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cod.27.1-2coast

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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 2017 autumn survey results, that will be available in December 2017. If the survey result for spawning–stock biomass (SSB) is lower than in 2016, the regulations for 2018 should ensure that fishing mortality (F) is reduced by at least 60% relative to F in 2009. If the survey result for SSB is above the 2016 value, the regulations should ensure that F in 2018 is reduced by at least 45% relative to F in 2009.

Stock development over time

The survey estimate in 2016 is well below the rebuiliding biomass set in the Norwegian rebuilding plan. Both SSB and recruitment have been stable overall in the last two decades. Fishing pressure (F) increased in 2015 and 2016, after a declining trend over the period 2000-2014.

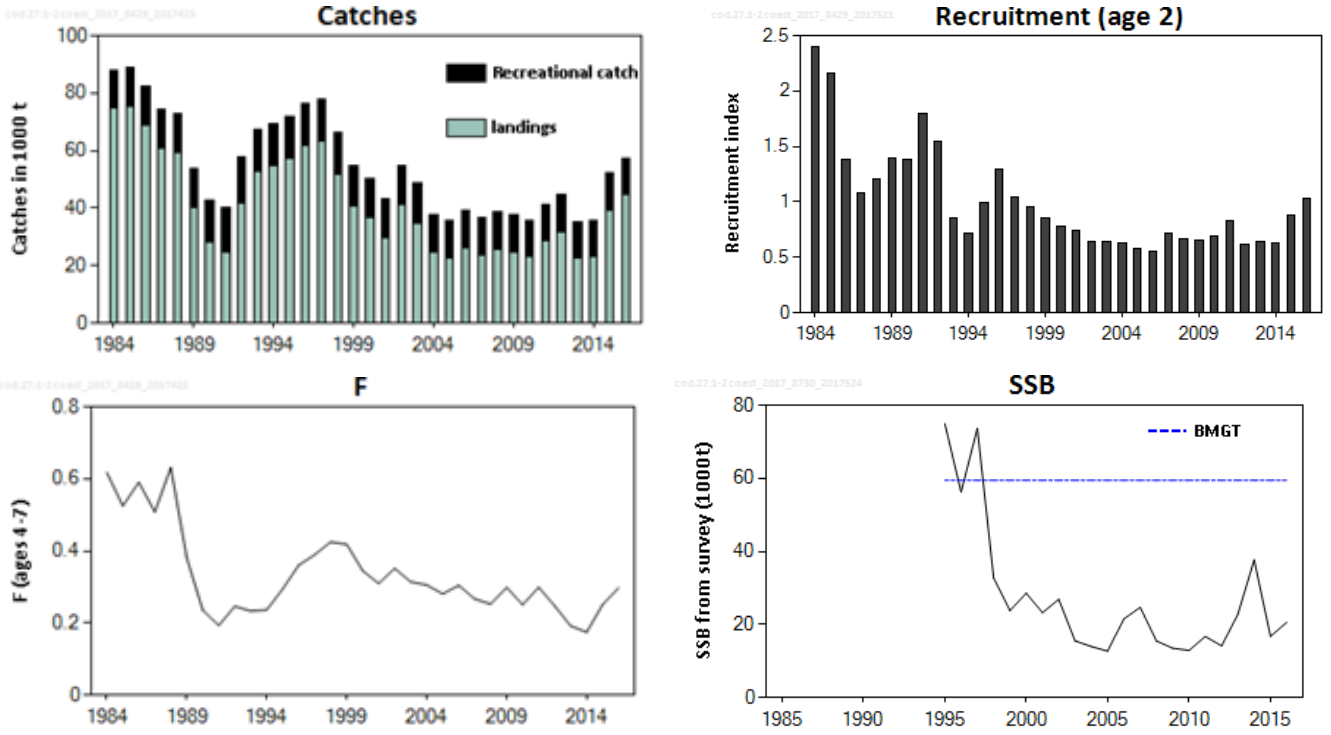

Figure 1 Cod in subareas 1 and 2 (Norwegian coastal waters cod). Summary of the stock assessment. Landings (recreational catches is fixed from 2009 at 12700 t), the relative recruitment index (long-term average = 1) from the exploratory VPA assessment, F estimate from the exploratory virtual population analysis (VPA) assessment,and the survey spawning–stock biomass (SSB) index (including the rebuilding biomass of 60 000 tonnes in the rebuilding plan).

Stock and exploitation status

Table 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				
		2014	2015	2016			2014	2015	2016	
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}	?	?	?	Undefined		B_{MGT}	✗	✗	✗	Below
Qualitative evaluation	-	↘	↗	↗	Increasing		-	✗	✗	✗	Below possible reference points

Catch options

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. The 45% reduction also applies to 2017, since the survey in 2016 gave a higher SSB estimate than in the previous year.

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 2017 SSB index is above the 2016 index, application of the rebuilding plan implies that the regulations should ensure that catches in 2018 are consistent with no less than 45% reduction in F relative to the 2009 value. If the SSB index in 2017 is lower than the index in 2016, the fisheries regulations should ensure that catches in 2018 are consistent with no less than 60% reduction in F relative to the 2009 value (step 4).

Basis of the advice

Table 3 Cod in subareas 1 and 2 . The basis of the 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

The assessment is rather uncertain due to uncertain catch split between Northeast Arctic cod and coastal cod, where coastal cod is the minor fraction. There is a lack of data for the recreational catch and uncertainty regarding stock identity (substocks). The survey is considered uncertain since it does not cover the shallow parts of the stock distribution area.

Issues relevant for the advice

Compared to F in 2009, the rebuilding plan specified a 30% reduction of F in 2015 and 45% reduction of F in 2016. The assessment indicates that some reduction of F occured in 2013 and 2014, while the regulation has not been sufficient for constraining the coastal cod catches in 2015 and 2016, and the most recent estimate of F is at the level of 2009. ICES evaluated the Rebuilding Plan in 2010 and considered it to be provisionally consistent with the precautionary approach. Given the situation of no reduction in F and no increase in SSB (as measured by the survey index), ICES will examine if the Rebuilding Plan can still be considered an appropriate basis for the advice on this stock.

According to the catch estimates, the commercial catch of coastal cod in 2015 was the highest since 2002, and the 2016 catch the highest since 1998. The high catches in 2015 and 2016 are mainly caused by targeting aggregations of cod during the first quarter in southern Troms and northern Nordland, prior to arrival of the spawning NEA cod. To obtain the reductions implied by the Rebuilding Plan, stronger restrictions are required in all areas where coastal cod is distributed. These restriction requirements include coastal cod taken as bycatch in Northeast Arctic cod, haddock, and saithe fisheries.

Reference points

Table 4 Cod in subareas 1 and 2. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger_{proxy}}$			
	$F_{MSY_{proxy}}$			
Precautionary approach	B_{lim}			
	B_{pa}			
	F_{lim}			
	F_{pa}			
Management plan	SSB_{mgt}	60 000 t	Rebuilding target (1995–1998 average survey SSB)	ICES (2010)
	F_{mgt}			

Basis of the assessment

Table 5 Cod in subareas 1 and 2. Basis of assessment and advice.

ICES stock data category	3 (ICES, 2016)
Assessment type	Based on survey SSB index and estimates of F and relative recruitment from an exploratory VPA assessment (ICES, 2017).
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. Estimated 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 6 Cod in subareas 1 and 2. ICES advice and official landings. All weights are in thousand tonnes.

Year	ICES advice	Predicted catch corresp.to advice	Agreed TAC*	ICES catches**
1987	Not assessed		40000	60972
1988	Not assessed		40000	59294
1989	No advice		40000	40285
1990	No advice		40000	28127
1991	Included in TAC for subareas 1 and 2		40000	24822
1992	Shot forecast included in TAC for 1 and 2		40000	41690
1993	Shot forecast included in TAC for 1 and 2		40000	52557
1994	No advice		40000	54562
1995	No advice		40000	57207
1996	No advice		40000	61776
1997	No advice		40000	63319
1998	No advice		40000	51572
1999	No advice		40000	40732
2000	No advice		40000	36715
2001	Reduce F considerably	22000	40000	29699
2002	Catches should be reduced by the same proportion as for Northeast Arctic cod	13000	40000	40994
2003	Reduce F considerably	8000	40000	34635
2004	A recovery plan	0	20000	24547
2005	A recovery plan	0	21000	22432
2006	A recovery plan	0	21000	26134
2007	A recovery plan	0	21000	23841
2008	A recovery plan	0	21000	25777
2009	Zero catch and a recovery plan	0	21000	24821
2010	Zero catch and a recovery plan	0	21000	22925
2011	Same advice as last year	0	21000***	28594
2012	Rebuilding plan, action dependent on autumn survey	-	21000	31907
2013	Rebuilding plan, action dependent on autumn survey	-	21000***	22464
2014	Rebuilding plan, action dependent on autumn survey	-	21000	23169
2015	Rebuilding plan, action dependent on autumn survey	-	21000	39455
2016	Rebuilding plan, action dependent on autumn survey	-	21000	44610
2017	Rebuilding plan, action dependent on autumn survey	-	21000	
2018	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 000t were still included in the combined TAC for coastal cod and Northeast Arctic cod.

History of the catch and landings

Table 7 Cod in subareas 1 and 2. Catch distribution by fleet in 2016 as estimated by ICES.

Catch (2016)	Commerical Landings				Recreational catch (unreported catches)	Discards
57 310 tonnes	41% gillnets	32% Danish seine	25% longline/handline	2% bottom trawl	Unreported catches in recreational fishing were estimated at 12 700 t in 2009 and the tonnage is assumed to be constant for 2010-2016	Considered to be negligible
	44610 tonnes					

Table 8 Cod in subareas 1 and 2. History of commercial catch and landings; both the official and ICES estimated values are presented by area for each country participating in the fishery. All weights are in tonnes.

Year	Norway		Total catch
	Commercial catch	Recreational catch	
1984	74824	13300	88124
1985	75451	13400	88851
1986	68905	13500	82405
1987	60972	13500	74472
1988	59294	13600	72894
1989	40285	13700	53985
1990	28127	14500	42627
1991	24822	15300	40122
1992	41690	16100	57790
1993	52557	14800	67357
1994	54562	14700	69262
1995	57207	14700	71907
1996	61776	14500	76276
1997	63319	14500	77819
1998	51572	14600	66172
1999	40732	13900	54632
2000	36715	13600	50315
2001	29699	13400	43099
2002	40994	13600	54594
2003	34635	13900	48535
2004	24547	13400	37947
2005	22432	13200	35632
2006	26134	13000	39134
2007	23841	13000	36841
2008	25777	12800	38577
2009	24821	12700	37521
2010	22925	12700	35625
2011	28594	12700	41294
2012	31907	12700	44607
2013	22464	12700	35164
2014	23169	12700	35869
2015	39455	12700	52155
2016	44610	12700	57310

Summary of the assessment

Table 9 Cod in subareas 1 and 2. Assessment summary. Weights are in tonnes.

Year	Recruitment	SSB	Commercial catch	Recreational catch	F
	Age 2 (relative to long term mean)	tonnes	tonnes	tonnes	Ages 4-7
1984	2.399		74824	13300	0.62
1985	2.158		75451	13400	0.53
1986	1.384		68905	13500	0.60
1987	1.083		60972	13500	0.51
1988	1.202		59294	13600	0.63
1989	1.393		40285	13700	0.38
1990	1.384		28127	14500	0.24
1991	1.794		24822	15300	0.19
1992	1.54		41690	16100	0.25
1993	0.853		52557	14800	0.23
1994	0.721		54562	14700	0.24
1995	0.991	74992	57207	14700	0.30
1996	1.295	56237	61776	14500	0.36
1997	1.049	73660	63319	14500	0.39
1998	0.952	32691	51572	14600	0.43
1999	0.851	23771	40732	13900	0.42
2000	0.777	28579	36715	13600	0.35
2001	0.748	23230	29699	13400	0.31
2002	0.647	26885	40994	13600	0.35
2003	0.645	15521	34635	13900	0.31
2004	0.63	13959	24547	13400	0.31
2005	0.581	12709	22432	13200	0.28
2006	0.548	21546	26134	13000	0.30
2007	0.72	24689	23841	13000	0.27
2008	0.671	15493	25777	12800	0.25
2009	0.66	13508	24821	12700	0.30
2010	0.689	12901	22925	12700	0.25
2011	0.83	16725	28594	12700	0.30
2012	0.619	14143	31907	12700	0.25
2013	0.639	22856	22464	12700	0.19
2014	0.628	37659	23169	12700	0.18
2015	0.882	16763	39455	12700	0.25
2016	1.036	20597	44610	12700	0.30
Average		**27232**	**41176**	**13639**	**0.33**

Sources and references

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