

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 2023 should be no more than 4590 tonnes.

Stock development over time

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

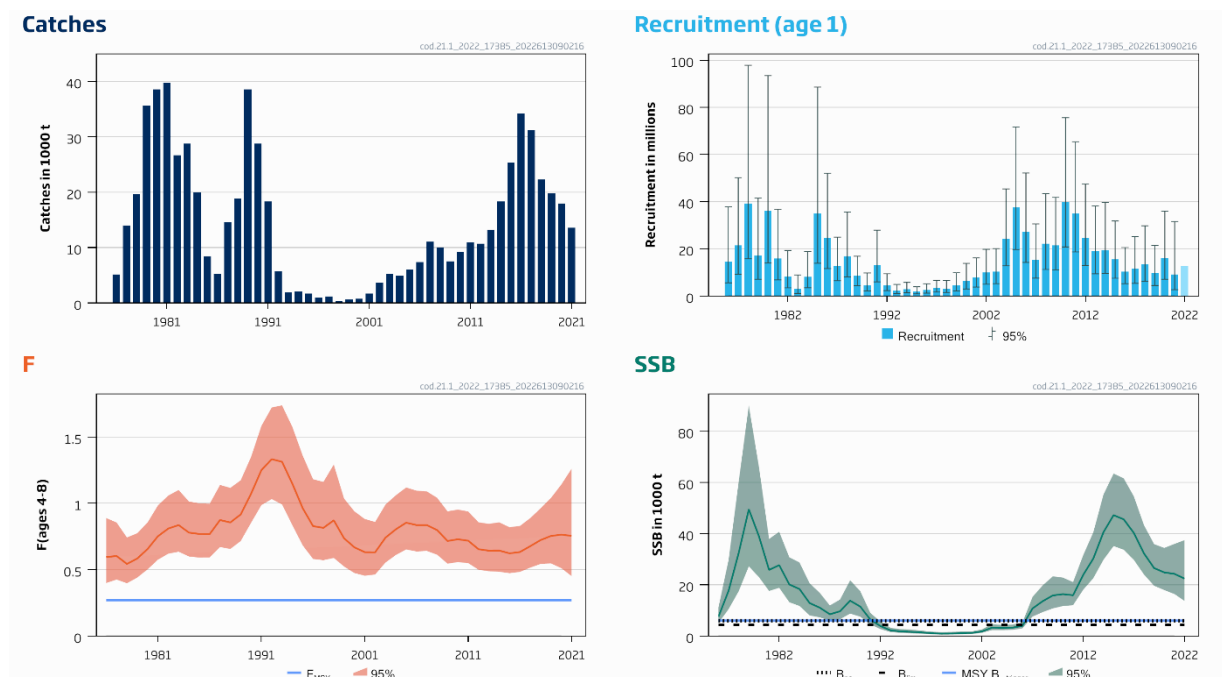


Figure 1 Cod in NAFO Subarea 1, inshore. Summary of the stock assessment. The assumed recruitment value for 2022 is shaded in a lighter colour.

Catch scenarios

Table 1 Cod in NAFO Subarea 1, inshore. Values in the forecast and for the interim year.

Variable	Value	Notes
$F_{ages\ 4-8}$ (2022)	0.755	$F_{sq} = F_{2021}$
SSB (2023)	20388	Short-term forecast; tonnes
$R_{age\ 1}$ (2022)	12732	Sample from the time-series 1976–2021*; thousands
Catch (2022)	11310	Based on $F_{ages\ 4-8}$ (2022) = 0.755; tonnes

* Recruitment is randomly resampled from the assessment estimates of 1976–2021.

Table 2 Cod in NAFO Subarea 1, inshore. 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}	4590	0.27	24549	+20	-4	-78
Other scenarios						
$F = 0$	0	0	30348	+49	-100	-100
$F = F_{2022}$	9913	0.755	18549	-9	+107	-53

* SSB_{2024} relative to SSB_{2023} .

** Advice value for 2023 relative to the advice value for 2022 (4780 tonnes).

*** Advice value for 2023 relative to TAC for 2022 (21 000 tonnes)

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 assessment 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.

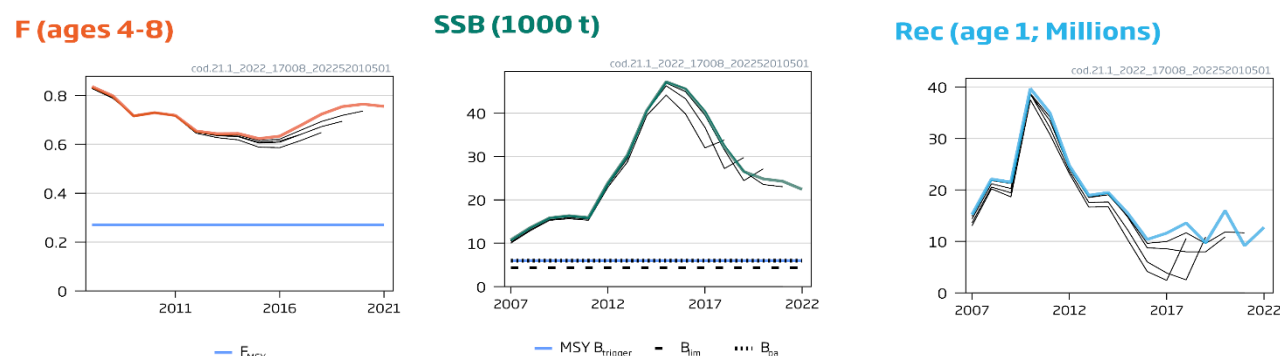


Figure 2 Cod in NAFO Subarea 1, inshore. Historical assessment results. Final-year recruitment assumption included for each line.

Issues relevant for the advice

The TAC area covers NAFO Subarea 1 inshore. The current stock boundaries do not reflect the complexity of the different genetic components that are caught in the area (ICES, 2022a). This will be the core issue dealt with in the 2023 benchmark.

A considerable proportion of catches in the inshore area are considered to originate from the West Greenland offshore stock, which is in a depleted condition; current ICES advice for that stock is zero (ICES, 2021) catch, so the mixed catch will prolong the stock recovery time.

TACs have not been taken in the last four years, and based on information from the fishing industry it is unlikely that the TAC of 21 000 tonnes in 2022 will be taken. ICES assumes that fishing will continue at current effort levels in 2022, resulting in estimated catches equal to 11 310 tonnes in 2022. The agreed TAC has never followed the catch advice.

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 _{trigger}	5983 tonnes	Assumed at B _{pa}	ICES (2018)
	F _{MSY}	0.27	Stochastic simulations with segmented regression and a Beverton–Holt stock-recruitment curve from 1976 to 2017	ICES (2018)
Precautionary approach	B _{lim}	4346 tonnes	Breakpoint in segmented regression	ICES (2018)
	B _{pa}	5983 tonnes	B _{lim} × e ^{1.645σ} , σ = 0.194	ICES (2018)
	F _{lim}	-	Not defined	
	F _{pa}	-	Not defined	
Management plan	SSB _{mgt}	-	-	
	F _{mgt}	-	-	

Basis of the assessment

Table 5 Cod in NAFO Subarea 1, inshore. The basis of the assessment and advice.

ICES stock data category	1 (ICES, 2022b)
Assessment type	Age-based analytical assessment (SAM; ICES, 2022a) 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	Northwestern Working Group (NWWG)

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	-	-	15000	10672
2013	Mean catch in recent ten years	8000	13500	13202
2014	20% increase in catch (relative to three-year average)	< 12379	18500	18331
2015	Same basis as 2014	< 12379	27500	25272
2016	Same advice as in 2014	< 12379	35400	34204
2017	Precautionary approach (same advice value as for 2014–2016)	< 12379	36500	31220
2018	MSY approach	< 8858	36500	22290
2019	MSY approach	≤ 6806	27800	19753
2020	MSY approach	≤ 5537	29800	17926
2021	MSY approach	≤ 5283	21000	13580
2022	MSY approach	≤ 4780	21000	
2023	MSY approach	≤ 4590		

History of the catch and landings

Table 7 Cod in NAFO Subarea 1, inshore. Catch distribution by fleet in 2021 as estimated by ICES. All weights are in tonnes.

Catch (2021)	Catches				Discards
13580	Poundnet 62%	Longline 18%	Gillnet 7%	Jigs 13%	Discarding is considered negligible
	13580				

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		12027	
1943	1507	5056	2016	1240	1134	2073		13026	
1944	1795	4322	2355	1547	1198	2168		13385	
1945	1585	4987	2844	1207	1474	2192		14289	
1946	1889	5210	2871	1438	1139	2715		15262	
1947	1573	5261	3323	2096	1658	4118		18029	
1948	1130	5660	3756	1657	1652	4820		18675	
1949	1403	4580	3666	2110	2151	3140		17050	
1950	1657	6358	4140	2357	2278	4383		21173	
1951	1277	5322	3324	2571	2101	3605		18200	
1952	646	4443	2906	2437	2216	4078		16726	
1953	1092	5030	3662	5513	3093	4261		22651	
1954	950	6164	3118	3275	1773	3418		18698	
1955	591	5523	3225	4061	2773	3614		19787	
1956	475	5373	3175	5127	3292	3586		21028	
1957	277	6146	3282	5257	4380	5251		24593	
1958	19	6178	3724	5456	3975	6450		25802	
1959	237	6404	5590	5009	3767	6570		27577	
1960	188	6741	6230	3614	3626	6610		27009	
1961	601	6569	6726	4178	6182	9709		33965	
1962	315	7809	6269	3824	5638	11525		35380	
1963	295	4877	3178	2804	3078	9037		23269	
1964	275	3311	2447	8766	2206	4981		21986	
1965	325	5209	4818	6046	2477	5447		24322	

Year	NAFO divisions							Total West Greenland	ICES Division 14.b
	1A	1B	1C	1D	1E	1F	Unknown NAFO division		
1966	483	8738	5669	7022	2335	4799		29046	
1967	310	5658	6248	6747	2429	6132		27524	
1968	142	1669	2738	6123	2837	7207		20716	
1969	57	1767	4287	7540	2017	5568		21236	
1970	136	1469	2219	3661	2424	5654		15563	
1971	255	1807	2011	3802	1698	3933		13506	
1972	263	1855	3328	3973	1533	3696		14648	
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		13999	
1978	348	1587	3244	2614	4642	7244		19679	
1979	433	1768	2201	6378	9609	15201		35590	
1980	719	2303	2269	7781	10647	14852		38571	
1981	281	2810	3599	6119	7711	11505	7678	39703	
1982	206	2448	3176	7186	4536	3621	5491	26664	
1983	148	2803	3640	7430	5016	2500	7205	28742	
1984	175	3908	1889	5414	1149	1333	6090	19958	
1985	149	2936	957	1976	1178	1245		8441	
1986	76	1038	255	1209	1456	1268		5302	
1987	77	2366	423	6407	3602	1326	403	14604	
1988	333	6294	1342	2992	3346	4484		18791	
1989	634	8491	5671	8212	10845	4676		38529	
1990	476	9857	1482	9826	1917	5241		28799	
1991	876	8641	917	2782	1089	4007		18312	
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		11050	42
2008	870	3066	1539	3172	225	1133		10005	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		11007	-
2012	546	1376	2061	4375	1989	325		10672	0
2013	1506	2552	2784	4711	1450	198		13202	35
2014	3084	6142	3710	4629	684	82		18331	38
2015	4088	7912	6426	6613	117	115		25272	50
2016	5929	11466	11270	5279	87	173		34204	39
2017	5797	11110	10060	4066	56	131		31220	82
2018	2213	6422	6190	7043	31	390		22290	51
2019	1987	2925	4214	8673	131	1823		19753	143
2020	1382	2324	4482	7412	222	2104		17926	223
2021	1133	2910	4144	4671	93	629		13580	286

Summary of the assessment

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

Year	Recruitment			Spawning-stock biomass			Landings	Fishing mortality		
	Age 1	High	Low	SSB	High	Low		Ages 4–8	High	Low
1976	14554	37795	5605	7491	11142	5037	5174	0.60	0.89	0.40
1977	21442	50154	9167	17605	29707	10433	13999	0.60	0.86	0.43
1978	39305	97839	15790	32425	60337	17425	19679	0.54	0.74	0.40
1979	17135	41473	7080	49521	90156	27201	35590	0.58	0.78	0.44
1980	36164	93486	13989	38972	66125	22969	38571	0.66	0.86	0.50
1981	15837	36757	6823	25823	37955	17570	39703	0.75	0.99	0.57
1982	8185	19321	3467	27684	40742	18811	26664	0.81	1.06	0.62
1983	3044	8897	1041	20119	30760	13159	28742	0.84	1.10	0.64
1984	8117	18873	3491	18362	28757	11725	19958	0.78	1.01	0.60
1985	35014	88575	13841	12861	20626	8019	8441	0.77	1.00	0.59
1986	24564	52016	11600	11068	16879	7258	5302	0.77	1.00	0.59
1987	12732	24922	6504	8480	11938	6024	14604	0.87	1.14	0.67
1988	16954	35540	8087	9646	14273	6518	18791	0.86	1.12	0.66
1989	8581	16846	4370	13803	21780	8747	38529	0.92	1.17	0.72
1990	4462	9743	2043	11483	17542	7517	28799	1.07	1.35	0.85
1991	12937	27932	5992	6373	9000	4513	18312	1.25	1.58	0.99
1992	4620	9434	2262	3855	5592	2657	5727	1.33	1.72	1.03
1993	2209	4879	1000	2176	3168	1494	1926	1.31	1.74	0.99
1994	2782	5745	1347	1794	2688	1198	2117	1.15	1.58	0.83
1995	1859	3855	896	1613	2534	1026	1701	0.96	1.36	0.68
1996	2488	5128	1208	1376	2111	897	944	0.83	1.18	0.58
1997	3304	6632	1646	1100	1694	714	1186	0.82	1.16	0.57
1998	3101	6594	1458	907	1538	535	322	0.87	1.29	0.59
1999	4477	9858	2034	967	1616	579	613	0.74	1.04	0.52
2000	6382	13804	2951	1102	1720	706	764	0.67	0.94	0.47
2001	7812	16169	3774	1192	1813	784	1680	0.63	0.88	0.45
2002	9932	19777	4988	1765	2565	1214	3622	0.63	0.86	0.46
2003	10254	20054	5243	3259	4660	2280	5215	0.74	0.99	0.55
2004	24124	45395	12820	3106	4284	2252	4948	0.80	1.06	0.61
2005	37563	71727	19672	3248	4452	2369	6043	0.85	1.12	0.65
2006	27236	52157	14222	3934	5256	2945	7388	0.84	1.10	0.64
2007	15189	30569	7547	10758	15288	7570	11050	0.84	1.09	0.64
2008	22106	43435	11251	13584	19808	9315	10005	0.80	1.04	0.61
2009	21517	41788	11079	15838	23308	10762	7534	0.72	0.94	0.55
2010	39687	75604	20833	16339	22824	11697	9268	0.73	0.95	0.56
2011	34967	65401	18695	15911	21075	12013	11007	0.72	0.94	0.55
2012	24730	47469	12883	23876	31612	18033	10672	0.65	0.86	0.50
2013	18950	38212	9398	30279	40599	22582	13202	0.64	0.85	0.49
2014	19494	39614	9593	40568	55312	29754	18331	0.64	0.86	0.48
2015	15474	31791	7532	47229	63509	35123	25272	0.62	0.82	0.47
2016	10375	20560	5236	45565	61618	33694	34204	0.63	0.83	0.48
2017	11606	25182	5349	40253	54578	29688	31220	0.68	0.89	0.52
2018	13572	29792	6183	32233	43314	23987	22288	0.72	0.96	0.54
2019	9732	21451	4415	26526	35904	19598	19753	0.75	1.04	0.55
2020	15978	36037	7084	24840	34427	17923	17926	0.76	1.14	0.51
2021	9146	31587	2648	24281	35993	16380	13580	0.76	1.26	0.45
2022*	12732			22418	37457	13677				

* Recruitment is randomly resampled from the assessment estimates of 1976–2021.

Sources and references

- ICES. 2018. Report of the InterBenchmark Protocol on Greenland Cod (IBPGCod), 8–9 January 2018, Copenhagen, Denmark. ICES CM 2018/ ACOM:30. 205 pp. <https://doi.org/10.17895/ices.pub.5266>.
- ICES. 2021. Cod (*Gadus morhua*) in NAFO divisions 1.A-E, offshore (West Greenland). In Report of the ICES Advisory Committee, 2021. ICES Advice 2021, cod.21.1a-e, <https://doi.org/10.17895/ices.advice.7739>
- ICES. 2022a. Northwestern Working Group (NWWG). ICES Scientific Reports. 4:42. <http://doi.org/10.17895/ices.pub.19771381>.
- ICES. 2022b. Advice on fishing opportunities. In Report of the ICES Advisory Committee, 2022. ICES Advice 2022, Section 1.1.1. <https://doi.org/10.17895/ices.advice.19928060>.
- Storr-Paulsen, M., Wieland, K., Hovgård, H., and Rätz, H-J. 2004. Stock structure of Atlantic cod (*Gadus morhua*) in West Greenland: implications of transport and migration. ICES Journal of Marine Science 61: 972–982. <https://doi.org/10.1016/j.icesjms.2004.07.021>.

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

Recommended citation: ICES. 2022. Cod (*Gadus morhua*) in NAFO Subarea 1, inshore (West Greenland cod). In Report of the ICES Advisory Committee, 2022. ICES Advice 2022, cod.21.1, <https://doi.org/10.17895/ices.advice.19447835>