

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, there should be zero catch in 2019.

In order to obtain samples to assess the status of the stock in 2020, however, ICES advises a monitoring TAC in 2019 with catches that should not exceed 5000 tonnes and with an associated sampling protocol in the fishery.

Stock development over time

Fishing mortality (F) has been low since 2006 but increased in 2018. Spawning-stock biomass (SSB) has increased from the time-series low in 2009 to levels well above precautionary reference points ($B_{pa} = MSY B_{escapement}$) and has remained at this level since 2016. The 2016 and 2017 year classes are estimated to be above the long-term average, but the 2018 year class is estimated to be the second lowest on record.

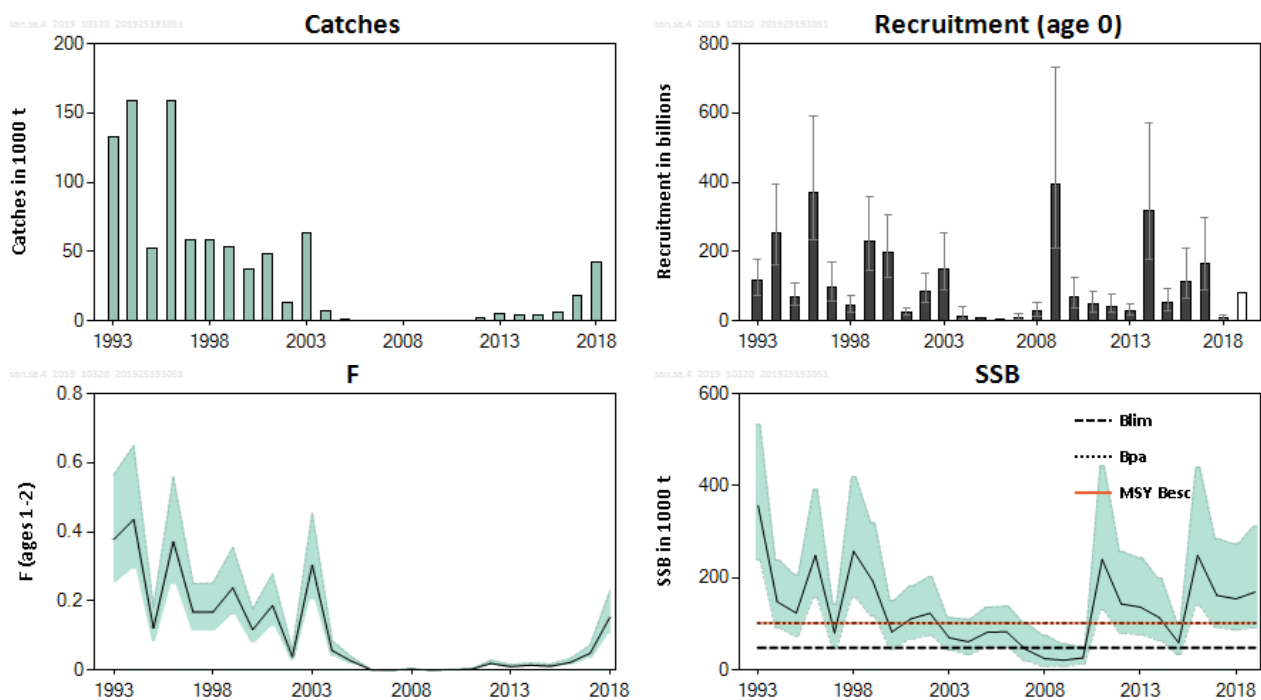


Figure 1 Sandeel in divisions 4.a–b, Sandeel Area 4. Historical development of the stock from the summary of the stock assessment, with 90% confidence intervals. Predicted values are not shaded.

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, Sandeel Area 4. 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, Sandeel Area 4. The basis for the catch scenarios.

Variable	Value	Notes
F (2018)	0.152	From the assessment
Recruitment (2018)	7 625 436	Estimated from the assessment; in thousands
Recruitment (2019)	80 801 276	Geometric mean (GM 2008–2017); in thousands
SSB (2019)	169 058	Tonnes

Table 3 Sandeel in divisions 4.a–b, Sandeel Area 4. 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}	0	0	100879	-40%	-100%	-100%
Other scenarios						
F = 0	0	0	100879	-40%	-100%	-100%
SSB ₂₀₂₀ = MSY B _{escapement} = B _{pa}	0	0	100879	-40%	-100%	-100%
Monitoring TAC	5000	0.022	97744	-42%	-92%	-92%
B _{lim}	87116	0.523	48000	-72%	47%	47%
F = F ₂₀₁₈	31410	0.152	81351	-52%	-47%	-47%

* SSB₂₀₂₀ relative to SSB₂₀₁₉.

** Catch scenario for 2019 relative to TAC in 2018 (59 345 t).

*** Advice value 2019 relative to advice value 2018 (59 345 t).

The small 2018 year class results in SSB falling to just below MSY B_{escapement} in 2020, even in the absence of fishing.

Basis of the advice

Table 4 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 quality of the assessment is influenced by a period of little commercial fishing (2004–2016), no data on catch age composition (2006–2011), and no survey indices (2004–2007).

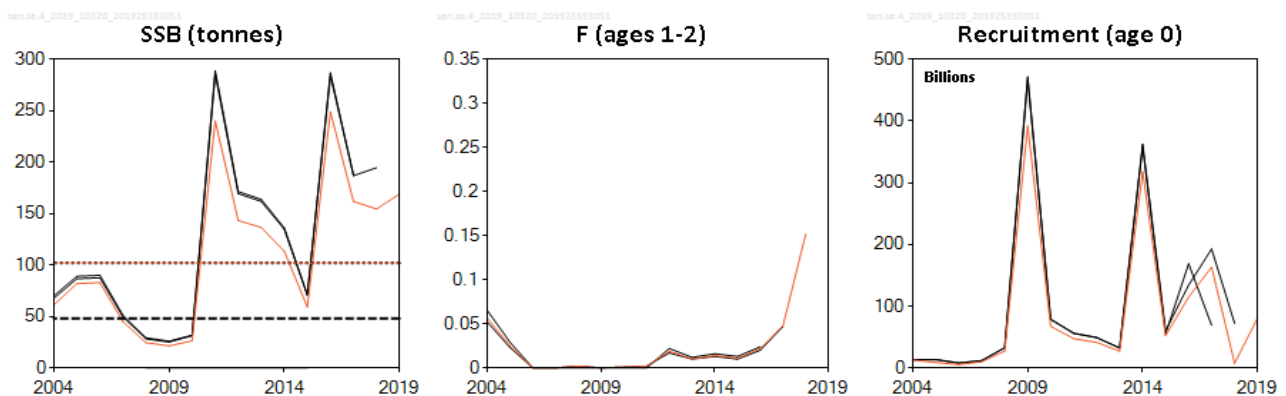


Figure 2 Sandeel in divisions 4.b–c, Sandeel Area 4. Historical assessment results (final-year recruitment estimates included).

Issues relevant for the advice

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. Information on the age structure of the catches will also require a monitoring fishery. The advice monitoring TAC of 5000 t in 2019 is based on obtaining a minimum of 30 samples to provide information on abundance and mean weight of sandeel in the assessment. Catches equal to the monitoring TAC will result in an F of 0.022 in 2019 and an SSB in 2020 that is 4% below $MSY_{B_{escapement}}$.

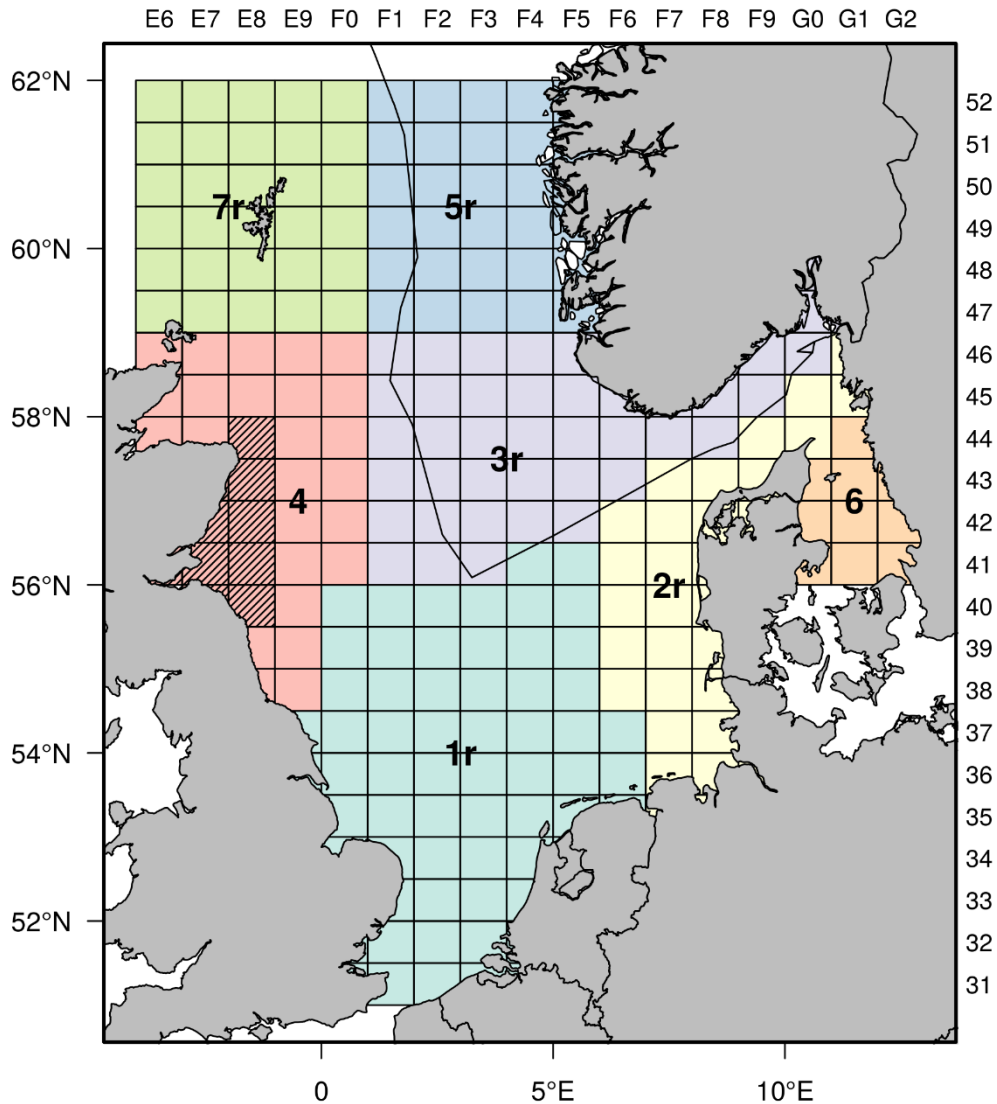


Figure 3 Sandeel in divisions 4.a–b, Sandeel Area 4. Stock areas for the seven sandeel stocks. The border of the Norwegian Exclusive Economic Zone (EEZ) is also shown. The closed area in sandeel area 4 is shown with hatched markings.

Reference points

Table 5 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_{MSY}	Not defined		
	F_{cap}^*	0.15	The maximum F estimated from MSE that results in less than 5% probability of $SSB < B_{\text{lim}}$.	ICES (2017)
Precautionary approach	B_{lim}	48000 t	Average SSB of the two lowest SSB estimates that provide high recruitment (2003, 2009).	ICES (2017)
	B_{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_{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 and 4.b, Sandeel Area 4. The basis of the assessment.

ICES stock data category	1 (see ICES, 2018a).
Assessment type	Age-structured model (SMS-effort), half-yearly time-step (ICES, 2019).
Input data	One survey index available in January (dredge survey). Total international catch and fishing effort. Fixed maturity data. Natural mortality estimated from multispecies assessment (assumed constant over time; 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, 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

Year	ICES advice	Catch corresponding to advice	TAC	ICES catch SA 4	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**	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
2012	Catches for monitoring purposes should not exceed 5000 t.	< 5000	5000	2585	102000
2013	Catch of 2012 reduced by 20% as a precautionary buffer.	< 2041	4000	5225	278000
2014	Catches for monitoring purposes should not exceed 5000 t (with associated sampling protocol).	< 5000	5000	4414	264000
2015	Catches for monitoring purposes should not exceed 5000 t (with associated sampling protocol).	< 5000	5000	4392	312000
2016	Precautionary approach	≤ 6000	6000	6188	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	42526***	270858***
2019	Catches for monitoring purposes 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.

History of catch and landings

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

Total catch (2018)	Landings	Discards
42526	100% industrial trawl fisheries	Negligible
	42526	

Table 9 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
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	6195
2017	18474
2018	42526

Summary of the assessment

Table 10 Sandeel in divisions 4.a–b, Sandeel Area 4. Assessment summary. 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 catch tonnes	F (ages 1–2)	High	Low
	thousands				tonnes				High	Low
1993	115525287	178636004	74711098	357182	532134	239749	132599	0.38	0.56	0.25
1994	253278441	395918062	162028397	148153	238772	91926	158690	0.44	0.65	0.29
1995	68544930	109118445	43057866	123500	206481	73868	52591	0.121	0.182	0.081
1996	371849589	590886786	234007800	248948	391712	158216	158490	0.37	0.56	0.25
1997	96784750	168420136	55618574	80660	142745	45578	58446	0.168	0.25	0.112
1998	42883599	73696818	24953629	257816	419378	158494	58746	0.168	0.25	0.112
1999	229405101	359722459	146298067	193300	318782	117212	53334	0.24	0.36	0.158
2000	196859336	305883100	126694146	82454	150390	45207	37714	0.117	0.176	0.078
2001	23441066	37261845	14746548	111190	181856	67984	47902	0.186	0.28	0.124
2002	85668864	135829942	54031932	123130	201663	75180	12736	0.039	0.058	0.026
2003	150278380	252228983	89536069	69982	113383	43195	63731	0.30	0.45	0.20
2004	12749467	42476159	3826827	61267	110253	34046	6882	0.056	0.085	0.038
2005	8753814	2590820135	29577	81961	136460	49228	1557	0.025	0.037	0.0160
2006	5422134	1207898341	24339	82951	138198	49789	0	0.00	0.00100	0.00
2007	9742419	20354542	4663074	44846	100528	20006	0	0.00	0.00	0.00
2008	27261881	51649245	14389565	24465	74691	8013	0	0.0020	0.0030	0.00100
2009	392089230	730055652	210578418	21367	56113	8136	0	0.00	0.00	0.00
2010	67456938	123524610	36838315	26265	49969	13806	0	0.00100	0.0020	0.00100
2011	47441124	86194828	26111314	240145	443013	130177	0	0.0020	0.0030	0.00100
2012	41284596	75472058	22583428	143344	256400	80138	2585	0.0190	0.028	0.0120
2013	26936694	49470103	14667151	136626	243364	76702	5225	0.0100	0.0160	0.0070
2014	318139333	570999185	177255306	113437	199348	64550	4314	0.0140	0.021	0.0090
2015	52273494	94625346	28877234	59278	104082	33761	4392	0.0110	0.0170	0.0070
2016	114834211	207428532	63573202	248948	439821	140910	6188	0.022	0.033	0.0140
2017	163283743	296018608	90067246	161943	284329	92237	18474	0.048	0.072	0.032
2018	7625436	15909070	3654976	154508	273084	87419	42526	0.152	0.23	0.102
2019	*80801275			**169058	311710	91690				

* Geometric mean (2008–2017).

** Mean weight-at-age (2014–2018).

Sources and references

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Recommended citation: ICES. 2019. Sandeel (*Ammodytes* spp.) in divisions 4.a–b, Sandeel Area 4 (northern and central North Sea). *In* Report of the ICES Advisory Committee, 2019. ICES Advice 2019, san.sa.4, <https://doi.org/10.17895/ices.advice.4723>