

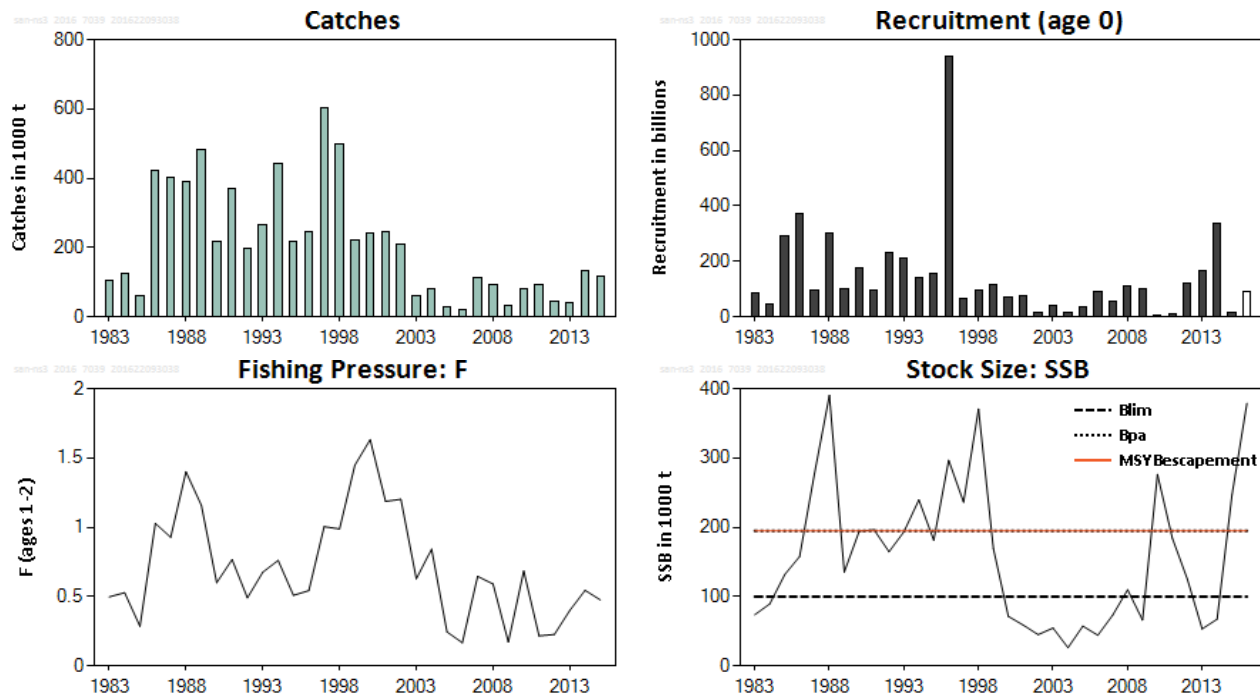
### 6.3.39 Sandeel (*Ammodytes* spp.) in Divisions 3a, 4a, and 4b, SA 3 (Skagerrak and Kattegat, North and Central North Sea)

#### ICES stock advice

ICES advises that when the MSY approach is applied, catches in 2016 should be no more than 123 135 tonnes.

#### Stock development over time

The spawning-stock biomass (SSB) in sandeel area 3 (SA 3) was below the lower biomass limit  $B_{lim}$  in 2013 and 2014 and has increased to above the precautionary biomass level  $B_{pa}$  (=  $MSY_{B_{escapement}}$ ) in 2015 and 2016. Recruitment in 2014 was high, but recruitment in 2015 is estimated to be low.



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

#### Stock and exploitation status

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

|                           |                   | Fishing pressure |      |      | Stock size |                        |      |   |   |                  |
|---------------------------|-------------------|------------------|------|------|------------|------------------------|------|---|---|------------------|
|                           |                   | 2013             | 2014 | 2015 | 2014       | 2015                   | 2016 |   |   |                  |
| Maximum sustainable yield | $F_{MSY}$         | ?                | ?    | ?    | Undefined  | $MSY_{B_{escapement}}$ | ✗    | ✓ | ✓ | Above escapement |
| Precautionary approach    | $F_{pa}, F_{lim}$ | ?                | ?    | ?    | Undefined  | $B_{pa}, B_{lim}$      | ✗    | ✓ | ✓ | Low risk         |
| Management plan           | $F_{MGT}$         | ?                | ?    | ?    | Undefined  | $SSB_{MGT}$            | ?    | ? | ? | Undefined        |

## Catch options

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

| Variable   | Value      | Source       | Notes                      |
|------------|------------|--------------|----------------------------|
| F (2015)   | 0.39       | ICES (2016a) | Sum of half yearly Fs      |
| R (2015)   | 14 billion | ICES (2016a) |                            |
| R (2016)   | 93 billion | ICES (2016a) | Geometric mean (1983–2014) |
| SSB (2016) | 379 kt     | ICES (2016a) |                            |

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

| Rationale                         | Catches (2015) | Basis  | F (2016) | SSB (2017) | %SSB change* | % TAC change** |
|-----------------------------------|----------------|--|----------|------------|--------------|----------------|
| MSY approach with $F_{cap} = 0.5$ | 123.135        | $SSB_{2017} \geq MSY B_{escapement}$ and $F_{cap}$ | 0.407    | 195        | -49%         | -58%           |
| MSY approach without $F_{cap}$    | 123.135        | $SSB_{2017} = MSY B_{escapement}$                  | 0.407    | 195        | -49%         | -58%           |
| Zero catch                        | 0              | $F = 0$  | 0        | 282        | -26%         | -100%          |
| Other options                     | 33.463         | $F_{2015} \times 0.25$                             | 0.098    | 258        | -32%         | -88%           |
|                                   | 64.143         | $F_{2015} \times 0.5$                              | 0.195    | 236        | -38%         | -78%           |
|                                   | 92.280         | $F_{2015} \times 0.75$                             | 0.293    | 217        | -43%         | -68%           |
|                                   | 118.097        | $F_{2015} \times 1$                                | 0.390    | 198        | -48%         | -59%           |

\* SSB 2017 relative to SSB 2016.

\*\* Catch option for 2016 relative to TAC in 2015 (290 kt = 190 EU + 100 kt Norway).

## Basis of the advice

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

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

## Quality of the assessment

An examination of the spatial distribution of reported catches, fishing days, and vessel monitoring system (VMS) data indicated that a substantial amount of catches taken in SA 1 was likely to have been misreported to SA 3. The catches used in the assessment were corrected and are considered to be the best estimates of catches. ICES reallocated from SA 3 to SA 1 a total of 44 000 t in 2014 and 15 000 t in 2015 associated with misreporting, and this correction is considered to be reliable.

High abundance of age 1 in the 2015 dredge survey was observed only in a small area; therefore, the index produced from the survey may be biased. This may have resulted in an overestimate of stock size. A Norwegian acoustic survey has been conducted since 2007, and in 2015 it also indicated high local densities. The ICES benchmark in 2016 will try to address the method for calculating the survey index used for assessment, taking the very heterogeneous distribution of both stock and fishery into account. It will also consider the inclusion of this acoustic survey as an index in the assessment.

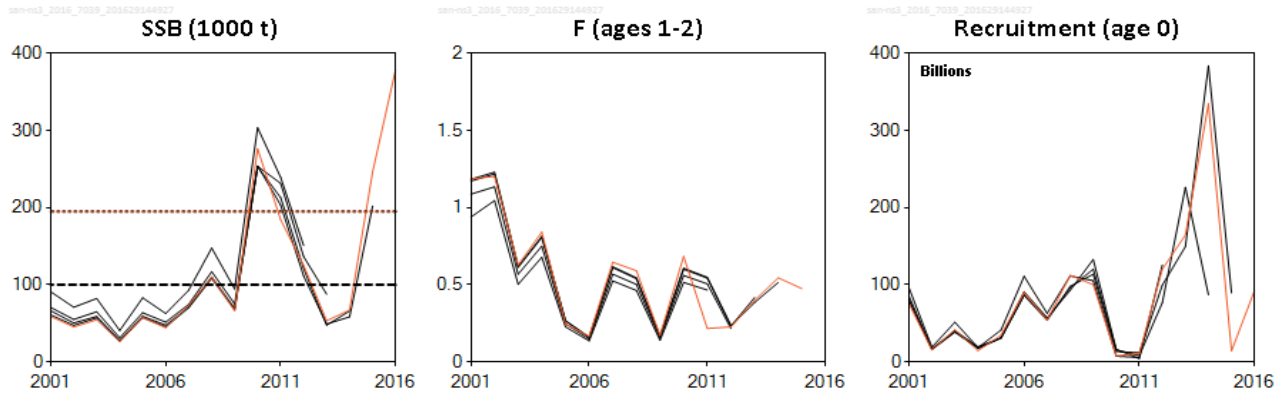


Figure 6.3.39.2 Sandeel in the North Sea (SA 3). Historical assessment results (final-year recruitment estimates included).

**Issues relevant for the advice**

The reported catches from SA 3 in 2014 and 2015 were revised based on information from VMS data and previous catch distributions to account for substantial area misreporting of catches taken in SA 1, but reported to SA 3. Based on the misreporting of catches as observed in 2014, management measures to avoid area misreporting (only one fishing area per trip) have been mandatory for the Danish fishery since 2015. This eliminated the misreporting issue for Danish catches; however, there are strong indications of area misreporting for other nations in 2015. Management measures, similar to those in the Danish fishery, should reduce area misreporting for all nations fishing in the EU EEZ.

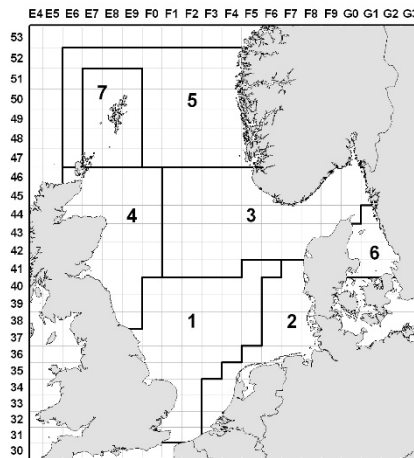


Figure 6.3.39.3 Sandeel in the North Sea (SA 3). Sandeel are largely sedentary after settlement and form a complex of local (sub-)stocks in the North Sea. To avoid local depletion, ICES advice for sandeel is provided separately for seven areas in Division 3a and Subarea 4. Advice for sandeel in the North Sea (SA 3) specifically applies to sandeel in rectangles 41 F1–F4; 42–43 F1–F9; 44 F1–G0; 45–46 F1–G1; and 47 G0.

## Reference points

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

| Framework              | Reference point             | Value       | Technical basis  | Source      |
|------------------------|-----------------------------|-------------|--|-------------|
| MSY approach           | MSY $B_{\text{escapement}}$ | 195 000 t   | = $B_{\text{pa}}$  | ICES (2010) |
|                        | $F_{\text{MSY}}$            | Not defined |  |             |
| Precautionary approach | $B_{\text{lim}}$            | 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   | $B_{\text{pa}} = B_{\text{lim}} \times \exp(\sigma \times 1.645)$ , with $\sigma = 0.40$ estimated from assessment uncertainty in the terminal year. | ICES (2010) |
|                        | $F_{\text{lim}}$            | Not defined |  |             |
|                        | $F_{\text{pa}}$             | Not defined |  |             |
| Management plan        | $SSB_{\text{MGT}}$          | Not defined |  |             |
|                        | $F_{\text{MGT}}$            | Not defined |  |             |

## Basis of the assessment

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

|                          |   |
|--------------------------|---|
| ICES stock data category | 1 (see <a href="#">ICES, 2016b</a> )  |
| Assessment type          | Seasonal age-based analytical (SMS-effort) (ICES, 2016a)  |
| Input data               | One survey index available in January (dredge survey since 2004). Total international catch and fishing effort. Annual maturity data from the dredge survey. Natural mortality estimated from multispecies assessment (assumed constant over time). Age and length frequencies from catch sampling. |
| Discards and bycatch     | Discarding is considered to be negligible.  |
| Indicators               | None  |
| Other information        | Last benchmark in 2010 ( <a href="#">ICES, 2010</a> )   |
| Working group            | Herring Assessment Working Group ( <a href="#">HAWG</a> )   |

## Information from stakeholders

There is no available information.

## History of advice, catch, and management

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

| Year  | ICES advice   | Catch corresponding to advice | EU zone TAC | Norwegian zone TAC | ICES catch SA 3 | Total ICES catch (SAs 1–7) |
|-------|---|-------------------------------|-------------|--------------------|-----------------|----------------------------|
| 2005* | Exploitation to be kept below the level of 2003. Adjustment to be made conditional on the abundance of the 2004 year class.                   | -                             | 661**       | 10***              | 30              | 177                        |
| 2006* | The fishery should remain closed until information is available which assures that the stock can be rebuilt to $B_{\text{pa}}$ by 2007.       | -                             | 300**       | 0                  | 19              | 293                        |
| 2007* | The fishery should remain closed until information is available which assures that the stock can be rebuilt to $B_{\text{pa}}$ by 2008.       | -                             | 173**       | 51                 | 114             | 230                        |
| 2008* | The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{\text{pa}}$ by 2009. | -                             | 375**       | 128                | 95              | 348                        |

| Year  | ICES advice  | Catch corresponding to advice | EU zone TAC | Norwegian zone TAC | ICES catch SA 3 | Total ICES catch (SAs 1–7) |
|-------|--|-------------------------------|-------------|--------------------|-----------------|----------------------------|
| 2009* | The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{pa}$ by 2010. | -                             | 377**       | 0                  | 34              | 353                        |
| 2010* | The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{pa}$ by 2011. | -                             | 377**       | 50                 | 81              | 414                        |
| 2011  | No fishery.  | 0                             | 10          | 90                 | 95              | 438                        |
| 2012  | Catches for monitoring purposes should not exceed 5 000 t.   | < 5                           | 5           | 42                 | 46              | 102                        |
| 2013  | MSY approach: allow for sufficient stock ( $MSY B_{escapement}$ ) to remain for successful recruitment.                                | < 78.331                      | 40          | 20                 | 39              | 278                        |
| 2014  | MSY approach: allow for sufficient stock ( $MSY B_{escapement}$ ) to remain for successful recruitment.                                | < 270                         | 140         | 90                 | 143             | 255                        |
| 2015  | MSY approach: allow for sufficient stock ( $MSY B_{escapement}$ ) to remain for successful recruitment, with additional $F_{cap}$ .    | < 370                         | 190         | 100                | 119***          | 307***                     |
| 2016  | MSY approach: allow for sufficient stock ( $MSY B_{escapement}$ ) to remain for successful recruitment.                                | $\leq 123.135$                |             |                    |                 |                            |

\* Advice for Subarea 4, excluding the Shetland area.

\*\* Set for EU waters of Divisions 2a and 3a and Subarea 4.

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

\*\*\*\* Preliminary.

### History of catch and landings

**Table 6.3.39.8** Sandeel in the in the North Sea (SA 3). Catch distribution by fleet in 2015 as estimated by ICES.

| Total catch (2015) | Landings                        | Discards   |
|--------------------|---------------------------------|------------|
| 119 kt             | 100% industrial trawl fisheries | Negligible |
|                    | 119 kt                          |            |

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

| Year | Catch  |
|------|--------|
| 1982 | 106707 |
| 1983 | 105974 |
| 1984 | 123639 |
| 1985 | 59090  |
| 1986 | 420304 |
| 1987 | 403897 |
| 1988 | 391050 |
| 1989 | 492395 |
| 1990 | 219103 |
| 1991 | 368324 |
| 1992 | 195733 |
| 1993 | 296118 |
| 1994 | 449847 |
| 1995 | 267559 |
| 1996 | 295489 |
| 1997 | 617570 |
| 1998 | 504251 |

| Year | Catch  |
|------|--------|
| 1999 | 233419 |
| 2000 | 255908 |
| 2001 | 252293 |
| 2002 | 195957 |
| 2003 | 62455  |
| 2004 | 88011  |
| 2005 | 26093  |
| 2006 | 18828  |
| 2007 | 114231 |
| 2008 | 98456  |
| 2009 | 33376  |
| 2010 | 84524  |
| 2011 | 95347  |
| 2012 | 43074  |
| 2013 | 39084  |
| 2014 | 142608 |
| 2015 | 118538 |

### Summary of the assessment

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

| Year | Recruitment<br>Age 0 | Stock size (SSB) | Total catch | Fishing pressure (F)<br>Ages 1–2 |
|------|----------------------|------------------|-------------|----------------------------------|
|      | thousands            | tonnes           | tonnes      |                                  |
| 1983 | 87531000             | 73863            | 105946      | 0.498                            |
| 1984 | 45266000             | 89425            | 123635      | 0.528                            |
| 1985 | 291712000            | 131518           | 59083       | 0.286                            |
| 1986 | 373974000            | 157665           | 420341      | 1.028                            |
| 1987 | 93985000             | 277054           | 403908      | 0.928                            |
| 1988 | 302441000            | 390192           | 391081      | 1.4                              |
| 1989 | 102662000            | 135313           | 481893      | 1.158                            |
| 1990 | 177139000            | 194334           | 219183      | 0.6                              |
| 1991 | 96352000             | 196285           | 368105      | 0.767                            |
| 1992 | 233258000            | 164682           | 195700      | 0.491                            |
| 1993 | 209163000            | 193398           | 263954      | 0.676                            |
| 1994 | 141910000            | 239552           | 444119      | 0.761                            |
| 1995 | 155188000            | 181268           | 218922      | 0.509                            |
| 1996 | 940878000            | 296559           | 247397      | 0.543                            |
| 1997 | 64022000             | 236264           | 604159      | 1.004                            |
| 1998 | 94696000             | 370516           | 499333      | 0.988                            |
| 1999 | 114488000            | 169227           | 223160      | 1.448                            |
| 2000 | 70713000             | 71454            | 242732      | 1.632                            |
| 2001 | 75749000             | 58907            | 245290      | 1.187                            |
| 2002 | 15405000             | 45162            | 209302      | 1.202                            |
| 2003 | 41826000             | 54610            | 58942       | 0.629                            |
| 2004 | 14516000             | 26267            | 79234       | 0.842                            |
| 2005 | 34640000             | 57397            | 29677       | 0.245                            |
| 2006 | 90084000             | 44190            | 18863       | 0.167                            |
| 2007 | 54142000             | 73157            | 113232      | 0.646                            |

| Year           | Recruitment<br>Age 0 | Stock size (SSB) | Total catch   | Fishing pressure (F)<br>Ages 1–2 |
|----------------|----------------------|------------------|---------------|----------------------------------|
|                | thousands            | tonnes           | tonnes        |                                  |
| 2008           | 112357000            | 109878           | 94491         | 0.591                            |
| 2009           | 100063000            | 66233            | 33350         | 0.172                            |
| 2010           | 7926000              | 276323           | 80576         | 0.684                            |
| 2011           | 10964000             | 184335           | 94750         | 0.217                            |
| 2012           | 120198000            | 125395           | 45111         | 0.227                            |
| 2013           | 164531000            | 53333            | 39082         | 0.4                              |
| 2014           | 334728000            | 67390            | 133413        | 0.545                            |
| 2015           | 14262000             | 246485           | 118541        | 0.475                            |
| 2016           | 92506000**           | 379000*          |               |                                  |
| <b>Average</b> | <b>143508088</b>     | <b>159901</b>    | <b>209288</b> | <b>0.711</b>                     |

\* Using mean weight-at-age from 2013 to 2015 and proportion mature from December 2015.

\*\* Geometric mean (1983–2014).

### Sources and references

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