

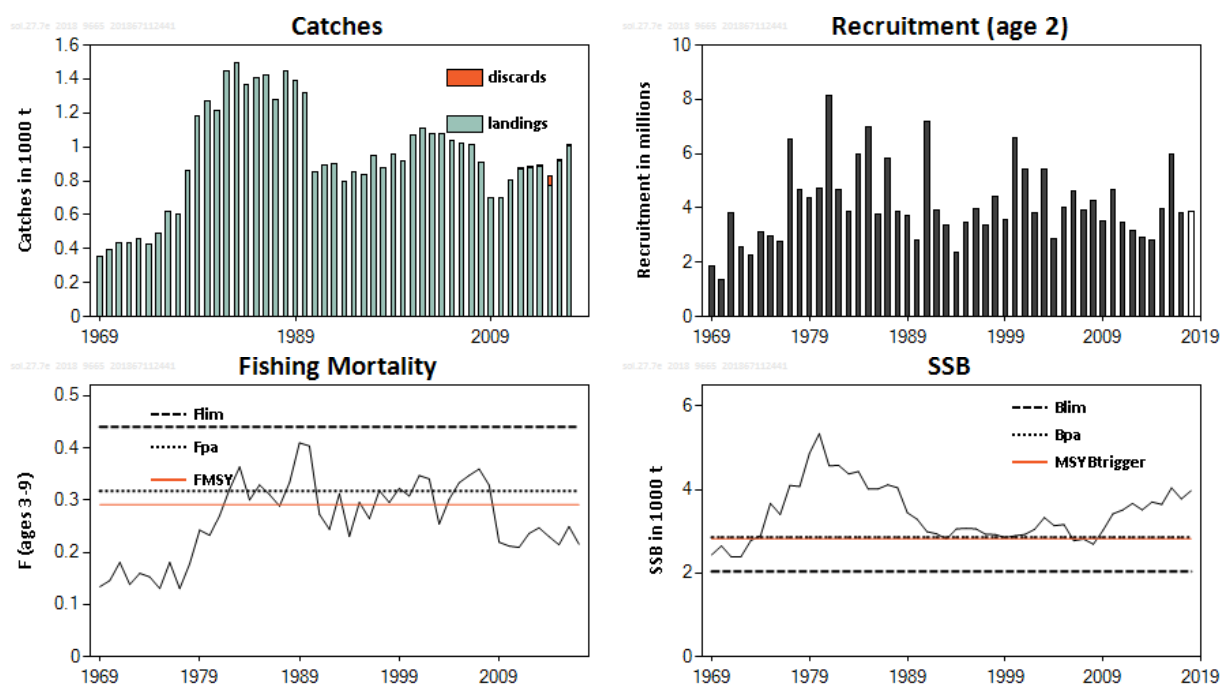
## Sole (*Solea solea*) in Division 7.e (western English Channel)

### ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2019 should be no more than 1272 tonnes.

### Stock development over time

Fishing mortality (F) has been below  $F_{MSY}$  since 2009. Spawning–stock biomass (SSB) has been above MSY  $B_{trigger}$  since 2009. Recruitment (R) has been variable without an overall trend and is currently around the long-term geometric mean.



**Figure 1** Sole in Division 7.e. Summary of the stock assessment. ICES estimated catches, recruitment, fishing mortality, and spawning–stock biomass. Assumed recruitment values are not shaded. Discard estimates are only available from 2012 onwards.

### 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 above MSY  $B_{trigger}$ ,  $B_{pa}$ , and  $B_{lim}$ .

**Table 1** Sole in Division 7.e. 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 $B_{trigger}$	✓	✓	✓	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 scenarios

**Table 2** Sole in Division 7.e. Assumptions made for the interim year and in the forecast.

Variable	Value	Notes
F ages 3–9 (2018)	0.22	$F_{sq} = F_{Average}(2015–2017)$ rescaled to $F_{2017}$
SSB (2019)	4 105 tonnes	Fishing at $F_{sq}$
R age 2 (2018–2019)	3 881 thousands	GM (1969–2017)
Total catch (2018)	936 tonnes	Wanted catches plus unwanted catches
Landings (2018)	910 tonnes	Fishing at $F_{sq}$
Discards (2018)	25 tonnes	Average discard rate (2015–2017, 2.7%)

**Table 3** Sole in Division 7.e. 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: $F_{MSY}$	1272	1237	35	0.29	3882	-5.4	5.8	2.7
Other scenarios								
$F = F_{MSY lower}$	748	728	20	0.160	4379	6.7	-38	-40
$F = F_{MSY upper}$	1456	1416	40	0.34	3709	-9.6	21	18
$F = 0$	0	0	0	0	5092	24	-100	-100
$F_{pa}$	1383	1346	38	0.32	3777	-8.0	15	12
$F_{lim}$	1797	1748	49	0.44	3387	-18	50	45
$SSB(2020) = B_{lim}$	3291	3202	89	1.05	2000	-51	174	166
$SSB(2020) = B_{pa} = MSY B_{trigger}$	2317	2254	63	0.61	2900	-29	93	87
$F = F_{2018}$	980	953	27	0.22	4159	1.32	-18	-21
Management plan: $F = 0.27$ with 15% TAC constraint	1196	1163	32	0.27	3955	-3.7	-0.50	-3.5

\* Total catch derived from the wanted catch and the unwanted catches ratio.

\*\* “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 estimates for 2015–2017.

\*\*\* SSB 2020 relative to SSB 2019.

^ Total catch in 2019 relative to TAC in 2018 (1202 tonnes).

^^ Advice value for 2019 relative to the advice value for 2018 (1239 tonnes).

The advice is similar to last year’s advice.

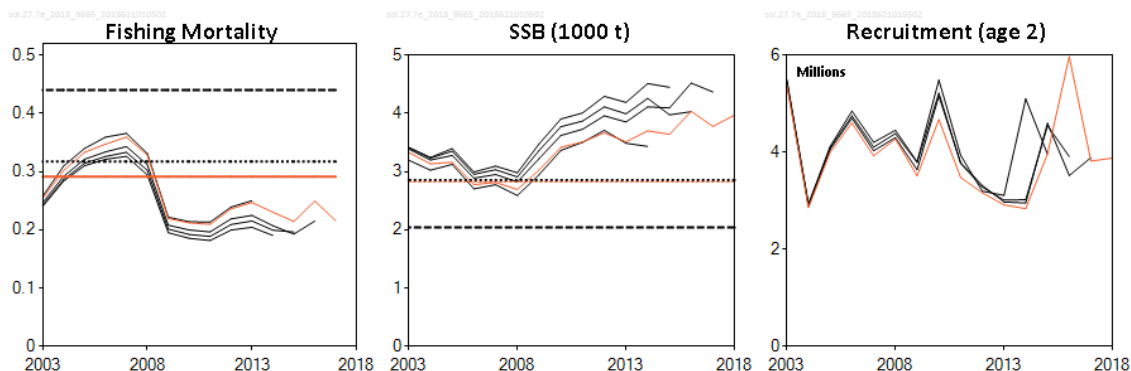
## Basis of the advice

**Table 4** Sole in Division 7.e. The basis of the advice.

Advice basis	MSY approach
Management plan	A management plan has been agreed by the EU in 2007 (EU, 2007). In its current phase, it aims at keeping $F$ at the target value of 0.27 with a 15% TAC constraint. This plan has not been evaluated by ICES. The EU has proposed a multiannual management plan for the Western Waters, which is not yet finalized (EU, 2018a).

### Quality of the assessment

The assessment is relatively uncertain since the historical perception of SSB and F changes between years. Compared to last year's assessment the SSB is revised downward and F revised upward. The 2014 year class is now estimated 70% higher than estimated last year.



**Figure 2** Sole in Division 7.e. Historical assessment results (final-year recruitment estimates included). The recruitment age in the assessment has changed from one to two, following the inter-benchmark in 2015 (ICES, 2015) and earlier recruitment estimates are not shown.

### Issues relevant for the advice

The advice takes account of the available discard estimates to give catch advice for the stock.

### Reference points

**Table 5** Sole in Division 7.e. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	2900 tonnes	The 5th percentile of the distribution of SSB when fishing at $F_{MSY}$ (0.29) with no error.	ICES (2016a)
	$F_{MSY}$	0.29	Median point estimate of EqSim simulations.	ICES (2016a)
Precautionary approach	$B_{lim}$	2000 tonnes	Rounded $B_{pa}/1.4$	ICES (2016a)
	$B_{pa}$	2900 tonnes	Rounded $B_{loss}$ (1999 year class). Lowest SSB with high recruitment.	ICES (2016a)
	$F_{lim}$	0.44	Segmented regression simulation of stock–recruitment, with $B_{lim}$ as the breakpoint and no error.	ICES (2016a)
	$F_{pa}$	0.32	$F_{lim} \times \exp(-1.645 \times \sigma)$ ; $\sigma = 0.2$ .	ICES (2016a)
Management plan	$F_{MGT}$	0.27		<a href="#">EU (2007)</a>
	MAP MSY $B_{trigger}$	2900 tonnes	MSY $B_{trigger}$	
	MAP $B_{pa}$	2900 tonnes	$B_{pa}$	
	MAP $B_{lim}$	2000 tonnes	$B_{lim}$	
	MAP $F_{MSY}$	0.29	$F_{MSY}$	
	MAP range $F_{lower}$	0.16	Minimum F which produces at least 95% of maximum yield.	ICES (2016a)
	MAP range $F_{upper}$	0.34	Maximum F which produces at least 95% of maximum yield.	ICES (2016a)

## Basis of the assessment

**Table 6** Sole in Division 7.e. 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 discards are then included to calculate a catch forecast (ICES, 2018).
Input data	Commercial catch-at-age data; two survey indices (UK-FSP and Q1SWBeam) and two commercial tuning fleets (UK-CBT-late and UK-COT); natural mortality is assumed constant over ages and years at 0.1; fixed maturity ogive from divisions 7.f and 7.g.
Discards and bycatch	Not included in the assessment, but used to provide catch advice.
Indicators	None
Other information	Last inter-benchmark in 2015 (IBPWCFat2; ICES, 2015)
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** Sole in Division 7.e. History of ICES advice, agreed TAC, official landings, and ICES estimates for landings and discards. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice	Landings corresponding to advice	Agreed TAC	Official landings	ICES landings	ICES discards
1987	No increase in F		1150	1150	1110	1280	
1988	No decrease in SSB; TAC		1300	1300	950	1444	
1989	No decrease in SSB; TAC		1000	1000	800	1390	
1990	SSB = 3000 t; TAC		900	900	750	1315	
1991	TAC		540	800	840	852	
1992	70% of F <sub>1990</sub>		770	800	770	895	
1993	35% reduction in F		700	900	790	904	
1994	No increase in F		1000	1000	840	800	
1995	No increase in F		860	950	880	856	
1996	F <sub>1996</sub> < F <sub>1994</sub>		680	700	740	833	
1997	No increase in F		690	750	860	949	
1998	No increase in F		670	670	770	880	
1999	Reduce F below F <sub>pa</sub>		670	700	660	957	
2000	Reduce F below F <sub>pa</sub>		< 640	660	660	914	
2001	Reduce F below F <sub>pa</sub>		< 580	600	650	1069	
2002	Reduce F below F <sub>pa</sub>		< 450	525	540	1106	
2003	Rebuilding plan or F = 0		-	394	620	1078	
2004	F = 0 or recovery plan 1		0	300	490	1075	
2005	80% reduction in F or recovery plan		< 230	865	960	1039	
2006	80% reduction in F or recovery plan		< 240	940	961	1022	
2007	68% reduction in F or recovery plan		< 350	900	954	1015	
2008	75% reduction in F		< 260	765	812	908	
2009	70% reduction in F		< 320	650	784	701	
2010	Reduce fishing effort and catches		-	618	761	698	
2011	MSY framework		< 660	710	876	801	
2012	MSY framework		< 740	777	870	872	2
2013	MSY framework		< 960	894	889	883	1
2014	MSY approach		< 832	832	886	885	10
2015	MSY approach		< 851	851	777	774	54

Year	ICES advice	Catch corresponding to advice	Landings corresponding to advice	Agreed TAC	Official landings	ICES landings	ICES discards
2016	MSY approach		≤ 1226	979	914*	913	10
2017	MSY approach	≤ 1198		1178	998*	1007	4
2018	MSY approach	≤ 1239		1202			
2019	MSY approach	≤ 1272					

\* Preliminary.

### History of the catch and landings

**Table 8** Sole in Division 7.e. Catch distribution by fleet in 2017 as estimated by ICES.

Catch (2017)	Landings				Discards			
	Beam trawl	Otter trawl	Gillnets	Other gears	Beam trawl	Otter trawl	Gillnets	Other gears
1012 tonnes	66%	18.5%	11.2%	4.2%	0%	100%	0%	0%
	1007 tonnes				4 tonnes			

**Table 9** Sole in Division 7.e. History of commercial catch and landings. All weights are in tonnes.

Year	Landings							Discards*
	Belgium	France	Netherlands	Ireland	UK and Channel Islands	Unallocated*	Total*	
1974		323				104	427	
1975	3	271			217		491	
1976	4	352			260		616	
1977	3	331			272		606	
1978	4	384			453	20	861	
1979	1	515			665		1181	
1980	45	447		13	764		1269	
1981	16	415	1		788	-5	1215	
1982	98	321			1028	-1	1446	
1983	47	405	3		1043		1498	
1984	48	421			901		1370	
1985	58	130			911	310	1409	
1986	62	467			840	50	1419	
1987	48	432			632	168	1280	
1988	67	98			784	495	1444	
1989	69	112	6		613	590	1390	
1990	41	81			636	556	1315	
1991	35	325			477	15	852	
1992	41	267			468	119	895	
1993	59	236			498	111	904	
1994	33	257			546	-38	800	
1995	21	294			565	-24	856	
1996	8	297			428	91	833	
1997	13	348		1	496	91	949	
1998	40	343			389	108	880	
1999	13				396	548	957	
2000	4	241			413	256	914	
2001	19	224			407	419	1069	
2002	33	198			309	566	1106	
2003	1	363		1	255	458	1078	
2004	7	302			185	581	1075	
2005	26	406			527	80	1039	
2006	32	357			572	61	1022	
2007	34	384			536	61	1015	
2008	28	312		0	472	96	908	
2009	17	386			381	-83	701	

Year	Landings							Discards*
	Belgium	France	Netherlands	Ireland	UK and Channel Islands	Unallocated*	Total*	
2010	17	375			370	-64	698	
2011	22	424			431	-76	801	
2012	39	325		0	506	2	872	2
2013	30	319			540	-6	883	1
2014	25	351			509	-1	884	10
2015	42	245		0	490	-3	774	54
2016^	46	245			623	-1	913	10
2017^	56	198		< 1	744	9	1007	4

\* ICES estimate.

^ Preliminary.

### Summary of the assessment

**Table 10** Sole in Division 7.e. Assessment summary. Weights are in tonnes, numbers in thousands.

Year	Recruitment (age 2)	Stock size SSB	Landings	Discards**	Fishing mortality (ages 3–9)
1969	1874	2437	353		0.134
1970	1343	2652	391		0.146
1971	3826	2390	432		0.181
1972	2568	2395	437		0.138
1973	2264	2778	459		0.160
1974	3107	2896	427		0.153
1975	2967	3670	491		0.131
1976	2791	3403	616		0.180
1977	6556	4098	606		0.130
1978	4657	4074	861		0.178
1979	4389	4865	1181		0.24
1980	4702	5338	1269		0.23
1981	8130	4572	1215		0.27
1982	4680	4575	1446		0.32
1983	3866	4374	1498		0.36
1984	5968	4430	1370		0.30
1985	6983	4009	1409		0.33
1986	3766	4014	1419		0.31
1987	5849	4112	1280		0.29
1988	3879	4044	1444		0.33
1989	3736	3443	1390		0.41
1990	2818	3288	1315		0.40
1991	7168	2993	852		0.27
1992	3906	2940	895		0.24
1993	3353	2813	904		0.31
1994	2379	3058	800		0.23
1995	3447	3073	856		0.30
1996	3965	3060	833		0.26
1997	3362	2929	949		0.32
1998	4436	2923	880		0.30
1999	3573	2849	957		0.32
2000	6595	2892	914		0.31
2001	5420	2925	1069		0.35
2002	3826	3048	1106		0.34
2003	5407	3329	1078		0.25
2004	2859	3135	1075		0.30
2005	4002	3162	1039		0.33
2006	4603	2777	1023		0.35
2007	3926	2815	1015		0.36
2008	4274	2693	908		0.33

Year	Recruitment (age 2)	Stock size SSB	Landings	Discards**	Fishing mortality (ages 3–9)
2009	3513	3028	701		0.22
2010	4675	3418	698		0.21
2011	3481	3511	801		0.21
2012	3164	3668	872	2	0.24
2013	2913	3512	883	1	0.25
2014	2837	3703	885	10	0.23
2015	3966	3642	774	54	0.21
2016	5974	4038	913	10	0.25
2017	3819	3776	1007	4	0.22
2018	3881*	3974			

\*Geometric mean (1969–2017).

\*\*Discards are not included in the assessment.

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