ECOREGION Barents Sea and Norwegian Sea
STOCK Haddock in Subareas I and II (Northeast Arctic)

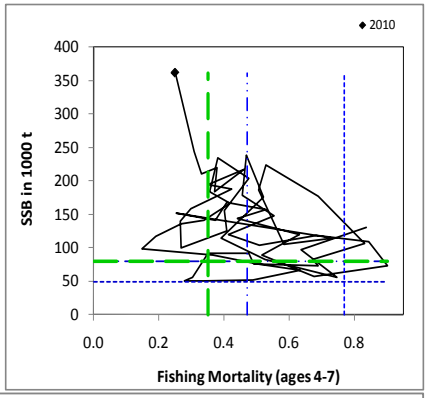
Advice for 2012

ICES advises on the basis of the Joint Russian–Norwegian Fisheries Commission management plan that catches in 2012 should be no more than 318 000 t.

Stock status

F (Fishing Mortality)	2008	2009	2010
MSY (F_{MSY})	✓	✓	✓ Appropriate
Precautionary approach (F_{pa},F_{lim})	✓	✓	✓ Harvested sustainably
Management plan (F_{MP})	✓	✓	✓ Below target

SSB (Spawning-Stock Biomass)	2009	2010	2011
MSY ($B_{trigger}$)	✓	✓	✓ Above trigger
Precautionary approach (B_{pa},B_{lim})	✓	✓	✓ Full reproductive capacity
Management plan (SSB_{MP})	✓	✓	✓ Above trigger



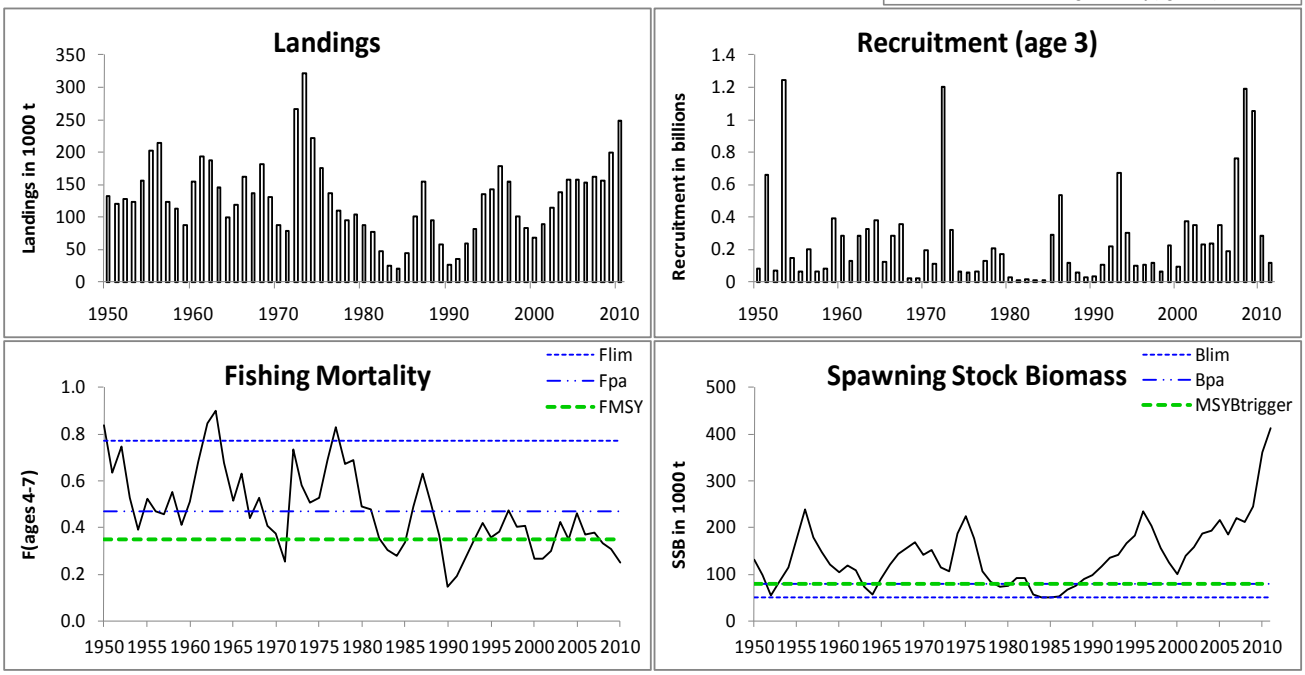


Figure 3.4.3.1 Haddock in Subareas I and II (Northeast Arctic). Summary of stock assessment (weights in '000 tonnes). Top right: SSB and F over the years.

The SSB has been above B_{pa} since 1989, it has been increasing since 2000 and is presently at the series maximum. Fishing mortality has been around F_{MSY} since the mid-1990s. Recruitment at age 3 has been at or above average since 2000. The year classes 2004–2006 are estimated to be very strong. Surveys indicate that the year classes 2008 and 2010 are below average and 2009 year class is around average.

Management plans

A management plan has been agreed by the Joint Russian–Norwegian Fisheries Commission in 2004 (see Annex 3.4.3). It was modified in 2007 from a three-year rule to a one-year rule on the basis of the HCR evaluation conducted by ICES. The plan is to be used until 2015. ICES has evaluated the modified management plan and concluded that it is in accordance with the precautionary approach but not against the MSY framework.

Biology

Haddock can vary their diet and eat fish, plankton, or benthos. During the spawning migration of capelin, haddock prey on capelin and their eggs on the spawning grounds. When the capelin abundance is low or when their areas do not overlap, haddock can compensate for the lack of capelin with other fish species such as young herring, or with euphausiids and benthos, which are predominant in the haddock diet throughout the year. Density-dependent growth has been observed for this stock and the present growth rate is low.

Environmental influence on the stock

Variation in the recruitment of haddock has been associated with the changes in the influx of Atlantic waters to the Barents Sea. Water temperature in the first and second years of the haddock life cycle is one of the factors that determine year-class strength; the probability of good recruitment is very low when the temperature is low. Additionally, a steep rise or fall of the water temperature shows a marked effect on the abundance of year classes. This information on environmental influence is not yet taken into account in the assessment.

The fisheries

Haddock is mainly fished by trawl as bycatch in the fishery for cod, with some directed fisheries by longline and trawl. TAC regulations are in place. Unreported catches have decreased in recent years and were close to zero in 2009 and 2010. Discarding is illegal in Norway and Russia. Data on discarding are scarce, but attempts to obtain better quantification continue. The fisheries are controlled by inspections at sea and when landing fish, by a requirement to report to catch control points when entering and leaving the EEZs, and by VMS satellite tracking for some fleets.

Catch by fleet	Total catch (2010) = 249 kt, where 100% are landings (74% trawl, 18% longline, and 8% other gear types).

Quality considerations

The uncertainties in this assessment relate both to catch and survey data. Unreported catches (IUU) and incomplete spatial coverage in surveys have been a problem in recent years, but do not affect the data collected in 2009–2010.

Norwegian sampling is believed to be less precise because of the termination of a Norwegian harbour sampling programme in mid-2009. The poor sampling caused problems in estimating Norwegian catches for the oldest ages.

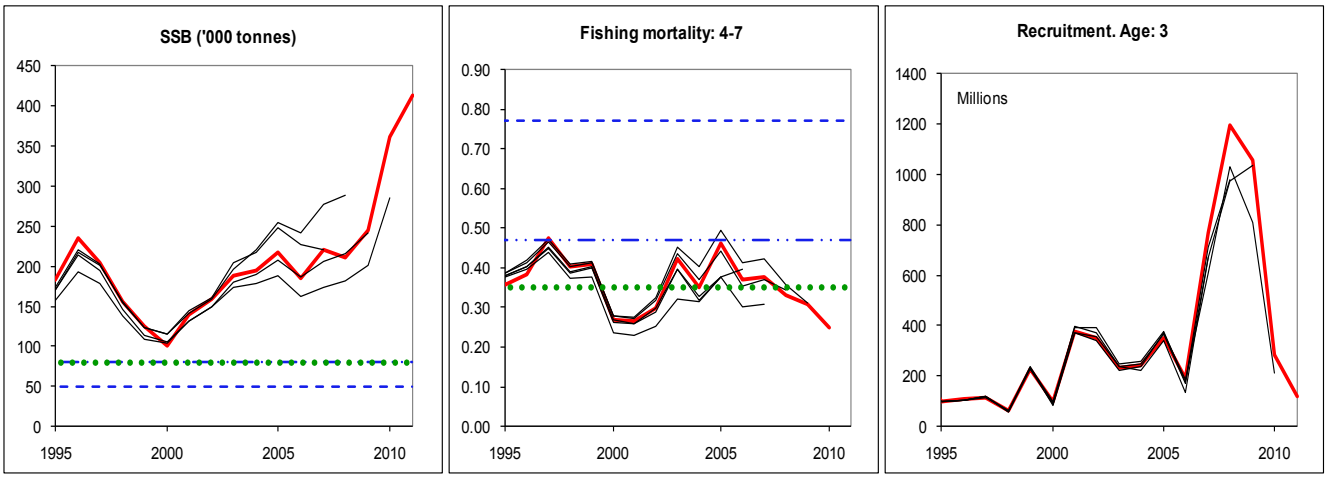


Figure 3.4.3.2 Haddock in Subareas I and II (Northeast Arctic). Historical assessment results (final year recruitment estimates included).

Scientific basis

Assessment type	XSA.
Input data	Four tuning fleets were used: Russian bottom trawl survey (RU-BTr-Q4); Joint Barents Sea survey – acoustic (BS-NoRU-Q1(Aco)); Joint Barents Sea survey – bottom trawl (BS-NoRu-Q1 (BTr)); Joint Russian–Norwegian ecosystem autumn survey in the Barents Sea – bottom trawl (Eco-NoRu-Q3 (Btr)).
Discards and bycatch	Discards are not included .
Indicators	None.
Other information	None.
Working group report	AFWG

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Reference points

	Type	*Value*	*Technical basis*
Management Plan	SSB_{MP}	80 000 t	B_{pa}. TAC is linearly reduced from F_{pa} at SSB = B_{pa} to 0 at SSB equal to zero.
	F_{MP}	0.35	Previous F_{pa} estimated prior to the revision of the historical time series for this stock.
MSY Approach	MSY $B_{trigger}$	80 000 t	B_{pa}.
	F_{MSY}	0.35	Stochastic long-term simulations.
Precautionary Approach	B_{lim}	50 000 t	B_{loss}.
	B_{pa}	80 000 t	B_{lim}*exp (1.645*0.3).
	F_{lim}	0.77	Corresponds to SPR value of slope of line from origin at SSB=0 to geometric mean recruitment at SSB=B_{lim}.
	F_{pa}	0.47	F_{lim}*exp (-1.645*0.3).

(changed in 2011)

The historical time-series for this stock was revised in 2006. Reference points were revised in 2011.

Yield and spawning biomass per Recruit F-reference points (2011):

	Fish Mort Ages 4–7	Yield/R	SSB/R
Average last 3 years	0.30	0.40	0.69
F_{max}*	-	-	-
$F_{0.1}$	0.26	0.39	0.79
$F_{35\%SPR}$	0.17	0.34	1.17
F_{med}	0.25	0.38	0.84

*F_{max} is not well defined.

Outlook for 2012

Basis: $F_{2011} = F_{2010} = 0.25$; SSB (2012) = 461; R (2011) = 120 million; landings (2011) = 265.

Rationale	**Landings (2012)**	**Basis**	**F (2012)**	**SSB (2013)**	**%SSB change[1)]**	**%TAC change[2)]**
Management plan[3)]	318	F_{MP}	0.35	381	-21 %	+5 %
MSY Framework	318	F_{MSY}	0.35	381	-21 %	+5 %
Precautionary approach	399	F_{pa}	0.47	328	-29 %	+32 %
Zero catch	0	F = 0	0	595	+29 %	-100 %
Status quo	240	F_{sq}	0.25	431	-7 %	-21 %

Weights in '000 tonnes.
[1)] SSB 2013 relative to SSB 2012.
[2)] Catch 2012 relative to TAC 2011.
[3)] Forecast based on F_{MSY}.

Management plan

The current HCR is based on F_{pa}. However, the F_{pa} value has changed in 2011 from 0.35 to 0.47. ICES advises the continued use of the HCR with target F = 0.35 (the newly estimated F_{MSY}). This implies an F_{MP} = 0.35 in 2012, corresponding to landings of 318 000 t in 2012. This is expected to keep SSB above B_{pa} in 2013 and near the historical maximum.

The management plan was introduced to ensure high and sustainable yield. However, testing and modifications done prior to 2011 were carried out in order to ensure that the HCR was precautionary.

MSY approach

Long-term stochastic simulations for Northeast Arctic (NEA) haddock show that the F = 0.35 currently used in the management plan corresponds to F_{MSY} and provides high long-term yield. MSY $B_{trigger}$ is chosen as B_{pa}, which is a biomass that is encountered with low probability if F_{MSY} is implemented (ICES, 2011a).

Fishing at F_{MSY} = 0.35 in 2012 corresponds to landings of no more than 318 000 t. This is expected to keep SSB above B_{pa} in 2013 and near the series maximum.

PA approach

F_{lim} and F_{pa} were revised in 2011. The new values of F_{lim} = 0.77 and F_{pa} = 0.47 are higher than the previous values (0.49 and 0.35) (ICES, 2011b). The fishing mortality in 2012 should be no more than F_{pa}, corresponding to landings of less than 399 000 t in 2012. This is expected to keep SSB above B_{pa} in 2013.

Additional considerations

Non-reported landings (IUU) for the period 2002–2008 were estimated as ranging from 6 kt to 40 kt (between 4% and 34% of the international reported landings). The IUU estimate for 2009–2010 is zero.

The 2011 benchmark assessment on NEA haddock proposed changes in assessment methodology (ICES, 2011c).

Regulations and their effects

The fishery is regulated by TACs. The fishery is also regulated by a minimum fish size, a minimum mesh size in trawls and Danish seine, a maximum bycatch of undersized fish, maximum bycatch of non-target species, closure of areas with high density of juveniles, and other area and seasonal restrictions. Since January 1997, sorting grids have been mandatory for the trawl fisheries in most of the Barents Sea and Svalbard area.

A real-time closure system has been in force along the Norwegian coast and in the Barents Sea since 1984, aimed at protecting juvenile fish. Based on scientific research vessel data and mapping of areas by hired fishing vessels, fishing is prohibited in areas where the proportion by number of undersized cod, haddock, and saithe combined has been observed by inspectors to exceed 15% (the size limits vary by species). The time of notice before a closure of an area comes into force is 2–4 hours for national vessels and 7 days for foreign vessels. Before or parallel to a closure, the Coast Guard requests vessels not to fish in an area where too many small fish have been observed during their inspections. A closed area is not opened until it is documented to be low in juvenile fish by trial fishing within the area by the Surveillance Service.

In addition to the temporary closed areas, some areas are permanently closed either protect juvenile cod and haddock (around Bear Island) or to reduce fishing pressure on coastal cod and to avoid gear conflicts. The use of selective gear technology in the demersal fisheries since 1997 has also reduced the catch and possible discarding of juveniles.

From 1 January 2011 onwards, the minimum mesh size for bottom trawl fisheries for cod and haddock is 130 mm for the entire Barents Sea (before it was 135 mm in the Norwegian EEZ and 125 mm in the Russian EEZ). This change is expected to have a minor impact on the total exploitation pattern for this stock; thus, a recent average exploitation pattern is used in the predictions.

From 1 January 2011, the technical regulations for the demersal fisheries were harmonized so that they now are the same in the Norwegian and Russian EEZs. The present minimum size is 40 cm for haddock (previously it was 44 cm in the Norwegian EEZ and 39 cm in the Russian EEZ). The maximum allowable percentage of fish below the minimum size is 15% by number of cod, haddock, and saithe combined in the Norwegian EEZ, and 15% by number of cod and haddock combined in the Russian EEZ. Previously, the maximum percentage was 15% for each species (cod and haddock) in the Russian EEZ. The effect of these changes is expected to be small as long as the fishing mortality is kept low, as implied by the agreed harvest control rule.

The fisheries are controlled by inspections of the trawler fleet at sea, both by a requirement to report catches at control points when entering and leaving the EEZs, and by inspections of all fishing vessels when landing the fish. Keeping a detailed fishing logbook on-board is mandatory for most vessels, and large parts of the fleet report to the authorities on a daily basis. Discarding is allowed neither in Russia nor in Norway. Discarding is known to be a problem in the longline and trawling fisheries related to the abundance of haddock close to, but below the minimum size.

Data and methods

Varying natural mortality caused by predation from cod is taken into account in the assessment.

Information from the fishing industry

Several Norwegian fishing vessels provide regular sampling data for length and age. These data are used to estimate catch-at-age for the corresponding fleets. Russian fishing vessels with observers on-board provide similar information on catch-length distribution and sample fish to receive data on length–age matrices.

Uncertainties in assessment and forecast

There are no estimates of discarding, but there is known to be a discarding problem in the longline and trawl fisheries. The present Norwegian sampling from commercial catches is believed to have deteriorated in recent years because of the termination of a Norwegian sampling program in mid-2009. Poor sampling caused problems in estimating Norwegian catches for the oldest ages in 2010.

Comparison with previous assessment and advice

The current assessment estimated the total stock to be about 13% higher and the SSB 23% higher in 2010 compared to the previous assessment. F in 2009 is close to that estimated last year.

The basis for the advice is the same as last year.

Sources

ICES. 2011a. Report of the Workshop on Implementing the ICES F_{MSY} Framework. 10–14 January 2011, ICES, Denmark. ICES CM 2011/ACOM:33.

ICES. 2011b. Report of the Arctic Fisheries Working Group. 28 April–4 May 2011. ICES CM 2011/ACOM:05.

ICES. 2011c. Report of the Benchmark Workshop on Roundfish and Pelagic Stocks (WKBENCH 2011). 24–31 January 2011, Lisbon, Portugal. ICES CM 2011/ACOM:38. 418 pp.

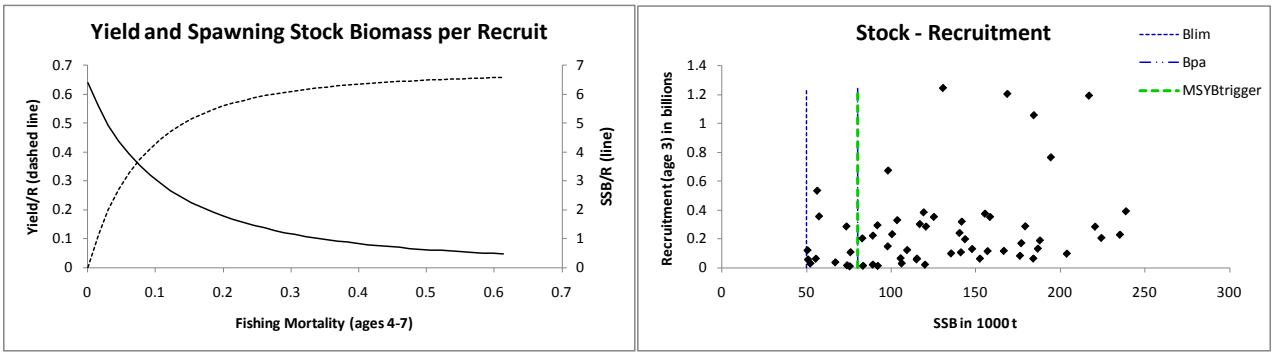

Figure 3.4.3.3 Haddock in Subareas I and II (Northeast Arctic). Yield-per-recruit analysis and stock–recruitment plot.

Table 3.4.3.1 Haddock in Subareas I and II (Northeast Arctic). ICES advice, management. and landings.

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official landings[1]	Unreported landings (included in ICES landings)	ICES landings[1]
1987	No increase in F; TAC	160	250	155		155
1988	No increase in F	< 240	240	95		95
1989	Large reduction in F	69	83	59		59
1990	No directed fishery	-	25	27		27
1991	No directed fishery	-	28	36		36
1992	Within safe biological limits	35[2]	63	60		60
1993	No long-term gains in increasing F	56[2]	72	82		82
1994	No long-term gains in F>F_{med}	97[3]	120	135		135
1995	No long-term gains in F>F_{med}	122[3]	130	142		142
1996	No long-term gains in F>F_{med}	169[3]	170	178		178
1997	Well below F_{med}	< 242	210	154		154
1998	Below F_{med}	< 120	130	101		101
1999	Reduce F below F_{pa}	< 74	78	83		83
2000	Reduce F below F_{pa}	< 37	62	69		69
2001	Reduce F below F_{pa}	< 66	85	90		90
2002	Reduce F below F_{pa}	< 64	85	96	19	115
2003	Reduce F below F_{pa}	< 101	101	106	33	139
2004	Reduce F below F_{pa}	< 120	130	125	34	158
2005	Reduce F below F_{pa}	< 106	117	118	40	158
2006	Reduce F below F_{pa}	< 112	120	132	21	153
2007	Limit catches	< 130	150	147	15	162
2008	Limit catches to 2001–2004 average	< 130	155	150	6	156
2009	Apply management plan	< 194	194	200	0	200
2010	Apply management plan	< 243	243	249	0	249
2011	Apply management plan	< 303	303			
2012	Apply management plan with F=0.35	< 318				

Weights in '000 t.
[1] Haddock in Norwegian statistical areas 06 and 07 are included.

Table 3.4.3.2 Haddock in Subareas I and II (Northeast Arctic). Total nominal catch (t) by fishing areas.
(Data provided by Working Group members).

Year	Faroe Islands	France	German Dem.Re.	Fed. Re. Germ.	Norway[4]	Poland	United Kingdom	Russia[2]	Others	Unreported catches[3]	Total[3]
1980	497	226	15	1365	66501	-	2948	20706	246	-	92504
1981	381	414	22	2402	63435	Spain	1682	13400	-	-	81736
1982	496	53	-	1258	43702	-	827	2900	-	-	49236
1983	428	-	1	729	22364	139	259	680	-	-	24600
1984	297	15	4	400	18813	37	276	1103	-	-	20945
1985	424	21	20	395	21272	77	153	22690	-	-	45052
1986	893	12	75	1079	52313	22	431	45738	-	-	100563
1987	464	7	83	3105	72419	59	563	78211	5	-	154916
1988	1113	116	78	1323	60823	72	435	31293	2	-	95255
1989	1217	-	26	171	36451	1	590	20062	-	-	58518
1990	705	-	5	167	20621	-	494	5190	-	-	27182
1991	1117	-	Greenland	213	22178	-	514	12177	17	-	36216
1992	1093	151	1719	387	36238	38	596	19699	1	-	59922
1993	546	1215	880	1165	40978	76	1802	35071	646	-	82379
1994	2761	678	770	2412	71171	22	4673	51822	877	-	135186
1995	2833	598	1097	2675	76886	14	3111	54516	718	-	142448
1996	3743	6	1510	942	94527	669	2275	74239	217	-	178128
1997	3327	540	1877	972	103407	364	2340	41228	304	-	154359
1998	1903	241	854	385	75108	257	1229	20559	94	-	100630
1999	1913	64	437	641	48182	652	694	30520	92	-	83195
2000	631	178	432	880	42009	502	747	22738	827	-	68944
2001	1210	324	553	554	49067	1497	1068	34307	1060	-	89640
2002	1564	297	858	627	52247	1505	1125	37157	682	18736/5310	114798/101372
2003	1959	382	1363	918	56485	1330	1018	41142	1103	33226/9417	138926/115117
2004	2484	103	1680	823	62192	54	1250	54347	1569	33777/8661	158279/133163
2005	2138	333	15	996	60850	963	1899	50012	1262	40283/9949	158751/128417
2006	2390	883	1830	989	69272	703	1164	53313	1162	21451/8949	153157/140655
2007	2307	277	1464	1123	71244	125	1351	66569	2511	14553/3102	161525/150074
2008	2687	311	1659	535	72779	283	971	68792	1759	5828/-	155604/149776
2009	2820	529	1410	1957	104354	317	1315	85514	1845	0/0	200061
2010[1]	3173	764	1970	3539	123517	379	1758	111372	2862	0/0	249334

[1] Provisional figures. **[2] USSR prior to 1991.** **[3] Figures based on Norwegian/Russian IUU estimates.**

[4] Landings in Norwegian statistical areas 06 and 07 (from 1983) are included.

Table 3.4.3.3 Haddock in Subareas I and II (Northeast Arctic). Summary of the assessment.

Year	Recruitment Age 3 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-7
1950	80445	130535	132125	0.8371
1951	662258	97875	120077	0.6358
1952	72667	55402	127660	0.7463
1953	1245502	82864	123920	0.5255
1954	147983	115108	156788	0.3898
1955	62332	176055	202286	0.5220
1956	203088	238661	213924	0.4680
1957	63225	179145	123583	0.4559
1958	82692	147772	112672	0.5544
1959	390902	120505	88211	0.4127
1960	286901	103485	154651	0.5093
1961	129579	119121	193224	0.6827
1962	285093	109350	187408	0.8449
1963	329333	73487	146224	0.9019
1964	383645	57308	99158	0.6756
1965	122085	89044	118578	0.5150
1966	285944	119915	161778	0.6313
1967	355684	143598	136397	0.4399
1968	21570	156889	181726	0.5277
1969	21172	168571	130820	0.4086
1970	197328	141613	88257	0.3741
1971	114719	152377	78905	0.2537
1972	1204665	114977	266153	0.7339
1973	319222	105465	322226	0.5828
1974	62740	186596	221157	0.5055
1975	57677	224139	175758	0.5283
1976	65272	176821	137264	0.6883
1977	132035	106152	110158	0.8305
1978	206306	83319	95422	0.6709
1979	169860	73840	103623	0.6880
1980	29524	75480	87889	0.4908
1981	13188	92002	77153	0.4766
1982	16435	91802	46955	0.3518
1983	9206	56202	24600	0.3034
1984	12259	50464	20945	0.2789
1985	293827	50748	45052	0.3378
1986	533759	52224	100563	0.4883
1987	120186	66921	154916	0.6332
1988	57121	75898	95255	0.5026
1989	28765	89091	58518	0.3661
1990	36968	98099	27182	0.1474
1991	107013	116825	36216	0.1909
1992	222307	135338	59922	0.2679
1993	673447	141121	82379	0.3390
1994	302155	166479	135186	0.4189
1995	98786	183938	142448	0.3564
1996	106472	235110	178128	0.3817
1997	116281	203724	154359	0.4756
1998	63564	155338	100630	0.4019
1999	228580	125167	83195	0.4080
2000	97331	100486	68944	0.2678
2001	374717	140302	89640	0.2648
2002	351908	158363	114798	0.2984
2003	231970	187825	138926	0.4236
2004	240625	194295	158279	0.3495
2005	351707	216831	158298	0.4614
2006	188696	184216	153157	0.3701
2007	765028	220419	161525	0.3775
2008	1192518	211150	155604	0.3316
2009	1056821	244365	200061	0.3079
2010	284421	361519	249334	0.2494
2011	120000	413258		
Average	259476	141048	129020	0.4731

Annex 3.4.3 Management plan

The current HCR for haddock is as follows (see details in Protocol of the 36th Session of the Joint Russian–Norwegian Fisheries Commission, 10 October 2007):

- *TAC for the next year will be set at level corresponding to Fpa.*
- *The TAC should not be changed by more than ±25% compared with the previous year TAC.*
- *If the spawning stock falls below Bpa, the procedure for establishing TAC should be based on a fishing mortality that is linearly reduced from Fpa at Bpa to F= 0 at SSB equal to zero. At SSB-levels below Bpa in any of the operational years (current year and a year ahead) there should be no limitations on the year-to-year variations in TAC.*

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