

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

Advice summary for 2011

Cautiously avoid impaired recruitment and achieve other objective(s) of the existing **management plan** (e.g., catch stability) suggests that catches should be less than 303 kt.

Stock status

Fishing mortality	2007	2008	2009
F_{MSY}	Not defined	Not defined	Not defined
F_{PA}/F_{lim}	Between	Between	Below
Spawning Stock Biomass (SSB)			
$MSY B_{trigger}$	Not defined	Not defined	Not defined
B_{PA}/B_{lim}	Above	Above	Above

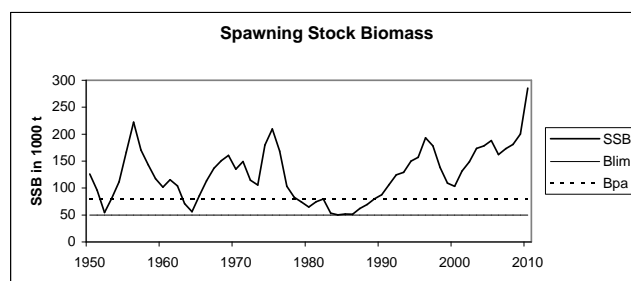
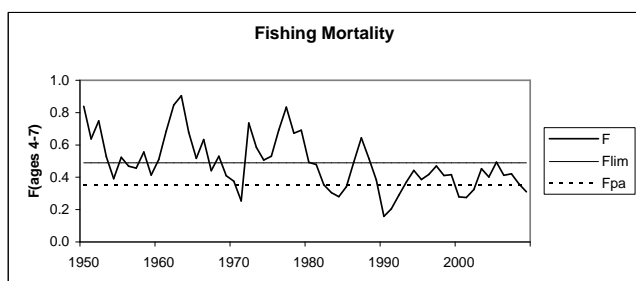
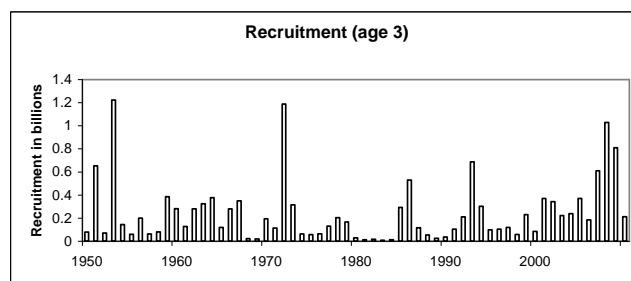
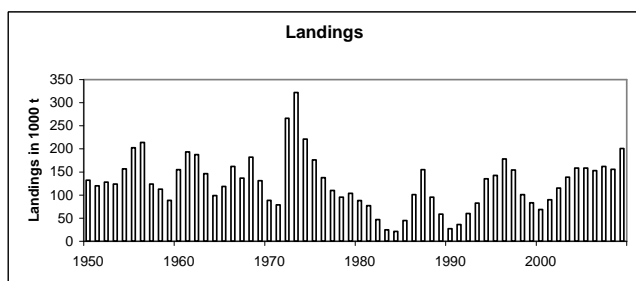
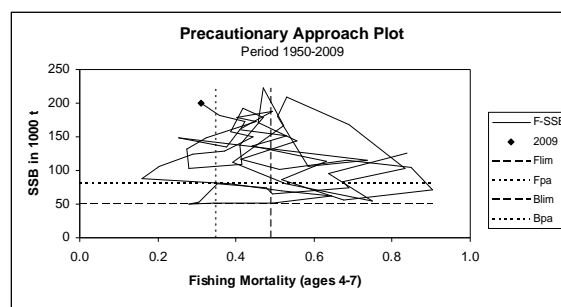


Figure 3.4.3.1 Northeast Arctic haddock (Subareas I and II). Summary of stock assessment (weights in '000 tonnes). Top right: SSB and F over the years.

The SSB has been above B_{pa} since 1989, has been increasing in recent years and is at present at historic highest value. Fishing mortality has been around F_{pa} 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 2007 - 2008 are below average and 2009 year class is around average.

Management plans

A management plan has been agreed by the Joint Norwegian Russian Fishery Commission and has been in force since 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. ICES has evaluated the modified management plan and concludes that it is in accordance with the precautionary principle.

Biology

Haddock can vary their diet and eat fish, plankton, or benthos. During 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, i.e. young herring or 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 determines year-class strength. If mean annual water temperature in the bottom layer during the first two years of haddock life does not exceed 3.8°C (Kola-section), the probability of the appearance of strong year classes is very low, even considering the favourable effects of other factors. 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 at present not taken into account in the assessment.

The fisheries

Haddock is mainly fished by trawl as by-catch in the fishery for cod. Part of the catches are taken by other conventional gears, mostly longline.

TAC regulations are in place but there was non-compliance, resulting in a significant amount of unreported landings in the past. However, IUU (Illegal, Unreported and Unregulated) catches have decreased in the last years and were close to zero in 2009.

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 of the trawler fleet at sea, i.e. by a requirement to report to catch control points when entering and leaving the EEZs, VMS satellite tracking for some fleets, and by random inspections of 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.

Catch by fleet	Total catch (2009) 200 kt where 100% landings (78% trawl, 15% longline and 7 % other gear-types).
-----------------------	---

Effects of the fisheries on the ecosystem

The direct haddock fisheries are taken other species as by-catches. The trawl fishery could impact bottom organisms but this has not been investigated. The longline fishery probably has no significant effects on the ecosystem.

Quality considerations

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

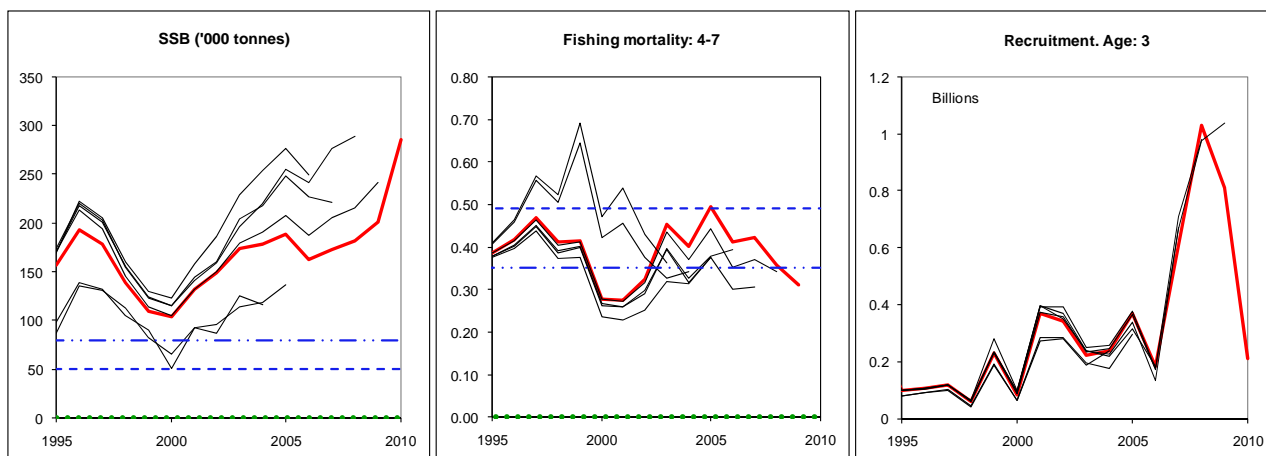


Figure 3.4.3.2 Northeast Arctic haddock (Subareas I and II). Historical assessment results (final year recruitment estimates included).

Scientific basis

Assessment type

XSA.

Input data

3 tuning fleets used
 Rus BT Russian bottom trawl survey
 Nor Ac Norwegian acoustic survey
 Nor BT Norwegian bottom trawl survey

Discards and by-catch

Discards are not accounted for.

Indicators

None

Other information

Working group report

[AFWG](#)

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

Reference points

	<i>Type</i>	<i>Value</i>	<i>Technical basis</i>
MSY Approach	MSY B_{trigger}	Not defined	
	F_{MSY}	Not defined	
Precautionary Approach	B_{lim}	50 kt	Poor recruitment has resulted from SSBs lower than 50 kt; moderate or large year-classes have been produced at higher SSBs.
	B_{pa}	80 kt	$B_{\text{lim}} * 1.67$
	F_{lim}	0.49	Median value of F_{loss}
	F_{pa}	0.35	F_{med}

(unchanged since: 2000)

The historical time series for this stock was revised in 2006, but these reference points were not revised then

Yield and spawning biomass per Recruit F-reference points (2010):

	Fish Mort	Yield/R	SSB/R
	Ages 4–7		
Average last 3 years	0.36	0.58	0.89
F_{max}^*			
$F_{0.1}$	0.17	0.50	1.77
$F_{35\% \text{SPR}}$	0.15	0.47	1.87
F_{med}	0.39	0.58	0.84

* F_{max} not well defined

Outlook for 2011

Basis: $F_{2010} = F_{\text{sq}}(2009) = 0.31$; SSB (2011) = 444 000; R (2010) = 212 000; landings (2010) = 269 000;

Rationale	Landings (2011)¹	Basis	F	SSB	%SSB change	%TAC change
			(2011)	(2012)	²⁾	³⁾
MSY approach		Not defined				
MSY transition		Not defined				
Management plan	303	25% constraint on TAC increase	0.31	473	+6	+25
Precautionary approach	333	$F_{\text{pa}} = 0.35$	0.35	452	+2	+37
Zero catch	0	0	0	689	+55	-100
<i>Status quo</i>	301	$F_{\text{sq}}(2009) = 0.31$	0.31	474	+7	+24

Weights in '000 t.

¹⁾ Landings are total landings without IUU landings. If this figure is taken as TAC, no implementation error is assumed.

²⁾ SSB 2012 relative to SSB 2011.

³⁾ Landings 2011 relative to TAC 2010.

MSY approach

For haddock, MSY information can be derived from simulations done during the evaluation of whether the HCR for these stocks are precautionary (see AFWG 2006). Also the biological model should be re-visited before any MSY reference points for advisory use are calculated. Work is in progress to evaluate the current management plan in relation to the MSY framework.

PA approach

The fishing mortality in 2011 should be no more than F_{pa} corresponding to landings of less than 333 kt in 2011. This is expected to keep SSB above B_{pa} in 2012.

Management plan

Following the agreed client management plan implies a TAC of 303 kt in 2011, which corresponds to a TAC increase of 25%. This is expected to keep SSB above B_{pa} in 2012.

Management considerations

ICES considers that application of the agreed management plan in 2011 has long-term benefits above the application of F_{pa} .

Under-reporting of landings has been an important issue for this stock in recent years, fluctuating between 4% to 34% of the international reported landings. Non-reported landings (IUU) for the period 2002-2008 were estimated ranging from 6 kt to 40 kt, but the IUU estimate is 0 for 2009.

Unreported landings will reduce the effect of management measures and will undermine the intended objectives of the harvest control rule. It is therefore important that management agencies ensure that all catches are counted against the TAC.

Regulations and their effects

The fishery is regulated by TACs. The fishery is also regulated by a minimum size of fish in the landings, 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 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 vessels 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 with too much small fish observed during their inspections. A closed area is not opened until it is documented OK by trial fishing within the area by the Surveillance Service.

A preliminary evaluation of the effectiveness of the system up to 1998 shows a clear decrease in the discarding of small cod and haddock. This work should be repeated although the historic good conditions of the stocks indirectly indicate the success of the joint Norwegian-Russian area closure system in the northeast Arctic.

In additions to the temporary closed areas there are permanently closed areas either for protecting juvenile cod and haddock (around Bear Island) or for the purpose of reducing fishing pressure on coastal populations and to avoid gear conflicts. Use of selective gear technology in the demersal fisheries since 1997 has also reduced the catch and possible discard of juveniles.

From 2011 onwards, the minimum mesh size for bottom trawl fisheries for cod and haddock will be 130 mm for the entire Barents Sea (at present the minimum mesh size is 135 mm in the Norwegian EEZ and 125 mm in the Russian EEZ). This change is not expected to have a significant impact on the total exploitation pattern for this stock, thus a recent average exploitation pattern is used in the predictions.

The fisheries are controlled by inspections of the trawler fleet at sea, both by a requirement to report to catch 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 not allowed neither in Russia nor Norway, nevertheless the present catch control and reporting systems are not sufficient to prevent under-reporting of catches and discarding.

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 (13 oceanic and 21 coastal) provide regular sampling data for length and age. These data are used for estimating catch at age for the corresponding fleets. Russian fishing vessels with observers onboard provide similar information on catch length distribution and sample fish to receive data on length-age matrices.

Uncertainties in assessment and forecast

The main uncertainties in this assessment derive from the biased catch statistics. Bias in the catch statistics appears to have decreased in recent years. Non-reported landings (IUU) for the period 2002-2008 were estimated ranging from 6 kt to 40 kt, for 2009 the IUU estimate equal zero.

There are no estimates of discarding, but there is known to be a discarding problem in the longline and trawl fisheries.

The Russian bottom trawl survey (in 2006) and Norwegian bottom trawl survey (in 2007) coverage were reduced compared to previous years. The survey indices were adjusted.

There is a retrospective pattern of over estimating stock size and under estimating fishing mortality the most recent years. The reason for this is not fully understood.

Comparison with previous assessment and advice:

The current assessment estimated SSB 17 % lower in 2009 compared to the previous assessment. F in 2008 is 5 % higher than estimated last year. The basis of the advice is the same as last year.

Sources

ICES 2006. Report of the Arctic Fisheries Working Group, 19-28 April 2006. ICES CM 2006/ACFM:25
ICES. 2010. Report of the Arctic Fisheries Working Group, 22-28 April 2010. ICES CM 2010/ACOM:05.

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

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official landings ¹	ICES landings ^{1,2}
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	115
2003	Reduce F below F_{pa}	< 101	101	106	139
2004	Reduce F below F_{pa}	< 120	130	125	158
2005	Reduce F below F_{pa}	<106	117	118	158
2006	Reduce F below F_{pa}	<112	120	132	153
2007	Limit catches	<130	150	147	162
2008	Limit catches to 2001-2004 average	<130	155	150	156
2009	Apply management plan	<194	194	200	200
2010	Apply management plan	<243	243		
2011	Apply management plan	<303			

Weights in '000 t.

¹ Haddock in Norwegian statistical areas 06 and 07 are included.² Unreported landings in 2002–2008 are included.

Table 3.4.3.2

North-East Arctic HADDOCK. Total nominal catch (t) by fishing areas.
(Data provided by Working Group members).

Year	Subarea I	Division IIa	Division IIb	unreported	Total
1960	125026	27781	1844	-	154651
1961	165156	25641	2427	-	193224
1962	160561	25125	1723	-	187409
1963	124332	20956	936	-	146224
1964	79262	18784	1112	-	99158
1965	98921	18719	943	-	118583
1966	125009	35143	1626	-	161778
1967	107996	27962	440	-	136398
1968	140970	40031	725	-	181726
1969	89948	40306	566	-	130820
1970	60631	27120	507	-	88258
1971	56989	21453	463	-	78905
1972	221880	42111	2162	-	266153
1973	285644	23506	13077	-	322227
1974	159051	47037	15069	-	221157
1975	121692	44337	9729	-	175758
1976	94054	37562	5648	-	137264
1977	72159	28452	9547	-	110158
1978	63965	30478	979	-	95422
1979	63841	39167	615	-	103623
1980	54205	33616	68	-	87889
1981	36834	39864	455	-	77153
1982	17948	29005	2	-	46955
1983	5837	16859	1904	-	24600
1984	2934	16683	1328	-	20945
1985	27982	14340	2730	-	45052
1986	61729	29771	9063	-	100563
1987	97091	41084	16741	-	154916
1988	45060	49564	631	-	95255
1989	29723	28478	317	-	58518
1990	13306	13275	601	-	27182
1991	17985	17801	430	-	36216
1992	30884	28064	974	-	59922
1993	46918	32433	3028	-	82379
1994	76748	50388	8050	-	135186
1995	75860	53460	13128	-	142448
1996	112749	61722	3657	-	178128
1997	78128	73475	2756	-	154359
1998	45640	53936	1054	-	100630
1999	38291	40819	4085	-	83195
2000	25931	39169	3844	-	68944
2001	35072	47245	7323	-	89640
2002	40721	42774	12567	18736	114798
2003	53653	43564	8483	33226	138926
2004	64873	47483	12146	33777	158279
2005	53518	48081	16416	40283	158298
2006	51124	47291	33291	21451	153157
2007	62904	58141	25927	14553	161525
2008	58379	60178	31219	5828	155604
2009 ¹	58177	66065	76270	0	200512

Table 3.4.3.3 North-East Arctic HADDOCK. Nominal catch (t) by countries. Subarea I and Divisions IIa and IIb combined. (Data provided by Working Group members).

Year	Faroe Islands	France	German Dem.Re.	Fed. Re. Germ.	Norway ⁵	Poland	United Kingdom	Russia ²	Others	unreported catches ³	Total
1960	172	-	-	5597	46263	-	45469	57025	125	-	154651
1961	285	220	-	6304	60862	-	39650	85345	558	-	193224
1962	83	409	-	2895	54567	-	37486	91910	58	-	187408
1963	17	363	-	2554	59955	-	19809	63526	-	-	146224
1964	-	208	-	1482	38695	-	14653	43870	250	-	99158
1965	-	226	-	1568	60447	-	14345	41750	242	-	118578
1966	-	1072	11	2098	82090	-	27723	48710	74	-	161778
1967	-	1208	3	1705	51954	-	24158	57346	23	-	136397
1968	-	-	-	1867	64076	-	40129	75654	-	-	181726
1969	2	-	309	1490	67549	-	37234	24211	25	-	130820
1970	541	-	656	2119	37716	-	20423	26802	-	-	88257
1971	81	-	16	896	45715	43	16373	15778	3	-	78905
1972	137	-	829	1433	46700	1433	17166	196224	2231	-	266153
1973	1212	3214	22	9534	86767	34	32408	186534	2501	-	322226
1974	925	3601	454	23409	66164	3045	37663	78548	7348	-	221157
1975	299	5191	437	15930	55966	1080	28677	65015	3163	-	175758
1976	536	4459	348	16660	49492	986	16940	42485	5358	-	137264
1977	213	1510	144	4798	40118	-	10878	52210	287	-	110158
1978	466	1411	369	1521	39955	1	5766	45895	38	-	95422
1979	343	1198	10	1948	66849	2	6454	26365	454	-	103623
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	-	Greenld	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	114798
2003	1959	382	1363	918	56485	1330	1018	41142	1103	33226	138926
2004	2484	103	1680	823	62192	54	1250	54347	1569	33777	158279
2005	2138	333	15	996	60850	963	1899	50012	1262	40283	158751
2006	2390	883	1830	989	69272	703	1164	53313	1162	21451	153157
2007	2307	277	1464	1123	71244	125	1351	66569	2511	14553	161525
2008 ¹	2687	311	1659	535	72779	283	971	68792	1759	5828	155604
2009 ¹	2953	529	1407	1942	104354	317	1315	85514	2181	0	200512

1 Provisional figures.

2 USSR prior to 1991.

Table 3.4.3.4 Northeast Arctic haddock. Summary.

Year	Recruitment Age 3 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-7
1950	78929	126115	132125	0.8394
1951	651926	95799	120077	0.6373
1952	71403	54608	127660	0.7485
1953	1222461	80920	123920	0.5273
1954	144946	111529	156788	0.391
1955	61068	166642	202286	0.5231
1956	199478	222445	213924	0.4691
1957	61960	170611	123583	0.4571
1958	81066	143338	112672	0.5557
1959	384257	117294	88211	0.4137
1960	282770	101643	154651	0.511
1961	127721	115302	193224	0.6846
1962	281114	104145	187408	0.8473
1963	323623	71199	146224	0.9043
1964	376636	56226	99158	0.6774
1965	119914	85889	118578	0.5164
1966	281051	113339	161778	0.6331
1967	349430	136736	136397	0.4414
1968	21121	150787	181726	0.5295
1969	20769	160490	130820	0.4099
1970	194157	135209	88257	0.3753
1971	112754	149142	78905	0.2545
1972	1187886	114833	266153	0.736
1973	314573	105653	322226	0.5853
1974	61846	179900	221157	0.5071
1975	56904	209653	175758	0.5303
1976	64566	168276	137264	0.6905
1977	130774	103296	110158	0.8335
1978	203475	82753	95422	0.6732
1979	166831	74067	103623	0.6905
1980	28872	64835	87889	0.4928
1981	12889	74504	77153	0.4785
1982	16183	79890	46955	0.3536
1983	9099	53412	24600	0.3051
1984	12123	50312	20945	0.2804
1985	293126	51769	45052	0.3411
1986	529530	51570	100563	0.4937
1987	116579	62044	154916	0.6443
1988	55307	69547	95255	0.5159
1989	26519	80270	58518	0.3829
1990	36506	87527	27182	0.158
1991	105072	106460	36216	0.2039
1992	210309	124594	59922	0.2895
1993	686543	129315	82379	0.3716
1994	302656	149832	135186	0.4429
1995	99083	156997	142448	0.3865
1996	104716	193041	178128	0.4177
1997	118576	178260	154359	0.4699
1998	59106	138400	100630	0.4108
1999	230521	108980	83195	0.4158
2000	84937	103324	68944	0.2788
2001	370480	131687	89640	0.275
2002	342198	148634	114798	0.324
2003	221794	173468	138926	0.4524
2004	237499	178372	158279	0.4018
2005	370823	188282	158298	0.4939
2006	185450	162129	153157	0.4124
2007	609862	173075	161525	0.4217
2008	1028683	181152	155604	0.3582
2009	810831	200339	200512	0.3104
2010	212000	285470		
Average	248578	122664	127022	0.48628

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 Norwegian Russian Fishery Commission, 10 October 2007):

- *TAC for the next year will be set at level corresponding to F_{pa} .*
- *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_{pa} 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.*