

Sole (*Solea solea*) 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 414 tonnes.

Stock development over time

Spawning-stock biomass (SSB) has shown a declining trend since the mid-1980s, being well below B_{lim} since 2004. The SSB increased from 2014 but still remains below B_{lim} in 2018. The fishing mortality (F) has been declining since the late 1980s and is presently well below F_{MSY} and close to zero. The 2011–2014 recruitments have been the lowest in the time-series. However, recruitments in 2015 and 2016 were above recent average (GM 2008–2016).

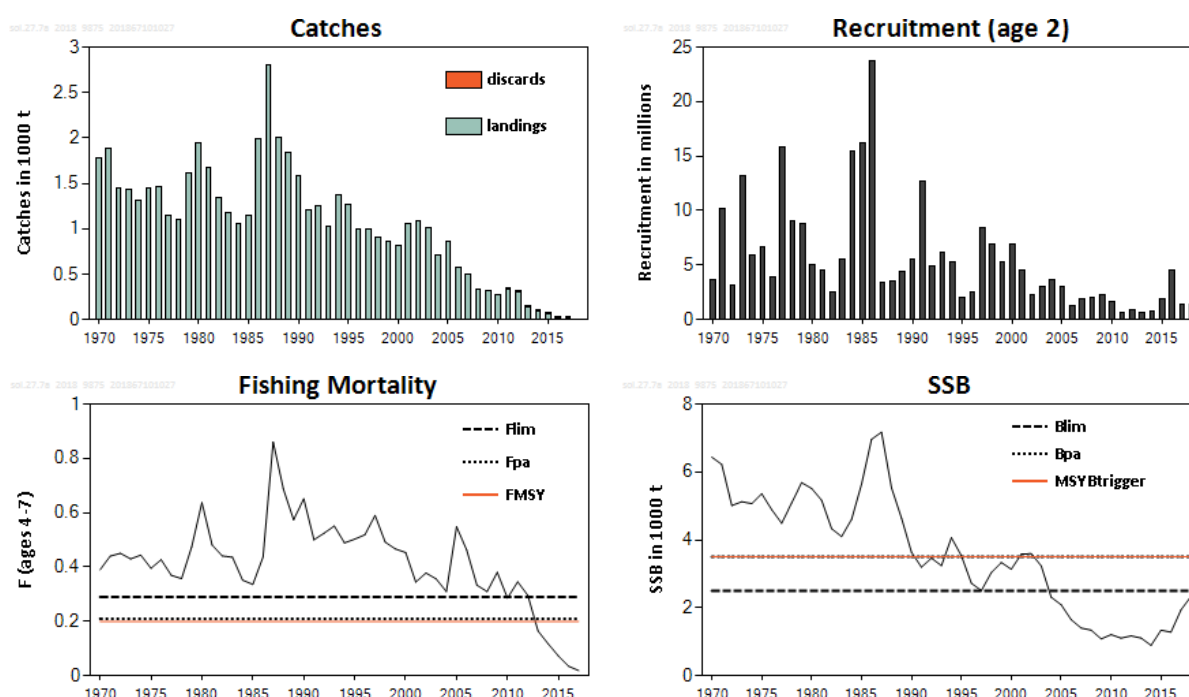


Figure 1 Sole in Division 7.a. Summary of the stock assessment. Predicted recruitment values are not shaded.

Stock and exploitation status

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

Table 1 Sole 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	✗	✗	✗	Below trigger
Precautionary approach	F_{pa}, F_{lim}	✓	✓	✓	Harvested sustainably	✗	✗	✗	Reduced reproductive capacity
Management plan	F_{MGT}	—	—	—	Not applicable	—	—	—	Not applicable

Catch scenarios

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

Variable	Value	Notes
$F_{\text{ages 4-7}}$ (2018)	0.0165	Catch constraint (TAC 2018)
SSB (2019)	2691 tonnes	Fishing at $F = 0.0165$
$R_{\text{age 2}}$ (2018, 2019)	1402 thousands	GM (2008–2016)
Catch (2018)	42 tonnes	TAC 2018 plus a 4.7% discard ratio in weight
Landings (2018)	40 tonnes	TAC 2018
Discards (2018)	2 tonnes	Average ratio of 2015–2017 (4.7%)

Table 3 Sole in Division 7.a. Annual catch scenarios. 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: $F_{\text{MSY}} \times \text{SSB (2019)} / \text{MSY } B_{\text{trigger}}$	414	395	19	0.154	2636	-2.0	936	-
Other scenarios								
$F = F_{\text{MSY lower}} \times \text{SSB (2019)} / \text{MSY } B_{\text{trigger}}$	336	320	16	0.123	2707	0.59	739	-
$F = F_{\text{MSY upper}} \times \text{SSB (2019)} / \text{MSY } B_{\text{trigger}}$	490	467	23	0.185	2567	-4.6	1125	
$F = F_{\text{MSY}}$	527	502	25	0.20	2533	-5.9	1217	
$F = F_{\text{MSY upper}}$	621	592	29	0.24	2447	-9.1	1453	
$F = F_{\text{MSY lower}}$	429	409	20	0.160	2622	-2.6	973	
$F = 0$	0	0	0	0	3014	12.0	-100	-
F_{pa}	551	525	26	0.21	2511	-6.7	1277	-
F_{lim}	733	699	34	0.29	2345	-12.9	1734	-
$\text{SSB (2020)} = B_{\text{lim}}$	563	537	26	0.22	2500	-7.1	1309	-
$\text{SSB (2020)} = B_{\text{pa}} = \text{MSY } B_{\text{trigger}}^{^^^}$	-	-	-	-	-	-	-	-
$F = F_{2018}$	47	45	2	0.0165	2971	10.4	18	-

* Total catches are calculated from wanted catch (fish that would be landed in the absence of the EU landing obligation), based on the average discard rate in 2015–2017 (4.7% in weight).

** The “wanted” and “unwanted catch” are used to describe fish that would be landed and discarded, respectively, in the absence of the EU landing obligation.

*** SSB 2020 relative to SSB 2019.

^ Total catch in 2019 relative to TAC 2018 (40 tonnes).

^^ Advice value 2019 relative to advice value 2018. This is not provided because catch advice in 2017 was zero.

^^^ The $\text{MSY } B_{\text{trigger}}$ option was left blank because $\text{MSY } B_{\text{trigger}}$ cannot be achieved in 2020, even with catch advice that is zero.

The advice for 2017 and 2018 was zero catch as B_{lim} could not be achieved in 2018, even with no fishing occurring. Due to higher recruitment in 2015 and 2016, the SSB is increasing and is predicted to be above B_{lim} and below $\text{MSY } B_{\text{trigger}}$ in 2020. Therefore, a non-zero catch advice is given this year.

Basis of the advice

Table 4 Sole 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).

Quality of the assessment

The assessment has shown consistency over the recent years in estimating SSB, fishing mortality, and recruitment. Discards are currently not included in the assessment, but given the low discard rates of sole (in the order of 5% in 2015–2017) it is unlikely that the inclusion of discards would change the perception of the stock.



Figure 2 Sole in Division 7.a. Historical assessment results (final-year recruitment estimates included).

Issues relevant for the advice

In recent years the TAC has been reduced significantly. A TAC constraint was used for the intermediate year (2018) in the forecast to reflect the restrictive management for this stock. Advice has previously been provided on a biennial basis. The stock is slowly recovering (SSB in 2018 is just below B_{lim}) and this is the first non-zero advice since 2012. The stock is projected to remain close to B_{lim} in 2019 and 2020. Therefore, advice is provided for one year only.

Reference points

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

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	3500 t	B_{pa}	ICES (2016a)
	F_{MSY}	0.20	Stochastic simulations with a segmented regression stock–recruitment relationship.	ICES (2016a)
Precautionary approach	B_{lim}	2500 t	Lowest value with above-average recruitment	ICES (2016b)
	B_{pa}	3500 t	$B_{pa} \sim B_{lim} \times 1.4$.	ICES (2016b)
	F_{lim}	0.29	Based on simulated recruitment to give median biomass = B_{lim}	ICES (2016b)
	F_{pa}	0.21	$F_{lim} \times 1.4$	ICES (2016b)
Management plan*	MAP			
	MSY $B_{trigger}$	3500 t	MSY $B_{trigger}$	
	MAP B_{lim}	2500 t	B_{lim}	
	MAP F_{MSY}	0.20	F_{MSY}	
	MAP range F_{lower}	0.16	Minimum F which produces at least 95% of maximum yield	ICES (2016a)
	MAP range F_{upper}	0.24	Maximum F which produces at least 95% of maximum yield	ICES (2016a)

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

Basis of the assessment

Table 6 Sole in Division 7.a. The basis of the assessment.

ICES stock data category	1 (ICES, 2016c)
Assessment type	Age-based analytical assessment (XSA) that uses landings in the model. Discards are included afterwards in the forecast (ICES, 2018).
Input data	International landings, age and length frequencies from catch sampling; one survey index (UK(E&W)-BTS-Q3); fixed maturity data from UK survey information; natural mortality is assumed to be constant.
Discards and bycatch	Not included in the assessment, but used to provide catch advice.
Indicators	None
Other information	This stock was benchmarked in 2011 (ICES, 2011)
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.a. History of ICES advice, the agreed TAC, official and ICES estimates of landings, and ICES estimates of discards. Weights are in tonnes.

Year	ICES advice	Landings corresponding to advice	Catch corresponding to advice	Agreed TAC	Official landings	ICES estimated discards	ICES estimated landings*
1987	No increase in F	1900		2100	2041	-	2808
1988	80% of F(86); TAC	1600		1750	1885	-	1999
1989	80% of F(87); TAC	< 1480		1480	1823	-	1833
1990	Interim advice	1050**		1500	1576	-	1583
1991	90% of F(89); TAC	1300		1500	1223	-	1212
1992	No long-term gains in increased F	1200***		1350	1234	-	1259
1993	F = F(91) ~ 920 t	920		1000	971	-	1023
1994	No long-term gains in increased F	1510***		1500	1367	-	1374
1995	20% reduction in F	800		1300	1300	-	1266
1996	20% reduction in F	800		1000	1023	-	1002
1997	20% reduction in F	800		1000	1027	-	1003
1998	20% reduction in F	850		900	895	-	911
1999	Reduce F below F_{pa}	830		900	810	-	863
2000	Reduce F below F_{pa}	< 1080		1080	833	-	818
2001	Reduce F below F_{pa}	< 930		1100	1012	-	1053
2002	Keep F below F_{pa}	< 1100		1100	1085	-	1090
2003	Keep F below F_{pa}	< 1010		1010	1014	-	1014
2004	Maintain SSB above B_{pa}	< 790		800	712	-	709
2005	$F < F_{pa}$	< 1000		960	854	-	855
2006	Recent catch levels (2002–2004)	< 930		960	576	-	569
2007	Maintain SSB above B_{pa}	0		820	491	-	492
2008	Zero catch	0		669	320	-	332
2009	Zero catch and recovery plan	0		502	325	-	325
2010	Zero catch and recovery plan	0		402	277	-	277
2011	See scenarios	-		390	330	14	330
2012	MSY transition	< 200		300	296	22	298
2013	No directed fisheries, bycatch and discards should be minimized	0		140	148	11	148

Year	ICES advice	Landings corresponding to advice	Catch corresponding to advice	Agreed TAC	Official landings	ICES estimated discards	ICES estimated landings*
2014	No directed fisheries, bycatch and discards should be minimized	0		95	96	7	99
2015	No directed fisheries, bycatch and discards should be minimized	0		90	76	7	76
2016	MSY approach (minimize all catches)	0		40	35^	2	35
2017	MSY approach		0	40	32^	2	34
2018	MSY approach		0	40			
2019	MSY approach		≤ 414				

* Not including misreporting.

** Revised to 1500 tonnes in 1990.

*** Catch at *status quo* F.

^ Preliminary.

History of the catch and landings

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

Total catch (2017)	Landings			Discards	
36 t	Beam trawlers	Otter trawlers	Other gears	Beam trawlers	Otter trawlers
	59%	35%	6%	68%	32%
	34 t			2 t	

Table 9 Sole in Division 7.a. History of commercial landings by country; both the official and ICES estimated values are presented. Weights are in tonnes.

Year	Belgium	France	Ireland	Netherlands	UK (E+W)	UK (Isle of Man)	UK (N. Ireland)*	UK (Scotland)	Officially reported	Unallocated	Total used by ICES	TAC
1973	793	12	27	281	258	-	46	11	1428	0	1428	
1974	664	54	28	320	218	-	23	-	1307	0	1307	
1975	805	59	24	234	281	-	24	15	1442	-1	1441	
1976	674	72	74	381	195	-	49	18	1463	0	1463	
1977	566	39	84	227	160	-	49	21	1146	1	1147	
1978	453	65	127	177	189	-	57	30	1098	8	1106	
1979	779	48	134	247	290	-	47	42	1587	27	1614	
1980	1002	41	229	169	367	-	44	68	1920	21	1941	
1981	884	13	167	186	311	-	41	45	1647	20	1667	
1982	669	9	161	138	277	-	31	44	1329	9	1338	
1983	544	3	203	224	219	-	33	29	1255	-86	1169	
1984	425	10	187	113	230	-	38	17	1020	38	1058	
1985	589	9	180	546	269	-	36	28	1657	-511	1146	
1986	930	17	235	-	637	1	50	46	1916	79	1995	
1987	987	5	312	-	599	3	72	63	2041	767	2808	2100
1988	915	11	366	-	507	1	47	38	1885	114	1999	1750
1989	1010	5	155	-	613	2	.	38	1823	10	1833	1480
1990	786	2	170	-	569	10	.	39	1576	7	1583	1500
1991	371	3	198	-	581	44	.	26	1223	-11	1212	1500
1992	531	11	164	-	477	14	.	37	1234	25	1259	1350
1993	495	8	98	-	338	4	.	28	971	52	1023	1000
1994	706	7	226	-	409	5	.	14	1367	7	1374	1500
1995	675	5	176	-	424	12	.	8	1300	-34	1266	1300
1996	533	5	133	149	194	4	.	5	1023	-21	1002	1000
1997	570	3	130	123	189	5	.	7	1027	-24	1003	1000
1998	525	3	134	60	161	3	.	9	895	16	911	900
1999	469	< 1	120	46	165	1	.	8	810	53	863	900
2000	493	3	135	60	133	1	.	8	833	-15	818	1080
2001	674	4	135	-	195	+	.	4	1012	41	1053	1100
2002	817	4	96	-	165	+	.	3	1085	5	1090	1100

Year	Belgium	France	Ireland	Netherlands	UK (E+W)	UK (Isle of Man)	UK (N. Ireland)*	UK (Scotland)	Officially reported	Unallocated	Total used by ICES	TAC
2003	687	4	103	-	217	+	.	3	1014	0	1014	1010
2004	527	1	77	-	106	+	.	1	712	-3	709	800
2005	662	3	85	-	103	+	.	1	854	1	855	960
2006	419	1	85	-	69	+	.	2	576	-7	569	960
2007	305	1	115	-	66	< 1	.	4	491	1	492	820
2008	216	1	66	-	37	n/a	.	n/a	320	12	332	669
2009	257	n/a	47	-	19	1	.	1	325	0	325	502
2010	217	< 1	47	-	12	< 1	.	n/a	277	0	277	402
2011	250	< 1	48	-	31	< 1	.	n/a	330	0	330	390
2012	222	< 1	51	-	21	< 1	-	n/a	294	0	294	300
2013	96	< 1	40	-	12	< 1	-	n/a	148	0	148	140
2014	43	n/a	43	-	10	< 1	-	n/a	96	3	99	95
2015	37	n/a	32	-	7	n/a	-	n/a	76	0	76	90
2016**	14	n/a	15	-	6	n/a	-	n/a	35	0	35	40
2017**	14	n/a	14	-	4	n/a	-	n/a	32	2	34	40

* 1989 onwards: N. Ireland included with England & Wales.

** Preliminary.

n/a = not available.

Summary of the assessment

Table 10 Sole in Division 7.a. Assessment summary. Weights are in tonnes and recruitment in thousands.

Year	Recruitment (age 2)	SSB	Landings	Discards**	F (ages 4–7)
1970	3695	6436	1785		0.39
1971	10177	6222	1882		0.44
1972	3186	5011	1450		0.45
1973	13133	5123	1428		0.43
1974	5870	5068	1307		0.44
1975	6680	5359	1441		0.40
1976	3857	4889	1463		0.43
1977	15772	4490	1147		0.37
1978	9041	5092	1106		0.36
1979	8849	5685	1614		0.47
1980	5071	5514	1941		0.64
1981	4499	5166	1667		0.48
1982	2463	4332	1338		0.44
1983	5560	4097	1169		0.44
1984	15487	4606	1058		0.35
1985	16260	5644	1146		0.34
1986	23777	6961	1995		0.44
1987	3465	7172	2808		0.86
1988	3501	5527	1999		0.69
1989	4379	4643	1833		0.57
1990	5570	3638	1583		0.65
1991	12704	3199	1212		0.50
1992	4960	3462	1259		0.53
1993	6199	3241	1023		0.55
1994	5260	4065	1374		0.49
1995	2006	3534	1266		0.50
1996	2502	2723	1002		0.52
1997	8401	2509	1003		0.59
1998	6919	3039	911		0.49
1999	5269	3334	863		0.47
2000	6979	3136	818		0.45
2001	4569	3580	1053		0.34
2002	2334	3595	1090		0.38
2003	3062	3234	1014		0.36
2004	3650	2312	709		0.31
2005	2965	2086	855		0.55
2006	1323	1650	569		0.46
2007	1875	1405	492		0.33
2008	1968	1344	332		0.31
2009	2284	1086	325		0.38
2010	1621	1211	277		0.29
2011	640	1108	330	14	0.35
2012	887	1173	298	22	0.30
2013	692	1110	148	11	0.165
2014	827	894	99	7	0.117
2015	1956	1341	76	7	0.073
2016	4509	1283	35	2	0.035
2017	1362	1941	34	2	0.0188
2018	1402*	2336			

* GM(2008–2016).

**Discards are not included in the assessment.

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