3.4.8 Barents Sea capelin (Subareas I and II, excluding Division IIa west of 5°W)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Reduced reproductive capacity	Not defined	Not defined	There was no commercial fishery in 2005/06. The fishery is managed according to a target escapement strategy.

Based on the most recent estimates of SSB and recruitment, ICES classifies the stock as having reduced reproductive capacity. The SSB for April 2007 is predicted to be 189 000 t, i.e. below $\mathbf{B}_{lim}$. The abundance at age 1 (2005 year class) is estimated to be far below the long-term average, and this is the fifth weak year class in a row. Observations during the international 0-group survey in August–September 2006 indicated that the size of the 2006 year class is twice as high as the long-term mean.

Management objectives

The fishery is managed according to a target escapement strategy, with a harvest control rule allowing (with 95% probability) the SSB to be above the proposed $\mathbf{B}_{lim}$, taking predation by cod into account. ICES considers the management plans to be consistent with the precautionary approach.

Reference points

	ICES considers that:	ICES proposes that:
Precautionary approach reference points	$\mathbf{B}_{lim}$ is set equal to 200 000 t.	$\mathbf{B}_{pa}$ not defined (not relevant).
	$\mathbf{F}_{lim}$ not defined (not relevant).	$\mathbf{F}_{pa}$ not defined (not relevant).
Target reference points		$\mathbf{F}_{msy}$ not defined (not relevant).

Single-stock exploitation boundaries

Exploitation boundaries in relation to existing management plans

With zero catch in the first part of 2007, the predicted SSB in April 2007 would be 189 000 t. This biomass is below $\mathbf{B}_{lim}$ with a probability of more than 50%. Therefore, under the management plan, no catch can be permitted in 2007.

Short-term implications

Outlook for 2007

The spawning stock in 2007 is predicted from the acoustic survey in September 2006 by a model which estimates maturity, growth, and mortality (including predation by cod). The model takes into account uncertainties both in the survey estimate and in other input data. Even with no catch in 2007, the probability of having an SSB below 200 000 t is above 50% (Figure 4.1.6.1**)**. Only catches of mature fish have been considered.

Management considerations

For this stock, a $\mathbf{B}_{lim}$ equal to the value of the 1989 spawning stock biomass, which is the lowest SSB having produced an outstanding year class, is considered a good basis for such a reference point in a non-herring situation. The mean value of the 1989 spawning stock biomass is less than 100 000 t. However, the assessment method may not yet account for all sources of uncertainty, and there are inconsistencies in the data series. Thus, it may be appropriate to use a somewhat higher $\mathbf{B}_{lim}$. In recent years ICES has used a $\mathbf{B}_{lim}$ of 200 000 t.

The $\mathbf{B}_{lim}$ rule is intended to be a safeguard against recruitment failure. However, it is likely that the recruitment would be larger at a larger spawning stock, especially for moderately good recruitment conditions. In such a situation, a target-based control rule in addition to the $\mathbf{B}_{lim}$-based rule could be appropriate. The negative influence of herring on capelin

recruitment should be included in the $\mathbf{B}_{lim}$-based rule if such a relationship can be described quantitatively. Adjustments of the harvest control rule should be investigated further to take the uncertainty in the predicted amount of spawners and the role of capelin as a prey item into account.

Factors affecting the fisheries and the stock

Regulations and their effects

Since 1979, the fishery has been regulated by a bilateral agreement between Norway and Russia. The catches have been very close to the advice in all years since 1987.

The environment

The estimated annual consumption of capelin by cod has varied between 0.2 and 3.0 million t over the period 1984–2005. Young herring consume capelin larvae, and this predation pressure is thought to be one of the causes for the poor year classes of capelin in the periods 1984–1986, 1992–1994, and from 2002. The abundance of herring in the Barents Sea is believed to stay at a high level in 2007.

Scientific basis

Data and methods

The assessment and stock history is based on joint Russian–Norwegian acoustic surveys during September each year. From 1998 onwards, a model incorporating predation by cod has been used for predicting SSB and for estimating the historical time-series of SSB.

Source of information: Report from the 2006 joint Russian–Norwegian meeting to assess the Barents Sea capelin stock, Kirkenes, 30 September–3 October 2006.

Year	ICES Advice	Recommended TAC	Agreed TAC	ACFM catch
1987	Catches at lowest practical level	0	0	0
1988	No catch	0	0	0
1989	No catch	0	0	0
1990	No catch	0	0	0
1991	TAC	1000[1]	900	933
1992	SSB > 4–500 000 t	834	1100	1123
1993	A cautious approach, SSB > 4–500 000 t	600	630	586
1994	No fishing	0	0	0
1995	No fishing	0	0	0
1996	No fishing	0	0	0
1997	No fishing	0	0	1
1998	No fishing	0	0	1
1999	SSB> 500,000 t	79[1]	80	101
2000	5% probability of SSB< 200 000 t	435[1]	435	414
2001	5% probability of SSB< 200 000 t	630[1]	630	568
2002	5% probability of SSB< 200 000 t	650[1]	650	651
2003	5% probability of SSB< 200 000 t	310[1]	310	282
2004	5% probability of SSB< 200 000 t	0	0	0
2005	5% probability of SSB< 200 000 t	0	0	1[2]
2006	5% probability of SSB< 200 000 t	0	0	0
2007	5% probability of SSB< 200 000 t	0		

Weights in thousand tonnes.
[1]Winter-spring fishery. [2]Research quota.

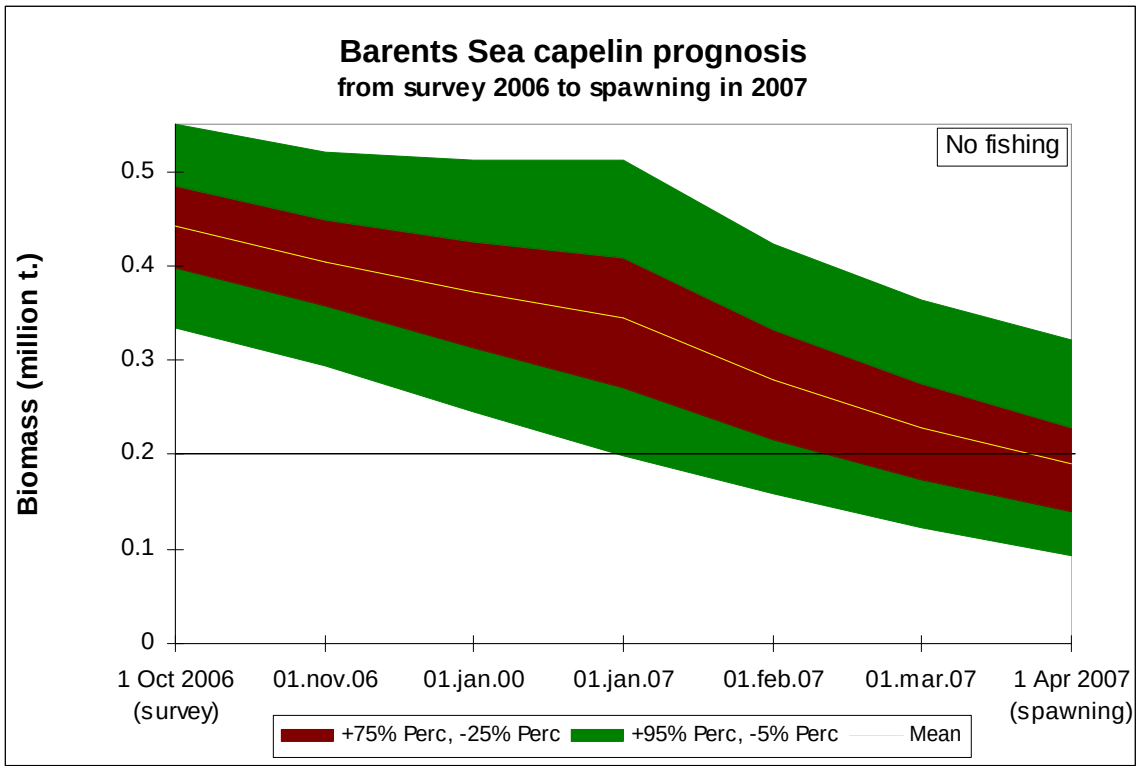

Figure 3.4.8.1 Probabilistic prognosis 1 October 2006–1 April 2007 for Barents Sea capelin (maturing stock, no catch). The dotted line is drawn at 200 000 tonnes, the $\mathbf{B}_{lim}$-value used by ICES in recent years.

Table 3.4.8.1 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
2004	0	0	0	0	0	0	0	0
2005	1	0	0	1	0	0	0	0
2006	0	0	0	0				

Table 3.4.8.2 Barents Sea CAPELIN. Stock summary table. Recruitment and total biomass are survey estimates back-calculated to 1 August (before the autumn fishing season). Maturing biomass is the survey estimate of fish above maturity length (14.0 cm). SSB is the median value of the modeled stochastic spawning stock biomass (after the winter/spring fishery).

Year	Stock biomass August 1	Maturing biomass survey Oct. 1	Recruitment Age 1, August 1	Forward Prediction of SSB as of April 1	Landings	Herring biomass age 1 and 2
1965					224	
1966					389	
1967					409	
1968					537	
1969					680	
1970					1314	
1971					1392	
1972	5831	2182			1592	
1973	6630	1350	1140	33	1336	1
1974	7121	907	737	*	1149	48
1975	8841	2916	494	*	1439	73
1976	7584	3200	433	253	2587	38
1977	6254	2676	830	22	2987	46
1978	6119	1402	855	*	1916	51
1979	6576	1227	551	*	1783	39
1980	8219	3913	592	*	1648	65
1981	4489	1551	466	316	1986	46
1982	4205	1591	611	106	1760	8
1983	4772	1329	612	100	2358	12
1984	3303	1208	183	109	1477	1263
1985	1087	285	47	*	868	1176
1986	157	65	9	*	123	171
1987	107	17	46	34	0	142
1988	361	200	22	*	0	53
1989	771	175	195	84	0	140
1990	4901	2617	708	92	0	371
1991	6647	2248	415	643	929	691
1992	5371	2228	396	302	1123	1653
1993	991	330	3	293	586	2615
1994	259	94	30	139	0	1785
1995	189	118	8	60	0	557
1996	467	248	89	60	0	199
1997	866	312	112	85	1	308
1998	1860	931	188	94	1	405
1999	2580	1718	171	382	106	1273
2000	3840	2099	475	599	414	1894
2001	3480	2019	128	626	568	1050
2002	2145	1290	62	496	651	401
2003	700	280	112	427	282	1468
2004	724	293	63	94	0	1943
2005	374	174	33	122	1	2858
2006	902	437	73	72	0	1966
2007				189		
Average	3392	1247	320	223	824	730

* Vanishing spawning stocks.

Table 3.4.8.3 Barents Sea CAPELIN. Larval abundance estimate (10^{12}) in June, and 0-group index in August.

Year	Larval abundance	0-group area index	New 0-group Index (10^6 ind.) Without K eff	With K eff
1980	-	502	217 454	809 193
1981	9.7	570	110 142	428 316
1982	9.9	393	181 125	611 698
1983	9.9	589	100 817	332 287
1984	8.2	320	73 228	168 660
1985	8.6	110	24 191	73 436
1986	0.0	125	13 519	56 472
1987	0.3	55	600	2 302
1988	0.3	187	28 826	92 075
1989	7.3	1300	258 741	881 764
1990	13.0	324	36 041	115 198
1991	3.0	241	55 879	164 819
1992	7.3	26	116	349
1993	3.3	43	257	776
1994	0.1	58	9 237	20 987
1995	0.0	43	614	2 067
1996	2.4	291	47 055	143 826
1997	6.9	522	57 585	196 013
1998	14.1	428	35 881	88 035
1999	36.5	722	88 855	294 999
2000	19.1	303	39 380	140 131
2001	10.7	221	5 212	19 895
2002	22.4	327	20 722	21 887
2003	11.9	630	130 672	458 890
2004	2.5	288	20 737	69 251
2005	8.8	348	47 256	154 692
2006	17.1	1031	170 851	525 357
Average	9.0	352	65 740	217 535