

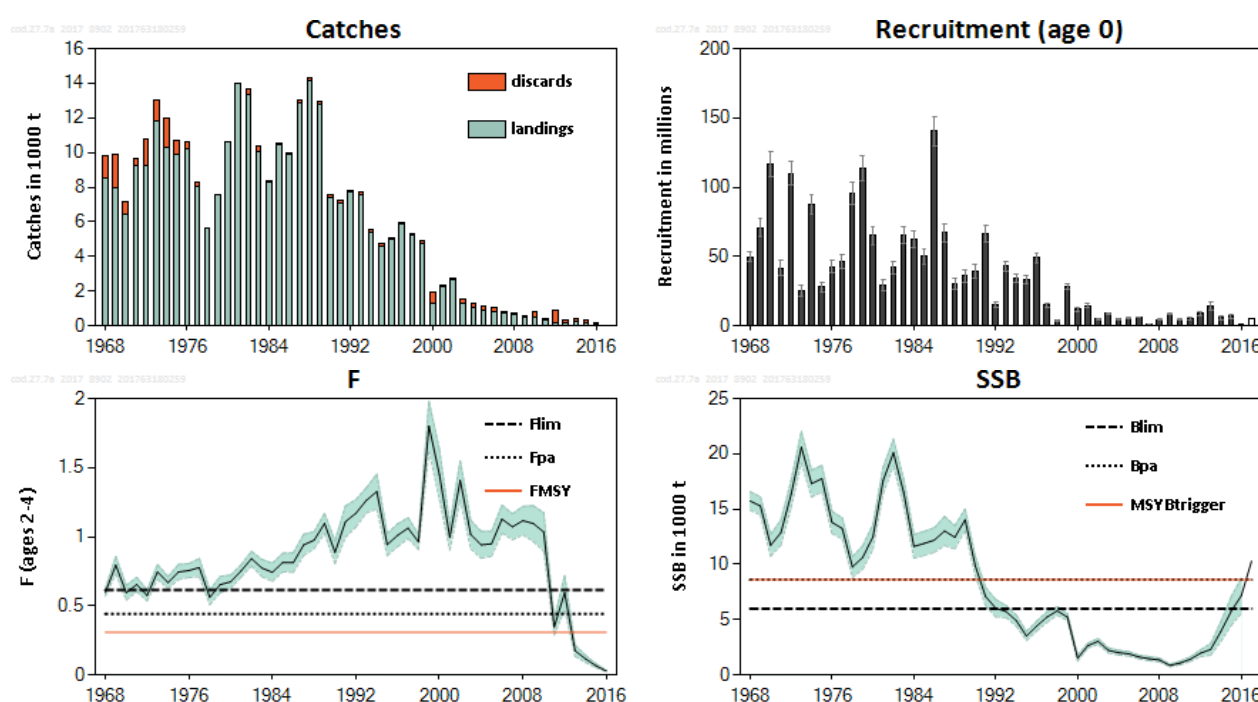
## Cod (*Gadus morhua*) in Division 7.a (Irish Sea)

### ICES stock advice

ICES advises that when the MSY approach is applied, catches in 2018 should be no more than 1073 tonnes. If discard rates do not change from the average of the last three years (2014–2016), this implies landings of no more than 695 tonnes.

### Stock development over time

The spawning-stock biomass (SSB) is increasing and was above MSY  $B_{trigger}$  in 2017 for the first time since the early 1990s. Recruitment remains low and was at its lowest historic value observed in 2016. Fishing pressure (F) has declined since 2012 and has been below  $F_{MSY}$  since 2013.



**Figure 1** Cod in Division 7.a. Summary of the stock assessment (weights in thousand tonnes) Recruitment, F, and SSB have uncertainty boundaries ( $1 \times$  standard deviation) in the plot. The predicted recruitment value is not shaded. Uncertainty boundaries not available for SSB and recruitment in 2017.

### Stock and exploitation status

**Table 1** Cod in Division 7.a. State of the stock and fishery relative to reference points.

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

## Catch options

**Table 2** Cod in Division 7.a. The basis for the catch options.

Variable	Value	Notes	Source
F ages 2–4 (2017)	0.071	$F_{sq} = F_{Average}(2014 - 2016)$	ICES (2017b)
SSB (2018)	11 001 tonnes	Fishing at $F=0.071$	ICES (2017b)
R (age 0) (2017-2018)	5 513 thousands	Geometric mean (GM) over years 2005–2014	ICES (2017b)
Catch (2017)	389 tonnes	Fishing at $F=0.071$	ICES (2017b)
Landings (2017)	246 tonnes	Average discard pattern (2014–2016)	ICES (2017b)
Discards (2017)	143 tonnes	Average discard pattern (2014–2016)	ICES (2017b)

**Table 3** Cod in Division 7.a. Annual catch options. All weights are in tonnes.

Basis	Total catch (2018)	Landings (2018)	Discards (2018)	$F_{total}$ (2018)	$F_{landings}$ (2018)	$F_{discards}$ (2018)	SSB (2019)	% SSB change *	% TAC change **
ICES advice basis									
MSY approach: $F_{MSY}$	1073 <sup>†</sup>	695	377	0.309	0.18	0.13	9570	-11	376
Other options									
$F = 0$	0	0	0	0	0	0	10903	1.7	-100
$F = FSQ$ (F in 2017)	268	173	94	0.071	0.041	0.029	10566	-1.5	18.5
$F_{pa}$	1466	950	515	0.442	0.26	0.183	9095	-15	551
$F_{lim}$	1924	1248	676	0.614	0.36	0.25	8550	-20	755
$SSB(2019) = B_{lim}$	3995	2597	1398	1.85	1.08	0.77	6000	-44	1679
$SSB(2019) = B_{pa} = MSY B_{trigger}$	1868	1212	656	0.59	0.35	0.25	8616	-19	730

\* SSB 2019 relative to SSB 2018.

\*\* Landings in 2018 relative to TAC in 2017 (146 t).

## Basis of the advice

**Table 4** Cod in Division 7.a. The basis of the advice.

Advice basis	MSY approach
Management plan	A long-term plan was agreed by the EU in 2008 (Council Regulation (EC) 1342/2008; EU, 2008). ICES (2009, 2010) evaluated the plan and does not consider the management plan to be in accordance with the precautionary approach.

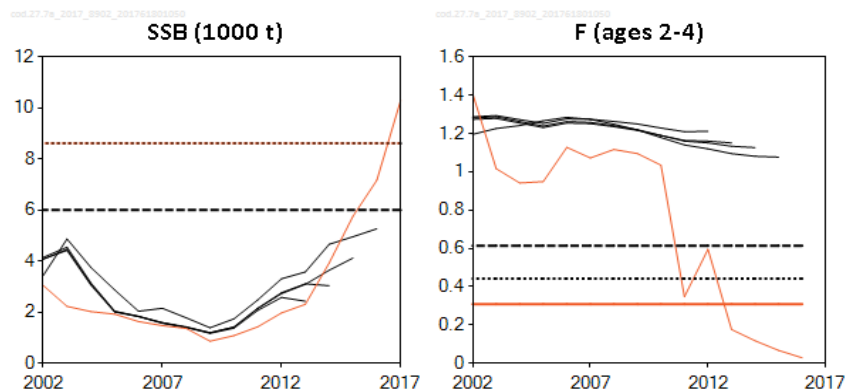
## Quality of the assessment

There is uncertainty around the historical discard estimates and reported landings in the period 2003–2007, but stock trends in the assessment appear to be robust to this uncertainty (ICES, 2017a).

The Irish Sea cod was benchmarked in January 2017 at WKIRISH (ICES, 2017a). A different assessment model and changes in the input data resulted in the change in the perception of the stock. The previous assessment estimated total removals of cod by raising the reported catch (landings) by a factor that could be very large (up to 20). This factor was estimated directly within the assessment model. These extra removals were considered to represent a mix of unallocated landings, discards, and losses due to potential migration. The updated assessment now includes information on both landings and discards and considers these catches as an unbiased estimate of removals.

There is not sufficient evidence to suggest movement of a significant portion of the stock into/out of the current stock area, so migration is not considered as an issue for this stock and has been left out of the new assessment model. The assessment also includes recruitment from age 0 rather than age 1, as was the case previously.

<sup>†</sup> Version 2: Value corrected



**Figure 2** Cod in Division 7.a. Historical assessment results. The 2017 benchmark led to a rescaling of the assessment outputs, particularly fishing pressure. The age of recruitment changed from age 1 to age 0 at the 2017 benchmark; therefore, the recruitment plot is not shown this year.

### Issues relevant for the advice

Landings have been adjusted since 2003 to exclude those taken from the southern rectangles (33E2 and 33E3) in the Irish Sea, as they are not believed to be part of this stock (Table 9) but rather of the stock in divisions 7.e–k (eastern English Channel and southern Celtic Seas). Thus, the assessment and the advice exclude these two southern rectangles but they are included in the assessment and advice for cod in 7.e–k. This should be considered when setting TACs for the two management areas for cod in divisions 7.a and 7.e–k.

The 2013 cohort, which currently accounts for approximately 60% of the total SSB, is followed by weaker year classes. SSB is therefore expected to decline in the medium term.

### Reference points

**Table 5** Cod in Division 7.a. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	8 616 tonnes	$B_{pa}$	ICES (2017a)
	$F_{MSY}$	0.309	Median point estimates of 'EqSim' simulations	ICES (2017a)
Precautionary approach	$B_{lim}$	6 000 tonnes	Suggested breakpoint in SSB where recruitment changes	ICES (2017a)
	$B_{pa}$	8 616 tonnes	$B_{lim}$ combined with the assessment error; $B_{lim} \times \exp(1.645 \times \sigma)$ ; $\sigma = 0.22$	ICES (2017a)
	$F_{lim}$	0.614	F with 50% probability of $SSB < B_{lim}$	ICES (2017a)
	$F_{pa}$	0.442	$F_{lim}$ combined with the assessment error; $F_{lim} \times \exp(-1.645 \times \sigma)$ ; $\sigma = 0.2$	ICES (2017a)
Management plan	$SSB_{mgt}$			
	$F_{mgt}$			

## Basis of the assessment

**Table 6** Cod in Division 7.a. Basis of assessment and advice.

ICES stock data category	1 ( <a href="#">ICES, 2016</a> )
Assessment type	Analytical assessment (ASAP)
Input data	Commercial landings; four survey indices (NIGFS-WIBTS-Q1, NIGFS-WIBTS-Q4, NIMIK, UK-FSP (Western Irish Sea)); maturity-at-age is time-varying; fixed natural mortality following Lorenzen (ICES 2017a).
Discards and bycatch	The model uses total catches (i.e. discards + landings). Discard information available since 2007, prior to 2007 estimated through raising procedures (ICES, 2017a).
Indicators	None.
Other information	This stock was benchmarked in 2017 (WKIRISH; ICES, 2017a).
Working group	Working Group for the Celtic Seas Ecoregion (WGCSE)

## Information from stakeholders

The estimate of SSB from the UK Fisheries Science Partnership survey (UK-FSP) in 2017 (not included in the current assessment) has the highest value in the series and shows the appearance of older year classes in very recent years.

## History of the advice, catch, and management

**Table 7** Cod in Division 7.a. ICES advice and official landings. All weights are in tonnes.

Year	ICES advice / single-stock exploitation boundaries since 2004	Predicted catch corresponding to advice	Agreed TAC	Official landings	ICES landings	ICES discards
1987	No increase in F; interaction with <i>Nephrops</i>	10 300	15 000	13 200	12 900	
1988	No increase in F; interaction with <i>Nephrops</i>	10 100	15 000	15 800	14 200	
1989	No increase in F	13 400	15 000	11 300	12 800	
1990	F at F <sub>med</sub> ; TAC	15 300	15 300	9900	7400	
1991	Stop SSB decline; TAC	6000	10 000	7000	7100**	
1992	20% of F(90) ~ 10 000 t	10 000	10 000	7400	7700**	
1993	F <sub>med</sub> ~ 10 200 t	10 200	11 000	5900	7600**	
1994	60% reduction in F	3700	6200	4500	5400**	
1995	50% reduction in F	3900	5800	4500	4600**	
1996	30% reduction in F	5400	6200	5303	4964**	
1997	30% reduction in F	5900	6200	4441	5859**	
1998	No increase in F	6200	7100	4962	5318**	
1999	Reduce F below F <sub>pa</sub>	4900	5500	2875	4784**	
2000	Lowest possible F	0	2100	1417	1274^	
2001	Lowest possible F	0	2100	2026	2252^	
2002	Establish recovery plan	-	3200	2715	2695^	
2003	Closure of all fisheries for cod	-	1950	1477	1285^	
2004	Zero catch	0	2150	1179	1072^	
2005	Zero catch	0	2150	967	910^	
2006	Zero catch	0	1828	948	840^	
2007	Zero catch	0	1462	1117	702^	148
2008	Zero catch	0	1199	1224	661^	62
2009	Zero catch	0	899	754	468^	60
2010	Zero catch	0	674	594	464^	377
2011	Zero catch	0	506	485	368	43
2012	Zero catch	0	380	326	198	658
2013	No directed fisheries, minimize bycatch and discards	0	285	281	206	118
2014	No directed fisheries, minimize bycatch and discards	0	228	236	213	149
2015	No directed fisheries, minimize bycatch and discards	0	182	199*	161	224
2016	No directed fisheries, minimize bycatch and discards	0	146	122*	82	60
2017	MSY approach	0	146			
2018	MSY approach	≤1073				

\* Preliminary.

\*\* Includes sample-based estimates of landings into three ports.

^ As reported to the working group.

## History of the catch and landings

**Table 8** Cod in Division 7.a. Catch distribution by fleet in 2016 as estimated by ICES.

Catch	Estimated landings					
	otter trawls		Scottish seines	mid-water trawl	Beam Trawls	other gear types
142 tonnes	<i>Nephrops</i> directed 74%	demersal fish directed 6.6%	1.5%	2.2%	14%	2.0%
	82 tonnes					
	Estimated discards					
	otter trawls		Scottish seines	mid-water trawl	Beam trawls	other gear types
	77% <i>Nephrops</i> directed	0.6% demersal fish directed	0.17%	1.1%	20%	1.2%
	60 tonnes					

**Table 9** Cod in Division 7.a. History of commercial catch and landings; official landings by country and ICES estimates of total landings and discards. All weights are in tonnes.

Year	Belgium	France	Ireland	Netherlands	Spain	UK (England Wales, & NI)	UK (Isle of Man)	UK (Scotland)	Total	Reallocated	Landings taken or reported in rectangles 33E2 & 33E3 (belonging to the 7.e-k stock)	Landings	Discards
1996	142	148	2476	25	-	2359	27	126	5303	-339		4964**	
1997	183	268	1492	29	-	2370	19	80	4441	1418		5859**	
1998	316	269	1739	20	-	2517	34	67	4962	356		5318**	
1999	150	n/a	966	5	-	1665	9	80	2875	1909		4784**	
2000	60	53	455	1	-	799	11	38	1417	-143		1274^	
2001	283	74	751	-	-	885	1	32	2026	226		2252^	
2002	318	116	1111	-	-	1134	7	29	2715	-20		2695^	
2003	183	151	594	-	14	505	7	23	1477	-192		1285^	
2004	104	29	380	-	-	646	5	15	1179	-107	108	1072^	
2005	115	35	220	-	-	594	n/a	3	967	-57	54	910^	
2006	60	18**	275	-	-	5892	n/a	6	948	-108	103	840^	
2007	67	17**	608	-	-	423	n/a	2	1117	-415	527	702^	148
2008	26	3	618**	-	-	5432	22	12	1224	-563	558	661^	62
2009	19	12	323**	-	-	3872	12	12	754	-286	193	468^	60
2010	21	1	289	-	-	282	1	-	594	-130	143	464^	377
2011	36	3	275	-	-	169	1	-	485	-117	147	368	43
2012	23	1	193	-	-	109	< 1	-	326	-128	85	198	658
2013	13	< 1	160	-	-	107	< 1	-	281	-75	76	206	118
2014	9	< 1	148	-	-	79	< 1	-	236	-33	24	213	149
2015*	12	< 1	137	-	-	50	< 1	-	199	-38	39	161	224
2016*	3	< 1	84	-	-	35	< 1	-	122	-40	40	82	60

\* Preliminary.

\*\* Includes sample-based estimates of landings into ports.

\*\*\* Landings in the south of Division 7.a (33E2 and 33E3) are not included in the assessment and are considered to be part of the stock (cod.27.7e-k).

^ As reported to the working group.

## Summary of the assessment

**Table 10** Cod in Division 7.a. Assessment summary. Weights are in tonnes. High and low refer to 1 x standard deviation.

Year	Recruitment age 0 Thousands	High	Low	SSB	High	Low	Landings	Discards	F ages (2-4)	High	Low
1968	49 674	53 367	45 981	15 734	16 573	14 895	8541	1285	0.60	0.63	0.57
1969	70 867	77 428	64 307	15 283	16 104	14 463	7991	1898	0.79	0.86	0.73
1970	116 580	125 317	107 843	11 726	12 715	10 737	6426	708	0.60	0.65	0.54
1971	41 587	47 156	36 017	12 870	14 001	11 739	9246	363	0.66	0.71	0.60
1972	110 043	118 668	101 417	16 333	17 556	15 110	9234	1546	0.58	0.62	0.54
1973	25 392	29 411	21 373	20 603	22 026	19 179	11 819	1222	0.75	0.80	0.69
1974	87 805	94 877	80 733	17 296	18 520	16 072	10 251	1749	0.67	0.71	0.62
1975	27 897	31 662	24 131	17 762	18 959	16 565	9863	857	0.75	0.80	0.69
1976	42 579	47 121	38 037	13 797	14 798	12 797	10 247	381	0.76	0.81	0.71
1977	45 999	51 035	40 962	13 253	14 213	12 293	8054	201	0.78	0.84	0.71
1978	95 706	103 576	87 835	9765	10 706	8825	5662	0	0.56	0.62	0.51
1979	113 803	122 768	104 838	10 631	11 695	9567	7548	0	0.65	0.71	0.59
1980	64 895	71 612	58 178	12 488	13 601	11 374	10 599	0	0.67	0.72	0.63
1981	28 807	32 760	24 855	17 601	18 788	16 413	13 958	0	0.75	0.80	0.71
1982	41 803	46 404	37 202	20 102	21 313	18 890	13 381	313	0.84	0.89	0.79
1983	65 429	71 419	59 438	16 519	17 713	15 325	10 015	372	0.77	0.84	0.71
1984	62 617	68 874	56 359	11 630	12 709	10 550	8383	2	0.74	0.81	0.68
1985	49 834	55 683	43 984	11 898	12 982	10 814	10 483	61	0.81	0.88	0.75
1986	140 519	151 063	129 975	12 202	13 315	11 090	9852	154	0.81	0.88	0.74
1987	67 127	73 795	60 459	13 021	14 339	11 702	12 894	128	0.94	1.02	0.86
1988	30 463	34 453	26 472	12 448	13 500	11 395	14 168	109	0.98	1.04	0.91
1989	35 902	40 422	31 382	14 034	14 998	13 070	12 751	202	1.10	1.17	1.02
1990	39 450	44 470	34 431	9854	10 722	8986	7379	159	0.89	0.97	0.81
1991	66 321	71 992	60 650	7103	7920	6285	7095	163	1.11	1.22	1.00
1992	15 410	17 442	13 378	6037	6821	5253	7735	98	1.17	1.27	1.07
1993	42 992	46 550	39 433	5745	6286	5204	7555	155	1.26	1.35	1.17
1994	34 654	37 680	31 627	4930	5440	4420	5402	142	1.33	1.45	1.20
1995	33 071	35 962	30 179	3528	3938	3118	4587	166	0.94	1.02	0.86
1996	48 934	52 555	45 312	4418	4864	3972	4964	140	1.01	1.09	0.93
1997	14947	16 584	13 309	5236	5718	4754	5859	120	1.06	1.14	0.99
1998	3773	4393	3154	5796	6179	5414	5318	29	0.96	1.02	0.91
1999	28 403	30 265	26 541	5240	5574	4906	4784	159	1.80	1.98	1.62
2000	11 677	12 798	10 556	1520	1795	1245	1274	699	1.45	1.63	1.27
2001	14 503	15 724	13 281	2655	2883	2428	2252	64	1.00	1.09	0.90
2002	5018	5578	4457	3046	3312	2780	2695	46	1.41	1.55	1.27
2003	8672	9351	7993	2228	2464	1992	1285	215	1.02	1.12	0.91
2004	4910	5351	4470	2021	2241	1800	1072	254	0.94	1.04	0.84
2005	5377	5784	4970	1921	2122	1719	910	204	0.95	1.04	0.86
2006	6145	6564	5726	1631	1802	1460	840	185	1.13	1.23	1.03
2007	1261	1420	1102	1473	1667	1280	702	145	1.07	1.17	0.98
2008	4515	4888	4142	1362	1536	1188	662	61	1.12	1.22	1.01
2009	8500	9305	7695	863	992	734	466	88	1.10	1.22	0.97
2010	4586	5193	3979	1081	1251	910	464	386	1.03	1.17	0.90
2011	5452	6351	4552	1423	1637	1209	365	48	0.35	0.41	0.29
2012	8777	10 407	7148	1971	2281	1660	198	678	0.60	0.72	0.47
2013	13 951	16 689	11 214	2309	2832	1786	206	152	0.18	0.22	0.14
2014	5943	7258	4629	3929	4823	3036	213	184	0.12	0.14	0.09
2015	6750	8381	5120	5759	7045	4473	161	147	0.07	0.08	0.05
2016	49	75	23	7173	8770	5576	82	60	0.03	0.03	0.02
2017	5513			11 002					0.07		

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