

6.3.3 Cod (*Gadus morhua*) in Subarea 4, Division 7.d, and Subdivision 3.a.20 (North Sea, eastern English Channel, Skagerrak) (update)

ICES stock advice

Please note: The present advice replaces the advice given for this stock in June 2016.

ICES advises that when the MSY approach is applied, catches in 2017 should be no more than 47 359 tonnes.

Stock development over time

Fishing mortality (F) has been declining since 2000 and is estimated to be above F_{MSY} . Spawning-stock biomass (SSB) has increased from the historical low in 2006 and is just above MSY $B_{trigger}$. Recruitment since 1998 remains poor.

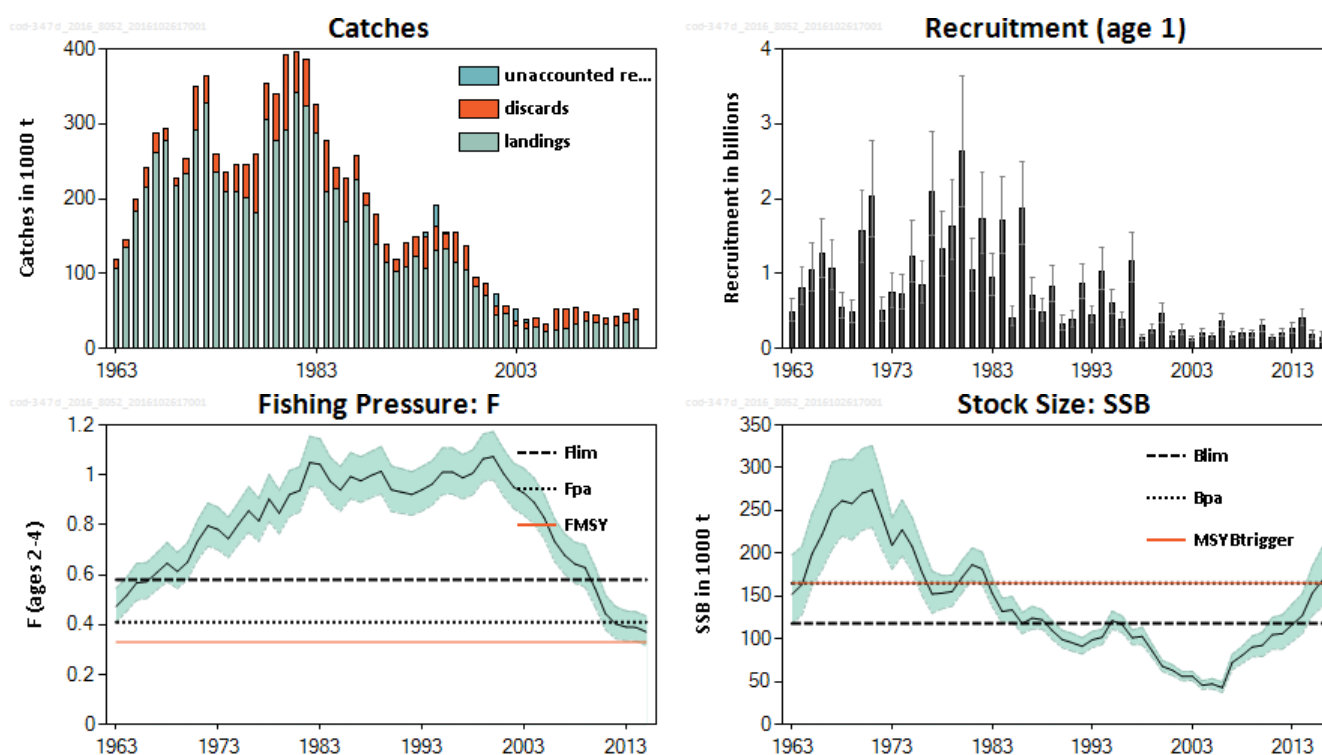


Figure 6.3.3.1 Cod in Subarea 4, Division 7.d, and Subdivision 3.a.20. Summary of stock assessment with point-wise 95% confidence intervals. Catch is estimated and adjusted for unaccounted removals (from 1993 to 2005).

Stock and exploitation status

Table 6.3.3.1 Cod in Subarea 4, Division 7.d, and Subdivision 3.a.20. 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}	✘	✘	✘ Above	MSY	✘	✘ Above trigger
Precautionary approach	F_{pa} , F_{lim}	✔	✔	✔ Harvested sustainably	B_{pa} , B_{lim}	○	○ Full reproductive capacity
Management plan	F_{MGT}	-	-	- Not applicable	SSB_{MGT}	-	- Not applicable

Catch options

Table 6.3.3.2 Cod in Subarea 4, Division 7.d, and Subdivision 3.a.20. The basis for the catch options.

Variable	Value	Source	Notes
F ages 2–4 (2016)	0.37	ICES (2016a)	= F ages 2–4 (2015), assuming effort similar to 2015
SSB (2017)	176299 t	ICES (2016a)	tonnes
R _{age1} (2016)	133 million	ICES (2016a)	Median recruitment estimate in 2016
R _{age1} (2017)	197 million	ICES (2016a)	Median recruitment resampled from the years 1998–2015
Catch (2016)	56962 t	ICES (2016a)	Short-term forecast, tonnes
Landings (2016)	46031 t	ICES (2016a)	Assuming 2015 landings fraction by age, tonnes
Discards (2016)	10930 t	ICES (2016a)	Assuming 2015 discard fraction by age, tonnes

Table 6.3.3.3 Cod in Subarea 4, Division 7.d, and Subdivision 3.a.20. The catch options. All weights are in tonnes.

Rationale	Total catch (2017)	Wanted catch* (2017)	Unwanted catch* (2017)	Basis	F _{total} (2017)	F _{wanted} (2017)	F _{unwanted} (2017)	SSB (2018)	% SSB Change**	% TAC Change wanted catch***
MSY approach	47359	39651	7708	F _{MSY}	0.33	0.23	0.1	181374	3	-2
EU-Norway Management Strategy (MS) with previous reference points	55876	46754	9122	Long-term phase	0.4	0.28	0.12	171971	-2	16
EU-Norway MS with new reference points	55876	46754	9122	Long-term phase	0.4	0.28	0.12	171971	-2	16
Zero catch	0	0	0	F = 0	0	0	0	192601	34	-100
Other options	57039	47740	9299	F _{pa}	0.41	0.29	0.12	170652	-3	18
	75481	63192	12289	F _{lim}	0.58	0.41	0.17	149955	-15	56
	105033	87793	17240	SSB (2018) = B _{lim}	0.91	0.64	0.27	118000	-33	117
	61928	51863	10065	SSB (2018) = B _{pa}	0.45	0.32	0.13	165000	-6	28
	61928	51863	10065	SSB (2018) = MSY B _{trigger}	0.45	0.32	0.13	165000	-6	28
	38404	32335	6069	TAC ₂₀₁₆ - 20%	0.26	0.18	0.08	192162	9	-20
	40813	34356	6457	TAC ₂₀₁₆ - 15%	0.28	0.20	0.08	189519	7	-15
	43224	36377	6847	TAC ₂₀₁₆ - 10%	0.30	0.21	0.09	186772	6	-10
	45635	38398	7237	TAC ₂₀₁₆ - 5%	0.32	0.22	0.10	184025	4	-5
	48049	40419	7630	Constant TAC	0.33	0.24	0.09	181234	3	0
	50464	42440	8024	TAC ₂₀₁₆ + 5%	0.35	0.25	0.10	178427	1	5
	52879	44461	8418	TAC ₂₀₁₆ + 10%	0.37	0.26	0.11	175714	0	10
	55295	46482	8813	TAC ₂₀₁₆ + 15%	0.39	0.28	0.11	173017	-2	15
57713	48503	9210	TAC ₂₀₁₆ + 20%	0.42	0.29	0.13	169100	-3	20	
52735	44156	8579	F ₂₀₁₆	0.37	0.26	0.11	175461	0	9	
<i>Mixed fisheries options –differences with calculations above can occur because of the different methodology used (ICES, 2016c.)</i>										
Maximum	101418			A	0.9572			102988	-42	
Minimum	27555			B	0.1942			184511	5	
Cod	44297			C	0.33			165509	-6	
SQ effort	53409			D	0.411			155275	-12	
Value	43203			E	0.3206			166742	-5	

* "Wanted" and "unwanted" catch are used to describe fish that would be landed and discarded in the absence of the EU landing obligation, based on discard rate estimates for 2015.

** SSB 2018 relative to SSB 2017.

*** Wanted catch in 2017 relative to TACs 2016: North Sea (33 651 t) + Skagerrak (4807 t) + Eastern English Channel (1961 t) = 40 419 t.

Mixed-fisheries assumptions

(note: "fleet's stock share" is used to describe the share of the fishing opportunities for each particular fleet, which has been calculated based on the single-stock advice for 2017 and the historical proportion of the stock landings taken by the fleet):

- A. Maximum scenario: Each fleet stops fishing when its last stock share is exhausted.
- B. Minimum scenario: Each fleet stops fishing when its first stock share is exhausted.
- C. Cod scenario: Each fleet stops fishing when its cod stock share is exhausted.
- D. SQ (*status quo*) effort scenario: The effort of each fleet in 2016 and 2017 is as in 2015.
- E. Value scenario: The effort of each fleet is equal to the weighted average of the efforts required to catch the fleet's quota share of each of the stocks, where the weights are the relative catch values of each stock in the fleet's portfolio.

Basis of the advice

Table 6.3.3.4 Cod in Subarea 4, Division 7.d, and Subdivision 3.a.20. The basis of the advice.

Advice basis	MSY approach
Management plan	<p>The EU–Norway management strategy was updated in December 2008. The EU has adopted a long-term plan with the same aims (EU management plan; EU, 2008). ICES evaluated the EU–Norway management strategy in 2009 and concluded that it was in accordance with the precautionary approach if implemented and enforced adequately. The management strategy was considered by ICES to switch from the recovery phase to the long-term phase in 2013.</p> <p>Changes to the stock assessment and reference points in 2015 imply a need to re-evaluate the management strategy to ascertain if it can still be considered precautionary under the new stock perception. Until such an evaluation is conducted, the ICES advice is based on the MSY approach.</p>

Quality of the assessment

The overall reporting of catch data provided to ICES has improved during 2012–2015 through such aspects as the fully documented fisheries (FDF) programme and increased coverage by the Scottish industry/science observer sampling scheme.

The benchmark in 2015 introduced annually varying maturity estimates to the assessment (ICES, 2015a). Maturity sampling in the southern North Sea was poor in 2016, leading ICES to reject the 2016 maturity estimates and use the 2015 estimates instead. This had no impact on the advice.

Changes to the assessment in 2015 resulted in an upscaling of SSB compared to previous assessments.

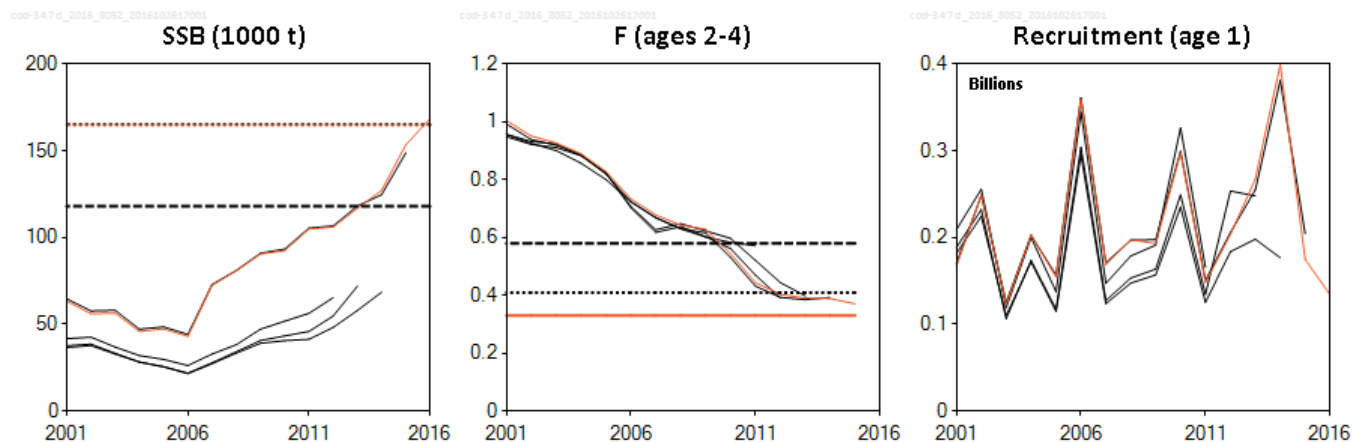


Figure 6.3.3.2 Cod in Subarea 4, Division 7.d, and Subdivision 3.a.20. Historical assessment results (final-year recruitment estimates included).

Issues relevant for the advice

The 2014 year class is estimated to be weak, and the 2016 surveys indicate that the incoming 2015 year class is also weak. ICES evaluated the EU–Norway management strategy for North Sea cod in 2009 and concluded that it was in accordance with the precautionary approach if implemented and enforced adequately. Until 2014, the basis of the ICES advice was the EU–Norway management strategy. However, changes to the stock assessment and reference points in 2015 imply a need to re-evaluate the management strategy in order to ascertain if it can still be considered precautionary under the new stock perception. Until such an evaluation is conducted, the ICES advice is based on the MSY approach.

The EU–Norway management strategy is based on B_{lim} and B_{pa} as part of the sliding rule. With the ICES revision of these reference points in 2015 an update of the strategy consistent with these reference points could be considered.

The EU cod management plan (EU, 2008) has the same aims as the EU–Norway management strategy and additionally complements the TAC with an effort regime. Following Article 12 of the plan, the maximum allowable effort for the relevant effort groups would be adjusted by the same percentage as the fishing mortality. The adjustment in F , according to the EU cod management plan catch option from 2016 to 2017, is a 8% increase.

Since the implementation of the management plan, fishing mortality rates have been reduced and the stock has increased since 2006, in spite of continued low recruitment. Furthermore, the decrease in F has led to an increase in the number of older fish in the population in recent years (Figure 6.3.3.3). Recent recruitments have been low, possibly influenced by changes in the availability of food resources for cod larvae, increasing predation pressure, and lower survival of eggs produced by younger cod. Multispecies model runs estimate an increase in cannibalism rates with increasing stock levels, and also high predation from grey gurnard on 0-group cod. Seal predation on ages 2 and 3 has increased slightly over the years after an increase in seal abundance. Harbour porpoises also take a substantial amount of cod, mainly of ages 1 and 2 (ICES, 2015b).

Cod is widely distributed throughout the North Sea, but there are indications of subpopulations inhabiting different regions of the North Sea (e.g. from genetic studies). The inferred limited degree of mixing suggests slow recolonization in areas where subpopulations are depleted. Figure 6.3.3.4 plots a cod biomass index by subregion (with subregions given in Figure 6.3.3.6), and highlights differing rates of change in this index. The figure shows a general decline in all areas prior to the mid-2000s and a general increase in all areas thereafter, apart from the southern area. It is unclear what the reasons for the lack of recovery are; further work is required to investigate climate change, biological, and fisheries effects. Recruitment has declined and has remained low in all areas (Figure 6.3.3.5).

Results from a North Sea mixed-fisheries analysis are presented in ICES (2016c). For 2017, assuming a strictly implemented discard ban (corresponding to the “Minimum” scenario), haddock would be the most limiting stock (assuming that the full advised catch is taken), constraining 36 out of 41 fleet segments (corresponding to 91% of the 2015 kW days of effort). Cod and eastern Channel sole would be limiting for fleets, corresponding to 5% and 4% of the 2015 effort, respectively. Conversely, in the “Maximum” scenario with *Nephrops* managed by separate TACs for the individual functional units (FUs), *Nephrops* would be considered the least limiting stocks in many FUs. *Nephrops* in FU 33, FU 5, FU 32, FU 7, and FU Others would be the least limiting stocks for fleets in these FUs, representing 32%, 16%, 10%, 4%, and 17% of the 2015 effort, respectively. Eastern Channel plaice and saithe would be least limiting for other fleet segments, representing 12% and 9% of the 2015 effort, respectively.

Results for the North Sea cod stock are also included as additional rows in the catch options table of this advice sheet.

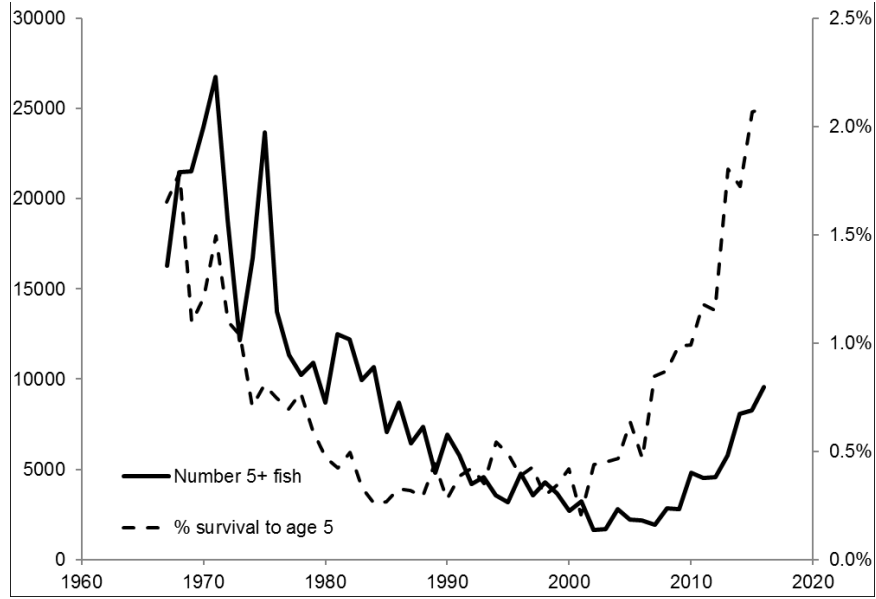


Figure 6.3.3.3 Cod in Subarea 4, Division 7.d, and Subdivision 3.a.20. Estimates of the number of 5-year-old and older cod in the population (solid line; thousands) and the percentage of 1-year-olds by number that have survived to age 5 in the given year (dashed line).

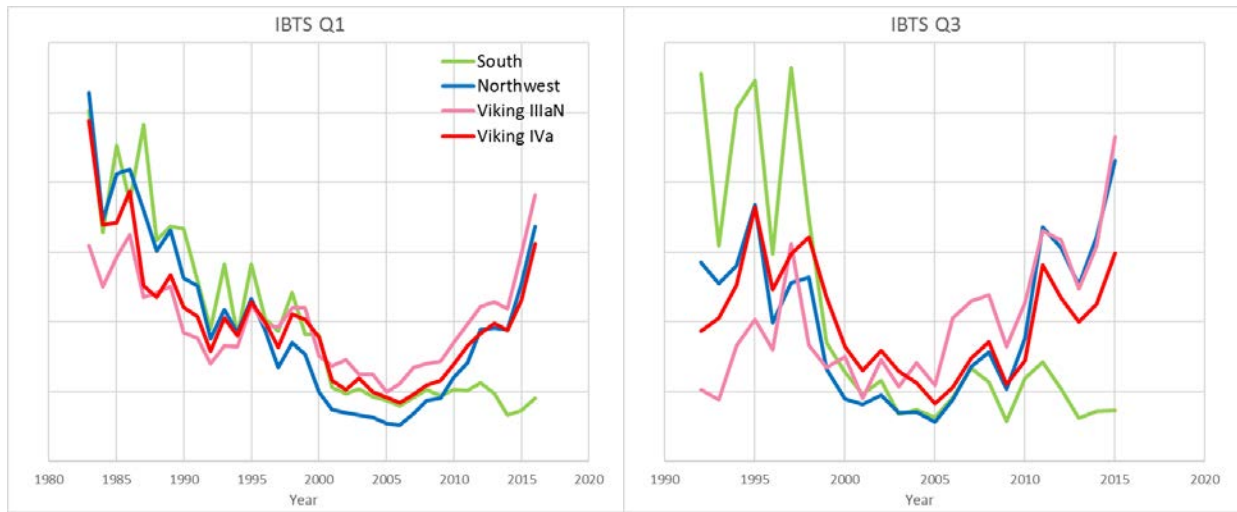


Figure 6.3.3.4 Cod in Subarea 4, Division 7.d, and Subdivision 3.a.20. Biomass indices by subregion (see Figure 6.3.3.6), based on the NS IBTS Q1 and Q3 survey data. The biomass indices are derived by fitting a non-stationary Delta-GAM model (including ship effects) to numbers-at-age for the entire dataset and integrating the fitted abundance surface over each of the subareas to obtain indices-at-age by area. These are then multiplied by smoothed weight-at-age estimates and summed to get the biomass indices.

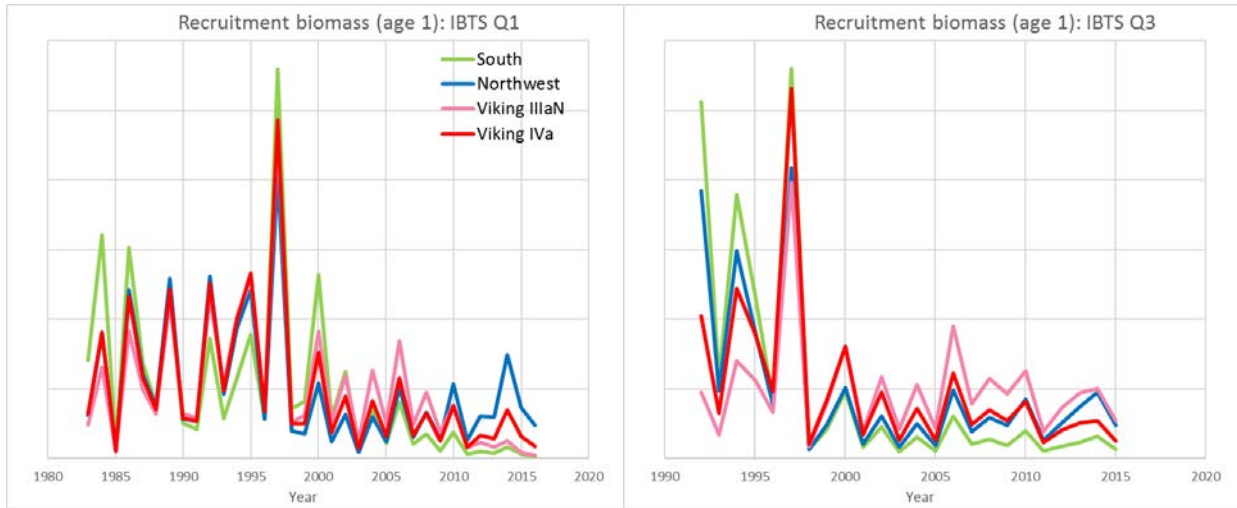


Figure 6.3.3.5 Cod in Subarea 4, Division 7.d, and Subdivision 3.a.20. Recruitment indices by subregion (see Figure 6.3.3.6), based on NS IBTS Q1 and Q3 survey data.

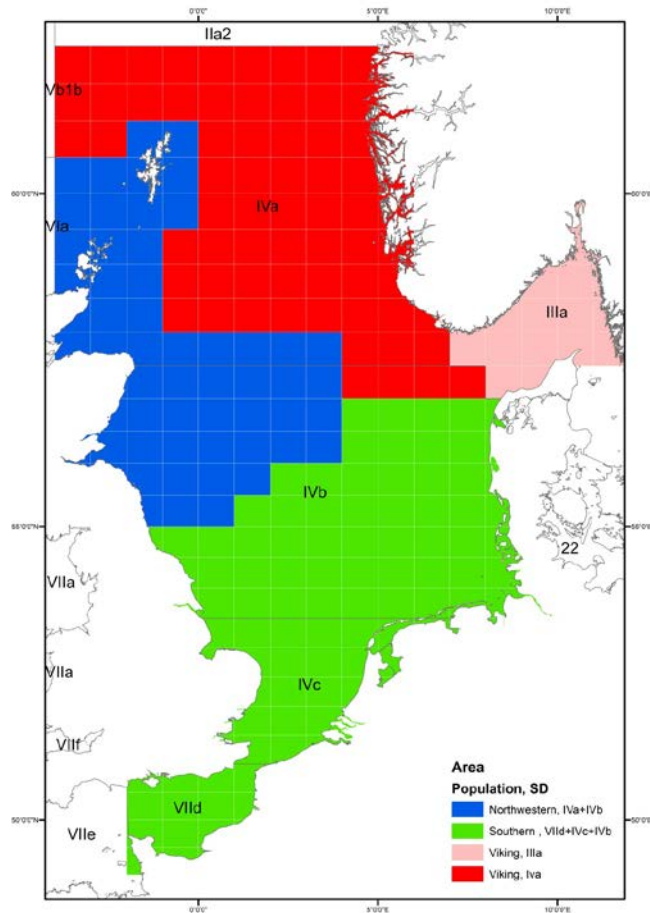


Figure 6.3.3.6 Cod in Subarea 4, Division 7.d, and Subdivision 3.a.20. Subregions used to derive area-specific biomass indices, based on NS IBTS Q1 and Q3 survey data.

Reference points

Table 6.3.3.5 Cod in Subarea 4, Division 7.d, and Subdivision 3.a.20. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	165000 t	B_{pa}	
	F_{MSY}	0.33	EQSim analysis based on recruitment period 1988–2014	ICES (2015b)
Precautionary approach	B_{lim}	118000 t	SSB associated with the last above-average recruitment (1996 year class)	ICES (2015b)
	B_{pa}	165000 t	$B_{pa} = B_{lim} * \exp(1.645 \sigma_B)$; $\sigma_B = 0.205$	ICES (2015b)
	F_{lim}	0.58	EQSim analysis based on recruitment period 1998–2014	ICES (2016a)
	F_{pa}	0.41	$F_{pa} = F_{lim} * \exp(-1.645 \sigma_F)$; $\sigma_F = 0.205$	ICES (2016a)
EU–Norway management strategy	$SSB_{MS-lower}$	70000 t	Former B_{lim}	EU (2008)
	$SSB_{MS-upper}$	150000 t	Former B_{pa}	
	$F_{MS-lower}$	0.2	Fishing mortality when $SSB < SSB_{MS-lower}$	
	$F_{MS-upper}$	0.4	Fishing mortality when $SSB > SSB_{MS-upper}$	

Basis of the assessment

Table 6.3.3.6 Cod in Subarea 4, Division 7.d, and Subdivision 3.a.20. The basis of the assessment.

ICES stock data category	1 (ICES, 2016b).
Assessment type	Age-based analytical assessment (SAM; ICES, 2016a) that uses catches in the model and in the forecast. Estimates of unaccounted removals are used for 1993–2005 (Nielsen and Berg, 2014).
Input data	Commercial catches (international landings, ages and length frequencies from catch sampling by métier), two survey indices (IBTS Q1, IBTS Q3) derived by a Delta-GAM approach assuming a stationary spatial model with ship effect. Smoothed annually varying maturity data from IBTS Q1 (1978–2015). Annually varying natural mortalities from multispecies model (1974–2013). Norwegian coastal cod data have been removed from all catch data used in the assessment.
Discards and bycatch	Discards included (78% reported, 22% raised), data series from the main fleets (in 2015 covering 70% of the landings by weight).
Indicators	NS-IBTS biomass indices by subregion.
Other information	Benchmarked in 2015 (ICES, 2015a; Annex 9 of ICES, 2015b).
Working groups	Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK) and Working Group on Mixed Fisheries Advice (WGMIXFISH-ADVICE).

Information from stakeholders

Comparison between the stock trends as recorded by the fishers' North Sea stock survey (Napier, 2014; Figure 6.3.3.7) and the IBTS survey data has shown that the time-series, as in previous years, are broadly in agreement in recording a stable overall stock abundance during 2001–2005, followed by a more recent strong increase. The latest fishers' survey reports continued strong increases in stock abundance in all areas apart from the south, in which an increase occurred until 2011 followed by a levelling off and in some areas a slight decline. No new information has been provided for 2015.

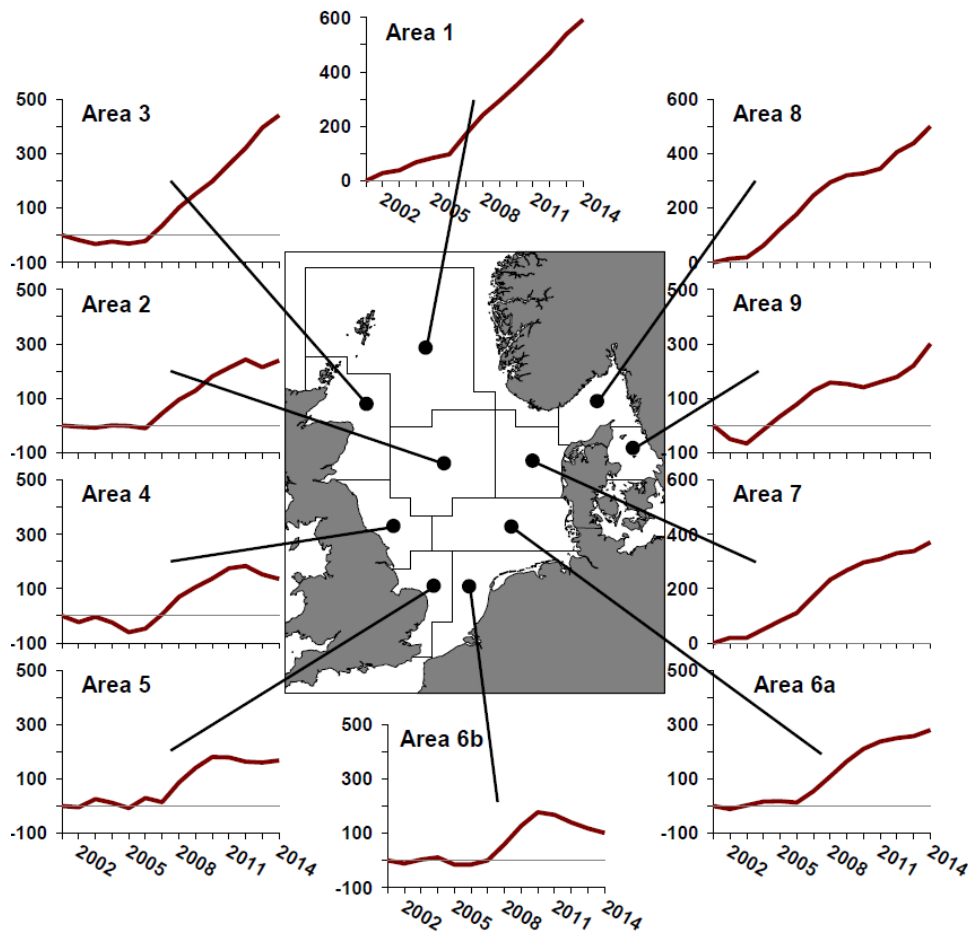


Figure 6.3.3.7 Cod in Subarea 4, Division 7.d, and Subdivision 3.a.20. Cumulative time-series of index of perceptions of abundance of cod by roundfish sampling area from the Fishers' North Sea Stock Survey (Napier, 2014; see page 14 for an explanation of the index).

History of the advice, catch, and management

Table 6.3.3.7 Cod in Subarea 4, Division 7.d, and Subdivision 3.a.20. History of ICES advice, the agreed TAC, and ICES estimates of landings. All weights are in thousand tonnes.

North Sea (Subarea 4)

Year	ICES advice	Predicted landings corresponding to advice	Predicted catch corresponding to advice	Agreed TAC	Official landings*	ICES landings**	ICES discards
1987	SSB recovery; TAC	100–125		175	167	182	
1988	70% of F(86); TAC	148		160	142	157	
1989	Halt SSB decline; protect juveniles; TAC	124		124	110	116	
1990	80% of F (88); TAC	113		105	99	105	
1991	70% of effort (89)			100	87	89	
1992	70% of effort (89)			100	98	97	
1993	70% of effort (89)			101	94	105	
1994	Significant effort reduction			102	87	95	
1995	Significant effort reduction			120	111	120	
1996	80% of F(94) = 0.7	141		130	107	107	
1997	80% of F(95) = 0.65	135		115	102	102	
1998	F(98) should not exceed F(96)	153		140	122	122	
1999	F = 0.60 to rebuild SSB	125		132	78	78	
2000	F less than 0.55	< 79		81	60.9	59	
2001	lowest possible catch	0		48.6	41.7	41	
2002	lowest possible catch	0		49.3	44.4	42.2	7.2
2003	Closure	0		27.3	25.9	24.1	2.6
2004	Zero catch	0		27.3	23.8	22.5	5.0
2005	Zero catch	0		27.3	22.5	22.9	5.2
2006	Zero catch	0		23.2	23.1	21.1	5.2
2007	Zero catch	0		20.0	20.8	19.1	22.4
2008	Exploitation boundaries in relation to precautionary limits. Total removals < 22 000 t	< 22		22.2	22.3	21.7	20.7
2009	Zero catch	0		28.8	27.4	27.6	13.5
2010	Management plan F (65% of F ₂₀₀₈)	< 40.3 ***		33.6	31.7	31.0	10.1
2011	See scenarios	-		26.8	27.8	26.7	6.1
2012	Management plan F (45% of F ₂₀₀₈)	< 31.8		26.5	27.6	26.6	6.5
2013	Management plan (TAC -20%)	< 25.441		26.5	26.3	25.3	8.4
2014	Management plan long-term phase	< 28.809		27.8	29.3	28.6	7.8
2015	Management plan long-term phase	< 26.713		29.2	32.0	31.2	9.7
2016	MSY approach	≤ 40.419	≤ 49.259	33.7			
2017	MSY approach	≤ 39.651	≤ 47.359				

* Official landings for Norway include Norwegian fjords.

** Norwegian fjords not included from 2002 onwards.

*** From 2010 onwards, the advice is for Subarea 4 (North Sea), Division 7.d (Eastern English Channel), and Subdivision 3.a.20 (Skagerrak).

Table 6.3.3.7 (cont.)
Skagerrak (Subdivision 3.a.20)

Year	ICES advice	Predicted landings corresponding to advice	Predicted catch corresponding to advice	Agreed TAC*	Official landings	ICES landings*	ICES discards
1987	F = F _{max}	< 21		22.5	19.9	20.9	
1988	Reduce F			21.5	17.0	16.9	
1989	F at F _{med}	< 23		20.5	18.7	19.6	
1990	F at F _{med} ; TAC	21.0		21.0	17.8	18.6	
1991	TAC	15.0		15.0	12.1	12.4	
1992	70% of F(90)			15.0	14.0	14.8	
1993	Precautionary TAC			15.0	14.7	15.3	
1994	No long-term gain in increased F + precautionary TAC			15.5	15.1	13.9	
1995	If required precautionary TAC; link to North Sea			20.0	19.8	12.1	
1996	If required precautionary TAC; link to North Sea			23.0	17.9	16.4	
1997	If required precautionary TAC; link to North Sea			16.1	15.7	14.9	
1998	If required precautionary TAC; link to North Sea	21.9		20.0	15.6	15.3	
1999	F = 0.60 to rebuild SSB	17.9		19.0	11.8	11.0	
2000	F less than 0.55	< 11.3		11.6	9.9	9.3	
2001	lowest possible catch	0		7.0	7.7	7.1	
2002	lowest possible catch	0		7.1	7.1	6.9	4.2
2003	Closure	0		3.9	4.5	4.0	1.2
2004	Zero catch	0		3.9	4.5	3.9	3.6
2005	Zero catch	0		3.9	4.3	4.0	4.6
2006	Zero catch	0		3.3	3.9	3.3	6.4
2007	Zero catch	0		2.9	3.7	3.0	5.9
2008	Exploitation boundaries in relation to precautionary limits. Total removals less than 22 000 t	< 22		3.2	3.8	3.4	2.7
2009	Zero catch	0		4.1	4.0	3.8	2.9
2010	Management plan F (65% of F ₂₀₀₈)	< 40.3**		4.8	4.2	4.1	2.0
2011	See scenarios	-		3.8	4.1	4.0	2.1
2012	Management plan F (45% of F ₂₀₀₈)	< 31.8		3.8	4.4	4.3	2.1
2013	Management plan (TAC -20%)	< 25.441		3.8	4.2	4.2	1.8
2014	Management plan long-term phase	< 28.809		4.0	4.6	4.7	2.2
2015	Management plan long-term phase	< 26.713		4.2	4.5	4.6	2.9
2016	MSY approach	≤ 40.419	≤ 49.259	4.8			
2017	MSY approach	≤ 39.651	≤ 47.359				

* Norwegian fjords not included.

** From 2010 onwards, the advice is for Subarea 4 (North Sea), Division 7.d (Eastern Channel), and Subdivision 3.a.20 (Skagerrak).

**Table 6.3.3.7 (cont.)
Eastern Channel (Division 7.d)**

Year	ICES Advice	Predicted landings corresponding to advice	Predicted catch corresponding to advice	Agreed TAC*	Official landings	ICES landings	ICES discards
1987	Not assessed	-		-	9.4	14.2	
1988	Precautionary TAC	-		-	10.1	10.7	
1989	No increase in F; TAC	10.0**		-	n/a	5.5	
1990	No increase in F; TAC	9.0**		-	n/a	2.8	
1991	Precautionary TAC	3.0**		-	n/a	1.9	
1992	If required, precautionary TAC	5.5**		-	2.7	2.7	
1993	If TAC required, consider SSB decline	-		-	2.5	2.4	
1994	Reduce F + precautionary TAC			-	2.9	2.9	
1995	Significant effort reduction; link to North Sea			-	4.0	4.0	
1996	Reference made to North Sea advice			-	3.5	3.5	
1997	No advice			-	7.2	7.0	
1998	Link to North Sea	4.9		-	8.7	8.6	
1999	F = 0.60 to rebuild SSB	4.0		-	n/a	6.9	
2000	F less than 0.55	< 2.5		-	3.6	2.3	
2001	lowest possible catch	0		-	2.0	1.6	
2002	lowest possible catch	0		-	1.6	3.1	0.5
2003	Closure	0		-	1.9	2.1	0.2
2004	Zero catch	0		-	1.0	1.0	0.2
2005	Zero catch	0		-	1.2	1.3	0.3
2006	Zero catch	0		-	1.5	1.5	0.4
2007	Zero catch	0		-	2.1	2.1	2.1
2008	Exploitation boundaries in relation to precautionary limits. Total removals less than 22 000 t	< 22		-	1.7	1.6	1.7
2009	Zero catch	0		1.7	2.0	1.9	4.5
2010	Management plan F (65% of F ₂₀₀₈)	< 40.3***		2.0	1.8	1.7	0.3
2011	See scenarios	-		1.6	1.3	1.3	0.6
2012	Management plan F (45% of F ₂₀₀₈)	< 31.8		1.5	1.1	1.1	0.1
2013	Management plan (TAC -20%)	< 25.441		1.5	0.9	0.9	0.1
2014	Management plan long-term phase	< 28.809		1.6	1.5	1.4	0.6
2015	Management plan long-term phase	< 26.713		1.7	1.4	1.4	0.02
2016	MSY approach	≤ 40.419	≤ 49.259	2.0			
2017	MSY approach	≤ 39.651	≤ 47.359				

* Until 2008 this area was included in the TAC for Subarea 7 (except Division 7.a). From 2009 a separate TAC is set.

** Including Division 7.e.

*** From 2010 onwards, the advice is for Subarea 4 (North Sea), Division 7.d (Eastern Channel), and Subdivision 3.a.20 (Skagerrak).

History of catch and landings

Table 6.3.3.8 Cod in Subarea 4, Division 7.d, and Subdivision 3.a.20. Catch distribution by fleet in 2015 as estimated by ICES.

Total catch (2015)	Landings					Discards
49841 t	66% demersal trawls and seines >100 mm	14% gillnets	8% demersal trawls 70–99 mm	5% beam trawls	7% other gears	12635 t
	37205 t					

Table 6.3.3.9 Cod in Subarea 4, Division 7.d, and Subdivision 3.a.20. History of commercial catch and landings; both the official and ICES estimated values are presented by area for each country participating in the fishery. Weights are in tonnes.

Subarea 4										
Country	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	3458	4642	5799	3882	3304	2470	2616	1482	1627	1722
Denmark	23573	21870	23002	19697	14000	8358	9022	4676	5889	6291
Faroe Islands	44	40	102	96	-	9	34	36	37	34
France	1934	3451	2934	.	1222	717	1777	620	294	664
Germany	8344	5179	8045	3386	1740	1810	2018	2048	2213	2648
Greenland	.	.	.	.	.	.	.	.	.	35
Netherlands	9271	11807	14676	9068	5995	3574	4707	2305	1726	1660
Norway	5869	5814	5823	7432	6410	4369	5217	4417	3223	2900
Poland	18	31	25	19	18	18	39	35	-	-
Sweden	617	832	540	625	640	661	463	252	240	319
UK (E/W/Nl)	15930	13413	17745	10344	6543	4087	3112	2213	1890	1270
UK (Scotland)	35349	32344	35633	23017	21009	15640	15416	7852	6650	4936
UK (combined)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Others	0	0	0	0	0	0	0	0	0	0
Danish industrial bycatch *	.	.	.	.	.	.	105	22	17	21
Norwegian industrial bycatch	.	.	.	.	.	.	.	.	.	.
Total Nominal Catch	104407	99423	114324	77566	60881	41713	44526	25958	23806	22500
Unallocated landings	2161	2746	7779	826	-1114	-740	-226	-111	-1277	356
WG estimate of total landings	106568	102169	122103	78392	59767	40973	44300	25847	22529	22855
Agreed TAC	130000	115000	140000	132400	81000	48600	49300	27300	27300	27300
Division 7.d										
Country	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	321	310	239	172	110	93	51	54	47	51
Denmark	-	-	-	-	-	-	-	-	-	-
France	2808	6387	7788	.	3084	1677	1361	1730	810	986
Netherlands	-	-	19	3	4	17	6	36	14	9
UK (E/W/Nl)	414	478	618	454	385	249	145	121	103	184
UK (Scotland)	4	3	1	-	-	-	-	-	-	-
UK (combined)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total Nominal Catch	3547	7178	8665	629	3583	2036	1563	1941	974	1230
Unallocated landings	-44	-135	-85	6229	-1258	-463	1534	-707	40	29
WG estimate of total landings	3503	7043	8580	6858	2325	1573	3097	1234	1014	1259

Table 6.3.3.9 (cont.)

Subdivision 3.a.20**										
Country	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Denmark	14573	12159	12339	8681	7684	5900	5525	3067	3038	3019
Germany	259	81	54	54	54	32	83	49	99	86
Norway	1046	1323	1293	1146	926	762	645	825	856	759
Sweden	1986	2173	1900	1909	1293	1035	897	510	495	488
Others	-	-	-	-	-	-	-	27	24	21
Danish industrial bycatch *	676	205	97	62	99	687	20	5	4	2
Total Nominal Catch	17864	15736	15586	11790	9957	7729	7170	4483	4516	4375
Unallocated landings	-1615	-790	-255	-816	-680	-643	298	-692	-602	-376
WG estimate of total landings	16249	14946	15331	10974	9277	7086	7468	3791	3914	3998
Agreed TAC	23000	16100	20000	19000	11600	7000	7100	3900	3900	3900
Subarea 4, Division 7.d, and Subdivision 3.a.20 (Skagerrak) (combined)										
Country	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Nominal Catch	125818	122337	138575	89985	74421	51478	53260	32382	29296	28104
Unallocated landings	502	1821	7439	6240	-3052	-1846	1605	-1510	-1839	9
WG estimate of total landings	126320	124158	146014	96225	71369	49632	54865	30872	27457	28113
Subarea 4 and Subdivision 3.a.20 (landings not included in the assessment)										
Country	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Danish industrial bycatch *	676	205	97	62	99	687	-	-	-	-
Norwegian industrial bycatch	.	.	.	.	.	.	.	.	.	.
Total	676	205	97	62	99	687	0	0	0	0

* The Danish industrial bycatch (up to 2001) is not included in the (WG estimate of) total landings.

** Skagerrak/Kattegat split derived from national statistics.

. = magnitude not available. - = magnitude known to be nil. < 0.5 = magnitude less than half the unit used in the table. n/a = not applicable.

Table 6.3.3.9 (cont.)

Subarea 4										
Country	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Belgium	1309	1009	894	946	666	653	862	1076	1257	1187
Denmark	5105	3430	3831	4402	5686	4863	4803	4536	5457	6026
Faroe Islands	3	0	16	45	32	0	0	0	0	.
France	354	659	573	950	781	619	368	287	638	521
Germany	2537	1899	1736	2374	2844	2211	2385	1921	2257	2133
Greenland	23	17	17	11	0	0	0	0	0	.
Netherlands	1585	1523	1896	2649	2657	1928	1955	1344	1242	1349
Norway	2749	3057	4128	4234	4496	4898	4601	4079	4590	5486
Poland	0	1	2	3	0	2	0	0	0	.
Sweden	309	387	439	378	363	315	472	332	401	417
UK (E/W/Nl)	1491	1588	1546	2384	2553	2169	1630	2129	2963	.
UK (Scotland)	6857	6511	7185	9052	11567	10141	10565	10619	10517	.
UK (combined)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	13480	14839
Others	786	0	0	0	0	0	0	0	0	0
Danish industrial bycatch	11	23	1	72	12	0	0	2	24	0
Norwegian indust bycatch *	48	101	22	4	201	1	.	.	.	.
Total Nominal Catch	23119	20104	22264	27500	31657	27799	27641	26325	29346	31959
Unallocated landings	-2041	-1047	-607	134	-677	-1124	-1014	-1010	-796	-715
WG estimate of total landings	21078	19056	21657	27634	30980	26675	26627	25315	28550	31244
Agreed TAC	23205	19957	22152	28798	33552	26842	26475	26475	27799	29189
Division 7.d										
Country	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Belgium	80	84	154	73	57	56	40	53	72	79
Denmark	.	.	.	.	.	.	.	.	.	.
France	1124	1743	1326	1779	1606	1078	885	768	1270	1100
Netherlands	9	59	30	35	45	51	40	38	50	47
UK (E/W/Nl)	267	174	144	133	127	125	99	100	156	.
UK (Scotland)	1	12	7	3	1	1	0	0	0	.
UK (combined)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	156	161
Total Nominal Catch	1481	2072	1661	2023	1836	1311	1064	959	1548	1387
Unallocated landings	-2	75	-32	-136	-128	8	56	-43	-112	11
WG estimate of total landings	1479	2147	1629	1887	1708	1319	1120	916	1436	1398
Agreed TAC				1678	1955	1564	1543	1543	1620	1701

Table 6.3.3.9 (cont.)

Subdivision 3.a.20**										
Country	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Denmark	2513	2246	2553	3024	3286	3118	3178	3033	3430	3344
Germany	84	67	52	55	56	60	78	69	84	87
Norway	628	681	779	440	375	421	615	575	528	499
Sweden	372	370	365	459	458	518	520	529	570	576
Others	373	385	13	2	26	0	0	33	28	24
Danish industrial bycatch	3	2	7	2	10	0	1	1	5	5
Total Nominal Catch	3973	3751	3769	3982	4211	4117	4392	4240	4645	4536
Unallocated landings	-715	-731	-376	-188	-154	-161	-65	-86	42	27
WG estimate of total landings	3258	3020	3393	3794	4057	3956	4327	4154	4687	4563
Agreed TAC	3315	2851	3165	4114	4793	3835	3783	3783	3972	4171
Subarea 4 Division 7.d and Subdivision 3.a.20 (combined)										
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total Nominal Catch	28573	25927	27694	33505	37705	33227	33097	31524	35538	37882
Unallocated landings	-2759	-1704	-1015	-190	-959	-1277	-1023	-1139	-865	-676
WG estimate of total landings	25815	24223	26679	33315	36746	31950	32074	30386	34673	37205
Subarea 4 and Subdivision 3.a.20 (landings not included in the assessment)										
Country	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Danish indust bycatch	-	-	-	-	-	-	-	-	-	-
Norwegian indust bycatch *	48	101	22	4	201	1	.	.	.	.
Total	48	101	22	4	201	1	-	-	-	-

* The Danish industrial bycatch (up to 2001) is not included in the (WG estimate of) total landings.

** Skagerrak/Kattegat split derived from national statistics.

. = magnitude not available. - = magnitude known to be nil. < 0.5 = magnitude less than half the unit used in the table. n/a = not applicable.

Summary of the assessment

Table 6.3.3.10a Cod in Subarea 4, Division 7.d, and Subdivision 3.a.20. Assessment summary. Weights are in tonnes.

Year	Recruits age 1 (thousands)	Low	High	TSB (tonnes)	Low	High	SSB (tonnes)	Low	High	F _{bar} 2–4	Low	High
1963	487478	357668	664400	512471	439164	598016	152207	116938	198114	0.473	0.410	0.546
1964	802109	589683	1091060	661986	563467	777731	163407	128333	208068	0.515	0.452	0.587
1965	1043405	769595	1414632	834009	717597	969306	199386	161487	246180	0.567	0.498	0.645
1966	1273144	940099	1724176	997493	859127	1158143	221682	180741	271897	0.572	0.505	0.648
1967	1074107	792335	1456082	1052838	916799	1209063	250446	204671	306459	0.609	0.540	0.687
1968	544161	400873	738665	879404	783787	986687	261450	220439	310091	0.646	0.572	0.729
1969	479740	351653	654482	735275	650537	831051	258074	215584	308937	0.613	0.545	0.689
1970	1561254	1149940	2119689	1193022	989390	1438564	270222	226848	321890	0.650	0.581	0.727
1971	2034987	1492585	2774497	1330413	1124452	1574100	274032	230600	325643	0.735	0.660	0.819
1972	508897	372786	694703	921723	815909	1041260	242802	204436	288368	0.796	0.714	0.887
1973	739700	542119	1009292	738222	654023	833261	209190	181291	241384	0.781	0.700	0.870
1974	725053	530396	991149	710696	628446	803710	227521	197289	262387	0.744	0.668	0.830
1975	1234282	895108	1701975	806130	686338	946829	208147	179111	241890	0.802	0.722	0.890
1976	845768	609101	1174391	636029	558569	724231	177371	150699	208764	0.856	0.770	0.952
1977	2090680	1514446	2886167	986580	803329	1211633	152512	129976	178956	0.815	0.733	0.906
1978	1329083	960376	1839345	1125795	937873	1351371	153430	135286	174008	0.903	0.814	1.001
1979	1634749	1184629	2255901	1039240	883871	1221920	155282	138233	174435	0.846	0.764	0.938
1980	2623448	1892369	3636965	1254189	1039136	1513749	171785	154018	191602	0.921	0.834	1.017
1981	1056001	763433	1460691	1037163	896687	1199647	186652	168862	206315	0.937	0.851	1.032
1982	1727179	1265098	2358037	1132570	947363	1353984	181680	163854	201444	1.049	0.954	1.154
1983	945057	703385	1269762	885582	761752	1029541	153584	138097	170807	1.042	0.949	1.144
1984	1709993	1275387	2292698	908000	761430	1082784	132058	118313	147400	0.974	0.887	1.070
1985	413743	304376	562406	586542	518972	662910	133920	120029	149419	0.939	0.854	1.033
1986	1863562	1392512	2493954	818313	671822	996747	117830	106244	130680	0.993	0.905	1.089
1987	709276	531469	946570	749379	644652	871119	124244	111709	138184	0.976	0.890	1.072
1988	490411	367096	655150	550730	481290	630188	122394	111793	134000	0.997	0.909	1.093
1989	829850	618777	1112923	556265	470358	657862	109754	99649	120884	1.014	0.924	1.113
1990	327093	245507	435792	371759	327430	422088	99310	89729	109914	0.940	0.853	1.035
1991	374370	282733	495707	342491	298970	392346	95511	85782	106344	0.931	0.846	1.024
1992	861991	655465	1133590	537132	448600	643136	91309	82439	101132	0.921	0.838	1.012
1993	435827	334516	567820	415817	365903	472539	98913	89968	108748	0.940	0.855	1.033
1994	1022744	777610	1345155	531256	449397	628027	101926	93458	111160	0.963	0.879	1.056
1995	598990	457760	783793	565802	488675	655103	121419	111338	132412	1.010	0.922	1.107
1996	374745	287478	488503	422101	373015	477646	116658	107469	126632	1.011	0.923	1.107
1997	1171740	881976	1556702	647582	529009	792732	101417	93291	110251	0.988	0.903	1.081
1998	141351	107469	185914	329062	289708	373760	102847	93115	113597	1.007	0.921	1.100
1999	252458	194125	328319	227067	203490	253376	85648	78533	93407	1.064	0.974	1.163

Year	Recruits age 1 (thousands)	Low	High	TSB (tonnes)	Low	High	SSB (tonnes)	Low	High	$F_{\text{bar } 2-4}$	Low	High
2000	459089	352851	597315	290106	247415	340162	68118	61981	74863	1.073	0.981	1.173
2001	166542	127920	216824	198392	175980	223659	63386	57568	69792	1.005	0.915	1.102
2002	249447	191925	324208	169228	148815	192440	56050	50967	61640	0.951	0.865	1.046
2003	122516	93928	159807	141917	127458	158017	56444	51365	62025	0.927	0.838	1.026
2004	202805	156392	262992	123871	108727	141125	45844	41235	50968	0.890	0.803	0.987
2005	154353	117795	202258	138690	121207	158696	47335	41742	53677	0.828	0.744	0.920
2006	359331	277468	465348	146679	123851	173714	43002	37440	49390	0.734	0.654	0.824
2007	168721	130724	217762	194853	172032	220701	72475	64100	81944	0.678	0.602	0.764
2008	197402	152732	255138	205870	180652	234608	80822	71493	91368	0.643	0.566	0.730
2009	193300	149564	249826	219916	193230	250288	90490	79262	103309	0.629	0.551	0.719
2010	297450	229280	385887	235861	203787	272984	92411	79388	107570	0.544	0.471	0.629
2011	148153	114375	191906	223463	193941	257479	104925	87982	125131	0.444	0.380	0.518
2012	203618	157642	263003	198988	171971	230249	106085	87951	127958	0.403	0.344	0.472
2013	267533	206741	346203	260928	224014	303924	116891	97007	140852	0.391	0.336	0.455
2014	399113	302761	526128	333701	282322	394430	127262	106149	152573	0.389	0.335	0.451
2015	174905	127145	240607	294785	252701	343877	153584	127598	184861	0.371	0.316	0.434
2016	134054	78009	230365				168552	137278	206952			

Table 6.3.3.10b Cod in Subarea 4, Division 7.d, and Subdivision 3.a.20. Assessment summary with weights (in tonnes).

Year	Estimated landings	Estimated discards	Estimated catch	Unaccounted	Total removals	Low	High
1963	106938	10880	117830		117830	104458	132914
1964	135131	9818	145074		145074	131312	160278
1965	182225	17125	199187		199187	177647	223339
1966	214701	26318	241108		241108	215680	269534
1967	260928	26742	287506		287506	256698	322012
1968	276509	17168	293608		293608	266424	323565
1969	217075	9685	226840		226840	209438	245688
1970	232582	19944	252458		252458	221946	287164
1971	291851	57931	349759		349759	300632	406914
1972	328404	34338	362580		362580	317387	414207
1973	234451	24884	259367		259367	236089	284941
1974	209400	26056	235390		235390	210316	263453
1975	208981	36062	244997		244997	213581	281033
1976	201189	43695	244997		244997	212673	282233
1977	181498	77575	258849		258849	213081	314447
1978	305896	48533	354336		354336	291550	430642
1979	277895	61821	339762		339762	290618	397215
1980	290686	100509	391210		391210	324295	471933
1981	342148	53745	395933		395933	337559	464401
1982	323191	63450	386544		386544	327558	456151
1983	287794	37123	324811		324811	277021	380847
1984	209819	67914	277895		277895	236097	327093
1985	213844	27945	241832		241832	209545	279095
1986	168721	58924	227749		227749	190730	271953
1987	225258	32598	257816		257816	217746	305259
1988	191377	14698	206076		206076	182779	232342
1989	138968	40336	179333		179333	154475	208191
1990	115151	23063	138275		138275	120936	158100
1991	102437	15709	118184		118184	104964	133070
1992	108662	31477	140225		140225	118377	166104
1993	130180	28557	158843	-9947	148896	128471	172568
1994	106186	41938	148146	5899	154045	132790	178703
1995	130522	31962	162478	28517	190995	163662	222891
1996	132366	21522	153941	2276	156217	138561	176122
1997	133460	46610	180153	-25800	154353	129050	184619
1998	148023	43876	191975	-55622	136353	116955	158968
1999	96833	13896	110718	-15683	95035	86812	104037
2000	73539	16615	90091	-4785	85306	73852	98536
2001	44499	11451	55950	16453	72403	63868	82078
2002	53494	11512	65012	-8399	56613	51180	62623
2003	31280	4788	36088	17282	53370	47856	59519
2004	27316	7546	34865	4514	39379	35829	43282
2005	29923	11382	41291	-1236	40055	35443	45266
2006	22652	9136	31793		31793	28245	35787
2007	24029	29144	53157		53157	46548	60704
2008	27065	25311	52365		52365	47603	57604
2009	33290	21673	54940		54940	49673	60766
2010	36207	12565	48776		48776	44312	53691
2011	34372	10446	44846		44846	40490	49672
2012	32696	7618	40336		40336	37289	43632
2013	30792	10777	41564		41564	38186	45241
2014	34787	11086	45844		45844	41567	50561
2015	38561	13558	52104		52104	46732	58094
2016							

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