

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 2021.

In order to obtain samples to assess the status of the stock in 2022, ICES advises a monitoring TAC in 2021. Catches should not exceed 5000 tonnes and should have an associated sampling protocol in the fishery.

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.

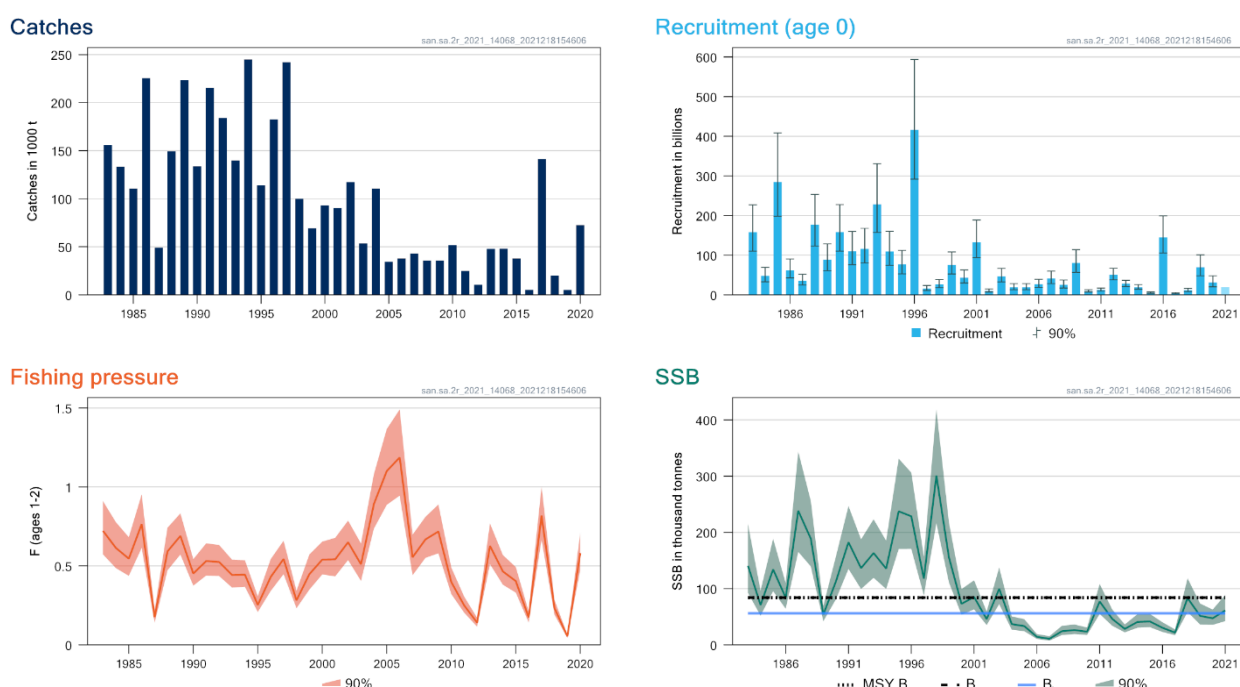


Figure 1 Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. Summary of the stock assessment. The assumed recruitment value for 2021 is shaded in a lighter colour.

Catch scenarios

Table 1 Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. The basis for the catch scenarios.

Variable	Value	Notes
F (2020)	0.58	From the assessment
Recruitment (2020)	31 046 604	From the assessment; in thousands
Recruitment (2021)	19 648 759	Geometric mean 2010–2019; in thousands
SSB (2021)	61 329	From the assessment; in tonnes

Table 2 Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. 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						
MSY approach: zero catch	0	0	72623	18	-100	-100
Other scenarios						
$F = 0$	0	0	72623	18	-100	-100
$SSB_{2022} = MSY B_{\text{escapement}} = B_{pa}^{\wedge}$	-	-	-	-	-	-
B_{lim}	25615	0.26	56000	-8.6	-59	-59
$F_{2021} = F_{sq}$	49562	0.58	40867	-33	-21	-21
5000 tonnes monitoring TAC	5000	0.045	69351	13	-92	-92

* SSB_{2021} relative to SSB_{2020} .

** Catch scenario for 2021 relative to TAC in 2020 (62 658 t).

*** Advice value 2021 relative to advice value 2020 (62 658 t).

\wedge $MSY B_{\text{escapement}}$ and B_{pa} cannot be achieved by 2022 even with zero catch advice.

Zero catch is advised because stock size in 2022 is expected to remain below $MSY B_{\text{escapement}}$ with zero catches in 2021 due to the current low stock size and below average incoming 2020 year class.

Basis of the advice

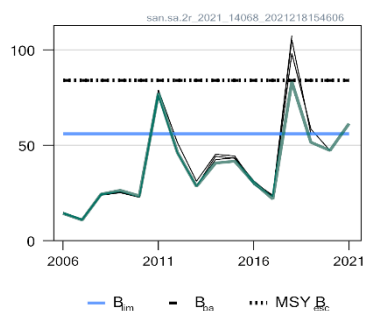
Table 3 Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. The basis of the advice.

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.

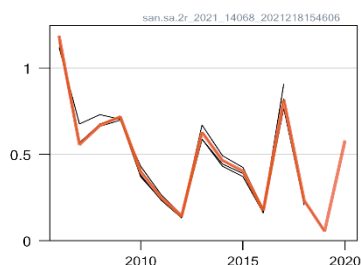
Quality of the assessment

The assessment this year is consistent with the assessments from 2019 and 2020.

SSB (thousand tonnes)



F (ages 1-2)



Rec (age 0; Billions)

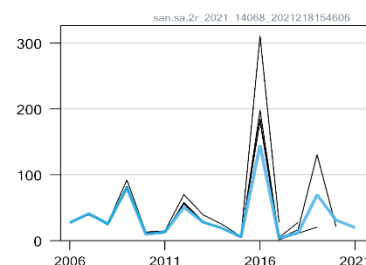


Figure 2 Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. Historical assessment results (final-year recruitment is the geometric mean).

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 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 2021 is based on obtaining a minimum of 30 samples in order to provide information on abundance and the mean weight of sandeel in the assessment (ICES, 2014). Catches equal to the monitoring TAC will result in an F of 0.045 in 2021 and an SSB in 2022 that is 4.5% below the predicted SSB in 2022 with zero catch.

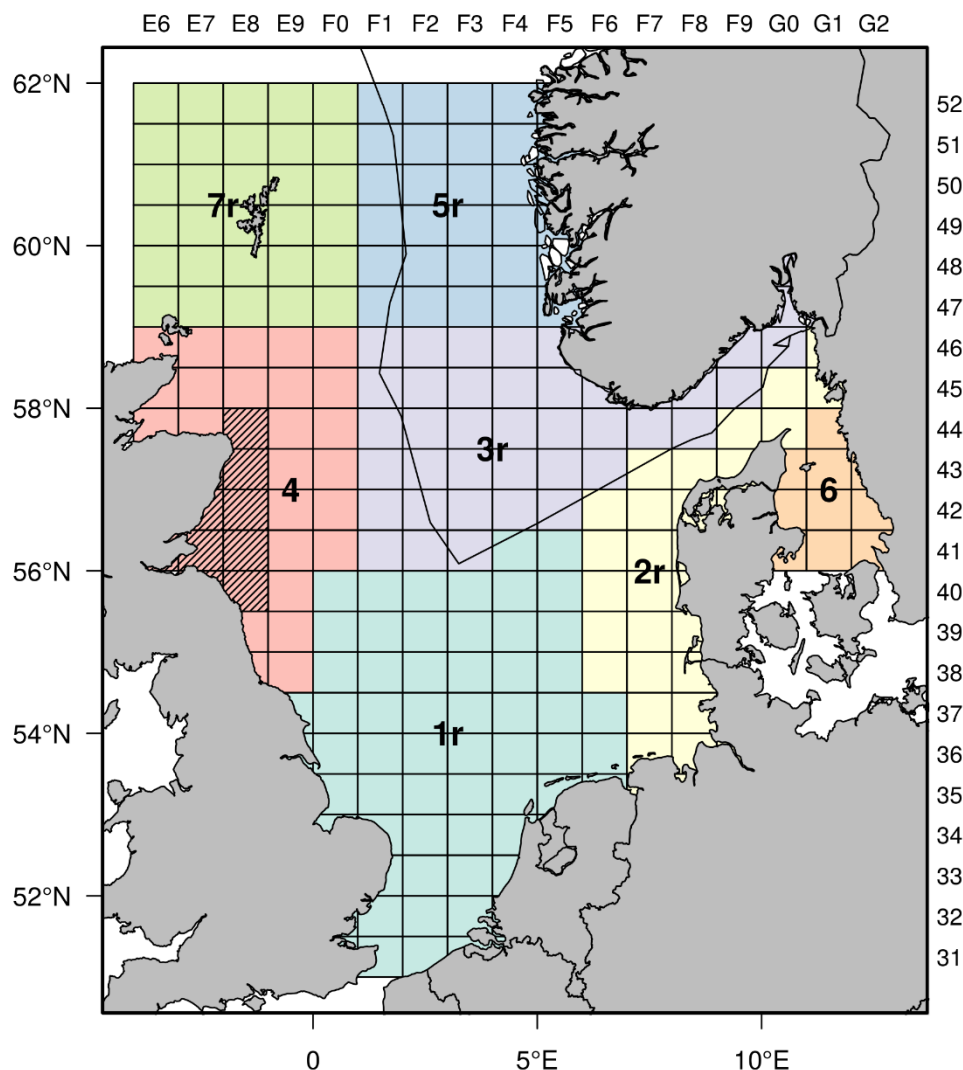


Figure 3 Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. Stock areas for the seven sandeel stocks. The border of the Norwegian Exclusive Economic Zone (EEZ) is shown as a black line. The closed part of Sandeel Area 4 is shown with hatched markings.

Reference points

Table 4 Sandeel in divisions 4.b–c 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 a management strategy evaluation (MSE), resulting in < 5% probability of SSB < B _{lim}	ICES (2017)
Precautionary approach	B _{lim}	56 000 t	Average SSB of the two lowest SSB estimates (in 2001 and 2009) that provide high recruitment	ICES (2017)
	B _{pa}	84 000 t	B _{pa} = B _{lim} × exp(σ × 1.645), with σ = 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 ICES MSY approach for stocks of short-lived species.

Basis of the assessment

Table 5 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, 2021a)
Assessment type	Analytical age-based (SMS-effort), half-yearly time-steps (ICES, 2021b)
Input data	One survey index (D9376) (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, 2018). Age frequencies from catch sampling.
Discards and bycatch	Discarding is considered to be negligible.
Indicators	None
Other information	Last benchmarked in 2016 (ICES, 2017). Inter-benchmarked in 2020 (ICES, 2020).
Working group	Herring Assessment Working Group (HAWG)

History of advice, catch, and management

Table 6 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
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	9569	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		20240	269579

Year	ICES advice	Catch corresponding to advice	TAC	ICES catch SA 2	ICES catch SA 2r	Total ICES catch (SAs 1r–7r)
2019 [^]	Catches for monitoring purposes should not exceed 5000 t.	≤ 5000	5000		5151	235537
2020 [^]	MSY approach: allow for sufficient stock (MSY $B_{\text{escapement}}$) to remain for successful recruitment.	≤ 62658	62658		73921***	447349***
2021 [^]	MSY approach: zero catch. Monitoring TAC 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 changed with the 2017 assessment and advice.

History of catch and landings

Table 7 Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. Catch distribution by fleet in 2020 data as estimated by ICES (in tonnes).

Total catch (2020)	Landings	Discards
73921	100% industrial trawl fisheries	Discarding is considered negligible.
	73921	

Table 8 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
2007	43402
2008	35120
2009	36709

Year	Catch
2010	51635
2011	24897
2012	12552
2013	47847
2014	65084
2015	37899
2016	9569
2017	141314
2018	20240
2019	5151
2020	73921*

* Preliminary

Summary of the assessment

Table 9 Sandeel in divisions 4.b–c and Subdivision 20, Sandeel Area 2r. 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 represent 90% confidence intervals.

Year	Recruitment (age 0)	High	Low	SSB	High	Low	Total Catch	Fishing pressure ages 1–2	High	Low
	thousands			tonnes			tonnes			
1983	158141380	227152379	110096562	140646	214375	92274	155664	0.72	0.91	0.57
1984	47870021	69435093	33002604	70827	96493	51988	133343	0.61	0.78	0.49
1985	284715217	408544631	198418358	134188	188675	95437	110546	0.55	0.68	0.44
1986	62146186	90487237	42681692	83952	109771	64206	225470	0.77	0.95	0.61
1987	35819393	51913034	24714966	238470	343789	165416	49070	0.176	0.22	0.140
1988	176706372	253505955	123173209	188905	255810	139498	149466	0.59	0.74	0.47
1989	88543100	128670035	60930119	54068	69465	42084	223507	0.69	0.83	0.57
1990	158457979	227648328	110297015	112758	157110	80927	133874	0.45	0.54	0.38
1991	110331497	160185106	75993577	182590	246865	135051	215508	0.53	0.64	0.44
1992	115988314	167844851	80153123	136489	187593	99307	184033	0.53	0.63	0.44
1993	228260939	330813062	157499996	163244	223389	119292	139826	0.44	0.54	0.36
1994	109342968	160514535	74484749	135673	185205	99387	244939	0.45	0.54	0.37
1995	77052688	112285841	52875025	237518	331155	170358	113899	0.25	0.31	0.21
1996	416334674	593871337	291872246	228662	306294	170706	182562	0.43	0.54	0.34
1997	16094691	23790671	10888262	117712	156911	88306	242094	0.54	0.66	0.45
1998	26456171	38615101	18125784	301040	418643	216474	99814	0.28	0.34	0.23
1999	75451453	108144264	52641921	155282	217355	110936	69427	0.45	0.57	0.35
2000	43488192	62876230	30078502	72984	99193	53700	92908	0.54	0.65	0.45
2001	133018663	188798125	93718964	85136	114804	63134	90200	0.54	0.68	0.43
2002	10252171	14929274	7040329	45752	59321	35288	117388	0.65	0.79	0.54
2003	46688106	66954211	32556268	99708	137381	72366	53710	0.51	0.64	0.41
2004	19249584	28402227	13046388	36901	50593	26915	110546	0.89	1.08	0.74
2005	19249584	28493950	13004391	33323	45747	24273	34396	1.10	1.37	0.89
2006	27044656	39333389	18595230	14192	19186	10497	37860	1.19	1.49	0.95
2007	41202109	59862715	28358449	10800	15474	7538	43090	0.56	0.70	0.44
2008	25418810	37412320	17270137	24367	33980	17474	35604	0.67	0.81	0.55
2009	80357822	114002197	56642589	26344	36170	19187	35687	0.72	0.89	0.58
2010	9435597	12796153	6957598	23435	30887	17781	51670	0.40	0.49	0.32
2011	12787773	17262535	9472950	77111	108199	54955	24896	0.25	0.31	0.20
2012	50374719	67161643	37783655	46212	62925	33938	10594	0.141	0.172	0.115
2013	27840434	37055172	20917182	28424	36328	22240	47814	0.63	0.77	0.51

Year	Recruitment (age 0)	High	Low	SSB	High	Low	Total Catch	Fishing pressure ages 1–2	High	Low
	thousands			tonnes			tonnes			
2014	19288122	25902948	14362521	40660	54438	30369	48033	0.47	0.57	0.38
2015	5443866	7421215	3993372	41606	55051	31445	37902	0.40	0.49	0.33
2016	144964581	199218718	105485719	30364	40189	22940	5230	0.174	0.21	0.142
2017	4077522	5823375	2855077	21820	27563	17274	141314	0.82	1.00	0.67
2018	11710542	16233694	8447664	83200	118425	58452	20239	0.23	0.28	0.191
2019	69650470	101030788	48016926	51534	73489	36138	5090	0.054	0.066	0.044
2020	31046604	48090156	20043429	47240	62780	35547	72612	0.58	0.71	0.48
2021	19648759*			61329**	42245	89033				

* Geometric mean (2010–2019).

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

Sources and references

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