

ECOREGION Faroe Plateau ecosystem
STOCK Cod in Subdivision Vb₁ (Faroe Plateau)

Advice for 2013

ICES advises on the basis of the MSY approach that effort should be reduced such that fishing mortality in 2013 will be no more than $F = 0.20$, corresponding to a 63% reduction in the present fishing mortality.

Stock status

| F (Fishing Mortality) | | | |
|--|------|------|------------------|
| | 2009 | 2010 | 2011 |
| MSY (F_{MSY}) | ✗ | ✗ | ✗ Above target |
| Precautionary approach (F_{pa}, F_{lim}) | ○ | ○ | ○ Increased risk |
| SSB (Spawning-Stock Biomass) | | | |
| | 2010 | 2011 | 2012 |
| MSY ($B_{trigger}$) | ✗ | ✗ | ✗ Below trigger |
| Precautionary approach (B_{pa}, B_{lim}) | ○ | ○ | ○ Increased risk |

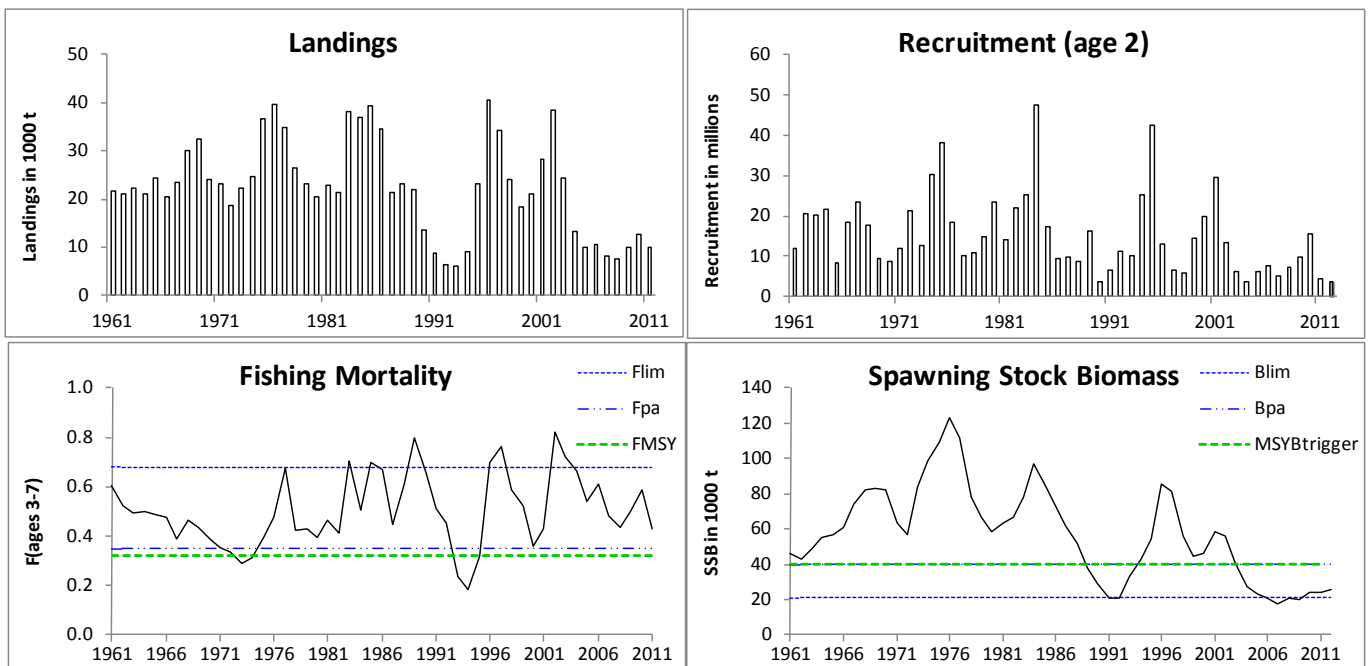
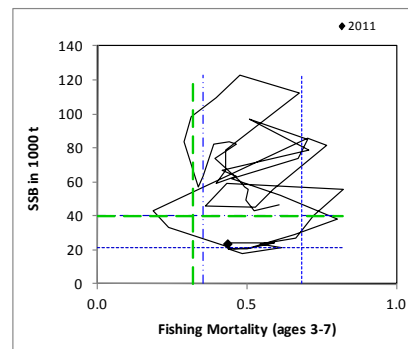


Figure 4.4.1.1 Cod in Subdivision Vb₁ (Faroe Plateau). Summary of stock assessment (weights in thousand tonnes). Top right: SSB/F for the time-series used in the assessment.

SSB has remained around B_{lim} since 2005. Fishing mortality has decreased since 2002 and is now between F_{lim} and F_{pa} , but still above F_{MSY} . The 2009 year class is estimated to be below average.

Management plans

A group representing the Ministry of Fisheries, the Faroese industry, the University of the Faroe Islands, and the Faroe Marine Research Institute has developed a management plan based on general maximum sustainable yield (MSY) principles developed by ICES. The plan has not yet been discussed by the political system.

Biology

Recent work suggests that cannibalism is a controlling factor of recruitment. In periods with low ecosystem productivity, the individual growth of cod is slow, and some of them move into the nearshore nursery areas of 1-group cod, which reduce the recruitment of 2-year-old cod the following year.

Environmental influence on the stock

The productivity of the Faroe Shelf ecosystem is important to the cod stock and recruitment depends both on the stock size and on the productive state of the Faroe Shelf ecosystem. The indices of primary production have been low since 2002 except for 2004 and 2008–2010, when they were estimated to be above average.

The individual growth of cod also depends on the productivity in the outer areas of the Faroe Plateau because cod growth is highly correlated with the ratio of total phytoplankton production to total fish biomass (cod+haddock+saithe) on the Faroe Plateau, i.e. “food per fish”. Phytoplankton production in the outer areas of the Faroe ecosystem (water depth 130–500 m) has stayed above average since 2000.

The fisheries

Cod are mainly taken in a directed cod and haddock fishery with longlines, in a directed jigging fishery, and as bycatch in the trawl fishery for saithe.

Catch distribution Total landings (2011) are 10 kt, where 62% was taken by the longlines, 7% by jigging, 31% by trawlers, and 0.1% by other gear types. There was no industrial bycatch or unaccounted removals.

Quality considerations

The landing data are considered accurate. There are no incentives to discard fish under the effort management system. The sampling of the landings is believed to be adequate. Estimates of F in the terminal year have varied considerably.

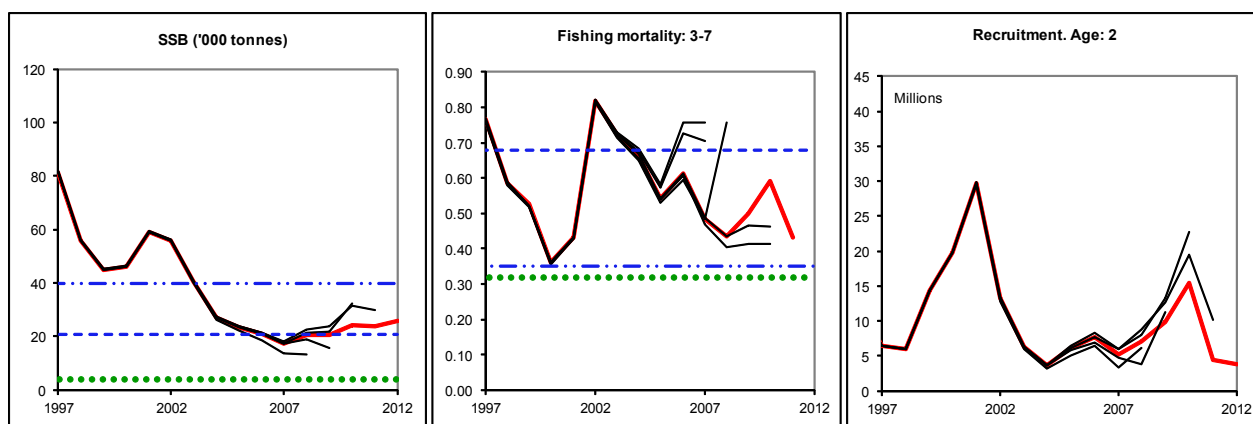


Figure 4.4.1.2 Cod in Subdivision Vb₁ (Faroe Plateau). Historical assessment results (final year recruitment estimates included).

Scientific basis

| | |
|-----------------------------|--|
| Assessment type | XSA using landings-at-age data and age-disaggregated indices. |
| Input data | Two survey indices (spring and summer survey). |
| Discards and bycatch | There are no discard data, but discarding is not considered to be a major problem in this fishery. |
| Indicators | None. |
| Other information | None. |
| Working group report | NWWG |

ECOREGION Faroe Plateau ecosystem
STOCK Cod in Subdivision Vb₁ (Faroe Plateau)

Reference points

| | <i>Type</i> | <i>Value</i> | <i>Technical basis</i> |
|------------------------|--------------------------|--------------|--|
| MSY Approach | MSY B _{trigger} | 40 000 t | B _{pa} . |
| | F _{MSY} | 0.32 | Provisional maximum sustainable yield, FLR stochastic simulations. |
| Precautionary Approach | B _{lim} | 21 000 t | Lowest observed SSB (1998 assessment). |
| | B _{pa} | 40 000 t | B _{lim} e ^{1.645σ} , assuming a σ of about 0.40 to account for the relatively large uncertainties in the assessment. |
| | F _{lim} | 0.68 | F _{pa} e ^{1.645σ} , assuming a σ of about 0.40 to account for the relatively large uncertainties in the assessment. |
| | F _{pa} | 0.35 | Close to F _{max} (0.34) and F _{med} (0.38) (1998 assessment). |

(unchanged since: 2011)

Yield and spawning biomass per Recruit F-reference points (2012):

| | Fish Mort Ages 3–7 | Yield/R | SSB/R |
|----------------------|-----------------------|---------|-------|
| Average last 3 years | 0.51 | 1.38 | 3.18 |
| F _{max} | 0.25 | 1.45 | 5.78 |
| F _{0.1} | 0.11 | 1.31 | 9.72 |
| F _{med} | 0.41 | 1.41 | 3.85 |

Outlook for 2013

Basis: F (2012) = F (2009–2011) = 0.51; SSB (2013) = 26; R (2012) = 4 million; landings (2012) = 11.0.

| Rationale | F (2013) | Landings (2013)²⁾ | Basis | SSB (2014) | %SSB change¹⁾ |
|------------------------|-----------------|-------------------------------------|--|-------------------|---------------------------------|
| MSY framework | 0.20 | 4.8 | F _{MSY} * SSB ₂₀₁₃ /B _{trigger} = F _{sq} * 0.37 | 29 | 21 |
| Precautionary Approach | 0.35 | 7.8 | F _{pa} (=F _{sq} *0.68) | 26 | 12 |
| Zero catch | 0 | 0 | F=0 | 34 | 32 |
| <i>Status quo</i> | 0.51 | 10.5. | F _{sq} | 23 | 0 |
| | 0.25 | 5.8 | F _{sq} * 0.50 | 28 | 18 |
| | 0.38 | 8.2 | F _{sq} * 0.75 | 25 | 8 |
| | 0.32 | 7,2 | F _{MSY} = F _{sq} * 0.65 | 26 | 12 |
| | 0.46 | 9,7 | F _{sq} * 0.90 | 24 | 4 |
| | 0.56 | 11,3 | F _{sq} * 1.1 | 22 | -5 |

Weights in thousand tonnes.

¹⁾ SSB 2014 relative to SSB 2013.

²⁾ Landings 2013.

Management plan

A management system based on number of fishing days, closed areas, and other technical measures was introduced in 1996 to ensure sustainable demersal fisheries in Division Vb. This was before ICES introduced precautionary approach (PA) and MSY reference values, and at that time it was believed that the purpose was achieved if the total allowable number of fishing days was set such that on average 33% of the haddock exploitable stock in numbers would be harvested annually. This translates into an average F of 0.45, above the F_{pa} and F_{MSY} of 0.35 and 0.32 respectively. ICES considers this to be inconsistent with the PA and the MSY approaches. Work is ongoing in the Faroes to move away from the F_{target} of 0.45 to be consistent with the ICES advice. This new management plan should include a stepwise reduction of the fishing mortality to F_{MSY} in 2015 and a recovery plan if the SSB declines below the B_{trigger}. The MSY B_{trigger} has been defined at 40 kt (the former B_{pa}) and F_{MSY} at 0.32. If the SSB declines below the MSY B_{trigger}, the fishing mortality will be reduced by the relationship F_{MSY} * B_{act}/B_{trigger} until the SSB has increased again above the MSY B_{trigger} and is thereafter kept at F_{MSY}.

MSY approach

ICES advises on the basis of the MSY approach to reduce fishing mortality by 63% in 2013 to 0.20. This is 38% below F_{MSY} , because SSB in 2013 is 38% below MSY $B_{trigger}$.

Precautionary approach

The fishing mortality should be kept below an F_{pa} of 0.35. This translates into a reduction in fishing mortality by 30% as compared to the average of the last 3 years (0.51).

Additional considerations

Management considerations

The present estimate of F_{MSY} should be regarded as provisional. Simulation studies that take the productivity of the ecosystem into account have been tried, but this model is still under development.

One of the expected benefits of the effort management system was more stability for the fishing fleet. The fleets were expected to target the most abundant fish species, thus reducing the fishing mortality on stocks that are at low levels. However, low prices on saithe and haddock and high prices for cod have kept the fishing mortality high on cod; the economic factors seem to be more important than the relative abundance of the stocks in determining which species is targeted. When considering future management, protection mechanisms should be included to ensure that appropriate action is taken when one or more stocks or fisheries develop in an unfavourable way.

It is not easy to control fishing mortality by effort management if catchability varies. For baited hook gear, catchability may be related to the amount of food available in the ecosystem (Steingrund *et al.*, 2009). Therefore, during the current low-productive period, fishing mortality may increase even though the number of fishing days is decreased.

Regulations and their effects

An effort management system was implemented 1 June 1996. Fishing days are allocated to all fleets fishing in waters < 380 m depth for the period 1 September–31 August. In addition the majority of the waters < ca. 200 m depth are closed to trawlers, and are mainly utilized by longliners. The main spawning areas for cod are closed for nearly all fishing gears during spawning time. In 2011, additional areas were closed in order to protect incoming year classes of cod.

Changes in fishing technology and fishing patterns

The effort management system can lead to improvement of fishing technology and efficiency. Presently, ICES is not able to quantify these changes.

Comparison with last year's assessment and advice

The perception of the status of the stock with respect to reference points and trends in this year's assessment is similar to that of last year's assessment. Comparing the 2010 estimates in last year's assessment (2011) with this year's assessment (2012) shows that recruitment has been revised downwards by 21%, the spawning-stock biomass revised downwards by 23%, and the fishing mortality revised upwards by 42%.

The basis of the advice is the same as last year.

Sources

ICES. 2012. Report of the North-Western Working Group, 26 April–3 May 2012. ICES CM 2012/ACOM:07.
Steingrund, P., Clementsen, D. H., and Mouritsen, R. 2009. Higher food abundance reduces the catchability of cod (*Gadus morhua*) to longlines on the Faroe Plateau. Fisheries Research, 100: 230–239.

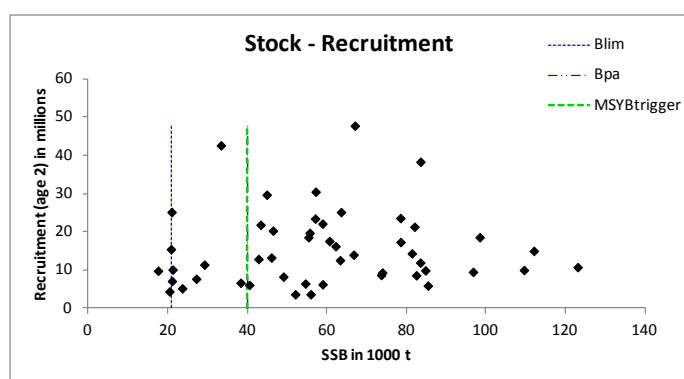


Figure 4.4.1.1 Cod in Subdivision Vb₁ (Faroe Plateau). Stock–recruitment plot.

Table 4.4.1.1 Cod in Subdivision Vb₁ (Faroe Plateau). ICES advice, management, and landings.

| Fishing Year | ICES Advice | Predicted catch corresp. to advice | Agreed TAC | ICES Landings |
|--------------|---|------------------------------------|-------------------------|---------------|
| 1987 | No increase in F | <31 | | 21.4 |
| 1988 | No increase in F (Revised estimate) | <29 (23) | | 23.2 |
| 1989 | No increase in F | <19 | | 22.1 |
| 1990 | No increase in F | <20 | | 13.5 |
| 1991 | TAC | <16 | | 8.8 |
| 1992 | No increase in F | <20 | | 6.4 |
| 1993 | No fishing | 0 | | 6.1 |
| 1994 | No fishing | 0 | 8.5/12.5 ^{1,2} | 9.0 |
| 1995 | No fishing | 0 | 12.5 ¹ | 23.0 |
| 1996 | F at lowest possible level | - | 20 ² | 40.4 |
| 1997 | 80% of F(95) | <24 | - | 34.3 |
| 1998 | 30% reduction in effort from 1996/97 | - | - | 24.0 |
| 1999 | F less than proposed F _{pa} (0.35) | <19 | | 18.3 |
| 2000 | F less than proposed F _{pa} (0.35) | <20 | | 21.0 |
| 2001 | F less than proposed F _{pa} (0.35) | <16 | | 28.2 |
| 2002 | 75% of F(2000) | <22 | | 38.5 |
| 2003 | 75% of F(2001) | <32 | | 24.5 |
| 2004 | 25% reduction in effort | - | | 13.2 |
| 2005 | Rebuilding plan involving large reduction | - | | 9.9 |
| 2006 | Rebuilding plan involving large reduction | - | | 10.5 |
| 2007 | Rebuilding plan involving large reduction in effort | - | | 8.1 |
| 2008 | No fishing. Development of a rebuilding plan. | 0 | | 7.5 |
| 2009 | No fishing. Development of a rebuilding plan. | 0 | | 10.0 |
| 2010 | No fishing. Development of a rebuilding plan. | 0 | | 12.8 |
| 2011 | Reduce F to below F _{pa} | <16 | | 9.9 |
| 2012 | MSY framework, reduce F by 30% | <10 | | 11.3 |
| 2013 | F<0.20 | 4.8 | | 11.5 |

Fishing year: 1 September–31 August the following year

Weights in thousand tonnes.

¹⁾ In the quota year 1 September–31 August the following year.

²⁾ The TAC was increased during the quota year.

Table 4.4.1.2 Faroe Plateau cod (Subdivision Vb₁). Nominal catch statistics (in tonnes) per country.

| | Denmark | Faroe Islands | France | Germany | Iceland | Norway | Greenland | Portugal | UK (E/W/NI) | UK (Scotland) | United Kingdom | Total |
|-------------------|---------|---------------|----------------|----------------|---------|------------------|-----------|----------|-----------------|---------------|----------------|--------|
| 1986 | 8 | 34,492 | 4 | 8 | | 83 | - | | - | - | - | 34,595 |
| 1987 | 30 | 21,303 | 17 | 12 | | 21 | - | | 8 | - | - | 21,391 |
| 1988 | 10 | 22,272 | 17 | 5 | | 163 | - | | - | - | - | 22,467 |
| 1989 | - | 20,535 | - | 7 | | 285 | - | | - | - | - | 20,827 |
| 1990 | - | 12,232 | - | 24 | | 124 | - | | - | - | - | 12,380 |
| 1991 | - | 8,203 | - ¹ | 16 | | 89 | - | | 1 | - | - | 8,310 |
| 1992 | - | 5,938 | 3 ² | 12 | | 39 | - | | 74 | - | - | 6,068 |
| 1993 | - | 5,744 | 1 ² | + | | 57 | - | | 186 | - | - | 5,990 |
| 1994 | - | 8,724 | - | 2 | | 36 | - | | 56 | - | - | 8,818 |
| 1995 | - | 19,079 | 2 ² | 2 | | 38 | - | | 43 | - | - | 19,166 |
| 1996 | - | 39,406 | 1 ² | + | | 507 | - | | 126 | - | - | 40,042 |
| 1997 | - | 33,556 | - | + | | 410 | - | | 61 ² | - | - | 34,029 |
| 1998 | - | 23,308 | - ¹ | - | | 405 | - | | 27 ² | - | - | 23,742 |
| 1999 | - | 19,156 | - ¹ | 39 | - | 450 | - | | 51 | - | - | 19,696 |
| 2000 | | | 1 | 2 | - | 374 | - | | 18 | - | - | 395 |
| 2001 | | 29,762 | 9 ² | 9 | - | 531 ¹ | - | | 50 | - | - | 30,363 |
| 2002 | | 40,602 | 20 | 6 | 5 | 573 | - | | 42 | - | - | 41,248 |
| 2003 | | 30,259 | 14 | 7 | - | 447 | - | | 15 | - | - | 30,742 |
| 2004 | | 17,540 | 2 | 3 ² | | 414 | | 1 | 15 | - | - | 17,977 |
| 2005 | | 13,556 | - | | | 201 | | | 24 | - | - | 13,781 |
| 2006 | | 11,629 | 7 | 1 ² | | 49 | 5 | | 1 | - | - | 11,694 |
| 2007 | | 9,905 | 1 ² | | | 71 | 7 | | 3 | 358 | - | 10,347 |
| 2008 | | 9,394 | 1 | | | 40 | | | | 383 | - | 9,818 |
| 2009 | | 10,736 | 1 | | | 14 | 7 | | | 300 | - | 11,058 |
| 2010 | | 13,878 | 1 | | | 10 | | | | 312 | - | 14,201 |
| 2011 [*] | | 11,497 | 1 | | | | | | | | - | 11,497 |

^{*} Preliminary,¹ Included in Vb², Reported as Vb.

Table 4.4.1.3 Faroe Plateau cod (Subdivision Vb₁). Officially reported catches as well as the corrections done to obtain the catches, which were used in the assessment.

| | Officially reported | Faroes catches: | | | Catches reported as Vb ² : | | Foreign catches: | | | Used in the assessment | | |
|------|---------------------|--------------------|--------------------|------------------------|---------------------------------------|-------------|------------------|----|---------------------|------------------------|------------------------|---------------------|
| | | in Vb1 | Corrections in Vb1 | on Faroe-Iceland ridge | in IIA within Faroe area jurisdiction | UK (E/W/NI) | UK (Scotland) | UK | French ² | | Greenland ² | Russia ² |
| 1986 | 34595 | | | | | | | | | | | 34595 |
| 1987 | 21391 | | | | | | | | | | | 21391 |
| 1988 | 22467 | | | | | 715 | | | | | | 23182 |
| 1989 | 20827 | | | | | 1229 | | | | 12 | | 22068 |
| 1990 | 12380 | | | | | 1090 - | | | 205 | 17 | | 13487 |
| 1991 | 8309 | | | | | 351 - | | | 90 | | | 8750 |
| 1992 | 6066 | | | | | 154 + | | | 176 | | | 6396 |
| 1993 | 5988 | | | | | | | 1 | 118 | | | 6107 |
| 1994 | 8818 | | | | | | | 1 | 227 | | | 9046 |
| 1995 | 19164 | 3330 ³ | | | | - | | | 551 | | | 23045 |
| 1996 | 40040 | | | | | - | | | 382 | | | 40422 |
| 1997 | 34027 | | | | | - | | | 277 | | | 34304 |
| 1998 | 23740 | | | | | - | | | 265 | | | 24005 |
| 1999 | 19696 | | | | | - | | | 210 | | | 18306 |
| 2000 | 395 | 21793 ¹ | | | | -1600 | | | 245 | | | 21033 |
| 2001 | 30361 | | -1766 | | | -1400 | | | 288 | | | 28183 |
| 2002 | 41248 | | -2409 | | | -700 | | | 218 - | | | 38457 |
| 2003 | 30742 | | -1795 | | | -4700 | | | 254 - | | | 24501 |
| 2004 | 17975 | | -1041 | | | -4000 | | | 244 - | | | 13178 |
| 2005 | 13781 | | -804 | | | -4200 | | | 1129 - | | | 9906 |
| 2006 | 11692 | | -690 | | | -800 | | | 278 | | | 10480 |
| 2007 | 10345 | | -588 | | | -1800 | | | 53 | | 6 | 8016 |
| 2008 | 9818 | | -557 | | | -1828 | | | 32 | | | 7465 |
| 2009 | 11058 | | -637 | | | -487 | | | 38 | | 26 | 10002 |
| 2010 | 14201 | | -823 | | | -680 | | | 54 | | 4.812 | 12757 |
| 2011 | 11497 ¹ | | -682 | | | -918 | | | | | 3.297 | 9901 |

¹ Preliminary,

² Reported to Faroese Coastal Guard, ³ expected misreporting/discard.

Table 4.4.1.3

Faroe Plateau cod (Subdivision Vb₁). Summary of the stock assessment.

| Year | Recruitment Age 2 thousands | SSB tonnes | Landings tonnes | Mean F Ages 3–7 |
|---------|-----------------------------------|---------------|--------------------|--------------------|
| 1961 | 12019 | 46439 | 21598 | 0.606 |
| 1962 | 20654 | 43326 | 20967 | 0.523 |
| 1963 | 20290 | 49054 | 22215 | 0.494 |
| 1964 | 21834 | 55362 | 21078 | 0.502 |
| 1965 | 8269 | 57057 | 24212 | 0.491 |
| 1966 | 18566 | 60629 | 20418 | 0.474 |
| 1967 | 23451 | 73934 | 23562 | 0.390 |
| 1968 | 17582 | 82484 | 29930 | 0.464 |
| 1969 | 9325 | 83487 | 32371 | 0.438 |
| 1970 | 8608 | 82035 | 24183 | 0.389 |
| 1971 | 11928 | 63308 | 23010 | 0.353 |
| 1972 | 21320 | 57180 | 18727 | 0.336 |
| 1973 | 12573 | 83547 | 22228 | 0.289 |
| 1974 | 30480 | 98434 | 24581 | 0.314 |
| 1975 | 38319 | 109565 | 36775 | 0.395 |
| 1976 | 18575 | 123077 | 39799 | 0.475 |
| 1977 | 9995 | 112057 | 34927 | 0.676 |
| 1978 | 10748 | 78497 | 26585 | 0.426 |
| 1979 | 14997 | 66722 | 23112 | 0.427 |
| 1980 | 23582 | 58886 | 20513 | 0.395 |
| 1981 | 14000 | 63560 | 22963 | 0.465 |
| 1982 | 22127 | 67031 | 21489 | 0.414 |
| 1983 | 25157 | 78539 | 38133 | 0.706 |
| 1984 | 47754 | 96760 | 36979 | 0.508 |
| 1985 | 17313 | 84766 | 39484 | 0.702 |
| 1986 | 9501 | 73661 | 34595 | 0.670 |
| 1987 | 9895 | 62189 | 21391 | 0.446 |
| 1988 | 8691 | 52049 | 23182 | 0.609 |
| 1989 | 16222 | 38300 | 22068 | 0.800 |
| 1990 | 3651 | 29188 | 13487 | 0.659 |
| 1991 | 6665 | 21213 | 8750 | 0.512 |
| 1992 | 11403 | 20953 | 6396 | 0.456 |
| 1993 | 10113 | 33353 | 6107 | 0.236 |
| 1994 | 25171 | 42794 | 9046 | 0.185 |
| 1995 | 42610 | 54578 | 23045 | 0.320 |
| 1996 | 12865 | 85401 | 40422 | 0.700 |
| 1997 | 6455 | 81372 | 34304 | 0.766 |
| 1998 | 5927 | 55667 | 24005 | 0.586 |
| 1999 | 14356 | 44879 | 18306 | 0.526 |
| 2000 | 19723 | 46031 | 21033 | 0.362 |
| 2001 | 29695 | 58926 | 28183 | 0.431 |
| 2002 | 13262 | 55918 | 38457 | 0.820 |
| 2003 | 6254 | 40488 | 24501 | 0.722 |
| 2004 | 3652 | 27144 | 13178 | 0.662 |
| 2005 | 6102 | 23616 | 9906 | 0.542 |
| 2006 | 7706 | 21054 | 10480 | 0.613 |
| 2007 | 5207 | 17549 | 8016 | 0.483 |
| 2008 | 7117 | 20792 | 7465 | 0.434 |
| 2009 | 9801 | 20412 | 10002 | 0.499 |
| 2010 | 15453 | 24065 | 12757 | 0.590 |
| 2011 | 4400 | 23813 | 9901 | 0.432 |
| 2012* | 3651 | 25829 | | |
| Average | 15293 | 57249 | 22526 | 0.5040 |

*1990 value.