

Tusk (*Brosme brosme*) in Subarea 14 and Division 5.a (East Greenland and Iceland grounds)

ICES stock advice

ICES advises that when the Icelandic management plan is applied, catches in the fishing year 1 September 2017 to 31 August 2018 should be no more than 4370 tonnes. All catches are assumed to be landed.

Stock development over time

Recruitment in 2011–2014 was very low, and has increased since. Harvest rate (HR) has declined in recent years and is below the maximum sustainable yield HR (HR_{MSY}). Spawning-stock biomass (SSB) has been increasing in recent years; the reference biomass (tusk longer than 40 cm) has declined, but remains at a high level.

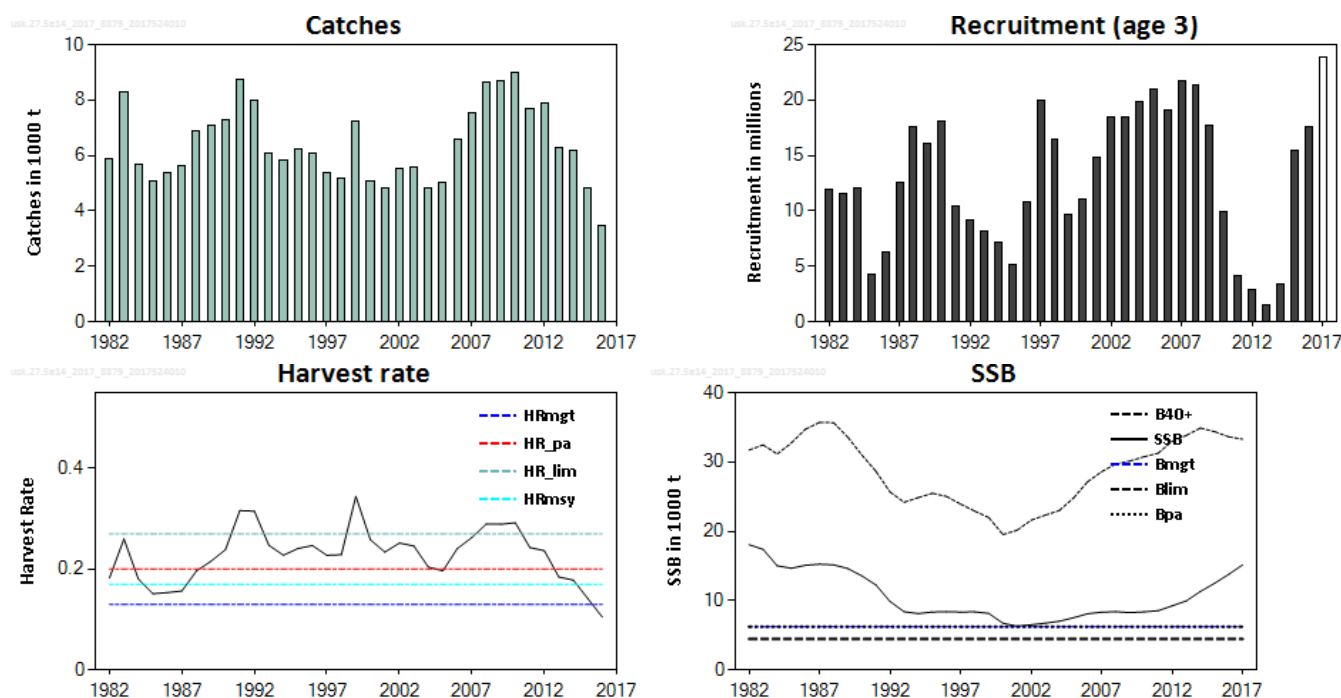


Figure 1 Tusk in Subarea 14 and Division 5.a. Summary of the stock assessment. In the lower right panel (SSB), the B40+ line represents the trend in the biomass of tusk at length 40 cm and greater that is used in the harvest control rule (HCR).

Stock and exploitation status

Table 1 Tusk in Subarea 14 and Division 5.a. State of the stock and fishery relative to reference points.

		Fishing pressure				Stock size			
		2014	2015	2016		2015	2016	2017	
Maximum Sustainable Yield	HR_{MSY}	✓	✓	✓	Below	MSY	✓	✓	✓ Above trigger
Precautionary Approach	HR_{pa}	✓	✓	✓	Harvested sustainably	B_{pa} , B_{lim}	✓	✓	✓ Full reproductive capacity
	HR_{lim}	✓	✓	✓					
Management plan	HR_{MGT}	✓	✓	✓	within the range	B_{MGT}	✓	✓	✓ Above

Catch options

The basis of the catch options for this stock is the management plan. A catch option is provided for the fishery year from September 2017 to end August 2018, based on the estimated reference biomass at the end of quarter 1 in 2017. A short-term forecast to the end of 2018 is provided to evaluate the impact of the catch on the SSB.

Table 2 Tusk in Subarea 14 and Division 5.a. The basis for the catch options.

Variable	Value	Source	Notes
HR _{MGT} (2017)	0.13	ICES (2017a)	
Reference biomass 2017	33280	ICES (2017a)	Biomass of tusk at length 40 cm and greater (40 cm +) at the end of quarter 1 (tonnes).
R _{age 3} (2018)	3906	ICES (2017a)	In thousands.

Table 3 Tusk in Subarea 14 and Division 5.a. Annual catch options. All weights are in tonnes.

Basis	Total catch (2017/2018)	HR (2018)	SSB (2019)	% SSB change **	% TAC change ***
Management plan	4370	0.135	15628	0	16%

Basis of the advice

Table 4 Tusk in Subarea 14 and Division 5.a. The basis of the advice.

Advice basis	Management plan.
Management plan	<p>The Icelandic Ministry of Industries and Innovation's fisheries management plan for Icelandic tusk (ICES, 2017a) has been evaluated by ICES. It is considered to be precautionary and conforms to the ICES MSY approach. According to the management plan the TAC for the fishing year Y/Y+1 (1 September of year Y to 31 August of year Y+1) is calculated as follows:</p> <p><i>When SSB_Y is equal or above $MGT B_{trigger}$:</i> $TAC_{Y/Y+1} = HR_{MGT} * B_{Ref,Y}$</p> <p><i>When SSB_Y is below $MGT B_{trigger}$:</i> $TAC_{Y/Y+1} = HR_{MGT} * (SSB_Y / MGT B_{trigger}) * B_{Ref,Y}$</p> <p><i>The spawning-stock biomass trigger ($MGT B_{trigger}$) is defined as 6.24 kt, the reference biomass is defined as the biomass of tusk 40+ cm and the target harvest rate (HR_{MGT}) is set to 0.13.</i></p>

Quality of the assessment

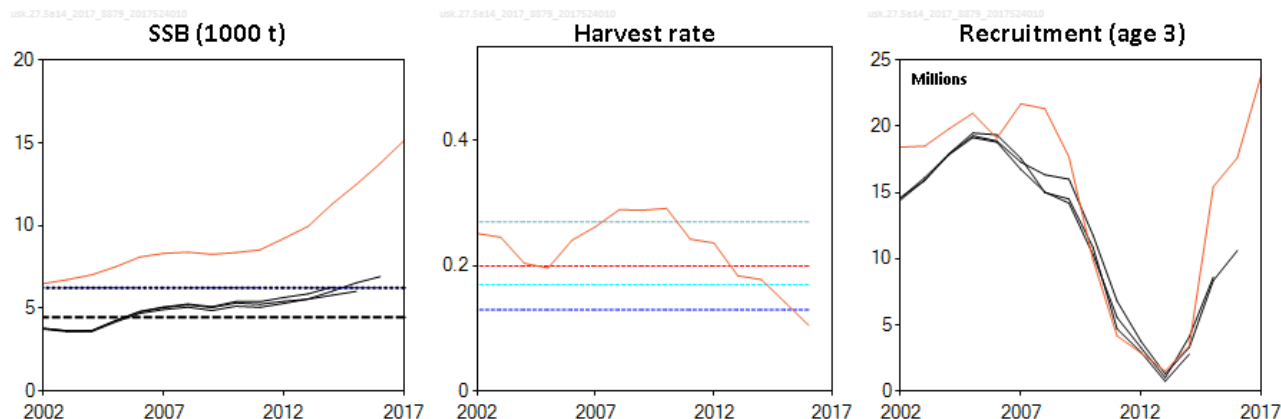


Figure 2 Tusk in Subarea 14 and Division 5.a. Historical assessment results. The harvest rate graph shows only the current assessment as fishing pressure in the historical assessments was estimated as fishing mortality.

This stock was benchmarked in 2017 (ICES, 2017a); therefore, the present assessment is not fully comparable with previous assessments of this stock. In previous assessments a fixed maturity ogive was used, but this is now estimated in the model. Fishing pressure was previously defined as F for ages 7–10, but is now defined as harvest rate on tusk at lengths 40 cm and longer.

The assessment of this stock has not included catch information from the Greenlandic part of Subarea 14. Historically the catches from this area have on average been around 1% of the total catches of tusk, but this increased to 10–15% of the total catches in 2015 and 2016. This was re-examined in the benchmark. It was not considered appropriate to include catches from the Greenlandic part of Subarea 14 in the assessment before conducting additional exploration as there are doubts about the catch information and whether the tusk in the area constitute a single population. In the management strategy evaluation (MSE) a sensitivity analysis, where the catches from this area were included in the stock assessment, showed a minor upward revision in the estimated stock biomass (1%–4% throughout the years) and a downwards revision of the estimated harvest rate (0%–3% in most years, although with an increase in 2015 and 2016). It is hence expected that conclusions from HCR evaluations are robust to not accounting for these catch data. The treatment of the survey and catch data in ICES Subarea 14 in the annual assessment needs to be explored further.

Issues relevant for the advice

Catch in the Greenlandic part of Subarea 14 were not included in the assessment; however, if the recent higher levels of catch in the area continue this may need to be reconsidered in future assessments and management. Studies have not shown a significant genetic difference between tusk from the Barents Sea–Faroe Islands, Iceland, and Greenland; this may be caused by larval drift between areas. For example, there may be larval drift from Iceland to Greenland in some years, which could explain the increase in catches in Greenland. However, once settled there is no evidence that tusk conduct extensive migrations.

Reference points

Table 5 Tusk in Subarea 14 and Division 5.a. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY B_{trigger}	6240	B_{pa}	ICES (2017a)
	F_{MSY}	0.226	Stochastic simulations	ICES (2017a)
	HR_{MSY}	0.17	Stochastic simulations	ICES (2017a)
Precautionary approach	B_{lim}	4460	$B_{\text{pa}}/1.4$	ICES (2017a)
	B_{pa}	6240	B_{loss}	ICES (2017a)
	F_{lim}	0.41	The equilibrium F that will maintain the stock above B_{lim} with a 50% probability.	ICES (2017a)
	F_{pa}	0.27	5% probability that true F has been above F_{lim} .	ICES (2017a)
	HR_{lim}	0.27	The equilibrium HR that will maintain the stock above B_{lim} with a 50% probability.	ICES (2017a)
	HR_{pa}	0.20	5% probability that true HR has been above HR_{lim} .	ICES (2017a)
	SSB_{mgt}	6240	B_{pa}	ICES (2017a)
Management plan	HR_{mgt}	0.13	Percentage of biomass of 40+ cm. Leads to long-term MSY. Realized HR can range from 0.09 to 0.18.	ICES (2017a)

Basis of the assessment

Table 6 Tusk in Subarea 14 and Division 5.a. Basis of assessment and advice.

ICES stock data category	1 (ICES, 2016).
Assessment type	Analytical length-based assessment (Gadget model) that uses catches in the model and in the forecast (ICES, 2017b).
Input data	March Icelandic groundfish survey and landings in Division 5.a.
Discards and bycatch	Discarding is considered negligible.
Indicators	None.
Other information	Last benchmarked in 2017 (WKICEMSE; ICES, 2017a).
Working group	Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources (WGDEEP)

Information from stakeholders

There is no available information.

History of the advice, catch, and management

Table 7 Tusk in Subarea 14 and Division 5.a. ICES advice and official landings. All weights are in tonnes.

Year*	ICES advice*	Predicted catch corresp. to advice**	ICES catches**	TAC Icelandic Division 5.a*	ICES catches Division 5.a*
2004/2005	^		4861	3500	4901
2005/2006	^		5099	3500	5928
2006/2007	^		6669	5000	7942
2007/2008	^		7581	5500	7594
2008/2009	Constrain catches to 5 000 t	< 5000	8215	5500	8162
2009/2010	Biennial	< 5000	8295	5500	8382
2010/2011	Fishing at $F_{0.1}$	< 6000	8988	6000	7777
2011/2012	Biennial	< 6000	7565	7000	7401
2012/2013	Fishing at F_{MSY} (F_{max})	< 6700	8014	6400	6833
2013/2014	No new advice, same as 2013	< 6700	6283	5900	5881
2014/2015	Fishing at F_{MSY}	< 3950	6055	4000	4958
2015/2016	Fishing at F_{MSY}	< 3440	5721	3440	3494
2016/2017	Fishing at F_{MSY}	≤ 3780			
2017/2018	Management plan	≤ 4370			

* National fishing year ending 31 August. The EU sets a small TAC (21 tonnes in 2017) exclusively for bycatches and for subareas 1, 2, and 14 combined.

** Calendar year (first year in fishing year).

^ Prior to 2008/2009 the advice for tusk was for the entire Northeast Atlantic, not split in several assessment units.

History of the catch and landings

Table 8 Tusk in Subarea 14 and Division 5.a. Catch distribution by fleet in 2016 as estimated by ICES.

Catch (2016)	Landings		Discards
	Gear type 98%	Other 2%	
3935 tonnes	3935 tonnes		Negligible

Table 9 Tusk in Subarea 14 and Division 5.a. History of official catches (tonnes) by country in Division 5.a.

Year	Faroese	Denmark	Germany	Iceland	Norway	UK	Total
1973	3363	0	576	2366	911	391	7607
1974	3172	0	375	1857	893	230	6527
1975	2445	0	384	1673	975	254	5731
1976	2397	0	334	2935	1352	94	7112
1977	2818	0	212	3122	1796	0	7948
1978	2168	0	0	3352	812	0	6332
1979	2050	0	0	3558	845	0	6453
1980	2873	0	0	3089	928	0	6890
1981	2624	0	0	2827	1025	0	6476
1982	2410	0	0	2801	666	0	5877
1983	4046	0	0	3468	772	0	8286
1984	2008	0	0	3430	254	0	5692
1985	1885	0	0	3064	111	0	5060
1986	2811	0	0	2549	21	0	5381
1987	2638	0	0	2987	19	0	5644
1988	3757	0	0	3087	20	0	6864
1989	3908	0	0	3158	10	0	7076
1990	2475	0	0	4821	0	0	7296
1991	2286	0	0	6476	0	0	8762
1992	1567	0	0	6432	0	0	7999
1993	1329	0	0	4745	0	0	6074
1994	1212	0	0	4616	0	0	5828
1995	979	0	1	5247	0	0	6227
1996	872	0	1	5227	3	0	6103
1997	575	0	0	4824	0	0	5399
1998	1052	0	1	4120	0	0	5173
1999	1035	0	2	5797	391	2	7227
2000	1154	0	0	4711	374	2	6241
2001	1125	0	1	3390	285	5	4806
2002	1269	0	0	3906	372	2	5549
2003	1163	0	1	4032	373	2	5571
2004	1478	0	1	3127	214	2	4822
2005	1157	0	3	3502	303	41	5006
2006	1239	0	2	5058	299	2	6600
2007	1250	0	0	5988	300	1	7539
2008	1398	0	0	6934	294	0	8626
2009	1516	0	0	6954	210	0	8680
2010	1794	0	0	6921	263	0	8978
2011	1655	0	0	5848	198	0	7701
2012	1310	0	0	6346	217	0	7873
2013	1094	0.12	0	4978	192	0	6264
2014	742	0	0	4996	425	0	6163
2015	637	0	0	4001	198	0	4836
2016	543	0	0	2650	301	0	3494

Table 10 Tusk in Subarea 14 and Division 5.a. History of official catches (tonnes) by country in Subarea 14.

Year	Faroes	Denmark	Greenland	Germany	Iceland	Norway	Russia*	Spain	UK	Total
1973	16	0	0	9	0	0	0	0	2	27
1974	259	0	0	2	15	0	0	0	1	277
1975	29	0	0	17	13	138	0	0	0	197
1976	0	0	0	5	89	47	0	0	1	142
1977	167	0	0	16	0	40	0	0	1	224
1978	0	0	0	47	0	38	0	0	0	85
1979	0	0	0	27	0	0	0	0	0	27
1980	0	0	0	13	0	0	0	0	0	13
1981	110	0	0	10	0	0	0	0	0	120
1982	0	0	0	10	0	0	0	0	0	10
1983	74	0	0	11	0	0	0	0	0	85
1984	0	0	0	5	0	58	0	0	0	63
1985	0	0	0	4	0	0	0	0	0	4
1986	33	0	0	2	0	0	0	0	0	35
1987	13	0	0	2	0	0	0	0	0	15
1988	19	0	0	2	0	0	0	0	0	21
1989	13	0	0	1	0	0	0	0	0	14
1990	0	0	0	2	0	7	0	0	0	9
1991	0	0	0	2	0	68	0	0	1	71
1992	0	0	0	0	3	120	0	0	0	123
1993	0	0	0	0	1	39	0	0	0	40
1994	0	0	0	0	0	16	0	0	0	16
1995	0	0	0	0	0	30	0	0	0	30
1996	0	0	0	0	0	157	0	0	0	157
1997	0	0	0	0	10	9	0	0	0	19
1998	0	0	0	0	0	12	0	0	0	12
1999	0	0	0	0	0	8	0	0	0	8
2000	0	0	0	0	11	11	0	3	0	25
2001	3	0	0	0	20	69	0	0	0	92
2002	4	0	0	0	86	30	0	0	0	120
2003	0	0	0	0	2	88	0	0	0	90
2004	0	0	0	0	0	40	0	0	0	40
2005	7	0	0	0	0	41	8	0	0	56
2006	3	0	0	0	0	19	51	0	0	73
2007	0	0	0	0	0	40	6	0	0	46
2008	0	0	33	0	0	7	0	0	0	40
2009	12	0	15	0	0	5	11	0	0	43
2010	7	0	0	0	0	5	0	0	0	12
2011	20	0	0	0	131	24	0	0	0	175
2012	33	0	0	0	174	46	0	0	0	253
2013	1.9	0.3	0	0	0	23.8	0	0	0	26
2014	2	0	0	0	0	26	0	0	0	28
2015	670	0.1	166	0	0	0	0	0	0	898
2016*	111	0	182	0	0	178	0	0	0	471

*Preliminary.

Summary of the assessment

Table 10 Tusk in Subarea 14 and Division 5.a. Assessment summary. Catches in the assessments are based on landings from the Icelandic Directorate of Fisheries to make splitting of catches by quarters possible. Weights are in tonnes.

Year	Recruitment (age 3) thousands	SSB tonnes	Total catch tonnes	Harvest rate	Biomass 40+ cm tonnes
1982	12000	18062	5877	0.182	31712
1983	11537	17385	8286	0.26	32453
1984	12069	15009	5692	0.18	31144
1985	4337	14666	5060	0.151	32736
1986	6305	15094	5381	0.153	34720
1987	12503	15248	5644	0.157	35714
1988	17629	15154	6864	0.196	35652
1989	16045	14632	7076	0.215	33578
1990	18117	13562	7296	0.238	30995
1991	10455	12248	8762	0.316	28639
1992	9229	9851	7999	0.315	25658
1993	8144	8386	6074	0.247	24178
1994	7164	8129	5828	0.228	24860
1995	5170	8351	6227	0.241	25482
1996	10858	8407	6103	0.247	25024
1997	20002	8346	5399	0.227	23918
1998	16411	8379	5173	0.229	22911
1999	9689	8149	7227	0.344	21971
2000	11109	6726	6241	0.258	19529
2001	14775	6300	4806	0.234	20147
2002	18434	6500	5549	0.252	21603
2003	18510	6740	5571	0.246	22327
2004	19807	7023	4822	0.204	22993
2005	20988	7518	5006	0.196	24793
2006	19106	8103	6600	0.241	27129
2007	21706	8326	7539	0.263	28598
2008	21338	8396	8626	0.29	29704
2009	17688	8267	8680	0.289	30126
2010	9893	8372	8978	0.292	30742
2011	4172	8536	7701	0.243	31261
2012	2870	9237	7873	0.236	32976
2013	1504	9962	6264	0.184	33827
2014	3422	11315	6163	0.178	34892
2015	15437	12491	4836	0.142	34369
2016	17635	13773	3494	0.105	33633
2017	23907	15165			33280

Sources and references

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