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Sole (*Solea solea*) in Division 7.d (eastern English Channel)

ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2019 should be no more than 2571 tonnes.

Stock development over time

The spawning-stock biomass (SSB) has been fluctuating without trend since the 1980s, but has decreased and is now around B_{lim}. Fishing mortality (F) has been decreasing since 2014 and is below F_{MSY} in 2017. Recruitment has been fluctuating without trend, and there has been no strong recruitment since 2011.
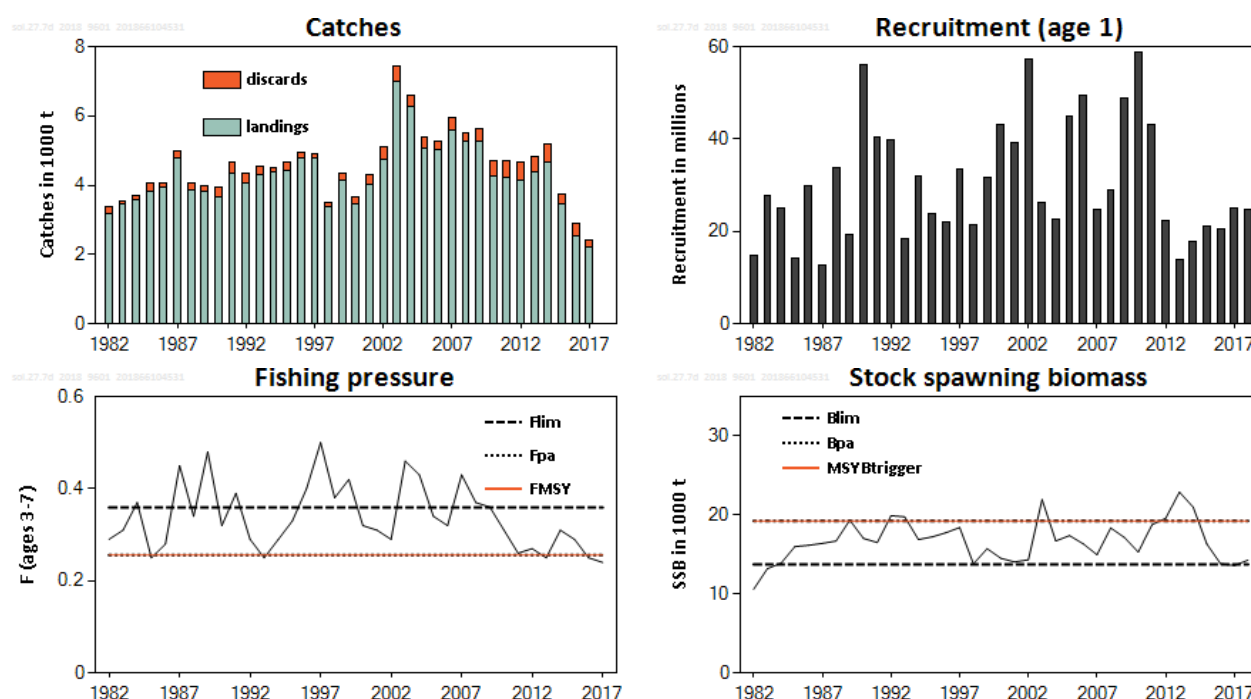

Figure 1   Sole in Division 7.d. Summary of the stock assessment.

Stock and exploitation status

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

Table 1   Sole in Division 7.d. 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   Sole in Division 7.d. Assumptions made for the interim year and in the forecast.

Variable	Value	Notes
$F_{ages\ 3-7}$ (2018)	0.24	Average exploitation pattern (2015–2017) scaled to F_{3-7} in 2017
SSB (2019)	15 224 tonnes	Short-term forecast (STF)
$R_{age\ 1}$ (2018)	24 875 thousands	RCT3
$R_{age\ 1}$ (2019)	28806 thousands	Geometric Mean (GM) (1982–2014)
Catch (2018)	2788 tonnes	Short-term forecast (STF)
Wanted catch (2018)	2452 tonnes	Average landings rate by age 2015–2017
Unwanted catch (2018)	336 tonnes	Average discard rate by age 2015–2017

Table 3   Sole in Division 7.d. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2019)	Wanted catch * (2019)	Unwanted catch* (2019)	F_{total} (ages 3–7) (2019)#	F_{wanted} (ages 3–7) (2019)	$F_{unwanted}$ (ages 1–3) (2019)	SSB (2020)	% SSB change **	% TAC change ***	% Advice change ^
ICES advice basis										
MSY approach: F_{MSY} × SSB (2019)/MSY $B_{trigger}$	2 571	2 266	305	0.20	0.185	0.056	16 615	+9.1	-24	-33
Other scenarios^^										
F= $F_{MSY\ lower}$ × SSB (2019)/MSY $B_{trigger}$	1 998	1762	236	0.154	0.141	0.043	17 205	+13.0	-41	-48
Constant TAC	3 405	2 997	408	0.28	0.25	0.076	15 757	+3.5	0.00	-11.9
TAC (2018) +15% ^	3 916	3 444	472	0.32	0.30	0.089	15 232	+0.053	+15.0	+1.29
TAC (2018) −15% ^	2 894	2 549	345	0.23	0.21	0.064	16 282	+7.0	-15.0	-25
F = 0	0	0	0	0	-	-	19 267	+27	-100	-100
F_{MSY}	3 181	2 800	381	0.256	0.23	0.071	15 988	+5.0	-6.6	-17.7
F_{pa}	3 181	2 800	381	0.256	0.23	0.071	15 988	+5.0	-6.6	-17.7
F_{lim}	4 279	3 761	518	0.359	0.33	0.099	14 860	-2.4	+26	+10.7
SSB (2020) = B_{lim}	5 360	4 704	656	0.47	0.43	0.130	13 751	-9.7	+57	+39
SSB (2020) = B_{pa}	16	14	2	0.00114	0.00104	0.00031	19 251	+26	-100	-100
SSB (2020) = MSY $B_{trigger}$	16	14	2	0.00114	0.00104	0.00031	19 251	+26	-100	-100
$F_{2019} = F_{2018}$	3 013	2 653	360	0.24	0.22	0.066	16 160	+6.1	-11.5	-22
F = $F_{MSY\ lower}$	2 484	2 189	295	0.195	0.179	0.054	16 704	+9.7	-27	-36
Mixed fisheries scenarios†										
A: Max.	4055			0.335			15199	-0.0016	19.1	4.9
B: Min.	1482			0.112			17847	17	-56	-62
C: COD	1923			0.147			17392	14	-44	-50
D: SQ effort	2874			0.227			16413	8	-15.6	-26
E: Value	2845			0.225			16442	8	-16.4	-26
F: Range‡	2271			0.177			16923	11	-33	-41

* "Wanted" and "unwanted" catch are used to describe fish that would be landed and discarded in the absence of the EU landing obligation.

** SSB 2020 relative to SSB 2019.

*** Total catch in 2019 relative to TAC in 2018 (3405 t)

^ Total catch in 2019 relative to advice value 2018 (3866 t).

^^ The option with $F_{MSY\ upper}$ is not included as the stock below MSY $B_{trigger}$.

F_{wanted} and $F_{unwanted}$ do not sum up to the F_{total} as they are calculated using different ages.

Mixed-fisheries assumptions (note: "fleet's stock share" is used to describe the share of the fishing opportunities for each particular fleet, which has been calculated based on the single-stock advice for 2018 and the historical proportion of the stock landings taken by the fleet):

A. Maximum scenario: Each fleet stops fishing when its last stock share is exhausted.

B. Minimum scenario: Each fleet stops fishing when its first stock share is exhausted.

C. COD: Each fleet stops fishing when its individual cod share is exhausted.

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† Version 3: All mixed-fisheries scenarios updated as part of the ICES reopening process.

‡ Version 2: Mixed fish range scenario updated.

D. SQ (*status quo*) effort scenario: The effort of each fleet in 2017 and 2018 is as in 2016.

E. Value scenario: The effort of each fleet is equal to the weighted average of the efforts required to catch the fleet's quota share of each of the stocks, where the weights are the relative catch values of each stock in the fleet's portfolio.

F. Range scenario: where the potential for TAC mismatches in 2018 are minimized within the F_{MSY} range, for the demersal fish stocks for which such a range is available (cod.27.47d20; had.27.46a20; pok.27.3a46; ple.27.420; ple.27.7d; sol.27.4; sol.27.7d).

The advice change (-33%) is due to a combination of a) an overestimation of the 2015 recruitment in the assessment last year, and b) a large reduction in the advised F below F_{MSY} because SSB(2019) is well below MSY $B_{trigger}$.

Basis of the advice

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

Advice basis	ICES 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 latest assessment has revised SSB downward compared to 2017 mainly because the estimate of the year class 2014 was revised down by 56% as the size of this year class has not been confirmed in the commercial catches in 2017.

This stock was benchmarked in 2017 (ICES, 2017), which resulted in an upward revision in SSB and downward revision in F. Recruitment estimates are uncertain.
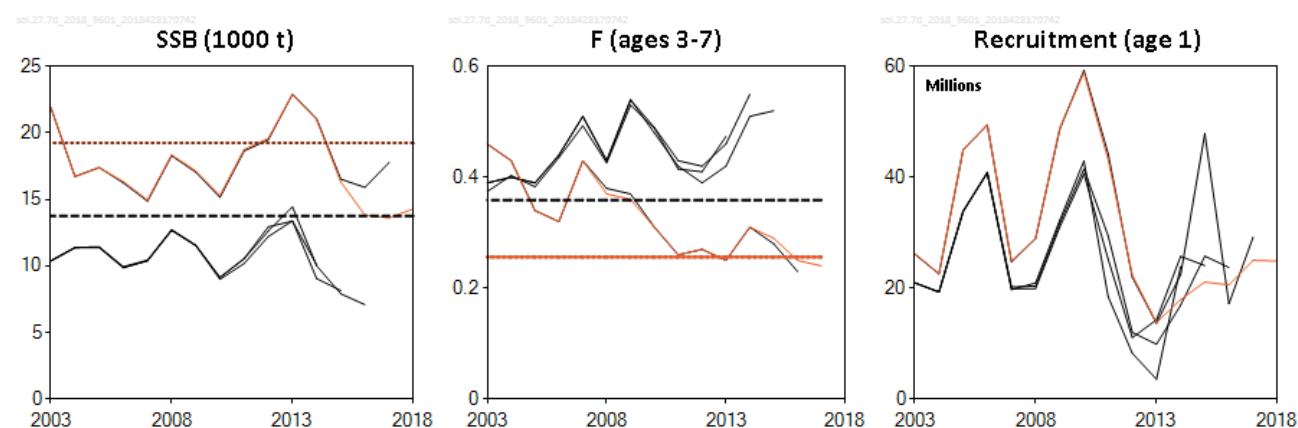

Figure 2   Sole in in Division 7.d. Historical assessment results (final-year recruitment estimates included).

Issues relevant for the advice

The EU is finalizing a MAP for the Western Waters, and ICES was requested by the EC to provide advice based on the proposed EU MAP.

Sole in the eastern English Channel is fully under the landing obligation since 2018 (partially since 2016). However, there is no indication that sole that would formerly have been discarded are being reported as BMS. This is based on the observation that BMS landings reported to ICES are currently much lower than the estimates of unwanted catches from observer programs, which are estimated at 8.0% of the total catch.

Technical measures applicable to the mixed flatfish beam-trawl fishery affect both sole and plaice. The minimum mesh size of 80 mm for the sole fishery generates high discards of plaice, which have a larger minimum landing size than sole. The use of larger mesh sizes would reduce the catch of undersized plaice and sole, but would also result in a loss of marketable sole in the short term.

From catch comparisons by gear and country it is clear that all important fleets are all fishing on the same year classes, and catch proportionally less of the younger ages (ages 2–4) and more of the older ages (ages 5–8) in recent years (2014–2017). It is however uncertain whether these changes result from the technical measures or from the lower recruitment in recent years.

Catch scenarios indicate that in order to reach MSY $B_{trigger}$ by 2020, fishing mortality should be close to zero because the SSB in 2018 is close to B_{lim}.

Mixed fisheries considerations[§]

Results from a North Sea mixed-fisheries analysis are presented in the ICES mixed fisheries advice (ICES, 2018c). The analysis has been updated taking into account latest changes made to the assessments and forecasts for stocks with reopened advice.

After years of positive development, North Sea cod is again estimated to be the most limiting stock in the Greater North Sea mixed-fisheries model. For 2019, assuming a strictly implemented landing obligation (corresponding to the "Minimum" scenario), cod is estimated to constrain 24 out of 40 fleet segments. Whiting is the second most limiting stock, constraining twelve fleet segments. Conversely, in the "Maximum" scenario, saithe and both plaice stocks (North Sea and Eastern Channel) would be the least limiting for 17, 9, and 3 fleet segments, respectively. Finally, if Norway lobster were managed by separate TACs, Norway lobster in FU 7 would be the least limiting for seven fleet segments. (ICES, 2018a). Eastern channel sole is not limiting in mixed fisheries scenarios (ICES, 2018c).

For those demersal fish stocks for which the F_{MSY} range is available, a "range" scenario is presented that minimizes the potential for TAC mismatches in 2019 within the F_{MSY} range. This scenario returns a fishing mortality by stock which, if used for setting single-stock fishing opportunities for 2019, may reduce the gap between the most and the least restrictive TACs, thus reducing the potential for quota over- and undershoots. This "range" scenario suggests that the potential for mixed-fisheries mismatch would be lowered with a 2019 TAC in the lower part of the F_{MSY} range for North Sea plaice and North Sea saithe, and at the highest possible value for cod in accordance with the MSY approach and the MAP (EU multiannual plan).

[§] Version 3: Mixed fisheries text updated

Reference points

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

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	19 251 t	B_{pa}	ICES (2016a, 2017)
	F_{MSY}	0.256	EQsim analysis based on the recruitment period 1983–2012	ICES (2016a, 2017)
Precautionary approach	B_{lim}	13 751 t	Break-point of hockey stick stock–recruit relationship, based on the recruitment period 1983–2012	ICES (2016a, 2017)
	B_{pa}	19 251 t	$B_{lim} \times \exp(1.645 \times 0.2) \approx 1.4 \times B_{lim}$	ICES (2016a, 2017)
	F_{lim}	0.359	EQsim analysis, based on the recruitment period 1983–2012	ICES (2016a, 2017)
	F_{pa}	0.256	$F_{lim} \times \exp(-1.645 \times 0.2) \approx F_{lim} / 1.4$	ICES (2016a, 2017)
Management plan*	MAP MSY $B_{trigger}$	19 251 t	MSY $B_{trigger}$	
	MAP B_{lim}	13 751 t	B_{lim}	
	MAP F_{MSY}	0.256	F_{MSY}	
	MAP range F_{lower}	0.195–0.256	Consistent with ranges provided by ICES (2017), resulting in no more than 5% reduction in long-term yield compared with MSY	
	MAP range F_{upper}	0.256–0.32	Consistent with ranges provided by ICES (2017), 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   Sole in Division 7.d. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2016b)
Assessment type	Age-based analytical assessment, XSA (ICES, 2018a) that uses catches in the model and in the forecast
Input data	Commercial catches: international landings and discards, ages and length frequencies from catch sampling by métier; 3 survey indices: UK(E&W)-BTS ,UK(E&W)-YFS, and FR-YFS; 3 commercial indices: BE-CBT, FR-COT and UK(E&W)-CBT; natural mortality is assumed to be constant; maturity-at-age data vary with age (ICES 2017, ICES 2018a).
Discards, BMS landings, and bycatch	Discards are included in the assessment. Discards (1982-2003) are reconstructed and combined with the landings as input in the model. In 2017, 85% of the landings had associated discarding information, and 67% of the discards were sampled. BMS landings, where reported, are included with discards as unwanted catch in the assessment from 2016 onwards.
Indicators	None
Other information	This stock was benchmarked in 2017 (ICES, 2017b)
Working group	Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK)

Information from stakeholders

There is no additional available information.

History of the advice, catch, and management

Table 7   Sole in Division 7.d. ICES advice, TAC, official landings and ICES catch estimates. All weights are in tonnes.

Year	ICES advice	Landings corresponding to advice	Catch corresponding to advice	Agreed TAC	Official landings	ICES landings	ICES discards**
1987	Precautionary TAC	3100		3850	3841	4791	179
1988	*Status quo* (Shot) TAC	3400		3850	3302	3853	188
1989	*Status quo* (Shot) TAC	3800		3850	2945	3805	171
1990	No effort increase; TAC	3700		3850	3036	3647	300
1991	*Status quo* F; TAC	3400		3850	3784	4351	317
1992	TAC	2700		3500	3794	4072	251
1993	70% of F(91)~2 800 t	2800		3200	3862	4299	247
1994	Reduce F	< 3800		3800	4037	4383	123
1995	No increase in F	3800		3800	3743	4420	249
1996	No long-term gain in increasing F	4700		3500	4098	4797	166
1997	No advice	-		5230	3941	4764	143
1998	No increase in effort	4500		5230	3047	3363	120
1999	Reduce F to F_{pa}	3800		4700	3900	4135	227
2000	$F < F_{pa}$	< 3900		4100	3832	3476	180
2001	$F < F_{pa}$	< 4700		4600	4617	4025	280
2002	$F < F_{pa}$	< 5200		5200	5399	4733	390
2003	$F < F_{pa}$	< 5400		5400	6247	6977	473
2004	$F < F_{pa}$	< 5900		5900	5667	6283	308
2005	$F < F_{pa}$	< 5700		5700	4620	5056	319
2006	$F < F_{pa}$	< 5700		5720	4852	5040	229
2007	$F < F_{pa}$	< 6440		6220	5313	5588	379
2008	$F < F_{pa}$	< 6590		6590	4972	5256	256
2009	$F < F_{pa}$	< 4380		5274	5121	5251	360
2010	$F < F_{pa}$	< 3190		4219	4374	4269	438
2011	See scenarios	< 4840		4852	4150	4225	477
2012	MSY transition	< 5600		5580	4018	4131	533
2013	MSY transition	< 5900		5900	4424	4372	466
2014	MSY transition	< 3251		4838	4621	4655	528
2015	MSY approach	< 1931		3483	3372	3443	294
2016	MSY approach		≤ 2685	3258*	2527	2538	344
2017	MSY approach		≤ 2487	2724*	2218	2228	200
2018	MSY approach		≤ 3866	3405*			
2019	MSY approach		≤ 2571				

* Catch TAC

** Discards since 2016 correspond to unwanted catch (included BMS landings)

History of the catch and landings

Table 8   Sole in Division 7.d. Catch distribution by fleet in 2017 as estimated by and reported to ICES.

Catch (2017)	Wanted catch				Unwanted catch
2428 tonnes	Trammel-/gillnets 43%	Beam trawls 39%	Otter trawls 17%	Other gears 0.0092%	200 tonnes
	2228 tonnes				

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

Year	Official landings					ICES estimates	
	Belgium	France	UK(E+W)	Others	Total	Landings	Discards
1974	159	383	309	3	854	884	
1975	132	464	244	1	841	882	
1976	203	599	404	.	1206	1305	
1977	225	737	315	.	1277	1335	
1978	241	782	366	.	1389	1589	
1979	311	1129	402	.	1842	2215	
1980	302	1075	159	.	1536	1923	
1981	464	1513	160	.	2137	2477	
1982	525	1828	317	4	2674	3190	183
1983	502	1120	419	.	2041	3458	100
1984	592	1309	505	.	2406	3575	131
1985	568	2545	520	.	3633	3837	219
1986	858	1528	551	.	2937	3932	139
1987	1100	2086	655	.	3841	4791	179
1988	667	2057	578	.	3302	3853	188
1989	646	1610	689	.	2945	3805	171
1990	996	1255	785	.	3036	3647	300
1991	904	2054	826	.	3784	4351	317
1992	891	2187	706	10	3794	4072	251
1993	917	2322	610	13	3862	4299	247
1994	940	2382	701	15	4038	4383	123
1995	817	2248	669	9	3743	4420	249
1996	899	2322	877	.	4098	4797	166
1997	1306	1702	933	.	3941	4764	143
1998	541	1703	803	.	3047	3363	120
1999	880	2251	769	.	3900	4135	227
2000	1021	2190	621	.	3832	3476	180
2001	1313	2482	822	.	4617	4025	280
2002	1643	2780	976	.	5399	4733	390
2003	1657	3475	1114	1	6247	6977	473
2004	1485	3070	1112	.	5667	6283	308
2005	1221	2832	567	.	4620	5056	319
2006	1547	2627	678	0	4852	5040	229
2007	1530	2981	801	1	5313	5588	379
2008	1368	2880	724	0	4972	5256	256
2009	1475	3047	760	0	5282	5251	360
2010	1294	2476	679	0	4449	4269	438
2011	1222	2281	700	0	4203	4225	477
2012	941	2475	627	0.25	4043	4131	533
2013	952	2884	605	0	4441	4372	466
2014	1496	2507	648	0.100	4651	4655	528
2015	1048	1895	468	0	3411	3443	294
2016	799	1337	391	0.044	2527	2538	344**
2017*	696	1178	344	0.154	2218	2228	200**

* Preliminary.
** Discards since 2016 corresponds to unwanted catch

Summary of the assessment

Table 10   Sole in Division 7.d. Assessment summary.

Year	Recruitment (age 1)	SSB	Landings	Discards*	F (ages 3–7)
	thousands	tonnes			per year
1982	14896	10604	3190	183	0.29
1983	27632	13203	3458	100	0.31
1984	25182	13917	3575	131	0.37
1985	14325	16007	3837	219	0.25
1986	29846	16171	3932	139	0.28
1987	12629	16415	4791	179	0.45
1988	33646	16711	3853	188	0.34
1989	19256	19350	3805	171	0.48
1990	56154	17037	3647	300	0.32
1991	40338	16518	4351	317	0.39
1992	39816	19929	4072	251	0.29
1993	18336	19768	4299	247	0.25
1994	31952	16891	4383	123	0.29
1995	23940	17231	4420	249	0.33
1996	22027	17762	4797	166	0.40
1997	33502	18419	4764	143	0.50
1998	21471	13814	3363	120	0.38
1999	31570	15742	4135	227	0.42
2000	43070	14525	3476	180	0.32
2001	39262	14065	4025	280	0.31
2002	57284	14338	4733	390	0.29
2003	26212	21942	6977	473	0.46
2004	22607	16715	6283	308	0.43
2005	44980	17396	5056	319	0.34
2006	49523	16344	5040	229	0.32
2007	24849	14967	5588	379	0.43
2008	29040	18365	5256	256	0.37
2009	48946	17152	5251	360	0.36
2010	58911	15307	4269	438	0.31
2011	43207	18762	4225	477	0.26
2012	22355	19597	4131	533	0.27
2013	13760	22898	4372	466	0.25
2014	17932	21004	4655	528	0.31
2015	21097	16320	3443	294	0.29
2016	20580	13828	2538	344	0.25
2017	25008	13609	2228	200	0.24
2018	24875**	14294			

* Discards estimates prior to 2004 assume the average discard proportion by age for 2004-2008 (WKNSEA; ICES, 2017). Discards since 2016 corresponds to unwanted catch.
** RCT3 estimate

Sources and references

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