

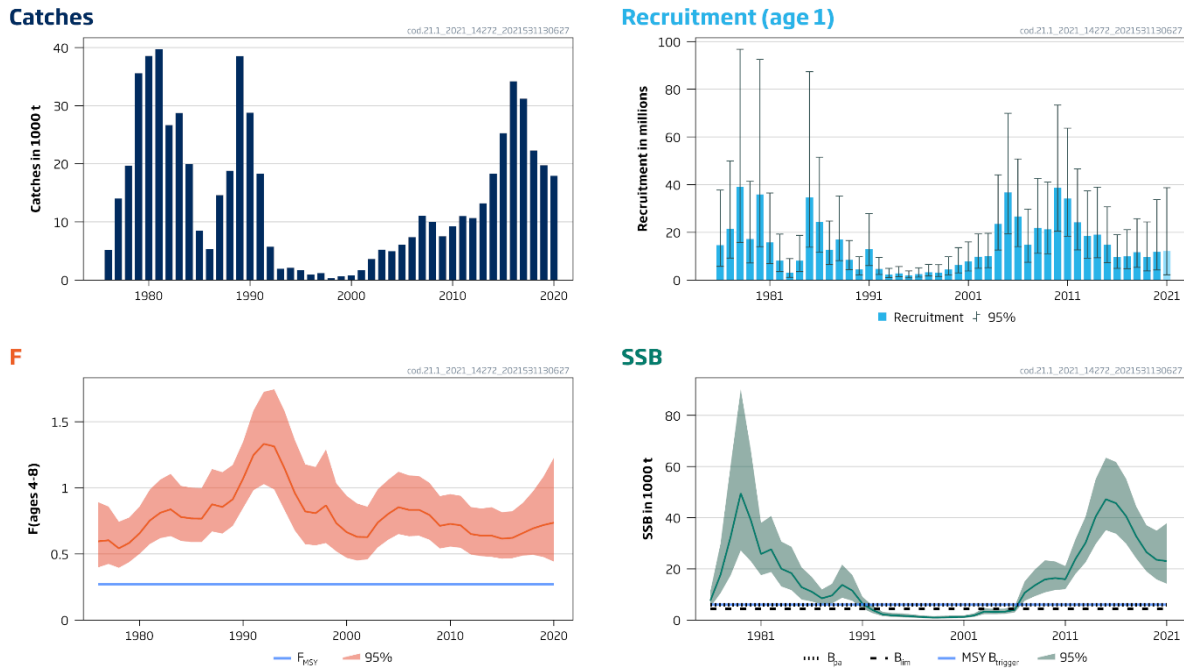
## Cod (*Gadus morhua*) in NAFO Subarea 1, inshore (West Greenland cod)

### ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2022 should be no more than 4780 tonnes.

### Stock development over time

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



**Figure 1** Cod in NAFO Subarea 1, inshore. Summary of the stock assessment. The assumed recruitment value for 2021 is shaded in a lighter colour.

### Catch scenarios

**Table 1** Cod in NAFO Subarea 1, inshore. Assumptions made for the interim year and in the 2021 forecast.

Variable	Value	Notes
$F_{ages\ 4-8}$ (2021)	0.74	$F_{sq} = F_{2020}$
SSB (2022)	20199	Fishing at $F_{sq}$ ; tonnes
$R_{age\ 1}$ (2021)	11666	Median of 1000 randomly drawn N at age 1 from 1973–2020; thousands
Catch (2021)	11793	Based on $F_{ages\ 4-8}$ (2021) = 0.74; tonnes

**Table 2** Cod in NAFO Subarea 1, inshore. Annual catch scenarios. All weights are in tonnes.

Rationale	Catch (2022)	F (2022)	SSB (2023)	% SSB change *	% advice change **
ICES advice basis					
MSY approach: $F_{MSY}$	4780	0.27	23928	+19%	-10%
Other scenarios					
F = 0	0	0	29570	+46%	-100%
F = $F_{2021}$ (status quo)	10141	0.74	17893	-11%	+92%

\*  $SSB_{2023}$  relative to  $SSB_{2022}$ .

\*\* Advice value for 2022 relative to the advice value for 2021.

**Basis of the advice**

**Table 3** Cod in NAFO Subarea 1, inshore. The basis of the advice.

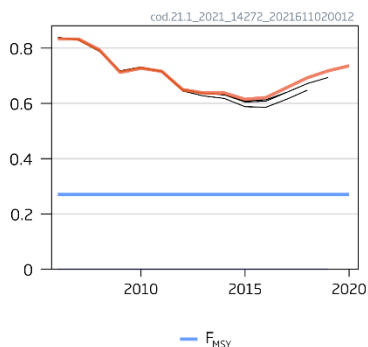
Advice basis	MSY approach.
Management plan	ICES is not aware of any agreed precautionary management plan for cod in this area.

**Quality of the assessment**

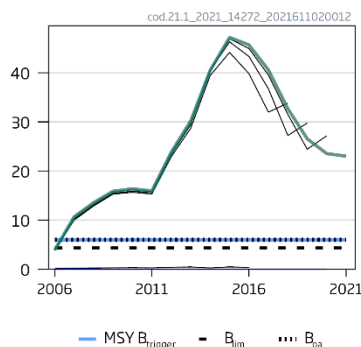
The assesment is considered uncertain because of known stock mixing that affects both surveys and commercial catches.

Genetics have shown that the reported landings include catches of other cod stocks in addition to the West Greenland inshore stock. This may cause a considerable overestimation of stock size of the inshore cod stock.

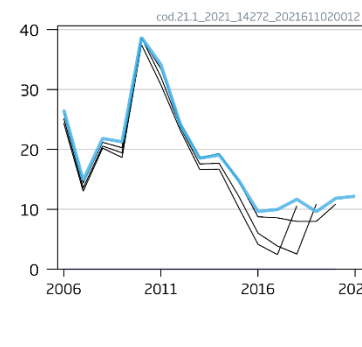
**F (ages 4-8)**



**SSB (1000 t)**



**Rec (age 1; Millions)**



**Figure 2** Cod in NAFO Subarea 1. Historical assessment results. Final-year recruitment assumptions included for each line.

**Issues relevant for the advice**

The TAC area covers NAFO Subarea 1 inshore. Several cod stocks mix in this inshore area, including West Greenland inshore and offshore cod, East Greenland cod, and Icelandic cod (Storr-Paulsen *et al.*, 2004). The proportional contribution of each stock is still being investigated, but preliminary results suggest a 50% mix between inshore and other stocks in the catches.

When setting species TAC there is an increased risk of overexploitation of the weakest stock. The West Greenland offshore stock is in a depleted condition and the current ICES advice is zero catch. Bycatch of offshore cod should be kept as low as possible in order to promote rebuilding of the offshore cod stock. This could be achieved by area closures in combination with genetic monitoring.

TACs have not been caught in the last four years, and based on information from the fishing industry it is unlikely that the species TAC of 21 000 tonnes in 2021 will be caught. ICES assumes that fishing continues at current effort levels in 2021, resulting in estimated catches of inshore cod equal to 11 793 tonnes.

Preliminary genetic studies show that there are bycatches of 30–50% of offshore cod in the inshore area. A considerable proportion of these are from the West Greenland offshore stock. This stock is in a depleted condition; the current ICES advice is zero catch, so the bycatch will prolong the stock recovery time.

## Reference points

**Table 4** Cod in NAFO Subarea 1, inshore. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{\text{trigger}}$	5983 tonnes	Assumed at $B_{\text{pa}}$	ICES (2018)
	$F_{\text{MSY}}$	0.27	Stochastic simulations with segmented regression and a Beverton–Holt stock-recruitment curve from 1973 to 2017.	ICES (2018)
Precautionary approach	$B_{\text{lim}}$	4346 tonnes	Breakpoint in segmented regression	ICES (2018)
	$B_{\text{pa}}$	5983 tonnes	$B_{\text{lim}} \times e^{1.645\sigma}$ , $\sigma = 0.194$	ICES (2018)
	$F_{\text{lim}}$	-	Not defined	
	$F_{\text{pa}}$	-	Not defined	
Management plan	$SSB_{\text{mgt}}$	-	-	
	$F_{\text{mgt}}$	-	-	

## Basis of the assessment

**Table 5** Cod in NAFO Subarea 1, inshore. Basis of the assessment and advice.

ICES stock data category	1 ( <a href="#">ICES, 2021a</a> )
Assessment type	Age-based analytical assessment (SAM; ICES, 2021b) that uses catches in the model and in the forecast.
Input data	Catch-at-age and age-disaggregated survey indices (WGRL-Gill, N6619, since 1987).
Discards and bycatch	Discarding is considered negligible.
Indicators	None.
Other information	Benchmarked in 2018 (ICES, 2018).
Working group	North-Western Working Group ( <a href="#">NWWG</a> ).

## History of the advice, catch, and management

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

Year	ICES advice	Catch corresponding to advice	Agreed TAC	ICES catch
2012	-	-	15 000	10 672
2013	Mean catch in recent 10 years	8000	13 500	13 202
2014	20% increase in catch (relative to 3-year average)	< 12 379	18 500	18 331
2015	Same basis as 2014	< 12 379	27 500	25 272
2016	Same advice as in 2014	< 12 379	35 400	34 204
2017	Precautionary approach (same advice value as for 2014–2016)	< 12 379	36 500	31 220
2018	MSY approach	< 8858	36 500	22 290
2019	MSY approach	≤ 6806	27 800	19 753
2020	MSY approach	≤ 5537	29 800	17 926
2021	MSY approach	≤ 5283	21 000	
2022	MSY approach	≤ 4780		

## History of the catch and landings

**Table 7** Cod in NAFO Subarea 1, inshore. Catch distribution by fleet in 2020 as estimated by ICES. All weights are in tonnes.

Catch (2020)	Catches				Discards
	Poundnet 69%	Longline 17%	Gillnet 6%	Jigs 8%	Discarding is considered negligible
17 926	17 926				

**Table 8** Historical catches of cod in NAFO Subarea 1, inshore. All weights are in tonnes.

Year	NAFO divisions						Total West Greenland	ICES Division 14.b	
	1A	1B	1C	1D	1E	1F			Unknown NAFO division
1911				19				19	
1912				5				5	
1913				66				66	
1914				60				60	
1915		47	6	45				98	
1916		66	24	103				193	
1917		67	28	59				154	
1918		106	26	140		169		441	
1919		39	37	140	148	137		501	
1920		117	32	187	23	95		454	
1921		116	92	97	7	196		508	
1922		82	178	144	40	158		602	
1923		120	116	147	-	307		690	
1924		131	223	221	1	267		843	
1925		122	371	318	45	168		1024	
1926		97	785	673	170	499		2224	
1927		282	974	982	305	1027		3570	
1928		426	888	1153	497	1199		4163	
1929		1479	1572	1335	642	2052		7080	
1930	137	2208	2326	1681	994	2312		9658	
1931	315	1905	2026	1520	835	2453		9054	
1932	358	1713	2130	1042	731	3258		9232	
1933	304	1799	1743	1148	948	2296		8238	
1934	451	2080	1473	652	921	3591		9168	
1935	524	1870	1277	769	670	2466		7576	
1936	329	2039	1199	705	717	2185		7174	
1937	135	1982	1433	854	496	2061		6961	
1938	258	1743	1406	703	347	1035		5492	
1939	416	2256	1732	896	431	1430		7161	
1940	482	2478	1600	1061	646	1759		8026	
1941	636	3229	1473	823	593	1868		8622	
1942	879	3831	2249	1332	1003	2733		12 027	
1943	1507	5056	2016	1240	1134	2073		13 026	
1944	1795	4322	2355	1547	1198	2168		13 385	
1945	1585	4987	2844	1207	1474	2192		14 289	
1946	1889	5210	2871	1438	1139	2715		15 262	
1947	1573	5261	3323	2096	1658	4118		18 029	
1948	1130	5660	3756	1657	1652	4820		18 675	
1949	1403	4580	3666	2110	2151	3140		17 050	
1950	1657	6358	4140	2357	2278	4383		21 173	
1951	1277	5322	3324	2571	2101	3605		18 200	
1952	646	4443	2906	2437	2216	4078		16 726	
1953	1092	5030	3662	5513	3093	4261		22 651	
1954	950	6164	3118	3275	1773	3418		18 698	
1955	591	5523	3225	4061	2773	3614		19787	
1956	475	5373	3175	5127	3292	3586		21 028	
1957	277	6146	3282	5257	4380	5251		24 593	
1958	19	6178	3724	5456	3975	6450		25 802	
1959	237	6404	5590	5009	3767	6570		27 577	
1960	188	6741	6230	3614	3626	6610		27 009	
1961	601	6569	6726	4178	6182	9709		33 965	

Year	NAFO divisions							Total West Greenland	ICES Division 14.b
	1A	1B	1C	1D	1E	1F	Unknown NAFO division		
1962	315	7809	6269	3824	5638	11 525		35 380	
1963	295	4877	3178	2804	3078	9037		23 269	
1964	275	3311	2447	8766	2206	4981		21 986	
1965	325	5209	4818	6046	2477	5447		24 322	
1966	483	8738	5669	7022	2335	4799		29 046	
1967	310	5658	6248	6747	2429	6132		27 524	
1968	142	1669	2738	6123	2837	7207		20 716	
1969	57	1767	4287	7540	2017	5568		21 236	
1970	136	1469	2219	3661	2424	5654		15 563	
1971	255	1807	2011	3802	1698	3933		13 506	
1972	263	1855	3328	3973	1533	3696		14 648	
1973	158	1362	1225	3682	1614	1581		9622	
1974	454	926	1449	2588	1628	1593		8638	
1975	216	1038	1930	1269	964	1140		6557	
1976	204	644	1224	904	1367	831		5174	
1977	216	580	2505	2946	3521	4231		13 999	
1978	348	1587	3244	2614	4642	7244		19 679	
1979	433	1768	2201	6378	9609	15201		35 590	
1980	719	2303	2269	7781	10 647	14 852		38 571	
1981	281	2810	3599	6119	7711	11 505	7678	39 703	
1982	206	2448	3176	7186	4536	3621	5491	26 664	
1983	148	2803	3640	7430	5016	2500	7205	28742	
1984	175	3908	1889	5414	1149	1333	6090	19 958	
1985	149	2936	957	1976	1178	1245		8441	
1986	76	1038	255	1209	1456	1268		5302	
1987	77	2366	423	6407	3602	1326	403	14 604	
1988	333	6294	1342	2992	3346	4484		18 791	
1989	634	8491	5671	8212	10845	4676		38 529	
1990	476	9857	1482	9826	1917	5241		28 799	
1991	876	8641	917	2782	1089	4007		18 312	
1992	695	2710	563	1070	239	450		5727	
1993	333	327	168	970	19	109		1926	
1994	209	332	589	914	11	62		2117	
1995	53	521	710	332	4	81		1701	
1996	41	211	471	164	11	46		944	
1997	18	446	198	99	13	130	282	1186	
1998	9	118	79	78	-	38		322	
1999	68	142	55	336	8	4		613	
2000	154	266	-	332	-	12		764	
2001	117	1183	245	54	-	81		1680	
2002	263	1803	505	214	24	813		3622	
2003	1109	1522	334	274	3	479	1494	5215	
2004	535	1316	242	116	47	84	2608	4948	
2005	650	2351	1137	1162	278	382	83	6043	
2006	922	1682	577	943	630	1461	1173	7388	
2007	416	2547	1195	1842	659	4391		11 050	42
2008	870	3066	1539	3172	225	1133		10 005	6
2009	325	1288	1189	2009	1142	1581		7534	2
2010	559	2990	1607	1795	1458	859		9268	2
2011	567	2364	2850	2905	1274	1047		11 007	-
2012	546	1376	2061	4375	1989	325		10 672	0
2013	1506	2552	2784	4711	1450	198		13 202	35
2014	3084	6142	3710	4629	684	82		18 331	38
2015	4088	7912	6426	6613	117	115		25 272	50

Year	NAFO divisions							Total West Greenland	ICES Division 14.b
	1A	1B	1C	1D	1E	1F	Unknown NAFO division		
2016	5929	11 466	11 270	5279	87	173		34 204	39
2017	5797	11 110	10 060	4066	56	131		31 220	82
2018	2213	6422	6190	7043	31	390		22 290	51
2019	1987	2925	4214	8673	131	1823		19 753	143
2020	1382	2324	4482	7412	222	2104		17 926	223

### Summary of the assessment

**Table 9** Cod in NAFO Subarea 1, inshore. Assessment summary. High and low values correspond to 95% confidence intervals. Weights are in tonnes, recruitment in thousands.

Year	Recruitment			SSB			Landings	Fishing mortality		
	Recruitment Age 1	High	Low	SSB	High	Low		F <sub>ages 4-8</sub>	High	Low
1976	14 624	37 756	5665	7498	11 151	5041	5174	0.60	0.89	0.40
1977	21 448	49 897	9220	17 623	29 732	10 446	13 999	0.60	0.86	0.42
1978	39 060	96 788	15 763	32 461	60 406	17 444	19 679	0.54	0.74	0.40
1979	17 196	41 376	7146	49 543	90 228	27 203	35 590	0.58	0.78	0.44
1980	35 916	92 546	13 939	38 984	66 222	22 949	38 571	0.66	0.86	0.50
1981	15 819	36 518	6853	25 801	37 971	17 532	39 703	0.75	0.99	0.57
1982	8177	19 219	3479	27 627	40 663	18 771	26 664	0.81	1.06	0.62
1983	3073	8971	1053	20 057	30 670	13 117	28 742	0.84	1.10	0.64
1984	8103	18 769	3498	18 294	28 635	11 688	19 958	0.78	1.01	0.60
1985	34 624	87 344	13 725	12 828	20 568	8001	8441	0.77	1.00	0.59
1986	24 423	51 499	11 583	11 056	16 863	7249	5302	0.77	1.00	0.59
1987	12 688	24 707	6516	8459	11 920	6003	14 604	0.88	1.14	0.67
1988	16 891	35 254	8093	9588	14 167	6489	18 791	0.86	1.12	0.65
1989	8490	16 602	4342	13 738	21 676	8707	38 529	0.91	1.17	0.71
1990	4479	9729	2062	11 484	17 582	7501	28 799	1.07	1.35	0.85
1991	12 947	27 879	6013	6388	9031	4518	18 312	1.25	1.58	0.98
1992	4630	9406	2279	3872	5614	2671	5727	1.33	1.73	1.03
1993	2212	4867	1006	2187	3187	1500	1926	1.31	1.75	0.99
1994	2746	5644	1336	1802	2707	1199	2117	1.15	1.58	0.83
1995	1837	3799	888	1619	2548	1029	1701	0.96	1.36	0.68
1996	2487	5095	1214	1388	2131	904	944	0.82	1.18	0.57
1997	3273	6537	1639	1114	1718	722	1186	0.81	1.16	0.56
1998	3046	6440	1441	919	1560	542	322	0.87	1.29	0.58
1999	4438	9713	2028	984	1653	585	613	0.73	1.03	0.52
2000	6318	13 584	2938	1114	1743	711	764	0.66	0.94	0.47
2001	7752	15 971	3763	1196	1821	786	1680	0.63	0.88	0.45
2002	9750	19 334	4916	1759	2556	1211	3622	0.63	0.86	0.46
2003	10 049	19 558	5163	3260	4662	2280	5215	0.74	0.99	0.55
2004	23 537	44 082	12 568	3107	4285	2253	4948	0.80	1.06	0.61
2005	36 788	69 918	19 357	3239	4440	2363	6043	0.85	1.12	0.65
2006	26 635	50 752	13 978	3921	5242	2933	7388	0.83	1.09	0.63
2007	14 870	29 756	7431	10 671	15 141	7520	11 050	0.83	1.09	0.64
2008	21 829	42 645	11 173	13 550	19 732	9305	10 005	0.79	1.04	0.61
2009	21 261	41 061	11 008	15 873	23 336	10 797	7534	0.71	0.94	0.54
2010	38 708	73 401	20 412	16 382	22 878	11 731	9268	0.73	0.95	0.56
2011	34 175	63 675	18 342	15 929	21 093	12 029	11 007	0.72	0.94	0.55
2012	24 212	46 528	12 600	23 854	31 567	18 027	10 672	0.65	0.85	0.50
2013	18 524	37 394	9177	30 201	40 455	22 547	13 202	0.64	0.84	0.48
2014	19 049	38 951	9316	40 495	55 138	29 740	18 331	0.64	0.85	0.48
2015	14 871	30 707	7201	47 217	63 461	35 131	25 272	0.62	0.82	0.46
2016	9627	18 952	4891	45 668	61 802	33 745	34 204	0.62	0.82	0.47
2017	9962	21 097	4704	40 570	55 190	29 822	31 220	0.66	0.89	0.49

Year	Recruitment			SSB			Landings	Fishing mortality		
	Recruitment Age 1	High	Low	SSB	High	Low		F <sub>ages 4-8</sub>	High	Low
2018	11 666	25 700	5295	32 670	44 361	24 061	22 288	0.69	0.97	0.49
2019	9600	24 354	3784	26 544	37 061	19 012	19 753	0.72	1.08	0.48
2020	11 829	33 708	4151	23 537	34 928	15 862	17 926	0.74	1.23	0.44
2021*	11 666	38 708	2212	23 024	37 840	14 190				

\* Median of 1000 randomly drawn N at age 1 from 1973–2020.

## Sources and references

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

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