5.3.7 Cod (*Gadus morhua*) in divisions 7.e–k (eastern English Channel and southern Celtic Seas)

ICES stock advice

ICES advises that when the MSY approach is applied, wanted catch[*] in 2017 should be no more than 1447 tonnes. ICES cannot quantify the corresponding total catches.

Stock development over time

Recruitment has been highly variable over time. Recent recruitment has been weak with the exception of the 2013 year class, which is above average. The 2014 year class is the lowest observed in the time-series. Spawning-stock biomass (SSB) was below B_{lim} in 2014 and 2015 and just above in 2016. Fishing mortality (F) has fluctuated in recent years remaining well above FMSY but was below Fpa in 2015.
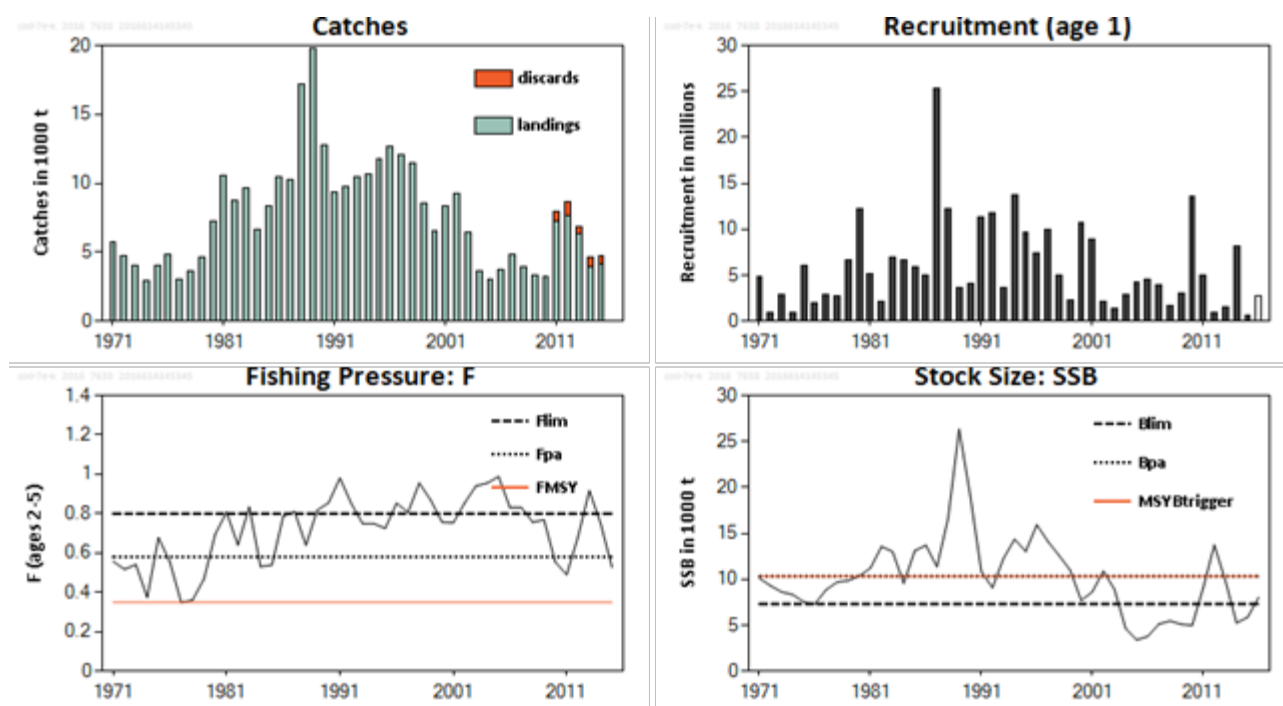

Figure 5.3.7.1 Cod in divisions 7.e–k. Summary of stock assessment (weights in thousand tonnes).The assumed recruitment value is unshaded. Discards emanating from highgrading are included in the assessment as landings in the period 2003–2011. Other discard estimates are available and plotted from 2011, but have not been used in the assessment.

Stock and exploitation status

Table 5.3.7.1 Cod in divisions 7.e–k. 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

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[*] "Wanted catch" is used to describe fish that would be landed in the absence of the EU landing obligation.

Catch options

Table 5.3.7.2   Cod in divisions 7.e–k. The basis for the catch options.

Variable	Value	Notes	Source
F ages 2–5 (2016)	0.73	F = F average (2013–2015), unscaled	ICES (2016a)
SSB (2017)	6202 t	Short-term forecast	ICES (2016a)
R age 1 (2016/2017)	2740 thousands	The 25th quantile of the recruitment time-series (1971-2015)	ICES (2016a)
Catch (2016)		Unknown	-
Landings (2016)	4865 t	Short-term forecast	ICES (2016a)
Discards (2016)	-	Not quantified because of variable discard rates in the recent past	ICES (2016a)

Table 5.3.7.3   Cod in divisions 7.e–k. The catch options.

Rationale	Wanted catch (2017)	Basis	F (wanted catch*)	SSB(2018)	% SSB change**	% TAC change***
MSY approach	1447 t	$F_{MSY} \times SSB_{2017}/MSY\ B_{trigger}$	0.21	8312	34	−68
Zero catch	0 t	F = 0	0	9929	60	−100
Other options^	2270 t	F_{MSY}	0.35	7402	19	−50
	4090 t	F_{2016}	0.73	5427	−12	−10
	3880 t	TAC_{2016} −15%	0.68	5651	−9	−15
	4565 t	TAC_{2016}	0.86	4917	−21	0
	5250 t	TAC_{2016} + 15%	1.06	4206	−32	15
	4362 t	F_{lim}	0.80	5137	−17	−4
	3436 t	F_{pa}	0.58	6129	−1	−25
	2356 t	$SSB_{2018} = B_{lim}$	0.37	7307	18	−48
		$SSB_{2018} = B_{pa} = MSY\ B_{trigger}$				
Mixed-fisheries options ([ICES, 2016b](#))						
Maximum	4236 t	A	0.77	5270	−15	−7
Minimum	1420 t	B	0.21	8340	34	−69
Cod	1447 t	C	0.21	8310	34	−68
Haddock	2826 t	D	0.45	6791	9	−38
Whiting	4216 t	E	0.76	5291	−15	−8
Status quo effort	3187 t	F	0.53	6398	3	−7

* "Wanted catch" is used to describe fish that would be landed in the absence of the EU landing obligation.

** SSB 2018 relative to SSB 2017.

*** Wanted catch 2017 relative to TAC 2016.

^ The B_{pa} and MSY $B_{trigger}$ options were left blank because $SSB_{2018} = B_{pa} = MSY\ B_{trigger}$ cannot be achieved in 2018 even with zero catch advice.

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: Each fleet stops fishing when its last stock share is exhausted.

B. Minimum: Each fleet stops fishing when its first stock share is exhausted.

C. Cod: Each fleet stops fishing when its cod stock share is exhausted.

D. Haddock: Each fleet stops fishing when its haddock stock share is exhausted.

E. Whiting: Each fleet stops fishing when its whiting stock share is exhausted.

F. *Status quo* effort: The effort of each fleet is as in 2015.

Basis of the advice

Table 5.3.7.4   Cod in divisions 7.e–k. The basis of the advice.

Advice basis	MSY approach
Management plan	There is no management plan for cod in this area.

Quality of the assessment

This year's assessment shows a substantial upward revision in F and a downward revision in SSB in recent years. These substantial changes in assessment between years may be due to strong year classes dominating the fishery in recent years, the unexpected disappearance of fish of older age, and discards being only partially included in the assessment.

As in previous assessments, landings have been adjusted to include partial highgrading estimates (2003–2011) and landings taken or reported in 33E2 and 33E3 since 2004, following the usual procedure for this stock.
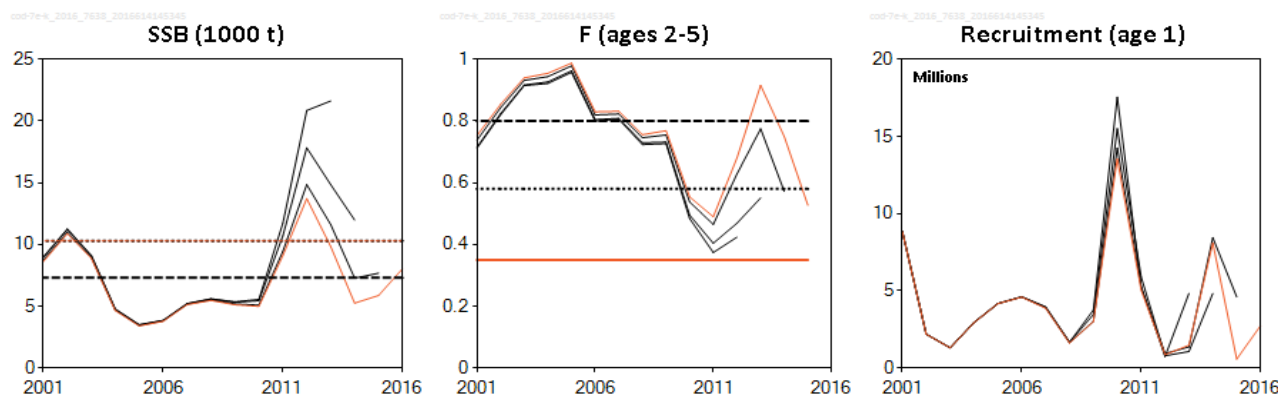

Figure 5.3.7.2   Cod in divisions 7.e–k. Historical assessment results (final-year recruitment estimates included).

Issues relevant for the advice

Fishing mortality on cod is difficult to control because of the mixed-fisheries interactions. The mixed-fisheries analysis carried out by ICES shows that cod will be the limiting species for most of the fleets in 2017 (ICES, 2016b).

F_{MSY} has been redefined using the agreed ICES guidelines (ICES, 2016c). None of the catch options will bring the SSB in 2018 above MSY $B_{trigger}$ because of the weak 2014 year class. The forecast is highly dependent on the incoming recruitment assumptions. Recruitment (age 1), in 2016 and thereafter, is assumed lower than average to account for recruitment dynamics of the stock (successive weak recruitments have often been observed).

ICES cannot quantify the corresponding total catches due to uncertainty in the estimation of discard rates. Discards normally constitute about 10% of the total catch, but discard rates in recent years have fluctuated substantially because of variable recruitment and restrictive quotas.

Reference points

Table 5.3.7.5   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 t	B_{pa}	ICES (2012)
	F_{MSY}	0.35	Segmented regression with B_{loss}, the lowest observed spawning-stock biomass (Eqsim).	ICES (2016d)
Precautionary approach	B_{lim}	7 300 t	Lowest observed SSB (1976), rounded value	ICES (2012)
	B_{pa}	10 300 t	$B_{lim} \times 1.4$	ICES (2012)
	F_{lim}	0.80	Based on segmented regression with B_{lim} as breakpoint	ICES (2016c)
	F_{pa}	0.58	$F_{lim}/1.4$	ICES (2016c)
Management plan	SSB_{MGT}	Not applicable.		
	F_{MGT}	Not applicable.		

Basis of the assessment

Table 5.3.7.6   Cod in divisions 7.e–k. The basis of the assessment.

ICES stock data category	1 (ICES, 2016e)
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 and the 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, 2012).
Working group	Working Group for the Celtic Seas Ecoregion (WGCSE) and Working Group on Mixed Fisheries Advice (WGMIXFISH-Advice)

Information from stakeholders

No information was available.

History of the advice, catch, and management

Table 5.3.7.7   Cod in divisions 7.e–k. History of ICES advice, the agreed TAC, and ICES estimates of landings and discards. Weights are in thousand tonnes.

Year	ICES advice	Predicted landings corresp. to advice	Agreed TAC*	ICES landings^^^	ICES discard estimates
1987	Reduce F	< 6.4**		10.2	
1988	No increase in F; TAC	7.0**		17.2	
1989	No increase in F; TAC	8.6**		19.8	
1990	No increase in F; TAC	9.2**		12.8	
1991	TAC; SSB = mean	4.5**		9.3	
1992	Appropriate to reduce F	-		9.7	
1993	20% reduction in F	6.5**	19.0	10.4	
1994	20% reduction in F	5.6**	17.0	10.6	
1995	20% reduction in F	4.7***	17.0	11.7	
1996	20% reduction in F	4.7***	20.0	12.7	
1997	20% reduction in F	7.4***	20.0	12	
1998	10% reduction in F	8.8^	20.0	11.4	
1999	Reduce F below F$_{pa}$	9.2^	19.0	8.6	
2000	Reduce F below F$_{pa}$	< 7.6^^	16.0	6.5	
2001	40% reduction in F	< 4.3^^	10.5	8.3	
2002	45% reduction in F	< 5.3^^	8.7	9.2	
2003	60% reduction in F	< 3.8^^	6.7	6.4	
2004	90% reduction in F or management plan	< 0.7	5.7	3.7	
2005	17% reduction in F	< 5.2	6.2	3.1	
2006	No increase in effort [should have been reduce effort]	Cannot be estimated	5.6	3.8	
2007	Zero catch	0	4.7	4.8	
2008	Zero catch	0	4.3	4	
2009	50% reduction in F	< 2.6	4.023	3.3	
2010	Substantial catch reduction	-	4.023	3.2	
2011	Catch and effort reduction	-	5.379	7.3	0.7
2012	MSY framework	< 10.0	10.059	7.7	1.0
2013	MSY framework	< 10.2	10.200	6.3	0.5
2014	MSY approach	< 6.848	6.848	3.9	0.7
2015	MSY approach	< 4.024	5.072	4.2	0.6
2016	MSY approach	≤ 3.569	4.565		
2017	MSY approach	≤ 1.447			

*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 catch and landings

Table 5.3.7.8   Cod in divisions 7.e–k. Catch distribution by fleet in 2015 as estimated by ICES.

Catch (2015)	Landings					Discards				
	otter trawl	beam trawl	seine	gillnets	other	otter trawl	beam trawl	seine	gillnets	other
4722 t	77%	8%	5%	6%	4%	75%	19%	1%	4%	1%
	4157 t					565 t				

Table 5.3.7.9   Cod in divisions 7.e–k. History of commercial landings and discards; the official and ICES estimates of landings. "NA" means not available. Weights are in tonnes.

Year	Belgium	France	Ireland	UK	Others	Total	Highgraded discard estimates	ICES 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

Year	Belgium	France	Ireland	UK	Others	Total	Highgraded discard estimates	ICES discard estimates	Landings taken or reported in 33E2 and 33E3***
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	NA	952	85
2013	202	4064	1478	546	0	6290	NA	530	76
2014	141	2080	1159	464	1	3845	NA	741	24
2015	120	2487	1126	422	2	4157	NA	565	39

*French highgrading estimates from self-sampling programme.
**International highgrading estimate.
*** Included in Ireland landings estimates.

Summary of the assessment

Table 5.3.7.10   Cod in divisions 7.e–k. Assessment summary.

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Discards tonnes	Mean F Ages 2–5
1971	4769	10093	5782		0.557
1972	928	9298	4737		0.517
1973	2810	8617	4015		0.541
1974	889	8327	2898		0.375
1975	6031	7526	3993		0.678
1976	1986	7316	4818		0.554
1977	2871	8841	3059		0.349
1978	2741	9689	3647		0.361
1979	6630	9848	4650		0.467
1980	12254	10347	7243		0.694
1981	5179	11212	10597		0.808
1982	2117	13547	8766		0.64
1983	6923	13008	9641		0.834
1984	6696	9568	6631		0.531
1985	5892	13103	8317		0.539
1986	5000	13692	10475		0.787
1987	25361	11364	10228		0.811
1988	12239	16607	17191		0.639
1989	3648	26324	19809		0.817
1990	4042	19126	12749		0.855
1991	11365	10846	9336		0.981
1992	11743	9074	9747		0.851
1993	3701	12282	10425		0.749
1994	13717	14361	10620		0.749
1995	9676	13029	11709		0.725
1996	7433	15919	12681		0.853
1997	10005	14106	12035		0.806
1998	5020	12601	11431		0.955
1999	2352	11002	8594		0.869
2000	10658	7695	6536		0.757
2001	8842	8618	8308		0.753
2002	2185	10881	9236		0.854

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Discards tonnes	Mean F Ages 2–5
2003	1301	8886	6420		0.94
2004	2932	4648	3672		0.955
2005	4167	3403	3062		0.988
2006	4588	3775	3776		0.83
2007	3871	5128	4830		0.832
2008	1614	5466	3961		0.756
2009	3008	5110	3292		0.769
2010	13548	4981	3229		0.554
2011	5025	9100	7261	696	0.49
2012	856	13719	7692	952	0.681
2013	1475	9830	6290	530	0.916
2014	8098	5247	3879	741	0.75
2015	570	5872	4154	565	0.527
2016	2741*	8035			
Average	**5859**	**10241**	**7587**	**697**	**0.717**

* 25th quantile of the recruitment time-series (1971–2015).

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