

6.3.2 Cod (*Gadus morhua*) in Subdivision 3.a.21 (Kattegat)

ICES stock advice

ICES advises that when the precautionary approach is applied, catches in 2017 should be no more than 643 tonnes. If discard rates do not change from 2015, this implies landings of no more than 129 tonnes.

Stock development over time

The assessment is indicative of trends only and shows that spawning-stock biomass (SSB) has strongly increased since 2009 from a historical low. The mortality has shown a decreasing trend since 2008. Recruitment in 2013 was among the highest in the recent time-series.

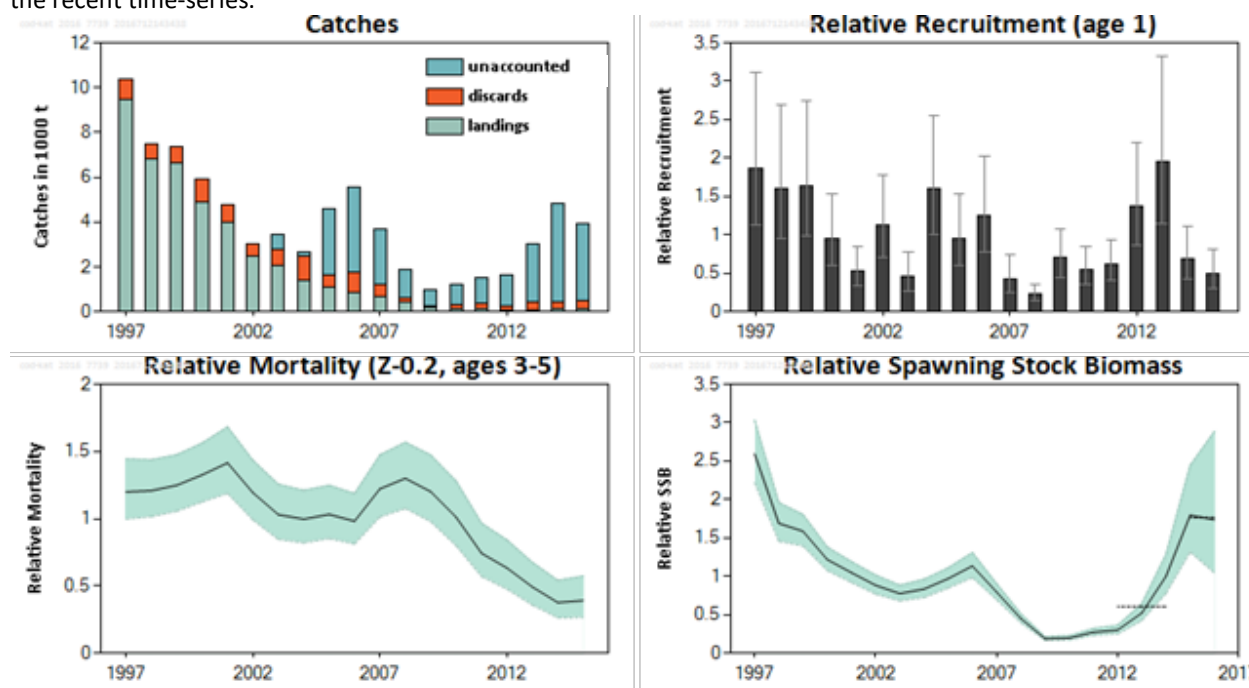


Figure 6.3.2.1* Cod in Subdivision 3.a.21. Summary of stock assessment. Recruitment, mortality, and SSB are relative to the average of the time-series. Bottom right panel: relative SSB, regarded as an indicator of the recent development of the stock. The dashed lines in the relative SSB plot indicate the average values of the respective years.

Stock and exploitation status

Table 6.3.2.1 Cod in Subdivision 3.a.21. State of the stock and fishery relative to reference points.

		Fishing pressure				Stock size				
		2013	2014	2015		2014	2015	2016		
Maximum sustainable yield	F _{MSY}	?	?	?	Undefined	MSY	?	?	?	Undefined
Precautionary approach	F _{pa} , F _{lim}	?	?	?	Undefined	B _{trigger} , B _{pa} , B _{lim}	?	?	?	Undefined
Management plan	F _{MGT}	-	-	-	Not applicable	SSB _{MGT}	-	-	-	Not applicable
Qualitative evaluation	-	↘	↘	→	Stable	-	↗	↗	→	Stable

*Version 2: Legend in Catches figure updated.

Catch options

The ICES framework for category 3 stocks was applied (ICES, 2012a). The SSB trends from the assessment are used as the index of stock development. The advice is based on a comparison of the two latest index values (index A) with the three preceding values (index B), multiplied by the last year's advised catches.

The index is estimated to have increased by more than 20% and thus the uncertainty cap was applied in estimating the catch advice. The stock status relative to candidate reference points is unknown. Considering that the SSB increase is more than 50%, no additional precautionary buffer was applied. Discarding is known to be increasing and the discard ratio has been estimated based on 2015 data.

Table 6.3.2.2 Cod in Subdivision 3.a.21. The basis for the catch options. For stocks in ICES data categories 3–6, one catch option is provided.

Index A (2015, 2016)		1.76
Index B (2012, 2013, 2014)		0.61
Index ratio (A/B)		2.90
Uncertainty cap	Applied	1.20
Recent advised catch for 2016		536 t
Discard rate (2015)		0.80
Precautionary buffer	Not applied	-
Catch advice*		643 t
Landings corresponding to the catch advice		129 t

*[Recent advised catch] × [uncertainty cap].

Basis of the advice

Table 6.3.2.3 Cod in Subdivision 3.a.21. The basis of the advice.

Advice basis	Precautionary approach.
Management plan	A multi-annual plan has been agreed by the EU in 2008 (EU, 2008). ICES evaluated this plan in 2009 and concluded it was in accordance with the precautionary approach if implemented and enforced adequately; however, this evaluation is not expected to be realistic in a situation of high unaccounted removals as estimated by the present assessment model. Therefore, the management plan is not used as basis for the advice.

Quality of the assessment

In recent years, reported landings and the discard estimates based on observer trips do not represent total removals from the stock. At present, the relative proportion of unallocated removals ensuing from fishing and biology-driven factors (e.g. migration) cannot be quantified. This year's advice is based on an assessment indicative of trends. The current level of mortality is still unknown because of a pronounced difference between the catch data (landings plus discards estimated from observer data) and the total removals from the stock estimated within the model based on survey data.

Issues relevant for the advice

The assessment results indicate that the SSB of the stock has increased since 2012 and that the total mortality of the stock has declined substantially since 2008. However, the increase in SSB should be considered in the historical light of the much higher SSB seen in the 1970s (ICES, 2012b).

The EU cod management plan (EU, 2008) is based on setting TACs complemented with an effort regime. Given the lack of a short-term forecast for this stock, application of the plan would correspond to a 15% decrease in the TAC and a 15% reduction in the maximum allowable fishing effort for the relevant effort groups (Articles 9 and 12 of the management plan).

ICES is not using the management plan as basis for the advice because it is unknown whether the plan is applicable in the current situation of unknown mortality rates ensuing from fishing and biological factors.

There is no directed cod fishery in Kattegat. Cod is taken mainly as bycatch in the *Nephrops* fishery. The rate of discarding has increased in recent years; consequently, the final-year (2015) discard ratio estimate has been used to calculate the landings advice. Catches of juvenile cod should be reduced to the minimum possible to promote stock recovery. The stock is still considered to be in a poor state. The year class of 2015 was the lowest observed in the time-series.

Reference points

Table 6.3.2.4 Cod in Subdivision 3.a.21. 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 _{MS-lower}	6400 t		EU (2008)
	SSB _{MS-upper}	10500 t		EU (2008)
	F _{MGT}	0.4		EU (2008)

* The biological basis of the assessment has changed and previous reference points are no longer valid.

Basis of the assessment

Table 6.3.2.5 Cod in Subdivision 3.a.21. The basis of the assessment.

ICES stock data category	3 (ICES, 2016a)
Assessment type	Age-based analytical assessment (stochastic state–space model SAM), considered indicative of trends only (ICES, 2016b).
Input data	Commercial catches (international landings, ages and length frequencies from catch sampling); five bottom trawl survey indices (IBTS-Q1; IBTS-Q3; Havfisker-Q1; Havfisker-Q4: cod survey; annual maturity data from survey (IBTS-Q1); Natural mortalities fixed at 0.2.
Discards and bycatch	Included in the assessment, data series from the majority of the fleets (covering 87% of the landings).
Indicators	None
Other information	Benchmarked in 2009 (ICES, 2009); next benchmark is planned for 2017.
Working group	Baltic Fisheries Assessment Working Group (WGBFAS)

Information from stakeholders

The latest fishers' survey (Napier, 2014; Figure 6.3.2.2) reports continued strong increases in stock abundance in Area 9. No new information has been provided for 2015.

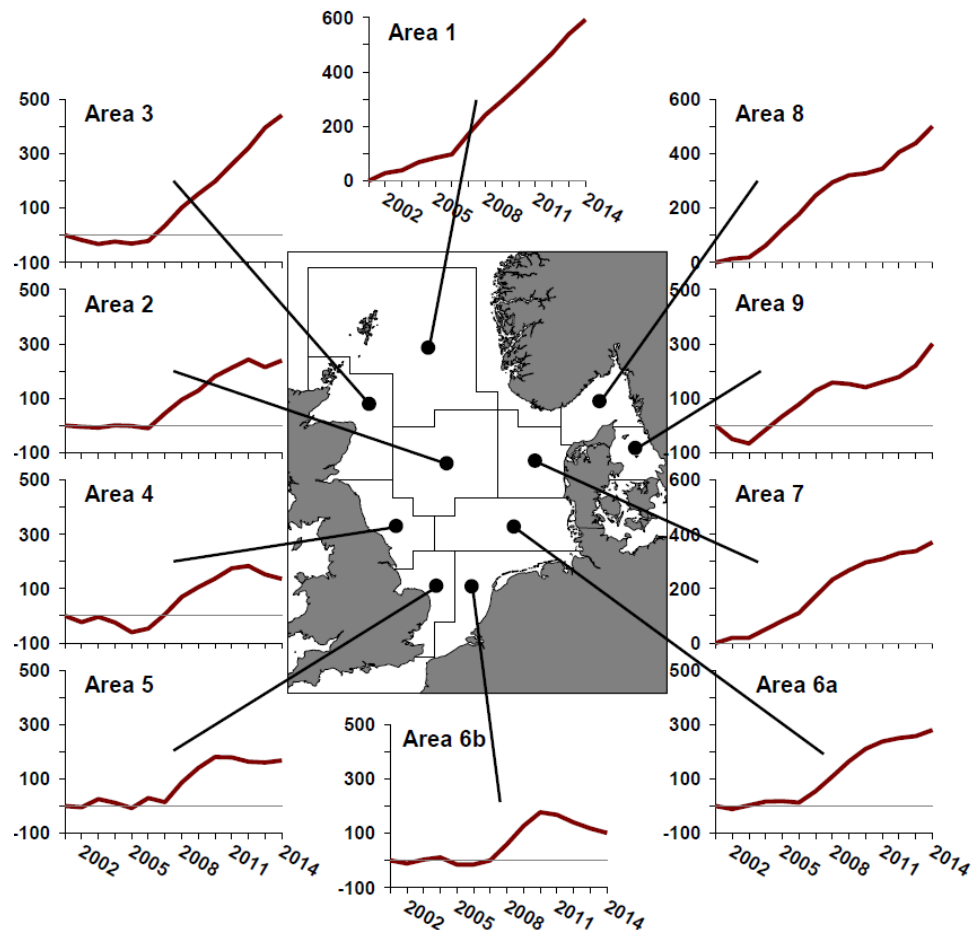


Table 6.3.2.2 Cumulative time-series of index of perceptions of abundance of cod by roundfish sampling area from the Fishers' North Sea Stock Survey (Napier, 2014; see page 14 for an explanation of the index).

History of the advice, catch, and management

Table 6.3.2.6 Cod in Subdivision 3.a.21. History of ICES advice, the agreed TAC, and ICES estimates of landings. Weights are in thousand tonnes.

Year	ICES advice	Predicted landings corresp. to advice	Predicted catch corresp. to advice	Agreed TAC	Landings (ICES estimates)	Catch (ICES estimates)
1987	Reduction in F	< 13.0		15.5	11.5	
1988	Reduction in F	< 15.0		15	5.5	
1989	TAC	10		12.5	8.6	
1990	TAC	7		8.5	5.9	
1991	TAC	6.3		6.65	6.8	
1992	30% reduction in fishing effort	-		6.65	6.3	
1993	Limit fishing effort to 70% of 1991 effort	-		6.8	7.2	
1994	Reduction in catch from 1991–1992	< 6.3–6.8		6.7	7.8	
1995	Precautionary TAC based on recent catches	6–7		6.7	8.2	
1996	30% Reduction in fishing effort from 1994 level	-		7.7	6.1	
1997	Fishing effort should not exceed 70% of the 1994 level	-		8.5	9.5	10.341
1998	Fishing effort should not exceed 70% of the 1994 level	-		7.5	6.8	7.499
1999	F = 0.6	4.5		6.3	6.6	7.372
2000	At least 40% reduction in F	6.4		7	4.9	5.889
2001	F = F _{pa} = 0.6	4.7		6.2	3.9	4.783
2002	No fishery	0		2.8	2.3	3.047
2003	No fishery	0		2.3	2	2.795
2004	No fishery	0		1.363	1.4	2.466
2005	No fishery	0		1	1.1	1.645
2006	No fishery	0		0.85	0.9	1.725
2007	No fishery	0		0.731	0.6	1.222
2008	No catch	0		0.673	0.45	0.614
2009	No catch	0		0.505	0.197	0.274
2010	No catch	0		0.379	0.155	0.322
2011	No directed fisheries, minimize bycatches	0		0.190	0.145	0.361
2012	No directed fisheries, minimize bycatch and discards	0		0.133	0.094	0.236
2013	No directed fisheries, minimize bycatch and discards	0		0.1	0.092	0.443
2014	Same advice as for 2013.	0		0.1	0.108	0.447
2015	Same advice as last year	0		0.1	0.107	0.508
2016	Precautionary approach (increase recent landings by no more than 20%)	≤ 0.130	≤ 0.536	0.370		
2017	Precautionary approach (increase recent catch advice by no more than 20%)	≤ 0.129	≤ 0.643			

History of catch and landings

Table 6.3.2.7 Cod in Subdivision 3.a.21. Catch distribution by fleet in 2015 as estimated by ICES.

Total catch (2015)	Landings		Discards
508 t	71% trawlers	29% passive gears	401 t
	107 t		

Table 6.3.2.8 Cod in Subdivision 3.a.21. History of commercial landings and ICES estimated values, by country. Total discards and total catch are presented. Weights are in tonnes.

Year	Denmark	Sweden	Germany*	Total landings	Discards	Catch
1971	11748	3962	22	15732		
1972	13451	3957	34	17442		
1973	14913	3850	74	18837		
1974	17043	4717	120	21880		
1975	11749	3642	94	15485		
1976	12986	3242	47	16275		
1977	16668	3400	51	20119		
1978	10293	2893	204	13390		
1979	11045	3763	22	14830		
1980	9265	4206	38	13509		
1981	10693	4380	284	15337		
1982	9320	3087	58	12465		
1983	9149	3625	54	12828		
1984	7590	4091	205	11886		
1985	9052	3640	14	12706		
1986	6930	2054	112	9096		
1987	9396	2006	89	11491		
1988	4054	1359	114	5527		
1989	7056	1483	51	8590		
1990	4715	1186	35	5936		
1991	4664	2006	104	6834		
1992	3406	2771	94	6271		
1993	4464	2549	157	7170		
1994	3968	2836	98	7802**		
1995	3789	2704	71	8164***		
1996	4028	2334	64	6126^		
1997	6099	3303	58	9460^^	881	10341
1998	4207	2509	38	6835	664	7499
1999	4029	2540	39	6608	764	7372
2000	3285	1568	45	4897	992	5889
2001	2752	1191	16	3960	823	4783
2002	1726	744	3	2470	577	3047
2003	1441	603#	1	2045	750	2795
2004	827	575	1	1403	1063	2466
2005	608	336	10	1070^^^	575	1645
2006	540	315	21	876	849	1725
2007	390	247	7	645	577	1222
2008	296	152	1	449	165	614
2009	134	62	0.3	197	77	274
2010	117	38	0.3	155	167	322
2011	102	42	1.4	145	216	361
2012	63	31	0.0	94	142	236
2013	60	32	0.0	92	351	443

Year	Denmark	Sweden	Germany*	Total landings	Discards	Catch
2014	75	32	0.0	108	339	447
2015	69	38	0	107	401	508

* Landings statistics incompletely split on the Kattegat and Skagerrak.

** Including 900 t reported in Skagerrak.

*** Including 1600 t misreported by area.

^ Excluding 300 t taken in subdivisions 22–24.

^^ Including 1700 t reported in Subdivision 23.

^^^ Including 116 t reported as pollack.

The catch reported to the EU exceeds the catch reported to the WG (shown in the table) by 40%.

Summary of the assessment

Table 6.3.2.9 Cod in Subdivision 3.a.21. Assessment summary. Weights are in tonnes.

Year	Relative						Landings	Discards	Unallocated catch	Relative		
	Recruitment (Age 1)	High	Low	Stock Size: SSB	High	Low				Mortality (Z-0.2, ages 3–5)	High	Low
1997	1.866	3.108	1.121	2.595	3.034	2.22	9460	881		1.199	1.445	0.997
1998	1.601	2.698	0.951	1.69	1.96	1.456	6835	664		1.208	1.439	1.015
1999	1.64	2.741	0.982	1.587	1.805	1.396	6608	764		1.248	1.476	1.055
2000	0.955	1.536	0.593	1.219	1.382	1.075	4897	992		1.326	1.563	1.125
2001	0.529	0.848	0.33	1.048	1.192	0.921	3960	823		1.415	1.683	1.188
2002	1.124	1.785	0.708	0.884	1.017	0.768	2470	577		1.193	1.434	0.992
2003	0.454	0.774	0.266	0.776	0.885	0.68	2045	750	671	1.03	1.257	0.846
2004	1.599	2.556	1.001	0.834	0.962	0.724	1403	1063	173	0.996	1.211	0.821
2005	0.957	1.525	0.601	0.97	1.111	0.848	1070	575	2961	1.032	1.249	0.852
2006	1.255	2.018	0.781	1.135	1.31	0.984	876	849	3812	0.981	1.187	0.812
2007	0.431	0.737	0.252	0.795	0.906	0.698	645	577	2432	1.222	1.475	1.013
2008	0.222	0.356	0.139	0.452	0.514	0.397	449	165	1283	1.3	1.569	1.076
2009	0.696	1.081	0.449	0.189	0.216	0.166	197	77	712	1.201	1.474	0.979
2010	0.548	0.839	0.358	0.197	0.227	0.17	155	167	869	1.011	1.28	0.799
2011	0.614	0.941	0.4	0.272	0.322	0.23	145	216	1170	0.743	0.967	0.57
2012	1.373	2.197	0.858	0.3	0.362	0.249	94	142	1416	0.633	0.842	0.476
2013	1.951	3.323	1.145	0.523	0.645	0.424	92	351	2596	0.492	0.676	0.358
2014	0.691	1.104	0.432	1.001	1.288	0.778	108	339	4394	0.377	0.542	0.263
2015	0.493	0.809	0.301	1.795	2.445	1.318	107	401	3407	0.391	0.574	0.267
2016				1.737	2.886	1.046						

Sources and references

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