

Cod (*Gadus morhua*) in Subarea 4, Division 7.d, and Subdivision 20 (North Sea, eastern English Channel, Skagerrak)

ICES stock advice

Please note: This advice was updated in November 2017 (ICES, 2017c).

ICES advises that when the MSY approach is applied, catches in 2018 should be no more than 59 888 tonnes.

Stock development over time

Fishing mortality (F) has declined since year 2000, but is estimated to be above F_{MSY} . Spawning–stock biomass (SSB) has increased from the historical low in 2006 to above $MSY B_{trigger}$ in 2017. There are indications of increased recruitment in 2017.

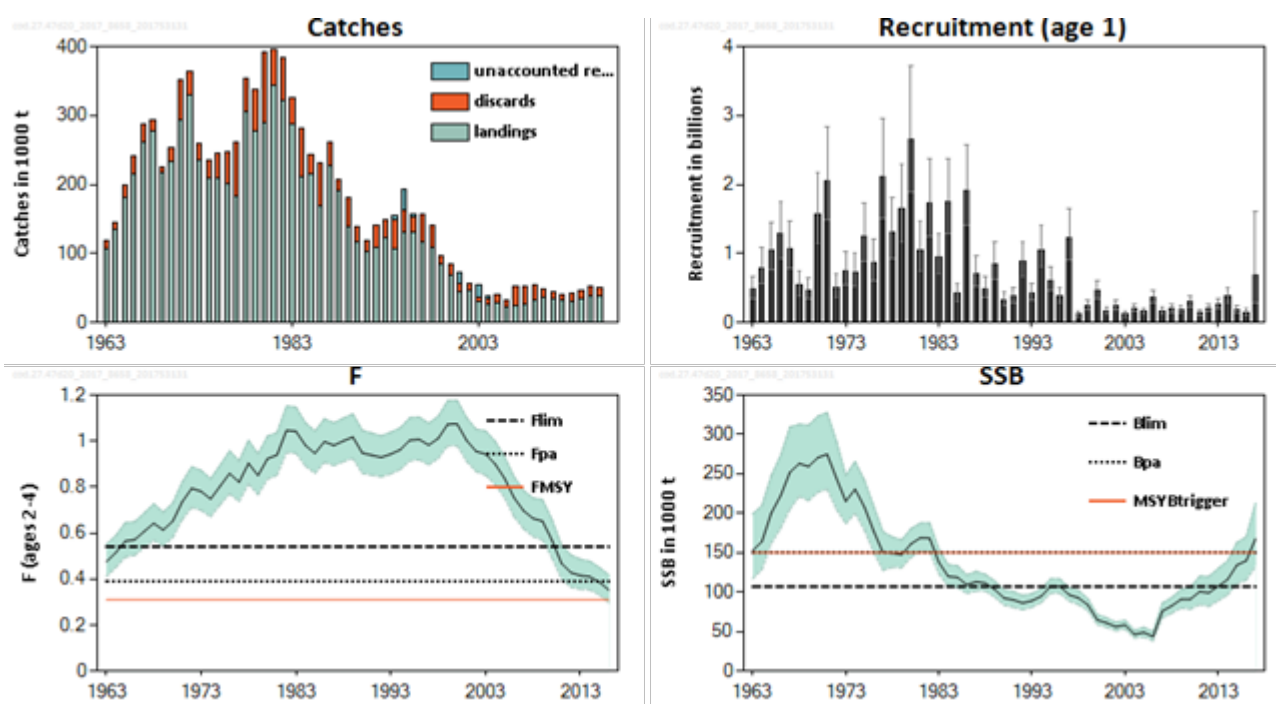


Figure 1 Cod in Subarea 4, Division 7.d, and Subdivision 20. Summary of the stock assessment. Catches are assessment estimates. Shaded areas (F, SSB) and error bars (R) indicate point-wise 95% confidence intervals.

Stock and exploitation status

Table 1 Cod in Subarea 4, Division 7.d, and Subdivision 20. State of the stock and fishery relative to reference points.

| | | Fishing pressure | | | Stock size | | | |
|---------------------------|-------------------|------------------|------|------|-------------------|------|------|------------------------------|
| | | 2014 | 2015 | 2016 | 2015 | 2016 | 2017 | |
| Maximum sustainable yield | F_{MSY} | ✘ | ✘ | ✘ | MSY | ✘ | ✘ | ✓ Above trigger |
| Precautionary approach | F_{pa}, F_{lim} | ○ | ✓ | ✓ | B_{pa}, B_{lim} | ○ | ○ | ✓ Full reproductive capacity |
| Management plan | F_{MGT} | — | — | — | B_{MGT} | — | — | — Not applicable |

Catch options

Table 2 Cod in Subarea 4, Division 7.d, and Subdivision 20. The basis for the catch options.

| Variable | Value | Source | Notes |
|------------------------------|--------|--------------|--|
| $F_{\text{ages 2-4}}$ (2017) | 0.35 | ICES (2017a) | $F_{\text{ages 2-4}}$ (2016), assuming effort similar to 2016. |
| SSB (2018) | 204267 | ICES (2017a) | Tonnes; short-term forecast. |
| $R_{\text{age 1}}$ (2017) | 692194 | ICES (2017a) | Thousands; median recruitment estimate in 2017. |
| $R_{\text{age 1}}$ (2018) | 198216 | ICES (2017a) | Thousands; median recruitment, resampled from the years 1998–2016. |
| Catch (2017) | 55207 | ICES (2017a) | Tonnes; short-term forecast. |
| Landings (2017) | 41939 | ICES (2017a) | Tonnes; assuming 2016 landings fraction by age. |
| Discards (2017) | 13268 | ICES (2017a) | Tonnes; assuming 2016 discards fraction by age. |

Table 3 Cod in Subarea 4, Division 7.d, and Subdivision 20. Annual catch options. All weights are in tonnes.

| Basis | Total catch (2018) | Wanted catch* (2018) | Unwanted catch* (2018) | F_{total} (2018) | F_{wanted} (2018) | F_{unwanted} (2018) | SSB (2019) | % SSB change ** | % TAC change *** |
|---|--------------------|----------------------|------------------------|---------------------------|----------------------------|------------------------------|------------|-----------------|------------------|
| ICES advice basis | | | | | | | | | |
| MSY approach: F_{MSY} | 59888 | 41309 | 18579 | 0.31 | 0.20 | 0.108 | 216473 | 6.0 | -12.2 |
| Other options | | | | | | | | | |
| EU–Norway Management Strategy (MS) with previous reference points | 74748 | 51393 | 23355 | 0.40 | 0.26 | 0.139 | 202395 | -0.92 | 9.3 |
| EU–Norway MS with new reference points | 74748 | 51393 | 23355 | 0.40 | 0.26 | 0.139 | 202395 | -0.92 | 9.3 |
| $F = 0$ | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 275777 | 35 | -100 |
| F_{pa} | 73133 | 50297 | 22836 | 0.39 | 0.25 | 0.135 | 203811 | -0.22 | 7.0 |
| F_{lim} | 95963 | 65753 | 30210 | 0.54 | 0.35 | 0.188 | 182048 | -10.9 | 40 |
| SSB (2019) = B_{lim} | 178836 | 119859 | 58977 | 1.29 | 0.84 | 0.45 | 107000 | -48 | 155 |
| SSB (2019) = B_{pa} | 130185 | 88465 | 41720 | 0.80 | 0.52 | 0.28 | 150000 | -27 | 88 |
| SSB (2019) = MSY B_{trigger} | 130185 | 88465 | 41720 | 0.80 | 0.52 | 0.28 | 150000 | -27 | 88 |
| TAC (2017) – 20% | 55135 | 37168 | 17517 | 0.28 | 0.182 | 0.097 | 220655 | 8.0 | -20 |
| TAC (2017) – 15% | 58613 | 39970 | 18643 | 0.30 | 0.195 | 0.104 | 217094 | 6.3 | -15.0 |
| TAC (2017) – 10% | 62089 | 42321 | 19768 | 0.32 | 0.21 | 0.111 | 213494 | 4.5 | -10.0 |
| TAC (2017) – 5% | 65567 | 44672 | 20895 | 0.34 | 0.22 | 0.118 | 210182 | 2.9 | -5.0 |
| Constant TAC | 69046 | 47023 | 22023 | 0.36 | 0.24 | 0.125 | 206804 | 1.24 | 0.0 |
| TAC (2017) + 5% | 72530 | 49374 | 23156 | 0.38 | 0.25 | 0.132 | 203532 | -0.36 | 5.0 |
| TAC (2017) + 10% | 76018 | 51725 | 24293 | 0.40 | 0.26 | 0.140 | 200116 | -2.0 | 10.0 |
| TAC (2017) + 15% | 79508 | 54076 | 25423 | 0.42 | 0.28 | 0.148 | 196951 | -3.6 | 15.0 |
| TAC (2017) + 20% | 83010 | 56428 | 26582 | 0.45 | 0.29 | 0.155 | 193442 | -5.3 | 20 |
| $F = F_{2017}$ | 66900 | 46061 | 20839 | 0.35 | 0.23 | 0.123 | 209849 | 2.7 | -2.0 |

| Basis | Total catch (2018) | Wanted catch* (2018) | Unwanted catch* (2018) | F _{total} (2018) | F _{wanted} (2018) | F _{unwanted} (2018) | SSB (2019) | % SSB change ** | % TAC change *** |
|-------------------------|--------------------|----------------------|------------------------|---------------------------|----------------------------|------------------------------|------------|-----------------|------------------|
| Mixed fisheries options | | | | | | | | | |
| A: Max. | 180241 | | | 1.44 | | | 91380 | -55 | |
| B: Min. | 47378 | | | 0.25 | | | 215196 | 5.4 | |
| C: HAD | 60863 | | | 0.32 | | | 214510 | 5.0 | |
| E: POK | 79380 | | | 0.53 | | | 156291 | -23 | |
| E: SQ effort | 70421 | | | 0.41 | | | 187234 | -8.3 | |
| F: Value | 63548 | | | 0.35 | | | 199183 | -2.5 | |
| G: Range | 63282 | | | 0.33 | | | 213162 | 4.4 | |

* "Wanted" and "unwanted" catch are used to describe fish that would be landed and discarded in the absence of the EU landing obligation, based on discard rate estimates for 2016.

** SSB 2019 relative to SSB 2018.

*** Wanted catch in 2018 relative to TAC in 2017: North Sea (39 220 t) + Skagerrak (5744 t) + Eastern English Channel (2059 t) = 47 023 t. Mixed-fisheries assumptions (note: "fleet's stock share" is used to describe the share of the fishing opportunities for each particular fleet, which has been calculated based on the single-stock advice for 2018 and the historical proportion of the stock landings taken by the fleet):

A. Maximum scenario: Each fleet stops fishing when its last stock share is exhausted.

B. Minimum scenario: Each fleet stops fishing when its first stock share is exhausted.

C. HAD: Each fleet stops fishing when its individual haddock share is exhausted.

D. POK: Each fleet stops fishing when its individual saithe share is exhausted.

E. SQ (*status quo*) effort scenario: The effort of each fleet in 2017 and 2018 is as in 2016.

F. Value scenario: The effort of each fleet is equal to the weighted average of the efforts required to catch the fleet's quota share of each of the stocks, where the weights are the relative catch values of each stock in the fleet's portfolio.

G. Range scenario: where the potential for TAC mismatches in 2018 are minimized within the FMSY range, for the demersal fish stocks for which such a range is available (cod.27.47d20; had.27.46a20; pok.27.3a46; ple.27.420; ple.27.7d; sol.27.4; sol.27.7d).

Basis of the advice

Table 4 Cod in Subarea 4, Division 7.d, and Subdivision 20. The basis of the advice.

| Advice basis | ICES MSY approach. |
|-----------------|---|
| Management plan | The EU–Norway management strategy was updated in December 2008. The EU has adopted a long-term plan with the same aims (EU management plan; EU, 2008). ICES evaluated the EU–Norway management strategy in 2009 and concluded that it was in accordance with the precautionary approach if implemented and enforced adequately. The management strategy was considered by ICES to switch from the recovery phase to the long-term phase in 2013. Changes to the stock assessment and reference points in 2015 and 2017 imply a need to re-evaluate the management strategy to ascertain if it can still be considered precautionary under the new stock perception. Until such an evaluation is conducted, the ICES advice is based on the MSY approach. |

Quality of the assessment

Catch data have been provided to ICES since 2012 through programmes such as Fully Documented Fisheries (FDF), and increased coverage by the Scottish industry/science observer sampling scheme.

The benchmark in 2015 introduced annually varying maturity estimates to the assessment (ICES, 2015a). Maturity-at-age was re-estimated in 2017 to produce a time-series of maturity estimates that are consistently calculated over time and corrected for errors. The re-estimated maturities caused a re-scaling of the SSB, to an extent that necessitated the re-calculation of reference points.

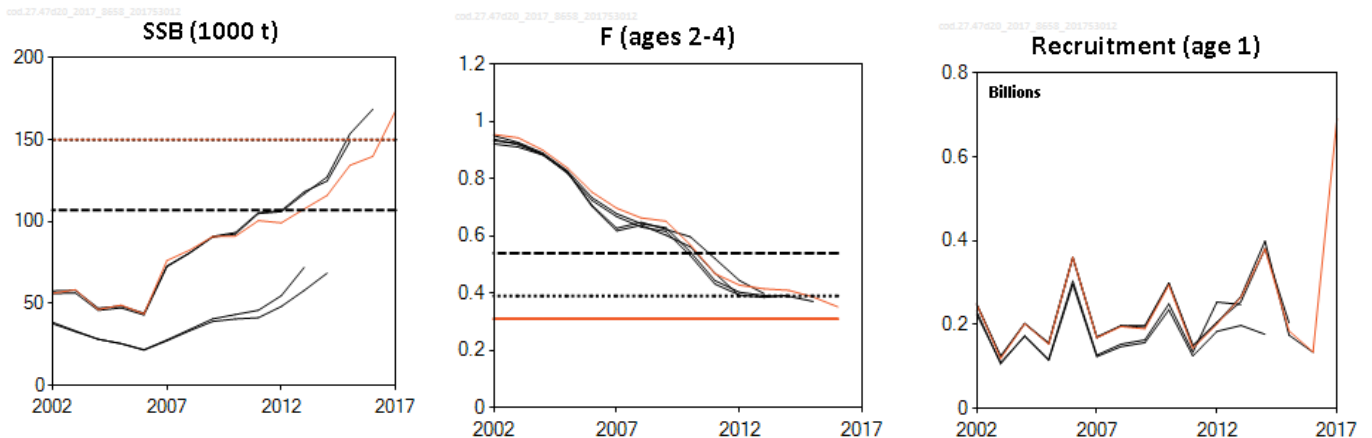


Figure 2 Cod in Subarea 4, Division 7.d, and Subdivision 20. Historical assessment results (final-year recruitment estimates included).

Issues relevant for the advice

ICES previously provided advice on the F_{MSY} range for this stock in 2015 (ICES, 2015b). F_{MSY} was revised in 2017 and the F_{MSY} range was updated as follows:

| Description | Value | Source |
|-----------------|-------|--------------|
| F_{MSY} lower | 0.198 | ICES (2017a) |
| F_{MSY} upper | 0.46 | ICES (2017a) |

The EU landing obligation was implemented from 1 January 2017 for several gears, including TR1, BT1, and fixed gears.

Since the implementation of effort management (days-at-sea regulation), fishing mortality rates have been reduced and the stock has increased from 2006. Furthermore, the decrease in F has led to an increase in the number of older fish in the population in recent years (Figure 3).

There are indications from the IBTS Q1 survey that recruitment in 2017 is substantially higher than the low level observed since 1998. Therefore, the forecast uses the assessment estimate of recruitment in 2017 rather than assuming the continuation of the recent period of low recruitment. The 2017 recruitment remains to be confirmed by the IBTS Q3 survey and a reopening of the advice may be triggered in October.

Cod is widely distributed throughout the North Sea, but there are indications of subpopulations inhabiting different regions of the North Sea (e.g. from genetic studies). The inferred limited degree of mixing suggests slow recolonization in areas where subpopulations are depleted. Figure 4 plots a cod biomass index by subregion (with subregions given in Figure 6), and highlights differing rates of change in this index. The figure shows a general decline in all areas prior to the mid-2000s and a general increase in all areas thereafter, apart from the southern area. It is unclear what the reasons for the lack of recovery are in this area; further work is required to investigate climate change, biological, and fisheries effects. Recruitment has declined, but there are indications of increased recruitment in the northern North Sea (Figure 5).

Results from a North Sea mixed-fisheries analysis are presented in ICES (2017c). For 2018, assuming a strictly implemented discard ban (corresponding to the “Minimum” scenario), whiting would be the most limiting stock, being estimated to constrain 24 out of 42 fleet segments. Haddock is the second most limiting stock, constraining eight fleet segments. Additionally, if Norway lobster (*Nephrops*) was managed by separate TACs for the individual functional units (FUs), Norway lobster in FU 6 would be considered the most limiting stock for ten fleet segments. Conversely, in the “Maximum” scenario, saithe and Eastern Channel plaice would be least limiting for 20 and 11 fleet segments, respectively. Finally, if Norway lobster was managed by separate TACs, Norway lobster in FUs 7, 5, 33, and 4.non-FU would be the least limiting for nine, two, one, and two fleet segments, respectively. For those demersal fish stocks for which the F_{MSY} range is available, a “range” scenario is presented that minimizes the potential for TAC mismatches in 2018 within the F_{MSY} range. This scenario returns a fishing mortality by stock which, if used for setting single-stock fishing opportunities for 2018, may reduce the gap between the most and the least restrictive TACs, thus reducing the potential for quota over- and undershoot. This “range” scenario suggests that the potential for

mixed-fisheries mismatch would be lowered with a 2018 TAC in the lower part of the F_{MSY} range for Eastern English Channel plaice and saithe, and in the upper part of the range for cod and North Sea plaice.

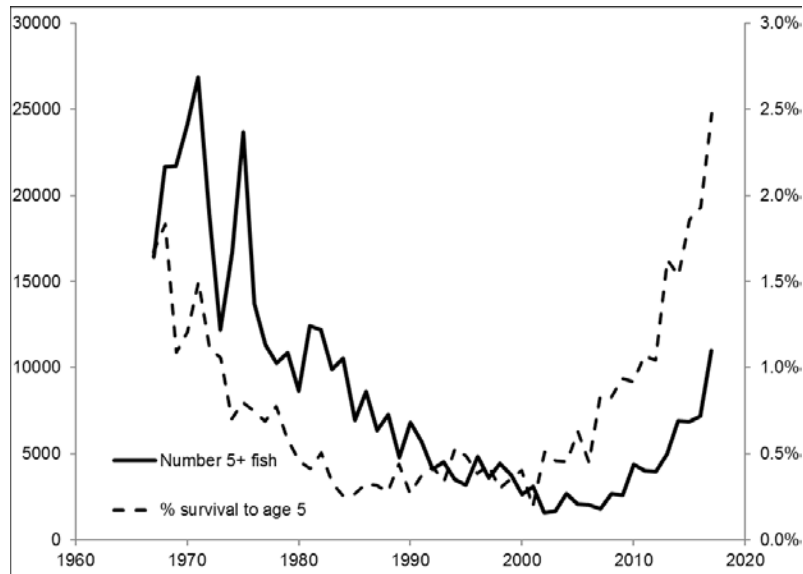


Figure 3 Cod in Subarea 4, Division 7.d, and Subdivision 20. Estimates of the number of 5-year-old and older cod in the population (solid line; thousands), and the percentage of 1-year-olds by number that have survived to age 5 in the given year (dashed line).

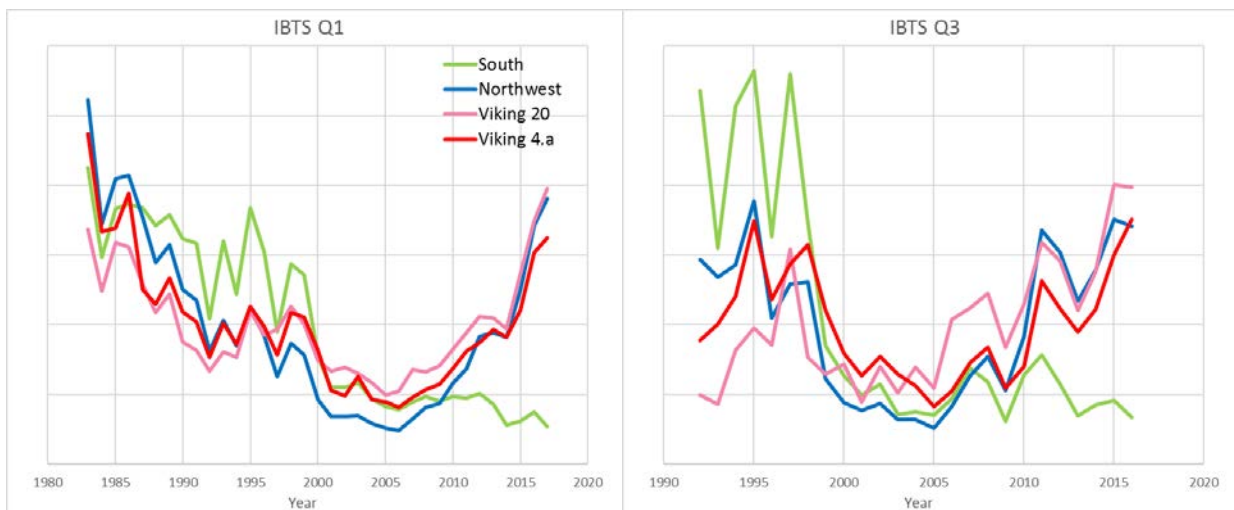


Figure 4 Cod in Subarea 4, Division 7.d, and Subdivision 20. Biomass indices by subregion (see Figure 6), based on the NS IBTS Q1 and Q3 survey data. The biomass indices are derived by fitting a non-stationary Delta-GAM model (including ship effects) to numbers-at-age for the entire dataset and integrating the fitted abundance surface over each of the subareas to obtain indices-at-age by area. These are then multiplied by smoothed weight-at-age estimates and summed to get the biomass indices.

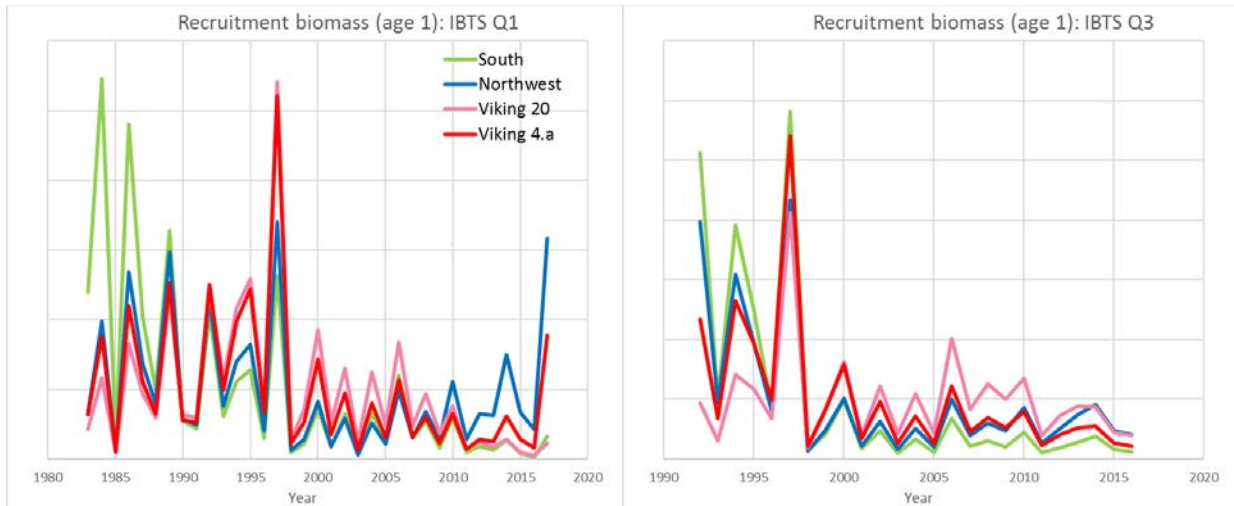


Figure 5 Cod in Subarea 4, Division 7.d, and Subdivision 20. Recruitment indices by subregion (see Figure 6), based on NS IBTS Q1 and Q3 survey data.

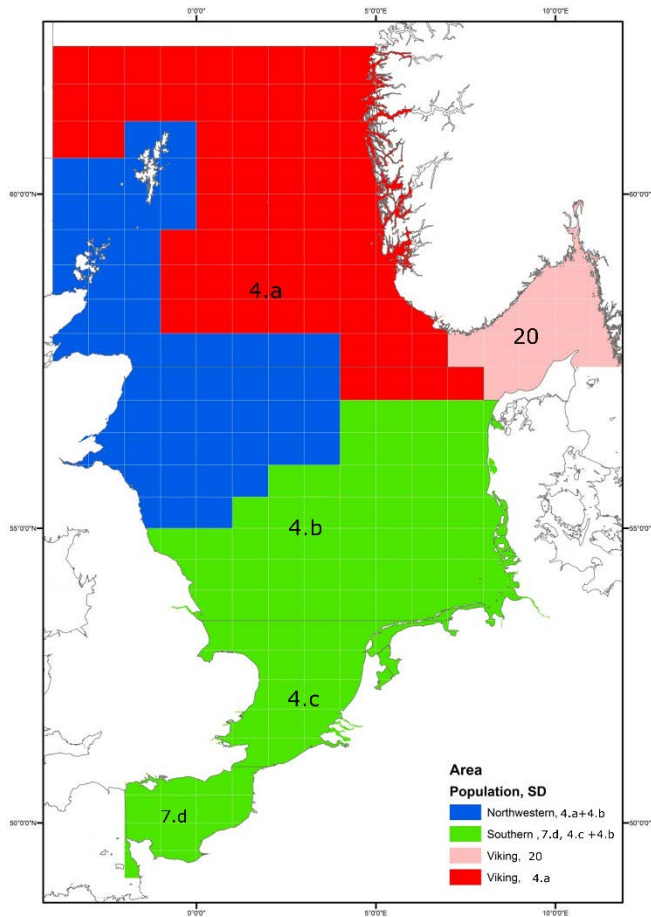


Figure 6 Cod in Subarea 4, Division 7.d, and Subdivision 20. Subregions used to derive area-specific biomass indices, based on NS IBTS Q1 and Q3 survey data.

Reference points

Table 5 Cod in Subarea 4, Division 7.d, and Subdivision 20. Reference points, values, and their technical basis.

| Framework | Reference point | Value | Technical basis | Source |
|-------------------------------|-------------------|----------|--|--------------|
| MSY approach | MSY $B_{trigger}$ | 150000 t | B_{pa} | |
| | F_{MSY} | 0.31 | EQsim analysis based on recruitment period 1988–2016 | ICES (2017a) |
| Precautionary approach | B_{lim} | 107000 t | SSB associated with the last above-average recruitment (1996 year class) | ICES (2017a) |
| | B_{pa} | 150000 t | $B_{lim} \times \exp(1.645 \times 0.2) \approx 1.4 \times B_{lim}$ | ICES (2017a) |
| | F_{lim} | 0.54 | EQsim analysis based on recruitment period 1998–2016 | ICES (2017a) |
| | F_{pa} | 0.39 | $F_{lim} \times \exp(-1.645 \times 0.2) \approx F_{lim} / 1.4$ | ICES (2017a) |
| EU–Norway Management Strategy | $SSB_{MS-lower}$ | 70000 t | Former B_{lim} | EU (2008) |
| | $SSB_{MS-upper}$ | 150000 t | Former B_{pa} | |
| | $F_{MS-lower}$ | 0.20 | Fishing mortality when $SSB < SSB_{MS-lower}$ | |
| | $F_{MS-upper}$ | 0.40 | Fishing mortality when $SSB > SSB_{MS-upper}$ | |

Basis of the assessment

Table 6 Cod in Subarea 4, Division 7.d, and Subdivision 20. Basis of assessment and advice.

| | |
|-------------------------------------|--|
| ICES stock data category | 1 (ICES, 2016a). |
| Assessment type | Age-based analytical assessment (SAM; ICES, 2017a) that uses catches in the model and in the forecast. Unaccounted removals were estimated for 1993–2005 (Nielsen and Berg, 2014). |
| Input data | Commercial catches (international landings, ages and length frequencies from catch sampling by métier), two survey indices (IBTS Q1, IBTS Q3) derived by a Delta–GAM approach, assuming a stationary spatial model with ship effect. Smoothed annually varying maturity data from IBTS Q1 (1978–2017). Annually varying natural mortalities from multispecies model (1974–2013). |
| Discards, BMS landings, and bycatch | Discards included (80% reported, 20% raised), data series from the main fleets (in 2016 covering 72% of the landings). Below minimum size (BMS) landings, where reported, are included with discards as unwanted catch in the assessment from 2016. |
| Indicators | NS-IBTS biomass indices by subregion. |
| Other information | Benchmarked in 2015 (ICES, 2015a; Annex 9 of ICES, 2015c). Reference points revised (ICES, 2017a). |
| Working group | Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK) |

Information from stakeholders

There is no additional available information.

History of the advice, catch, and management

Table 7 Cod in Subarea 4, Division 7.d, and Subdivision 20. ICES advice and official landings. All weights are in tonnes. Values of official landings and ICES landings for the period 1987 to 1996 are presented to the nearest thousand tonnes.

North Sea (Subarea 4)

| Year | ICES advice | Predicted landings corresponding to advice | Predicted catch corresponding to advice | Agreed TAC | Official landings* | ICES landings** | ICES discards | BMS reported to ICES |
|------|--|--|---|------------|--------------------|-----------------|---------------|----------------------|
| 1987 | SSB recovery; TAC | 100000–125000 | | 175000 | 167000 | 182000 | | |
| 1988 | 70% of F(86); TAC | 148000 | | 160000 | 142000 | 157000 | | |
| 1989 | Halt SSB decline; protect | 124000 | | 124000 | 110000 | 116000 | | |
| 1990 | 80% of F (88); TAC | 113000 | | 105000 | 99000 | 105000 | | |
| 1991 | 70% of effort (89) | | | 100000 | 87000 | 89000 | | |
| 1992 | 70% of effort (89) | | | 100000 | 98000 | 97000 | | |
| 1993 | 70% of effort (89) | | | 101000 | 94000 | 105000 | | |
| 1994 | Significant effort reduction | | | 102000 | 87000 | 95000 | | |
| 1995 | Significant effort reduction | | | 120000 | 111000 | 120000 | | |
| 1996 | 80% of F(94) = 0.7 | 141000 | | 130000 | 107000 | 107000 | | |
| 1997 | 80% of F(95) = 0.65 | 135000 | | 115000 | 99423 | 102169 | | |
| 1998 | F(98) should not exceed F(96) | 153000 | | 140000 | 114324 | 122103 | | |
| 1999 | F = 0.60 to rebuild SSB | 125000 | | 132400 | 77566 | 78392 | | |
| 2000 | F less than 0.55 | < 79000 | | 81000 | 60881 | 59767 | | |
| 2001 | lowest possible catch | 0 | | 48600 | 41713 | 40973 | | |
| 2002 | lowest possible catch | 0 | | 49300 | 44526 | 42193 | 7235 | |
| 2003 | Closure | 0 | | 27300 | 25958 | 24083 | 2643 | |
| 2004 | Zero catch | 0 | | 27300 | 23806 | 22529 | 5026 | |
| 2005 | Zero catch | 0 | | 27300 | 22500 | 22855 | 5236 | |
| 2006 | Zero catch | 0 | | 23205 | 23119 | 21078 | 5236 | |
| 2007 | Zero catch | 0 | | 19957 | 20104 | 19056 | 22418 | |
| 2008 | Exploitation boundaries in relation to precautionary limits. Total removals < 22 000 t | < 22000 | | 22152 | 22264 | 21657 | 20710 | |
| 2009 | Zero catch | 0 | | 28798 | 27500 | 27634 | 13542 | |
| 2010 | Management plan F (65% of F ₂₀₀₈) | < 40300 *** | | 33552 | 31657 | 30980 | 10122 | |
| 2011 | See scenarios | - | | 26842 | 27799 | 26675 | 6071 | |
| 2012 | Management plan F (45% of F ₂₀₀₈) | < 31800 | | 26475 | 27641 | 26627 | 6533 | |
| 2013 | Management plan (TAC –20%) | < 25441 | | 26475 | 26325 | 25315 | 8421 | |
| 2014 | Management plan long-term phase | < 28809 | | 27799 | 29346 | 28550 | 7831 | |
| 2015 | Management plan long-term phase | < 26713 | | 29189 | 31959 | 31244 | 9601 | |
| 2016 | MSY approach | ≤ 40419 | ≤ 49259 | 33651 | 34192 | 33035 | 10528 | 10 |
| 2017 | MSY approach | ≤ 39651 | ≤ 47359 | 39220 | | | | |
| 2018 | MSY approach | ≤ 41309 | ≤ 59888 | | | | | |

* Official landings for Norway include Norwegian fjords.

** Norwegian fjords not included from 2002 onwards.

*** From 2010 onwards, the advice is for Subarea 4 (North Sea), Division 7.d (Eastern English Channel), and Subdivision 20 (Skagerrak).

Table 7 (cont.)

Skagerrak (Subdivision 20). – Note: Values of official landings and ICES landings for the period 1987 to 1996 are presented to the nearest hundred tonnes.

| Year | ICES advice | Predicted landings corresponding to advice | Predicted catch corresponding to advice | Agreed TAC* | Official landings | ICES landings* | ICES discards | BMS reported to ICES |
|------|--|--|---|-------------|-------------------|----------------|---------------|----------------------|
| 1987 | $F = F_{\max}$ | < 21000 | | 22500 | 19900 | 20900 | | |
| 1988 | Reduce F | | | 21500 | 17000 | 16900 | | |
| 1989 | F at F_{med} | < 23000 | | 20500 | 18700 | 19600 | | |
| 1990 | F at F_{med} ; TAC | 21000 | | 21000 | 17800 | 18600 | | |
| 1991 | TAC | 15000 | | 15000 | 12100 | 12400 | | |
| 1992 | 70% of $F(90)$ | | | 15000 | 14000 | 14800 | | |
| 1993 | Precautionary TAC | | | 15000 | 14700 | 15300 | | |
| 1994 | No long-term gain in increased F + precautionary TAC | | | 15500 | 15100 | 13900 | | |
| 1995 | If required precautionary TAC; link to North Sea | | | 20000 | 19800 | 12100 | | |
| 1996 | If required precautionary TAC; link to North Sea | | | 23000 | 17900 | 16400 | | |
| 1997 | If required precautionary TAC; link to North Sea | | | 16100 | 15736 | 14946 | | |
| 1998 | If required precautionary TAC; link to North Sea | 21900 | | 20000 | 15586 | 15331 | | |
| 1999 | $F = 0.60$ to rebuild SSB | 17900 | | 19000 | 11790 | 10974 | | |
| 2000 | F less than 0.55 | < 11300 | | 11600 | 9957 | 9277 | | |
| 2001 | lowest possible catch | 0 | | 7000 | 7729 | 7086 | | |
| 2002 | lowest possible catch | 0 | | 7100 | 7170 | 6854 | 4168 | |
| 2003 | Closure | 0 | | 3900 | 4483 | 3979 | 1225 | |
| 2004 | Zero catch | 0 | | 3900 | 4516 | 3914 | 3552 | |
| 2005 | Zero catch | 0 | | 3900 | 4375 | 3998 | 4573 | |
| 2006 | Zero catch | 0 | | 3315 | 3973 | 3258 | 6398 | |
| 2007 | Zero catch | 0 | | 2851 | 3751 | 3020 | 5946 | |
| 2008 | Exploitation boundaries in relation to precautionary limits. Total removals less than 22 000 t | < 22000 | | 3165 | 3769 | 3393 | 2697 | |
| 2009 | Zero catch | 0 | | 4114 | 3983 | 3794 | 2910 | |
| 2010 | Management plan F (65% of F_{2008}) | < 40300** | | 4793 | 4211 | 4057 | 2023 | |
| 2011 | See scenarios | - | | 3835 | 4117 | 3956 | 2050 | |
| 2012 | Management plan F (45% of F_{2008}) | < 31800 | | 3783 | 4392 | 4327 | 2054 | |
| 2013 | Management plan (TAC -20%) | < 25441 | | 3783 | 4240 | 4154 | 1780 | |
| 2014 | Management plan long-term phase | < 28809 | | 3972 | 4644 | 4687 | 2210 | |
| 2015 | Management plan long-term phase | < 26713 | | 4171 | 4536 | 4563 | 2942 | |
| 2016 | MSY approach | ≤ 40419 | ≤ 49259 | 4807 | 5007 | 4774 | 1704 | 0 |
| 2017 | MSY approach | ≤ 39651 | ≤ 47359 | 5744 | | | | |
| 2018 | MSY approach | ≤ 41309 | ≤ 59888 | | | | | |

* Norwegian fjords not included.

** From 2010 onwards, the advice is for Subarea 4 (North Sea), Division 7.d (Eastern Channel), and Subdivision 20 (Skagerrak).

Table 7 (cont.)

Eastern Channel (Division 7.d). Note: Values of official landings and ICES landings for the period 1987 to 1996 are presented to the nearest hundred tonnes.

| Year | ICES advice | Predicted landings corresponding to advice | Predicted catch corresponding to advice | Agreed TAC* | Official landings | ICES landings | ICES discards | BMS reported to ICES |
|------|--|--|---|-------------|-------------------|---------------|---------------|----------------------|
| 1987 | Not assessed | - | | - | 9400 | 14200 | | |
| 1988 | Precautionary TAC | - | | - | 10100 | 10700 | | |
| 1989 | No increase in F; TAC | 10000** | | - | NA | 5500 | | |
| 1990 | No increase in F; TAC | 9000** | | - | NA | 2800 | | |
| 1991 | Precautionary TAC | 3000** | | - | NA | 1900 | | |
| 1992 | If required, precautionary TAC | 5500** | | - | 2700 | 2700 | | |
| 1993 | If TAC required, consider SSB decline | - | | - | 2500 | 2400 | | |
| 1994 | Reduce F + precautionary TAC | | | - | 2900 | 2900 | | |
| 1995 | Significant effort reduction; link to North Sea | | | - | 4000 | 4000 | | |
| 1996 | Reference made to North Sea advice | | | - | 3500 | 3500 | | |
| 1997 | No advice | | | - | 7178 | 7043 | | |
| 1998 | Link to North Sea | 4900 | | - | 8665 | 8580 | | |
| 1999 | F = 0.60 to rebuild SSB | 4000 | | - | 629 | 6858 | | |
| 2000 | F less than 0.55 | < 2500 | | - | 3583 | 2325 | | |
| 2001 | lowest possible catch | 0 | | - | 2036 | 1573 | | |
| 2002 | lowest possible catch | 0 | | - | 1563 | 3139 | 507 | |
| 2003 | Closure | 0 | | - | 1941 | 2131 | 213 | |
| 2004 | Zero catch | 0 | | - | 974 | 1014 | 225 | |
| 2005 | Zero catch | 0 | | - | 1230 | 1259 | 278 | |
| 2006 | Zero catch | 0 | | - | 1481 | 1479 | 377 | |
| 2007 | Zero catch | 0 | | - | 2072 | 2147 | 2086 | |
| 2008 | Exploitation boundaries in relation to precautionary limits. Total removals less than 22 000 t | < 22000 | | - | 1661 | 1629 | 1674 | |
| 2009 | Zero catch | 0 | | 1678 | 2023 | 1887 | 4513 | |
| 2010 | Management plan F (65% of F ₂₀₀₈) | < 40300*** | | 1955 | 1836 | 1708 | 343 | |
| 2011 | See scenarios | - | | 1564 | 1311 | 1319 | 623 | |
| 2012 | Management plan F (45% of F ₂₀₀₈) | < 31800 | | 1543 | 1064 | 1120 | 102 | |
| 2013 | Management plan (TAC -20%) | < 25441 | | 1543 | 959 | 916 | 123 | |
| 2014 | Management plan long-term phase | < 28809 | | 1620 | 1548 | 1436 | 624 | |
| 2015 | Management plan long-term phase | < 26713 | | 1701 | 1387 | 1398 | 19 | |
| 2016 | MSY approach | ≤ 40419 | ≤ 49259 | 1961 | 459 | 421 | 72 | 0 |
| 2017 | MSY approach | ≤ 39651 | ≤ 47359 | 2059 | | | | |
| 2018 | MSY approach | ≤ 41309 | ≤ 59888 | | | | | |

* Until 2008 this area was included in the TAC for Subarea 7 (except Division 7.a). From 2009 a separate TAC is set.

** Including Division 7.e.

*** From 2010 onwards, the advice is for Subarea 4 (North Sea), Division 7.d (Eastern Channel), and Subdivision 20 (Skagerrak).

History of the catch and landings

Table 8 Cod in Subarea 4, Division 7.d, and Subdivision 20. Catch distribution by fleet in 2016 as estimated by ICES.

| Catch (2016) | Wanted catch | | | | | Unwanted catch | |
|--------------|--|----------------|-------------------------------|------------------|------------------|----------------|--------------|
| | Demersal trawls and seines >100 mm 71% | Gillnets 12.6% | Demersal trawls 70–99 mm 5.0% | Beam trawls 4.1% | Other gears 7.0% | Discards | BMS landings |
| 50544 tonnes | | | | | | | |
| | 38230 tonnes | | | | | 12304 tonnes | 10 tonnes |

Table 9 Cod in Subarea 4, Division 7.d, and Subdivision 20. History of commercial catch and landings; both the official and ICES estimated values are presented by area for each country participating in the fishery. All weights are in tonnes.

| Subarea 4 | | | | | | | | | | |
|--------------------------------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|
| Country | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
| Belgium | 4642 | 5799 | 3882 | 3304 | 2470 | 2616 | 1482 | 1627 | 1722 | 1309 |
| Denmark | 21870 | 23002 | 19697 | 14000 | 8358 | 9022 | 4676 | 5889 | 6291 | 5105 |
| Faroe Islands | 40 | 102 | 96 | - | 9 | 34 | 36 | 37 | 34 | 3 |
| France | 3451 | 2934 | . | 1222 | 717 | 1777 | 620 | 294 | 664 | 354 |
| Germany | 5179 | 8045 | 3386 | 1740 | 1810 | 2018 | 2048 | 2213 | 2648 | 2537 |
| Greenland | . | . | . | . | . | . | . | . | 35 | 23 |
| Netherlands | 11807 | 14676 | 9068 | 5995 | 3574 | 4707 | 2305 | 1726 | 1660 | 1585 |
| Norway | 5814 | 5823 | 7432 | 6410 | 4369 | 5217 | 4417 | 3223 | 2900 | 2749 |
| Poland | 31 | 25 | 19 | 18 | 18 | 39 | 35 | - | - | 0 |
| Sweden | 832 | 540 | 625 | 640 | 661 | 463 | 252 | 240 | 319 | 309 |
| UK (E/W/NI) | 13413 | 17745 | 10344 | 6543 | 4087 | 3112 | 2213 | 1890 | 1270 | 1491 |
| UK (Scotland) | 32344 | 35633 | 23017 | 21009 | 15640 | 15416 | 7852 | 6650 | 4936 | 6857 |
| UK (combined) | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Others | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 786 |
| Danish industrial bycatch * | . | . | . | . | . | 105 | 22 | 17 | 21 | 11 |
| Norwegian industrial bycatch * | . | . | . | . | . | . | . | . | . | 48 |
| Total nominal catch | 99423 | 114324 | 77566 | 60881 | 41713 | 44526 | 25958 | 23806 | 22500 | 23119 |
| Unallocated landings | 2746 | 7779 | 826 | -1114 | -740 | -2333 | -1875 | -1277 | 356 | -2041 |
| WG estimate of total landings | 102169 | 122103 | 78392 | 59767 | 40973 | 42193 | 24083 | 22529 | 22855 | 21078 |
| Agreed TAC | 115000 | 140000 | 132400 | 81000 | 48600 | 49300 | 27300 | 27300 | 27300 | 23205 |

| Division 7.d | | | | | | | | | | |
|-------------------------------|------|------|------|-------|------|------|------|------|------|------|
| Country | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
| Belgium | 310 | 239 | 172 | 110 | 93 | 51 | 54 | 47 | 51 | 80 |
| Denmark | - | - | - | - | - | - | - | - | - | - |
| France | 6387 | 7788 | . | 3084 | 1677 | 1361 | 1730 | 810 | 986 | 1124 |
| Netherlands | - | 19 | 3 | 4 | 17 | 6 | 36 | 14 | 9 | 9 |
| UK (E/W/NI) | 478 | 618 | 454 | 385 | 249 | 145 | 121 | 103 | 184 | 267 |
| UK (Scotland) | 3 | 1 | - | - | - | - | - | - | - | 1 |
| UK (combined) | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Total nominal catch | 7178 | 8665 | 629 | 3583 | 2036 | 1563 | 1941 | 974 | 1230 | 1481 |
| Unallocated landings | -135 | -85 | 6229 | -1258 | -463 | 1576 | 190 | 40 | 29 | -2 |
| WG estimate of total landings | 7043 | 8580 | 6858 | 2325 | 1573 | 3139 | 1231 | 1014 | 1259 | 1479 |

| Subdivision 20 ** | | | | | | | | | | |
|-------------------------------|-------|-------|-------|-------|------|------|------|------|------|------|
| Country | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
| Denmark | 12159 | 12339 | 8681 | 7684 | 5900 | 5525 | 3067 | 3038 | 3019 | 2513 |
| Germany | 81 | 54 | 54 | 54 | 32 | 83 | 49 | 99 | 86 | 84 |
| Norway | 1323 | 1293 | 1146 | 926 | 762 | 645 | 825 | 856 | 759 | 628 |
| Sweden | 2173 | 1900 | 1909 | 1293 | 1035 | 897 | 510 | 495 | 488 | 372 |
| Others | - | - | - | - | - | - | 27 | 24 | 21 | 373 |
| Danish industrial bycatch * | 205 | 97 | 62 | 99 | 687 | 20 | 5 | 4 | 2 | 3 |
| Total nominal catch | 15736 | 15586 | 11790 | 9957 | 7729 | 7170 | 4483 | 4516 | 4375 | 3973 |
| Unallocated landings | -790 | -255 | -816 | -680 | -643 | -316 | -504 | -602 | -376 | -715 |
| WG estimate of total landings | 14946 | 15331 | 10974 | 9277 | 7086 | 6854 | 3979 | 3914 | 3998 | 3258 |
| Agreed TAC | 16100 | 20000 | 19000 | 11600 | 7000 | 7100 | 3900 | 3900 | 3900 | 3315 |

| Subarea 4 Divisions 7.d and Subdivision 20 combined | | | | | | | | | | |
|---|--------|--------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
| Total nominal catch | 122337 | 138575 | 89985 | 74421 | 51478 | 53260 | 32382 | 29296 | 28104 | 28573 |
| Unallocated landings | 1821 | 7439 | 6240 | -3052 | -1846 | -1074 | -2189 | -1839 | 9 | -2759 |
| WG estimate of total landings | 124158 | 146014 | 96225 | 71369 | 49632 | 52186 | 30193 | 27457 | 28113 | 25815 |

* The Danish (up to 2001) and Norwegian industrial bycatch are not included in the (WG estimate of) total landings.

** Skagerrak/Kattegat split derived from national statistics.

. Magnitude not available - Magnitude known to be nil < 0.5 Magnitude less than half the unit used in the table n/a Not applicable

| Subarea 4 and Subdivision 20 landings not included in the assessment | | | | | | | | | | |
|--|------|------|------|------|------|------|------|------|------|------|
| Country | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
| Danish industrial bycatch * | 205 | 97 | 62 | 99 | 687 | - | - | - | - | - |
| Norwegian industrial bycatch | . | . | . | . | . | . | . | . | . | 48 |
| Total | 205 | 97 | 62 | 99 | 687 | 0 | 0 | 0 | 0 | 48 |

Table 9 (contd).

| Subarea 4 | | | | | | | | | | |
|--------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Country | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| Belgium | 1009 | 894 | 946 | 666 | 653 | 862 | 1076 | 1257 | 1187 | 1103 |
| Denmark | 3430 | 3831 | 4402 | 5686 | 4863 | 4803 | 4536 | 5457 | 6026 | 6697 |
| Faroe Islands | 0 | 16 | 45 | 32 | 0 | 0 | 0 | 0 | . | . |
| France | 659 | 573 | 950 | 781 | 619 | 368 | 287 | 638 | 521 | 391 |
| Germany | 1899 | 1736 | 2374 | 2844 | 2211 | 2385 | 1921 | 2257 | 2133 | 2083 |
| Greenland | 17 | 17 | 11 | 0 | 0 | 0 | 0 | 0 | . | 2 |
| Netherlands | 1523 | 1896 | 2649 | 2657 | 1928 | 1955 | 1344 | 1242 | 1349 | 1365 |
| Norway | 3057 | 4128 | 4234 | 4496 | 4898 | 4601 | 4079 | 4590 | 5486 | 5592 |
| Poland | 1 | 2 | 3 | 0 | 2 | 0 | 0 | 0 | . | . |
| Sweden | 387 | 439 | 378 | 363 | 315 | 472 | 332 | 401 | 417 | 370 |
| UK (E/W/Ni) | 1588 | 1546 | 2384 | 2553 | 2169 | 1630 | 2129 | 2963 | . | . |
| UK (Scotland) | 6511 | 7185 | 9052 | 11567 | 10141 | 10565 | 10619 | 10517 | . | . |
| UK (combined) | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 13480 | 14839 | 16583 |
| Others | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Danish industrial bycatch | 23 | 1 | 72 | 12 | 0 | 0 | 2 | 24 | 0 | 5 |
| Norwegian industrial bycatch * | 101 | 22 | 4 | 201 | 1 | . | . | . | . | . |
| Total nominal catch | 20104 | 22264 | 27500 | 31657 | 27799 | 27641 | 26325 | 29346 | 31959 | 34192 |
| Unallocated landings | -1047 | -607 | 134 | -677 | -1124 | -1014 | -1010 | -796 | -715 | -1157 |
| WG estimate of total landings | 19056 | 21657 | 27634 | 30980 | 26675 | 26627 | 25315 | 28550 | 31244 | 33035 |
| Agreed TAC | 19957 | 22152 | 28798 | 33552 | 26842 | 26475 | 26475 | 27799 | 29189 | 33651 |

| Division 7.d | | | | | | | | | | |
|-------------------------------|------|------|------|------|------|------|------|------|------|------|
| Country | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| Belgium | 84 | 154 | 73 | 57 | 56 | 40 | 53 | 72 | 79 | 38 |
| Denmark | . | . | . | . | . | . | . | . | . | . |
| France | 1743 | 1326 | 1779 | 1606 | 1078 | 885 | 768 | 1270 | 1100 | 279 |
| Netherlands | 59 | 30 | 35 | 45 | 51 | 40 | 38 | 50 | 47 | 40 |
| UK (E/W/Ni) | 174 | 144 | 133 | 127 | 125 | 99 | 100 | 156 | . | . |
| UK (Scotland) | 12 | 7 | 3 | 1 | 1 | 0 | 0 | 0 | . | . |
| UK (combined) | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 156 | 161 | 101 |
| Total nominal catch | 2072 | 1661 | 2023 | 1836 | 1311 | 1064 | 959 | 1548 | 1387 | 459 |
| Unallocated landings | 75 | -32 | -136 | -128 | 8 | 56 | -43 | -112 | 11 | -38 |
| WG estimate of total landings | 2147 | 1629 | 1887 | 1708 | 1319 | 1120 | 916 | 1436 | 1398 | 421 |
| Agreed TAC | | | 1678 | 1955 | 1564 | 1543 | 1543 | 1620 | 1701 | 1961 |

| Subdivision 20 ** | | | | | | | | | | |
|-------------------------------|------|------|------|------|------|------|------|------|------|------|
| Country | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| Denmark | 2246 | 2553 | 3024 | 3286 | 3118 | 3178 | 3033 | 3430 | 3344 | 3695 |
| Germany | 67 | 52 | 55 | 56 | 60 | 78 | 69 | 84 | 87 | 94 |
| Norway | 681 | 779 | 440 | 375 | 421 | 615 | 575 | 528 | 499 | 549 |
| Sweden | 370 | 365 | 459 | 458 | 518 | 520 | 529 | 570 | 576 | 643 |
| Others | 385 | 13 | 2 | 26 | 0 | 0 | 33 | 28 | 24 | 25 |
| Danish industrial by-catch | 2 | 7 | 2 | 10 | 0 | 1 | 1 | 5 | 5 | 0 |
| Total nominal catch | 3751 | 3769 | 3983 | 4211 | 4117 | 4392 | 4240 | 4644 | 4536 | 5007 |
| Unallocated landings | -731 | -376 | -188 | -154 | -161 | -65 | -85 | 43 | 28 | -233 |
| WG estimate of total landings | 3020 | 3393 | 3794 | 4057 | 3956 | 4327 | 4154 | 4687 | 4563 | 4774 |
| Agreed TAC | 2851 | 3165 | 4114 | 4793 | 3835 | 3783 | 3783 | 3972 | 4171 | 4807 |

| Subarea 4, Division 7.d and Subdivision 20 combined | | | | | | | | | | |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| Total nominal catch | 25927 | 27694 | 33506 | 37705 | 33227 | 33097 | 31524 | 35538 | 37882 | 39657 |
| Unallocated landings | -1704 | -1015 | -190 | -959 | -1277 | -1024 | -1138 | -865 | -676 | -1427 |
| WG estimate of total landings | 24223 | 26679 | 33315 | 36746 | 31950 | 32074 | 30386 | 34673 | 37205 | 38230 |

* The Norwegian industrial bycatch are not included in the (WG estimate of) total landings.
 ** Skagerrak/Kattegat split derived from national statistics.
 *** 2016 WG estimates of total landings do not include BMS landings.

| Subarea 4 and Subdivision 20 landings not included in the assessment | | | | | | | | | | |
|--|------|------|------|------|------|------|------|------|------|------|
| Country | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| Norwegian industrial bycatch * | 101 | 22 | 4 | 201 | 1 | . | . | . | . | . |
| Total | 101 | 22 | 4 | 201 | 1 | 0 | 0 | 0 | 0 | 0 |

Summary of the assessment

Table 10 Cod in Subarea 4, Division 7.d, and Subdivision 20. Assessment summary. Weights are in tonnes. Highs and lows are point-wise 95% confidence intervals.

| Year | Recruitment (age 1) thousands | High | Low | SSB | High | Low | Wanted catch | Unwanted catch* | Unaccounted removals | F ages 2-4 | High | Low |
|------|-------------------------------|---------|---------|--------|--------|--------|--------------|-----------------|----------------------|------------|------|------|
| 1963 | 483110 | 668145 | 349319 | 152665 | 199016 | 117109 | 107581 | 10982 | | 0.48 | 0.55 | 0.41 |
| 1964 | 788589 | 1088618 | 571249 | 164226 | 209798 | 128553 | 134996 | 9673 | | 0.52 | 0.59 | 0.45 |
| 1965 | 1053891 | 1449139 | 766446 | 200186 | 247657 | 161814 | 181498 | 17187 | | 0.57 | 0.65 | 0.50 |
| 1966 | 1278247 | 1755668 | 930651 | 222348 | 273370 | 180849 | 215130 | 26450 | | 0.57 | 0.65 | 0.50 |
| 1967 | 1074107 | 1475755 | 781773 | 251954 | 309298 | 205241 | 260928 | 26689 | | 0.61 | 0.69 | 0.54 |
| 1968 | 537132 | 739478 | 390155 | 263024 | 312750 | 221204 | 276509 | 17021 | | 0.64 | 0.73 | 0.57 |
| 1969 | 469771 | 650854 | 339069 | 259367 | 311550 | 215924 | 216425 | 9541 | | 0.61 | 0.69 | 0.54 |
| 1970 | 1572221 | 2163029 | 1142786 | 270493 | 323041 | 226492 | 232582 | 20054 | | 0.65 | 0.73 | 0.58 |
| 1971 | 2053385 | 2834851 | 1487340 | 274855 | 327704 | 230529 | 293021 | 58454 | | 0.74 | 0.82 | 0.66 |
| 1972 | 505347 | 698381 | 365668 | 244263 | 291352 | 204784 | 329062 | 34303 | | 0.79 | 0.89 | 0.71 |
| 1973 | 741181 | 1023645 | 536660 | 215130 | 247995 | 186622 | 234451 | 24860 | | 0.78 | 0.87 | 0.70 |
| 1974 | 725053 | 1003054 | 524101 | 230499 | 265837 | 199858 | 209609 | 26134 | | 0.75 | 0.84 | 0.67 |
| 1975 | 1246687 | 1738268 | 894124 | 207939 | 241912 | 178737 | 208772 | 36316 | | 0.80 | 0.90 | 0.72 |
| 1976 | 861129 | 1208850 | 613429 | 177194 | 209031 | 150206 | 201995 | 44312 | | 0.86 | 0.96 | 0.77 |
| 1977 | 2115919 | 2953082 | 1516082 | 150091 | 176504 | 127632 | 182408 | 78669 | | 0.82 | 0.91 | 0.74 |
| 1978 | 1298863 | 1819296 | 927307 | 149492 | 169913 | 131526 | 305285 | 47954 | | 0.90 | 1.00 | 0.81 |
| 1979 | 1639661 | 2288896 | 1174579 | 147561 | 166234 | 130986 | 276509 | 62007 | | 0.85 | 0.94 | 0.77 |
| 1980 | 2655119 | 3723148 | 1893467 | 161135 | 180416 | 143915 | 290396 | 101620 | | 0.92 | 1.02 | 0.83 |
| 1981 | 1043405 | 1458968 | 746208 | 168890 | 187499 | 152127 | 342833 | 53370 | | 0.94 | 1.04 | 0.85 |
| 1982 | 1723728 | 2379783 | 1248533 | 168384 | 187789 | 150984 | 321579 | 63007 | | 1.05 | 1.15 | 0.95 |
| 1983 | 946002 | 1285425 | 696205 | 137861 | 154352 | 123131 | 287506 | 37123 | | 1.04 | 1.15 | 0.95 |
| 1984 | 1744537 | 2366636 | 1285965 | 119970 | 134760 | 106804 | 210871 | 69633 | | 0.98 | 1.08 | 0.89 |
| 1985 | 416649 | 574652 | 302090 | 118777 | 133539 | 105647 | 215777 | 28368 | | 0.95 | 1.04 | 0.86 |
| 1986 | 1901208 | 2574124 | 1404202 | 109426 | 121860 | 98260 | 169736 | 60476 | | 1.00 | 1.10 | 0.91 |
| 1987 | 714258 | 964032 | 529199 | 113210 | 126327 | 101455 | 227977 | 33157 | | 0.98 | 1.08 | 0.89 |
| 1988 | 485046 | 655701 | 358807 | 111413 | 122423 | 101393 | 191760 | 14694 | | 1.00 | 1.10 | 0.91 |
| 1989 | 853414 | 1159385 | 628191 | 103363 | 114207 | 93549 | 138968 | 41357 | | 1.02 | 1.12 | 0.92 |
| 1990 | 328733 | 442856 | 244019 | 92503 | 102682 | 83334 | 116192 | 23482 | | 0.95 | 1.05 | 0.86 |
| 1991 | 377755 | 505943 | 282044 | 90219 | 100851 | 80708 | 102642 | 15845 | | 0.94 | 1.03 | 0.85 |
| 1992 | 883812 | 1175660 | 664414 | 86250 | 95809 | 77644 | 109426 | 32273 | | 0.93 | 1.02 | 0.84 |
| 1993 | 430198 | 564311 | 327958 | 89054 | 98089 | 80852 | 130651 | 28319 | -9746 | 0.94 | 1.04 | 0.86 |
| 1994 | 1056001 | 1401032 | 795941 | 94940 | 103908 | 86746 | 106101 | 42665 | 5431 | 0.96 | 1.06 | 0.88 |
| 1995 | 604405 | 797120 | 458282 | 107474 | 117087 | 98649 | 130947 | 31842 | 29270 | 1.00 | 1.10 | 0.91 |
| 1996 | 382697 | 502304 | 291571 | 107259 | 116787 | 98508 | 131426 | 21159 | 4933 | 1.01 | 1.10 | 0.92 |
| 1997 | 1218340 | 1639103 | 905588 | 96568 | 105415 | 88463 | 133926 | 46866 | -23309 | 0.98 | 1.08 | 0.90 |
| 1998 | 121176 | 161348 | 91006 | 92689 | 102022 | 84209 | 146983 | 41985 | -48413 | 1.01 | 1.11 | 0.92 |
| 1999 | 248699 | 325651 | 189932 | 83784 | 91787 | 76479 | 94781 | 13085 | -11649 | 1.07 | 1.18 | 0.98 |
| 2000 | 456343 | 598056 | 348210 | 64926 | 71597 | 58876 | 73272 | 16670 | -6076 | 1.07 | 1.18 | 0.98 |

| Year | Recruitment (age 1) thousands | High | Low | SSB | High | Low | Wanted catch | Unwanted catch* | Unaccounted removals | F ages 2–4 | High | Low |
|------|-------------------------------------|---------|--------|--------|--------|--------|-----------------|--------------------|-------------------------|---------------|------|------|
| 2001 | 162592 | 213788 | 123656 | 61145 | 67491 | 55396 | 44747 | 11577 | 14935 | 1.00 | 1.10 | 0.91 |
| 2002 | 248699 | 326152 | 189639 | 56162 | 61855 | 50994 | 53486 | 11480 | -8380 | 0.96 | 1.05 | 0.87 |
| 2003 | 119253 | 157320 | 90396 | 58454 | 64289 | 53149 | 31104 | 4688 | 17932 | 0.94 | 1.04 | 0.85 |
| 2004 | 202197 | 264633 | 154492 | 46397 | 51536 | 41772 | 27316 | 7595 | 4050 | 0.90 | 1.00 | 0.81 |
| 2005 | 153430 | 203471 | 115696 | 49021 | 55518 | 43284 | 29863 | 11377 | -1592 | 0.84 | 0.93 | 0.75 |
| 2006 | 360411 | 471126 | 275714 | 43739 | 50061 | 38216 | 22697 | 9256 | | 0.75 | 0.85 | 0.67 |
| 2007 | 168721 | 219687 | 129578 | 76191 | 86164 | 67373 | 24077 | 29319 | | 0.70 | 0.79 | 0.62 |
| 2008 | 195243 | 254694 | 149669 | 82619 | 93213 | 73230 | 27092 | 25387 | | 0.66 | 0.75 | 0.58 |
| 2009 | 190042 | 247850 | 145717 | 90853 | 103520 | 79736 | 33223 | 21627 | | 0.65 | 0.75 | 0.57 |
| 2010 | 294490 | 386265 | 224520 | 91126 | 106045 | 78306 | 36279 | 12655 | | 0.57 | 0.66 | 0.49 |
| 2011 | 143631 | 187865 | 109811 | 100609 | 120292 | 84147 | 34441 | 10489 | | 0.47 | 0.55 | 0.40 |
| 2012 | 201189 | 262194 | 154378 | 99211 | 120074 | 81972 | 32696 | 7637 | | 0.43 | 0.50 | 0.36 |
| 2013 | 265136 | 346057 | 203138 | 107689 | 130187 | 89078 | 30853 | 10872 | | 0.43 | 0.49 | 0.36 |
| 2014 | 380408 | 498391 | 290355 | 115960 | 139583 | 96335 | 34752 | 11049 | | 0.41 | 0.48 | 0.35 |
| 2015 | 184979 | 246363 | 138890 | 134323 | 162941 | 110731 | 38139 | 13317 | | 0.39 | 0.45 | 0.33 |
| 2016 | 134592 | 193567 | 93584 | 139804 | 169982 | 114984 | 38330 | 12352 | | 0.35 | 0.42 | 0.30 |
| 2017 | 692194 | 1599321 | 285667 | 167711 | 212535 | 132341 | | | | | | |

* Unwanted catch values include discards and BMS landings from 2016.

Sources and references

EU. 2008. COUNCIL REGULATION (EC) No. 1342/2008 of 18 December 2008 establishing a long-term plan for cod stocks and the fisheries exploiting those stocks and repealing Regulation (EC) No. 423/2004. Official Journal of the European Union L 348/21. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:348:0020:0033:EN:PDF>.

ICES. 2015a. Report of the Benchmark Workshop on North Sea Stocks (WKNSEA), 2–6 February 2015, Copenhagen, Denmark. ICES CM 2015/ACOM:32. 253 pp.

ICES. 2015b. EU request to ICES to provide F_{MSY} ranges for selected North Sea and Baltic Sea stocks. In Report of the ICES Advisory Committee, 2015. ICES Advice 2015, Book 6, Section 6.2.3.1.

ICES. 2015c. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK) 28 April–7 May 2015, ICES Headquarters, Copenhagen, Denmark. ICES CM 2015/ACOM:13. 1229 pp.

ICES. 2016a. Advice basis. In Report of the ICES Advisory Committee, 2016. ICES Advice 2016, Book 1, Section 1.2.

ICES. 2016b. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK) 26 April–5 May 2016, Hamburg, Germany. ICES CM 2016/ACOM:14. 1096 pp.

ICES. 2017a. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK), 26 April–5 May 2017, ICES Headquarters, Copenhagen, Denmark. ICES CM 2017/ACOM:21.

ICES. 2017b. Report of the Working Group on Mixed-Fisheries Advice (WGMIXFISH-ADVICE), 22–26 May 2017, ICES Headquarters, Copenhagen, Denmark. In preparation.

ICES. 2017c. Sole (*Solea solea*) in Subarea 4 (North Sea). Updated in November 2017. In Report of the ICES Advisory Committee, 2017. ICES Advice 2017, sol.27.4. DOI: 10.17895/ices.pub.3526.

Nielsen, A., and Berg, C. W. 2014. Estimation of time-varying selectivity in stock assessments using state-space models. Fisheries Research, 158: 96–101.