

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

ICES advice on fishing opportunities

ICES advises that when the Joint Russian–Norwegian Fisheries Commission management plan is applied, catches in 2019 should be no more than 152 000 tonnes.

Stock development over time

The spawning-stock biomass (SSB) has been above MSY B_{trigger} since 1989. Due to the strong recruitment-at-age 3 in 2007–2009 (2004–2006 year classes) the stock reached an all-time high level around 2013. SSB is now decreasing, but remains well above MSY B_{trigger} . Fishing mortality has increased in recent years and is now above $F_{\text{MSY}} = F_{\text{target}}$, but below F_{pa} .

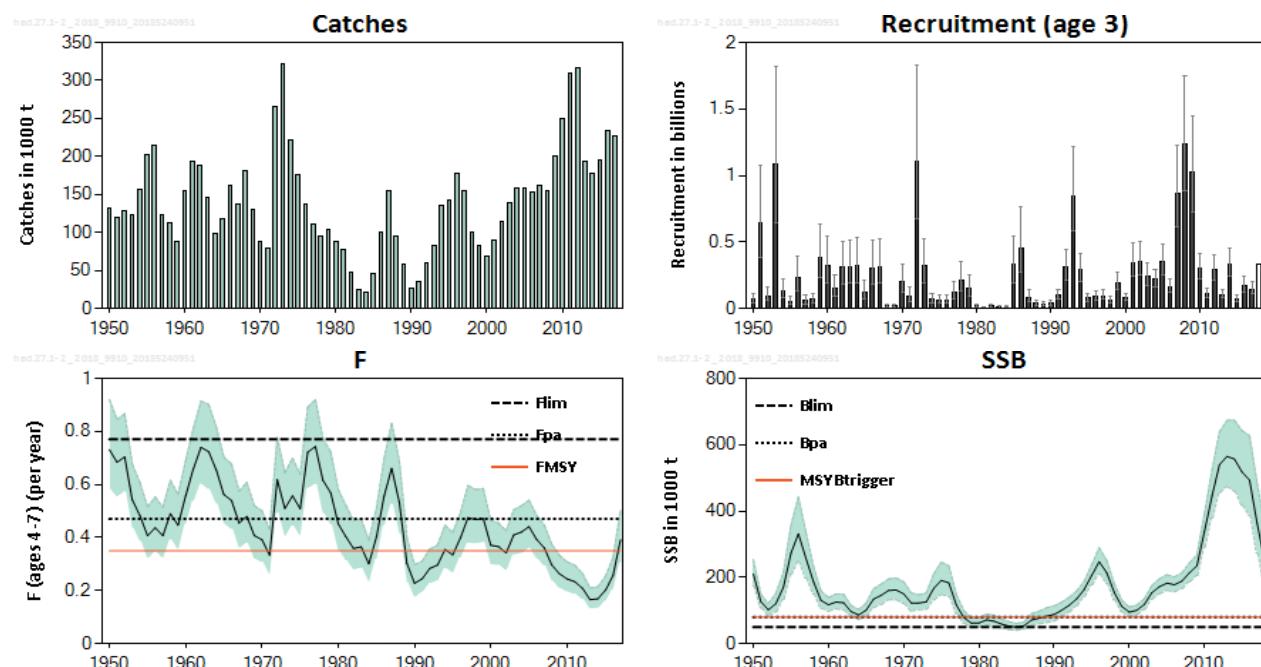


Figure 1 Haddock in subareas 1 and 2. Summary of the stock assessment (weights in thousand tonnes). Recruitment, F, and SSB have confidence intervals (95%) in the plot. For this stock, $F_{\text{MGT}} = F_{\text{MSY}}$ and $\text{SSB}_{\text{MGT}} = \text{MSY } B_{\text{trigger}} = B_{\text{pa}}$; therefore,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

Stock and exploitation status

ICES assesses that fishing pressure on the stock is above F_{MSY} but below F_{pa} and F_{lim} , while the spawning stock size is above MSY B_{trigger} , B_{pa} , and B_{lim} .

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

	Fishing pressure			Stock size						
	2015	2016	2017	2016	2017	2018				
Maximum sustainable yield	F_{MSY}	✓	✓	✗	Above	$\text{MSY } B_{\text{trigger}}$	✓	✓	✓	Above trigger
Precautionary approach	$F_{\text{pa}}, F_{\text{lim}}$	✓	✓	✓	Harvested sustainably	$B_{\text{pa}}, B_{\text{lim}}$	✓	✓	✓	Full reproductive capacity
Management plan	F_{MGT}	✓	✓	✗	Above	SSB_{MGT}	✓	✓	✓	Above

Catch scenarios

Table 2 Haddock in subareas 1 and 2. Assumptions made for the interim year and in the forecast.

Variable	Value	Notes
$F_{\text{ages } 4-7}$ (2018)	0.49	F corresponding to TAC in 2018
SSB (2019)	173 887 tonnes	Based on a catch constraint
$R_{\text{age } 3}$ (2018)	333 000 thousands	Based on survey indices (RCT3 estimate)
$R_{\text{age } 3}$ (2019)	933 000 thousands	Based on survey indices (RCT3 estimate)
Total catch (2018)	202 305	Agreed TAC in 2018
Landings (2018)	202 305 tonnes	
Discards (2018)	0 tonnes	

Table 3 Haddock in subareas 1 and 2. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2019)	F_{total} (2019)	SSB (2020)	% SSB change *	% TAC change **	% Advice change ***
ICES advice basis						
Management plan	152 000	0.35	184 694	6.2	-25	-25
Other scenarios						
MSY approach: F_{MSY}	152 000	0.35	184 694	6.2	-25	-25
$F = 0$	0	0	263 108	51	-100	-100
$F = F_{2017}$	166 500	0.39	177 005	1.79	-18	-18
F_{pa}	194 500	0.47	165 511	-4.8	-3.8	-3.8
F_{lim}	286 000	0.77	128 752	-26	41	41

* SSB 2020 relative to SSB 2019.

** Catch in 2019 relative to TAC in 2018 (202 305 t).

*** Advice value for 2019 relative to advice value for 2018.

The advised catch for 2019 is considerably lower than that advised for 2018 because the abundance of older age groups is now estimated to be lower, and also the strong 2004–2006 year classes no longer contribute much to the fishery. A reduction in fishing mortality is also required for 2019 to achieve the F_{MSY} target, which in 2019 coincides with the 25% constraint in TAC from the management plan.

Basis of the advice

Table 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 46th Session of the Joint Russian–Norwegian Fisheries Commission – JRNFC, 2016):</p> <ul style="list-style-type: none"> – <i>TAC for the next year will be set at level corresponding to FMSY.</i> – <i>The TAC should not be changed by more than ±25% compared with the previous year TAC.</i> – <i>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 FMSY 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.</i> <p>At the 46th Session of the Joint Russian–Norwegian Fisheries Commission in 2016 it was decided to keep the existing HCR for haddock for the next five years.</p> <p>Quota flexibility: In 2014, JNRFC decided that from 2015 onwards, Norway and Russia can transfer to, or borrow from, the following year up to 10% of the country's quota.</p> <p>ICES evaluated this HCR in 2016 (ICES, 2016a) and concluded that it is precautionary.</p>

Quality of the assessment

The retrospective pattern in SSB raises concerns about the reliability of the assessment; this will be investigated in a forthcoming benchmark.

The sampling level from commercial catches was reduced around 2010 and remained at a lower level in the following years, but has improved in 2016–2017.

Discarding is known to have taken place, but discards cannot be quantified (assumed to be negligible in recent years).

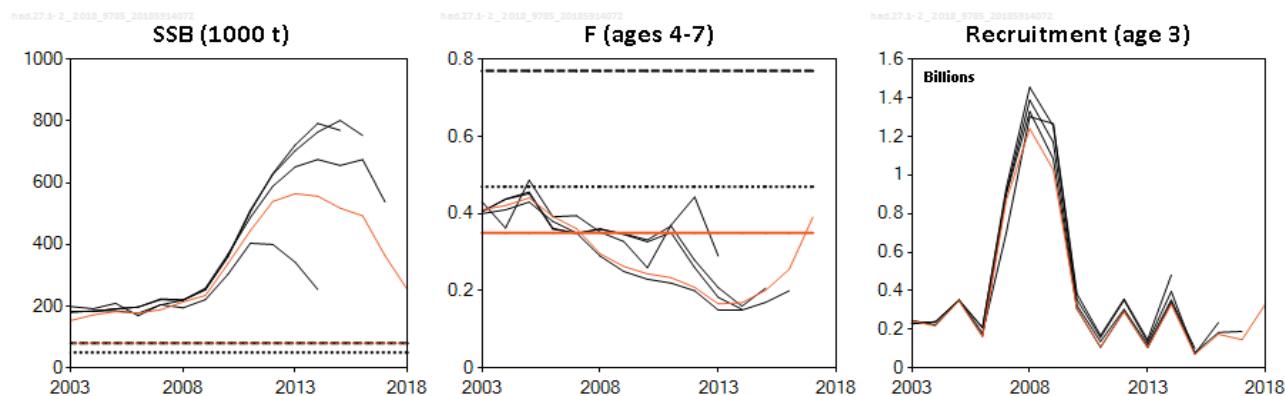


Figure 2 Haddock in subareas 1 and 2. Historical assessment results. For the 2015 and 2016 assessments, the fishing mortality plot shows $F+M_2$ (natural mortality due to predation by cod), instead of only F .

Issues relevant for the advice

The advice for 2019 is based on the assumption that catches in 2018 are equal to the TAC (202 305 tonnes), but fishing opportunities for 2017 (TAC plus transfers from 2016) were not fully taken. Parties have transferred the unused part (about 14 000 t) of their haddock quotas in 2017 to 2018, so the out-take in 2018 could be higher than the TAC, although catches equal to the TAC are considered to be more likely.

The advised TAC for 2019 (152 000 t) is lower than the forecast of last year (198 000 t). Given the abundant year classes in 2015–2017 surveys, there is a likelihood of higher catch of undersized fish in the next couple of years. Consequently, the reduction of TAC in 2019, following the HCR, will also have the benefit of protecting these incoming year classes.

Reference points

Table 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 6 Haddock in subareas 1 and 2. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2016b).
Assessment type	Age-based analytical assessment (SAM; ICES, 2018) 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 3–6 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). The implementation in SAM of predation by cod on haddock has been changed since 2016.
Working group	Arctic Fisheries Working Group (AFWG)

Information from stakeholders

There is no additional available information.

History of the advice, catch, and management

Table 7 Haddock in subareas 1 and 2. ICES advice, TACs and official and ICES landings. All weights are in tonnes.

Year	ICES advice	Predicted catch corresponding to advice	Agreed TAC	Official landings*	Unreported landings (included in ICES landings)	ICES landings**
1987	No increase in F; TAC	160 000	250 000	154 916		154 916
1988	No increase in F	< 240 000	240 000	95 255		95 255
1989	Large reduction in F	69 000	83 000	58 518		58 518
1990	No directed fishery	-	25 000	27 182		27 182
1991	No directed fishery	-	28 000	36 216		36 216
1992	Within safe biological limits	35 000	63 000	59 922		59 922
1993	No long-term gains in increasing F	56 000	72 000	82 379		82 379
1994	No long-term gains in $F > F_{med}$	97 000***	120 000	135 186		135 186
1995	No long-term gains in $F > F_{med}$	122 000***	130 000	142 448		142 448
1996	No long-term gains in $F > F_{med}$	169 000***	170 000	178 128		178 128
1997	Well below F_{med}	< 242 000	210 000	154 359		154 359
1998	Below F_{med}	< 120 000	130 000	100 630		100 630
1999	Reduce F below F_{pa}	< 74 000	78 000	83 195		83 195
2000	Reduce F below F_{pa}	< 37 000	62 000	68 944		68 944
2001	Reduce F below F_{pa}	< 66 000	85 000	89 640		89 640
2002	Reduce F below F_{pa}	< 64 000	85 000	96 062	18 736	114 798
2003	Reduce F below F_{pa}	< 101 000	101 000	105 700	33 226	138 926
2004	Reduce F below F_{pa}	< 120 000	130 000	124 502	33 777	158 279
2005	Reduce F below F_{pa}	< 106 000	117 000	118 015	40 283	158 298
2006	Reduce F below F_{pa}	< 112 000	120 000	131 706	21 451	153 157
2007	Limit catches	< 130 000	150 000	146 972	14 553	161 525
2008	Limit catches to 2001–2004 average	< 130 000	155 000	149 776	5 828	155 604
2009	Apply management plan	< 194 000	194 000	200 061	0	200 061
2010	Apply management plan	< 243 000	243 000	249 200	0	249 200

Year	ICES advice	Predicted catch corresponding to advice	Agreed TAC	Official landings*	Unreported landings (included in ICES landings)	ICES landings**
2011	Apply management plan	< 303 000	303 000	309 785	0	309 785
2012	Apply management plan	< 318 000	318 000	315 627	0	315 627
2013	Apply management plan	< 238 000	200 000	193 744	0	193 744
2014	Apply management plan	< 150 000	178 500	177 522	0	177 522
2015	Apply management plan	< 165 000	223 000	194 756	0	194 756
2016	Apply management plan	< 244 000^	244 000	233 416	0	233 416
2017	Apply management plan	≤ 233 000	233 000	227 588	0	227 588
2018	Apply management plan	≤ 202 305	202 305			
2019	Apply management plan	≤ 152 000				

* 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 on 7 July 2015 in response to a special request ([ICES, 2015b](#)) after a mid-year change in TAC in 2015 (from 178 500 t to 223 000 t).

History of the catch and landings

Table 8 Haddock in subareas 1 and 2. Catch distribution by fleet in 2017 as estimated by ICES.

Catch (2017)	Landings			Discards
	trawls 71.5%	longline 8.9%	other gears 19.6%	
227 588 t	227 588 t			

Table 9 Haddock in subareas 1 and 2. History of commercial catch and landings by country. All weights are in tonnes.

Year	Faroe Islands	France	German Dem. Rep.	Fed. Rep. Germ.	Greenland	Norway^	Poland	Russia**	Spain	United Kingdom	Others	Unreported catches***	Total ***
1960	172	-	-	5 597		46 263	-	57 025		45 469	125	-	154 651
1961	285	220	-	6 304		60 862	-	85 345		39 650	558	-	193 224
1962	83	409	-	2 895		54 567	-	91 910		37 486	58	-	187 408
1963	17	363	-	2 554		59 955	-	63 526		19 809	-	-	146 224
1964	-	208	-	1 482		38 695	-	43 870		14 653	250	-	99 158
1965	-	226	-	1 568		60 447	-	41 750		14 345	242	-	118 578
1966	-	1 072	11	2 098		82 090	-	48 710		27 723	74	-	161 778
1967	-	1 208	3	1 705		51 954	-	57 346		24 158	23	-	136 397
1968	-	-	-	1 867		64 076	-	75 654		40 129	-	-	181 726
1969	2	-	309	1 490		67 549	-	24 211		37 234	25	-	130 820
1970	541	-	656	2 119		37 716	-	26 802		20 423	-	-	88 257
1971	81	-	16	896		45 715	43	15 778		16 373	3	-	78 905
1972	137	-	829	1 433		46 700	1 433	196 224		17 166	2 231	-	266 153
1973	1 212	3 214	22	9 534		86 767	34	186 534		32 408	2 501	-	322 226
1974	925	3 601	454	23 409		66 164	3 045	78 548		37 663	7 348	-	221 157
1975	299	5 191	437	15 930		55 966	1 080	65 015		28 677	3 163	-	175 758
1976	536	4 459	348	16 660		49 492	986	42 485		16 940	5 358	-	137 264
1977	213	1 510	144	4 798		40 118	-	52 210		10 878	287	-	110 158
1978	466	1 411	369	1 521		39 955	1	45 895		5 766	38	-	95 422
1979	343	1 198	10	1 948		66 849	2	26 365		6 454	454	-	103 623
1980	497	226	15	1 365		66 501	-	20 706		2 948	246	-	92 504
1981	381	414	22	2 402		63 435		13 400		1 682	-	-	81 736
1982	496	53	-	1 258		43 702		2 900	-	827	-	-	49 236
1983	428	-	1	729		22 364		680	139	259	-	-	24 600
1984	297	15	4	400		18 813		1 103	37	276	-	-	20 945
1985	424	21	20	395		21 272		22 690	77	153	-	-	45 052
1986	893	12	75	1 079		52 313		45 738	22	431	-	-	100 563
1987	464	7	83	3 105		72 419		78 211	59	563	5	-	154 916
1988	1 113	116	78	1 323		60 823		31 293	72	435	2	-	95 255
1989	1 217	-	26	171		36 451		20 062	1	590	-	-	58 518
1990	705	-	5	167		20 621		5 190	-	494	-	-	27 182
1991	1 117	-		213		22 178		12 177	-	514	17	-	36 216
1992	1 093	151		387	1 719	36 238		19 699	38	596	1	-	59 922
1993	546	1 215		1 165	880	40 978		35 071	76	1 802	646	-	82 379
1994	2 761	678		2 412	770	71 171		51 822	22	4 673	877	-	135 186
1995	2 833	598		2 675	1 097	76 886		54 516	14	3 111	718	-	142 448

Year	Faroe Islands	France	German Dem. Rep.	Fed. Rep. Germ.	Greenland	Norway^	Poland	Russia**	Spain	United Kingdom	Others	Unreported catches***	Total ***
1996	3 743	6		942	1 510	94 527		74 239	669	2 275	217	-	178 128
1997	3 327	540		972	1 877	103 407		41 228	364	2 340	304	-	154 359
1998	1 903	241		385	854	75 108		20 559	257	1 229	94	-	100 630
1999	1 913	64		641	437	48 182		30 520	652	694	92	-	83 195
2000	631	178		880	432	42 009		22 738	502	747	827	-	68 944
2001	1 210	324		554	553	49 067		34 307	1 497	1 068	1 060	-	89 640
2002	1 564	297		627	858	52 247		37 157	1 505	1 125	682	18 736	114 798
2003	1 959	382		918	1 363	56 485		41 142	1 330	1 018	1 103	33 226	138 926
2004	2 484	103		823	1 680	62 192		54 347	54	1 250	1 569	33 777	158 279
2005	2 138	333		996	15	60 850		50 012	963	1 899	1 262	40 283	158 751
2006	2 390	883		989	1 830	69 272		53 313	703	1 164	1 162	21 451	153 157
2007	2 307	277		1 123	1 464	71 244		66 569	125	1 351	2 511	14 553	161 525
2008	2 687	311		535	1 659	72 779		68 792	283	971	1 759	5 828	155 604
2009	2 820	529		1 957	1 410	104 354		85 514	317	1 315	1 845	0	200 061
2010	3 173	764		3 539	1 970	123 384		111 372	379	1 758	2 862	0	249 200
2011	1 759	268		1 724	2 110	158 202		139 912	502	1 379	4 763	0	309 785
2012	2 055	322		1 111	3 984	159 602		143 886	441	833	3 393	0	315 627
2013	1 886	342		500	1 795	99 215		85 668	439	639	3 260	0	193 744
2014	1 470	198		340	1 150	91 306		78 725	187	355	3 791	0	177 522
2015	2 459	145		124	1 047	95 094		91 864	246	450	3 327	0	194 756
2016	2 460	340		170	1 401	108 718		115 710	200	575	3 838	0	233 416
2017*	2 776	108		170	1 810	113 132		106 714	228	372	2 279	0	227 588

* 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.

Year	Recruitment			SSB			Catch	F		
	Age 3	97.5 percentile	2.5 percentile	SSB	97.5 percentile	2.5 percentile		Mean F ages	97.5 percentile	2.5 percentile
2001	343964	489970	241466	100769	116169	87411	89640	0.37	0.46	0.30
2002	351852	498298	248446	118418	135649	103376	114798	0.34	0.43	0.28
2003	243532	342305	173260	153491	174920	134687	138926	0.41	0.51	0.33
2004	217767	294674	160932	171704	195454	150841	158279	0.42	0.52	0.34
2005	348878	479522	253828	182526	207635	160454	158298	0.44	0.54	0.36
2006	161432	218369	119341	177809	201513	156894	153157	0.39	0.48	0.32
2007	869330	1229877	614479	188665	213439	166766	161525	0.36	0.45	0.29
2008	1241134	1747291	881601	213691	243508	187526	155604	0.30	0.37	0.24
2009	1026798	1448354	727939	234729	267733	205794	200061	0.26	0.33	0.21
2010	305121	412012	225961	338146	391883	291778	249200	0.24	0.31	0.194
2011	109121	147239	80871	445077	522400	379198	309785	0.23	0.30	0.186
2012	291240	400765	211647	539727	638875	455966	315627	0.21	0.27	0.166
2013	105136	143208	77185	564781	673285	473764	193744	0.166	0.21	0.131
2014	329128	449716	240875	556572	673377	460028	177522	0.169	0.21	0.133
2015	69849	98130	49718	517746	642052	417506	194756	0.20	0.25	0.159
2016	174109	246948	122754	492816	627233	387205	233183	0.26	0.32	0.20
2017	145955	199272	106903	363474	484269	272810	227588	0.39	0.50	0.30
2018	333000^			251205	361105	174752				

[^] RCT3 estimate.

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