

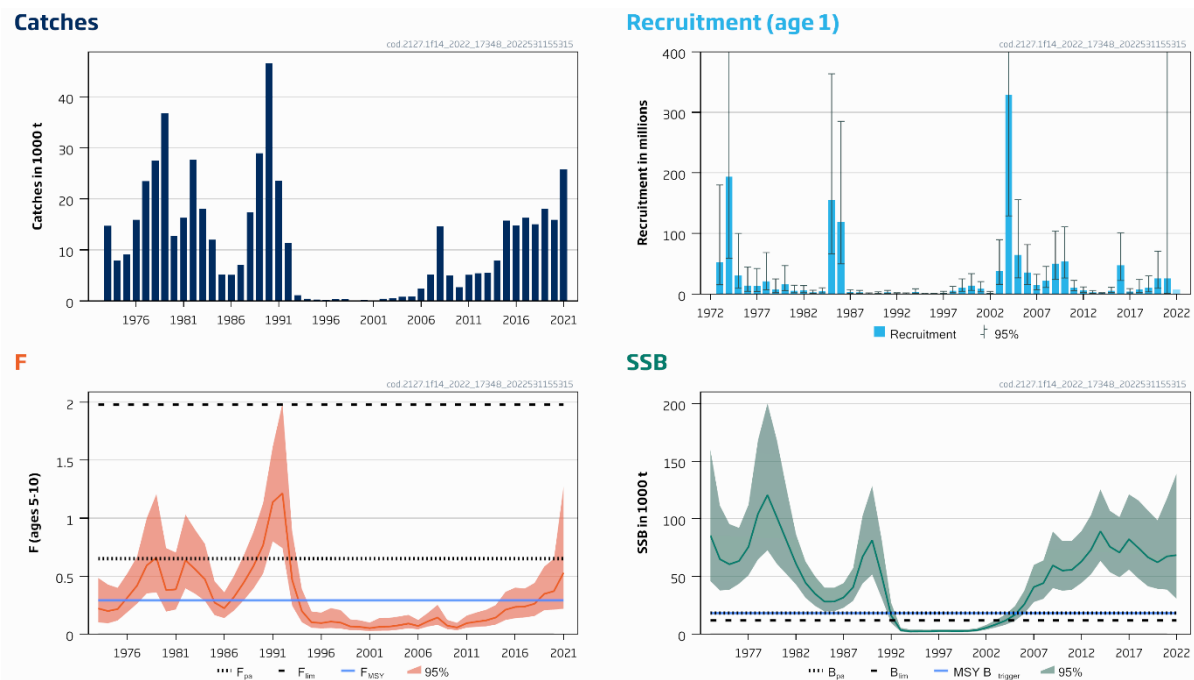
## Cod (*Gadus morhua*) in ICES Subarea 14 and NAFO Division 1F (East Greenland, Southwest Greenland)

### ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2023 should be no more than 8460 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. The assumed recruitment value for 2022 is shaded in a lighter colour.

### Catch scenarios

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

Variable	Value	Notes
$F_{ages\ 5-10}$ (2022)	0.995	Based on catch constraint
SSB (2023)	48317	Short-term forecast; tonnes
$R_{age\ 1}$ (2022)	7781	Median of resamples from the time-series 1973–2020. thousands
Catch (2022)	27430	TAC 2022; tonnes

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

Rationale	Catch (2023)	F (2023)	SSB (2024)	% SSB change*	% advice change**	% TAC change***
ICES advice basis						
MSY approach: $F_{MSY}$	8460	0.290	60722	+26	-4	-69
Other scenarios						
$F = 0$	0	0	76675	+59	-100	-100
$F = F_{2022}$	19782	0.995	45552	-6	+126	-28

\*  $SSB_{2024}$  relative to  $SSB_{2023}$  (48 317 tonnes).

\*\* Advice value for 2023 relative to the advice value for 2022 (8768 tonnes).

\*\*\* Advice value for 2023 relative to the TAC value for 2022 (27 430 tonnes).

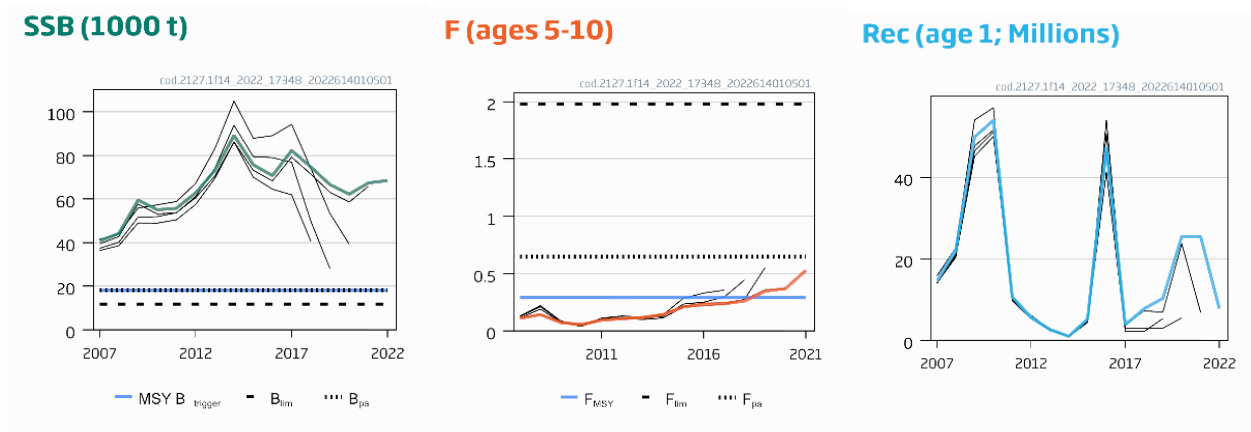
## Basis of the advice

**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 assessment is considered uncertain because of unknown levels of stock mixing that affects both surveys and commercial catches. There were no surveys in this area in 2021. In recent years, fishing effort on the slope south of the Dohrn Bank (northeastern part of Division 14b), where large old cod are caught, has been increasing. These factors all contribute to the uncertainty of the assessment.



**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 two years should be compared to the reference points indicated.

## Issues relevant for the advice

Population structure in the assessment area is poorly understood. Spawning is known to occur on Kleine Bank while juvenile migrations from west Greenland contribute substantially to the recruitment of the stock. Migration of spawning cod to Iceland has been observed. Population structure in the assessment area will be further investigated in the 2023 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. ICES advice is for the East Greenland stock (ICES Subarea 14 and NAFO Division 1F).

The agreed TAC has never followed the catch advice.

## 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 $B_{trigger}$	18146	$B_{pa}$	ICES (2021)
	$F_{MSY}$	0.29	Stochastic simulations with a segmented regression through $B_{lim}$	ICES (2021)
Precautionary approach	$B_{lim}$	11738	Based on the lowest SSB which still gave a large recruitment (mean SSB of 2003–2005)	ICES (2021)
	$B_{pa}$	18146	$B_{lim} \times e^{1.645\sigma}$ , $\sigma = 0.265$	ICES (2021)
	$F_{lim}$	1.98	Equilibrium $F$ , which will maintain SSB above $B_{lim}$ with a 50% probability and with stochastic recruitment	ICES (2021)
	$F_{pa}$	0.65	The $F$ that provides a 95% probability for SSB to be above $B_{lim}$ ( $F_{P05}$ with advice rule [AR])	ICES (2021)
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, 2022a</a> )
Assessment type	Age-based analytical assessment (SAM; ICES, 2022b) 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, 2021)
Working group	Northwestern 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	25829
2022	MSY approach	≤ 8768	27430	
2023	MSY approach	≤ 8460		

\*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 2021 as estimated by ICES. All weights are in tonnes.

Catch (2021)	Landings		Discards
25829	Trawl 77%	Longline 23%	Discarding is considered negligible
	25829		

## Summary of the assessment

**Table 8** Cod in ICES Subarea 14 and NAFO Division 1F. All weights are in tonnes, recruitment in thousands. ‘High’ and ‘Low’ correspond to 95% confidence intervals.

Year	Recruitment			Spawning-stock biomass			Catches	Fishing mortality		
	Age 1	High	Low	SSB	High	Low		Ages 5–10	High	Low
	thousands			tonnes			tonnes			
1973	52079	180110	15059	85635	159933	45853	14725	0.22	0.48	0.100
1974	193807	637364	58932	64904	111517	37775	7950	0.198	0.43	0.092
1975	30891	99948	9548	60527	95444	38384	9091	0.22	0.40	0.116
1976	13778	44538	4262	63346	92181	43531	15922	0.31	0.52	0.188
1977	13006	42052	4022	75551	112203	50872	23455	0.42	0.67	0.26
1978	21256	68327	6613	104305	168318	64637	27561	0.59	1.00	0.35
1979	7639	24791	2354	120625	200308	72640	36775	0.66	1.21	0.36
1980	15784	46827	5320	100998	168063	60695	12724	0.38	0.74	0.193
1981	5361	14561	1974	80977	126363	51892	16255	0.39	0.70	0.21
1982	5621	13791	2291	60960	86686	42870	27720	0.64	1.03	0.39
1983	2342	6185	887	44439	63001	31346	18054	0.56	0.90	0.35
1984	4301	10082	1835	34908	50041	24351	11997	0.47	0.78	0.29
1985	155111	363695	66153	28035	40263	19520	5187	0.27	0.46	0.162
1986	119280	285331	49864	28106	40164	19668	5074	0.22	0.36	0.137
1987	3091	7237	1320	31702	44195	22740	7093	0.32	0.50	0.20

Year	Recruitment			Spawning-stock biomass			Catches	Fishing mortality		
	Age 1	High	Low	SSB	High	Low		Ages 5–10	High	Low
	thousands			tonnes						
1988	2638	6070	1146	40527	57252	28688	17388	0.44	0.68	0.29
1989	756	1754	326	67127	102889	43796	28917	0.59	0.88	0.39
1990	1503	3633	622	81409	128525	51566	46519	0.77	1.13	0.52
1991	2455	5993	1006	50738	82493	31207	23538	1.14	1.62	0.80
1992	854	2003	364	16077	27129	9528	11349	1.22	1.99	0.74
1993	753	1790	316	3325	5350	2067	1135	0.47	0.89	0.24
1994	3492	8648	1410	2227	3968	1250	437	0.198	0.39	0.101
1995	244	637	94	2289	3825	1370	284	0.101	0.195	0.053
1996	321	911	113	2268	3687	1395	192	0.094	0.185	0.048
1997	1577	4384	567	2583	4110	1623	355	0.107	0.22	0.051
1998	5223	12593	2166	2561	4034	1626	345	0.098	0.21	0.046
1999	10150	24869	4143	2479	3934	1562	116	0.065	0.126	0.033
2000	13984	33577	5824	2584	4018	1662	152	0.061	0.118	0.031
2001	8561	20456	3582	3290	4901	2209	125	0.050	0.099	0.025
2002	1605	4159	619	5388	7909	3671	401	0.062	0.138	0.028
2003	37736	89628	15888	8271	12113	5648	485	0.064	0.139	0.029
2004	329291	841875	128799	11581	16939	7918	775	0.075	0.151	0.037
2005	64328	155702	26577	16607	24194	11400	890	0.090	0.165	0.049
2006	35350	81507	15331	25800	37691	17661	2456	0.069	0.121	0.040
2007	14656	32538	6601	40761	60031	27676	5205	0.109	0.183	0.064
2008	22127	45342	10798	44131	63869	30493	14628	0.142	0.25	0.079
2009	49915	103774	24009	59545	89065	39810	4965	0.072	0.122	0.042
2010	54005	110743	26336	55071	80737	37564	2669	0.056	0.097	0.032
2011	10715	22266	5157	55750	81015	38364	5113	0.093	0.159	0.054
2012	5636	11613	2735	62882	89385	44237	5411	0.106	0.186	0.061
2013	2720	5596	1322	73048	103247	51681	5509	0.117	0.21	0.066
2014	1033	2214	482	89203	125502	63403	7893	0.142	0.25	0.081
2015	5298	11095	2530	75723	106997	53590	15755	0.21	0.36	0.120
2016	47421	101069	22250	70739	101537	49283	14818	0.23	0.40	0.136
2017	3874	8845	1697	82296	121270	55848	16300	0.24	0.39	0.143
2018	7781	24014	2521	74666	116000	48060	15068	0.26	0.44	0.155
2019	10314	29825	3567	66588	107218	41355	18074	0.35	0.58	0.21
2020	25521	70590	9226	62209	98747	39191	15933	0.37	0.65	0.21
2021	25521	651399	1000	67384	117926	38503	25829	0.53	1.28	0.22
2022*	7781			68494	139406	30495				

\* Recruitment is randomly resampled from the assessment estimates of 1973–2020.

## Sources and references

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

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