

3.3.5 Haddock (*Melanogrammus aeglefinus*) in subareas 1 and 2 (Northeast Arctic)

ICES stock advice

ICES advises that when the Joint Russian–Norwegian Fisheries Commission management plan is applied, catches in 2017 should be no more than 233 000 tonnes.

Stock development over time

The spawning-stock biomass (SSB) has been above $MSY B_{trigger}$ since 1989, increasing since 2000, and reaching the series maximum in 2015. Fishing mortality (F) was around F_{MSY} from the mid-1990s to 2011, but has declined substantially since then. Recruitment-at-age 3 has been at or above the long-term average since 2000. The very strong year classes 2004–2006 are still dominating the spawning stock; there have been no strong year classes observed after these.

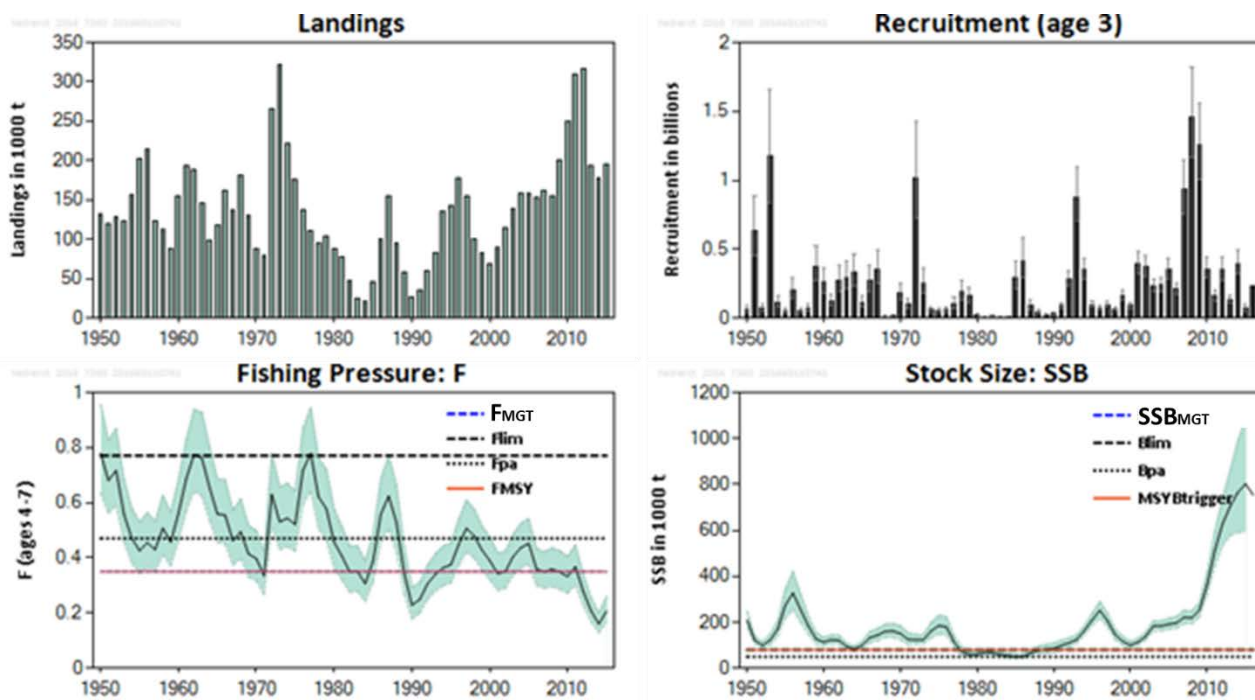


Figure 3.3.5.1 Haddock in subareas 1 and 2. Summary of stock assessment (weights in thousand tonnes). Recruitment, F, and SSB have confidence intervals (95%) in the plot. For this stock, $F_{MGT} = F_{MSY}$, and $SSB_{MGT} = MSY B_{trigger} = B_{pa}$; therefore, the horizontal lines representing these points in the graph overlap.

Stock and exploitation status

Table 3.3.5.1 Haddock in subareas 1 and 2. State of the stock and fishery relative to reference points.

		Fishing pressure			Stock size			
		2013	2014	2015	2014	2015	2016	
Maximum sustainable yield	F_{MSY}	✓	✓	✓	Below	MSY	✓	Above trigger
Precautionary approach	F_{pa} , F_{lim}	✓	✓	✓	Harvested sustainably	B_{pa} , B_{lim}	✓	Full reproductive capacity
Management plan	F_{MGT}	✓	✓	✓	Below	SSB_{MGT}	✓	Above

Catch options

Table 3.3.5.2 Haddock in subareas 1 and 2. The basis for the catch options.

Variable	Value	Source	Notes
$F_{\text{ages 4-7}}$ (2016)	0.28	ICES (2016a)	TAC constraint
SSB (2017)	574 kt	ICES (2016a)	
R_{age3} (2016)	235 million	ICES (2016a)	RCT3 from multiple surveys.
Total catch (2016)	244 kt	ICES (2016a)	TAC
Landings (2016)	244 kt	ICES (2016a)	TAC
Discards (2016)	0	ICES (2016a)	Discarding is considered negligible.

Table 3.3.5.3 Haddock in subareas 1 and 2. The catch options. Weights in thousand tonnes.

Rationale	Catches (2017)	Basis	F (2017)	SSB (2018)	%SSB change*	%TAC change**
Management plan	233	F_{MP}	0.35	405	-29	-5
MSY approach	233	F_{MSY}	0.35	405	-29	-5
Precautionary approach	295	F_{pa}	0.47	353	-39	21
Zero catch	0	$F = 0$	0	608	6	-100
<i>Status quo</i>	193	$F_{\text{sq}(2016)}$	0.28	439	-24	-21
Other options***	187	HCR 1; $F = 0.27$, TAC change: $\pm 25\%$	0.27	444	-23	-22
	275	HCR 3; $F = 0.43$, TAC change: $\pm 25\%$	0.43	369	-36	13
	233	HCR 4; $F = 0.35$, TAC change: $\pm 10\%$	0.35	405	-29	-5
	233	HCR 5; $F = 0.35$, TAC change: no constraint	0.35	405	-29	-5
	233	HCR 6; $F = 0.35$, TAC change: 25% downward constraint	0.35	405	-29	-5

* SSB 2018 relative to SSB 2017.

** Catches 2017 relative to TAC 2016.

*** Harvest control rules (HCRs) evaluated by ICES (2016b). HCR 2 is the rule in the current management plan.

Basis of the advice

Table 3.3.5.4 Haddock in subareas 1 and 2. The basis of the advice.

Advice basis	Joint Russian–Norwegian Fisheries Commission management plan.
Management plan	<p>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):</p> <ul style="list-style-type: none"> - 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. <p>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. At the 45th Session of the Joint Russian–Norwegian Fisheries Commission in 2015 it was decided that a number of alternative harvest control rules (HCRs) for Northeast Arctic haddock should be evaluated by ICES. ICES provided advice on these harvest control rules in 2016 (ICES, 2016b).</p>

Quality of the assessment

Sampling of commercial catches is believed to be less precise because of the termination of a Norwegian port sampling programme in mid-2009. Russian sampling of commercial catches has decreased in recent years. Poor sampling of commercial catches is impairing the quality of the assessment and the advice.

Discarding is known to have taken place but discards cannot be quantified (assumed to be below 5% in recent years).

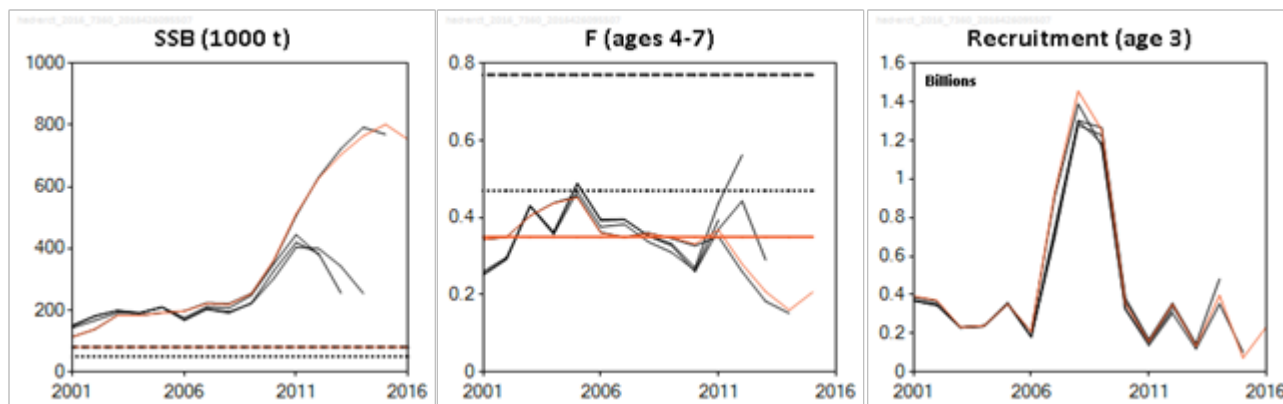


Figure 3.3.5.2 Haddock in subareas 1 and 2. Historical assessment results (final-year recruitment estimates included). The basis of the assessment changed in 2015 when the stock was benchmarked (ICES, 2015a).

Issues relevant for the advice

The advice for 2017 is based on the assumption that catches in 2016 equal the TAC (244 000 tonnes); this corresponds to a 25% increase in catches in 2016 relative to the observed catches in 2015.

A large fraction of the current fishable biomass is at age 10 and older, a situation that has not previously been observed during the time period described in this assessment and it is likely to generate some instabilities in the assessment results. Although relatively large revisions in historic SSB estimates may occur in stock assessments in the coming years, it is expected that the stock status is unlikely to be affected.

Reference points

Table 3.3.5.5 Haddock in subareas 1 and 2. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	80 000 t	B_{pa} .	ICES (2011)
	F_{MSY}	0.35	Stochastic long-term simulations.	ICES (2011)
Precautionary approach	B_{lim}	50 000 t	B_{loss} .	ICES (2011)
	B_{pa}	80 000 t	$B_{lim} \times \exp(1.645 \times 0.3)$.	ICES (2011)
	F_{lim}	0.77	Corresponds to the SPR value of the slope of the line leading from SSB = 0 to the geometric mean recruitment at SSB = B_{lim} .	ICES (2011)
	F_{pa}	0.47	$F_{lim} \times \exp(-1.645 \times 0.3)$.	ICES (2011)
Management plan	SSB_{MGT}	80 000 t	B_{pa} . TAC is linearly reduced from F_{pa} at SSB = B_{pa} to zero at SSB = 0.	ICES (2011)
	F_{MGT}	0.35	Previous F_{pa} estimated prior to the revision of the historical time-series for this stock.	ICES (2011)

Basis of the assessment

Table 3.3.5.6 Haddock in subareas 1 and 2. The basis of the assessment.

ICES stock data category	1 (ICES, 2016c)
Assessment type	Age-based analytical assessment (SAM; ICES, 2015a) that uses landings in the model and in the forecast.
Input data	Commercial landings (international landings, ages and length frequencies from catch sampling); four survey indices (RU-BTr-Q4, BS-NoRU-Q1(Aco), BS-NoRu-Q1 (BTr), and Eco-NoRu-Q3 (Btr)); annual maturity data from surveys; natural mortalities from cod consumption of ages 1–6 haddock are available from 1984.
Discards and bycatch	Discarding is considered negligible in recent years (below 5%). Bycatch is included.
Indicators	None
Other information	Last benchmarked in January 2015 (WKARCT; ICES, 2015a).
Working group	Arctic Fisheries Working Group (AFWG)

Information from stakeholders

There is no available information.

History of the advice, catch, and management

Table 3.3.5.7 Haddock in subareas 1 and 2. History of ICES advice, the agreed TAC, and ICES estimates of landings. Weights are in thousand tonnes.

Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC	Official landings*	Unreported landings (included in ICES landings)	ICES landings**
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	63	60		60
1993	No long-term gains in increasing F	56	72	82		82
1994	No long-term gains in $F > F_{med}$	97***	120	135		135
1995	No long-term gains in $F > F_{med}$	122***	130	142		142
1996	No long-term gains in $F > F_{med}$	169***	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	315	0	315
2013	Apply management plan	< 238	200	194	0	194
2014	Apply management plan	< 150	178.5	178	0	178
2015	Apply management plan	< 165	223	195	0	195
2016	Apply management plan	< 244^	244			
2017	Apply management plan	≤ 233				

* Haddock in Norwegian statistical areas 06 and 07 are included.

** Unreported landings in 2002–2008 are included.

*** Predicted landings at F_{med} .

^ This advice was updated 7 July 2015 in response to a special request (ICES, 2015b) after a mid-year change in TAC in 2015 (from 178.5 kt to 223 kt).

History of catch and landings

Table 3.3.5.8 Haddock in subareas 1 and 2. Catch distribution by fleet in 2015 as estimated by ICES.

Total catch (2015)	Landings			Discards Assumed to be negligible
	68% trawl	12% longline	20% other gear types	
195 kt	195 kt			

Table 3.3.5.9 Haddock in subareas 1 and 2. History of official landings by country and total ICES estimated landings. commercial catch and landings; both the official and ICES estimated values are presented for each country participating in the fishery.

Year	Faroe Islands	France	German Dem. Rep.	Fed. Rep. Germ.	Greenland	Norway^	Poland	Russia**	Spain	United Kingdom	Others	Unreported catches***	Total ***
1960	172	-	-	5597		46263	-	57025		45469	125	-	154651
1961	285	220	-	6304		60862	-	85345		39650	558	-	193224
1962	83	409	-	2895		54567	-	91910		37486	58	-	187408
1963	17	363	-	2554		59955	-	63526		19809	-	-	146224
1964	-	208	-	1482		38695	-	43870		14653	250	-	99158
1965	-	226	-	1568		60447	-	41750		14345	242	-	118578
1966	-	1072	11	2098		82090	-	48710		27723	74	-	161778
1967	-	1208	3	1705		51954	-	57346		24158	23	-	136397
1968	-	-	-	1867		64076	-	75654		40129	-	-	181726
1969	2	-	309	1490		67549	-	24211		37234	25	-	130820
1970	541	-	656	2119		37716	-	26802		20423	-	-	88257
1971	81	-	16	896		45715	43	15778		16373	3	-	78905
1972	137	-	829	1433		46700	1433	196224		17166	2231	-	266153
1973	1212	3214	22	9534		86767	34	186534		32408	2501	-	322226
1974	925	3601	454	23409		66164	3045	78548		37663	7348	-	221157
1975	299	5191	437	15930		55966	1080	65015		28677	3163	-	175758
1976	536	4459	348	16660		49492	986	42485		16940	5358	-	137264
1977	213	1510	144	4798		40118	-	52210		10878	287	-	110158
1978	466	1411	369	1521		39955	1	45895		5766	38	-	95422
1979	343	1198	10	1948		66849	2	26365		6454	454	-	103623
1980	497	226	15	1365		66501	-	20706		2948	246	-	92504
1981	381	414	22	2402		63435		13400		1682	-	-	81736
1982	496	53	-	1258		43702		2900	-	827	-	-	49236
1983	428	-	1	729		22364		680	139	259	-	-	24600
1984	297	15	4	400		18813		1103	37	276	-	-	20945
1985	424	21	20	395		21272		22690	77	153	-	-	45052
1986	893	12	75	1079		52313		45738	22	431	-	-	100563
1987	464	7	83	3105		72419		78211	59	563	5	-	154916
1988	1113	116	78	1323		60823		31293	72	435	2	-	95255
1989	1217	-	26	171		36451		20062	1	590	-	-	58518
1990	705	-	5	167		20621		5190	-	494	-	-	27182
1991	1117	-		213		22178		12177	-	514	17	-	36216
1992	1093	151		387	1719	36238		19699	38	596	1	-	59922
1993	546	1215		1165	880	40978		35071	76	1802	646	-	82379

Year	Faroe Islands	France	German Dem. Rep.	Fed. Rep. Germ.	Greenland	Norway^	Poland	Russia**	Spain	United Kingdom	Others	Unreported catches***	Total ***
1994	2761	678		2412	770	71171		51822	22	4673	877	-	135186
1995	2833	598		2675	1097	76886		54516	14	3111	718	-	142448
1996	3743	6		942	1510	94527		74239	669	2275	217	-	178128
1997	3327	540		972	1877	103407		41228	364	2340	304	-	154359
1998	1903	241		385	854	75108		20559	257	1229	94	-	100630
1999	1913	64		641	437	48182		30520	652	694	92	-	83195
2000	631	178		880	432	42009		22738	502	747	827	-	68944
2001	1210	324		554	553	49067		34307	1497	1068	1060	-	89640
2002	1564	297		627	858	52247		37157	1505	1125	682	18736/5310	114798/101372
2003	1959	382		918	1363	56485		41142	1330	1018	1103	33226/9417	138926/115117
2004	2484	103		823	1680	62192		54347	54	1250	1569	33777/8661	158279/133163
2005	2138	333		996	15	60850		50012	963	1899	1262	40283/9949	158751/128417
2006	2390	883		989	1830	69272		53313	703	1164	1162	21451/8949	153157/140655
2007	2307	277		1123	1464	71244		66569	125	1351	2511	14553/3102	161525/150074
2008	2687	311		535	1659	72779		68792	283	971	1759	5828/-	155604/149776
2009	2820	529		1957	1410	104354		85514	317	1315	1845	0	200061
2010	3173	764		3539	1970	123384		111372	379	1758	2862	0	249200
2011	1759	268		1724	2110	158202		139912	502	1379	4763	0	309785
2012	2055	322		1111	3984	159602		143886	441	833	3393	0	315627
2013	1886	342		500	1795	99215		85668	439	639	3260	0	193744
2014	1470	198		340	1150	91306		78725	187	355	3791	0	177522
2015*	2459	145		124	1047	95094		91864	246	450	3327	0	194756

* Provisional figures.

** USSR prior to 1991.

*** Figures based on Norwegian/Russian IUU estimates.

^ Landings in Norwegian statistical areas 06 and 07 (from 1983) are included.

Summary of the assessment

Table 3.3.5.10 Haddock in subareas 1 and 2. Assessment summary (weights in tonnes). Recruitment in thousands.

Year	Recruitment (Age 3)	High (95% confidence interval)	Low (95% confidence interval)	Stock size: SSB	High (95% confidence interval)	Low (95% confidence interval)	Landings	Fishing pressure: F (ages 4–7)	High (95% confidence interval)	Low (95% confidence interval)
1950	65121	92718	45738	209190	247809	176590	132125	0.78	0.957	0.635
1951	630961	887301	448678	121419	141396	104264	120077	0.681	0.827	0.561
1952	69633	98110	49422	99310	115455	85423	127660	0.717	0.87	0.591
1953	1174085	1656040	832393	120572	146669	99118	123920	0.558	0.684	0.456
1954	111413	158011	78557	169058	206844	138176	156788	0.471	0.582	0.381
1955	53370	75613	37670	273758	344242	217706	202286	0.426	0.529	0.342
1956	204025	287667	144703	326766	420509	253921	213924	0.455	0.565	0.366
1957	52680	74506	37248	253470	321747	199682	123583	0.43	0.532	0.347
1958	68734	97205	48602	183139	225339	148842	112672	0.508	0.627	0.412
1959	373622	521185	267839	127007	156201	103270	88211	0.457	0.565	0.37
1960	260146	362950	186461	113210	133457	96035	154651	0.561	0.683	0.46
1961	122272	170290	87793	123377	144638	105241	193224	0.687	0.829	0.569
1962	270763	379034	193420	120572	142954	101694	187408	0.775	0.938	0.641
1963	293608	411029	209731	93807	109297	80513	146224	0.762	0.929	0.624
1964	329391	463536	234066	84120	97818	72340	99158	0.655	0.803	0.535
1965	113664	158825	81344	98716	116665	83528	118578	0.559	0.686	0.455
1966	271848	380332	194308	132323	158697	110332	161778	0.555	0.684	0.451
1967	349060	489050	249142	143200	172060	119182	136397	0.462	0.572	0.372
1968	15357	21712	10862	159851	190324	134258	181726	0.495	0.614	0.399
1969	16963	23857	12061	161297	194028	134087	130820	0.414	0.518	0.33
1970	181498	254919	129224	151146	184647	123723	88257	0.398	0.499	0.317
1971	103156	144813	73482	124742	152995	101706	78905	0.335	0.422	0.266
1972	1017643	1430193	724097	123871	147467	104052	266153	0.63	0.778	0.51
1973	255761	358649	182390	123007	145956	103667	322226	0.531	0.657	0.43
1974	60962	85263	43586	161458	197474	132011	221157	0.544	0.671	0.441
1975	54068	75395	38774	185165	231117	148349	175758	0.521	0.641	0.424
1976	58279	84976	39970	179333	223503	143892	137264	0.718	0.869	0.593
1977	101316	147700	69498	112871	140733	90525	110158	0.779	0.945	0.642
1978	192144	270363	136555	72475	92689	56670	95422	0.621	0.764	0.505
1979	159213	223915	113208	57989	71753	46865	103623	0.578	0.721	0.464
1980	22765	32731	15834	59456	71717	49292	87889	0.457	0.577	0.362
1981	9474	13520	6639	69564	84574	57218	77153	0.406	0.514	0.32
1982	17473	24697	12362	67104	82941	54291	46955	0.349	0.442	0.275

Year	Recruitment (Age 3)	High (95% confidence interval)	Low (95% confidence interval)	Stock size: SSB	High (95% confidence interval)	Low (95% confidence interval)	Landings	Fishing pressure: F (ages 4–7)	High (95% confidence interval)	Low (95% confidence interval)
1983	7601	10827	5336	59338	73306	48031	24600	0.351	0.444	0.278
1984	10850	15234	7727	54394	67404	43894	20945	0.306	0.389	0.241
1985	293021	411301	208756	49070	60184	40008	45052	0.389	0.484	0.312
1986	416649	587434	295517	50362	59807	42409	100563	0.558	0.686	0.455
1987	92226	132851	64024	66970	81741	54868	154916	0.624	0.771	0.505
1988	40255	57188	28336	76496	94487	61931	95255	0.529	0.666	0.42
1989	25926	36338	18497	82207	103748	65139	58518	0.344	0.44	0.269
1990	32016	43373	23633	85734	108575	67697	27182	0.229	0.294	0.178
1991	87553	110640	69283	99012	121599	80621	36216	0.249	0.31	0.2
1992	281532	346369	228831	109645	131556	91383	59922	0.306	0.374	0.25
1993	879404	1092282	708015	124742	145212	107157	82379	0.34	0.414	0.279
1994	349759	428189	285695	163407	185556	143902	135186	0.364	0.443	0.299
1995	95130	117247	77185	209400	238545	183816	142448	0.375	0.454	0.309
1996	75433	93528	60839	251702	290451	218122	178128	0.448	0.539	0.372
1997	96182	118732	77915	205870	238486	177715	154359	0.507	0.61	0.422
1998	61759	76914	49591	145801	171515	123943	100630	0.48	0.577	0.4
1999	165215	204336	133583	116425	137904	98291	83195	0.428	0.516	0.356
2000	87466	108804	70312	99509	116802	84776	68944	0.39	0.477	0.32
2001	393171	482917	320104	113437	130789	98387	89640	0.343	0.418	0.282
2002	371387	453967	303829	138413	157561	121592	114798	0.35	0.423	0.289
2003	231422	283260	189071	183139	207411	161707	138926	0.405	0.486	0.338
2004	238709	291249	195647	182956	206606	162013	158279	0.437	0.525	0.363
2005	351512	430499	287018	191377	216894	168862	158298	0.452	0.542	0.376
2006	207939	253101	170836	196811	223666	173181	153157	0.36	0.434	0.299
2007	930056	1148515	753150	221018	251416	194296	161525	0.349	0.422	0.29
2008	1455704	1816641	1166479	218819	248512	192673	155604	0.359	0.436	0.296
2009	1254189	1560723	1007860	252963	287541	222544	200061	0.348	0.426	0.285
2010	355045	438450	287506	362943	418042	315105	249200	0.332	0.405	0.271
2011	157472	204548	121229	511959	593807	441393	309785	0.368	0.447	0.302
2012	351161	445370	276880	627187	739833	531692	315627	0.279	0.341	0.228
2013	133252	165205	107480	704328	859194	577377	193744	0.208	0.256	0.169
2014	396726	493264	319081	764517	989446	590722	177522	0.16	0.2	0.129
2015	72839	100875	52594	802109	1081457	594919	194756	0.207	0.26	0.166
2016	235000*			753485						
Average	258418	341156	197083	192207	222012	152373	137295	0.461	0.567	0.376

*Predicted RCT3.

Sources and references

- ICES. 2011. 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. 2015a. Report of the Benchmark Workshop on Arctic Stocks (WKARCT), 26–30 January 2015, ICES Headquarters, Denmark. ICES CM 2015/ACOM:30. 126 pp.
- ICES. 2015b. Norway and Russia request to ICES for revised advice for Haddock in Subareas I and II. *In* Report of the ICES Advisory Committee, 2015. ICES Advice 2015, Book 3, Section 3.2.3.1.
http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2015/Special_Requests/Norway_Russia_had-arct_update.pdf.
- ICES. 2016a. Report of the Arctic Fisheries Working Group (AFWG), 19–25 April 2016, ICES HQ, Copenhagen, Denmark. ICES CM 2016/ACOM:06.
- ICES. 2016b. Norway/Russia request for evaluation of harvest control rules for Northeast Arctic cod and haddock and for Barents Sea capelin. *In* Report of the ICES Advisory Committee, 2016. ICES Advice 2016, Book 3, Section 3.4.1. [ICES Special Request Advice](#).
- ICES. 2016c. General context of ICES advice. *In* Report of the ICES Advisory Committee, 2016. ICES Advice 2016, Book 1, Section 1.2.