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

ICES advice on fishing opportunities

ICES advises that when the Icelandic management plan is applied, catches in the fishing year 1 September 2022 to 31 August 2023 should be no more than 4464 tonnes.

Stock development over time

Fishing pressure on the stock is above F_{MSY}, and spawning-stock size is above MSY $B_{trigger}$, B_{pa}, and B_{lim}.

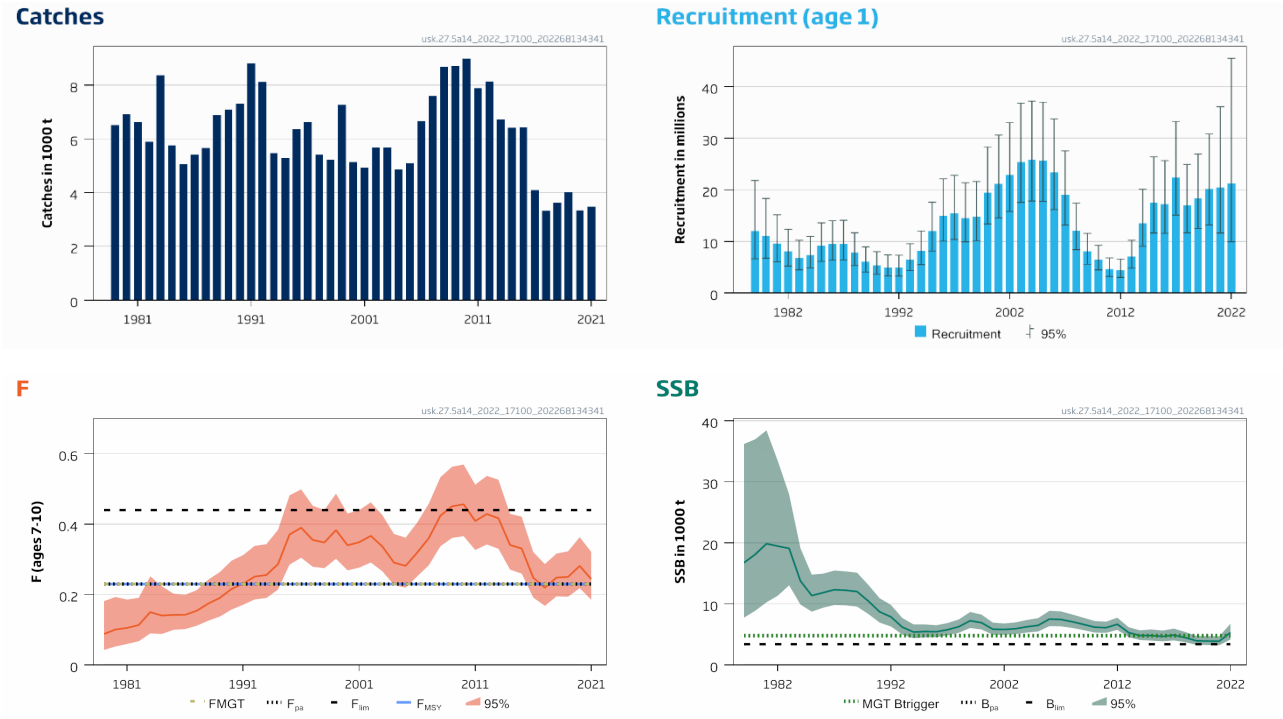

Figure 1 Tusk in Subarea 14 and Division 5.a. Summary of the stock assessment in Division 5.a. The top left panel shows total catches. The top right panel shows recruitment, the final-year recruitment estimate is included. The lower left panel shows trends in F and right panel the SSB.

Catch scenarios

The catch scenario is provided for the fishery year from 1 September 2022 to 31 August 2023.

Table 1 Tusk in Subarea 14 and Division 5.a. Assumptions made for the interim year and in the forecast.

Variable	Value	Notes
$F_{ages\ 7–10}$(2022)	0.25	Assuming status quo F (average over the last three years) for the 2022 part of fishing year 2021/2022 and F_{mgt} for the remainder of 2022
SSB 2023	5 902	Short-term forecast; in tonnes
$R_{age\ 1}$ (2023)	17 502	Resampled from the years 2013-2022; in thousands
Catch (2022)	4 224	Results from $F_{ages\ 7–10}$ (2022); in tonnes

Table 2 Tusk in Subarea 14 and Division 5.a. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2022/2023)	F (2023)	SSB (2024)	% SSB change*	% TAC change**	% advice change
Management plan	4 464	0.23	6 945	18%	105.5%	105.5%

* SSB in 2024 relative to SSB in 2023.
** Advice value for 2022/2023 relative to the TAC in 2021/2022 (2172 t).

The advice for 2022/2023 is higher than the advice in 2021/2022 because of a change in the basis of the advice and reference points.

Basis of the advice

Table 3 Tusk in Subarea 14 and Division 5.a. The basis of the advice.

Advice basis	Management plan for the stock component in Division 5.a (ICES, 2017a)
Management plan	The Icelandic Ministry of Food, Agriculture and Fisheries management plan for Icelandic tusk has been evaluated by ICES (ICES, 2022a). It is considered to be precautionary and conforms to ICES MSY approach. According to the management plan, $F_{y/y+1}$, the advice fishing mortality that is applied from 1st September year 'y' to 31st August year 'y+1' is calculated from the HCR as: $$F_{Y/Y+1} = min\left(\frac{SSB_Y}{MGT\ B_{trigger}}, 1\right) * F_{mgt}$$ To calculate the catch in the last four months of the year "y" (September-December), the following F is used in the year "y": $$F_{\mathrm{Y}} = \frac{2}{3} * F_{\mathrm{SQ}} + \frac{1}{3} * F_{\mathrm{mgt}}$$ In year "y+1" $F_{Y/Y+1}$ is used. Finally, the catch advice for the year "y/y+1" is calculated using the following formula: $$C_{Y/Y+1} = \frac{1}{3} * \mathrm{C}[F_{\mathrm{Y}}] + \frac{2}{3} * C[F_{\mathrm{Y/Y+1}}]$$ Where the catch C[.] is calculated using the Baranov catch equation with the corresponding biomass, natural mortality and fishing mortality values in each year.

Quality of the assessment

In the evaluation of the management plan (MP) for tusk in Icelandic waters (ICES, 2022a), the basis for assessment was revised and the adopted harvest control rule (HCR) was considered to be in accordance with the precautionary approach and consistent with ICES MSY framework.

A higher proportion of catches in Subarea 14 have been reported in recent years. If these catches continue, they should be sampled to ensure that data are representative of the full stock. The Greenlandic deep-sea survey has shown that an unknown proportion of the stock extends from the Icelandic exclusive economic zone (EEZ) and along the east Greenland continental shelf edge down to 62°north.

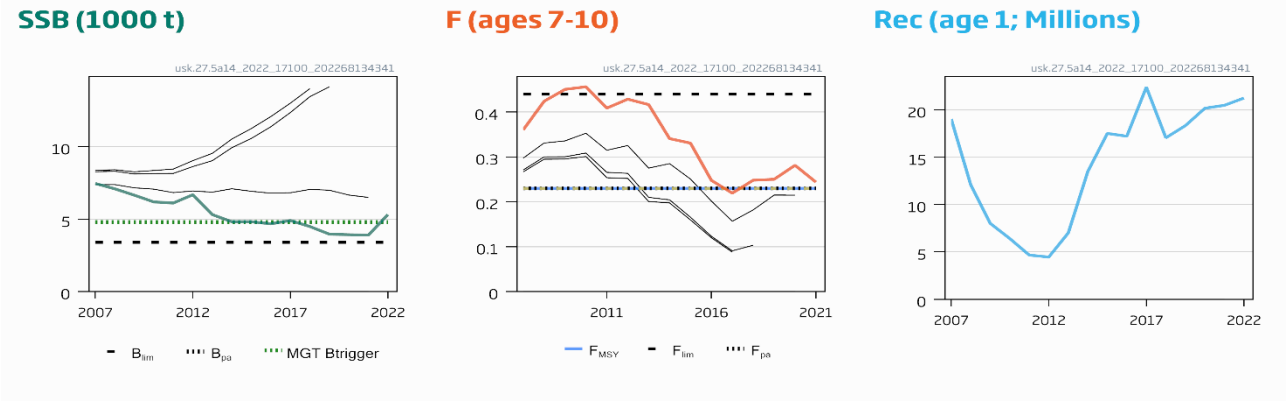

Figure 2 Tusk in Subarea 14 and Division 5.a. Historical assessment results. Final-year recruitment and biomass estimates are included. No ICES assessment was conducted in 2020. Note that this year's assessment was based on a newly benchmarked model. Prior to the benchmark, recruitment was estimated at age 3 and is not shown.

Issues relevant for the advice

This stock is classified as Category 4 in the NEAFC categorization of deep-sea species/stocks (NEAFC, 2016). This implies that fisheries are primarily restricted to coastal state exclusive economic zones (EEZs), and therefore management measures are not taken by NEAFC unless complementary to coastal state conservation and management measures.

Reference points

Table 4 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 $B_{trigger}$	4800	B_{pa}	ICES (2022a)
	F_{MSY}	0.23	F_{pa}	
Precautionary approach	B_{lim}	3400	$B_{pa} \times e^{-1.645 * \sigma B}$, using the default $\sigma_B = 0.2$	
	B_{pa}	4800	B_{loss} (SSB in 2016)	
	F_{lim}	0.44	Fishing mortality that in stochastic equilibrium will result in median SSB at B_{lim}.	
	F_{pa}	0.23	Maximum F at which the probability of SSB falling below B_{lim} is < 5%	
Management plan	MGT $B_{trigger}$	4800	From the management plan	
	F_{mgt}	0.23	From the management plan	

Basis of the assessment

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

ICES stock data category	1 (ICES, 2022b)
Assessment type	Analytical age-based assessment (SAM model)
Input data	Icelandic groundfish survey (G3239), autumn survey (G4493), gillnet survey (N2702) and data from commercial catches
Discards and bycatch	Discarding is considered negligible
Indicators	None
Other information	Last benchmarked in 2022 (ICES, 2022a)
Working group	Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources (WGDEEP)

History of the advice, catch, and management

Table 6 Tusk in Subarea 14 and Division 5.a. ICES advice for Division 5.a, catches and TACs. All weights are in tonnes. The EU sets a small TAC (21 tonnes since 2016) exclusively for bycatches and for subareas 1, 2, and 14 combined.

Year	ICES advice	Catch corresponding to advice	TAC Icelandic Division 5.a*	Greenland TAC for Subarea 14**	ICES catches Division 5.a*	ICES catches **
2005	^		3500		4901	5099
2006	^		3500		5928	6669
2007	^		5000		7942	7581
2008	^		5500		7594	8215
2009	Constrain catches to 5 000 t	< 5000	5500		8162	8295
2010	Biennial	< 5000	5500		8382	8988
2011	Fishing at $F_{0.1}$	< 6000	6000		7777	7565
2012	Biennial	< 6000	7000		7401	8014
2013	Fishing at F_{MSY} (F_{max})	< 6700	6400		6833	6283
2014	No new advice, same as 2013	< 6700	5900		5881	6055
2015	Fishing at F_{MSY}	< 3950	3700	1500	4958	5721
2016	Fishing at F_{MSY}	< 3440	3000	1500	4121	3965
2017	Fishing at F_{MSY}	≤ 3780	3380	1500	2418	3100
2017/2018	Management plan	≤ 4370	3770	1500	3139	3621
2018/2019	Management plan	≤ 3776	3100	1500	3232	4037
2019/2020	Management plan	≤ 3856	3856	1500	3241	3536
2020/2021	No ICES advice		2289***	1500	2949	3480
2021/2022	Management plan	≤ 2172	2172	1500		
2022/2023	Management plan	≤ 4464				

* Icelandic national fishing year from 1 September ending 31 August.
** Calendar year (last year in the Icelandic national fishing year).
*** Domestic advice and TAC (no ICES advice requested due to the COVID-19 disruption).
^ Prior to 2008/2009 the advice for tusk was for the entire Northeast Atlantic and was not split into several assessment units.

History of the catch and landings

This stock is distributed primarily in Icelandic waters and there are no reported catches from the NEAFC Regulatory Area.

Table 7 Tusk in Subarea 14 and Division 5.a. Catch distribution by fleet in the calendar year 2021 as estimated by ICES.

Catch (2021)	Landings		Discards
3480 t	Longlines 95%	Other gears 5%	Negligible
	3480 t		

Table 8 Tusk in Subarea 14 and Division 5.a. History of official catches by country and calendar year in Division 5.a. All weights are in tonnes.

Year	USSR/Russia	Faroes	Germany	Iceland	Norway	UK	Total
1973	0	3363	576	2377	911	391	7618
1974	0	3172	375	1898	893	230	6568
1975	0	2445	384	1694	975	254	5752
1976	0	2397	334	3073	1352	94	7150
1977	0	2818	212	3170	1796	0	7996
1978	0	2168	0	3386	812	0	6366
1979	0	2050	0	3580	845	0	6475
1980	0	2873	0	3109	928	0	6910
1981	0	2624	0	2864	1025	0	6513
1982	0	2410	0	2801	666	0	5877
1983	0	4046	0	3468	772	0	8286
1984	0	2008	0	3430	254	0	5692
1985	0	1885	0	3064	111	0	5060
1986	0	2811	0	2549	21	0	5381
1987	0	2638	0	2987	19	0	5644

Year	USSR/Russia	Faroes	Germany	Iceland	Norway	UK	Total
1988	0	3757	0	3087	20	0	6864
1989	0	3908	0	3158	10	0	7076
1990	0	2475	0	4821	0	0	7296
1991	0	2286	0	6449	0	0	8735
1992	0	1567	0	6432	0	0	7999
1993	0	1333	0	4086	0	0	5419
1994	0	1217	0	4065	0	0	5282
1995	0	1168	1	5151	0	0	6320
1996	11	916	1	5540	3	0	6471
1997	0	579	0	4816	0	0	5395
1998	0	1080	1	4130	0	0	5211
1999	0	1041	2	5821	391	2	7257
2000	0	10	0	4727	374	2	5114
2001	0	1150	1	3397	285	5	4838
2002	0	1279	0	3910	372	2	5563
2003	0	1198	1	4024	373	2	5598
2004	0	1478	1	3135	214	2	4830
2005	0	1157	4	3539	303	41	5044
2006	0	1244	2	5054	299	2	6601
2007	0	1250	0	5987	300	1	7538
2008	0	1398	0	6934	298	0	8629
2009	0	1516	0	6953	210	0	8679
2010	0	1794	0	6919	263	0	8976
2011	0	1655	0	5847	198	0	7701
2012	0	1310	0	6344	217	0	7872
2013	0	1132	0	4979	192	0	6302
2014	0	742	0	4995	425	0	6163
2015	0	637	0	4001	198	0	4836
2016	0	543	0	2649	302	0	3494
2017	0	492	0	1833	216	0	2541
2018	0	517	0	2097	326	0	2940
2019	0	549	0	2579	316	0	3445
2020	0	558	0	2358	271	0	3187
2021	0	342	0	2049	388	0	2779

Table 9 Tusk in Subarea 14 and Division 5.a. History of official catches by country and calendar year in Subarea 14. All weights are in tonnes. There have been no catches in the NEAFC Regulatory Area since 2010.

Year	Faroes	Germany	Greenland	Iceland	Norway	USSR/Russia*	Spain	UK	Total
1973	16	9	0	0	0	0	0	2	27
1974	259	2	0	15	0	0	0	1	277
1975	29	17	0	13	138	0	0	0	197
1976	0	5	0	89	47	0	0	1	142
1977	167	16	0	0	40	0	0	1	224
1978	0	47	0	0	38	0	0	0	85
1979	0	27	0	0	0	0	0	0	27
1980	0	13	0	0	0	0	0	0	13
1981	110	10	0	0	0	0	0	0	120
1982	0	10	0	0	0	0	0	0	10
1983	74	11	0	0	0	0	0	0	85
1984	0	5	0	0	58	0	0	0	63
1985	0	4	0	0	0	0	0	0	4
1986	33	2	0	0	0	0	0	0	35
1987	13	2	0	0	0	0	0	0	15
1988	19	2	0	0	0	0	0	0	21
1989	13	1	0	0	0	0	0	0	14
1990	0	2	0	0	7	0	0	0	9
1991	0	2	0	0	68	0	0	1	71

Year	Faroes	Germany	Greenland	Iceland	Norway	USSR/Russia*	Spain	UK	Total
1992	0	0	0	3	120	0	0	0	123
1993	0	0	0	1	39	0	0	0	40
1994	0	0	0	0	17	0	0	0	17
1995	0	0	0	0	30	0	0	0	30
1996	0	0	0	0	158	0	0	0	158
1997	0	0	0	10	9	0	0	0	19
1998	0	0	0	0	12	0	0	0	12
1999	0	0	0	0	8	0	0	0	8
2000	0	0	0	11	11	0	3	0	25
2001	3	0	0	20	69	0	0	0	92
2002	4	0	0	86	30	0	0	0	120
2003	0	0	0	2	88	0	0	0	90
2004	0	0	0	0	40	0	0	0	40
2005	7	0	0	0	41	8	0	0	56
2006	3	0	0	0	19	51	0	0	73
2007	0	0	0	0	40	6	0	0	46
2008	0	0	33	0	7	0	0	0	40
2009	12	0	15	0	5	11	0	0	43
2010	7	0	0	0	5	0	0	0	12
2011	20	0	0	131	24	0	0	0	175
2012	33	0	0	174	46	0	0	0	253
2013	2	0	0	401	24	0	0	0	427
2014	145	0	74	0	35	0	0	0	254
2015	759	0	785	0	55	0	0	0	1599
2016	243	3	182	0	178	0	0	0	606
2017	281	0	358	0	141	0	0	0	781
2018	345	0	108	0	228	0	0	0	681
2019	41	1	66	0	458	0	0	0	566
2020	0	2	41	0	114	0	0	0	157
2021**	260	2	59	0	380	0	0	0	701

*Russian catches were taken in Subdivision 14.b.1 (Mid-Atlantic Ridge).
**Preliminary.

Summary of the assessment

Table 10 Tusk in Subarea 14 and Division 5.a. Assessment summary by calendar year in Division 5.a and Subarea 14. 'High' and 'Low' indicate 95% confidence intervals.

Year	Recruitment			Spawning-stock biomass			Catches	Fishing mortality		
	Age 1	High	Low	SSB	High	Low		Ages 7–10	High	Low
	thousands			tonnes			tonnes			
1979	12029	21824	6630	16740	36198	7741	6502	0.088	0.182	0.043
1980	11131	18350	6752	18117	36984	8874	6923	0.101	0.193	0.052
1981	9585	15161	6061	19868	38446	10268	6633	0.105	0.186	0.060
1982	8024	12348	5214	19476	33431	11347	5887	0.114	0.191	0.067
1983	6781	10230	4495	19104	27968	13049	8371	0.150	0.25	0.090
1984	7323	10992	4879	13763	19148	9892	5755	0.140	0.22	0.088
1985	9134	13608	6131	11377	14808	8741	5065	0.142	0.20	0.100
1986	9433	14005	6353	11850	14970	9380	5416	0.143	0.200	0.102
1987	9496	14107	6392	12333	15488	9820	5659	0.154	0.21	0.112
1988	7894	11687	5332	12238	15342	9762	6885	0.175	0.24	0.126
1989	6031	8956	4062	12030	15127	9567	7090	0.191	0.26	0.138
1990	5377	8016	3606	10471	13137	8347	7305	0.22	0.30	0.157
1991	4937	7386	3300	8713	10936	6942	8806	0.23	0.31	0.171
1992	4907	7330	3285	7875	9846	6299	8122	0.25	0.34	0.186
1993	6434	9543	4337	6198	7710	4982	5459	0.26	0.34	0.190
1994	8127	12021	5495	5396	6650	4378	5298	0.29	0.38	0.21
1995	11967	17617	8129	5491	6662	4526	6351	0.37	0.48	0.28

Year	Recruitment			Spawning-stock biomass			Catches	Fishing mortality		
	Age 1	High	Low	SSB	High	Low		Ages 7–10	High	Low
	thousands			tonnes			tonnes			
1996	14926	22152	10058	5451	6523	4554	6628	0.39	0.50	0.30
1997	15385	22809	10377	5782	6882	4858	5413	0.36	0.45	0.28
1998	14548	21386	9896	6284	7482	5278	5223	0.35	0.44	0.28
1999	14770	21614	10094	7257	8696	6055	7265	0.38	0.49	0.30
2000	19491	28323	13412	6929	8263	5811	5139	0.34	0.43	0.27
2001	21114	30628	14555	5863	6955	4942	4930	0.35	0.44	0.28
2002	22841	33034	15793	5814	6813	4962	5683	0.37	0.46	0.29
2003	25412	36793	17552	5940	6987	5050	5688	0.34	0.43	0.27
2004	25764	37205	17842	6264	7384	5314	4870	0.29	0.37	0.23
2005	25640	37010	17763	6497	7691	5488	5100	0.28	0.36	0.22
2006	23373	33760	16182	7523	8884	6370	6674	0.32	0.40	0.25
2007	19057	27555	13180	7466	8799	6334	7584	0.36	0.46	0.28
2008	12101	17430	8401	7098	8291	6077	8669	0.42	0.53	0.34
2009	8022	11568	5563	6659	7756	5717	8722	0.45	0.56	0.36
2010	6423	9258	4456	6192	7216	5314	8988	0.46	0.57	0.37
2011	4674	6800	3213	6115	7104	5264	7876	0.41	0.51	0.33
2012	4464	6577	3030	6684	7763	5755	8125	0.43	0.54	0.34
2013	7017	10235	4811	5317	6197	4562	6729	0.42	0.53	0.33
2014	13498	20136	9049	4825	5684	4097	6417	0.34	0.43	0.27
2015	17521	26405	11627	4825	5834	3991	6434	0.33	0.42	0.26
2016	17228	25658	11568	4680	5649	3877	4100	0.25	0.32	0.192
2017	22411	33259	15100	4904	5971	4027	3321	0.22	0.29	0.168
2018	17062	24946	11670	4493	5416	3727	3621	0.25	0.32	0.195
2019	18347	26945	12493	3965	4777	3292	4011	0.25	0.32	0.194
2020	20183	30835	13211	3928	4736	3257	3344	0.28	0.36	0.22
2021	20493	36125	11625	3899	4705	3232	3480	0.24	0.32	0.185
2022	21258	45511	9930	5322	6781	4177				

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Download the stock assessment data and figures.

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