

cod.27.7a

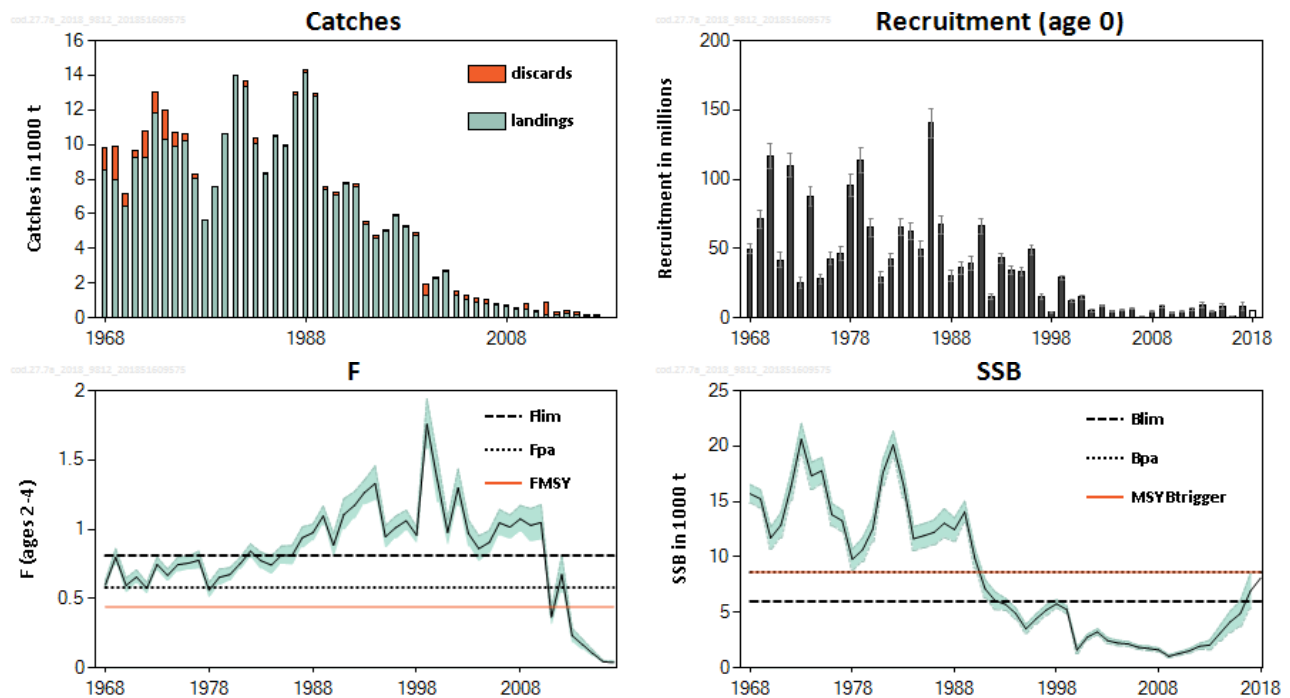
## Cod (*Gadus morhua*) in Division 7.a (Irish Sea)

### ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2019 should be no more than 807 tonnes.

### Stock development over time

The spawning-stock biomass (SSB) is increasing but remains below MSY  $B_{trigger}$ . Recruitment remains low and was estimated at its lowest in 2016. Fishing pressure (F) has declined from very high levels and has been below  $F_{MSY}$  since 2013, and is very low in 2016 and 2017.



**Figure 1** Cod in Division 7.a. Summary of the stock assessment (weights in thousand tonnes). The assumed 2018 recruitment value is not shaded. Shaded areas in F and SSB plots and error bars in the recruitment plot represent  $1 \times$  standard deviation. Uncertainty boundaries are not available for 2018.

### Stock and exploitation status

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

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

		Fishing pressure			Stock size		
		2015	2016	2017	2016	2017	2018
Maximum sustainable yield	$F_{MSY}$	✓	✓	✓	Below	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	$B_{MGT}$	— Not applicable

## Catch scenarios

**Table 2** Cod in Division 7.a. Assumptions made for the interim year and in the forecast.

Variable	Value	Notes
F <sub>ages 2-4</sub> (2018)	0.25	F corresponding to TAC constraint
SSB (2019)	7938 tonnes	Fishing at F = 0.25
R <sub>age 0</sub> (2018–2019)	5107 thousands	Geometric mean (2006–2015)
Catch (2018)	746 tonnes	Landings + discards
Landings (2018)	695 tonnes	TAC 2018
Discards (2018)	51 tonnes	Average discard rate of 0- to 1-year-olds, estimates for 2015–2017

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

Basis	Total catch (2019)	Wanted* catch (2019)	Unwanted* catch (2019)	F <sub>total</sub> (2019)	F <sub>wanted</sub> (2019)	F <sub>unwanted</sub> <sup>^</sup> (2019)	SSB (2020)	% SSB change **	% TAC change ***	% Advice change ^^
ICES advice basis										
MSY approach: F <sub>MSY</sub> × SSB (2019)/MSY B <sub>trigger</sub>	807	753	54	0.41	0.41	0	7671	-3.4	8.4	-25
Other scenarios										
F = 0	0	0	0	0	0	0	8841	11	-100	-100
F <sub>MSY</sub>	866	808	58	0.44	0.44	0	7589	-4.4	16.3	-19
F = F <sub>MSY upper</sub> × SSB (2019)/MSY B <sub>trigger</sub>	807	753	54	0.41	0.41	0	7671	-3.4	8	-25
F = F <sub>MSY lower</sub> <sup>†</sup> × SSB (2019)/MSY B <sub>trigger</sub>	677	633	44	0.33	0.33	0	7857	-1.0	-9	-37
TAC <sub>2018</sub>	744	695	49	0.37	0.37	0	7762	-2.2	0	-31
TAC <sub>2018</sub> -15%	632	591	41	0.31	0.31	0	7922	-0.199	-15	-41
TAC <sub>2018</sub> +15%	857	799	59	0.43	0.43	0	7601	-4.2	+15	-20
F <sub>sq</sub> (F = F <sub>2018</sub> )	534	499	34	0.25	0.25	0	8063	-5.4	-28	-50
F <sub>pa</sub>	1095	1019	76	0.58	0.58	0	7265	-8.5	47	2
F <sub>lim</sub>	1415	1311	104	0.81	0.81	0	6824	-14	89	32
SSB <sub>2020</sub> = B <sub>lim</sub>	2034	1867	167	1.38	1.38	0	6000	-24	19	90
SSB <sub>2020</sub> = B <sub>pa</sub> = MSY B <sub>trigger</sub>	153	144	9	0.068	0.068	0	8616	8.5	-79	-86

\* “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 discard rate of 0- to 1-year-olds, estimated for 2015–2017, assuming that unwanted catch will only be fish under the minimum conservation reference size (MCRS).

\*\* SSB 2020 relative to SSB 2019.

\*\*\* Wanted catch in 2019 relative to TAC in 2018 (695 tonnes).

<sup>^</sup> In the forecast it is assumed that unwanted catch will only occur at ages 0–1, which is outside the F<sub>bar</sub> age range.

<sup>^^</sup> Advice value (total catch) for 2019 relative to the advice value for 2018 (1073 tonnes).

As a result of the current assessment, and of forecast assumptions, the SSB is forecast to be below MSY B<sub>trigger</sub> in 2019 and, following the ICES advice rule, a reduction in F below F<sub>MSY</sub> was applied. Therefore, the catch advice is reduced when compared to 2018.

## Basis of the advice

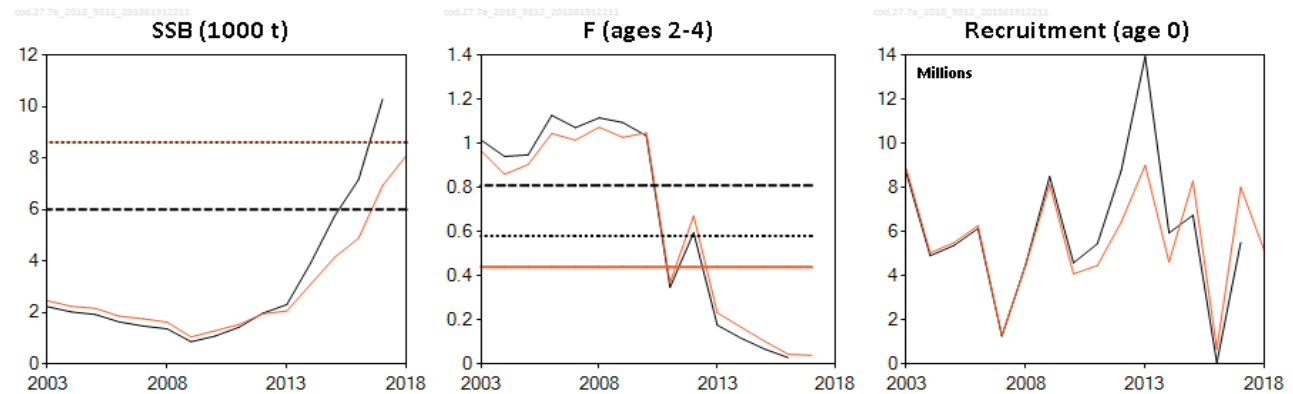
**Table 4** Cod in Division 7.a. The basis of the advice.

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).

<sup>†</sup> Version 2: Changed upper to lower

### Quality of the assessment

The current assessment shows a significant downward revision of SSB and a slight upward revision in F. The 2013 cohort, predicted to form a major part of the SSB in 2017, was observed in the FSP survey in 2017 but was not similarly present in catches. The steep age decline in cod remains unexplained under conditions with very low fishing pressure.



**Figure 2** Cod in Division 7.a. Historical assessment results. The 2017 benchmark led to a rescaling of the assessment; therefore, only the assessments from 2017 onwards are shown.

### 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 (western English Channel and southern Celtic Seas). Thus, the assessment and the advice exclude these two southern rectangles for the present stock but include them in the assessment and advice for cod in divisions 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 contribution of the 2013 cohort, which accounted for approximately 60% of the total SSB in 2016, has been substantially reduced in the new assessment. The following year classes have been weaker, with 2016 year class being the lowest historically recorded. SSB is therefore expected to decline in the short term.

Discards in recent years have been largely from the *Nephrops* fishery, with discards characteristically above MCRS and having a similar age composition to landings. It is uncertain how the fishery will respond to the increase in TAC permitted in 2018. The forecast assumes that in 2018 discards will only be below MCRS, given the increase in the TAC.

## 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 $B_{trigger}$	8616 tonnes	$B_{pa}$	ICES (2018a)
	$F_{MSY}$	0.44	$F_{p,05}$ EqSim simulation	ICES (2018a)
Precautionary approach	$B_{lim}$	6000 tonnes	SSB where recruitment is reduced (visual inspection).	ICES (2018a)
	$B_{pa}$	8616 tonnes	$B_{lim}$ combined with the assessment error; $B_{lim} \times \exp(1.645 \times \sigma)$ ; $\sigma = 0.22$	ICES (2018a)
	$F_{lim}$	0.81	F with 50% probability of $SSB < B_{lim}$	ICES (2018a)
	$F_{pa}$	0.58	$F_{lim}$ combined with the assessment error; $F_{lim} \times \exp(-1.645 \times \sigma)$ ; $\sigma = 0.2$	ICES (2018a)
Management plan*	MAP MSY $B_{trigger}$	8616 tonnes	MSY $B_{trigger}$	
	MAP $B_{lim}$	6000 tonnes	$B_{lim}$	
	MAP $F_{MSY}$	0.44	$F_{MSY}$	
	MAP range $F_{lower}$	0.36	Consistent with ranges provided by ICES (2018a), resulting in no more than 5% reduction in long-term yield compared with MSY.	
	MAP range $F_{upper}$	0.44	Consistent with ranges provided by ICES (2018a), 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 Division 7.a. Basis of assessment and advice.

ICES stock data category	1 ( <a href="#">ICES, 2016</a> ).
Assessment type	ASAP (Age-Structured Assessment Programme; NOAA toolbox) that uses catches in the model and in the forecast.
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; Lorenzen, 1996).
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). Reference points were redefined in 2018 (ICES, 2018a).
Working group	Working Group for the Celtic Seas Ecoregion ( <a href="#">WGCSE</a> )

## Information from stakeholders

No additional information is available for this stock.

## 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	Catch corresponding to advice	Agreed TAC	Official landings	ICES landings <sup>^</sup>	ICES discards
1987	No increase in F; interaction with <i>Nephrops</i>	10300	15000	13200	12900	
1988	No increase in F; interaction with <i>Nephrops</i>	10100	15000	15800	14200	
1989	No increase in F	13400	15000	11300	12800	
1990	F at $F_{med}$ ; TAC	15300	15300	9900	7400	
1991	Stop SSB decline; TAC	6000	10000	7000	7100**	
1992	20% of F(90) ~ 10 000 t	10000	10000	7400	7700**	
1993	$F_{med}$ ~ 10 200 t	10200	11000	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 $F_{pa}$	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	103*	84	59
2018	MSY approach	≤ 1073	695			
2019	MSY approach	≤ 807				

\* Preliminary.

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

<sup>^</sup> Excludes landings reported from rectangles 33E2 and 33E3 since 2004.

### History of the catch and landings

**Table 8** Cod in Division 7.a. Catch distribution by fleet in 2017 as estimated by ICES.

Catch	Estimated landings					
	otter trawls		Scottish seines	mid-water trawl	beam trawls	other gear types
143 tonnes	<i>Nephrops</i> directed 47%	demersal fish directed 23%	<1%	10%	12%	7%
	84 tonnes					
	Estimated discards					
	otter trawls		Scottish seines	mid-water trawl	beam trawls	other gear types
	99% <i>Nephrops</i> directed	0% demersal fish directed	0%	0%	0%	1%
	59 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 in rectangles 33E2 & 33E3 ***	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
2017*	5	< 1	57	-	-	41	< 1	< 1	103	-19	19	84	59

\* Preliminary.

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

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

**Summary of the assessment**

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

Year	Recruitment age 0	High	Low	SSB	High	Low	Landings	Discards	F ages 2–4	High	Low
	thousands			tonnes			tonnes				
1968	49789	53488	46089	15691	16526	14856	8541	1285	0.60	0.63	0.57
1969	70917	77482	64352	15242	16059	14426	7991	1898	0.80	0.86	0.73
1970	116627	125367	107886	11707	12694	10721	6426	708	0.60	0.65	0.54
1971	41582	47151	36012	12867	13997	11737	9246	363	0.65	0.71	0.60
1972	110048	118675	101421	16340	17564	15117	9234	1546	0.58	0.62	0.54
1973	25382	29401	21363	20616	22040	19191	11819	1222	0.75	0.80	0.69
1974	87804	94878	80731	17311	18536	16087	10251	1749	0.67	0.71	0.62
1975	27894	31660	24128	17777	18975	16579	9863	857	0.74	0.80	0.69
1976	42583	47126	38039	13812	14814	12810	10247	381	0.75	0.80	0.70
1977	45993	51031	40956	13268	14229	12307	8054	201	0.78	0.84	0.71
1978	95695	103567	87823	9780	10722	8839	5662	0	0.56	0.61	0.51
1979	113785	122751	104819	10647	11712	9582	7548	0	0.65	0.71	0.59
1980	64883	71601	58166	12503	13618	11389	10599	0	0.67	0.72	0.62
1981	28801	32753	24849	17616	18805	16428	13958	0	0.75	0.80	0.71
1982	41797	46398	37195	20118	21331	18905	13381	313	0.84	0.89	0.79
1983	65423	71415	59431	16537	17733	15342	10015	372	0.77	0.83	0.71
1984	62610	68868	56351	11647	12728	10566	8383	2	0.74	0.81	0.68
1985	49817	55667	43967	11915	13001	10829	10483	61	0.81	0.88	0.75
1986	140508	151056	129960	12220	13333	11106	9852	154	0.81	0.88	0.74
1987	67138	73809	60467	13040	14360	11719	12894	128	0.94	1.02	0.86
1988	30476	34469	26482	12466	13520	11411	14168	109	0.97	1.04	0.91
1989	35851	40367	31335	14053	15019	13087	12751	202	1.09	1.17	1.02
1990	39225	44226	34223	9879	10749	9009	7379	159	0.89	0.97	0.80
1991	66160	71818	60502	7128	7948	6308	7095	163	1.11	1.22	0.99
1992	15559	17597	13521	6047	6834	5261	7735	98	1.17	1.27	1.07
1993	42872	46417	39327	5730	6270	5189	7555	155	1.27	1.36	1.18
1994	34669	37691	31648	4908	5416	4400	5402	142	1.33	1.46	1.20
1995	33209	36102	30316	3515	3924	3107	4587	166	0.95	1.03	0.87
1996	49019	52643	45394	4417	4862	3972	4964	140	1.01	1.09	0.93
1997	15143	16789	13497	5223	5705	4741	5859	120	1.06	1.14	0.98
1998	3914	4548	3279	5766	6154	5378	5318	29	0.96	1.01	0.90
1999	28820	30664	26976	5256	5605	4908	4784	159	1.76	1.94	1.57
2000	11841	12970	10711	1593	1894	1291	1274	699	1.35	1.52	1.19
2001	14783	16003	13563	2766	3023	2508	2252	64	0.98	1.07	0.89
2002	5194	5766	4622	3244	3540	2947	2695	46	1.30	1.43	1.16
2003	8859	9533	8185	2457	2723	2190	1285	215	0.97	1.07	0.87
2004	5040	5484	4596	2240	2481	1998	1072	254	0.86	0.95	0.77
2005	5506	5912	5100	2157	2376	1938	910	204	0.90	0.99	0.82
2006	6282	6697	5868	1855	2039	1671	840	185	1.05	1.14	0.95
2007	1302	1464	1139	1756	1962	1550	702	145	1.02	1.10	0.93
2008	4475	4833	4116	1621	1802	1440	662	61	1.07	1.17	0.98
2009	8134	8820	7449	1046	1179	913	466	88	1.03	1.15	0.91
2010	4085	4583	3586	1289	1459	1118	464	386	1.05	1.18	0.92
2011	4466	5151	3781	1535	1733	1337	365	48	0.37	0.42	0.31
2012	6435	7580	5291	1946	2216	1676	198	678	0.67	0.81	0.54
2013	9013	10734	7291	2059	2491	1627	206	152	0.23	0.29	0.178
2014	4621	5596	3646	3101	3800	2402	213	184	0.167	0.21	0.128
2015	8298	10097	6499	4146	5103	3190	161	147	0.103	0.127	0.079
2016	670	880	460	4892	6046	3737	82	60	0.044	0.053	0.034
2017	8018	10910	5126	6939	8518	5359	84	59	0.039	0.048	0.031
2018	5107*			8110							

\*Geometric mean 2006–2015.

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