

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 6.4.22.1). Generic information is given below, and the advice for sandeel in each of the seven areas is given separately in Sections 6.4.22.1–7.

Section	Sandeel Area (SA)	Name	Rectangles
6.4.22.1	1	Dogger Bank area	31–34 E9–F2; 35 E9–F3; 36 E9–F4; 37 E9–F5; 38–40 F0–F5; 41 F5–F6
6.4.22.2	2	Southeastern North Sea	31–34 F3–F4; 35 F4–F6; 36 F5–F8; 37–40 F6–F8; 41 F7–F8
6.4.22.3	3	Central Eastern North Sea	41 F1–F4; 42–43 F1–F9; 44 F1–G0; 45–46 F1–G1; 47 G0
6.4.22.4	4	Central Western North Sea	38–40 E7–E9; 41–46 E6–F0
6.4.22.5	5	Viking and Bergen Bank areas	47–51 E6 + F0–F5; 52 E6–F5
6.4.22.6	6	Division IIIa East (Kattegat)	41–43 G0–G3; 44 G1
6.4.22.7	7	Shetland area	47–51 E7–E9

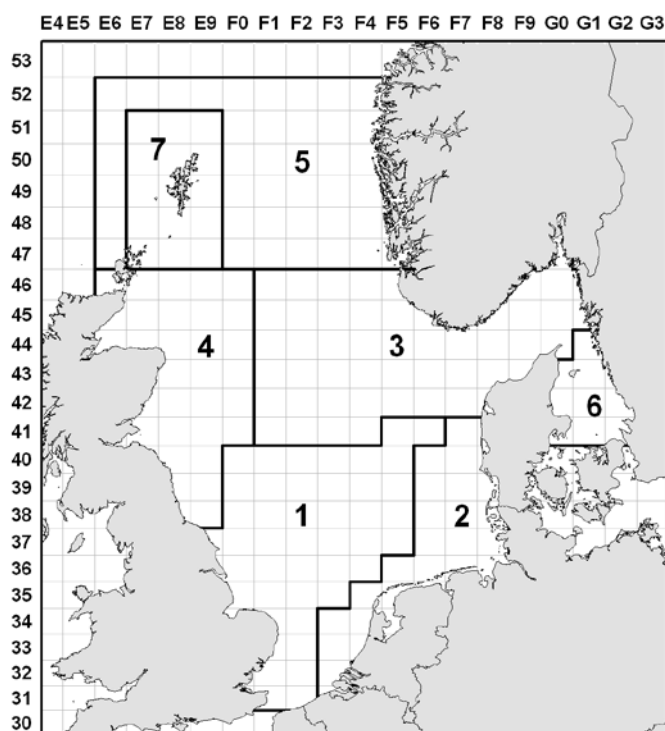


Figure 6.4.22.1 Sandeel in Division IIIa and Subarea IV. Map of sandeel areas (SAs).

Summary of advice for 2013

An overview of the advice by SA can be found in Table 6.4.22.1.

Table 6.4.22.1 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	EC zone TAC	NOR zone TAC	ICES landings
2005 ¹	-	-	-	-	-	No advice	No advice	661	10 ²	177
2006 ¹	-	-	-	-	-	No advice	No advice	300	0	293
2007 ¹	-	-	-	-	-	No advice	No advice	173	51	230
2008 ¹	-	-	-	-	-	No advice	No advice	375	128	348
2009 ¹	-	-	-	-	-	No advice	No advice	377	0	353
2010	-	-	-	-	-	No advice	No advice	377	50	414
2011	< 320	< 34	0	5–10	No increase in effort unless there is evidence that this is sustainable. No increase in catches unless there is evidence that this is sustainable.			354	90	438
2012	< 23	< 5	< 5	< 5				61	42	101 ³
2013	< 224.544	< 17.544	< 78.331	< 2.041	0	< 0.219	0	0 ³	20	

Weights in thousand tonnes.

¹ Advice for Subarea IV excluding the Shetland area.

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

³ Preliminary.

Dredge survey information for December has been available since 2010 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 2010, ICES presented advice for this region in three units: North Sea excluding the Shetland area, the Shetland area, and the Skagerrak–Kattegat area. From 2010 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.

The sources of uncertainty within the new assessment and forecast framework are derived from the following sources:

- Use of common, time-invariant natural mortality values over all areas.
- Assumption of correspondence between commercial effort and fishing mortality.
- Observations of effort prior to 2011 are only available from the Danish fishery (which also has the largest catches) and only few observations in the 2011 data can be used to estimate national differences in catchability.
- Age and length sampling uncertainty, in particular in the less sampled Norwegian EEZ.
- There are apparent differences in recruitment between the Norwegian EEZ and the rest of SA 3.
- Assumption that the maturity pattern in the forecast year is the long-term average.

Comparison with previous assessment and advice

For all SAs covered by dredge surveys, the 2012 surveys confirmed the estimates of the 2011 year classes and indicated a larger recruitment around median value in 2012 for SAs 1–3, and a low recruitment in 2012 for SA 4.

For SAs 1–3 the advice is based on ICES MSY approach to short-lived species as it was last year. For SAs 4–7 the advice this year is based on ICES approach to data-limited stocks, whereas last year the advice was based on precautionary considerations.

Sources

- ICES. 2010. Report of the Benchmark Workshop on Sandeel (WKSAN), 6–10 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57.
- ICES. 2013. Report of the Herring Assessment Working Group (HAWG), 24–26 January 2013. ICES CM 2013/ACOM:06.
- 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.

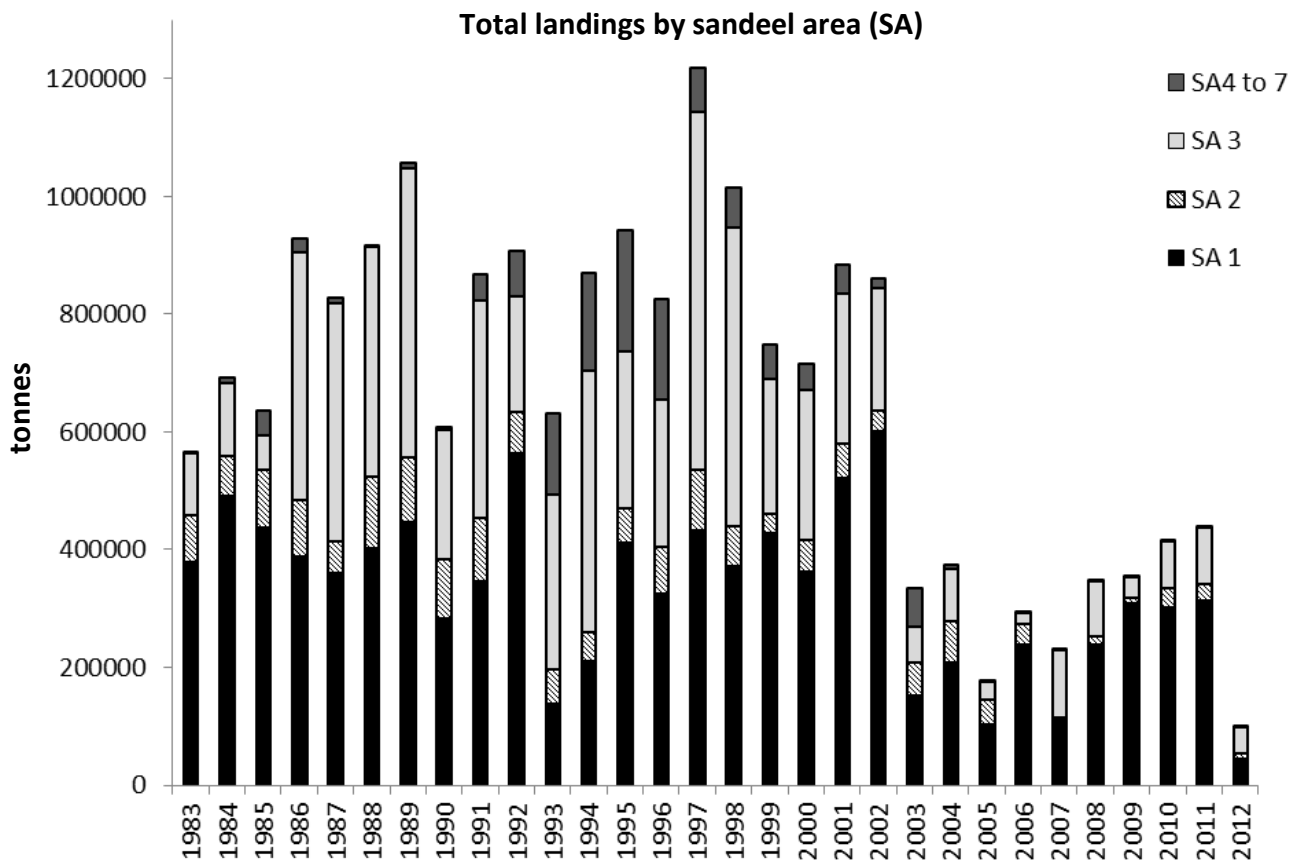


Figure 6.4.22.2 Sandeel in Division IIIa and Subarea IV. Total landings by SA (tonnes).

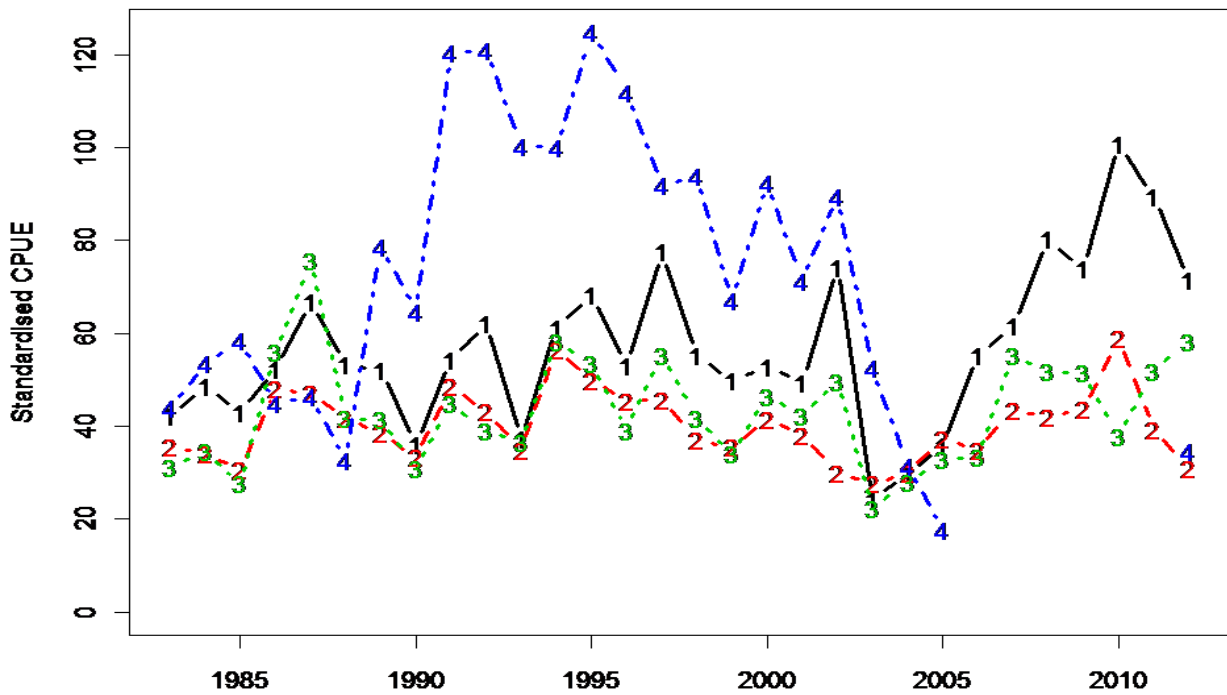


Figure 6.4.22.3 Sandeel in Division IIIa and Subarea IV. Catch (tonnes) per day fishing for a standardized 200 GT vessel in SAs 1–4. Figure labels correspond to SA numbers.

Table 6.4.22.2 Sandeel in Division IIIa and Subarea IV. Total landings (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	SA 1	SA 2	SA 3	SA 4	SA 5	SA 6	SA 7	All areas
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	428307	32117	228163	53959	140	134	4263	747083
2000	363356	52235	256250	37748	325	680	4370	714964
2001	521724	58645	253088	47828	1687	312	976	884260
2002	599585	35553	209344	12213	10	2378	521	859604
2003	150711	56262	62569	64002	44	869	261	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	301433	31760	80887	104	0	132	0	414183
2011	312378	29916	94714	272	0	481	0	437761
2012	44713	8048	45734	2551	0	210	0	101256
Average	334185	61046	227251	28579	7047	791	242	659139

Table 6.4.22.3 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
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	51.4	1.7	-	-	-	42.5	5.7	-	-	101.3

+ = less than half a unit; - = no information or no catch.

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

Advice for 2013

ICES advises on the basis of the MSY approach that the catch in 2013 should be no more than 224 544 t to maintain SSB in 2014 above MSY $B_{escapement}$. All catches are assumed to be landed. The advised catch is mainly driven by the medium recruitment in 2012 (in contrast to the historically low recruitments in 2010 and 2011).

Stock status

F (Fishing Mortality)			
	2010	2011	2012
MSY (F_{MSY})	?	?	? Undefined
Precautionary approach (F_{pa} , F_{lim})	?	?	? Undefined

SSB (Spawning-Stock Biomass)			
	2011	2012	2013
MSY ($B_{escapement}$)	✓	✓	✗ Below escapement trigger
Precautionary approach (B_{pa} , B_{lim})	✓	✓	⚠ Increased risk

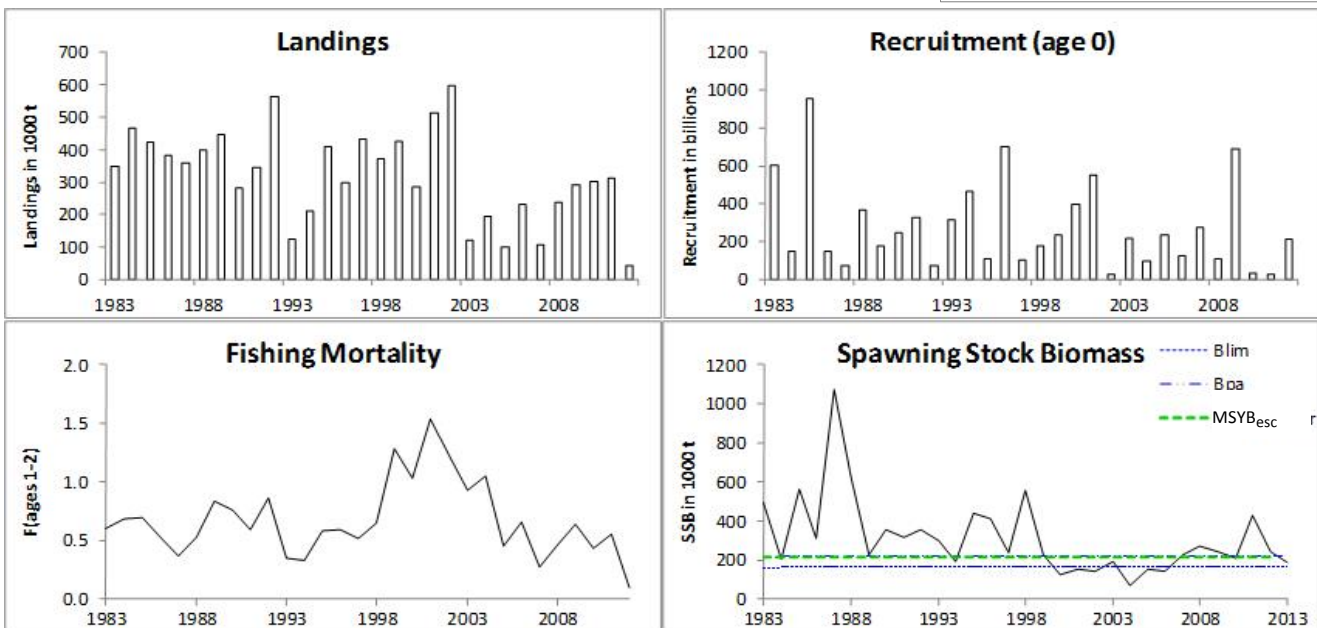
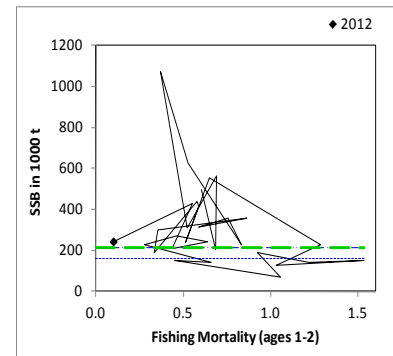


Figure 6.4.22.1.1 Sandeel in the Dogger Bank area (SA 1). Summary of stock assessment (weights in thousand tonnes). Top right: SSB and F over the years.

The stock at the start of 2013 is expected to be just above B_{lim} , which is the result of the very low recruitments in both 2010 and 2011. The 2010 and 2011 year classes were the lowest of any two consecutive years in the time-series. It is therefore mainly the amount of young fish, represented as a medium recruitment in 2012, that drives the advised catch for 2013. F has fluctuated around 0.5 since 2005, except in 2012 when F was the lowest observed.

Management plans

No specific management objectives are known to ICES.

Fisheries

Catch distribution Total landings (2012): 45 kt, where 100% were landings by industrial fisheries.

Quality considerations

The quality of the assessment is considered to be fairly good. The assessment relies heavily on the assumption that the fisheries selection pattern 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). If a change in the fishing pattern occurred, this would make the current advice less accurate.

Scientific basis

Assessment type	Seasonal age-based analytical (SMS-effort).
Input data	One survey index in December (dredge survey since 2004). Total international 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 (WKSAN, 2010).
Working group report	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	$B_{\text{pa}} = B_{\text{lim}} * \exp^{(\sigma * 1.645)}$, with $\sigma = 0.18$ estimated from assessment uncertainty in the terminal year (ICES, 2010).
	F_{lim}	Not defined.	
	F_{pa}	Not defined.	

(unchanged since: 2010)

Outlook for 2013

Basis: $F(2012) = \text{sum of half yearly } F_s = 0.08$; $\text{Yield}(2012) = 45$; $\text{Recruitment}(2012) = 211$ billion; $\text{Recruitment}(2013) = \text{geometric mean (GM 83–11)} = 191$ billion; $\text{SSB}(2013) = 193$.

Rationale	Catches (2013)	Basis	F (2013)	SSB (2014)	%SSB change ¹
MSY approach	224.544	MSY	0.60	215	11%
Zero catch	0	$F = 0$	0	353	83%
Other options	9.273	$F_{2012} * 0.25$	0.02	348	80%
	18.399	$F_{2012} * 0.5$	0.04	342	77%
	27.381	$F_{2012} * 0.75$	0.06	336	74%
	36.221	$F_{2012} * 1$	0.08	331	71%
	44.922	$F_{2012} * 1.25$	0.10	325	68%
	53.486	$F_{2012} * 1.5$	0.12	320	66%

Weights in thousand tonnes.

¹⁾ SSB 2014 relative to SSB 2013.

MSY approach

Following the ICES MSY approach to a short-lived species the fishery in 2013 should allow for sufficient stock (MSY $B_{\text{escapement}}$) to remain for successful recruitment. This implies a catch of no more than 224 544 t in 2013.

Additional considerations*Uncertainties in assessment and forecast*

The medium–high survey catch rate of age 0 sandeel in 2012 is largely determined by a single position in ICES square 37F1 (Figure 6.4.22.1). Despite this fact, the survey results are considered reliable enough to provide catch advice for 2013.

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. However, taking the historical F and stock development into account, an F value above 0.6 can probably not be recommended in any year. As effort is assumed proportional to F, a management plan could include an upper limit on effort estimated on the basis of the effort applied in recent years.

Sources

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



Figure 6.4.22.1.2 Sandeel in the Dogger Bank area (SA 1). Stock–recruitment plot.

Table 6.4.22.1.1 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 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 ²	45 ³	101 ³
2013	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	< 224.544			

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 Preliminary.

Table 6.4.22.1.2 Sandeel in the Dogger Bank area (SA 1). Summary of the assessment.

Year	Recruitment			Mean F Ages 1–2
	Age 0 (millions)	SSB (tonnes)	Landings (tonnes)	
1983	602486	497144	349232	0.60
1984	147000	203620	467609	0.68
1985	957303	564799	424114	0.69
1986	150338	310271	382735	0.52
1987	72948	1073280	357671	0.37
1988	365047	624134	398271	0.53
1989	175015	227983	445695	0.83
1990	243967	356375	283040	0.76
1991	326782	315199	347096	0.59
1992	75106	356380	564298	0.86
1993	316001	299495	124082	0.35
1994	463747	189224	209538	0.33
1995	109805	439279	410513	0.58
1996	699089	413201	298702	0.59
1997	105526	238310	431808	0.51
1998	178080	556191	371117	0.65
1999	237244	226405	427691	1.28
2000	399318	126441	284521	1.03
2001	549783	150147	513068	1.54
2002	29034	139953	596049	1.22
2003	217960	190716	121863	0.97
2004	95590	71012	195274	1.05
2005	233050	151417	100835	0.45
2006	127247	140201	231448	0.66
2007	276914	226964	108600	0.28
2008	110348	272326	237447	0.46
2009	687532	240522	291247	0.64
2010	36157	206943	300954	0.44
2011	26236	428674	311542	0.55
2012	210933	244155	44594	0.10
2013		186297*		
Average**	274186	311841	321022	0.67

* Using mean weight-at-age from 2012.

**Period 1983–2012.

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

Advice for 2013

ICES advises on the basis of the MSY approach that the catch in 2013 should be no more than 17 544 t to maintain SSB in 2014 above MSY $B_{escapement}$. All catches are assumed to be landed. The advised catch is mainly driven by the medium recruitment in 2012 (in contrast to the historically low recruitments in 2010 and 2011).

Stock status

F (Fishing Mortality)			
	2010	2011	2012
MSY (F_{MSY})	?	?	? Undefined
Precautionary approach (F_{pa} , F_{lim})	?	?	? Undefined

SSB (Spawning-Stock Biomass)			
	2011	2012	2013
MSY ($B_{escapement}$)	✓	✓	✗ Below escapement trigger
Precautionary approach (B_{pa} , B_{lim})	✓	✓	⚠ Increased risk

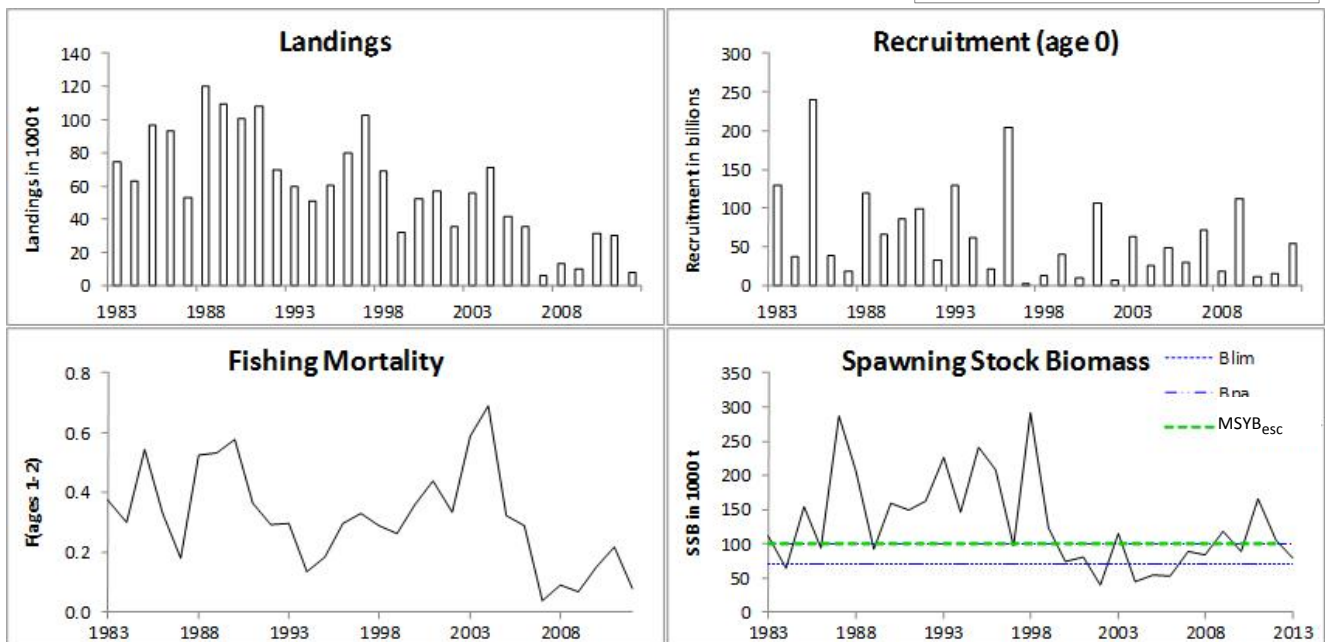
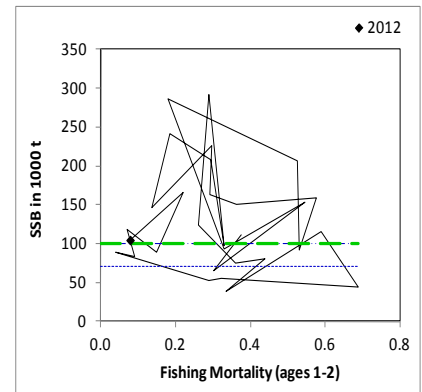


Figure 6.4.22.2.1 Sandeel in the Southeastern North Sea (SA 2). Summary of stock assessment (weights in thousand tonnes). Top right: SSB and F over the years.

Despite a very low F in 2012, SSB in 2013 has dropped below B_{pa} due to the very low recruitments in both 2010 and 2011. Recruitment in 2012 is estimated to be medium and this leads to a predicted increase in SSB in 2014.

Management plans

No specific management objectives are known to ICES.

Fisheries

Catch distribution Total landings (2012): 8 kt, where 100% were landings by industrial fisheries.

Quality considerations

The assessment relies heavily on the assumption that the fisheries 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 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 (currently only available for 2010–2012) exists.

Scientific basis

Assessment type	Seasonal age-based analytical (SMS-effort).
Input data	One survey index (dredge survey since 2004) from SA 1 is applied. Total international 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 (WKSAN, 2010).
Working group report	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	$B_{\text{pa}} = B_{\text{lim}} * \exp^{(\sigma * T.645)}$, with $\sigma = 0.23$ estimated from assessment uncertainty in the terminal year (ICES, 2010).
	F_{lim}	Not defined.	
	F_{pa}	Not defined.	

(unchanged since: 2010)

Outlook for 2013

Basis: $F(2012) = \text{sum of half yearly } F_s = 0.06$; $\text{Yield}(2012) = 8$; $\text{Recruitment}(2012) = 54$ billion; $\text{Recruitment}(2013) = \text{geometric mean (GM 1983–2011)} = 41$ billion; $\text{SSB}(2013) = 70$.

Rationale	Catches (2013)	Basis	F (2013)	SSB (2014)	%SSB change¹
MSY-approach	17.544	MSY	0.12	100	43%
Zero catch	0	$F=0$	0	110	57%
Other options	2.426	$F_{2012} * 0.25$	0.02	108	55%
	4.820	$F_{2012} * 0.5$	0.03	107	53%
	7.183	$F_{2012} * 0.75$	0.05	106	51%
	9.516	$F_{2012} * 1$	0.06	104	50%
	11.819	$F_{2012} * 1.25$	0.08	103	48%

Weights in thousand tonnes.

¹⁾ SSB 2014 relative to SSB 2013.

MSY approach

Following the ICES MSY approach to a short-lived species, the fishery in 2013 should allow for sufficient stock (MSY $B_{\text{escapement}}$) to remain for successful recruitment. This implies a catch of no more than 17 544 t in 2013.

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. The medium–high survey catch rate of age 0 sandeel in 2012 (adopted from SA 1) is largely determined by a single position in ICES square 37F1 (Figure 6.4.22.1).

Management plans

A management plan needs to be developed. The ICES approach to MSY-based management of a short-lived species such as 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 . However, taking the historical F and stock development into account, an F value above 0.4–0.5 is probably not recommendable. Such an F ceiling can be expressed as an effort limit for management, assuming that fishing mortality is proportional to effort.

Sources

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

ICES. 2013. Report of the Herring Assessment Working Group (HAWG), 24–26 January 2013. ICES CM 2013/ACOM:06.

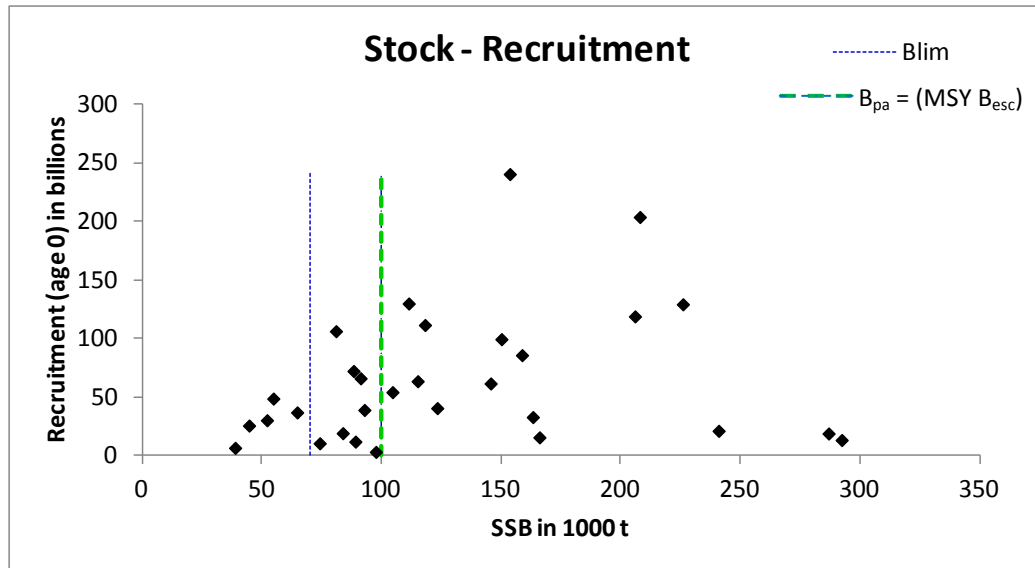


Figure 6.4.22.2.2 Sandeel in the Southeastern North Sea (SA 2). Stock–recruitment plot.

Table 6.4.22.2.1 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 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 ³	100 ³
2013	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	< 17.544			

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 Preliminary.

Table 6.4.22.2.2 Sandeel in the Southeastern North Sea (SA 2). Summary of the assessment.

Year	Recruitment	SSB (tonnes)	Landings (tonnes)	Mean F (Ages 1–2)
	Age 0 (millions)			
1983	129796	111401	74481	0.38
1984	36791	64774	63046	0.30
1985	240324	153640	96645	0.55
1986	38893	92871	93146	0.33
1987	18796	286846	53284	0.18
1988	118797	205942	120382	0.53
1989	65930	91293	109703	0.53
1990	85695	158738	100917	0.58
1991	99343	150144	107795	0.36
1992	32826	163266	69825	0.29
1993	129134	225964	59652	0.30
1994	61516	145641	50656	0.14
1995	21057	240903	60138	0.18
1996	203660	207975	80012	0.30
1997	3086	97674	102726	0.33
1998	13222	292317	68953	0.29
1999	40463	123314	32108	0.26
2000	10437	74209	52228	0.36
2001	106166	80997	56934	0.44
2002	6541	38865	35494	0.34
2003	63432	115140	55924	0.59
2004	25561	44684	71413	0.69
2005	48597	54817	41420	0.32
2006	30105	52175	35351	0.29
2007	72165	88332	5911	0.04
2008	19079	83839	13064	0.09
2009	111425	118187	10240	0.07
2010	11861	89110	31747	0.15
2011	15505	166020	29900	0.22
2012	54118	104613	8048	0.08
2013		79269*		
Average**	63811	129128	59705	0.32

*Using mean weight-at-age from 2012.

**Period 1983–2012.

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

Advice for 2013

ICES advises on the basis of the MSY approach that the catch in 2013 should be no more than 78 331 t to maintain SSB in 2014 above MSY $B_{\text{escapement}}$. All catches are assumed to be landed. The advised catch is mainly driven by the medium recruitment in 2012 (in contrast to the historically low recruitments in 2010 and 2011).

Stock status

F (Fishing Mortality)			
	2010	2011	2012
MSY (F_{MSY})	?	?	?
Precautionary approach ($F_{\text{pa}}, F_{\text{lim}}$)	?	?	?
			Undefined

SSB (Spawning Stock Biomass)			
	2011	2012	2013
MSY ($B_{\text{escapement}}$)	✓	✗	✗
Precautionary approach ($B_{\text{pa}}, B_{\text{lim}}$)	✓	○	✗
			Below escapement trigger
			Below Blim

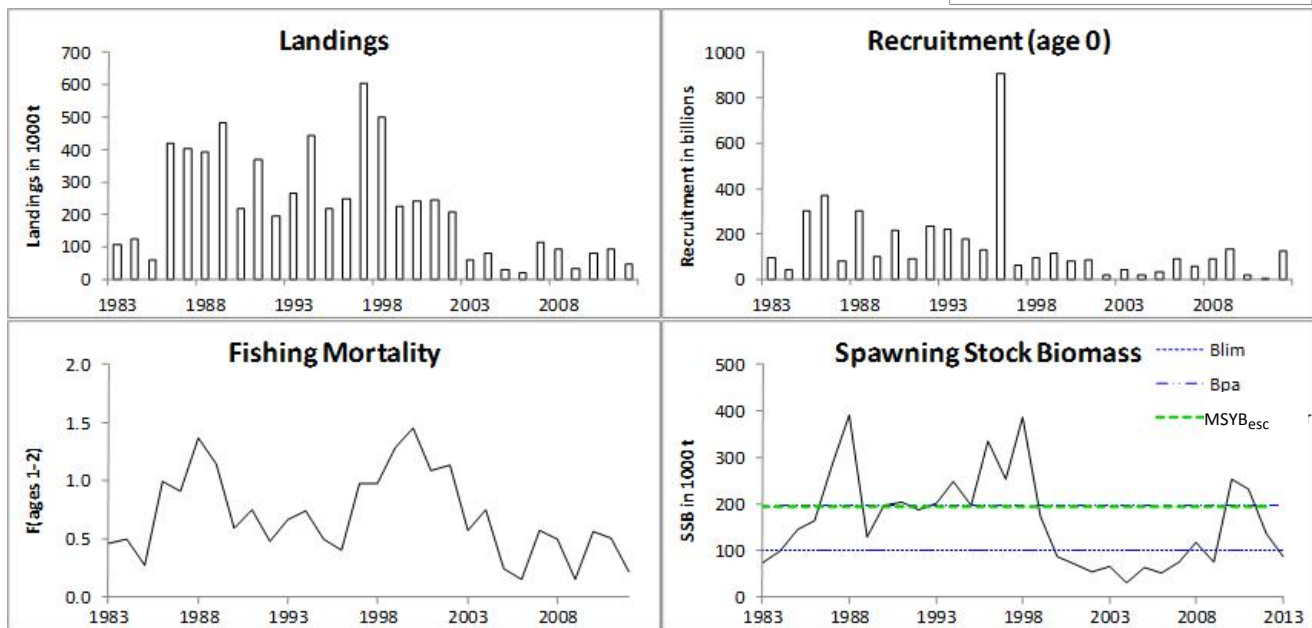
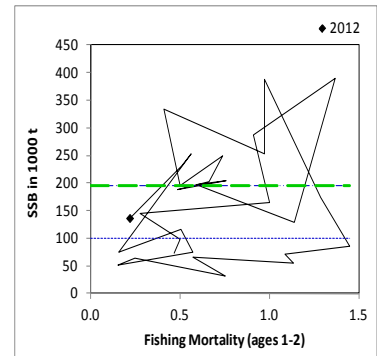


Figure 6.4.22.3.1 Sandeel in the Central Eastern North Sea (SA 3). Summary of stock assessment (weights in thousand tonnes). Top right: SSB and F over the years.

Since 2005, F has been variable between years and below the long-term mean. The stock has increased from a record low SSB in 2004 (at half of B_{lim}) to above B_{pa} in 2010, but SSB has since declined, being below B_{pa} in 2012 and just below B_{lim} in 2013. The low SSB is the result of the historically low recruitments in 2010 and 2011. The advised catch for 2013 is mainly driven by young fish represented by a relatively strong recruitment in 2012.

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 landings (2012): 46 kt, where 100% were landings by industrial 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. 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 heavily on the assumption of a constant selection pattern and on the commercial fishery supplying sufficient sampling information on the older age groups.

It should be noted that the estimated recruitment in 2012 is largely driven by extremely high survey catch rates at a single position in the southwestern corner of SA 3. Despite this fact, the survey results are considered reliable enough to provide catch advice for 2013.

Scientific basis

Assessment type	Seasonal age-based analytical (SMS-effort).
Input data	One survey index available in January (dredge survey since 2004). Total international catch and effort.
Discards and bycatch	Not included in the assessment, but discards are considered to be negligible.
Indicators	None.
Other information	Last benchmark in 2010 (WKSAN, 2010).
Working group report	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	$B_{\text{pa}} = B_{\text{lim}} \cdot \exp^{(\sigma \cdot 1.645)}$, with $\sigma = 0.40$ estimated from assessment uncertainty in the terminal year (ICES, 2010).
	F_{lim}	Not defined.	
	F_{pa}	Not defined.	

(unchanged since: 2010)

Outlook for 2013

Basis: $F(2012) = \text{sum of half yearly } F_s = 0.18$; $\text{Yield}(2012) = 46$; $\text{Recruitment}(2012) = 126$ billion; $\text{Recruitment}(2013) = \text{geometric mean (GM 1983–2011)} = 87$ billion; $\text{SSB}(2013) = 98$.

Rationale	Catches (2013)	Basis	F (2013)	SSB (2014)	%SSB change¹
MSY approach	78.331	MSY	0.27	195	98%
Zero catch	0	$F=0$	0	249	153%
Other options	14.281	$F_{2012} \cdot 0.25$	0.04	239	143%
	27.990	$F_{2012} \cdot 0.5$	0.09	230	134%
	41.151	$F_{2012} \cdot 0.75$	0.13	221	124%
	53.788	$F_{2012} \cdot 1$	0.18	212	115%
	65.924	$F_{2012} \cdot 1.25$	0.22	204	107%
	77.579	$F_{2012} \cdot 1.5$	0.26	196	99%

Weights in thousand tonnes.

¹⁾ SSB 2014 relative to SSB 2013.

MSY approach

Following the ICES MSY approach to a short-lived species, the fishery in 2013 should allow for sufficient stock (MSY $B_{\text{escapement}}$) to remain for successful recruitment. This implies a catch of no more than 78 331 t in 2013.

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. 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.

Norwegian fishing effort data with sufficient resolution are only available for 2011 and 2012, 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. However, in 2012 the country effect was not statistically significant and no standardization for country effects was performed. Data on fishing effort in 2012 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 heavily on the assumption of a constant 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. It is advised that a joint management plan be developed for SA 3 sandeel. 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 influence catch options in both EEZs in the following years.

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. Report of the Herring Assessment Working Group (HAWG), 24–26 January 2013. ICES CM 2013/ACOM:06.

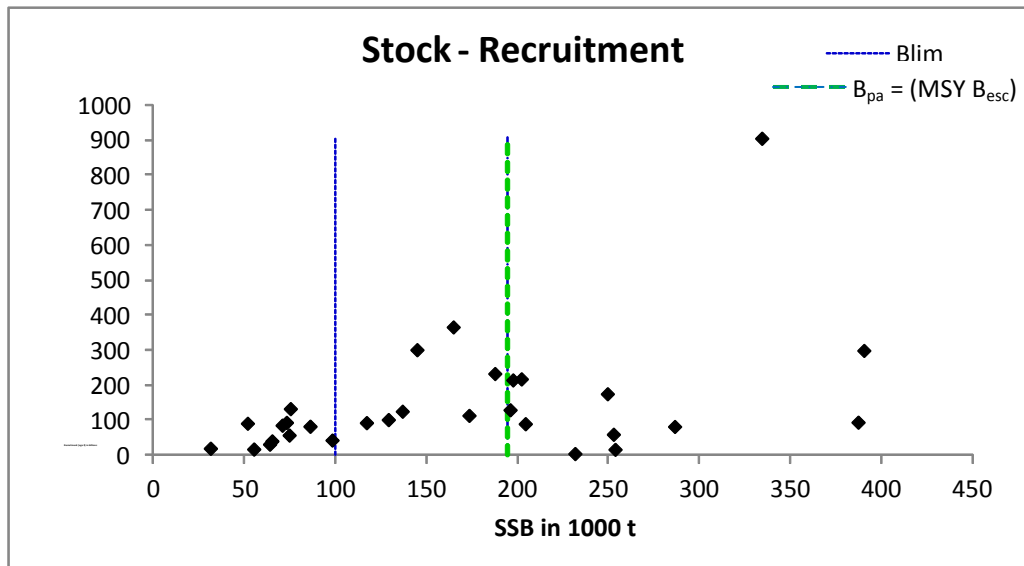


Figure 6.4.22.3.2 Sandeel in the Central Eastern North Sea (SA 3). Stock–recruitment plot.

Table 6.4.22.3.1 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 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 ⁴	101 ⁴
2013	MSY approach: allow for sufficient stock ($MSY B_{escapement}$) to remain for successful recruitment.	< 78.331		20		

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 EC fisheries 10 kt, seasonal effort limitations set for Norwegian fisheries.

⁴ Preliminary.

Table 6.4.22.3.2 Sandeel in the Central Eastern North Sea (SA 3). Summary of the assessment.

Year	Recruitment			
	Age 0 (millions)	SSB (tonnes)	Landings (tonnes)	Mean F (Ages 1–2)
1983	93541	72970	105946	0.47
1984	43127	98069	123635	0.50
1985	301553	144725	59083	0.27
1986	366512	164671	420341	0.10
1987	81847	286371	403908	0.91
1988	299345	390381	391081	1.37
1989	101591	129003	481893	1.14
1990	214895	197463	219183	0.59
1991	89705	204302	368105	0.75
1992	233340	187543	195700	0.48
1993	218037	202089	263954	0.66
1994	175473	249410	444119	0.74
1995	129582	195920	218922	0.50
1996	905879	334269	247397	0.41
1997	59564	252688	604159	0.97
1998	94269	387225	499333	0.97
1999	113488	173351	223160	1.29
2000	82514	85968	242732	1.45
2001	85574	70652	245290	1.09
2002	17216	55015	209302	1.14
2003	40604	65058	58942	0.57
2004	19495	31198	79234	0.75
2005	31358	63722	29677	0.25
2006	91037	51576	18863	0.15
2007	57220	74514	113232	0.57
2008	92742	116971	94491	0.50
2009	132851	75172	33350	0.16
2010	16382	253618	80576	0.56
2011	4274	231559	94750	0.51
2012	125675	136655	45732	0.22
2013		87742*		
Average**	143956	163544	220536	0.70

*Using mean weight-at-age from 2012.

**Period 1983–2012.

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

Advice for 2013

ICES advises on the basis of the approach to data-limited stocks that catches should not exceed 2041 t.

This is the first year ICES provides quantitative advice for data-limited sandeel stocks (see Quality considerations).

Stock status

F (Fishing Mortality)			
	2010	2011	2012
MSY (F_{MSY})	?	?	? Unknown
Precautionary approach (F_{pa} , F_{lim})	?	?	? Unknown
Qualitative evaluation	→	→	→ Very low
SSB (Spawning-Stock Biomass)			
	2011	2012	2013
MSY ($B_{escapement}$)	?	?	? Unknown
Precautionary approach (B_{pa} , B_{lim})	?	?	? Unknown
Qualitative evaluation	↗	→	↘ Declining

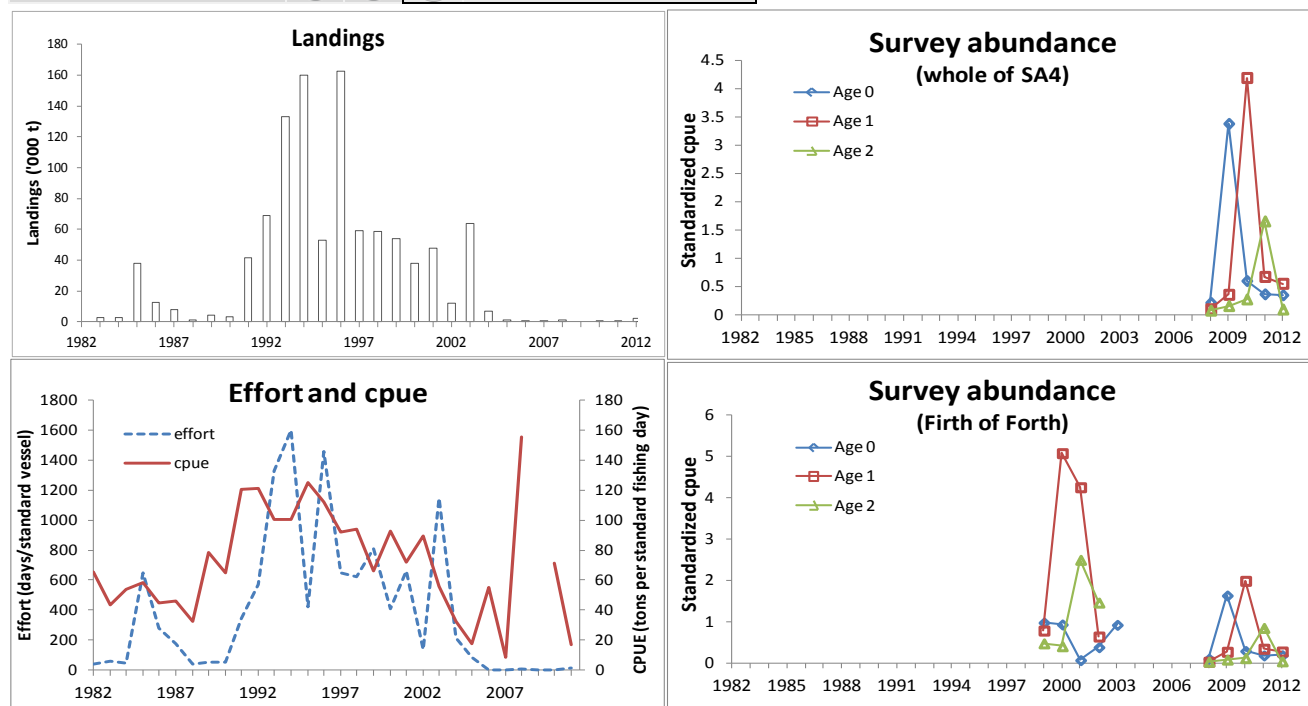


Figure 6.4.22.4.1 Sandeel in the Central Western North Sea (SA 4). Top left: landings, bottom left: effort (days fishing per standard 200 GT vessel) and catch per unit effort (tonnes per standard fishing day). Right: catch indices from the dredge survey (number per hour standardized to mean) in the entire 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, and 2012. The very limited effort applied in the area suggests a very low fishing mortality.

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 (2551 t) occurred in SA 4 in 2012 for monitoring purposes. The fishery ceased before the full TAC (5000 t) was taken.

Catch distribution	Total landings (2012): 2.5 kt, where 100% were landings by industrial 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 this area. 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.

The advice is based on an abundance index from a survey used as an indicator of stock size. The available survey series is short and difficult to interpret numerically at this time; therefore, this information is used in a qualitative sense. The methods applied to derive quantitative advice for data-limited stocks are expected to evolve as they are further developed and validated.

Scientific basis

Assessment type	Trends-based assessment (Data-limited stock approach category 3.2.0/5.2.0).
Input data	One survey index available in January (dredge survey). Total international catch and effort.
Discards and bycatch	Not included in the assessment, but discards are considered to be negligible.
Indicators	None.
Other information	Last benchmark in 2010 (WKSAN, 2010).
Working group report	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 2013

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.

For this stock, the available survey series is short and difficult to interpret numerically at this time. It shows high recruitment in 2009 followed by much lower recruitment. The recent catches have been very low with some increase in 2012; therefore, catches in 2013 should remain low. Following ICES approach to data-limited stocks, catches in 2013 should decrease by a precautionary buffer of 20% in relation to the 2012 catch, leading to catches of no more than 2041 t.

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. The advised catch limit of 2041 t will contribute towards providing monitoring information that may be valuable to future assessments.

Sources

- ICES. 2010. Report of the Benchmark Workshop on Sandeel (WKSAN), 6–10 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57.
- ICES. 2013. Report of the Herring Assessment Working Group (HAWG), 24–26 January 2013. ICES CM 2013/ACOM:06.

Table 6.4.22.4.1 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 5000–10 000 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 5000t.	< 5	0	2.551 ³	101 ³
2013	Catch of 2012 reduced by 20% as a precautionary buffer.	< 2.041			

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 Preliminary.

Table 6.4.22.4.2 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. No data were collected in 2004–2007. (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						
2005						
2006						
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

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

Advice for 2013

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.

This is the first year ICES provides quantitative advice for data-limited sandeel stocks (see Quality considerations).

Stock status

F (Fishing Mortality)	
	2010–2012
Qualitative evaluation	→ Very low
SSB (Spawning-Stock Biomass)	
	2011–2013
Qualitative evaluation	? Insufficient information

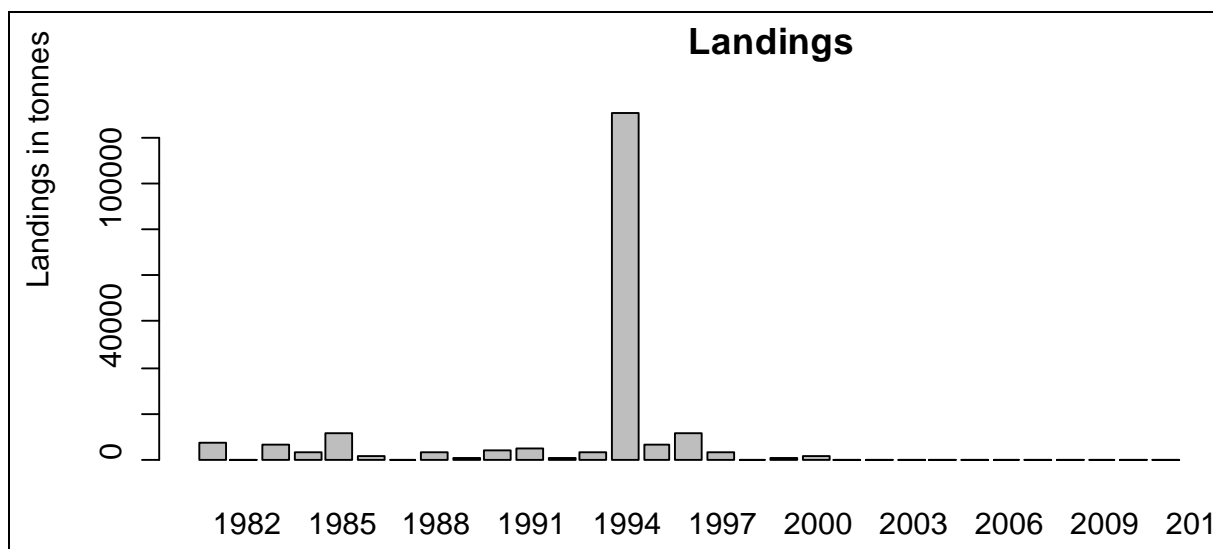


Figure 6.4.22.5.1 Sandeel in the Viking and Bergen Bank area (SA 5). ICES estimates of landings (in thousand tonnes).

Catch statistics are available for this stock. No landings have occurred since 2004 (except for 4 t landed in 2007). The available information is inadequate to evaluate stock status or trends. The state of the stock is therefore unknown.

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.

Quality considerations

The advice is based on precautionary low catches because of missing or non-representative data. The methods applied to derive quantitative advice for data-limited stocks are expected to evolve as they are further developed and validated.

Scientific basis

Assessment type	No assessment (Data-limited stock approach category 6.3.0).
Indicators	Catch statistics.
Other information	Last benchmark in 2010 (WKSAN, 2010).
Working group report	HAWG

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

Reference points

No reference points are defined for this stock.

Outlook for 2013

No forecast can be presented for this stock because the available catch and survey data are insufficient to conduct an analytical assessment.

ICES approach to data-limited stocks

For data-limited stocks without information on abundance or exploitation ICES considers that a precautionary reduction of catches should be implemented, unless there is ancillary information clearly indicating that the current level of exploitation is appropriate for the stock.

For this stock, current catches are zero. ICES advises that catches in 2013 should remain at zero unless there is evidence that an increase would be sustainable.

Additional considerations

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).

Sources

- ICES. 2010. Report of the Benchmark Workshop on Sandeel (WKSAN), 6–10 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57.
- ICES. 2013. Report of the Herring Assessment Working Group (HAWG), 24–26 January 2013. ICES CM 2013/ACOM:06.

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

Advice for 2013

ICES advises on the basis of the approach to data-limited stocks that catches should be no more than 219 tonnes.

This is the first year ICES provides quantitative advice for data-limited sandeel stocks (see Quality considerations).

Stock status

F (Fishing Mortality)	
	2010–2012
Qualitative evaluation	? Insufficient information
SSB (Spawning-Stock Biomass)	
	2011–2013
Qualitative evaluation	? Insufficient information

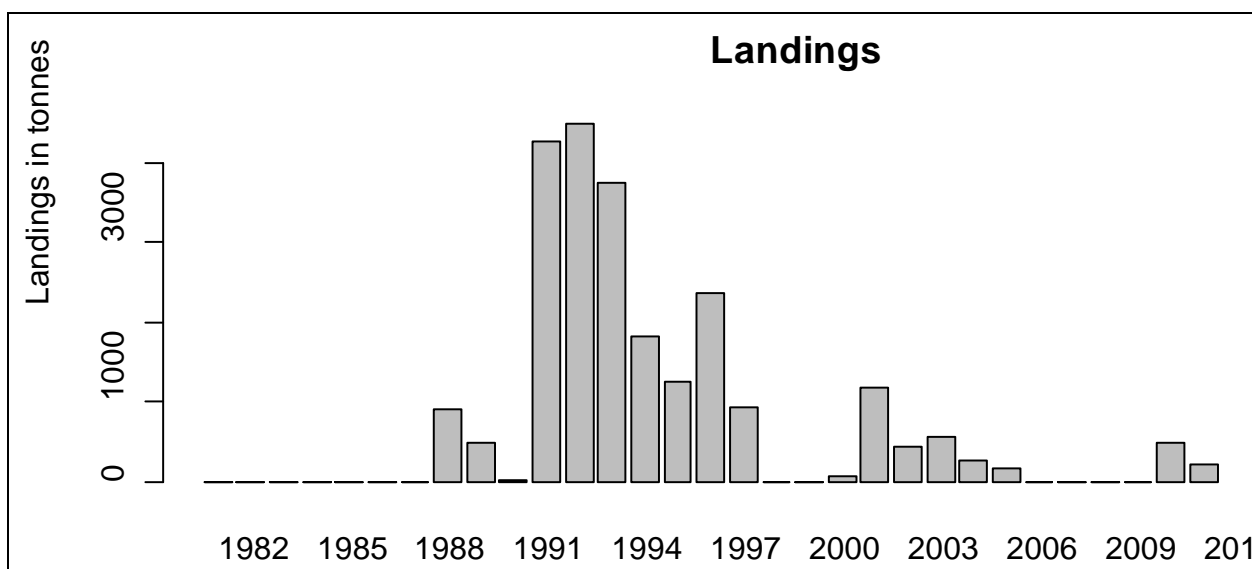


Figure 6.4.22.6.1 Sandeel in Division IIIa East (Kattegat, SA 6). ICES estimates of landings (in tonnes).

Only catch statistics are available for this stock. The available information is inadequate to evaluate stock status or trends. The state of the stock is therefore unknown.

Management plans

No specific management objectives are known to ICES.

Catch distribution Total landings (2012): 0.21 kt, where 100% were landings by industrial fisheries.

Quality considerations

The advice is based on precautionary low catches because of missing or non-representative data. The methods applied to derive quantitative advice for data-limited stocks are expected to evolve as they are further developed and validated.

Scientific basis

Assessment type	No assessment (Data-limited stock approach category 5.2.0).
Indicators	Catch statistics.
Other information	Last benchmark in 2010 (WKSAN, 2010).
Working group report	HAWG

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

Reference points

No reference points are defined for this stock.

Outlook for 2013

No forecast can be presented for this stock because the available data are insufficient to conduct an analytical assessment.

ICES approach to data-limited stocks

For data-limited stocks without information on abundance or exploitation ICES considers that a precautionary reduction of catches should be implemented, unless there is ancillary information clearly indicating that the current exploitation is appropriate for the stock.

For this stock, ICES advises that catches should decrease by 20% in relation to the last three years average catch, corresponding to catches of no more than 219 t. This advice is expected to remain unchanged for several years unless information on stock status becomes available.

Source

ICES. 2013. Report of the Herring Assessment Working Group (HAWG), 24–26 January 2013. ICES CM 2013/ACOM:06.

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

Advice for 2013

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.

This is the first year ICES provides quantitative advice for data-limited sandeel stocks (see Quality considerations).

Stock status

F (Fishing Mortality)	
	2010–2012
Qualitative evaluation	→ Very low
SSB (Spawning-Stock Biomass)	
	2010–2013
Qualitative evaluation	? Insufficient information

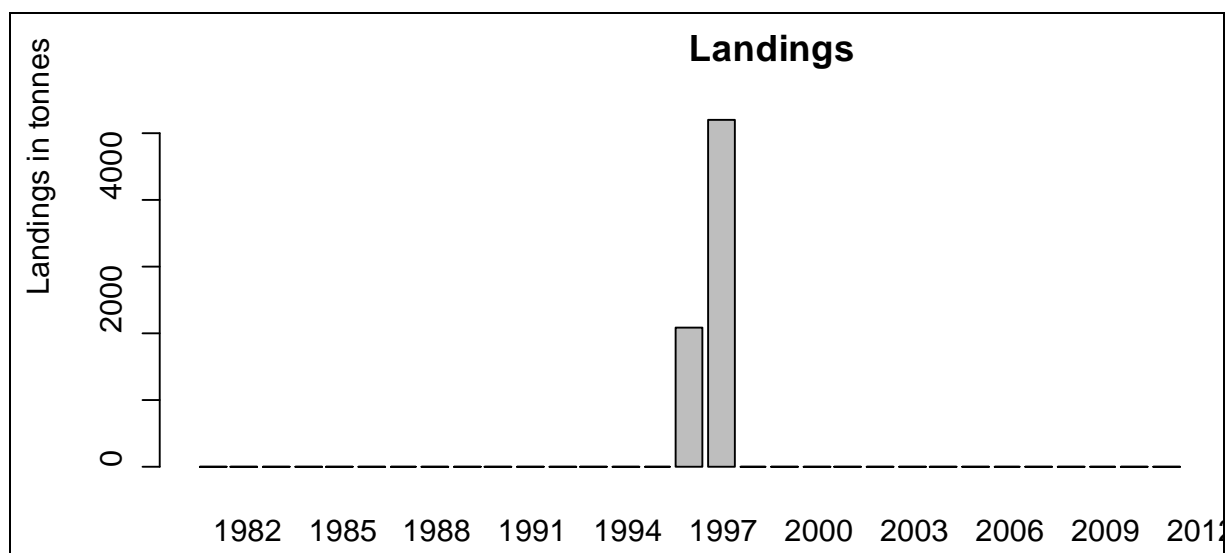


Figure 6.4.22.7.1 Sandeel in the Shetland area (SA 7). ICES estimates of landings (in tonnes).

Catch statistics are available for this stock. The available information is inadequate to evaluate stock status or trends. The state of the stock is therefore unknown. There are no active fisheries for sandeel in this area currently.

Management plans

No specific management objectives are known to ICES.

Quality considerations

The advice is based on precautionary low catches because of missing or non-representative data. The methods applied to derive quantitative advice for data-limited stocks are expected to evolve as they are further developed and validated.

Scientific basis

Assessment type	No assessment (Data-limited stock approach category 6.3.0).
Indicators	Catch statistics.
Other information	Last benchmark in 2010 (WKSAN, 2010).
Working group report	HAWG

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

Reference points

No reference points are defined for this stock.

Outlook for 2013

No forecast can be presented for this stock because the available data are insufficient to conduct an analytical assessment.

ICES approach to data-limited stocks

For data-limited stocks without information on abundance or exploitation ICES considers that a precautionary reduction of catches should be implemented, unless there is ancillary information clearly indicating that the current level of exploitation is appropriate for the stock.

For this stock, because the current catches are zero, ICES advises that catches in 2013 should be remain at zero unless there is evidence that an increase would be sustainable.

Additional considerations*Management plan*

A national management plan was in place for this stock until 2009, overseen by the Scottish Government. This restricted sandeel fishing around Shetland to small inshore grounds. However, as there have not been any reported landings from the area since 2003 the national plan has ended. Any future request from fishers to resume the fishery would require an evaluation of potential ecosystem implications under the Habitats and Species Act.

Source

ICES. 2013. Report of the Herring Assessment Working Group (HAWG), 24–26 January 2013. ICES CM 2013/ACOM:06.