

Sandeel (*Ammodytes* spp.) in divisions 4.b–c and Subdivision 20, Sandeel Area 2r (central and southern North Sea)

ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, there should be zero catch in 2018.

However, in order to obtain samples to assess the status of the stock in 2019, ICES advises a monitoring TAC in 2018 with catches that should not exceed 5000 tonnes and with an associated sampling protocol in the fishery.

Stock development over time

The spawning-stock biomass (SSB) has been below the limit biomass level (B_{lim}) since 2004 (except in 2011), increasing in 2018 to above B_{pa} . Recruitment has been low since 2000; however, the 2016 year class is estimated to be one of the largest in the time-series. This year class is followed by the lowest recruitment on record in 2017. Fishing mortality (F) has fluctuated since 2007 and increased in 2017 to the third highest value in the time-series.

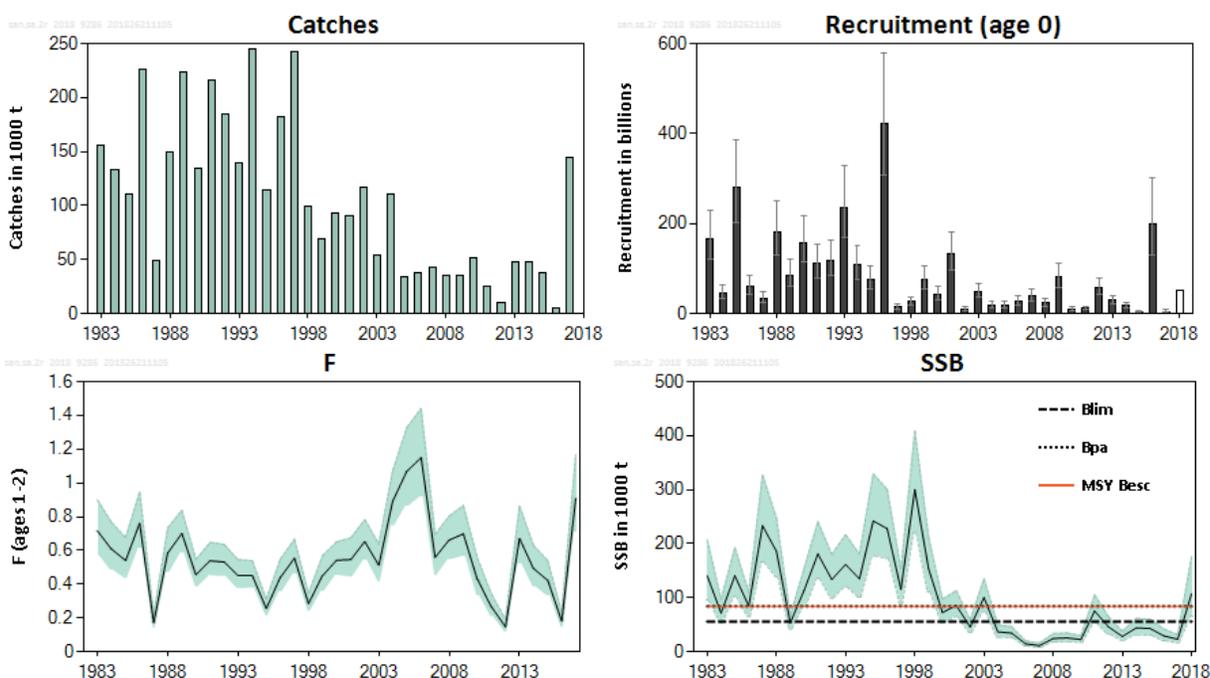


Figure 1 Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. Historical development of the stock from the summary of the stock assessment with 90% confidence intervals. Predicted values are not shaded.

Stock and exploitation status

Table 1 Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. 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}	?	?	?	Unknown	MSY $B_{escapement}$	✗ ✗ ✔ Above escapement
Precautionary approach	F_{pa}, F_{lim}	?	?	?	Unknown	B_{pa}, B_{lim}	✗ ✗ ✔ Full reproductive capacity
Management plan	F_{MGT}	-	-	-	Not applicable	SSB_{MGT}	- - - Not applicable

Catch scenarios

Table 2 Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. The basis for the catch scenarios.

Variable	Value	Notes
F (2017)	0.91	Sum of half-yearly Fs
Recruitment (2017)	4 648 244	In thousands
Recruitment (2018)	27 576 627	Geometric mean (2007–2016) in thousands
SSB (2018)	107 366	In tonnes

Table 3 Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2018)	F _{total} (2018)	SSB (2019)	% SSB change *	% TAC change **	% advice change ***
ICES advice basis						
SSB ₂₀₁₉ ≥ MSY B _{escapement} with F _{cap}	0	0	75 893	-29%	-100%	-100%
Other scenarios						
F = 0	0	0	75 893	-29%	-100%	-100%
SSB ₂₀₁₉ = MSY B _{escapement} = B _{pa}	Not applicable					
B _{lim}	29 416	0.25	56 000	-48%	-83%	-83%
F ₂₀₁₈ = F _{sq}	76 307	0.91	25 946	-76%	-57%	-57%
Monitoring TAC	5 000	0.038	72 469	-33%	-97%	-97%

* SSB 2019 relative to SSB 2018.

** Catch scenario for 2018 relative to TAC in 2017.

*** Advice value 2018 relative to advice value 2017.

The large change in the advice from year to year can be explained by the marked interannual variability in biomass and recruitment and the early maturation, both of which are typical for a short-living species. For the stock in Sandeel Area 2r, recruitment in 2017 is estimated to have been very weak. The fishing mortality in 2017 was higher than anticipated in the forecast last year. SSB in 2019 is not predicted to be above MSY B_{escapement}, even in the absence of fishing.

Basis of the advice

Table 4 Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. The basis of the advice.

Advice basis	MSY approach (Escapement strategy with F _{cap})
Management plan	ICES is not aware of any agreed precautionary management plan for sandeel in this area.

Quality of the assessment

The uncertainty in the estimate of the SSB, F, and recruitment are low, but recruitment and SSB have both been downscaled in the final year of the assessment (ICES, 2018). Figure 2 reflects the changes in the stock assessment agreed at the benchmark in 2016.

This year's assessment shows a large downward revision of SSB for several years (ICES, 2018). There was a large reduction in the recruitment estimate for 2016. The main reasons for this are thought to be the lack of ages 3–4+ in the 2017 catch. The reasons for this are not known. Further sampling in 2018 is expected to shed light on this issue.

In addition, the mean weights-at-age observed in 2017 were lower than assumed in the forecast made last year. This has contributed to a higher F in 2017 and a lower SSB in 2018 than was forecasted last year.

The dredge survey time-series in this area is still short (2010–2017) and the quality of the assessment will likely improve once a longer time-series becomes available.

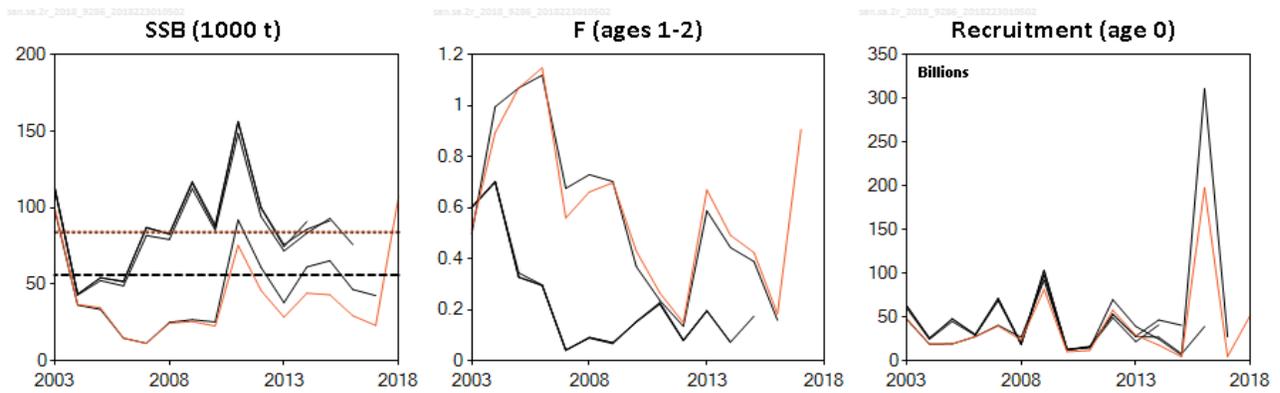


Figure 2 Sandeel in divisions 4.b-c and Subdivision 20, Sandeel Area 2r. Historical assessment results (final-year recruitment estimates included).

Issues relevant for the advice

Without information on the abundance of older age groups it is not possible to determine if there have been changes in the selectivity of the fishery or in the survival of age 2+. The dredge survey does not provide information on the abundance of age 2+. Information on the age structure of the catches will require a monitoring fishery. The advice monitoring TAC of 5000 t in 2018 is based on obtaining a minimum of 30 samples to provide information on older fish for the assessment (ICES, 2014). Catches equal to the monitoring TAC will result in an F of 0.038 in 2018, which is the lowest F on record, and an SSB in 2019 that is above B_{lim} .

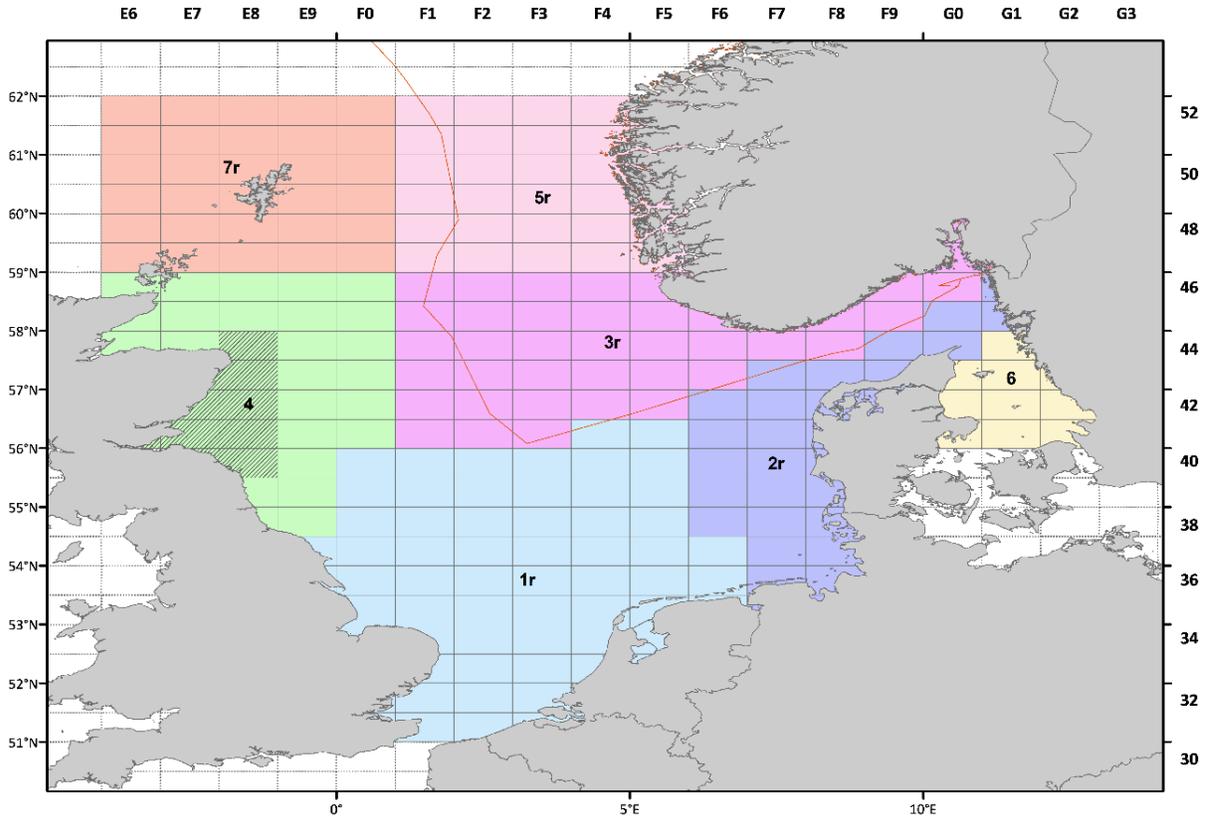


Figure 3 Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. Stock areas for the seven sandeel stocks. The Norwegian Exclusive Economic Zone (EEZ) is shown as a red line. The closed area in sandeel area 4 is shown with hatched markings.

Reference points

Table 5 Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{\text{escapement}}$	84 000 t	$= B_{\text{pa}}$	ICES (2017)
	F_{MSY}	Not defined		
	F_{cap}^*	0.44	Maximum F estimated from MSE, resulting in less than 5% probability of $SSB < B_{\text{lim}}$.	ICES (2017)
Precautionary approach	B_{lim}	56 000 t	Average SSB of the two lowest SSB estimates providing high recruitment (2001, 2009).	ICES (2017)
	B_{pa}	84 000 t	$B_{\text{pa}} = B_{\text{lim}} \times \exp(\sigma \times 1.645)$, with $\sigma = 0.25$ estimated from the assessment uncertainty in the terminal year.	ICES (2017)
	F_{lim}	Not defined		
Management plan	SSB_{MGT}	Not defined		
	F_{MGT}	Not defined		

* Not used as a biological reference point, but used in the ICES MSY approach for stocks of short-lived species.

Basis of the assessment

Table 6 Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. The basis of the assessment and advice.

ICES stock data category	1 (see ICES, 2016a).
Assessment type	Analytical age-based (SMS-effort), seasonal (ICES, 2018).
Input data	One survey index (dredge survey since 2010). Total international catch and fishing effort. Constant maturity-at-age from surveys. Natural mortality estimated from multispecies assessment (assumed constant over time; ICES, 2016b). Age frequencies from catch sampling.
Discards and bycatch	Discarding is considered to be negligible.
Indicators	None.
Other information	Last benchmarked in 2016 (ICES, 2017).
Working group	Herring Assessment Working Group (HAWG)

Information from stakeholders

The industry reports high CPUE in 2017. This information is consistent with the assessment.

History of advice, catch, and management

Table 7 Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. History of ICES advice, the agreed TAC, and ICES estimates of catch. All weights are in tonnes. Values of catch for the period 2005 to 2015 are presented to the nearest thousand tonnes.

Year	ICES advice	Catch corresponding to advice	TAC	ICES catch SA 2	ICES catch SA 2r	Total ICES catch (SAs 1r–7r)
2005*	Exploitation to be kept below the level of 2003. Adjustment to be made conditional on the abundance of the 2004 year class.	-	661000**	41000		177000
2006*	The fishery should remain closed until information is available which assures that the stock can be rebuilt to B_{pa} by 2007.	-	300000**	35000		293000
2007*	The fishery should remain closed until information is available which assures that the stock can be rebuilt to B_{pa} by 2008.	-	173000**	6000		230000
2008*	The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to B_{pa} by 2009.	-	375000**	13000		348000
2009*	The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to B_{pa} by 2010.	-	377000**	10000		353000
2010*	The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to B_{pa} by 2011.	-	377000**	32000		414000
2011	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	< 34000	34000	30000		438000
2012	Catches for monitoring purposes should not exceed 5000 t.	< 5000	5000	8000		102000
2013	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	< 17544	18000	23000		278000

Year	ICES advice	Catch corresponding to advice	TAC	ICES catch SA 2	ICES catch SA 2r	Total ICES catch (SAs 1r–7r)
2014	Catches for monitoring purposes should not exceed 5000 t.	< 5000	5000	8900		264000
2015	MSY approach: allow for sufficient stock (MSY $B_{escapement}$) to remain for successful recruitment.	< 29000	29000	21000		312000
2016	Catches for monitoring purposes should not exceed 5000 t.	≤ 5000	5000	4037	9757	75405
2017 [^]	MSY approach: allow for sufficient stock (MSY $B_{escapement}$) to remain for successful recruitment.	≤ 175941	175941		144247***	518410***
2018 [^]	Catches for monitoring purposes should not exceed 5000 t.	≤ 5000				

* Advice for Subarea 4, excluding the Shetland area.

** Set for EU waters of divisions 2.a and 3.a and Subarea 4.

*** Preliminary.

[^] ICES statistical rectangles included in this sandeel area have changed in the 2017 assessment and advice.

History of catch and landings

Table 8 Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. Catch distribution by fleet in 2017 data as estimated by ICES (in tonnes).

Total catch (2017)	Landings	Discards
144 247	100% industrial trawl fisheries	Negligible
	144 247	

Table 9 Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. History of total catch (in tonnes) as estimated by ICES.

Year	Catch
1982	138899
1983	156208
1984	133398
1985	111889
1986	225581
1987	49067
1988	151543
1989	227292
1990	133796
1991	215565
1992	184241
1993	147964
1994	244944
1995	122155
1996	186460
1997	242680
1998	100425
1999	63165
2000	100336
2001	84682
2002	117557
2003	44504
2004	116767
2005	34568
2006	37768

Year	Catch
2007	43402
2008	35120
2009	36709
2010	51635
2011	24897
2012	12552
2013	47847
2014	65084
2015	37899
2016	9238
2017	144247

Summary of the assessment

Table 10 Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. Assessment summary. The SSB is estimated for 1 January. Catch values used for the assessment do not include catches of age 0 in the first half of the year and, hence, may differ slightly from the ICES catch estimates presented in other tables.

Year	Recruitment (age 0)	High	Low	SSB	High	Low	Catches	F ages 1–2	High	Low
	thousands			tonnes			tonnes	Per year		
1983	166582293	230442133	120419214	140787	207481	95531	155664	0.715	0.899	0.568
1984	46501727	64792409	33374443	71826	97017	53176	133343	0.608	0.767	0.481
1985	279077478	387150203	201173183	140646	192528	102745	110546	0.541	0.676	0.434
1986	61527821	86175565	43929769	84542	109868	65054	225470	0.76	0.945	0.611
1987	34760770	48426172	24951613	233281	326899	166474	49070	0.174	0.219	0.139
1988	181179716	250030177	131288509	185907	247671	139545	149466	0.586	0.734	0.468
1989	86184422	120186399	61801957	53423	67415	42335	223507	0.7	0.838	0.585
1990	156881296	217061501	113386026	113664	154275	83743	133874	0.457	0.546	0.383
1991	111106527	154907786	79690380	180954	240812	135975	215508	0.539	0.648	0.449
1992	116686336	162329091	83877146	133786	179994	99441	184033	0.532	0.636	0.445
1993	236628037	329989326	169680724	161619	216836	120464	139826	0.451	0.545	0.373
1994	107607403	151826717	76266900	134996	180688	100858	244939	0.451	0.54	0.376
1995	75376039	105448082	53880044	242074	329508	177841	113899	0.257	0.311	0.213
1996	420939636	577899427	306610751	227977	300454	172984	182562	0.441	0.549	0.354
1997	15279154	21594404	10810790	115497	152553	87442	242094	0.553	0.666	0.459
1998	26509136	37131010	18925806	300139	408437	220556	99814	0.287	0.346	0.238
1999	76209753	105115024	55253057	153430	211412	111350	69427	0.451	0.569	0.358
2000	43444725	60348057	31275972	72548	97314	54084	92908	0.542	0.651	0.452
2001	133284967	182551266	97314484	85819	113153	65089	90200	0.546	0.674	0.442
2002	10019062	13993691	7173346	45890	58715	35866	117388	0.652	0.783	0.543
2003	48885921	67363351	35476758	100308	134963	74551	53710	0.513	0.638	0.413
2004	19134432	26864034	13628872	36864	49890	27239	110546	0.895	1.076	0.745
2005	19365429	27429131	13672319	34648	46448	25846	34396	1.07	1.329	0.862
2006	27618600	38827831	19645368	14863	20174	10949	37860	1.149	1.441	0.916
2007	39626157	55575118	28254233	11290	16241	7849	43090	0.56	0.695	0.452
2008	23676653	33553745	16707044	24514	33592	17889	35604	0.662	0.804	0.545
2009	81572275	112667052	59059290	25642	34804	18892	35687	0.698	0.866	0.564
2010	10386319	15301047	7050212	22720	29765	17343	51670	0.43	0.556	0.332

Year	Recruitment (age 0)	High	Low	SSB	High	Low	Catches	F ages 1–2	High	Low
	thousands			tonnes			tonnes	Per year		
2011	11804602	16326172	8535291	75433	105339	54018	24896	0.266	0.342	0.207
2012	57944719	77856448	43125400	45982	64582	32738	10594	0.149	0.191	0.116
2013	29238591	40098826	21319707	28453	38006	21301	47814	0.67	0.862	0.521
2014	17948193	25555096	12605612	44179	61731	31617	48033	0.492	0.629	0.384
2015	4501855	6405639	3163883	43131	60492	30753	37902	0.424	0.54	0.332
2016	198044042	300243471	130632125	29437	42131	20567	5230	0.183	0.233	0.143
2017	4648244	9079090	2379772	23063	31658	16802	144247	0.907	1.165	0.706
2018	27576627*			107366**	175749	65591				
Average	83548860 [†]	118872700	61038286	98519	134405	72347	105566	0.552	0.683	0.446

* Geometric mean (2007–2016).

** Using mean weight-at-age from 2013 to 2017.

Sources and references

ICES. 2014. Sandeel in Division IIIa and Subarea IV *In* Report of the ICES Advisory Committee, 2014. ICES Advice 2014, Book 6, Section 6.3.22.

ICES. 2016a. Advice basis. *In* Report of the ICES Advisory Committee, 2016. ICES Advice 2016, Book 1, Section 1.2.

ICES. 2016b. Report of the Working Group on Multispecies Assessment Methods (WGSAM), 9–13 November 2015, Woods Hole, USA. ICES CM 2015/SSGEPI:20. 206 pp.

ICES. 2017. Report of the Benchmark Workshop on Sandeel Stocks (WKSAND), 31 October–4 November 2016, Bergen, Norway. ICES CM 2016/ACOM:33. 319 pp.

ICES. 2018. Sandeel in Division 3.a and Subarea 4. Section 9 *in* Report of the Herring Assessment Working Group for the Area South of 62°N (HAWG), 29–31 January and 12–20 March 2018, ICES HQ, Denmark. ICES CM 2018/ACOM:07. Section 9 is available separately at the [HAWG](#) website.

[†] Version 2: value corrected.