

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

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
Full reproductive capacity	Not defined	Not defined	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 full reproductive capacity. The maturing component in autumn 2009 was estimated to be 2.3 million tonnes. The spawning stock in 2010 will consist of fish from the 2006 and 2007 year classes, but the 2006 year class will dominate. The survey estimate at age 1 of the 2008 year class is below the long-term average, while 0-group observations during the joint Russian-Norwegian ecosystem survey in August-September 2009 indicated that the 2009 year class is strong.

Management objectives

The fishery is managed according to a target escapement strategy taking into account the predation by cod. The harvest control rule is designed to ensure that at the close of the fishery, the SSB remains above the proposed B_{lim} of 200,000 t (with 95% probability). ICES considers the management plan to be consistent with the precautionary approach.

The harvest control rule assumes that all catch is taken during January-April, prior to spawning.

Reference points:

	Type	Value	Technical basis
Precautionary approach	B_{lim}	200 000 t	Above SSB_{1989} , the lowest SSB that has produced a good year class.
	B_{pa}	not defined	
	F_{lim}	not defined	
	F_{pa}	not defined	
Targets	F_y	not defined	

(unchanged since: 1998)

Single-stock exploitation boundaries

ICES advises on the basis of the management plan that catches should not exceed 360 000 tonnes in January-April 2010.

Exploitation boundaries in relation to existing management plans

Following the agreed management plan, catches not exceeding 360 000 tonnes in spring 2010 would be expected to maintain the SSB above 200,000 t with 95% probability..

Short-term implications

Outlook for 2010:

An update assessment was carried out. Following the agreed management plan would imply catches of 360 000 tonnes in spring 2010. Only catches of mature fish have been considered.

Management considerations

For this stock, a 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 when abundance of young herring is low. The mean value of the 1989 spawning-stock biomass is less than 100,000 t. However, the assessment method is unlikely to account for all sources of uncertainty. Thus, ICES considers it appropriate to use a somewhat higher B_{lim} and a value of 200,000 t has been used in recent years.

The 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 moderate to good recruitment conditions. In such a situation a target-based control rule in addition to the B_{lim} -based rule could be appropriate. The negative influence of herring on capelin recruitment should be included in the B_{lim} -based rule if such a relationship can be described quantitatively. Adjustments to the harvest control rule should be investigated further and should take into account the uncertainty associated with the impacts of the environment and 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 (formerly USSR). The catches have been very close to the advice in all years since 1987.

Impacts of the environment on the fish stock

Capelin is an important part of the diet for many predators, including cod, harp seals, minke whales, humpback whales and haddock. Capelin is the main prey item for cod. Growth, maturation, and cannibalism of cod are all affected by the capelin abundance. The estimated annual consumption of capelin by cod has varied between 0.2 and 3.0 million t over the period 1984-2008. Young herring consume capelin larvae, and this predation pressure is thought to be one of the reasons for the poor year classes of capelin in the periods 1984–1986, in 1992–1994 and in 2001-2005. The abundance of young herring in the Barents Sea is expected to be at a low level in 2010.

Low capelin abundance has also in some periods had a negative impact on harp seal and seabird populations. However, these effects were much stronger during the first capelin collapse (caused by the 1983 year class of herring) than during the two later collapses. After spawning, dead capelin may also be of importance as food for haddock and other benthic feeders.

Scientific basis

Data and methods

The assessment and stock history is based on joint Russian-Norwegian acoustic surveys during September each year. The spawning stock in 2010 is predicted from the acoustic survey in September 2009, by a model estimating maturity, growth, and mortality (including predation by cod). The model takes account of uncertainties both in the survey estimate and in other input data.

Uncertainties in assessment and forecast

There is a large decrease in the estimated abundance of the 2008 year class from the 0-group estimate to the measurement as one year-old in 2009. This could be due either to increased mortality on young capelin or to an underestimation in the last assessment.

Source of information:

Report from the 2009 joint Russian-Norwegian meeting to assess the Barents Sea capelin stock, Kirkenes, October 3-4 2009.

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	0	4 ²
2008	5% probability of SSB < 200,000 t	0	0	12 ²
2009	5% probability of SSB < 200,000 t	390 ¹	390	306
2010	5% probability of SSB < 200,000 t	360 ¹		

¹Winter-spring fishery.

²Research catch.

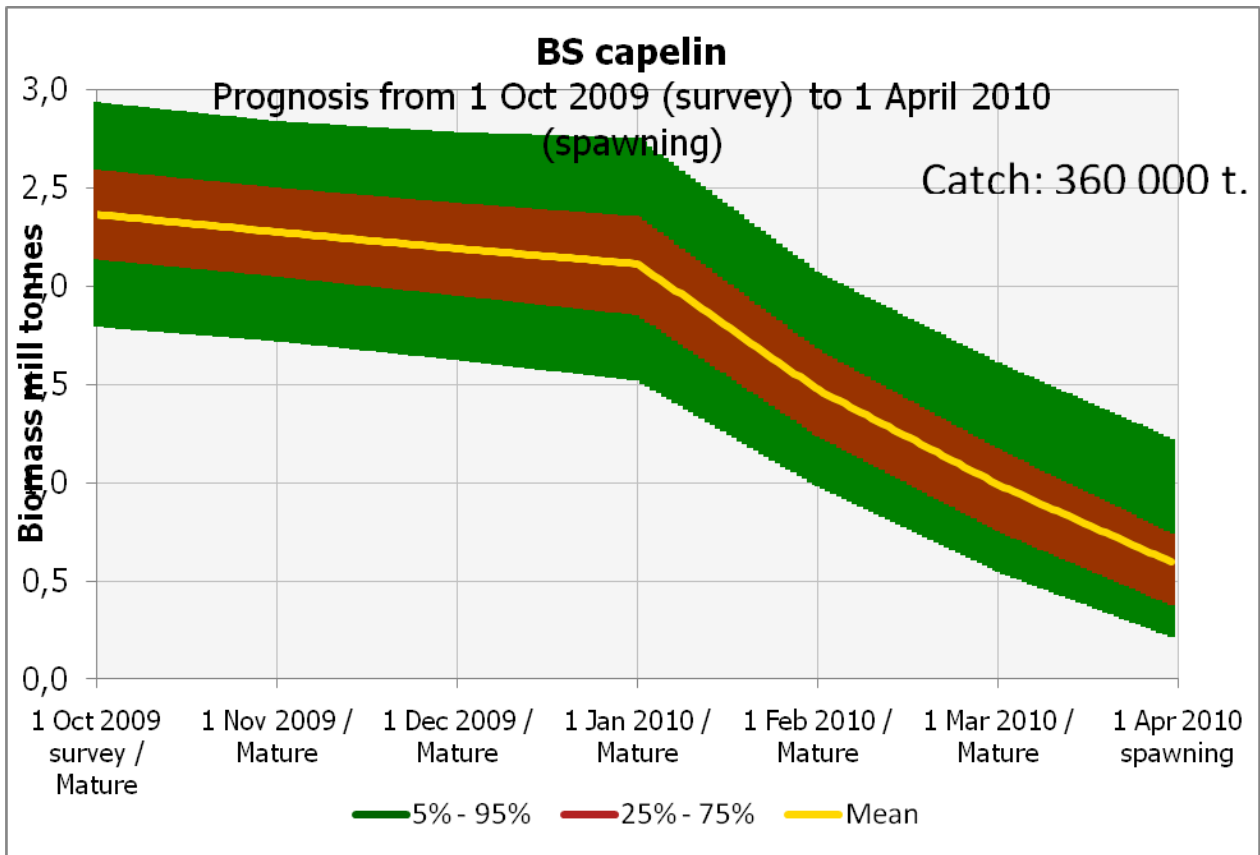


Figure 3.4.8.1 Probabilistic prognosis 1 October 2009-1 April 2010 for Barents Sea capelin (maturing stock, catch of 360 000 tonnes).

Table 3.4.8.1 Barents Sea CAPELIN. International catch ('000 t) as used by the Working Group.

Year	Winter			Total	Summer-Autumn			Total
	Norway	Russia	Others		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	1
2006	0	0	0	0	0	0	0	0
2007	2	2	0	4	0	0	0	4
2008	5	5	0	10	0	2	2	12
2009	233	73	0	306				

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) for 1985 and earlier, for 1986 and later it is the survey estimate. Maturing biomass is the survey estimate of fish above maturity length (14.0 cm). SSB is the median value of the modelled stochastic spawning stock biomass (after the winter/spring fishery).

Year	Stock biomass August 1/Oct. 1	Maturing biomass survey Oct. 1	Recruitment Age 1, August 1/Oct. 1	Spawning stock biomass, assessment model, April 1	Landings
1965					224
1966					389
1967					409
1968					537
1969					680
1970					1314
1971					1392
1972	5831	2182			1592
1973	6630	1350	1140	33	1336
1974	7121	907	737	*	1149
1975	8841	2916	494	*	1439
1976	7584	3200	433	253	2587
1977	6254	2676	830	22	2987
1978	6119	1402	855	*	1916
1979	6576	1227	551	*	1783
1980	8219	3913	592	*	1648
1981	4489	1551	466	316	1986
1982	4205	1591	611	106	1760
1983	4772	1329	612	100	2358
1984	3303	1208	183	109	1477
1985	1087	285	47	*	868
1986	120	65	6	*	123
1987	100	17	38	34	0
1988	427	200	21	*	0
1989	869	174	189	84	0
1990	5838	2617	700	92	0
1991	7282	2248	402	643	929
1992	5155	2228	351	302	1123
1993	797	330	2	293	586
1994	199	94	20	139	0
1995	189	118	8	60	0
1996	502	248	82	60	0
1997	910	312	99	85	1
1998	2055	932	179	94	1
1999	2774	1718	156	382	106
2000	3629	2019	475	599	414
2001	3480	2019	114	626	568
2002	2209	1290	60	496	651
2003	534	280	82	427	282
2004	628	293	51	94	0
2005	324	174	27	122	1
2006	787	437	60	72	0
2007	1882	844	222	189	4
2008	4427	2468	313	330	10
2009	3757	2326	124	517	306
Average	3419	1294	306	181	776

* Vanishing spawning stocks

Table 3.4.8.3 Barents Sea CAPELIN. Larval abundance estimate (10^{12}) in June, and 0-group indices (10^9) in August-September.

Year	Larval abundance	New 0-group Index (10^9 ind.)	
		Not adjusted for trawl catchability of 0-group	Adjusted for trawl catchability of 0-group
1980	-	197.3	740.3
1981	9.7	123.9	477.3
1982	9.9	168.1	599.6
1983	9.9	100.0	340.2
1984	8.2	68.1	275.2
1985	8.6	21.3	63.8
1986	0.0	11.4	41.8
1987	0.3	1.2	4.0
1988	0.3	19.6	65.1
1989	7.3	251.5	862.4
1990	13.0	36.5	115.6
1991	3.0	57.4	169.5
1992	7.3	1.0	2.3
1993	3.3	0.3	1.0
1994	0.1	5.4	13.9
1995	0.0	0.9	2.9
1996	2.4	44.3	136.7
1997	6.9	54.8	189.4
1998	14.1	33.8	113.4
1999	36.5	85.3	287.8
2000	19.1	39.8	140.8
2001	10.7	33.6	90.2
2002	22.4	19.4	67.1
2003	11.9	94.9	340.9
2004	2.5	16.7	53.9
2005	8.8	41.8	148.5
2006	17.1	166.4	515.8
2007	-	157.9	480.1
2008	-	288.8	995.1
2009	-	189.8	673.0
Average	9.0	77.8	266.9