

ECOREGION **Barents Sea and Norwegian Sea**
STOCK **Capelin in Subareas I and II, excluding Division IIa west of 5°W (Barents Sea capelin)**

Advice for 2015

ICES advises on the basis of the management plan agreed by the Joint Norwegian–Russian Fisheries Commission (JNRFC) that catches in 2015 should be no more than 6000 tonnes. All catches are assumed to be landed.

Stock status

		Fishing pressure		
		2012	2013	2014
MSY (F_{MSY})		-	-	- Not relevant
Precautionary approach (F_{pa} , F_{lim})		-	-	- Not relevant
		Stock size		
		2013	2014	2015
MSY ($B_{trigger}$)		?	?	?
Precautionary approach (B_{lim})		✓	✓	✓

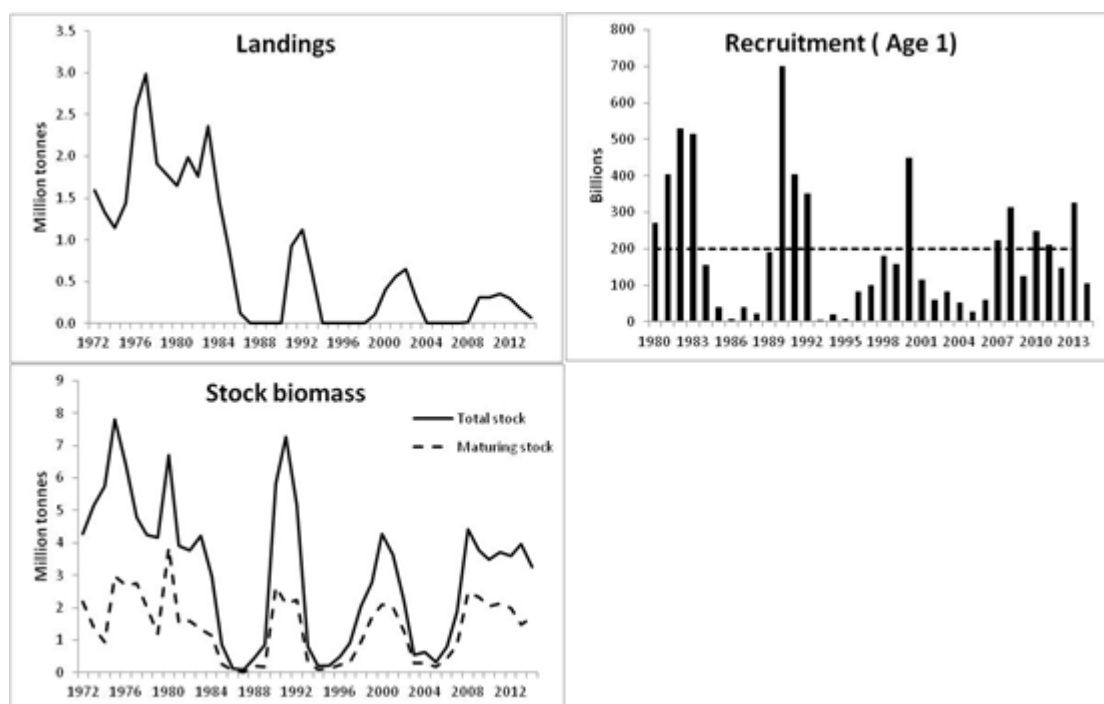


Figure 3.3.1.1 Capelin in Subareas I and II, excluding Division IIa west of 5°W (Barents Sea capelin). Summary of stock assessment (weights in million tonnes). The recruitment plot is shown only from 1980 onwards, since earlier survey estimates of age 1 capelin are unreliable; the dashed line is the long-term average. The stock biomass in 2014 includes a correction because of reduced survey area due to ice coverage.

The maturing component of the stock in autumn 2014 in the area covered by the acoustic survey was estimated to be 0.87 million tonnes. This value is considered an underestimate due to reduced survey coverage which was limited by ice. Following a correction, based on area coverage, the maturing biomass is estimated to be 1.45 million tonnes. The spawning stock in 2015 will consist of fish from the 2011 and 2012 year classes. The 2013 Joint Russian–Norwegian ecosystem survey estimated the 2011 year class to be above average level. The estimate of the 2013 year class at age 1, during the survey in August–September 2014, was found to be below the long-term average, and the 0-group observations indicated that the 2014 year class is also below the long-term average (see Table 3.3.1.4).

Management plans

In 2002, the Joint Norwegian–Russian Fisheries Commission (JNRFC) adopted a management plan, in which the fishery is managed according to a target escapement strategy that includes the predation by cod by accounting for removals based on the size of the cod stock. A basis for the management plan is that all catches are taken on pre-spawning capelin. The harvest control rule is designed to ensure that when the fishery is closed, the SSB remains above the proposed B_{lim} of 200 000 tonnes (with 95% probability). ICES considers the management plan to be consistent with the precautionary approach.

In 2010, the JNRFC decided that the management plan should remain unchanged for the following five years.

Biology

Capelin has a life-span of 3–5 years, and almost all individuals die after spawning. Capelin that are 14 cm or longer in autumn are assumed to mature and spawn the following spring.

Environmental influence on the stock

Capelin is an important part of the diet for many predators, including cod, harp seals, minke whales, humpback whales, seabirds, and haddock. Capelin is the main prey item for cod. Cod growth, maturation, and cannibalism are all affected by capelin abundance. The estimated annual consumption of capelin by cod varied between 0.2 and 4.3 million tonnes over the period 1984–2013. Young herring consume capelin larvae and this predation pressure is suggested to be among the main reasons for the poor year classes of capelin in the periods 1984–1986, 1992–1994, and 2001–2005. The abundance of young herring in the Barents Sea is expected to be at an intermediate level in 2015.

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

The fisheries

The gears used in the capelin fishery are purse-seine and trawl. 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.

Catch distribution Total catches (2014) = 66 kt, all of which are landed.

Quality considerations

The acoustic survey in September 2014 had an incomplete coverage of the spatial distribution of the capelin stock due to drift ice in the northern Barents Sea and a general lack of ship time, and therefore failed to provide a total stock size estimate of capelin. Using the abundance estimate from the reduced survey, the 2011 and 2012 year classes are seen to decline too rapidly to be consistent with current levels of mortality. This leads to the conclusion that the survey is an underestimate; however, the extent of the underestimation is uncertain. Two alternative assessments were investigated; one based on a projection from the 2013 survey estimate using mortality values derived from surveys in the last three years, and one based on historical area coverage; both methods imply greater uncertainty.

Scientific basis

Stock data category	1 (ICES, 2014a).
Assessment type	Model based on acoustic survey, predicted six months ahead to calculate spawning biomass (Figure 3.3.1.3). The model estimates maturity, growth, and mortality (including predation by immature cod on pre-spawning capelin). Target escapement strategy used.
Input data	Russian–Norwegian acoustic survey in September (Eco-NoRu-Q3 (Aco)). • Model estimates of maturation based on survey data • Natural mortalities from multispecies model (predation by immature cod on pre-spawning capelin) and based on historical survey estimates.
Discards and bycatch	All catches are assumed to be landed. The amount of bycatch in the pelagic fisheries is unknown, but is assumed to be low.
Indicators	None.
Other information	The latest benchmark is from 2009; a new benchmark is planned for January 2015. Northeast Arctic cod will be benchmarked at the same time, making interactions between these stocks an important topic at this meeting.
Working group	Arctic Fisheries Working Group (AFWG).

3.3.1

Supporting information October 2014

ECOREGION **Barents Sea and Norwegian Sea**
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Reference points

	<i>Type</i>	<i>Value</i>	<i>Technical basis</i>
MSY approach	MSY $B_{trigger}$	Undefined.	
	F_{MSY}	n/a	
Precautionary approach	B_{lim}	200 000 t	Above SSB_{1989} , the lowest SSB that has produced a good year class.
	B_{pa}	n/a	
	F_{lim}	n/a	
	F_{pa}	n/a	

(Last changed in: 2010)

Outlook for 2015

Management plan

The poor 2014 survey makes the advice this year particularly uncertain (see section below on uncertainties in the assessment). Following the management plan agreed by the Joint Norwegian–Russian Fisheries Commission and based on a re-scaled 2014 acoustic survey value, catches in 2015 should be no more than 6000 t. The harvest control rule in the management plan states that the quota set should ensure that the SSB remains above the proposed B_{lim} of 200 000 t with 95% probability.

Additional considerations

Management considerations

For this stock, a B_{lim} equal to the value of the lowest spawning-stock biomass (SSB) that has produced an outstanding year class (i.e. the 1989 SSB), is considered a good basis for a reference point if the abundance of young herring is low. The mean value of the 1989 spawning-stock biomass is less than 100 000 tonnes. 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} ; a value of 200 000 tonnes has been used in recent years.

The B_{lim} rule is intended as a safeguard against recruitment failure by maintaining the SSB above B_{lim} with 95% probability.

Regulations and their effects

Since 1979, the Barents Sea capelin fishery has been regulated by a bilateral fishery management agreement between Norway and Russia (formerly USSR), with a minimum landing size of 11 cm in force since 1979. TACs have been set separately for the winter fishery and for the autumn fishery.

No commercial autumn fishery has taken place since 1999, but a small Russian experimental autumn fishery has been conducted in some years.

Data and methods

The assessment and stock history is based on the joint Russian–Norwegian acoustic surveys in September each year. The spawning stock in 2015 is predicted from the acoustic survey in September–October 2014 (scaled by area coverage), by a model estimating maturity, growth, and mortality (including predation by immature cod).

Uncertainties in assessment and forecast

The survey coverage in 2014 was incomplete, because drift ice prevented two of the four vessels from covering their planned cruise tracks in the northern central area between Svalbard and Franz Josef Land, and time constraints prevented complete survey coverage in the areas north and northeast of Novaya Zemlya (Figure 3.3.1.2). Capelin concentrations were dense in areas close to the drift ice, both to the south and to the east of the ice “tongue” which extended south from the opening between the Svalbard and the Franz Josef archipelagos. Drift ice overlapping with the capelin distribution has hardly ever been encountered during the last 40 years of September capelin surveys.

Two methods for estimating 2015 maturing biomass from the surveys were investigated; one is based on a projection from the 2013 survey estimate using mortality values derived from surveys in the last three years, and the other is based on an average proportion of the abundance in the area that could not be surveyed. The percentage of maturing capelin found in those areas between Svalbard and Franz Josef archipelagos inaccessible to the survey in 2014 was 43%, 34%, and 44% in the period 2011–2013. Figure 3.3.1.3 shows the spatial distribution of the total capelin stock (acoustic survey S_a values) in 2009–2013.

Method one, based on the 2013 survey and recent mortalities, involves a projection 18 months ahead, from September 2013 to early 2015, providing a maturing population that is much larger than the 2014 survey estimate. It implies that 62% of the mature stock is outside the area covered by the 2014 survey. This method, with the forward projection of 18 months instead of the normal 6 months, creates increased uncertainty. Method two is based on the average proportion of the stock in the unsurveyed area and implies that 40% of the mature stock is outside the survey area. The change in abundance of the 2011 and 2012 year classes resulting from the application of the two methods is shown in Figures 3.3.1.4 and 3.3.1.5. The impact of both methods are also considered in a historical context in Figures 3.3.1.4 and 3.3.1.5. Method one appears to give an optimistic correction for both year classes (black points above the line). Method two provides a plausible correction for the 2011 year class and a slightly conservative correction for the 2012 year class (red points just above and below the line). Both of these correction methods are subject to some additional uncertainty which has not been quantified, and neither method provides a strong basis for advice. Based on consistency with history (Figures 3.3.1.1 through 3.3.1.5) it was decided to base the advice on method two; the resulting 6-month prediction for method 2 is given in Figure 3.3.1.6.

In summary: with no correction to the 2014 survey value the catch advice would have been for zero catch, and any correction factor up to 39% would also give a zero catch advice. The correction based on historical area occupancy (40.2%) provides for a small fishery of 6000 t. The mortality-based correction method, which implies that the 2014 survey misses 62% of the maturing biomass would give catch advice of 195 000 tonnes.

Comparison of the basis of previous assessment and advice

The basis of the assessment is the same as in previous years, but includes a correction for survey coverage. The basis for the advice is the same as last year; the management plan.

Sources

- ICES. 2013. Annex 12: Update of Barents Sea capelin assessment (October 2013). *In* Report of the Arctic Fisheries Working Group (AFWG), 18–24 April 2013, Copenhagen, Denmark. ICES CM 2013/ACOM:05. 726 pp.
- ICES. 2014a. Advice basis. *In* Report of the ICES Advisory Committee, 2014. ICES Advice 2014, Book 1, Section 1.2.
- ICES 2014b. Report of the Arctic Fisheries Working Group (AFWG), 23–29 April 2014, Lisbon, Portugal. ICES CM 2014/ACOM:05.

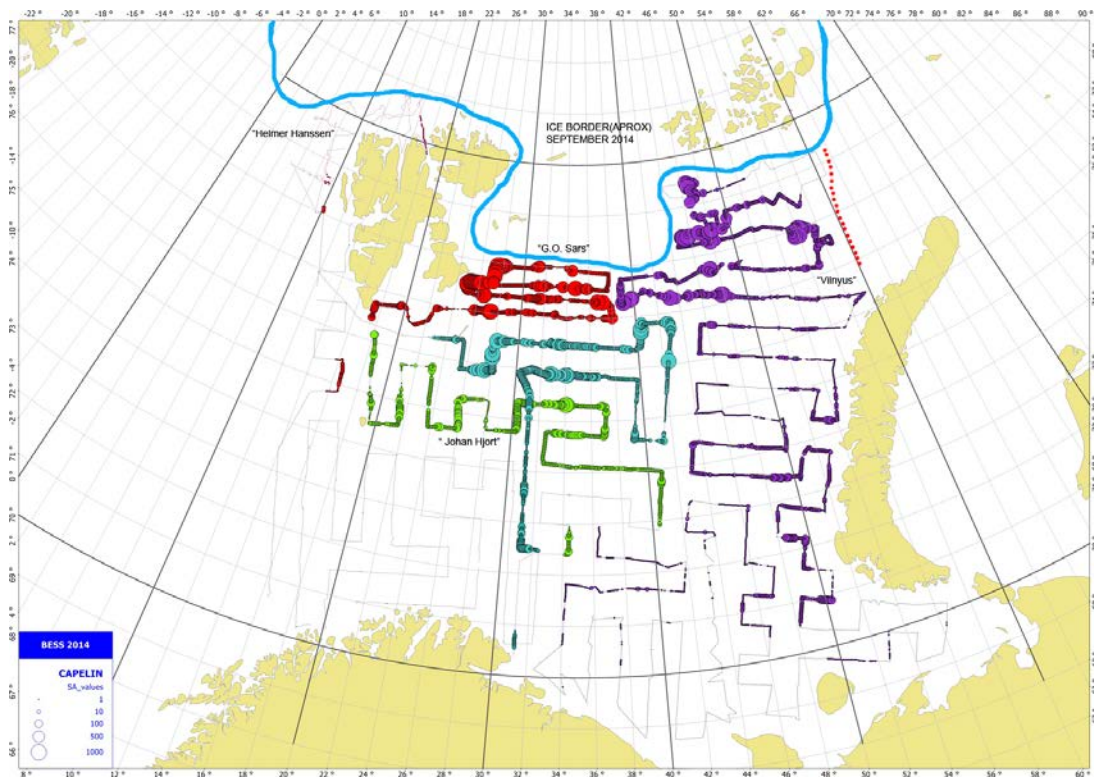


Figure 3.3.1.2 Distribution of capelin in the covered area during 2014 (Acoustic backscatter from capelin (s_A)), showing high values close to the upper boundary which was restricted by ice-coverage.

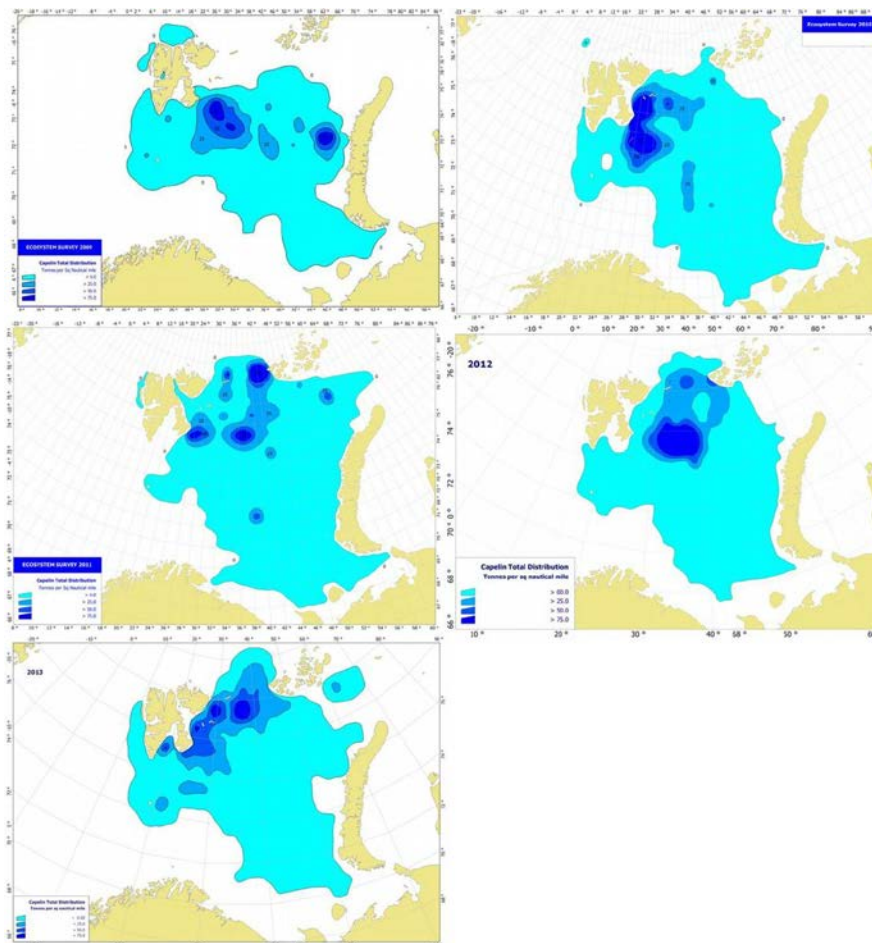


Figure 3.3.1.3 Distribution area of capelin (total stock) during the surveys in August–September 2009–2013.

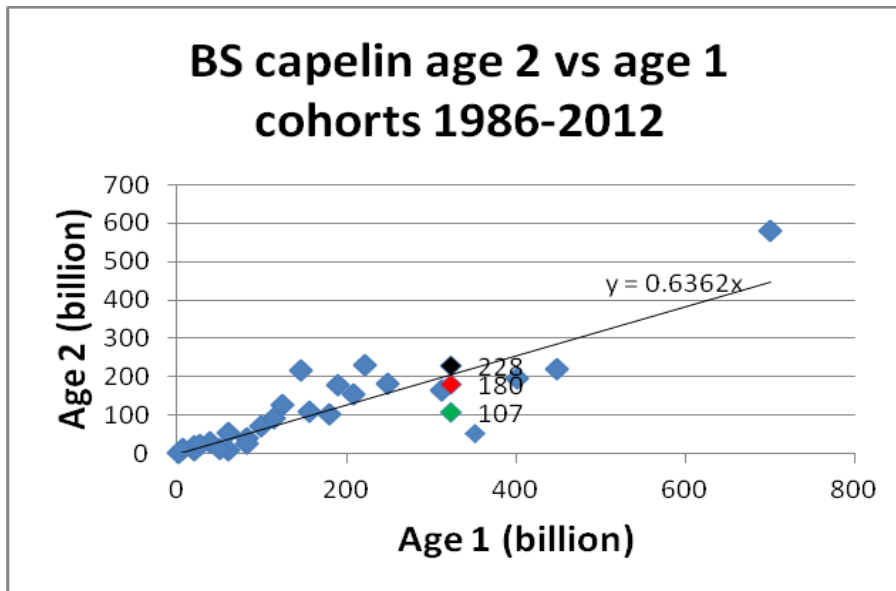


Figure 3.3.1.4 Acoustic survey age 2 versus age 1 in the previous year. The blue points are historical values, the green point (107) is the original 2013/2014 estimate, the red point (180) is corrected by method two, and the black point (228) is corrected by method one. The line indicates the long-term average relationship.

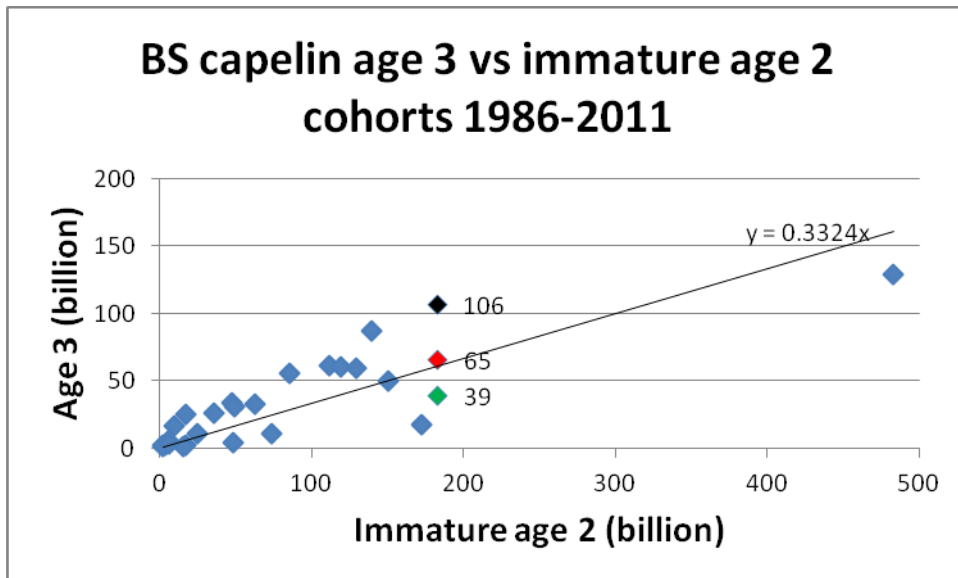


Figure 3.3.1.5 Acoustic survey age 3 versus age 2 (immatures) in the previous year. The blue points are historical values, the green point (39) is the original 2013/2014 estimate, the red point (65) is corrected by method two, and the black point (106) is corrected by method one. The line indicates the long-term average relationship.

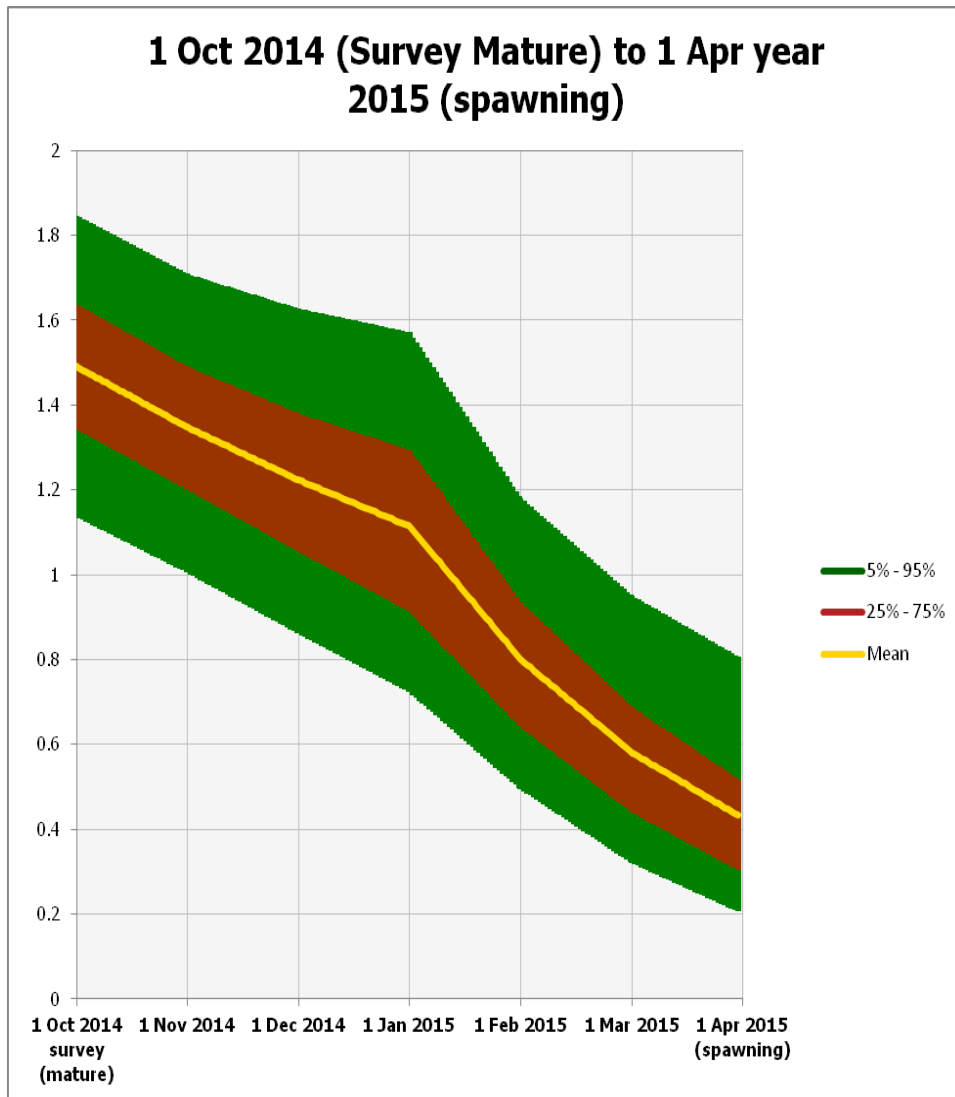


Figure 3.3.1.6

Capelin in Subareas I and II, excluding Division IIa west of 5°W (Barents Sea capelin). Probabilistic prognosis 1 October 2014–1 April 2015 (maturing stock, catch of 6000 t).

Table 3.3.1.1 Capelin in Subareas I and II, excluding Division IIa west of 5°W (Barents Sea capelin). ICES advice, management, and catches.

Year	ICES advice	Recommended TAC	Agreed TAC	ICES 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 ^a	80	101
2000	5% probability of SSB < 200 000 t	435 ^a	435	414
2001	5% probability of SSB < 200 000 t	630 ^a	630	568
2002	5% probability of SSB < 200 000 t	650 ^a	650	651
2003	5% probability of SSB < 200 000 t	310 ^a	310	282
2004	No fishing	0	0	0
2005	No fishing	0	0	1 ^b
2006	No fishing	0	0	0
2007	No fishing	0	0	4 ^b
2008	No fishing	0	0	12 ^b
2009	5% probability of SSB < 200 000 t	390 ^a	390	307
2010	5% probability of SSB < 200 000 t	360 ^a	360	323
2011	5% probability of SSB < 200 000 t	380 ^a	380	360
2012	5% probability of SSB < 200 000 t	320 ^a	320	296
2013	5% probability of SSB < 200 000 t	200 ^a	200	177 ^c
2014	5% probability of SSB < 200 000 t	65 ^a	65	66
2015	5% probability of SSB < 200 000 t	6 ^a		

Weights in thousand tonnes.

^a Winter–spring fishery.

^b Research catch.

^c Preliminary.

Table 3.3.1.2

Capelin in Subareas I and II, excluding Division IIa west of 5°W (Barents Sea capelin). International catch (thousand tonnes) as used by ICES.

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	13	360	1591
1973	1078	34	0	1112	213	12	225	1337
1974	749	63	0	812	237	99	336	1148
1975	559	301	43	903	407	131	538	1441
1976	1252	228	0	1480	739	368	1107	2587
1977	1441	317	2	1760	722	504	1226	2986
1978	784	429	25	1238	360	318	678	1916
1979	539	342	5	886	570	326	896	1782
1980	539	253	9	801	459	388	847	1648
1981	784	429	28	1241	454	292	746	1986
1982	568	260	5	833	591	336	927	1760
1983	751	373	36	1160	758	439	1197	2357
1984	330	257	42	629	481	368	849	1477
1985	340	234	17	591	113	164	277	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	159	20	707	31	195	226	933
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	2	0	2	0	1	1	3
1999	50	33	0	83	0	22	22	105
2000	279	94	8	381	0	29	29	410
2001	376	180	8	564	0	14	14	578
2002	398	228	17	643	0	16	16	659
2003	180	93	9	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	0	12
2009	233	73	0	306	0	1	1	307
2010	246	77	0	323	0	0	0	323
2011	273	87	0	360	0	0	0	360
2012	228	68	0	296	0	0	0	296
2013	116	60	0	177	0	0	0	177
2014	40	26	0	66				

Table 3.3.1.3

Capelin in Subareas I and II, excluding Division IIa west of 5°W (Barents Sea capelin). Stock summary table. Recruitment and total biomass (TSB) are survey estimates back-calculated to 1 August (before the autumn fishing season) for 1985 and earlier; values for 1986 and later are the survey estimate. Maturing biomass (MSB) is the survey estimate of fish above length of maturity (14.0 cm). SSB is the median value of the modeled stochastic spawning-stock biomass (after the winter/spring fishery). 2014 survey figures are scaled to account for incomplete survey coverage.

Year	Estimated stock by autumn acoustic survey 1 October (10 ³ t)		SSB, assessment model, April 1 (10 ³ t)	SSB, by winter acoustic survey (10 ³ t)	Recruitment Age 1+, survey assessment 1 October (10 ⁹ sp.)	Young herring biomass age 1 and 2 in the Barents Sea. (10 ³ t)	Herring 0-group index corr. for catching efficiency (10 ⁹ sp)	Landing (10 ³ t)
	TSB	MSB						
1972	6600	2727						1591
1973	5144	1350	33		528	2		1337
1974	5733	907	*		305	48		1148
1975	7806	2916	*		190	74		1441
1976	6417	3200	253		211	39		2587
1977	4796	2676	22		360	46		2986
1978	4247	1402	*		84	52		1916
1979	4162	1227	*		12	39		1782
1980	6715	3913	*		270	66	0.1	1648
1981	3895	1551	316		403	47	+	1986
1982	3779	1591	106		528	9	2.5	1760
1983	4230	1329	100		515	12	195.4	2357
1984	2964	1208	109		155	1313	27.3	1477
1985	860	285	*		39	1220	20.1	868
1986	120	65	*		6	155	0.1	123
1987	101	17	34	4	38	145	+	0
1988	428	200	*	10	21	69	60.8	0
1989	864	175	84	378	189	128	18.0	0
1990	5831	2617	92	94	700	348	15.2	0
1991	7287	2248	643	1769	402	637	267.6	933
1992	5150	2228	302	1735	351	1493	83.9	1123
1993	796	330	293	1498	2	2369	291.5	586
1994	200	94	139	187	20	1632	103.9	0
1995	193	118	60	29	7	516	11.0	0
1996	503	248	60		82	200	549.6	0
1997	909	312	85		99	279	463.2	1
1998	2056	932	94	414	179	317	476.1	3
1999	2775	1718	382		156	1039	35.9	105
2000	4273	2098	599	700	449	1464	469.6	410
2001	3630	2019	626		114	775	10.0	578
2002	2210	1291	496	1417	60	317	151.5	659
2003	533	280	427		82	1490	177.7	282
2004	628	294	94	105	51	1850	773.9	0
2005	324	174	122		27	1609	125.9	1
2006	787	437	72		60	1185	294.6	0
2007	2119	844	189		277	462	144.0	4
2008	4428	2468	330	469	313	321	201.0	12
2009	3765	2323	517	180	124	142	104.2	307
2010	3500	2051	504	452	248	231	117.1	315
2011	3707	2115	487	160	209	187	83.1	360
2012	3586	1997	504		146	95	177.2	296
2013	3956	1471	479		324	85	289.4	177
2014 ¹	3255	1458	389		105		136.0	66

* Very small spawning stock.

¹ 2014 survey figures scaled to account for incomplete survey coverage.

Table 3.3.1.4

Capelin in Subareas I and II, excluding Division IIa west of 5°W (Barents Sea capelin). Larval abundance estimate (10^{12}) in June, and 0-group indices (10^9) in August–September.

Year class	Larval abundance (10^{12})	0-group index (10^9 ind.)	
		Without correction for catching efficiency	With correction for catching efficiency
1980	-	197.3	740
1981	9.7	123.9	477
1982	9.9	168.1	600
1983	9.9	100.0	340
1984	8.2	68.1	275
1985	8.6	21.3	64
1986	0.0	11.4	42
1987	0.3	1.2	4
1988	0.3	19.6	65
1989	7.3	251.5	862
1990	13.0	36.5	116
1991	3.0	57.4	169
1992	7.3	1.0	2
1993	3.3	0.3	1
1994	0.1	5.4	14
1995	0.0	0.9	3
1996	2.4	44.3	137
1997	6.9	54.8	189
1998	14.1	33.8	113
1999	36.5	85.3	288
2000	19.1	39.8	141
2001	10.7	33.6	90
2002	22.4	19.4	67
2003	11.9	94.9	341
2004	2.5	16.7	54
2005	8.8	41.8	148
2006	17.1	166.4	516
2007	-	157.9	480
2008	-	288.8	995
2009	-	189.8	673
2010	-	91.7	319
2011	-	175.8	594
2012	-	310.5	989
2013	-	94.7	316
2014	-	48.9	164
Average	9.0	87.2	297

Annex 3.3.1 Barents Sea capelin Management Agreement

At the 31st meeting of the Joint Russian–Norwegian Fisheries Commission (JRNFC) in November 2002, the following management plan was adopted:

“For capelin, the following harvest rule should be used: The TAC for the following year should be set so that, with 95% probability, at least 200 000 t of capelin (B_{lim}) will be allowed to spawn.”¹

At the 39th Session of the Joint Russian–Norwegian Fisheries Commission in October 2010 it was agreed that the current management plan should be used ‘for five more years’ before it is evaluated.

¹ This quotation is taken from Annex 12 in the Protocol of the 42nd Session of the Joint Russian–Norwegian Fisheries Commission and translated from Norwegian to English. For an accurate interpretation, please consult the text in the official languages of the Commission (Norwegian and Russian) at www.jointfish.com.