ICES Advice on fishing opportunities, catch and effort
Greater North Sea Ecoregion
Code: san.sa.1r

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Sandeel (*Ammodytes* spp.) in divisions 4.b–c, Sandeel Area 1r (central and southern North Sea, Dogger Bank)

ICES stock advice

ICES advises that when the MSY approach is applied, catches in 2017 should be no more than 255 956 tonnes.

Stock development over time

The spawning-stock biomass (SSB) was in-between the lower biomass limit (B_{lim}) and the precautionary reference points (B_{pa} = MSY $B_{escapement}$) in 2015. In 2016 and 2017 SSB was estimated to be above B_{pa}. Recruitment (R) in 2015 was the second lowest in the time-series, followed by above-average recruitment in 2016. Fishing mortality (F) has decreased substantially from 2009 onwards.
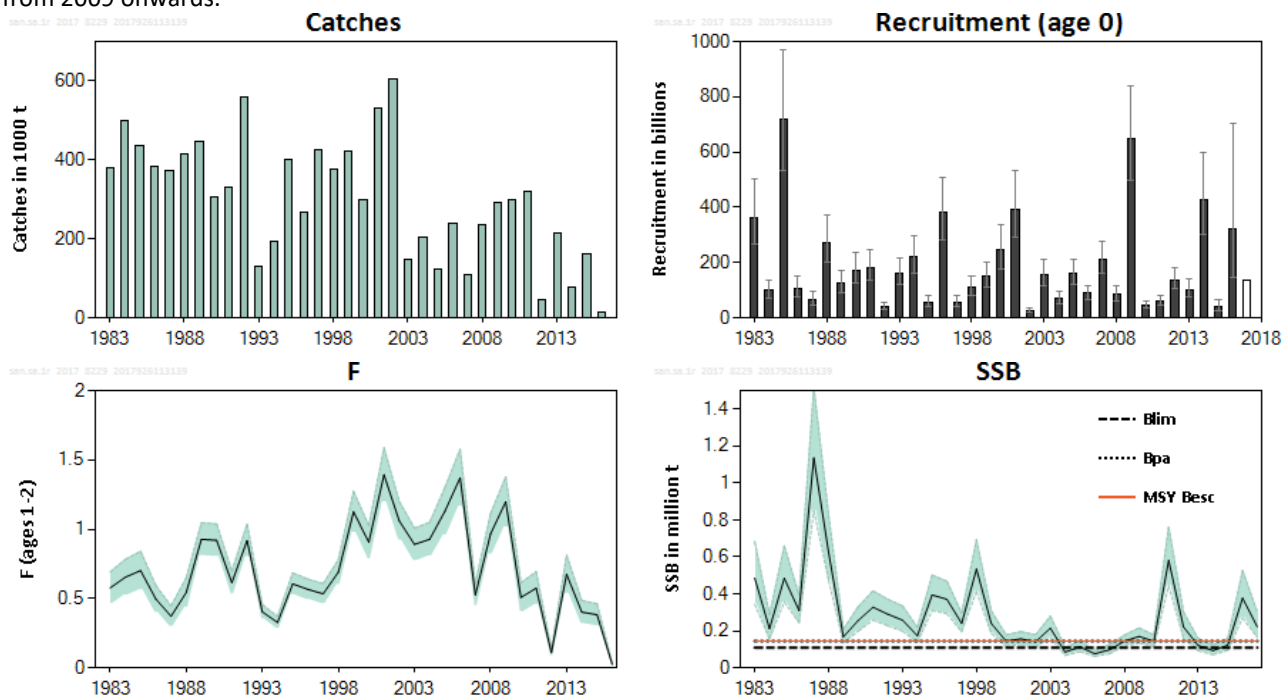

Figure 1   Sandeel in divisions 4.b–c, Sandeel Area 1r. Historical development of the stock from the summary of the stock assessment, with 90% confidence intervals. Predicted values are not shaded. [*]

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[*] Version 2: Y axis legend changed to 1000 tonnes in catch plot.

Stock and exploitation status

Table 1　　　Sandeel in divisions 4.b–c, Sandeel Area 1r. State of the stock and fishery relative to reference points.

		Fishing pressure				Stock size			
		2014	2015	2016			2015	2016	2017
Maximum sustainable yield	F_{MSY}	❓	❓	❓ Unknown		MSY $B_{escapement}$	❌	✅	✅ Above escapement
Precautionary approach	F_{pa}, F_{lim}	❓	❓	❓ Unknown		B_{pa}, B_{lim}	🟠	✅	✅ Full reproductive capacity
Management plan	F_{MGT}	-	-	- Not applicable		SSB_{MGT}	-	-	- Not applicable

Catch options

Table 2   Sandeel in divisions 4.b–c, Sandeel Area 1r. The basis for the catch options.

Variable	Value	Source	Notes
F (2016)	0.0189	ICES (2017a)	Sum of half-yearly Fs
Recruitment (2016)	322 598 404	ICES (2017a)	In thousands
Recruitment (2017)	134 688 373	ICES (2017a)	Geometric mean 1983–2015 (in thousands)
SSB (2017)	222 189	ICES (2017a)	In tonnes

Table 3   Sandeel in divisions 4.b–c, Sandeel Area 1r. Annual catch options. All weights are in tonnes.

Basis	Total catch (2017)	F_{total} (2017)	SSB (2018)	% SSB change *	% TAC change **
ICES advice basis					
$SSB_{2018} \geq MSY\ B_{escapement}$ with F_{cap}	255956	0.49	233586	5	1869
Other options					
F = 0	0	0	360409	62	-100
F_{pa}	Not applicable				
F_{lim}	Not applicable				
$SSB_{2018} = MSY_{Bescapement} = B_{pa}$	454596	1.18	145000	−35	3397
B_{lim}	540577	1.65	110000	−50	4058
$F = F_{2016}$	13136	0.0189	353638	59	1.05

* SSB 2018 relative to SSB 2017.
** Catch option for 2017 relative to TAC in 2016.

Basis of the advice

Table 4   Sandeel in divisions 4.b–c, Sandeel Area 1r. 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

This stock was benchmarked in the period between the 2016 and 2017 assessments. Changes in stock area, assessment methodology, and input data cause a difference between the 2017 and historical results. The uncertainty in the estimate of the SSB is low and there is no apparent retrospective pattern in the assessment. There is confidence in the above average recruitment estimate for 2016 because the 2016 dredge survey shows large densities of age 0 over a wide range of sandeel banks.

Figure 2   Sandeel in divisions 4.b–c, Sandeel Area 1r. Historical assessment results (final-year recruitment estimates included).

Issues relevant for the advice

In 2017 the name of this sandeel area was changed from Sandeel Area 1 to Sandeel Area 1r because of a change in the statistical rectangles included in the stock area (ICES, 2017a).

The reported catches from this area in 2014 and 2015 were revised, based on information from VMS and previous catch distributions, to account for substantial area misreporting of catches. Based on the misreporting of catches as observed in 2014, management measures to avoid area misreporting (only one fishing area per trip) have been mandatory for the Danish fishery since 2015. This eliminated the misreporting issue for Danish catches; however, there are strong indications of area misreporting for other nations in 2015. Area misreporting in 2016 is not considered to have been an issue in the monitoring fishery. Management measures for all nations, similar to those in the Danish fishery, should reduce area misreporting.
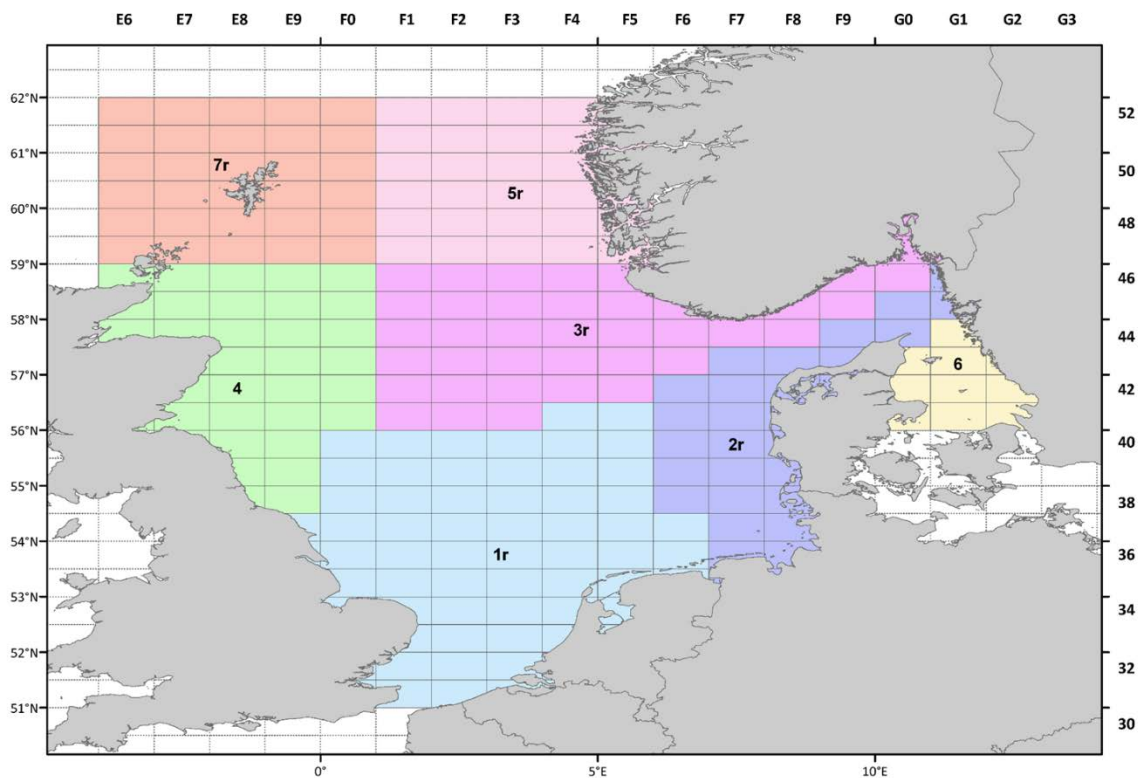
Figure 3   Sandeel in divisions 4.b–c, Sandeel Area 1r. Sandeel are largely sedentary after settlement and form a complex of local (sub-)stocks in the North Sea. To avoid local depletion, ICES advice for sandeel is provided separately for seven areas in Division 3.a and Subarea 4. Advice for sandeel in divisions 4.b and 4.c, Sandeel Area 1r is defined as rectangles 31–33 E9–F4; 33 F5; 34–37 E9–F6; 38–40 F0–F5; 41 F4–F5. ICES revised this sandeel area by ICES statistical rectangle at the 2016 benchmark (ICES, 2017a).

Reference points

Table 5   Sandeel in divisions 4.b–c, Sandeel Area 1r. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{escapement}$	145000 t	= B_{pa}	ICES (2017a)
	F_{MSY}	Not defined		
	F_{cap}	0.49	Maximum F estimated from MSE that results in less than 5% probability of SSB < B_{lim}	ICES (2017a)
Precautionary approach	B_{lim}	110000 t	The lowest SSB at which a high recruitment is observed.	ICES (2017a)
	B_{pa}	145000 t	$B_{pa} = B_{lim} \times \exp(\sigma \times 1.645)$, with $\sigma = 0.17$ estimated from assessment uncertainty in the terminal year.	ICES (2017a)
	F_{lim}	Not defined		
Management plan	SSB_{MGT}	Not defined		
	F_{MGT}	Not defined		

Basis of the assessment

Table 6   Sandeel in divisions 4.b–c, Sandeel Area 1r. The basis of the assessment and advice.

ICES stock data category	1 (see ICES, 2016)
Assessment type	Age-structured model (SMS-effort), seasonal (ICES, 2017b)
Input data	One survey index in December (dredge survey since 2004) and commercial catch rates in April. Total international catch and fishing effort. Annual natural mortality estimated from multispecies assessment. Constant maturity-at-age from surveys. Age and length frequencies from catch sampling.
Discards and bycatch	Discarding is considered to be negligible.
Indicators	None
Other information	Last benchmarked in 2016 (ICES, 2017a).
Working group	Herring Assessment Working Group (HAWG)

Information from stakeholders

The industry considers that the 2016 Real-Time Monitoring (RTM) fishery TAC of 13 000 tonnes was not large enough to provide sufficient coverage of the stock area in that year.

History of the advice, catch, and management

Table 7 Sandeel in divisions 4.b–c, Sandeel Area 1r. History of ICES advice, the agreed TAC, and ICES estimates of catch. All weights are in tonnes. Values of catches for the period 2005 to 2015 are presented to the nearest thousand tonnes.

Year	ICES advice	Catch corresponding to advice	TAC	ICES catch SA 1	ICES catch SA 1r	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**	104000		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**	238000		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**	109000		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**	239000		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**	309000		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**	301000		414000
2011	MSY approach: allow for sufficient stock (MSY $B_{escapement}$) to remain for successful recruitment.	< 320000	320000	312000		438000
2012	MSY approach: allow for sufficient stock (MSY $B_{escapement}$) to remain for successful recruitment.	< 23000	23000	46000		102000
2013	MSY approach: allow for sufficient stock (MSY $B_{escapement}$) to remain for successful recruitment.	< 224544	225000	210000		278000
2014	MSY approach: allow for sufficient stock (MSY $B_{escapement}$) to remain for successful recruitment.	< 57000	57000	99000		264000
2015	MSY approach: allow for sufficient stock (MSY $B_{escapement}$) to remain for successful recruitment.	< 133000	133000	163000		312000
2016	Catches for monitoring purposes should not exceed 5 000 t.	≤ 5000	13000	12751***	14316***	73420***
2017^	MSY approach: allow for sufficient stock (MSY $B_{escapement}$) to remain for successful recruitment.	≤ 255956				

* 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 have changed in the 2017 assessment and advice.

History of catch and landings

Table 8 Sandeel in divisions 4.b–c, Sandeel Area 1r. Catch distribution by fleet in 2016 as estimated by ICES (in tonnes).

Total catch (2016)	Landings	Discards
14316	100% industrial trawl fisheries	Negligible
	14316	

Table 9 Sandeel in divisions 4.b-4.c, Sandeel Area 1r. History of the total catch (in tonnes) as estimated by ICES.

Year	Catch
1983	382629
1984	498671
1985	460057
1986	382844
1987	373021
1988	422805
1989	446129
1990	306302
1991	332204
1992	558602
1993	144389
1994	193241
1995	400759
1996	291709
1997	426414
1998	377473
1999	424279
2000	374703
2001	508016
2002	610123
2003	178488
2004	215351
2005	126261
2006	247504
2007	110389
2008	236066
2009	309591
2010	300892
2011	319656
2012	46116
2013	214981
2014	98732
2015	164770
2016	14316

Summary of the assessment

Table 10   Sandeel in divisions 4.b-4.c, Sandeel Area 1r. Assessment summary. The SSB is estimated for 1st of January. Yield 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.

Year	Recruitment Age 0 thousands	High	Low	SSB tonnes	High	Low	Total catch tonnes	F Ages 1–2 per year	High	Low
1983	363882257	500964928	264310512	485730	684429	344716	378795	0.58	0.69	0.46
1984	98645782	135843627	71633764	212220	288020	156369	498626	0.65	0.78	0.52
1985	717818846	969399186	531529119	484960	659516	356604	437114	0.70	0.84	0.56
1986	108025739	149248399	78188848	310240	393889	244355	382844	0.50	0.60	0.40
1987	67748200	95561249	48030124	1135900	1516137	851024	373021	0.37	0.45	0.30
1988	274136290	372843269	201561116	625020	825034	473496	413646	0.54	0.65	0.44
1989	124806023	170988665	91096936	168280	209834	134955	446028	0.93	1.05	0.81
1990	173179322	235535195	127331618	256430	331169	198558	306240	0.92	1.04	0.80
1991	183083960	248780964	134735938	328370	416938	258616	332204	0.62	0.70	0.53
1992	41419634	57048679	30072319	290750	370983	227869	558599	0.92	1.04	0.80
1993	160771356	217611760	118777721	258230	335454	198784	132024	0.40	0.46	0.35
1994	220527533	297788381	163311922	173790	219658	137500	193241	0.33	0.37	0.29
1995	57490373	78835138	41924744	394630	501878	310300	400588	0.61	0.69	0.53
1996	379779570	508072628	283881701	371060	468913	293627	265869	0.57	0.64	0.49
1997	58238085	79839440	42481191	240760	296513	195490	426089	0.53	0.61	0.46
1998	109893216	150835235	80064310	535000	692968	413042	377073	0.69	0.78	0.60
1999	149451929	203518670	109748551	240530	308930	187275	422718	1.13	1.27	0.98
2000	245368537	337254728	178517050	145010	178896	117543	299167	0.91	1.03	0.79
2001	392533130	531574731	289860013	156960	196010	125690	531265	1.39	1.59	1.20
2002	25567933	35349079	18493245	141710	179264	112023	606466	1.06	1.20	0.92
2003	156323908	212495346	115000938	214960	280233	164891	148039	0.89	1.01	0.77
2004	69667676	93650826	51826399	86060	110524	67011	203646	0.93	1.05	0.81
2005	159419472	211004575	120445578	113760	146851	88126	123422	1.13	1.30	0.96
2006	88470461	115452896	67794076	76503	93517	62585	240646	1.37	1.58	1.17
2007	211216005	277326255	160865406	98028	126173	76161	109624	0.53	0.61	0.45
2008	84323630	115475055	61575849	144580	177240	117938	234447	0.97	1.11	0.82
2009	646361743	838417403	498300132	170350	216105	134282	290995	1.20	1.38	1.02
2010	46572769	62912097	34477039	143550	177701	115962	300508	0.51	0.61	0.40
2011	58613955	78733549	43635728	581460	761065	444240	318840	0.58	0.69	0.46
2012	138156255	182692612	104476862	221840	302990	162424	46117	0.11	0.13	0.09
2013	103456781	140527556	76165172	120980	157725	92795	214359	0.68	0.81	0.54
2014	426682577	599597896	303633523	94055	124821	70872	78830	0.40	0.49	0.32
2015	40745062	65364288	25398580	122920	159459	94754	163381	0.38	0.46	0.30
2016	322598404	705867977	147435121	377800	526709	270990	13695	0.026	0.031	0.020
2017	134688373**			222189*	301245	163881				
Average	189704698	266953302	138722975	279381	363908	213279	302005	0.71	0.82	0.60

* Using mean weight-at-age from 2012 to 2016 and proportion mature from December 2016.
** Geometric mean (1983–2015).

Sources and references

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