

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

ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, there should be zero catch in 2019.

Stock development over time

Spawning-stock biomass (SSB) has been below B_{lim} since 2004, except from 2011 to 2013. Fishing mortality has been above F_{MSY} for the entire time-series but has been decreasing since 2014. Recruitment has been highly variable over time. Recent recruitment has been very weak with the exception of the 2013 year class, which is above average.

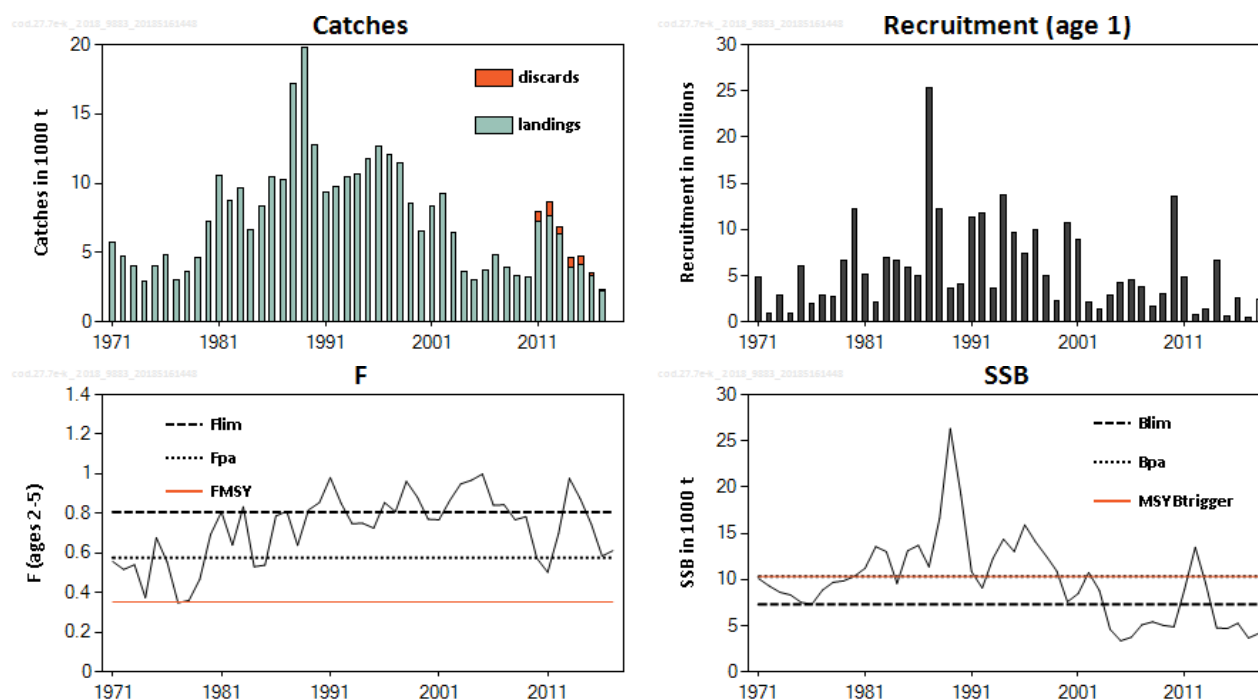


Figure 1 Cod in divisions 7.e-k. Summary of the stock assessment (weights in thousand tonnes). The assumed recruitment value is unshaded. Discards resulting from high-grading are included in the assessment as landings in the period 2003–2011; high-grading is considered to be negligible from 2012 onward. Discard estimates other than high-grading are available and plotted from 2011.

Stock and exploitation status

ICES assesses that fishing pressure on the stock is above F_{MSY} and between F_{pa} and F_{lim} , and that the spawning-stock size is below $MSY B_{trigger}$, B_{pa} , and B_{lim} .

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

		Fishing pressure			Stock size		
		2015	2016	2017	2016	2017	2018
Maximum sustainable yield	F_{MSY}	✘	✘	✘ Above	$MSY B_{trigger}$	✘	✘ Below trigger
Precautionary approach	F_{pa}, F_{lim}	○	○	○ Increased risk	B_{pa}, B_{lim}	✘	✘ Reduced reproductive capacity
Management plan	F_{MGT}	—	—	— Not applicable	B_{MGT}	—	— Not applicable

Catch scenarios

Table 2 Cod in divisions 7.e-k. Assumptions made for the interim year and in the forecast.

Variable	Value	Notes
F _{ages 2-5} (2018)	0.612	F _{sq} = F _{average} (2015-2017) rescaled to F ₂₀₁₇
SSB (2019)	3618 tonnes	Fishing at F = 0.612
R _{age 1} (2018-2019)	2439 thousand	25th quantile of the recruitment time-series (1971-2017)
Catch (2018)	2551 tonnes	Landings + estimated discards
Landings (2018)	2354 tonnes	Fishing at F = 0.612
Discards (2018)	197 tonnes	Average discard rate (2015-2017) = 7.73%

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

Basis	Total catch ^ (2019)	Wanted catch * (2019)	Unwanted catch * (2019)	F _{wanted} (2019)	SSB (2020)	% SSB change **	% TAC change ***	% Advice change ^^^
ICES advice basis								
MSY approach: zero catch	0	0	0	0	6906	90.9	-100	-100
Other scenarios								
MSY approach: F _{MSY} × SSB (2019)/MSY B _{trigger}	588	543	45	0.12	6266	73.2	-82	-83
F _{MSY lower} : F _{MSY lower} × SSB (2019)/MSY B _{trigger}	389	359	30	0.08	6482	79.2	-88	-89
F _{MSY upper} : F _{MSY upper} × SSB (2019)/MSY B _{trigger}	914	843	71	0.2	5914	63.5	-73	-73
F _{pa}	2334	2154	180	0.58	4403	21.7	-30	-32
F _{lim}	2970	2740	230	0.801	3744	3.5	-10.9	-13.4
SSB (2020) = B _{lim} ^^								
SSB (2020) = B _{pa} = MSY B _{trigger} ^^								
F = F ₂₀₁₈	2430	2242	188	0.61	4303	18.9	-27	-29
F = F _{MSY}	1531	1413	118	0.35	5252	45.2	-54	-55
F = F _{MSY lower}	1059	977	82	0.23	5756	59	-66	-69
Mixed fisheries options								
A: Max	2439	-	-	0.62	4278	18	-20	-
B: Min	0	-	-	0	6906	91	-100	-
C: Stock	0	-	-	0	6906	91	-100	-
D: SQ effort	2453	-	-	0.62	4263	18	-20	-
E: Value	1644	-	-	0.38	5129	42	-47	-
F: Range	0	-	-	0	6905	91	-100	-

* "Wanted" and "unwanted" catch are used to describe fish that would be landed and discarded, respectively, in the absence of the EU landing obligation, based on average discard rate estimates for 2015-2017.

**SSB 2020 relative to SSB 2019.

*** Wanted catch in 2019 relative to TAC 2018 (3076 tonnes).

^ Total catch derived from the wanted catch and average discard rate for 2015-2017.

^^ The B_{lim} and MSY B_{trigger} option are left blank because both B_{lim} and MSY B_{trigger} cannot be achieved in 2020, even with zero advice.

^^^ Advice value for 2019 relative to the advice value for 2018 (3428 tonnes).

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):

- Maximum scenario: Each fleet stops fishing when its last stock share is exhausted.
- Minimum scenario: Each fleet stops fishing when its first stock share is exhausted.
- Stock scenario: Each fleet stops fishing when its individual stock share is exhausted.
- SQ (*status quo*) effort scenario: The effort of each fleet in 2018 and 2019 is the same as in 2017.
- 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 (price × weight) of each stock in the fleet's portfolio.

F. Range scenario: The potential for TAC mismatch in 2019 is minimized 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-c and 7.e-k).

Recent recruitment is very weak and the short-term outlook is very dependent on recruitment for this stock. The stock size has also been revised down significantly in the latest assessment. Catch advice for 2019 is 0 (zero) tonnes because no scenario would result in the stock recovering to B_{lim} by 2020.

Basis of the advice

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

Advice basis	MSY approach
Management plan	The EU has proposed a multiannual management plan for the Western Waters, which is not yet finalized (EU, 2018).

Quality of the assessment

The addition of the 2017 catch, commercial and survey data has resulted in a large downward revision of the stock size in several years compared to the previous assessment. The assessment has also revised down the 2014 and 2016 recruitment estimates and increased fishing mortality. In addition, the estimate of the 2017 recruitment (501 thousands) is also much lower than the assumption of average recruitment of 4505 thousands that was made last year in the forecast for 2018.

The change in perception of the stock is supported by the fact that realized catches in 2017 of 2354 tonnes have been much lower than those anticipated assuming a similar level of effort as in recent years (3704 tonnes in ICES 2017 advice). Data do not indicate a decline in effort in 2017 (ICES, 2018a). Furthermore, the l_{pue} for most of the fleets have continued to decline to a relatively low level.

Owing to a lack of French market sampling of length in Q1 and Q2 of 2017 (biological and on-board sampling was unaffected), some sampling strata length data were supplemented using data from previous years, which is considered to have limited impact on the assessment.

The French contribution to the combined IBTS survey tuning index was not available for 2017 and was partially replaced by extended Irish survey coverage. This was not considered to have impacted on the quality of the assessment.

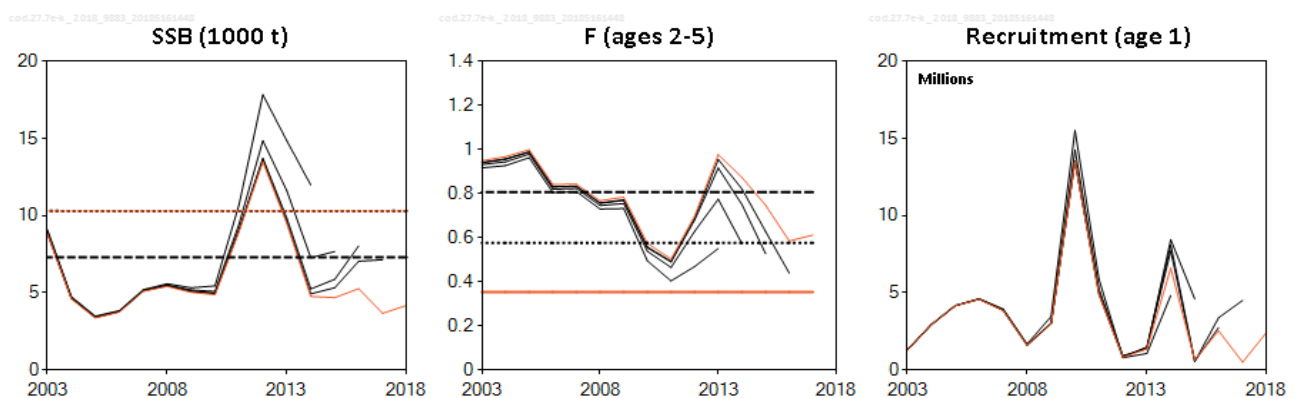


Figure 2 Cod in divisions 7.e-k. Historical assessment results (final-year recruitment estimates included).

Issues relevant for the advice

SSB in 2019 at F_{sq} is forecasted to be below B_{lim} and $MSY B_{trigger}$. Predicted SSB at the end of the forecast period (in this case 2020) is very sensitive to the assumption on recruitment, since cod is maturing at age 2 in this area. As indicated above, the 2018 assessment estimates a very low recruitment in 2017 (the lowest in the time-series), which is much lower than what was assumed for the forecast in 2017 (geometric mean 1971–2014). Therefore, the assumptions for the 2018 and 2019 recruitment (25th percentile (1971–2014)) in the forecast are more conservative, and along with the revision in the stock perception, result in the $SSB < B_{lim}$ and zero catch advice for 2019.

Mixed-fisheries considerations

Fishing mortality on cod is difficult to control, among other reasons because cod are caught in mixed fisheries with haddock and whiting. The mixed-fisheries analysis carried out by ICES shows that cod will be the limiting species for all fleets (representing 100% of fleet effort) in 2019 (ICES, 2018b). With zero catch advice for cod in 2019, all scenarios, except the ‘min’ scenario, indicate overshoots of cod in 2019. The undershoots of all gadoids in ‘min’ scenario demonstrate that cod is a “choke” species for all other stocks in 2019 (representing 100% of fleet effort; ICES, 2018b).

This year, two “range” scenarios are presented: the traditional range scenario which uses ICES advice of zero catches for cod, and a new range scenario which uses the uncapped reduced MSY approach for cod. Both of these scenarios search for the minimum sum of differences between potential catches by stock under the “min” and the “max” scenarios within the F_{MSY} ranges. The outcome of both of these scenarios are driven by the limiting cod catch in 2019. All fleets within the Celtic Sea catch cod to a greater or lesser extent; therefore, these large reductions in fishing mortality of cod result in a “choke” for both haddock and whiting in all fleets.

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 $B_{trigger}$	10300 tonnes	B_{pa}	ICES (2012a)
	F_{MSY}	0.35	Segmented regression with B_{lim} (EqSim).	ICES (2016a)
Precautionary approach	B_{lim}	7300 tonnes	B_{loss} , lowest observed SSB (1976), rounded value	ICES (2012a)
	B_{pa}	10300 tonnes	$B_{lim} \times 1.4$	ICES (2012a)
	F_{lim}	0.80	Segmented regression with B_{lim} (EqSim).	ICES (2016a)
	F_{pa}	0.58	$F_{lim}/1.4$	ICES (2016a)
Management plan*	MAP MSY $B_{trigger}$	10300 tonnes	MSY $B_{trigger}$	
	MAP B_{lim}	7300 tonnes	B_{lim}	
	MAP F_{MSY}	0.35	F_{MSY}	
	MAP range F_{lower}	0.23	Consistent with ranges provided by ICES (2016a), resulting in no more than 5% reduction in long-term yield compared with MSY.	
	MAP range F_{upper}	0.55	Consistent with ranges provided by ICES (2016a), resulting in no more than 5% reduction in long-term yield compared with MSY.	

* Proposed EU multiannual plan (MAP) for the Western Waters (EU, 2018).

Basis of the assessment

Table 6 Cod in divisions 7.e–k. Basis of the 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.
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.

History of the advice, catch, and management

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

Year	ICES advice	Landings corresponding to advice	Catch corresponding to advice	Agreed TAC*	ICES landings ^{^^}	ICES discards
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 Fpa	9200 [^]		19000	8594	
2000	Reduce F below Fpa	< 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	6431	
2004	90% reduction in F or management plan	< 700		NA	3671	
2005	17% reduction in F	< 5200		6200	3062	
2006	No increase in effort [should have been reduce effort]	Cannot be estimated		5580	3758	
2007	Zero catch	0		4743	4831	
2008	Zero catch	0		4316	3961	
2009	50% reduction in F	< 2600		4023	3288	
2010	Substantial catch reduction	-		4023	3236	
2011	Catch and effort reduction	-		5379	6565	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	220
2017	MSY approach	≤ 1447		2830	2237	117
2018	MSY approach	≤ 3076	≤ 3428	3076		
2019	MSY approach	0	0			

* 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 high-grading estimates (2003-2011) and landings taken or reported in rectangles 33E2 and 33E3 since 2004.

History of the catch and landings

Table 8 Cod in divisions 7.e-k. Catch distribution by fleet in 2017 as estimated by ICES.

Catch (2017)	Landings					Discards
	Otter trawl	Beam trawl	Gillnet	Seine	Other	
2354 tonnes	81.6%	6.8%	5.6%	4.9%	0.8%	117 tonnes
2237 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 landings	High-graded 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
2017	82	1348	624	184	0.1	2237	negligible	117	19

* French high-grading estimates from self-sampling programme.

** International high-grading estimates.

*** Included in Ireland landings estimates. Landings in the southern part of Division 7.a (rectangles 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, recruitment in thousands.

Year	Recruitment age 1	SSB	Landings	Discards**	F ages 2-5
	thousands				
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	16606	17191		0.64
1989	3648	26324	19809		0.82
1990	4042	19126	12749		0.86
1991	11365	10846	9336		0.98
1992	11742	9073	9747		0.85
1993	3699	12280	10425		0.75
1994	13712	14358	10620		0.75
1995	9669	13022	11709		0.73
1996	7418	15904	12681		0.86
1997	9987	14076	12035		0.81
1998	5008	12544	11431		0.96
1999	2349	10912	8594		0.88
2000	10651	7580	6536		0.77
2001	8838	8470	8308		0.77
2002	2183	10756	9236		0.87
2003	1299	8810	6420		0.95
2004	2926	4606	3672		0.97
2005	4164	3368	3062		1.00
2006	4575	3746	3776		0.84
2007	3845	5093	4830		0.84
2008	1602	5412	3961		0.77
2009	2997	5027	3292		0.78
2010	13504	4872	3229		0.57
2011	4881	8957	7261	696	0.50
2012	816	13480	7692	952	0.70
2013	1360	9486	6290	530	0.98
2014	6595	4762	3879	741	0.87
2015	650	4687	4154	565	0.75
2016	2530	5264	3299	220	0.59
2017	501	3669	2237	117	0.61
2018	2439 *	4179			

* 25th quantile of the recruitment time-series.

**Discards are not included in the assessment.

Sources and references

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