

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

Advice for 2013

ICES advises on the basis of the Joint Russian–Norwegian Fisheries Commission management plan that catches in 2013 should be no more than 238 000 t.

Stock status

F (Fishing Mortality)			
	2009	2010	2011
MSY (F_{MSY})	✓	✓	✓ Appropriate
Precautionary approach (F_{pa}, F_{lim})	✓	✓	✓ Harvested sustainably
Management plan (F_{MP})	✓	✓	✓ Above target Within target range
SSB (Spawning-Stock Biomass)			
	2010	2011	2012
MSY ($B_{trigger}$)	✓	✓	✓ Above trigger
Precautionary approach (B_{pa}, B_{lim})	✓	✓	✓ Full reproductive capacity
Management plan (SSB_{MP})	✓	✓	✓ Above trigger

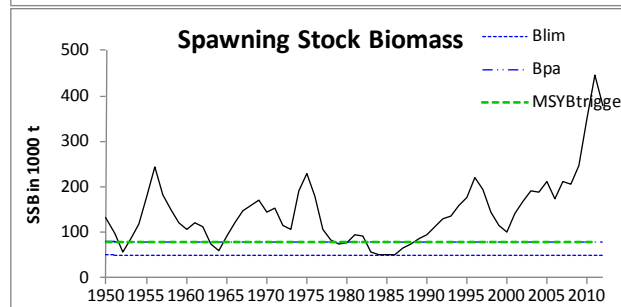
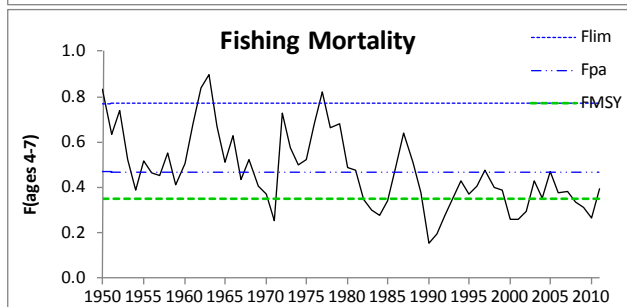
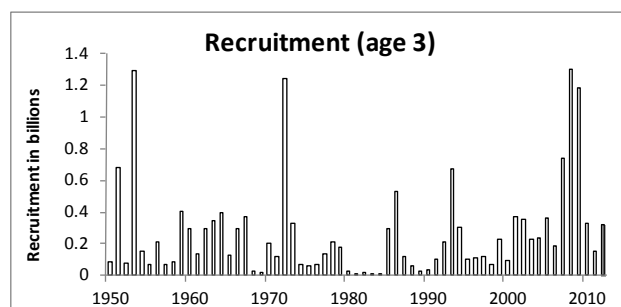
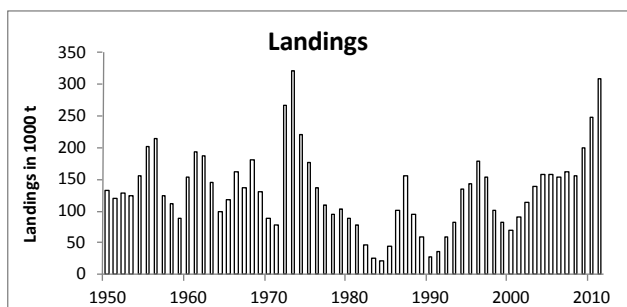
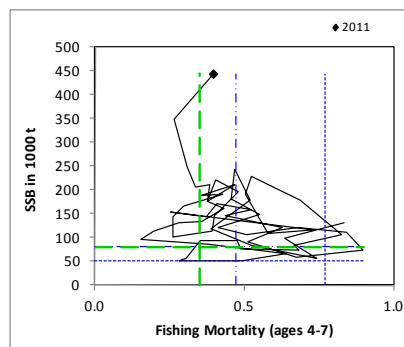


Figure 3.4.3.1 Haddock in Subareas I and II (Northeast Arctic). Summary of stock assessment (weights in thousand tonnes). Top right: SSB/F for the time-series used in the assessment.

The SSB has been above $MSY B_{trigger}$ since 1990, increasing since 2000 and reaching the series maximum in 2011. 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 and are now dominating the spawning stock. Surveys indicate that the year classes 2008 and 2010 are below average, while 2009 and 2011 year classes are above average.

Management plans

A management plan has been agreed upon 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 harvest control rule (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 and not in contradiction with the maximum sustainable yield (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. Cod is the main predator on haddock and this predation is included in the natural mortality used in the assessment. The predation by cod on haddock has been high in recent years due to the large cod stock size.

Environmental influence on the stock

Variation in the recruitment of haddock has been associated with 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 distribution area of cod has expanded northwards and eastwards in recent years and is now the widest ever reported, stretching from northwest of Spitsbergen to the entrance to the Kara Sea in the southeast.

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 2009–2011. 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, by a requirement to report to catch control points when entering and leaving the EEZs to land fish, and by VMS satellite tracking for some fleets.

Catch distribution Total landings (2011) = 310 kt, where 100% are landings (73% trawl, 17% longline, and 10% other gear types).

Quality considerations

The uncertainties in this assessment relate both to catch and survey data. Unreported catches (illegal, unregulated, and unreported (IUU)) have been a problem in recent years, but do not affect the data collected in 2009–2011. Due to technical problems with a Norwegian survey vessel the spatial coverage in the 2012 Joint winter survey was incomplete.

Norwegian sampling of commercial catches is believed to be less precise because of the termination of a Norwegian port sampling programme in mid-2009. The poor sampling caused problems in estimating Norwegian catches for the oldest ages in 2010. A small Norwegian port sampling programme from 2011 and onwards and an expansion of the high seas reference fleet has improved the situation somewhat. But there is still a lack of samples from certain gears and areas and the working group recommends an increase in port sampling effort.

Russian sampling of commercial catches has also shown a declining trend.

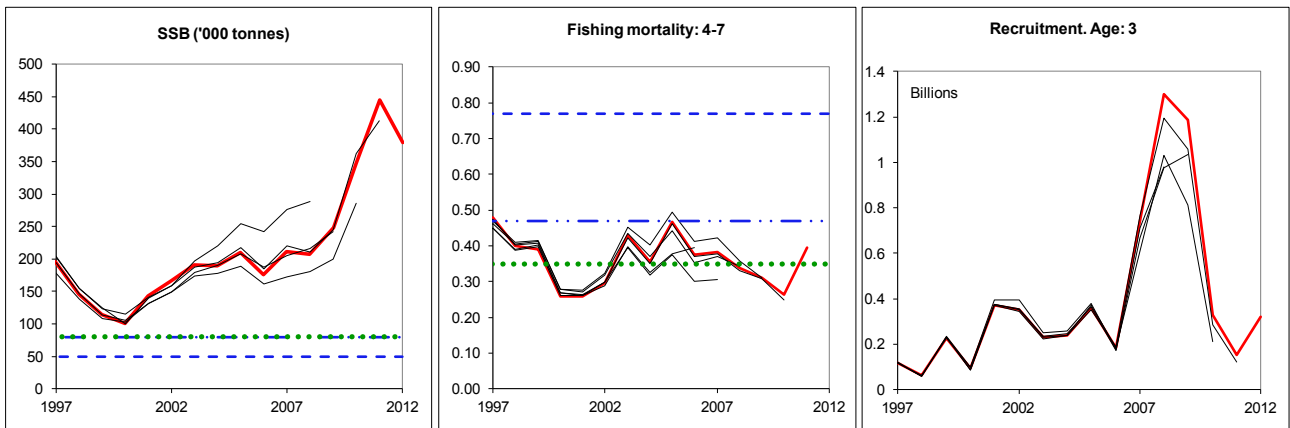


Figure 3.4.3.2 Haddock in Subareas I and II (Northeast Arctic). Historical assessment results (final-year recruitment estimates included).

Scientific basis

Assessment type	Age-based analytical assessment 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)). Data on cod consumption of age 0–6 haddock is available from 1984.
Discards and bycatch	Discards are not included.
Indicators	None.
Other information	None.
Working group report	AFWG

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Reference points

	<i>Type</i>	<i>Value</i>	<i>Technical basis</i>
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).

(unchanged in 2011)

Yield and spawning biomass per Recruit F-reference points (2012):

	Fish Mort Ages 4–7	Yield/R	SSB/R
Average last 3 years	0.32	0.30	0.43
F _{max} *	-	-	-
F _{0.1}	0.26	0.28	0.56
F _{35%SPR}	0.16	0.24	0.87
F _{med}	0.16	0.24	0.87

*F_{max} is not well defined.**Outlook for 2013**Basis: F₂₀₁₂ = F₂₀₁₁ = 0.39; SSB (2013) = 311; R (2012) = 317 million; landings (2012) = 246.

Rationale	Landings (2013)	Basis	F (2013)	SSB (2014)	%SSB change¹⁾	%TAC change²⁾
Management plan ³⁾	238	F _{MP}	0.61	188	-40	-25
MSY Framework	154	F _{MSY}	0.35	252	-19	-52
Precautionary approach	195	F _{pa}	0.47	220	-29	-39
Zero catch	0	F = 0	0	375	+21	-100
<i>Status quo</i>	170	F _{sq}	0.39	240	-23	-47

Weights in thousand tonnes.

¹⁾ SSB 2014 relative to SSB 2013.²⁾ Catch 2013 relative to TAC 2012.³⁾ Forecast based on F_{MSY}.**Management plan**

The current HCR is based on F_{MSY}. ICES advises the continued use of the HCR with target F = 0.35 and maximum +/- 25% change in TAC compared with the previous year's TAC. This implies F_{MP} = 0.61 in 2013, corresponding to landings of 238 000 t in 2013, which is expected to keep SSB above B_{pa} in 2014. The harvest control rule contains a 25% limit on change in TAC when the stock is above B_{pa}. Under certain circumstances this will lead to advisory F values substantially higher than F_{MSY}; this is expected to occur in 2013 due to three very large year classes followed by average recruitment.

MSY approach

Fishing at $F_{MSY} = 0.35$ in 2013 corresponds to landings of no more than 154 000 t. This is expected to keep SSB above MSY $B_{trigger}$ in 2014.

Precautionary approach

The fishing mortality in 2013 should be no more than F_{pa} , corresponding to landings of less than 195 000 t in 2013. This is expected to keep SSB above B_{pa} in 2014.

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 2009–2011 is zero.

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 to 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 2011 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, 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 prohibited both in Russian and in Norwegian waters. However, discarding of haddock just below the minimum size is known to be a problem in the longline and trawl fisheries when those fish are abundant.

Data and methods

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

Information from the fishing industry

A reference fleet of Norwegian 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. Assuming *F status quo* in the intermediate year (2012) gives a catch which is 23% lower than the TAC.

Comparison with previous assessment and advice

The current assessment estimated the total stock to be about 3% higher and the SSB 7% higher in 2011 compared to the estimates in the previous assessment. *F* in 2010 is 6% higher than 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.
- ICES. 2012. Report of the Arctic Fisheries Working Group. 20 April–26 April 2012. ICES CM 2012/ACOM:05.

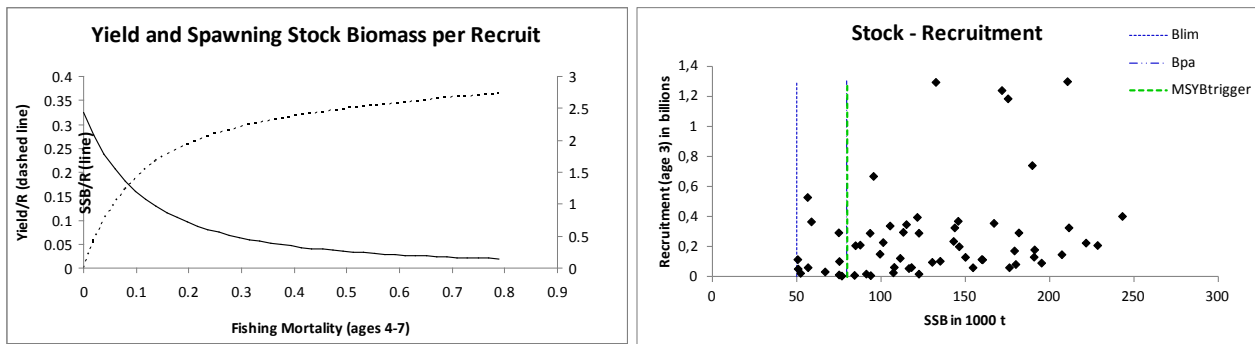


Figure 3.4.3.3 Haddock in Subareas I and II (Northeast Arctic). Yield-per-recruit analysis and stock–recruitment plot.

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	310	0	310
2012	Apply management plan	< 318	318			
2013	Apply management plan	< 238				

Weights in thousand tonnes.

¹ Haddock in Norwegian statistical areas 06 and 07 are included.² Unreported landings in 2002–2008 are included.³ Predicted landings at F_{med} .

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	Subarea I	Division IIa	Division IIb	un-reported ²	Total ³	Used in assessment	Norw. stat. areas 06 and 07 ⁴
1960	125026	27781	1844	-	154651	154651	6000
1961	165156	25641	2427	-	193224	193224	4000
1962	160561	25125	1723	-	187409	187408	3000
1963	124332	20956	936	-	146224	146224	4000
1964	79262	18784	1112	-	99158	99158	6000
1965	98921	18719	943	-	118583	118578	6000
1966	125009	35143	1626	-	161778	161778	5000
1967	107996	27962	440	-	136398	136397	3000
1968	140970	40031	725	-	181726	181726	3000
1969	89948	40306	566	-	130820	130820	2000
1970	60631	27120	507	-	88258	88257	-
1971	56989	21453	463	-	78905	78905	-
1972	221880	42111	2162	-	266153	266153	-
1973	285644	23506	13077	-	322227	322226	-
1974	159051	47037	15069	-	221157	221157	10000
1975	121692	44337	9729	-	175758	175758	6000
1976	94054	37562	5648	-	137264	137264	2000
1977	72159	28452	9547	-	110158	110158	2000
1978	63965	30478	979	-	95422	95422	2000
1979	63841	39167	615	-	103623	103623	6000
1980	54205	33616	68	-	87889	87889	5098
1981	36834	39864	455	-	77153	77153	4767
1982	17948	29005	2	-	46955	46955	3335
1983	5837	16859	1904	-	24600	24600	3112
1984	2934	16683	1328	-	20945	20945	3803
1985	27982	14340	2730	-	45052	45052	3583
1986	61729	29771	9063	-	100563	100563	4021
1987	97091	41084	16741	-	154916	154916	3194
1988	45060	49564	631	-	95255	95255	3756
1989	29723	28478	317	-	58518	58518	4701
1990	13306	13275	601	-	27182	27182	2912
1991	17985	17801	430	-	36216	36216	3045
1992	30884	28064	974	-	59922	59922	5634
1993	46918	32433	3028	-	82379	82379	5559
1994	76748	50388	8050	-	135186	135186	6311
1995	75860	53460	13128	-	142448	142448	5444

1996	112749	61722	3657	-	178128	178128	5126
1997	78128	73475	2756	-	154359	154359	5987
1998	45640	53936	1054	-	100630	100630	6338
1999	38291	40819	4085	-	83195	83195	5743
2000	25931	39169	3844	-	68944	68944	4536
2001	35072	47245	7323	-	89640	89640	4542
2002	40721	42774	12567	18736/5310	114798/101372	114798	6898
2003	53653	43564	8483	33226/9417	138926/115117	138926	4279
2004	64873	47483	12146	33777/8661	158279/133163	158279	3743
2005	53518	48081	16416	40283/9949	158298/127964	158298	5538
2006	51124	47291	33291	21451/8949	153157/140655	153157	5410
2007	62904	58141	25927	14553/3102	161525/150074	161525	7110
2008	58379	60178	31219	5828/-	155604/149776	155604	6629
2009	57723	66045	76293	0	200061	200061	4498
2010	62604	86279	100318	0	249200	249200	3770
2011 ¹	86951	99324	123600	0	309874	309874	4578

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	Year	Recruitment Age 3 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4–7
1950	83777	132405	132125	0.8325	2000	95397	101100	68944	0.2598
1951	685114	99224	120077	0.633	2001	373317	142922	89640	0.26
1952	75457	56525	127660	0.742	2002	351091	166877	114798	0.2972
1953	1296180	84705	123920	0.522	2003	231920	190991	138926	0.4288
1954	154657	117926	156788	0.3872	2004	239247	189608	158279	0.3562
1955	65108	179834	202286	0.52	2005	359434	210523	158298	0.4682
1956	211035	243114	213924	0.4658	2006	183233	175232	153157	0.376
1957	66005	181643	123583	0.4532	2007	743256	211369	161525	0.3828
1958	86262	149938	112672	0.5518	2008	1300846	207177	155604	0.3378
1959	405538	122328	88211	0.4105	2009	1187060	248075	200061	0.31
1960	296038	105210	154651	0.506	2010	329645	349502	249200	0.264
1961	133694	121379	193224	0.679	2011	151339	444837	309874	0.3942
1962	293925	111232	187408	0.84	2012	317000	373646		
1963	341919	74756	146224	0.8968	Average	268449	141026	131934	0.4723
1964	399059	58530	99158	0.672					
1965	126871	91108	118578	0.5122					
1966	296726	122326	161778	0.6272					
1967	369466	146241	136397	0.4368					
1968	22556	159667	181726	0.5242					
1969	22059	171606	130820	0.406					
1970	204309	143577	88257	0.3718					
1971	119042	154417	78905	0.2518					
1972	1241920	116388	266153	0.7298					
1973	329506	107678	322226	0.5778					
1974	64722	190687	221157	0.5022					
1975	59386	228397	175758	0.5242					
1976	66851	179055	137264	0.684					
1977	134855	107145	110158	0.8245					
1978	212456	84114	95422	0.6662					
1979	176240	74953	103623	0.6835					
1980	30836	76563	87889	0.4878					
1981	13702	93711	77153	0.4742					
1982	16901	93336	46955	0.3505					
1983	9294	56273	24600	0.3025					
1984	12187	50410	20945	0.2795					
1985	293453	50619	45052	0.3398					
1986	531442	52070	100563	0.4908					
1987	118589	66673	154916	0.6392					
1988	56167	75127	95255	0.5092					
1989	27448	87489	58518	0.3748					
1990	36742	95399	27182	0.153					
1991	105998	113057	36216	0.1975					
1992	214813	130240	59922	0.2795					
1993	671488	134968	82379	0.3562					
1994	299849	160116	135186	0.4322					
1995	100466	176035	142448	0.374					
1996	107553	221524	178128	0.4045					
1997	117151	195133	154359	0.479					
1998	64811	145638	100630	0.4002					
1999	228449	114921	83195	0.391					

Annex 3.4.3 Management plan

The current HCR for haddock is as follows (see details in Protocol of the 40th Session of the Joint Russian–Norwegian Fisheries Commission, 14 October 2011):

- *TAC for the next year will be set at level corresponding to F_{msy} .*
- *The TAC should not be changed by more than $\pm 25\%$ compared with the previous year TAC.*
- *If the spawning stock falls below B_{pa} , the procedure for establishing TAC should be based on a fishing mortality that is linearly reduced from F_{msy} at B_{pa} to $F=0$ at SSB equal to zero. At SSB-levels below B_{pa} 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.