

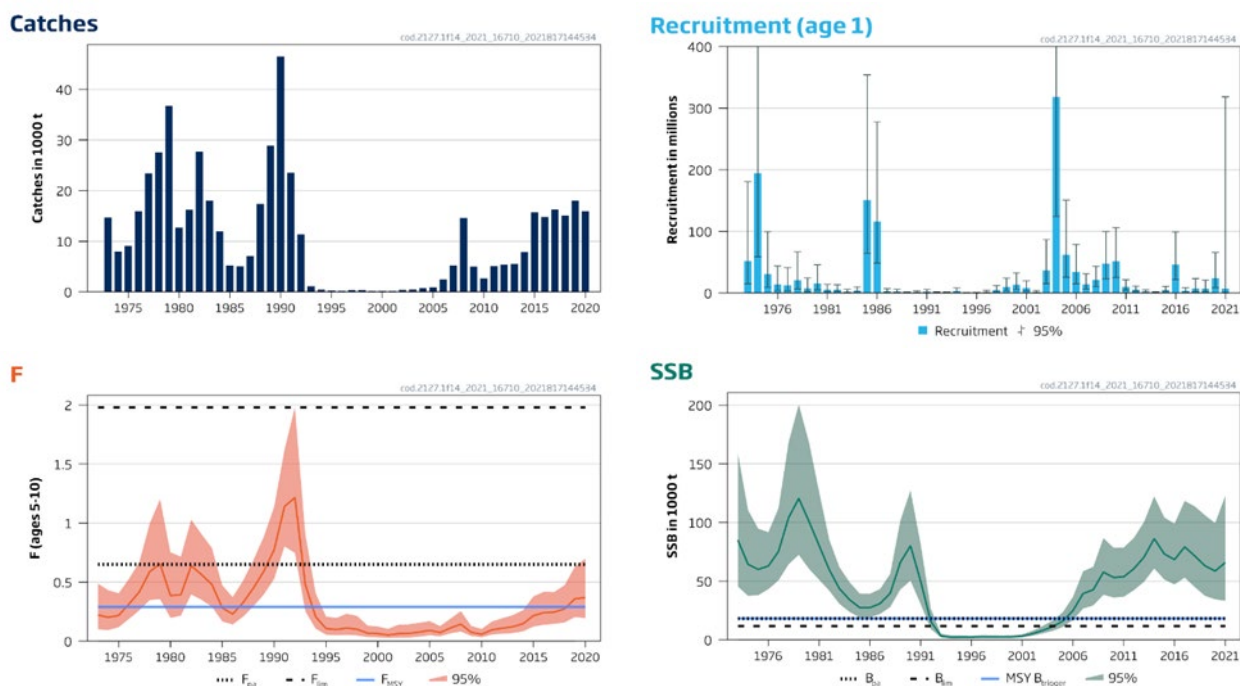
## Cod (*Gadus morhua*) in ICES Subarea 14 and NAFO Division 1F (East Greenland, Southwest Greenland)

### ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2022 should be no more than 8768 tonnes.

### Stock development over time

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



**Figure 1** Cod in ICES Subarea 14 and NAFO Division 1F. Summary of the stock assessment.

### Catch scenarios

**Table 1** Cod in ICES Subarea 14 and NAFO Division 1F. Assumptions made for the interim year and in the forecast.

Variable	Value	Notes
$F_{ages\ 5-10}$ (2021)	0.893	$F_{ages\ 5-10}$ (2021) assuming $Catch_{2021} = TAC$
SSB (2022)	51 350	Calculated from the assessment; tonnes
$R_{age\ 1}$ (2021)	6 925	Assuming random walk recruitment drawn from the full time-series (1973–2020); thousands
$R_{age\ 1}$ (2022)	7 455	Assuming random walk recruitment drawn from the full time-series (1973–2020); thousands
Catch (2021)	26 091	TAC 2021; tonnes

**Table 2** Cod in ICES Subarea 14 and NAFO Division 1F. Annual catch scenarios. All weights are in tonnes.

Rationale	Catch (2022)	F (2022)	SSB (2023)	% SSB change *	% advice change **	% TAC change ***
ICES advice basis						
MSY approach: $F_{MSY}$	8 768	0.29	53 622	+4	+44	-66
Other scenarios						
$F = 0$	0	0	68 680	+34	-100	-100
$F = F_{2021}$	19 261	0.89	38053	-26	+216	-26

\*  $SSB_{2023}$  relative to  $SSB_{2022}$  (51 350 tonnes).

\*\* Advice value for 2022 relative to the advice value for 2021 (6091 tonnes).

\*\*\* Advice value for 2022 relative to the TAC value for 2021 (26091 tonnes).

The increase in the catch advice is caused by a general upscaling of the stock size this year.

### Basis of the advice

**Table 3** Cod in ICES Subarea 14 and NAFO Division 1F. The basis of the advice.

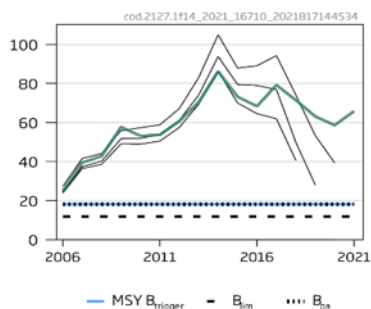
Advice basis	MSY approach
Management plan	ICES is not aware of any agreed precautionary management plan for cod in this area

### Quality of the assessment

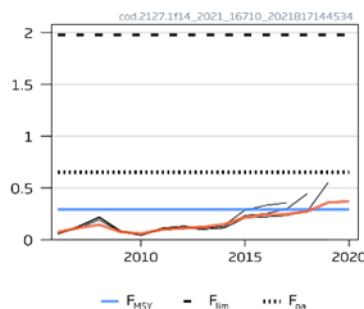
The stock went through a interim benchmark (IBPGCOD2). The model revision, changes in natural mortality to reflect changes in fishing patterns and migration, alleviate previous issues concerning retrospective patterns and divergence between the German survey and the Greenlandic survey and catch data.

Given genetic and tagging studies it is inferred that the cod in East Greenland is a mixture of cod that spawns in East Greenland and Iceland, with some immature cod from these spawning areas also growing up in West Greenland waters (north of NAFO 1F). In recent years, fishing effort on the slope south of the Dohrn Bank (northeastern part of East Greenland), where large old cod are caught, has been increasing. These factors contribute to the uncertainty of the assessment.

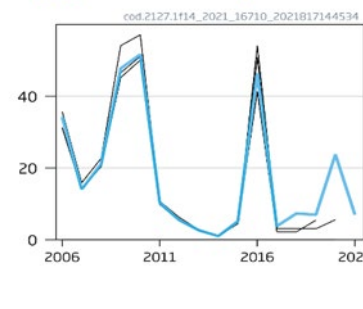
#### SSB (1000 t)



#### F (ages 5-10)



#### Rec (age 1; Millions)



**Figure 2** Cod in ICES Subarea 14 and NAFO Division 1F. Historical assessment results. Final-year recruitment values are assumed. The reference points were revised in 2021 following an interbenchmark, and only assessment results from the last year should be compared to the reference points indicated.

### Issues relevant for the advice

ICES provides advice for cod caught in this area, which may include more than one cod population. There are linkages between this stock, the West Greenland offshore stock, and the Icelandic offshore cod stock; some of the spawning stock migrates to Iceland, and there is drift of eggs and larvae from Iceland. Population structure in the assessment area is poorly understood and will be further investigated in the next benchmark.

In 2021 East Greenland was split into two management areas by Greenland authorities: the Dohrn Bank area (east of 35°15W) and the remaining part. The ICES advice is for the entire East Greenland area.

## Reference points

**Table 4** Cod in ICES 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 $B_{trigger}$	18 146	Assumed at $B_{pa}$	ICES (2021a)
	$F_{MSY}$	0.29	Stochastic simulations with a segmented regression through $B_{lim}$	ICES (2021a)
Precautionary approach	$B_{lim}$	11 738	Based on the lowest SSB which still gave a large recruitment (mean SSB of 2003–2005)	ICES (2021a)
	$B_{pa}$	18 146	$B_{lim} \times e^{1.645\sigma}$ , $\sigma = 0.265$	ICES (2021a)
	$F_{lim}$	1.98	Equilibrium F, which will maintain SSB above $B_{lim}$ with a 50% probability and with stochastic recruitment	ICES (2021a)
	$F_{pa}$	0.65	The F that provides a 95% probability for SSB to be above $B_{lim}$ ( $F_{P05}$ with advice rule [AR])	ICES (2021a)
Management plan	$SSB_{mgt}$	-	-	
	$F_{mgt}$	-	-	

## Basis of the assessment

**Table 5** Cod in ICES Subarea 14 and NAFO Division 1F. Basis of the assessment and advice.

ICES stock data category	1 ( <a href="#">ICES, 2021b</a> )
Assessment type	Age-based analytical assessment (SAM; ICES, 2021c) that uses catches in the model and in the forecast
Input data	Catch-at-age and age-disaggregated survey indices: Greenland August bottom trawl (G2064) since 2008 and German DTS (GFS) October bottom trawl (G3244) since 1982; age-specific natural mortality incorporating emigration to Icelandic waters (from age 5 onwards) until 2015
Discards and bycatch	Discarding is considered negligible
Indicators	None
Other information	Interbenchmarked in 2021 (ICES, 2021a)
Working group	North-Western Working Group ( <a href="#">NWWG</a> )

## History of the advice, catch, and management

**Table 6** Cod in ICES Subarea 14 and NAFO Division 1F. ICES advice, TACs, and catch. All weights are in tonnes.

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	15068
2019	MSY approach	≤ 5363	20000	18074
2020	MSY approach	≤ 3409	18824	15933
2021	MSY approach	≤ 6091	26091	
2022	MSY approach	≤ 8768		

\*The advice until 2011 was included in the advice for inshore cod in NAFO Subarea 1 and offshore cod in NAFO divisions 1A–1E.

\*\* The advice for 2012–2015 was combined advice with offshore cod in NAFO divisions 1A–1E.

## History of the catch and landings

**Table 7** Cod in ICES Subarea 14 and NAFO Division 1F. Catch distribution by fleet in 2020 as estimated by ICES. All weights are in tonnes.

Catch (2020)	Landings		Discards
15933	Trawl 72%	Longline 28%	Discarding is considered negligible
	15933		

**Table 8** Cod in ICES Subarea 14 and NAFO Division 1F. Historical catches, not included in the assessment, in tonnes.

Year	Catch	Year	Catch	Year	Catch	Year	Catch
1954	23759	1973	14725	1992	11349	2011	5113
1955	11567	1974	7950	1993	1135	2012	5411
1956	19189	1975	9091	1994	437	2013	5509
1957	30659	1976	15922	1995	284	2014	7893
1958	46972	1977	23455	1996	192	2015	15755
1959	35500	1978	27561	1997	355	2016	14818
1960	39219	1979	36775	1998	345	2017	16300
1961	40212	1980	12724	1999	116	2018	15068
1962	41874	1981	16255	2000	152	2019	18074
1963	46626	1982	27720	2001	125	2020	15933
1964	55451	1983	18054	2002	401		
1965	38063	1984	11997	2003	485		
1966	38956	1985	5187	2004	775		
1967	40738	1986	5074	2005	890		
1968	37844	1987	7093	2006	2456		
1969	31879	1988	17388	2007	5205		
1970	40023	1989	28917	2008	14628		
1971	59789	1990	46519	2009	4965		
1972	32188	1991	23538	2010	2669		

Summary of the assessment

**Table 9** Cod in ICES Subarea 14 and NAFO Division 1F. All weights are in tonnes, recruitment in thousands. The high and low values correspond to 95% confidence intervals.

Year	Recruitment			Spawning-stock biomass			Catches	Fishing mortality		
	Recruitment (age 1)	High	Low	SSB	High	Low		F (ages 5–10)	High	Low
	thousands			tonnes			tonnes			
1973	52131	180567	15051	85035	159224	45414	14725	0.22	0.49	0.101
1974	194208	639652	58964	64382	110712	37440	7950	0.20	0.43	0.094
1975	30679	99409	9468	60019	94780	38007	9091	0.22	0.41	0.118
1976	13566	43910	4191	62909	91783	43119	15922	0.32	0.53	0.188
1977	12712	41160	3926	75315	112114	50594	23455	0.42	0.67	0.26
1978	20739	66774	6441	104184	168508	64414	27561	0.59	1.00	0.35
1979	7455	24253	2291	120454	200535	72352	36775	0.65	1.20	0.36
1980	15387	45762	5174	100971	168558	60485	12724	0.39	0.75	0.197
1981	5202	14162	1911	80376	126219	51184	16255	0.39	0.72	0.22
1982	5475	13463	2226	59776	85394	41843	27720	0.64	1.03	0.40
1983	2274	6016	859	43574	62011	30618	18054	0.56	0.91	0.35
1984	4168	9792	1774	34169	49152	23753	11997	0.48	0.79	0.29
1985	150818	354081	64239	27412	39469	19039	5187	0.28	0.47	0.167
1986	116062	277772	48494	27396	39302	19097	5074	0.23	0.37	0.141
1987	2987	7012	1272	30886	43295	22034	7093	0.33	0.51	0.21
1988	2556	5898	1108	39634	56236	27933	17388	0.45	0.69	0.30
1989	729	1697	314	65976	101583	42850	28917	0.59	0.89	0.40
1990	1451	3513	599	80133	127360	50418	46519	0.78	1.14	0.53
1991	2374	5805	971	49917	81865	30437	23538	1.14	1.62	0.80
1992	822	1933	350	15649	26618	9201	11349	1.22	1.98	0.75
1993	727	1733	305	3239	5216	2012	1135	0.48	0.91	0.25
1994	3382	8390	1363	2142	3822	1201	437	0.21	0.41	0.105
1995	236	616	90	2194	3688	1306	284	0.107	0.21	0.055
1996	309	879	109	2172	3555	1327	192	0.099	0.197	0.050
1997	1520	4235	546	2478	3970	1547	355	0.111	0.23	0.053
1998	5036	12167	2085	2460	3903	1551	345	0.101	0.21	0.048
1999	9792	24038	3989	2379	3804	1488	116	0.068	0.133	0.035
2000	13497	32476	5609	2479	3886	1581	152	0.064	0.124	0.033
2001	8260	19784	3449	3165	4752	2108	125	0.052	0.105	0.026
2002	1540	3998	593	5192	7681	3510	401	0.064	0.141	0.029
2003	36368	86582	15276	7984	11779	5412	485	0.066	0.143	0.031
2004	318375	815108	124355	11186	16478	7594	775	0.077	0.156	0.038
2005	62150	150695	25632	16045	23543	10936	890	0.092	0.170	0.050
2006	34173	78942	14793	24935	36680	16951	2456	0.073	0.128	0.041
2007	14014	31189	6297	39462	58507	26617	5205	0.112	0.191	0.066
2008	21167	43499	10300	42715	62269	29302	14628	0.144	0.26	0.081
2009	47717	99549	22873	57677	86706	38366	4965	0.075	0.129	0.044
2010	51597	106155	25079	53170	78491	36017	2669	0.059	0.104	0.033
2011	10239	21345	4912	53709	78698	36655	5113	0.096	0.166	0.056
2012	5390	11138	2608	60623	86889	42297	5411	0.110	0.195	0.063
2013	2602	5367	1262	70506	100508	49460	5509	0.122	0.22	0.068
2014	987	2120	459	86220	122304	60783	7893	0.148	0.26	0.083
2015	5096	10709	2425	73173	104299	51335	15755	0.22	0.38	0.123
2016	46410	99217	21709	68324	99005	47151	14818	0.24	0.42	0.139
2017	3732	8585	1622	79218	118409	52998	16300	0.25	0.42	0.146
2018	7284	23559	2252	71426	113691	44873	15068	0.27	0.47	0.158
2019	6925	20967	2287	63087	106211	37472	18074	0.36	0.63	0.20
2020	23741	65906	8552	58617	99550	34515	15933	0.37	0.70	0.195
2021*	6925	318375	236	65849	122664	33133				

\* 2021 value for recruitment is from a model forecast, assuming random walk recruitment drawn from the full time-series (1973–2020).

## Sources and references

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[Download the stock assessment data and figures.](#)

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