

Cod (*Gadus morhua*) in divisions 7.e-k (western English Channel and southern Celtic Seas)[†]

ICES stock advice

ICES advises that when the MSY approach is applied, catches in 2018 should be no more than 3428 tonnes. If discard rates do not change from the average of the last 3 years (2014–2016), this implies landings of no more than 3076 tonnes.

Stock development over time

The spawning-stock biomass (SSB) has increased since 2014 but is just below B_{lim} in 2017. Fishing mortality has been decreasing since 2014 but is still above F_{MSY} in 2016. Recruitment has been highly variable over time. Recent recruitment has been weak with the exception of the 2013 year class, which is above average.

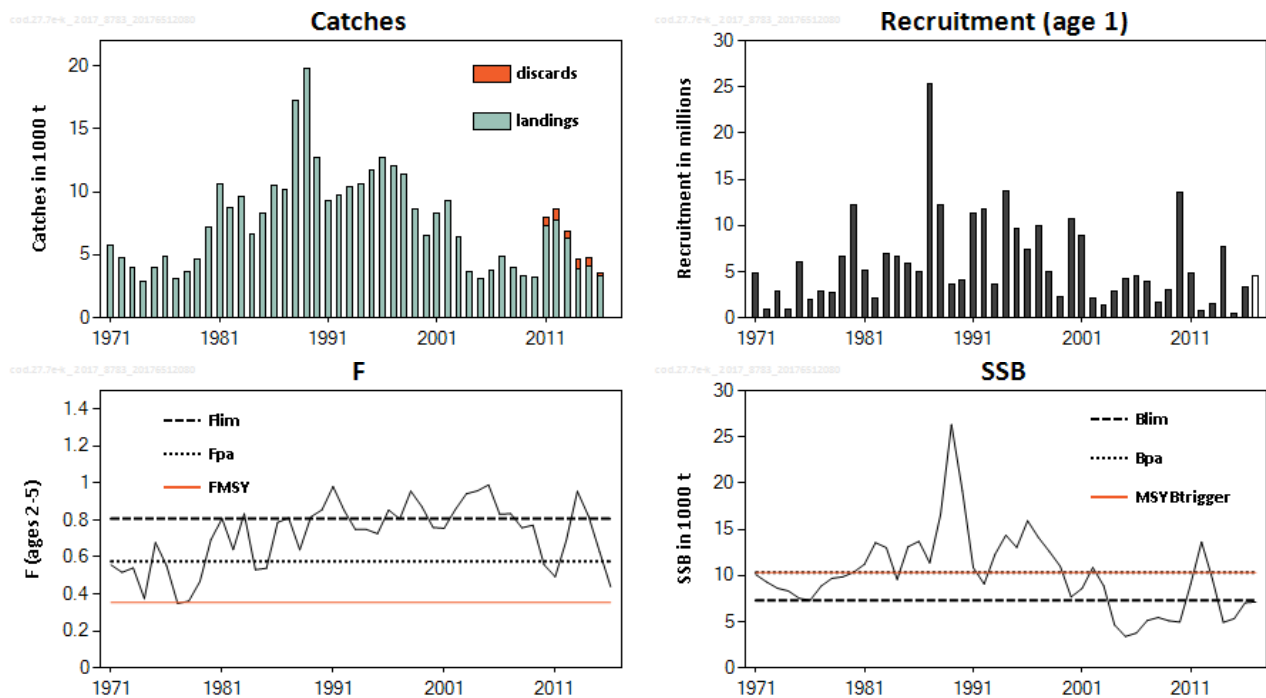


Figure 1 Cod in divisions 7.e-k. Summary of the stock assessment (weights in thousand tonnes). The assumed recruitment value is unshaded. Discards emanating from highgrading are included in the assessment as landings in the period 2003–2011. Discard estimates other than highgrading are available and plotted from 2011, but have not been used in the assessment.

Stock and exploitation status

Table 1 Cod in divisions 7.e-k. State of the stock and fishery relative to reference points.

		Fishing pressure			Stock size		
		2014	2015	2016	2015	2016	2017
Maximum sustainable yield	F_{MSY}	✗	✗	✗	MSY	✗	✗
				Above	$B_{trigger}$	✗	✗
Precautionary approach	F_{pa}, F_{lim}	✗	○	✓			✗
				Harvested sustainably	B_{pa}, B_{lim}	✗	✗
Management plan	F_{MGT}	—	—	—			—
				Not applicable	B_{MGT}	—	—
							Not applicable

[†] Version 2: Stock area corrected

Catch options

Table 2 Cod in divisions 7.e-k. The basis for the catch options.

Variable	Value	Notes	Source
F ages 2–5 (2017)	0.44	$F_{sq}=F_{average}(2014-2016)$ rescaled to F2016	ICES (2017a)
SSB (2018)	8 755 tonnes	Fishing at F=0.44	ICES (2017a)
R age 1 (2017/2018)	4 505 thousand	GM (1971-2014)	ICES (2017a)
Catch (2017)	3 704 tonnes	Landings + estimated discards	ICES (2017a)
Landings (2017)	3 323 tonnes	Fishing at F=0.44	ICES (2017a)
Discards (2017)	381 tonnes	Average discard rate 2014–2016 = 10.3%	ICES (2017a)

Table 3 Cod in divisions 7.e-k. Annual catch options. All weights are in tonnes.

Basis	Total catch (2018)^	Landings (2018)	Discards (2018)	F _{landings} (2018)	SSB (2019)	% SSB change *	% TAC change **
ICES advice basis							
MSY approach	3428	3076	352	0.30	12009	37	8.7
Other options							
F = 0	0	0	0	0	15663	79	-100
F _{pa}	5938	5328	610	0.58	9395	7.3	88
F _{lim}	7506	6734	772	0.80	7800	-10.9	138
SSB (2019) = B _{lim}	8004	7181	823	0.88	7300	-16.6	154
SSB (2019) = B _{pa} = MSY B _{trigger}	5062	4542	520	0.47	10300	17.6	61
F = F ₂₀₁₇	4760	4271	489	0.44	10615	21	51
F = F _{MSY}	3944	3539	405	0.35	11468	31	25
Mixed fisheries options							
A: Max	5291	-	-	0.50	10063	14.9	
B: Min	3036	-	-	0.26	12423	42	
C: Stock	3429	-	-	0.30	12009	37	
D: SQ effort	4760	-	-	0.44	10615	21	
E: Value	4295	-	-	0.39	11100	27	
F: Range	3834			0.34	11583	32	

*SSB 2019 relative to SSB 2018.

** Landings in 2018 relative to TAC in 2017 (2830 t). The % change is not indicated for the mixed fishery options as calculations are available for total catch.

^ Total catch derived from the landings and discards catches ratio.

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 2018 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. Stock scenario: Each fleet stops fishing when its individual stock share is exhausted.

D. SQ (*status quo*) effort scenario: The effort of each fleet in 2017 and 2018 is as in 2016.

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.

F. Range scenario: where the potential for TAC mismatch in 2018 is minimised within the F_{MSY} range, for the demersal fish stocks for which such a range is available (Cod in divisions 7.e-k, Haddock in divisions 7.b-k, and Whiting in divisions 7.b-ce-k)

Basis of the advice

Table 4 Cod in divisions 7.e-k. The basis of the advice.

Advice basis	MSY approach
Management plan	ICES is not aware of any agreed precautionary management plan for cod in this area.

Quality of the assessment

This year's assessment is consistent with last year's assessment, and the revisions of estimates of SSB and F are less than have been observed in the recent past.

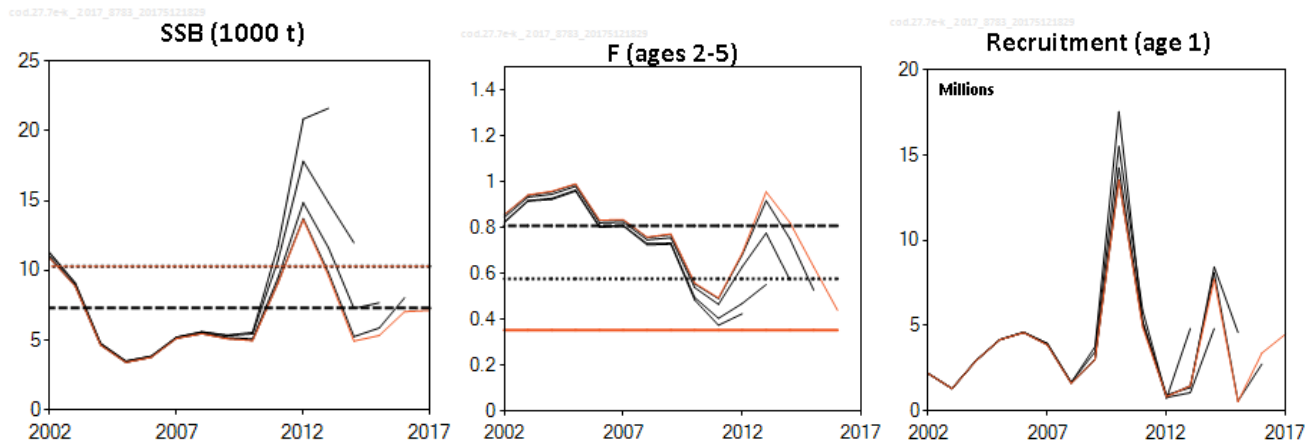


Figure 2 Cod in divisions 7.e-k. Historical assessment results (final-year recruitment estimates included).

Issues relevant for the advice

Fishing mortality on cod is difficult to control because of the mixed-fisheries interactions. Cod are caught in mixed fisheries with haddock and whiting; management should take this into account. The mixed-fisheries analysis carried out by ICES shows that haddock will be the limiting species for over half the fleets (64%) in 2018, with cod limiting 24% of fleet effort. Cod is fished at or below F_{MSY} in 2018 under the 'min', 'cod', 'haddock', and 'range' scenarios. It's fished above F_{MSY} under the 'max', 'whiting', 'status quo effort' and 'value' scenarios (ICES, 2017b).

This year, a "range" scenario is presented. This scenario searches for the minimum sum of differences between potential catches by stock under the "min" and the "max" scenarios within the F_{MSY} ranges. The outcomes of this scenario are largely driven by the restrictive nature of haddock this year, needing to bring the stock's fishing mortality to within the F_{MSY} range, which implies that many mixed fisheries should reduce their effort to avoid over-catching this stock.

SSB in 2018 at F_{sq} is forecasted to be above B_{lim} but still below $MSY B_{trigger}$. Predicted SSB at the end of the forecast period (in this case 2019) is very sensitive to the assumption on recruitment, since cod is maturing at age 2 in this area.

Discards are normally composed of undersized fish in the order of 10% by weight, but this fluctuates when large year classes recruit. They have been estimated and reported as discards since 2011. In the past (2003–2011), when quotas were restrictive for some fleets, highgrading occurred. Highgraded values were estimated for France in 2003–2011, and for Ireland in 2011. Since they were composed of marketable fish, they were treated in these years' assessments and forecasts as part of the landings component. No estimation of highgrading has been available since 2011 but it is considered to be negligible, since quotas have not been restrictive.

Forecasted catches at F_{sq} in 2017 are calculated to be higher than the TAC, which could result in an increase of the discard rate.

Reference points

Table 5 Cod in divisions 7.e-k. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	10 300 tonnes	B_{pa}	ICES (2012c)
	F_{MSY}	0.35	Segmented regression with B_{lim} (EqSim).	ICES (2016c)
Precautionary approach	B_{lim}	7 300 tonnes	B_{loss} , lowest observed SSB (1976), rounded value	ICES (2012a)
	B_{pa}	10 300 tonnes	$B_{lim} \times 1.4$	ICES (2012a)
	F_{lim}	0.80	Segmented regression with B_{lim} (EqSim).	ICES (2016a)
Management plan	F_{pa}	0.58	$F_{lim}/1.4$	ICES (2016a)
	SSB_{MGT}	Not applicable		
	F_{MGT}	Not applicable		

Basis of the assessment

Table 6 Cod in divisions 7.e-k. Basis of assessment and advice.

ICES stock data category	1 (ICES, 2016b)
Assessment type	Age-based analytical assessment (XSA) that uses landings in the model and in the forecast.
Input data	Commercial landings, ages, and length frequencies from sampling by métier; one combined survey index (EVHOE-WIBTS-Q4; IGFS-WIBTS-Q4); one commercial index (FR-OTDEF Q2+3+4 trawlers in divisions 7.e-k); fixed maturity ogive derived from data from UK-WCGFS survey-Q1; age-dependent natural mortalities from Lorenzen (1996).
Discards and bycatch	Not included in the assessment, but used to provide catch advice. Discards are normally composed of undersized fish in the order of 10% by weight, but this fluctuates when large year classes recruit to the fishery or when quotas are restrictive.
Indicators	None
Other information	Benchmarked at WKROUND 2012 (ICES, 2012b).
Working group	Working Group for the Celtic Seas Ecoregion (WGCSE)

Information from stakeholders

There is no additional available information for this stock.

History of the advice, catch, and management

Table 7 Cod in divisions 7.e-k. ICES advice and official landings. All weights are in tonnes.

Year	ICES advice	Predicted landings corresp. to advice	Predicted catch corresp. to advice	Agreed TAC*	ICES landings ^{^^}	ICES discard estimates
1987	Reduce F	< 6400**			10228	
1988	No increase in F; TAC	7000**			17191	
1989	No increase in F; TAC	8600**			19809	
1990	No increase in F; TAC	9200**			12749	
1991	TAC; SSB mean	4500**			9336	
1992	Appropriate to reduce F	-			9747	
1993	20% reduction in F	6500**		17500	10425	
1994	20% reduction in F	5600**		17000	10620	
1995	20% reduction in F	4700***		17000	11709	
1996	20% reduction in F	4700***		20000	12681	
1997	20% reduction in F	7400***		20000	12035	
1998	10% reduction in F	8800 [^]		20000	11431	
1999	Reduce F below F _{pa}	9200 [^]		19000	8594	
2000	Reduce F below F _{pa}	< 7600 ^{^^}		16000	6535	
2001	40% reduction in F	< 4300 ^{^^}		10500	8309	
2002	45% reduction in F	< 5300 ^{^^}		8700	9235	
2003	60% reduction in F	< 3800 ^{^^}		NA	6221	
2004	90% reduction in F or management plan	< 700		NA	3523	
2005	17% reduction in F	< 5200		6200	2988	
2006	No increase in effort [should have been reduce effort]	Cannot be estimated		5580	3326	
2007	Zero catch	0		4743	4239	
2008	Zero catch	0		4316	3639	
2009	50% reduction in F	< 2600		4023	3263	
2010	Substantial catch reduction	-		4023	3229	
2011	Catch and effort reduction	-		5379	4737	696
2012	MSY framework	< 10000		10059	7693	952
2013	MSY framework	< 10200		10200	6290	530
2014	MSY approach	< 6848		6848	3845	741
2015	MSY approach	< 4024		5072	4157	565
2016	MSY approach	≤ 3569		4565	3299.2	220
2017	MSY approach	≤ 1447		2830		
2018	MSY approach	≤ 3076	≤ 3428			

*TAC covers subareas 7 (except Division 7.a) and 8. From 2009 onwards the TAC covers divisions 7.b-c and 7.e-k, subareas 8-10, and EU waters of CECAF 34.1.1 (with a separate TAC established for Division 7.d).

**For the divisions 7.f-g stock component.

***For the divisions 7.f-h stock component.

[^]For the divisions 7.e-h stock component.

^{^^}For the divisions 7.e-k stock component.

^{^^^}Landings have been adjusted to include highgrading estimates (2003-2011) and landings taken or reported in 33E2 and 33E3 since 2004.

History of the catch and landings

Table 8 Cod in divisions 7.e-k. Catch distribution by fleet in 2016 as estimated by ICES.

Catch (2016)	Landings					Discards
	Otter trawl	Beam trawl	Gillnet	Seine	Other	
3 519 tonnes	79%	8%	8%	4%	1%	220 tonnes
	3 299 tonnes					

Table 9 Cod in divisions 7.e-k. History of official commercial landings presented by country. All weights are in tonnes.

Year	Belgium	France	Ireland	UK	Others	Total	Highgraded discard estimates	Discard estimates	Landings taken or reported in 33E2 and 33E3 *** ^
1971	NA	NA	NA	NA	NA	5782			NA
1972	NA	NA	NA	NA	NA	4737			NA
1973	NA	NA	NA	NA	NA	4015			NA
1974	NA	NA	NA	NA	NA	2898			NA
1975	NA	NA	NA	NA	NA	3993			NA
1976	NA	NA	NA	NA	NA	4818			NA
1977	NA	NA	NA	NA	NA	3059			NA
1978	NA	NA	NA	NA	NA	3647			NA
1979	NA	NA	NA	NA	NA	4650			NA
1980	NA	NA	NA	NA	NA	7243			NA
1981	NA	NA	NA	NA	NA	10597			NA
1982	NA	NA	NA	NA	NA	8766			NA
1983	NA	NA	NA	NA	NA	9641			NA
1984	NA	NA	NA	NA	NA	6631			NA
1985	NA	NA	NA	NA	NA	8317			NA
1986	NA	NA	NA	NA	NA	10475			NA
1987	NA	NA	NA	NA	NA	10228			NA
1988	554	13863	1480	1292	2	17191			NA
1989	910	15801	1860	1223	15	19809			NA
1990	621	9383	1241	1346	158	12749			NA
1991	303	6260	1659	1094	20	9336			NA
1992	195	7120	1212	1207	13	9747			NA
1993	391	8317	766	945	6	10425			NA
1994	398	7692	1616	906	8	10620			NA
1995	400	8321	1946	1034	8	11709			NA
1996	552	8981	1982	1166	0	12681			NA
1997	694	8662	1513	1166	0	12035			NA
1998	528	8096	1718	1089	0	11431			NA
1999	326	5488	1883	897	0	8594			NA
2000	208	4281	1302	744	0	6535			NA
2001	347	6033	1091	838	0	8309			NA
2002	555	7368	694	618	0	9235			NA
2003	136	5222	517	346	0	6221	210*	NA	NA
2004	153	2425	663	282	0	3523	148*	NA	108
2005	186	1623	870	309	0	2988	74*	NA	54
2006	103	1896	959	368	0	3326	432*	NA	103
2007	108	2509	1210	412	0	4239	592*	NA	527
2008	65	2064	1221	289	0	3639	322*	NA	558
2009	49	2080	870	264	0	3263	25*	NA	193
2010	51	1853	1034	289	2	3229	7*	NA	143
2011	124	3171	1011	414	17	4737	1828**	696	147
2012	290	5166	1536	701	0	7693	negligible	952	85
2013	202	4064	1478	546	0	6290	negligible	530	76
2014	141	2080	1159	464	1	3845	negligible	741	24
2015	120	2487	1126	422	2	4157	negligible	565	39
2016	97	2013	824	365	1	3299	negligible	220	40

*French highgrading estimates from self-sampling programme.

**International highgrading estimate.

*** Included in Ireland landings estimates.

^ Landings in the south of Division 7.a (33E2 and 33E3) are included in the assessment and are considered to be part of the stock.

Summary of the assessment

Table 10 Cod in divisions 7.e-k. Assessment summary. Weights are in tonnes.

Year	Recruitment age 1 thousands	SSB	Landings	Discards	F ages 2-5
1971	4769	10093	5782		0.56
1972	928	9298	4737		0.52
1973	2810	8617	4015		0.54
1974	889	8327	2898		0.38
1975	6031	7526	3993		0.68
1976	1986	7316	4818		0.55
1977	2871	8841	3059		0.35
1978	2741	9689	3647		0.36
1979	6630	9848	4650		0.47
1980	12254	10347	7243		0.69
1981	5179	11212	10597		0.81
1982	2117	13547	8766		0.64
1983	6923	13008	9641		0.83
1984	6696	9568	6631		0.53
1985	5892	13103	8317		0.54
1986	5000	13692	10475		0.79
1987	25361	11364	10228		0.81
1988	12239	16607	17191		0.64
1989	3648	26324	19809		0.82
1990	4042	19126	12749		0.86
1991	11365	10846	9336		0.98
1992	11743	9074	9747		0.85
1993	3700	12281	10425		0.75
1994	13716	14360	10620		0.75
1995	9675	13027	11709		0.73
1996	7430	15916	12681		0.85
1997	10001	14101	12035		0.81
1998	5018	12590	11431		0.96
1999	2352	10985	8594		0.87
2000	10657	7673	6536		0.76
2001	8841	8590	8308		0.76
2002	2185	10858	9236		0.86
2003	1300	8873	6420		0.94
2004	2931	4641	3672		0.96
2005	4166	3397	3062		0.99
2006	4585	3769	3776		0.83
2007	3865	5121	4830		0.83
2008	1610	5455	3961		0.76
2009	3004	5092	3292		0.77
2010	13533	4956	3229		0.56
2011	4897	9064	6565	696	0.50
2012	830	13628	7692	952	0.69
2013	1461	9604	6290	530	0.96
2014	7711	4929	3879	741	0.82
2015	537	5327	4154	565	0.63
2016	3385	7043	3299	220	0.44
2017	4505	7140			

Sources and references

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