

Cod (*Gadus morhua*) in ICES Subarea 14 and NAFO Division 1F (East Greenland, Southwest Greenland)

ICES advice on fishing opportunities

Please note: The present advice replaces the catch advice given for 2018 (in June 2017) and it provides the catch advice for 2019.¹

ICES advises that when the MSY approach is applied, catches in 2018 should be no more than 12 151 tonnes.

ICES advises that when the MSY approach is applied, catches in 2019 should be no more than 5363 tonnes.

Stock development over time

The spawning-stock biomass (SSB) increased to above MSY B_{trigger} from 2005 and has decreased since 2014, but is still above MSY B_{trigger} . Fishing mortality (F) has been below F_{MSY} in the last 25 years, but has increased in the three most recent years. Recruitment has been dominated by occasional large year classes, with the latest being the 2003 year class.

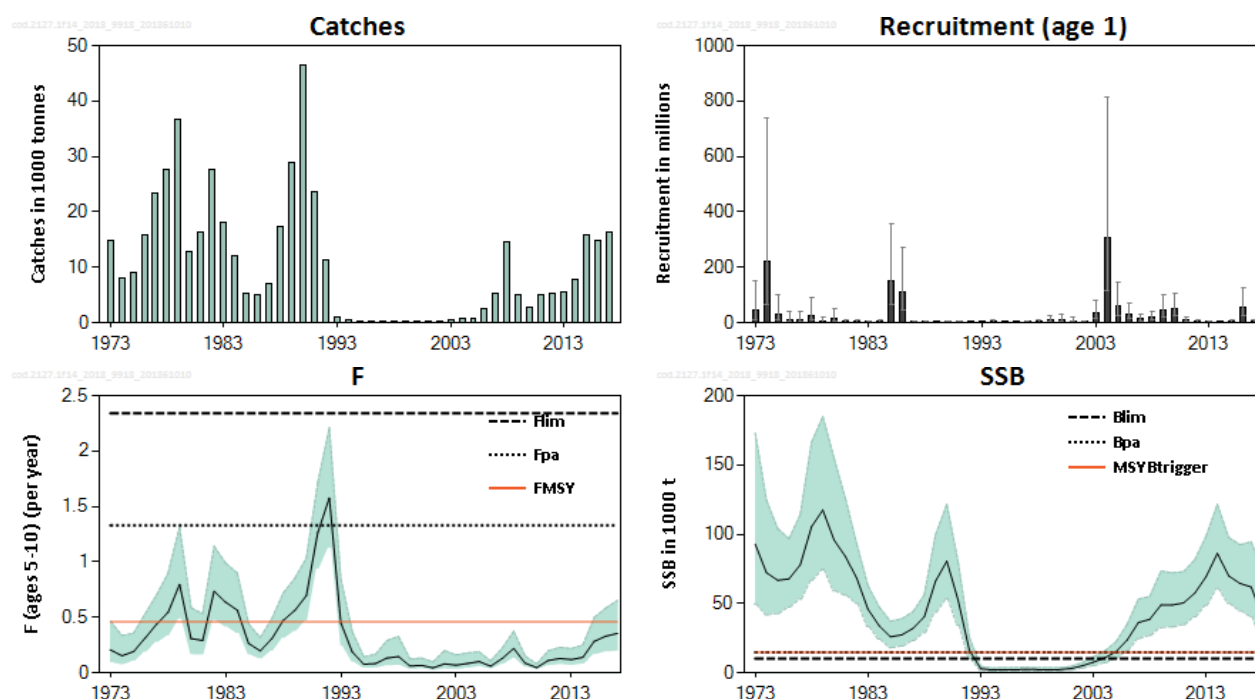


Figure 1 Cod in NAFO Subarea 14 and NAFO Division 1F. Summary of the stock assessment with 95% confidence intervals.

Stock and exploitation status

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

¹ In January 2018 an Inter-benchmark protocol was conducted, IBPGreenlandCod, and the assessment type and data category for this stock changed following this benchmark (ICES, 2018a). Updated catch advice for 2018 was requested, based on the new assessment. The new assessment results in a 92% increase in advised catch for 2018 relative to the previously released catch advice for 2018 (ICES, 2017).

Table 1 Cod in NAFO Subarea 14 and NAFO Division 1F. 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}	✓	✓	✓ Appropriate		MSY $B_{trigger}$	✓	✓ Above trigger
Precautionary approach	F_{pa}, F_{lim}	✓	✓	✓ Harvested sustainably		B_{pa}, B_{lim}	✓	✓ Full reproductive capacity
Management plan	F_{MGT}	—	—	— Not applicable		B_{MGT}	—	— Not applicable

Catch scenarios

Table 2 Cod in NAFO Subarea 14 and NAFO Division 1F. Assumptions made for the interim year and in the forecast for the 2018 updated advice. All weights are in tonnes.

Variable	Value	Notes
$F_{ages\ 5-10}$ (2017)	0.36	Estimated by the assessment.
SSB (2018)	40568	Estimated by the assessment.
$R_{age\ 1}$ (2018)	5513	In thousands. Estimated by the assessment.
Total catch (2017)	16300	Known, reported catch.

Table 3 Cod in NAFO Subarea 14 and NAFO Division 1F. Annual catch scenarios for the 2018 updated advice. All weights are in tonnes.

Rationale	Catch (2018)	F (2018)	SSB (2019)	% SSB change *	% advice change **	% TAC change ***
ICES advice basis						
MSY approach: F_{MSY} 2018	12151	0.46	29402	-28%	-35%	-24%
Other scenarios						
$Catch_{2018} = TAC_{2018}$	16500	0.72	25094	-38%	-52%	3.0%

* SSB_{2019} relative to SSB_{2018} .

** Advice value for 2018, from this updated assessment, relative to the advice value for 2017.

*** Advice value for 2018, from this updated assessment, relative to the TAC value for 2017.

Following a 2018 benchmark (ICES, 2018a), the assessment model changed for this stock. The new assessment changed the perception of the stock and, therefore, also the advice. This advice is an update of the previous advice for 2018 (ICES, 2017).

Table 4 Cod in NAFO Subarea 14 and NAFO Division 1F. Assumptions made for the interim year and in the forecast for the 2019 advice. All weights are in tonnes.

Variable	Value	Notes
$F_{ages\ 5-10}$ (2018)	0.72	$F_{ages\ 5-10}$ (2018) assuming $Catch_{2018} = TAC_{2018} = 16\ 500$ t
SSB (2019)	25094	Calculated from the assessment.
$R_{age\ 1}$ (2019)	7000	In thousands. Assuming random walk recruitment drawn from the full time-series (1973–2017).
Total catch (2018)	16500	Based on $F_{ages\ 5-10}$ (2018) = 0.72

Table 5 Cod in NAFO Subarea 14 and NAFO Division 1F. Annual catch scenarios for the 2019 advice. All weights are in tonnes.

Rationale	Catch (2019)	F (2019)	SSB (2020)	% SSB change *	% advice change **	% TAC change ***
ICES advice basis						
MSY approach: F_{MSY}	5363	0.46	31024	24%	-56%	-67%
Other scenarios						
$F = 0$	0	0	36776	47%	-100%	
F_{pa}	7799	1.33	24367	-3%	-36%	-53%
F_{lim}	14808	2.34	22822	-9%	22%	-10.0%
$F = F_{2018}$ (<i>status quo</i>)	7351	0.716	28922	15%	-40%	-55%
$SSB_{2020} = B_{lim}$	32236	17.6	10339	-59%	165%	95%
$SSB_{2020} = B_{pa} = MSY B_{trigger}$	25242	8.9	14606	-42%	108%	53%

* SSB_{2020} relative to SSB_{2019} .

** Advice value for 2019 relative to the advice value for 2018, from this updated assessment.

*** Advice value for 2019 relative to the TAC value for 2018, from this updated assessment.

Basis of the advice

Table 6 Cod in NAFO Subarea 14 and NAFO Division 1F. The basis of the advice.

Advice basis	MSY approach
Management plan	There is no management plan.

Quality of the assessment

The stock was benchmarked in 2018 (ICES, 2018a). Input data and assessment model were changed, reference points were defined, and uncertainty estimates are now available to assess the quality of the assessment.

Data from tagging experiments show a considerable emigration from East Greenland to Iceland; this is accounted for in this assessment. The level is not exactly known and therefore adds uncertainty to the assessment.

This stock has not previously been assessed analytically, and there are no comparable historical assessment results.

Issues relevant for the advice

There are linkages between this stock and the Icelandic cod stock where some of the spawning stock migrates to Iceland and there is spasmodic import of juveniles from Iceland.

Reference points

Table 7 Cod in NAFO Subarea 14 and NAFO Division 1F. Reference points, values, and their technical basis. All weights are in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	$MSY B_{trigger}$	14803	Assumed at B_{pa}	ICES (2018a)
	F_{MSY}	0.46	Stochastic simulations with a Type 1 stock–recruitment relationship.	ICES (2018a)
Precautionary approach	B_{lim}	10354	Breakpoint in segmented regression	ICES (2018a)
	B_{pa}	14803	$B_{lim} \times e^{1.645\sigma}$, $\sigma = 0.217$ *	ICES (2018a)
	F_{lim}	2.34	Equilibrium F , which will maintain the stock above B_{lim} with a 50% probability and with stochastic recruitment.	ICES (2018a)
	F_{pa}	1.33	$F_{lim} / e^{1.645\sigma}$, $\sigma = 0.343$	ICES (2018a)
Management plan	SSB_{mgt}	-	-	
	F_{mgt}	-	-	

* The figures in the table are rounded. Calculations were done with unrounded inputs and computed values may not match exactly when calculated using the rounded figures in the table.

Basis of the assessment

Table 8 Cod in NAFO Subarea 14 and NAFO Division 1F. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2016)
Assessment type	Age-based analytical assessment (SAM; ICES, 2018b) that uses catches in the model and in the forecast.
Input data	Catch-at-age and age-disaggregated survey indices: Greenland (August, trawl since 2008) and German (October, trawl since 1982). Age-specific natural mortality incorporating emigration to Iceland (from age 5 onwards).
Discards and bycatch	Discarding is considered negligible.
Indicators	None
Other information	Benchmarked in 2018 (ICES, 2018a)
Working group	North-Western Working Group (NWWG)

Information from stakeholders

There is no additional available information.

History of the advice, catch, and management

Table 9 Cod in NAFO Subarea 14 and NAFO Division 1F. ICES advice and catch. All weights are in tonnes. Separate advice for this cod stock was provided for the first time in this area for 2016. The advice up to 2011 was included in the advice for inshore cod in NAFO Subarea 1 and offshore cod in NAFO divisions 1A–1E (ICES, 2011). The advice for 2012–2015 was combined advice and TAC with offshore cod in NAFO divisions 1A–1E (ICES, 2014).

Year	ICES advice	Catch corresponding to advice	Agreed TAC	ICES catch
2004	Precautionary approach	0	5000	775
2005	Precautionary approach	0	5000	890
2006	Precautionary approach	0	5000	2456
2007	Precautionary approach	0	5000	5205
2008	Precautionary approach	0	15000	14628
2009	Precautionary approach	0	10000	4965
2010	Precautionary approach	0	5000	2669
2011	Precautionary approach	0	5000	5113
2012	Precautionary approach	0	5500	5411
2013	Precautionary approach	0	6500	5509
2014	Precautionary approach	0	10000	7893
2015	Precautionary approach	0	18104	15755
2016	Precautionary approach	7577	16000	14818
2017	Precautionary approach	≤ 7930	16000	16300
2018	MSY approach	≤ 12151*	16500	
2019	MSY approach	≤ 5363		

* This is the updated advice for 2018. The original advice value for 2018 was 6344 tonnes ([ICES, 2017](#)).

History of the catch and landings

Table 10 Cod in NAFO Subarea 14 and NAFO Division 1F. All weights are in tonnes.

Catch (2017)	Landings		Discards
16300	Longline 38.8%	Trawl 61.2%	Discarding is negligible
	16300		

Table 11 Cod in NAFO Subarea 14 and NAFO Division 1F. Historical catches not included in the assessment, in tonnes.

Year	NAFO 1F + ICES Division 14.b
1954	23759
1955	11567
1956	19189
1957	30659
1958	46972
1959	35500
1960	39219
1961	40212
1962	41874
1963	46626
1964	55451
1965	38063
1966	38956
1967	40738
1968	37844
1969	31879
1970	40023
1971	59789
1972	32188

Summary of the assessment

Table 12 Cod in NAFO Subarea 14 and NAFO Division 1F. All weights are in tonnes.

Year	Recruitment Age 1	High	Low	SSB	High	Low	Catch	F Ages 5–10	High	Low
	thousands			tonnes			tonnes			
1973	44501	151856	13041	92816	173096	49769	14725	0.21	0.47	0.092
1974	223991	737349	68044	72245	124491	41925	7950	0.155	0.34	0.071
1975	31194	101013	9633	66785	104077	42854	9091	0.192	0.36	0.103
1976	12798	41541	3943	67791	96794	47478	15922	0.31	0.53	0.185
1977	12591	40808	3885	77951	114186	53215	23455	0.44	0.70	0.27
1978	28125	91164	8677	105498	166345	66908	27561	0.55	0.90	0.33
1979	7000	23070	2124	117424	184842	74596	36775	0.80	1.31	0.48
1980	17040	51192	5672	95756	154645	59292	12724	0.31	0.59	0.162
1981	4298	11760	1571	84044	125878	56114	16255	0.29	0.53	0.161
1982	4685	11593	1893	68476	93305	50254	27720	0.74	1.14	0.47
1983	2289	6118	856	45948	62897	33566	18054	0.64	0.99	0.41
1984	3988	9476	1679	33984	47542	24293	11997	0.57	0.90	0.36
1985	150977	355724	64078	26026	37243	18188	5187	0.27	0.44	0.160
1986	112853	272705	46702	27444	39022	19301	5074	0.199	0.32	0.124
1987	2855	6766	1204	32061	44129	23293	7093	0.31	0.49	0.194
1988	2366	5475	1023	40411	56235	29040	17388	0.47	0.72	0.31
1989	641	1497	274	66126	99602	43901	28917	0.56	0.85	0.37
1990	1269	3138	513	80618	121507	53488	46519	0.70	1.03	0.47
1991	2150	5344	865	52413	80116	34290	23538	1.27	1.72	0.93
1992	800	1886	339	16333	25679	10389	11349	1.58	2.2	1.12
1993	734	1776	303	3050	4694	1982	1135	0.45	0.85	0.24
1994	3260	8239	1290	2129	3588	1264	437	0.187	0.37	0.095
1995	213	568	80	2329	3868	1403	284	0.078	0.145	0.042

Year	Recruitment Age 1	High	Low	SSB	High	Low	Catch	F Ages 5–10	High	Low
	thousands			tonnes			tonnes			
1996	282	820	97	2300	3737	1415	192	0.084	0.167	0.043
1997	1449	4109	511	2536	4044	1590	355	0.134	0.29	0.062
1998	4826	11777	1978	2423	3848	1525	345	0.147	0.33	0.066
1999	9413	23561	3761	2295	3708	1420	116	0.062	0.124	0.031
2000	12777	31179	5236	2418	3782	1546	152	0.068	0.134	0.035
2001	7810	18925	3223	3137	4688	2099	125	0.046	0.099	0.021
2002	1437	3856	535	5080	7447	3465	401	0.081	0.20	0.033
2003	33483	80261	13969	7761	11427	5271	485	0.070	0.162	0.030
2004	309275	812998	117652	10766	15831	7321	775	0.085	0.180	0.041
2005	58389	145790	23385	15246	22334	10408	890	0.102	0.190	0.055
2006	31275	73246	13354	23751	34996	16119	2456	0.061	0.108	0.035
2007	13989	31494	6214	36375	53278	24835	5205	0.130	0.22	0.075
2008	20689	43029	9948	38590	55069	27043	14628	0.22	0.38	0.129
2009	46516	99198	21813	49008	73459	32695	4965	0.087	0.151	0.051
2010	51075	106336	24532	48949	72158	33205	2669	0.048	0.082	0.028
2011	10027	21137	4757	50467	73024	34877	5113	0.112	0.199	0.063
2012	5513	11561	2629	57495	81584	40519	5411	0.130	0.23	0.073
2013	2530	5293	1209	69393	98563	48857	5509	0.120	0.22	0.066
2014	926	2005	428	86196	121595	61103	7893	0.140	0.25	0.078
2015	4421	9491	2060	70026	97766	50157	15755	0.28	0.50	0.163
2016	54094	124909	23426	64517	92483	45007	14818	0.33	0.59	0.187
2017	3479	9843	1230	61930	94548	40565	16300	0.36	0.65	0.194
2018				40568	74171	21828				

Sources and references

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