

## 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 is applied, catches in 2021 should be no more than 77 512 tonnes.

### Stock development over time

ICES assesses that the spawning-stock size is above  $MSY B_{escapement}$  and  $B_{pa}$ . 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 2021 is shaded in a lighter colour.

### Catch scenarios

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

Variable	Value	Notes
F (2020)	0.0462	From the assessment
Recruitment (2020)	303 836 413	Estimated from the assessment; in thousands
Recruitment (2021)	73 785 221	Geometric mean 2010–2019; in thousands
SSB (2021)	201 592	From the assessment; in tonnes

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

Basis	Total catch (2021)	$F_{\text{total}}$ (2021)	SSB (2022)	% SSB change *	% TAC change **	% advice change ***
ICES advice basis						
$\text{SSB}_{2022} \geq \text{MSY } B_{\text{escapement}}$ with $F_{\text{cap}}$	77512	0.15	266680	32	96	96
Other scenarios						
$F = 0$	0	0	307491	53	-100	-100
$\text{SSB}_{2022} = \text{MSY } B_{\text{escapement}} = B_{\text{pa}}$	419269	1.22	102000	-49	958	958
$B_{\text{lim}}$	555552	2.13	48000	-76	1303	1303
$F = F_{2020}$	24989	0.046	294232	46	-37	-37

\*  $\text{SSB}_{2022}$  relative to  $\text{SSB}_{2021}$ .

\*\* Catch scenario for 2021 relative to the TAC in 2020 (39 611 t).

\*\*\* Advice value 2021 relative to advice value 2020 (39 611 t).

The large increase in the advised catch is driven by the high 2019 and 2020 recruitments.

### Basis of the advice

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

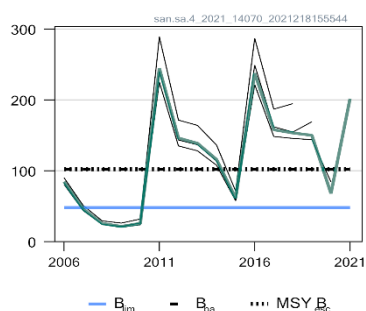
Advice basis	MSY approach (escapement strategy with $F_{\text{cap}}$ )
Management plan	ICES is not aware of any agreed precautionary management plan for sandeel in this area.

### Quality of the assessment

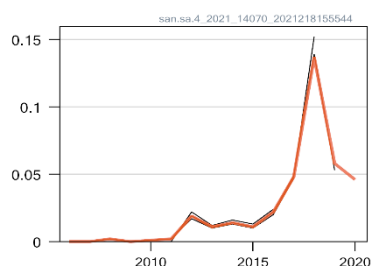
The uncertainty of the estimated SSB and  $F$  is large in the assessment. This uncertainty results from a period of low commercial fishing effort (2004–2016), no data on catch age composition (2006–2011), and no survey indices (2004–2007). The 2019 recruitment was upscaled considerably (more than doubled) with the inclusion of the 2020 dredge survey.

The number of sample stations in the dredge survey in 2020 was considerably less (11 stations) compared to last year (50 stations) and only covered two out of the four banks normally covered by the survey. This generated a bias in the index, which was corrected by the working group (ICES, 2021b).

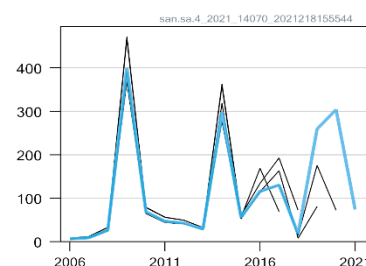
**SSB (thousand tonnes)**



**F (ages 1-2)**

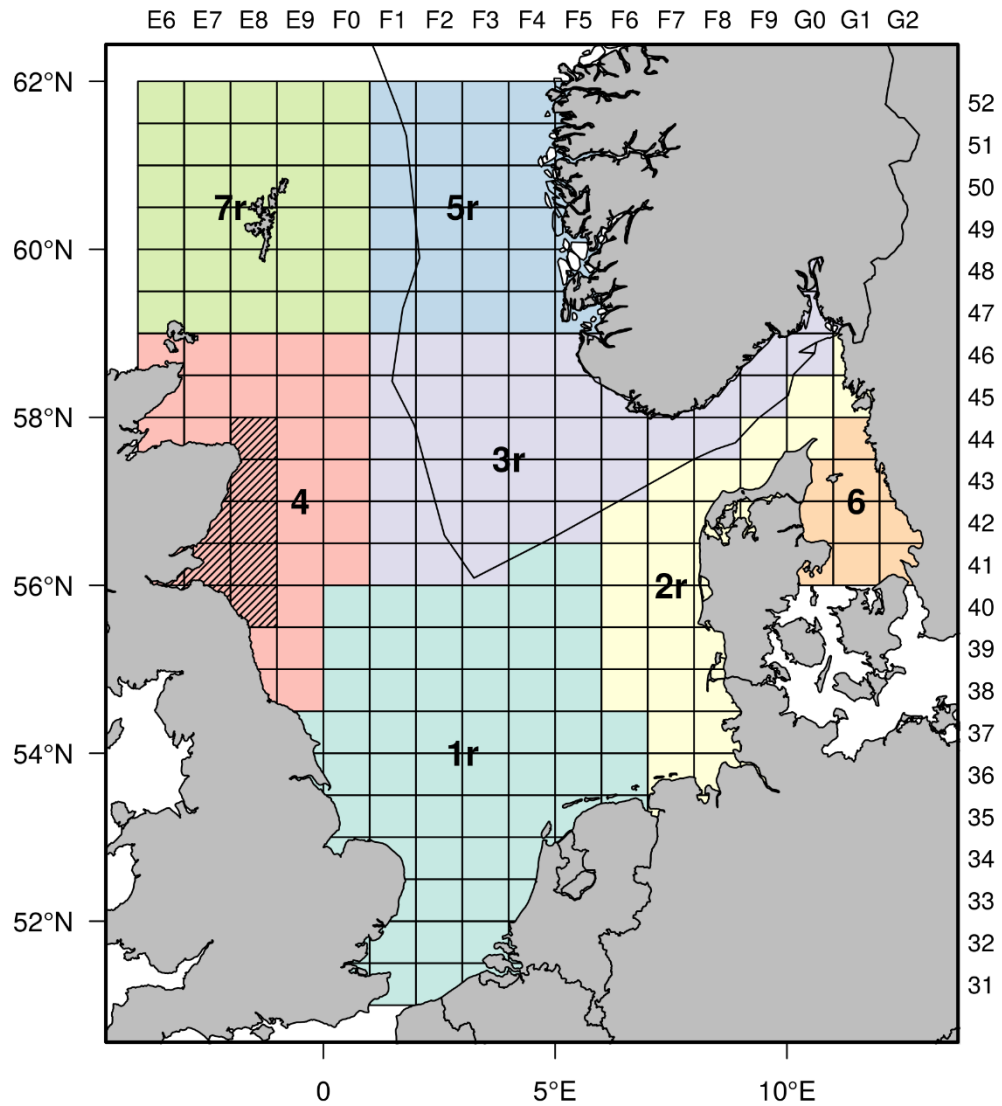


**Rec (age 0; Billions)**



**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



**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 $B_{\text{escapement}}$	102000 t	$= B_{\text{pa}}$	ICES (2017)
	$F_{\text{MSY}}$	Not defined		
	$F_{\text{cap}}^*$	0.15	The maximum F estimated from the management strategy evaluation (MSE) that results in < 5% probability of $SSB < B_{\text{lim}}$	ICES (2017)
Precautionary approach	$B_{\text{lim}}$	48000 t	The average SSB of the two lowest SSB estimates that provide high recruitment (2003, 2009)	ICES (2017)
	$B_{\text{pa}}$	102000 t	$B_{\text{pa}} = B_{\text{lim}} \times \exp(\sigma \times 1.645)$ , with $\sigma = 0.46$ estimated from the assessment uncertainty in the terminal year	ICES (2017)
	$F_{\text{lim}}$	Not defined		
Management plan	$SSB_{\text{MGT}}$	Not defined		
	$F_{\text{MGT}}$	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 <a href="#">ICES, 2021a</a> )
Assessment type	Age-structured model (SMS-effort), half-yearly time-step (ICES, 2021b)
Input data	One survey index available in January (dredge survey) (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 ( <a href="#">ICES, 2017</a> )
Working group	Herring Assessment Working Group ( <a href="#">HAWG</a> )

## 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 $B_{\text{pa}}$ by 2007.	-	300000**	55	293000
2007*	The fishery should remain closed until information is available which assures that the stock can be rebuilt to $B_{\text{pa}}$ 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 $B_{\text{pa}}$ 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 $B_{\text{pa}}$ 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 $B_{\text{pa}}$ 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 <sub>escapement</sub> ) to remain for successful recruitment.	≤ 54043	54043	18474	517499
2018	MSY approach: allow for sufficient stock (MSY B <sub>escapement</sub> ) 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 <sub>escapement</sub> ) to remain for successful recruitment.	< 39611	39611	19707***	447349***
2021	MSY approach: allow for sufficient stock (MSY B <sub>escapement</sub> ) to remain for successful recruitment.	< 77512			

\* 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 2020 as estimated by ICES (in tonnes).

Total catch (2020)	Landings	Discards
19707	100% industrial trawl fisheries	Discarding is considered negligible.
	19707	

**Table 8** Sandeel in divisions 4.a–b, Sandeel Area 4. History of total catch (in tonnes) as estimated by ICES.

Year	Catch
1983	2782
1984	2563
1985	38122
1986	12718
1987	8154
1988	1338
1989	4384
1990	3314
1991	41372
1992	68905
1993	133136
1994	158690
1995	52591
1996	158490
1997	58446
1998	58746
1999	53334
2000	37792

Year	Catch
2001	47918
2002	12761
2003	64048
2004	6882
2005	1557
2006	86
2007	11
2008	1168
2009	0
2010	275
2011	272
2012	2585
2013	5225
2014	4414
2015	4392
2016	6232
2017	18474
2018	42298
2019	6666
2020	19707*

\*Preliminary

## Summary of the assessment

**Table 9** 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. 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. 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	119401223	187213661	76151772	371759	562380	245749	132599	0.38	0.59	0.24
1994	260991918	416890107	163392655	156686	263525	93162	158690	0.44	0.68	0.28
1995	70986480	115066769	43792664	129444	226485	73981	52591	0.122	0.191	0.078
1996	384325343	624035286	236694900	257816	420511	158067	158490	0.37	0.57	0.23
1997	98739932	175467167	55563524	84881	158187	45545	58446	0.168	0.26	0.108
1998	43969202	77076497	25082753	267533	450215	158978	58746	0.169	0.26	0.108
1999	235212519	378416288	146201236	199985	344598	116060	53334	0.24	0.37	0.152
2000	202044797	322610045	126536978	86682	166468	45136	37714	0.118	0.184	0.075
2001	23986459	39099340	14715087	114921	195610	67516	47902	0.187	0.29	0.120
2002	88189635	143428330	54225074	127007	217495	74166	12736	0.039	0.061	0.025
2003	152702173	262751791	88745175	72042	121824	42602	63731	0.30	0.48	0.195
2004	12509514	43160070	3625757	64151	121052	33997	6882	0.057	0.089	0.036
2005	9899551	***	***	83952	144919	48634	1557	0.025	0.039	0.0160
2006	6261936	***	***	84626	146208	48982	0	0.00	0.00100	0.00
2007	8658049	20083069	3732588	46212	108508	19681	0	0.00	0.00	0.00
2008	26350558	52650465	13187954	25642	82580	7962	0	0.0020	0.0030	0.00100
2009	400410168	781771689	205083281	21420	61256	7490	0	0.00	0.00	0.00
2010	69026428	131843862	36138563	25668	51720	12739	0	0.00100	0.0020	0.00100
2011	46969077	89231953	24723141	244507	472772	126454	0	0.0020	0.0030	0.00100
2012	42797917	82218134	22278075	146093	272791	78240	2585	0.0190	0.029	0.0120
2013	28860949	56689186	14693356	138690	257727	74633	5225	0.0110	0.0160	0.0070
2014	297522378	555207282	159435166	115844	212126	63264	4314	0.0140	0.022	0.0090

Year	Recruitment Age 0	High	Low	SSB	High	Low	Total catches	Fages 1–2	High	Low
	thousands			tonnes			tonnes			
2015	55839943	107560904	28989151	61390	112611	33467	4392	0.0110	0.0170	0.0070
2016	116220522	217107870	62214280	237518	434548	129824	6188	0.022	0.034	0.0140
2017	129994149	243137732	69501671	157787	285954	87065	18474	0.048	0.075	0.031
2018	18329090	36767823	9137216	153277	279688	84000	42296	0.137	0.22	0.088
2019	259430655	510660773	131798384	149941	284391	79055	6651	0.058	0.091	0.037
2020	303836413	646334327	142830981	67914	131170	35163	19638	0.046	0.072	0.030
2021	73785221*			201592**	392113	103642				

\* Geometric mean (2010–2019).

\*\* Mean weight-at-age (2016–2020).

\*\*\* Uncertainty bounds not shown because they are too wide.

## 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.

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