

ECOREGION Celtic Sea and West of Scotland
STOCK Sole in Divisions VIIIf,g (Celtic Sea)

Advice for 2015

ICES advises on the basis of the MSY approach that catches should be no more than 652 t. All catches are assumed to be landed.

Stock status

Fishing pressure				
	2011	2012	2013	
MSY (F_{MSY})	✗	✗	✗	Above target
Precautionary approach (F_{pa}, F_{lim})	✓	⦿	✗	Harvest unsustainable
Stock size				
	2012	2013	2014	
MSY ($B_{trigger}$)	✓	✓	✓	Above trigger
Precautionary approach (B_{pa}, B_{lim})	✓	✓	✓	Full reproductive capacity

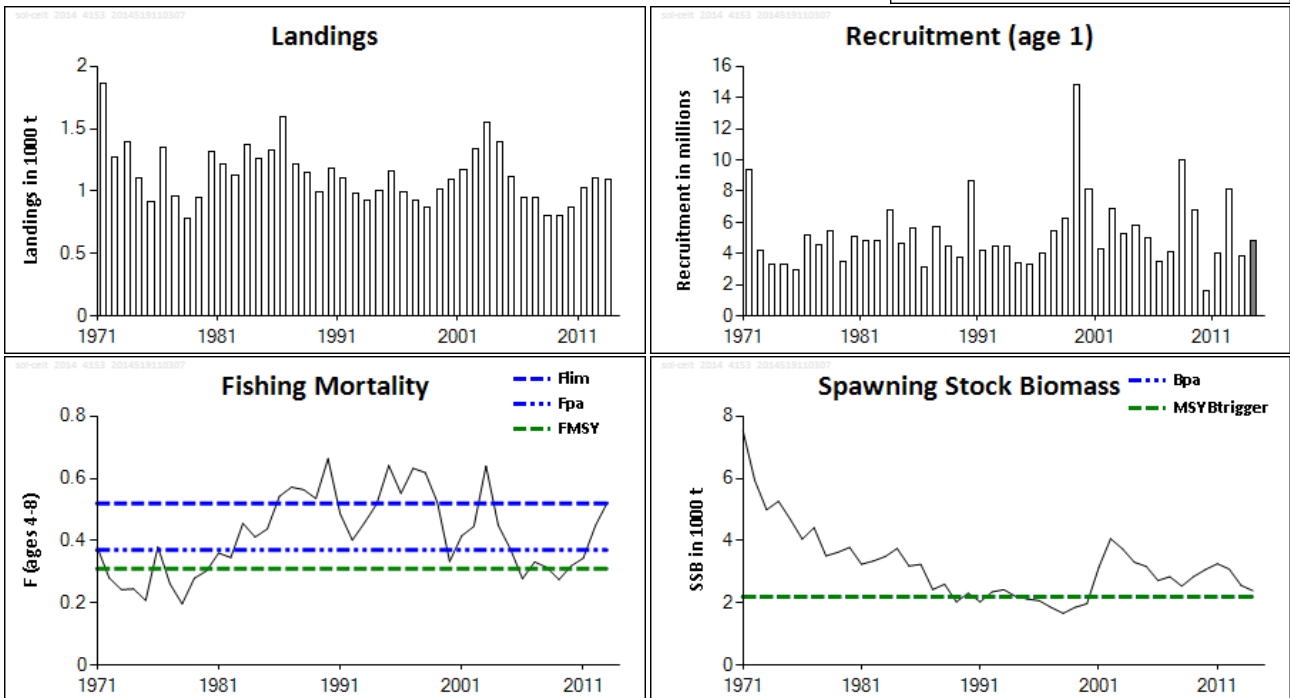
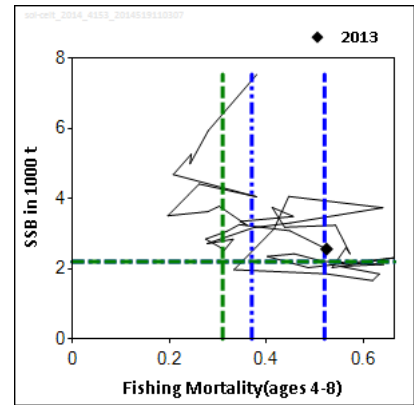


Figure 5.3.37.1 Sole in Divisions VIIIf,g. Summary of stock assessment. Predicted recruitment values are shaded. Top right: SSB and F over the years.

The spawning-stock biomass has been above MSY $B_{trigger}$ since 2001, but is declining. Since 2010, fishing mortality has been increasing and is now at F_{lim} . Recruitment has been fluctuating around average.

Management plans

No specific management objectives are known to ICES.

Biology

The main spawning areas for sole in the Celtic Sea are at depths of 40–75 m, off Trevose Head. Spawning usually takes place between February and April. Juvenile sole are found in relatively high abundance in depths up to 40 m, while adult sole (fish aged 3 plus) are generally found in deeper water. Spawning and nursery grounds are well defined. The results of recent tagging experiments suggest that there is only limited movement of sole between the Bristol Channel (Division VIIIf) and adjacent areas (Division VIIg).

The fisheries

Sole are taken mainly in a beam trawl fishery that started in the early 1960s and, to a lesser extent, in the longer established otter trawl fisheries. In the 1970s, the fishery was mainly carried out by Belgian beam trawlers and Belgian and UK otter trawlers. The use of beam trawls increased during the mid-1970s, and the Belgian otter trawlers have now been almost entirely replaced by beam trawlers. In the Celtic Sea, the beam and otter trawl fleets also take other demersal species such as plaice, cod, rays, brill, turbot, and anglerfish. The average discard rate in the last three years was estimated to be 3%. Discard rates are known to vary across different métiers.

Catch distribution Total catch (2013) is unknown, estimated landings = 1096 t (86% beam trawlers, 11% otter trawlers, and 3% other gear). Discards are considered negligible.

Effects of the fisheries on the ecosystem

Although discard rates of sole are low in beam trawl fisheries (about 2–5% in weight), discard rates of other (commercial and non-commercial) species can be considerable. Beam trawling, especially when using chain-mat gear, is known to have a significant impact on the benthic communities, although less so on soft substrates and in areas which have been historically exploited by this fishing method. Benthic drop-out panels have been shown to release around 75% of benthic invertebrates from the catches.

Quality considerations

The SSB estimates in this year's assessment are substantially lower since 2003 because of the revisions of catch and stock weights at this year's benchmark. The estimates of fishing mortality are revised upwards due to corrections of misreporting for the period 2003–2005. The discard estimate (in the order of 3%) is based on discard information for 2011–2013 from the major beam trawl and otter trawl fleets that take 81–86% of the total landings.

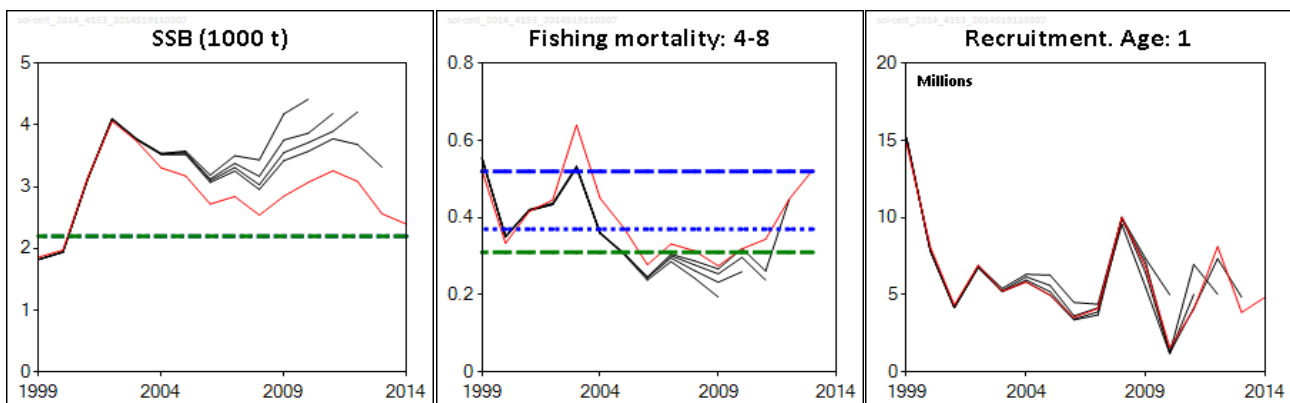


Figure 5.3.37.2 Sole in Divisions VIII.g (Celtic Sea). Historical assessment results (final-year recruitment estimates are included). The stock was benchmarked in 2014, which caused a revision in SSB and F.

Scientific basis

Stock data category	1 (ICES, 2014a).
Assessment type	Age analytical (XSA).
Input data	Commercial catches: international landings, ages and length frequencies from catch sampling by métier; one survey index (UK(E&W)-BTS-Q3); three commercial indices (BE-CBT, BE-CBT2 and UK(E&W)-CBT); maturity data from a combined-sex maturity (ICES, 1998); natural mortality is assumed to be constant.
Discards and bycatch	Not included, considered negligible.
Indicators	None.
Other information	Benchmarked in 2014 (ICES, 2014b).
Working group	Working Group for the Celtic Seas Ecoregion (WGCSE).

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Reference points

	<i>Type</i>	<i>Value</i>	<i>Technical basis</i>
MSY approach	MSY $B_{trigger}$	2200 t.	B_{pa} .
	F_{MSY}	0.31	Provisional proxy based on stochastic simulations.
Precautionary approach	B_{lim}	Not defined.	
	B_{pa}	2200 t.	There is no evidence of reduced recruitment at the lowest biomass observed and B_{pa} can therefore be set equal to the lowest observed SSB.
	F_{lim}	0.52	F_{lim} : F_{loss} .
	F_{pa}	0.37	This F is considered to have a high probability of avoiding F_{lim} and maintaining SSB above B_{pa} for ten years, taking into account the uncertainty of assessments. F_{pa} : $F_{lim} \times 0.72$ implies a less than 5% probability that $(SSB_{MT} < B_{pa})$.

(Last changed in: 2010)

Outlook for 2015

Basis: F (2014) = average F (2011–2013) scaled to 2014 = 0.52; SSB (2015) = 2229; R (2014, 2015, and 2016) = GM (1971–2011) = 4857 (thousands); Catches (2014) = landings (2014) = 1150; Discards = negligible.

Rationale	Catches (2015)	Basis	F (2015)	SSB (2016)	%SSB change¹⁾	% TAC change²⁾
MSY approach	652	F_{MSY}	0.31	2352	+6%	-35%
Precautionary approach	760	F_{pa}	0.37	2250	+1%	-24%
Zero catch	0	$F = 0$	0.00	2978	+34%	-100%
Other options	851	TAC - 15% ($F_{2014} \times 0.81$)	0.42	2163	-3%	-15%
	1013	F_{2014}	0.52	2010	-10	+1%
	1001	Stable TAC ($F_{2014} \times 0.99$)	0.52	2021	-9%	0%
	1151	TAC + 15% ($F_{2014} \times 1.78$)	0.62	1880	-16%	+15%

Weights in tonnes.

¹⁾ SSB 2016 relative to SSB 2015.

²⁾ Catches 2015 relative to TAC 2014.

MSY approach

Following the ICES MSY approach implies that fishing mortality is reduced to 0.31. The implied catches should be no more than 652 t. Discards are considered negligible. This is expected to lead to an SSB of 2352 t in 2016.

Precautionary approach

The fishing mortality in 2015 should be no more than F_{pa} . The implied catches should be no more than 760 t. This is expected to keep SSB above B_{pa} in 2016. Discards are considered negligible.

Additional considerations

Sole are mainly taken in a beam trawl fishery as part of a mixed demersal fishery with plaice and, to a lesser extent, cod.

The Celtic Sea is an area without days-at-sea limitations for demersal fisheries. In the past this has resulted in increased effort in the Celtic Sea as a direct result of restrictive effort in other areas. This was particularly the case in 2004–2005 when effort in the sole fishery increased because of restrictive days-at-sea in the eastern Channel (Division VIIId). The

removal of the restrictive days-at-sea EU regulation in Division VIIId that was in place prior to 2006, resulted in an area shift of the Belgian beam trawl fleet back to Division VIIId and a strong decrease in effort deployment in the Celtic Sea by that fleet. Since 2008 the effort of this fleet has gradually increased to the levels observed before the days-at-sea limitations were introduced in Division VIIId.

Regulations and their effects

Since 2005, ICES rectangles 30E4, 31E4, and 32E3 have been closed during the first quarter (in EU Council Regulations for TACs) with the intention of reducing the fishing mortality of cod. The effects of the closure on sole are not known although there have been spatial and temporal changes in the distribution of effort.

Changes in fishing technology and fishing patterns

Beam trawlers account for the majority of the vessels targeting sole. High fuel costs may have contributed to a reduction in effort in Divisions VIIIf,g since 2008. In addition, several vessels of this fleet segment are developing methods to reduce fuel costs. Effort deployment of the Belgian beam trawl fleet increased substantially in 2012 but declined in 2013.

Data and methods

At the 2014 benchmark (ICES, 2014b), the following changes to the assessment inputs were made: introduction of a new commercial tuning series (BE-CBT2 – period 1997–2012); truncation of the ages used in the survey tuning series from ages 1–9 to ages 1–5; revisions of the catch and stock weights for the period 2008–2012, and corrections for misreporting in 2003–2005.

Comparison of the basis of previous assessment and advice

The assessment method is the same used last year, but there have been several changes to the historical input data.

The basis for the advice this year is the same as last year: the MSY approach.

Sources

- ICES. 2014a. Advice basis. *In* Report of the ICES Advisory Committee, 2014. ICES Advice 2014, Book 1, Section 1.2.
- ICES. 2014b. Report of the Benchmark Workshop on Celtic Sea stocks (WKCELT), 3–7 February 2014, Copenhagen, Denmark. ICES CM 2014/ACOM:42.
- ICES. 2014c. Report of the Working Group for the Celtic Seas Ecoregion (WGCSE), 13–22 May 2014, Copenhagen, Denmark. ICES CM 2014/ACOM:12.
- Pawson, M. G., and Harley, B. F. M. 1998. Revision of maturity ogives for plaice and sole in the Celtic Sea (ICES Div. VIIIf+g). *In* Working Group on Southern Shelf Demersal Stocks (WGSSDS). ICES CM 1998/Assess:04. WD presented to the WGSSDS.

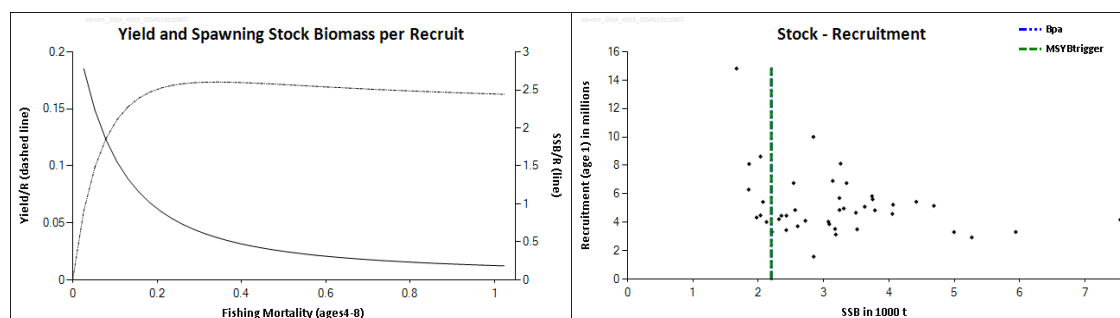


Figure 5.3.37.3 Sole in Divisions VIIIf,g (Celtic Sea). Yield-per-recruit analysis (left panel) and stock–recruitment (right panel) plots.

Table 5.3.37.1 Sole in Divisions VIII.f,g (Celtic Sea). Advice, management, and landings.

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official landings	ICES landings
1987	<i>Status quo</i> F; TAC	1.6	1.6	1.23	1.22
1988	F = F(pre-86); TAC	0.9	1.1	1.2	1.15
1989	F at F(81–85); TAC	1.0	1.0	0.99	0.99
1990	No increase in F	1.2	1.2	1.24	1.19
1991	No increase in F	1.1	1.2	1.50	1.11
1992	No long-term gains in increasing F	1.1	1.2	1.06	0.98
1993	No long-term gains in increasing F	-	1.1	1.03	0.93
1994	No long-term gains in increasing F	-	1.1	1.02	1.01
1995	No increase in F	1.0	1.1	1.17	1.16
1996	20% reduction in F	0.8	1.0	1.08	1.00
1997	20% reduction in F	0.8	0.9	1.04	0.93
1998	20% reduction in F	0.7	0.85	1.01	0.88
1999	Reduce F below F_{pa}	0.81	0.96	0.95	1.01
2000	Reduce F below F_{pa}	< 1.16	1.16	1.04	1.09
2001	Reduce F below F_{pa}	< 0.81	1.02	1.12	1.17
2002	Reduce F below F_{pa}	< 1.00	1.07	1.12	1.35
2003	Reduce F below F_{pa}	< 1.24	1.24	1.21	1.39
2004	Reduce F below F_{pa}	< 1.00	1.05	1.13	1.25
2005	Reduce F below F_{pa}	< 0.84	1.00	1.00	1.04
2006	Reduce F below F_{pa}	< 0.88	0.95	0.89	0.95
2007	Reduce F below F_{pa}	< 0.84	0.89	0.94	0.95
2008	Keep F below F_{pa}	< 1.00	0.964	0.75	0.80
2009	No long-term gain in increasing F	< 0.94	0.993	0.73	0.79
2010	No long-term gain in increasing F	< 0.92	0.993	0.87	0.86
2011	See scenarios	-	1.241	1.01	1.03
2012	MSY approach	< 1.06	1.060	1.08	1.1
2013	MSY approach	< 1.10	1.100	1.09	1.10
2014	MSY approach	< 0.92	1.001		
2015	MSY approach	< 0.652			

Weights in thousand tonnes.

Table 5.3.37.2 Sole in Divisions VIIf,g (Celtic Sea). Official nominal landings (t), 1986–2010, and data used by ICES (all catches are assumed to be landed).

Year	Belgium	Denmark	France	Ireland	UK(E.&W,NI.)	UK(Scotland)	Netherlands	Total- Official	Unallocated	ICES Total used landings	TAC
1986	1039 *	2	146	188	611	-	3	1989	-389	1600	
1987	701 *	-	117	9	437	-	-	1264	-42	1222	1600
1988	705 *	-	110	72	317	-	-	1204	-58	1146	1100
1989	684 *	-	87	18	203	-	-	992	0	992	1000
1990	716 *	-	130	40	353	0	-	1239	-50	1189	1200
1991	982 *	-	80	32	402	0	-	1496	-389	1107	1200
1992	543 *	-	141	45	325	6	-	1060	-79	981	1200
1993	575 *	-	108	51	285	11	-	1030	-102	928	1100
1994	619 *	-	90	37	264	8	-	1018	-9	1009	1100
1995	763 *	-	88	20	294	-	-	1165	-8	1157	1100
1996	695 *	-	102	19	265	0	-	1081	-86	995	1000
1997	660 *	-	99	28	251	0	-	1038	-111	927	900
1998	675 *	-	98	42	198	-	-	1013	-138	875	850
1999	604	-	61	51	231	0	-	947	65	1012	960
2000	694	-	74	29	243	-	-	1040	51	1091	1160
2001	720	-	77	35	288	-	-	1120	48	1168	1020
2002	703	-	65	32	318	+	-	1118	227	1345	1070
2003	715	-	124	26	342	+	-	1207	340	1547	1240
2004	735	-	79	33	283	-	-	1130	268	1398	1050
2005	645	-	101	34	217	-	-	997	121	1118	1000
2006	576	-	75	38	232	-	-	921	25	946	950
2007	582	-	85	32	244	-	-	943	2	945	890
2008	466	-	68	28	218	-	-	780	20	800	964
2009	513	-	74	26	194	-	-	807	-2	805	993
2010	620	-	45	27	179	-	-	871	5	876	993
2011	766	-	50	30	168	-	-	1013	16	1029	1241
2012	827	-	48	33	170	-	-	1078	26	1104	1060
2013 ^a	788	-	49	42	206	-	-	1085	11	1096	1100

^a Preliminary.

* Including Divisions VIIg–k.

Table 5.3.37.3

Sole in Divisions VIII.g (Celtic Sea). Summary of stock assessment (all catches are assumed to be landed).

Year	Recruitment Age 1 thousands	SSB (tonnes)	Landings (tonnes)	Mean F Ages 4–8
1971	9358	7542	1861	0.38
1972	4175	5941	1278	0.28
1973	3313	4996	1391	0.243
1974	3303	5269	1105	0.245
1975	2930	4687	919	0.208
1976	5156	4053	1350	0.38
1977	4587	4419	961	0.261
1978	5440	3513	780	0.197
1979	3502	3629	954	0.279
1980	5095	3785	1314	0.303
1981	4838	3243	1212	0.36
1982	4862	3351	1128	0.346
1983	6753	3493	1373	0.456
1984	4670	3751	1266	0.412
1985	5613	3187	1328	0.438
1986	3133	3241	1600	0.543
1987	5704	2430	1222	0.572
1988	4462	2602	1146	0.564
1989	3718	2034	992	0.536
1990	8624	2315	1189	0.664
1991	4215	2034	1107	0.486
1992	4481	2354	981	0.402
1993	4460	2428	928	0.458
1994	3445	2209	1009	0.518
1995	3318	2126	1157	0.642
1996	4020	2071	995	0.552
1997	5432	1852	927	0.633
1998	6299	1666	875	0.619
1999	14826	1859	1012	0.523
2000	8102	1974	1091	0.333
2001	4333	3140	1168	0.416
2002	6910	4063	1345	0.446
2003	5234	3741	1547	0.64
2004	5830	3308	1398	0.45
2005	4970	3175	1118	0.374
2006	3527	2721	946	0.278
2007	4104	2843	945	0.332
2008	10012	2541	800	0.314
2009	6757	2848	805	0.275
2010	1579	3073	876	0.319
2011	4039	3260	1029	0.344
2012	8126	3087	1104	0.448
2013	3860	2564	1096	0.524
2014	4857*	2394		
Average	5272	3200	1131	0.418

* Geometric mean (1971–2011).