

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

ICES stock advice

Please note: This advice was updated in November 2016 (ICES, 2016c).

ICES advises that when the MSY approach is applied, catches in 2017 should be no more than 47 431 tonnes.¹

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 close to $MSY B_{trigger}$. Recruitment since 1998 remains poor.

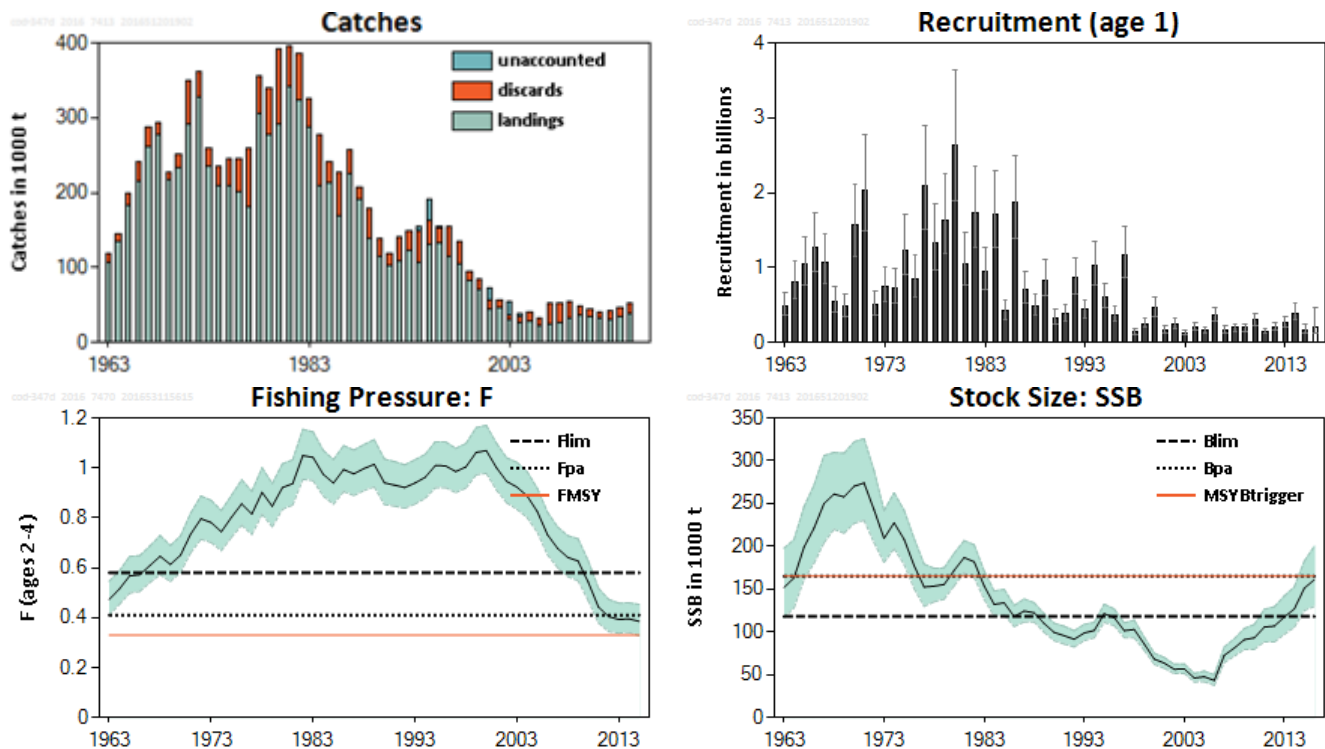


Figure 6.3.3.1 Cod in Subarea 4, Division 7.d and Subdivision 3.a.20. Summary of stock assessment with point-wise 95% confidence intervals. Catch is estimated and adjusted for unaccounted removals (from 1993 to 2005). Predicted values are not shaded.

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	$MSY B_{trigger}$	✘	✘ Below trigger
Precautionary approach	F_{pa} , F_{lim}	✔	✔	✔ Harvested sustainably	B_{pa} , B_{lim}	○	○ Increased risk
Management plan	F_{MGT}	-	-	- Not applicable	SSB_{MGT}	-	- Not applicable

¹ Version 2: The reference to the EU landings obligation was removed from the advice statement.

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)	0.39	ICES (2016a)	= F ages 2–4 (2015), assuming effort similar to 2015
SSB (2017)	174300 t	ICES (2016a)	tonnes
R _{age1} (2016)	196 million	ICES (2016a)	Median recruitment resampled from the years 1998–2015
R _{age1} (2017)	196 million	ICES (2016a)	Median recruitment resampled from the years 1998–2015
Catch (2016)	56302 t	ICES (2016a)	Short-term forecast, tonnes
Landings (2016)	44837 t	ICES (2016a)	Assuming 2015 landings fraction by age, tonnes
Discards (2016)	11465 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 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	47431	38691	8740	F _{MSY}	0.33	0.23	0.1	182807	5	-4
EU-Norway Management Strategy (MS) with previous reference points	55959	45612	10347	Long-term phase	0.4	0.28	0.12	173495	0	13
EU-Norway MS with new reference points	54046	44091	9955	Long-term phase	0.38	0.27	0.11	175637	1	9
Zero catch	0	0	0	F = 0	0	0	0	237118	36	-100
Other options ^	57140	46551	10589	F _{pa}	0.41	0.29	0.12	172171	-1	15
	75810	61629	14181	F _{lim}	0.58	0.41	0.17	151846	-13	52
	107401	87011	20390	SSB (2018) = B _{lim}	0.94	0.66	0.28	118000	-32	115
	63653	51839	11814	SSB (2018) = B _{pa}	0.47	0.33	0.14	165000	-5	28
	63653	51839	11814	SSB (2018) = MSY B _{trigger}	0.47	0.33	0.14	165000	-5	28
	39518	32335	7183	TAC ₂₀₁₆ - 20%	0.27	0.19	0.08	191608	10	-20
	41995	34356	7639	TAC ₂₀₁₆ - 15%	0.29	0.20	0.09	188858	8	-15
	44478	36377	8101	TAC ₂₀₁₆ - 10%	0.31	0.22	0.09	186052	7	-10
	46962	38398	8564	TAC ₂₀₁₆ - 5%	0.33	0.23	0.10	183206	5	-5
	49454	40419	9035	Constant TAC	0.35	0.24	0.11	180305	3	0
	51939	42440	9499	TAC ₂₀₁₆ + 5%	0.37	0.26	0.11	177556	2	5
	54425	44461	9964	TAC ₂₀₁₆ + 10%	0.39	0.27	0.12	174736	0	10
	56914	46482	10432	TAC ₂₀₁₆ + 15%	0.41	0.29	0.12	171902	-1	15
	59410	48503	10907	TAC ₂₀₁₆ + 20%	0.43	0.30	0.13	169100	-3	20
54214	44226	9988	F ₂₀₁₆	0.39	0.27	0.12	175459	1	9	

* "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 considerations as part of this advice will be provided by ICES in November 2016.

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.

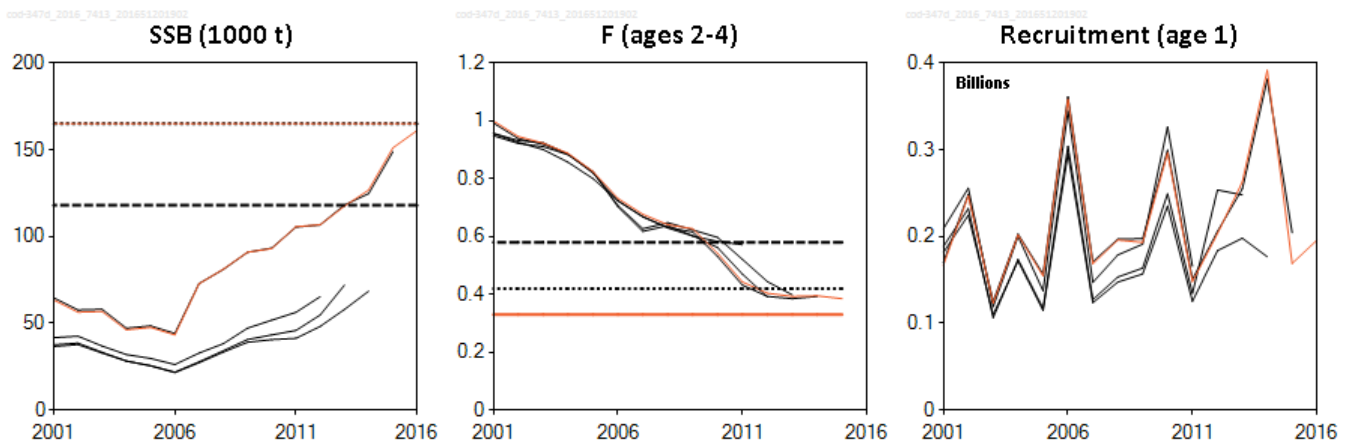


Figure 6.3.3.2 Cod in Subarea 4, Division 7.d and Subdivision 3.a.20. Historical assessment results (final-year recruitment estimates included).

Issues relevant for the advice

The 2014 year class is estimated to be weak, and there are indications (from one survey only) 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 3% 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).

Mixed-fisheries considerations as part of this advice will be provided by ICES in November 2016.

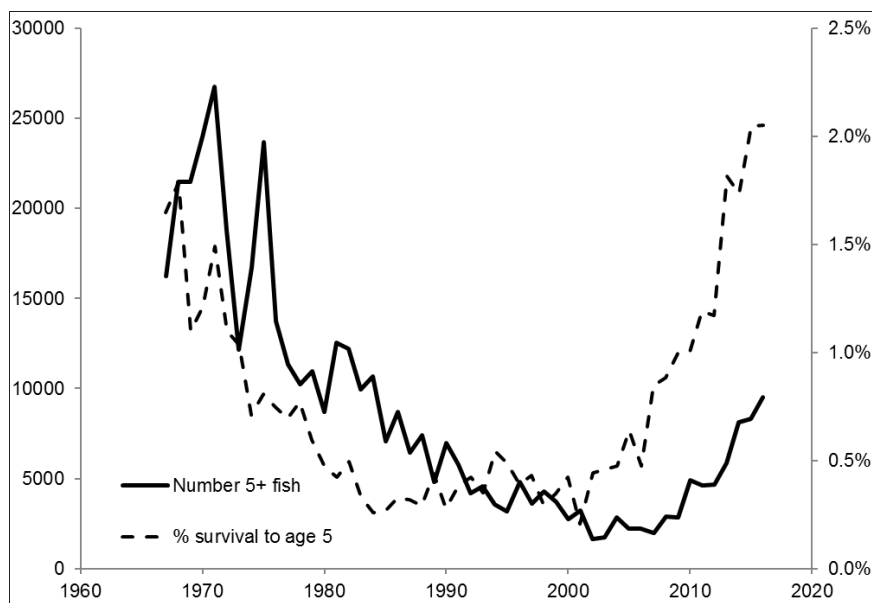


Figure 6.3.3.3 Cod in Subarea 4, Division 7.d and Subdivision 3.a.20. Estimates of the number of 5-year-old and older cod in the population (solid line; thousands) and the percentage of 1-year-olds by number that have survived to age 5 in the given year (dashed line).

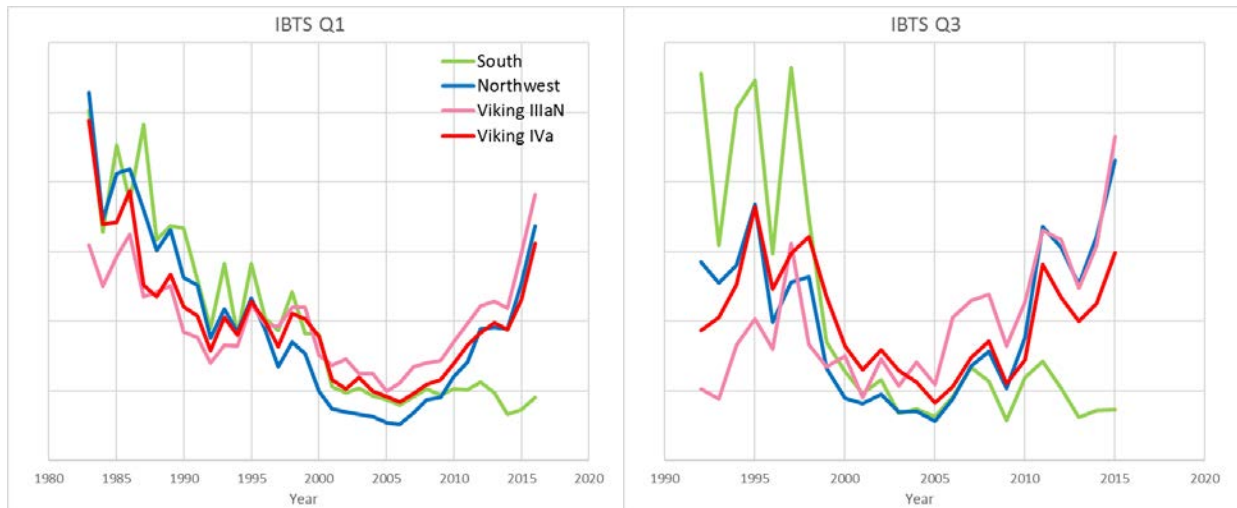


Figure 6.3.3.4 Cod in Subarea 4, Division 7.d and Subdivision 3.a.20. Biomass indices by subregion (see Figure 6.3.3.6), based on the NS IBTS Q1 and Q3 survey data. The biomass indices are derived by fitting a non-stationary Delta-GAM model (including ship effects) to numbers-at-age for the entire dataset 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.

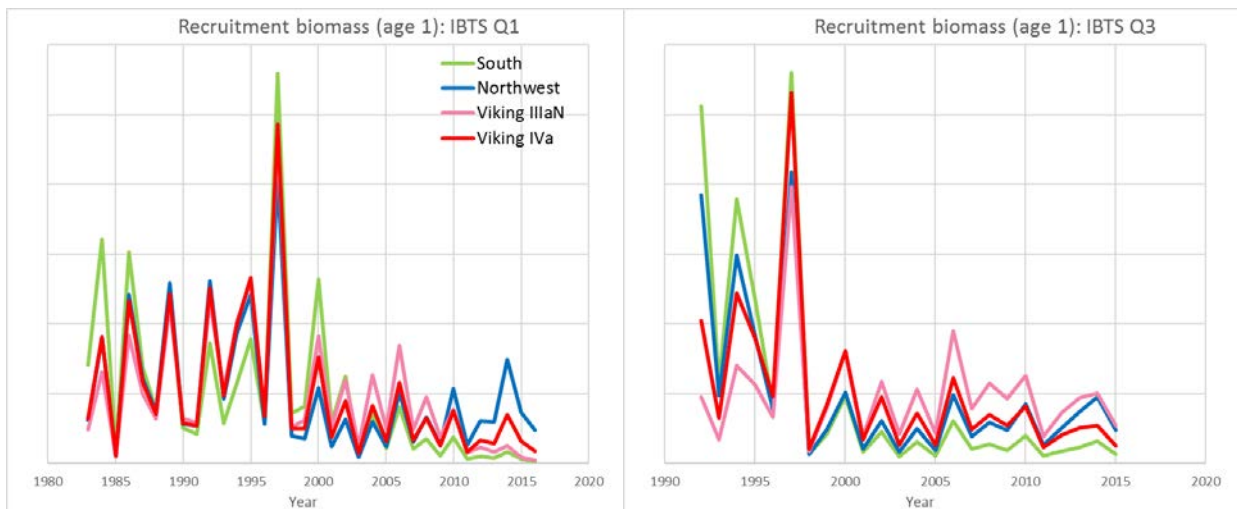


Figure 6.3.3.5 Cod in Subarea 4, Division 7.d and Subdivision 3.a.20. Recruitment indices by subregion (see Figure 6.3.3.6), based on NS IBTS Q1 and Q3 survey data.

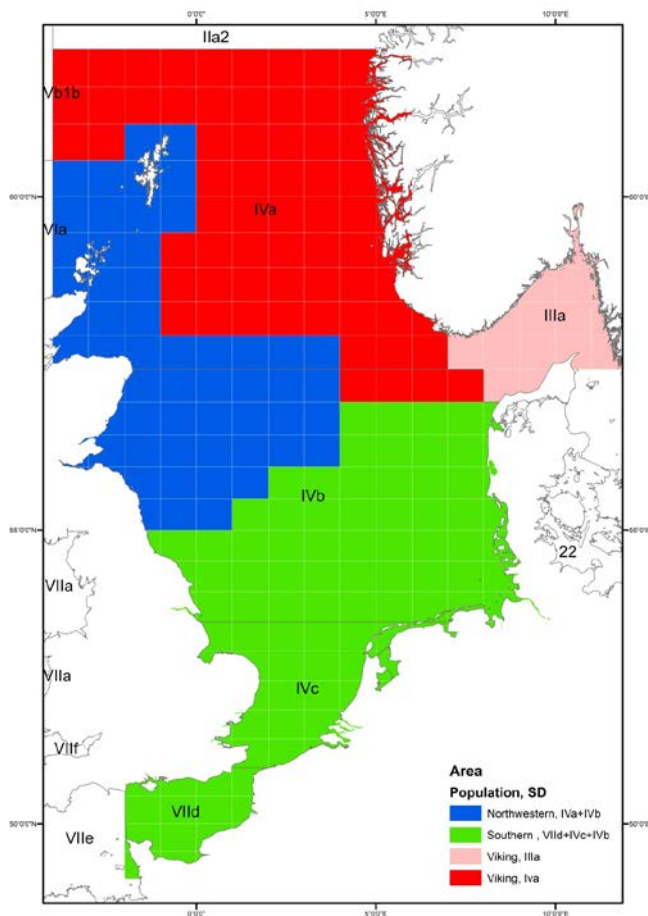


Figure 6.3.3.6 Cod in Subarea 4, Division 7.d and Subdivision 3.a.20. Subregions used to derive area-specific biomass indices, based on NS IBTS Q1 and Q3 survey data.

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.

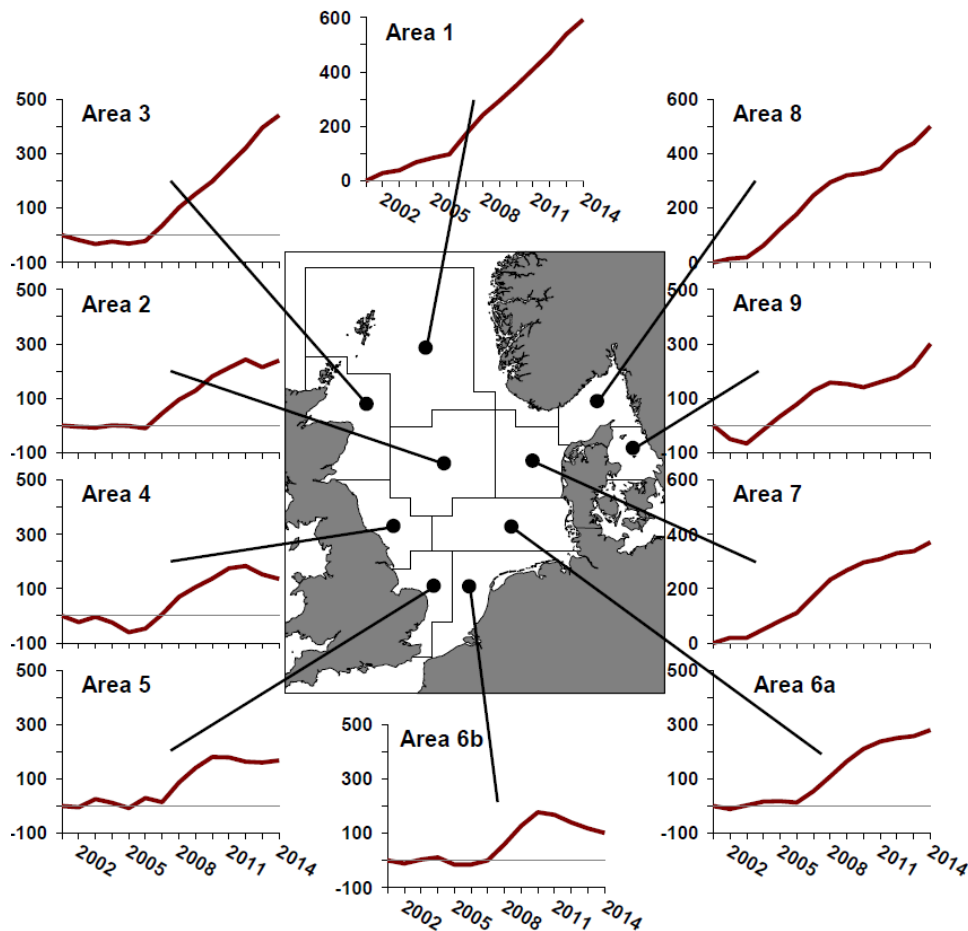


Figure 6.3.3.7 Cod in Subarea 4, Division 7.d and Subdivision 3.a.20. Cumulative time-series of index of perceptions of abundance of cod by roundfish sampling area from the Fishers' North Sea Stock Survey (Napier, 2014; see page 14 for an explanation of the index).

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	≤ 38.691	≤ 47.431				

* 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	≤ 38.691	≤ 47.431				

* 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	≤ 38.691	≤ 47.431				

* 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
	66% demersal trawls and seines >100 mm	14% gillnets	8% demersal trawls 70–99 mm	5% beam trawls	7% other gears	
49841 t	37205 t					12635 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/NI)	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/NI)	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)										
	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	358327	663179	511959	438909	597167	151903	116620	197861	0.473	0.410	0.546
1964	802109	590710	1089163	661986	563847	777207	163081	128015	207752	0.515	0.453	0.587
1965	1042362	770073	1410931	834009	718024	968731	199187	161242	246062	0.567	0.498	0.645
1966	1271872	940738	1719562	996496	858764	1156316	221239	180297	271479	0.572	0.505	0.648
1967	1074107	793636	1453696	1051786	916308	1207294	249946	204164	305994	0.609	0.541	0.687
1968	544161	401563	737396	879404	784009	986407	260928	219902	309608	0.646	0.572	0.729
1969	480220	352625	653985	735275	650773	830750	257816	215292	308739	0.613	0.545	0.689
1970	1561254	1151735	2116385	1191829	989256	1435885	270222	226747	322033	0.650	0.581	0.727
1971	2034987	1494855	2770283	1330413	1125138	1573140	274032	230490	325799	0.735	0.660	0.819
1972	509406	373697	694398	921723	816093	1041025	242559	204115	288243	0.796	0.714	0.887
1973	740440	543432	1008869	738222	654242	832983	209190	181178	241534	0.781	0.701	0.870
1974	726505	532203	991744	710696	628630	803476	227521	197185	262526	0.744	0.668	0.829
1975	1236753	898049	1703201	806936	687318	947373	208147	178992	242051	0.802	0.722	0.890
1976	846614	610455	1174132	636029	558694	724069	177549	150733	209135	0.856	0.770	0.952
1977	2092772	1517872	2885417	987567	804712	1211973	152512	129838	179147	0.815	0.733	0.906
1978	1333077	964302	1842880	1126921	939155	1352228	153430	135157	174173	0.902	0.814	1.000
1979	1636385	1187309	2255315	1040280	885178	1222558	155438	138265	174743	0.846	0.764	0.937
1980	2623448	1894717	3632458	1255444	1040773	1514394	171785	153907	191740	0.921	0.834	1.016
1981	1056001	764334	1458968	1037163	896985	1199249	186839	168927	206650	0.937	0.851	1.032
1982	1727179	1266440	2355539	1132570	947803	1353356	181861	163890	201804	1.049	0.954	1.154
1983	946949	705301	1271388	885582	761846	1029414	153737	138111	171131	1.042	0.949	1.144
1984	1709993	1276254	2291140	908000	761709	1082388	132191	118318	147690	0.974	0.887	1.070
1985	415817	306386	564333	586542	519056	662802	134054	120046	149698	0.939	0.854	1.033
1986	1861699	1392122	2489668	817495	671484	995255	117948	106247	130938	0.993	0.905	1.089
1987	709276	531862	945870	748630	644155	870050	124368	111732	138432	0.976	0.889	1.071
1988	490411	367376	654653	550730	481387	630062	122394	111714	134095	0.997	0.909	1.093
1989	827364	617442	1108657	555154	469661	656209	109754	99560	120993	1.014	0.924	1.113
1990	327420	245925	435923	371759	327466	422042	99409	89727	110136	0.940	0.853	1.035
1991	374370	282954	495320	342491	299039	392256	95607	85764	106579	0.931	0.847	1.025
1992	856834	651596	1126719	534988	446930	640396	91400	82417	101362	0.921	0.838	1.012
1993	434521	333421	566278	414571	364768	471175	98815	89788	108748	0.939	0.855	1.032
1994	1018661	774196	1340321	529136	447527	625626	101722	93173	111056	0.962	0.878	1.054
1995	596002	455413	779993	564107	487180	653183	121297	111138	132385	1.009	0.920	1.105
1996	372876	286009	486124	420837	371918	476190	116658	107364	126756	1.008	0.921	1.104
1997	1160081	873759	1540226	643064	525791	786494	101519	93269	110499	0.985	0.901	1.078
1998	141210	107355	185739	328076	288902	372562	102847	93052	113674	1.004	0.919	1.097
1999	251450	193327	327047	226840	203275	253136	85819	78573	93734	1.062	0.972	1.161
2000	457257	351456	594907	289526	246955	339435	68255	62000	75140	1.069	0.978	1.170

Year	Recruits age 1 (thousands)	Low	High	TSB (tonnes)	Low	High	SSB (tonnes)	Low	High	F _{bar} 2–4	Low	High
2001	167042	128335	217423	198590	176133	223911	63513	57588	70047	1.000	0.911	1.098
2002	246965	190137	320777	168890	148613	191932	56387	51162	62146	0.946	0.860	1.040
2003	123254	94570	160637	142344	127825	158512	56783	51588	62503	0.923	0.834	1.022
2004	201793	155640	261634	123995	108845	141254	46212	41454	51516	0.888	0.801	0.985
2005	154508	117922	202444	139107	121516	159244	47620	41866	54164	0.825	0.742	0.918
2006	358255	276697	463852	146679	123856	173707	43261	37523	49876	0.732	0.652	0.822
2007	168552	130595	217540	195048	172164	220974	72766	64232	82433	0.677	0.600	0.763
2008	196025	151700	253303	205664	180468	234378	81227	71691	92031	0.641	0.564	0.728
2009	193300	149561	249831	220356	193500	250939	90944	79475	104068	0.627	0.548	0.716
2010	296262	228415	384262	236097	203918	273355	93060	79738	108608	0.542	0.469	0.627
2011	148153	114403	191860	223910	194119	258273	105662	88341	126379	0.443	0.379	0.518
2012	203211	157358	262425	199586	172234	231281	106831	88281	129277	0.404	0.344	0.473
2013	263024	203288	340313	259886	223095	302746	117477	97190	142000	0.393	0.338	0.458
2014	391601	295327	519260	329391	278089	390156	126880	105516	152570	0.395	0.341	0.459
2015	169058	118172	241857	288082	245194	338472	151146	125031	182714	0.385	0.327	0.453
2016	196026*	123254	457257				161135	129713	200170			

* Preliminary.

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	10849	117830		117830	104453	132921
1964	135131	9788	144929		144929	131184	160114
1965	182043	17057	199187		199187	177659	223324
1966	214701	26239	240867		240867	215473	269254
1967	260667	26662	287506		287506	256711	321996
1968	276509	17127	293608		293608	266422	323568
1969	217075	9664	226840		226840	209423	245706
1970	232350	19897	252206		252206	221705	286903
1971	291560	57873	349410		349410	300289	406565
1972	328076	34372	362580		362580	317364	414237
1973	234685	24959	259627		259627	236256	285309
1974	209609	26160	235626		235626	210477	263779
1975	209190	36243	245242		245242	213679	281467
1976	201390	43871	245242		245242	212833	282586
1977	181680	77964	259367		259367	213325	315347
1978	306202	48728	355045		355045	291999	431704
1979	278173	62131	340102		340102	290766	397808
1980	290977	100912	391601		391601	324430	472680
1981	342148	53960	395933		395933	337515	464462
1982	323191	63577	386930		386930	327705	456860
1983	287794	37235	324811		324811	276910	380999
1984	209819	68050	278173		278173	236185	327626
1985	213844	28029	241832		241832	209515	279134
1986	168890	59042	227749		227749	190592	272150
1987	225032	32565	257558		257558	217457	305054
1988	191377	14707	206076		206076	182711	232429
1989	138968	40296	179154		179154	154255	208071
1990	115151	23086	138275		138275	120905	158140
1991	102437	15755	118302		118302	105025	133259
1992	108554	31414	140084		140084	118184	166044
1993	130115	28543	158606	-10305	148301	127906	171948
1994	106116	41910	148048	5382	153430	132162	178121
1995	130522	31930	162316	27916	190232	162909	222137
1996	132275	21451	153682	1911	155593	137976	175460
1997	133070	46149	179267	-25837	153430	128317	183458
1998	147449	43575	191040	-55367	135673	116389	158151
1999	96722	13843	110592	-15747	94845	86633	103836
2000	73373	16493	89798	-4833	84965	73561	98138
2001	44416	11411	55846	16340	72186	63669	81843
2002	53422	11395	64794	-8350	56444	51043	62416

Year	Estimated landings	Estimated discards	Estimated catch	Unaccounted	Total removals	Low	High
2003	31131	4750	35881	17435	53316	47825	59439
2004	27269	7503	34770	4649	39419	35863	43328
2005	29902	11366	41262	-1207	40055	35433	45280
2006	22629	9121	31761		31761	28205	35766
2007	24005	29144	53104		53104	46487	60662
2008	27038	25261	52313		52313	47548	57555
2009	33223	21610	54830		54830	49572	60647
2010	36207	12545	48728		48728	44262	53644
2011	34372	10443	44802		44802	40440	49634
2012	32728	7632	40336		40336	37275	43648
2013	30822	10808	41606		41606	38211	45303
2014	34822	11121	45936		45936	41634	50682
2015	38638	13654	52313		52313	46831	58436
2016							

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