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 2020 should be no more than 39 611 tonnes.

Stock development over time

Fishing mortality (F) has been low since 2005; however, it increased in 2018 before decreasing again in 2019. Spawning-stock biomass (SSB) has fluctuated above precautionary reference points (B_{pa} = MSY $B_{escapement}$) since 2011, with the exception of the years 2015 and 2019. The 2019 year class is estimated to be above the long-term average, following the low recruitment of 2018.

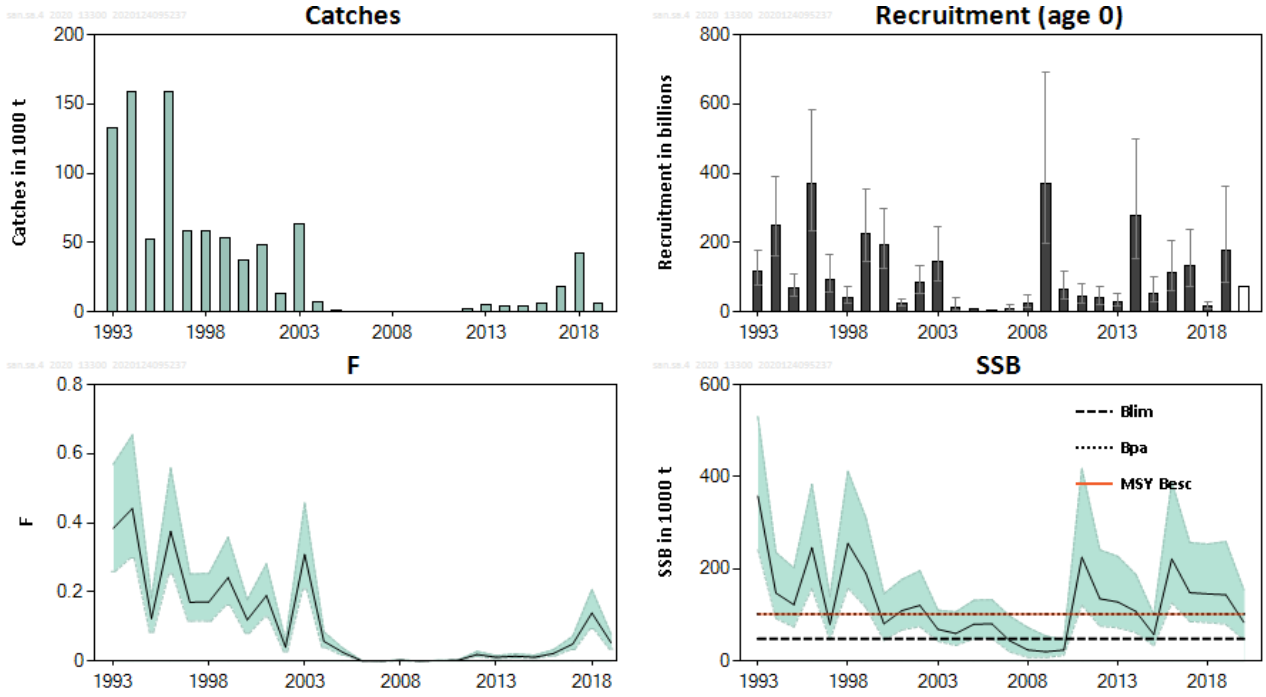

Figure 1 Sandeel in divisions 4.a–b, Sandeel Area 4. Historical development of the stock from the summary of the stock assessment, with 90% confidence intervals. Assumed recruitment values are not shaded.

Stock and exploitation status

ICES assesses that the spawning-stock size is below MSY $B_{trigger}$, but between 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				
		2017	2018	2019			2018	2019	2020	
Maximum sustainable yield	F_{MSY}	?	?	?	Undefined	MSY $B_{escapement}$	✓	✓	✗	Below escapement
Precautionary approach	F_{pa},F_{lim}	?	?	?	Undefined	B_{pa},B_{lim}	✓	✓	o	Increased risk
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 (2019)	0.053	From the assessment
Recruitment (2019)	175 473 747	Estimated from the assessment; in thousands
Recruitment (2020)	72 088 133	Geometric mean (GM 2009–2018); in thousands
SSB (2020)	84 120	In tonnes

Table 3 Sandeel in divisions 4.a–b, Sandeel Area 4. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2020)	F_{total} (2020)	SSB (2021)	% SSB change *	% TAC change **	% advice change ***
ICES advice basis						
$SSB_{2021} \geq MSY\ B_{escapement}$ with F_{cap}	39611	0.15	136457	+62	+692	-
Other scenarios						
F = 0	0	0	158773	+89	−100	-
$SSB_{2021} = MSY\ B_{escapement} = B_{pa}$	103276	0.45	102000	+21	+1966	-
B_{lim}	213651	1.305	48000	−43	+4173	-
$F = F_{2019}$	14645	0.053	150454	+79	+193	-

* SSB_{2021} relative to SSB_{2020}.
** Catch scenario for 2020 relative to the TAC in 2019 (5 000 t).
*** Advice value 2020 relative to the advice value 2019 (0 t).

The large increase in the advised catch is driven by the well-above-average 2019 recruitment.

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 uncertainty of the estimated SSB and F is large in the assessment, resulting from a period of low commercial fishing effort (2004–2016), no data on catch age composition (2006–2011), and no survey indices (2004–2007). SSB in recent years has been downscaled, while F has been estimated to have remained at a more consistent level.

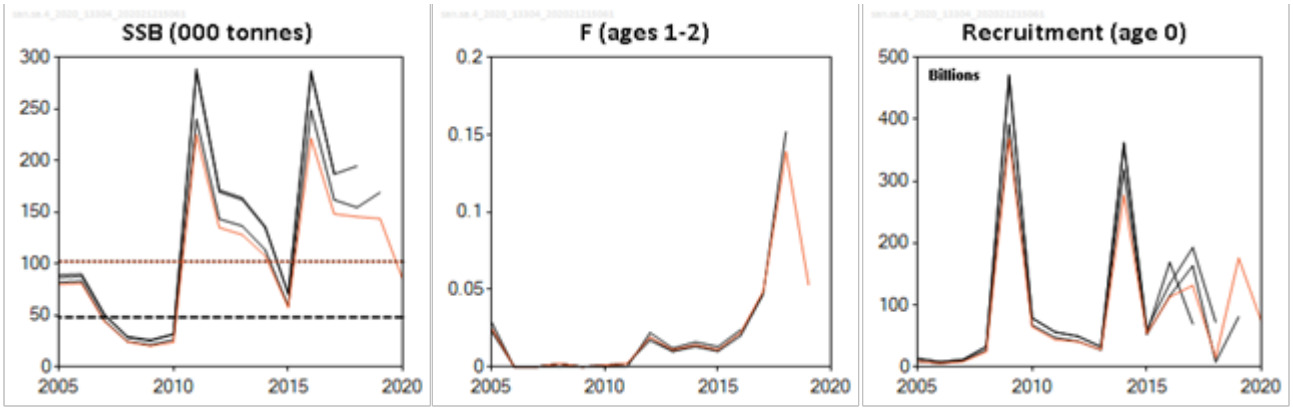

Figure 2 Sandeel in divisions 4.b–c, Sandeel Area 4. Historical assessment results (final-year recruitment includes geometric means).

Issues relevant for the advice

The incoming year class is well above the average recruitment and among the highest in the time-series. The estimation is supported by high catch rates of the dredge survey on both the northern and the southern banks of Sandeel Area 4.

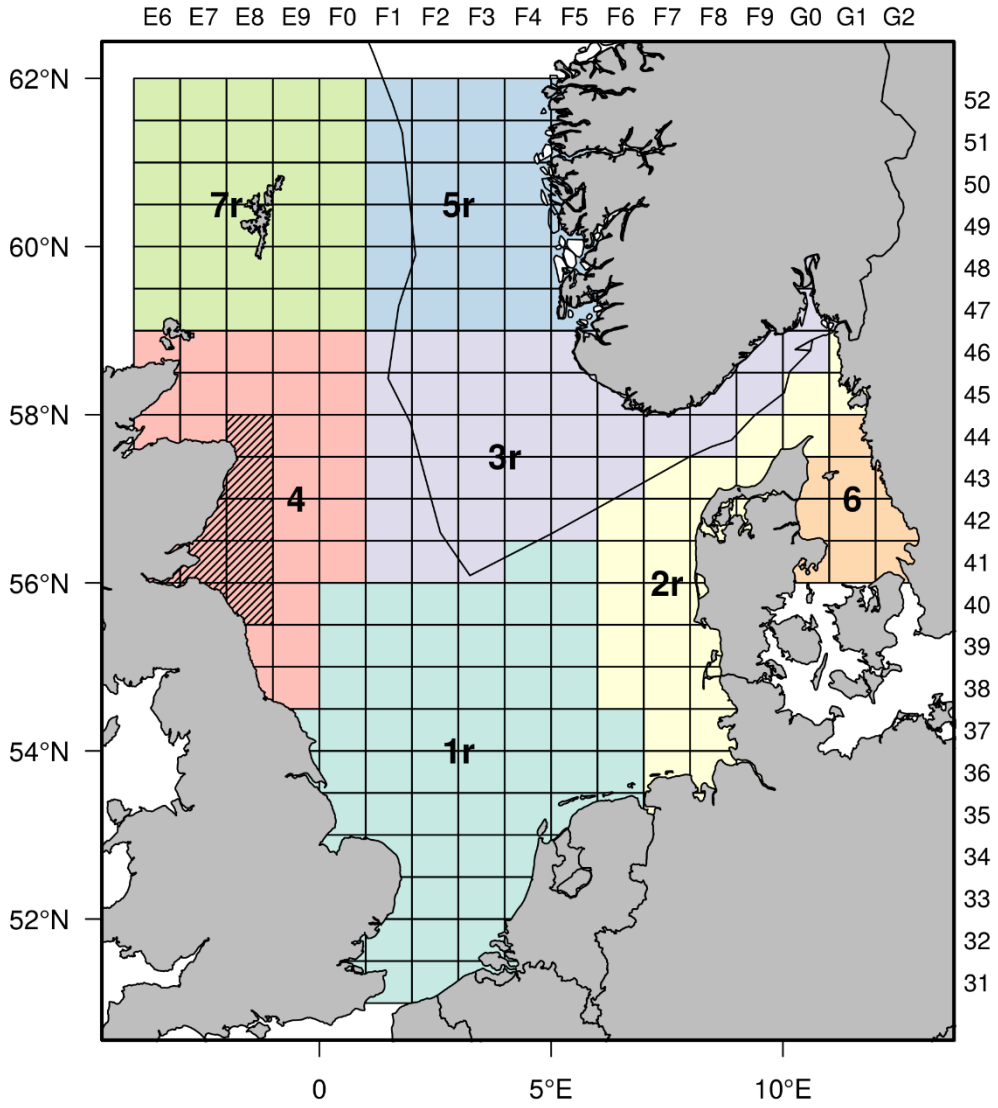

Figure 3 Sandeel in divisions 4.a–b, Sandeel Area 4. Stock areas for the seven sandeel stocks. The border of the Norwegian Exclusive Economic Zone (EEZ) is also shown. The closed area in Sandeel Area 4 is shown with hatched markings.

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 $B_{escapement}$	102000 t	= B_{pa}	ICES (2017)
	F_{MSY}	Not defined		
	F_{cap}*	0.15	The maximum F estimated from the management strategy evaluation (MSE) that results in less than 5% probability of SSB < B_{lim}.	ICES (2017)
Precautionary approach	B_{lim}	48000 t	The average SSB of the two lowest SSB estimates that provide high recruitment (2003, 2009).	ICES (2017)
	B_{pa}	102000 t	$B_{pa} = B_{lim} \times \exp(\sigma \times 1.645)$, 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; 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, 2019).
Assessment type	Age-structured model (SMS-effort), half-yearly time-step (ICES, 2020).
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, 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)

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	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 t.	≤ 5000	5000	6603***	234778***
2020	MSY approach: allow for sufficient stock (MSY $B_{escapement}$) to remain for successful recruitment.	< 39611			

* 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 2019 as estimated by ICES (in tonnes).

Total catch (2019)	Landings	Discards
6603	100% industrial trawl fisheries	Discarding is considered negligible
	6603	

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

Year	Catch
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	6232
2017	18474
2018	42298
2019	6603

Summary of the assessment

Table 10 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 catch	Fishing pressure (ages 1–2)	High	Low
	thousands			tonnes			tonnes			
1993	116104360	177926137	75763025	357897	530374	241509	132599	0.38	0.57	0.26
1994	251009162	389566682	161732516	147414	235647	92218	158690	0.44	0.65	0.30
1995	68544930	108124972	43453490	122027	202011	73712	52591	0.123	0.183	0.083
1996	370365162	583803181	234959927	245733	383725	157364	158490	0.38	0.56	0.25
1997	94489568	163149073	54724666	79618	139300	45507	58446	0.170	0.25	0.115
1998	42627068	72811441	24955788	255250	411892	158179	58746	0.171	0.25	0.115
1999	227122482	353057420	146108307	190232	310983	116367	53334	0.24	0.36	0.162
2000	194316727	299582316	126038783	80822	146024	44733	37714	0.119	0.177	0.080
2001	23138304	36476895	14677267	109316	177116	67470	47902	0.189	0.28	0.127
2002	84901303	133494930	53996292	120813	195989	74473	12736	0.040	0.059	0.027
2003	146567994	244058612	88020565	68734	110303	42831	63731	0.31	0.46	0.21
2004	12151947	40854762	3614507	59814	106684	33536	6882	0.057	0.085	0.039
2005	8841791	***	***	79858	131769	48397	1557	0.025	0.037	0.0170
2006	5520616	***	***	80660	133212	48840	0	0.00	0.00100	0.00
2007	8301942	19375251	3557231	43783	97266	19708	0	0.00	0.00	0.00
2008	24106691	46720971	12438367	24029	72672	7945	0	0.0020	0.0030	0.00100
2009	368517958	691083111	196511075	20137	54368	7458	0	0.00	0.00	0.00
2010	64553184	118770668	35085376	23718	45948	12243	0	0.00100	0.0020	0.00100
2011	43706177	79969939	23886850	225032	417619	121258	0	0.0020	0.0030	0.00100
2012	40507593	74762766	21947624	134996	241143	75573	2585	0.0190	0.028	0.0130
2013	27757038	52269967	14739883	128027	227188	72148	5225	0.0110	0.0160	0.0070
2014	277130757	498223732	154150538	107689	187950	61702	4314	0.0140	0.021	0.0090

Year	Recruitment (age 0)	High	Low	SSB	High	Low	Total catch	Fishing pressure (ages 1–2)	High	Low
	thousands			tonnes			tonnes			
2015	53919352	99632452	29180216	57584	100543	32980	4392	0.0110	0.0170	0.0080
2016	113011484	204381370	62489040	221461	388635	126198	6188	0.022	0.033	0.0150
2017	131563476	238524414	72566778	148301	256931	85600	18474	0.049	0.072	0.033
2018	14592234	29462092	7227365	145510	253852	83408	42296	0.139	0.21	0.093
2019	175473747	361539350	85166486	143774	259136	79769	6598	0.053	0.078	0.035
2020	72088133*			84120**	154764	45722				

* Geometric mean (2009–2018).
** Mean weight-at-age (2015–2019).
*** Uncertainty bounds not shown becauses they are too wide.

Sources and references

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