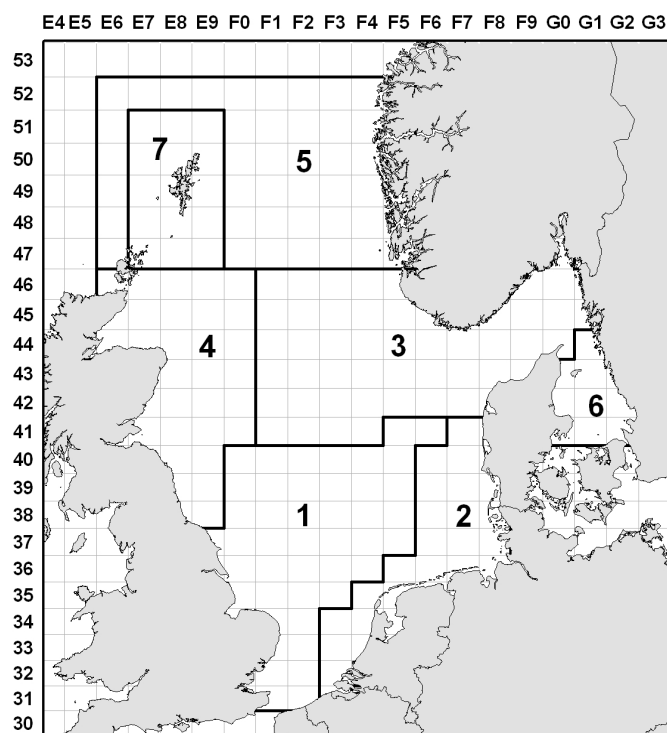


**ECOREGION** North Sea  
**STOCK** Sandeel in Division IIIa and Subarea IV

Sandeel are largely stationary after settlement and there is 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 6.4.21.1).

Section	Sandeel Area (SA)	Name	Rectangles
6.4.21.1	1	Dogger Bank area	31-34 E9-F2; 35 E9- F3; 36 E9-F4; 37 E9-F5; 38-40 F0-F5; 41 F5-F6
6.4.21.2	2	South Eastern North Sea	31-34 F3-F4; 35 F4-F6; 36 F5-F8; 37-40 F6-F8; 41 F7-F8
6.4.21.3	3	Central Eastern North Sea	41 F1-F4; 42-43 F1-F9; 44 F1-G0; 45-46 F1-G1; 47 G0
6.4.21.4	4	Central Western North Sea	38-40 E7-E9; 41-46 E6-F0
6.4.21.5	5	Viking and Bergen Bank area	47-51 E6 + F0-F5; 52 E6-F5
6.4.21.6	6	Division IIIa East (Kattegat)	41-43 G0-G3; 44 G1
6.4.21.7	7	Shetland area	47-51 E7-E9



**Figure 6.4.21.1** Sandeel in Division IIIa and Subarea IV. Map of Sandeel Areas (SA).

**Advice for 2011**

Following the ICES advice provided in October 2010, dredge survey information from December 2010 became available and was used to estimate recruitment for 2010 and to conduct forecasts for 2011. Updated advice is given for Sandeel Areas 1, 2, 3 and 4. For the other three areas, the information provided in 2010 is extended. The advice summary for sandeel in different areas is given in sections 6.4.21.1–7. A summary can be found in table 6.4.2.1.1.

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. From 2010 onward, ICES advice is provided for these seven areas to better reflect the stock structure and to enable management to direct action avoiding local depletions, as has been repeatedly advised in recent years. The amount of scientific and fisheries information differs by area and so does the level of detail per advice.

**Table 6.4.21.1** 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	Agreed TAC <sup>1)</sup>	ICES landings
2005 <sup>2</sup>	-	-	-	-	-	No advice	No advice	661	172
2006 <sup>2</sup>	-	-	-	-	-	No advice	No advice	300	288
2007 <sup>2</sup>	-	-	-	-	-	No advice	No advice	173	206
2008 <sup>2</sup>	-	-	-	-	-	No advice	No advice	400	335
2009 <sup>2</sup>	-	-	-	-	-	No advice	No advice	400	347
2010	-	-	-	-	-	No advice	No advice	400	398 <sup>3</sup>
2011	< 320	< 34	0	5–10	No advice, no increase in effort unless evidence that this is sustainable				

Weights in '000 t

<sup>1</sup> Advice for Subarea IV excluding the Shetland area.

<sup>2</sup> Set for zone IIIa, EC waters of Division IIa and Subarea IV.

<sup>3</sup> Preliminary

## 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 stationary after settlement and there is 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 a prey for many predators. Changes in the abundances of predators will have 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* 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 (Wright and Bailey, 1996; van Deurs *et al.*, 2009).

## The fisheries

Sandeel is taken by trawlers using small-mesh 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, the 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 advised fishery has taken place. This escapement strategy should allow for sufficient stock to remain for successful recruitment and providing adequate resource for predators of sandeel.

### 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 for fishery in May and June of each year to monitor the stock.

Since 2004, sandeel catch regulation has been based on the abundance of 1-group sandeel, as estimated from an exploratory fishery in the beginning of the fishing season.

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 fisheries subsequently ceased.

#### *Uncertainties in assessment and forecast*

The quality of the current assessment is considered much improved compared to the combined assessment for whole North Sea conducted before 2010. This is because the stock assessment areas used now 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 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.

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:

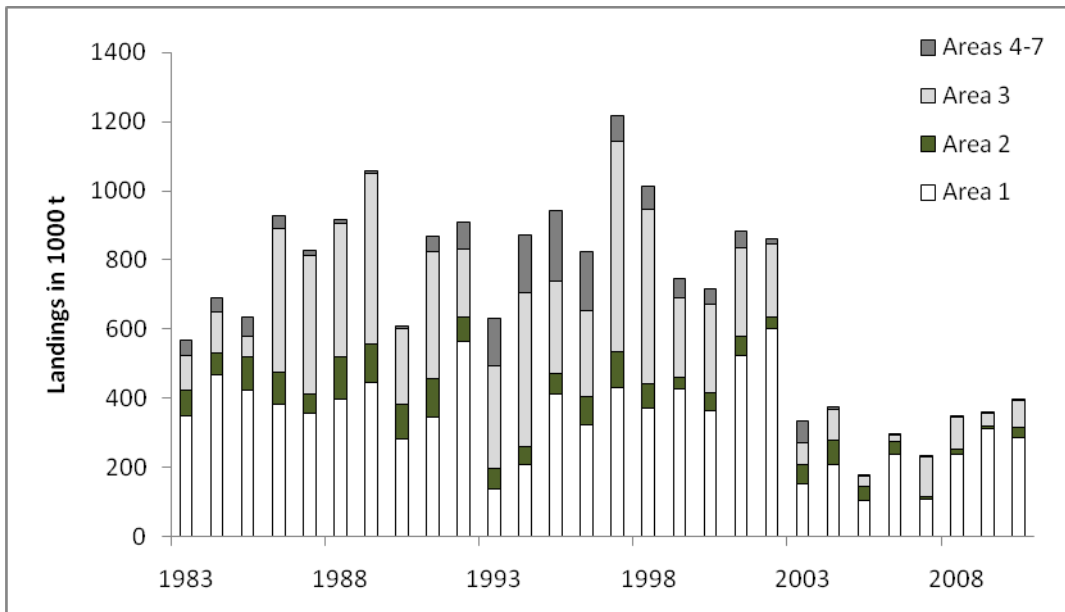
- Use of common, time-invariant natural mortality values over all areas.
- Assumption of correspondence between commercial effort and fishing mortality.
- Observations of effort are only available from the Danish fishery (which also has the largest catches).
- Age and length sampling uncertainty (as with any stock).
- Assumption that the maturity pattern in the forecast year is the long term average.

#### *Comparison with previous assessment and advice*

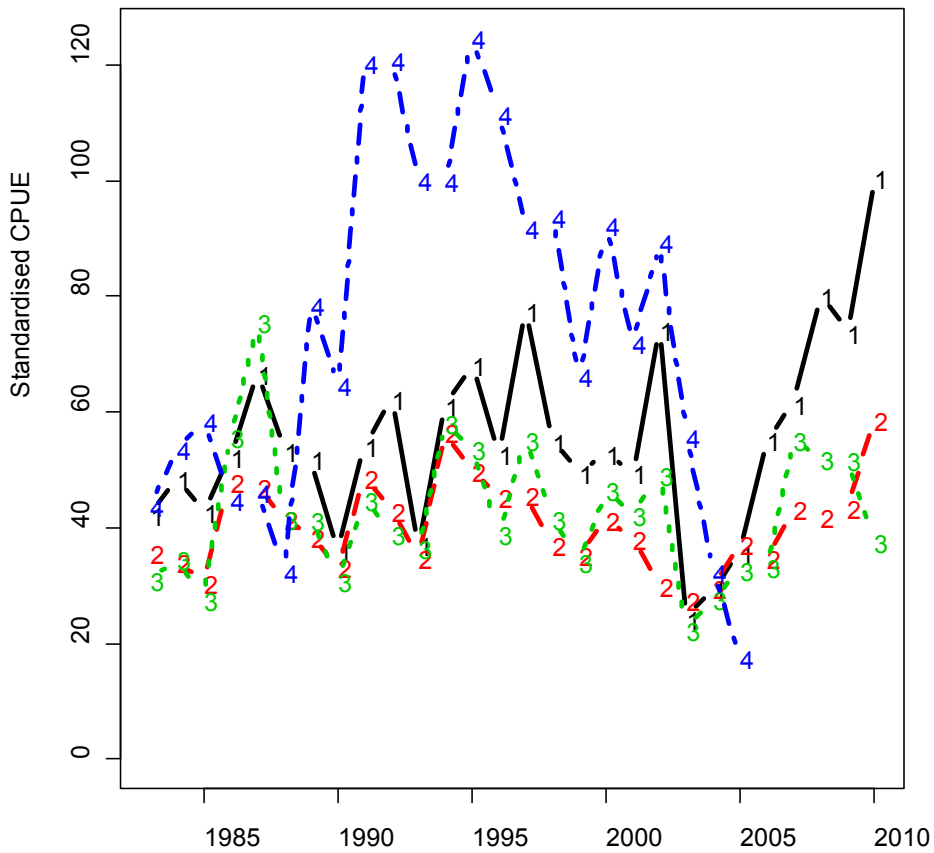
The 2010 dredge survey results confirmed a large 2009 year classes in area 1, 2 and 4 and a modest 2009 year class in area 3. For all areas the 2010 year class was estimated to be low.

#### **Sources**

- ICES. 2010. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 5–11 May 2010 ICES CM 2010/ACOM13.
- ICES. 2011. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, ICES CM 2011/ACOM13.
- van Deurs, M., van Hal, R., Tomczak, M.T., Jónasdóttir, S.H., 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., 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 6.4.21.2** Sandeel in Division IIIa and Subarea IV. Total landings by Sandeel Area ('000 tonnes).



**Figure 6.4.21.3** Sandeel in Division IIIa and Subarea IV. Catch (tonnes) per day fishing for a standardised 200GT vessel for Sandeel Area 1-4. Figure labels correspond to area.

**Table 6.4.21.2** Sandeel in Division IIIa and Subarea IV. Total landings (tonnes) by Sandeel Area 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
1983	349,397	74,479	100,330	2,588	2,815	0	37,201	566,810
1984	467,664	63,077	118,651	2,443	6,103	0	33,161	691,098
1985	424,058	96,658	57,835	37,060	2,929	0	17,320	635,858
1986	382,912	93,104	414,911	12,505	10,517	0	14,023	927,973
1987	357,714	53,292	400,402	8,108	1,535	0	7,367	828,417
1988	398,221	120,387	387,994	1,324	2,450	0	4,953	915,330
1989	446,151	109,830	492,999	4,389	2,040	909	0	1,056,318
1990	283,148	100,920	219,023	3,313	605	499	0	607,508
1991	347,102	107,812	368,801	41,429	2,532	17	0	867,694
1992	564,287	69,848	195,733	68,905	4,551	4,277	0	907,600
1993	136,600	59,848	296,232	133,197	401	4,490	0	630,768
1994	209,631	50,648	444,084	159,789	2,765	3,748	0	870,666
1995	410,687	60,143	266,720	52,759	150,637	1,830	0	942,776
1996	324,561	80,205	250,252	162,338	6,176	1,263	0	824,796
1997	431,871	102,730	608,164	59,353	11,279	2,373	2,068	1,217,839
1998	371,060	68,950	507,269	58,460	2,984	936	5,182	1,014,841
1999	428,307	32,117	228,163	53,959	140	134	4,263	747,083
2000	363,356	52,235	256,250	37,748	325	680	4,370	714,964
2001	521,724	58,645	253,088	47,828	1,687	312	976	884,260
2002	599,585	35,553	209,344	12,213	10	2,378	521	859,604
2003	150,711	56,262	62,569	64,002	44	869	261	334,718
2004	206,696	71,426	87,695	6,915	0	570	0	373,302
2005	103,777	41,447	29,667	1,486	0	262	0	176,640
2006	238,296	35,392	18,867	85	0	161	0	292,802
2007	109,363	5,910	113,905	11	4	661	0	229,855
2008	238,523	13,065	94,576	1,201	0	472	0	347,836
2009	310,471	10,239	34,052	0	0	260	0	355,022
2010	285,794	30,530	78,067	262	0	132	0	394,785
<b>arith. mean</b>	337,917	62,670	235,559	36,917	7,590	973	4,702	686,327

**Table 6.4.21.3** Sandeel in Division IIIa and Subarea IV. Landings ('000 t) per country as provided by Working Group members.

Year	Denmark	Germany	Faroes	Ireland	Netherlands	Norway	Sweden	UK	Lithuania	Total
1952	1.6	-	-	-	-	-	-	-	-	1.6
1953	4.5	+	-	-	-	-	-	-	-	4.5
1954	10.8	+	-	-	-	-	-	-	-	10.8
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	273.0	-	1.4	-	-	17.2	1.1	4.2	-	296.9
1974	424.1	-	6.4	-	-	78.6	0.2	15.5	-	524.8
1975	355.6	-	4.9	-	-	54.0	0.1	13.6	-	428.2
1976	424.7	-	-	-	-	44.2	-	18.7	-	487.6
1977	664.3	-	11.4	-	-	78.7	5.7	25.5	-	785.6
1978	647.5	-	12.1	-	-	93.5	1.2	32.5	-	786.8
1979	449.8	-	13.2	-	-	101.4	-	13.4	-	577.8
1980	542.2	-	7.2	-	-	144.8	-	34.3	-	728.5
1981	464.4	-	4.9	-	-	52.6	-	46.7	-	568.6
1982	506.9	-	4.9	-	-	46.5	0.4	52.2	-	610.9
1983	485.1	-	2.0	-	-	12.2	0.2	37.0	-	536.5
1984	596.3	-	11.3	-	-	28.3	-	32.6	-	668.5
1985	587.6	-	3.9	-	-	13.1	-	17.2	-	621.8
1986	752.5	-	1.2	-	-	82.1	-	12.0	-	847.8
1987	605.4	-	18.6	-	-	193.4	-	7.2	-	824.6
1988	686.4	-	15.5	-	-	185.1	-	5.8	-	892.8
1989	824.4	-	16.6	-	-	186.8	-	11.5	-	1039.1
1990	496.0	-	2.2	-	0.3	88.9	-	3.9	-	591.3
1991	701.4	-	11.2	-	-	128.8	-	1.2	-	842.6
1992	751.1	-	9.1	-	-	89.3	0.5	4.9	-	854.9
1993	482.2	-	-	-	-	95.5	-	1.5	-	579.2
1994	603.5	-	10.3	-	-	165.8	-	5.9	-	785.5
1995	647.8	-	-	-	-	263.4	-	6.7	-	917.9
1996	601.6	-	5.0	-	-	160.7	-	9.7	-	776.9
1997	751.9	-	11.2	-	-	350.1	-	24.6	-	1137.8
1998	617.8	-	11.0	-	+	343.3	8.5	23.8	-	1004.4
1999	500.1	-	13.2	0.4	+	187.6	22.4	11.5	-	735.1
2000	541.0	-	-	-	+	119.0	28.4	10.8	-	699.1
2001	630.8	-	-	-	-	183.0	46.5	1.3	-	861.6
2002	629.7	-	-	-	-	176.0	0.1	4.9	-	810.7
2003	274.0	-	-	-	-	29.6	21.5	0.5	-	325.6
2004	277.1	2.7	-	-	-	48.5	33.2	+	-	361.5
2005	154.8	-	-	-	-	17.3	-	-	-	172.1
2006	250.6	3.2	-	-	-	5.6	27.8	-	-	287.9
2007	144.6	1.0	2.0	-	-	51.1	6.6	1.0	-	206.3
2008	234.4	4.4	2.4	-	-	81.6	12.4	-	-	335.2
2009	285.7	12.2	2.5	-	1.8	27.4	12.1	3.6	2.0	347.4
2010	275.1	13.0	-	-	-	78.0	32.0	-	0.2*	398.3*

\* Preliminary

+ = less than half unit.

- = no information or no landings.

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

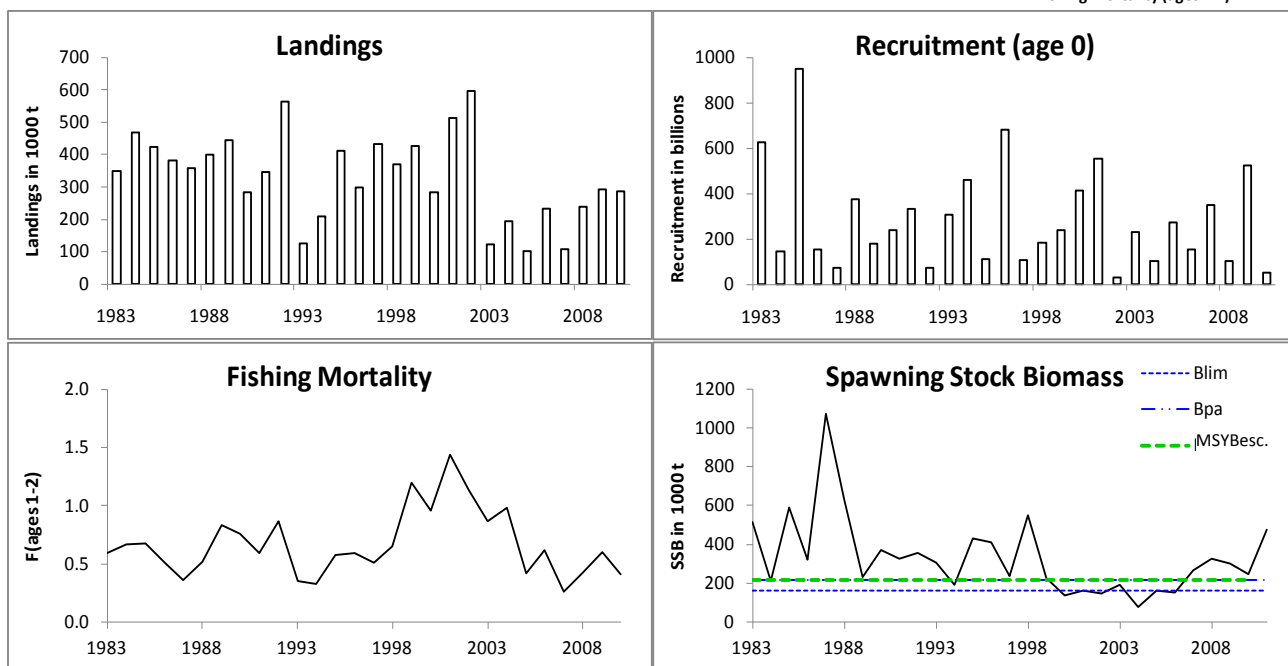
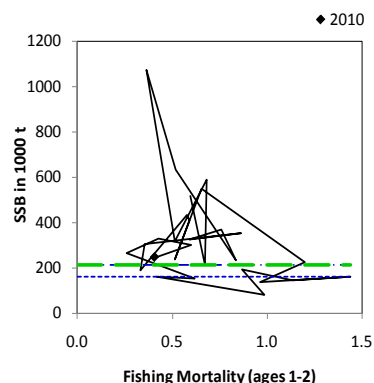
**Advice for 2011**

ICES advises on the basis of the MSY approach that the catch in 2011 should be less than 320 000 t to maintain SSB in 2012 above MSY  $B_{escapement}$ .

To protect the stock on a local scale, management should be implemented on the area level.

**Stock status**

F (Fishing Mortality)			
	2008	2009	2010
MSY ( $F_{MSY}$ )	?	?	Undefined
Precautionary approach ( $F_{pa}, F_{lim}$ )	?	?	Undefined
SSB (Spawning Stock Biomass)			
	2009	2010	2011
MSY ( $B_{escapement}$ )	✓	✓	Above trigger
Precautionary approach ( $B_{pa}, B_{lim}$ )	✓	✓	Full reproductive capacity



**Figure 6.4.21.1.1** Sandeel in the DoggerBank area (SA1). Summary of stock assessment (weights in '000 t). Top right: SSB and F over the years.

The stock at the start of 2011 is expected to be at full reproductive capacity owing to the large recruitment in 2009. Fishing mortality decreased in 2005 from a high level and has since fluctuated without trend.

**Management plans**

No specific management objectives are known to ICES.

In light of the EU policy paper on fisheries management (17 May 2010, [COM\(2010\) 241](#)) this stock is classified under category 5. ICES notes that the TAC and the stock assessment areas do not match.

## Fisheries

**Catch by fleet** Total catch (2010) 286 kt where 100% landings by industrial fisheries

### Quality considerations

The December 2010 dredge survey results confirmed the very large 2009 year class observed in the fishery in 2010. Although there is high uncertainty on the absolute size of the 2010 year class, the survey index suggests that this cohort is likely to be in the very low end of the historical time series.

### Scientific basis

<b>Assessment type</b>	Seasonal age based analytical (SMS-effort)
<b>Input data</b>	1 survey index in December (Dredge survey 2004-) Total international fishing effort
<b>Discards and bycatch</b>	Not included in the assessment
<b>Indicators</b>	None
<b>Other information</b>	Last benchmark in 2010.
<b>Working group report</b>	<a href="#">WGNSSK</a>

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

## Reference points

	<i>Type</i>	<i>Value</i>	<i>Technical basis</i>
<b>MSY Approach</b>	MSY $B_{\text{escapement}}$	215 000 t	= $B_{\text{pa}}$
	$F_{\text{MSY}}$	Not defined	
<b>Precautionary Approach</b>	$B_{\text{lim}}$	160 000 t	Median SSB in the years (2000–2006) of lowest SSB and no impaired recruitment (ICES, 2010)
	$B_{\text{pa}}$	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)
	$F_{\text{lim}}$	Not defined	
	$F_{\text{pa}}$	Not defined	

(unchanged since: 2010)

## Outlook for 2011

Basis:  $F_{\text{sq}} = F(2010) = 0.34$ ; Yield(2010)=286; Recruitment(2010)=50 billion; Recruitment(2011)= geometric mean (GM 83-09) = 223 billion; SSB(2011)=430

Rationale	Landings (2011)	Basis	F (2011)	SSB (2012)	%SSB change <sup>1</sup>
Zero catch	0	$F=0$	0	410	-4%
	50	$F_{\text{sq}} * 0.25$	0.08	380	-11%
	96	$F_{\text{sq}} * 0.50$	0.17	350	-18%
	140	$F_{\text{sq}} * 0.75$	0.25	330	-24%
Status quo	180	$F_{\text{sq}} * 1$	0.34	300	-30%
	210	$F_{\text{sq}} * 1.25$	0.42	280	-35%
	250	$F_{\text{sq}} * 1.50$	0.50	260	-40%
	280	$F_{\text{sq}} * 1.75$	0.59	240	-45%
	310	$F_{\text{sq}} * 2$	0.67	220	-49%
MSY-approach	320	$F_{\text{sq}} * 2.08$	0.70	220	-50%

Weights in '000 t.

<sup>1)</sup> SSB 2012 relative to SSB 2011.

**MSY approach**

Following the ICES MSY framework for a short lived species the fishery in 2011 should allow for sufficient stock (MSY  $B_{\text{escapement}}$ ) to remain for successful recruitment. This implies a catch of less than 320 000 t in 2011.

**Policy paper**

In light of the EU policy paper on fisheries management (17 May 2010, [COM\(2010\) 241](#)) this stock is classified under category 5, because this is a short lived species. ICES notes that the TAC and the stock assessment areas do not match.

**Additional considerations***Uncertainties in assessment and forecast*

The dredge survey results are sufficiently robust to provide a reliable estimate of the incoming 1-group. Hence, fishing opportunities for 2011 can be established based on this information.

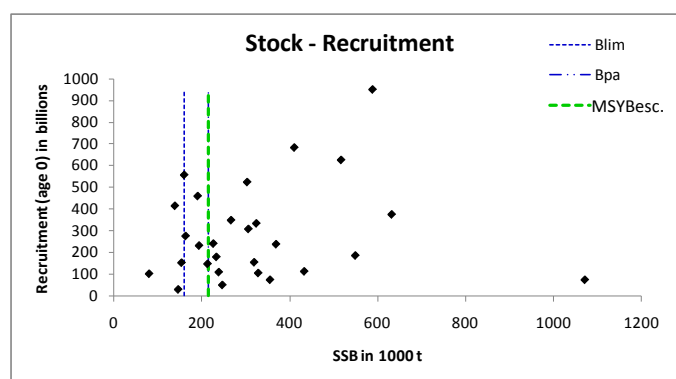
## Management plans

A management plan needs to be developed. The ICES approach for MSY based management of a short-lived species as sandeel is an escapement strategy, i.e. to maintain SSB above MSY  $B_{\text{escapement}}$  after the fishery has taken place. With the current MSY  $B_{\text{escapement}}$  at  $B_{\text{pa}}$  (215 000 t) the outlook table indicates that the 2011 catch according to the MSY approach will require an  $F$  at 0.70, which is twice the  $F$  value in 2010. However, taking the historical  $F$  and stock development into account an  $F$  value above 0.6 is probably not recommendable. As effort is assumed proportional to  $F$ , effort must be doubled to take the TAC in 2012. A management plan should include an upper limit on effort estimated on the basis of the effort applied in the most recent years.

## Sources

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

ICES. 2011. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, ICES CM 2011/ACOM13.



**Figure 6.4.21.1.2** Sandeel in the Dogger Bank area (SA1). Stock–recruitment plot.

**Table 6.4.21.1.1** Sandeel in the Dogger Bank area (SA1). ICES advice, management and landings

Year	ICES Advice	Catch corresponding to advice	TAC <sup>2</sup>	ICES Landings SA1	ICES Landings Total
2005 <sup>1</sup>	Exploitation to be kept below level of 2003. Adjustment to be made conditional on the abundance of the 2004 year class	-	661	104	172
2006 <sup>1</sup>	The fishery should remain closed until information is available which assures that the stock can be rebuilt to $B_{\text{pa}}$ by 2007.	-	300	238	288
2007 <sup>1</sup>	The fishery should remain closed until information is available which assures that the stock can be rebuilt to $B_{\text{pa}}$ by 2008.	-	173	109	206
2008 <sup>1</sup>	The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{\text{pa}}$ by 2009.	-	400	239	335
2009 <sup>1</sup>	The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{\text{pa}}$ by 2010	-	400	310	347
2010 <sup>1</sup>	The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{\text{pa}}$ by 2011	-	400	286	402
2011	MSY approach: allow for sufficient stock ( $\text{MSY } B_{\text{escapement}}$ ) to remain for successful recruitment.	< 320			

Weights in '000 t.

<sup>1</sup> Advice for Subarea IV excluding the Shetland area.

<sup>2</sup> Set for zone IIIa, EC waters of Division IIa and Subarea IV.

**Table 6.4.21.1.4** Sandeel in the Dogger Bank area (SA1). Summary of the assessment.

<b>Year</b>	<b>Recruits (million)</b>	<b>TSB (tonnes)</b>	<b>SSB (tonnes)</b>	<b>Yield (tonnes)</b>	<b>Mean F ages 1-2</b>
<b>1983</b>	624999	705504	516578	349232	0.593
<b>1984</b>	146868	1502250	212681	467609	0.671
<b>1985</b>	949287	1002100	588145	424114	0.679
<b>1986</b>	154159	2291220	318719	382735	0.513
<b>1987</b>	73517	1607230	1071200	357671	0.362
<b>1988</b>	374394	782061	631713	398271	0.518
<b>1989</b>	178837	816099	232759	445695	0.833
<b>1990</b>	237255	705553	368557	283040	0.759
<b>1991</b>	333141	1083600	323676	347096	0.590
<b>1992</b>	73641	1315990	354859	564298	0.864
<b>1993</b>	307426	551211	305634	124082	0.352
<b>1994</b>	458848	826458	190239	209538	0.331
<b>1995</b>	112303	1802890	432631	410513	0.578
<b>1996</b>	682124	699271	410037	298702	0.589
<b>1997</b>	108893	2102340	238242	431808	0.511
<b>1998</b>	185283	899570	548917	371117	0.652
<b>1999</b>	240085	606838	225830	427691	1.198
<b>2000</b>	414021	704641	138388	284521	0.960
<b>2001</b>	556016	873627	159572	513068	1.437
<b>2002</b>	29121	1376710	145830	596049	1.136
<b>2003</b>	230977	265522	193364	121863	0.865
<b>2004</b>	101371	508802	79690	195274	0.983
<b>2005</b>	274993	400372	162804	100835	0.418
<b>2006</b>	152165	772613	153474	231448	0.616
<b>2007</b>	347812	598874	266195	108600	0.258
<b>2008</b>	104680	1151790	328004	237447	0.427
<b>2009</b>	523224	671086	302830	291247	0.598
<b>2010</b>	49689	1534960	246330	285540	0.407
<b>2011</b>			473850		
<b>arith. Mean</b>	286612	1005685	331750	330682	0.668
<b>geo. Mean<sup>1</sup></b>	222948				

1) Period 1983-2009

**ECOREGION** North Sea  
**STOCK** Sandeel in the South Eastern North Sea (SA 2)

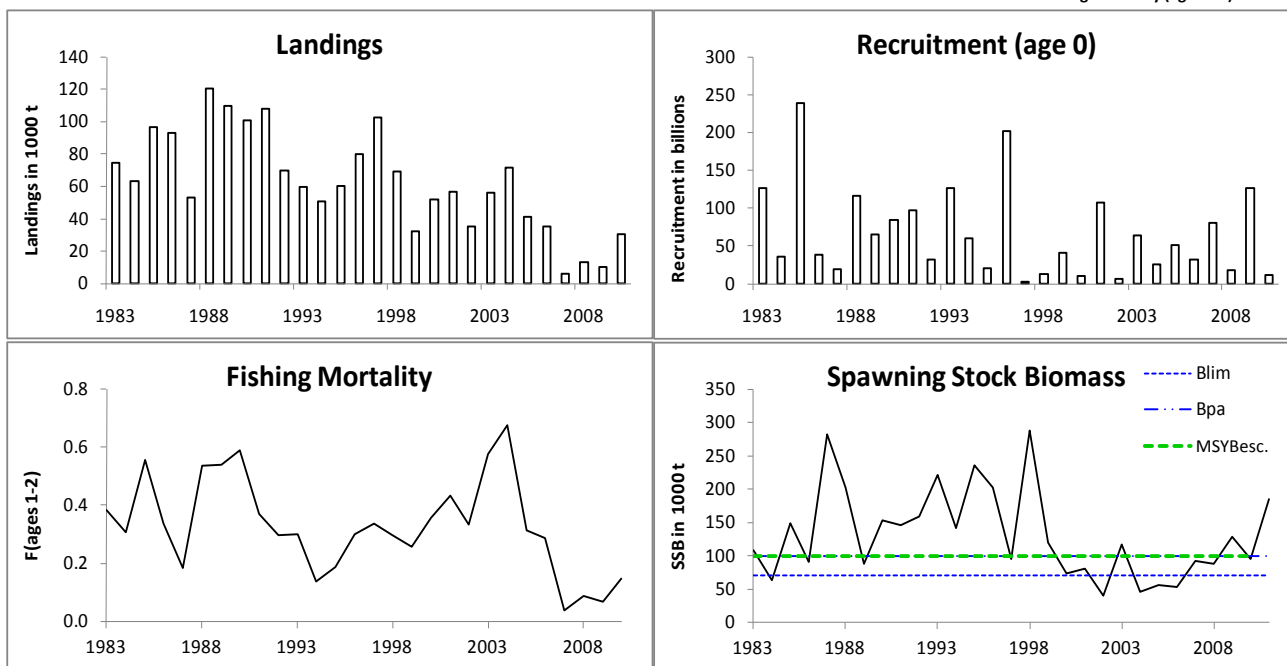
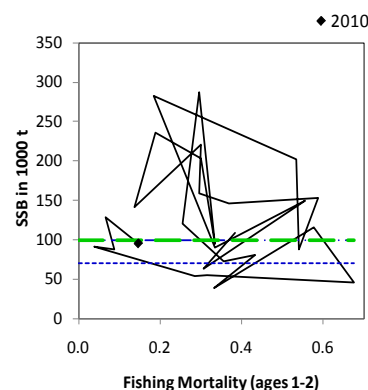
**Advice for 2011**

ICES advises on the basis of the MSY approach that catch in 2011 should be less than 34 000 t in 2011 to maintain SSB in 2012 above MSY  $B_{escapement}$ .

To protect the stock on a local scale, management should be implemented on the area level.

**Stock status**

F (Fishing Mortality)			
	2008	2009	2010
MSY ( $F_{MSY}$ )	?	?	? Undefined
Precautionary approach ( $F_{pa}, F_{lim}$ )	?	?	? Undefined
SSB (Spawning Stock Biomass)			
	2009	2010	2011
MSY ( $B_{escapement}$ )	✓	✗	✓ Above trigger
Precautionary approach ( $B_{pa}, B_{lim}$ )	✓	○	✓ Full reproductive capacity



**Figure 6.4.21.2.1** Sandeel in the South Eastern North Sea (SA2). Summary of stock assessment (weights in '000 t). Top right: SSB and F over the years

Due to low values of  $F$  ( $\sim 0.1$ ) since 2007 and the strong 2009 year class, SSB in 2011 is estimated around twice as high as  $B_{pa}$ .

**Management plans**

No specific management objectives are known to ICES.

In light of the EU policy paper on fisheries management (17 May 2010, [COM\(2010\) 241](#)) this stock is classified under category 5. ICES notes that the TAC and the stock assessment areas do not match.

## Fisheries

**Catch by fleet** Total catch (2010) 31 kt where 100 % landings by industrial fisheries.

### Quality considerations

The December 2010 dredge survey results confirmed the very large 2009 year class observed in the fishery in 2010. Although there is high uncertainty on the absolute size of the 2010 year class, the survey index suggests that this cohort is likely to be in the very low end of the historical time series.

### Scientific basis

<b>Assessment type</b>	Seasonal age based analytical (SMS-effort)
<b>Input data</b>	1 survey index (Dredge survey, 2004-) from Area 1 is applied Total international fishing effort
<b>Discards and bycatch</b>	Not included in the assessment
<b>Indicators</b>	None
<b>Other information</b>	Last benchmark in 2010.
<b>Working group report</b>	<a href="#">WGNSSK</a>

**ECOREGION** North Sea  
**STOCK** Sandeel in the South Eastern North Sea (SA 2)

**Reference points**

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

(unchanged since: 2010)

**Outlook for 2011**

Basis:  $F_{\text{sq}} = F(2010) = 0.14$ ; Yield(2010)=31; Recruitment(2010)=11 billion; Recruitment(2011)= geometric mean (GM 83-09) = 45 billion; SSB(2011)=188.

<b>Rationale</b>	<b>Landings (2011)</b>	<b>Basis</b>	<b>F (2011)</b>	<b>SSB (2012)</b>	<b>%SSB change<sup>1</sup></b>
Zero Catch	0	$F=0$	0	130	-33%
	7	$F_{\text{sq}} * 0.25$	0.04	120	-36%
	13	$F_{\text{sq}} * 0.50$	0.07	120	-38%
	19	$F_{\text{sq}} * 0.75$	0.11	110	-41%
Status quo	25	$F_{\text{sq}} * 1$	0.14	110	-43%
	31	$F_{\text{sq}} * 1.25$	0.18	100	-45%
MSY-approach	34	$F_{\text{sq}} * 1.40$	0.20	100	-47%
	36	$F_{\text{sq}} * 1.50$	0.21	98	-48%
	41	$F_{\text{sq}} * 1.75$	0.25	94	-50%
	47	$F_{\text{sq}} * 2$	0.28	90	-52%

Weights in '000 t.

<sup>1)</sup>SSB 2012 relative to SSB 2011.

**MSY approach**

Following the ICES MSY framework for a short lived species the fishery in 2011 should allow for sufficient stock (MSY  $B_{\text{escapement}}$ ) to remain for successful recruitment. This implies a catch of less than 34 000 t in 2011.

**Policy paper**

In light of the EU policy paper on fisheries management (17 May 2010, [COM\(2010\) 241](#)) this stock is classified under category 5, because this is a short-lived species. ICES notes that the TAC and the stock assessment areas do not match.

**Additional considerations***Uncertainties in assessment and forecast*

There appears to be a sufficiently robust relationship between the recruitments in SA 1 and SA 2 to be able to use the same data sources and procedures from SA 1 for the estimation of the incoming year class strength. The dredge survey was expanded in 2010 to cover area 2.

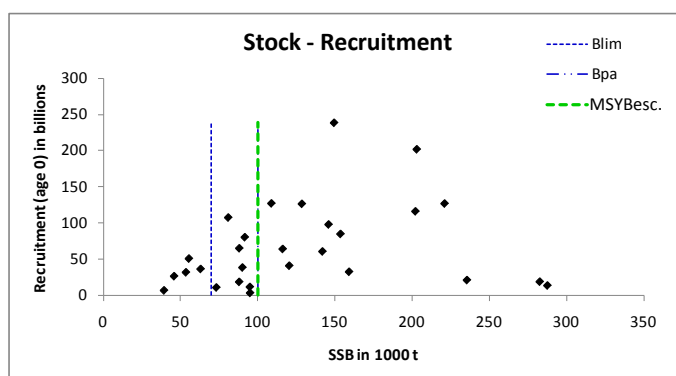
## Management plans

A management plan needs to be developed. The ICES approach for MSY based management of a short-lived species as sandeel is the escapement strategy, i.e. to maintain SSB above  $MSY B_{escapement}$  after the fishery has taken place. Such an approach 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 usage as fishing mortality is assumed 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. 2011. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, ICES CM 2011/ACOM:13.



**Figure 6.4.21.2.2** Sandeel in the South Eastern North Sea (SA2). Stock–recruitment plot.

**Table 6.4.21.2.1** Sandeel in the South Eastern North Sea (SA2). ICES advice, management and landings

Year	ICES Advice	Catch corresponding to advice	TAC <sup>2</sup>	ICES Landings SA2	ICES Landings Total
2005 <sup>1</sup>	Exploitation to be kept below level of 2003. Adjustment to be made conditional on the abundance of the 2004 year class	-	661	41	172
2006 <sup>1</sup>	The fishery should remain closed until information is available which assures that the stock can be rebuilt to $B_{pa}$ by 2007.	-	300	35	288
2007 <sup>1</sup>	The fishery should remain closed until information is available which assures that the stock can be rebuilt to $B_{pa}$ by 2008.	-	173	6	206
2008 <sup>1</sup>	The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{pa}$ by 2009.	-	400	13	335
2009 <sup>1</sup>	The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{pa}$ by 2010	-	400	10	347
2010 <sup>1</sup>	The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{pa}$ by 2011	-	400	31	402
2011	MSY approach: allow for sufficient stock ( $MSY B_{escapement}$ ) to remain for successful recruitment.	< 34			

Weights in '000 t.

<sup>1</sup> Advice for Subarea IV excluding the Shetland area.

<sup>2</sup> Set for zone IIIa, EC waters of Division IIa and Subarea IV.

**Table 6.4.21.2.4** Sandeel in the South Eastern North Sea (SA2). Summary of the assessment.

<b>Year</b>	<b>Recruits (million)</b>	<b>TSB (tonnes)</b>	<b>SSB (tonnes)</b>	<b>Yield (tonnes)</b>	<b>Mean F ages 1-2</b>
<b>1983</b>	127058	151775	108802	74481	0.383
<b>1984</b>	36278	326571	62947	63046	0.306
<b>1985</b>	238563	248260	149408	96645	0.555
<b>1986</b>	38332	586268	90031	93146	0.335
<b>1987</b>	18705	415460	282628	53284	0.184
<b>1988</b>	116061	240438	202090	120382	0.535
<b>1989</b>	64956	271447	88007	109703	0.540
<b>1990</b>	84749	277160	153555	100917	0.587
<b>1991</b>	97869	418513	145842	107795	0.369
<b>1992</b>	32427	436339	159113	69825	0.297
<b>1993</b>	126814	353954	220981	59652	0.301
<b>1994</b>	60542	516387	141866	50656	0.138
<b>1995</b>	20914	452347	235459	60138	0.188
<b>1996</b>	201859	309225	202961	80012	0.300
<b>1997</b>	3145	649194	94993	102726	0.335
<b>1998</b>	13433	349607	287570	68953	0.296
<b>1999</b>	40814	177520	120354	32108	0.256
<b>2000</b>	10702	236062	73132	52228	0.355
<b>2001</b>	107467	134520	80838	56934	0.433
<b>2002</b>	6658	318847	39240	35494	0.332
<b>2003</b>	63967	159762	116110	55924	0.576
<b>2004</b>	26297	228285	45770	71413	0.676
<b>2005</b>	50677	135432	55374	41420	0.315
<b>2006</b>	31683	220979	53449	35351	0.286
<b>2007</b>	80246	208715	91560	5911	0.039
<b>2008</b>	18446	308837	87941	13064	0.088
<b>2009</b>	126414	193851	128541	10240	0.067
<b>2010</b>	11481	401504	94852	30531	0.147
<b>2011</b>			184604		
<b>arith. mean</b>	66306	311688	130966	62571	0.329
<b>geo. mean<sup>1</sup></b>	44626				

1) Period 1983–2009

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

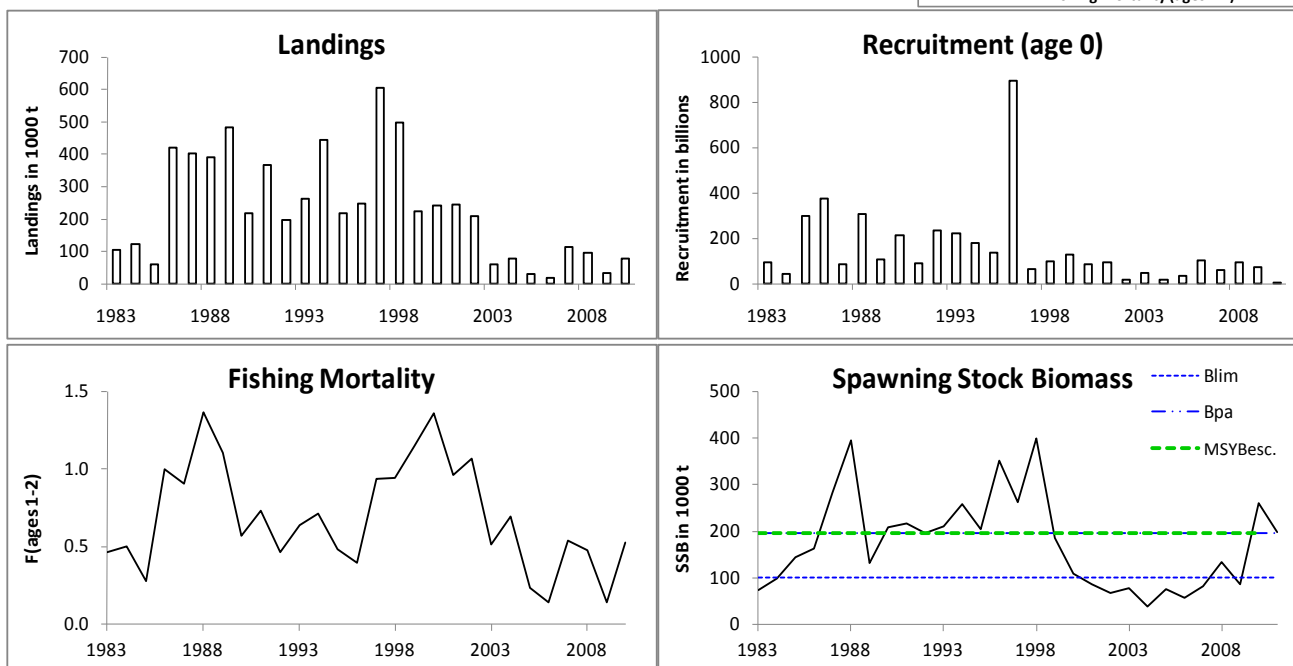
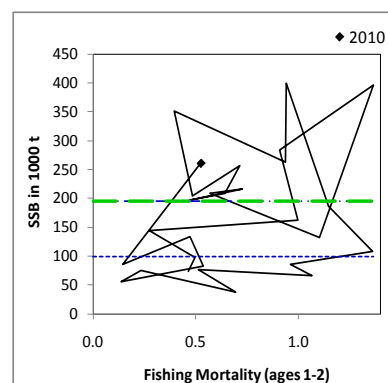
**Advice for 2011**

ICES advises on the basis of the MSY approach that no catches of sandeel in area 3 should be allowed in 2011.

To protect the stock on a local scale, management should be implemented on the area level.

**Stock status**

F (Fishing Mortality)			
	2008	2009	2010
MSY ( $F_{MSY}$ )	?	?	Undefined
Precautionary approach ( $F_{pa}, F_{lim}$ )	?	?	Undefined
SSB (Spawning Stock Biomass)			
	2009	2010	2011
MSY ( $B_{escapement}$ )	✗	✓	✓ Above trigger
Precautionary approach ( $B_{pa}, B_{lim}$ )	✗	✓	✓ Full reproductive capacity



**Figure 6.4.21.3.1** Sandeel in the Central Eastern North Sea (SA3). Summary of stock assessment (weights in '000 tonnes). Top right: SSB and F over the years.

The stock has increased from a record low SSB in 2004 (at half of  $B_{lim}$ ) to above  $B_{pa}$  in 2010. SSB in 2011 is estimated to be just above  $B_{pa}$  and MSY  $B_{escapement}$ . Recruitment was above the long term mean in 2001 and has been below since with a very low recruitment in 2010. Since 2004, F has been highly variable between years and below the long-term mean.

**Management plans**

No specific management objectives are known to ICES.

In light of the EU policy paper on fisheries management (17 May 2010, [COM\(2010\) 241](#)) this stock is classified under category 5. ICES notes that the TAC and the stock assessment areas do not match.

## The fisheries

<b>Catch by fleet</b>	Total catch (2010) 78 kt where 100 % landings by industrial fisheries
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### Quality considerations

The assessment is considered less robust than the assessments for SA 1 and SA 2. The dredge survey only covers the southern part of Area 3. Therefore the very low estimate of recruitment in 2010 is considered uncertain.

### Scientific basis

<b>Assessment type</b>	Seasonal age based analytical (SMS-effort)
<b>Input data</b>	1 survey index available in January (Dredge survey, 2004-) Total international catch and effort
<b>Discards and bycatch</b>	Not included in the assessment
<b>Indicators</b>	None
<b>Other information</b>	Last benchmark in 2010.
<b>Working group report</b>	<a href="#">WGNSSK</a>

**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>
<b>MSY Approach</b>	MSY $B_{\text{escapement}}$	195 000 t	= $B_{\text{pa}}$
	$F_{\text{MSY}}$	Not defined	
<b>Precautionary Approach</b>	$B_{\text{lim}}$	100 000 t	The highest SSB (in 2001) in the period (2001–2007) with the lowest SSB and low recruitment (ICES, 2010)
	$B_{\text{pa}}$	195 000 t	$B_{\text{pa}} = B_{\text{lim}} * \exp^{(\sigma * 1.645)}$ with $\sigma = 0.40$ estimated from assessment uncertainty in the terminal year (ICES, 2010)
	$F_{\text{lim}}$	Not defined	
	$F_{\text{pa}}$	Not defined	

(unchanged since: 2010)

#### Outlook for 2011

Basis:  $F_{\text{sq}} = F(2010) = 0.43$ ; Yield(2010)=78; Recruitment(2010)=4 billion; Recruitment(2011)= geometric mean (GM 83-09) = 105 billion; SSB(2011)=166.

<b>Rationale</b>	<b>Landings (2011)</b>	<b>Basis</b>	<b>F (2011)</b>	<b>SSB (2012)</b>	<b>%SSB change<sup>1</sup></b>
Zero catch	0	$F=0$	0	120	-27%
	10	$F_{\text{sq}} * 0.25$	0.10	110	-32%
	20	$F_{\text{sq}} * 0.50$	0.22	110	-36%
	29	$F_{\text{sq}} * 0.75$	0.32	100	-40%
	37	$F_{\text{sq}} * 1$	0.43	95	-43%
	45	$F_{\text{sq}} * 1.25$	0.54	89	-46%
	53	$F_{\text{sq}} * 1.50$	0.64	84	-49%

Weights in '000 t.

<sup>1)</sup>SSB 2012 relative to SSB 2011.

#### *MSY approach*

Following the ICES MSY framework for a short lived species the fishery in 2011 should allow for sufficient stock (MSY  $B_{\text{escapement}}$ ) to remain for successful recruitment. ICES advises a zero catch in 2011 as even this will not allow SSB to increase above MSY  $B_{\text{escapement}}$  in 2012.

#### *Policy paper*

In light of the EU policy paper on fisheries management (17 May 2010, [COM\(2010\) 241](#)) this stock is classified under category 5, because this is a short-lived species. ICES notes that the TAC and the stock assessment areas do not match.

#### **Additional considerations**

##### *Uncertainties in assessment and forecast*

The assessment is considered less robust than the assessments for SA 1 and SA 2.

No Norwegian effort data are available to ICES with the appropriate resolution. Norwegian fishing effort has therefore been estimated on the basis of Norwegian landings and the assumption that Danish and Norwegian cpue are similar. Observed Norwegian effort would probably 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 limitations on the access to the Norwegian EEZ.

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 purpose.

The Benchmark group (ICES, 2010) concluded that the dredge survey estimates of the incoming year class appear less robust for area 3 and it is therefore appropriate that in-season monitoring (e.g. acoustic monitoring and age-based commercial cpue) should continue in area 3. The survey index for the 2010 year-class is very low and outside the range of previously observed values; this might reflect a very low recruitment or simply poor survey coverage. However, the ICES advice from October 2010 indicated that even with zero TAC in 2011 a recruitment higher than 60% of long term average would be required to increase SSB above MSY  $B_{\text{escapement}}$  in 2012.

#### Management considerations

Extension of the area covered by the dredge survey will probably reduce the assessment uncertainty.

Pre-season estimates of the incoming year class appear less robust for this area and it is therefore appropriate that in-season monitoring (e.g. acoustic monitoring and age-based commercial cpue) to continue in SA 3. The quality (internal and external consistency) of the acoustic survey is not yet known and the dredge survey results in SA 3 are less consistent than in the other areas.

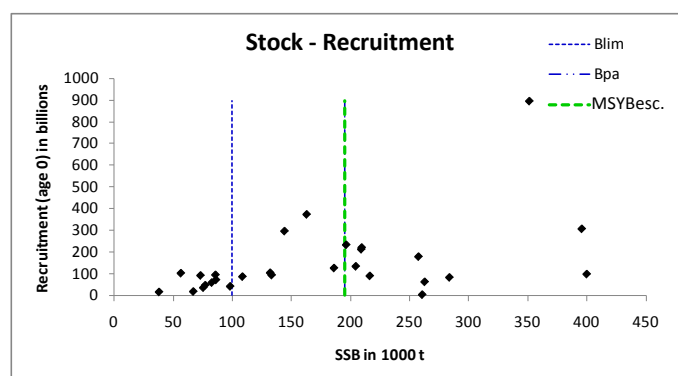
Norway has set a national quota at 60 000 t in 2011 in three management boxes in the Norwegian EEZ in SA 3, whereas two other management boxes will remain closed. The Norwegian quota is based on acoustic monitoring in April/May 2010. An upcoming acoustic survey in April/May 2011 in Norwegian EEZ will update the information on the stock status; however, the estimated stock abundance from the survey will not be used to change the national quota in SA 3. The sandeel fishery in the Norwegian EEZ was closed in 2009 and no effort data from the 2010 fishery in the Norwegian EEZ were included in the ICES estimates for SA 3. This renders the assessment highly uncertain.

The Norwegian management plan is based on preserving local spawning stocks using a rotational system of opening and closing fishing grounds. The Norwegian EEZ has been divided into six areas, five of which are located in SA 3. If the abundance of sandeel in an area is above a predefined level, half of the area will be opened for fishing. If sandeel abundance remains above the predefined level, the second half of the area will be opened for fishing the following year and the first half will then be closed. ICES has not evaluated the Norwegian management plan for sandeel in the Norwegian part of SA 3.

#### Sources

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

ICES. 2011. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, ICES CM 2011/ACOM13.



**Figure 6.4.21.3.2** Sandeel in the Central Eastern North Sea (SA3). Stock–recruitment plot

**Table 6.4.21.3.1** Sandeel in the Central Eastern North Sea (SA3). ICES advice, management and landings

Year	ICES Advice	Catch corresponding to advice	TAC <sup>2</sup>	ICES Landings SA3	ICES Landings Total
2005	<sup>1</sup> Exploitation to be kept below level of 2003. Adjustment to be made conditional on the abundance of the 2004 year class	-	661	30	172
2006	<sup>1</sup> The fishery should remain closed until information is available which assures that the stock can be rebuilt to B <sub>pa</sub> by 2007.	-	300	19	288
2007	<sup>1</sup> The fishery should remain closed until information is available which assures that the stock can be rebuilt to B <sub>pa</sub> by 2008.	-	173	114	206
2008	<sup>1</sup> The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to B <sub>pa</sub> by 2009.	-	400	95	335
2009	<sup>1</sup> The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to B <sub>pa</sub> by 2010	-	400	34	347
2010	<sup>1</sup> The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to B <sub>pa</sub> by 2011	-	400	78	402
2011	No fishery	0			

Weights in '000 t.

<sup>1</sup> Advice for Subarea IV excluding the Shetland area.

<sup>2</sup> Set for zone IIIa, EC waters of Division IIa and Subarea IV.

**Table 6.4.21.3.4** Sandeel in the Central Eastern North Sea (SA3). Summary of the assessment.

<b>Year</b>	<b>Recruits (million)</b>	<b>TSB (tonnes)</b>	<b>SSB (tonnes)</b>	<b>Yield<sup>1</sup> (tonnes)</b>	<b>Mean F ages 1-2</b>
<b>1983</b>	92758	212748	73212	105946	0.465
<b>1984</b>	42576	303276	98284	123635	0.498
<b>1985</b>	296767	256659	144227	59083	0.274
<b>1986</b>	373688	777859	162984	420341	0.997
<b>1987</b>	83827	1082840	283715	403908	0.906
<b>1988</b>	307226	655548	395663	391081	1.365
<b>1989</b>	105207	814245	132104	481893	1.102
<b>1990</b>	213244	449784	209168	219183	0.568
<b>1991</b>	90715	752755	216384	368105	0.728
<b>1992</b>	233592	396339	196446	195700	0.466
<b>1993</b>	221185	739822	209529	263954	0.640
<b>1994</b>	179289	701169	257567	444119	0.713
<b>1995</b>	134746	591643	204541	218922	0.482
<b>1996</b>	894735	776379	351306	247397	0.394
<b>1997</b>	63391	1661550	262786	604159	0.938
<b>1998</b>	99007	595816	399834	499333	0.940
<b>1999</b>	126854	405745	186104	223160	1.147
<b>2000</b>	87267	416370	108675	242732	1.361
<b>2001</b>	95479	299116	85852	245290	0.961
<b>2002</b>	18789	298045	67089	209302	1.066
<b>2003</b>	47851	126557	77218	58942	0.514
<b>2004</b>	16809	148769	38127	79234	0.692
<b>2005</b>	36661	120188	75562	29677	0.232
<b>2006</b>	103184	148729	56591	18863	0.138
<b>2007</b>	60029	360019	82761	113232	0.536
<b>2008</b>	94415	318333	133409	94491	0.473
<b>2009</b>	72280	321592	86326	33350	0.143
<b>2010</b>	4420	440423	260710	78051	0.525
<b>2011</b>			197580		
<b>arith. mean</b>	149857	506154	174267	231182	0.688
<b>geo. mean<sup>1</sup></b>	105252				

1) Period 1983-2009

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

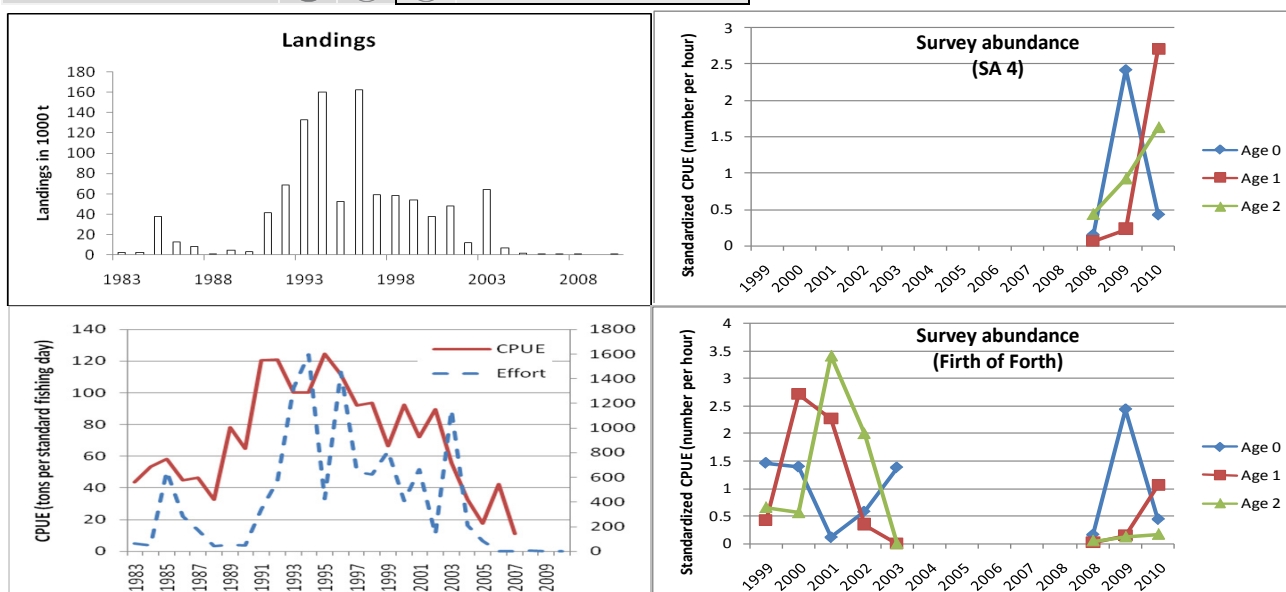
**Advice for 2011**

For 2011, ICES advises that a catch between 5000 and 10 000 tonnes is likely to impose a low risk to the sandeel stock in area 4. This is based on precautionary considerations founded on fishery independent data indicating an increasing stock size in recent years.

To protect the stock on a local scale, management should be implemented on the area level.

**Stock status**

F (Fishing Mortality)			
	2008	2009	2010
MSY ( $F_{MSY}$ )	?	?	? Unknown
Precautionary approach ( $F_{pa}, F_{lim}$ )	?	?	? Unknown
Qualitative evaluation	→	→	→ Stable and very low
SSB (Spawning Stock Biomass)			
	2009	2010	2011
MSY ( $B_{escapement}$ )	?	?	? Unknown
Precautionary approach ( $B_{pa}, B_{lim}$ )	?	?	? Unknown
Qualitative evaluation	?	↗	↗ Increase



**Figure 6.4.21.4.1** Sandeel in the Central Western North Sea (SA4). Top left: landings, bottom left: effort (days fishing/standard 200GT vessel) and catch per unit effort (tons per standard fishing day). Right: catch indices from the dredge survey (number per hour standardized to mean) in the entire Area 4 (top) and in Firth of Forth only (bottom).

Catch and survey data are not sufficient to conduct a traditional age-based assessment. The result from the dredge survey indicates that recruitment (measured as cpue of 0-group) was high in 2009 and low in 2010 as observed in SA 1 and 2. Based on the 3 years of data the temporal changes in 0-group abundance for the whole area 4 appears to follow that in the Firth of Forth. The very limited effort applied in the area indicates a very low fishing mortality.

**Management plans**

No specific management objectives are known to ICES.

In light of the EU policy paper on fisheries management (17 May 2010, [COM\(2010\) 241](#)) this stock is classified under category 5. ICES notes that the TAC and the stock assessment areas do not match.

## 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. Almost no sandeel fishery occurred in SA 4 in 2010, probably due to very high catch rates on other fishing banks closer to the landing sites in Denmark and Norway.

<b>Catch by fleet</b>	Total catch (2010) 0.26 kt where 100 % landings by industrial fisheries.
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## Quality considerations

Prior to the establishment of dedicated recruitment survey in 2008, dredge sampling intensity was low in this area. The Benchmark group (ICES, 2010) noted that because commercial fishing effort has been very low in recent years there was insufficient overlap between dredge and commercial cpue time series to provide reliable estimates of incoming 1-group strength. There are limited data to estimate the risk of overfishing, since fishing effort also depends on fishing opportunities in other areas.

## Scientific basis

<b>Assessment type</b>	Trends based assessment
<b>Input data</b>	1 survey index available in January (Dredge survey) Total international catch and effort
<b>Discards and bycatch</b>	Not included in the assessment
<b>Indicators</b>	None
<b>Other information</b>	Last benchmark in 2010.
<b>Working group report</b>	<a href="#">WGNSSK</a>

**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 2011**

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

*PA considerations*

The fishery independent data indicate that the recruitment was high in 2009 and low in 2010 as observed in SA 1 and SA 2. Given the large 2009 year class and the moratorium of Firth of Forth since 2000, ICES advises that a TAC in the range of 5000–10 000 t is likely to imply a low risk of overfishing while allowing catches at the low end of the historical range.

*Policy paper*

In light of the EU policy paper on fisheries management (17 May 2010, [COM\(2010\) 241](#)) this stock is classified under category 5, because this is a short-lived species. ICES notes that the TAC and the stock assessment areas do not match.

**Additional considerations**

It is important to continue the Scottish dredge survey in this area, even though the overlap between this survey and the commercial cpue time series is currently too short to provide reliable estimates of incoming 1-group strength. 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. 2011. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, ICES CM 2010/ACOM13.

**Table 6.4.21.4.1** Sandeel in the Central Western North Sea (SA4). ICES advice, management and landings

Year	ICES Advice	Catch corresponding to advice	TAC <sup>2</sup>	ICES Landings SA4	ICES Landings Total
2005 <sup>1</sup>	Exploitation to be kept below level of 2003. Adjustment to be made conditional on the abundance of the 2004 year class	-	661	1.49	172
2006 <sup>1</sup>	The fishery should remain closed until information is available which assures that the stock can be rebuilt to B <sub>pa</sub> by 2007.	-	300	0.09	288
2007 <sup>1</sup>	The fishery should remain closed until information is available which assures that the stock can be rebuilt to B <sub>pa</sub> by 2008.	-	173	0.01	206
2008 <sup>1</sup>	The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to B <sub>pa</sub> by 2009.	-	400	1.20	335
2009 <sup>1</sup>	The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to B <sub>pa</sub> by 2010	-	400	0	347
2010 <sup>1</sup>	The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to B <sub>pa</sub> by 2011	-	400	0.26	402
2011	A TAC at 5000 – 10 000 tonnes will impose a low risk of overfishing sandeel in area 4.	5-10			

Weights in '000 t.

<sup>1</sup> Advice for Subarea IV excluding the Shetland area.<sup>2</sup> Set for zone IIIa, EC waters of Division IIa and Subarea IV.**Table 6.4.21.4.2** Sandeel in the Central Western North Sea (SA4). Abundance index (average CPUE) from the Scottish December dredge survey for a) the whole area 4 and b) Firth of Forth. No data were collected in 2004–2007.

Year	a) 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

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

**Advice for 2011**

There is no basis for an advice. Therefore no increase of the fisheries should take place unless there is evidence that this will be sustainable.

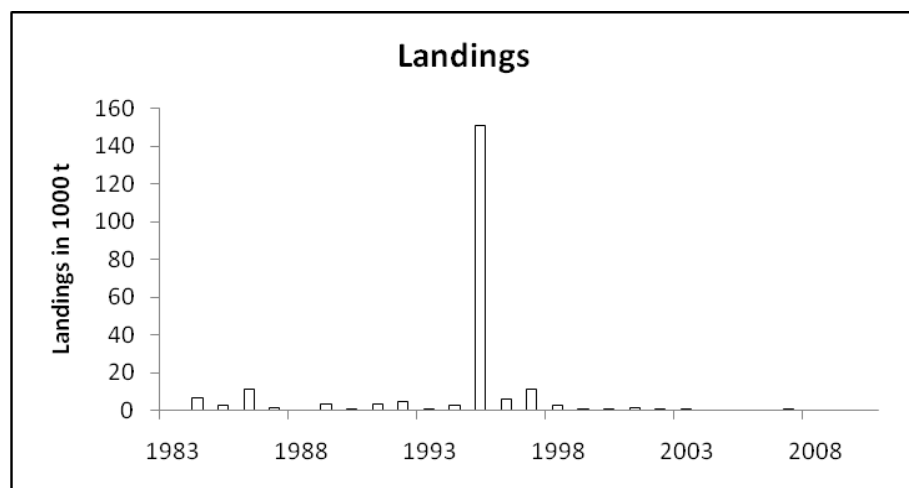
To protect the stock on a local scale, management should be implemented on the area level.

**Stock status**

F (Fishing Mortality)			
	2008	2009	2010
MSY ( $F_{MSY}$ )	?	?	? Unknown
Precautionary approach ( $F_{pa}, F_{lim}$ )	?	?	? Unknown

SSB (Spawning Stock Biomass)			
	2009	2010	2011
MSY ( $B_{escapement}$ )	?	?	? Unknown
Precautionary approach ( $B_{pa}, B_{lim}$ )	?	?	? Unknown



**Figure 6.4.21.5.1** Sandeel in the Viking and Bergen Bank area (SA5). ICES estimates of landings (in '000 tonnes).

Catch statistics and acoustic data 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.

In light of the EU policy paper on fisheries management (17 May 2010, [COM\(2010\) 241](#)) this stock is classified under category 11. ICES notes that the TAC and the stock assessment areas do not match.

**Catch by fleet** Total catch (2010) 0 kt

**Scientific basis**

<b>Assessment type</b>	No assessment
<b>Input data</b>	Catch statistics
<b>Discards and bycatch</b>	Not included in the assessment
<b>Indicators</b>	Acoustic measurements in the Norwegian zone
<b>Other information</b>	Last benchmark in 2010.
<b>Working group report</b>	<a href="#">WGNSSK</a>

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

**Reference points**

No reference points are defined for this stock.

**Outlook for 2011**

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

***Policy paper***

In light of the EU policy paper on fisheries management (17 May 2010, [COM\(2010\) 241](#)) this stock assessment area is classified under category 11 because there is no TAC advice for this area. ICES notes that the TAC and the stock assessment areas do not match.

**Additional considerations**

Norway has closed fisheries on the Viking Bank Area in 2011 because of very low estimates of sandeel abundance as measured using acoustics in 2007–2010 (ICES, 2010b).

**Sources**

- ICES. 2010a. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 5–11 May 2010 ICES CM 2010/ACOM13.
- ICES. 2010b. Report of the Benchmark Workshop on Sandeel (WKSAN), 6–10 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57.

**ECOREGION** North Sea  
**STOCK** Sandeel in Division IIIa East (Kattegat, SA6)

**Advice for 2011**

There is no basis for an advice. Therefore no increase of the fisheries should take place unless there is evidence that this will be sustainable.

To protect the stock on a local scale, management should be implemented on the area level.

**Stock status**

F (Fishing Mortality)			
	2008	2009	2010
MSY ( $F_{MSY}$ )	?	?	? Unknown
Precautionary approach ( $F_{pa}, F_{lim}$ )	?	?	? Unknown

SSB (Spawning Stock Biomass)			
	2009	2010	2011
MSY ( $B_{escapement}$ )	?	?	? Unknown
Precautionary approach ( $B_{pa}, B_{lim}$ )	?	?	? Unknown

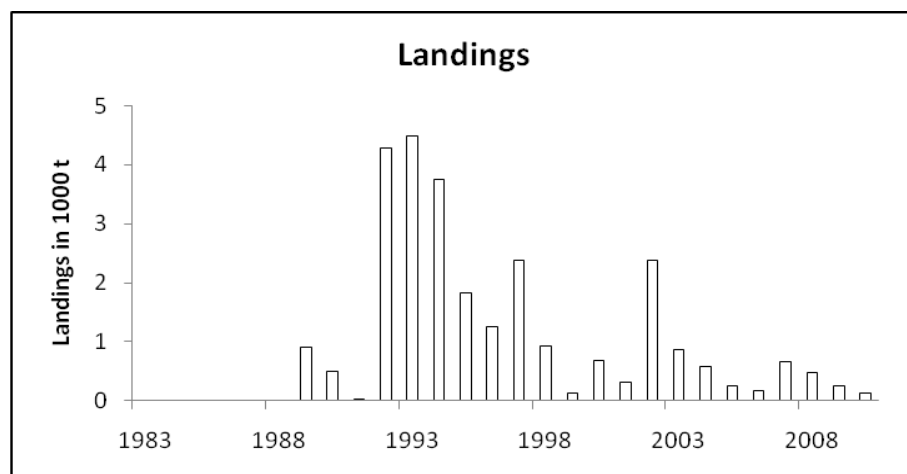


Figure 6.4.21.6.1 Sandeel in Division IIIa East (Kattegat, SA6). ICES estimates of landings (in '000 tonnes).

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.

In light of the EU policy paper on fisheries management (17 May 2010, [COM\(2010\) 241](#)) this stock is classified under category 11. ICES notes that the TAC and the stock assessment areas do not match.

**Catch by fleet** Total catch (2010) 0.1 kt where 100% landings by industrial fisheries

**Scientific basis**

Assessment type	No assessment
Input data	Catch statistics
Discards and bycatch	Not included in the assessment
Indicators	None
Other information	Last benchmark in 2010
Working group report	<a href="#">WGNSSK</a>

**ECOREGION**      **North Sea**  
**STOCK**            **Sandeel in Division IIIa East (Kattegat, SA6)**

**Reference points**

No reference points are defined for this stock.

**Outlook for 2011**

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

***Policy paper***

In light of the EU policy paper on fisheries management (17 May 2010, [COM\(2010\) 241](#)) this stock assessment area is classified under category 11 because there is no advice for this area. ICES notes that the TAC and the stock assessment areas do not match.

**Sources**

ICES. 2010. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 5-11 May 2010 ICES CM 2010/ACOM13.

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

### Advice for 2011

There is no basis for an advice. Therefore no increase of the fisheries should take place unless there is evidence that this will be sustainable.

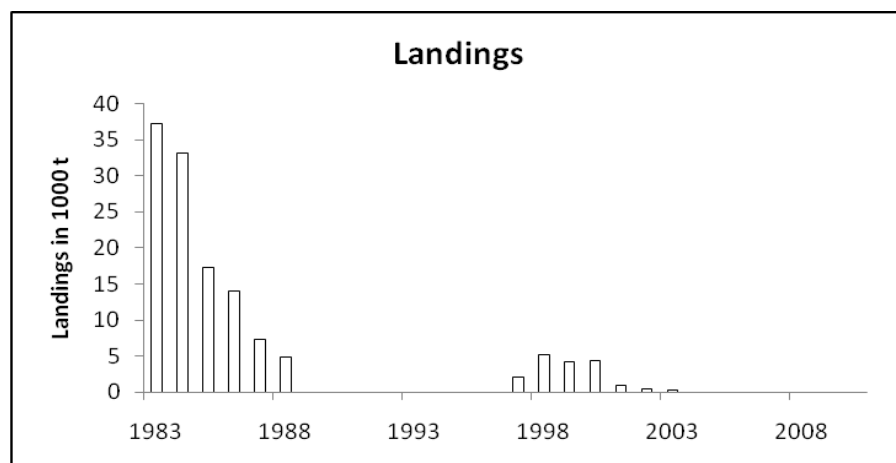
To protect the stock on a local scale, management should be implemented on the area level.

### Stock status

F (Fishing Mortality)			
	2008	2009	2010
<b>MSY</b> ( $F_{MSY}$ )	?	?	?
<b>Precautionary approach</b> ( $F_{pa}, F_{lim}$ )	?	?	?

SSB (Spawning Stock Biomass)			
	2009	2010	2011
<b>MSY</b> ( $B_{escapement}$ )	?	?	?
<b>Precautionary approach</b> ( $B_{pa}, B_{lim}$ )	?	?	?



**Figure 6.4.21.7.1** Sandeel in The Shetland area (SA7). ICES estimates of landings (in '000 tonnes).

Catch statistics and trawl survey data 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

Since 2007, a national management plan has regulated the inshore sandeel fisheries. This plan takes account of both fisheries and wildlife conservation concerns. ICES has not evaluated the management plan.

In light of the EU policy paper on fisheries management (17 May 2010, [COM\(2010\) 241](#)) this stock is classified under category 11.

**Catch by fleet** Total catch (2010) 0 kt

### Scientific basis

<b>Assessment type</b>	No assessment
<b>Input data</b>	Catch statistics
<b>Discards and bycatch</b>	Not included in the assessment
<b>Indicators</b>	Stock monitoring took place between 1985-2007 by a trawl survey
<b>Other information</b>	Last benchmark in 2010
<b>Working group report</b>	<a href="#">WGNSSK</a>

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

**Reference points**

No reference points are defined for this stock.

**Outlook for 2011**

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

***Management plan***

A national management plan has been in place for this stock since 2007. Sandeel fishing around Shetland is restricted to small inshore grounds. The fishery is managed by the Scottish Government. Since 2007 the management regime has included (a) a precautionary TAC of 1000 tonnes; (b) closure of grounds south of 60° 10' N, including around Foula and Fair Isle; (c) a seasonal closure of the fishery in June and July during the chick rearing period of seabirds and (d) a vessel length restriction of 20 metres. ICES has not evaluated this management plan.

***Policy paper***

In light of the EU policy paper on fisheries management (17 May 2010, [COM\(2010\) 241](#)) this stock assessment area is classified under category 11 because there is no advice for this area.

**Sources**

ICES. 2010. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 5–11 May 2010 ICES CM 2010/ACOM13.