

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 2020.

Stock development over time

Spawning–stock biomass (SSB) has been below B_{lim} since 2004, except from 2011 to 2013. Fishing mortality (F) has been above F_{MSY} for the entire time-series and has fluctuated around F_{lim} in recent years. Recruitment has been highly variable over time. Recent recruitment has been low, with the exception of 2014, which was above average.

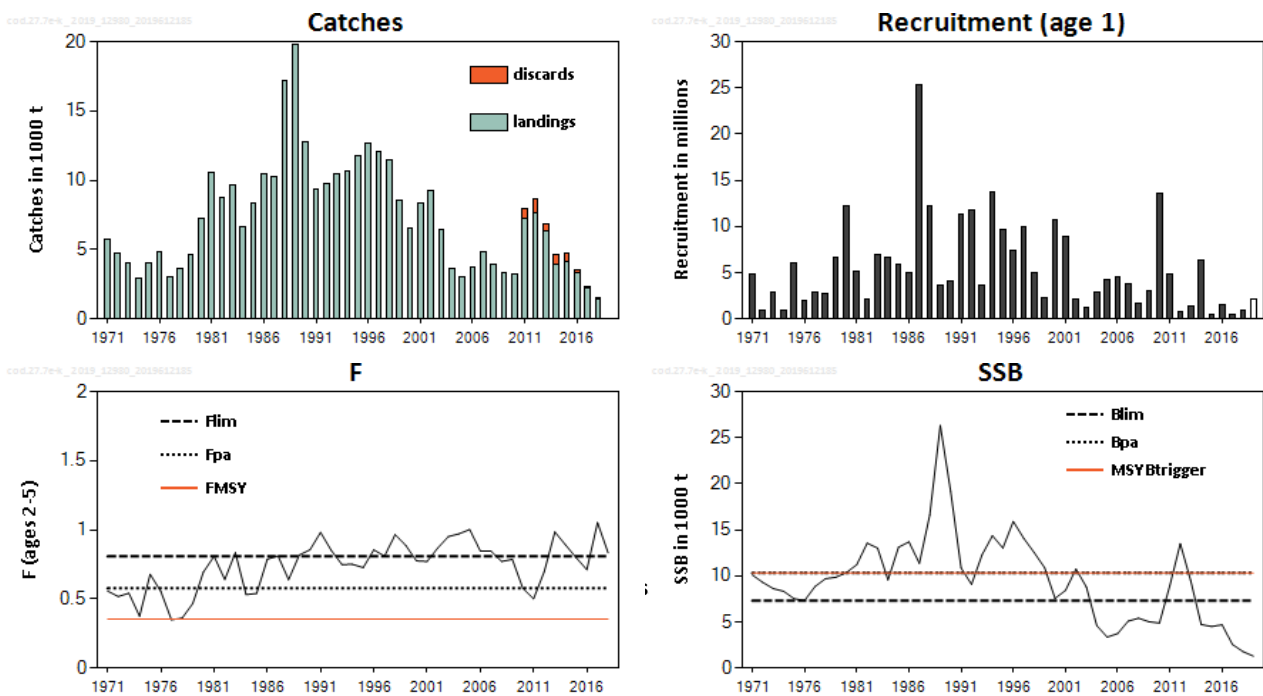


Figure 1 Cod in divisions 7.e–k. Summary of the stock assessment (weights in thousand tonnes). The assumed recruitment value is unshaded. Discards resulting from high-grading are included in the assessment as landings in the period 2003–2011. Discard estimates other than high-grading are available since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

Stock and exploitation status

ICES assesses that fishing pressure on the stock is above F_{MSY} , 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		
		2016	2017	2018	2017	2018	2019
Maximum sustainable yield	F_{MSY}	✘	✘	✘ Above	$MSY B_{trigger}$	✘	✘ Below trigger
Precautionary approach	F_{pa}, F_{lim}	⦿	✘	✘ Harvested unsustainably	B_{pa}, B_{lim}	✘	✘ Reduced reproductive capacity
Management plan	F_{MGT}	✘	✘	✘ Above range	B_{MGT}	✘	✘ Below trigger

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)	0.87	$F_{sq} = F_{average}$ (2016–2018)
SSB (2020)	1664	Tonnes; fishing at $F = 0.87$
Rage 1 (2019–2020)	2166	Thousands; 25th quantile of the recruitment time-series (1971–2018)
Catch (2019)	1321	Tonnes; landings + estimated discards
Wanted catch (2019)	1228	Tonnes; fishing at $F = 0.87$
Unwanted catch (2019)	93	Tonnes; average ratio of 2016–2018 (7.6%)

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

Basis	Total catch (2020)	Wanted catch * (2020)	Unwanted catch * (2020)	F_{total} (2020)	F Wanted (2020)	F Unwanted (2020)	SSB (2021)	% SSB change **	% TAC change ***
ICES advice basis									
MSY approach: $F = 0$	0	0	0	0	0	0	4447	167	-100
Other scenarios									
F_{pa}	1560	1450	110	0.58	0.58	0	2820	69	-3.1
$F_{MSY} \times SSB_{2020} / MSY B_{trigger}$	189	176	13	0.057	0.057	0	4246	155	-88
$F_{MSY lower} \times SSB_{2020} / MSY B_{trigger}^{\dagger}$	125	116	8.8	0.037	0.037	0	4314	159	-92
$F_{MSY upper} \times SSB_{2020} / MSY B_{trigger}^{\dagger}$	293	272	21	0.089	0.089	0	4136	149	-82
$F = F_{MSY}$	1033	960	73	0.35	0.35	0	3361	102	-36
F_{lim}	1977	1838	139	0.8	0.8	0	2402	44	23
$SSB_{2021} = B_{lim}^{\wedge}$									
$SSB_{2021} = B_{pa} = MSY B_{trigger}^{\wedge}$									
$F = F_{2019}$	2088	1941	147	0.87	0.87	0	2293	38	30

* Wanted catch is the predicted landed catch above the minimum conservation reference size (MCRS). Unwanted catch are the landings below MCRS and discards.

** SSB 2021 relative to SSB 2020.

*** Total catch in 2020 relative to TAC 2019 (1610 tonnes).

\wedge The B_{lim} , B_{pa} , and MSY $B_{trigger}$ options were left blank because B_{lim} , B_{pa} , and MSY $B_{trigger}$ cannot be achieved in 2021, even with zero advice.

The advice is the same as for 2019, because the SSB is expected to remain below B_{lim} even with zero catch.

Basis of the advice

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

Advice basis	MSY approach
Management plan	<p>The EU multiannual plan (MAP) for stocks in the Western Waters and adjacent waters applies to this stock. The plan specifies conditions for setting fishing opportunities depending on stock status and making use of the F_{MSY} range for the stock.</p> <p>Full details of the plan are described in EU (2019).</p>

[†] Version 2: Formula corrected

Quality of the assessment

There is a very strong tendency for the assessment to overestimate SSB and to underestimate F. While the magnitude of the bias suggests that the impact of catches on the stock is very uncertain, it is clear that the stock is well below B_{lim} .

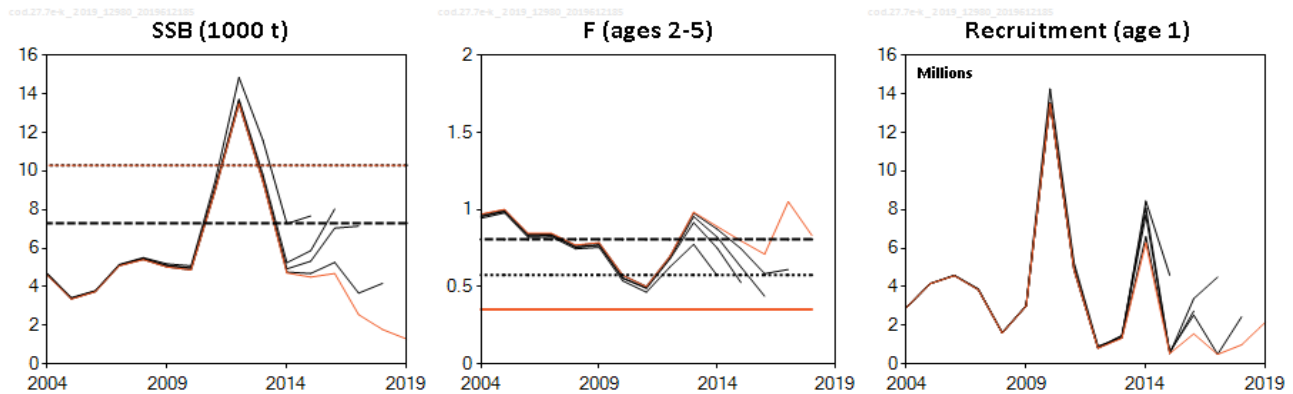


Figure 2 Cod in divisions 7.e-k. Historical assessment results (final-year recruitment assumptions included).

Issues relevant for the advice

The retrospective patterns in SSB and F raises concerns about the reliability of the assessment; this will be investigated in a benchmark prior to the next assessment. However, the catch advice is unaffected by the uncertainty in the assessment because the stock is known to be well below B_{lim} .

The assessment and the advice are for divisions 7.e-k, including the rectangles 33E2 and 33E3 in the Irish Sea.

Landings are adjusted to include those reported from rectangles 33E2 and 33E3 in the Irish Sea, as they are considered part of this stock. This amounts to an average of 18% of total Irish Sea landings being reallocated over the past 5 years and accounts for 14.3% of official landings in divisions 7.e-k over the past 5 years. This should be considered when setting TACs for the two management areas (divisions 7.a and 7.e-k), as a portion of the catch taken under the 7.a TAC are considered part of the 7.e-k stock.

Mixed-fisheries considerations

Cod in 7e-k is caught as part of a mixed fishery with haddock and whiting. Mixed-fisheries advice will be provided in the Celtic Seas fisheries overview later in the year.

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 (2012a)
	F_{MSY}	0.35	Segmented regression with B_{lim} (EqSim).	ICES (2017)
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 (2017)
	F_{pa}	0.58	$F_{lim}/1.4$	ICES (2017)
Management plan	MAP MSY $B_{trigger}$	10 300	Tonnes; MSY $B_{trigger}$	EU (2019), ICES (2012a)
	MAP B_{lim}	7 300	Tonnes; B_{lim}	EU (2019), ICES (2012a)
	MAP F_{MSY}	0.35	F_{MSY}	EU (2019), ICES (2017)
	MAP range F_{lower}	0.23	Consistent with ranges provided by ICES (2017), resulting in no more than 5% reduction in long-term yield compared with MSY.	EU (2019), ICES (2017)
	MAP range F_{upper}	0.55	Consistent with ranges provided by ICES (2017), resulting in no more than 5% reduction in long-term yield compared with MSY.	EU (2019), ICES (2017)

Basis of the assessment

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

ICES stock data category	1 (ICES, 2018).
Assessment type	Age-based analytical assessment (XSA) (ICES, 2019).
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 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	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	1385	180
2019	MSY approach		0	1610		
2020	MSY approach		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 2018 as estimated by ICES.

Catch	Landings					Discards
	1565 tonnes	Otter trawl 76%	Beam trawl 10%	Gillnet 6%	Seine 7%	
1385 tonnes						

Table 9 Cod in divisions 7.e-k. History of official commercial landings presented by country and ICES discards estimates. All weights are in tonnes (N/A: data not available).

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

Year	Belgium	France	Ireland	UK	Others	Total landings	High-graded discard estimates	Discard estimates	Landings taken or reported in 33E2 and 33E3 ***
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
2018 #	49	499	706	130	0.5	1385	Negligible	180	20

* 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.

Preliminary.

Summary of the assessment

Table 10 Cod in divisions 7.e-k. Assessment summary. Recruitments are in thousands, weights are in tonnes.

Year	Recruitment age 1	SSB	Landings	Discards *	F Ages 2-5
1971	4769	10093	5782	0	0.56
1972	928	9298	4737	0	0.52
1973	2810	8617	4015	0	0.54
1974	889	8327	2898	0	0.38
1975	6031	7526	3993	0	0.68
1976	1986	7316	4818	0	0.55
1977	2871	8841	3059	0	0.35
1978	2741	9689	3647	0	0.36
1979	6630	9848	4650	0	0.47
1980	12254	10347	7243	0	0.69
1981	5179	11212	10597	0	0.81
1982	2117	13547	8766	0	0.64
1983	6923	13008	9641	0	0.83
1984	6696	9568	6631	0	0.53
1985	5892	13103	8317	0	0.54
1986	5000	13692	10475	0	0.79
1987	25361	11364	10228	0	0.81
1988	12239	16606	17191	0	0.64
1989	3648	26324	19809	0	0.82
1990	4042	19126	12749	0	0.86
1991	11365	10846	9336	0	0.98
1992	11742	9073	9747	0	0.85
1993	3698	12280	10425	0	0.75
1994	13711	14357	10620	0	0.75
1995	9666	13019	11709	0	0.73
1996	7410	15899	12681	0	0.86
1997	9985	14065	12035	0	0.81
1998	5005	12522	11431	0	0.97
1999	2348	10883	8594	0	0.89
2000	10649	7548	6536	0	0.78
2001	8837	8421	8308	0	0.77
2002	2182	10738	9236	0	0.87
2003	1298	8795	6420	0	0.95
2004	2925	4596	3672	0	0.97
2005	4163	3359	3062	0	1.00
2006	4571	3739	3776	0	0.85
2007	3850	5084	4830	0	0.85
2008	1606	5402	3961	0	0.77
2009	2995	5022	3292	0	0.79
2010	13499	4875	3229	0	0.57

Year	Recruitment age 1	SSB	Landings	Discards *	F Ages 2–5
2011	4874	8961	7261	696	0.50
2012	813	13492	7692	952	0.70
2013	1327	9470	6290	530	0.98
2014	6277	4716	3879	741	0.89
2015	540	4501	4154	565	0.80
2016	1561	4689	3299	220	0.71
2017	496	2554	2237	117	1.05
2018	990	1783	1385	180	0.83
2019	2166 **	1290			

* Discards are not included in the assessment.

** 25th quantile of the recruitment time-series (1971–2018)

Sources and references

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