

Sandeel (*Ammodytes* spp.) in divisions 4.a–b and Subdivision 20, Sandeel Area 3r (northern and central North Sea, Skagerrak)

ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2019 should be no more than 133 610 tonnes.

Stock development over time

The spawning-stock biomass (SSB) has been above $B_{pa} = MSY B_{escapement}$ since 2015. The recruitments (R) in 2016 and 2018 were among the five highest on record, whereas recruitment in 2017 was very low. Fishing mortality (F) declined in the early 2000s and has been low since then.

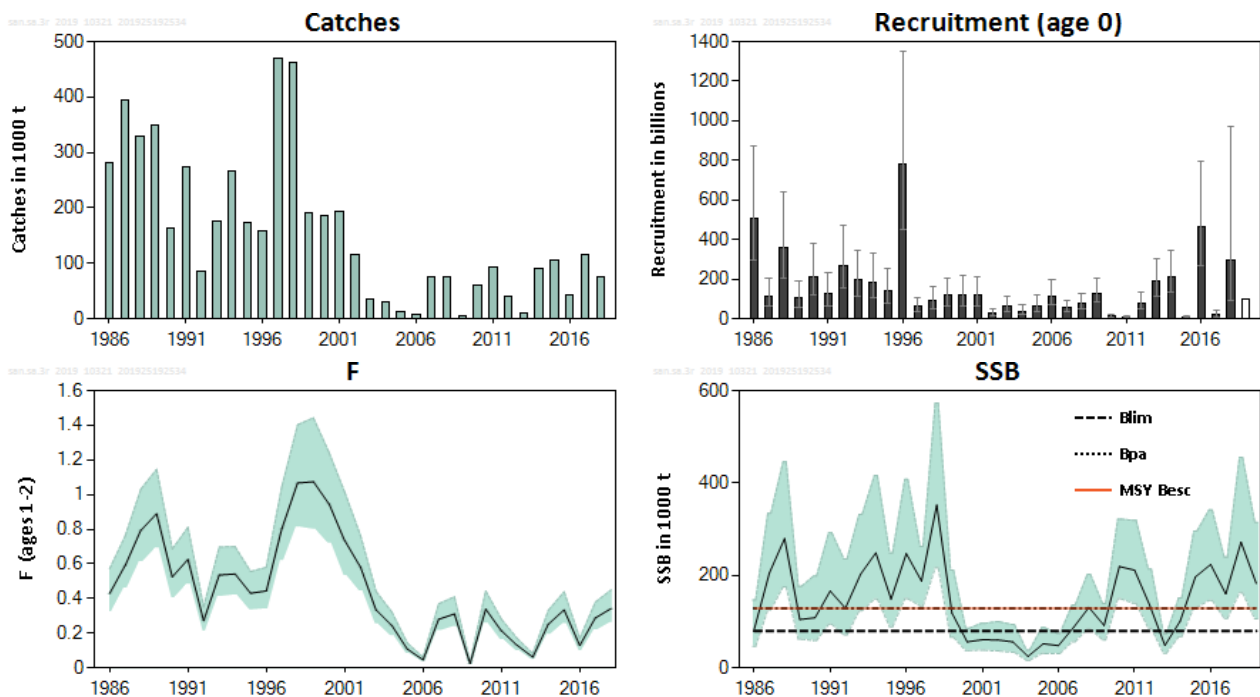


Figure 1 Sandeel in divisions 4.a–b and Subdivision 20, Sandeel Area 3r. Historical development of the stock from the summary of the stock assessment, with 90% confidence intervals. Predicted values are not shaded.

Stock and exploitation status

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

Table 1 Sandeel in divisions 4.a–b and Subdivision 20, Sandeel Area 3r. 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	$MSY B_{escapement}$	✓	✓	✓	Above escapement
Precautionary approach	F_{pa}, F_{lim}	?	?	?	Undefined	B_{pa}, B_{lim}	✓	✓	✓	Full reproductive capacity
Management plan	F_{MGT}	—	—	—	Not applicable	B_{MGT}	—	—	—	Not applicable

Catch scenarios

Table 2 Sandeel in divisions 4.a–b and Subdivision 20, Sandeel Area 3r. The basis for the catch scenarios.

Variable	Value	Notes
F (2018)	0.34	From the assessment
Recruitment (2018)	297 225 004	From the assessment; in thousands
Recruitment (2019)	98 516 877	Geometric mean 1986–2017; in thousands
SSB (2019)	182 590	Tonnes

Table 3 Sandeel in divisions and 4.a–b and Subdivision 20, Sandeel Area 3r. 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 ≥ MSY B _{escapement} with F _{cap}	133610	0.29	262800	+44%	+70%	+23%
Other scenarios						
F = 0	0	0	340918	+87%	0%	0%
SSB ₂₀₂₀ ≥ MSY B _{escapement}	380226	1.12	129000	-29%	+383%	+251%
B _{lim}	482287	1.72	80000	-56%	+513%	+345%
F ₂₀₁₈	154348	0.34	250965	+37%	+96%	+42%

* SSB₂₀₂₀ relative to SSB₂₀₁₉.

** Catch scenario for 2019 relative to TAC in 2018 (78 669 t).

*** Advice value 2019 relative to advice value 2018 (108 365 t).

Recruitment in 2018 is high and, together with the high abundance of age 3, contributes to the increase in catch advice for 2019.

Basis of the advice

Table 4 Sandeel in divisions 4.a–b and Subdivision 20, Sandeel Area 3r. 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

In the past there have been large downward revisions of strong year classes. However, F_{cap} may in part take account of some of this uncertainty.



Figure 2 Sandeel in divisions 4.a–b and Subdivision 20, Sandeel Area 3r. Historical assessment results (final-year recruitment estimates included).

Issues relevant for the advice

The high recruitment in 2018 and the survivors of the large 2016 year class provide the basis for the fishery in 2019. ICES provides catch advice for this stock according to the MSY approach; however, most of this area is within the Norwegian EEZ where fisheries are managed by alternately opening and closing areas (ICES, 2019). ICES has not evaluated this management measure.

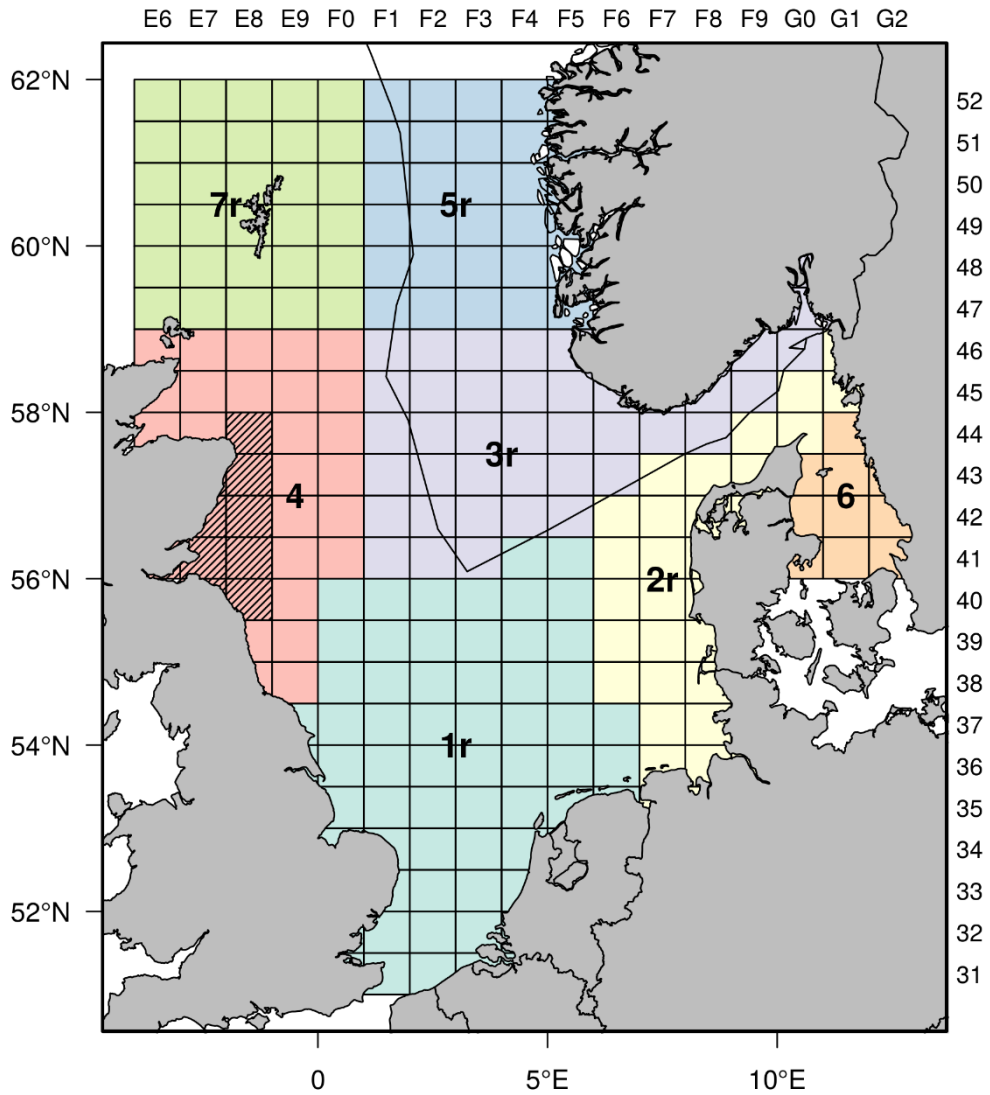


Figure 3 Sandeel in divisions 4.a–b and Subdivision 20, Sandeel Area 3r. Stock areas for the seven sandeel stocks. The border of the Norwegian Exclusive Economic Zone (EEZ) is also shown. The closed part of Sandeel Area 4 is shown with hatched markings.

Reference points

Table 5 Sandeel in divisions 4.a–b and Subdivision 20, Sandeel Area 3r. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{\text{escapement}}$	129 000 t	= B_{pa}	ICES (2017)
	F_{MSY}	Not defined		
	F_{cap}^*	0.29	Maximum F estimated from MSE that results in less than 5% probability of $SSB < B_{\text{lim}}$.	ICES (2017)
Precautionary approach	B_{lim}	80 000 t	The lowest SSB at which a high recruitment is observed.	ICES (2017)
	B_{pa}	129 000 t	$B_{\text{pa}} = B_{\text{lim}} \times \exp(\sigma \times 1.645)$, with $\sigma = 0.29$ 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.a–b and Subdivision 20, Sandeel Area 3r. The basis of the assessment and advice.

ICES stock data category	1 (see ICES, 2018a).
Assessment type	Age-structured model (SMS-effort), half-yearly time-step (ICES, 2019).
Input data	Acoustic survey index (2009–2018) and dredge survey index (2005–2018). Total international catch and fishing effort. Constant maturity-at-age estimated from the dredge survey. Natural mortality estimated from multispecies assessment (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.a–b and Subdivision 20, Sandeel Area 3r. 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	EU zone TAC	Norwegian zone TAC	ICES catch SA 3	ICES catch SA 3r	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**	10000***	30000		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**	0	19000		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**	51000	114000		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**	128000	95000		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**	0	34000		353000

Year	ICES advice	Catch corresponding to advice	EU zone TAC	Norwegian zone TAC	ICES catch SA 3	ICES catch SA 3r	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**	50000	81000		414000
2011	No fishery	0	10000	90000	95000		438000
2012	Catches for monitoring purposes should not exceed 5 000 t.	< 5000	5000	42000	46000		102000
2013	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	< 78331	40000	20000	39000		278000
2014	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	< 270000	140000	90000	143000		264000
2015	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment, with additional F_{cap} .	< 370000	190000	100000	122000		312000
2016	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	≤ 123135	63000	40000	50737	44076	75405
2017 [^]	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	≤ 74176	0	120000		115642	517498
2018 [^]	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	≤ 108365	8669	70000		74933 ^{^^}	270858 ^{^^}
2019	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	≤ 133610					

* Advice for Subarea 4, excluding the Shetland area.

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

*** TAC for EU fisheries set at 10 000 t; seasonal effort limitations set for Norwegian fisheries.

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

^{^^} Preliminary.

History of catch and landings

Table 8 Sandeel in divisions 4.a–b and Subdivision 20, Sandeel Area 3r. Catch distribution by fleet in 2018 as estimated by ICES (in tonnes).

Total catch (2018)	Landings	Discards
74933	100% industrial trawl fisheries	Negligible
	74933	

Table 9 Sandeel in divisions 4.a–b and Subdivision 20, Sandeel Area 3r. History of total catch (in tonnes) as estimated by ICES.

Year	Catch
1982	45648
1983	24828
1984	49111
1985	20859
1986	282334
1987	395298
1988	336919
1989	374252
1990	163224
1991	274839
1992	87022
1993	200123
1994	267281
1995	213168
1996	159304
1997	474093
1998	469183
1999	145159
2000	196177
2001	150534
2002	116007
2003	33788
2004	30496
2005	13994
2006	7008
2007	75391
2008	74992
2009	6362
2010	61243
2011	92452
2012	40134
2013	9844
2014	95464
2015	104631
2016	44076
2017	115642
2018	74933

Summary of the assessment

Table 10 Sandeel in divisions 4.a–b and Subdivision 20, Sandeel Area 3r. Assessment summary with weights (in tonnes) and recruits (at age 0, in thousands). 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 refer to 90% confidence intervals.

Year	Recruitment (age 0)	High	Low	SSB	High	Low	Catch	F	High	Low
	thousands			tonnes			tonnes	ages 1–2		
1986	508512319	873693233	295967474	82951	146961	46821	282315	0.43	0.57	0.32
1987	115409820	207687852	64131948	205253	334657	125887	395296	0.59	0.76	0.46
1988	361582215	638928864	204626376	279847	445782	175679	330358	0.80	1.03	0.61
1989	106005337	190318757	59043742	104715	176262	62210	350409	0.89	1.15	0.69
1990	211555937	380096108	117748942	108445	198731	59177	163224	0.53	0.69	0.40
1991	124522876	229428797	67585006	166209	292352	94493	274839	0.63	0.81	0.48
1992	269748338	472540729	153984961	129444	235327	71202	86788	0.27	0.35	0.21
1993	196466011	347236803	111160145	202805	332433	123724	175786	0.54	0.70	0.41
1994	185209838	332634997	103124098	248948	416020	148972	267281	0.54	0.70	0.42
1995	143235402	255814549	80200209	148747	248670	88976	173607	0.43	0.56	0.33
1996	780152522	1349478967	451017002	247212	407744	149882	159024	0.44	0.58	0.34
1997	61159759	108849408	34364138	187775	262737	134200	470670	0.81	1.05	0.62
1998	92803972	164452625	52371175	352216	572765	216592	462081	1.07	1.40	0.81
1999	117154016	205393982	66823104	118539	211259	66513	191253	1.07	1.44	0.80
2000	121448395	218651774	67457549	56444	85464	37278	186837	0.95	1.24	0.72
2001	117036920	209334462	65434236	60840	96179	38485	193684	0.73	1.01	0.53
2002	27701580	51525891	14893047	60415	99884	36543	116298	0.58	0.77	0.44
2003	61712681	112510690	33849717	56444	94220	33813	34673	0.33	0.44	0.25
2004	39349743	74183412	20872621	25009	38258	16348	31285	0.25	0.32	0.185
2005	67322159	121258490	37376955	52156	87079	31239	13991	0.108	0.143	0.082
2006	115640870	194179209	68868397	48194	74703	31092	7094	0.047	0.062	0.036
2007	57024981	93576970	34750522	87816	136136	56647	74972	0.28	0.37	0.21
2008	79717524	128102014	49607992	130875	202485	84591	74933	0.31	0.41	0.24
2009	129994149	204366601	82687086	91766	139119	60531	6261	0.026	0.035	0.020
2010	13403146	22899609	7844864	219476	321745	149715	61241	0.34	0.44	0.26
2011	9869897	16830819	5787887	211504	319565	139984	92452	0.21	0.28	0.163
2012	78766631	131664592	47121113	135673	213698	86136	40116	0.130	0.171	0.099
2013	188197029	303240050	116798958	48582	73905	31935	9844	0.063	0.083	0.048
2014	214538550	343320723	134063534	101215	151380	67674	90876	0.25	0.33	0.193
2015	8452730	15211014	4697165	196811	295989	130865	104631	0.33	0.44	0.25
2016	463816705	794896934	270633747	223686	341947	146325	42845	0.130	0.171	0.099
2017	19835821	40448932	9727322	160011	239196	107040	115642	0.29	0.38	0.22
2018	297225004	973310631	90765168	272120	455597	162533	74933	0.34	0.45	0.26
2019	**98516877			*182590	314692	105942				

* Using mean weight-at-age from 2014 to 2018.

** Geometric mean (1986–2017).

Sources and references

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. 2018a. Advice basis. *In* Report of the ICES Advisory Committee, 2018. ICES Advice 2018, Book 1, Section 1.2. <https://doi.org/10.17895/ices.pub.4503>

ICES. 2018b. Interim Report of the Working Group on Multispecies Assessment Methods (WGSAM), 16–20 October 2017, San Sebastian, Spain. ICES CM 2017/SSGEPI:20. 395 pp.

ICES. 2019. Sandeel in Division 3.a and Subarea 4. Section 9 *in* Herring Assessment Working Group for the Area South of 62 deg N (HAWG). ICES Scientific Reports. VOL 1:ISS 2. Section 9 is available separately at the [HAWG](#) website.

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