

ECOREGION North Sea
STOCK Sandeel in Division IIIa and Subarea IV

Introduction

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 for seven areas in Division IIIa and Subarea IV (Figure 6.3.22.1). Generic information is given below, and the advice for sandeel in each of the seven areas is given separately in Sections 6.3.22.1–7.

Section	Sandeel Area (SA)	Name	Rectangles
6.3.22.1	1	Dogger Bank area	31–34 E9–F2; 35 E9–F3; 36 E9–F4; 37 E9–F5; 38–40 F0–F5; 41 F5–F6
6.3.22.2	2	Southeastern North Sea	31–34 F3–F4; 35 F4–F6; 36 F5–F8; 37–40 F6–F8; 41 F7–F8
6.3.22.3	3	Central Eastern North Sea	41 F1–F4; 42–43 F1–F9; 44 F1–G0; 45–46 F1–G1; 47 G0
6.3.22.4	4	Central Western North Sea	38–40 E7–E9; 41–46 E6–F0
6.3.22.5	5	Viking and Bergen Bank areas	47–51 E6 + F0–F5; 52 E6–F5
6.3.22.6	6	Division IIIa East (Kattegat)	41–43 G0–G3; 44 G1
6.3.22.7	7	Shetland area	47–51 E7–E9

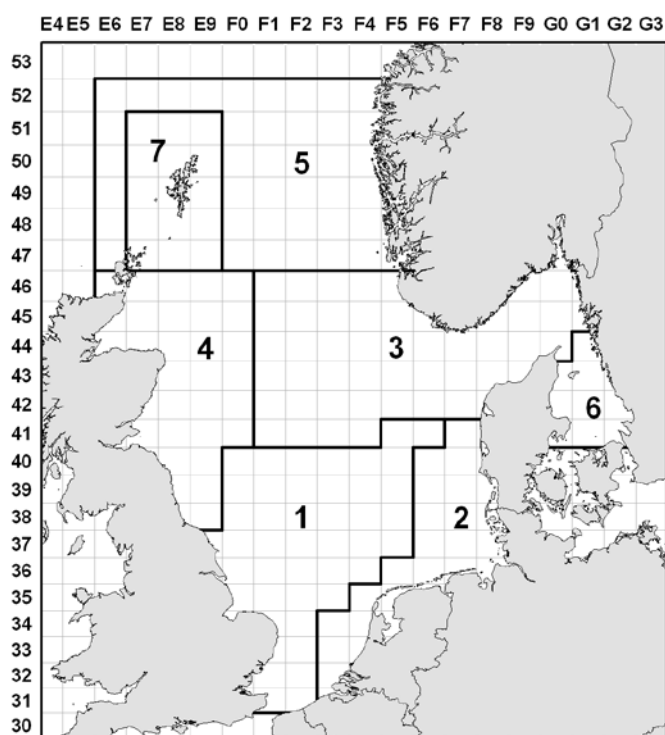


Figure 6.3.22.1 Map of sandeel areas (SAs) in Division IIIa and Subarea IV.

Summary of advice for 2014

An overview of the advice by SA can be found in Table 6.3.22.1.

Table 6.3.22.1 Sandeel in Division IIIa and Subarea IV. Advice overview for all areas.

Year	Sandeel Area 1	Sandeel Area 2	Sandeel Area 3	Sandeel Area 4	Sandeel Area 5	Sandeel Area 6	Sandeel Area 7	EU zone TAC	NOR zone TAC	ICES landings
2005 ¹	Exploitation to be kept below level of 2003. Adjustment to be made conditional on the abundance of the 2004 year class.					No advice		661	10 ²	177
2006 ¹	The fishery should remain closed until information is available which assures that the stock can be rebuilt to B _{pa} by 2007.					No advice		300	0	293
2007 ¹	The fishery should remain closed until information is available which assures that the stock can be rebuilt to B _{pa} by 2008.					No advice		173	51	230
2008 ¹	The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to B _{pa} by 2009.					No advice		375	128	348
2009 ¹	The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to B _{pa} by 2010.					No advice		377	0	353
2010 ¹	The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to B _{pa} by 2011.					No advice		377	50	414
2011	< 320	< 34	0	5–10	No increase in effort unless there is evidence that this is sustainable.			354	90	438
2012	< 23	< 5	< 5	< 5	No increase in catches unless there is evidence that this is sustainable.			61	42	102
2013	< 224.544	< 17.544	< 78.331	< 2.041	0	< 0.219	0	286	20	243 ³
2014	< 57	< 5	< 270	< 5	0	< 0.219	0			

Weights in thousand tonnes.

¹ Advice for Subarea IV, excluding the Shetland area.

² TAC set for EU fisheries 10 kt, seasonal effort limitations set for Norwegian fisheries.

³ Preliminary.

Dredge survey information for December has been available since 2004 and was used to estimate annual recruitment and conduct forecasts for SAs 1, 2, and 3. A dredge survey is also available for SA 4, but at present there is not enough overlap with fishery data to provide a catch forecast. The advice for SAs 4–7 is based on the ICES approach to data-limited stocks.

Prior to 2011, ICES presented advice for this region in three units: the North Sea (excluding the Shetland area), the Shetland area, and the Skagerrak–Kattegat area. From 2011 onward, ICES advice has been provided for seven areas to better reflect the stock structure and to enable management to take action to avoid local depletions, as has been repeatedly advised in recent years. The amount of scientific and fisheries information differs by area and so do the details for each area's advice.

Biology

Sandeel is a short-lived species. The high natural mortality of sandeel and the few age groups in the fishery imply that stock size and catch opportunities are largely dependent on the abundance of incoming year classes. Sandeel are largely sedentary after settlement and form a complex of local (sub-) stocks in the North Sea. Whilst recruitment to individual fishing banks is largely related to the local (sub-) stock, some interchange can occur between (sub-) stocks before sandeel larvae settle.

Environmental influence on the stock

Sandeel is an important prey for many predators, including fish, marine mammals, and seabirds. Changes in the abundances of those predators will affect sandeel natural mortality.

There are indications that the survival of sandeel larvae is linked to the availability of copepod prey in the early spring, especially *Calanus finmarchicus* which supports the survival of sandeel larvae, and that climate-generated shifts in the *Calanus* species composition lead to a mismatch in timing between food availability and the early life history of lesser sandeel, *Ammodytes marinus* (Wright and Bailey, 1996; van Deurs *et al.*, 2009).

The fisheries

Sandeel is taken by trawlers using small-meshed demersal gear. The fishery is seasonal, taking place mostly in the spring and summer. Most of the catch consists of *Ammodytes marinus*, but other sandeel species are caught as well.

Effects of the fisheries on the ecosystem

Sandeel fisheries have a low percentage of bycatch of other fish species, including species for which a TAC has been set (ICES, 2010). A major function of sandeel in the North Sea ecosystem is the provision of food to predators, including fish, marine mammals, and seabirds. As previously noted by ICES, local depletion of sandeel aggregations at a distance less than 100 km from seabird colonies may affect some species of birds, especially black-legged kittiwake and terns, whereas the more mobile marine mammals and fish may be less vulnerable.

Additional considerations

MSY reference points

For short-lived species such as sandeel, ICES interpretation of the MSY concept uses B_{pa} estimates as the default value for MSY $B_{escapement}$. ICES advice is based on the sandeel stock being at or above MSY $B_{escapement}$ in the year after the fishery has taken place. This escapement strategy should retain a stock that is sufficient for successful recruitment and which can also provide an adequate resource for predators of sandeel (ICES, 2010).

Regulations and their effects

In the light of studies linking low sandeel availability to poor breeding success of kittiwake, all commercial fishing in the Firth of Forth (SA 4) has been prohibited since 2000, except for a limited opening to fishing in May and June of each year to monitor the stock.

Fisheries on sandeel are not managed jointly by the coastal states. Since 2004, the sandeel catch advice provided by ICES has been based on the abundance of 1-group sandeel, as estimated from an exploratory fishery in the beginning of the fishing season (years 2004–2010) or from a dredge survey in November/December of the previous year (beginning with 2011 advice). Norway has implemented an experimental area-based sandeel management plan in the Norwegian EEZ since 2010, and regulations in the Norwegian EEZ have differed from those in the EU EEZ.

The number of Danish vessels has declined from 200 vessels in 2004 to 84 in 2009, leading to a 43% reduction in total kilowatt days. In 2007, the Danish industrial vessels were given individual tradable quotas (ITQ) on sandeel which prompted a change towards fewer and larger vessels. The Norwegian fleet fishing for sandeel declined from 90 to 33 vessels between 2002 and 2009.

Changes in fishing technology and fishing patterns

Before 2004, a targeted 0-group fishery occurred in autumn (3rd quarter). This fishery subsequently ceased.

Uncertainties in assessment and forecast

The quality of the current assessment is considered much improved compared to the combined assessment for the whole North Sea as conducted before 2010. This is because the stock assessment areas used since 2010 better reflect the actual spatial stock structure and dynamics of sandeel. The use of fishery-independent data from dredge surveys has also improved the quality of the assessment. Application of the new statistical assessment model “SMS-effort” in combination with the Sandeel Area-based assessment approach has removed retrospective bias in F and SSB for the most recent years. This is probably due to the robust model assumption of fishing mortality being proportional to fishing effort (ICES, 2010).

The confidence limits of the model estimates of F, SSB, and recruitment indicate a high to medium precision for the SA 1 assessment, a medium precision for the SA 2 assessment, and a lower precision for the SA 3 assessment.

Main sources of uncertainty in the assessment and forecast derive from:

- The use of common, time-invariant natural mortality values over all areas.
- The assumption of correspondence between commercial effort and fishing mortality.
- The assumption of a stable age selection pattern over time, in view of the observed changes in fleet structure.
- Observations of effort prior to 2011 that are only available from the Danish fishery (which also has the largest catches), whereas only few observations since 2011 can be used to estimate national differences in catchability.
- Age and length sampling uncertainty, in particular in the less sampled Norwegian EEZ.
- Apparent differences in recruitment between the Norwegian EEZ and the rest of SA 3.
- The assumption that the maturity pattern in the forecast year is the long-term average.

For young fish the sandeel assessments rely on the indices obtained from the dredge surveys and for older fish on biological information provided by the commercial fishery. The low and variable catchability of ages 1 and older in the dredge surveys renders the sandeel assessments very dependent on information on age distributions from the commercial fishery, and obtaining this information is only possible through the TAC for sandeel (as sandeel is not taken as bycatch in other fisheries). Past analyses have shown that stable estimates of catch per unit effort and mean weights-at-age could be achieved with less than 100 samples (see advice on Real Time Monitoring in ICES, 2010a). Based on past average sandeel tonnes per haul (commercially around 55 t) and the fact that it would be preferable to sample no more than one in every three hauls in order to reduce correlation, a monitoring catch obtaining a minimum of 30 samples would be of the order of 5000 t. A monitoring TAC should be taken in a manner that is as similar as possible to the previous years' fishery, and there should be an associated sampling protocol in the fishery as well.

Comparison with previous assessment and advice

In SAs 1 and 2 the 2013 surveys confirmed the 2012 recruitment values estimated in last year's assessment. In SA 3 the 2012 recruitment value estimated in last year's assessment was revised downwards in this year's assessment.

For SAs 1–3 the advice in 2014 is based on the ICES MSY approach to short-lived species and for SAs 4–7 on the ICES approach to data-limited stocks, consistent with the advice in 2013.

Sources

- ICES. 2010a. EC request on in-year management advice for sandeel in the North Sea. *In* Report of the ICES Advisory Committee, 2010, Section 6.3.3.1. ICES Advice 2010, Book 6: 7–10.
- ICES. 2010b. Report of the Benchmark Workshop on Sandeel (WKSAN), 6–10 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57.
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- Van Deurs, M., Van Hal, R., Tomczak, M. T., Jónasdóttir, S. H., and Dolmer, P. 2009. Recruitment of lesser sandeel *Ammodytes marinus* in relation to density dependence and zooplankton composition. *Marine Ecology Progress Series*, 381: 249–258.
- Wright, P. J., and Bailey, M. C. 1996. Timing of hatching in *Ammodytes marinus* from Shetland waters and its significance to early growth and survivorship. *Marine Biology*, 126: 143–152.

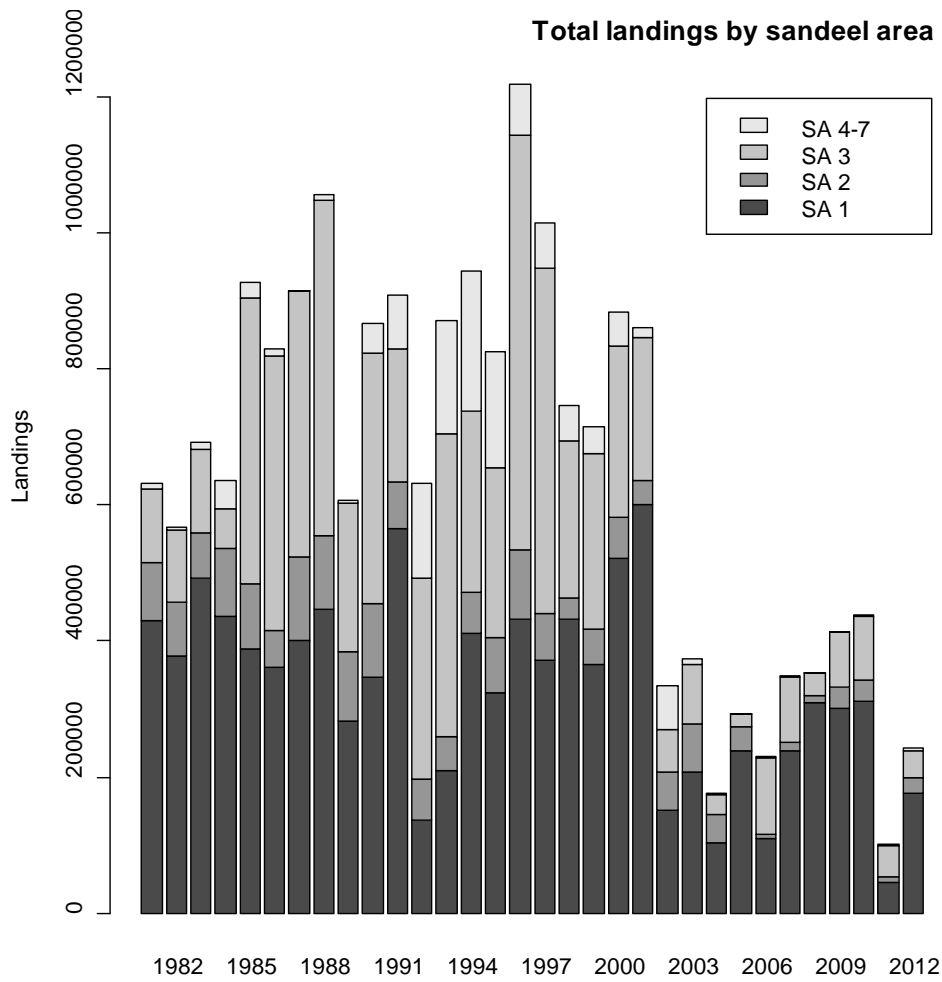


Figure 6.3.22.2 Sandeel in Division IIIa and Subarea IV. Total catch by SA (tonnes).

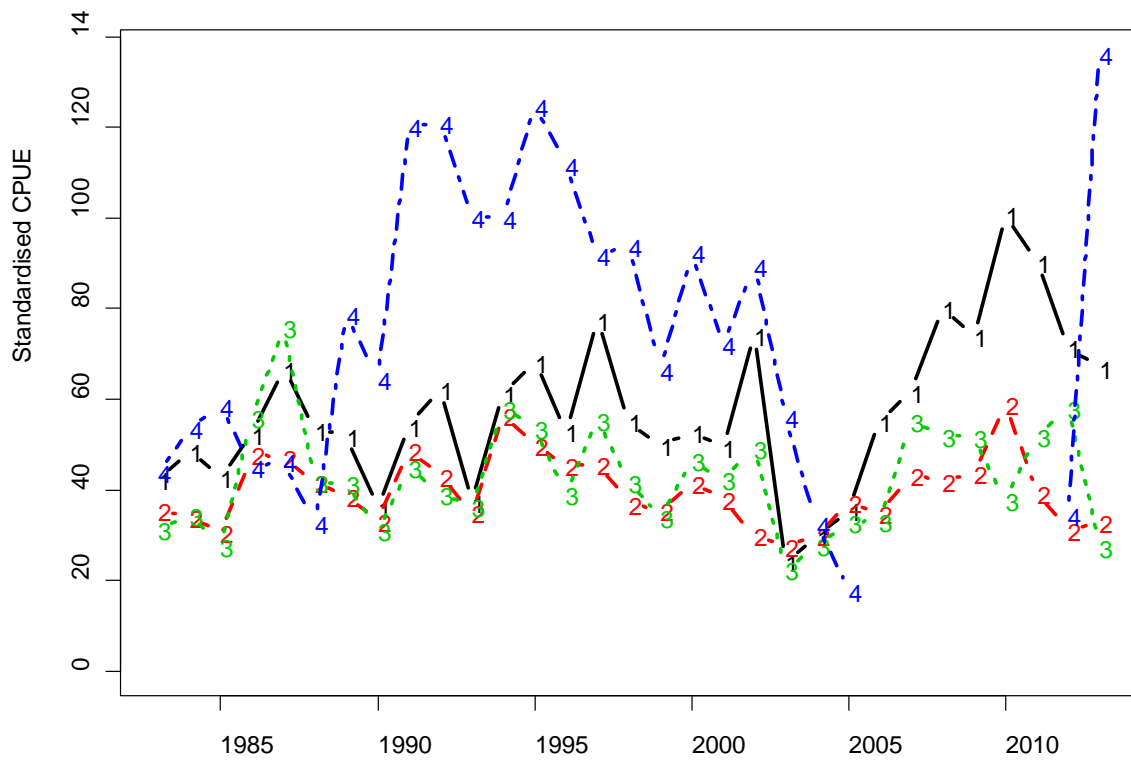


Figure 6.3.22.3 Sandeel in Division IIIa and Subarea IV. Catch (tonnes) per day fishing for a standardized 200 GT vessel in SAs 1-4. Figure labels correspond to SA numbers.

Table 6.3.22.2

Sandeel in Division IIIa and Subarea IV. Total catch (tonnes) by SA as reported to ICES. Yield values used for assessments per area are corrected for SOP (sum of products of catch numbers by mean weight-at-age) and hence may differ slightly from landings values in this table.

Year	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	All
1983	377558	80482	105974	2796	0	0	0	566810
1984	491950	66352	123639	2570	6587	0	0	691098
1985	436214	99428	59090	38123	3004	0	0	635858
1986	389081	94604	420304	12706	11277	0	0	927973
1987	360867	53761	403897	8179	1713	0	0	828417
1988	401551	121394	391050	1335	0	0	0	915330
1989	445586	109691	492395	4384	3353	909	0	1056318
1990	283259	100960	219103	3314	374	499	0	607508
1991	346621	107663	368324	41372	3697	17	0	867694
1992	564285	69848	195733	68905	4554	4277	0	907600
1993	136538	59820	296118	133136	666	4490	0	630768
1994	209631	50648	444084	159789	2765	3748	0	870666
1995	410687	60143	266720	52759	150637	1830	0	942776
1996	324561	80205	250252	162338	6176	1263	0	824796
1997	431871	102730	608164	59353	11279	2373	2068	1217839
1998	371060	68950	507269	58460	2984	936	5182	1014841
1999	431774	32377	229914	52743	141	134	0	747083
2000	365702	52573	257802	37875	327	680	0	714959
2001	522315	58711	253350	47883	1689	312	0	884260
2002	599971	35576	209448	12221	10	2378	0	859604
2003	150887	56328	62632	63885	44	869	73	334718
2004	206696	71426	87695	6915	0	570	0	373302
2005	103777	41447	29667	1486	0	262	0	176640
2006	238296	35392	18867	85	0	161	0	292802
2007	109363	5910	113905	11	4	661	0	229855
2008	238523	13065	94576	1201	0	472	0	347836
2009	308596	10177	33889	0	0	260	0	352922
2010	301304	31750	80724	273	0	132	0	414183
2011	311945	29874	95190	272	0	481	0	437761
2012	45636	8098	45109	2546	0	211	0	101599
2013	176747	22348	39115	5032	0	102	0	243345
Average	325576	59088	219484	33611	6816	904	236	645715

Table 6.3.22.3 Sandeel in Division IIIa and Subarea IV. ICES estimates of landings (thousand tonnes) per country.

Year	Denmark	Germany	Faroes	Ireland	Netherlands	Norway	Sweden	UK	Lithuania	Total
1955	37.6	+	-	-	-	-	-	-	-	37.6
1956	81.9	5.3	-	-	+	1.5	-	-	-	88.7
1957	73.3	25.5	-	-	3.7	3.2	-	-	-	105.7
1958	74.4	20.2	-	-	1.5	4.8	-	-	-	100.9
1959	77.1	17.4	-	-	5.1	8.0	-	-	-	107.6
1960	100.8	7.7	-	-	+	12.1	-	-	-	120.6
1961	73.6	4.5	-	-	+	5.1	-	-	-	83.2
1962	97.4	1.4	-	-	-	10.5	-	-	-	109.3
1963	134.4	16.4	-	-	-	11.5	-	-	-	162.3
1964	104.7	12.9	-	-	-	10.4	-	-	-	128.0
1965	123.6	2.1	-	-	-	4.9	-	-	-	130.6
1966	138.5	4.4	-	-	-	0.2	-	-	-	143.1
1967	187.4	0.3	-	-	-	1.0	-	-	-	188.7
1968	193.6	+	-	-	-	0.1	-	-	-	193.7
1969	112.8	+	-	-	-	-	-	0.5	-	113.3
1970	187.8	+	-	-	-	+	-	3.6	-	191.4
1971	371.6	0.1	-	-	-	2.1	-	8.3	-	382.1
1972	329.0	+	-	-	-	18.6	8.8	2.1	-	358.5
1973	282.9	-	1.4	-	-	17.2	1.1	4.2	-	306.8
1974	432.0	-	6.4	-	-	78.6	0.2	15.5	-	532.7
1975	372.0	-	4.9	-	-	54.0	0.2	13.6	-	444.7
1976	446.1	-	-	-	-	44.2	0.1	18.7	-	509.1
1977	680.4	-	11.4	-	-	78.7	6.1	25.5	-	802.1
1978	669.2	-	12.1	-	-	93.5	2.3	32.5	-	809.7
1979	483.1	-	13.2	-	-	101.4	-	13.4	-	611.1
1980	581.6	-	7.2	-	-	144.8	-	34.3	-	767.9
1981	523.8	-	4.9	-	-	52.6	-	46.7	-	628.1
1982	528.4	-	4.9	-	-	46.5	0.4	52.2	-	632.4
1983	515.2	-	2.0	-	-	12.2	0.2	37.0	-	566.8
1984	618.9	-	11.3	-	-	28.3	-	32.6	-	691.1
1985	601.7	-	3.9	-	-	13.1	-	17.2	-	635.9
1986	832.7	-	1.2	-	-	82.1	-	12.0	-	928.0
1987	609.2	-	18.6	-	-	193.4	-	7.2	-	828.4
1988	708.8	-	15.5	-	-	185.1	-	5.8	-	915.3
1989	841.6	-	16.6	-	-	186.8	-	11.5	-	1056.3
1990	512.1	-	2.2	-	0.3	88.9	-	3.9	-	607.5
1991	726.5	-	11.2	-	-	128.8	-	1.2	-	867.7
1992	803.7	-	9.1	-	-	89.3	0.6	4.9	-	907.6
1993	533.4	-	0.3	-	-	95.5	-	1.5	-	630.8
1994	688.6	-	10.3	-	-	165.8	-	5.9	-	870.7
1995	672.6	-	-	-	-	263.4	-	6.7	-	942.8
1996	649.5	-	5.0	-	-	160.7	-	9.7	-	824.8
1997	831.8	-	11.2	-	-	350.1	-	24.6	-	1217.8
1998	628.2	-	11.0	-	+	343.3	8.6	23.8	-	1014.8
1999	511.3	-	13.2	0.4	+	187.6	23.2	11.5	-	747.1

Year	Denmark	Germany	Faroese	Ireland	Netherlands	Norway	Sweden	UK	Lithuania	Total
2000	557.3	-	-	-	+	119.0	28.6	10.8	-	715.7
2001	650.0	-	-	-	-	183.0	50.0	1.3	-	884.3
2002	659.5	-	-	-	-	176.0	19.2	4.9	-	859.6
2003	282.8	-	-	-	-	29.6	21.8	0.5	-	334.7
2004	288.8	2.7	-	-	-	48.5	33.3	+	-	373.3
2005	158.9	-	-	-	-	17.3	0.5	-	-	176.6
2006	255.4	3.2	-	-	-	5.6	27.9	-	-	292.8
2007	166.9	1.0	2.0	-	-	51.1	7.9	1.0	-	229.9
2008	246.9	4.4	2.4	-	-	81.6	12.5	-	-	347.8
2009	293.0	12.2	2.5	-	1.8	27.4	12.4	3.6	2.0	352.9
2010	285.9	13.0	-	-	-	78.0	32.7	4.0	0.6	414.2
2011	278.5	9.8	-	-	-	109.0	32.7	6.1	1.7	437.8
2012	51.5	1.7	-	-	-	42.5	5.7	-	-	101.4
2013	206.0	7.9	-	-	0.4	29.1	-	-	-	243.4

+ = less than half unit.

- = no information or no catch.

ECOREGION North Sea
STOCK Sandeel in the Dogger Bank area (SA 1)

Advice for 2014

ICES advises on the basis of the MSY approach that the catch in 2014 should be no more than 57 000 t to maintain SSB in 2015 above MSY $B_{\text{escapement}}$. All catches are assumed to be landed.

Stock status

		Fishing pressure		
		2011	2012	2013
MSY (F_{MSY})		?	?	? Undefined
Precautionary approach ($F_{\text{pa}}, F_{\text{lim}}$)		?	?	? Undefined
		Stock size		
		2012	2013	2014
MSY ($B_{\text{escapement}}$)		✓	✗	✗ Below escapement trigger
Precautionary approach ($B_{\text{pa}}, B_{\text{lim}}$)		✓	✗	○ Increased risk

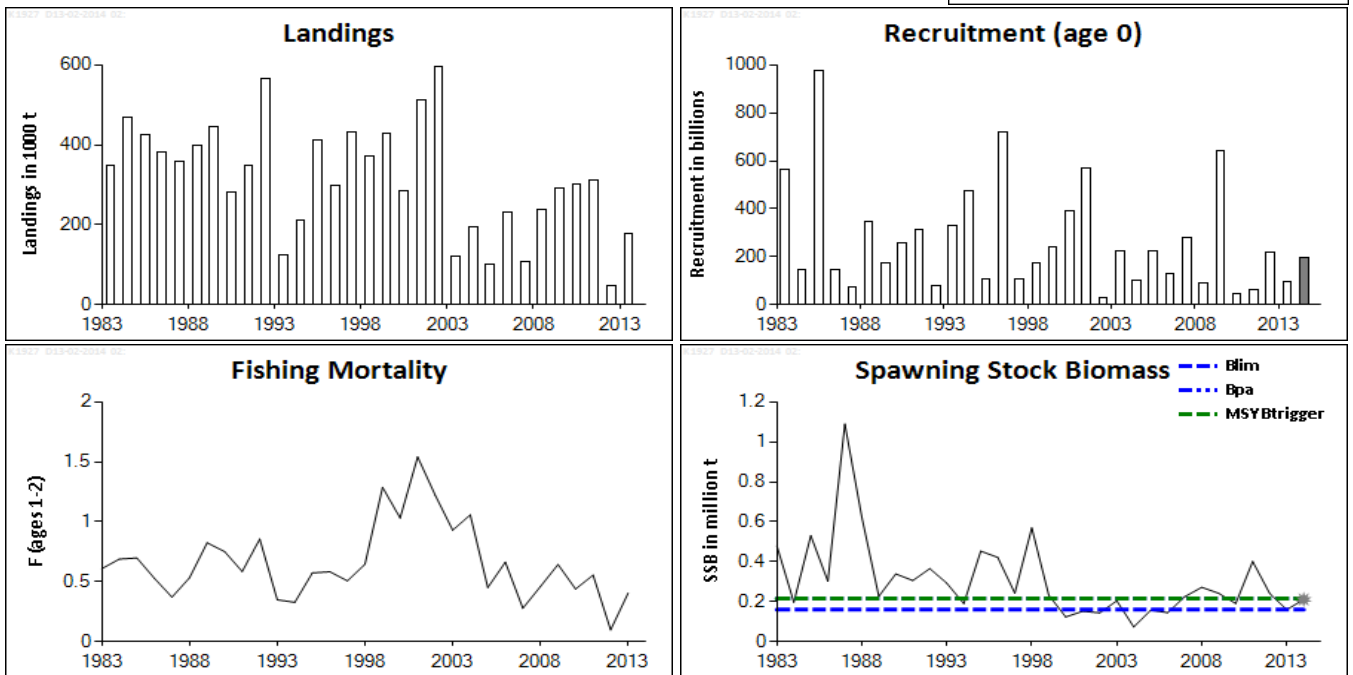
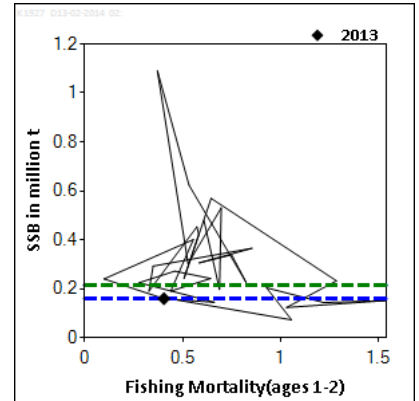


Figure 6.3.22.1.1 Sandeel in the Dogger Bank area (SA 1). Summary of stock assessment. Top right: SSB and F over the years. Predicted values are shaded.

The stock was at B_{lim} in 2013 and is estimated to be just below B_{pa} in 2014. Low mean weights in 2013 seem to be the main reason for the stock size being lower than expected. Recruitment in 2013 was below average.

Management plans

No specific management objectives are known to ICES.

Fisheries

Catch distribution Total catch (2013): 177 kt, where 177 kt were official landings (100% industrial trawl fisheries).

Quality considerations

The quality of the assessment is considered to be fairly good. The assessment relies on the assumption that the age selectivity of the fishery has remained the same since 1999 and that the commercial fishery supplies sufficient sampling information on older age groups (which are not caught representatively in the dredge survey). Observed changes in fleet structure during the last decade may have changed the fishing selection pattern to some extent, but the assessment is considered to be robust to moderate departures.

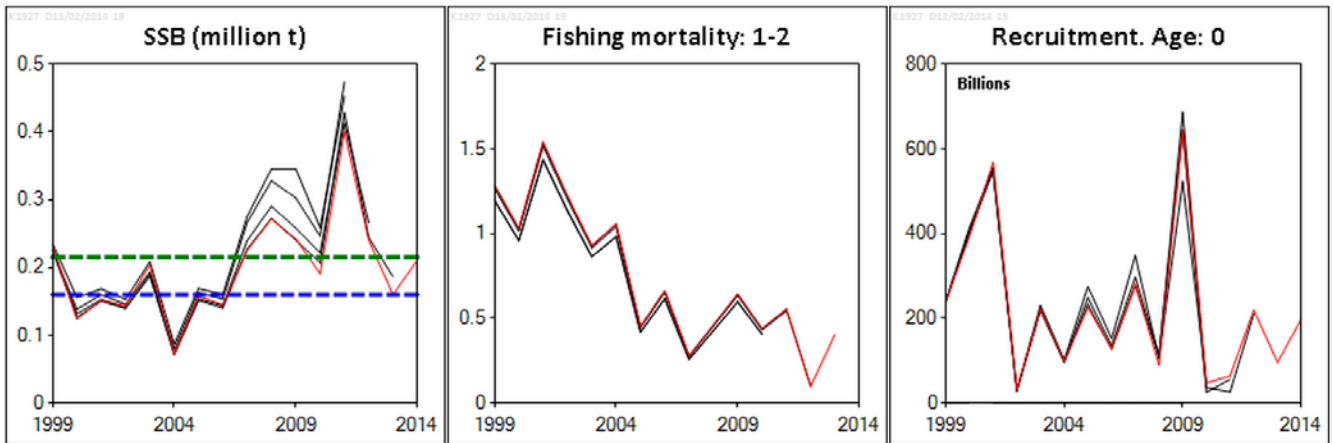


Figure 6.3.22.1.2 Sandeel in the Dogger Bank area (SA 1). Historical assessment results (final-year recruitment estimates included).

Scientific basis

Stock data category	1 (see ICES, 2013)
Assessment type	Seasonal age-based analytical (SMS-effort).
Input data	One survey index in December (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	Not included in the assessment, and discards are considered to be negligible.
Indicators	None.
Other information	Last benchmark in 2010 (ICES, 2010).
Working group	Herring Assessment Working Group (HAWG).

ECOREGION North Sea
STOCK Sandeel in the Dogger Bank area (SA 1)

Reference points

	<i>Type</i>	<i>Value</i>	<i>Technical basis</i>
MSY Approach	MSY $B_{\text{escapement}}$	215 000 t	= B_{pa}
	F_{MSY}	Not defined.	
Precautionary Approach	B_{lim}	160 000 t	Median SSB in the years (2000–2006) of lowest SSB and no impaired recruitment (ICES, 2010).
	B_{pa}	215 000 t	$B_{\text{pa}} = B_{\text{lim}} \times \exp^{(\sigma * 1.645)}$, with $\sigma = 0.18$ estimated from assessment uncertainty in the terminal year (ICES, 2010).
	F_{lim}	Not defined.	
	F_{pa}	Not defined.	

(last changed in: 2010)

Outlook for 2014

Basis: $F(2013) = \text{sum of half yearly } F_s = 0.33$; $\text{Recruitment}(2013) = 96 \text{ billion}$; $\text{Recruitment}(2014) = \text{geometric mean (GM } 1983\text{--}2012) = 198 \text{ billion}$; $\text{SSB}(2014) = 211$; $\text{catches}(2013) = 177$; $\text{discards} = \text{negligible}$.

Rationale	Catches (2014)	Basis	F (2014)	SSB (2015)	%SSB change¹
MSY approach	57	MSY	0.16	215	2%
Zero catch	0	$F = 0$	0	252	19%
Other options	30	$F_{2013} \times 0.25$	0.08	232	10%
	57	$F_{2013} \times 0.5$	0.17	215	2%
	83	$F_{2013} \times 0.75$	0.25	198	-6%
	106	$F_{2013} \times 1$	0.33	183	-13%
	128	$F_{2013} \times 1.25$	0.41	170	-20%
	148	$F_{2013} \times 1.5$	0.5	157	-26%

Weights in thousand tonnes.

¹⁾ SSB 2015 relative to SSB 2014.

MSY approach

Following the ICES MSY approach to a short-lived species the fishery in 2014 should allow for sufficient stock (MSY $B_{\text{escapement}}$) to remain for successful recruitment. This implies a catch of no more than 57 000 t in 2014.

Additional considerations*Uncertainties in assessment and forecast*

The main uncertainties were noted in the introductory section for this advice (Section 6.3.22). Year-to-year variations in weights or maturity may increase the uncertainty of the forecast. In 2013, unusually low mean weights were observed, and last year's forecast could not account for this.

Management plans

A management plan needs to be developed. The ICES approach to MSY-based management of a short-lived species like sandeel is an escapement strategy, i.e. to maintain SSB above MSY $B_{\text{escapement}}$ after the fishery has taken place. This does not include an upper limit on F . Taking the historical F and stock development into account, an F value above 0.6 can probably not be recommended in any year.

Sources

- ICES. 2010. Report of the Benchmark Workshop on Sandeel (WKSAN), 6–10 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57.
- ICES. 2013. Advice basis. *In* Report of the ICES Advisory Committee, 2013. ICES Advice 2013, Book 1, Section 1.2.
- ICES. 2014. Sandeel in Divisions IIIa and IV. *In* Report of the Herring Assessment Working Group (HAWG). ICES CM 2014/ACOM:06, Section 11.

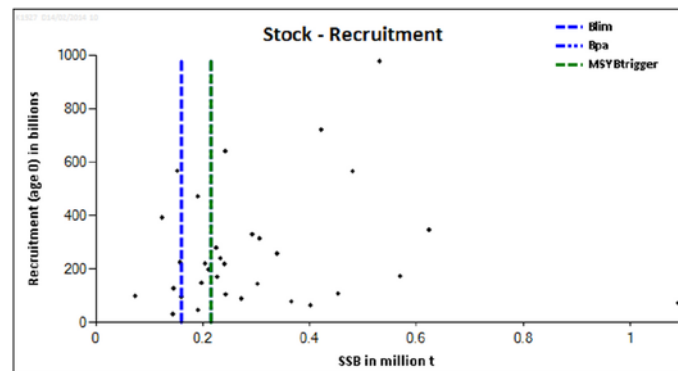


Figure 6.3.22.1.3 Sandeel in the Dogger Bank area (SA 1). Stock–recruitment plot.

Table 6.3.22.1.1 Sandeel in the Dogger Bank area (SA 1). ICES advice, management, and landings.

Year	ICES Advice	Catch corresponding to advice	TAC	ICES landings SA 1	ICES landings total
2005 ¹	Exploitation to be kept below the level of 2003. Adjustment to be made conditional on the abundance of the 2004 year class.	-	661 ²	104	177
2006 ¹	The fishery should remain closed until information is available which assures that the stock can be rebuilt to B_{pa} by 2007.	-	300 ²	238	293
2007 ¹	The fishery should remain closed until information is available which assures that the stock can be rebuilt to B_{pa} by 2008.	-	173 ²	109	230
2008 ¹	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 ²	239	348
2009 ¹	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 ²	309	353
2010 ¹	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 ²	301	414
2011	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	< 320	320	312	438
2012	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	< 23	23	46	102
2013	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	< 224.544	225	177 ³	243 ³
2014	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	< 57			

Weights in thousand tonnes.

¹ Advice for Subarea IV, excluding the Shetland area.

² Set for EU waters of Divisions IIa and IIIa and Subarea IV.

³ Preliminary.

Table 6.3.22.1.2 Sandeel in the Dogger Bank area (SA 1). Summary of the assessment.

Year	Recruitment Age 0 thousands	SSB tonnes	Landings Tonnes	Mean F Ages 1–2
1983	566593000	480185	349232	0.609
1984	148331000	197290	467609	0.689
1985	978622000	530581	424114	0.698
1986	144794000	302234	382735	0.528
1987	72600000	1089740	357671	0.371
1988	347441000	623237	398271	0.533
1989	170905000	226754	445695	0.825
1990	258065000	338863	283040	0.751
1991	315213000	306016	347096	0.585
1992	78474000	365652	564298	0.856
1993	330130000	292555	124082	0.349
1994	472180000	190516	209538	0.328
1995	108383000	453055	410513	0.573
1996	722061000	421642	298702	0.583
1997	105152000	242655	431808	0.507
1998	173758000	569343	371117	0.646
1999	240312000	232458	427691	1.288
2000	392761000	123602	284521	1.032
2001	568040000	152005	513068	1.542
2002	31178000	143947	596049	1.223
2003	221089000	204094	121863	0.93
2004	99008000	73288	195274	1.058
2005	225507000	157282	100835	0.451
2006	127864000	145013	231448	0.663
2007	280385000	224968	108600	0.278
2008	89644000	272043	237447	0.46
2009	642042000	242079	291247	0.644
2010	46640000	190957	300954	0.439
2011	64248000	401209	311542	0.555
2012	219507000	240475	45636	0.098
2013	95886000	159757	176203	0.405
2014	198000000**	211000*		
Average	266712906	306390	316384	0.661

* Using mean weight-at-age from 2011 to 2013.

**Period 1983–2012.

ECOREGION North Sea
STOCK Sandeel in the Southeastern North Sea (SA 2)

Advice for 2014

ICES advises on the basis of the MSY approach that there should be zero catch in 2014. However, a zero TAC will not provide samples from the fishery that help the continuity of the assessment in coming years. A monitoring TAC should be considered, with an associated sampling protocol in the fishery. Total catches should not exceed 5000 t. All catches are assumed to be landed.

Stock status

Fishing pressure			
	2011	2012	2013
MSY (F_{MSY})	?	?	?
Precautionary approach (F_{pa} , F_{lim})	?	?	?
			Undefined
			Undefined
Stock size			
	2012	2013	2014
MSY ($B_{escapement}$)	✗	✗	✗
Precautionary approach (B_{pa} , B_{lim})	○	○	○
			Below escapement trigger
			Increased risk

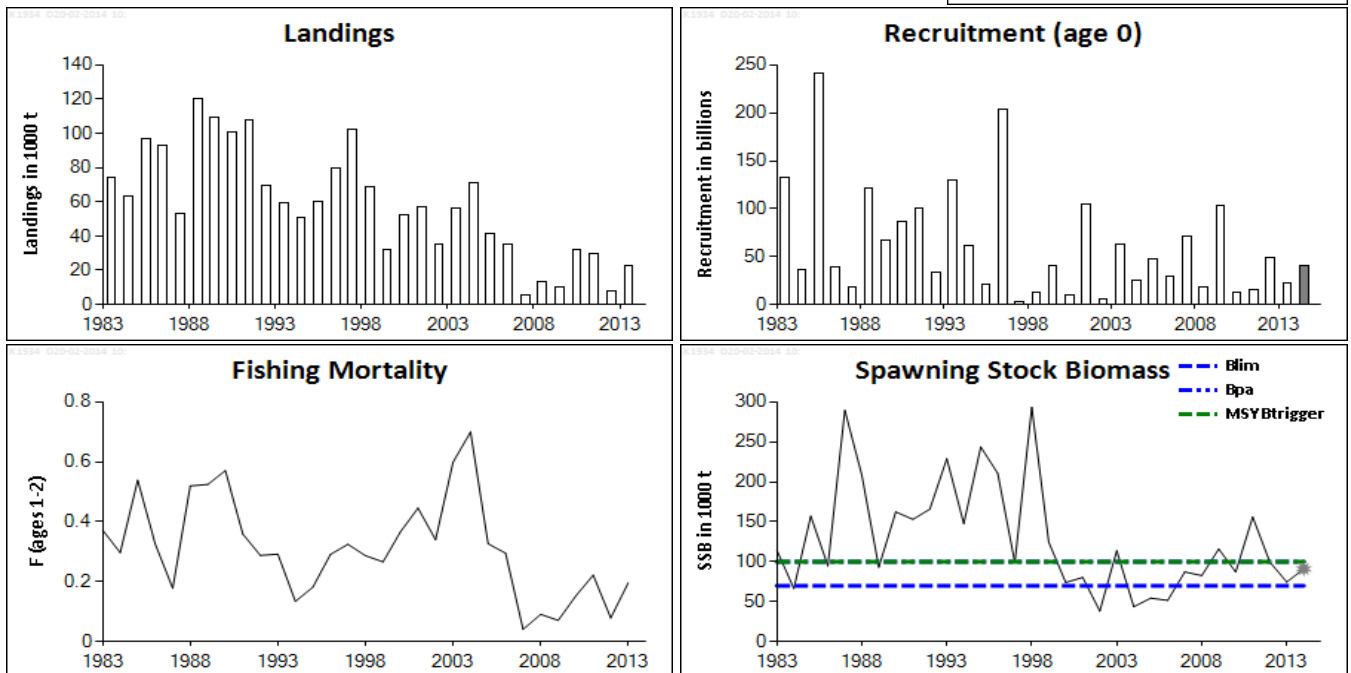
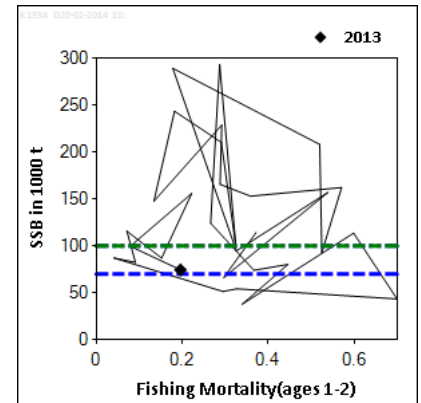


Figure 6.3.22.2.1 Sandeel in the Southeastern North Sea (SA 2). Summary of stock assessment (weights in thousand tonnes). Top right: SSB and F over the years. Predicted values are shaded.

SSB has increased in 2014, but remains below B_{pa} . Recruitment in 2013 is estimated to be low, and this is expected to keep SSB below B_{pa} in 2015.

Management plans

No specific management objectives are known to ICES.

Fisheries

Catch distribution Total catch (2013): 22 kt, where 22 kt were official landings (100% industrial trawl fisheries).

Quality considerations

The assessment relies on the assumption that the fisheries age selection pattern has remained the same since 1999 and that the commercial fishery supplies sufficient sampling information on older age groups. A change in the fishing pattern would make the current advice less accurate. The available survey time-series in SA 2 is still short (2010–2013), therefore the survey index from SA 1 (age 0) is applied in the SA 2 assessment. The assessment is considered to be of medium quality, but will be further improved once a longer time-series of dredge survey catches from SA 2 exists.

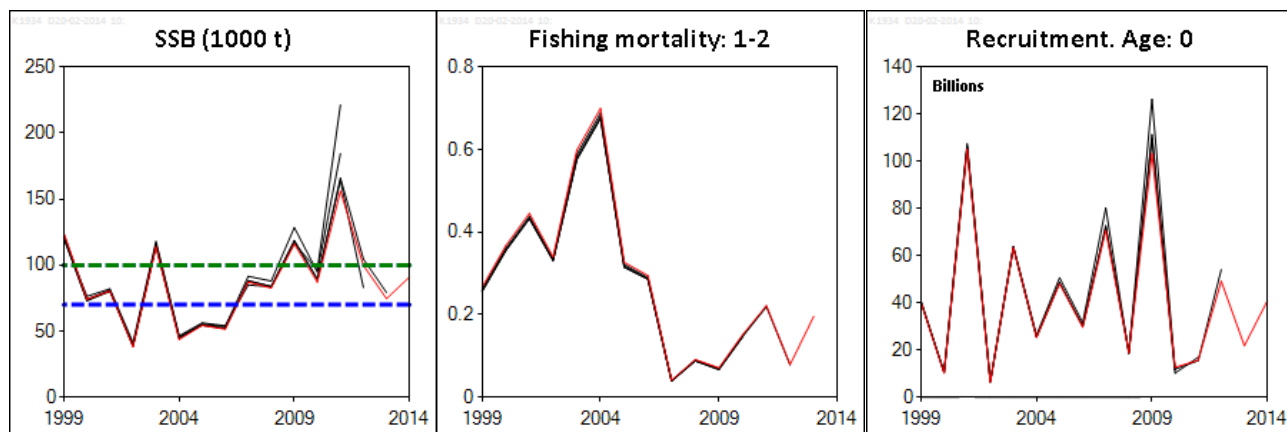


Figure 6.3.22.2.2 Sandeel in the Southeastern North Sea (SA 2). Historical assessment results (final-year recruitment estimates included).

Scientific basis

Stock data category	1 (see ICES, 2013)
Assessment type	Seasonal age-based analytical (SMS-effort).
Input data	One survey index (dredge survey since 2004) from SA 1 is applied. 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	Not included in the assessment, and discards are considered to be negligible.
Indicators	None.
Other information	Last benchmark in 2010 (ICES, 2010).
Working group	Herring Assessment Working Group (HAWG).

ECOREGION North Sea
STOCK Sandeel in the Southeastern North Sea (SA 2)

Reference points

	<i>Type</i>	<i>Value</i>	<i>Technical basis</i>
MSY Approach	MSY $B_{\text{escapement}}$	100 000 t	$= B_{\text{pa}}$
	F_{MSY}	Not defined.	
Precautionary Approach	B_{lim}	70 000 t	Median SSB in the years (2000–2006) of lowest SSB and no impaired recruitment (ICES, 2010).
	B_{pa}	100 000 t	$B_{\text{pa}} = B_{\text{lim}} \times \exp^{(\sigma * 1.645)}$, with $\sigma = 0.23$ estimated from assessment uncertainty in the terminal year (ICES, 2010).
	F_{lim}	Not defined.	
	F_{pa}	Not defined.	

(last changed in: 2010)

Outlook for 2014

Basis: $F(2013) = \text{sum of half yearly } F_s = 0.2$; Recruitment(2013) = 22 billion; Recruitment(2014) = geometric mean (GM 1983–2012) = 41 billion; SSB(2014) = 91; catches (2013) = 22; discards = negligible.

Rationale	Catches (2014)	Basis	F (2014)	SSB (2015)	%SSB change¹
MSY-approach	0	MSY	0	84	–8%
5000 t monitoring TAC	5	$F_{2013} \times 0.23$	0.04	80	–12%
Zero catch	0	$F = 0$	0	84	–8%
Other options	6	$F_{2013} \times 0.25$	0.05	80	–13%
	11	$F_{2013} \times 0.5$	0.1	76	–17%
	16	$F_{2013} \times 0.75$	0.15	72	–21%
	21	$F_{2013} \times 1$	0.2	69	–25%
	25	$F_{2013} \times 1.25$	0.25	65	–28%

Weights in thousand tonnes.

¹⁾ SSB 2015 relative to SSB 2014.

MSY approach

Following the ICES MSY approach to a short-lived species, the fishery in 2014 should allow for sufficient stock (MSY $B_{\text{escapement}}$) to remain for successful recruitment. This implies zero catch in 2014, and even then the SSB is expected to be below MSY $B_{\text{escapement}}$ in 2015.

In order to present an assessment, data on biological characteristics of the catch composition and catch and effort data are required. A zero TAC will not provide any information on the status of 1-year old and older sandeel, important for the continuity of the assessment in coming years. The advice of a maximum of 5000 t of catch in 2014, with an associated sampling protocol in the fishery, should provide sufficient samples and, thus, reliable estimates. This catch would result in $F = 0.04$ in 2014 and 80 kt of SSB in 2015, as opposed to 84 kt with no catch. In both cases, SSB would be between B_{lim} and B_{pa} in 2015. This amount of catch in 2014 is not considered to compromise the long-term sustainability of sandeel in SA 2.

Additional considerations*Uncertainties in assessment and forecast*

There appears to be a sufficiently robust relationship between the recruitments in SAs 1 and 2 to be able to apply the data sources and procedures from SA 1 to estimate the incoming year-class strength in SA 2 as well. The dredge survey was expanded in 2010 to cover SA 2.

Management plans

A management plan needs to be developed. The 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. This does not include an upper limit on F . Taking the historical F and stock development into account, an F value above 0.4–0.5 can probably not be recommended in any year.

Sources

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

ICES. 2013. Advice basis. *In* Report of the ICES Advisory Committee, 2013. ICES Advice 2013, Book 1, Section 1.2.

ICES. 2014. Sandeel in Divisions IIIa and IV. *In* Report of the Herring Assessment Working Group (HAWG). ICES CM 2014/ACOM:06, Section 11.

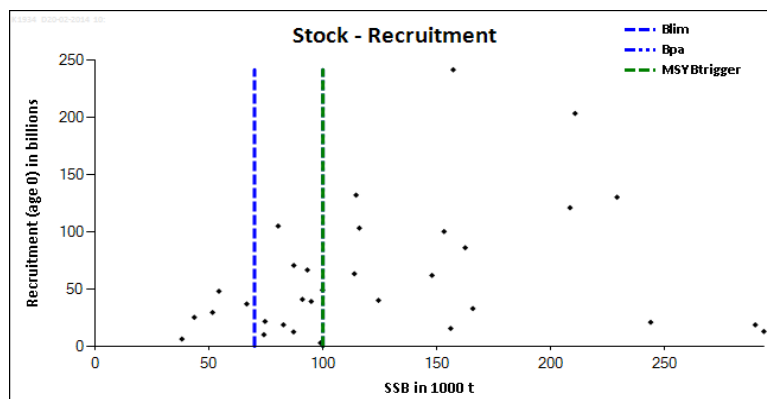


Figure 6.3.22.2.3 Sandeel in the Southeastern North Sea (SA 2). Stock–recruitment plot.

Table 6.3.22.2.1 Sandeel in the Southeastern North Sea (SA 2). ICES advice, management, and landings.

Year	ICES Advice	Catch corresponding to advice	TAC	ICES landings SA 2	ICES landings total
2005 ¹	Exploitation to be kept below the level of 2003. Adjustment to be made conditional on the abundance of the 2004 year class.	-	661 ²	41	177
2006 ¹	The fishery should remain closed until information is available which assures that the stock can be rebuilt to B_{pa} by 2007.	-	300 ²	35	293
2007 ¹	The fishery should remain closed until information is available which assures that the stock can be rebuilt to B_{pa} by 2008.	-	173 ²	6	230
2008 ¹	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 ²	13	348
2009 ¹	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 ²	10	353
2010 ¹	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 ²	32	414
2011	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	< 34	34	30	438
2012	Catches for monitoring purposes should not exceed 5 000 t.	< 5	0	8	102
2013	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	< 17.544	18	22 ³	243 ³
2014	Catches for monitoring purposes should not exceed 5 000 t.	< 5			

Weights in thousand tonnes.

¹ Advice for Subarea IV, excluding the Shetland area.² Set for EU waters of Divisions IIa and IIIa and Subarea IV.³ Preliminary.

Table 6.3.22.2.2 Sandeel in the Southeastern North Sea (SA 2). Summary of the assessment.

Year	Recruitment Age 0 thousands	SSB tonnes	Landings Tonnes	Mean F Ages 1–2
1983	132153000	114552	74481	0.372
1984	37040000	66582	63046	0.297
1985	241606000	157150	96645	0.539
1986	39260000	94848	93146	0.326
1987	18772000	289637	53284	0.178
1988	121089000	208420	120382	0.52
1989	66695000	93149	109703	0.525
1990	86157000	162435	100917	0.571
1991	100317000	153165	107795	0.359
1992	33018000	165784	69825	0.288
1993	130283000	229037	59652	0.292
1994	62000000	147831	50656	0.134
1995	21034000	243763	60138	0.182
1996	203518000	210608	80012	0.291
1997	3013000	98944	102726	0.325
1998	13036000	293413	68953	0.287
1999	40196000	124332	32108	0.266
2000	10210000	74118	52228	0.367
2001	105119000	80390	56934	0.446
2002	6416000	38152	35494	0.34
2003	63427000	113777	55924	0.599
2004	25357000	43590	71413	0.7
2005	48135000	54389	41420	0.327
2006	29652000	51559	35351	0.295
2007	70718000	87237	5911	0.041
2008	18806000	82636	13064	0.091
2009	103315000	115980	10240	0.071
2010	12652000	87135	31747	0.152
2011	15653000	156047	29900	0.222
2012	49188000	99818	8098	0.079
2013	21803000	74594	22348	0.196
2014	41000000**	91000*		
Average	61582438	128252	58501	0.312

*Using mean weight-at-age from 2011 to 2013.

**Period 1983–2012.

ECOREGION North Sea
STOCK Sandeel in the Central Eastern North Sea (SA 3)

Advice for 2014

ICES advises on the basis of the MSY approach that the catch in 2014 should be no more than 270 000 t to maintain SSB in 2015 above MSY $B_{escapement}$. All catches are assumed to be landed. The advised catch is mainly driven by a large recruitment in 2013 as estimated by the dredge survey.

Stock status

Fishing pressure				
	2011	2012	2013	
MSY (F_{MSY})	?	?	?	Undefined
Precautionary approach (F_{pa}, F_{lim})	?	?	?	Undefined
Stock size				
	2012	2013	2014	
MSY ($B_{escapement}$)	✗	✗	✗	Below escapement trigger
Precautionary approach (B_{pa}, B_{lim})	○	✗	✗	Below B_{lim}

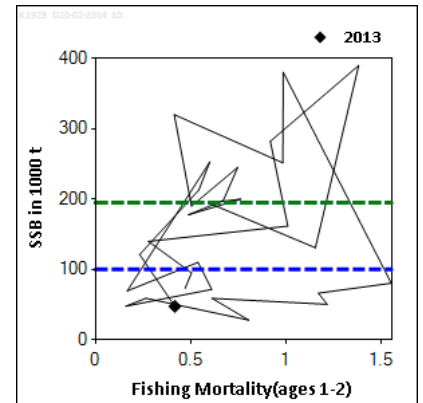


Figure 6.3.22.3.1 Sandeel in the Central Eastern North Sea (SA 3). Summary of stock assessment (weights in thousand tonnes). Top right: SSB and F over the years. Predicted values are shaded.

The SSB in 2014 is below B_{lim} and recruitment in 2013 was estimated to be high. This high recruitment should lead to an increase in SSB in 2015 and is the main reason for the high catch advice in 2014.

Low SSB in 2013 and 2014 is caused by historically low fish weights in 2013. Further factors contributing to the low SSB in 2014 are the historically low proportion of mature fish at age 2 observed in the dredge survey at the end of 2013 and the downward revision of the 2012 recruitment in this year's assessment.

Management plans

An experimental sandeel management plan has been applied in the Norwegian EEZ since 2010. ICES has not been requested to evaluate this management plan.

The fisheries

Catch distribution Total catch (2013): 39 kt, where 39 kt were official landings (100% industrial trawl fisheries).

Quality considerations

The quality of the assessment for SA 3 is considered to be less than the assessment for SA 1. The dredge survey only covers the southern part of SA 3. The 2012 recruitment estimate was mainly driven by data from one sampling station. This recruitment has been revised downwards by 39% in this year's assessment. The 2013 survey shows high recruitment on several stations, suggesting a more robust recruitment estimate than last year's. There have been substantial differences in management in the past five 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). This raises questions regarding the reliability of a common assessment, as the current assessment relies on the assumption of a constant age selection pattern and on the commercial fishery supplying sufficient sampling information on the older age groups.

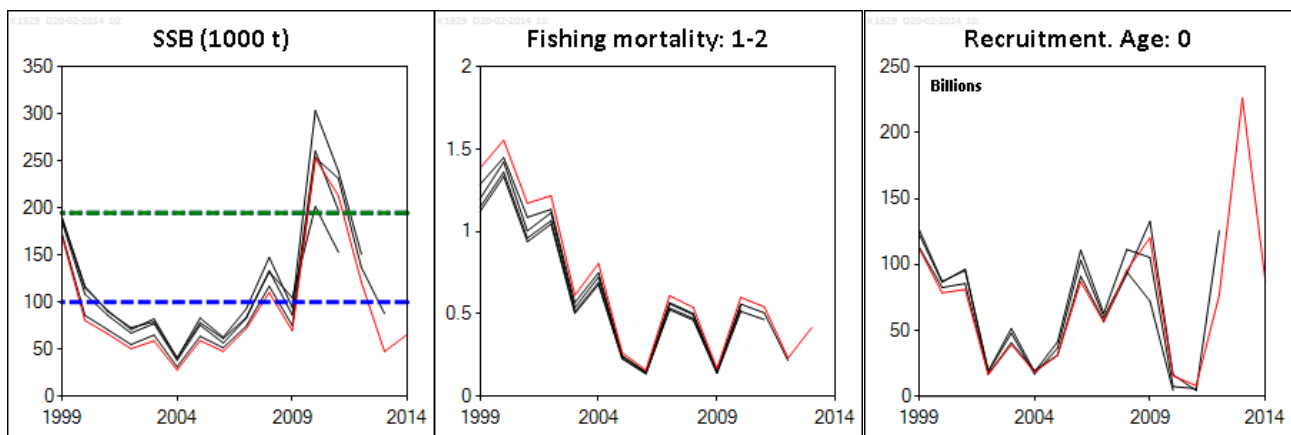


Figure 6.3.22.3.2 Sandeel in the Central Eastern North Sea (SA 3). Historical assessment results (final-year recruitment estimates included).

Scientific basis

Stock data category	1 (see ICES, 2013)
Assessment type	Seasonal age-based analytical (SMS-effort).
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	Not included in the assessment, and discards are considered to be negligible.
Indicators	None.
Other information	Last benchmark in 2010 (ICES, 2010).
Working group	Herring Assessment Working Group (HAWG).

ECOREGION North Sea
STOCK Sandeel in the Central Eastern North Sea (SA 3)

Reference points

	<i>Type</i>	<i>Value</i>	<i>Technical basis</i>
MSY Approach	MSY $B_{\text{escapement}}$	195 000 t	= B_{pa}
	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	$B_{\text{pa}} = B_{\text{lim}} \times \exp^{(\sigma \cdot 1.645)}$, with $\sigma = 0.40$ estimated from assessment uncertainty in the terminal year (ICES, 2010).
	F_{lim}	Not defined.	
	F_{pa}	Not defined.	

(last changed in: 2010)

Outlook for 2014

Basis: $F(2013) = \text{sum of half yearly } F_s = 0.34$; $\text{Recruitment}(2013) = 226 \text{ billion}$; $\text{Recruitment}(2014) = \text{geometric mean (GM } 1983\text{--}2012) = 87 \text{ billion}$; $\text{SSB}(2014) = 66$; $\text{catches}(2013) = 39$; $\text{discards} = \text{negligible}$.

Rationale	Catches (2014)	Basis	F (2014)	SSB (2015)	%SSB change¹
MSY approach	270	MSY	0.64	195	197%
Zero catch	0	$F = 0$	0.00	353	437%
Other options	45	$F_{2013} \times 0.25$	0.09	326	396%
	88	$F_{2013} \times 0.5$	0.17	301	358%
	127	$F_{2013} \times 0.75$	0.25	278	323%
	163	$F_{2013} \times 1$	0.34	257	291%
	196	$F_{2013} \times 1.25$	0.42	237	261%
	227	$F_{2013} \times 1.5$	0.51	219	234%

Weights in thousand tonnes.

¹⁾ SSB 2015 relative to SSB 2014.

MSY approach

Following the ICES MSY approach to a short-lived species, the fishery in 2014 should allow for sufficient stock (MSY $B_{\text{escapement}}$) to remain for successful recruitment in 2015. This implies a catch of no more than 270 000 t in 2014.

The MSY approach results in $F = 0.64$ in 2014. This value is close to the long-term average F for this stock and does not suggest a very high risk of overfishing.

Management plan

Based on the Norwegian national management plan, a TAC for the Norwegian EEZ of SA 3 was set at 20 000 t in 2013 (the 2014 TAC for the Norwegian EEZ of SA 3 was not available at the time of the drafting of this advice). This experimental management plan has been applied in the Norwegian zone since 2010 and is based on geographical areas that are opened and closed on alternate years, with an area opened only if the spawning stock is estimated by the national institute to be large and widely distributed within it. The main objective of the plan is to rebuild the spawning stock and to increase the total recruitment and catch potential.

Additional considerations

Uncertainties in assessment and forecast

The assessment is considered less robust than the assessments for SA 1 because the dredge survey covers mainly the southern part of SA 3. A northerly extension of the survey area and coverage of the Skagerrak area would probably increase the quality of the survey results for assessment purposes. In 2011 the survey was extended into the Skagerrak, but a longer time-series is needed before this extension can be included in the assessment.

The forecast applies a 3-year average of mean weights-at-age and a long-term average for maturity-at-age. Last year's forecast did, therefore, not reflect the unexpected low mean weights-at-age in the catches in 2013 and the low proportion of mature fish observed in the dredge survey in November/December 2013. There is currently no method to predict these kinds of environmental effects or to account for them in the forecast.

Norwegian fishing effort data with sufficient resolution are only available since 2011, and the estimates of the country effect in cpue are uncertain due to the differences in regulations and the resulting lack of spatial overlap between the Danish and the Norwegian fleets. Data on fishing effort since 2011 from both Denmark and Norway were included in the assessment. A time-series of observed Norwegian effort and a series of logbook observations overlapping in time and space would increase the quality of the assessment as the Norwegian fleet generally fishes more northerly than the Danish fleet, especially in the most recent years with Danish fishers having limited access to the Norwegian EEZ.

Management considerations

Sandeel Area 3 comprises both Norwegian and EU EEZ and currently there is no agreement between the parties on management. The differences in management between the EU and Norwegian EEZs seen in recent years raise questions regarding the reliability of a common assessment, as the current assessment relies on the assumption of a constant age selection pattern and on the commercial fishery supplying sufficient sampling information on the older age groups.

The EU fishery has been managed in accordance with the ICES advice, while fisheries in the Norwegian EEZ are managed based on a system of closed areas in combination with acoustic monitoring of the geographical distribution and size of the stock. In 2012 a TAC at 42 000 tonnes was set for the Norwegian EEZ, which was considerably higher than the ICES advice (< 5000 tonnes for monitoring purposes) for the combined EU and Norwegian EEZ. Given the present combined assessment, overfishing in one EEZ will increase risk to stock biomass in the whole of SA 3 and influence catch options in both EEZs in the following years.

ICES recommends that a joint EU–Norway management plan is developed for SA 3 sandeel. As part of the development of this management plan, alternative strategies to the escapement strategy could be explored to increase the probability of the stock being kept within safe biological limits as well as producing stable, high yields. Such a plan could include options depending on the age structure of the stock. For example, in a situation such as observed this year, where a good recruitment arises after a period of low stock biomass, the management plan could explore setting a lower TAC (than implied by the escapement strategy) in that year in order to have higher probability of rebuilding stock biomass to high levels without losing significant future catch opportunities.

Pre-season estimates of the incoming year class appear less robust for this sandeel area and it is therefore appropriate that in-season monitoring (e.g. acoustic monitoring and age-based commercial cpue) should continue in SA 3. The quality (internal and external consistency) of the acoustic survey in the Norwegian EEZ is not yet fully investigated and the dredge survey results in SA 3 are less consistent than in the other SAs (ICES, 2010).

Sources

- ICES. 2010. Report of the Benchmark Workshop on Sandeel (WKSAN), 6–10 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57.
- ICES. 2013. Advice basis. *In* Report of the ICES Advisory Committee, 2013. ICES Advice 2013, Book 1, Section 1.2.
- ICES. 2014. Sandeel in Divisions IIIa and IV. *In* Report of the Herring Assessment Working Group (HAWG). ICES CM 2014/ACOM:06, Section 11.

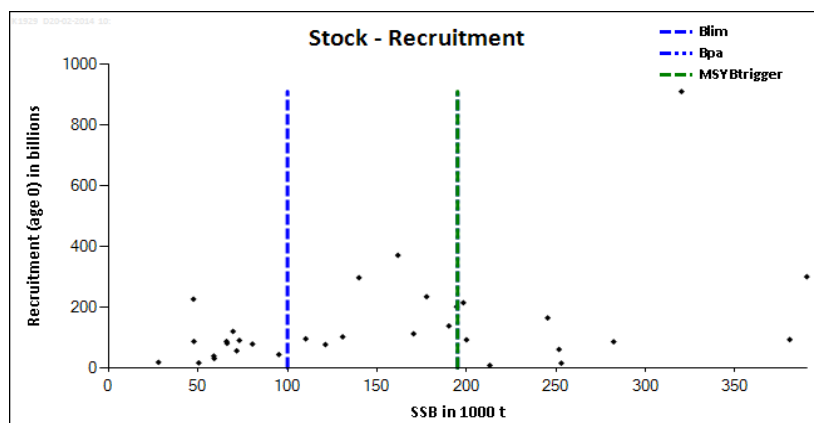


Figure 6.3.22.3.3 Sandeel in the Central Eastern North Sea (SA 3). Stock–recruitment plot.

Table 6.3.22.3.1 Sandeel in the Central Eastern North Sea (SA 3). ICES advice, management, and landings.

Year	ICES Advice	Catch corresponding to advice	EC zone TAC	NOR zone TAC	ICES landings SA 3	ICES landings total
2005 ¹	Exploitation to be kept below the level of 2003. Adjustment to be made conditional on the abundance of the 2004 year class.	-	661 ²	10 ³	30	177
2006 ¹	The fishery should remain closed until information is available which assures that the stock can be rebuilt to B_{pa} by 2007.	-	300 ²	0	19	293
2007 ¹	The fishery should remain closed until information is available which assures that the stock can be rebuilt to B_{pa} by 2008.	-	173 ²	51	114	230
2008 ¹	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 ²	128	95	348
2009 ¹	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 ²	0	34	353
2010 ¹	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 ²	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 ⁴	243 ⁴
2014	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	< 270				

Weights in thousand tonnes.

¹ Advice for Subarea IV, excluding the Shetland area.

² Set for EC waters of Divisions IIa and IIIa and Subarea IV.

³ TAC set for EU fisheries 10 kt, seasonal effort limitations set for Norwegian fisheries.

⁴ Preliminary.

Table 6.3.22.3.2 Sandeel in the Central Eastern North Sea (SA 3). Summary of the assessment.

Year	Recruitment Age 0 thousands	SSB tonnes	Landings Tonnes	Mean F Ages 1–2
1983	90652000	73150	105946	0.471
1984	43857000	95168	123635	0.505
1985	297152000	139928	59083	0.278
1986	370963000	161723	420341	1.011
1987	86220000	282258	403908	0.919
1988	300251000	390131	391081	1.384
1989	102216000	130839	481893	1.156
1990	201308000	194463	219183	0.596
1991	92569000	200049	368105	0.764
1992	234394000	177758	195700	0.489
1993	214704000	198295	263954	0.672
1994	164647000	245333	444119	0.748
1995	138228000	190173	218922	0.505
1996	910029000	320093	247397	0.414
1997	60851000	251716	604159	0.985
1998	93234000	380592	499333	0.987
1999	112432000	170445	223160	1.385
2000	78474000	80497	242732	1.555
2001	81046000	66292	245290	1.172
2002	16399000	50484	209302	1.218
2003	39097000	58909	58942	0.613
2004	18374000	27927	79234	0.806
2005	31050000	59122	29677	0.265
2006	86998000	47716	18863	0.159
2007	56174000	71636	113232	0.611
2008	95761000	110222	94491	0.539
2009	120232000	69594	33350	0.167
2010	15461000	252969	80576	0.601
2011	8102000	213014	94750	0.543
2012	76723000	121189	45109	0.232
2013	226380000	47531	39115	0.417
2014	87000000**	66000*		
Average	142218063	154538	214664	0.715

*Using mean weight-at-age from 2011 to 2013.

**Period 1983–2012.

ECOREGION North Sea
STOCK Sandeel in the Central Western North Sea (SA 4)

Advice for 2014

ICES advises, based on the data-limited stocks approach, that catches in 2014 should not exceed 2041 t. However, this TAC level will not provide enough samples from the fishery to develop a full assessment for this stock. A monitoring TAC should therefore be considered, with an associated sampling protocol in the fishery. Total catches should not exceed 5000 t. All catches are assumed to be landed.

Stock status

Fishing pressure			
	2011	2012	2013
MSY (F_{MSY})	?	?	?
Precautionary approach (F_{pa} , F_{lim})	?	?	?
Qualitative evaluation	→	→	→
Very low			
Stock size			
	2012	2013	2014
MSY ($B_{escapement}$)	?	?	?
Precautionary approach (B_{pa} , B_{lim})	?	?	?
Qualitative evaluation	→	↘	→
Stable			

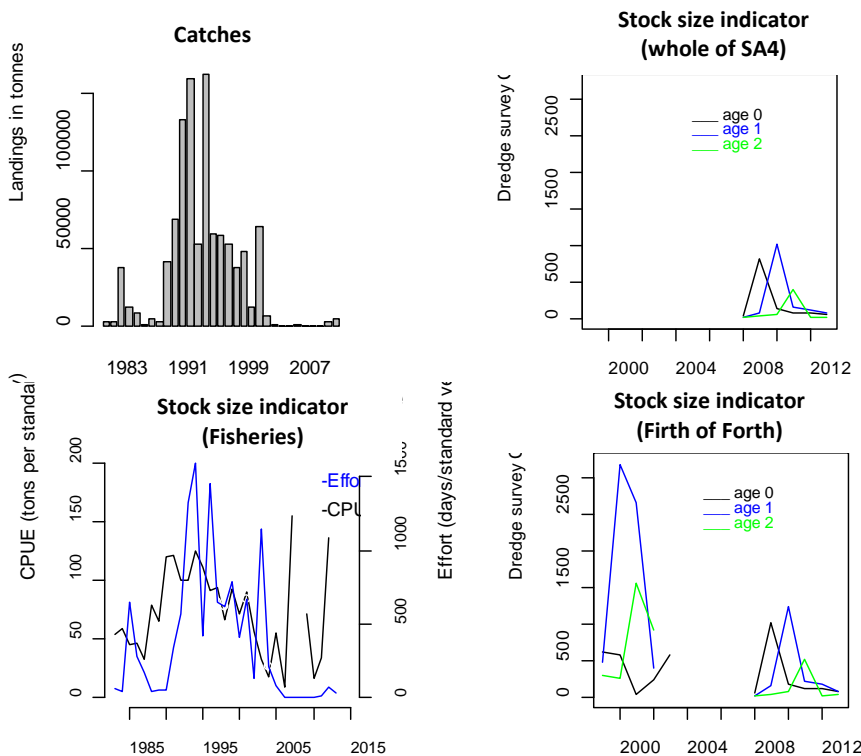


Figure 6.3.22.4.1 Sandeel in the Central Western North Sea (SA 4). Top left: Landings. Bottom left: Effort (days fishing per standard 200 GT vessel) and catch per unit effort (tonnes per standard fishing day). Right: catch indices from the dredge survey (number per hour standardized to mean) in the entire SA 4 (top) and in the Firth of Forth only (bottom).

Survey data indicate that the strong 2009 year class has been followed by lower recruitments in 2010, 2011, 2012, and 2013. Despite indications of a low recruitment for four consecutive years, the 5000 t taken in the southern part of SA 4 in 2013 were caught at a very high cpue.

Management plans

No specific management objectives are known to ICES.

Fisheries

Because low sandeel availability affects the breeding success of kittiwake, all commercial fishing in the Firth of Forth has been prohibited since 2000, except for a limited fishery conducted in May and June to monitor the stock. This closure includes most of the fishing banks in SA 4. A few banks (e.g. Turbot Bank) outside the closed area have historically provided large landings. A limited commercial sandeel fishery (2546 t) occurred in SA 4 in 2012 for monitoring purposes. The fishery ceased before the full TAC (5000 t) was taken. In 2013 5032 t were taken at a very high cpue on “Eventyr Banke” (also known as the East Bank), which is outside the area covered by the Scottish dredge survey (the TAC in 2013 was 4000 t).

Catch distribution	Total catch (2013): 5 kt, where 5 kt were official landings (100% industrial trawl fisheries).
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Quality considerations

Prior to the establishment of the dedicated Scottish dredge survey in 2008, dredge sampling intensity was low in SA 4. The Scottish dredge survey generally covers the northwestern parts of SA 4. Hence, no dredge sampling is available for the eastern parts of SA 4. As commercial fishing effort has been very low in recent years, there is insufficient information in the commercial catch to be able to provide an analytical assessment similar to those for SAs 1–3.

Scientific basis

Stock data category	3.2.0 (see ICES, 2013)
Assessment type	Survey trends-based assessment.
Input data	One survey index available in January (dredge survey). Total international catch and fishing effort.
Discards and bycatch	Not included in the assessment, and discards are considered to be negligible.
Indicators	None.
Other information	Last benchmark in 2010 (ICES, 2010).
Working group	Herring Assessment Working Group (HAWG).

ECOREGION **North Sea**
STOCK **Sandeel in the Central Western North Sea (SA 4)**

Reference points

No reference points are defined for this stock.

Outlook for 2014

No forecast can be presented for this stock because catch and survey data are insufficient to conduct a traditional age-based assessment.

ICES approach to data-limited stocks

For data-limited stocks for which an abundance index is available, ICES uses as harvest control rule an index-adjusted *status quo* catch. Knowledge about the exploitation status also influences the advised catch.

Because the precautionary buffer (20% reduction in catch) was applied in the 2013 advice and the new data available do not change the perception of the stock, the same catch advice (2041 t) would still be applicable for 2014. However, in order to present an analytical assessment in the future, data on biological characteristics of the catch composition and catch and effort data are required. A total maximum advised catch of 5000 t, with an associated sampling protocol in the fishery, should provide sufficient samples and, thus, reliable estimates. The lack of a short-term forecast for this area precludes a direct evaluation of the impact of this catch on F or SSB, but 5000 t constitutes only a small fraction of the historical catches taken in SA 4 before the closure of commercial fishing in the Firth of Forth and is not considered to compromise the long-term sustainability of sandeel in SA 4. Aided by this information, it is expected that an analytical assessment for SA 4 can be developed in the next 3–5 years.

As this is a short-lived species, the advice will be considered again next year.

Additional considerations

It is important to continue the Scottish dredge survey in this area. The overlap between this survey and the commercial cpue time-series is currently too short to provide an assessment with catch forecast similar to those in SAs 1–3. Little or no information is available for this area from the in-year monitoring system in recent years because of low fishing effort. Until there is sufficient overlap in the time-series of dredge survey and commercial data there will be no scientific basis to present a catch forecast.

Sources

- ICES. 2010. Report of the Benchmark Workshop on Sandeel (WKSAN), 6–10 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57.
- ICES. 2013. Advice basis. *In* Report of the ICES Advisory Committee, 2013. ICES Advice 2013, Book 1, Section 1.2.
- ICES. 2014. Sandeel in Divisions IIIa and IV. *In* Report of the Herring Assessment Working Group (HAWG). ICES CM 2014/ACOM:06, Section 11.

Table 6.3.22.4.1 Sandeel in the Central Western North Sea (SA 4). ICES advice, management, and landings.

Year	ICES Advice	Catch corresponding to advice	TAC	ICES landings SA 4	ICES landings total
2005 ¹	Exploitation to be kept below level of 2003. Adjustment to be made conditional on the abundance of the 2004 year class.	-	661 ²	1.49	177
2006 ¹	The fishery should remain closed until information is available which assures that the stock can be rebuilt to B_{pa} by 2007.	-	300 ²	0.09	293
2007 ¹	The fishery should remain closed until information is available which assures that the stock can be rebuilt to B_{pa} by 2008.	-	173 ²	0.01	230
2008 ¹	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 ²	1.20	348
2009 ¹	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 ²	0	353
2010 ¹	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 ²	0.10	414
2011	A TAC at 5 000–10 000 tonnes will impose a low risk of overfishing sandeel in this area.	5–10	10	0.27	438
2012	Catches for monitoring purposes should not exceed 5 000 t.	< 5	0	2.546	102
2013	Catch of 2012 reduced by 20% as a precautionary buffer.	< 2.041	4	5.032 ³	243 ³
2014	Catches for monitoring purposes should not exceed 5 000 t (with associated sampling protocol).	< 5			

Weights in thousand tonnes.

¹ Advice for Subarea IV, excluding the Shetland area.

² Set for EU waters of Divisions IIa and IIIa and Subarea IV.

³ Preliminary.

Table 6.3.22.4.2 Sandeel in the Central Western North Sea (SA 4). Abundance index (average cpue) from the Scottish December dredge survey for a) the whole of SA 4 and b) the Firth of Forth. Shaded cells denote that no data were collected. (Weights are in tonnes per standard fishing day.)

Year	a) Sandeel Area 4			b) Firth of Forth		
	Age 0	Age 1	Age 2	Age 0	Age 1	Age 2
1999				615	494	301
2000				586	3170	258
2001				48	2656	1561
2002				243	404	916
2003				580		
2004 - 2007						
2008	52	24	18	68	24	24
2009	832	87	38	1023	174	56
2010	147	1032	67	186	1244	78
2011	89	165	407	119	220	534
2012	85	135	23	122	178	30
2013	62	85	35	82	89	45

ECOREGION **North Sea**
STOCK **Sandeel in the Viking and Bergen Bank areas (SA 5)**

Advice for 2014

The new data (catches) available do not change the perception of sandeel in SA 5; therefore, the advice for this stock in 2014 is the same as the advice for 2013 (see [ICES, 2013a](#)): *ICES advises on the basis of the approach to data-limited stocks that catches should not increase unless there is evidence that this will be sustainable. This corresponds to zero catch.*

Quality considerations

Catch statistics are available for SA 5. No landings have occurred since 2004 (except for 4 t landed in 2007). The available information is inadequate to evaluate stock status or trends, and the state of the stock is therefore unknown. It should be noted that the Norwegian acoustic survey conducted in the Viking Bank during 2005–2013 indicates that the stock in this area is very small. Norway closed fisheries on the Viking Bank area in 2011 because of very low estimates of sandeel abundance based on acoustic surveys in 2007–2010 (ICES, 2010).

Scientific basis

Stock data category	5.3.0 (see ICES, 2013b)
Assessment type	No assessment
Input data	Commercial catch statistics
Discards and bycatch	Discards are considered to be negligible.
Indicators	None
Other information	Last benchmark in 2010 (ICES, 2010).
Working group	Herring Assessment Working Group (HAWG).

Sources

- ICES. 2010. Report of the Benchmark Workshop on Sandeel (WKSAN), 6–10 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57.
- ICES. 2013a. Sandeel in Division IIIa and Subarea IV. *In* Report of the ICES Advisory Committee, 2013. ICES Advice 2013, Book 6, Section 6.4.22.
- ICES. 2013b. Advice basis. *In* Report of the ICES Advisory Committee, 2013. ICES Advice 2013, Book 1, Section 1.2.
- ICES. 2014. Sandeel in Divisions IIIa and IV. *In* Report of the Herring Assessment Working Group (HAWG). ICES CM 2014/ACOM:06, Section 11.

Table 6.3.22.5.1 Sandeel in Viking and Bergen Bank areas (SA 5). ICES advice, management, and landings.

Year	ICES Advice	Catch corresponding to advice	ICES landings SA 5	ICES landings total
2005 ¹	Exploitation to be kept below the level of 2003. Adjustment to be made conditional on the abundance of the 2004 year class.		0	177
2006 ¹	The fishery should remain closed until information is available which assures that the stock can be rebuilt to B_{pa} by 2007.		0	293
2007 ¹	The fishery should remain closed until information is available which assures that the stock can be rebuilt to B_{pa} by 2008.		4	230
2008 ¹	The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to B_{pa} by 2009.		0	348
2009 ¹	The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to B_{pa} by 2010.		0	353
2010 ¹	The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to B_{pa} by 2011.		0	414
2011	No increase in effort unless there is evidence that this is sustainable.		0	438
2012	No increase in effort unless there is evidence that this is sustainable.		0	102
2013	Zero catch advised	0	0	243 ²
2014	No new advice, same as for 2013	0		

Weights in thousand tonnes.

¹ Advice for Subarea IV, excluding the Shetland area.

² Preliminary.

ECOREGION **North Sea**
STOCK **Sandeel in Division IIIa East (Kattegat, SA 6)**

Advice for 2014

The new data (catches) available do not change the perception of sandeel in SA 6; therefore, the advice for this stock in 2014 is the same as the advice for 2013 (see [ICES, 2013a](#)): *ICES advises on the basis of the approach to data-limited stocks that catches should be no more than 219 tonnes. All catches are assumed to be landed.*

Quality considerations

Only catch statistics are available for SA 6. This information is inadequate to evaluate stock status or trends, and the state of the stock is therefore unknown. Because the precautionary buffer (20% reduction in catch) was applied in the 2013 advice and the new data (catch statistics) available do not change the perception of the stock, the same catch advice (219 t) is still be applicable for 2014. This advice is expected to remain unchanged for several years unless information on stock status becomes available.

Scientific basis

Stock data category	5.2.0 (see ICES, 2013b).
Assessment type	No assessment.
Input data	Commercial catches statistics.
Discards and bycatch	Discards are considered to be negligible.
Indicators	None.
Other information	Last benchmark in 2010 (ICES, 2010).
Working group	Herring Assessment Working Group (HAWG).

Sources

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

ICES. 2013a. Sandeel in Division IIIa and Subarea IV. *In* Report of the ICES Advisory Committee, 2013. ICES Advice 2013, Book 6, Section 6.4.22.

ICES. 2013b. Advice basis. *In* Report of the ICES Advisory Committee, 2013. ICES Advice 2013, Book 1, Section 1.2.

ICES. 2014. Sandeel in Divisions IIIa and IV. *In* Report of the Herring Assessment Working Group (HAWG). ICES CM 2014/ACOM:06, Section 11.

Table 6.3.22.6.1 Sandeel in Sandeel Area 6 (SA 6). ICES advice, management, and landings.

Year	ICES Advice	Catch corresponding to advice	ICES landings SA 6	ICES landings total
2005	No advice		0.262	177
2006	No advice		0.161	293
2007	No advice		0.661	230
2008	No advice		0.472	348
2009	No advice		0.260	353
2010	No advice		0.132	414
2011	No increase in effort unless there is evidence that this is sustainable.		0.481	438
2012	No increase in effort unless there is evidence that this is sustainable.		0.211	102
2013	20% reduction in catches from last 3-year average	< 0.219	0.102 ¹	243 ¹
2014	No new advice, same as for 2013	< 0.219		

Weights in thousand tonnes.

¹Preliminary.

ECOREGION **North Sea**
STOCK **Sandeel in the Shetland area (SA 7)**

Advice for 2014

The new data (catches) available do not change the perception of sandeel in SA 7; therefore, the advice for this stock in 2014 is the same as the advice for 2013 (see [ICES, 2013a](#)): *ICES advises on the basis of the approach to data-limited stocks that no increase in the fisheries should take place unless there is evidence that this will be sustainable. This corresponds to zero catch.*

Quality considerations

Catch statistics are available for SA 7; however, the available information is inadequate to evaluate stock status or trends and the state of the stock is therefore unknown.

Scientific basis

Stock data category	5.3.0 (see ICES, 2013b)
Assessment type	No assessment
Input data	Commercial catch statistics
Discards and bycatch	Discards are considered to be negligible
Indicators	None
Other information	Last benchmark in 2010 (ICES, 2010)
Working group	Herring Assessment Working Group (HAWG).

Sources

- ICES. 2010. Report of the Benchmark Workshop on Sandeel (WKSAN), 6–10 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57.
- ICES. 2013a. Sandeel in Division IIIa and Subarea IV. *In* Report of the ICES Advisory Committee, 2013. ICES Advice 2013, Book 6, Section 6.4.22.
- ICES. 2013b. Advice basis. *In* Report of the ICES Advisory Committee, 2013. ICES Advice 2013, Book 1, Section 1.2.
- ICES. 2014. Sandeel in Divisions IIIa and IV. *In* Report of the Herring Assessment Working Group (HAWG). ICES CM 2014/ACOM:06, Section 11.

Table 6.3.22.7.1 Sandeel in Sandeel Area 7 (SA 7). ICES advice, management, and landings.

Year	ICES Advice	Catch corresponding to advice	ICES landings SA 7	ICES landings total
2005 ¹	No advice		0	177
2006 ¹	No advice		0	293
2007 ¹	No advice		0	230
2008 ¹	No advice		0	348
2009 ¹	No advice		0	353
2010 ¹	No advice		0	414
2011	No increase in effort unless there is evidence that this is sustainable.		0	438
2012	No increase in effort unless there is evidence that this is sustainable.		0	102
2013	No increase in fisheries unless there is evidence that this is sustainable	0	0	243 ²
2014	No new advice, same as for 2013	0		

Weights in thousand tonnes.

¹ Advice for Subarea IV, excluding the Shetland area.

² Preliminary.