3.3.3 Cod (*Gadus morhua*) in subareas 1 and 2 (Norwegian coastal waters cod)

ICES stock advice

ICES advises on the basis of the Norwegian rebuilding plan, which requires access to the 2016 autumn survey results that will be available in December 2016. If the spawning-biomass index in the 2016 autumn survey is lower than the index in 2015, the fisheries regulations should aim at a reduction of F in 2017 of at least 60% relative to 2009. If the survey index is higher than in 2015, the plan stipulates that the fisheries regulations should aim at a reduction of F in 2017 of at least 45% relative to 2009.

Stock development over time

The survey estimate in 2015 is close to the lowest value in the time-series and well below the rebuilding biomass set in the Norwegian rebuilding plan. Recruitment has been stable overall in the last decade. Fishing pressure (F) appears variable without a clear trend since 2000.

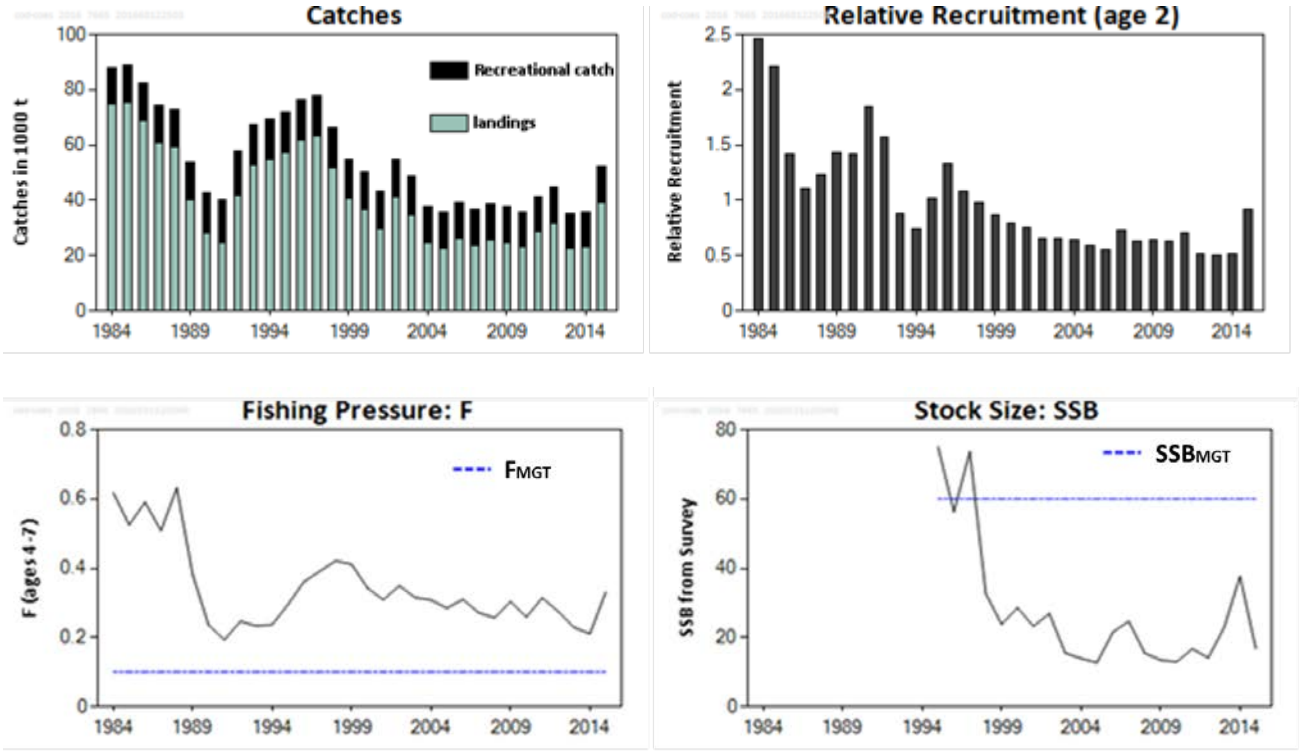

Figure 3.3.3.1 Cod in subareas 1 and 2 (Norwegian coastal waters cod). Landings, the survey spawning-stock biomass (SSB) index (including the rebuilding biomass of 60 000 tonnes in the rebuilding plan), F estimate from the exploratory virtual population analysis (VPA) assessment (including the limit F = 0.1 in the rebuilding plan), and the relative recruitment index (long-term average = 1) from the exploratory VPA assessment.

https://doi.org/10.17895/ices.advice.18668066

Stock and exploitation status

Table 3.3.3.1 Cod in subareas 1 and 2 (Norwegian coastal waters cod). State of the stock and fishery relative to reference points.

		Fishing pressure					Stock size				
		2013	2014	2015			2013	2014	2015	
Maximum sustainable yield	F_{MSY}	?	?	?	Undefined	MSY $B_{trigger}$	?	?	?	Undefined
Precautionary approach	F_{pa}, F_{lim}	?	?	?	Undefined	B_{pa}, B_{lim}	?	?	?	Undefined
Management plan	F_{MGT}	✗	✗	✗	Above	SSB_{MGT}	✗	✗	✗	Below
Qualitative evaluation	-	↘	↘	↗	Increasing	-	✗	✗	✗	Close to its lowest value

Catch options

Rebuilding plan

The rebuilding plan was put into operation in 2011. The plan specifies the following reductions in fishing mortality:

Action step*	1	2	3	4	5	6 and later
Reduction of F relative to F_{2009}	15%	30%	45%	60%	75%	Keep F at or below 0.1

* A new step is initiated when the most recent survey index for SSB is lower than the index in the previous year (and at the same time the most recent estimate of F is above 0.10).

The spawning-stock biomass (SSB) index in the 2010 survey was below the index in the 2009 survey. Step 1 was thus initiated in 2011. This means that the regulation in 2011 was aimed at a 15% reduction of F relative to F_{2009}. The 2011 survey gave a higher SSB index than in 2010, allowing the regulation for step 1 to continue in 2012. The 2012 survey resulted in a lower SSB index compared to 2011; accordingly step 2 was set in motion in 2013, with regulations aiming for an F at least 30% below F_{2009}. The 2013 and 2014 surveys provided an increased SSB index, allowing for the existing regulations to be continued in 2014 and 2015 (still step 2). The lower survey result in 2015 implies that step 3 (45% reduced F compared to 2009) should have been introduced in 2016.

There is no apparent increase in stock size. Under these circumstances regulations should be put in place that reduce catches according to the required reductions in F. If the 2016 SSB index is above the 2015 index, application of the rebuilding plan implies that the regulations should ensure that catches in 2017 are consistent with no less than 45% reduction in F relative to the 2009 value. If the SSB index in 2016 is lower than the index in 2015, the fisheries regulations should ensure that catches in 2017 are consistent with no less than 60% reduction in F relative to the 2009 value (step 4).

Basis of the advice

Table 3.3.3.2 Cod in subareas 1 and 2 (Norwegian coastal waters cod). The basis of the assessment and advice.

Advice basis	Rebuilding plan.
Management plan	Norwegian rebuilding plan for coastal cod (ICES, 2010). The rebuilding plan, as communicated to ICES by the Norwegian Ministry of Fisheries and Coastal Affairs, states: *"The overarching aim is to rebuild the stock complex to full reproductive capacity, as well as to give sufficient protection to local stock components. Until a biologically founded rebuilding target is defined, the stock complex will only be regarded as restored when the survey index of spawning stock in two successive years is observed to be above 60 000 tons*. Importantly, this rebuilding target will be redefined on the basis of relevant scientific information. Such information could, for instance, include a reliable stock assessment, as well as an estimate of the spawning stock corresponding to full reproductive capacity.* *Given that the survey index for SSB does not increase, the regulations will aim to reduce F** by at least 15 per cent annually compared to the F estimated for 2009. If, however, the latest survey index of SSB is higher than the preceding one – or if the estimated F for the latest catch year is less than 0.1 – the regulations will be unchanged.* *Special regulatory measures for local stock components will be viewed in the context of scientific advice. A system with stricter regulations inside fjords than outside fjords is currently in operation, and this particular system is likely to be continued in the future.* *The management regime employed is aiming for improved ecosystem monitoring in order to understand and possibly enhance the survival of coastal cod. Potential predators are – among others – cormorants, seals and saithe.* *When the rebuilding target is reached, a thorough management plan is essential. In this regard, the aim will be to keep full reproductive capacity and high long-term yield."*

*Average survey index in the years 1995–1998.
**Ages 4–7.

Quality of the assessment

Estimated catches in the recreational fishery represented about 35% of the total catch in 2009. However, total catches from the recreational fisheries have not been monitored since 2009. The assumption of constant removals from the recreational fisheries does not influence the information on the state of the stock but may influence the effectiveness of management actions. The absence of information regarding recreational fishing, in particular in connection with local stock components, is impairing the quality of the advice that can be provided. Estimates of commercial catches of coastal cod have been more uncertain in recent years because of the large spawning stock of Northeast Arctic cod mixing with coastal cod during the migration along the coast.

Issues relevant for the advice

Current restrictions have not led to the reductions in F implied by the Rebuilding Plan (ICES, 2010). For 2013 the rebuilding plan specified a 30% reduction of F compared to 2009. For 2013–2016 no additional regulations, supplementing those already in place in 2011 and 2012, have been communicated to ICES. According to the catch estimates the commercial catches of coastal cod in 2013 and 2014 were reduced by less than 10% compared to 2009, while the 2015 commercial catch is nearly 60% above the 2009 catch, the highest since 2002. The high catch in 2015 is mainly caused by high catches during the first quarter in southern Troms and northern Nordland, where coastal cod were feeding on aggregations of herring. To obtain the reductions implied by the Rebuilding Plan, stronger restrictions are required in all areas where coastal cod is

distributed, especially since the survey results in 2015 triggered stock status to action step 3 in the Rebuilding Plan. These restriction requirements include coastal cod taken as bycatch in fisheries for Northeast Arctic cod, haddock, and saithe.

Reference points

Table 3.3.3.3 Cod in subareas 1 and 2 (Norwegian coastal waters 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}	Not defined		
	B_{pa}	Not defined		
	F_{lim}	Not defined		
	F_{pa}	Not defined		
Management plan	SSB_{MGT}	60 000 t	Rebuilding target	ICES (2010)
	F_{MGT}	0.1	F limit (value towards which F should be reduced in the absence of stock rebuilding)	ICES (2010)

Basis of the assessment

Table 3.3.3.4 Cod in subareas 1 and 2 (Norwegian coastal waters cod). The basis of the assessment.

ICES stock data category	3 (ICES, 2016a)
Assessment type	Based on survey SSB index and estimates of F and relative recruitment from an exploratory VPA assessment (ICES, 2016b).
Input data	Catch-at-age and an acoustic survey; commercial catches (landings, age and length frequencies from catch sampling); one survey index (coastal survey, NOcoast-Aco-4Q); annual maturity data from surveys; natural mortalities assumed, M = 0.2. Total recreational catch.
Discards and bycatch	Discarding is considered to be negligible. Bycatch is included.
Indicators	None
Other information	Last benchmarked in 2015 (WKARCT; ICES, 2015).
Working group	Arctic Fisheries Working Group (AFWG)

Information from stakeholders

There is no available information.

History of the advice, catch, and management

Table 3.3.3.5 Cod in subareas 1 and 2 (Norwegian coastal waters cod). History of ICES advice, the agreed TAC, and ICES estimates of catches. Weights are in thousand tonnes.

Year	ICES advice	Predicted catch corresp.to advice	Agreed TAC*	ICES catches**
1987	Not assessed		40	61
1988	Not assessed		40	59
1989	No advice		40	40
1990	No advice		40	28
1991	Included in TAC for subareas 1 and 2		40	25
1992	Shot forecast included in TAC for 1 and 2		40	42
1993	Shot forecast included in TAC for 1 and 2		40	53
1994	No advice		40	55
1995	No advice		40	57
1996	No advice		40	62
1997	No advice		40	63
1998	No advice		40	52
1999	No advice		40	41
2000	No advice		40	37
2001	Reduce F considerably	22	40	30
2002	Catches should be reduced by the same proportion as for Northeast Arctic cod	13	40	41
2003	Reduce F considerably	8	40	35
2004	A recovery plan	0	20	24
2005	A recovery plan	0	21	22
2006	A recovery plan	0	21	26
2007	A recovery plan	0	21	23
2008	A recovery plan	0	21	26
2009	Zero catch and a recovery plan	0	21	25
2010	Zero catch and a recovery plan	0	21	23
2011	Same advice as last year	0	21***	29
2012	Rebuilding plan, action dependent on autumn survey	-	21***	32
2013	Rebuilding plan, action dependent on autumn survey	-	21***	22
2014	Rebuilding plan, action dependent on autumn survey	-	21***	23
2015	Rebuilding plan, action dependent on autumn survey	-	21***	39
2016	Rebuilding plan, action dependent on autumn survey	-	21***	
2017	Rebuilding plan, action dependent on autumn survey	-		

* These TACs have been added to the Norwegian TAC of Northeast Arctic cod.

** Estimated according to otolith type, does not include estimated recreational catches.

*** Additional regulations were introduced to meet the objectives of the Recovery Plan, while the 21 000 t were still included in the combined TAC for coastal cod and Northeast Arctic cod.

History of catch and landings

Table 3.3.3.6 Cod in subareas 1 and 2 (Norwegian coastal waters cod). Catch distribution by fleet in 2015 as estimated by ICES.

Total catch	Commercial landings				Recreational catch (unreported catches)	Discards
52.2 kt	40% gillnets	34% Danish seine	24% longline/ handline	2% bottom trawl	Unreported catches in recreational fishing were estimated at 12.7 kt in 2009 and the tonnage is assumed to be constant for 2010–2015.	Discarding is considered to be negligible.
	39.4 kt					

Table 3.3.3.7 Cod in subareas 1 and 2 (Norwegian coastal waters cod). History of commercial catch and landings; both the official and ICES estimated values are presented. Weights in thousand tonnes.

Year	Norway		Total catch
	Commercial catch	Recreational catch	
1984	74.8	13.3	88.1
1985	75.5	13.4	88.9
1986	68.9	13.5	82.4
1987	61	13.5	74.5
1988	59.3	13.6	72.9
1989	40.3	13.7	54
1990	28.1	14.5	42.6
1991	24.8	15.3	40.1
1992	41.7	16.1	57.8
1993	52.6	14.8	67.4
1994	54.6	14.7	69.3
1995	57.2	14.7	71.9
1996	61.8	14.5	76.3
1997	63.3	14.5	77.8
1998	51.6	14.6	66.2
1999	40.7	13.9	54.6
2000	36.7	13.6	50.3
2001	29.7	13.4	43.1
2002	41	13.6	54.6
2003	34.6	13.9	48.5
2004	24.5	13.4	37.9
2005	22.4	13.2	35.6
2006	26.1	13	39.1
2007	23.8	13	36.8
2008	25.8	12.8	38.6
2009	24.8	12.7	37.5
2010	22.9	12.7	35.6
2011	28.6	12.7	41.3
2012	31.9	12.7	44.6
2013	22.5	12.7	35.2
2014	23.2	12.7	35.9
2015	39.4	12.7	52.2

Summary of the assessment

Table 3.3.3.8 Cod in subareas 1 and 2 (Norwegian coastal waters cod). Assessment summary with catches in tonnes.

Year	Relative recruitment (Age 2)	Stock size: SSB	Commercial catches	Recreational catches	Fishing pressure: F (Ages 4–7)
1984	2.459		74824	13300	0.618
1985	2.212		75451	13400	0.525
1986	1.418		68905	13500	0.59
1987	1.11		60972	13500	0.508
1988	1.232		59294	13600	0.632
1989	1.427		40285	13700	0.381
1990	1.417		28127	14500	0.236
1991	1.84		24822	15300	0.193
1992	1.568		41690	16100	0.247
1993	0.876		52557	14800	0.233
1994	0.746		54562	14700	0.237
1995	1.02	74992	57207	14700	0.295
1996	1.326	56237	61776	14500	0.361
1997	1.082	73660	63319	14500	0.391
1998	0.976	32691	51572	14600	0.421
1999	0.871	23771	40732	13900	0.411
2000	0.793	28579	36715	13600	0.343
2001	0.759	23230	29699	13400	0.309
2002	0.658	26885	40994	13600	0.349
2003	0.653	15521	34635	13900	0.315
2004	0.641	13959	24547	13400	0.308
2005	0.591	12709	22432	13200	0.285
2006	0.558	21546	26134	13000	0.31
2007	0.725	24689	23841	13000	0.272
2008	0.623	15493	25777	12800	0.257
2009	0.637	13508	24821	12700	0.304
2010	0.634	12901	22925	12700	0.259
2011	0.706	16725	28594	12700	0.314
2012	0.511	14143	31907	12700	0.275
2013	0.503	22856	22464	12700	0.229
2014	0.511	37659	23169	12700	0.211
2015	0.918	16763	39454	12700	0.331

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