	.100	.130	.200	.230	.282	
(2)	.000	.372	.505	.379	.262	.047	.194	.207	.229	.353	.254	
(3)	.000	.464	.504	.223	.286	.041	.125	.169	.172	.280	.178	

**Table 4.3.15** VIRTUAL POPULATION ANALYSIS (Assessment 2)

SPRAT IN FISHING AREAS 26 AND 28

STOCK SIZE IN NUMBERS UNIT: millions

BIOMASS TOTALS UNIT: tonnes

ALL VALUES, EXCEPT THOSE REFERRING TO THE SPANNING STOCK ARE GIVEN FOR 1 JANUARY; THE SPANNING STOCK DATA REFLECT THE STOCK SITUATION AT SPANNING TIME, WHEREBY THE FOLLOWING VALUES ARE USED: PROPORTION OF ANNUAL F BEFORE SPANNING: .500  
PROPORTION OF ANNUAL M BEFORE SPANNING: .500

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1979-86
0	3016	2698	8728	57880	34966	20720	10617	57080	4873	68749	0	27488
1	6116	3011	15079	5295	35100	21143	12560	6108	32925	3266	41644	13050
2	1571	3169	1714	8073	3116	20497	12409	7444	3552	21644	1995	7249
3	2969	309	1411	872	3674	1817	11647	7376	4709	2166	13528	3797
4	2724	1771	304	611	383	2144	1153	7049	4925	2719	1701	1985
5	256	955	530	198	278	212	1351	582	4608	2391	1553	545
6	294	94	201	289	91	163	109	829	288	2361	1394	259
7	318	130	38	35	154	53	88	65	531	99	1309	110
84	134	247	172	27	360	265	52	106	165	130	111	162
TOTAL 00	19381	2634	28029	73269	78121	66954	49986	86638	56575	103526		
20% 80	3632	3011	2575	5449	5554	15210	18306	17322	13073	70248		
101.8108	130963	212787	176811	316246	391661	404329	453626	569374	426035	626757		
52% 8168	76003	52022	52311	61109	75445	158952	212457	213075	177162	229456		

Table 4.3.16 (Assessment 2)

List of input variables for the ICES prediction program.

SPRAT 26 AND 28

The reference F is the mean F for the age group range from 2 to 6

The number of recruits per year is as follows:

Year	Recruitment
1989	27488.0
1990	27488.0
1991	27488.0

Proportion of F (fishing mortality) effective before spawning: .5000

Proportion of M (natural mortality) effective before spawning: .5000

Data are printed in the following units:

Number of fish: millions  
 Weight by age group in the catch: gram  
 Weight by age group in the stock: gram  
 Stock biomass: tonnes  
 Catch weight: tonnes

age	stock size	fishing pattern	natural mortality	maturity ogive	weight in the catch	weight in the stock
0	27488.0	.00	.50	.00	4.103	3.924
1	41644.0	.01	.48	.00	6.832	5.593
2	1995.0	.13	.39	.75	10.709	10.649
3	13528.0	.33	.28	1.00	12.943	13.023
4	1201.0	.32	.28	1.00	14.275	14.375
5	1553.0	.25	.30	1.00	15.197	15.417
6	1394.0	.24	.35	1.00	16.157	16.497
7	1309.0	.23	.39	1.00	17.393	17.473
8+	111.0	.23	.42	1.00	18.483	18.293



Table 4.3.18

Effects of different levels of fishing mortality on catch, stock biomass and spawning stock biomass.

SPRAT 26&28 ASSESSMENT 2

Year 1989					Year 1990					Year 1991		
fac- tor	ref. F	stock biomass	sp.stock biomass	catch	fac- tor	ref. F	stock biomass	sp.stock biomass	catch	stock biomass	sp.stock biomass	
1.0	.25	627	208	65	.0	.00	645	316	0	671	379	
					.1	.03		313	7	664	368	
					.2	.05		310	15	658	357	
					.4	.10		303	29	644	337	
					.6	.15		297	42	631	318	
					.8	.20		291	55	619	300	
					1.0	.25		285	67	608	284	
					1.2	.30		279	79	596	268	
					1.4	.36		274	90	586	254	
					1.6	.41		268	101	575	240	
					1.8	.46		263	112	566	228	
					2.0	.51		258	122	556	216	

The data unit of the biomass and the catch is 1000 tonnes.

The spawning stock biomass is given for the time of spawning.

The spawning stock biomass for 1991 has been calculated with the same fishing mortality as for 1990.

The reference F is the mean F for the age group range from 2 to 6



Table 4.3.19 Sprat in Sub-divisions 26 and 28. Assessment 2. Detailed output for prediction.

## Results

17.37.13 02 MAY 1989  
SPRAI 26&28 ASSESSMENT 2

Year 1989. F-factor 1.000 and reference F .2540

age	at 1 January		at spawning time						
	absolute F	catch in numbers	catch in weight	stock size	stock biomass	sp.stock size	sp.stock biomass	sp.stock size	sp.stock biomass
0+	.0010	21.62	85.7	27488.0	107862	.0	.0	.0	.0
1+	.0130	427.90	2020.0	41644.9	232074	.0	.0	.0	.0
2+	.1400	382.13	2165.7	1995.0	7274	1496.2	15933	1153.7	12285
3+	.3300	3341.95	43254.9	13528.0	176175	1528.0	176175	9971.8	129862
4+	.3200	285.90	4125.5	1201.0	17264	1201.0	17264	809.7	12789
5+	.2500	786.84	4536.4	1781.0	23047	1573.0	23942	1179.6	18188
6+	.2400	292.72	4081.2	1394.0	22996	1394.0	22996	1037.9	17121
7+	.2300	224.37	3962.5	1309.0	22872	1309.0	22872	850.1	16775
8+	.2300	18.77	347.0	111.0	2030	111.0	2030	80.2	1467
Total		5076.71	65425.8	96223.0	627304	20592.2	281215	15273.0	208488

Year 1990. F-factor 1.000 and reference F .2540

age	at 1 January		at spawning time						
	absolute F	catch in numbers	catch in weight	stock size	stock biomass	sp.stock size	sp.stock biomass	sp.stock size	sp.stock biomass
0+	.0010	21.82	88.7	27488.0	107862	.0	.0	.0	.0
1+	.0130	170.94	167.9	1595.6	93155	.0	.0	.0	.0
2+	.1300	2578.42	2737.3	25435.8	270865	10076.0	203149	14709.2	156638
3+	.3300	293.01	3792.4	1486.1	15446	1136.1	15446	874.3	11385
4+	.3200	1768.77	25249.2	7350.5	105662	7350.5	105662	5445.3	78276
5+	.2500	126.75	1926.2	659.1	13161	659.1	10161	500.7	7718
6+	.2400	162.44	2624.5	896.0	14781	896.0	14781	667.1	11005
7+	.2300	132.45	2303.7	772.7	13501	772.7	13501	566.8	9902
8+	.2300	128.89	2382.3	762.1	13941	762.1	13941	550.6	10073
Total		5383.28	67147.1	81205.9	65379	30703.3	376644	23314.0	285001

Year 1991. F-factor 1.000 and reference F .2540

age	at 1 January		at spawning time						
	absolute F	catch in numbers	catch in weight	stock size	stock biomass	sp.stock size	sp.stock biomass	sp.stock size	sp.stock biomass
0+	.0010	21.62	89.7	27488.0	107862	.0	.0	.0	.0
1+	.0130	170.94	1167.9	16955.6	93155	.0	.0	.0	.0
2+	.1300	1031.25	11043.6	10173.1	108335	7629.8	81250	5883.0	62648
3+	.3300	3735.75	48351.9	15172.1	136835	15172.1	136835	11146.9	145165
4+	.3200	155.09	2713.7	644.5	5763	644.5	9263	477.4	6862
5+	.2500	775.72	11780.7	4034.0	62192	4034.0	62192	3064.1	47239
6+	.2400	68.94	1113.9	380.3	8273	380.3	6773	283.1	4670
7+	.2300	35.13	1389.7	496.7	8679	496.7	8679	364.3	6353
8+	.2300	137.59	7343.1	813.5	14882	813.5	14882	557.9	10752
Total		6182.03	79792.2	75807.6	607572	29120.9	379475	21806.6	283704

Table 4.4.1 SUM OF PRODUCTS CHECK

SPRAT IN FISHING AREAS 27, 29-32  
CATEGORY: TOTAL

CATCH IN NUMBERS	UNIT: millions											
-----	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
0	15	9	104	101	22	0	2	66	12	3	3	9
1	940	249	592	2677	522	184	2232	283	54	76	109	448
2	633	1674	520	1049	3011	861	193	3262	246	45	127	230
3	3956	626	1695	617	864	2477	672	309	1877	126	58	120
4	257	3526	431	1085	381	555	1597	376	99	1273	102	20
5	82	184	3065	526	870	143	232	725	143	68	784	45
6	317	95	70	1617	350	552	119	91	334	63	25	402
7	0	356	23	151	1019	122	447	78	44	234	42	7
8	29	0	155	64	129	505	70	127	25	13	131	13
9	11	28	3	149	53	13	299	47	88	12	8	55
10+	13	36	25	78	82	8	15	129	49	60	50	12
TOTAL	6253	6783	6683	8114	7303	5420	5878	5493	2969	1971	1439	1361
	1982	1983	1984	1985	1986	1987	1988					
0	3	0	46	2	3	1	68					
1	35	127	131	175	22	166	4					
2	352	61	346	151	269	38	260					
3	83	183	58	316	83	224	35					
4	54	45	120	23	242	63	237					
5	8	33	19	93	16	170	53					
6	24	8	9	10	53	14	144					
7	230	16	5	11	9	49	11					
8	1	134	5	1	4	3	41					
9	4	2	58	2	1	3	4					
10+	31	16	8	51	26	26	33					
TOTAL	825	625	805	835	728	757	890					

Table 4.4.2 SUM OF PRODUCTS CHECK

SPRAT IN FISHING AREAS 27, 29-32

CATEGORY: TOTAL

MEAN WEIGHT AT AGE IN THE CATCH UNIT: gram

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
0	4.300	4.300	4.300	4.300	5.200	5.200	7.000	4.600	6.300	3.800	5.200	4.400
1	9.500	9.500	9.500	9.500	9.600	9.400	8.700	7.800	9.800	11.400	11.000	9.500
2	10.000	10.000	10.000	10.000	10.200	11.300	10.800	10.500	10.900	12.900	12.600	12.600
3	11.800	11.800	11.800	11.800	11.400	12.000	12.200	13.100	12.400	13.700	14.600	14.600
4	12.600	12.600	12.600	12.600	12.300	12.200	12.800	13.500	13.000	14.000	14.300	14.800
5	12.700	12.700	12.700	12.700	13.000	12.400	13.700	13.900	13.600	14.300	14.200	15.800
6	13.300	13.300	13.300	13.300	13.300	12.900	13.900	14.800	14.100	14.400	15.300	15.800
7	13.100	13.100	13.100	13.100	13.300	13.500	14.000	14.200	14.400	14.900	14.300	16.200
8	12.500	12.500	12.500	12.500	13.800	13.200	13.200	14.500	14.900	15.000	14.900	15.600
9	13.400	13.400	13.400	13.400	14.900	14.200	13.800	15.600	14.100	15.100	13.800	15.600
10+	12.600	12.600	12.600	12.600	13.300	12.300	14.200	14.400	14.500	15.000	15.000	14.000

	1982	1983	1984	1985	1986	1987	1988
0	3.600	3.000	3.600	1.000	3.200	.000	4.900
1	9.800	7.600	8.200	7.400	10.100	9.900	10.000
2	12.500	12.600	12.100	11.200	12.400	12.200	13.200
3	14.600	14.900	13.800	13.000	13.900	14.000	13.800
4	15.200	16.200	15.200	15.200	14.900	14.600	15.700
5	16.100	16.000	16.100	15.300	15.600	15.400	16.100
6	15.900	16.400	16.300	15.800	15.600	16.300	16.600
7	16.100	16.500	16.400	15.700	16.200	16.600	17.200
8	16.700	16.700	16.900	16.500	16.700	17.400	17.300
9	16.500	17.700	16.900	15.400	16.200	15.500	16.400
10+	16.200	17.100	16.700	15.600	16.300	16.500	16.800

Table 4.4.3 SUM OF PRODUCTS CHECK

SPRAT IN FISHING AREAS 27, 29-32  
CATEGORY: TOTAL

CATCH WEIGHT AND SOP CHECK

SUM OF PRODUCTS UNIT: tonnes  
NOMINAL CATCH UNIT: tonnes

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
0	65	39	447	434	114	0	14	304	75	10	16	40
1	8930	2366	5624	25432	5011	1730	19418	2207	524	864	1199	4260
2	6330	16740	5200	10490	30712	9729	2084	34251	2684	574	1600	2893
3	46681	7387	20001	7281	9850	29724	8198	4048	23269	1719	847	1745
4	3238	44428	5431	13671	4686	6771	20442	5076	1292	17818	1459	299
5	1041	2337	38926	6680	11310	1773	3178	10078	1942	971	11133	711
6	4216	1264	931	21506	4655	7121	1654	1347	4707	912	383	6352
7	0	4664	301	1978	13553	1647	6258	1108	639	3481	601	110
8	363	0	1938	800	1780	6666	924	1842	368	201	1952	207
9	147	375	40	1997	790	185	4126	733	1238	183	110	852
10+	169	457	319	983	1091	98	213	1858	703	900	750	174
A) SOP	71180	80055	79157	91251	83552	65444	66511	62850	37441	27632	20048	17643
B)NOMIN.	62676	73942	77457	84575	82283	67045	65901	59433	37718	30758	19765	17445
(B/A) %	88	92	98	93	98	102	99	95	101	111	99	99
	1982	1983	1984	1985	1986	1987	1988					
0	11	0	166	2	10	0	335					
1	343	965	1074	1295	222	1643	42					
2	4400	769	4187	1691	3336	464	3429					
3	1212	2727	800	4108	1154	3136	477					
4	821	729	1824	350	3606	920	3718					
5	129	528	306	1423	250	2618	857					
6	382	131	147	158	827	228	2389					
7	3703	264	82	173	146	813	182					
8	17	2238	85	17	67	52	713					
9	66	35	980	31	16	47	67					
10+	502	274	134	796	424	429	551					
A) SOP	11585	8660	9784	10042	10056	10350	12760					
B)NOMIN.	10952	8964	9922	10679	10430	10304	12787					
(B/A) %	95	104	101	106	104	100	100					

Table 4.4.4 VIRTUAL POPULATION ANALYSIS

SPRAT IN FISHING AREAS 27, 29-32 Run 1

FISHING MORTALITY COEFFICIENT	UNIT: Year-1										NATURAL MORTALITY COEFFICIENT =	.30
-----	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1983-87	
0	.002	.001	.010	.000	.000	.006	.002	.001	.007	.003	.003	
1	.077	.103	.109	.055	.020	.077	.034	.037	.046	.043	.043	
2	.174	.198	.366	.130	.143	.079	.133	.074	.092	.104	.104	
3	.261	.404	.326	.244	.103	.219	.107	.111	.090	.126	.126	
4	.263	.396	.268	.268	.226	.101	.141	.124	.129	.144	.144	
5	.583	.287	.342	.180	.292	.156	.117	.153	.134	.170	.170	
6	.409	.501	.262	.347	.308	.134	.128	.101	.217	.178	.178	
7	.348	.598	.275	.263	.465	.362	.269	.181	.141	.284	.284	
8	.279	.378	.433	.065	.270	.289	.126	.165	.094	.189	.189	
9	.300	.300	.300	.250	.200	.200	.200	.200	.200	.200	.200	
10+	.300	.300	.300	.250	.200	.200	.200	.200	.200	.200	.200	
( 2- 8)U	.331	.395	.324	.214	.258	.191	.146	.130	.128	.171		
( 2- 8)W	.279	.302	.301	.179	.159	.093	.117	.096	.110	.135		



Table 4.4.6 VIRTUAL POPULATION ANALYSIS

SPRAT IN FISHING AREAS 27, 29-32 Run 2

FISHING MORTALITY COEFFICIENT			UNIT: Year-1			NATURAL MORTALITY COEFFICIENT = .30						
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
0	.002	.001	.003	.014	.009	.000	.001	.100	.008	.002	.001	.009
1	.048	.050	.090	.122	.104	.110	.099	.178	.122	.070	.100	.117
2	.102	.125	.157	.254	.219	.279	.179	.228	.259	.157	.179	.351
3	.145	.154	.200	.316	.387	.316	.412	.545	.222	.228	.354	.285
4	.155	.208	.168	.212	.371	.524	.390	.485	.380	.258	.329	.223
5	.114	.177	.315	.356	.295	.259	.493	.346	.387	.552	.280	.264
6	.137	.208	.105	.306	.483	.347	.401	.413	.297	.333	.457	.254
7	.000	.251	.079	.386	.363	.347	.599	.571	.410	.395	.435	.241
8	.119	.000	.184	.366	.774	.347	.387	.380	.401	.233	.455	.267
9	.139	.180	.164	.303	.673	.176	.402	.556	.562	.395	.237	.393
10+	.139	.180	.164	.303	.673	.176	.402	.556	.562	.395	.237	.393
( 2- 8)U	.110	.160	.173	.314	.413	.346	.409	.424	.337	.308	.356	.269
( 2- 8)W	.137	.174	.232	.277	.283	.329	.396	.273	.245	.272	.289	.280
	1982	1983	1984	1985	1986	1987	1988	1979-86				
0	.000	.000	.007	.002	.001	.007	.003	.003				
1	.046	.021	.066	.036	.036	.040	.043	.061				
2	.141	.117	.081	.112	.080	.089	.091	.152				
3	.231	.112	.173	.110	.092	.098	.122	.198				
4	.225	.211	.111	.107	.129	.104	.158	.199				
5	.144	.233	.144	.131	.112	.139	.134	.232				
6	.245	.234	.102	.116	.114	.150	.187	.232				
7	.252	.288	.251	.194	.162	.163	.181	.277				
8	.056	.256	.152	.081	.111	.083	.224	.201				
9	.133	.168	.187	.093	.120	.127	.173	.216				
10+	.133	.168	.187	.093	.120	.127	.173	.216				
( 2- 8)U	.185	.207	.145	.122	.114	.118	.157					
( 2- 8)W	.181	.155	.095	.114	.099	.113	.130					

Table 4.4.7. VIRTUAL POPULATION ANALYSIS

SPRAT IN FISHING AREAS 27, 29-32												
STOCK SIZE IN NUMBERS      UNIT: millions												
-----												
BIOMASS TOTALS      UNIT: tonnes												
-----												
ALL VALUES, EXCEPT THOSE REFERING TO THE SPAWNING STOCK ARE GIVEN FOR 1 JANUARY; THE SPAWNING STOCK DATA REFLECT THE STOCK SITUATION AT SPAWNING TIME, WHEREBY THE FOLLOWING VALUES ARE USED: PROPORTION OF ANNUAL F BEFORE SPAWNING: .700												
PROPORTION OF ANNUAL S BEFORE SPAWNING: .500												
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	
0	7925	19728	68435	8311	2783	37017	1787	653	1767	1733	6338	1229
1	23325	5858	7940	26963	6693	2043	27423	2600	538	1275	1526	4693
2	7564	16474	4127	5375	17641	4067	1356	18466	1790	263	695	869
3	33766	5062	10774	2813	3668	10501	2296	650	10854	709	223	554
4	1958	21635	3215	6535	1411	1554	5672	1119	361	6441	418	116
5	887	1305	13619	2814	8915	721	681	2846	510	983	3687	223
6	2834	582	810	7037	1045	2160	413	368	1492	257	79	2064
7	47	1644	356	640	883	478	1131	295	151	821	136	37
8	299	31	1968	240	272	1977	270	660	46	74	410	65
9	98	196	23	655	2	93	1395	126	233	43	44	193
10+	119	254	194	343	191	57	82	124	211	273	44	
TOTAL NO	78930	83969	17948	60596	49400	60669	42956	27457	17356	12179	13829	10107
SPS NO	51259	40867	31945	32747	26077	18532	22855	18180	13093	8369	5717	5518
TOT. BIOM	811903	653537	637728	600709	429423	474000	421788	298295	205755	149478	134363	112373
SPS BIOM	577867	475134	378468	369591	293941	223152	242233	206755	163893	116243	78943	71392
	1982	1983	1984	1985	1986	1987	1988	1989	1979-86			
0	9514	3192	7731	972	6548	157	26428	0	4665			
1	903	7045	2365	5688	718	4848	115	19520	3664			
2	3093	639	5110	1640	4064	513	3449	82	2685			
3	464	1991	421	3490	1086	2780	348	2333	1117			
4	309	273	1318	262	2315	733	1668	226	1432			
5	69	184	164	874	175	1508	429	1182	695			
6	127	44	207	195	568	116	522	117	419			
7	1186	74	26	72	69	375	74	597	303			
8	21	683	41	15	44	41	236	16	169			
9	37	15	392	26	10	29	36	160	95			
10+	287	119	54	663	285	252	258	167	740			
TOTAL NO	16010	14258	17729	13806	15862	11355	34348					
SPS NO	4655	6625	6756	8601	7113	7756	8137					
TOT. BIOM	121074	123822	147932	137935	146112	140592	244168					
SPS BIOM	64129	76304	84999	99769	97555	103051	91286					



Table 4.4.8

List of input variables for the ICES prediction program.

SPRAT IN FISHING AREA 27

The reference F is the mean F for the age group range from 2 to 8

The number of recruits per year is as follows:

Year	Recruitment
1989	4665.0
1990	4665.0
1991	4665.0

Proportion of F (fishing mortality) effective before spawning: .2000  
 Proportion of M (natural mortality) effective before spawning: .3000

Data are printed in the following units:

Number of fish: millions  
 Weight by age group in the catch: gram  
 Weight by age group in the stock: gram  
 Stock biomass: tonnes  
 Catch weight: tonnes

age	stock size	fishing pattern	natural mortality	maturity ogive	weight in the catch	weight in the stock
0	4665.0	.00	.30	.00	3.270	3.270
1	19520.0	.04	.30	.50	9.490	9.490
2	82.0	.09	.30	.75	12.430	12.430
3	2333.0	.12	.30	1.00	14.090	14.090
4	228.0	.16	.30	1.00	15.010	15.010
5	1182.0	.13	.30	1.00	15.490	15.490
6	317.0	.19	.30	1.00	15.840	15.840
7	597.0	.18	.30	1.00	16.010	16.010
8	46.0	.22	.30	1.00	16.370	16.370
9	140.0	.17	.30	1.00	15.910	15.910
10+	167.0	.17	.30	1.00	15.920	15.920



Table 4.4.10 Sprat in Sub-divisions 27, 29-32. Short-term yield in detailed format.

\*\*\*\*\*  
 \* Year 1989, F-factor 1.000 and reference F .1567 \*  
 \*\*\*\*\*

age	at 1 January				at spawning time				
	absolute F	catch in numbers	catch in weight	stock size	stock biomass	sp.stock size	sp.stock biomass	sp.stock size	sp.stock biomass
0	.0030	12.07	39.5	4665.0	15254	.0	0	.0	0
1	.0430	710.55	6743.1	19520.0	185244	9760.0	92622	8843.6	83925
2	.0910	6.18	76.8	82.0	1019	61.5	764	55.2	686
3	.1220	232.20	3271.7	2333.0	32871	2333.0	32871	2080.8	29318
4	.1580	28.90	433.8	228.0	3422	228.0	3422	201.9	3030
5	.1340	128.49	1990.4	1182.0	18509	1182.0	18509	1051.7	16290
6	.1870	46.93	743.3	317.0	5021	317.0	5021	279.1	4420
7	.1810	85.78	1373.3	597.0	9557	597.0	9557	526.2	8424
8	.2240	8.02	131.3	46.0	753	46.0	753	40.2	658
9	.1730	19.30	307.0	140.0	2227	140.0	2227	123.6	1966
10+	.1730	23.02	366.5	167.0	2658	167.0	2658	147.4	2347
Total		1301.44	15476.7	29277.0	276340	14831.5	168208	13349.7	151068

\*\*\*\*\*  
 \* Year 1990, F-factor 1.000 and reference F .1567 \*  
 \*\*\*\*\*

age	at 1 January				at spawning time				
	absolute F	catch in numbers	catch in weight	stock size	stock biomass	sp.stock size	sp.stock biomass	sp.stock size	sp.stock biomass
0	.0030	12.07	39.5	4665.0	15254	.0	0	.0	0
1	.0430	125.42	1190.3	3445.6	32698	1722.8	16349	1561.0	14814
2	.0910	1043.32	12968.2	13852.1	172182	10389.1	12913.6	9323.7	115893
3	.1220	5.52	77.8	55.5	781	55.5	781	49.5	696
4	.1580	193.95	2910.8	1529.8	22962	1529.8	22962	1354.7	20333
5	.1340	15.68	242.9	144.2	2233	144.2	2233	128.3	1987
6	.1870	115.37	1795.8	765.8	765.8	12130	12130	674.2	10679
7	.1810	27.99	448.1	194.8	3118	194.8	3118	171.7	2748
8	.2240	64.34	1053.3	369.0	6041	369.0	6041	322.5	5279
9	.1730	3.75	59.7	27.2	433	27.2	433	24.0	382
10+	.1730	26.37	419.8	191.3	3045	191.3	3045	168.9	2688
Total		1631.76	21206.3	25240.4	270832	15389.6	196233	13778.5	175504

\*\*\*\*\*  
 \* Year 1991, F-factor 1.000 and reference F .1567 \*  
 \*\*\*\*\*

age	at 1 January				at spawning time				
	absolute F	catch in numbers	catch in weight	stock size	stock biomass	sp.stock size	sp.stock biomass	sp.stock size	sp.stock biomass
0	.0030	12.07	39.5	4665.0	15254	.0	0	.0	0
1	.0430	125.42	1190.3	3445.6	32698	1722.8	16349	1561.0	14814
2	.0910	184.16	2289.1	2445.1	30321	1833.8	22794	1645.8	20456
3	.1220	932.50	13138.9	9369.3	132015	9369.3	132013	8356.5	117743
4	.1580	4.61	69.2	36.4	545	36.4	545	32.2	483
5	.1340	105.20	1629.5	967.7	14989	967.7	14989	861.0	13337
6	.1870	13.83	219.1	93.4	1480	93.4	1480	82.3	1303
7	.1810	67.61	1082.5	470.6	7533	470.6	7533	414.8	6640
8	.2240	20.99	343.7	120.4	1971	120.4	1971	105.2	1722
9	.1730	50.12	479.2	218.5	3476	218.5	3476	192.9	3069
10+	.1730	18.77	298.8	136.2	2167	136.2	2167	120.2	1913
Total		1515.30	20779.8	21968.2	242524	14969.1	203322	13371.9	181484

Table 4.4.11

Effects of different levels of fishing mortality on catch, stock biomass and spawning stock biomass.

SPRAT IN SUB DIVISIONS 27

Year 1989					Year 1990					Year 1991		
fac- tor	ref. F	stock biomass	sp.stock biomass	catch	fac- tor	ref. F	stock biomass	sp.stock biomass	catch	stock biomass	sp.stock biomass	
1.0	.16	276	151	15	.0	.00	271	179	0	263	204	
					.1	.02		179	2	260	201	
					.2	.03		179	4	258	199	
					.4	.06		178	9	254	195	
					.6	.09		177	13	250	190	
					.8	.13		176	17	246	186	
					1.0	.16		176	21	243	181	
					1.2	.19		175	25	239	177	
					1.4	.22		174	29	235	173	
					1.6	.25		173	33	232	169	
					1.8	.28		173	37	228	166	
					2.0	.31		172	40	225	162	

The data unit of the biomass and the catch is 1000 tonnes.

The spawning stock biomass is given for the time of spawning.

The spawning stock biomass for 1991 has been calculated with the same fishing mortality as for 1990.

The reference F is the mean F for the age group range from 2 to 8

Table 4.5.1 SUM OF PRODUCTS CHECK

11.00.40 03 MAY 1989

SPRAT IN FISHING AREAS 22 TO 32  
CATEGORY: TOTAL

CATCH IN NUMBERS	UNIT: millions											
-----	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
0	33	125	215	104	97	51	35	26	24	105	76	65
1	2615	628	4682	2371	500	1340	369	2303	363	1852	1005	566
2	6172	2032	818	8399	3325	597	1476	920	2460	297	2393	1703
3	3618	5678	2106	997	4936	1037	378	405	425	531	388	2521
4	1940	2387	3510	1907	480	2291	500	94	225	107	447	447
5	1929	790	1040	1739	817	188	1357	88	64	47	77	271
6	933	878	350	364	683	150	72	527	57	12	38	30
7	1213	247	548	140	73	335	67	13	231	18	9	19
8+	278	546	422	399	189	125	235	99	51	148	83	65
TOTAL	18731	13311	13691	16420	11100	6114	4489	4475	3900	3117	4516	5687
	1986	1987	1988									
0	32	4	180									
1	495	779	79									
2	1142	394	2693									
3	1425	1320	742									
4	2099	1833	1150									
5	340	1805	762									
6	188	227	751									
7	16	149	64									
8+	50	73	108									
TOTAL	5787	6584	6530									

Table 4.5.2 SUM OF PRODUCTS CHECK

SPRAT IN FISHING AREAS 22 TO 32  
 CATEGORY: TOTAL

MEAN WEIGHT AT AGE IN THE CATCH		UNIT: gram										
-----												
	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
0	4.800	4.000	4.000	4.400	4.300	4.000	4.200	4.300	4.200	4.700	3.900	3.400
1	6.600	6.800	6.900	5.400	5.100	5.500	7.800	6.300	8.800	9.200	9.700	9.100
2	10.500	11.200	10.700	11.000	10.900	12.700	11.300	14.100	11.700	14.500	11.100	11.300
3	12.200	12.400	12.700	13.400	12.500	13.000	14.300	16.100	16.000	16.200	14.600	12.700
4	13.400	13.400	13.500	14.000	13.100	13.700	14.100	18.000	16.200	17.100	15.300	14.000
5	13.900	14.700	14.500	14.400	14.100	15.100	14.300	16.500	16.700	16.900	15.800	16.000
6	15.400	14.300	16.100	15.900	15.200	15.800	16.700	15.900	16.400	17.000	16.300	17.100
7	14.100	15.700	14.700	15.900	15.800	15.600	15.800	16.800	16.300	16.900	16.900	17.100
8+	14.300	13.500	14.300	15.800	15.100	16.200	16.000	16.100	17.300	16.800	17.200	15.800
	1986	1987	1988									
0	4.400	3.800	4.380									
1	7.900	8.500	5.630									
2	12.100	11.700	10.290									
3	12.900	13.300	12.160									
4	14.000	14.500	14.210									
5	14.800	15.200	15.210									
6	16.100	16.400	15.300									
7	17.000	17.000	16.580									
8+	16.700	17.600	16.800									

Table 4.5.3

## BALTIC SPRAT Tuning Data: Acoustical Surveys

102

Internat. Surveys 24-29

1984, 1988

1, 1

2, 8

1, 36493,9426, 8309, 2016, 310, 199, 114

1,12411,19142, 4827, 1673, 189, 45, 67

1, 3718,10968, 8455, 1920, 269, 75, 56

1, 1234,6256, 8530, 2496, 359, 26, 20

1, 11203, 2899, 6307, 2675, 962, 185, 19

USSR Surveys 26+28

1984, 1988

1, 1

2, 8

1, 21087,2066, 1938, 501, 166, 20, 69

1, 16531, 12765, 981, 441, 61, 0, 0

1, 9752, 7748, 7174, 663, 357, 37, 58

1, 5604, 5351, 5283, 4693, 107, 175, 19

1, 23035, 2246, 2992, 2489, 2341, 110, 81

Table 4.5.4 Sprat in Sub-divisions 22-32. Tuning analysis.

Module run at 08.54.21 13 APRIL 1989

DISAGGREGATED QS

LOG TRANSFORMATION

NO explanatory variate (Mean used)

Fleet 1 ,Internat. Surveys 24, has terminal q estimated as the mean

Fleet 2 ,USSR Surveys 26+28 , has terminal q estimated as the mean

FLEETS COMBINED BY \*\* VARIANCE \*\*

Regression weights

, 1.000, 1.000, 1.000, 1.000, 1.000,

Oldest age F = 1.000\*average of 5 younger ages. Fleets combined by variance of predictions

Fishing mortalities

Age,	84,	85,	86,	87,	88,
1,	.032,	.024,	.049,	.016,	.100,
2,	.062,	.085,	.074,	.061,	.087,
3,	.090,	.106,	.117,	.143,	.194,
4,	.121,	.177,	.149,	.271,	.221,
5,	.224,	.124,	.247,	.230,	.215,
6,	.151,	.158,	.147,	.327,	.175,
7,	.130,	.130,	.147,	.206,	.179,

Log catchability estimates

Age 2	84,	85,	86,	87,	88
1,	-.06,	-.48,	-1.42,	-1.65,	-1.01
2,	-.60,	-.19,	-.45,	-.14,	-.29

## SUMMARY STATISTICS

Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
, q	, F	, F	, F	, F	, Slope	, Slope	, Intrcpt	, Intrcpt
1	-.92	.720	.3972	.0955	.000E+00	.000E+00	-.923	.294
2	-.34	.211	.7145	.0835	.000E+00	.000E+00	-.336	.086
Fbar		SIGMA(int.)	SIGMA(ext.)		SIGMA(overall)		Variance ratio	
.084		.202	.360E-01		.202		.032	

Age 3

Fleet,	84,	85,	86,	87,	88
1,	-.79,	-.22,	-.10,	-.39,	-.27
2,	-.73,	-.62,	-.45,	-.55,	-.53

## SUMMARY STATISTICS

Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
, q	, F	, F	, F	, F	, Slope	, Slope	, Intrcpt	, Intrcpt
1	-.04	.519	.9602	.2457	.000E+00	.000E+00	-.041	.212
2	-.58	.116	.5616	.1855	.000E+00	.000E+00	-.577	.047
Fbar		SIGMA(int.)	SIGMA(ext.)		SIGMA(overall)		Variance ratio	
.188		.113	.598E-01		.113		.279	

Age 4

Fleet,	84,	85,	86,	87,	88
1,	.81,	.65,	-.51,	.23,	.19
2,	-.64,	-.95,	-.68,	-.25,	-.55

cont'd.



Table 4.5.4 cont'd.

SUMMARY STATISTICS									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	.27	.562	1.3162	.2400	.000E+00	.000E+00	.275	.230	
2	-.61	.275	.5418	.2082	.000E+00	.000E+00	-.613	.112	
Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio					
.214	.247	.560E-01	.247	.051					

Age 5					
Fleet	84	85	86	87	88
1	1.77	-.27	.33	-1.15	-.28
2	.30	-1.60	-.73	-.51	-.35

SUMMARY STATISTICS									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	.08	1.185	1.0850	.3092	.000E+00	.000E+00	.082	.484	
2	-.56	.782	.5687	.1742	.000E+00	.000E+00	-.564	.319	
Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio					
.207	.652	.264	.652	.163					

Age 6					
Fleet	84	85	86	87	88
1	.21	.00	-1.56	-.66	-1.49
2	-.41	-1.13	-1.28	-1.87	-.60

SUMMARY STATISTICS									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	-.70	.898	.4959	.3873	.000E+00	.000E+00	-.701	.367	
2	-1.06	.633	.3464	.1112	.000E+00	.000E+00	-1.060	.258	
Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio					
.168	.517	.588	.588	1.290					

Table 4.5.5 VIRTUAL POPULATION ANALYSIS

SPRAT IN FISHING AREAS 22 TO 32

	FISHING MORTALITY COEFFICIENT				UNIT: Year-1	NATURAL MORTALITY COEFFICIENT = .40							
	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	
1	.12	.09	.09	.18	.14	.20	.08	.12	.03	.03	.03	.02	
2	.17	.16	.19	.27	.54	.32	.45	.36	.23	.04	.06	.08	
3	.38	.30	.30	.47	.32	.41	.43	.26	.35	.09	.09	.10	
4	.49	.59	.39	.64	.57	.31	.45	.23	.29	.17	.12	.18	
5	.34	.48	.75	.43	.83	.59	.38	.17	.30	.11	.22	.12	
6	.58	.32	.53	.86	.38	.45	.62	.31	.19	.10	.15	.16	
7	.39	.37	.43	.53	.53	.42	.47	.27	.27	.10	.13	.13	
8+	.39	.37	.43	.53	.53	.42	.47	.27	.27	.10	.13	.13	
( 2- 6)W	.27	.30	.36	.34	.42	.34	.42	.30	.24	.07	.07	.10	
	1986	1987	1988	1974-86									
1	.05	.02	.10	.09									
2	.07	.06	.08	.23									
3	.11	.14	.19	.28									
4	.14	.26	.21	.35									
5	.25	.22	.21	.38									
6	.15	.33	.17	.37									
7	.15	.21	.18	.32									
8+	.15	.21	.18	.32									
( 2- 6)W	.12	.18	.12										

Tuned with 2 acoustic surveys.

Table 4.5.6 VIRTUAL POPULATION ANALYSIS

SPRAT IN FISHING AREAS 22 TO 32

STOCK SIZE IN NUMBERS UNIT: millions

-----  
BIOMASS TOTALS UNIT: tonnes  
-----

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1	28434	9257	68548	16975	4527	8926	5941	24343	13060	75807	39744	30169
2	46658	16941	5696	42152	9462	2630	4901	3683	14452	8459	49310	25825
3	13787	26285	9712	3157	21486	3686	1283	2102	1729	7702	5429	31111
4	5990	6336	13047	4814	1318	10431	1639	557	1083	818	4732	3325
5	8055	2463	2343	5928	1708	500	5148	698	297	544	461	2810
6	2536	3848	1018	745	2579	498	185	2361	397	148	327	247
7	4489	955	1873	403	212	1180	214	67	1158	220	89	188
8+	1029	2112	1442	1148	548	440	750	509	256	1808	824	644
TOTAL NO	110978	68197	103680	75323	41841	28292	20060	34320	32432	95505	100917	94319
SPS NO	68547	53858	33423	45702	34475	18578	12649	8871	15036	17161	46380	56403
TOT. BIOM	1235436	834647	908849	803034	516916	338707	238142	310118	345231	821776	1008821	1055295
SPS BIOM	891045	719733	471055	565476	457107	271064	178913	136970	201785	258138	564929	718125

	1986	1987	1988	1989	1974-86
1	12928	60988	1008	0	26051
2	19763	8264	40248	611	19226
3	15930	12321	5220	24795	11031
4	18811	9523	7190	2899	5608
5	1867	10911	4906	3891	2525
6	1664	977	5856	2673	1273
7	141	963	472	3318	861
8+	442	472	795	710	919
TOTAL NO	71547	104420	65696		
SPS NO	52689	40952	52613		
TOT. BIOM	919119	1138903	770881		
SPS BIOM	740668	602949	640961		

Table 4.5.7

Title : SPRAT IN FISHING AREAS 22 TO 32  
 At 16.38.31 to APRIL 1989  
 from 74 to 88 on ages 1 to 7  
 with Terminal F of .200 on age 4 and terminal S of 1.000

Initial sum of squared residuals was 34.791 and  
 final sum of squared residuals is 9.233 after 74 iterations

## Matrix of Residuals

Years	74/75	75/76	76/77	77/78										
Ages														
1/ 2	-.509	.167	-.022	-.102										
2/ 3	-.280	-.226	-.283	.092										
3/ 4	-.114	.122	-.181	.074										
4/ 5	.033	.140	.074	-.187										
5/ 6	-.205	-.002	.296	-.236										
6/ 7	.320	-.361	.150	.427										
	.000	.000	.000	.000										
WTS	.100	.100	.100	.100										
Years	78/79	79/80	80/81	81/82	82/83	83/84	84/85	85/86	86/87	87/88	WTS			
Ages														
1/ 2	-.084	.254	-1.208	.250	-.366	.331	-.065	-.180	.912	-.835	-.002	.342		
2/ 3	.594	.158	.369	.507	.407	-.211	-.124	.163	-.005	-.779	-.001	.485		
3/ 4	-.008	.236	.299	.193	.150	.146	-.299	.081	-.207	-.109	-.001	1.000		
4/ 5	-.211	-.324	.292	-.315	.042	.039	.075	-.098	-.077	.350	-.001	.894		
5/ 6	.410	-.018	-.635	-.385	.029	-.190	.405	-.118	.063	.234	-.001	.608		
6/ 7	-.584	-.185	.113	-.018	-.521	-.146	.125	.114	-.137	.594	-.001	.533		
	.000	.000	.000	-.001	-.001	-.001	-.001	.000	.000	.000	-.305			
WTS	.100	.100	.100	1.000	1.000	1.000	1.000	1.000	1.000	1.000				
Fishing Mortalities (F)														
F-values	74	75	76	77	78									
	.4815	.4520	.5099	.6856	.6775									
F-values	79	80	81	82	83	84	85	86	87	88				
	.5657	.6093	.3247	.3076	.1152	.1345	.1391	.1531	.2006	.2000				
Selection-at-age (S)														
S-values	1	2	3	4	5	6	7							
	.2062	.4952	.7217	1.0000	1.0877	1.0622	1.0000							

Table 4.5.8 VIRTUAL POPULATION ANALYSIS

SPRAT IN FISHING AREAS 22 TO 32

FISHING MORTALITY COEFFICIENT UNIT: Year-1 NATURAL MORTALITY COEFFICIENT = .40

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1	.12	.09	.09	.20	.15	.20	.07	.12	.03	.03	.03	.02
2	.19	.16	.19	.29	.59	.33	.45	.31	.23	.04	.06	.08
3	.37	.34	.31	.49	.35	.47	.47	.27	.29	.09	.08	.11
4	.50	.58	.46	.66	.59	.34	.57	.25	.29	.13	.12	.16
5	.41	.51	.70	.56	.90	.64	.44	.23	.34	.11	.17	.12
6	.60	.42	.57	.76	.58	.52	.71	.39	.29	.12	.16	.11
7	.48	.39	.65	.61	.42	.85	.61	.33	.38	.17	.16	.13
8+	.48	.39	.65	.61	.42	.85	.61	.33	.38	.17	.16	.13
( 2- 6)U	.41	.40	.45	.55	.60	.46	.53	.29	.29	.10	.12	.12

	1986	1987	1988	1979-86
1	.04	.03	.04	.07
2	.07	.05	.14	.20
3	.10	.14	.17	.23
4	.15	.24	.22	.25
5	.22	.23	.18	.28
6	.15	.28	.18	.31
7	.10	.21	.15	.34
8+	.10	.21	.15	.34
( 2- 6)U	.14	.19	.18	

Table 4.5.9 VIRTUAL POPULATION ANALYSIS

SPRAT IN FISHING AREAS 22 TO 32

STOCK SIZE IN NUMBERS UNIT: millions

BIOMASS TOTALS UNIT: tonnes

ALL VALUES, EXCEPT THOSE REFERRING TO THE SPAWNING STOCK ARE GIVEN FOR 1 JANUARY; THE SPAWNING STOCK DATA REFLECT THE STOCK SITUATION AT SPAWNING TIME, WHEREBY THE FOLLOWING VALUES ARE

USED: PROPORTION OF ANNUAL F BEFORE SPAWNING: .400  
 PROPORTION OF ANNUAL M BEFORE SPAWNING: .400

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1	27977	9124	65463	16053	4370	8863	6662	24234	14133	73342	42985	29890
2	42931	16635	5607	40085	8845	2525	4859	4166	14379	9178	47658	27997
3	14006	23789	9507	3097	20104	3277	1212	2074	2052	7653	5911	30004
4	5855	6482	11380	4677	1278	9508	1366	510	1064	1033	4700	3648
5	6923	2373	2440	4816	1618	474	4531	517	266	532	606	2788
6	2469	3093	959	809	1840	439	168	1949	275	127	318	344
7	3824	911	1369	363	254	689	174	55	884	139	75	183
8+	876	2014	1054	1036	656	257	612	422	195	1140	694	625
TOTAL NO	104861	64421	97778	70937	38965	26031	19584	33928	33248	93144	102947	95478
SPS NO	48085	37421	22136	31243	22779	11885	8069	6357	11385	14074	37765	46801
TOT.BIOM	1159513	783755	847485	753809	479500	304794	225269	303468	348390	802735	1018998	1068467
SPS BIOM	620119	496980	308170	381832	301252	171997	113280	97180	151701	208964	460817	593884

	1986	1987	1988	1989	1974-86
1	14002	37818	2379	0	25931
2	19576	8984	24717	1530	18803
3	17385	12195	5702	14388	10775
4	18069	10499	7106	3222	5352
5	2084	10413	5558	3835	2305
6	1649	1122	5524	3110	1111
7	206	953	569	3095	702
8+	644	467	957	884	787
TOTAL NO	73616	82452	52513		
SPS NO	43692	33260	34040		
TOT.BIOM	943548	962115	632625		
SPS BIOM	614632	487307	432039		

**Table 4.5.10**

List of input variables for the ICES prediction program.

**TOTAL BALTIC SPRAT (22-32)**

The reference F is the mean F for the age group range from 2 to 6

The number of recruits per year is as follows:

Year	Recruitment
1989	57000.0
1990	26000.0
1991	26000.0

Proportion of F (fishing mortality) effective before spawning: .4000

Proportion of M (natural mortality) effective before spawning: .4000

Data are printed in the following units:

Number of fish: millions  
 Weight by age group in the catch: gram  
 Weight by age group in the stock: gram  
 Stock biomass: tonnes  
 Catch weight: tonnes

age	stock size	fishing; pattern	natural; mortality	maturity; ogive	weight in; the catch	weight in; the stock
1	57000.0	.04	.40	.00	8.166	7.506
2	1530.0	.14	.40	.70	11.298	11.338
3	14388.0	.17	.40	1.00	13.132	13.552
4	3222.0	.22	.40	1.00	14.402	14.762
5	3835.0	.18	.40	1.00	15.402	15.902
6	3110.0	.18	.40	1.00	16.240	16.660
7	3095.0	.15	.40	1.00	16.916	17.276
8+	884.0	.15	.40	1.00	16.820	17.360





Table 4.5.12

Effects of different levels of fishing mortality on catch, stock biomass and spawning stock biomass.

TOTAL BALTIC SPRAT (22-32)

Year 1989					Year 1990					Year 1991	
fac- tor	ref. F	stock biomass	sp.stock biomass	catch	fac- tor	ref. F	stock biomass	sp.stock biomass	catch	stock biomass	sp.stock biomass
1.0	.18	869	347	72	.0	.00	877	474	0	913	561
					.1	.02		471	9	904	550
					.2	.04		468	19	895	539
					.4	.07		462	37	878	518
					.6	.11		456	55	861	498
					.8	.14		450	72	845	479
					1.0	.18		444	89	829	461
					1.2	.21		439	105	814	443
					1.4	.25		433	121	799	426
					1.6	.28		427	136	785	410
					1.8	.32		422	151	771	395
					2.0	.36		416	166	757	380

The data unit of the biomass and the catch is 1000 tonnes.

The spawning stock biomass is given for the time of spawning.

The spawning stock biomass for 1991 has been calculated with the same fishing mortality as for 1990.

The reference F is the mean F for the age group range from 2 to 6

Table 4.5.13

10.02.32 20 APRIL 1989  
 SPRAT SD 22-32

\*\*\*\*\*  
 \* Year 1989, F-factor 1.000 and reference F .1780 \*  
 \*\*\*\*\*

age	absolute F	catch in numbers	catch in weight	stock size	stock biomass	at 1 January		at spawning time	
						sp.stock size	sp.stock biomass	sp.stock size	sp.stock biomass
1	.0400	1844.54	15062.5	57009.0	42784.2	.0	0	.0	0
2	.1400	165.51	1869.9	1530.0	1734.7	1071.0	1214.2	862.9	978.4
3	.1700	1304.40	24483.3	14388.0	19498.1	14388.0	19498.6	11454.6	15523.3
4	.2200	528.24	7608.1	3222.0	4756.3	4222.0	4756.5	2514.3	3711.6
5	.1800	523.80	8067.5	3855.0	6098.4	3835.0	6098.4	3040.9	4835.7
6	.1800	424.77	6878.3	3110.0	5181.2	3110.0	5181.2	2466.1	4108.4
7	.1500	357.09	6040.6	3095.0	5346.9	3095.0	5346.9	2483.8	4291.0
8+	.1500	101.99	1715.5	884.0	1346.1	884.0	1346.1	709.4	1231.5
Total		5810.37	71745.7	87064.0	869350	29605.0	436304	23532.1	346801

\*\*\*\*\*  
 \* Year 1990, F-factor 1.000 and reference F .1780 \*  
 \*\*\*\*\*

age	absolute F	catch in numbers	catch in weight	stock size	stock biomass	at 1 January		at spawning time	
						sp.stock size	sp.stock biomass	sp.stock size	sp.stock biomass
1	.0400	841.37	6870.6	26000.0	19515.6	.0	0	.0	0
2	.1400	3971.16	44866.2	36710.1	41621.8	25697.1	29135.3	20705.0	23475.3
3	.1700	115.53	1517.2	891.6	1208.3	891.6	1208.3	709.8	961.9
4	.2200	134.07	19213.2	8136.8	12011.5	8136.8	12011.5	6349.6	9373.3
5	.1800	236.73	3646.2	1733.3	2756.2	1733.3	2756.2	1374.4	2185.5
6	.1800	293.27	4762.8	2147.2	3577.2	2147.2	3577.2	1702.6	2836.9
7	.1500	200.90	3598.5	1741.3	3008.2	1741.3	3008.2	1397.4	2414.1
8+	.1500	264.97	4455.1	2295.7	3985.3	2295.7	3985.3	1842.3	3198.2
Total		7257.92	88729.8	79655.9	87684.3	42642.9	55682.1	34081.2	44445.1

\*\*\*\*\*  
 \* Year 1991, F-factor 1.000 and reference F .1780 \*  
 \*\*\*\*\*

age	absolute F	catch in numbers	catch in weight	stock size	stock biomass	at 1 January		at spawning time	
						sp.stock size	sp.stock biomass	sp.stock size	sp.stock biomass
1	.0400	841.37	6870.6	26000.0	19515.6	.0	0	.0	0
2	.1400	1811.41	20465.3	16744.9	18985.4	11721.5	15289.7	9444.4	10708.0
3	.1700	2772.07	36402.9	21392.7	28991.4	21392.7	28991.6	17031.3	23080.7
4	.2200	82.67	1190.6	504.2	744.3	504.2	744.3	393.5	580.8
5	.1800	597.84	9208.0	4377.1	6960.5	4377.1	6960.5	3470.8	5519.3
6	.1800	132.55	2152.6	970.4	1616.7	970.4	1616.7	769.5	1282.0
7	.1500	131.71	2364.4	1202.2	2076.9	1202.2	2076.9	964.8	1666.7
8+	.1500	268.73	4520.0	2329.1	404.53	2329.1	404.53	1869.2	3244.8
Total		6645.35	83156.4	73520.8	82934.3	42497.3	57723.1	33943.5	46082.6

Table 5.1 HERRING effort and CPUE for 1987.

Sub-division and country	Total catch (t)	Pelagic trawl			Bottom trawl			Trap net		
		Catch (t)	Trawling days	Catch per day (t)	Catch (t)	Trawling days	Catch per day (t)	Catch (t)	No. of nets	Catch per net (t)
22										
Denmark	22,555	-	-	-	-	-	-	-	-	-
German Dem. Rep.	465	-	-	-	-	-	-	-	-	-
Germany, Fed. Rep.	5,178	-	-	-	-	-	-	-	-	-
Total	28,198	-	-	-	-	-	-	-	-	-
23										
Denmark	754	-	-	-	-	-	-	-	-	-
Sweden	172	-	-	-	-	-	-	-	-	-
Total	956	-	-	-	-	-	-	-	-	-
24										
Denmark	6,506	-	-	-	-	-	-	-	-	-
German Dem. Rep. <sup>1</sup>	46,802	9,651	36,692	0.243	-	-	-	-	-	-
Germany, Fed. Rep.	628	-	-	-	-	-	-	-	-	-
Poland <sup>1</sup>	7,997	7,997	2,423	3.3	-	-	-	-	-	-
Sweden <sup>1</sup>	7,814	6,074	3,914	1.552	878	3,555	0.247	-	-	-
USSR	69,747	-	-	-	-	-	-	-	-	-
Total	139,494	-	-	-	-	-	-	-	-	-
25										
Denmark	4,158	-	-	-	-	-	-	-	-	-
German Dem. Rep. <sup>1</sup>	1,991	1,991	8,484	0.235	-	-	-	-	-	-
Germany, Fed. Rep.	-	-	-	-	-	-	-	-	-	-
Poland <sup>1</sup>	39,732	39,732	14,661	2.71	-	-	-	-	-	-
Sweden <sup>1</sup>	15,602	4,443	3,938	1.128	6,766	10,064	0.672	-	-	-
USSR	8,061	-	-	-	-	-	-	-	-	-
Total	69,544	-	-	-	-	-	-	-	-	-

(cont'd)

Table 5.1 (cont'd)

Sub-division and country	Total catch (t)	Pelagic trawl			Bottom trawl			Trap net		
		Catch (t)	Trawling days	Catch per day (t)	Catch (t)	Trawling days	Catch per day (t)	Catch (t)	No. of nets	Catch per net (t)
26										
German Dem. Rep.	-	-	-	-	-	-	-	-	-	-
Poland <sup>3</sup>	15,398	15,398	8,552	1.8	-	-	-	-	-	-
Sweden <sup>1</sup>	88	7	108	0.065	9	14	0.643	-	-	-
USSR <sup>5</sup>	24,140	13,648	-	8.3	-	-	-	10,492	91	115.297
Total	39,621	-	-	-	-	-	-	-	-	-
27										
Finland	344	344	45	6.7	44	7	6.3	-	-	-
German Dem. Rep. <sup>1</sup>	611	611	1,854	0.33	-	-	-	-	-	-
Poland <sup>1</sup>	344	-	-	-	-	-	-	-	-	-
Sweden <sup>1</sup>	7,738	3,078	1,772	1.737	2,817	7,417	0.38	-	-	-
USSR	3,577	-	-	-	-	-	-	-	-	-
Total	12,614	-	-	-	-	-	-	-	-	-
28 (except Gulf of Riga)										
German Dem. Rep.	-	-	-	-	-	-	-	-	-	-
Finland	2,111	2,111	200	10.6	-	-	-	-	-	-
Sweden <sup>1</sup>	1,606	151	442	0.342	1,193	1,933	0.617	-	-	-
USSR <sup>1</sup>	14,660	14,660	-	6.3	-	-	-	-	-	-
Total	18,377	-	-	-	-	-	-	-	-	-
28 Gulf of Riga										
USSR <sup>1</sup>	17,676	10,743	-	4.6	-	-	-	6,933	209	33.172
Total	36,053	-	-	-	-	-	-	-	-	-

(cont'd)

Table 5.1 (cont'd)

Sub-division and country	Total catch (t)	Pelagic trawl			Bottom trawl			Trap net		
		Catch (t)	Trawling days	Catch per day (t)	Catch (t)	Trawling days	Catch per day (t)	Catch (t)	No. of nets	Catch per net (t)
29S										
Finland	325	325	33	9.8	-	-	-	-	-	-
German Dem. Rep.	-	-	-	-	-	-	-	-	-	-
Sweden <sup>1</sup>	8	8	13	0.615	-	-	-	-	-	-
USSR <sup>2</sup>	24,268	18,551	3,088	6.008	-	-	-	5,717	132	43.311
Total	24,601	-	-	-	-	-	-	-	-	-
29N										
Finland	30,557	18,124	3,388	5.3	5,147	1,450	3.5	4,030	350	11.5
Sweden <sup>1</sup>	311	21	31	0.677	136	236	0.576	-	-	-
Total	30,868	-	-	-	-	-	-	-	-	-
30										
Finland	22,615	10,655	1,895	5.6	2,060	639	3.2	8,376	792	10.6
Sweden <sup>1</sup>	1,533	1,533	2,228	0.7	-	-	-	-	-	-
Total	27,942	-	-	-	-	-	-	-	-	-
31										
Finland	7,788	1,962	1,249	1.6	4,876	2,596	1.9	801	263	3
Sweden <sup>1</sup>	-	-	-	-	-	-	-	-	-	-
Total	7,788	-	-	-	-	-	-	-	-	-
32										
Finland	17,080	8,681	2,476	3.5	691	260	2.7	6,915	315	22
USSR <sup>2</sup>	21,462	19,088	4,150	4.6	-	-	-	2,370	127	18.7
Total	38,542	-	-	-	-	-	-	-	-	-

<sup>1</sup> Trawling hours, catch per hour.<sup>2</sup> Standardized effort.<sup>3</sup> Standardized effort for Sub-divisions 24, 25, and 26.<sup>4</sup> Catch per pair of vessels (80-150 HP) with pair trawl.<sup>5</sup> Catch per pair of vessels (150-300 HP) with pair trawl.

Table 5.2 HERRING effort and CPUE for 1988.

Sub-division and country	Total catch (t)	Pelagic trawl			Bottom trawl			Trap net		
		Catch (t)	Trawling days	Catch per day (t)	Catch (t)	Trawling days	Catch per day (t)	Catch (t)	No. of nets	Catch per net (t)
22										
Denmark	23,987	-	-	-	-	-	-	-	-	-
German Dem.Rep.	-	-	-	-	-	-	-	-	-	-
Germany, Fed.Rep.	4,937	-	-	-	-	-	-	-	-	-
Total	28,924	-	-	-	-	-	-	-	-	-
23										
Denmark	102	-	-	-	-	-	-	-	-	-
Sweden	117	-	-	-	-	-	-	-	-	-
Total	219	-	-	-	-	-	-	-	-	-
24										
Denmark	9,088	-	-	-	-	-	-	-	-	-
German Dem.Rep. <sup>1</sup>	49,488	49,488	12,372	4	-	-	-	-	-	-
Germany, Fed.Rep.	251	-	-	-	-	-	-	-	-	-
Poland <sub>5</sub>	6,590	6,590	2,021	3.26	-	-	-	-	-	-
Sweden <sub>5</sub>	4,586	2,945	1,722	1.71	-	-	-	-	-	-
USSR	-	-	-	-	-	-	-	-	-	-
Total	70,003	-	-	-	-	-	-	-	-	-
25										
Denmark	10,794	-	-	-	-	-	-	-	-	-
German Dem.Rep. <sup>4</sup>	3,866	-	-	-	-	-	-	-	-	-
Germany, Fed.Rep.	-	-	-	-	-	-	-	-	-	-
Poland <sub>5</sub>	36,777	36,777	13,722	2.68	-	-	-	-	-	-
Sweden <sub>5</sub>	16,941	5,557	3,185	1.745	-	-	-	-	-	-
USSR	9,051	-	-	-	-	-	-	-	-	-
Total	77,429	-	-	-	-	-	-	-	-	-

(cont'd)

Table 5.2 (cont'd)

Sub-division and country	Total catch (t)	Pelagic trawl			Bottom trawl			Trap net		
		Catch (t)	Trawling days	Catch per day (t)	Catch (t)	Trawling days	Catch per day (t)	Catch (t)	No. of nets	Catch per net (t)
26										
German Dem.Rep.	102	-	-	-	-	-	-	-	-	-
Poland <sup>5</sup>	20,379	20,379	11,449	1.78	-	-	-	-	-	-
Sweden <sup>5</sup>	24	14	158	0.086	-	-	-	-	-	-
USSR <sup>1</sup>	26,767	16,687	2,317	7.2	-	-	-	10,080	90	112
Total	47,272	-	-	-	-	-	-	-	-	-
27										
Finland	81	81	12	6.75	-	-	-	-	-	-
Poland <sup>5</sup>	-	-	-	-	-	-	-	-	-	-
Sweden <sup>5</sup>	14,366	14,366	3,807	3.774	-	-	-	-	-	-
USSR	4,795	-	-	-	-	-	-	-	-	-
Total	19,242	-	-	-	-	-	-	-	-	-
28 (except Gulf of Riga)										
German Dem.Rep.	82	-	-	-	-	-	-	-	-	-
Finland	1,840	1,840	174	10.6	-	-	-	-	-	-
Sweden <sup>5</sup>	1,319	122	240	0.51	-	-	-	-	-	-
USSR <sup>1</sup>	16,894	16,894	3,372	5	-	-	-	-	-	-
Total	20,135	-	-	-	-	-	-	-	-	-
28 Gulf of Riga										
USSR <sup>2</sup>	19,779	11,582	1,964	5.9	-	-	-	8,190	165	49.6
Total	39,914	-	-	-	-	-	-	-	-	-

(cont'd)

Table 5.2 (cont'd)

Sub-division and country	Total catch (t)	Pelagic trawl			Bottom trawl			Trap net		
		Catch (t)	Trawling days	Catch per day (t)	Catch (t)	Trawling days	Catch per day (t)	Catch (t)	No. of nets	Catch per net (t)
29S										
Finland	449	449	46	9.8	-	-	-	-	-	-
German Dem. Rep.	-	-	-	-	-	-	-	-	-	-
Sweden <sup>2</sup>	100	-	-	-	-	-	-	-	-	-
USSR	22,423	17,593	2,315	7.6	-	-	-	4,830	115	42
Total	22,972	-	-	-	-	-	-	-	-	-
29N										
Finland	31,423	17,625	3,295	5.3	5,005	1,410	3.5	3,919	340	11.5
Sweden	648	-	-	-	-	-	-	-	-	-
Total	32,071	-	-	-	-	-	-	-	-	-
30										
Finland	20,928	9,860	1,754	5.621	1,906	591	3.2	7,751	733	10.6
Sweden	3,172	-	-	-	-	-	-	-	-	-
Total	24,100	-	-	-	-	-	-	-	-	-
31										
Finland	7,171	1,807	1,150	1.6	4,490	2,345	1.9	738	242	3
Sweden	267	-	-	-	-	-	-	-	-	-
Total	7,438	-	-	-	-	-	-	-	-	-
32										
Finland	15,021	7,635	2,178	3.5	608	229	2.7	6,081	277	22
USSR	23,140	21,193	3,785	5.6	-	-	-	1,947	130	14.9
Total	38,161	-	-	-	-	-	-	-	-	-

<sup>1</sup> Catch per pair of vessels (150-300 HP) with pair trawl.

<sup>2</sup> Catch per pair of vessels (80-150 HP) with pair trawl.

<sup>3</sup> Standardized effort.

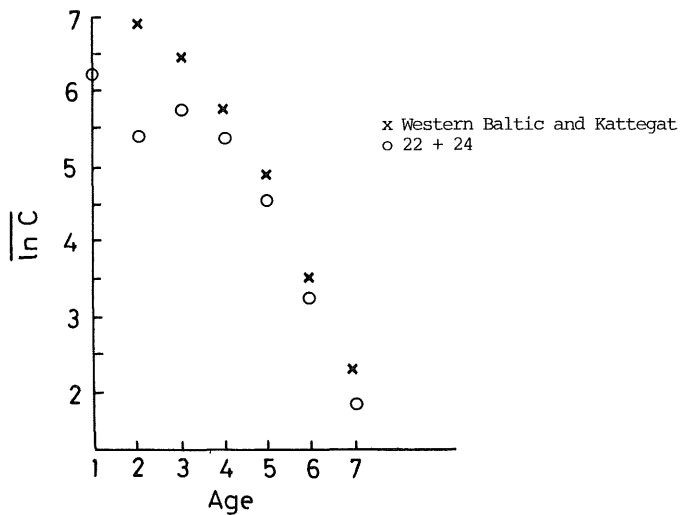
<sup>4</sup> 26 meter cutters, pelagic pair trawling system.

<sup>5</sup> Trawling hours, catch per hour.

Data preliminary.



Figure 3.2.6.1 Mean catch curve for the Western Baltic and Kattegat herring (1984-1988 mean) and 22 + 24 herring (1985-1988 mean).



$$y = -0.95 t + 9.24, R = -0.98, Z = 0.95$$

$$y = -0.66 t + 7.34, R = -0.92, Z = 0.66$$

If only age  $\geq 3$  are included:

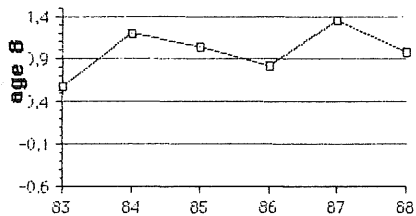
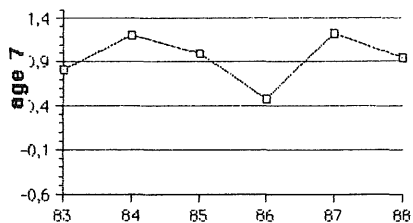
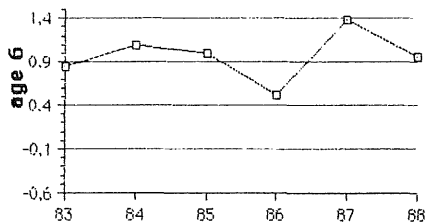
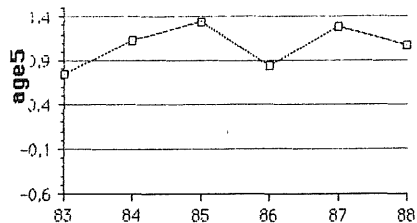
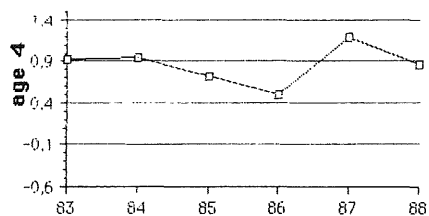
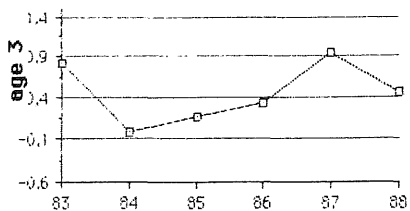
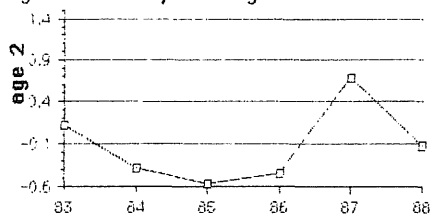
$$y = -1.05 + 9.8, R^2 = 0.98, Z = 1.05$$

$$y = -0.99 + 9.1, R^2 = 0.96, Z = 0.99$$



Figure 3.3.2

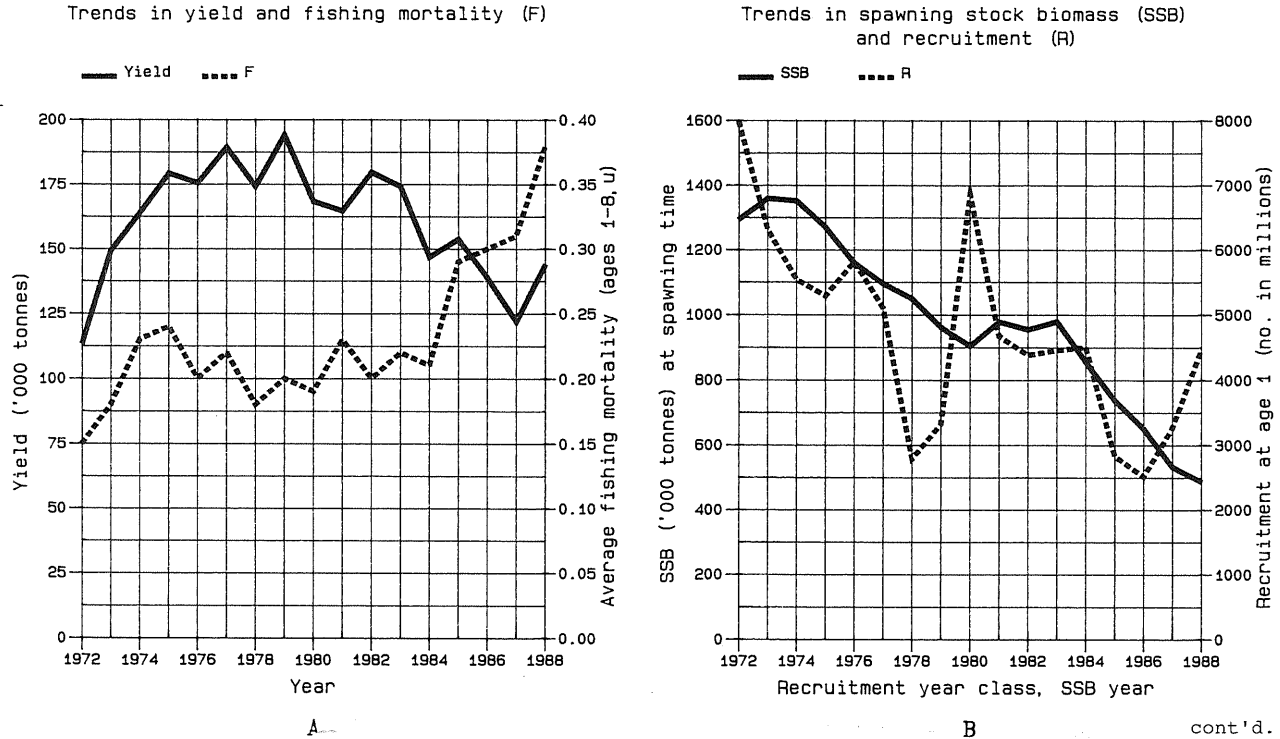
Log catchability.Herring SD 25-27.



## FISH STOCK SUMMARY

STOCK: Herring in the Southern Central Baltic  
26-04-1989

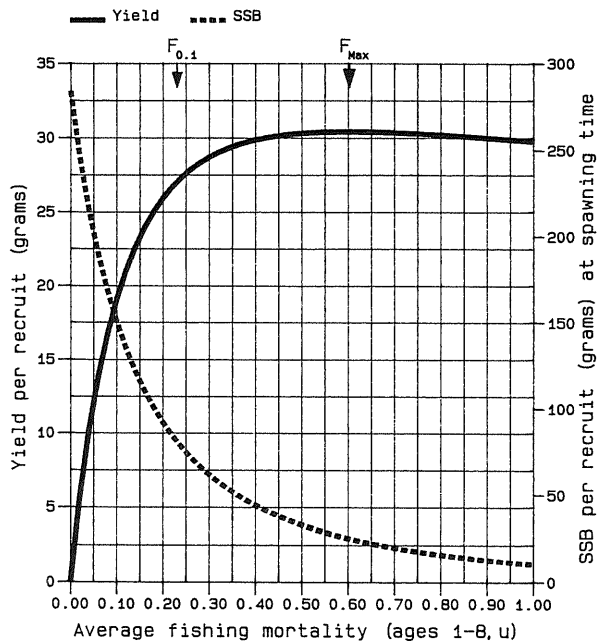
Figure 3.3.3



## FISH STOCK SUMMARY

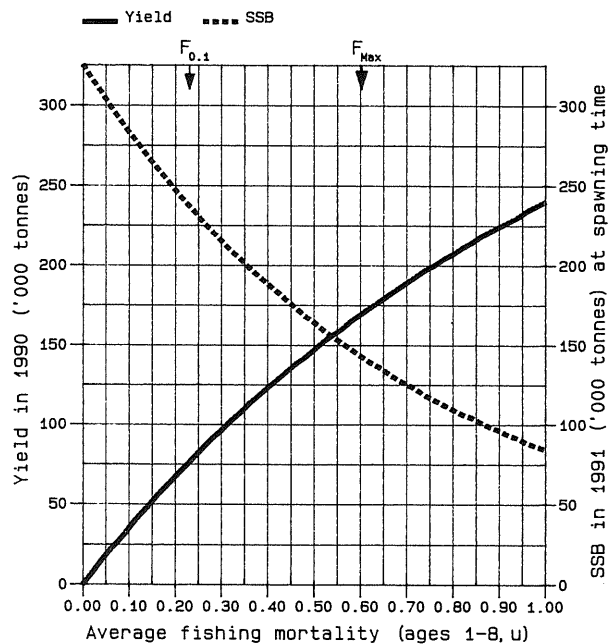
Figure 3.3.3 cont'd. STOCK: Herring in the Southern Central Baltic  
26-04-1989

Long-term yield and spawning stock biomass



C

Short-term yield and spawning stock biomass



D

Figure 3.3.4 Mean fishing mortality effort vs index of fishing effort.

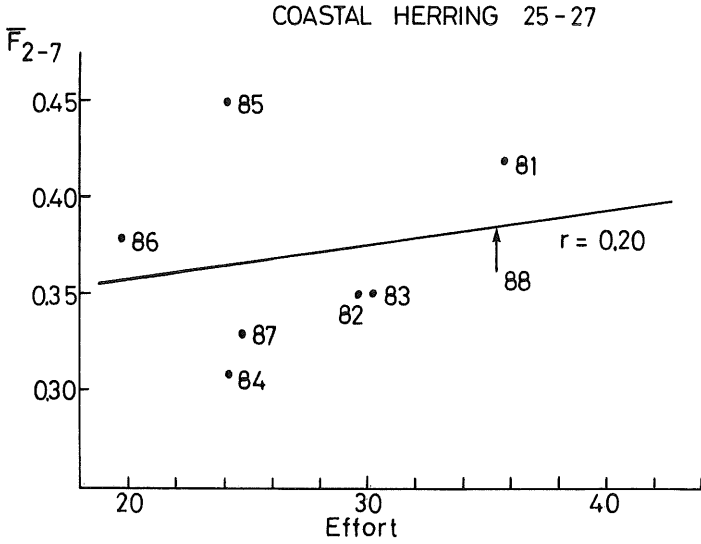
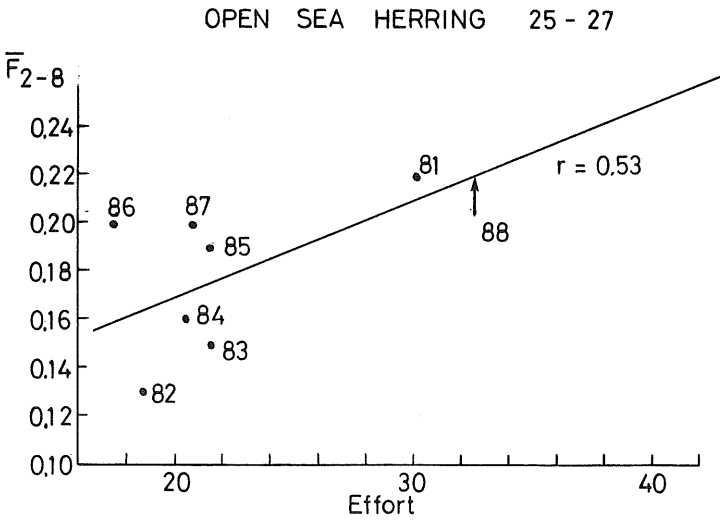


Figure 3.3.5 Mean fishing mortality effort vs index of fishing effort.



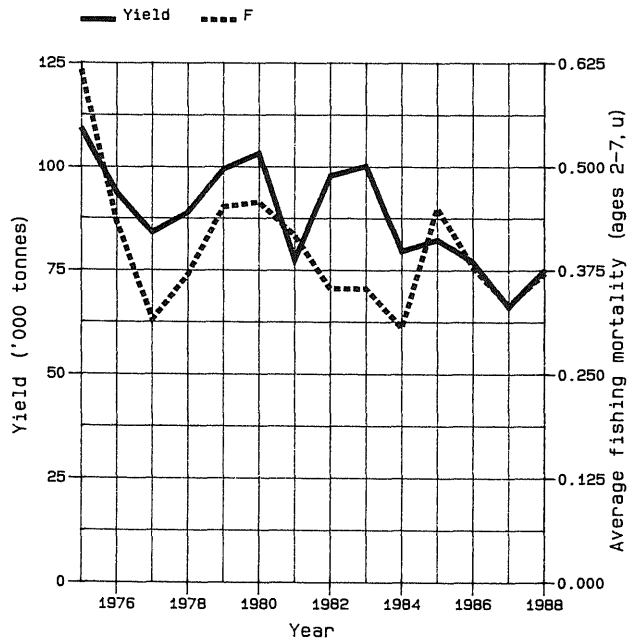
## FISH STOCK SUMMARY

### STOCK: Herring - Coastal Areas 25-27

26-04-1989

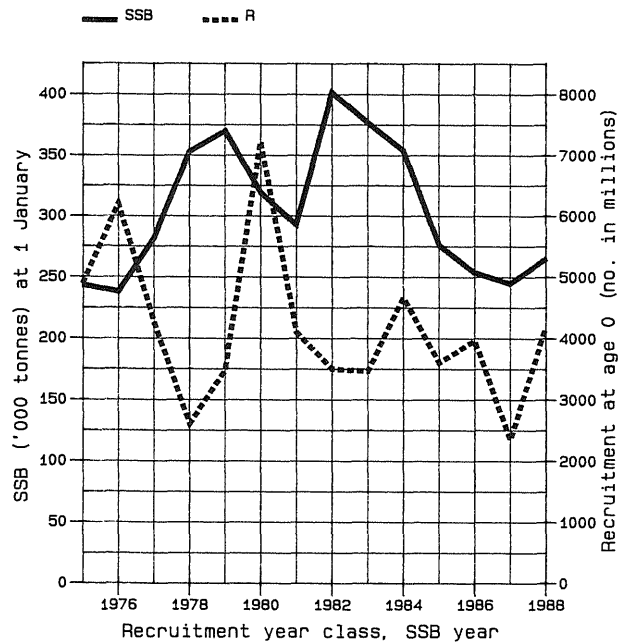
Figure 3.3.6

Trends in yield and fishing mortality (F)



A

Trends in spawning stock biomass (SSB) and recruitment (R)



B

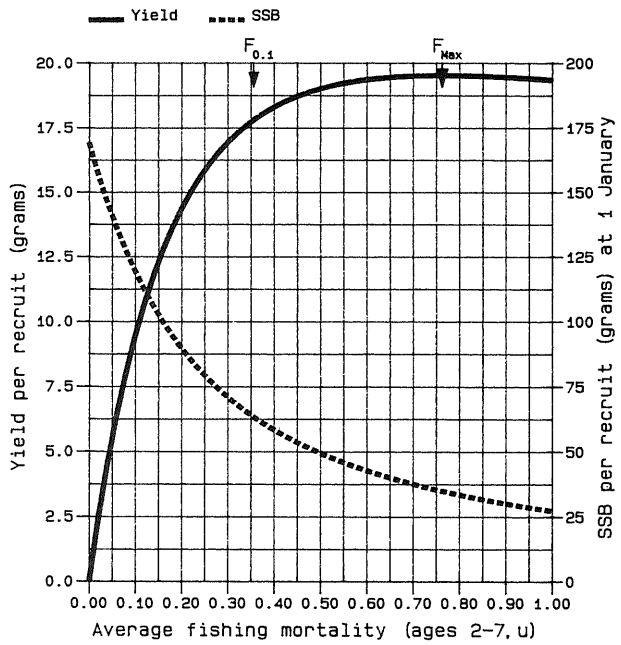
cont'd.

### FISH STOCK SUMMARY

Figure 3.3.6 cont'd.

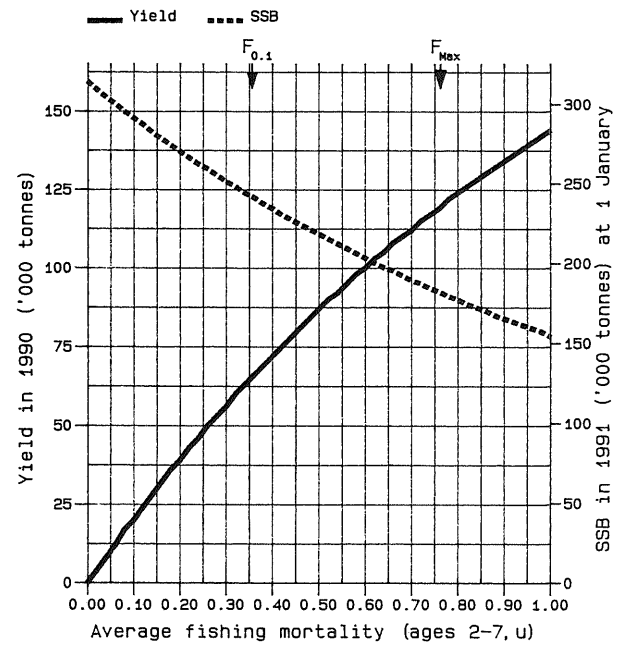
STOCK: Herring - Coastal Areas 25-27  
26-04-1989

Long-term yield and spawning stock biomass



C

Short-term yield and spawning stock biomass



D

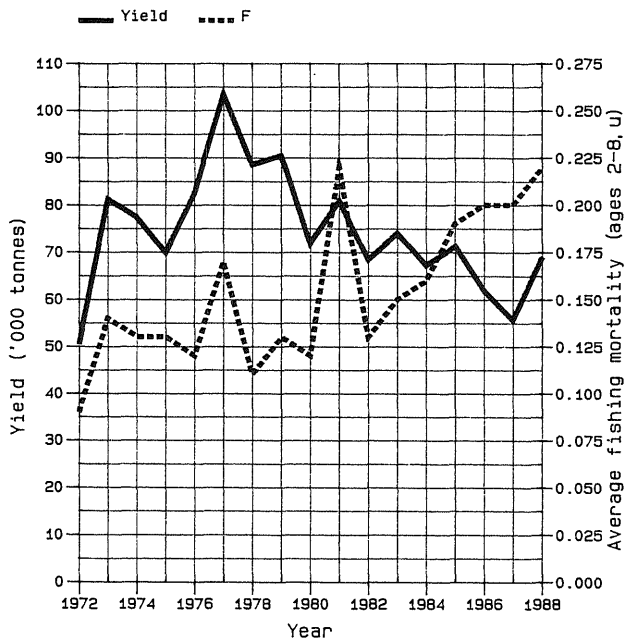


# FISH STOCK SUMMARY

## STOCK: Herring - Open Sea Areas 25-27 27-04-1989

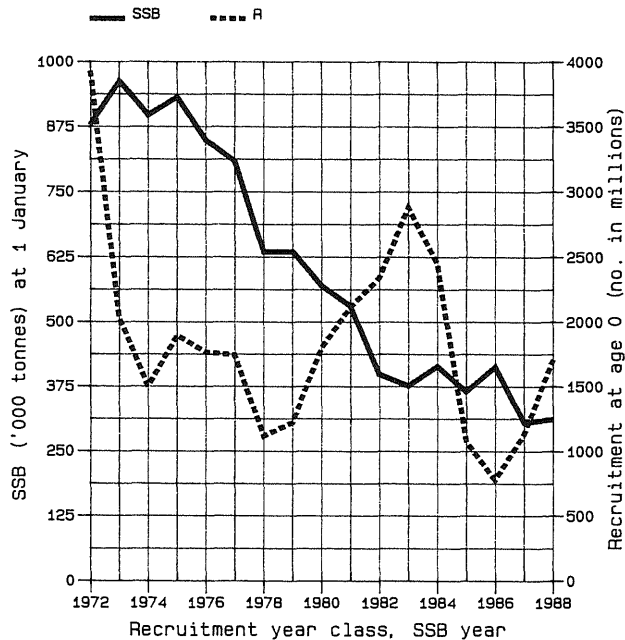
Figure 3.3.7

Trends in yield and fishing mortality (F)



A

Trends in spawning stock biomass (SSB) and recruitment (R)



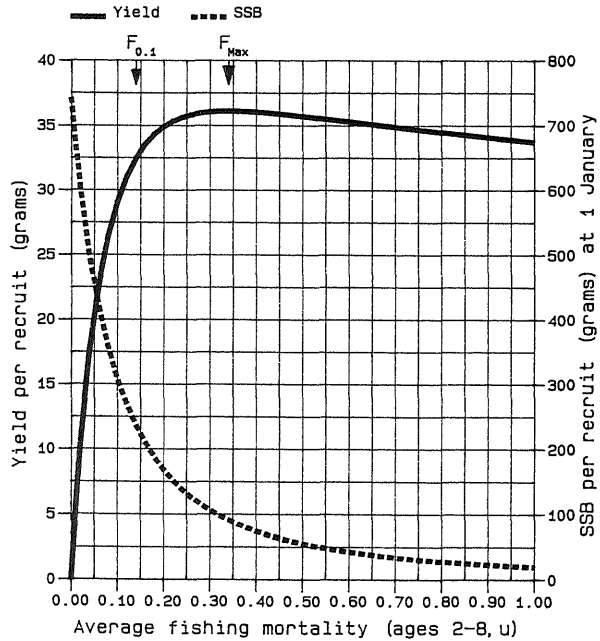
B

cont'd.

## FISH STOCK SUMMARY

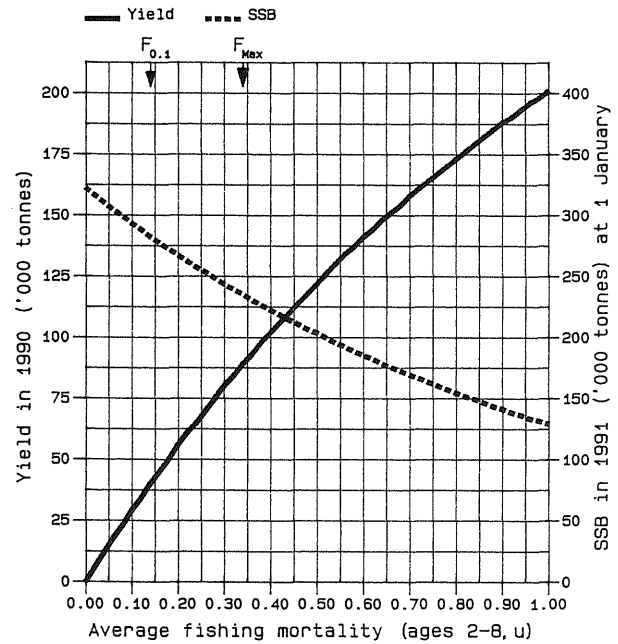
Figure 3.3.7 cont'd. STOCK: Herring - Open Sea Areas 25-27  
27-04-1989

Long-term yield and spawning stock biomass



C

Short-term yield and spawning stock biomass

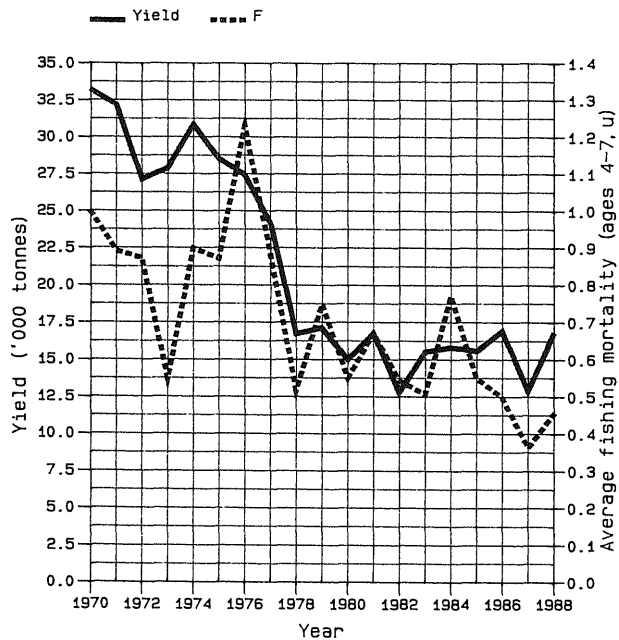


D

FISH STOCK SUMMARY  
 STOCK: Herring - Gulf of Riga  
 27-04-1989

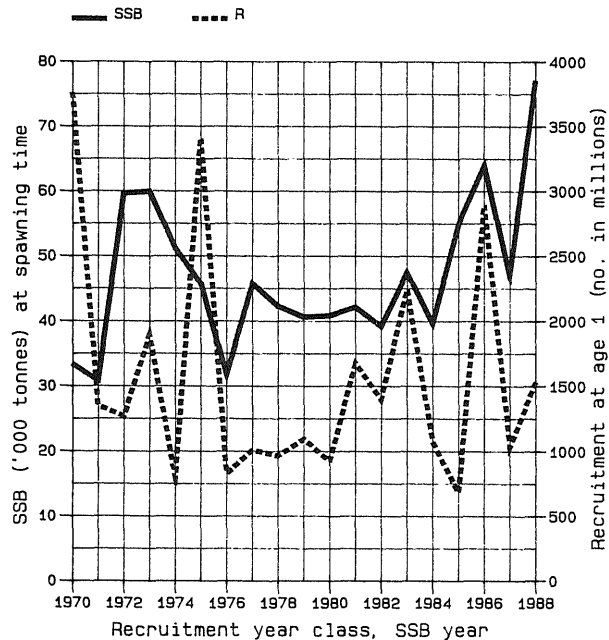
Figure 3.4.1

Trends in yield and fishing mortality (F)



A

Trends in spawning stock biomass (SSB) and recruitment (R)



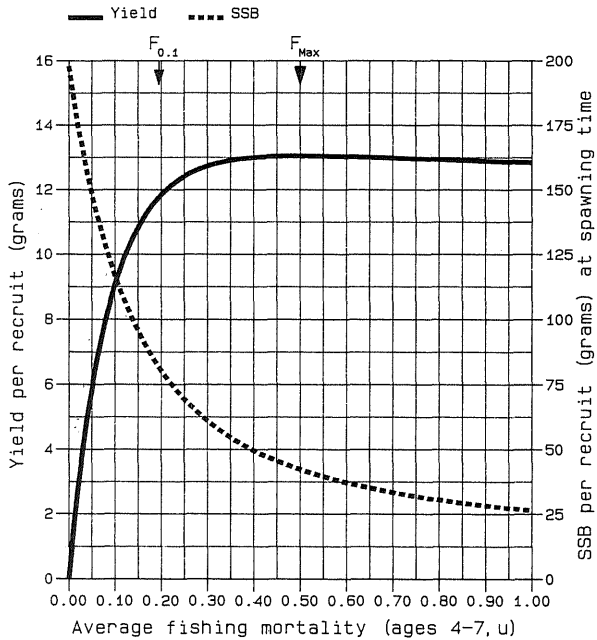
B

cont'd.

FISH STOCK SUMMARY  
 STOCK: Herring - Gulf of Riga  
 27-04-1989

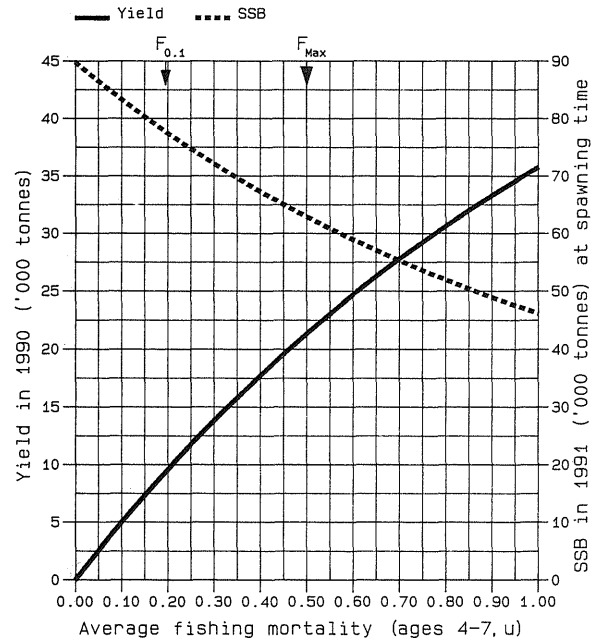
Figure 3.4.1 cont'd.

Long-term yield and spawning stock biomass



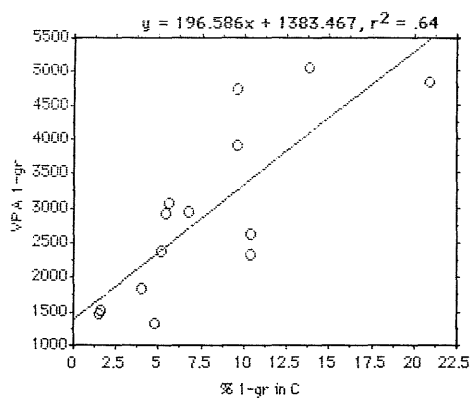
C

Short-term yield and spawning stock biomass



D

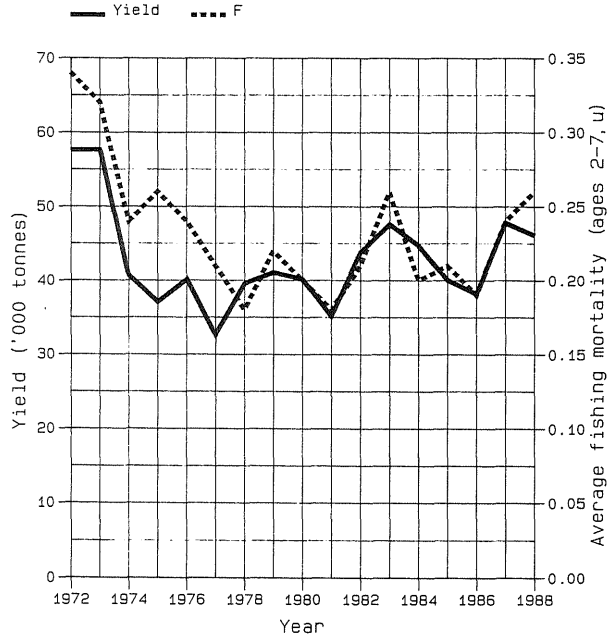
Figure 3.4.2 Herring in Sub-divisions 28+29S.  
VPA-1-group vs % 1-group herring  
catch.



FISH STOCK SUMMARY  
 STOCK: Herring - 28 and 29S  
 28-04-1989

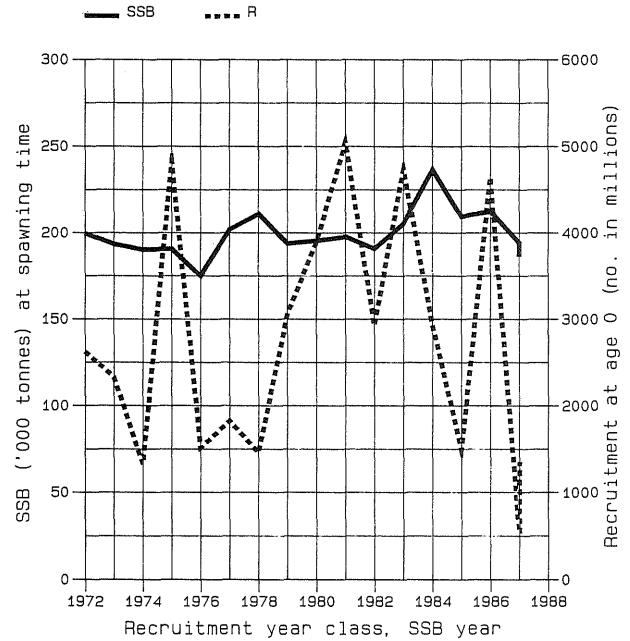
Figure 3.4.3

Trends in yield and fishing mortality (F)



A

Trends in spawning stock biomass (SSB) and recruitment (R)



B

cont'd.

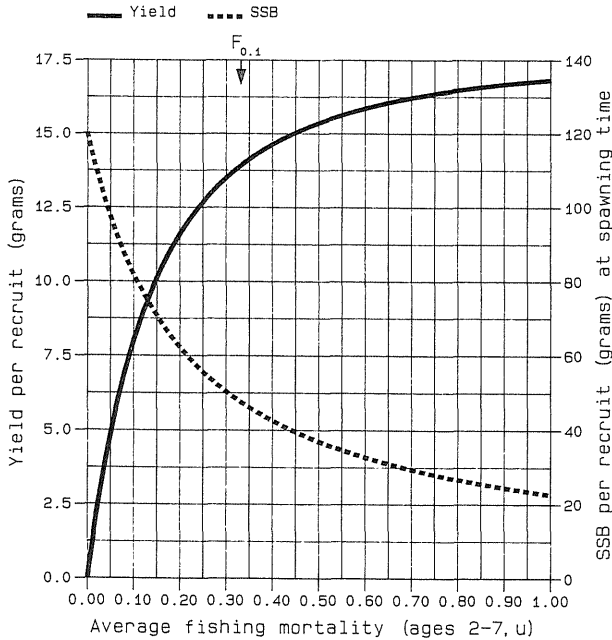
# FISH STOCK SUMMARY

STOCK: Herring - 28 and 29S

28-04-1989

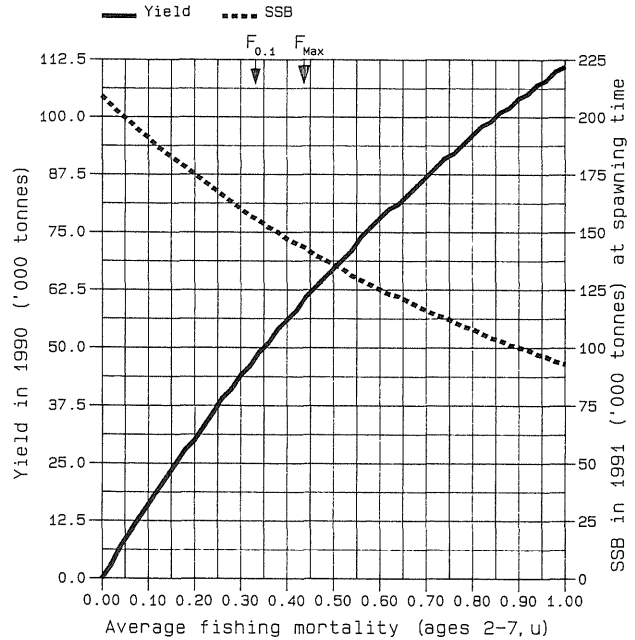
Figure 3.4.3 cont'd.

Long-term yield and spawning stock biomass



C

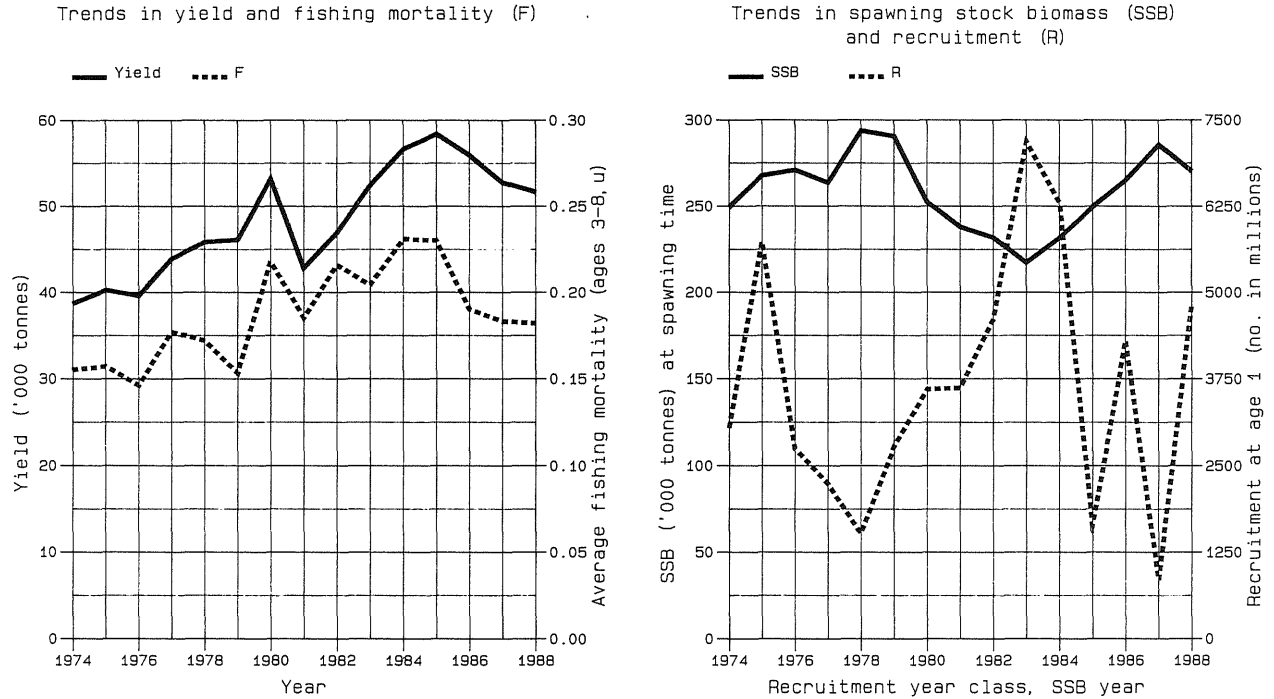
Short-term yield and spawning stock biomass



D

FISH STOCK SUMMARY  
 STOCK: Herring - 29NE and 30E  
 28-04-1989

Figure 3.5.1



A

B

cont'd.



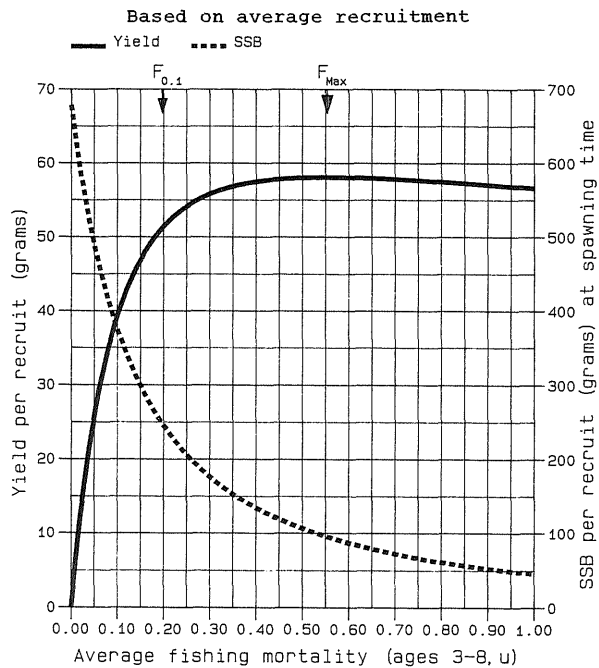
# FISH STOCK SUMMARY

Figure 3.5.1 cont'd.

STOCK: Herring - 29NE and 30E

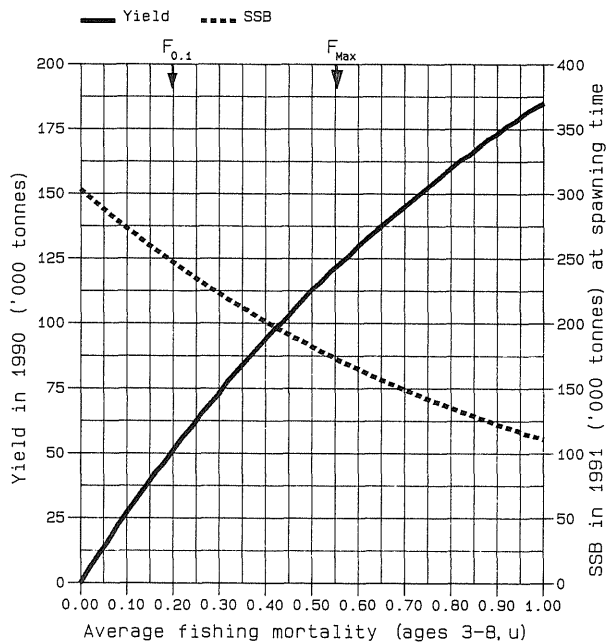
28-04-1989

Long-term yield and spawning stock biomass



C

Short-term yield and spawning stock biomass



D

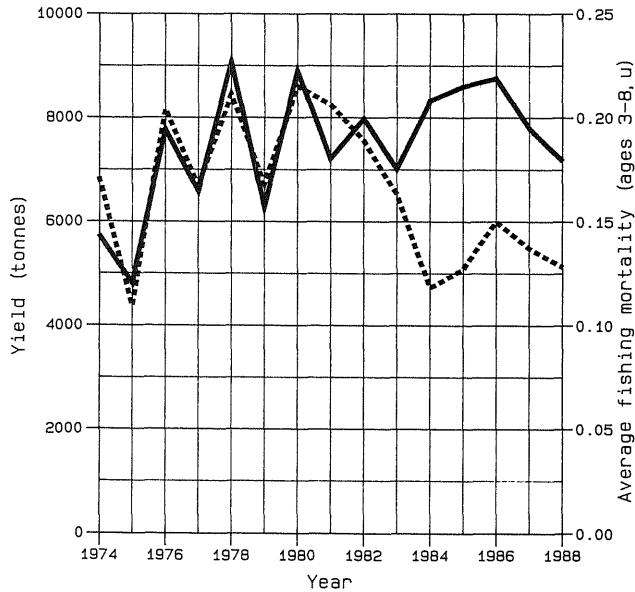
FISH STOCK SUMMARY  
 STOCK: Herring - 31E  
 28-04-1989

Figure 3.6.1

Trends in yield and fishing mortality (F)

Average recruitment: 540.0000

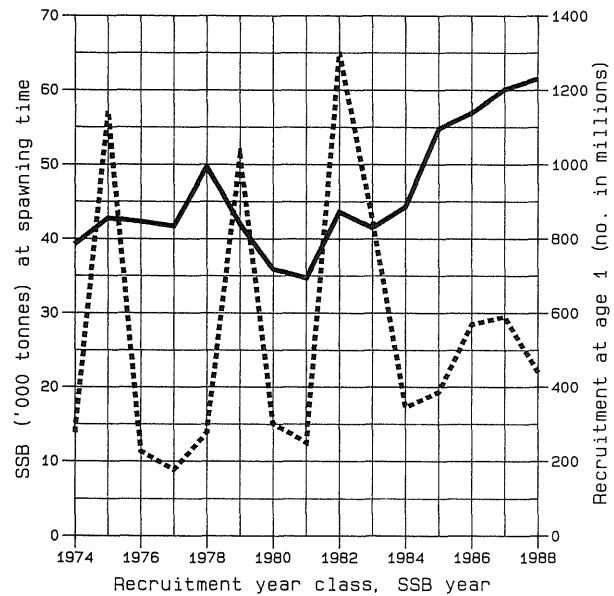
— Yield    ..... F



A

Trends in spawning stock biomass (SSB) and recruitment (R)

— SSB    ..... R



B

cont'd.

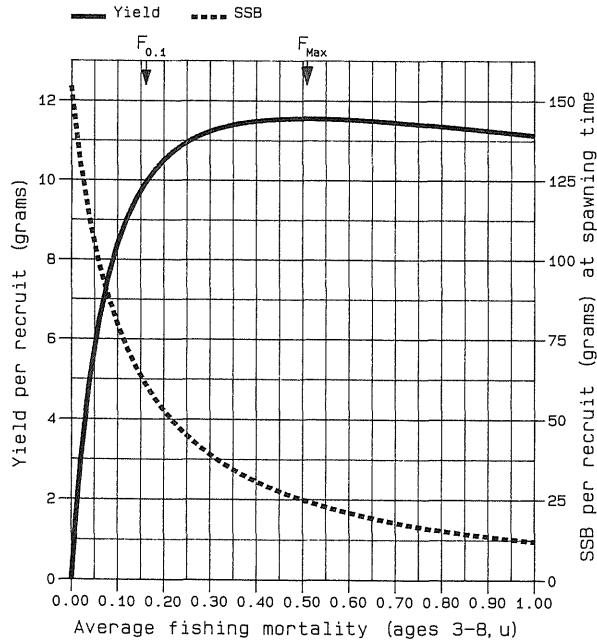
# FISH STOCK SUMMARY

STOCK: Herring - 31E

28-04-1989

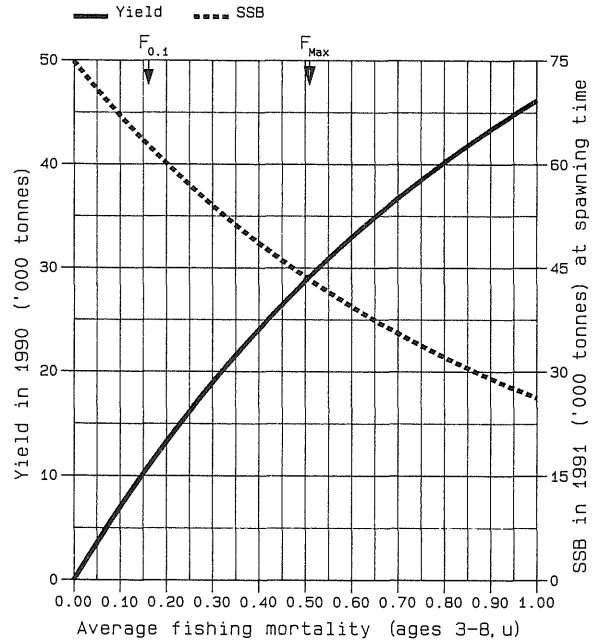
Figure 3.6.1 cont'd.

Long-term yield and spawning stock biomass



C

Short-term yield and spawning stock biomass



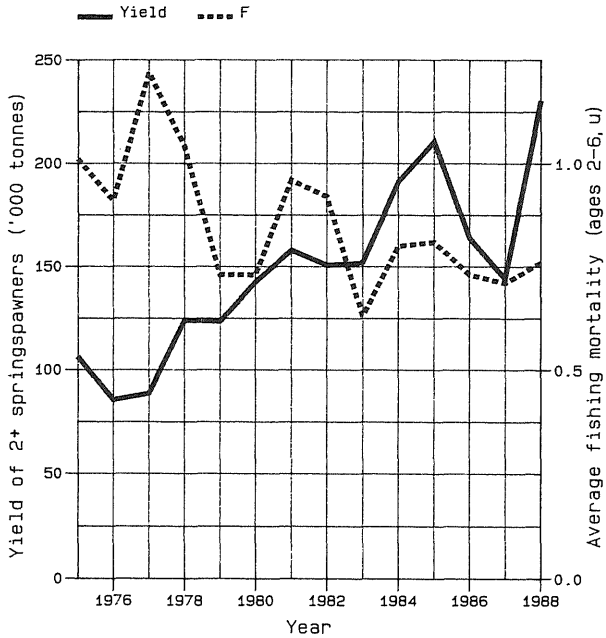
D

FISH STOCK SUMMARY

Figure 3.2.6.2

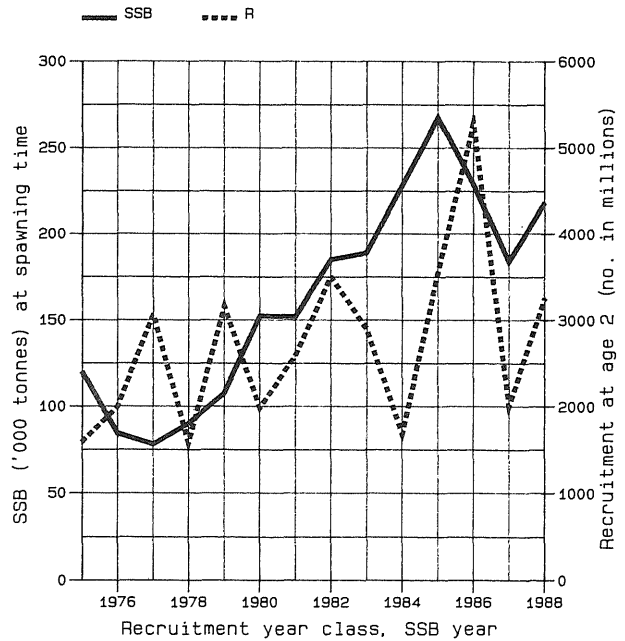
STOCK: Herring in the Western Baltic and Kattegat  
26-04-1989

Trends in yield and fishing mortality (F)



A

Trends in spawning stock biomass (SSB) and recruitment (R)



B

cont'd.

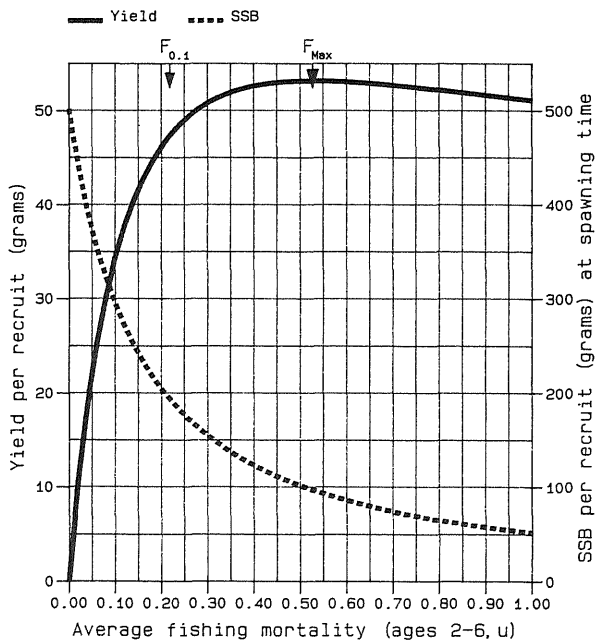
## FISH STOCK SUMMARY

### STOCK: Herring in the Western Baltic and Kattegat

26-04-1989

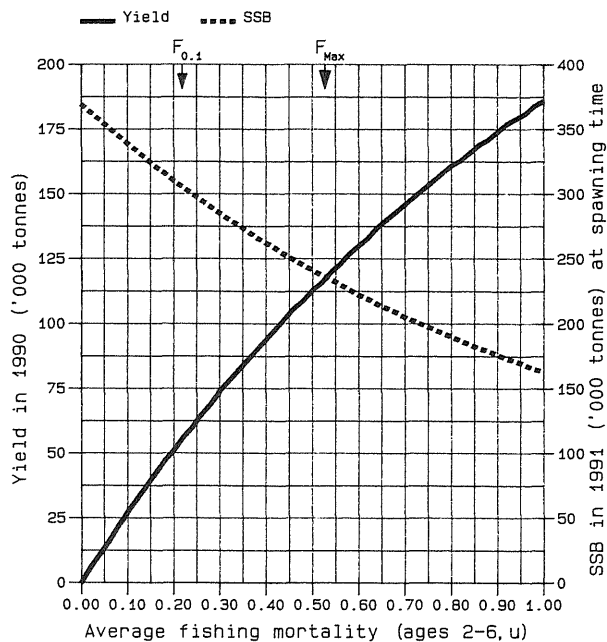
Figure 3.2.6.2  
cont'd.

Long-term yield and spawning stock biomass



C

Short-term yield and spawning stock biomass

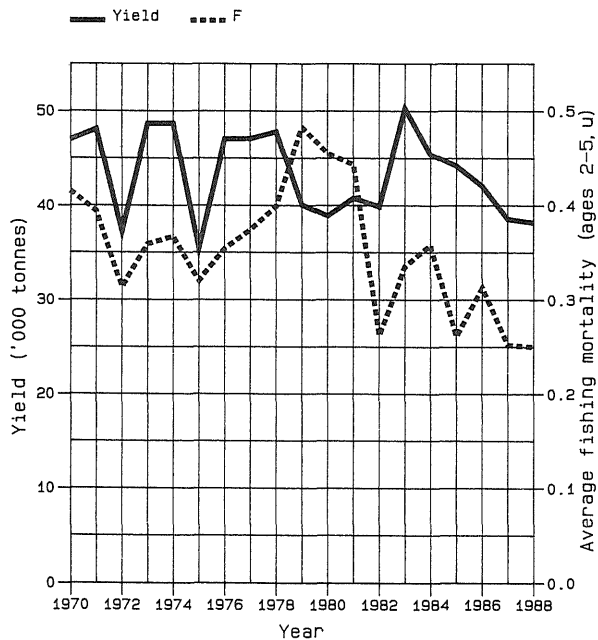


D

FISH STOCK SUMMARY  
 STOCK: Herring - Gulf of Finland  
 01-05-1989

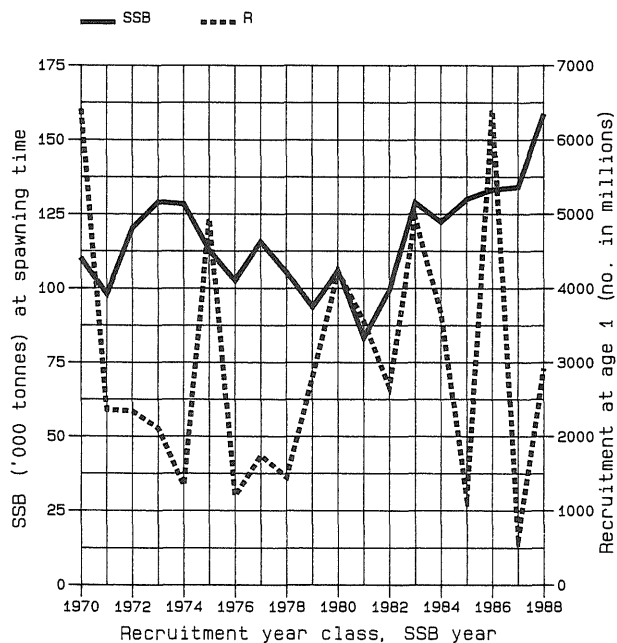
Figure 3.8.1

Trends in yield and fishing mortality (F)



A

Trends in spawning stock biomass (SSB) and recruitment (R)



B

cont'd.

# FISH STOCK SUMMARY

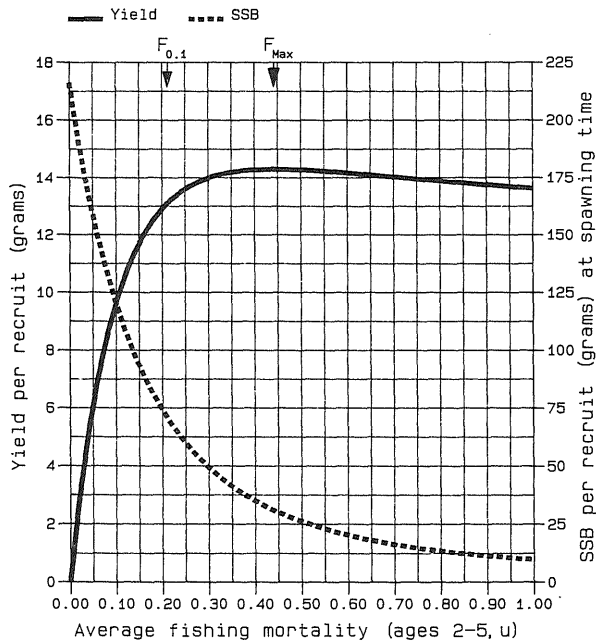
STOCK: Herring - Gulf of Finland

01-05-1989

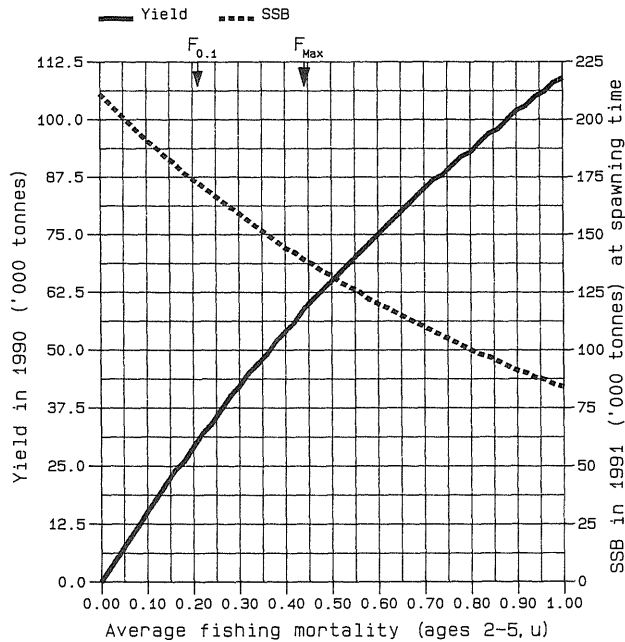
Figure 3.6.1 cont'd.

Long-term yield and spawning stock biomass

Short-term yield and spawning stock biomass



C



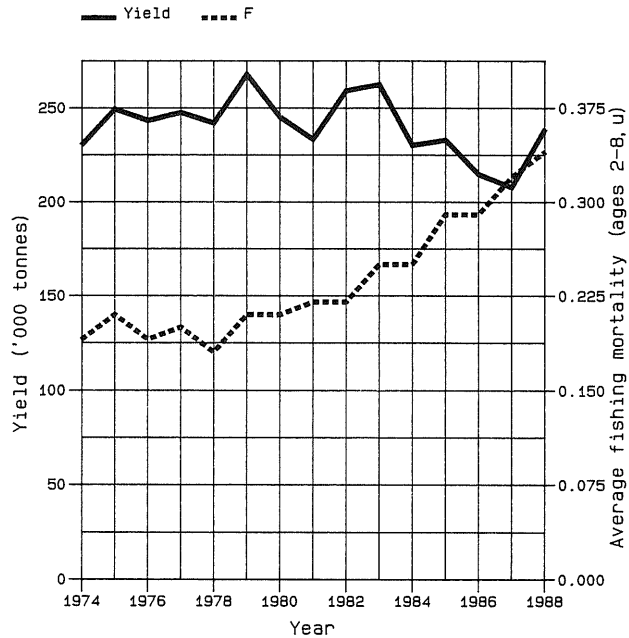
D

## FISH STOCK SUMMARY

STOCK: Herring - Baltic area 25 to 29  
01-05-1989

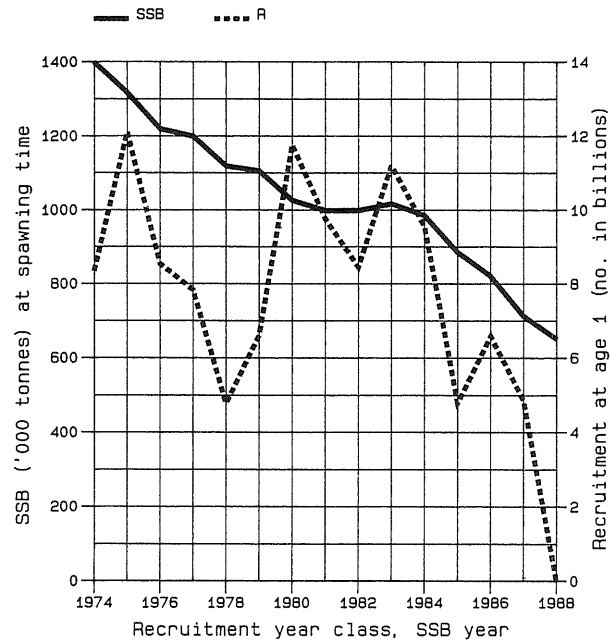
Figure 3.9.1

Trends in yield and fishing mortality (F)



A

Trends in spawning stock biomass (SSB) and recruitment (R)



B

cont'd.



# FISH STOCK SUMMARY

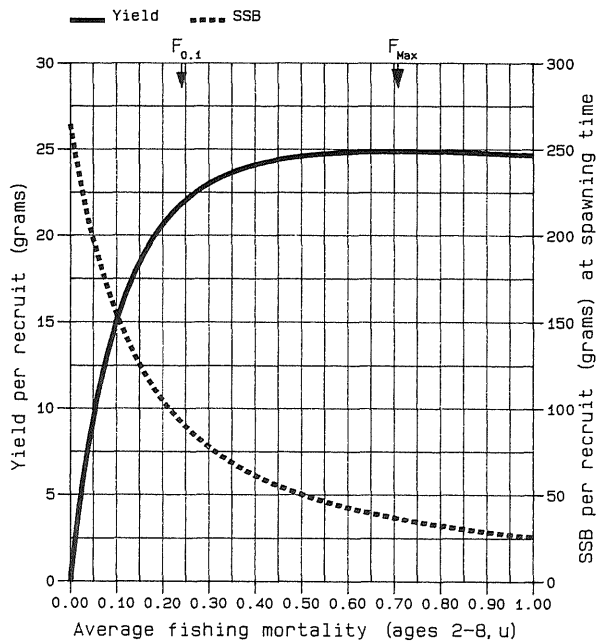
Figure 3.9.1 cont'd.

STOCK: Herring - Baltic area 25 to 29

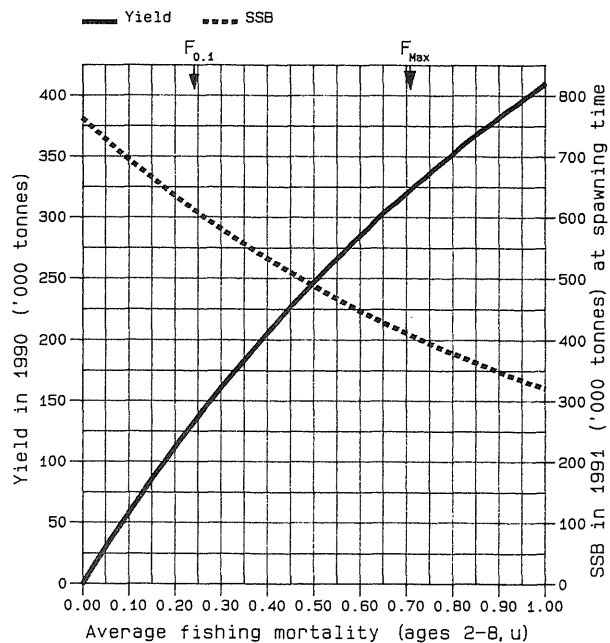
01-05-1989

Long-term yield and spawning stock biomass

Short-term yield and spawning stock biomass



C



D

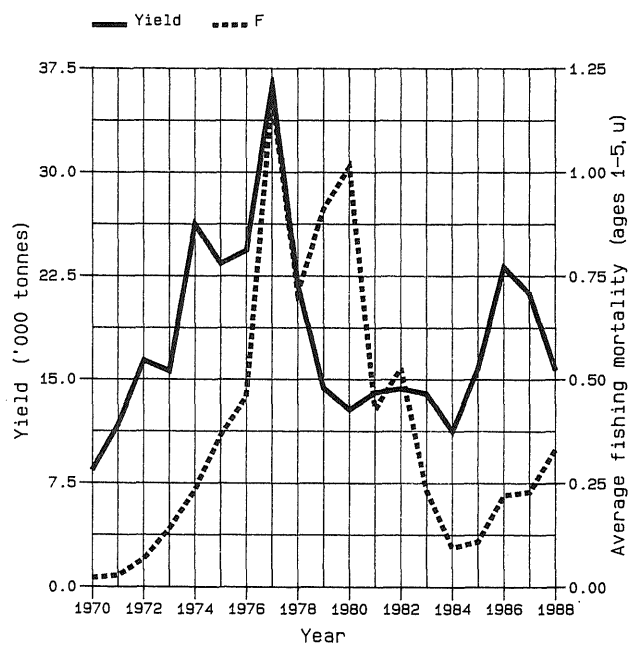
## FISH STOCK SUMMARY

### STOCK: Sprat - 22-25

### 02-05-1989

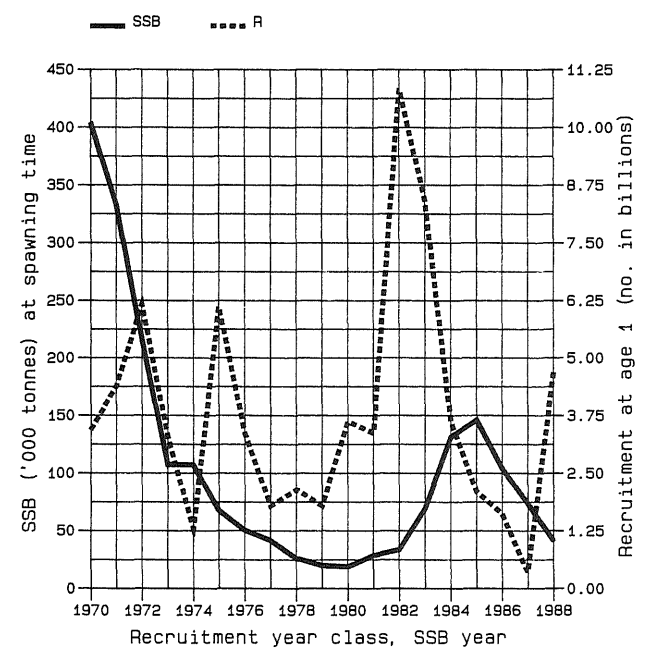
Figure 4.2.1

Trends in yield and fishing mortality (F)



A

Trends in spawning stock biomass (SSB) and recruitment (R)



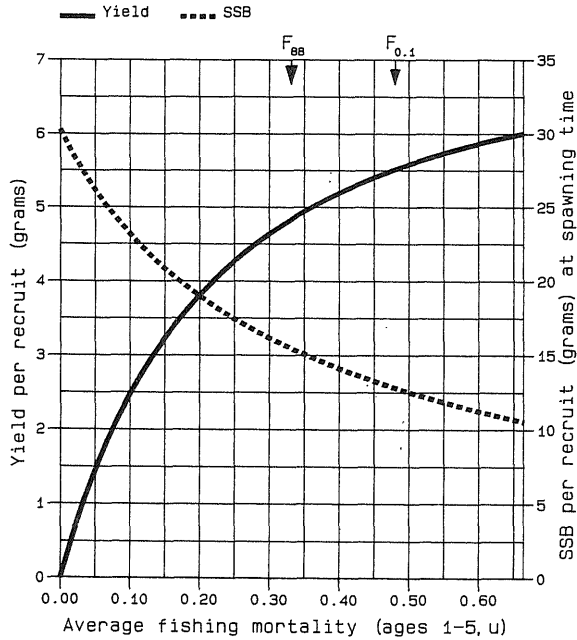
B

cont'd.

FISH STOCK SUMMARY  
 STOCK: Sprat - 22-25  
 02-05-1989

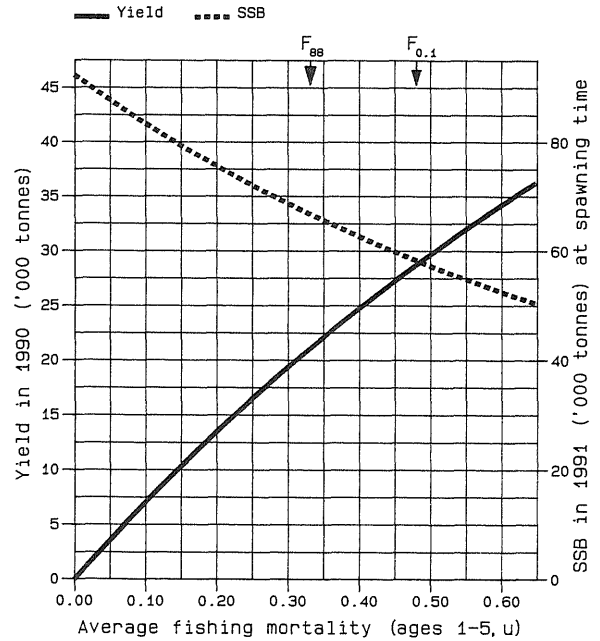
Figure 4.2.1 cont'd.

Long-term yield and spawning stock biomass



C

Short-term yield and spawning stock biomass



D

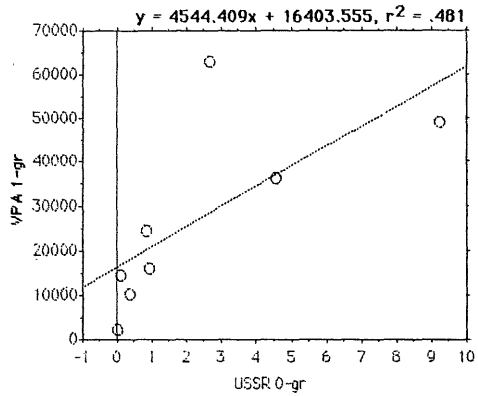


Figure 4.3.1 Relationship between USSR 0-group indices from September trawl survey and VPA 1-group for sprat in Sub-divisions 26 and 28.

1988 year class: index = 6.90  
 1-group = 47,760

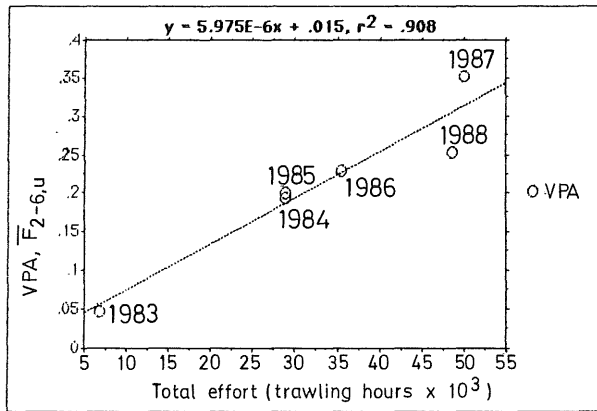
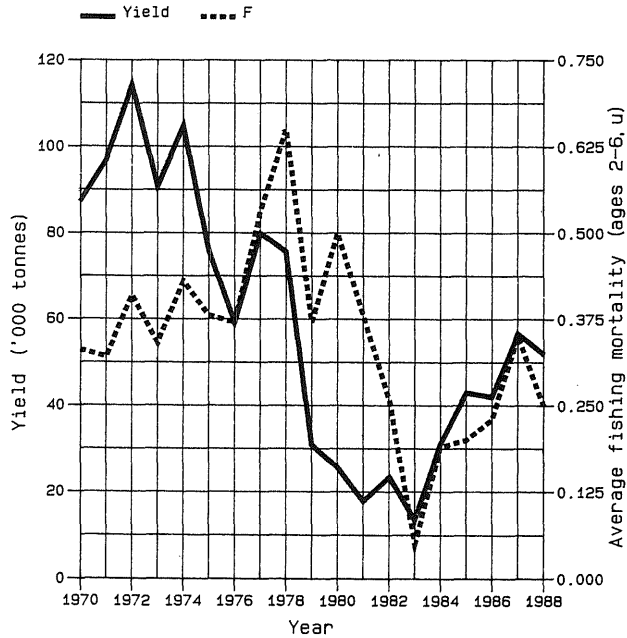


Figure 4.3.2 Relationship between  $F_{(2-6)u}$  from the VPA and total effort for the period 1983-1988.

FISH STOCK SUMMARY  
 STOCK: Sprat - 26 and 28  
 Assessment 2 - 03-05-1989

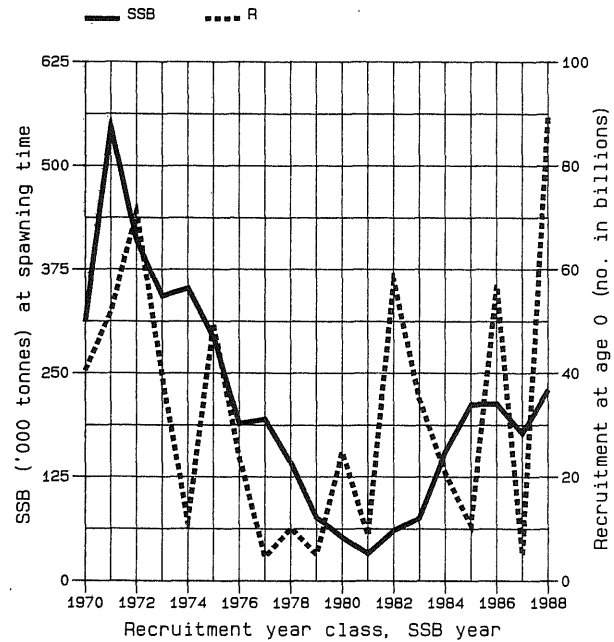
Figure 4.3.3

Trends in yield and fishing mortality (F)



A

Trends in spawning stock biomass (SSB) and recruitment (R)



B

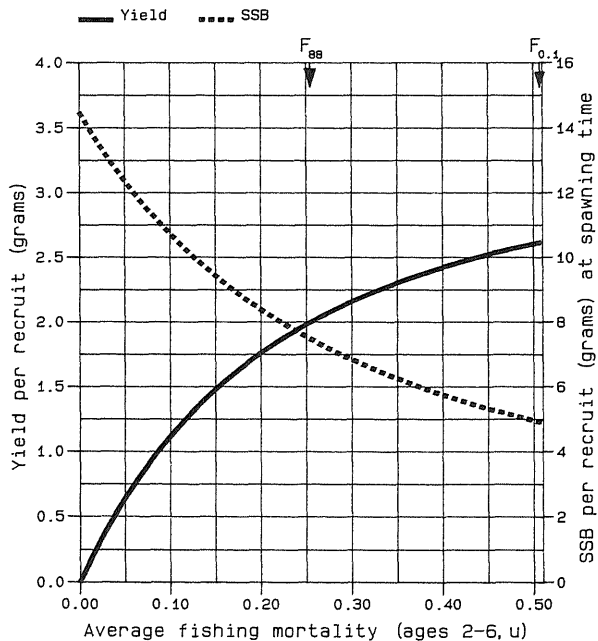
cont'd.

# FISH STOCK SUMMARY

STOCK: Sprat - 26 and 28  
 Assessment 2 - 03-05-1989

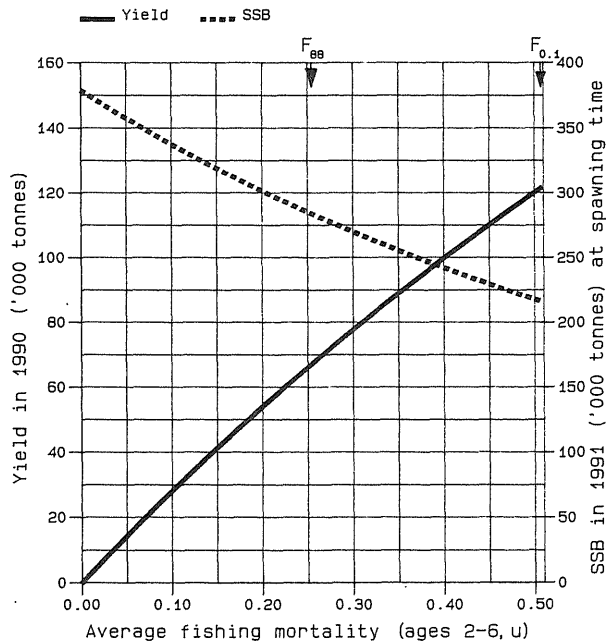
Figure 4.3.3 cont'd.

Long-term yield and spawning stock biomass



C

Short-term yield and spawning stock biomass

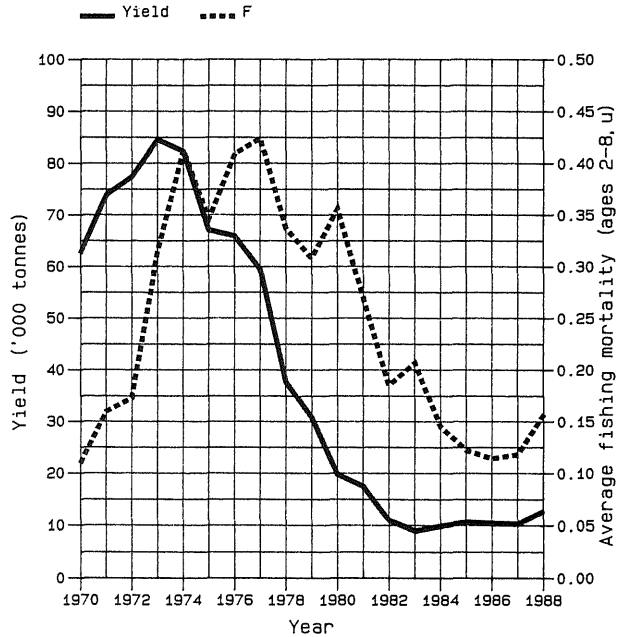


D

FISH STOCK SUMMARY  
 STOCK: Sprat: 27 and 29-32  
 03-05-1989

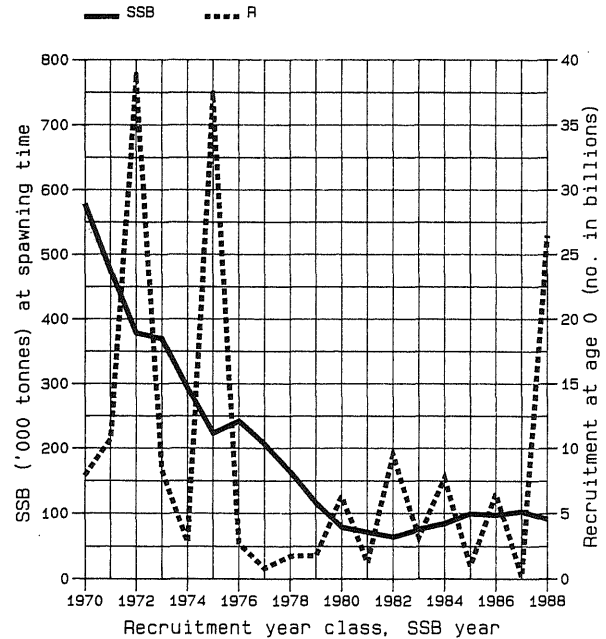
Figure 4.4.1

Trends in yield and fishing mortality (F)



A

Trends in spawning stock biomass (SSB) and recruitment (R)



B

cont'd.



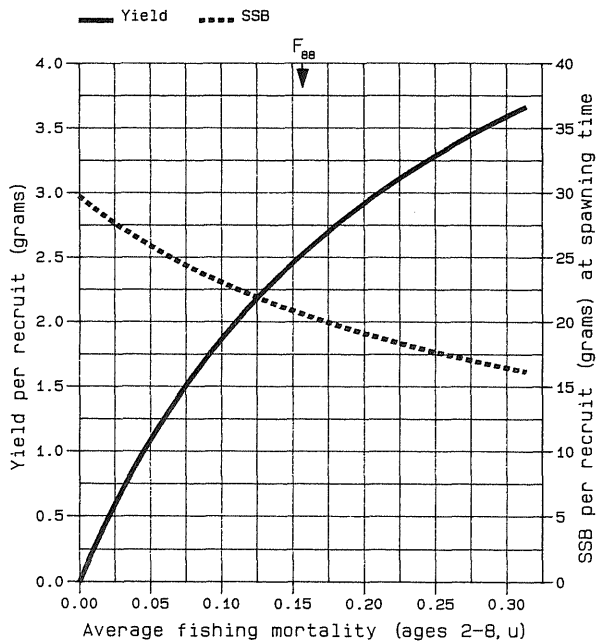
# FISH STOCK SUMMARY

STOCK: Sprat: 27 and 29-32

03-05-1989

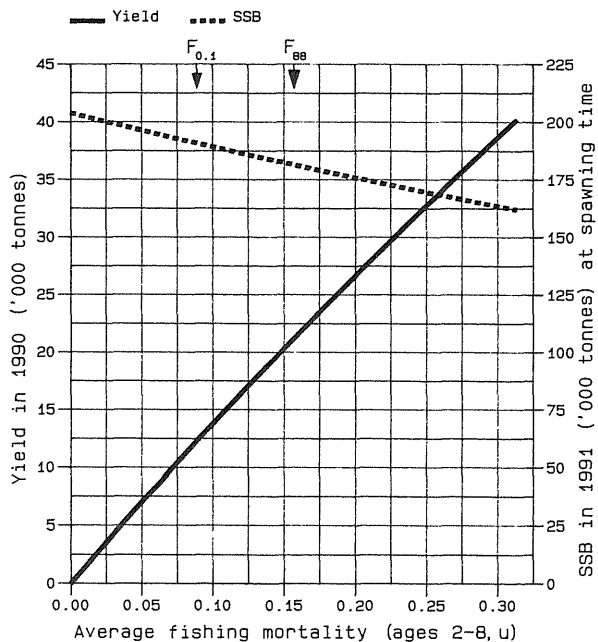
Figure 4.4.1 cont'd.

Long-term yield and spawning stock biomass



C

Short-term yield and spawning stock biomass



D

Figure 4.5.1 Sprat. Biomass in SD 22-32 compared with two acoustic stock estimates and with the summed biomass for three assessment units.

