Cod (*Gadus morhua*) in subareas 1 and 2 north of 67°N (Norwegian Sea and Barents Sea), northern Norwegian coastal cod

ICES advice on fishing opportunities

Please note: The present advice replaces the advice given in June 2021 for catches in 2022.

ICES advises that when the MSY approach is applied, catches in 2022 should be no more than 7865[†] tonnes (recreational and commercial catches combined).

ICES recommends the development of a rebuilding plan for this stock.

Stock development over time

Spawning-stock size is below B_{pa} and B_{lim}; no reference points for fishing pressure have been defined for this stock.

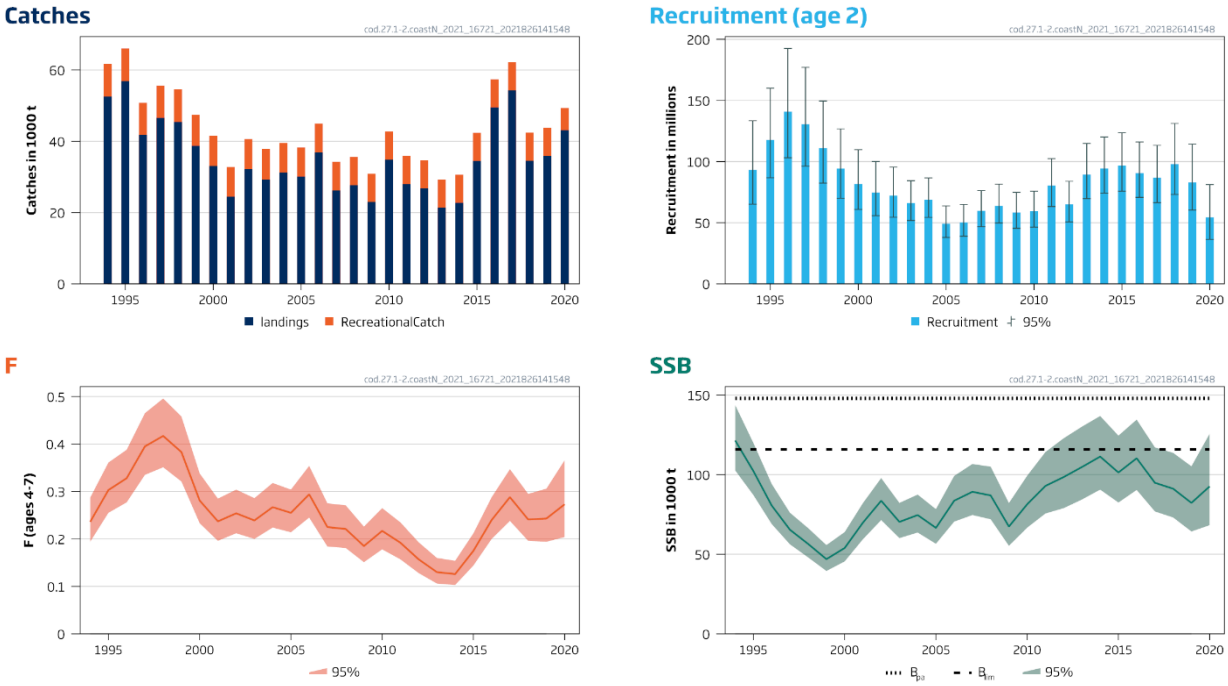

Figure 1 Cod in subareas 1 and 2 north of 67°N, northern Norwegian coastal cod. Catch, recruitment, F, and SSB.

Catch scenarios

Table 1 Cod in subareas 1 and 2 north of 67°N, northern Norwegian coastal cod. Values in the forecast and for the interim year.

Variable	Value	Notes
$F_{ages\ 4–7}$ (2021)	0.27	F_{sq} = Fishing mortality in 2020
SSB (2021)	92 885	Short-term forecast fishing at *status quo* (F_{sq}); tonnes
$R_{age\ 2}$ (2021, 2022, and 2023)	88 137	Median, resampled recruitment (2011–2020); thousands
Total catch (2021)	47 809	Short-term forecast fishing at F_{sq}; tonnes.

[†] Value corrected. The assessment and advice were revised due to errors in stock identification (northern coastal cod vs. Northeast arctic cod) in the coastal survey in 2020. Values and figures have been updated in this sheet.

Table 2 Cod in subareas 1 and 2 north of 67°N, northern Norwegian coastal cod. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2022)	F_{total} (2022)	SSB (2022)*	% SSB change **	% Advice change ***	% Probability of SSB falling below Blim in 2022
ICES advice basis						
MSY approach	7865	0.039	115 782	25	-	50
Other scenarios						
F = 0	0	0	120 404	30	-	42
F = F_{2020}	48 497	0.275	92 748	−0.15	-	83
F = 0.1^	19 435	0.10	109 084	17	-	60

* For this stock, SSB is calculated at the time of survey (October) as maturity ogives and stock weights are from the survey. Thus SSB is influenced by fisheries between 1 January and 1 October. The actual spawning time is March–June.
** SSB in October 2022 relative to SSB in October 2021.
*** Advice value for 2022 relative to advice value for 2021. Not presented this year as it is the first advice for this stock.
^ Corresponding to the target F in 2021 according to the previous management plan for the combined northern and southern coastal cod.

Basis of the advice

Table 3 Cod in subareas 1 and 2 north of 67°N, northern Norwegian coastal cod. The basis of the advice.

Advice basis	MSY approach
Management plan	ICES is not aware of any agreed precautionary management plan for Northern Norwegian coastal cod. ICES advice for the Norwegian coastal cod stock before it was split into two stocks was based on the Norwegian rebuilding plan, which is not considered applicable to the new stock units.

Quality of the assessment

No historical assessment results are available as this is the first assessment for this stock.

A benchmark in 2021 (ICES, 2021a) resulted in a new stock definition. Uncertainty in splitting the catch between NEA cod and coastal cod impacts on the quality of the assessment. Difficulties in estimating recreational catch have a lesser impact on the assessment.

Issues relevant for the advice

The advice issued for Norwegian coastal cod prior to 2021 was for the entire stock complex north of 62°N (cod.27.1-2.coast). After the 2021 benchmark (ICES, 2021a), the stock was split into two units: 1) cod.27.1-2.coastN: Cod (*Gadus morhua*) in subareas 1 and 2 north of 67°N, northern Norwegian coastal cod, presented in this advice sheet; and 2) cod.27.2.coastS: Cod (*Gadus morhua*) in Subarea 2 between 62°N and 67°N, southern Norwegian coastal cod, presented in a separate advice sheet.

The split of the coastal cod stock into two units—one data-rich in the north and one data-limited in the south—combined with improved genetic stock identification techniques improves the spatial resolution of the assessment and allows development of more targeted management measures. The stock split follows the Norwegian catch reporting areas, with areas 0, 3, 4, and 5 encompassing the northern stock and areas 6 and 7 encompassing the southern stock (Figure 2).

Norwegian coastal cod is taken as part of a mixed fishery with Northeast Arctic cod (cod.27.1-2), from which it cannot be visually distinguished. Without the option of setting a direct TAC, the coastal cod stocks are managed by technical regulatory measures (ICES, 2021c). Ensuring the stock is rebuilt above B_{lim} requires a new plan with regulations better targeted to areas and seasons where catches of coastal cod are high.

Because the SSB is currently below B_{lim}, ICES has provided the probability of SSB being below B_{lim} in 2022 for each of the scenarios presented in Table 2. Given the advised catch of 7865 tonnes, the probability of SSB being below B_{lim} in 2022 is 50%. In comparison, the scenario with 0 catches in 2022 has a 42% probability of SSB being below B_{lim} in 2022 while the scenario with status quo F has an 83% probability of SSB being below B_{lim} in 2022.

The fact that the catch advice of 7613 tonnes for cod.27.2coastS (southern Norwegian coastal cod) is similar to the catch advice of 7865 tonnes for cod.27.1-2coastN (northern Norwegian coastal cod) despite a considerably higher fraction of the coastal cod being in the north is not necessarily indicative of a better state for the southern stock. There is a more certain knowledge base supporting the assessment of the northern stock than the southern one. The northern stock is assessed to be below B_{lim}, and there is less evidence for this with the southern stock. The difference in advice basis is primarily due to the default ICES advice arising from the use of an analytic category 1 assessment for the northern stock and a data-limited category 3 assessment for the southern one.

The average recreational catch of northern Norwegian coastal cod in 2018–2020 was 7344 tonnes. Given the quota advice of 7865 tonnes for 2022, this implies a need for stronger regulatory measures not only of the commercial fishery but also of the recreational fishery.

The catch options table (Table 2) includes the advice that would have arisen from implementing the previous management plan for the combined coastal cod stock (northern and southern).

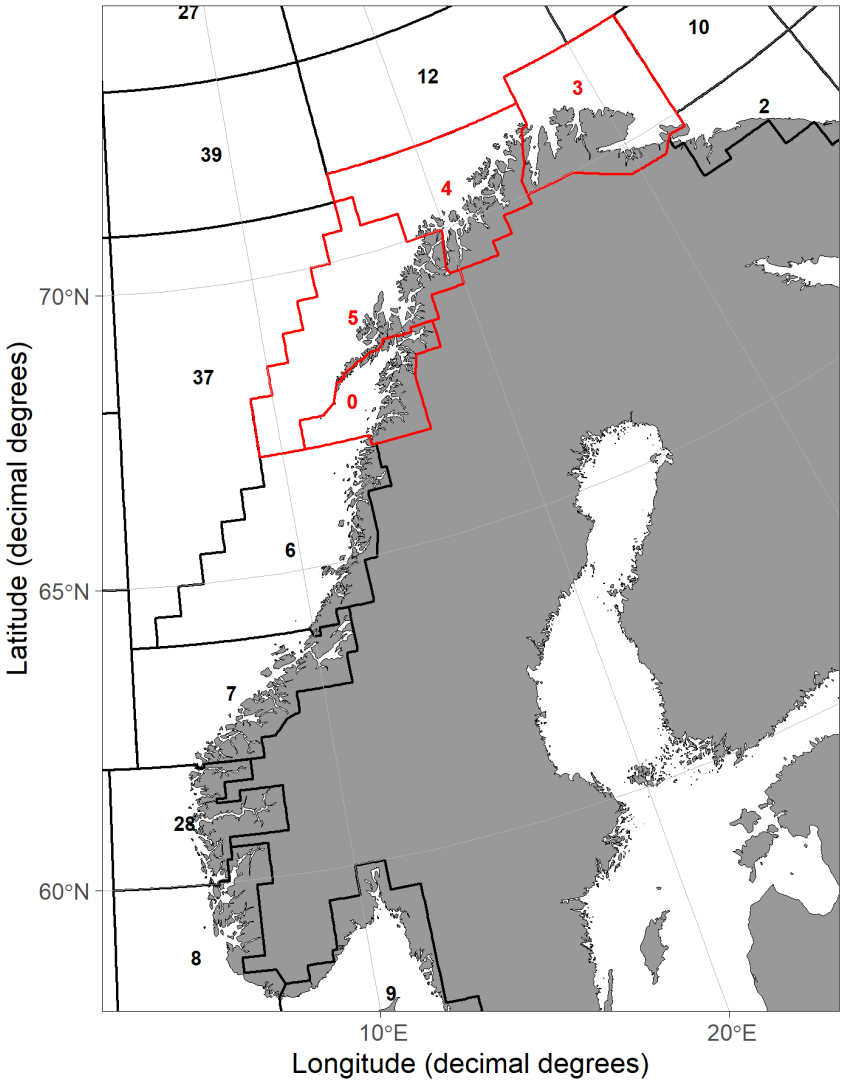

Figure 2 Cod in subareas 1 and 2 north of 67°N, northern Norwegian coastal cod. Norwegian catch reporting areas 0, 3, 4, and 5 (marked in red) are included in the new stock definition.

Reference points

Table 4 Cod in subareas 1 and 2 north of 67°N, northern Norwegian coastal cod. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	Not defined		
	F_{MSY}	Not defined		
Precautionary approach	B_{lim}	115 782	SSB in 2014 (highest observed since 1994), in tonnes, as estimated at 2021 benchmark with 1994–2019 data	ICES (2021a)
	B_{pa}	147 843	$B_{lim} \times \exp(1.645 \times \sigma)$, $\sigma = 0.15$; in tonnes	ICES (2021a)
	F_{lim}	Not defined		
	F_{pa}	Not defined		
Management plan	SSB_{mgt}	Not defined		
	F_{mgt}	Not defined		

Basis of the assessment

Table 5 Cod in subareas 1 and 2 north of 67°N, northern Norwegian coastal cod. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2021b).
Assessment type	Age-based analytical assessment (SAM; ICES, 2021c) that uses catches in the model and the forecast.
Input data	Commercial catches (national landings, ages, and mean weights-at-age from catch sampling); recreational catches [landings]; three survey indices from the Norwegian coastal survey Q4 (A6335; two acoustic indices, split in 2002, and one swept area index); annual maturity data from the surveys; annual weight-based natural mortalities.
Discards and bycatch	Discarding in the commercial catch is considered negligible. Bycatch is included.
Indicators	None.
Other information	Last benchmarked in February 2021 (ICES, 2021a).
Working group	Arctic Fisheries Working Group (AFWG).

History of the advice, catch, and management

Table 6a Cod in subareas 1 and 2 north of 67°N, northern Norwegian coastal cod. ICES advice, TAC, and catches for the previous combined Norwegian coastal cod stock. All weights are in tonnes. During WKBARFAR (ICES, 2021a), the Norwegian coastal cod stock north of 62°N was split into two stocks.

Year	ICES advice for combined Norwegian coastal cod stock	Catch corresponding to advice	Agreed TAC *	ICES estimates of commercial catches **	ICES estimates of recreational catch	ICES estimates of total catch**
1987	Not assessed		40000	48274	13500	61774
1988	Not assessed		40000	55065	13600	68665
1989	No advice		40000	41242	13700	54942
1990	No advice		40000	20920	14500	35420
1991	Included in TAC for subareas 1 and 2		40000	24837	15300	40137
1992	Short-term forecast included in TAC for subareas 1 and 2		40000	38195	16100	54295
1993	Short-term forecast included in TAC for subareas 1 and 2		40000	50420	14800	65220
1994	No advice		40000	51664	14700	66364
1995	No advice		40000	64964	14700	79664
1996	No advice		40000	41672	14500	56172
1997	No advice		40000	51123	14500	65623
1998	No advice		40000	30472	14600	45072
1999	No advice		40000	35805	13900	49705
2000	No advice		40000	34815	13600	48415
2001	Reduce F considerably	22000	40000	27253	13400	40653
2002	Catches should be reduced by the same proportion as for Northeast Arctic cod	13000	40000	36405	13600	50005

Year	ICES advice for combined Norwegian coastal cod stock	Catch corresponding to advice	Agreed TAC *	ICES estimates of commercial catches **	ICES estimates of recreational catch	ICES estimates of total catch**
2003	Reduce F considerably	8000	40000	35381	13900	49281
2004	Recovery plan	0	20000	33650	13400	47050
2005	Recovery plan	0	21000	29255	13200	42455
2006	Recovery plan	0	21000	39343	13000	52343
2007	Recovery plan	0	21000	29227	13000	42227
2008	Recovery plan	0	21000	35552	12800	48352
2009	Zero catch and recovery plan	0	21000	29987	12700	42687
2010	Zero catch and recovery plan	0	21000	40397	12700	53097
2011	Same advice as previous year	0	21000	36714	12700	49414
2012	Rebuilding plan, action dependent on autumn survey	-	21000	35540	12700	48240
2013	Rebuilding plan, action dependent on autumn survey	-	21000	30144	12700	42844
2014	Rebuilding plan, action dependent on autumn survey	-	21000	33660	12700	46360
2015	Rebuilding plan, action dependent on autumn survey	-	21000	35843	12700	48543
2016	Rebuilding plan, action dependent on autumn survey	-	21000	54767	12700	67467
2017	Rebuilding plan, action dependent on autumn survey	-	21000	51053	12700	63753
2018	Rebuilding plan, action dependent on autumn survey	-	21000	36375	12700	49075
2019	Rebuilding plan, action dependent on autumn survey	-	21000	40107	12700	52807
2020	Rebuilding plan, action dependent on autumn survey	-	21000	43133	6233	49366
2021	Rebuilding plan, action dependent on autumn survey	-	21000			

* These TACs have been added to the quota of Northeast Arctic cod.
** Estimated according to otolith type.

Table 6b Cod in subareas 1 and 2 north of 67°N, northern Norwegian coastal cod. ICES advice, TAC, and catches. All weights are in tonnes. During WKBARFAR (ICES, 2021a), the Norwegian coastal cod stock north of 62°N was split into two stocks.

Year	ICES advice	Catch corresponding to advice	Agreed TAC	ICES estimates of commercial catches *	ICES estimates of recreational catch*	ICES estimates of total catch*
2022	MSY approach	7865				

* Estimated according to otolith type.

History of the catch and landings

Table 7 Cod in subareas 1 and 2 north of 67°N, northern Norwegian coastal cod. Catch distribution by fleet in 2020 as estimated by ICES.

<table>
<tr><th>Catch (2020)</th><th colspan="3">Commercial landings</th><th>Recreational catch estimates (unreported catches)</th><th>Discards</th></tr>
<tr><td rowspan="2">49 366 tonnes</td><td>30% gillnets</td><td>58% Danish seine, longline/handline</td><td>12% bottom trawl</td><td rowspan="2">6233 tonnes</td><td rowspan="2">Discarding is not included in the commercial catch, but discarding in the rod and line (from boat) sector of the recreational fishery is included in the recreational catch estimate</td></tr>
<tr><td colspan="3">43 133 tonnes</td></tr>
</table>

Summary of the assessment

Table 8 Cod in subareas 1 and 2 north of 67°N, northern Norwegian coastal cod. Assessment summary. High and low refer to 95% confidence bounds. Weights are in tonnes.

Year	Recruitment			Spawning-stock biomass			Total catch		Fishing mortality		
	Recruitment (Age 2)	High	Low	SSB	High	Low	Commercial	Recreational**	F (ages 4–7)	High	Low
	thousands			tonnes			tonnes				
1994	93255	133484	65151	121473	143722	102668	52579	9144	0.236	0.287	0.194
1995	117847	160026	86785	102196	119855	87139	56907	9144	0.303	0.361	0.255
1996	140946	192570	103161	80613	94195	68990	41820	9020	0.328	0.388	0.277
1997	130577	177077	96288	65414	76097	56231	46605	9020	0.395	0.465	0.335
1998	111048	149631	82414	56451	66388	48002	45462	9082	0.417	0.496	0.351
1999	94243	126773	70060	46921	55761	39482	38743	8646	0.383	0.458	0.321
2000	81710	109741	60839	53932	63940	45491	33081	8460	0.281	0.338	0.233
2001	74734	100143	55772	69840	82123	59394	24470	8335	0.237	0.285	0.196
2002	72109	95467	54467	83613	97858	71441	32188	8460	0.254	0.304	0.212
2003	66126	84385	51817	70323	82239	60134	29253	8646	0.239	0.286	0.2
2004	68658	86656	54397	74611	87471	63641	31198	8335	0.267	0.318	0.224
2005	49178	63738	37944	66563	78345	56553	30097	8211	0.255	0.304	0.214
2006	50300	64944	38958	83621	99203	70487	36884	8087	0.294	0.354	0.245
2007	59807	76361	46841	89237	106703	74629	26200	8087	0.225	0.275	0.184
2008	63708	81562	49763	86923	105007	71954	27711	7962	0.221	0.271	0.181
2009	58336	74883	45445	67390	82140	55289	22988	7900	0.185	0.226	0.151
2010	59296	75839	46362	81387	99319	66692	34804	7900	0.217	0.265	0.178
2011	80455	102445	63185	92899	114191	75576	27982	7900	0.192	0.235	0.157
2012	65191	83938	50630	98481	122828	78960	26778	7900	0.157	0.193	0.128
2013	89485	114840	69728	104775	130147	84350	21376	7900	0.13	0.16	0.106
2014	94428	120163	74205	111338	136844	90587	22750	7900	0.126	0.154	0.103
2015	96804	123635	75796	101329	124501	82470	34483	7900	0.175	0.212	0.144
2016	90624	116072	70756	110281	134569	90376	49503	7900	0.24	0.288	0.2
2017	86788	113353	66449	94880	117112	76869	54273	7900	0.288	0.347	0.238
2018	97956	131241	73113	91151	113683	73085	34532	7900	0.241	0.295	0.196
2019	83054	114334	60331	82254	105244	64286	35861	7900	0.243	0.306	0.194
2020	54381	81240	36402	92630	125706	68257	43133	6233	0.273	0.366	0.204
2021	88137*	54381*	97956*	92885	134131	63720					

* Resampled from the years 2011–2020.
** Estimated as 7900 t in 2009 and assumed at the same value since, except in 2020 when it was estimated to be 6233 t (reduced fishing tourism due to COVID-19).

Sources and references

ICES. 2021a. Benchmark Workshop for Barents Sea and Faroese Stocks (WKBARFAR 2021). ICES Scientific Reports. 3:21. 205 pp. https://doi.org/10.17895/ices.pub.7920

ICES. 2021b. Advice on fishing opportunities. *In* Report of the ICES Advisory Committee, 2021. ICES Advice 2021, section 1.1.1. https://doi.org/10.17895/ices.advice.7720.

ICES. 2021c. Arctic Fisheries Working Group (AFWG). ICES Scientific Reports. 3:58. https://doi.org/10.17895/ices.pub.8196.

Download the stock assessment data and figures.

Recommended citation: ICES. 2021. Cod (*Gadus morhua*) in subareas 1 and 2 north of 67°N (Norwegian Sea and Barents Sea), northern Norwegian coastal cod. *In* Report of the ICES Advisory Committee, 2021. ICES Advice 2021, cod.27.1-2coastN, https://doi.org/10.17895/ices.advice.7986.