

Cod (*Gadus morhua*) in Division 5.a (Iceland grounds)

ICES advice on fishing opportunities

ICES advises that when the Iceland management plan is applied, catches in the fishing year 2018/2019 should be no more than 264 437 tonnes.

Stock development over time

The spawning-stock biomass (SSB) of Icelandic cod is increasing and is higher than has been observed over the last five decades. Fishing pressure has declined in the last two decades and is presently at a historical low. Year classes are estimated to have been relatively stable since 1988, but with the mean around the lower values observed in the period 1955 to 1985.

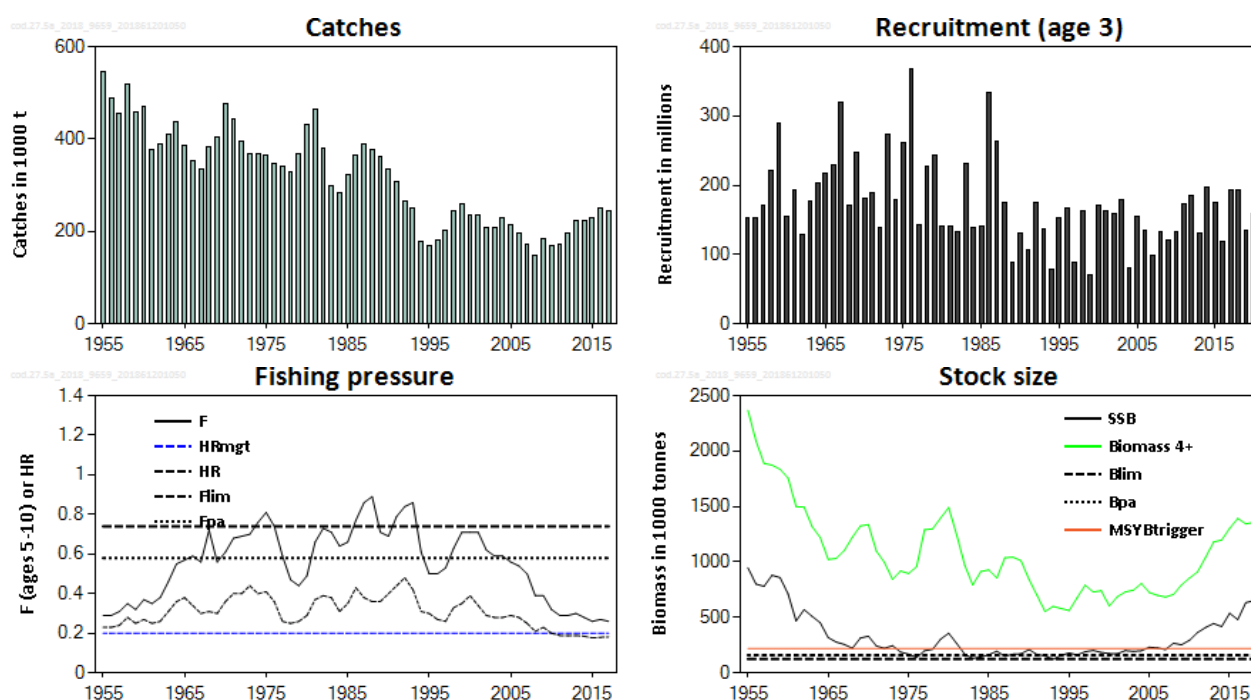


Figure 1 Cod in Division 5.a. Summary of the stock assessment. Harvest rates are calculated based on biomass age 4+. All biomass reference points refer to SSB levels (SSB is shown as a black line). $HR_{MGT} = HR_{MSY}$ and $MGT B_{trigger} = MSY B_{trigger}$.

Stock and exploitation status

ICES assesses that fishing pressure on the stock is below HR_{MSY} , F_{pa} , and F_{lim} . Spawning stock size is above $MSY B_{trigger}$, $MGT B_{trigger}$, B_{pa} , and B_{lim} .

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

		Fishing pressure				Stock size		
		2015	2016	2017		2016	2017	2018
Maximum sustainable yield	HR_{MSY}	✓	✓	✓	Below	$MSY B_{trigger}$	✓	✓
Precautionary approach	F_{pa}, F_{lim}	✓	✓	✓	Harvested sustainably	B_{pa}, B_{lim}	✓	✓
Management plan	HR_{MGT}	✓	✓	✓	Within expected range	$MGT B_{trigger}$	✓	✓
								Above trigger
								Full reproductive capacity
								Above

Catch scenarios

Table 2 Cod in Division 5.a. Assumptions made for the interim year and in the forecast. All weights are in tonnes.

Variable	Value	Notes
F _{ages 5–10} (2018)	0.28	TAC constraint
SSB (2019)	668111	
B ₄₊ (2019)	1420373	
R _{age 3} (2018)	192225	From the assessment (thousands)
R _{age 3} (2019)	135203	From the assessment (thousands)
R _{age 3} (2020)	158173	From the assessment (thousands)
Total catch (2018)	254000	Estimated catch until the end of the fishing year (31.08.2018) and estimated catch in the first four months of the next fishing year (01.09–31.12.2018).
Landings (2018)	254000	
Discards (2018)	-	Negligible

Table 3 Cod in Division 5.a. Annual catch scenarios. All weights are in tonnes.

Rationale	Catch (2018/19)	F (2019)	SSB (2020)	Biomass age 4+ (2020)	% SSB change *	% TAC change **	% advice change ***
Management plan	264437	0.28	683634	1393295	2.3	2.7	2.7

* SSB₂₀₂₀ relative to SSB₂₀₁₉.

** Catch in 2018/19 relative to TAC_{2017/18} (257 572 t). Because SSB₂₀₁₈ is bigger than MGT B_{trigger}, the TAC for 2018/19 is calculated as $(0.2 \times B_{4+,2018} + TAC_{2017/18}) / 2$.

*** Advice value for 2018/2019 relative to the advice value for 2017/2018.

The advice is similar to last year.

Basis of the advice

Table 4 Cod in Division 5.a. The basis of the advice.

Advice basis	Management plan (MII, 2015)
Management plan	<p>The Icelandic Ministry of Industries and Innovation has a fisheries management plan for Icelandic cod (MII, 2015). In 2015, the plan was extended until 2020. The plan, which aims at providing maximum sustainable yield, has been evaluated by ICES and is considered to be precautionary. 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> $TAC_{Y/Y+1} = \frac{\min\left(\frac{SSB_Y}{MGT B_{trigger}}, 1\right) 0.2 B_{4+,Y} + TAC_{Y-1/Y}}{2}$ <p>where B_{4+,Y} is the biomass of cod aged 4 and older in year Y and MGT B_{trigger} = 220 000 tonnes.</p> <p>The expected range of realized harvest rate (HR) following the management plan (HR_{MGT}) can be found in the NWWG report (ICES, 2018).</p>

Quality of the assessment

This assessment is considered consistent.

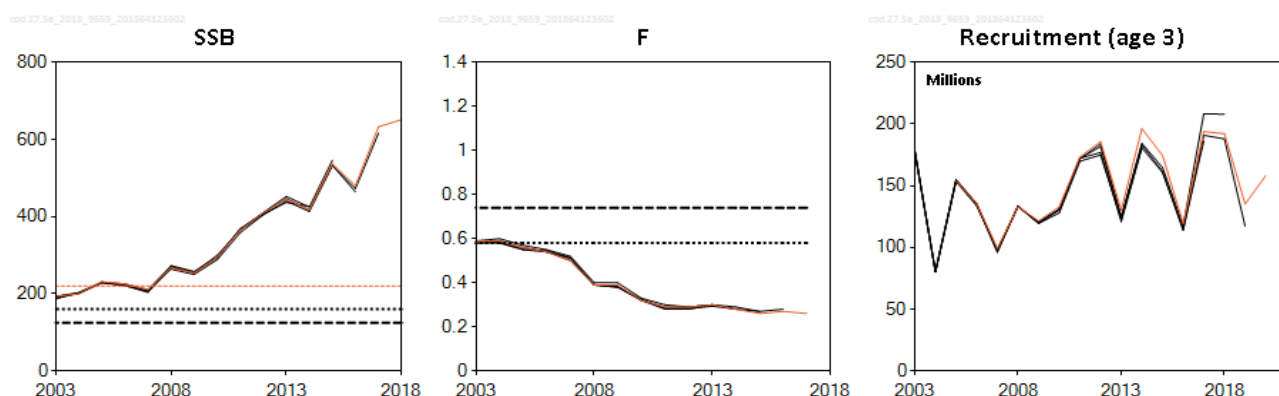


Figure 2 Cod in Division 5.a. Historical assessment results.

Issues relevant for the advice

There is no information to present for this stock.

Reference points

Table 5 Cod in Division 5.a. Reference points, values, and their technical basis. All weights are in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	220000	The trigger point in HCR that is considered consistent with ICES MSY framework.	ICES (2010)
	HR_{MSY}	20%	Stochastic HCR evaluation. Percentage of age 4+ biomass.	ICES (2010)
Precautionary approach	B_{lim}	125000	B_{loss}	ICES (2010)
	B_{pa}	160000	$B_{pa} = B_{lim} \times \exp(1.645\sigma_B)$; $\sigma_B = 0.15$.	ICES (2016a)
	F_{lim}	0.74	The equilibrium F that will maintain the stock above B_{lim} with a 50% probability.	ICES (2016a)
	F_{pa}	0.58	5% probability that true F has been above F_{lim} . $F_{pa} = F_{lim} \times \exp(-1.645\sigma_F)$; $\sigma_F = 0.15$.	ICES (2016a)
Management plan	MGT $B_{trigger}$	220000	The 5th percentile on the distribution of SSB when the TAC is based on HR_{MGT} .	ICES (2009)
	HR_{MGT}	20%	Percentage of age 4+ biomass. Leads to long-term MSY.	ICES (2009)

Basis of the assessment

Table 6 Cod in Division 5.a. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2016b)
Assessment type	A forward-based statistical catch-at-age model that is implemented in the AD model builder, using catches in the model and in the forecast (ICES, 2018)
Input data	Catch-at-age and age-structured spring and autumn survey indices
Discards and bycatch	Discarding is considered negligible and is not included.
Indicators	None
Other information	None
Working group	North-Western Working Group (NWWG)

Information from stakeholders

There is no additional available information.

History of the advice, catch, and management

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

Year	ICES advice	Catch corresponding to advice	Agreed TAC	ICES catch for the fishing year	ICES catch for the calendar year
1988*	National advice	300000	350000		377554
1989*	National advice	300000	325000		363125
1990*	National advice	250000	300000		335316
1991*	National advice	240000	245000		307759
1991/1992	National advice	250000	265000	274000	264834
1992/1993	Reduce F by 40%	154000	205000	241000	250704
1993/1994	Reduce F by 40%	150000	165000	197000	178138
1994/1995	Reduce F by 50%	130000	155000	165000	168592
1995/1996	Apply catch rule #	155000	155000	170000	180701
1996/1997	Apply catch rule	186000	186000	202000	203112
1997/1998	Apply catch rule	218000	218000	227000	243987
1998/1999	Apply catch rule	250000	250000	254000	260147
1999/2000	Apply catch rule	247000	250000	257000	235092
2000/2001	Apply catch rule	203000	220000**	221000	236705
2001/2002	Apply catch rule	164000	190000**	219000	209537
2002/2003	Apply catch rule	183000	179000**	202000	207246
2003/2004	Apply catch rule	210000	209000	227000	228337
2004/2005	Apply catch rule	205000	205000	217000	213865
2005/2006	Apply catch rule	198000	198000	207000	197247
2006/2007	Apply catch rule	187000	193000	191000	171646
2007/2008	Apply catch rule	152000	130000	143000	147668
2008/2009	Apply F _{max}	< 124000	160000^	171000	183302
2009/2010	Apply F _{max}	< 135000	150000^^	170000	170009
2010/2011	Apply catch rule	160000	160000	167000	172207
2011/2012	Apply catch rule	177000	177000	185000	196177
2012/2013	Apply catch rule	196000	196000	213000	223594
2013/2014	Apply catch rule	215000	215000	226000	221990
2014/2015	Apply catch rule	218000	218000	223000	230229
2015/2016	Apply catch rule	239000	239000	249000	251134
2016/2017	Management plan	244000	244000	237644	243990
2017/2018	Management plan	257572	257572		
2018/2019	Management plan	264437			

* Calendar year.

** Amended catch rule.

^ Initial TAC set to 130 000 tonnes according to the catch rule, raised to 160 000 tonnes in January 2009.

^^ Set according to the catch rule.

History of the catch and landings

Table 8 Cod in Division 5.a. Catch distribution by fleet in 2017 as estimated by ICES. All weights are in tonnes.

Table 3 COD in Division 3A: Catch distribution by fleet in 2017 as estimated by ICES. All weights are in tonnes.						
Catch (2017)	Landings					Discards
243990	Bottom trawl 49%	Longline 32%	Gillnet 7%	Scottish seine 6%	Hooks 6%	Negligible
	243990					

Summary of the assessment

Table 9 Cod in Division 5.a. Assessment summary. Weights are in tonnes.

Year	Recruitment Age 3	Stock size		Fishing pressure		Total catch
		SSB	Reference biomass Age 4+	F ages 5–10	Harvest rate	
	thousands	tonnes				tonnes
1955	152038	947569	2368250	0.29	0.23	545250
1956	152828	801431	2092380	0.29	0.23	486909
1957	170632	781071	1888140	0.31	0.24	455182
1958	220670	880754	1873750	0.35	0.28	517359
1959	288804	859254	1835810	0.32	0.25	459081
1960	154489	711838	1756750	0.37	0.27	470121
1961	192959	468893	1498960	0.35	0.25	377291
1962	129114	570804	1494470	0.38	0.26	388985
1963	177603	509293	1317380	0.46	0.31	408800
1964	203989	452463	1220700	0.55	0.36	437012
1965	216366	318269	1023180	0.57	0.38	387106
1966	229128	277840	1032090	0.59	0.34	353357
1967	319877	256987	1103400	0.56	0.3	335721
1968	171830	221930	1222830	0.72	0.31	381770
1969	247346	313863	1325290	0.56	0.3	403205
1970	180428	331270	1336510	0.61	0.36	475077
1971	188585	242637	1097660	0.68	0.4	444248
1972	139285	221872	996800	0.69	0.4	395166
1973	273048	245649	843908	0.70	0.44	369205
1974	178971	187466	918677	0.76	0.4	368133
1975	260816	168857	895993	0.81	0.41	364754
1976	367274	139174	956278	0.74	0.36	346253
1977	143304	199545	1290270	0.59	0.26	340086
1978	227408	213191	1298510	0.47	0.25	329602
1979	243525	304915	1397430	0.44	0.26	366462
1980	140080	357963	1490960	0.49	0.29	432237
1981	140113	265292	1243200	0.66	0.37	465032
1982	131908	168661	971772	0.73	0.39	380068
1983	232137	131592	792757	0.71	0.38	298049
1984	139155	142651	914145	0.64	0.31	282022
1985	140962	163327	927882	0.66	0.35	323428
1986	333991	195839	855615	0.77	0.43	364797
1987	264086	150055	1037820	0.86	0.38	389915
1988	175709	168477	1043520	0.89	0.36	377554
1989	88892	172157	1011780	0.71	0.36	363125
1990	131090	210378	843534	0.69	0.4	335316
1991	107245	166021	700367	0.79	0.44	307759
1992	175680	153853	553127	0.84	0.48	264834
1993	136182	122552	599269	0.86	0.42	250704
1994	78657	159021	580401	0.61	0.31	178138
1995	152663	179555	562038	0.50	0.3	168592
1996	165961	161580	677690	0.50	0.27	180701
1997	89200	190715	790641	0.53	0.26	203112
1998	161997	202525	729444	0.63	0.33	243987
1999	71335	184373	741042	0.71	0.35	260147
2000	171385	174563	602656	0.71	0.39	235092
2001	162031	172779	686535	0.71	0.34	236707
2002	158790	201473	730009	0.62	0.29	209535
2003	178012	193944	745161	0.59	0.28	207241
2004	80583	199556	805951	0.59	0.28	228330
2005	154018	231336	725377	0.56	0.29	213863
2006	135550	225363	699481	0.54	0.28	197257

Year	Recruitment Age 3	Stock size		Fishing pressure		Total catch
		SSB	Reference biomass Age 4+	F ages 5–10	Harvest rate	
	thousands	tonnes				tonnes
2007	99365	210909	684245	0.50	0.25	171652
2008	132962	267640	706869	0.39	0.21	147663
2009	121512	254019	793493	0.39	0.23	183315
2010	133001	294766	855455	0.32	0.20	170018
2011	173355	364649	910781	0.29	0.189	172197
2012	185846	409972	1043130	0.29	0.188	196192
2013	130411	445218	1180210	0.30	0.189	223593
2014	196261	417899	1198030	0.28	0.185	222016
2015	174602	537283	1303270	0.26	0.177	230231
2016	119414	480458	1392850	0.27	0.180	251132
2017	193946	633123	1344220	0.26	0.182	243990
2018	192225	651600	1356509			
2019	135203					
2020	158173					

Sources and references

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