

## **4 BARENTS SEA CAPELIN**

### **4.1 Regulation of the Barents Sea Capelin Fishery**

Since 1979, the Barents Sea capelin fishery has been regulated by a bilateral fishery management agreement between Russia (former USSR) and Norway. A TAC has been set separately for the winter fishery and for the autumn fishery. In recent years no autumn fishery has taken place, except for a small Russian experimental fishery. The fishery was closed from 1 May to 15 August until 1984. During the period 1984 to 1986, the fishery was closed from 1 May to 1 September. A minimum landing size of 11 cm has been in force for several years. From the autumn of 1986 to the winter of 1991, and from the autumn 1993 to the winter 1999 no fishery took place. The fishery was re-opened in the winter season 1991 and again in the winter season 1999, on a recovered stock.

In its autumn meeting of 2003, ACFM considered a harvest control rule, which was consistent with the precautionary approach. This rule defined the harvest level based on a maximum probability of 5% that SSB would fall below  $B_{lim}$  of 200 000 t (corresponding to no catch of pre-spawning capelin in 2003). ACFM also recommended that this harvest control rule be applied in 2003. (See also paragraph 4.5). During its Autumn 2003 meeting the Mixed Russian Norwegian Fishery Commission decided that no fishing should take place on Barents Sea capelin for the winter season 2004.

In 2002, the Mixed Russian Norwegian Fishery Commission agreed to adopt a management strategy based on the rule that, with 95% probability, at least 200 000 t of capelin should be allowed to spawn.

### **4.2 Catch Statistics**

The international catch by country and season in the years 1965-2003 is given in Table 4.2.1. The catch by age and length groups during the spring season 2003 is given in Table 4.2.2. The total catch in winter 2003 given in Table 4.2.1 was 282 000 t. This is 28 000 t below the quota set for 2003. No catches were taken during autumn 2003.

### **4.3 Stock Size Estimates**

#### **4.3.1 Larval and 0-group estimates in 2003**

Norwegian larval surveys based on Gulf III plankton samples have been carried out in June each year since 1981. The estimated total number of larvae is shown in Table 4.3.1.1. These larval abundance estimates do not show a high correlation with year class strength at age one, but should reflect the amount of larvae produced each year (Gundersen and Gjørseter, 1998). The year 1986 was exceptional, in that no larvae were found. This may have been due to late spawning that year, and eggs may have hatched after the survey was carried out. Also in other years some spawning is known to have taken place during the summer, and offspring from such late spawning is not reflected in the larval abundance estimates in Table 4.3.1.1. Since 1997, permission has not been granted to enter the Russian EEZ during the larval survey or permission has been granted so late that it could not be employed to good purpose, and consequently the total larval distribution area has not been covered. The estimate of  $11.9 \cdot 10^{12}$  larvae in 2003 is half of the estimate in 2002, at the same level as that obtained in 2001 and above the average for the period 1981-2003. During the international 0-group surveys in August an area-based index for the abundance of 0-group capelin is calculated (Table 4.3.1.1). Gundersen and Gjørseter (1998) found these indices to be well correlated ( $r^2 = 0.75$ ) with the 1-group acoustic estimates for the same year class obtained by the annual capelin acoustic surveys in autumn. Data points up to 1994 were included in this analysis. When this regression is updated with the survey results from 1981-2003 the parameters in the regression were changed slightly and the  $r^2$  was reduced to 0.65. Based on this regression, ( $\ln$  1-group estimate =  $-1.74 + 1.18 \cdot \ln$  0-group index), the 0-group index obtained in 2003 of 630 would correspond to a year class strength of 347 billion one-year-olds in autumn 2004. A year class of this size would be about 1.6 times an average year class in the period 1972-2002.

#### **4.3.2 Acoustic stock size estimates in 2003**

Two Russian and three Norwegian vessels jointly carried out the 2003 acoustic survey as part of an ecosystem-survey during autumn (WD by Bogstad *et al.*). The coverage of the total stock was considered complete. The results from the survey are given in Table 4.3.2.1, and are compared to previous years' results in Table 4.3.2.2. The stock size was estimated at 0.5 million tonnes. About 50% (0.28 mill t) of the stock biomass consisted of maturing fish (> 14 cm).

### 4.3.3 Other surveys

During the period of 20/02-08/03, two Russian research vessels surveyed and good coverage the area of capelins spawning stock distribution. It was about 99 thousand square nautical miles and located in the Norwegian, Russian and Grey Zones. Capelin as very scattered concentrations were recorded in the area from the 32°-37° everywhere. Typical "moving schools" practically were not found. The most part of fish was dispersed in the layers close to the bottom. It was weak migration  $F_{low}$  in the central part and there was not a considerable  $F_{low}$  in the east of the Barents Sea. The maturing stock, determined as the part of the stock exceeding 14 cm length, was estimated at **5224.42x10<sup>6</sup> ind.**, and **104.95x10<sup>3</sup> tonnes**. Capelin at the age of 3 and 4 (poor year-classes of 2001 and 2000) made up the bulk of the capelin spawning stock, in 28/60 proportion, in spring 2004.

During the Norwegian demersal fish survey in February 2004 observations of capelin by acoustics and by pelagic and demersal trawls were made. Although no stock size estimate was attempted, due to inadequate coverage and low number of pelagic trawl hauls for identification and sampling purposes, the overall impression was very low abundance of capelin found pelagically and sporadic catches of capelin in the bottom trawl hauls. Samples of cod stomachs during this period give valuable information for the modelling of maturing capelin as prey for cod (Bogstad and Gjørseter, 2001).

### 4.4 Historical stock development

An overview of the development of the Barents Sea capelin stock in the period 1991-2003 is given in Tables 4.4.1-4.4.7. The methods and assumptions used for constructing the tables are explained in Appendix A to ICES 1995 Assess: 9. In that report, the complete time series back to 1973 can also be found. It should be noted that several of the assumptions and parameter values used in constructing these tables differ from those used in the assessment. For instance, in the assessment model the M-values for immature capelin are calculated using new estimates of the length at maturity and M-values for mature capelin are calculated taking the predation by cod into account. This will also affect the estimates of spawning stock biomass given in the stock summary table (Table 4.4.7). It should be noted that these values, coming from a deterministic model cannot directly be compared to those coming from the probabilistic assessment model (Bifrost) used for this stock. However, as a crude overview of the development of the Barents Sea capelin stock the tables may be adequate.

Estimates of stock in number by age group and total biomass for the period are shown in Table 4.4.1. Catch in numbers at age and total landings are shown for the spring and autumn seasons in Tables 4.4.2 and 4.4.3. Natural mortality coefficients by age group for immature and mature capelin are shown in Table 4.4.4. Stock size at 1 January in numbers at age and total biomass is shown in Table 4.4.5. Spawning stock biomass per age group is shown in Table 4.4.6. Table 4.4.7 gives an aggregated summary for the entire period 1973-2003.

### 4.5 Stock assessment autumn 2003

As decided by the Northern Pelagic and Blue Whiting Fisheries Working Group at its 2003 meeting (ICES 2003/ACFM:23), the assessment of Barents Sea capelin was left to the parties responsible for the autumn survey, i.e. IMR in Bergen and PINRO in Murmansk, who reported directly to ACFM before its autumn 2003 meeting (Bogstad *et al.*, WD).

A probabilistic projection of the spawning stock to the time of spawning at 1 April 2004 was presented, using the spreadsheet model CapTool (implemented in the @RISK add-on for EXCEL). The projection was based on a probabilistic maturation model with parameters estimated by the model Bifrost (Gjørseter *et al.* 2002) with uncertainty taken into account and data on size and composition of the cod stock (from the Arctic Fisheries Working Group, ICES 2003/ACFM:22, but made probabilistic in CapTool in accordance with the risk analysis made by the Arctic Fisheries Working Group). It was very good relationship between results of calculation SSB which getting by CapTool model and Russian winter capelin survey.

There is clearly a need for a target biomass reference point for capelin. Calculations of  $B_{target}$  were attempted, but were not presented because the results were considered preliminary. A  $B_{lim}$  ( $SSB_{lim}$ ) management approach was suggested for this stock. In 2002, the Mixed Russian Norwegian Fishery Commission agreed to adopt a management strategy based on the rule that, with 95% probability, at least 200 000 t of capelin should be allowed to spawn. Consequently, 200 000 t was used as a  $B_{lim}$ .

Probabilistic prognoses for the maturing stock from October 1 2003 until April 1 2004 were made, with a CV of 0.20 on the abundance estimate. The meeting concluded that capelin recruitment in 2004 could be seriously negatively affected by the stock of young herring now found in the Barents Sea.

ACFM at its autumn 2003 meeting (ICES 2003/CRR:261) took all the points in the report into account. ACFM advised that no fishing should take place in spring 2004. This was based on adopting the forecast of the SSB using the limit reference points referred above, and following the harvest control rule that the SSB should fall below  $B_{lim}$  with a maximum 5% probability. ACFM also considered that adjustments of the harvest control rule should be further investigated for the purpose of taking better account of the uncertainty in the predicted estimate of spawner abundance, the likely interactions with herring, and the role of capelin as prey.

#### 4.6 Management considerations

Since the assessment of the stock is directly based on the acoustic survey conducted annually in September-October, and the main fishing season does not begin until January, advice for this stock must be given during the autumn ACFM meeting and the TAC must be set by the Mixed Norwegian-Russian Fishery Commission during its meeting in November-December. As previously decided by the Northern Pelagic and Blue Whiting Fisheries Working Group, the assessment of Barents Sea capelin is left to the parties responsible for the autumn survey, i.e. IMR in Bergen and PINRO in Murmansk, who will meet in Kirkenes from 05-08 October 2004 and report directly to the 2004 ACFM autumn meeting.

#### 4.7 Sampling

The sampling from scientific surveys and from commercial fishing on capelin in 2003 and winter 2004 is summarised below:

Investigation	No. of samples	Length measurements	Aged individuals
Russian capelin investigation winter 2003	135	4808	-
Russian fishery winter-spring 2003	114	19449	800
Norwegian capelin investigations winter 2003	163	5581	1742
Norwegian fishery winter-spring 2003	44	4340	1461
Acoustic survey autumn 2003 (Norway)	196	7707	2231
Acoustic survey autumn 2003 (Russia)	142	7330	725
Other samples 2003 (Norway)	139	8500	-
Other sample 2003 (Russia)	79	5739	50
Norwegian capelin investigations winter 2004	213	6590	1994
Russian capelin investigation winter 2004	167	9368	883

**Table 4.2.1** Barents Sea CAPELIN. International catch ('000 t) as used by the Working Group.

Year	Winter				Summer-Autumn			Total
	Norway	Russia	Others	Total	Norway	Russia	Total	
1965	217	7	0	224	0	0	0	224
1966	380	9	0	389	0	0	0	389
1967	403	6	0	409	0	0	0	409
1968	460	15	0	475	62	0	62	537
1969	436	1	0	437	243	0	243	680
1970	955	8	0	963	346	5	351	1314
1971	1300	14	0	1314	71	7	78	1392
1972	1208	24	0	1232	347	11	358	1591
1973	1078	35	0	1112	213	10	223	1336
1974	749	80	0	829	237	82	319	1149
1975	559	301	43	903	407	129	536	1439
1976	1252	231	0	1482	739	366	1105	2587
1977	1441	345	2	1788	722	477	1199	2987
1978	784	436	25	1245	360	311	671	1916
1979	539	343	5	887	570	326	896	1783
1980	539	253	9	801	459	388	847	1648
1981	784	428	28	1240	454	292	746	1986
1982	568	260	5	833	591	336	927	1760
1983	751	374	36	1161	758	439	1197	2358
1984	330	257	42	628	481	367	849	1477
1985	340	234	17	590	113	164	278	868
1986	72	51	0	123	0	0	0	123
1987	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0
1991	528	156	20	704	31	195	226	929
1992	620	247	24	891	73	159	232	1123
1993	402	170	14	586	0	0	0	586
1994	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	1	1	1
1998	0	0	0	0	0	1	1	1
1999	46	32	0	78	0	23	23	101
2000	283	95	8	386	0	28	28	414
2001	368	180	8	557	0	11	11	568
2002	391	228	17	635	0	16	16	651
2003	190	93	0	282	0	0	0	282

**Table 4.2.2** Barents Sea CAPELIN. International catch in number (10<sup>6</sup>) and biomass (t) during the spring season 2003, as used by the Working Group

Length cm	Age 1		Age 2		Age 3		Age 4		Age 5+		Sum			
	N	B	N	B	N	B	N	B	N	B	N	%	B	%
5.0-5.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.5-6.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.0-6.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.5-7.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.0-7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5-8.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.0-8.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.5-9.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9.0-9.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9.5-10.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10.0-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10.5-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11.0-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11.5-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.0-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.5-	0	0	0	0	4480	41	0	0	0	0	4480	0	41	0
13.0-	0	0	0	0	227047	2138	4692	43	0	0	231739	2	2180	1
13.5-	0	0	0	0	248431	2598	123197	1262	0	0	371627	3	3860	1
14.0-	0	0	0	0	462853	5347	330091	3869	0	0	792944	6	9217	3
14.5-	0	0	0	0	311292	4088	776663	10559	4692	72	1092647	8	14718	5
15.0-	0	0	0	0	352191	5178	1058475	15343	0	0	1410666	11	20521	7
15.5-	0	0	0	0	168810	2828	1364395	23405	36993	678	1570199	12	26910	10
16.0-	0	0	0	0	139504	2736	1482273	28883	53564	1091	1675342	13	32710	12
16.5-	0	0	0	0	132094	2741	1534349	34363	56778	1409	1723222	13	38513	14
17.0-	0	0	0	0	21942	581	1370535	35220	36723	777	1429201	11	36579	13
17.5-	0	0	0	0	36700	1094	1188436	34896	78429	2270	1303564	10	38259	14
18.0-	0	0	0	0	9384	302	759772	24561	95860	3037	865016	6	27900	10
18.5-	0	0	0	0	33854	1096	454478	16325	46960	1661	535292	4	19082	7
19.0-	0	0	0	0	0	0	235440	8719	4692	175	240132	2	8895	3
19.5-	0	0	0	0	0	0	52999	2207	0	0	52999	0	2207	1
20.0-	0	0	0	0	0	0	16624	790	0	0	16624	0	790	0
20.5-	0	0	0	0	0	0	372	20	0	0	372	0	20	0
21.0-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21.5-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Sum</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2148582</b>	<b>30766</b>	<b>1075279</b>	<b>240464</b>	<b>414691</b>	<b>11170</b>	<b>1331606</b>	<b>100</b>	<b>282400</b>	<b>100</b>

**Table 4.3.1.1** Barents Sea CAPELIN. Larval abundance estimate ( $10^{12}$ ) in June, and 0-group index in August.

Year	Larval abundance	0-group index
1981	9.7	570
1982	9.9	393
1983	9.9	589
1984	8.2	320
1985	8.6	110
1986	0.0	125
1987	0.3	55
1988	0.3	187
1989	7.3	1300
1990	13.0	324
1991	3.0	241
1992	7.3	26
1993	3.3	43
1994	0.1	58
1995	0.0	43
1996	2.4	291
1997	6.9	522
1998	14.1	428
1999	36.5	722
2000	19.1	303
2001	10.7	221
2002	22.4	327
2003	11.9	630

**Table 4.3.2.1** Barents Sea CAPELIN. Estimated stock size from the acoustic survey in September-October 2003. Based on TS value  $19.1 \log L - 74.0$  dB, corresponding to  $\sigma = 5.0 \cdot 10^{-7} \cdot L^{1.91}$ .

Length (cm)	Age/Year class				Sum ( $10^6$ )	Biomass ( $10^3$ t)	Mean weight (g)
	1 2002	2 2001	3 2000	4 1999			
6.5 - 7.0	4482				4482	4.5	1.0
7.0 - 7.5	8670				8670	9.3	1.1
7.5 - 8.0	4980				4980	7.5	1.5
8.0 - 8.5	14626				14626	28.9	2.0
8.5 - 9.0	15621				15621	35.4	2.3
9.0 - 9.5	13086				13086	37.1	2.8
9.5 - 10.0	9251	5			9256	29.5	3.2
10.0 - 10.5	6994	2			6996	26.5	3.8
10.5 - 11.0	3238	29			3267	14.9	4.6
11.0 - 11.5	1317	262			1579	7.4	4.7
11.5 - 12.0	163	952			1115	6.7	6.0
12.0 - 12.5	16	1137			1153	7.9	6.9
12.5 - 13.0		902			902	7.3	8.1
13.0 - 13.5		1407	98		1505	13.4	8.9
13.5 - 14.0		1450	161		1611	16.7	10.4
14.0 - 14.5		1430	741		2171	26.2	12.1
14.5 - 15.0		1211	1443	19	2673	37.7	14.1
15.0 - 15.5		570	1785	47	2402	39.3	16.4
15.5 - 16.0		181	2113	190	2484	45.2	18.2
16.0 - 16.5		58	2171	199	2428	47.9	19.7
16.5 - 17.0			1351	260	1611	36.2	22.4
17.0 - 17.5			765	346	1111	27.6	24.9
17.5 - 18.0			330	199	529	14.4	27.2
18.0 - 18.5			21	97	118	3.6	30.6
18.5 - 19.0			3	42	45	1.5	33.6
19.0 - 19.5				3	3	0.1	37.1
TSN ( $10^6$ )	82444	9596	10982	1402	104424		
TSB ( $10^3$ t)	200.8	97.4	201.6	33.0		532.8	
Mean length (cm)	8.8	13.5	15.8	16.9	10.1		
Mean weight (g)	2.4	10.2	18.4	23.5			5.1
SSN ( $10^6$ )		3450	10723	1402	15572		
SSB ( $10^3$ t)		48.2	198.7	32.6		279.6	

Based on TS value:  $19.1 \log L - 74.0$ , corresponding to  $\sigma = 5.0 \cdot 10^{-7} \cdot L^{1.9}$

**Table 4.3.2.2** Barents Sea CAPELIN. Stock size in numbers by age, total stock biomass and biomass of the maturing component. Stock in numbers (unit:10<sup>9</sup>) and stock and maturing stock biomass (unit:10<sup>3</sup> tonnes) are given at 1. October.

Year	Stock in numbers (10 <sup>9</sup> )					Stock in weight ('000 t)		
	Age 1	Age 2	Age 3	Age 4	Age 5	Total	Total	Maturing
1973	528	375	40	17	0	961	5144	1350
1974	305	547	173	3	0	1029	5733	907
1975	190	348	296	86	0	921	7806	2916
1976	211	233	163	77	12	696	6417	3200
1977	360	175	99	40	7	681	4796	2676
1978	84	392	76	9	1	561	4247	1402
1979	12	333	114	5	0	464	4162	1227
1980	270	196	155	33	0	654	6715	3913
1981	403	195	48	14	0	660	3895	1551
1982	528	148	57	2	0	735	3779	1591
1983	515	200	38	0	0	754	4230	1329
1984	155	187	48	3	0	393	2964	1208
1985	39	48	21	1	0	109	860	285
1986	6	5	3	0	0	14	120	65
1987	38	2	0	0	0	39	101	17
1988	21	29	0	0	0	50	428	200
1989	189	18	3	0	0	209	864	175
1990	700	178	16	0	0	894	5831	2617
1991	402	580	33	1	0	1016	7287	2248
1992	351	196	129	1	0	678	5150	2228
1993	2	53	17	2	2	75	796	330
1994	20	3	4	0	0	28	200	94
1995	7	8	2	0	0	17	193	118
1996	82	12	2	0	0	96	503	248
1997	99	39	2	0	0	140	911	312
1998	179	73	11	1	0	263	2056	931
1999	156	101	27	1	0	285	2776	1718
2000	449	111	34	1	0	595	4273	2099
2001	114	219	31	1	0	364	3630	2019
2002	60	91	50	1	0	201	2210	1290
2003	82	10	11	1	0	104	533	280



**Table 4.4.1** Barents Sea CAPELIN. Estimated stock size in numbers (unit:10<sup>9</sup>) by age group and total, and biomass ('000 t) of total stock, by 1. August, back-calculated from the survey in September-October.

Age	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
1	29.5	8.3	88.9	111.8	188.4	171.4	474.7	128.0	67.3	92.9
2	5.1	9.4	12.5	44.2	76.5	111.5	116.8	246.6	102.3	13.0
3	6.4	1.6	2.2	2.2	12.1	27.9	35.9	33.0	54.4	14.6
4	0.3	0.4	0.1	0.1	0.7	0.9	0.8	1.2	0.6	1.9
5	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.0
Sum	41.4	19.7	103.7	158.3	277.8	311.7	628.4	408.8	224.7	122.4
Biomass	259	189	467	866	1860	2580	3840	3480	2122	662

**Table 4.4.2** Barents Sea CAPELIN. Catch in numbers (unit:10<sup>9</sup>) by age group and total landings ('000 t) in the spring season.

Age	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.5	0.4	0.0
3	0.0	0.0	0.0	0.0	0.0	1.6	5.5	7.6	10.0	2.1
4	0.0	0.0	0.0	0.0	0.0	1.2	8.4	12.1	14.2	10.8
5	0.0	0.0	0.0	0.0	0.0	0.1	1.0	2.2	0.7	1.4
Sum	0.0	0.0	0.0	0.0	0.0	3.0	15.1	22.5	25.3	14.3
Landings	0	0	0	0	0	78	386	557	635	635

**Table 4.4.3** Barents Sea CAPELIN. Catch in numbers (unit:10<sup>9</sup>) by age group and total landings ('000 t) in the autumn season.

Age	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
1	0.0	0.0	0.0	0.0	0.0	0.4	0.1	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.9	0.9	0.4	0.3	0.0
3	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.2	0.6	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sum	0.0	0.0	0.0	0.0	0.1	1.6	1.5	0.6	0.9	0.0
Landings	0	0	0	1	1	23	28	11	16	0

**Table 4.4.4** Barents Sea CAPELIN. Natural mortality coefficients (per month) for immature fish ( $M_{imm}$ ), used for the whole year, and for mature fish (per season) ( $M_{mat}$ ) used January to March, by age group and average for age groups 1-5.

Age	1994		1995		1996		1997		1998	
	$M_{imm}$	$M_{mat}$	$M_{imm}$	$M_{mat}$	$M_{imm}$	$M_{mat}$	$M_{imm}$	$M_{mat}$	$M_{imm}$	$M_{mat}$
1	0.201	0.602	0.073	0.219	0.041	0.122	0.062	0.185	0.026	0.077
2	0.201	0.602	0.073	0.219	0.041	0.122	0.062	0.185	0.026	0.077
3	0.201	0.602	0.019	0.058	0.041	0.122	0.062	0.185	0.071	0.212
4	0.282	0.847	0.044	0.133	0.050	0.149	0.014	0.041	0.071	0.212
5	0.282	0.847	0.044	0.133	0.050	0.149	0.014	0.041	0.071	0.212
Avr	0.221	0.700	0.052	0.152	0.043	0.133	0.042	0.127	0.053	0.158

**Table 4.4.4** (Continued)

Age	1999		2000		2001		2002		2003	
	M <sub>imm</sub>	M <sub>mat</sub>	M <sub>imm</sub>	M <sub>mat</sub>	M <sub>imm</sub>	M <sub>mat</sub>	M <sub>imm</sub>	M <sub>mat</sub>	M <sub>imm</sub>	M <sub>mat</sub>
1	0.047	0.142	0.028	0.083	0.060	0.180	0.060	0.180	0.060	0.180
2	0.047	0.142	0.028	0.083	0.060	0.180	0.060	0.180	0.152	0.456
3	0.025	0.074	0.026	0.079	0.040	0.120	0.040	0.120	0.142	0.426
4	0.025	0.074	0.026	0.079	0.040	0.120	0.040	0.120	0.142	0.426
5	0.025	0.074	0.026	0.079	0.040	0.120	0.040	0.120	0.142	0.426
Avr	0.034	0.101	0.027	0.080	0.048	0.144	0.048	0.144	0.128	0.383

**Table 4.4.5** Barents Sea CAPELIN. Estimated stock size in numbers (unit:10<sup>9</sup>) by age group and total, and biomass ('000 t) of total stock, by 1. January.

Age	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
1	120.3	13.8	118.2	172.0	225.5	238.5	576.1	194.7	102.3	141.3
2	1.4	10.8	5.7	72.5	82.2	165.8	135.3	413.3	94.6	75.4
3	33.3	1.9	6.5	10.2	32.5	67.3	88.1	100.9	182.6	44.5
4	9.8	2.4	1.4	1.8	1.6	8.5	24.7	31.1	27.0	0.5
5	1.3	0.1	0.3	0.1	0.1	0.5	0.8	0.7	0.9	0.0
Sum	166.1	28.9	132.2	256.6	341.9	480.6	824.9	740.6	407.5	261.7
Biomass	737	156	313	779	1240	2456	3571	4558	3539	2008

**Table 4.4.6** Barents Sea CAPELIN. Estimated spawning stock biomass ('000 t) by 1. April.

Age	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
1	0	0	0	0	0	0	0	0	0	0
2	0	1	3	1	1	2	24	5	0	169
3	34	15	71	175	217	650	819	943	867	663
4	60	38	24	49	34	193	472	539	339	0
5	11	1	7	2	2	10	0	0	9	0
Sum	105	55	105	228	254	856	1315	1487	1215	832

**Table 4.4.7** Barents Sea CAPELIN. Stock summary table. Recruitment (number of 1 year old fish (unit:10<sup>9</sup>) and stock biomass ('000 t) given at 1. August, spawning stock ('000 t) at time of spawning (1. April). Landings ('000 t) are the sum of the total landings in the two fishing seasons within the year indicated. The SSB is obtained by projecting the stock forward assuming a natural mortality that does not take the current predation mortality fully into account.

Year	Stock biomass	Recruitment Age 1	Spawning stock biomass	Landings
1965				224
1966				389
1967				409
1968				537
1969				680
1970				1314
1971				1392
1972	5831			1592
1973	6630	1140	1242	1336
1974	7121	737	343	1149
1975	8841	494	90	1439
1976	7584	433	1147	2587
1977	6254	830	890	2987
1978	6119	855	460	1916
1979	6576	551	193	1783
1980	8219	592	87	1648
1981	4489	466	1731	1986
1982	4205	611	546	1760
1983	4772	612	47	2358
1984	3303	183	171	1477
1985	1087	47	106	868
1986	157	9	13	123
1987	107	46	16	0
1988	361	22	11	0
1989	771	195	141	0
1990	4901	708	179	0
1991	6647	415	1584	929
1992	5371	396	998	1123
1993	991	3	460	586
1994	259	30	105	0
1995	189	8	55	0
1996	467	89	105	0
1997	866	112	228	1
1998	1860	188	254	1
1999	2580	171	856	106
2000	3840	475	1315	414
2001	3480	128	1487	568
2002	2122	67	1215	651
2003	662	93	832	282