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

ICES advice on fishing opportunities

ICES advises that when the MSY approach and precautionary considerations are applied, there should be zero catch in 2022.

Stock development over time

Spawning-stock size is below MSY $B_{escapement}$ and between B_{pa} and B_{lim}. No reference points for fishing pressure have been defined for this stock.

Figure 1   Sandeel in divisions 4.a–b, Sandeel Area 4. Summary of the stock assessment. The assumed recruitment value for 2022 is shaded in a lighter colour. Uncertainty bounds of recruitment in 2005 and 2006 are not shown as these could not be reliably estimated.

Catch scenarios

Table 1   Sandeel in divisions 4.a–b, Sandeel Area 4. Values in the forecast.

Variable	Value	Notes
F_{1-2} (2021)	0.44	Assessment model estimate. Selection pattern in 2022 assumed to be the same as 2021.
Recruitment (2021)	46548252	Assessment model estimate.;thousands
Recruitment (2022)	55898143	Geometric mean 2011–2020; thousands
SSB (2022)	72766	Assessment model estimate; tonnes

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

Basis	Total catch (2022)	F_{total} (2022)	SSB (2023)	% SSB change *	% TAC change **	% advice change ***
ICES advice basis						
SSB(2023) ≥ MSY $B_{escapement}$ with F_{cap}	0	0	70783	−2.7	−100	−100
Other scenarios						
F = 0	0	0	70783	−2.7	−100	−100
SSB(2023) = MSY $B_{escapement}$ = B_{pa}^	-	-	-	-	-	-
SSB(2023) = B_{lim}	38317	0.32	48000	−34	−50	−51
F = F_{2021}	49577	0.44	41872	−42	−35	−36
5000 tonnes monitoring TAC	5000	0.0349	67714	−6.9	−93	−94

* SSB_{2023} relative to SSB_{2022}.

** Catch scenario for 2022 relative to the TAC in 2021 (75 914 t).

*** Advice value 2022 relative to advice value 2021 (77 512 t).

^ MSY $B_{escapement}$ and B_{pa} cannot be achieved by 2023 even with zero catch advice.

Zero catch is advised because there is no catch that will maintain the stock above MSY $B_{escapement}$ in 2023 due to low recruitment since 2020

Basis of the advice

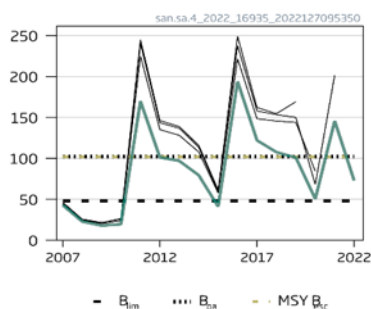**Table 3**   Sandeel in divisions 4.a–b, Sandeel Area 4. The basis of the advice.

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 of the estimated SSB and F is large in the assessment. This uncertainty results from a period of low commercial fishing effort (2004–2016), no data on catch age composition (2006–2011), and no survey indices (2004–2007).

The 2022 assessment estimates lower SSB and recruitment across the time-series compared to previous assessments. The 2019 and 2020 recruitments were downscaled by 23% and 79%, respectively, as compared to last year.
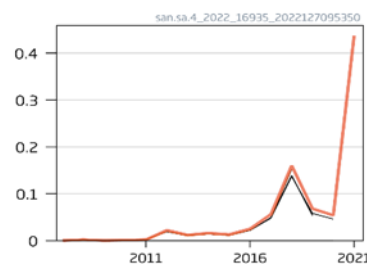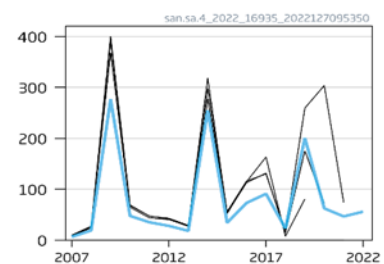

Figure 2   Sandeel in divisions 4.b–c, Sandeel Area 4. Historical assessment results (final-year recruitment includes geometric means).

Issues relevant for the advice

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

In order to obtain samples to assess the status of the stock in 2023, ICES recommends a monitoring TAC in 2022. Catches should not exceed 5000 tonnes and should have an associated sampling protocol in the fishery (ICES, 2017).

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 are obtained from samples from the commercial fishery.

The advice monitoring TAC of 5000 t in 2022 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).
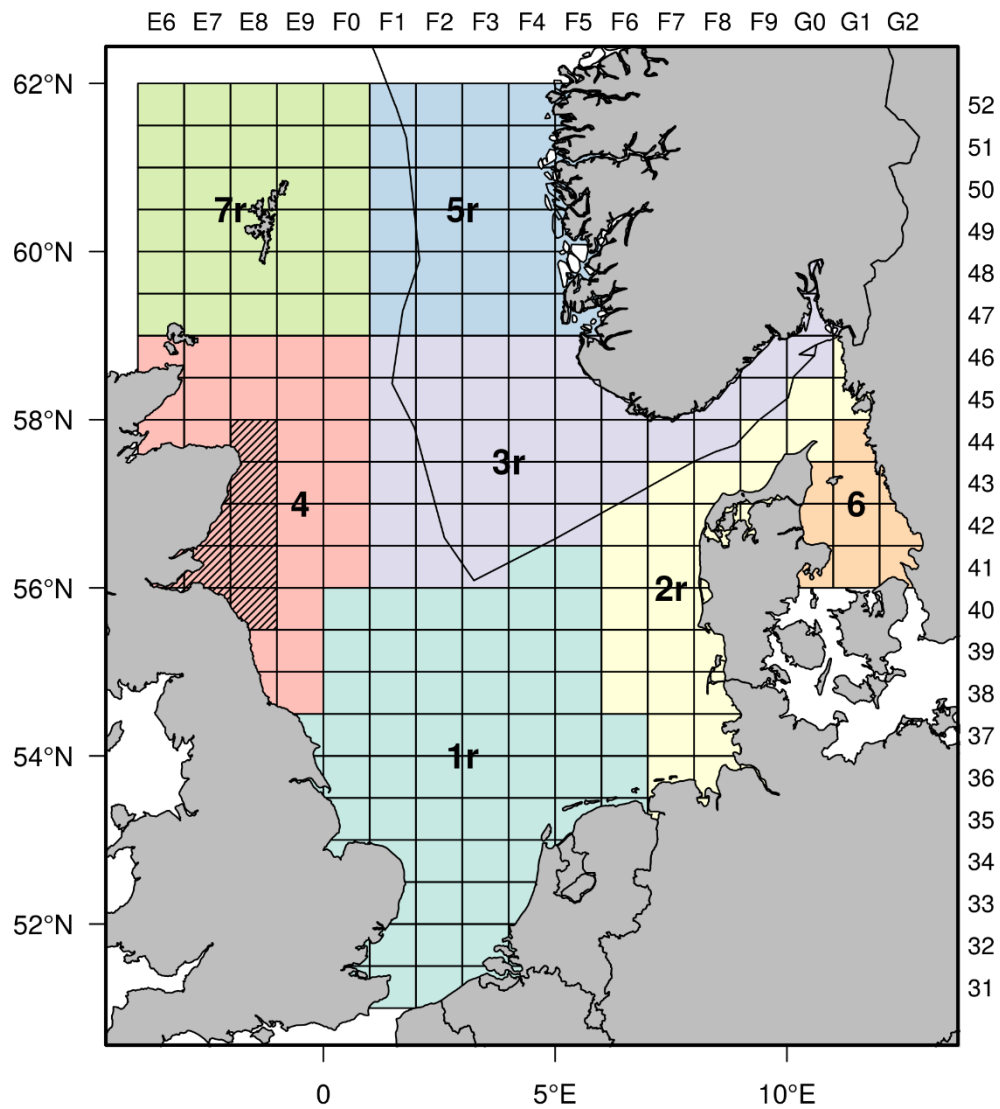
Figure 3 Sandeel in divisions 4.a–b, Sandeel Area 4. Stock areas for the seven sandeel stocks. The border of the Norwegian Exclusive Economic Zone (EEZ) is shown as a black line. The closed area in Sandeel Area 4 is shown with hatched markings.

Reference points

Table 4   Sandeel in divisions 4.a and 4.b, Sandeel Area 4. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{escapement}$	102000	B_{pa}; tonnes	ICES (2017)
	F_{MSY}	Not defined		
	F_{cap}*	0.15	The maximum F estimated from the management strategy evaluation (MSE) that results in < 5% probability of SSB < B_{lim}	ICES (2017)
Precautionary approach	B_{lim}	48000	The average SSB of the two lowest SSB estimates that provide high recruitment (2003, 2009); tonnes.	ICES (2017)
	B_{pa}	102000	$B_{pa} = B_{lim} \times \exp(\sigma \times 1.645)$, with $\sigma = 0.46$ estimated from the assessment uncertainty in the terminal year; tonnes	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.a and 4.b, Sandeel Area 4. The basis of the assessment.

ICES stock data category	1 (see ICES, 2021)
Assessment type	Age-structured model (SMS-effort), half-yearly time-step (ICES, 2022)
Input data	One survey index available in January (dredge survey since 1999; D9376). Total international catch and fishing effort. Fixed maturity data. 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)
Working group	Herring Assessment Working Group (HAWG)

History of advice, catch, and management

Table 6   Sandeel in divisions 4.a–b, Sandeel Area 4. 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 4	Total ICES catch (SAs 1r–7r)
2005*	Exploitation to be kept below level of 2003. Adjustment to be made conditional on the abundance of the 2004 year class	-	661000**	1557	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**	55	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**	11	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**	1168	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	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**	275	414000
2011	A TAC at 5000–10 000 tonnes will impose a low risk of overfishing sandeel in this area	5000–10000	10000	272	438000

Year	ICES advice	Catch corresponding to advice	TAC	ICES catch SA 4	Total ICES catch (SAs 1r–7r)
2012	Catches for monitoring purposes should not exceed 5000 tonnes	< 5000	5000	2585	102000
2013	Catch in 2012 reduced by 20% as a precautionary buffer	< 2041	4000	5225	278000
2014	Catches for monitoring purposes should not exceed 5000 tonnes (with associated sampling protocol)	< 5000	5000	4414	264000
2015	Catches for monitoring purposes should not exceed 5000 tonnes (with associated sampling protocol)	< 5000	5000	4392	312000
2016	Precautionary approach	≤ 6000	6000	6232	75405
2017	MSY approach: allow for sufficient stock (MSY $B_{escapement}$) to remain for successful recruitment	≤ 54043	54043	18474	517499
2018	MSY approach: allow for sufficient stock (MSY $B_{escapement}$) to remain for successful recruitment	≤ 59345	59345	42298	269579
2019	Catches for monitoring purposes should not exceed 5000 tonnes	≤ 5000	5000	6666	235537
2020	MSY approach: allow for sufficient stock (MSY $B_{escapement}$) to remain for successful recruitment	≤ 39611	39611	20116	446765
2021	MSY approach: allow for sufficient stock (MSY $B_{escapement}$) to remain for successful recruitment	≤ 77512	75914	53370***	233178***
2022	MSY approach: zero catch	0			

* Advice for Subarea 4, excluding the Shetland area.
** Set for EU waters of divisions 2.a and 3.a, and Subarea 4.
*** Preliminary.

History of catch and landings

Table 7   Sandeel in divisions 4.a–b, Sandeel Area 4. Catch distribution by fleet in 2021 as estimated by ICES (in tonnes).

Total catch (2021)	Landings	Discards
53370	100% industrial trawl fisheries	Discarding is considered negligible
	53370	

Summary of the assessment

Table 8   Sandeel in divisions 4.a–b, Sandeel Area 4. Assessment summary. All weights are in tonnes, recruitment age 0 is in thousands. The SSB is estimated for 1 January. Zero catch denotes years with very low catches in which there was no biological sampling of the fishery.

Year	Recruitment Age 0	High	Low	SSB	High	Low	Total catches	Fages 1–2	High	Low
	thousands			tonnes			tonnes			
1993	119043556	192154809	73749745	366957	554222	242967	133136	0.43	0.59	0.32
1994	233805469	370551496	147523348	145801	218176	97435	158690	0.50	0.68	0.37
1995	62332904	103761589	37445368	120090	187296	76999	52591	0.142	0.194	0.104
1996	329142057	533203902	203176483	228662	344978	151564	158490	0.38	0.53	0.27
1997	93642978	166771290	52581036	72330	114759	45589	58446	0.189	0.26	0.138
1998	42118600	69222822	25627046	226387	357574	143330	58911	0.195	0.27	0.142
1999	225538177	337649852	150651537	169397	258679	110930	53338	0.28	0.38	0.20
2000	182817693	271442814	123128361	69564	111850	43264	37792	0.137	0.187	0.100
2001	23277552	35655074	15196839	103881	155708	69304	47918	0.22	0.30	0.159
2002	79957036	125640160	50884428	111302	166215	74531	12762	0.046	0.062	0.033
2003	154545638	254593083	93813837	63831	94800	42979	64049	0.35	0.48	0.26
2004	11570855	39609504	3380115	53210	87217	32462	6882	0.066	0.090	0.048

Year	Recruitment Age 0	High	Low	SSB	High	Low	Total catches	Fages 1–2	High	Low
	thousands			tonnes			tonnes			
2005	6948247	***	***	79937	126376	50563	1557	0.029	0.039	0.021
2006	4248175	***	***	80178	126531	50805	86	0.00	0.00100	0.00
2007	6305924	12043831	3301663	42702	82816	22018	11	0.00	0.00	0.00
2008	19038999	34330243	10558721	22652	55990	9164	1168	0.0020	0.0030	0.0020
2009	276577049	477115971	160327612	17771	40950	7712	0	0.00	0.00	0.00
2010	47583661	81477276	27789402	19456	34133	11090	275	0.00100	0.0020	0.00100
2011	35039971	59745657	20550441	169736	288604	99827	270	0.0020	0.0030	0.0020
2012	27979985	48334297	16197185	101114	164142	62287	2618	0.022	0.030	0.0160
2013	18201235	31753247	10433105	96761	155002	60404	5119	0.0120	0.0170	0.0090
2014	254548005	417578167	155167803	79301	125009	50305	4505	0.0160	0.022	0.0120
2015	34038405	58018823	19969605	40905	64536	25926	4736	0.0130	0.0180	0.0100
2016	73075229	121962231	43783957	193881	310217	121173	6232	0.025	0.035	0.0190
2017	90966330	147839632	55971955	121905	192811	77075	18474	0.056	0.076	0.041
2018	23115178	39717628	13452753	107474	169039	68331	42298	0.160	0.22	0.117
2019	200635422	330601350	121761671	100811	160964	63137	6666	0.068	0.093	0.050
2020	62395268	112408369	34634160	50312	80027	31631	20116	0.054	0.073	0.039
2021	46548252	127859805	16946215	145656	233765	90756	53370^	0.44	0.60	0.32
2022	55898143*			72766**	128613**	41169**				

* Geometric mean (2011–2020).
** Mean weight-at-age (2017–2021).
*** Uncertainty bounds not reliably estimated.
^ Preliminary.

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Download the stock assessment data and figures.

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