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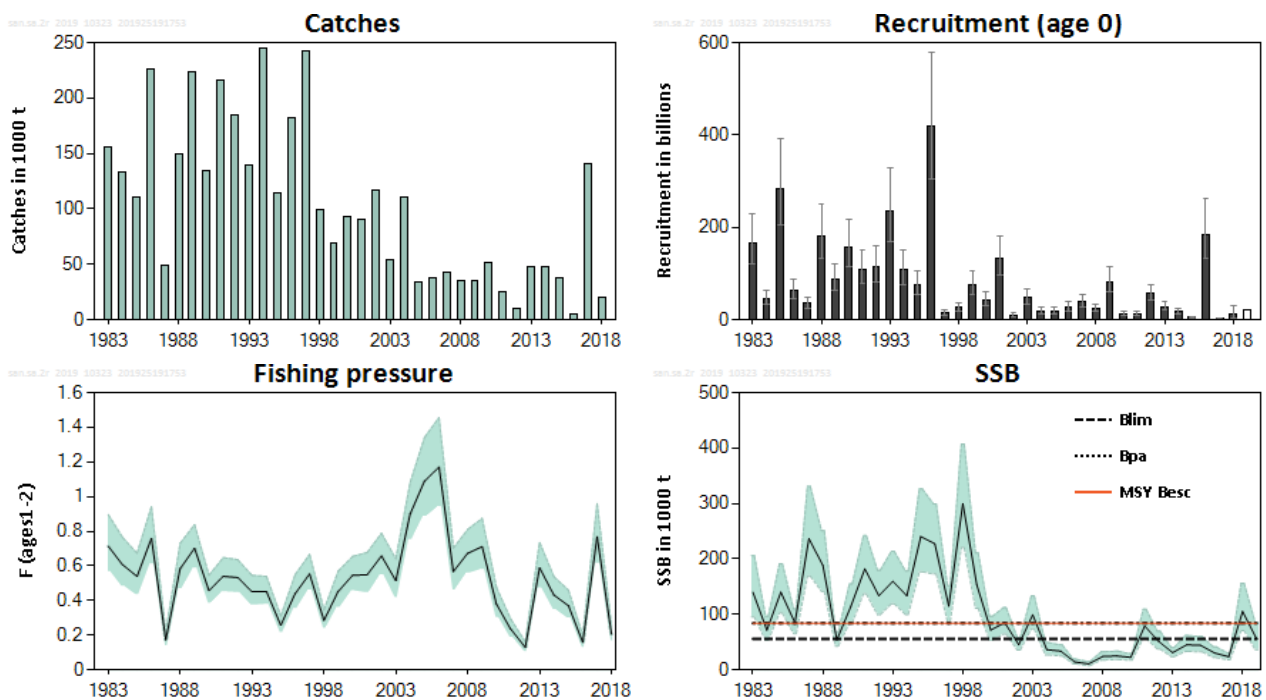
ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, there should be zero catch in 2019.

In order to obtain samples to assess the status of the stock in 2020, however, ICES advises a monitoring TAC in 2019. Catches should not exceed 5000 tonnes, and should have 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} but then decreasing again in 2019 to just below B_{lim}. Recruitment has been low since 2000, with the exception of the 2016 year class which is estimated to be one of the largest in the time-series. This year class is followed by the lowest recruitment on record (2017) and the fifth lowest on record (2018). Fishing mortality (F) was low in 2018, as in previous years, when a monitoring TAC was advised (2012 and 2016).

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

ICES assesses that the spawning stock size is below MSY $B_{escapement}$ and below B_{pa} and B_{lim}. No reference points for fishing pressure have been defined for this stock.

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			
		2016	2017	2018			2017	2018	2019
Maximum sustainable yield	F_{MSY}	?	?	?	Undefined	MSY $B_{escapement}$	❌	✅	❌ Below escapement
Precautionary approach	F_{pa}, F_{lim}	?	?	?	Undefined	B_{pa}, B_{lim}	❌	✅	❌ Reduced reproductive capacity
Management plan	F_{MGT}	—	—	—	Not applicable	B_{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 (2018)	0.21	From the assessment
Recruitment (2018)	11 061 708	From the assessment; in thousands
Recruitment (2019)	20 477 415	Geometric mean 2008–2017; in thousands
SSB (2019)	55 770	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 (2019)	F_{total} (2019)	SSB (2020)	% SSB change *	% TAC change **	% advice change ***
ICES advice basis						
$SSB_{2020} \geq$ MSY $B_{escapement}$ with F_{cap}	0	0	44435	−20%	−100%	−100%
Other scenarios						
F = 0	0	0	44435	−20%	−100%	−100%
SSB_{2020} = MSY $B_{escapement}$ = B_{pa}	0	0	44435	−20%	−100%	−100%
B_{lim}	0	0	44435	−20%	−100%	−100%
$F_{2019} = F_{sq}$	18622	0.206	32046	−43%	272%	272%
Monitoring TAC	5000	0.048	38915	−30%	0%	0%

* SSB_{2020} relative to SSB_{2019}.
** Catch scenario for 2019 relative to TAC in 2018 (5000 t).
*** Advice value 2019 relative to advice value 2018 (5000 t).

For the stock in Sandeel Area 2r, recruitments in 2017 and 2018 are estimated to have been very weak, leading to a zero catch advice.
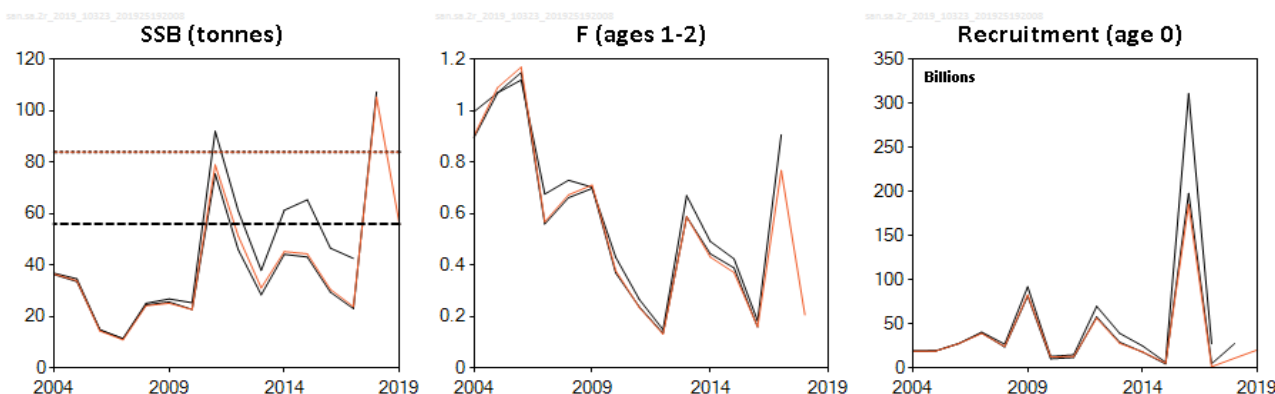
Basis of the advice

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 assessment this year is consistent with the assessment from 2018. However, the assessment from 2017 showed a higher recruitment and SSB.
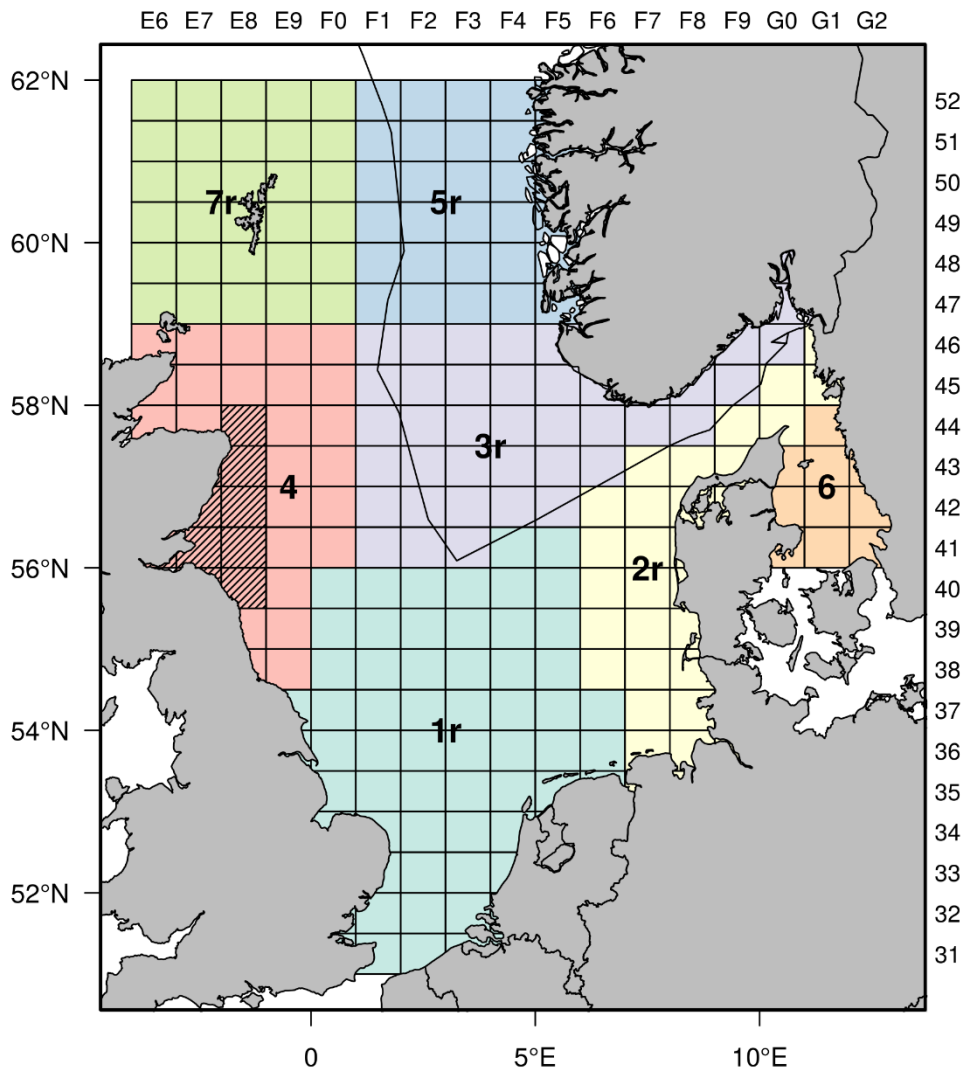

Figure 2   Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. Historical assessment results (final-year recruitment estimates included).

Issues relevant for the advice

The dredge survey does not provide reliable information on the abundance of ages 2+. Information on the age structure and mean weights of older fish will require a monitoring fishery. The advice monitoring TAC of 5000 t in 2019 is based on obtaining a minimum of 30 samples, to provide information on abundance and mean weight of sandeel in the assessment (ICES, 2014). An evaluation of the 2016 monitoring TAC showed that without this information the SSB in the 2017 assessment would have been overestimated by 205%. Catches equal to the monitoring TAC will result in an F of 0.048 in 2019, which is the lowest F on record, and an SSB in 2020 that is 25% below B_{lim}.

The fishing mortality in 2018 was higher than anticipated in the forecast last year, as the catches exceeded the monitoring TAC by 311% due to interannual quota flexibility.

Figure 3   Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. Stock areas for the seven sandeel stocks. The border of the Norwegian Exclusive Economic Zone (EEZ) is also shown. The closed part of 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 $B_{escapement}$	84 000 t	= B_{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_{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	$B_{pa} = B_{lim} \times \exp(\sigma \times 1.645)$, 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, 2018a).
Assessment type	Analytical age-based (SMS-effort), half-yearly time-steps (ICES, 2019).
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, 2018b). 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

There is no additional available information.

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

Year	ICES advice	Catch corresponding to advice	TAC	ICES catch SA 2	ICES catch SA 2r	Total ICES catch (SAs 1r–7r)
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
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		141314	517499
2018^	Catches for monitoring purposes should not exceed 5000 t.	≤ 5000	5000		20568***	270858***
2019^	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 2018 data as estimated by ICES (in tonnes).

Total catch (2018)	Landings	Discards
20568	100% industrial trawl fisheries	Negligible
	20568	

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

Year	Catch
1997	242680
1998	100425
1999	63165
2000	100336
2001	84682
2002	117557
2003	44504
2004	116767
2005	34568
2006	37768
2007	43402
2008	35120
2009	36709
2010	51635
2011	24897
2012	12552
2013	47847
2014	65084
2015	37899
2016	9238
2017	141314
2018	20568

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. High and low represent 90% confidence intervals.

Year	Recruitment (age 0)	High	Low	SSB	High	Low	Total catch	F (ages 1–2)	High	Low
	thousands			tonnes			tonnes			
1983	165751461	228998780	119972459	140225	205967	95466	155664	0.71	0.90	0.57
1984	46688106	64852295	33611444	71682	96648	53166	133343	0.61	0.76	0.48
1985	282164276	390731133	203763336	140225	191548	102653	110546	0.54	0.67	0.43
1986	62270602	87046771	44546488	84881	110103	65436	225470	0.76	0.94	0.61
1987	35110121	48801951	25259658	236570	330865	169149	49070	0.174	0.22	0.139
1988	182087883	250668303	132270401	188528	250824	141704	149466	0.59	0.73	0.47
1989	86876663	121052139	62349617	53960	68001	42819	223507	0.70	0.84	0.59
1990	156567847	216097495	113437181	114462	154986	84534	133874	0.46	0.55	0.38
1991	109124501	151929303	78379592	182225	242184	137111	215508	0.54	0.65	0.45
1992	115525287	160436535	83186114	133786	179609	99654	184033	0.53	0.64	0.45
1993	234977424	327515017	168585827	159692	213824	119264	139826	0.45	0.55	0.37
1994	108038694	151967045	76808491	133519	178356	99954	244939	0.45	0.54	0.38
1995	74700698	104305799	53498409	240386	326564	176949	113899	0.26	0.31	0.21
1996	420518907	579948942	304916758	227521	299351	172928	182562	0.44	0.55	0.35
1997	15309743	21624826	10838850	115036	151665	87254	242094	0.55	0.67	0.46
1998	26140594	36564238	18688497	299839	407452	220647	99814	0.29	0.35	0.24
1999	75905523	104538797	55114929	153123	210705	111278	69427	0.45	0.57	0.36
2000	43055477	59686472	31058530	71898	96326	53664	92908	0.55	0.66	0.46
2001	132752892	181556516	97068013	85050	112012	64579	90200	0.55	0.68	0.45
2002	10221460	14220364	7347086	45342	57926	35492	117388	0.66	0.79	0.55
2003	48013847	66038787	34908719	99409	133611	73962	53710	0.52	0.64	0.42
2004	19019969	26665582	13566523	36534	49345	27049	110546	0.90	1.08	0.75
2005	19134432	27024040	13548177	33894	45321	25349	34396	1.09	1.34	0.89

Year	Recruitment (age 0)	High	Low	SSB	High	Low	Total catch	F (ages 1–2)	High	Low
	thousands			tonnes			tonnes			
2006	27508346	38440059	19685430	14354	19237	10711	37860	1.17	1.46	0.94
2007	39036201	54360925	28031623	10895	15346	7736	43090	0.57	0.70	0.46
2008	24276030	34107326	17278565	24173	32881	17771	35604	0.67	0.81	0.56
2009	82887929	114770839	59861972	25135	33756	18715	35687	0.71	0.87	0.58
2010	12434681	17741260	8715350	22675	29283	17558	51670	0.38	0.48	0.30
2011	12994022	18130637	9312669	78984	109403	57023	24896	0.23	0.29	0.187
2012	56401144	76403305	41635490	51328	69871	37707	10594	0.131	0.163	0.105
2013	27868289	38368842	20241464	31101	40307	23998	47814	0.59	0.74	0.47
2014	18020130	25166353	12903144	45252	61828	33120	48033	0.43	0.54	0.35
2015	5482107	7704022	3901014	44356	60230	32666	37902	0.37	0.46	0.30
2016	185395141	261248797	131565613	30516	41645	22361	5230	0.160	0.199	0.129
2017	1386094	2365995	812029	23813	30851	18381	141314	0.77	0.96	0.62
2018	11061708	29981393	4081244	105345	156458	70931	20568	0.21	0.26	0.166
2019	*20477415			**55770	85172	36519				

* Geometric mean (2008–2017).
** Using mean weight-at-age from 2014 to 2018.

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