

Sandeel (*Ammodytes* spp.) in divisions 4.b–c, Sandeel Area 1r (central and southern North Sea, Dogger Bank)

ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2021 should be no more than 5464 tonnes. In order to obtain samples to assess the status of the stock in 2022, ICES advises a sampling protocol in the fishery similar to that implemented for a monitoring TAC.

Stock development over time

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

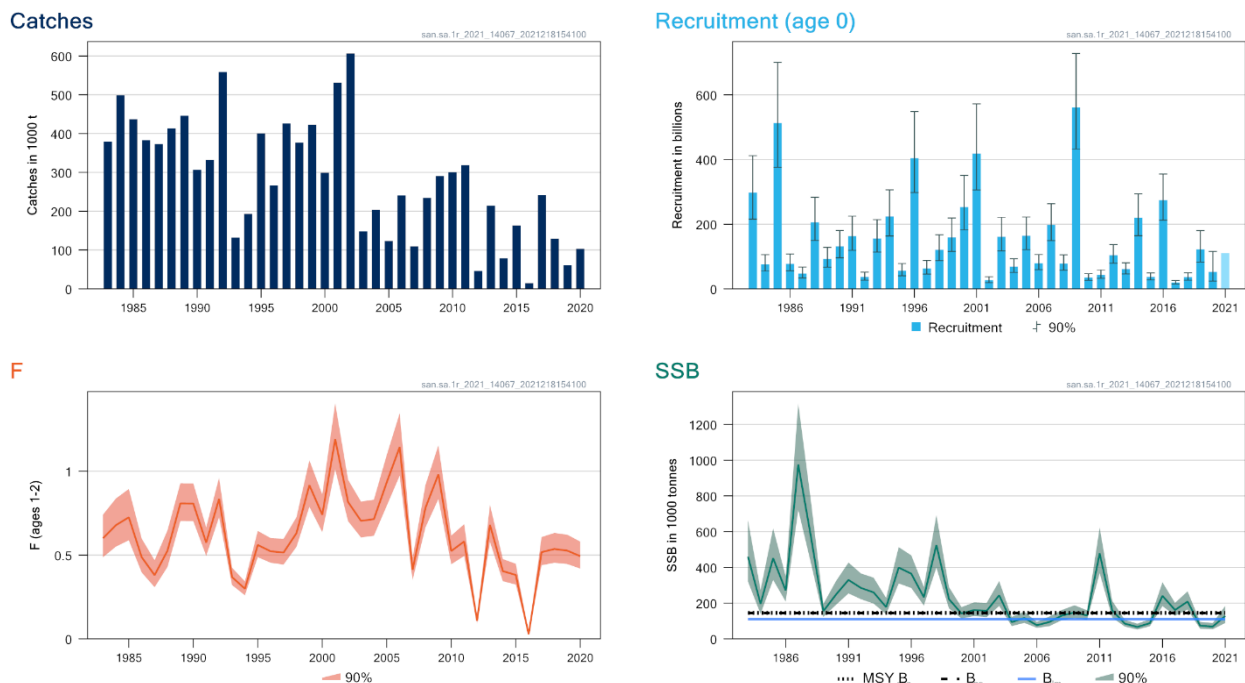


Figure 1 Sandeel in divisions 4.b–c, Sandeel Area 1r. Summary of the stock assessment. The assumed recruitment value for 2021 is shaded in a lighter colour.

Catch scenarios

Table 1 Sandeel in divisions 4.b–c, Sandeel Area 1r. The basis for the catch scenarios.

Variable	Value	Notes
F (2020)	0.49	From the assessment
Recruitment (2020)	52 640 692	From the assessment; in thousands
Recruitment (2021)	110 640 139	Geometric mean 1983–2019; in thousands
SSB (2021)	128 284	From the assessment; in tonnes

Table 2 Sandeel in divisions 4.b–c, Sandeel Area 1r. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2021)	F _{total} (2021)	SSB (2022)	% SSB change *	% TAC change **	% advice change ***
ICES advice basis						
SSB ₂₀₂₂ ≥ MSY B _{escapement}	5464	0.022	145000	13	-95	-95
Other scenarios						
F = 0	0	0	148321	16	-100	-100
SSB ₂₀₂₂ = MSY B _{escapement} = B _{pa}	5464	0.022	145000	13	-95	-95
B _{lim}	64243	0.30	110000	-14	-34	-34
F = F ₂₀₂₀	96104	0.49	91699	-29	-16	-16
ICES MSY advice + transfer of interannual quota flex (8059 tonnes)	13524	0.054	140123	9	-88	-88

* SSB₂₀₂₂ relative to SSB₂₀₂₁.

** Catch scenario for 2021 relative to TAC in 2020 (113 987 t).

*** Advice value 2021 relative to advice value 2020 (113 987 t).

The catch advice for 2021 has decreased compared to 2020 because the 2020 year class is below average and a large reduction in fishing mortality is required to bring the SSB above MSY B_{escapement} at the start of 2022.

Basis of the advice

Table 3 Sandeel in divisions 4.b–c, Sandeel Area 1r. The basis of the advice.

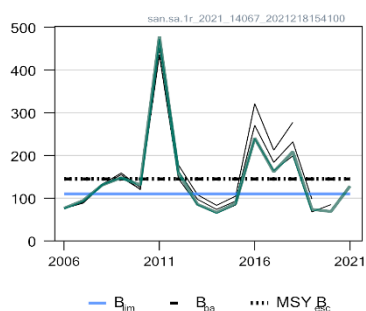
Advice basis	MSY approach (escapement strategy with F _{cap})
Management plan	ICES is not aware of any agreed precautionary management plan for sandeel in this area.

Quality of the assessment

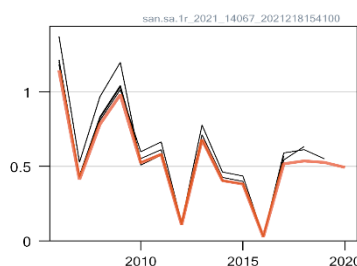
The confidence intervals of SSB, F, and recruitment are estimated to be small; however, the tendency of the assessment to downscale SSB cannot presently be explained or resolved.

The 2018 and 2019 recruitment values have been revised downwards by this year’s assessment.

SSB (thousand tonnes)



F (ages 1-2)



Rec (age 0; Billions)

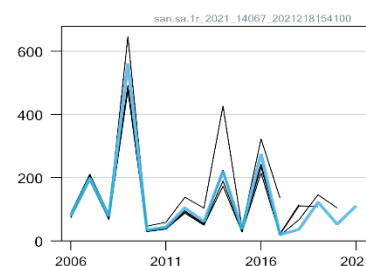


Figure 2 Sandeel in divisions 4.b–c, Sandeel Area 1r. Historical assessment results (final-year recruitment is the geometric mean).

Issues relevant for the advice

The large change in the advice from year to year can be explained by the marked interannual variability of recruitment and biomass as well as early maturation, both of which are typical for a short-lived species.

The TAC was not taken in 2020, so there is a possibility that 8059 tonnes might be transferred to the 2021 TAC. The management strategy evaluation (MSE) conducted for this stock has not accounted for the interannual quota flex practiced for this fishery, and such a practice therefore may be unprecautionary (ICES, 2017).

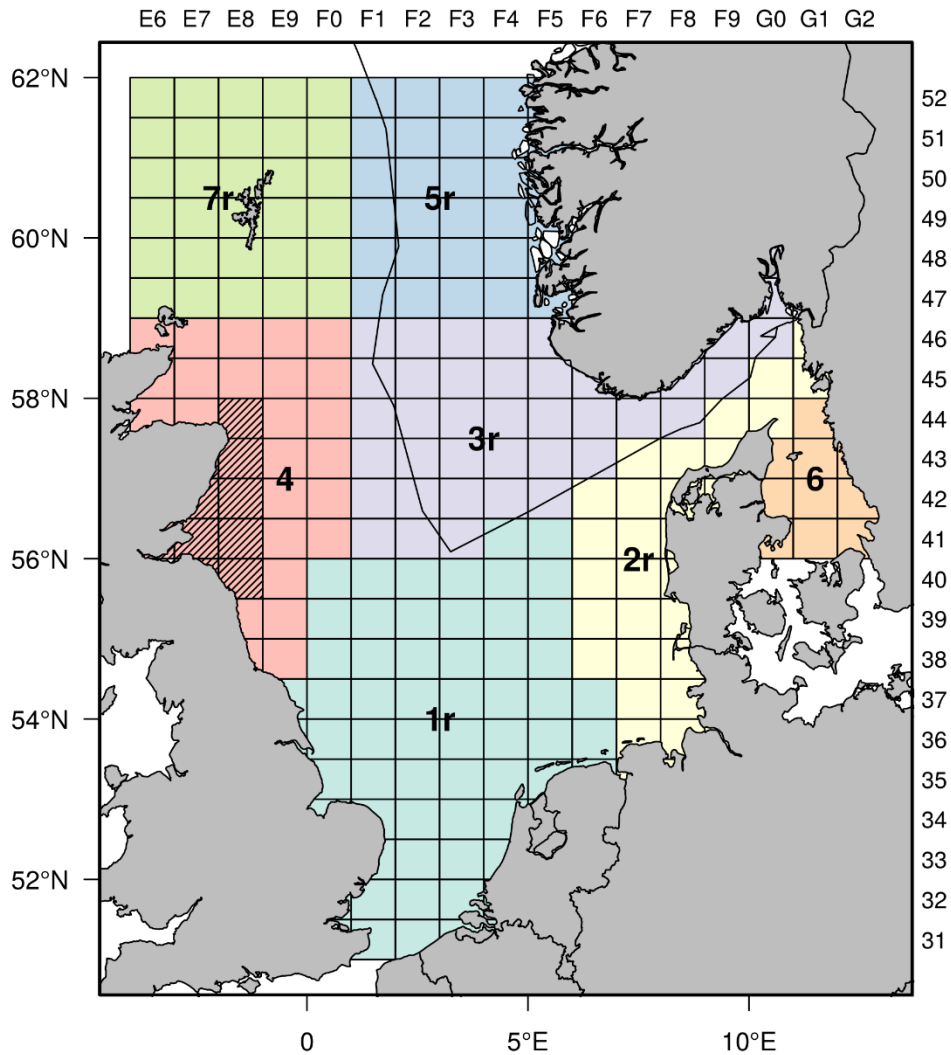


Figure 3 Sandeel in divisions 4.b–c, Sandeel Area 1r. Stock areas for the seven sandeel stocks. The border of the Norwegian Exclusive Economic Zone (EEZ) is shown as a black line. The closed part of Sandeel Area 4 is shown with hatched markings.

Reference points

Table 4 Sandeel in divisions 4.b–c, Sandeel Area 1r. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{\text{escapement}}$	145 000 t	= B_{pa}	ICES (2017)
	F_{MSY}	Not defined		
	F_{cap}^*	0.49	Maximum F, estimated from the management strategy evaluation (MSE), resulting in < 5% probability of $SSB < B_{\text{lim}}$	ICES (2017)
Precautionary approach	B_{lim}	110 000 t	The lowest SSB at which a high recruitment is observed	ICES (2017)
	B_{pa}	145 000 t	$B_{\text{pa}} = B_{\text{lim}} \times \exp(\sigma \times 1.645)$, with $\sigma = 0.17$ 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 ICES MSY approach for stocks of short-lived species.

Basis of the assessment

Table 5 Sandeel in divisions 4.b–c, Sandeel Area 1r. The basis of the assessment and advice.

ICES stock data category	1 (see ICES, 2021a)
Assessment type	Age-structured model (SMS-effort), half-yearly time-steps (ICES, 2021b)
Input data	One survey index (D9376) in December (dredge survey since 2004) and commercial catch rates in April. Total international catch and fishing effort. Annual natural mortality estimated from multispecies assessment (ICES, 2021c). Constant maturity-at-age from surveys. 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)

History of the advice, catch, and management

Table 6 Sandeel in divisions 4.b–c, Sandeel Area (SA) 1r. History of ICES advice, the agreed TAC, and ICES estimates of catch. All weights are in tonnes. Values of catches for the period 2005 to 2015 are presented to the nearest thousand tonnes.

Year	ICES advice	Catch corresponding to advice	TAC	ICES catch SA 1	ICES catch SA 1r	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**	104000		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**	238000		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**	109000		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**	239000		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**	309000		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**	301000		414000
2011	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	< 320000	320000	312000		438000
2012	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	< 23000	23000	46000		102000
2013	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	< 224544	225000	210000		278000
2014	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	< 57000	57000	99000		264000
2015	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	< 133000	133000	163000		312000
2016	Catches for monitoring purposes should not exceed 5 000 t.	≤ 5000	13000	12751	15264	75405

Year	ICES advice	Catch corresponding to advice	TAC	ICES catch SA 1	ICES catch SA 1r	Total ICES catch (SAs 1r–7r)
2017 [^]	MSY approach: allow for sufficient stock (MSY B _{escapement}) to remain for successful recruitment.	≤ 255956	255956		242069	517499
2018 [^]	MSY approach: allow for sufficient stock (MSY B _{escapement}) to remain for successful recruitment.	≤ 134461	134461		131898	269579
2019 [^]	MSY approach: allow for sufficient stock (MSY B _{escapement}) to remain for successful recruitment.	≤ 91916	91916		86723	235537
2020 [^]	MSY approach: allow for sufficient stock (MSY B _{escapement}) to remain for successful recruitment.	≤ 113987	113987		105928 ^{***}	447349 ^{***}
2021 [^]	MSY approach: allow for sufficient stock (MSY B _{escapement}) to remain for successful recruitment.	≤ 5464				

* 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 changed with the 2017 assessment and advice.

History of catch and landings

Table 7 Sandeel in divisions 4.b–c, Sandeel Area 1r. Catch distribution by fleet in 2020 as estimated by ICES (in tonnes).

Total catch (2020)	Landings	Discards
105928	100% industrial trawl fisheries	Discarding is considered negligible.
	105928	

Table 8 Sandeel in divisions 4.b–c, Sandeel Area 1r. History of the total catch (in tonnes) as estimated by ICES.

Year	Catch
1983	382629
1984	498671
1985	460057
1986	382844
1987	373021
1988	422805
1989	446129
1990	306302
1991	332204
1992	558602
1993	144389
1994	193241
1995	400759
1996	291709
1997	426414
1998	377473
1999	424279
2000	374703
2001	508016
2002	610123
2003	178488
2004	215351
2005	126261
2006	247504
2007	110389
2008	236066
2009	309591
2010	300892
2011	319656
2012	46116
2013	214981
2014	98732
2015	164770
2016	15264
2017	242069
2018	131898
2019	86723
2020	105928*

* Preliminary

Summary of the assessment

Table 9 Sandeel in divisions 4.b–c, Sandeel Area 1r. Assessment summary. Weights are in tonnes, recruitment is 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 ICES catch estimates presented in other tables. High and Low refer to 90% confidence intervals.

Year	Recruitment (age 0)	High	Low	SSB	High	Low	Total catch	F ages 1–2	High	Low
	thousands			tonnes			tonnes			
1983	297820049	411617708	215483396	460469	662010	320284	378795	0.60	0.74	0.49
1984	76057485	105771409	54690971	196025	274561	139954	498626	0.68	0.84	0.55
1985	513109587	700381986	375911222	451802	618813	329866	437114	0.73	0.89	0.59
1986	77438916	107880481	55587310	270493	350554	208716	382844	0.49	0.60	0.40
1987	47583661	67512747	33537441	975787	1317673	722608	373021	0.38	0.47	0.31
1988	205920350	283458226	149592379	576079	777203	427002	413646	0.53	0.65	0.43
1989	92618550	128322431	66848763	155127	195552	123059	446028	0.81	0.93	0.70
1990	131563476	180522784	95882347	247459	322623	189806	306240	0.81	0.93	0.70
1991	163610637	224673133	119143933	329720	427270	254442	332204	0.57	0.67	0.50
1992	37058192	51622527	26602913	284930	366005	221815	558599	0.84	0.96	0.73
1993	155942826	214006214	113632986	260146	342749	197451	132024	0.37	0.43	0.32
1994	223741069	306301662	163433870	177726	228891	137998	193241	0.30	0.34	0.26
1995	56288454	78156833	40538875	399113	513589	310153	400588	0.56	0.64	0.49
1996	404030125	548144730	297805183	364762	467505	284598	265869	0.52	0.60	0.45
1997	63148522	87524997	45561108	233048	291023	186622	426089	0.52	0.60	0.44
1998	120842669	167371699	87248625	525445	692205	398859	377073	0.63	0.73	0.55
1999	159252253	219127447	115737579	222571	290366	170604	422718	0.92	1.06	0.79
2000	253025289	350957344	182420451	142201	177559	113885	299167	0.74	0.86	0.64
2001	418421560	572226040	305957070	161458	204469	127494	531265	1.19	1.40	1.01
2002	26775558	37395758	19171439	156530	201138	121814	606466	0.82	0.95	0.70
2003	161174792	221062562	117511140	243775	323038	183960	148039	0.70	0.82	0.61
2004	68819659	93350237	50735227	93620	122685	71441	203646	0.71	0.83	0.62
2005	164102206	222259363	121162653	116891	152720	89468	123422	0.93	1.10	0.79
2006	79478730	106238329	59459412	76344	94628	61592	240646	1.14	1.35	0.97
2007	198242185	263206904	149312057	94466	125322	71208	109624	0.41	0.48	0.35
2008	77827080	105245814	57551499	130614	162074	105260	234447	0.78	0.92	0.67
2009	560870164	727979032	432121431	147709	188039	116029	290995	0.98	1.15	0.83
2010	35039971	46875306	26192887	130875	159912	107111	300508	0.52	0.62	0.45
2011	43618852	58372008	32594463	478303	622663	367412	318840	0.58	0.68	0.49
2012	104218478	137149812	79194356	159213	212668	119194	46117	0.108	0.127	0.092
2013	60976555	80832384	45998151	85391	106172	68678	214359	0.68	0.80	0.58
2014	219749759	293601778	164474334	66636	85212	52110	78830	0.40	0.48	0.34
2015	36910256	49149592	27718785	87904	109562	70527	163381	0.38	0.45	0.32
2016	274647770	355084977	212431961	240867	316331	183406	14613	0.027	0.031	0.023
2017	19677767	25815659	14999212	161619	201749	129472	241916	0.52	0.61	0.44
2018	36433528	49707152	26704446	208772	266020	163845	129525	0.54	0.63	0.45
2019	122179276	180186155	82846407	73718	95740	56761	60678	0.53	0.62	0.45
2020	52640692	115793592	23930880	68734	88558	53348	103282	0.49	0.58	0.42
2021	110640139**			128284*	184985	88962				

* Using mean weight-at-age from 2016 to 2020.

** Geometric mean (1983–2019).

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. 2021a. Advice on fishing opportunities. *In* Report of the ICES Advisory Committee, 2021. ICES Advice 2021, section 1.1.1. <https://doi.org/10.17895/ices.advice.7720>.

ICES. 2021b. Herring Assessment Working Group for the Area South of 62° N (HAWG). ICES Scientific Reports. 779 pp. 3:12. <https://doi.org/10.17895/ices.pub.8214>.

ICES. 2021c. Working Group on Multispecies Assessment Methods (WGSAM; outputs from 2020 meeting). ICES Scientific Reports. 3:10. 231 pp. <https://doi.org/10.17895/ices.pub.7695>.

Recommended citation: ICES. 2021. Sandeel (*Ammodytes* spp.) in divisions 4.b and 4.c, Sandeel Area 1r (central and southern North Sea, Dogger Bank). *In* Report of the ICES Advisory Committee, 2021. ICES Advice 2021, san.sa.1r, <https://doi.org/10.17895/ices.advice.7672>.