

6.3.39 Sandeel (*Ammodytes* spp.) in Divisions IIIa, IVa, and IVb, SA 3 (Skagerrak and Kattegat, North and Central North Sea)

ICES stock advice

ICES advises that when the MSY approach is applied, catches in 2015 should be no more than 370 000 tonnes to maintain SSB in 2016 above MSY $B_{escapement}$. The advised catch is mainly driven by a large recruitment in 2014 as estimated by the dredge survey, combined with a ceiling on F (F_{cap}) to ensure precautionarity.

Stock development over time

The sandeel area 3 (SA 3) spawning-stock biomass (SSB) was below the lower biomass limit B_{lim} in 2013 and 2014, but following the high recruitment in 2013 and 2014, SSB is estimated to be above precautionary biomass level B_{pa} (= MSY $B_{escapement}$) in 2015.

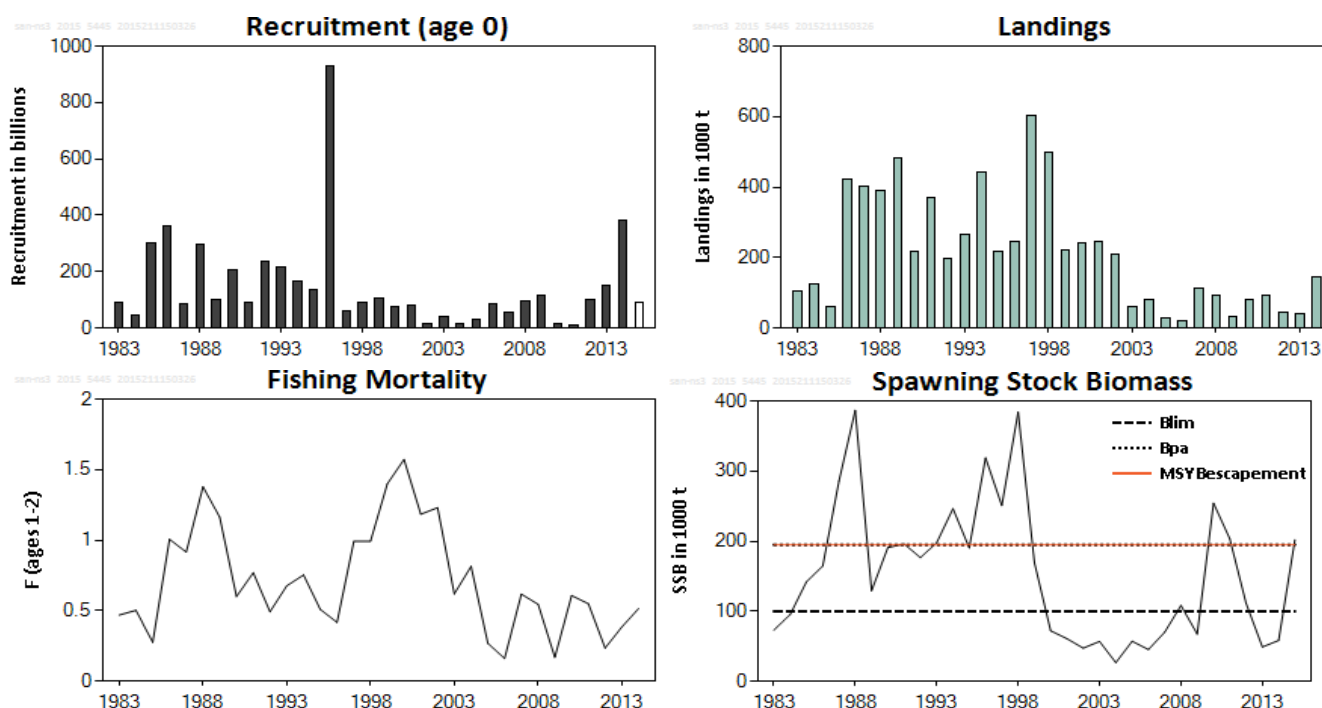


Figure 6.3.39.1 Sandeel in the North Sea (SA 3). Historical development of the stock from the summary of the stock assessment (weights in thousand tonnes and recruitment in billions of fish). Predicted values are not shaded.

Stock and exploitation status

Table 6.3.39.1 Sandeel in the North Sea (SA 3). State of the stock and fishery, relative to reference points.

		Fishing pressure			Stock size					
		2012	2013	2014	2013	2014	2015			
Maximum Sustainable Yield	F_{MSY}	?	?	?	Undefined	MSY	✗	✗	✓	Above escapement
Precautionary approach	F_{pa}, F_{lim}	?	?	?	Undefined	B_{pa}, B_{lim}	✗	✗	✓	Low risk
Management plan	F_{MGT}	?	?	?	Undefined	SSB_{MGT}	?	?	?	Undefined

Catch options

Table 6.3.39.2 Sandeel in the North Sea (SA 3). The basis for the catch options.

Variable	Value	Source	Notes
F (2014)	0.42	ICES, 2015a	Sum of half yearly Fs
R (2014)	384 billion	ICES, 2015a	
R (2015)	89 billion	ICES, 2015a	Geometric mean (1983–2013)
SSB (2015)	202 kt	ICES, 2015a	

Table 6.3.39.3 Sandeel in the North Sea (SA 3). Annual catch options. All weights are in thousand tonnes.

Rationale	Catches (2015)	Basis	F (2015)	SSB (2016)	%SSB change*	%TAC change**
MSY approach with $F_{cap} = 0.5$	370	$SSB_{2016} \geq MSY B_{escapement}$ and F_{cap}	0.5	356	76%	61%
MSY approach without F_{cap}	666	$SSB_{2016} = MSY B_{escapement}$	1.16	195	-4%	190%
Zero catch	0	$F = 0$	0.00	569	181%	-100%
Other options	93	$F_{2014} \times 0.25$	0.11	515	155%	-60%
	177	$F_{2014} \times 0.5$	0.21	466	131%	-23%
	254	$F_{2014} \times 0.75$	0.32	422	109%	10%
	324	$F_{2014} \times 1$	0.42	382	89%	41%
	388	$F_{2014} \times 1.25$	0.53	346	71%	69%
	446	$F_{2014} \times 1.5$	0.64	314	55%	94%

* SSB 2016 relative to SSB 2015.

** Catch option for 2015 relative to TAC in 2014 (230 kt = 140 EU + 90 Norway).

Basis of the advice

Table 6.3.39.4 Sandeel in the North Sea (SA 3). The basis of the advice.

Advice basis	MSY, escapement strategy with additional application of F_{cap} .
Management plan	There is no agreed management plan that applies to all of SA 3; therefore, ICES bases the advice on the MSY approach.

Quality of the assessment

The assessment of SA 3 in 2015 is of medium quality. In recent years, the assessment shows a tendency to overestimate the most recent recruitment (in this year's assessment, the 2012 year class was revised downwards by 21% with respect to the assessment in 2013, and the 2013 year class by 34% with respect to the assessment in 2014). A northerly extension of the dredge survey area has been made in 2014 in cooperation between Denmark and Norway. This has increased the quality of the survey index.

The assessment is considered to be more uncertain this year due to area misreporting in 2014. An examination of the spatial distribution of reported catches, fishing days, and VMS data indicated that there was likely to have been substantial misreporting of catches taken in SA 1 that were reported to SA 3. ICES has reallocated from SA 3 to SA 1 a total of 44 000 t associated with obvious misreporting and has removed the associated fishing days from the estimation of effort in SA 3.

There have been substantial differences in management in the past several years between the EU and Norwegian EEZs, potentially changing the selection pattern of the overall fishery (because age distributions seem to differ between the two EEZs), whereas the assessment assumes constant age selection through time. The current assessment relies on representative fishery data from the full stock area, which could be violated under area restrictions on different fleets.

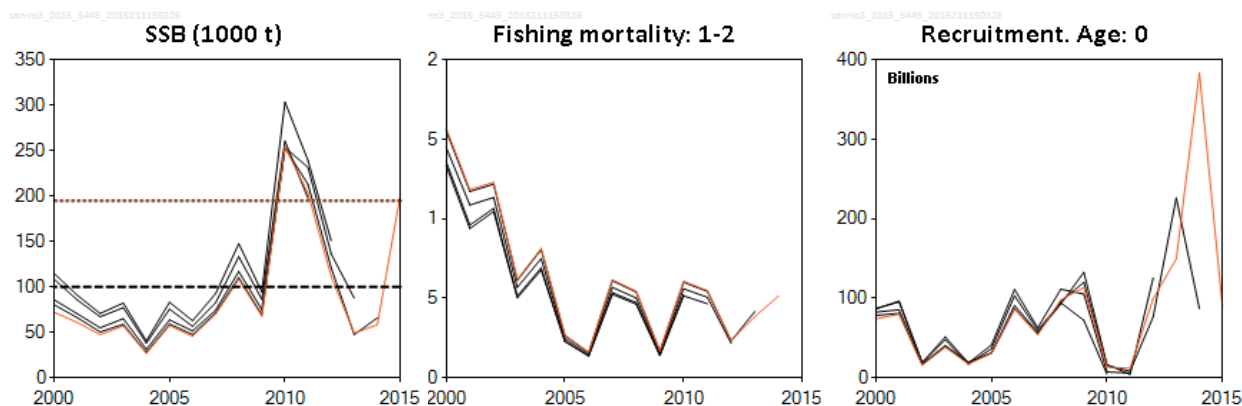


Figure 6.3.39.2 Sandeel in the North Sea (SA 3). Historical assessment results (final-year recruitment estimates included).

Issues relevant for the advice

The catches and fishing effort in SA 3 in 2014 were revised based on information from VMS and previous catch distributions, to account for substantial area misreporting of catches taken in SA 1 but reported to SA3. Management measures should be taken to avoid similar misreporting in the future.

The default ICES approach to MSY-based management of a short-lived species like sandeel is an escapement strategy, i.e. to maintain SSB above $MSY B_{escapement}$ after the fishery has taken place. However, such a strategy can lead to a high probability of SSB falling below B_{lim} when a high incoming recruitment is estimated. This is because the absolute error of the forecast SSB can then easily be of the order of magnitude of $MSY B_{escapement}$. Hence, conducting a short-term forecast that aims at $MSY B_{escapement}$ is not sufficient to buffer the biomass against falling below B_{lim} . One way to ensure the ICES precautionary criterion (probability of SSB being below B_{lim} is $\leq 5\%$) is met, is by incorporating a ceiling on F (F_{cap}) on the escapement strategy, where the value of F_{cap} should ideally be set and evaluated as part of a full stock benchmark.

Examining the development of recruitment in SA 3, ICES considers that a new regime of generally low recruitment has occurred since 1997. During this period, SSB has been rebuilding from 2005 onwards and, hence, even the highest fishing mortality recorded since 2005 ($F = 0.5$, sum of half-yearly F_s used as the basis for the catch options) appears to be precautionary under reduced recruitment. Therefore, ICES uses an $F_{cap} = 0.5$ for this year's advice. This value is considered preliminary and should be reviewed using a full management strategy evaluation during the next benchmark.

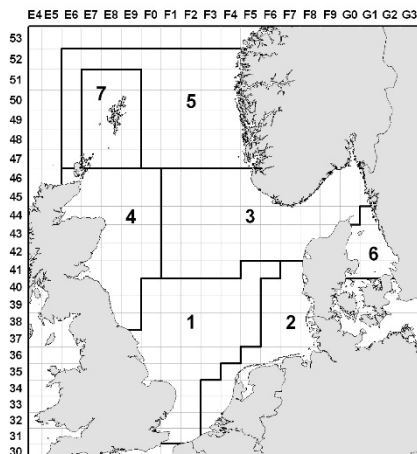


Figure 6.3.39.3 Sandeel in the North Sea (SA 3). Sandeel are largely sedentary after settlement and form a complex of local (sub-) stocks in the North Sea. To avoid local depletion, ICES advice for sandeel is provided separately for seven areas in Division IIIa and Subarea IV. Advice for sandeel in the North Sea (SA 3) specifically applies to sandeel in rectangles 41 F1–F4; 42–43 F1–F9; 44 F1–G0; 45–46 F1–G1; and 47 G0.

Reference points

Table 6.3.39.5 Sandeel in the North Sea (SA 3). Reference points, values and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{\text{escapement}}$	195 000 t	$= B_{\text{pa}}$	ICES, 2010
	F_{MSY}	Not defined.		
Precautionary approach	B_{lim}	100 000 t	The highest SSB (in 2001) in the period (2001–2007) with the lowest SSB and low recruitment.	ICES, 2010
	B_{pa}	195 000 t	$B_{\text{pa}} = B_{\text{lim}} \times \exp(\sigma \times 1.645)$, with $\sigma = 0.40$ estimated from assessment uncertainty in the terminal year.	ICES, 2010
	F_{lim}	Not defined.		
	F_{pa}	Not defined.		
Management plan	SSB_{MGT}	Not defined.		
	F_{MGT}	Not defined.		

Basis of the assessment

Table 6.3.39.6 Sandeel in the North Sea (SA 3).The basis of the assessment and advice.

ICES stock data category	1 (see ICES, 2015b).
Assessment type	Seasonal age-based analytical (SMS-effort) (ICES, 2015a).
Input data	One survey index available in January (dredge survey since 2004). Total international catch and fishing effort. Annual maturity data from the dredge survey. Natural mortality estimated from multispecies assessment (assumed constant over time). Age and length frequencies from catch sampling.
Discards and bycatch	Discarding is considered to be negligible.
Indicators	None.
Other information	Last benchmark in 2010 (ICES, 2010).
Working group	Herring Assessment Working Group (HAWG).

Information from stakeholders

Fishing industry representatives indicated that area misreporting occurred in 2014 and was in the order of magnitude estimated by ICES. They reported that in 2014 the management system operated with individual vessel quotas by sandeel area (SA), which created the incentive and opportunity for misreporting through allocating small shares to vessels in the low TAC areas.

History of advice, catch, and management

Table 6.3.39.7 Sandeel in the North Sea (SA 3). History of ICES advice, the agreed TAC, and ICES estimates of catch. All weights are in thousand tonnes.

Year	ICES advice	Catch corresponding to advice	EU zone TAC	Norwegian zone TAC	ICES catch SA 3	Total ICES catch (SAs 1–7)
2005 *	Exploitation to be kept below the level of 2003. Adjustment to be made conditional on the abundance of the 2004 year class.	-	661 **	10 ***	30	177
2006 *	The fishery should remain closed until information is available which assures that the stock can be rebuilt to B_{pa} by 2007.	-	300 **	0	19	293
2007 *	The fishery should remain closed until information is available which assures that the stock can be rebuilt to B_{pa} by 2008.	-	173 **	51	114	230
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.	-	375 **	128	95	348
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.	-	377 **	0	34	353
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.	-	377 **	50	81	414
2011	No fishery.	0	10	90	95	438
2012	Catches for monitoring purposes should not exceed 5 000 t.	< 5	5	42	46	102
2013	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	< 78.331	40	20	39	278
2014	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	< 270	140	90	154****	262****
2015	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment, with additional F_{cap} .	< 370				

* Advice for Subarea IV, excluding the Shetland area.

** Set for EU waters of Divisions IIa and IIIa and Subarea IV.

*** TAC set for EU fisheries 10 kt, seasonal effort limitations set for Norwegian fisheries.

**** Preliminary.

History of catch and landings

Table 6.3.39.8 Sandeel in the in the North Sea (SA 3). Catch distribution by fleet in 2014 as estimated by ICES.

Total catch (2014)	Landings	Discards
154 kt	100% industrial trawl fisheries	Negligible
	154 kt	

Table 6.3.39.9 Sandeel in the in the North Sea (SA 3). History of total catch (tonnes) as estimated by ICES.

Year	Catch
1982	106707
1983	105974
1984	123639
1985	59090
1986	420304
1987	403897
1988	391050
1989	492396
1990	219103
1991	368324
1992	195733
1993	296118
1994	444084
1995	266720
1996	250253
1997	608164
1998	507269
1999	228163
2000	256250
2001	253088
2002	209344
2003	62569
2004	87695
2005	29667
2006	18867
2007	113906
2008	94576
2009	33889
2010	80724
2011	95190
2012	45141
2013	39233
2014	153746

Summary of the assessment

Table 6.3.39.10 Sandeel in the North Sea (SA 3). Assessment summary with weights (in tonnes), recruits (at age 0, in thousands). The SSB is estimated for January 1st. Yield values used for the assessment do not include catches of age 0 in the 1st half of the year and, hence, may differ slightly from the ICES catch estimates presented in other tables.

Year	Recruits (thousands)	SSB (tonnes)	Yield (tonnes)	Mean F (ages 1–2)
1983	92568000	73091	105946	0.469
1984	44414000	95454	123635	0.502
1985	302008000	141974	59083	0.276
1986	363681000	164638	420341	1.006
1987	84853000	285808	403908	0.915
1988	296648000	386598	391081	1.378
1989	99705000	129312	481893	1.163
1990	203957000	190842	219183	0.6
1991	92749000	196051	368105	0.769
1992	237392000	176535	195700	0.492
1993	216216000	197964	263954	0.676
1994	164432000	246387	444119	0.753
1995	135386000	190400	218922	0.509
1996	930757000	318834	247397	0.417
1997	59256000	250820	604159	0.991
1998	90345000	384086	499333	0.993
1999	107430000	169768	223160	1.399
2000	73916000	72249	242732	1.572
2001	79980000	60960	245290	1.184
2002	15960000	47523	209302	1.23
2003	38593000	56968	58942	0.619
2004	17286000	26839	79234	0.814
2005	30937000	57322	29677	0.268
2006	86299000	45486	18863	0.161
2007	53888000	70118	113232	0.617
2008	98104000	108243	94491	0.545
2009	113609000	67557	33350	0.169
2010	13466000	254199	80576	0.607
2011	11783000	203338	94750	0.549
2012	99625000	111560	45111	0.235
2013	149542000	49103	39233	0.385
2014	383868000	58454	144393	0.515
2015	89426000**	202124*		
Average	149645000	154261	212472	0.712

* Using mean weight-at-age from 2012 to 2014 and proportion mature from December 2014.

** Geometric mean (1983–2013).

Sources and references

ICES. 2010. Report of the Benchmark Workshop on Sandeel (WKSAN), 6–10 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57. 201 pp.

ICES. 2015a. Sandeel in Divisions IIIa and IV. *In* Report of the Herring Assessment Working Group for the Area South of 62°N (HAWG), 10–19 March 2015, ICES HQ, Denmark. ICES CM 2015/ACOM:06.

ICES. 2015b. General context of ICES advice. *In* Report of the ICES Advisory Committee, 2015. ICES Advice 2015, Book 1, Section 1.2.