# ICES ADVICE 2012

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Books 1 – 10

# Report of the ICES Advisory Committee 2012

# Book 2
# Iceland and East Greenland

International Council for the Exploration of the Sea

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**BOOK 2**

**Section** **Page**

# 2 ICELAND AND EAST GREENLAND

## 2.1 Ecosystem overview

This Section has not been updated in 2012. The most recent ecosystem overview is available in ICES Advisory Report 2008, Section 2.1. This overview can also be found on the ICES website: http://www.ices.dk/advice/icesadvice.asp.

### 2.2 Fishery effects on benthos and fish communities

This Section has not been updated in 2012. The most recent description on Fishery effects on benthos and fish communities is available in ICES Advisory Report 2008, Section 2.2. This description can also be found on the ICES website: http://www.ices.dk/advice/icesadvice.asp.

### 2.3 Assessments and Advice

#### 2.3.1 Assessment and advice regarding protection of biota and habitats

In 2011, ICES has not provided advice regarding protection of biota and habitats for this area.

#### 2.3.2 Assessments and Advice regarding fisheries

**Mixed fisheries and fisheries interactions**

This Section has not been updated in 2012. The most recent description on mixed fisheries and fisheries interactions is available in ICES Advisory Report 2008, Section 2.3. This description can also be found on the ICES website: http://www.ices.dk/advice/icesadvice.asp.

**Table 2.3.2.1** State of the stock and advice in the Iceland and East Greenland ecoregion.

### Single-stock exploitation boundaries and critical stocks

The state and advice of the individual stocks are presented in the stock sections. The state of stocks and advice (according to the Section 1.2) are summarized in the table below.

| **Stock** | **State of the stock** | | | | **Outlook options** | | | **ICES advice for 2012** (in tonnes or effort) |
|---|---|---|---|---|---|---|---|---|
| | **Fishing mortality in relation to $F_{MSY}$** | **Fishing mortality in relation to precautionary approach ($F_{PA}/F_{lim}$)** | **Spawning biomass in relation to MSY $B_{trigger}$** | **Spawning biomass in relation to precautionary approach ($B_{PA}/B_{lim}$)** | **MSY approach** (within the precautionary appraoch) | **Precautionary approach / considerations** | **Management plan** | |
| Inshore cod in NAFO Subarea 1 (Greenland cod) | Unknown ? | Unknown ? | Qualitative evaluation: Increasing | | - | Catches should not increase beyond 8000 t on basis of average catches over the last 10 years | - | Precautionary approach: Catches should not increase beyond 8000 t on basis of average catches over the last 10 years |
| Offshore cod in ICES Subarea XIV and NAFO Subarea 1 (Greenland cod) | Unknown ? | Unknown ? | Qualitative evaluation: Local high densities | | - | No offshore fishery should take place in 2013 | - | Precautionary considerations: No offshore fishery should take place in 2013 |
| Icelandic cod | Appropriate | Harvested sustainably | Above trigger | Full reproductive capacity | - | - | Landings in the fishing year 2011/2012 should be no more than 196 000 t. | Management plan: landings in the fishing year 2011/2012 should be no more than 196 000 t. |
| Icelandic haddock | Undefined ? | Harvested unsustainably | Undefined ? | Full reproductive capacity | - | Catches in 2013 should be no more than 32 000 t | - | Precautionary approach: Catches in 2013 should be no more than 32 000 t |
| Icelandic saithe | Appropriate | Undefined ? | Above target | Full reproductive capacity | Catches in 2013 should be no more than 49 000 t | - | - | MSY approach: catches in 2013 should be no more than 49 000 t |
| Greenland halibut | Above target | Undefined ? | Qualitative evaluation: Above possible reference points | | - | Landings in 2013 should be no more than 20 000 t | - | MSY approach: Landings in 2013 should be no more than 20 000 t |
| Golden redfish *Sebastes marinus* | Unknown ? | Unknown ? | Undefined ? | Full reproductive capacity | - | Catches should be no more than 40 000 t | - | Precautionary considerations: that catches should be no more than 40 000 t |

| **Stock** | **State of the stock** | | | | **Outlook options** | | | **ICES advice for 2012** (in tonnes or effort) |
|---|---|---|---|---|---|---|---|---|
| | **Fishing mortality in relation to $F_{MSY}$** | **Fishing mortality in relation to precautionary approach ($F_{PA}/F_{lim}$)** | **Spawning biomass in relation to MSY $B_{trigger}$** | **Spawning biomass in relation to precautionary approach ($B_{PA}/B_{lim}$)** | **MSY approach** (within the precautionary appraoch) | **Precautionary approach / considerations** | **Management plan** | |
| Beaked redfish Sebastes mentella (Icelandic slope stock) | Unknown ? | Unknown ? | Qualitative evaluation: → Without trend | | - | ICES advises that catches are set no higher than 10 000 t as a starting point for the adaptive part of the management plan. | - | Precautionary approach: ICES advises that catches are set no higher than 10 000 t as a starting point for the adaptive part of the management plan. |
| Beaked redfish Sebastes mentella (Shallow pelagic stock) | Unknown ? | Unknown ? | Qualitative evaluation: ✗ Stable at very low | | - | No directed fishery should be conducted and bycatch of this stock in non-directed fisheries should be kept as low as possible | - | Precautionary considerations: that no directed fishery should be conducted and bycatch of this stock in non-directed fisheries should be kept as low as possible |
| Beaked redfish *Sebastes mentella* (Deep pelagic stock) | Unknown ? | Unknown ? | Qualitative evaluation: → Stable | | - | Catches should be reduced to less than 20 000 t and a management plan should be developed and implemented | - | Precautionary considerations: Catches should be reduced to less than 20 000 t and a management plan should be developed and implemented |
| Beaked Redfish *(Sebastes mentella)* in Subarea XIVb (Demersal) | Unknown ? | Unknown ? | Qualitative evaluation: ↘ Declining | | - | Catches should be reduced from the current level to no more than 3500 t | - | Precautionary approach: catches should be reduced from the current level to no more than 3500 t 1000 t |
| Icelandic Capelin | Undefined ? | Undefined ? | Qualitative evaluation: → Stable above average | | - | No fishery until new information on stock size becomes available that proves SSB to be above the escapement threshold | - | Precautionary considerations: No fishery until new information on stock size becomes available that proves SSB to be above the escapement threshold |
| Icelandic summer-spawning herring | Appropriate ✓ | Harvested sustainably ✓ | Above trigger ✓ | Full reproductive capacity ✓ | Catches in 2012/2013 should be no more than 67 000 t | - | - | MSY approach: Catches in 2012/2013 should be no more than 67 000 t |

**Table 2.3.2.2** Summary of the stock categories in the Iceland and East Greenland ecoregion (see section 1.2 for category definitions).

| | |
|---|---|
| Total Number of stock in the ecoregion | 12 |
| Data rich stocks | 5 |
| Data-limited stocks | 7 |

**Table 2.3.2.3** Status of data rich stocks (n=5) for the Iceland and East Greenland ecoregion relative to MSY and PA reference points for Fishing Mortality (F) and Spawning Stock Biomass (SSB). Table shows percentage of stocks per stock status. Values in brackets denote the number of data rich stocks per stock status.

| | | Spawning Stock Biomass… | | | |
|---|---|---|---|---|---|
| | | is at or above MSY $B_{trigger}$ $SSB_{2012} \geq$ MSY $B_{trigger}$ | is below MSY $B_{trigger}$ $SSB_{2012} <$ MSY $B_{trigger}$ | | is not defined |
| **MSY Approach** | **Fishing Mortality…** | ✓ | ✗ | | ? |
| | is at or below MSY ($F_{2011} \leq F_{MSY}$) ✓ | 60% (3) | - | | - |
| | is above MSY ($F_{2011} > F_{MSY}$) ✗ | 20% (1) | - | | - |
| | is not defined ? | - | - | | 20% (1) |
| | | is at or above PA $SSB_{2012} \geq B_{pa}$ | is at increased risk $B_{pa} > SSB_{2012} > B_{lim}$ | is below limit $SSB_{2012} < B_{lim}$ | is not defined |
| **Precautionary Approach** | **Fishing Mortality…** | ✓ | ○ | ✗ | ? |
| | is at or below PA ($F_{2011} \leq F_{pa}$) ✓ | 40% (2) | - | - | - |
| | is at increased risk ($F_{lim} > F > F_{pa}$) ○ | - | - | - | - |
| | is above PA ($F_{2011} > F_{pa}$) ✗ | 20% (1) | - | - | - |
| | is not defined ? | 40% (2) | - | - | - |

The advice for ling, blue ling, tusk, and argentines appear in 2012 in Volume 9 on widely distributed and migratory stocks. This advice is issued only every second year.

## ECOREGION East and West Greenland
## SUBJECT Request from Greenland on cod stocks in Greenlandic waters

**Advice summary**

ICES recommends that separate assessments and advice for i) the offshore cod stocks in Greenland and for ii) inshore fjord stocks of cod in West Greenland be provided in the future, based on information that suggests isolated reproductive populations in the fjords and separate populations on the banks. ICES is currently not able to estimate or provide guidelines for biological reference points for the two stock complexes due to lack of information.

**Request**

Greenland has requested ICES to:

1. *ICES is requested to estimate or to provide guidelines for estimation of reference points for cod in ICES Subarea XIV and NAFO Subarea 1 (Greenlandic cod) including limit reference points or other estimates that are presently used to distinguish between a zero advice and an advice of reopening the fisheries.*
2. *ICES is requested to provide separate advice for the offshore stocks in ICES Subarea XIV and NAFO Subarea 1, and for the inshore fjord stocks in NAFO Subarea 1.*

Background

*Ad 1. For Cod in ICES Subarea XIV and NAFO Subarea 1 (Greenlandic cod) ICES has in the past 20 years advised that no fishery or similar should take place based on the ceased fishery since the early 1990s and low stock and recruitment indices from surveys. With the implementation of the Precautionary Approach in the 1990s and recently the MSY framework in the ICES advisory system, various justifications have formed the basis for principally the same advice, namely zero catch. In the recent decade a number of strong year-classes of cod have been observed in Greenland waters, and these year-classes have to some extent resulted in an increase in adult biomass, although not in the expected increase. Despite these optimistic stock trends, ICES has kept its zero catch advice. The Greenland fishing industry and the Government of Greenland both have difficulties in interpreting the basis for the advice and also in understanding the necessary criteria that could allow for an opening of the fishery.*

*Ad 2. The cod stocks in the West Greenland fjords have supported an increasing fishery over the recent decades and the stock dynamics for the components seem to deviate from the offshore cod stock dynamic. Greenland authorities therefore aim at a separate management of the inshore fjord populations and therefore request separate assessment and advice commonly for the inshore cod. This request is further based on an assumption that the inshore cod constitute biological reproductive units. Similarly the offshore cod is expected to be comprised of reproductive units on the banks of West Greenland and East Greenland when the stocks have been rebuilt.*

**Basis of advice**

Results and conclusions

Ad 1.

Calculation of reference points for these cod stocks was attempted during the workshop on reference points based on life history traits (WKLIFE) in February 2012 (ICES, 2012a). Several difficulties, including the inability to identify an appropriate period representative for the present biological regime, and also scarce survey and catch data, have prevented calculation of reference points for both the offshore bank stock and for the inshore fjord stocks. Therefore, ICES is presently not in a position to define reference points or to suggest candidates for reference points.

For the offshore stocks the management objective has been defined as the establishment of spawning populations on the banks, both in East and West Greenland, and subsequent robust recruitment to ensure the maintenance of the population. Since this is not assessed to be the case yet and is not foreseen to happen in the next few years, the requirement for biological reference points for the offshore stock is not immediate.

Ad 2.

Several studies on stock entity and dynamics of the Greenland cod stocks have been conducted in the past.

Historical and present recent tagging studies have shown that there is relative clear separation between fjord and bank cod in the spawning stage, north of 61°N on the west coast, but some mixing occurs at younger ages in the coastal area (Storr-Paulsen *et al.*, 2004; Hovgård and Christensen, 1990; Hansen, 1949; ICES, 2012c).

Preliminary genetics investigations had sufficient power to distinguish spawning populations (ICES, 2012d). It was found that cod spawning in inshore areas was more similar to other inshore locations than to offshore samples in West Greenland, which suggests the presence of distinct inshore and offshore genetic components with limited connectivity. This supports a previous genetic study which addresses the same issue (Pampoulie *et al.*, 2011).

Life history traits show a difference in maturity between inshore and offshore spawning cod where 50% maturity was found at approx. 60 cm and ages 5–6 for offshore spawning cod, whereas it was approx. 45 cm and ages 4–5 for the inshore spawning cod (ICES, 2008b). The comparisons where made between inshore spawning cod in West Greenland and offshore spawning cod in East Greenland as no significant data is available for the offshore spawning cod in West Greenland.

An analysis of the Fulton condition factor in the commercial catch information indicated substantial differences in the Fulton condition factor between various areas. The overall pattern was that offshore condition was significantly lower than inshore condition and that inshore condition increased when moving north along the coast of West Greenland (ICES, 2008b).

The fisheries are clearly separated between the fjords and the banks. In recent years, though, virtually no offshore fishery has been conducted, while the fjord fishery has increased to about 10 000 t.

Based on this information ICES considers it justified to assess the Greenlandic inshore cod stock separately from the offshore cod stock. Further work should however be done to further clarify the degree of connectivity between the stock components.

**Sources**


Hansen, P. M. 1949. Studies on the biology of the cod in Greenland waters. Rapports et Procés-Verbaux des Réunions, 123: 1–77.

Hovgård, H., and Christensen, S. 1990. Population structure and migration patterns of Atlantic cod at West Greenland waters based on tagging experiments from 1946 to 1964. NAFO Scientific Council Studies, 14: 45–50.

ICES. 2008a. Cod stocks in the Greenland area (NAFO Area 1 and ICES Subdivision XIVb). *In* Report of the North-Western Working Group (NWWG).

ICES. 2008b. Greenland survey results and commercial data for Atlantic cod in Greenland inshore and offshore waters for 2006 and 2007, by H. Hovgård and A. Retzel. North-Western Working Group (NWWG) WD 19.

ICES. 2012a. Report of the Workshop on the Development of Assessments based on Life History Traits and Exploitation Characteristics (WKLIFE). ICES CM 2012/ACOM:36.

ICES. 2012b. Cod stocks in the Greenland area (NAFO Area 1 and ICES Subdivision XIVb). *In* Report of the North-Western Working Group (NWWG), 26 April–3 May 2012, Copenhagen, Denmark. ICES CM 2012/ACOM:07.

ICES. 2012c. A short review of available mark-recapture studies on Atlantic cod (*Gadus morhua*) in Greenland with the objective to separate in- and offshore components, by R. Hedeholm, A. Retzel, and J. Boje. North-Western Working Group (NWWG) WD 12.

ICES. 2012d. Genetic differentiation in Atlantic cod (*Gadus morhua*) in Greenland – preliminary results, by R. Hedeholm, A. Retzel, and N. O. Therkildsen. North-Western Working Group (NWWG) WD 13.

Pampoulie, C., Daníelsdóttir, A. K., Storr-Paulsen, M., Hovgård, H., Hjörleifsson, E., and Steinarsson, B. Æ. 2011. Neutral and Nonneutral Genetic Markers Revealed the Presence of Inshore and Offshore Stock Components of Atlantic Cod in Greenland Waters. Transactions of the American Fisheries Society, 140(2): 307–319.

Storr-Paulsen, M., Wieland, K., Hovgård, H., and Rätz, H-J. 2004. Stock structure of Atlantic cod (*Gadus morhua*) in West Greenland waters: implications of transport and migration. ICES Journal of Marine Science. 61: 972–982.

**ECOREGION** Iceland and East Greenland
**STOCK** Offshore cod in ICES Subarea XIV and NAFO Subarea 1 (Greenland cod)

### Advice for 2013

ICES advises on the basis of precautionary considerations that no offshore fishery should take place in 2013, to improve the likelihood of establishing offshore spawning stocks in West and East Greenland.

### Stock status

| F (Fishing Mortality) | | |
|---|---|---|
| | 2009-2011 | |
| **MSY ($F_{MSY}$)** | ? | Unknown |
| **Precautionary approach ($F_{pa}$,$F_{lim}$)** | ? | Unknown |
| **SSB (Spawning-Stock Biomass)** | | |
| | 2009-2011 | |
| **MSY ($B_{trigger}$)** | ? | Unknown |
| **Precautionary approach ($B_{pa}$,$B_{lim}$)** | ? | Unknown |
| **Qualitative evaluation** | → | Local high densities |

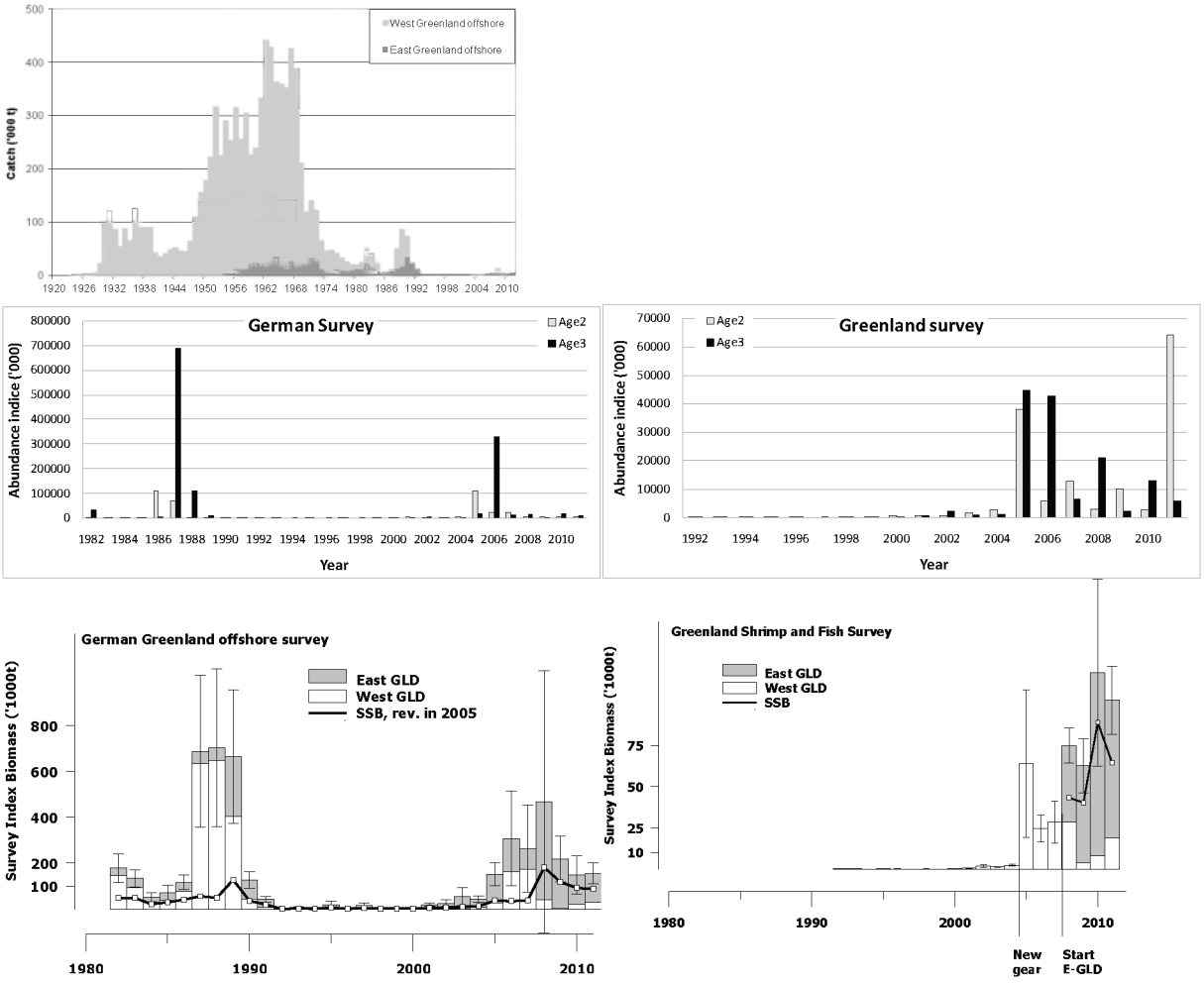



**Figure 2.4.1a.1** Offshore cod in ICES Subarea XIV and NAFO Subarea 1 (Greenland cod). Upper left: landings. Middle panels: offshore recruitment indices West Greenland (ages 2 and 3, Greenland survey) and offshore recruitment indices East and West Greenland combined (ages 2 and 3, German survey). Lower panels: biomass indices from German (left) and Greenland surveys (right).

All information indicates that the offshore cod biomass is low compared to before the 1990s. The offshore component has been severely depleted since 1990, but has started to recover since 2005.

**Management plans**

In 2011 a management plan was agreed for the offshore cod stocks. The overall objective is to rebuild the stock and the following objectives are defined:

- Establishment of offshore spawning population in both West and East Greenland;
- Stable recruitment from this spawning population as an indicator of a stable/robust condition of the spawning population.

Overall strategy to fulfil the objective:

- ICES advice must be followed.

Initiative to fulfil these objectives:

- Yearly scientific surveys in order to monitor the spawning population and recruitment;
- Biological sampling from any experimental fishery;
- Increased logbook requirements for any experimental fishery.

The management plan has not been evaluated by ICES.

**Biology**

Cod in Greenland derives from three stock components, labeled by their spawning areas: I) an offshore Greenland spawning stock, II) spawning populations of inshore West Greenland fiords, and III) Icelandic spawned cod that drift to Greenland as larvae in the Irminger Current. Especially the Icelandic inputs are believed to have been responsible for the previous large year classes in Greenland (i.e. 1984 and 2003). A proportion of these cod return to Iceland when reaching maturity.

**Environmental influence on the stock**

Deterioration of the environmental conditions, combined with high fishing mortality, caused the offshore cod stock to be severely depleted in the 1970s. However, recent warming and documented offshore spawning, especially in East Greenland waters, indicate that environmental conditions have changed around Greenland, and continued warming can be expected. Environmental conditions may continue to lead to enhanced productivity of cod.

**The fisheries**

In 2011 90% of the landings were taken in East Greenland. Cod is taken in a targeted trawl fishery and to a lesser extent by longliners. Bycatches of juvenile cod occur mainly in the shrimp fishery. Before the introduction of the sorting grid in 2002, a large amount of juvenile cod may have been caught in the shrimp fishery, but the present bycatches are estimated to be insignificant.

| | |
|---|---|
| **Catch distribution** | Total catch (2011) is 5129 kt, where 97% are landings (79% trawl, 21% long-line), 0% discards, 3% industrial bycatch, and 0% unaccounted removals. |

**Quality considerations**

Both surveys in the area are considered adequate as a biomass indicator for cod. The Greenland shrimp and fish survey time-series is, however, short as East Greenland was first covered from 2008, and the German autumn groundfish survey has in recent years had incomplete coverage. In recent years the quality and quantity of sampling from the industry has improved greatly in compliance with the license agreement.

**Scientific basis**

| | |
|---|---|
| **Assessment type** | Qualitative stock trends. |
| **Input data** | Two survey indices: Greenland fish and shrimp survey, German groundfish survey. |
| **Discards and bycatch** | Not available, but not considered relevant. |
| **Indicators** | None. |
| **Other information** | None. |
| **Working group report** | NWWG |

# ECOREGION Iceland and East Greenland
# STOCK Offshore cod in ICES Subarea XIV and NAFO Subarea 1 (Greenland cod)

**Reference points**

No reference points are defined for this stock. In 2012 Greenland requested ICES to estimate or to provide guidelines for the estimation of reference points for this stock, but ICES has not been able to provide this at present (see Section 2.3.3.1).

**Outlook for 2013**

No analytical assessment is available for this stock because of the lack of a time-series of landings since 1993. Therefore, fishing possibilities cannot be projected.

***Precautionary considerations***

ICES advices that no fishery should take place in 2013 to allow for rebuilding of the offshore spawning stocks in West and East Greenland in accordance with the management plan. Though the stock has been slightly increasing in recent years, it is still far below any possible biomass reference points.

**Additional considerations**

No offshore fisheries have taken place over a period of 13 years (1993–2004). An offshore cod directed fishery commenced in 2005. Offshore catches peaked in 2008 with annual catches of 13 000 t. Since 2008 offshore catches have declined due to area closure and emigration of the 2003 year class. Surveys indicate a large 2003 year class, the first significant year class since 1985. In 2011 the 2009 year class was recorded in the Greenland shrimp and fish survey in West Greenland in considerable numbers (Figure 2.4.1a.1). The German groundfish survey did not record this year class in as high numbers since it was found north of 66°N, and the German survey in West Greenland stopped at 64°N in 2011.

*Management considerations*

To ensure the survival of the relatively abundant 2009 year class presently observed in Greenland waters and to build the biomass and age composition, no offshore fishery should take place in 2013.

A redfish fishery in East Greenland has been developing in recent years and the fishery takes place in regions of cod spawning aggregations. Measures should be implemented to minimize the bycatch of cod.

In the last century, migration of adult cod from Greenland to Icelandic waters is indicated by results from tagging returns and catch-at-age anomalies. The high abundance of larvae in East Greenland waters in years with high recruitments in Iceland indicate that some of these year classes originate from spawning in Iceland. Based on catch-at-age data anomalies attempts have been made to estimate the extent of the migration in the historical part of the assessment. Tag returns and survey estimates in Greenlandic waters as well as anomalies in the catch-at-age matrix in Iceland, indicate that a portion of the moderate 2003 year class observed in Greenlandic waters in recent years may have migrated to Icelandic waters in 2009. No sustainable offshore cod fishery at Greenland can presently be based on the infrequent inflow of cod from Iceland waters.

*Regulations and their effects*

Regulations in the offshore fisheries include quota constraints, closed areas, minimum mesh size, and minimum landing size (40 cm). Greenland has set an offshore cod TAC of 5000 t in 2012 as a limited fishery in order to provide information. In East Greenland east of 44°W, fishing is only allowed from 1 July–31 December, and the "Kleine Bank" area in East Greenland is closed for all fisheries. This area is delimited by: 1) 64°40'N 37°30'W, 2) 64°40'N 36°30'W, 3) 64°15'N 36°30'W, and 4) 64°15'N 37°30'W.

*Comparison with previous assessment and advice*

The assessment and advice are the same as in previous years.

**Sources**

Horsted, S. A. 1994. A review with some proposals for amendments of the catch statistics for the cod fisheries in Greenland waters since 1911. NAFO SCR Doc., No. 38, Serial No. N2407. 33 pp. (mimeo).

Horsted, S. A. 2000. A review of the cod fisheries at Greenland, 1910–1995. Journal of Northwest Atlantic Fishery Science, 28: 1–112.

ICES. 2012. Report of the North-Western Working Group, 26 April–3 May 2012. ICES CM 2012/ACOM:07.

**Table 2.4.1a.1** Offshore cod in ICES Subarea XIV (Greenland cod). ICES advice, management, and catches.

| Year | ICES advice for Subarea XIV[1] | Pred. catch corresp. to advice | TAC | | | Catch | | |
|---|---|---|---|---|---|---|---|---|
| | | | East | West | Total | East | West | Total |
| 1987 | TAC | 5 | 11.5 | 12.5 | | 7 | 4 | 11 |
| 1988 | No increase in F | 10[2] | 11.5 | 53 | | 12 | 37 | 49 |
| 1989 | TAC | 5 | 15 | 90 | | 15 | 70 | 85 |
| 1990 | No specific recommendation | - | 15 | 110 | 125 | 34 | 40 | 74 |
| 1991 | No advice | - | 25 | 90 | 115 | 22 | 2 | 24 |
| 1992 | No advice | - | 17.25 | 66 | 99.25 | 11 | <1 | 11 |
| 1993 | No fishing | 0 | 17.25 | 66 | 83.25 | 1 | 0 | 1 |
| 1994 | No fishing on offshore stock complex | 0 | 17.25 | 66 | 83.25 | < 1 | 0 | <1 |
| 1995 | No fishing on offshore stock complex | 0 | 17.25 | 66 | 83.25 | < 1 | 0 | <1 |
| 1996 | No fishing on offshore stock complex | 0 | 17.25 | 66 | 83.25 | < 1 | 0 | <1 |
| 1997 | No fishing on offshore stock complex | 0 | 17.25 | 66 | 83.25 | < 1 | 0 | <1 |
| 1998 | No fishing on offshore stock complex | 0 | 17.25 | 66 | 83.25 | < 1 | 0 | <1 |
| 1999 | No fishing on offshore stock complex | 0 | 17.25 | 66 | 83.25 | < 1 | 0 | <1 |
| 2000 | No commercial fishing | 0 | 17.25 | 66 | 83.25 | < 1 | 0 | <1 |
| 2001 | No commercial fishing | 0 | 17.25 | 66 | 83.25[3] | < 1 | 0 | <1 |
| 2002 | No commercial fishing | 0 | | | 54.25[3] | <1 | 0 | <1 |
| 2003 | No commercial fishing | 0 | | | 54.25[3] | <1 | <1 | <1 |
| 2004 | No commercial fishing | 0 | | | 5 | <1 | <1 | <1 |
| 2005 | No fishing | 0 | | | 5 | <1 | <1 | 1 |
| 2006 | No fishing | 0 | | | 5 | 2 | <1 | 2 |
| 2007 | No fishing | 0 | | | 5 | 3 | 2 | 5 |
| 2008 | No fishing | 0 | | | 15 | 3 | 10 | 13 |
| 2009 | No fishing | 0 | | | 10 | 2 | 3 | 5 |
| 2010 | No fishing | 0 | | | 5 | 2 | <1 | 2 |
| 2011 | No fishing | 0 | | | 5 | 5 | <1 | 5 |
| 2012 | No fishing | 0 | | | 5 | | | |
| 2013 | No fishing | 0 | | | | | | |

Weights in thousand tonnes.

[1]Advice for NAFO Subarea 1 provided by NAFO Scientific Council.

[2]Preliminary catch corresponding to advice.

[3]Since 2001 the agreed TAC has been based on a variable system accounting for the actual stock status and more flexibility between East and West Greenland. The given TAC figures represent the maximum levels that could be taken in case of stock recovery only.

Previously assessed together with the inshore cod (Cod in ICES Subarea XIV and NAFO Subarea 1 (Greenland cod)).

**Table 2.4.1a.2** German survey, catch curve analysis. Year-class mortalities at ages 4–8 estimated from German survey catch-at-age data. No values for year classes 1986–1997 due to many zeros in the catch-at-age data. Yellow highlights strong year classes.

| YC | Z (4–8) | R2 | Ages in analysis |
|---|---|---|---|
| 1982 | 1.04 | 0.68 | no 7-year-olds |
| 1983 | 1.46 | 0.95 | |
| 1984 | 1.57 | 0.96 | no 8-year-olds |
| 1985 | 2.42 | 0.95 | no 8-year-olds |
| 1986 | | | |
| 1987 | | | |
| 1988 | | | |
| 1989 | | | |
| 1990 | | | |
| 1991 | | | |
| 1992 | | | |
| 1993 | | | |
| 1994 | | | |
| 1995 | | | |
| 1996 | | | |
| 1997 | | | |
| 1998 | 0.41 | 0.52 | |
| 1999 | 0.32 | 0.59 | |
| 2000 | 0.13 | 0.08 | |
| 2001 | 0.43 | 0.46 | |
| 2002 | 0.55 | 0.81 | |
| 2003 | 0.85 | 0.97 | |

**Table 2.4.1a.3** Cod off Greenland (inshore and offshore components). Catches (t) as used by the Working Group, inshore total and offshore divided into East and West Greenland, and total. Data until 1995 are based on Horsted (1994, 2000). * indicates preliminary results.

| Cod | | Offshore | | | Total |
|---|---|---|---|---|---|
| Year | Total inshore | East | West | Total offshore | Greenland |
| 1924 | 843 | | 200 | 200 | 1043 |
| 1925 | 1024 | | 1871 | 1871 | 2895 |
| 1926 | 2224 | | 4452 | 4452 | 6676 |
| 1927 | 3570 | | 4427 | 4427 | 7997 |
| 1928 | 4163 | | 5871 | 5871 | 10034 |
| 1929 | 7080 | | 22304 | 22304 | 29384 |
| 1930 | 9658 | | 94722 | 94722 | 104380 |
| 1931 | 9054 | | 120858 | 120858 | 129912 |
| 1932 | 9232 | | 87273 | 87273 | 96505 |
| 1933 | 8238 | | 54351 | 54351 | 62589 |
| 1934 | 9468 | | 88122 | 88122 | 97590 |
| 1935 | 7526 | | 65846 | 65846 | 73372 |
| 1936 | 7174 | | 125972 | 125972 | 133146 |
| 1937 | 6961 | | 90296 | 90296 | 97257 |
| 1938 | 5492 | | 90042 | 90042 | 95534 |
| 1939 | 7161 | | 89807 | 89807 | 96968 |
| 1940 | 8026 | | 43122 | 43122 | 51148 |
| 1941 | 8622 | | 35000 | 35000 | 43622 |
| 1942 | 12027 | | 40814 | 40814 | 52841 |
| 1943 | 13026 | | 47400 | 47400 | 60426 |
| 1944 | 13385 | | 51627 | 51627 | 65012 |
| 1945 | 14289 | | 45800 | 45800 | 60089 |
| 1946 | 15262 | | 44395 | 44395 | 59657 |
| 1947 | 18029 | | 63458 | 63458 | 81487 |
| 1948 | 18675 | | 109058 | 109058 | 127733 |
| 1949 | 17050 | | 156015 | 156015 | 173065 |
| 1950 | 21173 | | 179398 | 179398 | 200571 |
| 1951 | 18200 | | 222340 | 222340 | 240540 |
| 1952 | 16726 | | 317545 | 317545 | 334271 |
| 1953 | 22651 | | 225017 | 225017 | 247668 |
| 1954 | 18698 | 4321 | 286120 | 290441 | 309139 |
| 1955 | 19787 | 5135 | 247931 | 253066 | 272853 |
| 1956 | 21028 | 12887 | 302617 | 315504 | 336532 |
| 1957 | 24593 | 10453 | 246042 | 256495 | 281088 |
| 1958 | 25802 | 10915 | 294119 | 305034 | 330836 |
| 1959 | 27577 | 19178 | 207665 | 226843 | 254420 |
| 1960 | 27099 | 23914 | 215737 | 239651 | 266750 |
| 1961 | 33965 | 19690 | 313626 | 333316 | 367281 |
| 1962 | 35380 | 17315 | 425278 | 442593 | 477973 |
| 1963 | 23269 | 23057 | 405441 | 428498 | 451767 |
| 1964 | 21986 | 35577 | 327752 | 363329 | 385315 |
| 1965 | 24322 | 17497 | 342395 | 359892 | 384214 |
| 1966 | 29076 | 12870 | 339130 | 352000 | 381076 |
| 1967 | 27524 | 24732 | 401955 | 426687 | 454211 |
| 1968 | 20587 | 15701 | 373013 | 388714 | 409301 |
| 1969 | 21492 | 17771 | 193163 | 210934 | 232426 |

**Table 2.4.1.3a** *continued* Cod off Greenland (inshore and offshore components). Catches (t) as used by the Working Group, inshore total and offshore divided into East and West Greenland, and total. Data until 1995 are based on Horsted (1994, 2000). * indicates preliminary results.

| Cod | | Offshore | | | Total |
|---|---|---|---|---|---|
| Year | Total inshore | East | West | Total offshore | Greenland |
| 1970 | 15613 | 20907 | 97891 | 118798 | 134411 |
| 1971 | 13506 | 32616 | 107674 | 140290 | 153796 |
| 1972 | 14645 | 26629 | 95974 | 122603 | 137248 |
| 1973 | 9622 | 11752 | 53320 | 65072 | 74694 |
| 1974 | 8638 | 6553 | 39396 | 45949 | 54587 |
| 1975 | 6557 | 5925 | 41352 | 47277 | 53834 |
| 1976 | 5174 | 13027 | 28114 | 41141 | 46315 |
| 1977 | 13999 | 8775 | 23997 | 32772 | 46771 |
| 1978 | 19679 | 7827 | 18852 | 26679 | 46358 |
| 1979 | 35590 | 8974 | 12315 | 21289 | 56879 |
| 1980 | 38571 | 11244 | 8291 | 19535 | 58106 |
| 1981 | 39703 | 10381 | 13753 | 24134 | 63837 |
| 1982 | 26664 | 20929 | 30342 | 51271 | 77935 |
| 1983 | 28652 | 13378 | 27825 | 41203 | 69855 |
| 1984 | 19958 | 8914 | 13458 | 22372 | 42330 |
| 1985 | 8441 | 2112 | 6437 | 8549 | 16990 |
| 1986 | 5302 | 4755 | 1301 | 6056 | 11358 |
| 1987 | 18486 | 6909 | 3937 | 10846 | 29332 |
| 1988 | 18791 | 12457 | 36824 | 49281 | 68072 |
| 1989 | 38529 | 15910 | 70295 | 86205 | 124734 |
| 1990 | 28799 | 33508 | 40162 | 73670 | 102469 |
| 1991 | 18311 | 21596 | 2024 | 23620 | 41931 |
| 1992 | 5723 | 11349 | 4 | 11353 | 17076 |
| 1993 | 1924 | 1135 | 0 | 1135 | 3059 |
| 1994 | 2115 | 437 | 0 | 437 | 2552 |
| 1995 | 1710 | 284 | 0 | 284 | 1994 |
| 1996 | 948 | 192 | 0 | 192 | 1140 |
| 1997 | 1186 | 370 | 0 | 370 | 1556 |
| 1998 | 323 | 346 | 0 | 346 | 669 |
| 1999 | 622 | 112 | 0 | 112 | 734 |
| 2000 | 764 | 100 | 0 | 100 | 864 |
| 2001 | 1680 | 221 | 0 | 221 | 1901 |
| 2002 | 3698* | 448 | 0 | 448 | 4146 |
| 2003 | 5215* | 286 | 7 | 293 | 5508 |
| 2004 | 4948* | 369 | 27 | 396* | 5344 |
| 2005 | 6043 | 773 | 75 | 847* | 6890* |
| 2006 | 7388* | 1981 | 408 | 2389 | 9777* |
| 2007 | 11693 | 3221 | 1620 | 4841 | 16533 |
| 2008 | 12270 | 2997 | 9651 | 12648 | 24918 |
| 2009 | 7672 | 1720 | 3286 | 5006 | 12678 |
| 2010 | 9270 | 2127 | 290 | 2417 | 11687 |
| 2011 | 11007 | 4579 | 550 | 5129 | 16136 |

# ECOREGION Iceland and East Greenland
# STOCK Inshore cod in NAFO Subarea 1 (Greenland cod)

## Advice for 2013

ICES advises, based on the precautionary approach, that catches should not increase beyond 8000 t on basis of average catches over the last 10 years.

## Stock status

| F (Fishing Mortality) | | 2009–2011 |
|---|---|---|
| **MSY ($F_{MSY}$)** | ? | Unknown |
| **Precautionary approach** ($F_{pa}$,$F_{lim}$) | ? | Unknown |

| SSB (Spawning-Stock Biomass) | | 2009–2011 |
|---|---|---|
| **MSY** ($B_{trigger}$) | ? | Unknown |
| **Precautionary approach** ($B_{pa}$,$B_{lim}$) | ? | Unknown |
| **Qualitative evaluation** | ↗ | Increasing |

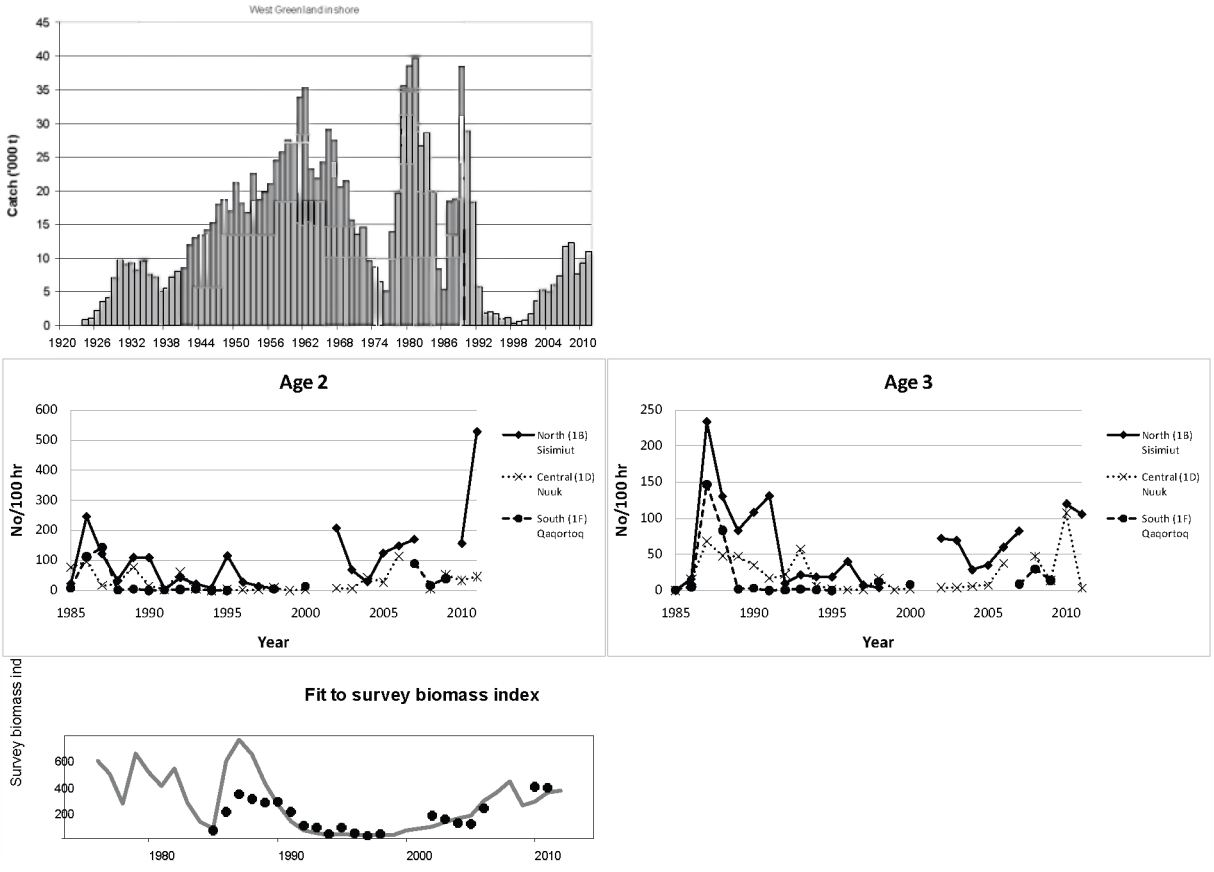



**Figure 2.4.1b.1** Inshore Cod in NAFO Subarea 1 (Greenland cod). Upper left: landings; Middle: inshore recruitment index ages 2 and 3 (West Greenland gillnet survey); Lower: results from the exploratory statistical catch-at-age model, showing the model fit (black line) to the observed survey biomass index.

The recruitment and the biomass of the Greenland inshore cod have been increasing in recent years, and catches have been increasing. Several year classes are seen in the landings and the average size in landings has increased in the past six years. The stock size and exploitation rates are however unknown.

**Management plans**

There is no management plan for the Greenland inshore cod.

**Biology**

In recent years, inshore cod spawning has been documented in numerous fjords, especially on the Greenland west coast. These extend from Kap Farvel (60°N) at the southern tip of Greenland to the Uummannaq area (72°N). Spawning in the Nuuk (64°N) and Sisimiut (68°N) fjord areas is believed to be of particular importance. Recent genetic studies, knowledge on life history traits, and reviewed information on tagging all indicate separation from the offshore stock component. The Greenland Government has requested separate advice for the inshore cod component in 2011 (Section 2.3.3.1).

**Environmental influence on the stock**

Cod in Greenland live close to the distributional limit, which renders the population vulnerable to environmental fluctuations – especially in the northern fjords, where cod spawning is not believed to have been common prior to recent warming. To what extent these effects are direct temperature effects or indirect feeding-related effects is unknown. It is believed that the inshore Greenland cod rely on capelin, at least during the summer period.

**The fisheries**

No trawling is allowed in the inshore area. Inshore cod is primarily targeted by poundnets in the summer months (June–September, ~85% of catches) close to shore in shallow waters, and partly using longlines and gillnets during winter. The dominating poundnet fishery is gentle and fish under the legal size can be released. No other fisheries in the fjord catch cod as bycatch.

| | |
|---|---|
| **Catch distribution** | Total catches (2011) are 11007 t, where 100% landings (80% gear-type poundnet and 20% handlines, longlines, gillnets, and other gear types). 0% discards, 0% industrial bycatch, and 0% unaccounted removals. |

**Quality considerations**

The recruitment gillnet survey has low coverage in some years, but is in most years considered adequate as a measure of recruitment (ages 2 and 3). Overall landings statistics are reliable but the more detailed information, such as fishing effort and precise fishing grounds, is limited (no logbook data prior to 2008) and the quality is questionable. Sampling from the fishery is considered good, covering large parts of the area and season. The quality of these inputs was considered sufficient to allow for exploratory model runs (statistical catch-at-age).

The present survey presently only targets juveniles.

**Scientific basis**

| | |
|---|---|
| **Assessment type** | Qualitative. |
| **Input data** | One survey indices: West Greenland inshore gillnet survey, landings, catch-at-age. |
| **Discards and bycatch** | Not relevant (0 t). |
| **Indicators** | None. |
| **Other information** | None. |
| **Working group report** | NWWG |

# ECOREGION Iceland and East Greenland
# STOCK Inshore cod in NAFO Subarea 1 (Greenland cod)

## Reference points

No reference points are defined for this stock.

### *Management plan*

There are no explicit management objectives for the inshore cod in Greenland.

### *Precautionary approach*

ICES advises that catches should not exceed 8000 t, which is the average catch for the past 10 years and represents the latest period of fishery.

## Additional considerations

Landings by the coastal fleet component have increased by a factor of ten over the last decade. The dynamics of recent year classes differ for inshore and offshore areas, indicating differences in environment and stock dynamics. The recruitment index of the 2009 year class is the highest recorded in the time-series in the northern part of the survey area (Figure 2.4.1b.1). A large 2005 year class is recognized, which is believed to be partly of offshore origin.

*Management considerations*

Presently, no management objectives have been set for this stock. It should be noted that the inshore cod tend to form dense spawning aggregations in limited areas, providing a possibility for spatial management measures such as closed areas and times, especially if the stock shows a declining trend. This is especially important in areas that are considered to have maintained the stocks in periods of overall stock decline in Greenland (i.e. the Nuuk and Sisimiut fjords).

Migration of young cod (3–6 years) in the last century, from the offshore regions to the coastal regions in West Greenland, is indicated by results from tagging returns. High abundance of young cod in offshore West Greenland waters in years where recruitments has been high in the offshore region indicate that some of these year classes in the coastal region have originated from offshore spawning. Strong year classes in the fjords, however, are believed to originate from local spawning stocks, as tagging returns indicate that only the coastal region is a zone of mixing between young inshore and offshore cod.

*Quality considerations*

Exploratory model runs (statistical catch-at-age) were performed using landings and the inshore gillnet survey as well as catch-at-age in both survey and landings, but further development is needed before advice can be based on these runs.

*Regulations and their effects*

The TAC for the coastal fleet is set at 15 000 t in 2012. The fleet is limited by gear, vessel size, and minimum landing size (40 cm), and operates in inshore and coastal waters.

*Comparison with previous assessment and advice*

This is the first year an assessment and advice has been drafted for this stock.

## Sources

Horsted, S. A. 1994. A review with some proposals for amendments of the catch statistics for the cod fisheries in Greenland waters since 1911. NAFO SCR Doc., No. 38, Serial No. N2407. 33 pp. (mimeo).

Horsted, S. A. 2000. A review of the cod fisheries at Greenland, 1910–1995. Journal of Northwest Atlantic Fishery Science, 28: 1–112.

ICES. 2012. Report of the North-Western Working Group, 26 April–3 May 2012. ICES CM 2012/ACOM:07.

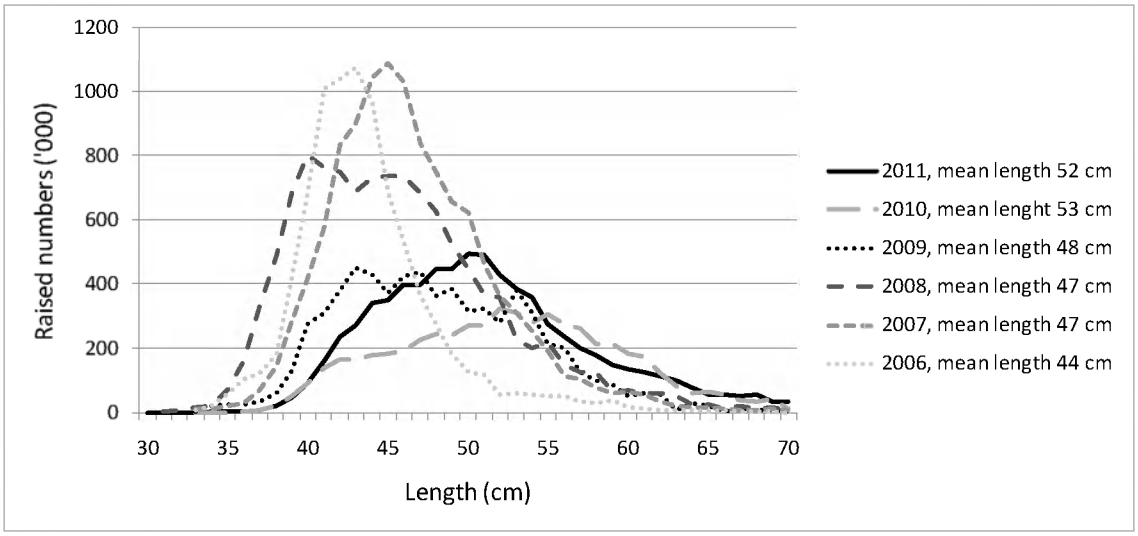



**Figure 2.4.1b.2** Length distribution in the inshore fishery in the period 2006–2011.

**Table 2.4.1b.1** Inshore cod in NAFO Subarea 1 (Greenland cod). ICES advice, management, and catches.

| Year | ICES advice for NAFO Subarea 1 | Pred. catch corresp. to advice | TAC | Catch |
|---|---|---|---|---|
| | | | Coastal | West inshore |
| 2013 | 8 | | | |

Weights in thousand tonnes.

Previously assessed together with the offshore cod (Cod in ICES Subarea XIV and NAFO Subarea 1 (Greenland cod)).

**Table 2.4.1b.3** Cod off Greenland (inshore and offshore components). Catches (t) as used by the Working Group, inshore total and offshore divided into East and West Greenland and total. Data until 1995 are based on Horsted (1994, 2000). * indicates preliminary results.

| Cod | | Offshore | | | Total |
|---|---|---|---|---|---|
| Year | Total inshore | East | West | Total offshore | Greenland |
| 1924 | 843 | | 200 | 200 | 1043 |
| 1925 | 1024 | | 1871 | 1871 | 2895 |
| 1926 | 2224 | | 4452 | 4452 | 6676 |
| 1927 | 3570 | | 4427 | 4427 | 7997 |
| 1928 | 4163 | | 5871 | 5871 | 10034 |
| 1929 | 7080 | | 22304 | 22304 | 29384 |
| 1930 | 9658 | | 94722 | 94722 | 104380 |
| 1931 | 9054 | | 120858 | 120858 | 129912 |
| 1932 | 9232 | | 87273 | 87273 | 96505 |
| 1933 | 8238 | | 54351 | 54351 | 62589 |
| 1934 | 9468 | | 88122 | 88122 | 97590 |
| 1935 | 7526 | | 65846 | 65846 | 73372 |
| 1936 | 7174 | | 125972 | 125972 | 133146 |
| 1937 | 6961 | | 90296 | 90296 | 97257 |
| 1938 | 5492 | | 90042 | 90042 | 95534 |
| 1939 | 7161 | | 89807 | 89807 | 96968 |
| 1940 | 8026 | | 43122 | 43122 | 51148 |
| 1941 | 8622 | | 35000 | 35000 | 43622 |
| 1942 | 12027 | | 40814 | 40814 | 52841 |
| 1943 | 13026 | | 47400 | 47400 | 60426 |
| 1944 | 13385 | | 51627 | 51627 | 65012 |
| 1945 | 14289 | | 45800 | 45800 | 60089 |
| 1946 | 15262 | | 44395 | 44395 | 59657 |
| 1947 | 18029 | | 63458 | 63458 | 81487 |
| 1948 | 18675 | | 109058 | 109058 | 127733 |
| 1949 | 17050 | | 156015 | 156015 | 173065 |
| 1950 | 21173 | | 179398 | 179398 | 200571 |
| 1951 | 18200 | | 222340 | 222340 | 240540 |
| 1952 | 16726 | | 317545 | 317545 | 334271 |
| 1953 | 22651 | | 225017 | 225017 | 247668 |
| 1954 | 18698 | 4321 | 286120 | 290441 | 309139 |
| 1955 | 19787 | 5135 | 247931 | 253066 | 272853 |
| 1956 | 21028 | 12887 | 302617 | 315504 | 336532 |
| 1957 | 24593 | 10453 | 246042 | 256495 | 281088 |
| 1958 | 25802 | 10915 | 294119 | 305034 | 330836 |
| 1959 | 27577 | 19178 | 207665 | 226843 | 254420 |
| 1960 | 27099 | 23914 | 215737 | 239651 | 266750 |
| 1961 | 33965 | 19690 | 313626 | 333316 | 367281 |
| 1962 | 35380 | 17315 | 425278 | 442593 | 477973 |
| 1963 | 23269 | 23057 | 405441 | 428498 | 451767 |
| 1964 | 21986 | 35577 | 327752 | 363329 | 385315 |
| 1965 | 24322 | 17497 | 342395 | 359892 | 384214 |
| 1966 | 29076 | 12870 | 339130 | 352000 | 381076 |
| 1967 | 27524 | 24732 | 401955 | 426687 | 454211 |
| 1968 | 20587 | 15701 | 373013 | 388714 | 409301 |
| 1969 | 21492 | 17771 | 193163 | 210934 | 232426 |

**Table 2.4.1.3b** *continued* Cod off Greenland (inshore and offshore components). Catches (t) as used by the Working Group, inshore total and offshore divided into East and West Greenland and total. Data until 1995 are based on Horsted (1994, 2000). * indicates preliminary results.

| Cod | | Offshore | | | Total |
|---|---|---|---|---|---|
| Year | Total inshore | East | West | Total offshore | Greenland |
| 1970 | 15613 | 20907 | 97891 | 118798 | 134411 |
| 1971 | 13506 | 32616 | 107674 | 140290 | 153796 |
| 1972 | 14645 | 26629 | 95974 | 122603 | 137248 |
| 1973 | 9622 | 11752 | 53320 | 65072 | 74694 |
| 1974 | 8638 | 6553 | 39396 | 45949 | 54587 |
| 1975 | 6557 | 5925 | 41352 | 47277 | 53834 |
| 1976 | 5174 | 13027 | 28114 | 41141 | 46315 |
| 1977 | 13999 | 8775 | 23997 | 32772 | 46771 |
| 1978 | 19679 | 7827 | 18852 | 26679 | 46358 |
| 1979 | 35590 | 8974 | 12315 | 21289 | 56879 |
| 1980 | 38571 | 11244 | 8291 | 19535 | 58106 |
| 1981 | 39703 | 10381 | 13753 | 24134 | 63837 |
| 1982 | 26664 | 20929 | 30342 | 51271 | 77935 |
| 1983 | 28652 | 13378 | 27825 | 41203 | 69855 |
| 1984 | 19958 | 8914 | 13458 | 22372 | 42330 |
| 1985 | 8441 | 2112 | 6437 | 8549 | 16990 |
| 1986 | 5302 | 4755 | 1301 | 6056 | 11358 |
| 1987 | 18486 | 6909 | 3937 | 10846 | 29332 |
| 1988 | 18791 | 12457 | 36824 | 49281 | 68072 |
| 1989 | 38529 | 15910 | 70295 | 86205 | 124734 |
| 1990 | 28799 | 33508 | 40162 | 73670 | 102469 |
| 1991 | 18311 | 21596 | 2024 | 23620 | 41931 |
| 1992 | 5723 | 11349 | 4 | 11353 | 17076 |
| 1993 | 1924 | 1135 | 0 | 1135 | 3059 |
| 1994 | 2115 | 437 | 0 | 437 | 2552 |
| 1995 | 1710 | 284 | 0 | 284 | 1994 |
| 1996 | 948 | 192 | 0 | 192 | 1140 |
| 1997 | 1186 | 370 | 0 | 370 | 1556 |
| 1998 | 323 | 346 | 0 | 346 | 669 |
| 1999 | 622 | 112 | 0 | 112 | 734 |
| 2000 | 764 | 100 | 0 | 100 | 864 |
| 2001 | 1680 | 221 | 0 | 221 | 1901 |
| 2002 | 3698* | 448 | 0 | 448 | 4146 |
| 2003 | 5215* | 286 | 7 | 293 | 5508 |
| 2004 | 4948* | 369 | 27 | 396* | 5344 |
| 2005 | 6043 | 773 | 75 | 847* | 6890* |
| 2006 | 7388* | 1981 | 408 | 2389 | 9777* |
| 2007 | 11693 | 3221 | 1620 | 4841 | 16533 |
| 2008 | 12270 | 2997 | 9651 | 12648 | 24918 |
| 2009 | 7672 | 1720 | 3286 | 5006 | 12678 |
| 2010 | 9270 | 2127 | 290 | 2417 | 11687 |
| 2011 | 11007 | 4579 | 550 | 5129 | 16136 |

## ECOREGION Iceland and East Greenland
## STOCK Cod in Division Va (Icelandic cod)

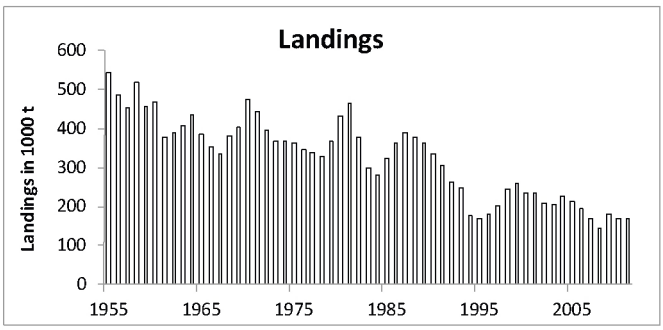
### Advice for 2012/2013

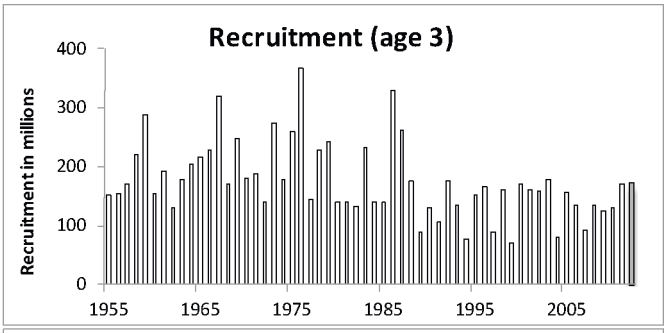
ICES advises on the basis of the Icelandic 2009 management plan that landings in the fishing year 2012/2013 should be no more than 196 000 t.

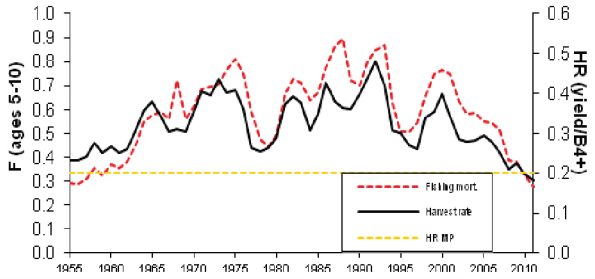
### Stock status

| F (Fishing Mortality) | 2009 | 2010 | 2011 |
|---|---|---|---|
| **MSY ($F_{MSY}$)** | ✓ | ✓ | ✓ Below possible candidate |
| **Precautionary approach** ($F_{pa}$,$F_{lim}$) | ✓ | ✓ | ✓ Below possible candidate $F_{pa}$ and $F_{lim}$ |
| **Management plan ($HR_{MP}$)** | ✓ | ✓ | ✓ Within expected range |

| SSB (Spawning-stock Biomass) | 2010 | 2011 | 2012 |
|---|---|---|---|
| **MSY** ($B_{trigger}$) | ✓ | ✓ | ✓ Above trigger |
| **Precautionary approach** ($B_{lim}$) | ✓ | ✓ | ✓ Full reproductive capacity |
| **Management plan ($MP_{Btrigger}$)** | ✓ | ✓ | ✓ Above trigger |

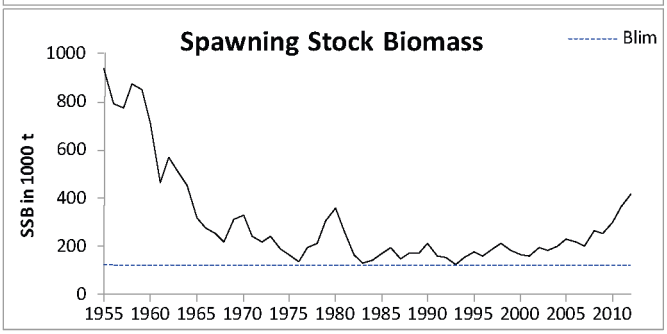




**Figure 2.4.2.1** Cod in Division Va (Icelandic cod). Summary of stock assessment (weights in thousand tonnes). Top right: SSB/F for the time-series used in the assessment.

The spawning stock of Icelandic cod is increasing and is higher than has been observed over the last four decades. Fishing mortality has declined significantly in the last decade and is presently at a historical low and below likely candidates for $F_{pa}$ and $F_{lim}$. Year classes since early 1990s are estimated to be stable around lower values than previously.

### Management plan

In spring 2009 the Icelandic Government adopted a management plan for the Icelandic cod. ICES has evaluated the plan and concludes that it is in accordance with the precautionary approach and the ICES MSY framework.

**Biology**

The Icelandic cod is distributed all around Iceland. Spawning takes place in late winter mainly off the southwestern coast, but smaller and variable regional spawning components have also been observed all around Iceland. The pelagic eggs and larvae drift clockwise around the island to the main nursery ground off the north coast. A larval drift to Greenland waters has been recorded in some years and substantial immigrations of mature cod from Greenland, which are considered to be of Icelandic origin, have been observed in some years.

**Environmental influence on the stock**

An increased inflow of Atlantic water has been observed in Icelandic waters since 1997, resulting in higher temperature and higher salinity. A northward shift in distribution of immature capelin may be linked to these hydrographical changes, resulting in lower availability of capelin for cod. In the past low weights-at-age of cod have been related to a low biomass of capelin. In recent years the productivity of capelin has improved to some degree and may be the reason for increased weights-at-age in the cod stock.

**The fisheries**

Cod has traditionally been targeted in the trawl fisheries with other species being bycatch. With the recent constraints in TAC the fleet has reduced effort in areas were cod is in relatively high abundance, manifested in a higher proportion of the annual catches being taken in tows where the species composition is more mixed in nature. For vessels that can target cod the catch rates are very high.

Estimates of annual cod discards since 2001 are in the range of 1.4–4.3% of numbers landed.

| | |
|---|---|
| **Catch distribution** | Total landings (2011) are 173 kt (45% bottom trawl, 35% longline, 10% gillnet, 5% Danish seine, and 5% hooks). Discards are in the range of 1.4–4.3%. |

**Quality considerations**

This assessment is considered very consistent.

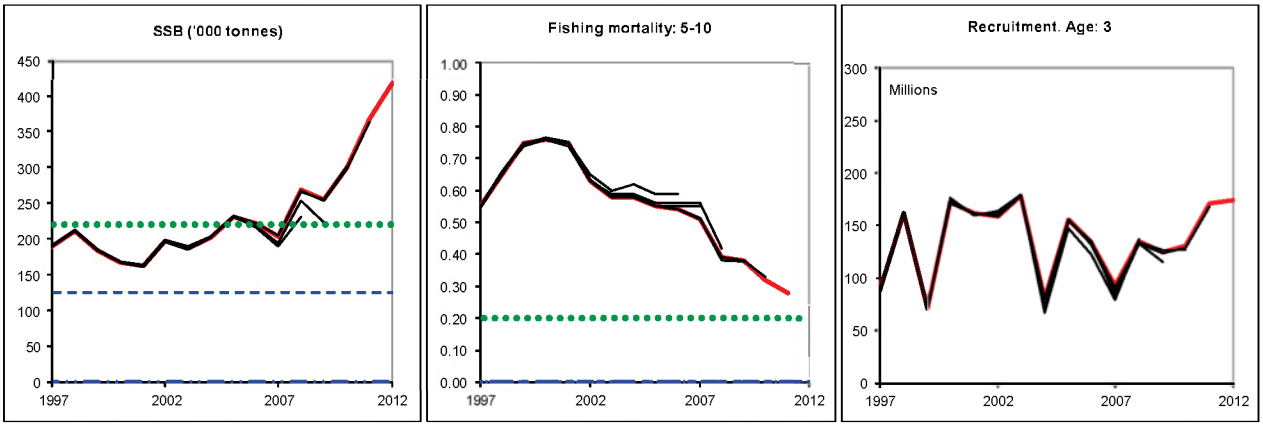



**Figure 2.4.2.2** Cod in Division Va (Icelandic cod). Historical assessment results (final year recruitment estimates included).
SSB plot: green line $MSYB_{trigger}$, blue line $B_{lim}$. F plot: green line Harvest $Rate_{MP}$

**Scientific basis**

| | |
|---|---|
| **Assessment type** | A forward-based statistical catch-at-age model, implemented in the AD model builder. |
| **Input data** | Landings-at-age and age-structured spring and fall survey indices. |
| **Discards and bycatch** | Not included in the assessment and considered low. |
| **Indicators** | None. |
| **Other information** | Immigration has been taken into account. |
| **Working group report** | NWWG |

## ECOREGION Iceland and East Greenland
## STOCK Cod in Division Va (Icelandic cod)

**Reference points**

| | *Type* | *Value* | *Technical basis* |
|---|---|---|---|
| Management plan | $MP_{Btrigger}$ | 220 000 t | Set by managers, consistent with ICES MSY framework. |
| | Harvest $Rate_{MP}$ | 0.2 | Set by managers, consistent with ICES MSY framework. |
| MSY Framework | MSY $B_{trigger}$ | 220 000t | Trigger point in HCR considered consistent with ICES MSY framework. |
| | $F_{MSY}$ | Not relevant | |
| Precautionary Approach | $B_{lim}$ | 125 000 t | $B_{loss}$ |
| | $B_{pa}$ | Not defined | |
| | $F_{lim}$ | Not defined | |
| | $F_{pa}$ | Not defined | |

*(unchanged since 2011)*

**Outlook for 2013**

Basis: F(2012) = TAC constraint: F = 0.26; landings (2012) = 177; SSB(2013) = 460; B4+(2013) = 1195; R (2012) = 174 million.

| Rationale | Landings (2013) | Basis | F (2013) | SSB (2014) | %SSB change [1)] | % TAC change [2)] |
|---|---|---|---|---|---|---|
| Management plan | 196 | Harvest Control Rule | 0.26 | 523 | 13% | 11% |
| Zero catch | 0 | F=0 | 0 | 739 | 43% | |

Weights in thousand tonnes.

[1)] SSB 2014 relative to SSB 2013.

[2)] Landings 2013 relative to TAC 2012.

***Management plan***

The TAC value is given for the calendar year (i.e. 2013) while it is applied in the fishery for the fishing year (September 2012 to august 2013).

Following the agreed management plan (Annex 2.4.2) implies a TAC of 196 000 t in the fishing year 2012/2013. The management plan has been evaluated to be in conformity with the ICES MSY framework.

**Additional considerations**

*Management considerations*

Prior to allocating the ITQ catches to the Icelandic fishing fleet, managers should ensure that all expected catches from other sources are subtracted. The amount is not known in advance, but is likely to be of a similar magnitude as in recent years and estimated to be 6 kt in the 2012/2013 fishing year.

Stock size is at present high in spite of low productivity because of a sharply decreasing harvest rate in recent years.

The immigration of adult cod from Greenland to Icelandic waters has occurred in some years, based on results from tagging returns and catch-at-age anomalies. The high abundance of larvae in East Greenland waters in years with high recruitments in Iceland indicate that some of these year classes originate from spawning in Iceland. Based on catch-at-age data anomalies attempts have been made to estimate some of these migrations in the historical part of the assessment. Tag returns, survey estimates in Greenlandic waters, as well as anomalies in the catch-at-age matrix in Iceland indicate that a portion of the moderate 2003 year class observed in Greenlandic waters in recent years may have migrated to Icelandic waters in 2009. This has been taken into account in the assessment, resulting in an additional 5% increase (40 kt) in the estimates of the reference biomass in 2009.

*Regulations and their effects*

The restrictions of the catches by the TAC have resulted in 60% reduction in fishing mortality since 2000.

A real-time-closure system aimed at protecting juvenile fish has been in force since 1976. Fishing is prohibited, for at least two weeks, in areas where the proportion by number of small cod (< 55 cm) in the catches is observed by inspectors to exceed 25%. This is the measure taken rather than setting a minimum landing size and allowing discarding. A preliminary evaluation of the effectiveness of the system indicates that the relatively small areas closed for a short time most likely do not contribute significantly to the protection of juveniles. On the other hand, several consecutive quick closures often lead to closures of larger areas for a longer time and force the fleet to operate in other areas. The effect of these longer closures has not been evaluated.

Since 1995, spawning areas have been closed for 2–3 weeks during the spawning season for all fisheries. The intent of this measure was to protect spawning fish. In 2005, the maximum mesh size allowed in gillnets was decreased to 20.3 cm (8 inches) in order to protect the largest spawners. The effect of these measures has not been evaluated.

The mesh size in the codend in the trawling fishery was increased from 120 mm to 155 mm in 1977. Since 1998 the minimum codend mesh size allowed is 135 mm, provided that a so-called "Polish cover" is not used. Numerous areas are closed temporarily or permanently for all fisheries or specific gears to protect juveniles and habitat, or for socio-political reasons. The effects of these measures have not been evaluated.

*Data and methods*

The data used in the assessment are landings-at-age and two age-structured survey indices. The analytical assessment is based on landings and survey data using a forward-based statistical catch-at-age model, implemented in the AD model builder. Landings-at-age data as well as survey indices are considered reliable. The modelling setup is the same as last year, using both the spring and the fall survey indices in the final assessment.

*Comparison with previous assessment and advice*

The SSB, F, and recruitment estimates are consistent with last year's estimates (Figure 2.4.2.2).

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

**Sources**

ICES. 2010. Icelandic request on evaluation of Icelandic cod management plan. Report of the ICES Advisory Committee, 2010. ICES Advice, 2010. Book 2, Section 2.3.3.1, pp. 4–8.

ICES. 2012. Report of the North-Western Working Group, 26 April–3 May 2012. ICES CM 2012/ACOM:07.

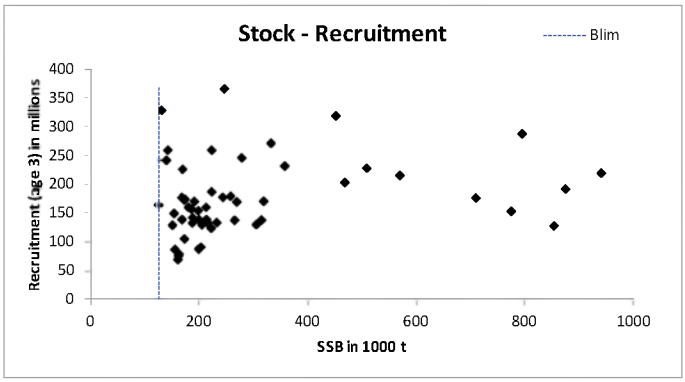



**Figure 2.4.2.3** Cod in Division Va (Icelandic cod). Stock–recruitment plot.

**Table 2.4.2.1** Cod in Division Va (Icelandic cod). ICES advice, management, and landings.

| Year | ICES Advice | Predicted catch corresp. to advice | Agreed TAC | ICES landings for the fishing year | ICES landings for the calendar year |
|---|---|---|---|---|---|
| 1988[1] | National advice | 300 | 350 | | 378 |
| 1989[1] | National advice | 300 | 325 | | 356 |
| 1990[1] | National advice | 250 | 300 | | 335 |
| 1991[1] | National advice | 240 | 245 | | 309 |
| 1991/1992[2] | National advice | 250 | 265 | 274 | 274 |
| 1992/1993[2] | Reduce F by 40% | 154 | 205 | 241 | 241 |
| 1993/1994[2] | Reduce F by 40% | 150 | 165 | 197 | 197 |
| 1994/1995[2] | Reduce F by 50% | 130 | 155 | 165 | 169 |
| 1995/1996[2] | Apply catch rule | 155 | 155 | 170 | 182 |
| 1996/1997[2] | Apply catch rule | 186 | 186 | 202 | 203 |
| 1997/1998[2] | Apply catch rule | 218 | 218 | 227 | 243 |
| 1998/1999[2] | Apply catch rule | 250 | 250 | 254 | 260 |
| 1999/2000[2] | Apply catch rule | 247 | 250 | 257 | 236 |
| 2000/2001[2] | Apply catch rule | 203 | 220[3] | 221 | 235 |
| 2001/2002[2] | Apply catch rule | 164 | 190[3] | 217 | 209 |
| 2002/2003[2] | Apply catch rule | 183 | 179[3] | 198 | 206 |
| 2003/2004[2] | Apply catch rule | 210 | 209 | 225 | 226 |
| 2004/2005[2] | Apply catch rule | 205 | 205 | 214 | 214 |
| 2005/2006 | Apply catch rule | 198 | 198 | 209 | 196 |
| 2006/2007 | Apply catch rule | 187 | 193[4] | 187 | 170 |
| 2007/2008 | Apply catch rule | 152 | 130 | 140 | 147 |
| 2008/2009 | Apply $F_{max}$ | < 124 | 160[5] | 168 | 181 |
| 2009/2010 | Apply $F_{max}$ | < 135 | 150[6] | 168 | 169 |
| 2010/2011 | Apply catch rule | 160 | 160 | 165 | 165 |
| 2011/2012 | Apply catch rule | 177 | 177 | | |
| 2012/2013 | Apply catch rule | 196 | | | |

Weights in thousand tonnes.
[1] Calendar year.
[2] National fishing year ending 31 August.
[3] Amended catch rule.
[4] Catch rule 2006.
[5] Initial TAC set to 130 according to the catch rule, raised to 160 in January 2009.
[6] Set according to the catch rule.

**Table 2.4.2.2** Cod in Division Va (Icelandic cod). Summary of the assessment.

| Year | Landings | F5-10 | SSB | N3 | B4+ | Harvest rate |
|---|---|---|---|---|---|---|
| 1955 | 545 | 0.29 | 940 | 152 | 2359 | 0.23 |
| 1956 | 487 | 0.29 | 794 | 153 | 2083 | 0.23 |
| 1957 | 455 | 0.31 | 774 | 171 | 1880 | 0.24 |
| 1958 | 517 | 0.35 | 874 | 221 | 1866 | 0.28 |
| 1959 | 459 | 0.32 | 853 | 289 | 1828 | 0.25 |
| 1960 | 470 | 0.37 | 709 | 154 | 1754 | 0.27 |
| 1961 | 377 | 0.36 | 467 | 193 | 1496 | 0.25 |
| 1962 | 389 | 0.38 | 569 | 129 | 1492 | 0.26 |
| 1963 | 409 | 0.46 | 508 | 178 | 1316 | 0.31 |
| 1964 | 437 | 0.55 | 451 | 204 | 1219 | 0.36 |
| 1965 | 387 | 0.58 | 318 | 216 | 1023 | 0.38 |
| 1966 | 353 | 0.59 | 277 | 229 | 1032 | 0.34 |
| 1967 | 336 | 0.56 | 256 | 320 | 1103 | 0.30 |
| 1968 | 382 | 0.72 | 222 | 172 | 1223 | 0.31 |
| 1969 | 403 | 0.56 | 314 | 248 | 1326 | 0.30 |
| 1970 | 475 | 0.61 | 331 | 181 | 1337 | 0.36 |
| 1971 | 444 | 0.68 | 242 | 189 | 1098 | 0.40 |
| 1972 | 395 | 0.69 | 222 | 139 | 997 | 0.40 |
| 1973 | 369 | 0.70 | 245 | 273 | 844 | 0.44 |
| 1974 | 368 | 0.76 | 187 | 179 | 918 | 0.40 |
| 1975 | 365 | 0.81 | 168 | 261 | 895 | 0.41 |
| 1976 | 346 | 0.75 | 138 | 367 | 955 | 0.36 |
| 1977 | 340 | 0.59 | 199 | 143 | 1289 | 0.26 |
| 1978 | 330 | 0.48 | 212 | 228 | 1297 | 0.25 |
| 1979 | 366 | 0.45 | 304 | 243 | 1397 | 0.26 |
| 1980 | 432 | 0.49 | 357 | 140 | 1490 | 0.29 |
| 1981 | 465 | 0.66 | 264 | 140 | 1242 | 0.37 |
| 1982 | 380 | 0.73 | 167 | 132 | 970 | 0.39 |
| 1983 | 298 | 0.71 | 130 | 233 | 791 | 0.38 |
| 1984 | 282 | 0.64 | 141 | 139 | 914 | 0.31 |
| 1985 | 323 | 0.67 | 172 | 140 | 928 | 0.35 |
| 1986 | 365 | 0.77 | 198 | 330 | 854 | 0.43 |
| 1987 | 390 | 0.86 | 150 | 261 | 1030 | 0.38 |
| 1988 | 378 | 0.89 | 172 | 176 | 1033 | 0.37 |
| 1989 | 363 | 0.72 | 171 | 89 | 1003 | 0.36 |
| 1990 | 335 | 0.70 | 214 | 130 | 841 | 0.40 |
| 1991 | 308 | 0.80 | 161 | 107 | 698 | 0.44 |
| 1992 | 265 | 0.85 | 153 | 175 | 550 | 0.48 |
| 1993 | 251 | 0.87 | 124 | 135 | 595 | 0.42 |
| 1994 | 178 | 0.63 | 154 | 78 | 576 | 0.31 |
| 1995 | 169 | 0.51 | 179 | 151 | 557 | 0.30 |
| 1996 | 181 | 0.51 | 159 | 165 | 670 | 0.27 |
| 1997 | 203 | 0.55 | 190 | 88 | 782 | 0.26 |
| 1998 | 244 | 0.65 | 211 | 162 | 720 | 0.34 |
| 1999 | 260 | 0.75 | 184 | 71 | 731 | 0.36 |
| 2000 | 235 | 0.76 | 167 | 172 | 590 | 0.40 |
| 2001 | 234 | 0.75 | 162 | 162 | 687 | 0.34 |
| 2002 | 208 | 0.63 | 197 | 159 | 728 | 0.29 |
| 2003 | 208 | 0.58 | 186 | 179 | 739 | 0.28 |
| 2004 | 227 | 0.58 | 202 | 80 | 799 | 0.28 |
| 2005 | 213 | 0.55 | 231 | 156 | 722 | 0.30 |
| 2006 | 196 | 0.54 | 221 | 134 | 700 | 0.28 |
| 2007 | 170 | 0.51 | 204 | 92 | 680 | 0.25 |
| 2008 | 146 | 0.39 | 268 | 135 | 697 | 0.21 |
| 2009 | 181 | 0.38 | 254 | 125 | 798 | 0.23 |
| 2010 | 169 | 0.32 | 299 | 131 | 849 | 0.20 |
| 2011 | 172 | 0.28 | 367 | 171 | 944 | 0.18 |
| 2012 | | | 419 | 174 | 1070 | |
| 2013 | | | | 108 | | |
| 2014 | | | | 182 | | |

## Annex 2.4.2 Icelandic management plan

The Icelandic Government has adopted a management plan for the Icelandic cod stock for the next five fishing years, starting with the 2009/2010 fishing season. The main objective of the management plan is to ensure that the spawning-stock biomass (SSB) will, with high probability (>95%), be above the present size of 220 thousand tonnes by the year 2015. This will be achieved by applying the following harvest control rule (HCR) to calculate the total allowable catch (TAC):

$TACy+1 = (\alpha\ B4^{+},y + TACy)/2$, where y refers to the assessment year, $B4^{+}$ to the biomass of 4-year and older cod, and $\alpha$ to the harvest rate. $\alpha$ is set to 0.2 when SSBy is higher than 220 thousand tonnes ($SSB_{MP}$*) but set to $\alpha = 0.2\ SSBy / SSB_{MP}$ when SSBy is lower.

*ICES interprets $SSB_{MP}$ as $B_{trigger}$.

## ECOREGION Iceland and East Greenland
## STOCK Haddock in Division Va (Icelandic haddock)

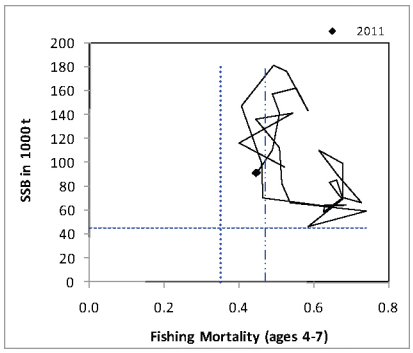
### Advice for 2013

ICES advises on the basis of the precautionary approach that catches in 2013 should be no more than 32 000 t.

### Stock status

| F (Fishing Mortality) | 2009 | 2010 | 2011 | |
|---|---|---|---|---|
| MSY ($F_{MSY}$) | ? | ? | ? | Undefined |
| Precautionary approach ($F_{pa}$) | ✗ | ✗ | ✗ | Harvested unsustainably |

| SSB (Spawning-Stock Biomass) | 2010 | 2011 | 2012 | |
|---|---|---|---|---|
| MSY ($B_{trigger}$) | ? | ? | ? | Undefined |
| Precautionary approach ($B_{lim}$) | ✓ | ✓ | ✓ | Full reproductive capacity |



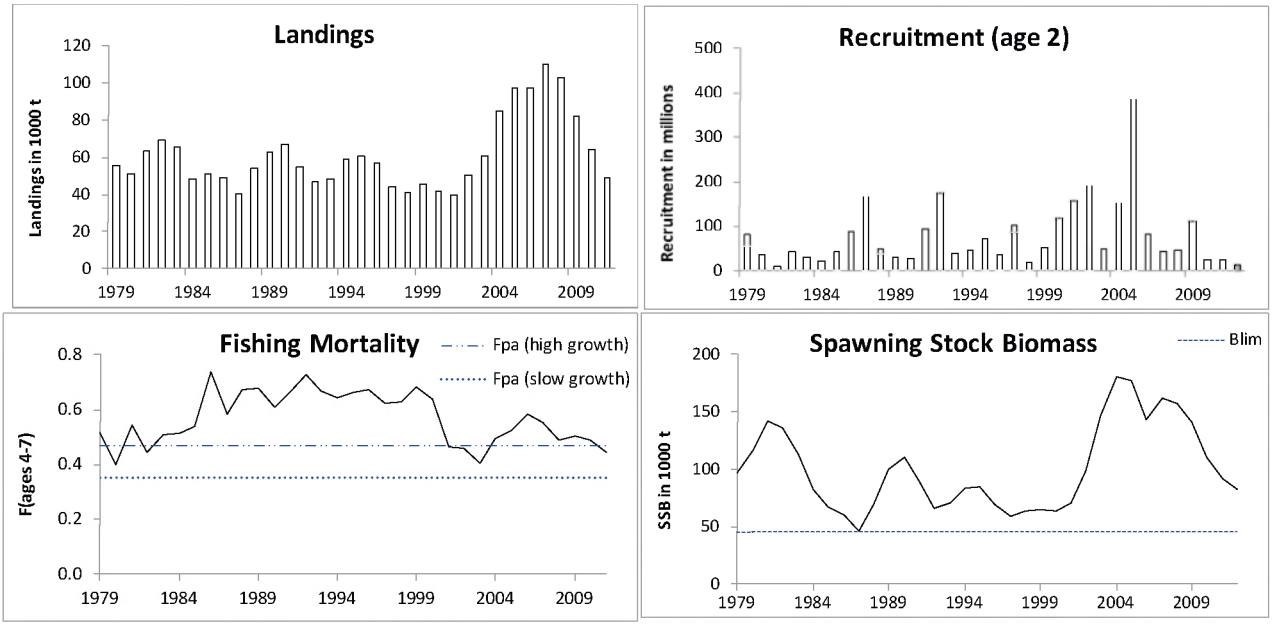




**Figure 2.4.3.1** Haddock in Division Va. Summary of stock assessment (weights in thousand tonnes). Top right: SSB/ F for the time-series used in the assessment.

SSB increased from 2001 to 2005 after several strong year classes. Since then the spawning stock has decreased. Fishing mortality is currently above $F_{pa}$ (0.35, accounting for low growth). Recruitment was high for the year classes 1998–2003, with five strong year classes of which the 2003 year class was very strong. Recruitment has been below the long-term average since the 2004 year class. The 2008–2011 year classes are estimated to be very poor.

### Management plans

A management plan in accordance with the MSY approach is under development and will likely be put into force this year.

**Biology of the stock**

Growth of haddock is considered density dependent and the high biomass in recent years may therefore have contributed to the slower observed growth after 2003. Growth has started to improve after a number of years with poor growth, and is estimated to be above average in 2011. Mean weight-at-age remains low for most year classes contributing to the SSB.

**Environmental influence on the stock**

Haddock in Icelandic waters is near the northern boundary of its distribution. In cold periods the area north and east of Iceland is probably too cold for haddock, but in warmer periods the temperature in this area is suitable for haddock. The areas north and east of Iceland constitute a large part of the Icelandic continental shelf, so in warm periods much larger areas are available for haddock. Landing figures from the early 1960s support the observation that the stock can become very large in warm periods. The groundfish surveys show that the proportion of the haddock stock inhabiting the waters north of Iceland has increased from 2000 to 2006 and has remained high since then.

**The fisheries**

Haddock is caught in directed haddock fisheries, as well as in mixed demersal fisheries targeting cod. Recent changes in seawater temperature have had considerable effects on the spatial distribution and the distribution of the catches. In recent years an increasing proportion of haddock has been caught by longliners. The discard estimates for haddock have been ranging between 0.7% and 5% by weight since 2001 (see Section 7 of the NWWG report "Overview on ecosystem, fisheries and their management" – ICES, 2012).

| | |
|---|---|
| **Catch distribution** | Total landings (2011) are 49.5 kt, with 44% taken by bottom trawl, 41% by longlines, 13% by Danish seine, and 2% by other gear. Discarding is considered minor since 2001. |

**Quality considerations**

The assessment is considered very consistent. Discards are not included in the assessment. Discards in 2011 were small, as they have been in most years since 2001. The main uncertainty in the assessment relates to difference between assessments based on each of the two surveys, with the final assessment fitting in between.

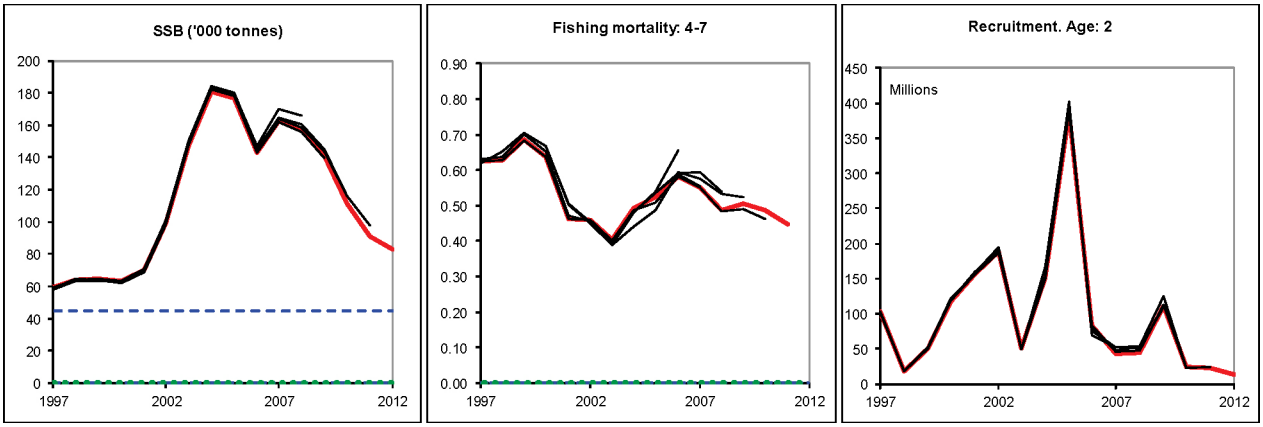



**Figure 2.4.3.2** Haddock in Division Va. Historical assessment results (final-year recruitment estimates included).

**Scientific basis**

| | |
|---|---|
| **Assessment type** | Adapt-type model (in ADMB). |
| **Input data** | Landings-at-age and two survey indices (Icelandic spring and fall groundfish surveys). |
| **Discards and bycatch** | Discards are not included in the assessment. |
| **Indicators** | None. |
| **Other information** | None. |
| **Working group report** | NWWG |

## ECOREGION Iceland and East Greenland
## STOCK Haddock in Division Va (Icelandic haddock)

**Reference points**

| | *Type* | *Value* | *Technical basis* |
|---|---|---|---|
| MSY Approach | MSY $B_{trigger}$ | Not defined | |
| | $F_{MSY}$ | Not defined | |
| Precautionary Approach | $B_{lim}$ | 45 000 t | $B_{loss}$ (ICES, 2011). |
| | $B_{pa}$ | Not defined | |
| | $F_{lim}$ | Not defined | |
| | $F_{pa}$ | 0.47<br>0.35 | $F_{pa} = F_{med}$ proposed in 2000 with normal/high growth rate.<br>Adjusted to 0.35 with low growth rate. |

*(unchanged since: 2011)*

**Outlook for 2013**

Basis: F(2012) = TAC constraint = 44; F=0.4; SSB(2013) = 85; R (2013) = 21.5 million (Adapt); landings (2012) = 44.

| Rationale | Landings (2013) | Basis | F (2013) | SSB (2014) | %SSB change [1)] | % TAC change [2)] |
|---|---|---|---|---|---|---|
| Precautionary (modified to account for size) | 32 | $F_{pa} = 0.35$ | 0.35 | 71 | −17 | −28 |
| Zero catch | 0 | F = 0 | 0.00 | 102 | 20 | −100 |
| Less than 5% probability of $SSB_{2015} < B_{lim}$ | 27 | F = 0.28 | 0.28 | 76 | −11 | −37 |
| *Status quo* | 39 | $F_{2011}$ | 0.44 | 65 | −24 | −12 |
| *Proposed HCR* | 31 | | 0.33 | 72 | −15 | −30 |

Weights in thousand tonnes.
[1)] SSB 2014 relative to SSB 2013.
[2)] Landings 2012/2013 relative to TAC 2011/2012.

***Precautionary approach***

The fishing mortality in 2013 should be no more than (0.35), corresponding to landings of less than 32 000 t.

**Additional considerations**

*Management considerations*

Given the low incoming recruitment, fishing at $F_{pa}$ in 2012–2014 would result in a non-negligible probability of SSB falling below $B_{lim}$ within 3 years. F around 0.28 will lead to the probability of $SSB_{2015} < B_{lim}$ being around 5%.

Work is in progress to evaluate candidate harvest control rules that are in conformity with the ICES MSY framework. This work is based on an approach similar to the one used for Icelandic saithe and cod. The proposed rule is based on landings as a proportion of biomass of fish above a certain size and is presented in the Working Group report (ICES, 2012).

SSB is predicted to decrease over the next years when the average year classes (2004–2007) disappear from the stock and are replaced by the poor (2008–2011) year classes. The 2008–2011 year classes are the smallest four year classes in sequence seen since 1979 or further back. With such low year classes, the maximum yield would be expected to be less than 20 000 t.

*Regulations and their effects*

The regulation is a TAC supplemented with technical measures like area closures for protecting juveniles, and minimum mesh size. The regulatory system includes provision for real-time closures of areas where juveniles are a high proportion of the catch. The effects of these measures have not been evaluated. Trawl grids are mandatory in certain areas.

*Changes in fishing technology and fishing patterns*

Discards have been low since 2001. Before that discards of undersized fish were high and variable during 1994–1997. Discarding seems related to the overlap between the spatial distribution of the fisheries and recruits and is higher when fishing mortality is high and stock size low. At low stock sizes juveniles mix more with adults.

*Information from the fishing industry*

Commercial cpue from the most important fleets targeting haddock are available for 20 years or more, but these data are not used in the analytical assessment. The cpue data show much more stability than the results from the assessment. The discrepancy between cpue and stock abundance is partly due to the increase in haddock biomass occurring in areas north of Iceland, where there is little fishing effort.

*Data and methods*

The assessment is based on age-disaggregated landings from 1979 to 2011 and on survey data from the March survey 1985–2012 and the October survey 1995–2010. The models used are an Adapt-type model, a time-series analysis, XSA, and a separable model used for evaluation of the harvest control rule for the stock The selection pattern in the separable model is a function of mean weight-at-age, not age directly. The assessment does not include discards.

*Comparison with previous assessment and advice*

This year's assessment is conducted in the same way as last year. The assessment does not show any retrospective pattern.

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

**Source**

ICES. 2012. Report of the North-Western Working Group, 26 April–3 May 2012. ICES CM 2012/ACOM:07.

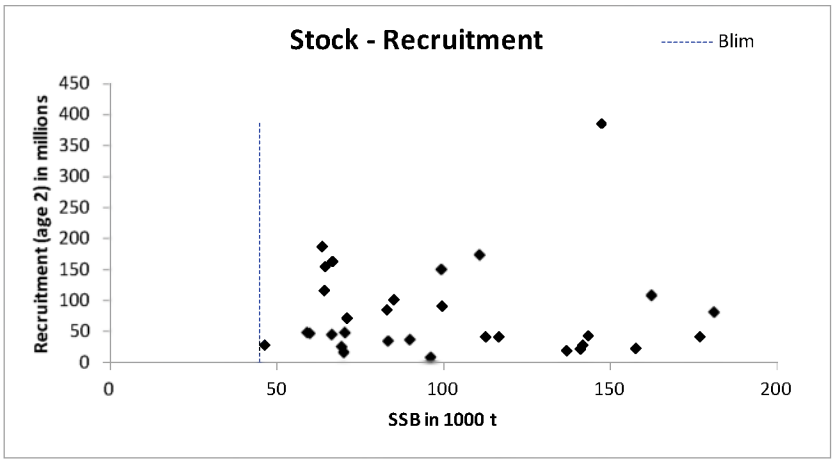



**Figure 2.4.3.3** Haddock in Division Va. Stock–recruitment plot.

**Table 2.4.3.1** Haddock in Division Va. ICES advice, management, and landings.

| Year | ICES Advice | Predicted catch corresp. to advice | Agreed TAC | ICES landings for the fishing year | ICES landings for the calendar year |
|---|---|---|---|---|---|
| 1987 | National advice | <50 | 60 | | 41 |
| 1988[1] | National advice | <60 | 65 | | 54 |
| 1989[1] | National advice | <60 | 65 | | 63 |
| 1990[1] | National advice | <60 | 65 | | 67 |
| 1991[2] | National advice | <38 | 48 | | 54 |
| 1991/1992[3] | National advice | <50 | 50 | 48 | 47 |
| 1992/1993[3] | National advice | <60 | 65 | 48 | 49 |
| 1993/1994[3] | National advice | <65 | 65 | 57 | 59 |
| 1994/1995[3] | National advice | <65 | 65 | 61 | 61 |
| 1995/1996[3] | National advice | <55 | 60 | 54 | 57 |
| 1996/1997[3] | National advice | <40 | 45 | 51 | 44 |
| 1997/1998[3] | National advice | <40 | 45 | 38 | 41 |
| 1998/1999[3] | National advice | <35 | 35 | 46 | 45 |
| 1999/2000[3] | F reduced below $F_{med}$ | <35 | 35 | 42 | 42 |
| 2000/2001[3] | F reduced below provisional $F_{pa}$ | <31 | 30 | 40 | 40 |
| 2001/2002[3] | F reduced below provisional $F_{pa}$ | <30 | 41 | 45 | 50 |
| 2002/2003[3] | F reduced below provisional $F_{pa}$ | <55 | 55 | 56 | 61 |
| 2003/2004[3] | F reduced below provisional $F_{pa}$ | <75 | 75 | 79 | 84 |
| 2004/2005[3] | F reduced below provisional $F_{pa}$ | <97 | 90 | 98 | 97 |
| 2005/2006[3] | F reduced below provisional $F_{pa}$ | <110 | 105 | 98 | 98 |
| 2006/2007[3] | F reduced below provisional $F_{pa}$ | < 112 | 105 | 110 | 110 |
| 2007/2008[3] | F reduced below provisional $F_{pa}$ | 120 | 100 | 102 | 102 |
| 2008/2009 | F reduced below 0.35 | <83 | 93 | 82 | 82 |
| 2009/2010 | F reduced below 0.35 | <57 | 63 | 73 | 64 |
| 2010/2011 | F reduced below 0.35 | <51 | 50 | 53 | |
| 2011/2012 | F reduced below 0.35 | <42 | 45 | | |
| 2012/2013 | F reduced below 0.35 | <32 | | | |

Weights in thousand tonnes.
[1] Calendar year.
[2] January/August.
[3] National TAC for year ending 31 August.

**Table 2.4.3.2** Icelandic haddock (Division Va). Summary of the assessment.

| Year | Recruitment in thousands at age 2 | Biomass 3+ tonnes | SSB tonnes | Landings tonnes | Yield/SSB | F4–7 |
|---|---|---|---|---|---|---|
| 1979 | 80923 | 162177 | 96072 | 55330 | 0.576 | 0.521 |
| 1980 | 37390 | 192244 | 116521 | 51110 | 0.439 | 0.398 |
| 1981 | 10426 | 206988 | 141628 | 63558 | 0.449 | 0.542 |
| 1982 | 42788 | 180380 | 136817 | 69428 | 0.507 | 0.444 |
| 1983 | 29306 | 148112 | 112589 | 65942 | 0.586 | 0.508 |
| 1984 | 20574 | 112797 | 82961 | 48282 | 0.582 | 0.515 |
| 1985 | 42788 | 102394 | 66652 | 51102 | 0.767 | 0.537 |
| 1986 | 86501 | 96480 | 59837 | 48859 | 0.817 | 0.739 |
| 1987 | 164036 | 105395 | 46298 | 40760 | 0.88 | 0.584 |
| 1988 | 48742 | 153708 | 69391 | 54204 | 0.781 | 0.675 |
| 1989 | 29778 | 168184 | 99537 | 62885 | 0.632 | 0.676 |
| 1990 | 27094 | 145507 | 110745 | 67198 | 0.607 | 0.611 |
| 1991 | 92280 | 122708 | 89825 | 54692 | 0.609 | 0.664 |
| 1992 | 175094 | 106310 | 66379 | 47121 | 0.71 | 0.728 |
| 1993 | 38437 | 130461 | 71000 | 48123 | 0.678 | 0.669 |
| 1994 | 46842 | 127836 | 83295 | 59502 | 0.714 | 0.641 |
| 1995 | 72857 | 124042 | 85054 | 60884 | 0.716 | 0.661 |
| 1996 | 36341 | 108036 | 70008 | 56890 | 0.813 | 0.675 |
| 1997 | 102509 | 87152 | 58993 | 43764 | 0.742 | 0.624 |
| 1998 | 17976 | 97121 | 64203 | 41192 | 0.642 | 0.627 |
| 1999 | 50160 | 91024 | 64439 | 45411 | 0.705 | 0.685 |
| 2000 | 117308 | 90674 | 63507 | 42105 | 0.663 | 0.636 |
| 2001 | 156016 | 115000 | 70340 | 39654 | 0.564 | 0.462 |
| 2002 | 188084 | 168156 | 99249 | 50498 | 0.509 | 0.461 |
| 2003 | 49866 | 219674 | 147350 | 60883 | 0.413 | 0.404 |
| 2004 | 151764 | 252575 | 181089 | 84828 | 0.468 | 0.492 |
| 2005 | 385847 | 258893 | 176847 | 97225 | 0.55 | 0.525 |
| 2006 | 83024 | 299177 | 143347 | 97614 | 0.681 | 0.582 |
| 2007 | 43021 | 295783 | 162319 | 109966 | 0.677 | 0.553 |
| 2008 | 44529 | 247415 | 157573 | 102872 | 0.653 | 0.488 |
| 2009 | 110125 | 189982 | 141004 | 82045 | 0.582 | 0.506 |
| 2010 | 24044 | 162037 | 110958 | 64168 | 0.578 | 0.487 |
| 2011 | 23122 | 138234 | 91371 | 49433 | 0.541 | 0.446 |
| 2012 | 13515 | 121144 | 82681 | | | |
| Mean 79-2011 | 79685 | 157777 | 101127 | 61137 | 0.631 | 0.569 |

## ECOREGION Iceland and East Greenland
## STOCK Saithe in Division Va (Icelandic saithe)

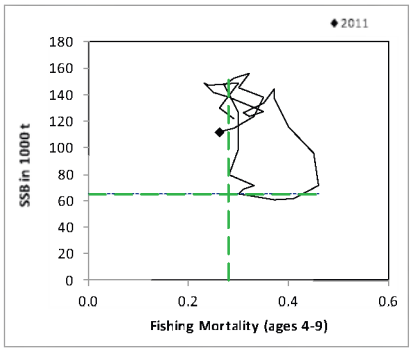
### Advice for 2013

ICES advises on the basis of the MSY approach (B-rule) that catches in 2013 should be no more than 49 000 t.

### Stock status

| F (Fishing Mortality) | 2009 | 2010 | 2011 | |
|---|---|---|---|---|
| MSY ($F_{MSY}$) | ✗ | ✗ | ✓ | Appropriate |
| Precautionary approach ($F_{pa}$,$F_{lim}$) | ? | ? | ? | Undefined |

| SSB (Spawning-Stock Biomass) | 2010 | 2011 | 2012 | |
|---|---|---|---|---|
| MSY ($B_{trigger}$) | ✓ | ✓ | ✓ | Above target |
| Precautionary approach ($B_{lim}$) | ✓ | ✓ | ✓ | Full reproductive capacity |



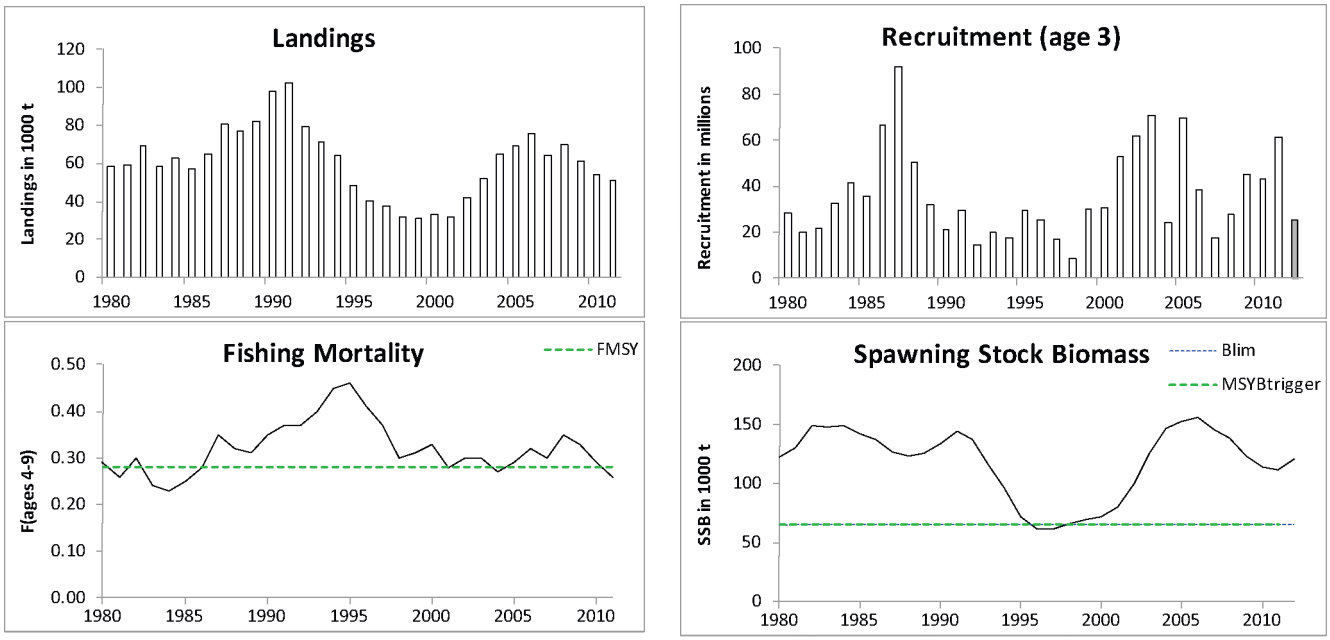




**Figure 2.4.4.1** Saithe in Division Va (Icelandic saithe). Summary of stock assessment (weights in thousand tonnes). Top right: SSB/F for the time-series used in the assessment.

The fishing mortality has fluctuated around 0.3 between 1998 and 2011, decreasing from around 0.4 in the mid-1990s. SSB has been declining since 2006 and is at present close to the long-term average. Year classes 1998–2000 and 2002 were large, but recruitment since then has been around the long-term average, except for the 2008 cohort which is estimated to be large.

### Management plans

A management plan in accordance with the MSY approach is under development and will likely be put into force this year.

**Biology**

Saithe is a migrating fish and makes both feeding and spawning migrations. The evidence from tagging experiments (ICES, 2008) shows some migrations along the Faroe–Iceland Ridge, as well as onto the East Greenland shelf.

**Environmental influence on the stock**

Icelandic saithe is near the northern boundary of its distribution, and a relatively small part of the stock inhabits the waters off the northern and eastern coasts of Iceland, except in warm years. The fishery and the survey show a more northerly distribution in recent years, possibly because of relative warming in the northern waters. Significant changes in the length- and weight-at-age have been observed in the Icelandic saithe. It is unknown whether these changes are fisheries or environmentally driven.

**The fisheries**

Saithe are caught in directed saithe fisheries, as well as in mixed demersal fisheries targeting cod. The fishery is regulated by TACs and minimum mesh size in fishing gears.

| | |
|---|---|
| **Catch distribution** | Total landings (2011) are 51 kt, where 80% were caught by bottom trawl and 7% by gillnet, with jiggers and Danish seine taking the majority of the rest. 1–2% discards by numbers. |

**Quality considerations**

The assessment of Icelandic saithe is relatively uncertain due to fluctuations in the spring survey data. This produces high uncertainty in the present estimates of SSB and fishing mortality.

An issue in this year's assessment involves the 2008 cohort which is estimated to be large by the default assessment model, and this increases the biomass estimate compared to recent years. However, the size of the 2008 cohort is very uncertain, due to mixed signals about this cohort in the commercial and survey catch-at-age data.

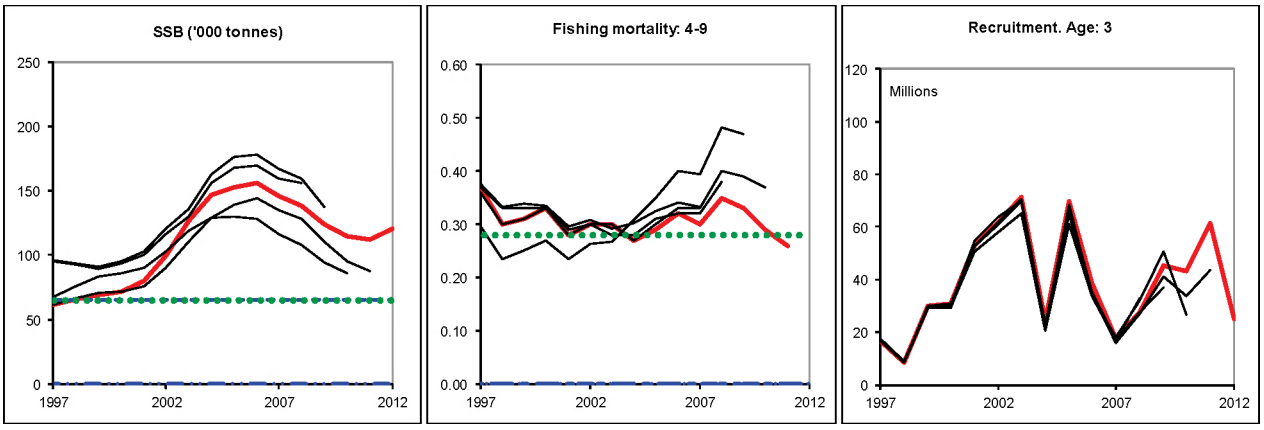



**Figure 2.4.4.2** Saithe in Division Va (Icelandic saithe). Historical assessment results (final-year recruitment estimates included).

**Scientific basis**

| | |
|---|---|
| **Assessment type** | Separable statistical catch-at-age model, with changes in selectivity for three different time periods. |
| **Input data** | Catch-at-age and spring groundfish survey. |
| **Discards and bycatch** | Not included in the assessment, estimated to be very low. |
| **Indicators** | None. |
| **Other information** | Benchmark performed in 2010. |
| **Working group report** | NWWG |

## ECOREGION Iceland and East Greenland
## STOCK Saithe in Division Va (Icelandic saithe)

**Reference points**

| | *Type* | *Value* | *Technical basis* |
|---|---|---|---|
| MSY Approach | MSY $B_{trigger}$ | 65 000 t | Stochastic projections based on hockeystick S–R function. |
| | $F_{MSY}$ | 0.28 | Stochastic projections based on hockeystick S–R function. |
| Precautionary Approach | $B_{lim}$ | 65 000 t | $B_{loss}$ estimate in 2010. |
| | $B_{pa}$ | Not defined | |
| | $F_{lim}$ | Not defined | |
| | $F_{pa}$ | Not defined | |

*(MSY $B_{trigger}$ corrected in 2012, technical basis is the same as in 2010corrected in 2012)*

**Outlook for 2013**

Basis: F(2011) = 0.26; F(2012) = 0.24 based on landings 2012 = 52; SSB(2013) = 130; B4+(2013) = 259; N3(2012) = 25 from assessment model.

| Rationale | Landings (2013) | Basis | F (2013) | SSB (2014) | %SSB change [1)] | % TAC change [2)] |
|---|---|---|---|---|---|---|
| Zero catch | 0 | F=0 | 0.00 | 180 | 38 | −100 |
| MSY framework B-rule[3)] | 49 | 20% HCR | 0.22 | 143 | 9 | −6 |
| *Status quo* | 57 | $F = F_{2011}$ | 0.26 | 137 | 5 | 10 |
| MSY framework F-rule | 61 | $F = F_{MSY}$ | 0.28 | 134 | 2 | 17 |

Weights in thousand tonnes.
[1)] SSB 2014 relative to SSB 2013.
[2)] Landings 2013 relative to TAC 2012.
[3)] Average of 0.2 B4+ and last year's advice.

***MSY approach***

Given that the harvest rate of 20% of B4+ is more robust to changes in selectivity, ICES bases its advice on the B-rule (Figure 2.4.4.5).

Following the ICES MSY framework (B-rule) implies that the TAC is based on the average of 20% of the reference biomass in 2012 and last year's advice (2011). This implies that the TAC should be no more than 49 000 t.

**Additional considerations**

*Management considerations*

Analysis of the Icelandic saithe data (NWWG, 2012; ICES, 2010) indicates considerable changes in selectivity, and the $F_{MSY}$ = 0.28 is based on the selectivity pattern estimated in 2010. The currently estimated selectivity targets younger fish, and simulation analysis with this selectivity would lead to a different $F_{MSY}$.

The spring survey data are relatively noisy and have therefore led to considerable fluctuations in retrospective biomass estimates.

Given the aforementioned changes in selectivity, as well as the fluctuations in the spring survey data, the B-rule with a two-year stabilizer reduces the probability of giving advice that leads to temporary overfishing or underutilization.

*Information from the fishing industry*

Commercial cpue from the most important fleets targeting saithe are available for 20 years or more. However, the potential for bias in commercial cpue (for example hyper-stability) is a serious concern for shoaling species such as saithe. Therefore, although these indices have been explored for inclusion in the past, they were not considered in calibrating the present assessment, as they are considered unreliable as an indicator of abundance.

*Uncertainties in assessment and forecast*

The Icelandic discards monitoring programme has not detected large amounts of discards in the saithe fishery. Excluding discards in the assessment is thus not considered to cause a significant bias in the assessment and the advice.

The assessment is relatively uncertain, due to high variances in survey measurements and lack of reliable recruitment estimates.

The discrepancy between the applied assessment model and a TSA model (NWWG, 2012) is greater than in recent years, estimating the total biomass (B4+) as 265 kt and 219 kt, respectively. This difference is mainly due to uncertainty about the 2008 cohort. Next year's data should decrease this uncertainty about the 2008 cohort size. If the 2008 cohort does not turn out to be large, then the current biomass estimate of 265 kt is most likely an overestimate.

*Comparison with previous assessment and advice*

In the current assessment, SSB in 2011 is estimated 27% higher and F in 2010 is estimated 22% lower than in last year's assessment.

This year's advice is based on the MSY framework B-rule. Last year's advice was based on the F-rule.

**Sources**

ICES. 2008. Report of the North-Western Working Group (NWWG). ICES CM 2008/ACOM:03.
ICES. 2010. Report of the Benchmark Workshop on Roundfish (WKROUND). ICES CM 2010/ACOM:36.
ICES. 2011. Report of the North-Western Working Group, 26 April–3 May 2011. ICES CM 2011/ACOM:07.
ICES. 2012. Report of the North-Western Working Group, 26 April–3 May 2012. ICES CM 2012/ACOM:07.
NWWG. 2012. Gudmundur Gudmundsson. Fish stock assessment by time-series analysis. North-Western Working Group, WD 27.

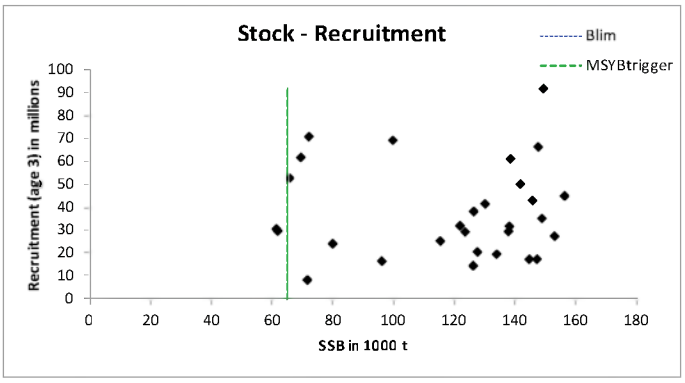



**Figure 2.4.4.3** Saithe in Division Va (Icelandic saithe). Stock–recruitment plot.

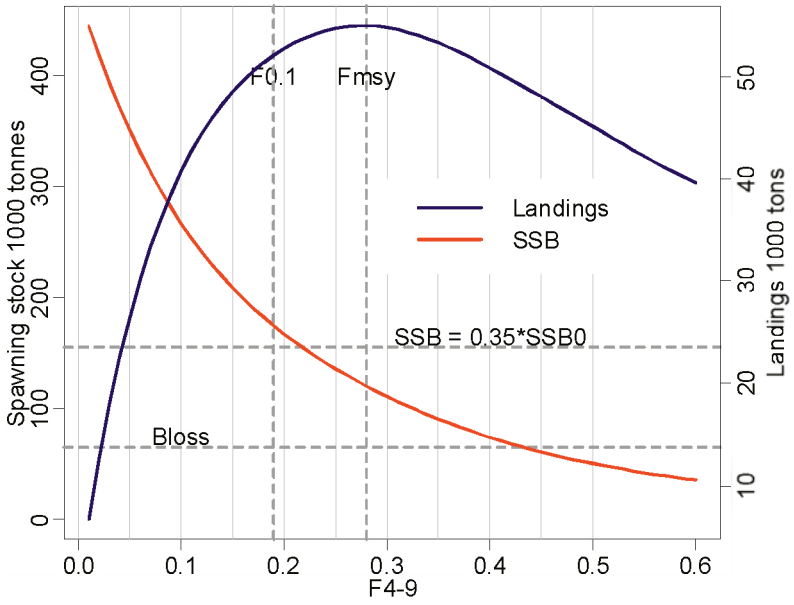



**Figure 2.4.4.4** Saithe in Division Va (Icelandic saithe). Yield and SSB as a function of $F_{4\text{-}9}$, based on stochastic simulations from the WKROUND benchmark (ICES, 2010).

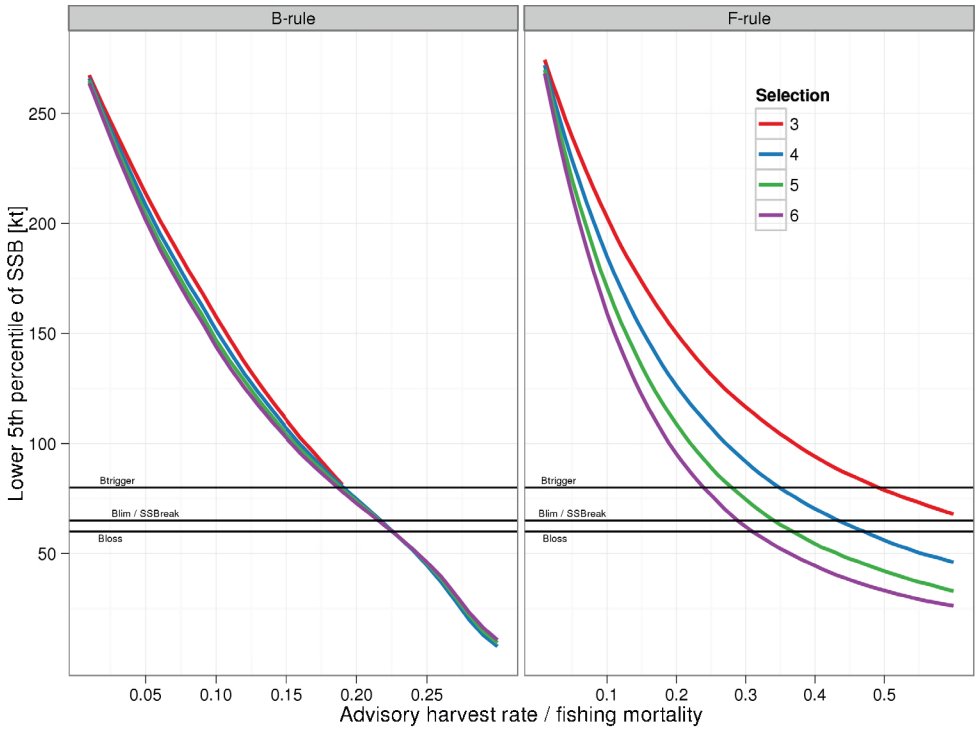



**Figure 2.4.4.5** The lower 5th percentile of the spawning-stock biomass based on four arbitrary selection patterns, where higher scenario numbers reflect increasing targeting of younger fish. The left hand panel shows the outcome of the SSB when advice is based on the reference biomass (B4+). The right hand panel the shows outcome of the SSB when the advice is based on the conventional F-based rule.

**Table 2.4.4.1** Saithe in Division Va (Icelandic saithe). ICES advice, management, and catches.

| Year | ICES Advice | Predicted catch corresp. to advice | Agreed TAC | Landings |
|---|---|---|---|---|
| 1987[1] | TAC | 64 | 70 | 81 |
| 1988[1] | TAC | 64 | 80 | 77 |
| 1989[1] | TAC | 80 | 80 | 82 |
| 1990[1] | TAC | 80 | 90 | 98 |
| 1991[1] | TAC | 87 | 65 | 71 |
| 1991/92[2] | TAC | 70 | 75[2] | 88 |
| 1992/93[2] | Marginal gains from increase in F | 75[1] | 95[2] | 78 |
| 1993/94[2] | No measurable gains from increase in F | 84[1] | 85[2] | 69 |
| 1994/95[2] | No measurable gains from increase in F | 72[1] | 75[2] | 61 |
| 1995/96[2] | No measurable gains from increase in F | 65[1] | 70[2] | 41 |
| 1996/97[2] | No measurable gains from increase in F | 52[1] | 50[2] | 38 |
| 1997/98[2] | F below $F_{med}$ = 0.23 | 30[3] | 30[2] | 33 |
| 1998/99[2] | F below 60% of F(97) | 28 | 30[2] | 32 |
| 1999/00[2] | F below 60% of F(98) | 24 | 30[2] | 30 |
| 2000/01[2] | F=70% of F(99) | 25 | 30[2] | 32 |
| 2001/02[2] | No directed fishing | - | 37[2] | 36 |
| 2002/03[2] | 2/3 $F_{pa}$ to rebuild stock | 24 | 45 | 47 |
| 2003/04[2] | No advice | | 50 | 56 |
| 2004/05[2] | $F_{pa}$ | 69 | 70 | 71 |
| 2005/06[2] | $F_{pa}$ | 78 | 80 | 78 |
| 2006/07[2] | $F_{pa}$ | 81 | 80 | 66 |
| 2007/08[2] | No advice | - | 75 | 68 |
| 2008/09[2] | Maintain SSB > $B_{pa}$ | < 22 | 65 | 62 |
| 2009/10[2] | F reduced below 0.22 | < 34 | 50 | 54 |
| 2010/11[2] | $F_{MSY}$ | < 40 | 50 | 51 |
| 2011/12 | $F_{MSY}$ | ≤ 45 | 52 | |
| 2012/13 | MSY framework [B-rule] | ≤ 49 | | |

Weights in thousand tonnes.
[1]Calendar year.
[2]National fishing year ending 31 August.

**Table 2.4.4.2** Saithe in Icelandic waters (Division Va). Summary of the assessment.

| | B4+ | SSB | Landings | Landings/B4+ | F4–9 | N3 | Cohort |
|---|---|---|---|---|---|---|---|
| 1980 | 312 | 122 | 58 | 0.19 | 0.29 | 28 | 32 |
| 1981 | 305 | 130 | 59 | 0.19 | 0.26 | 20 | 42 |
| 1982 | 294 | 149 | 69 | 0.23 | 0.30 | 22 | 35 |
| 1983 | 270 | 147 | 58 | 0.22 | 0.24 | 32 | 67 |
| 1984 | 287 | 149 | 63 | 0.22 | 0.23 | 42 | 92 |
| 1985 | 299 | 142 | 57 | 0.19 | 0.25 | 35 | 50 |
| 1986 | 318 | 138 | 65 | 0.20 | 0.28 | 67 | 32 |
| 1987 | 335 | 127 | 81 | 0.24 | 0.35 | 92 | 21 |
| 1988 | 416 | 123 | 77 | 0.19 | 0.32 | 50 | 30 |
| 1989 | 398 | 126 | 82 | 0.21 | 0.31 | 32 | 15 |
| 1990 | 378 | 134 | 98 | 0.26 | 0.35 | 21 | 20 |
| 1991 | 336 | 144 | 102 | 0.30 | 0.37 | 30 | 18 |
| 1992 | 288 | 138 | 80 | 0.28 | 0.37 | 15 | 30 |
| 1993 | 231 | 115 | 72 | 0.31 | 0.40 | 20 | 26 |
| 1994 | 187 | 96 | 64 | 0.34 | 0.45 | 18 | 17 |
| 1995 | 153 | 71 | 49 | 0.32 | 0.46 | 30 | 9 |
| 1996 | 149 | 62 | 40 | 0.27 | 0.41 | 26 | 30 |
| 1997 | 156 | 61 | 37 | 0.24 | 0.37 | 17 | 31 |
| 1998 | 153 | 66 | 32 | 0.21 | 0.30 | 9 | 53 |
| 1999 | 131 | 69 | 31 | 0.24 | 0.31 | 30 | 62 |
| 2000 | 142 | 72 | 33 | 0.23 | 0.33 | 31 | 71 |
| 2001 | 161 | 80 | 32 | 0.20 | 0.28 | 53 | 24 |
| 2002 | 216 | 100 | 42 | 0.19 | 0.30 | 62 | 70 |
| 2003 | 274 | 126 | 52 | 0.19 | 0.30 | 71 | 38 |
| 2004 | 315 | 147 | 65 | 0.21 | 0.27 | 24 | 18 |
| 2005 | 279 | 153 | 69 | 0.25 | 0.29 | 70 | 28 |
| 2006 | 301 | 156 | 76 | 0.25 | 0.32 | 38 | 45 |
| 2007 | 267 | 146 | 64 | 0.24 | 0.30 | 18 | 43 |
| 2008 | 234 | 138 | 70 | 0.30 | 0.35 | 28 | 61 |
| 2009 | 211 | 124 | 61 | 0.29 | 0.33 | 45 | 25 |
| 2010 | 219 | 114 | 54 | 0.25 | 0.29 | 43 | |
| 2011 | 234 | 112 | 51 | 0.22 | 0.26 | 61 | |
| 2012 | 265 | 121 | | | | 25 | |
| Average | 258 | 118 | 61 | 0.24 | 0.32 | 36 | 36 |

The table shows official landings, based on data from the Icelandic Directorate of Fisheries. The difference between the official data (51 123 t in 2011) and ICES data (51 215 t) is less than 0.2%.

**ECOREGION** Iceland and East Greenland
**STOCK** Greenland halibut in Subareas V, VI, XII, and XIV

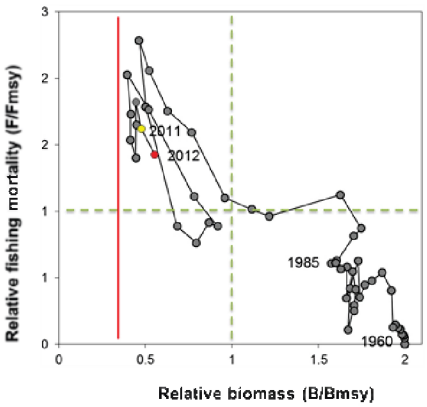
### Advice for 2013

ICES advises on the basis of the MSY approach that landings in 2013 should be no more than 20 000 t.

### Stock status

| F (Fishing Mortality) | 2009 | 2010 | 2011 |
|---|---|---|---|
| **MSY ($F_{MSY}$)** | ✗ | ✗ | ✗ Overfishing |
| **Precautionary approach** ($F_{pa}$, $F_{lim}$) | ? | ? | ? Undefined |

| SSB (Spawning-Stock Biomass) | 2010 | 2011 | 2012 |
|---|---|---|---|
| **MSY** ($B_{trigger}$) | ✓ | ✓ | ✓ At or above possible candidate MSY $B_{trigger}$. |
| **Precautionary approach** ($B_{pa}$, $B_{lim}$) | ? | ? | ? Not defined |



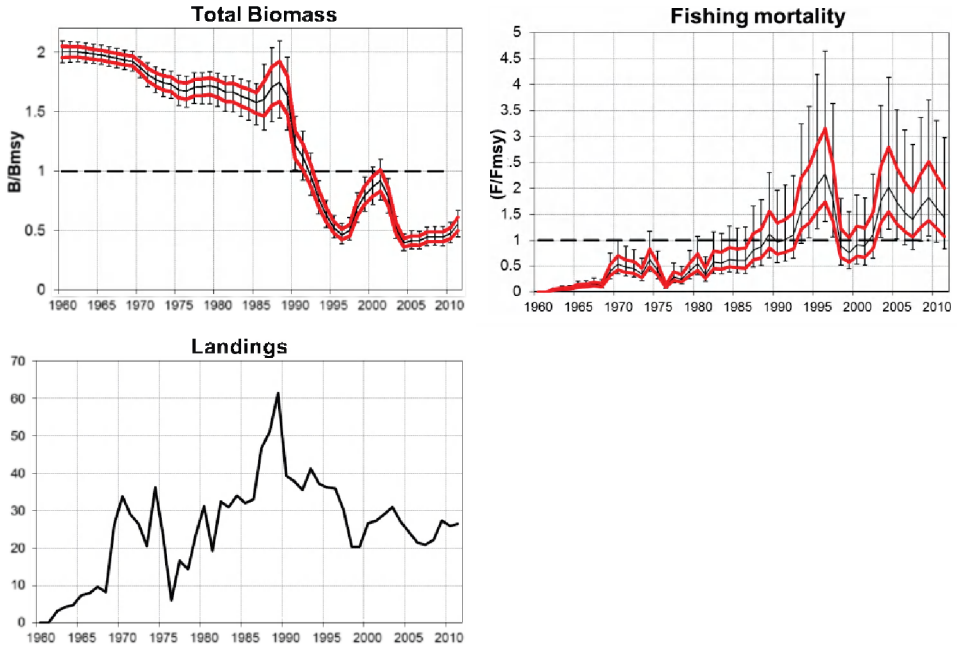




**Figure 2.4.5.1** Greenland halibut in Subareas V, VI, XII, and XIV. Summary of the stock assessment (weights in '000 tonnes). Lower panels: trends of biomass and fishing mortality relative to MSY reference points (medians) with indication of 25–75 percentiles (red curves) and 95% conf. intervals (error bars). Top right: relative SSB and F over the years with indication of $B_{MSY}$ (1.0), $B_{lim}$ (0.3$B_{MSY}$), $F_{msy}$ (1.0), and $F_{lim}$ (1.7$F_{MSY}$). Bottom: Landings (000 tons).

The assessment is indicative of stock trends, and provides relative measures of stock status. The stock has been below $B_{MSY}$ since the early 1990s and is presently at 55% of $B_{MSY}$. Since the record low biomass observed in 2004 the stock has been stable with a sign of slow increase. Landings for more than a decade has been between 20 000 and 30 000 t. Present fishing mortality is estimated to be 1.4 times the Fmsy.

**Management plans**

In 2012 the coastal states have initiated work on a common management plan for Greenland halibut in V,XII and VIX. The plan is aiming on two steps, a graduals lowering of the total catches until biological reference points have been evaluated by ICES, and thereafter implementation of a harvest control rule in accordance with ICES MSY approach. The plan will include continuous monitoring of the resource and requirements on information from the fishery.

**Biology**

Greenland halibut is a relatively slow-growing and long-lived species. Changes in stock dynamics may take several years. Available biological data and distribution of the fisheries suggest that Greenland halibut in Subareas XIV and V belong to the same entity and do mix, although precise stock associations are not known. Tagging studies suggest that some mixing occurs also with Greenland halibut in the Norwegian Sea/Barents Sea. Nursery grounds are unknown.

**The fisheries**

The fishery is distributed over a vast area, mainly conducted by factory trawlers operating with demersal trawl.

| | |
|---|---|
| **Catch distribution** | Total landings (2011) = 26424 t, 96% bottom trawl, 4% gillnets/longlines. Discarding is considered to be small (less than 1% by weight) |

**Quality considerations**

Lack of knowledge on life history and stock structure of Greenland halibut in relation to the assessment area (Subareas V, VI, XII, and XIV) impede the interpretation and weighting of the different biomass indices. Lack of information on recruitment to the stock prevents an accurate short term forecast.

**Scientific basis**

| | |
|---|---|
| **Assessment type** | A probabilistic (Bayesian) version of a surplus-production model. |
| **Input data** | One cpue series of the Icelandic trawl fleet (since 1985) and two trawl surveys (Va: since 1996, XIV: since 1998). |
| **Discards and bycatch** | Not considered relevant for the assessment. |
| **Indicators** | None. |
| **Other information** | A benchmark is planned for 2013 |
| **Working group report** | NWWG |

## ECOREGION Iceland and East Greenland
## STOCK Greenland halibut in Subareas V, VI, XII, and XIV

**Reference points**

Relative reference points are defined for this stock. Fishing mortality is estimated in relation to $F_{MSY}$ and total stock biomass is estimated in relation to $B_{MSY}$. A possible candidate for MSY $B_{trigger}$ will be within the range 30%-50%$B_{MSY}$. MSYbtrigger in this range have been adopted for a number of ICES and NAFO stocks.

**Outlook for 2013**
Basis: Assumed landings 2012 according to TACs = 25 000 t.

| Catch option 2013 (in '000 t): | 0 | 5 | 10 | 15 | 20 | 30 |
|---|---|---|---|---|---|---|
| Probability of falling below $0.3B_{MSY}$ | 1% | 2% | 2% | 2% | 3% | 10% |
| Probability of being below $B_{MSY}$ | 93% | 94% | 94% | 95% | 96% | 97% |
| Probability of exceeding $F_{MSY}$ | - | 3% | 13% | 31% | 53% | 86% |
| Probability of exceeding $1.7F_{MSY}$ | - | 1% | 4% | 10% | 20% | 55% |
| Stock size ($B/B_{MSY}$), median | 0.62 | 0.61 | 0.60 | 0.59 | 0.57 | 0.49 |
| Fishing mortality ($F/F_{MSY}$), | 0.00 | 0.24 | 0.49 | 0.75 | 1.04 | 1.83 |
| Productivity (% of MSY) | 86% | 85% | 84% | 83% | 82% | 74% |

Probabilities are for the catch option year

***MSY approach***

The stock is considered to be above any potential MSY $B_{trigger}$.(30%-50%$B_{MSY}$) Following the ICES MSY framework implies that the advised fishing mortality should be $F_{MSY}$ or a transitional $F_{MSY}$.

Aiming directly for a harvest at $F_{MSY}$ because this is a vulnerable long lived species, will correspond to maximum landings in 2013 of less than 20 000 t and is expected to lead to a status quo in stock size in 2013. 20 000 t will give a 50% probability of reaching Fmsy in 5-10 years.

**Additional considerations**

*Management considerations*

There is no regional management agreement in place, TACs are set separately for Iceland and Greenland EEZs, and the number of licences is set separately by the Faroe Islands. A common management plan by the three coastal states is presently being developed. The management plan will include monitoring of the effort and stock development as well as a framework for adapting future fishing according to the response of the stock aiming at a harvest control rule in accordance with MSY. Since Greenland halibut is a slow-growing species, it is expected that a change in stock dynamics may take several years and this will be taken into consideration in the management plan. The plan is intended to be fully implemented in 2015, however, a stepwise reduction in catches is predicted to take place already from 2013 until MSY reference points have been evaluated by ICES for this stock.

Previously, the stock have sustained catches between 20 000 t and 30 000 t in the past decades. It should be taken into account that Greenland halibut is a slow-growing and long-lived species and rebuilding the stock is therefore only likely only to be achieved within a long time frame. The medium-term forecasts suggest that stock recovery is slow under all fishing scenarios, even in the case of no fishery.

Available biological information such as tagging and genetic studies and the distribution of the fisheries suggest that Greenland halibut in Divisions XIV and V belong to the same stock entity and that a common management is therefore required.

Because the nursery grounds are not known, there is no monitoring of recruits and juveniles. Because Greenland halibut is a slow-growing species that first appears in catches at ages 4–6, recruitment failure will only be detected in the fishery some 5–10 years after it occurs. The management plan that is under development should consider these features.

*Information from fishing industry*

Information from the fisheries in East Greenland and the Faroe Islands, which is not contained in the assessment model, suggest stable biomasses in recent years.

*Regulations and their effects*

No formal agreement on the management of the Greenland halibut fishery exists presently among the three coastal states, Greenland, Iceland, and the Faroe Islands. In Greenland and Iceland, the fishery is regulated by a TAC and in the Faroe Islands by effort limitation (number of fishing licenses). This management practice has resulted in adoption of TACs by Greenland and Iceland that in total are set substantially higher than TACs advised by ICES. In addition to this a number of fishery licenses at the Faroe Islands also contributed to landings. As a result of these national TACs and effort regulations, landings have been in excess of the TACs advised by ICES since 1987. The management plan that is under development will solve this lack of coordination.

*Data and methods*

Two surveys (Greenland and Icelandic) and CPUE data from the Icelandic trawler fleet along with landings data back to the start of the fishery (1960) were used as input to the stock production model. Additional data was available (CPUE's from East Greenland trawlers and from Faroese trawlers) but these data had conflicting trends with the other indices and the model did not allow to include them. All available indices are considered equal relevant as biomass indicators.

*Uncertainties in the assessment*

Survey coverage is considered adequate to monitor the stock, but lack of sufficient knowledge on life history and stock structure of Greenland halibut in relation to the assessment area (Subareas V,VI, XII, and XIV) impede the interpretation and weighting of the different indices. Furthermore, conflicting indices cannot be accommodated by the stock production model. In the present assessment cpues from Subarea XIV have not been used for that reason. Increasing conflict between the two remaining survey indices contributes to increased uncertainty in the population estimates. Further the lack of a 2011 survey in Div. Va contributes also to the increased uncertainty.

Prior to the introduction of sorting grids in the shrimp fisheries a substantial number of juvenile Greenland halibut was expected to be discarded. However, there is no quantification of the historical as well as the present discard levels. Hence, the potential bias by not including discards in the assessment cannot be evaluated.

*Comparison with previous assessment and advice*

The assessment and estimates for the state of the stock are consistent with last year's results.

The basis for advice this year is the same as last year, MSY approach. A potential range for a candidate MSY Btrigger was defined and this have resulted in a substantial change in advice.

**Source**

ICES. 2012. Report of the North-Western Working Group, 26 April–3 May 2012. ICES CM 2012/ACOM:07.

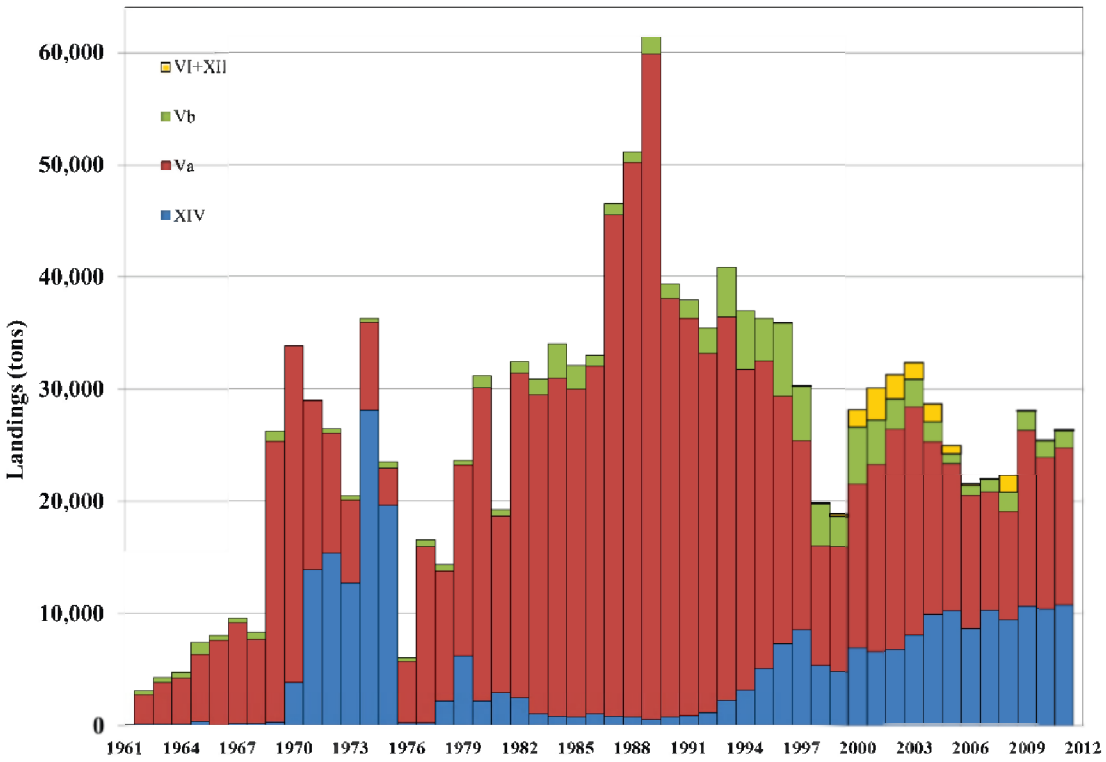



**Figure 2.4.5.2** Greenland halibut in Subareas V, VI, XII, and XIV. Landings by area (tonnes).

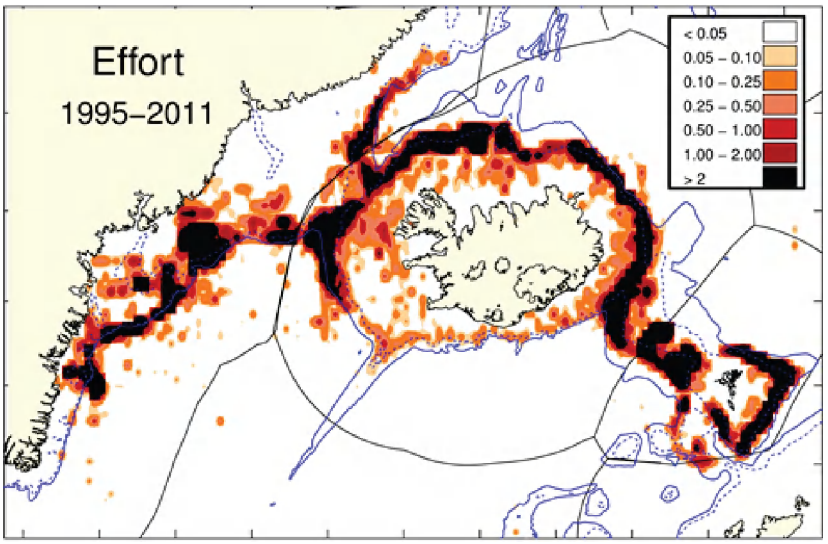



**Figure 2.4.5.3** Greenland halibut in Subareas V, VI, XII, and XIV. Distribution of total effort in the fishery for the period 1991–2011. 500 m and 1000 m depth contours are shown.

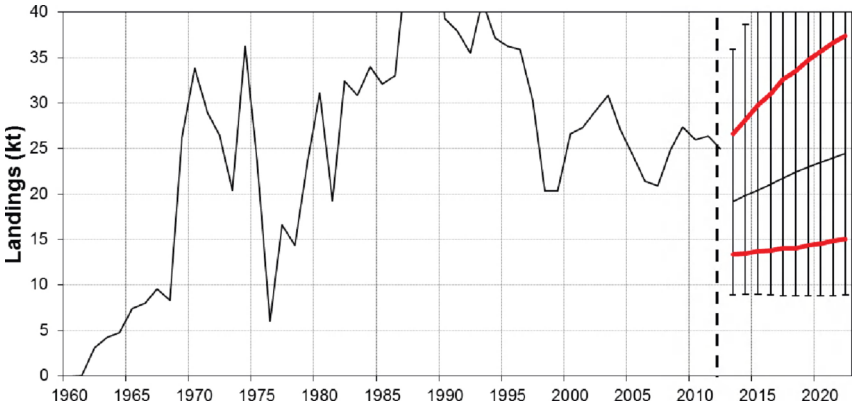



**Figure 2.4.5.4** Historic landings (000` t) and projected landings 2013-2022 assuming F/Fmsy (2013-22)=1.0. Solid line is median, red bold lines are quartiles and bars indicate 90% conf. limit.

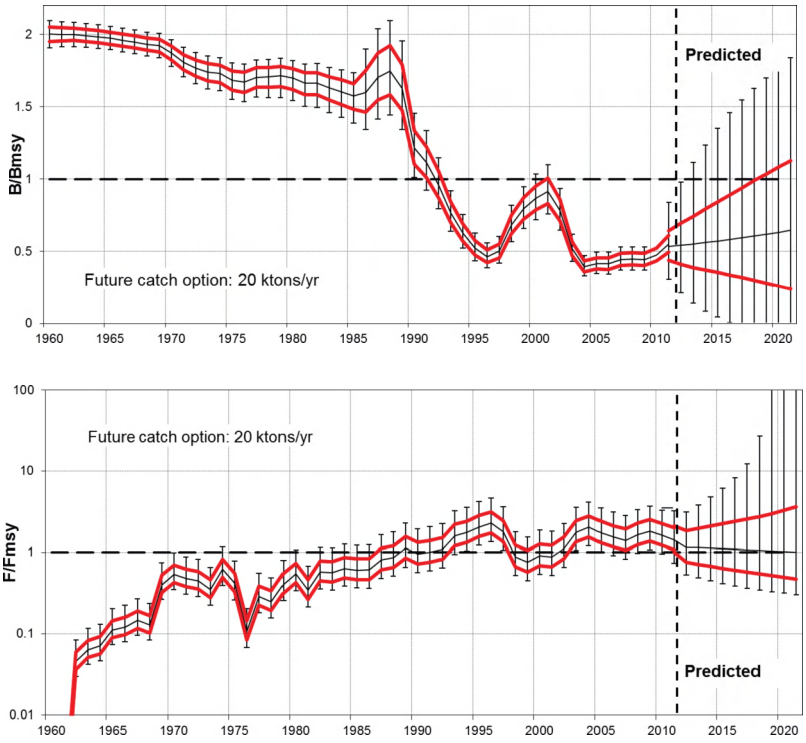



**Figure 2.4.5.5** SSB (upper) and fishing mortality (lower) assuming future fixed catch option on 20 kt per year. Solid line is median, red bold lines are quartiles and bars indicate 90% conf. limit.

**Table 2.4.5.1** Greenland halibut in Subareas V, VI, XII, and XIV. ICES advice, management, and landings.

| Year | ICES Advice | Predicted catch Corresp. to advice | TAC for Icelandic EEZ | Greenland TAC | Landings in Va | ICES landings V, VI, XII, and XIV |
|---|---|---|---|---|---|---|
| 1987 | No increase in F | 28 | 30 | | 45 | 47 |
| 1988 | No increase in F | 28 | 30 | | 49 | 51 |
| 1989 | TAC | 33 | 30 | | 59 | 61 |
| 1990 | No advice | - | 45 | | 37 | 39 |
| 1991 | TAC | 40 | 30 | | 35 | 38 |
| 1992 | TAC | 30 | 25 | | 32 | 35 |
| 1993 | No increase in effort | 28[1] | 30[2] | | 34 | 41 |
| 1994 | No increase in effort | 34[1] | 30[2] | | 29 | 37 |
| 1995 | TAC | 32 | 30[2] | | 27 | 36 |
| 1996 | TAC | 21 | 20[2] | | 22 | 36 |
| 1997 | 60% reduction in F from 1995 | 13 | 15[2] | | 18 | 30 |
| 1998 | 70% reduction in F from 1996 | 11 | 10[2] | 8.1 | 11 | 20 |
| 1999 | 65% reduction in F from 1997 | 11 | 10[2] | 8 | 11 | 21 |
| 2000 | 60% reduction in F from 1998 | 11 | 10[2] | 8 | 15 | 26 |
| 2001 | catch less than 98–99 catch | <20 | 20[2] | 14.5 | 17 | 28 |
| 2002 | F reduced below 0.67*$F_{MSY}$ | <21 | 20[2] | 14.5 | 20 | 29 |
| 2003 | F reduced below 0.67*$F_{MSY}$ | <23 | 23[2] | 14.5 | 20 | 30 |
| 2004 | F reduced below 0.67*$F_{MSY}$ | <20 | 23[2] | 14.1 | 15 | 28 |
| 2005 | Effort reduced to 1/3 of the 2003 level | <15 | 15 | 12 | 13 | 24 |
| 2006 | Effort reduced to 1/3 of the 2003 level | <15 | 15 | 10 | 12 | 21 |
| 2007 | Adaptive management plan, start at 15 000 t | <15 | 15 | 11.7 | 10 | 21 |
| 2008 | Adaptive management plan, start at 15 000 t | <15 | 15 | 11 | 12 | 24 |
| 2009 | Adaptive management plan, reduce to 5000 t | <5 | 15 | 10 | 16 | 28 |
| 2010 | Adaptive management plan, reduce to 5000 t | <5 | 12 | 12 | 14 | 26 |
| 2011 | Adaptive management plan, reduce F substantially below $F_{MSY}$ | <5 | 13 | 12 | 14 | 26 |
| 2012 | No directed fishery, multi-annual management plan to be developed and implemented | - | 13 | 13 | | |
| 2013 | F reduced to $F_{MSY}$ | <20 | | | | |

Weights in '000 t.
[1]Catch at *status quo* F.
[2]Year ending 31 August.

**Table 2.4.5.2** Greenland halibut in Subareas V, VI, XII, and XIV. Nominal landings (tonnes) by country, as officially reported to ICES and estimated by the working group.

| Country | 1981 | 1982 | 1983 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|
| Denmark | - | - | - | - | - | 6 | + | - |
| Faroe Islands | 767 | 1,532 | 1,146 | 1,052 | 853 | 1,096 | 1,378 | 2,319 |
| France | 8 | 27 | 236 | 845 | 52 | 19 | 25 | - |
| Germany | 3,007 | 2,581 | 1,142 | 863 | 858 | 565 | 637 | 493 |
| Greenland | + | 1 | 5 | 81 | 177 | 154 | 37 | 11 |
| Iceland | 15,457 | 28,300 | 28,360 | 29,231 | 31,044 | 44,780 | 49,040 | 58,330 |
| Norway | - | - | 2 | 3 | + | 2 | 1 | 3 |
| Russia | - | - | - | - | - | - | - | - |
| UK (Engl. and Wales) | - | - | - | - | - | - | - | - |
| UK (Scotland) | - | - | - | - | - | - | - | - |
| United Kingdom | - | - | - | - | - | - | - | - |
| Total | 19,239 | 32,441 | 30,891 | 32,075 | 32,984 | 46,622 | 51,118 | 61,156 |
| Working Group estimate | - | - | - | - | - | - | - | 61,396 |

| Country | 1990 | 1991 | 1992 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|
| Denmark | - | - | - | - | - | 1 | - | |
| Faroe Islands | 1,803 | 1,566 | 2,128 | 6,241 | 3,763 | 6,148 | 4,971 | 3,817 |
| France | - | - | 3 | - | - | 29 | 11 | 8 |
| Germany | 336 | 303 | 382 | 648 | 811 | 3,368 | 3,342 | 3,056 |
| Greenland | 40 | 66 | 437 | 867 | 533 | 1,162 | 1,129 | 747 |
| Iceland | 36,557 | 34,883 | 31,955 | 27,778 | 27,383 | 22,055 | 18,569 | 10,728 |
| Norway | 50 | 34 | 221 | 1,173 [1] | 1,810 | 2,164 | 1,939 | 1,367 |
| Russia | - | - | 5 | - | 10 | 424 | 37 | 52 |
| Spain | | | | | | | | 89 |
| UK (Engl. and Wales) | 27 | 38 | 109 | 513 | 1,436 | 386 | 218 | 190 |
| UK (Scotland) | - | - | 19 | 84 | 232 | 25 | 26 | 43 |
| United Kingdom | | | | | | | | |
| Total | 38,813 | 36,890 | 35,259 | 37,305 | 36,006 | 35,762 | 30,242 | 20,360 |
| Working Group estimate | 39,326 | 37,950 | 35,423 | 36,958 | 36,300 | 35,825 | 30,309 | 20,382 |

| Country | 1999 | 2000 | 2001 | 2003 [1] | 2004 [1] | 2005 [1] | 2006 [1] | 2007 [1] |
|---|---|---|---|---|---|---|---|---|
| Denmark | | - | - | - | - | - | - | - |
| Estonia | | - | - | - | - | 5 | 3 | - |
| Faroe Islands | 3,884 | - | 121 | 458 | 338 | 1,150 | 855 | 1,141 |
| France | - | 2 | 32 | 177 | 157 | - | 62 | 17 |
| Germany | 3,082 | 3,265 | 2,800 | 2,948 | 5,169 | 5,150 | 4,299 | 4,930 |
| Greenland | 200 | 1,740 | 1,553 | 1,459 | - | - | - | - |
| Iceland | 11,180 | 14,537 | 16,590 | 20,366 | 15,478 | 13,023 | 11,798 | - |
| Ireland | | - | 56 | - | - | - | - | - |
| Lithuania | | - | - | 2 | 1 | - | 2 | 3 |
| Norway | 1,187 | 1,750 | 2,243 | 1,074 | 1,233 | 1,124 | 1,097 | 692 |
| Poland | | - | 2 | 93 | 207 | - | - | - |
| Portugal | | - | 6 | - | - | - | 1,094 | - |
| Russia | 138 | 183 | 187 | - | 262 | - | 552 | 501 |
| Spain | | 779 | 1,698 | 3,075 | 4,721 | 506 | 33 | - |
| UK (Engl. and Wales) | 261 | 370 | 227 | 40 | 49 | 10 | 1 | - |
| UK (Scotland) | 69 | 121 | 130 | 367 | 367 | 391 | 1 | - |
| United Kingdom | - | 166 | 252 | 841 | 1,304 | 220 | 93 | 17 |
| Total | 20,001 | 22,913 | 25,897 | 30,900 | 29,286 | 21,579 | 19,890 | 7,301 |
| Working Group estimate | 20,371 | 26,644 | 27,291 | 30,891 | 27,102 | 24,978 | 21,466 | 21,873 |

| Country | 2008 [1] | 2009 [1] | 2010 [1] | 2011 [1] |
|---|---|---|---|---|
| Denmark | - | - | - | - |
| Estonia | - | - | - | - |
| Faroe Islands | - | 270 | 1,408 | 1,266 |
| France | 114 | - | - | 43 |
| Germany | 4,846 | 427 | 5,287 | 5,782 |
| Greenland | - | 2,819 | - | 3,415 |
| Iceland | - | - | 13,293 | 13,192 |
| Ireland | - | - | - | - |
| Lithuania | 566 | | - | - |
| Norway | 639 | 124 | 233 | 176 |
| Poland | 1,354 | 988 | 960 | - |
| Portugal | - | - | - | - |
| Russia | 799 | 762 | 1,070 | 1,095 |
| Spain | - | - | - | - |
| United Kingdom | 422 | 581 | 577 | 648 |
| Total | 9,744 | 5,974 | 22,901 | 25,618 |
| Working Group estimate | 24,481 | 28,197 | 25,995 | 26,347 |

1) Provisional data

**Table 2.4.5.3** Greenland Halibut in **Division Va**. Nominal landings (tonnes) by country, as officially reported to ICES and estimated by the working group.

| Country | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|
| Faroe Islands | 325 | 669 | 33 | 46 | | | 15 | 379 | 719 |
| Germany | | | | | | | | | |
| Greenland | | | | | | | | | |
| Iceland | 15,455 | 28,300 | 28,359 | 30,078 | 29,195 | 31,027 | 44,644 | 49,000 | 58,330 |
| Norway | | | + | + | 2 | | | | |
| Total | 15,780 | 28,969 | 28,392 | 30,124 | 29,197 | 31,027 | 44,659 | 49,379 | 59,049 |
| Working Group estimate | | | | | | | | | 59,272 [2] |

| Country | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|
| Faroe Islands | 739 | 273 | 23 | 166 | 910 | 13 | 14 | 26 | 6 |
| Germany | | | | | 1 | 2 | 4 | | 9 |
| Greenland | | | | | 1 | | | | |
| Iceland | 36,557 | 34,883 | 31,955 | 33,968 | 27,696 | 27,376 | 22,055 | 16,766 | 10,580 |
| Norway | | | | | | | | | |
| Total | 37,296 | 35,156 | 31,978 | 34,134 | 28,608 | 27,391 | 22,073 | 16,792 | 10,595 |
| Working Group estimate | 37,308 [2] | 35,413 [2] | | | | | | | |

| Country | 1999 | 2000 | 2001 | 2002 | 2003 [1] | 2004 [1] | 2005 [1] | 2006 [1] | 2,007 [1] |
|---|---|---|---|---|---|---|---|---|---|
| Faroe Islands | 9 | | 15 | 7 | 34 | 29 | 77 | 16 | 25 |
| Germany | 13 | 22 | 50 | 31 | 23 | 10 | 6 | 1 | 228 |
| Greenland | | | | | | | | | |
| Iceland | 11,087 | 14,507 | 2,310 [4] | 2,277 [4] | 20,360 | 15,478 | 13,023 | 11,798 | |
| Norway | | | | | | | 100 | | 691 |
| Russia | | | | | | | | | |
| UK (E/W/I) | 26 | 73 | 50 | 21 | 16 | 8 | 8 | 1 | |
| UK Scottland | 3 | 5 | 12 | 16 | 5 | 2 | 27 | 1 | |
| UK | | | | | | | | | 1 |
| Total | 11,138 | 14,607 | 2,437 | 2,352 | 20,438 | 15,527 | 13,241 | 11,817 | 945 |
| Working Group estimate | | 14,607 | 16,752 | 19,714 | 20,415 | 15,477 | 13,172 | 11,817 | 10,525 |

| Country | 2008 [1] | 2009 [1] | 2010 [1] | 2011 [1] |
|---|---|---|---|---|
| Faroe Islands | | | 37 | 123 |
| Germany | 4 | 423 | 797 | 576 |
| Greenland | | | | 157 |
| Iceland | | | 13,293 | 13,192 |
| Norway | | | | |
| Russia | 4 | | | |
| Poland | | 270 | | |
| UK | 179 | | | |
| Total | 187 | 693 | 14,128 | 14,048 |
| Working Group estimate | 11,859 | 15,782 | 14,128 | 14,048 |

1) Provisional data

2) Includes 223 t catch by Norway.

3) Includes 12 t catch by Norway.

4) fished in Icelandic EEZ, but allocated to XIVb

**Table 2.4.5.4** Greenland Halibut in **Division Vb**. Nominal landings (tonnes) by country, as officially reported to ICES and estimated by the working group.

| Country | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|
| Denmark | - | - | - | - | - | - | 6 | + | - |
| Faroe Islands | 442 | 863 | 1,112 | 2,456 | 1,052 | 775 | 907 | 901 | 1,513 |
| France | 8 | 27 | 236 | 489 | 845 | 52 | 19 | 25 | ... |
| Germany | 114 | 142 | 86 | 118 | 227 | 113 | 109 | 42 | 73 |
| Greenland | - | - | - | - | - | - | - | - | - |
| Norway | 2 | + | 2 | 2 | 2 | + | 2 | 1 | 3 |
| UK (Engl. and Wales) | - | - | - | - | - | - | - | - | - |
| UK (Scotland) | - | - | - | - | - | - | - | - | - |
| United Kingdom | - | - | - | - | - | - | - | - | - |
| Total | 566 | 1,032 | 1,436 | 3,065 | 2,126 | 940 | 1,043 | 969 | 1,589 |
| Working Group estimate | - | - | - | - | - | - | - | - | 1,606 [2] |

| Country | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|
| Denmark | - | - | - | - | - | - | - | - | |
| Faroe Islands | 1,064 | 1,293 | 2,105 | 4,058 | 5,163 | 3,603 | 6,004 | 4750 | 3660 |
| France 6 | ... | ... | 3 [1] | 2 | 1 | 28 | 29 | 11 | 8 [1] |
| Germany | 43 | 24 | 71 | 24 | 8 | 1 | 21 | 41 | |
| Greenland | - | - | - | - | - | - | - | - | |
| Norway | 42 | 16 | 25 | 335 | 53 | 142 | 281 | 42 [1] | 114 [1] |
| UK (Engl. and Wales) | - | - | 1 | 15 | - | 31 | 122 | | |
| UK (Scotland) | - | - | 1 | - | - | 27 | 12 | 26 | 43 |
| United Kingdom | - | - | - | - | - | | | | |
| Total | 1,149 | 1,333 | 2,206 | 4,434 | 5,225 | 3,832 | 6,469 | 4,870 | 3825 |
| Working Group estimate | 1,282 [2] | 1,662 [2] | 2,269 [2] | - | - | | - | - | - |

| Country | 1999 | 2000 [1] | 2001 [1] | 2002 [1] | 2003 [1] | 2004 [1] | 2005 [1] | 2006 [1] | 2007 [1] |
|---|---|---|---|---|---|---|---|---|---|
| Denmark | | | | | | | | | |
| Faroe Islands | 3873 | | 106 | 13 | 58 | 35 | 887 | 817 | 1116 |
| France | | 1 | 32 | 4 | 8 | 17 | | 40 | 9 |
| Germany | 22 | | | | | | | | |
| Iceland | | | | | | | | | |
| Ireland | | | | | | | | | |
| Norway | 87 | 1 | 2 | 1 | 1 | | 1 | | 1 |
| UK (Engl. and Wales) | 9 | 35 | 77 | 50 | 24 | 41 | 2 | | |
| UK (Scotland) | 66 | 116 | 118 | 141 | 174 | 87 | 204 | | |
| United Kingdom | | | | | | | | 19 | 1 |
| Total | 4057 | 153 | 335 | 209 | 265 | 180 | 1,094 | 876 | 1,127 |
| Working Group estimate | 2694 [2] | 5079 | 3,951 | 2,694 | 2,459 | 1,771 | 892 | 873 | 1060 |

| Country | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|
| Denmark | | | | |
| Faroe Islands | | | 1,037 | 1,476 |
| France | 36 | | 35 | 1 |
| Germany | | | | |
| Iceland | | | | |
| Ireland | | | | |
| Norway | 1 | 1 | 5 | |
| UK (Engl. and Wales) | | | | |
| UK (Scotland) | | | | |
| United Kingdom | 32 | 117 | 336 | 11 |
| Total | 69 | 118 | 1,413 | 1,489 |
| Working Group estimate | 1,759 | 1,739 | 1,413 | 1,489 |

1) Provisional data

2) WG estimate includes additional catches as described in Working Group reports for each year and in the report from 2001.

**Table 2.4.5.5** Greenland Halibut in **Subarea XIV**. Nominal landings (tonnes) by country, as officially reported to ICES and estimated by the working group.

| Country | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|
| Faroe Islands | - | - | - | - | - | 78 | 74 | 98 | 87 |
| Germany | 2,893 | 2,439 | 1,054 | 818 | 636 | 745 | 456 | 595 | 420 |
| Greenland | + | 1 | 5 | 15 | 81 | 177 | 154 | 37 | 11 |
| Iceland | - | - | 1 | 2 | 36 | 17 | 136 | 40 | + |
| Norway | - | - | - | + | - | - | - | - | - |
| Russia | - | - | - | - | - | - | - | - | + |
| UK (Engl. and Wales) | - | - | - | - | - | - | - | - | - |
| UK (Scotland) | - | - | - | - | - | - | - | - | - |
| United Kingdom | - | - | - | - | - | - | - | - | - |
| Total | 2,893 | 2,440 | 1,060 | 835 | 753 | 1,017 | 820 | 770 | 518 |
| Working Group estimate | - | - | - | - | - | - | - | - | - |

| Country | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|
| Denmark | - | - | - | - | - | - | 1 | + | + |
| Faroe Islands | - | - | - | 181 | 168 | 147 | 130 | 148 | 151 |
| Germany | 293 | 279 | 311 | 391 | 639 | 808 | 3,343 | 3,301 | 3,399 |
| Greenland | 40 | 66 | 437 | 288 | 866 | 533 | 1,162 | 1,129 | 747 [1,7] |
| Iceland | - | - | - | 19 | 82 | 7 | - | 1,803 | 148 |
| Norway | 8 | 18 | 196 | 511 | 1,120 | 1,668 | 1,881 | 1,897 [1] | 1,253 [1] |
| Russia | - | - | 5 | - | - | 10 | 424 | 37 | 52 |
| UK (Engl. and Wales) | 27 | 38 | 108 | 796 | 513 | 1405 | 264 | 218 | 190 |
| UK (Scotland) | - | - | 18 | 26 | 84 | 205 | 13 | | |
| United Kingdom | - | - | - | - | - | - | - | | |
| Total | 368 | 401 | 1,075 | 2,212 | 3,472 | 4,783 | 7,218 | 8,533 | 5940 |
| Working Group estimate | 736 [2] | 875 [3] | 1,176 [4] | 2,249 [5] | 3,125 [6] | 5,077 [7] | 7,283 [8] | 8,558 [9] | |

| Country | 1999 | 2000 | 2001 [1] | 2002 [1] | 2003 [1] | 2004 [1] | 2005 [1] | 2006 [1] | 2007 [1] |
|---|---|---|---|---|---|---|---|---|---|
| Denmark | | | | | | | | | |
| Faroe Islands | 2 | | | 274 | 366 | 274 | 186 | 22 | |
| Germany | 3047 | 3243 | 2,750 | 2,019 | 2,925 | 5,159 | 5,144 | 4,298 | 4,702 |
| Greenland | 200 [1,4] | 1740 | 1,553 | 1,887 | 1,459 | | | | |
| Iceland | 93 | 30 | 14,280 | 16,947 | 6 | | | | |
| Ireland | | | 7 | | | | | | |
| Norway | 1100 | 1161 | 1,424 | 1,660 | 846 | 1,114 | 1,023 | 1,094 | |
| Poland | | | | | | 205 | | | |
| Portugal | | | 6 | 130 | | | | 1,094 | |
| Russia | 138 | 183 | 186 | 44 | | 261 | | 505 | 500 |
| Spain | | 8 | 10 | | 2,131 | 3,406 | 2 | | |
| UK (Engl. and Wales) | 226 | 262 | 100 | | | | | | |
| UK (Scotland) | | | | 24 | 188 | 278 | 160 | | |
| United Kingdom | | | | 178 | 799 | 1,294 | | | |
| Total | 4806 | 6627 | 20,316 0 | 22,889 | 8,720 | 11,991 | 6,515 | 7,013 | 5,202 |
| Working Group estimate | 5376 [11] | 6958 | 6,588 [6] | 6,750 [6] | 8,017 | 9,854 | 10,185 | 8,589 | 10,261 |

| Country | 2008 [1] | 2009 [1] | 2010 [1] | 2011 [1] |
|---|---|---|---|---|
| Denmark | | | | |
| Faroe Islands | | 270 | 333 | |
| Germany | 4,842 | 4 | 4,490 | 5,206 |
| Greenland | | 2,819 | | 3,258 |
| Iceland | | | | |
| Ireland | | | | |
| Norway | 637 | 29 | 226 | 164 |
| Poland | 1,354 | 718 | 960 | |
| Portugal | | | | |
| Russia | 763 | | 1,070 | 1,095 |
| Spain | | | | |
| United Kingdom | 131 | 452 | 229 | 309 |
| Total | 7,727 | 4,292 | 7,308 | 10,032 |
| Working Group estimate | 9,102 | 9,805 | 10,402 | 10,761 |

1) Provisional data

2)WG estimate includes additional catches as described in working Group reports for each year and in the report from 2001.

3) Includes 125 t by Faroe Islands and 206 t by Greenland.

4) Excluding 4732 t reported as area unknown.

5) Includes 1523 t by Norway, 102 t by Faroe Islands, 3343 t by Germany, 1910 t by Greenland, 180 t by Russia, as reported to Greenland authorities.

6) Does not include most of the Icelandic catch as those are included in WG estimate of Va.

7) Excluding 138 t reported as area unknown.

**Table 2.4.5.6** Greenland Halibut in **Subarea XII**. Nominal landings (tonnes) by country, as officially reported to ICES and estimated by the working group.

| Country | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 [1] | 2004 [1] |
|---|---|---|---|---|---|---|---|---|---|
| Faroe Islands | | 47 | | | | | 40 | | |
| France | | | | | 1 | | | 4 | 30 |
| Ireland | | | | | | 49 | | | |
| Lithuania | | | | | | | | 2 | 1 |
| Poland | | | | | | 2 | | 2 | 1 |
| Spain [2] | 2 | 42 | 67 | 137 | 751 | 1338 | 28 | 730 | 1145 |
| UK | | | | | 7 | 5 | | | |
| Russia | | | | | | | | | |
| Norway | 2 | | | | 553 | 500 | 316 | 201 | 119 |
| Estonia | | | | | | | | | |
| Total | 4 | 89 | 67 | 137 | 1,312 | 1,894 | 384 | 939 | 1,296 |
| WG estimate | | | | | | | | | |

| Country | 2005 [1] | 2006 [1] | 2007 [1] | 2008 [1] | 2009 [1] | 2010 [1] | 2011 [1] |
|---|---|---|---|---|---|---|---|
| Faroe Islands | | | | | | | 106 |
| France | | | | | | | |
| Ireland | | | | | | | |
| Lithuania | | 2 | 3 | 566 | | | |
| Poland | | | | | | | |
| Spain [2] | 501 | | | | | | |
| UK | 3 | | | | | | |
| Russia | | 46 | 1 | | 762 | | |
| Norway | | | | | 94 | | |
| Estonia | | 2 | | | | | |
| Total | 504 | 50 | 4 | 566 | 856 | 0 | 106 |
| WG estimate | 504 | 50 | 4 | 566 | 856 | 0 | 106 |

[1] Provisional data

[2] Based on estimates by observers onboard vessels

**Table 2.4.5.7** Greenland Halibut in **Subarea VI**. Nominal landings (tonnes) by country, as officially reported to ICES and estimated by the working group.

| Country | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 [1] | 2004 [1] |
|---|---|---|---|---|---|---|---|---|---|
| Estonia | | | | | | | 8 | | |
| Faroe Islands | | | | | | | | | |
| France | | | | | | | 286 | 165 | 110 |
| Poland | | | | | | | 16 | 91 | 1 |
| Spain [2] | | | 22 | 88 | 20 | 350 | 1367 | 214 | 170 |
| UK | | | | | 159 | 247 | 77 | 42 | 10 |
| Russia | | | | | | 1 | | | 1 |
| Norway | | | | | 35 | 317 | 21 | 26 | |
| Total | 0 | 0 | 22 | 88 | 214 | 915 | 1775 | 538 | 292 |
| WG estimate | | | | | | | | | |

| Country | 2005 [1] | 2006 [1] | 2007 [1] | 2008 [1] | 2009 [1] | 2010 [1] | 2011 [1] |
|---|---|---|---|---|---|---|---|
| Estonia | 5 | 1 | | | | | |
| Faroe Islands | | | | | | 1 | |
| France | | 22 | 8 | 114 | | 38 | 8 |
| Poland | | | | | | | |
| Spain [2] | 3 | 33 | | | | | |
| UK | 217 | 74 | 15 | 80 | 12 | 11 | 3 |
| Russia | | 1 | | 32 | | | |
| Norway | | 3 | | 1 | 3 | 2 | 7 |
| Lithuania | | | | 968 | | | |
| Total | 225 | 134 | 23 | 1195 | 15 | 52 | 18 |
| WG estimate | 225 | 134 | 23 | 1195 | 15 | 52 | 18 |

[1] Provisional data

[2] Based on estimates by observers onboard vessels

# ECOREGION Iceland and East Greenland
# STOCK Introduction to the redfish complex in Subareas V, VI, XII, and XIV

**Introduction**

Species of the genus *Sebastes* are common and widely distributed in the North Atlantic. They are found off the coast of Great Britain, along Norway and Spitzbergen, in the Barents Sea, off the Faroe Islands, Iceland, East and West Greenland, and along the east coast of North America from Baffin Island to Cape Cod.

Three species of redfish are commercially exploited in ICES Subareas V, VI, XII, and XIV: *S. marinus*, *S. mentella,* and *S. viviparus*. The latter has minor commercial value in Icelandic waters and is exploited in two small areas south of Iceland at depths of 150–250 m (Table 2.4.6.1).

**Nominal landings and splitting of the landings into species**

The official statistics reported to ICES do not divide the catch by species/stocks. The splitting of the landings into species and stocks was performed with a set of criteria (Section 7.1 in ICES, 2007).

Information from various sources is used to split demersal landings into species. In Division Va, if no direct information is available on the catches for a given vessel, the landings are allocated based on logbooks and samples from the fishery. According to the proportion of biological samples from each cell (one fourth of an ICES statistical square), the unknown catches within that cell are split accordingly and raised to the landings of a given vessel. For other areas, samples from the landings are used as basis for dividing the demersal redfish catches between *S. marinus* and *S. mentella*.

A comparison of the number of vessels fishing the deep and shallow stocks and reporting to NEAFC by VMS with those visible on satellite images indicates that the unreported effort has been significant. During the observation days in June 2002 to 2006 (in the main fishing season), the effort could have been 15–33% higher than reported to NEAFC, and thus the unreported catch could be in that order of magnitude. The latest information available for 2007 indicated that unreported effort could be around 20%. No information has been available since then, but unreported effort is expected to be much less than in previous years.

**Stock identity and management units of *S. mentella***

The Workshop on Redfish Stock Structure (ICES, 2009) reviewed the stock structure of *Sebastes mentella* in the Irminger Sea and adjacent waters. ICES concluded, based on the outcome of the WKREDS meeting, that there are three biological stocks of *S. mentella*:

- a 'Deep Pelagic' stock (NAFO Areas1–2, ICES Subareas V, XII, and XIV >500 m) – primarily pelagic habitats, and includes demersal habitats west of the Faroe Islands;
- a 'Shallow Pelagic' stock (NAFO Areas 1–2, ICES Subareas V, XII, and XIV <500 m) – extends to ICES Subareas I and II, but primarily pelagic habitats, and includes demersal habitats east of the Faroe Islands;
- an 'Icelandic slope' stock (ICES Division Va and Subarea XIV) – primarily demersal habitats.

This conclusion is primarily based on genetic information, i.e. microsatellite information, and supported by analysis of allozymes, fatty acids, and other biological information on stock structure, such as some parasite patterns.

Adult redfish on the Greenland shelf have been attributed to several stocks and there remains a need to investigate the affinity of the adult *S. mentella* in this region. The East Greenland shelf is most likely a common nursery area for the three biological stocks.

The demersal *S. mentella* in Icelandic waters (in ICES Divisions Va and XIV, 'Icelandic Slope stock') is considered to be one biological stock, separated from the demersal *S. mentella* found on the continental slopes of Greenland (Division XIV) and Faroe Islands (Vb). Regarding the latter component there is insufficient information to allow an assessment for advice. The advice on the 'Icelandic slope stock' is found in Section 2.4.8.

ICES advice until and including 2009 for *S. mentella* fisheries was provided for two distinct management units, i.e. a demersal unit on the continental shelves and slopes and a pelagic unit in the Irminger Sea and adjacent waters. Based on this new stock identification information, ICES recommended three management units that are geographic proxies for

biological stocks that were partly defined by depth and whose boundaries are based on the spatial pattern of the fishery to minimize mixed-stock catches (Figure 2.4.6.1; ICES, 2010):

- Management unit in the northeast Irminger Sea: ICES Division Va and Subareas XII and XIV.
- Management unit in the southwest Irminger Sea: NAFO Areas 1 and 2, ICES Division Vb and Subareas XII and XIV.
- Management unit on the Icelandic slope: ICES Division Va and Subarea XIV, and to the north and east of the boundary proposed in the management unit in the northeast Irminger Sea.

The pelagic fishery in the Irminger Sea and adjacent waters shows clear distinction between two widely separated grounds fished at different seasons and depths. Spatial analysis of pelagic fishery catch and effort by depth, inside and outside the boundaries proposed for the management units in the northeast Irminger Sea, indicate that the boundaries effectively delineate the pelagic fishery in the northeast Irminger Sea from the pelagic fishery in the southwest Irminger Sea, with a small portion of mixed-stock catches. The northeastern fisheries on the pelagic *S. mentella* occur at the start of the fishing season deeper than 500 m and overlap to some extent with demersal fisheries on the continental slopes of Iceland. The boundary for the deep pelagic *Sebastes mentella* fishery is shown in Table 2.4.6.2.

A schematic illustration of the relationship between the management units and biological stocks is given in Figure 2.4.6.2. New scientific information is currently being reviewed. If additional scientific information becomes available a future review may be appropriate.

The decision to advise on two stocks of pelagic redfish instead of one stock was not unanimous among ACOM members. The Russian Federation still maintains its point of view that there is only one stock of beaked redfish in the pelagic waters of the Irminger Sea and that is why no split catches information about the fisheries is presented to the NWWG. Russia reiterates its standpoint that studies of the redfish stock structure should be continued with the aim of developing agreed recommendations using all available scientific and fisheries data as a basis.

However, ICES reiterates its previous advice that "Management action should be taken to prevent a disproportional exploitation rate of any one component."

The individual Stock Summary Sheets provide descriptions of these stocks.

**Icelandic *S. mentella* fisheries and current management practice**

Detailed portrayals of the geographical, vertical, and seasonal distribution of the *S. mentella* fisheries by Icelandic vessels as well as corresponding length distributions are given in Figures 2.4.6.3–2.4.6.6. These figures show that the fisheries within the pelagic *S. mentella* management unit are separated geographically, seasonally, and by depth. These figures also show that the northeastern fisheries on the pelagic *S. mentella* that occur at the start of the fishing season at depths below 500 m overlap to some extent with the fisheries on the continental slopes of Iceland. This overlap was most pronounced in 2003 and 2007 when the Irminger Sea pelagic fishery merged with the continental slope fishery.

**Abundance and distribution of 0-group and juvenile redfish**

Available data on the distribution of juvenile *S. marinus* indicate that the nursery grounds are located in Icelandic and Greenlandic waters. No nursery grounds have been found in Faroese waters. The nursery areas for *S. marinus* in Icelandic waters are found all around Iceland, but are mainly located west and north of the island at depths between 50 and 350 m. The migration of juveniles is along the north coast towards the most important fishing areas off the west coast.

The only known nursery grounds of *S. mentella* are in Greenland waters mostly at depths between 100 m and 400 m. When the fish located on the nursery grounds become close to being sexually mature, they start to move out of the area. It is reported that at lengths of around 29–30 cm the fish start to emigrate from the East Greenland shelf. The emigrated young *S. mentella* can be tracked both in the Icelandic shelf fishery and in the open Irminger Sea fishery.

Abundance and biomass indices of juvenile (<17 cm) redfish (juveniles were only classified to the genus *Sebastes* spp. due to identification difficulties) from the German annual groundfish survey, conducted on the continental shelf and slope off West and East Greenland down to 400 m, show that juveniles were abundant in 1993 and 1995–1998. Figure 2.4.6.7 shows the survey abundance indices for juvenile *Sebastes* spp ≤17 cm..

**Demersal *S. mentella* in Division Vb and Subareas VI and XIV**

Historically, the *S. mentella* on the East Greenland shelf (Subarea XIV) has been included in the demersal catches of Greenland, Iceland, and Faroe Islands. However, adult *S. mentella* in this area have not been attributed to any of the three biological stocks of *S. mentella*. ICES therefore decided to conduct a separate assessment of *S. mentella* in Division XIVb until further information is available to assign origin. The advice is found in Section 2.4.8.

The *S. mentella* on the Faroe Islands shelf has not been assigned to the Shallow and Deep Pelagic *S. mentella* stocks. The catches are, therefore, included here (Table 2.4.6.3). Trends in cpue and effort of the fishery are shown in Figure 2.4.6.8.

**Discards and bycatch of small redfish**

Information on the bycatch and length distribution of the redfish caught in the shrimp fishery indicated bycatch rates of 0.5% in 2006–2007, most of these being redfish <15 cm. Sorting grids have been mandatory in the shrimp fisheries in ICES Division XIVb since 2002 and in Division Va since 1 September 1995.

**Sources**

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ICES. 2011. Report of the North-Western Working Group, 26 April–3 May 2011. ICES CM 2011/ACOM:07.

ICES 2012. Report of the Benchmark Workshop on Redfish stocks, 1-8 February 2012. ICES CM 2012:48.

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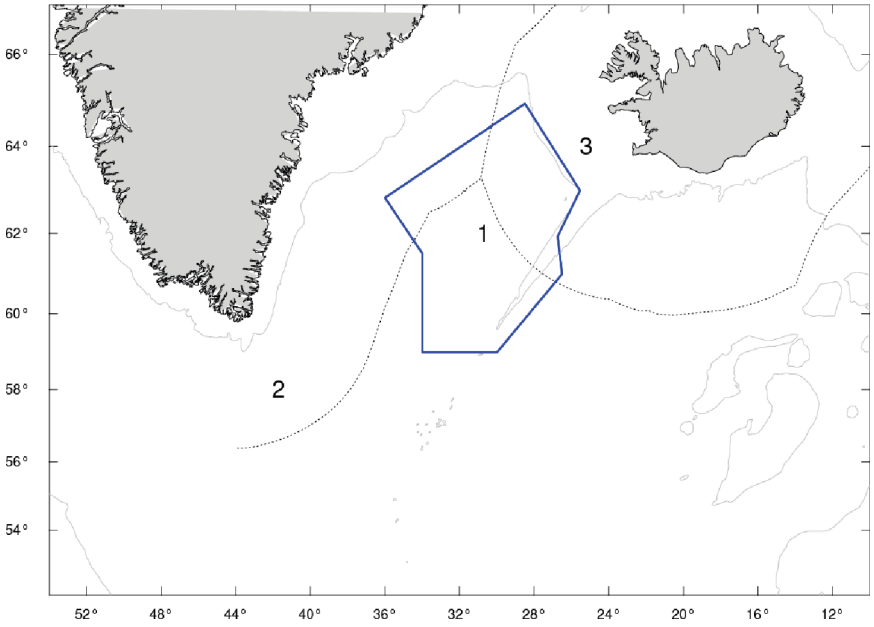



**Figure 2.4.6.1** Proposed management unit boundaries for *S. mentella* in the Irminger Sea and adjacent waters. The polygon bounded by blue lines, i.e. 1, indicates the region for the 'deep pelagic' management unit in the northwest Irminger Sea, 2 is the "shallow pelagic" management unit in the southwest Irminger Sea, and 3 is the Icelandic slope management unit. Coordinates of the recommended boundary of the "deep pelagic" management unit (the blue box) are given in Table 2.4.6.3.

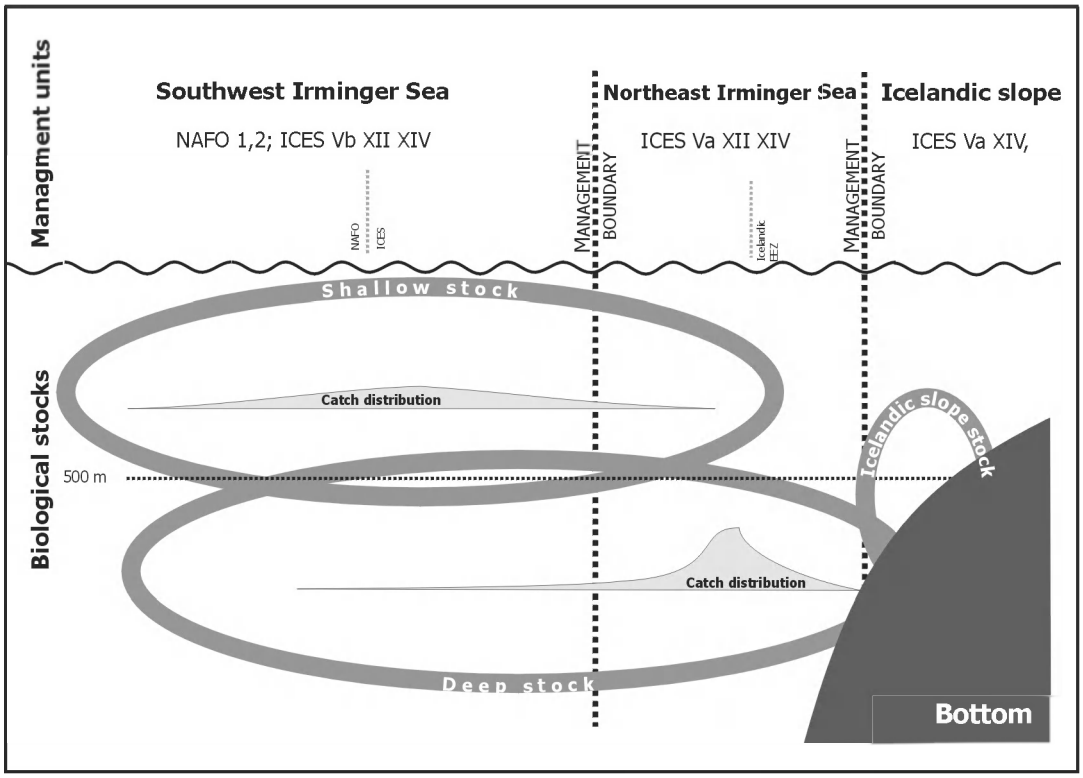



**Figure 2.4.6.2** Schematic representation of biological stocks and recommended management units of *S. mentella* in the Irminger Sea and adjacent waters. The management units are shown in Figure 2.4.6.1. Included is a schematic representation of the geographical catch distribution in recent years. Note that the shallow pelagic stock includes demersal *S. mentella* east of the Faroe Islands and the deep pelagic stock includes demersal *S. mentella* west of the Faroe Islands.

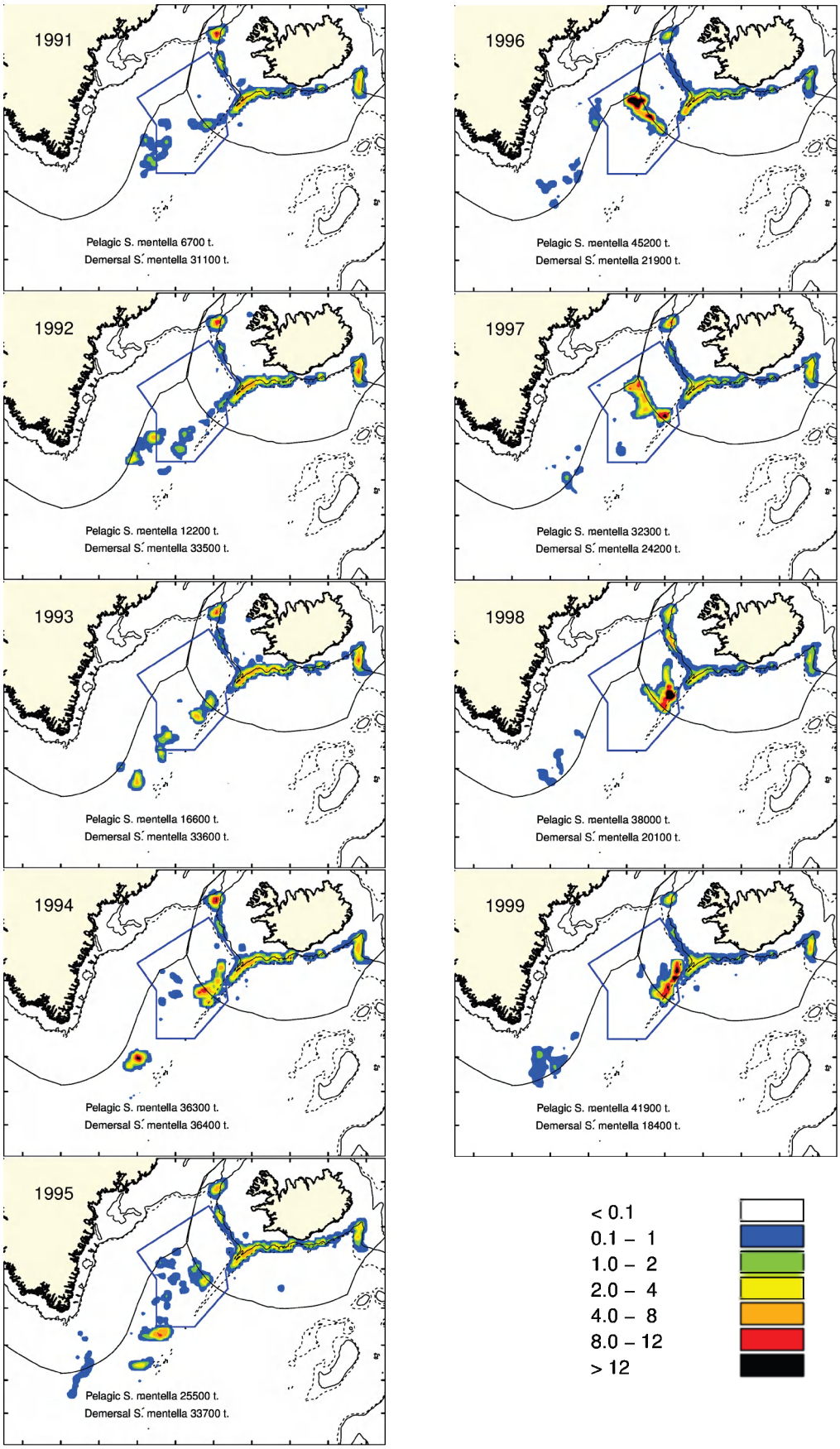



**Figure 2.4.6.3** Geographical distribution of the Icelandic catches of *S. mentella* 1991–1999. The colour scale indicates catches (tonnes per $NM^2$). The blue line marks the recommended geographical boundaries of the "deep pelagic" management unit.

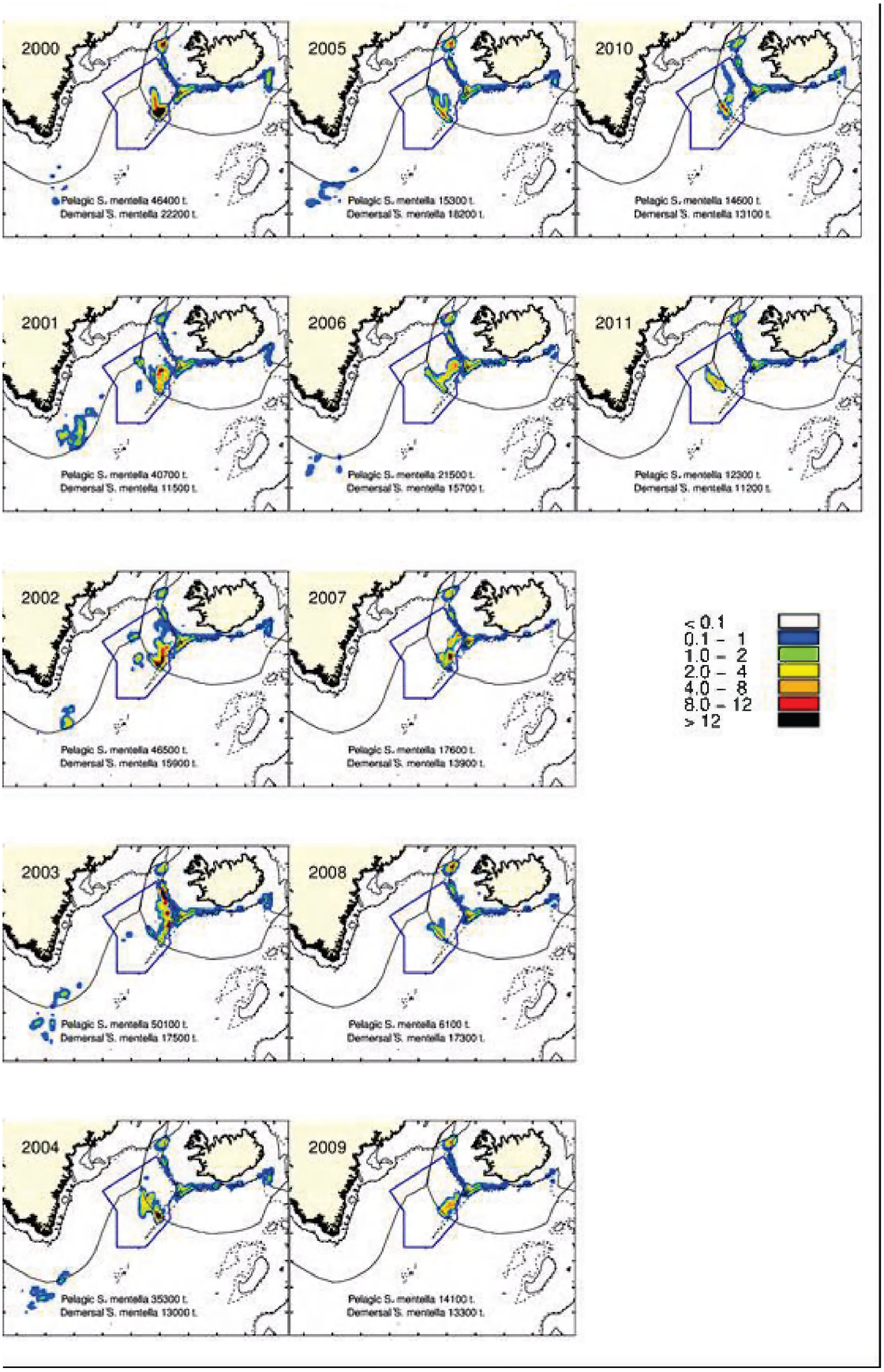



**Figure 2.4.6.3 (Continued)** Geographical distribution of the Icelandic catches of *S. mentella* 2000–2011. The colour scale indicates catches (tonnes per $NM^2$). The blue line marks the recommended geographical boundaries of the "deep pelagic" management unit.

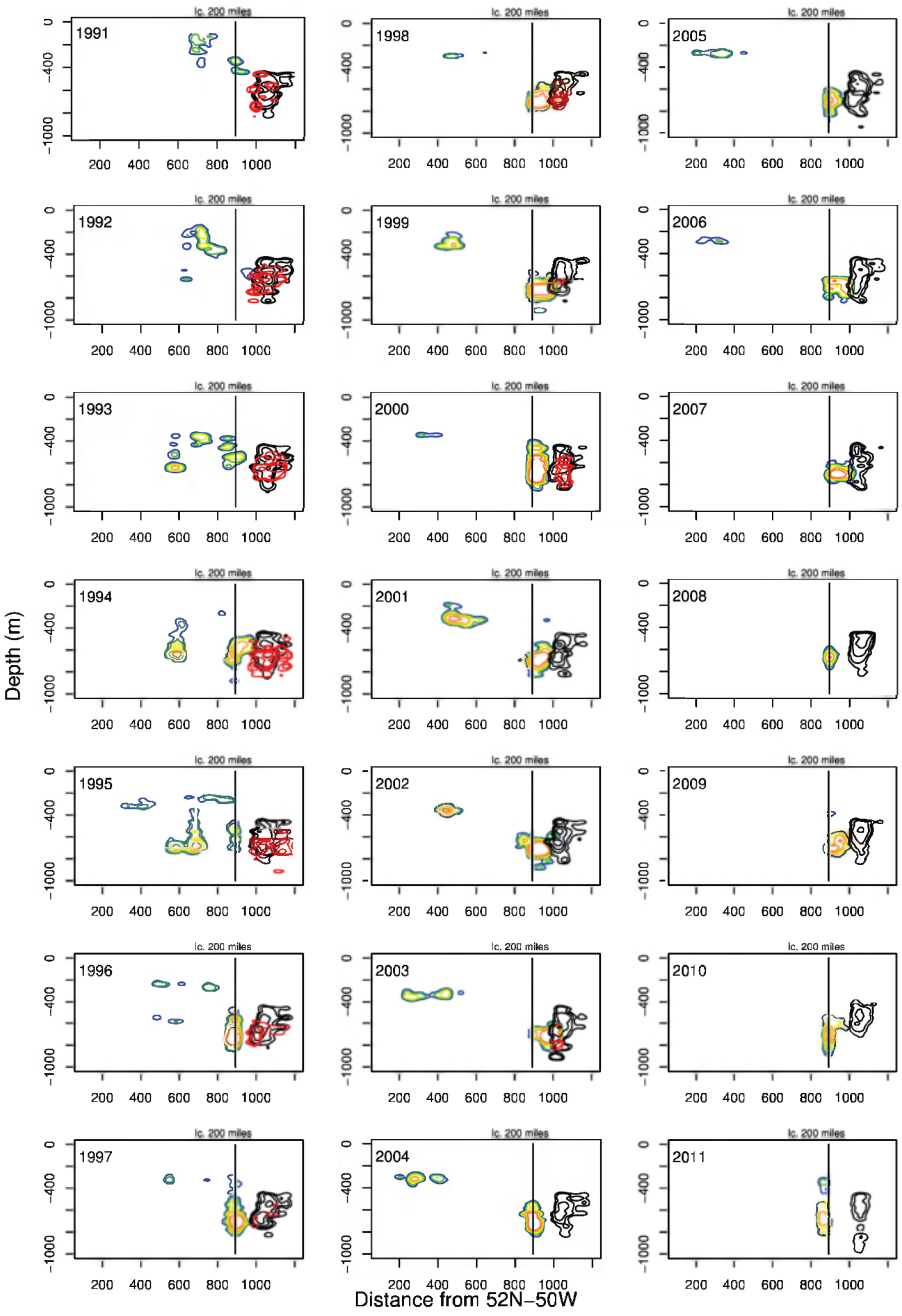



**Figure 2.4.6.4** Location–depth plots for *S. mentella* catches as reported by Icelandic vessels. Location is represented by the distance (in NM in the SW–NE direction) from a fixed position (52°N 50°W). The contour lines indicate relative catches. The coloured contours represent the fishery on pelagic *S. mentella*, the black contours indicate bottom trawl catches of demersal *S. mentella*, and the red contours represent catches of demersal *S. mentella* taken with pelagic trawls. The Icelandic EEZ boundary is shown as a reference.

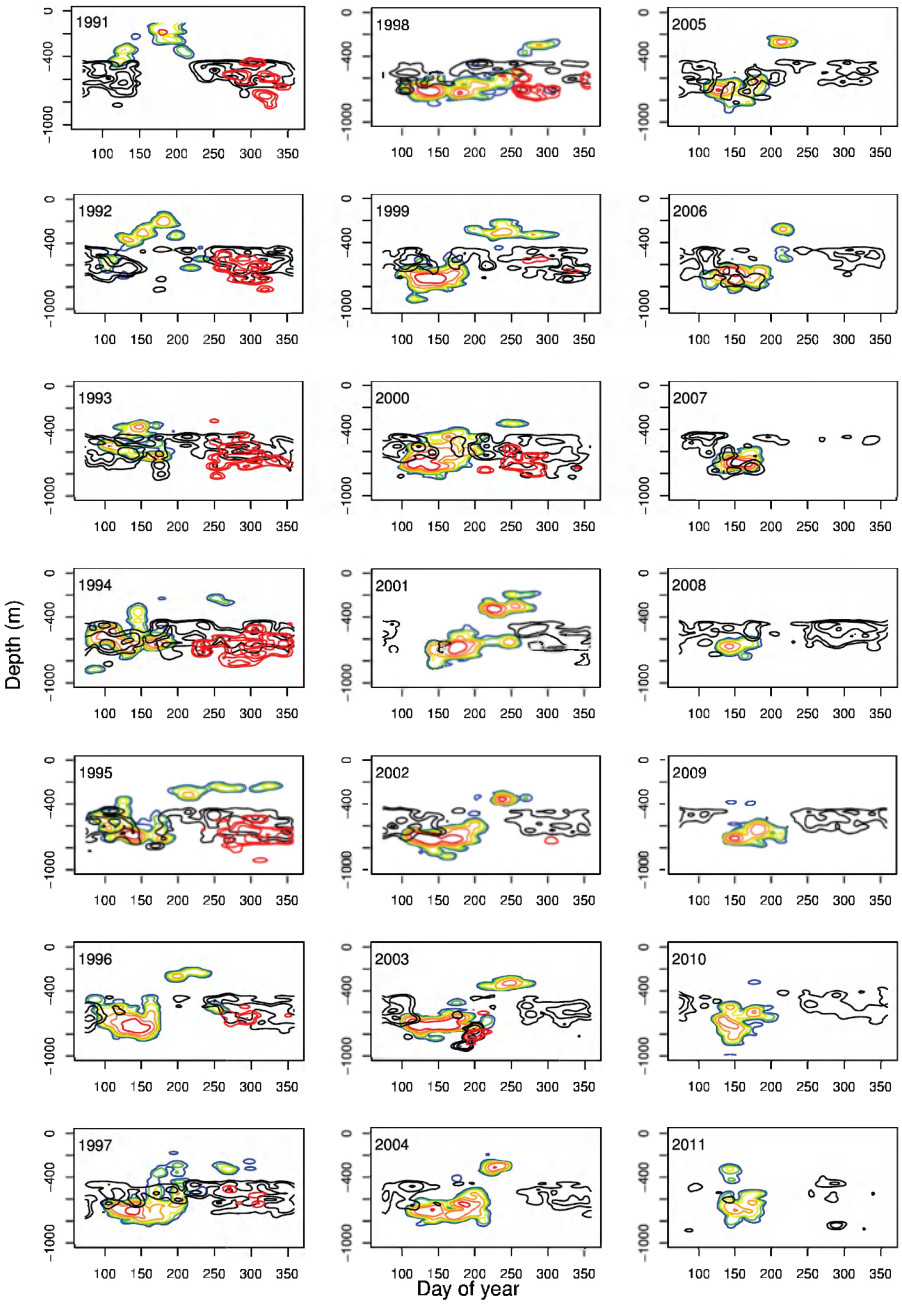



**Figure 2.4.6.5** Depth–time plots for Icelandic *S. mentella* catches, where the y-axis is depth, the x-axis is day of the year, and the colour indicates the catches. The coloured contours represent the fishery on pelagic *S. mentella*, the black contours indicate bottom trawl catches of demersal *S. mentella*, and the red contours represent catches of demersal *S. mentella* taken with pelagic trawls.

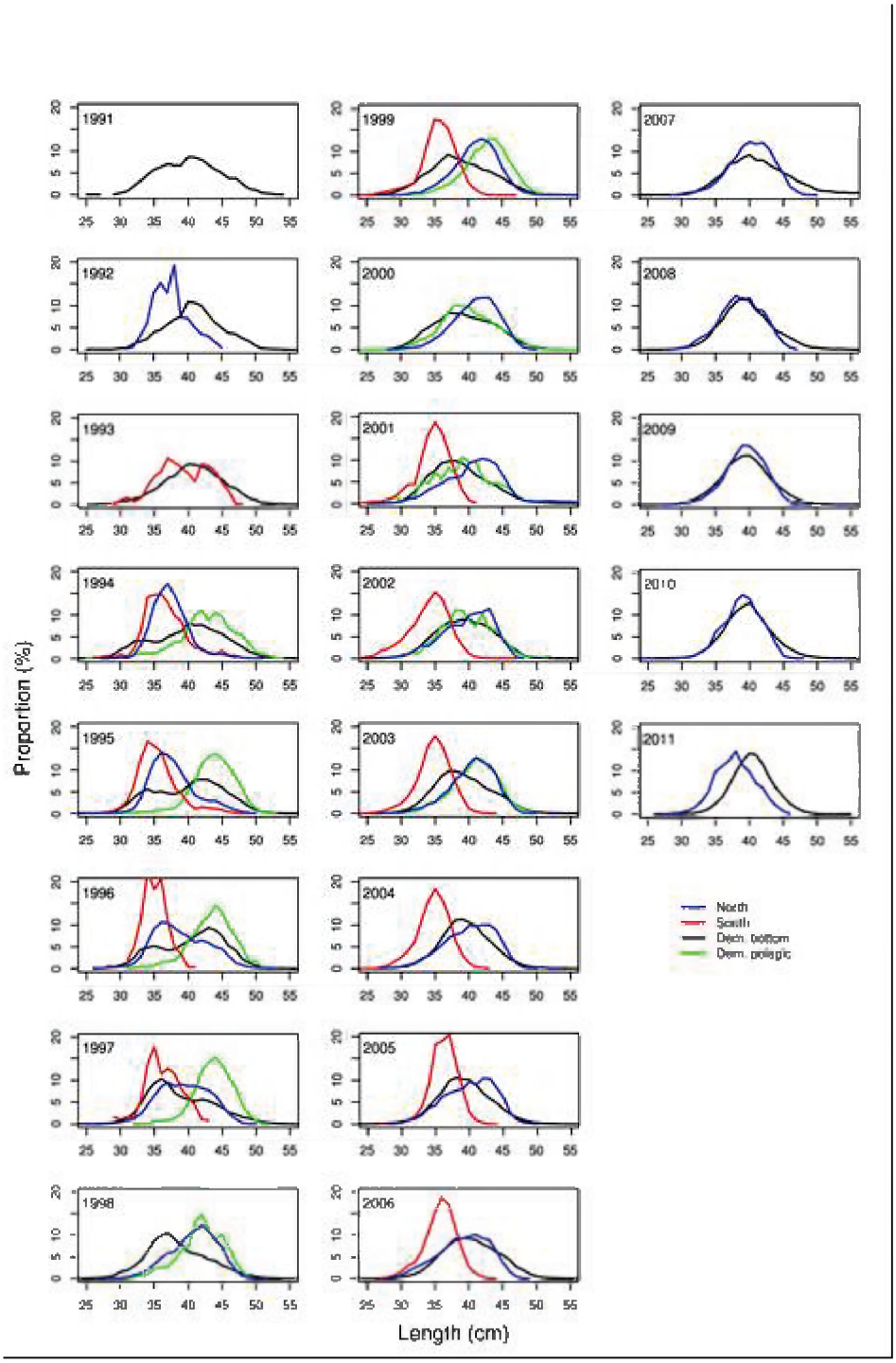



**Figure 2.4.6.6** Length distributions from different Icelandic *S. mentella* fisheries. The blue lines represent the fishery on pelagic *S. mentella* in the northeastern area, the red lines the pelagic fishery in the southwestern area, the black lines indicate bottom trawl catches of demersal *S. mentella*, and the green lines represent catches of demersal *S. mentella* taken with pelagic trawls.

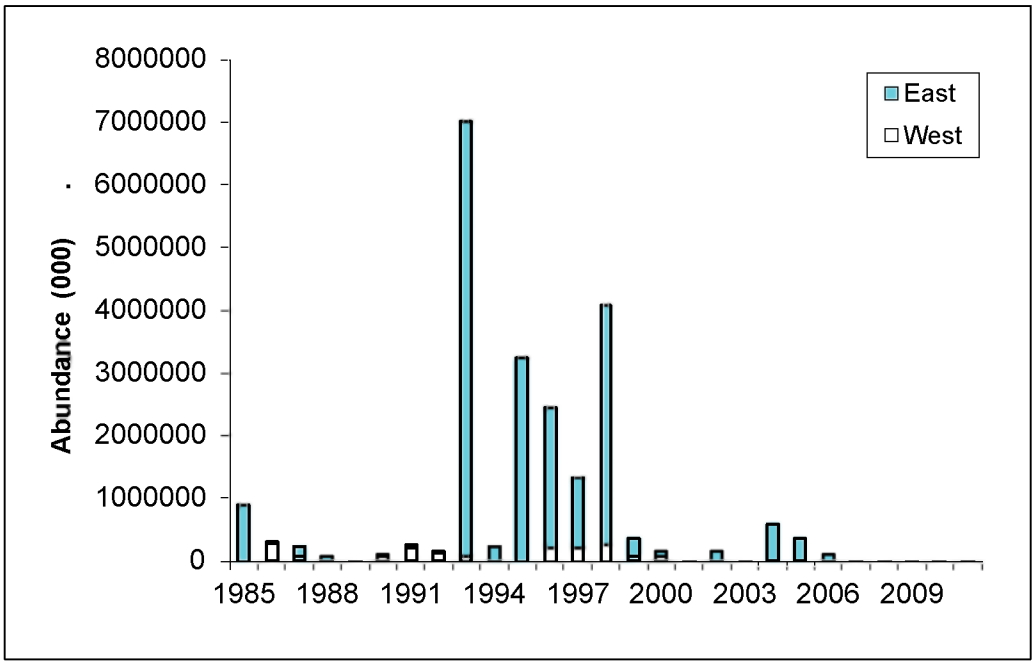



**Figure 2.4.6.7** Survey abundance indices of juvenile *Sebastes* spp (≤17 cm) from the German groundfish survey conducted on the continental shelves off East and West Greenland.

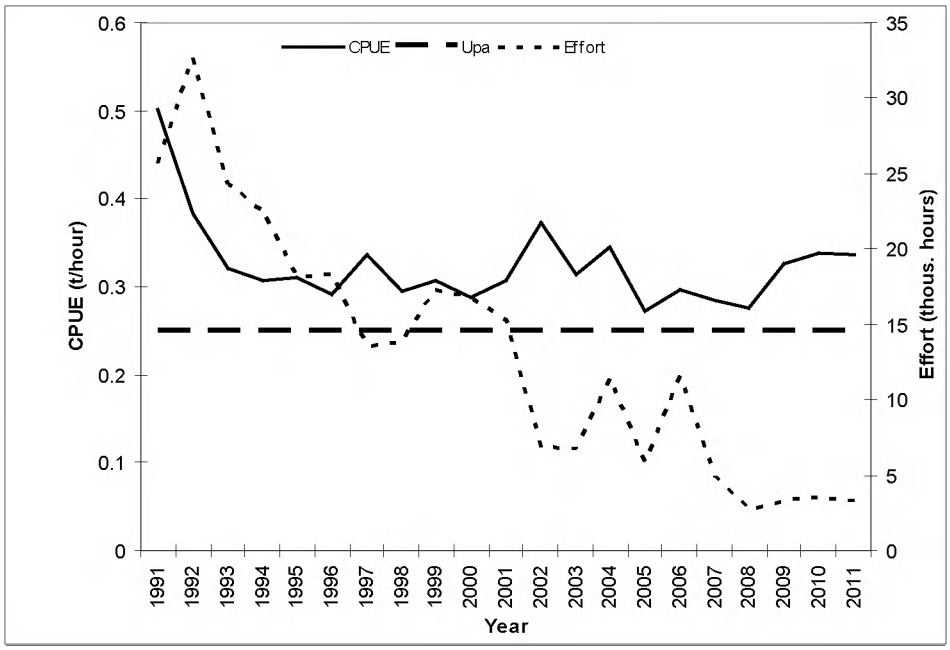



**Figure 2.4.6.8** Demersal *S. mentella* on the continental shelf. Cpue (t/hour) and fishing effort (in thousands) from the Faroese Otter Board fleet where 70% of the total catch was *S. mentella*.

**Table 2.4.6.1** Landings of *S. viviparus* in Division Va.

| Year | Landings (t) |
|---|---|
| 1996 | 22 |
| 1997 | 1159 |
| 1998 | 994 |
| 1999 | 498 |
| 2000 | 227 |
| 2001 | 21 |
| 2002 | 20 |
| 2003 | 3 |
| 2004 | 2 |
| 2005 | 4 |
| 2006 | 9 |
| 2007 | 24 |
| 2008 | 15 |
| 2009 | 37 |
| 2010 | 2602 |
| 2011 | 1427 |

**Table 2.4.6.2** Coordinates of the recommended boundary of the "deep pelagic" management unit.

| Point no. | Latitude | Longitude | Latitude | Longitude |
|---|---|---|---|---|
| 1 | 64.75000 | - 28.50 | 64° 45' N | 28° 30' W |
| 2 | 62.83333 | - 25.75 | 62° 50' N | 25° 45' W |
| 3 | 61.91667 | - 26.75 | 61° 55' N | 26° 45' W |
| 4 | 61.00000 | - 26.50 | 61° 00' N | 26° 30' W |
| 5 | 59.00000 | - 30.00 | 59° 00' N | 30° 00' W |
| 6 | 59.00000 | - 34.00 | 59° 00' N | 34° 00' W |
| 7 | 61.50000 | - 34.00 | 61° 30' N | 34° 00' W |
| 8 | 62.83333 | - 36.00 | 62° 50' N | 36° 00' W |
| 9 | 64.75000 | - 28.50 | 64° 45' N | 28° 30' W |

**Table 2.4.6.3** Nominal landings (tonnes) of demersal *S. mentella* 1978–2011 in ICES Divisions Vb and VI.

| Year | Vb | VI |
|---|---|---|
| 1978 | 7 767 | 18 |
| 1979 | 7 869 | 819 |
| 1980 | 5 119 | 1 109 |
| 1981 | 4 607 | 1 008 |
| 1982 | 7 631 | 626 |
| 1983 | 5 990 | 396 |
| 1984 | 7 704 | 609 |
| 1985 | 10 560 | 247 |
| 1986 | 15 176 | 242 |
| 1987 | 11 395 | 478 |
| 1988 | 10 488 | 590 |
| 1989 | 10 928 | 424 |
| 1990 | 9 330 | 348 |
| 1991 | 12 897 | 273 |
| 1992 | 12 533 | 134 |
| 1993 | 7 801 | 346 |
| 1994 | 6 899 | 642 |
| 1995 | 5 670 | 536 |
| 1996 | 5 337 | 1 048 |
| 1997 | 4 558 | 419 |
| 1998 | 4 089 | 298 |
| 1999 | 5 294 | 243 |
| 2000 | 4 841 | 885 |
| 2001 | 4 696 | 36 |
| 2002 | 2 552 | 20 |
| 2003 | 2 114 | 197 |
| 2004 | 3 931 | 6 |
| 2005 | 1 593 | 111 |
| 2006 | 3 421 | 179 |
| 2007 | 1 376 | 1 |
| 2008 | 750 | 50 |
| 2009 | 1,077 | 0 |
| 2010 | 1202 | |
| 2011[1)] | 1126 | |

[1)] Provisional

## ECOREGION Iceland and East Greenland
## STOCK Golden redfish (*Sebastes marinus*) in Subareas V, VI, XII, and XIV

### Advice for 2013

ICES advises on the basis of precautionary considerations that catches should be no more than 40 000 t.

### Stock status

| F (Fishing Mortality) | | 2009–2011 |
|---|---|---|
| **MSY ($F_{MSY}$)** | ? | Unknown |
| **Precautionary approach ($F_{pa}$,$F_{lim}$)** | ? | Unknown |
| **SSB (Spawning-Stock Biomass)** | | 2010–2012 |
| **MSY ($B_{trigger}$)** | ? | Unknown |
| **Precautionary approach ($B_{pa}$,$B_{lim}$)** | ✓ | Full reproductive capacity |
| **Qualitative evaluation** | ↗ | Increasing in main area |

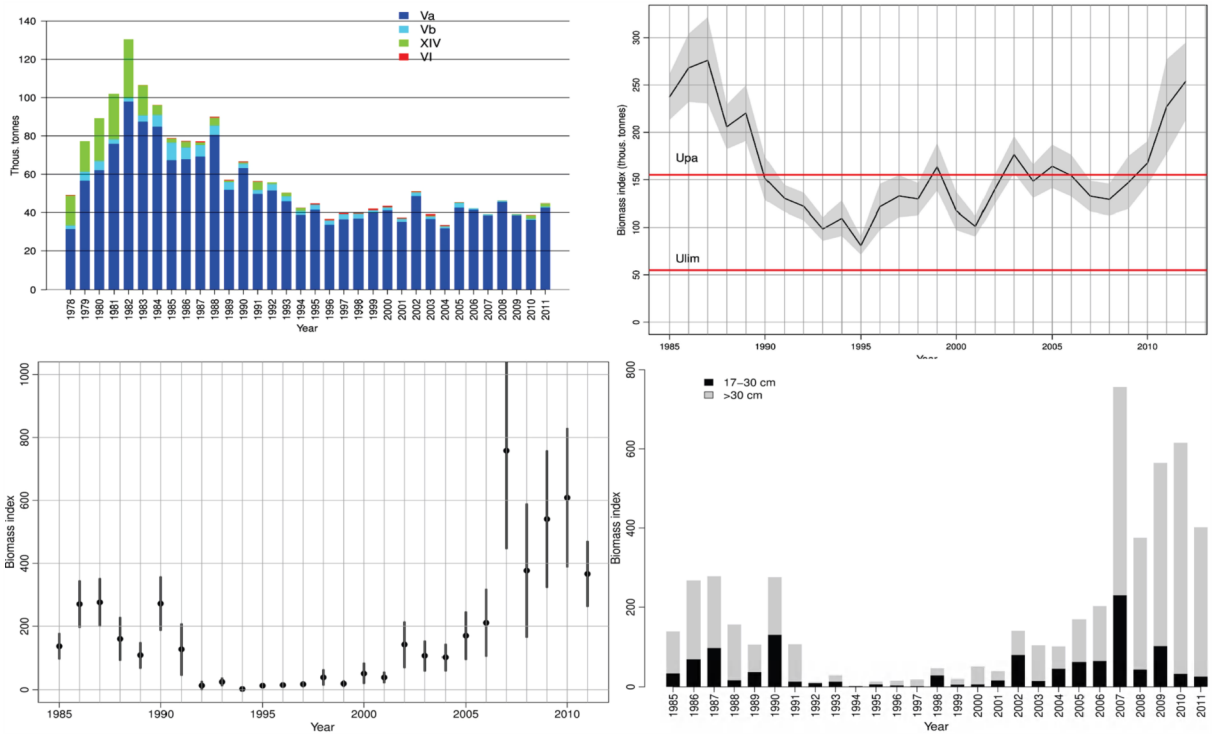



**Figure 2.4.7.1** Golden redfish (*Sebastes marinus*) in Subareas V, VI, XII, and XIV. Top left: Landings by area, Top right: Survey biomass (±1 standard error) from for Icelandic waters (spring survey). Bottom: Survey biomass and abundance indices for East and West Greenland. Left: Total biomass index, including one standard error. Right: Total biomass index split into pre-fishery recruits (17–30 cm) and fishable redfish (>30 cm).

In Division Va the survey index (U) has been increasing since 2008 and is currently far above $U_{pa}$. In Division XIVb (East Greenland) survey indices of both pre-fishery recruits and fishable size have increased in recent years. In Division Vb the Faroese groundfish survey indicates that the abundance has been decreasing since 2001.

**Management plans**

The regulation is based on TAC in Iceland and in Greenland, but through an effort system in the Faroe Islands. The separation of golden redfish and Icelandic slope *S. mentella* in the quota was implemented in the 2010/2011 fishing season. The TAC in Greenland is set for redfish, with no distinction being made between *S. marinus* and *S. mentella*.

**Biology**

*Sebastes marinus* is a species with late maturation (matures between 10 and 14 years old) and slow growth (can get older than 50 years) and is hence considered to be vulnerable to overexploitation. It can therefore only sustain low exploitation and management should be based on that consideration.

**The fisheries**

The majority of the golden redfish catch is taken in ICES Division Va, which has contributed 95–98% of the total landings since 1990. Between 90 and 95% of the golden redfish catch in Division Va is taken by bottom trawlers targeting redfish. The remaining catches are caught as bycatch in gillnet, longline, and *Nephrops* fishery. Average annual landings 2000–2011 have been 40 000 tonnes. *S. marinus* in Division Va is to a small extent caught in a mixed fishery with *S. mentella* (Icelandic slope).

| | |
|---|---|
| **Catch distribution** | Total landings (2011) = 44.8 kt, where 94% was taken by bottom trawls and 6% by other gear-types. Discards considered very small. |

**Quality considerations**

Due to the aggregating behavior of the species, survey indices are often largely composed of a few large hauls. This causes high CVs in the indices and large interannual fluctuation in estimates of biomass.

**Scientific basis**

| | |
|---|---|
| **Assessment type** | Trends-based assessment. |
| **Input data** | Two survey indices (Icelandic spring survey since 1985 and autumn survey since 1996). |
| **Discards and bycatch** | Not incorporated in the assessment, but very small. |
| **Indicators** | Gadget model used as trend indicator. |
| **Other information** | Faroese groundfish surveys since 1994 and 1996, German groundfish survey on the Greenland shelf since 1985. Benchmarked in February 2012, further review of the model settings needed before 2013. |
| **Working group report** | NWWG |

## ECOREGION Iceland, East Greenland, Faroe Islands
## STOCK Golden redfish (*Sebastes marinus*) in Subareas V, VI, XII, and XIV

**Reference points**

ICES suggests that the relative state of the stock be assessed through a survey biomass index series (U) in Icelandic waters.

| | Type | Value | Technical basis |
|---|---|---|---|
| MSY Approach | MSY $B_{trigger}$ | Undefined | |
| | $F_{MSY}$ | Undefined | |
| Precautionary approach | $U_{lim}$ | 55 | 20% of highest observed survey index*. |
| | $U_{pa}$ | 155 | 60% of highest observed survey index*. |
| | $F_{lim}$ | Undefined | |
| | $F_{pa}$ | Undefined | |

*(unchanged since 1998)*
** Technical basis for the survey index:*

The basis for the calculation of the $U_{pa}$ is the Icelandic spring groundfish survey index series starting in 1985. Since 1990 the average U has been around half of $U_{max}$ – the highest observed index in the time-series (276 in 1987). This has not resulted in any strong year classes compared to higher U's. A precautionary $U_{pa}$ is therefore proposed at $U_{max}$*0.6, corresponding to the U's associated with the most recent strong year class. U is regarded as a proxy for SSB but represents the fishable biomass.

**Outlook for 2013**

No analytical assessment can be presented for this stock, therefore, fishing possibilities cannot be projected.

***Precautionary approach***

The new data (landings and surveys) suggest the stock is increasing. The stock seems to have increased, with catches around 40 000 t since 1995. ICES advises that catches in 2013 should be no more than 40 000 t.

**Additional considerations**

*Management considerations*

*Sebastes marinus* is a species with late maturation and slow growth and is hence considered to be vulnerable to overexploitation. It can therefore only sustain low exploitation and management should be based on that consideration.

The strong 1990 year class has been in the Icelandic fishery for a decade and will also sustain the stock in the short term. The 1996–2001 year classes are above average and have been recruiting to the fishery since 2006.

An exploratory assessment based on the Gadget model indicates that the fishing mortality has decreased since the early 1990s and is currently close to $F_{max}$ (Figure 2.4.7.2).

Subarea XIV is an important nursery area for *S. mentella* and *S. marinus*. The survey index of the fishable stock of *S. marinus* in Subarea XIV has increased in recent years, but with a large measurement uncertainty (Figure 2.4.7.2). Measures to protect juvenile redfish in Subarea XIV should be continued (sorting grids in the shrimp fishery).

In Subarea XIV redfish and cod are found in the same areas and depths and historically these species have been taken in the same fisheries. For 2012, ICES advises that no fishery should take place on cod in Greenland waters. Management measures should be put in place that minimize catches of cod in a directed fishery for *S. marinus*.

No formal agreement on the management of *S. marinus* exists among the three coastal states, Greenland, Iceland, and the Faroe Islands. In Greenland and Iceland, the fishery is regulated by a TAC and in the Faroe Islands by effort limitation.

On average, about 5% of the total landings have been taken in Division Vb and Subareas VI and XIV. In 2009 a fishery targeting redfish was initiated in Subarea XIV. Total catches were 1118 t in 2009, 8266 t in 2010, and 8381 t in 2011. The fishery does not distinguish between species, but based on survey information, *S. marinus* is estimated to account for 20% of catches, i.e. 224 t in 2009, 1653 t in 2010, and 1676 t in 2011.

*Regulations and their effects*

A quick closure system was implemented in 1977 in Iceland to protect juvenile redfish. If more than 20% of a catch observed on board is below 33 cm a small area can be closed for at least two weeks. For this reason there is no minimum landing size for golden redfish. The effect of the quick closure has not been evaluated and since 2001 there have been relatively few quick closures on small golden redfish, or on average three every year. The reason for the few quick closures on small golden redfish is because large areas southwest and west of Iceland are closed permanently or temporarily for trawling to protect juvenile golden redfish. These areas were closed partly because of frequent quick closures on redfish fisheries in 1991–1995. The effects of these closed areas have not been evaluated, but the increase in the spring survey index since 2003 is partly related to increased aggregation of golden redfish in these areas.

Since the late 1980s in Division Va and since 2002 in Subarea XIV it has been mandatory in the shrimp fishery to use sorting grids in order to reduce bycatches of juvenile redfish in the shrimp fishery.

*Uncertainty in the assessment*

A single abundance index that covers the whole distributional range of the stock is not available. The exploratory assessment is based on a survey index from Division Va only and landings from all three areas. This approach may create a bias in the assessment that cannot be quantified.

*Comparison with previous assessment and advice*

The basis and the advice has not changed compared to last year.

**Sources**

ICES 2012a. Report of the Benchmark Workshop on Redfish Stocks, 1–8 February 2012. ICES CM 2012/ACOM:48.
ICES. 2012b. Report of the North-Western Working Group, 26 April–3 May 2012. ICES CM 2012/ACOM:07.

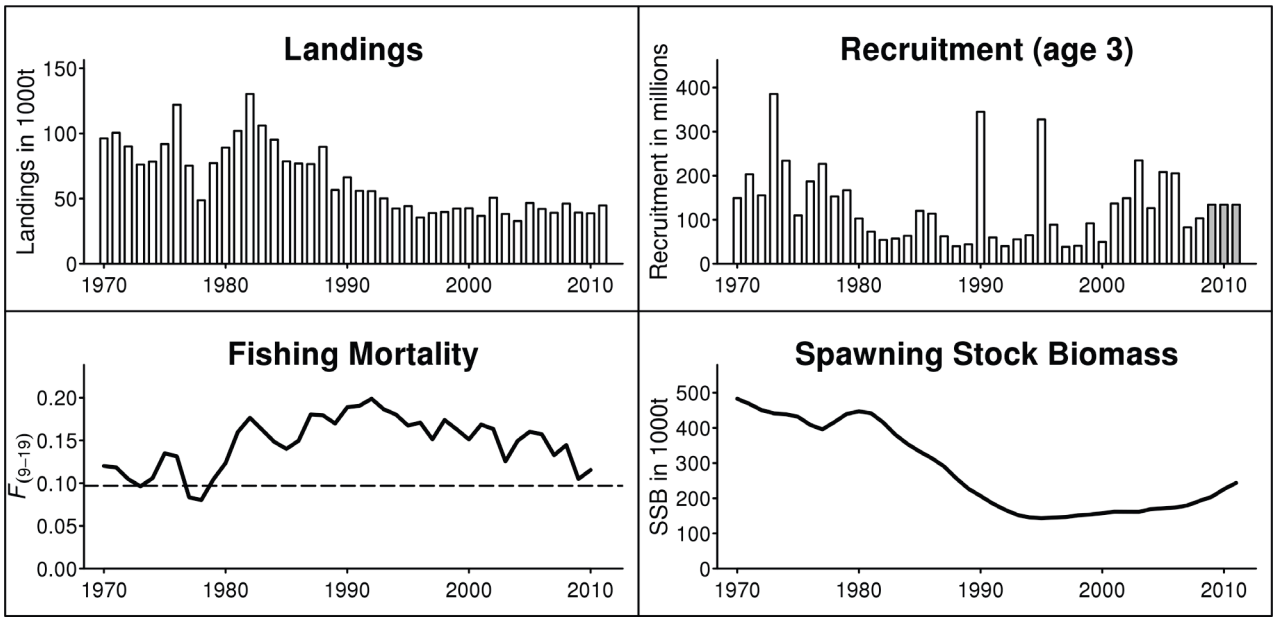



**Figure 2.4.7.2** Golden redfish in Subareas V, VI, XII, and XIV. Summary of stock assessment (weights in thousand tonnes.).

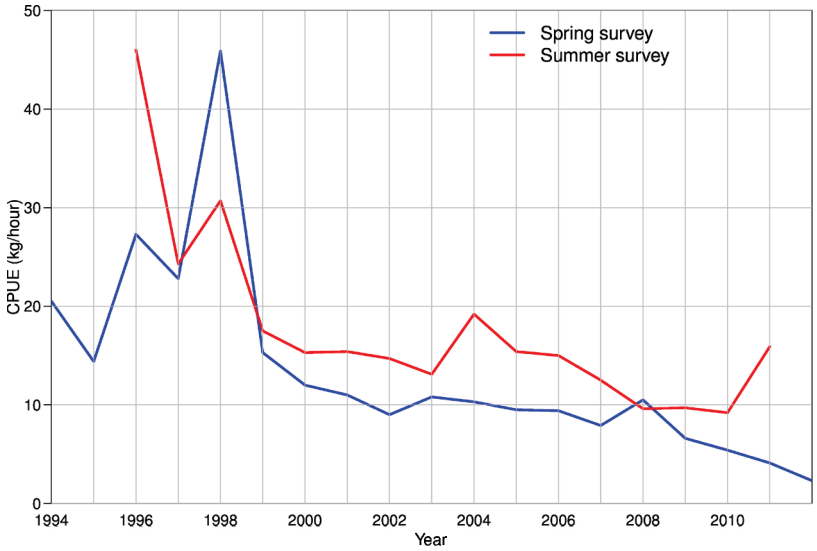



**Figure 2.4.7.3** Golden redfish (*Sebastes marinus*) in Subareas V, VI, XII, and XIV. Cpue in the Faroese spring groundfish survey and the summer groundfish survey in ICES Division Vb.

**Table 2.4.7.1** Golden redfish (*Sebastes marinus*) in Subareas V, VI, XII, and XIV. ICES advice, management, and landings.

| Year | ICES Advice | Predicted catch corresp. to advice | Iceland TAC[1,6] | Greenland TAC[7] | *S. marinus* ICES landings |
|---|---|---|---|---|---|
| 1987 | No increase in F | 83 | 95 | | 77 |
| 1988 | No increase in F | 84 | 85 | | 90 |
| 1989 | TAC[1] | 117[1] | 77 | | 57 |
| 1990 | TAC[1] | 116[1] | 80 | | 67 |
| 1991 | Precautionary TAC | 77 (117[1]) | 55[5] | | 56 |
| 1992 | Precautionary TAC | 76 (116[1]) | 90 | | 56 |
| 1993 | Precautionary TAC[1] | 120[1] | 104 | | 50 |
| 1994 | Precautionary TAC, if required | 100[1] | 90 | | 43 |
| 1995 | TAC | 90[1] | 77 | | 45 |
| 1996 | TAC for Division Va (28); precautionary TAC for Division Vb and Subarea XIV (4) | 32[2] | 65 | | 37 |
| 1997 | Effort 75% of 1995 value | 32[2] | 65 | | 40 |
| 1998 | Effort reduced in steps of 25% from the 1995 level | 37.2[2] | 65 | | 39 |
| 1999 | Effort not increased compared to 1997 | 35[2] | 65 | | 42 |
| 2000 | Catch not increased compared to 1998 | 35[2] | 60 | | 44 |
| 2001 | Effort not increased compared to 1999 | 33[2,3] | 57 | | 37 |
| 2002 | 25% reduction in effort | 29[4] | 65 | | 51 |
| 2003 | 25% reduction in effort(2001) | 31[4] | 60 | | 39 |
| 2004 | 25% reduction in effort(2002) | 37.4[4] | 57 | | 33.4 |
| 2005 | Maintain fishable biomass above $U_{pa}$ | 37[4] | 57 | | 45.4 |
| 2006 | Maintain fishable biomass above $U_{pa}$ | 37[4] | 57 | | 42.2 |
| 2007 | Maintain fishable biomass above $U_{pa}$ | 37[4] | 57 | 5 | 39.1 |
| 2008 | Maintain fishable biomass above $U_{pa}$ | 37[4] | 57 | 1 | 46.3 |
| 2009 | Maintain fishable biomass above $U_{pa}$ | < 30 | 50 | | 39.2 |
| 2010 | Maintain fishable biomass above $U_{pa}$ | < 30 | 50 | 6 | 38.7 |
| 2011 | Same advice as last year | < 30 | 37.5 | 8 | 44.8 |
| 2012 | Maintain catches | < 40 | 40 | 8 | |
| 2013 | Maintain catches | < 40 | | | |

Weights in '000 t.
[1] Deep-sea *S. mentella* and *S. marinus* combined.
[2] *S. marinus* only.
[3] In Division Va only.
[4] Both Divisions Va and Vb and Subarea XIV.
[5] Year ending 31 August.
[6] From 1992 onwards: Quota year September–August
[7] Demersal redfish (*Sebastes marinus* and *S. mentella*).

**Table 2.4.7.2** Golden redfish (*Sebastes marinus*) in Subareas V, VI, XII, and XIV. Official landings (in tonnes) by area.

| | Area | | | | |
|---|---|---|---|---|---|
| Year | Va | Vb | VI | XIV | Total |
| 1978 | 31,300 | 2,039 | 313 | 15,477 | 49,129 |
| 1979 | 56,616 | 4,805 | 6 | 15,787 | 77,214 |
| 1980 | 62,052 | 4,920 | 2 | 22,203 | 89,177 |
| 1981 | 75,828 | 2,538 | 3 | 23,608 | 101,977 |
| 1982 | 97,899 | 1,810 | 28 | 30,692 | 130,429 |
| 1983 | 87,412 | 3,394 | 60 | 15,636 | 106,502 |
| 1984 | 84,766 | 6,228 | 86 | 5,040 | 96,120 |
| 1985 | 67,312 | 9,194 | 245 | 2,117 | 78,868 |
| 1986 | 67,772 | 6,300 | 288 | 2,988 | 77,348 |
| 1987 | 69,212 | 6,143 | 576 | 1,196 | 77,127 |
| 1988 | 80,472 | 5,020 | 533 | 3,964 | 89,989 |
| 1989 | 51,852 | 4,140 | 373 | 685 | 57,050 |
| 1990 | 63,156 | 2,407 | 382 | 687 | 66,632 |
| 1991 | 49,677 | 2,140 | 292 | 4,255 | 56,364 |
| 1992 | 51,464 | 3,460 | 40 | 746 | 55,710 |
| 1993 | 45,890 | 2,621 | 101 | 1,738 | 50,350 |
| 1994 | 38,669 | 2,274 | 129 | 1,443 | 42,515 |
| 1995 | 41,516 | 2,581 | 606 | 62 | 44,765 |
| 1996 | 33,558 | 2,316 | 664 | 59 | 36,597 |
| 1997 | 36,342 | 2,839 | 542 | 37 | 39,761 |
| 1998 | 36,771 | 2,565 | 379 | 109 | 39,825 |
| 1999 | 39,824 | 1,436 | 773 | 7 | 42,040 |
| 2000 | 41,187 | 1,498 | 776 | 89 | 43,550 |
| 2001 | 35,067 | 1,631 | 535 | 93 | 37,326 |
| 2002 | 48,570 | 1,941 | 392 | 189 | 51,092 |
| 2003 | 36,577 | 1,459 | 968 | 215 | 39,220 |
| 2004 | 31,686 | 1,139 | 519 | 107 | 33,451 |
| 2005 | 42,593 | 2,484 | 137 | 115 | 45,329 |
| 2006 | 41,521 | 656 | 0 | 34 | 42,211 |
| 2007 | 38,364 | 689 | 0 | 83 | 39,134 |
| 2008 | 45,538 | 569 | 64 | 80 | 46,251 |
| 2009 | 38,442 | 462 | 50 | 224 | 39,177 |
| 2010 | 36,155 | 620 | 220 | 1,653 | 38,648 |
| 2011[1)] | 42,605 | 493 | 83 | 1,676 | 44,875 |

[1)] Provisional.

**ECOREGION** Iceland and East Greenland
**STOCK** Beaked redfish (*Sebastes mentella*) in Division Va and Subarea XIV (Icelandic slope stock)

### Advice for 2013

The 2011 data (landings and survey) do not change the perception of the stock and give no reason to change the advice from that given last year: *"ICES advises that catches should be no higher than 10 000 t. This value should be a starting point for the adaptive part of a management plan"*.

### Stock status

| F (Fishing Mortality) | | 2009–2011 |
|---|---|---|
| **MSY ($F_{MSY}$)** | ? | Unknown |
| **Precautionary approach** ($F_{pa}$,$F_{lim}$) | ? | Unknown |
| **SSB (Spawning-Stock Biomass)** | | 2010–2012 |
| **MSY** ($B_{trigger}$) | ? | Unknown |
| **Precautionary approach** ($B_{pa}$,$B_{lim}$) | ? | Unknown |
| **Qualitative evaluation** | → | Without trend |

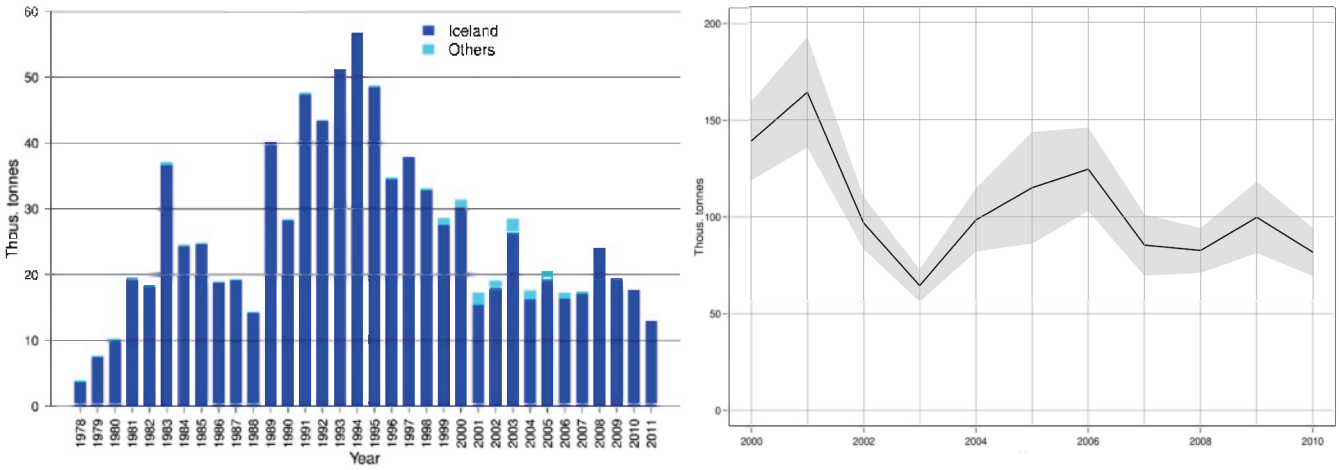



**Figure 2.4.8.1** Beaked redfish (*Sebastes mentella*) in Division Va and Subarea XIV (Icelandic slope stock). Left: Landings (thousand tonnes, 1978–2010). Right: Survey biomass in Division Va (Autumn survey).

Available survey biomass estimates indicate that in Division Va the biomass shows no trend in recent years. No survey biomass estimates where available for 2011.

### Management plans

There are no explicit management objectives for this stock.

**Biology**

*Sebastes mentella* is a species with late maturation (matures between 10 and 14 years old), slow growth (can get older than 50 years), and a schooling behaviour. Hence it is considered to be vulnerable to overexploitation. It can therefore only sustain low exploitation rates, and management should be based on that consideration.

Subarea XIV in Greenland waters is believed to be an important nursery area for *S. mentella* found in Icelandic waters, but data to estimate the magnitude of this contribution are not available.

**The fisheries**

Beaked redfish is taken by Icelandic trawlers using bottom trawl on the continental slope at depths between 450 and 700 m. Small amounts (<2%) of *S. marinus* are caught in the fishery and are possibly classified as beaked redfish in the catches.

The average annual catches in 2001–2011 have been about 20 thousand tonnes.

| | |
|---|---|
| **Catch distribution** | Total landings (2011) = 13 kt, 100% bottom trawl. |

**Quality considerations**

There are a number of uncertainties in the assessment of *Sebastes mentella.* The lack of long time-series of abundance indices prevents the determination of stock status.

**Scientific basis**

| | |
|---|---|
| **Assessment type** | Trend-based assessment. |
| **Input data** | Survey index (Autumn survey Division Va). |
| **Discards and bycatch** | There are no discard data, but discarding is not considered to be a major problem. |
| **Indicators** | None. |
| **Other information** | Stock benchmarked in 2012, but no assessment method agreed. |
| **Working group report** | NWWG |

# ECOREGION Iceland and East Greenland
# STOCK Beaked redfish (*Sebastes mentella*) in Division Va and Subarea XIV (Icelandic slope stock)

**Reference points**

No reference points are defined for this stock.

**Outlook for 2013**

The lack of long time-series indices of abundance prevents analytical assessment. Information on recruitment is not available. Therefore, fishing possibilities cannot be projected.

***Precautionary approach***

ICES advises that catches should be no higher than 10 000 t. This value should be a starting point for the adaptive part of a management plan.

**Additional considerations**

ICES has since 2009 advised that a management plan be developed and implemented for Icelandic slope beaked redfish which takes into account the uncertainties in science and the properties of the fisheries. Although there are no explicit management objectives for Icelandic slope beaked redfish, it is within the Icelandic TAC system. Until 2010/2011 Icelandic authorities set a joint quota for golden redfish and Icelandic slope beaked redfish in Icelandic waters, but now separate quotas are set for the species.

ICES also recommended that the management plan should also include:

- Objectives;
- Knowledge base (life history considerations, catch statistics, effort, surveys, etc.);
- Rules to determine removal rate (adaptive approach: start low, change according to agreed criteria);
- Implementation and enforcement.

Furthermore, the dialogue between managers, scientists, and stakeholders should go further than specifying a harvest control rule.

A catch of 10 000 t would be a significant reduction in catches compared with the recent past. This is expected to result in a lower exploitation rate, but the absolute magnitude of this reduction cannot be estimated at this time.

Measures to protect juvenile redfish in Subarea XIV should be continued (sorting grids in the shrimp fishery).

*Changes in fishing technology and fishing patterns*

In Icelandic waters, demersal *S. mentella* are taken mainly by Icelandic trawlers at depths greater than 500 m in a directed fishery. Prior to 2001 *S. mentella* on the continental shelf was taken in both a pelagic fishery and a demersal fishery, but since then pelagic catches have only occurred in 2003 and 2007.

A fishery for *S. mentella* on the shelf southeast of Iceland has decreased gradually since 2000 and is now insignificant.

*Uncertainties in assessment and forecasts*

The lack of long time-series of abundance indices prevents the determination of stock status. It is not clear to what extent observed changes in survey catch rates during 2000–2010 represent abundance rather than other factors. There was no survey in 2011.

*Comparison with previous assessment and advice*

The assessment and advice are the same as last year.

**Sources**

ICES 2012a. Report of the Benchmark Workshop on Redfish Stocks, 1–8 February 2012. ICES CM 2012/ACOM:48.
ICES. 2012b. Report of the North-Western Working Group, 26 April–3 May 2012. ICES CM 2012/ACOM:07.

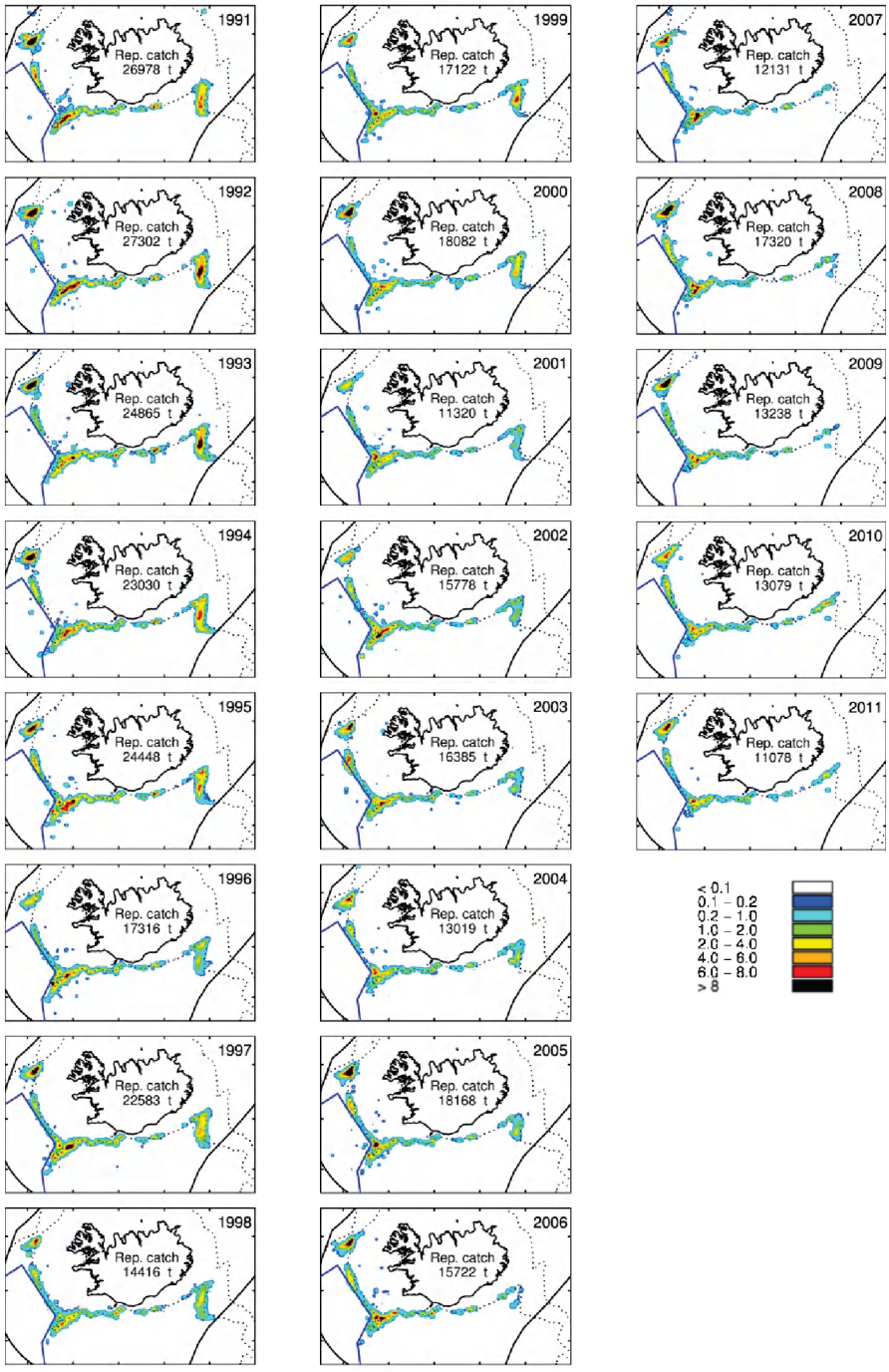



**Figure 2.4.8.2** Beaked redfish (*Sebastes mentella*) in Division Va and Subarea XIV (Icelandic slope stock). Geographical location of the catch in Icelandic waters as reported in logbooks from the Icelandic bottom trawl fleet. Red line indicates the border used by Icelandic authorities to assign catches of *S. mentella* as pelagic (west of) or demersal (east of).

**Table 2.4.8.1** Beaked redfish (*Sebastes mentella*) in Division Va and Subarea XIV (Icelandic slope stock). ICES advice, management, and landings.

| Year | ICES Advice | Predicted catch corresponding to advice | TAC for Icelandic EEZ | Deep-sea *S. mentella* ICES landings |
|---|---|---|---|---|
| 1987 | Precautionary TAC | 41–58 | 95[1] | 37.5 |
| 1988 | Precautionary TAC | 41–58 | 85[1] | 31.4 |
| 1989 | TAC[1] | 117[1] | 77[1] | 53.9 |
| 1990 | TAC[1] | 116[1] | 80[1] | 44.2 |
| 1991 | Precautionary TAC | (40) 117[1] | 55[1,5] | 67.9 |
| 1992 | Precautionary TAC | (40) 116[1] | 90[1,6] | 63.1 |
| 1993 | Precautionary TAC | 120[1] | 104[1,6] | 74.2 |
| 1994 | Precautionary TAC, if required | 100[1] | 90[1,6] | 83.6 |
| 1995 | TAC | 90[1] | 77[1,6] | 55.7 |
| 1996 | Precautionary TAC (45 in Va; 23 in VI and XIV) | 68[2] | 65[1,6] | 41.9 |
| 1997 | Effort 75% of 95-value | 39[2] | 65[1,6] | 43.1 |
| 1998 | Fishing mortality to be further reduced towards the 86–90 levels | | 65[1,6] | 38.9 |
| 1999 | Fishing mortality to be further reduced towards the 86–90 levels | | 65[1,6] | 35.0 |
| 2000 | Fishing effort to be further reduced by 25% | | 60[1,6] | 38.1 |
| 2001 | Fishing effort to be reduced by 25% from 1998 level | 22[3] | 57[1,6] | 23.9 |
| 2002 | *Status quo* fishing effort | 36[4] | 65[1,6] | 23.5 |
| 2003 | Not higher fishing effort than recent average | 30[4] | 60[1,6] | 31.1 |
| 2004 | Not higher fishing effort than recent average | 26.4[4] | 57[1,6] | 21.9 |
| 2005 | Reduce catch to 2001 level in Subarea V | 22.5[4] | 57[1,6] | 22.4 |
| 2006 | Reduce catch to 2001 level in Subarea V | 22.0[4] | 57[1,6] | 21.0 |
| 2007 | Same advice as last year | 22.0[4] | 57[1,6] | 24.1 |
| 2008 | Same advice as last year | 22.0[4] | 57[1,6] | |
| 2009 | Develop management plan and reduce catch | <10.0[5] | 50[1,6] | 19.4 |
| 2010 | Develop management plan and reduce catch | <10.0[5] | 50[1,6] | 17.7 |
| 2011 | Same advice as last year | <10.0[5] | 12.5[2,6] | 12.9 |
| 2012 | Same advice as last year | <10.0[5] | | |
| 2013 | Same advice as last year | <10.0[5] | | |

Weights in thousand tonnes.
[1] Deep-sea *S. mentella* and *S. marinus* combined.
[2]Deep-sea *S. mentella* only.
[3]In Division Va only.
[4] For entire Subarea V.
[5] Year ending 31 August.
[6] Quota year September–August.

**Table 2.4.8.2** Beaked redfish (*Sebastes mentella*) in Division Va and Subarea XIV (Icelandic slope stock). Nominal landings (tonnes) per country.

| Year | Iceland | Others | Total |
|---|---|---|---|
| 1978 | 3 693 | 209 | 3 902 |
| 1979 | 7 448 | 246 | 7 694 |
| 1980 | 9 849 | 348 | 10 197 |
| 1981 | 19 242 | 447 | 19 689 |
| 1982 | 18 279 | 213 | 18 492 |
| 1983 | 36 585 | 530 | 37 115 |
| 1984 | 24 271 | 222 | 24 493 |
| 1985 | 24 580 | 188 | 24 768 |
| 1986 | 18 750 | 148 | 18 898 |
| 1987 | 19 132 | 161 | 19 293 |
| 1988 | 14 177 | 113 | 14 290 |
| 1989 | 40 013 | 256 | 40 269 |
| 1990 | 28 214 | 215 | 28 429 |
| 1991 | 47 378 | 273 | 47 651 |
| 1992 | 43 414 | 0 | 43 414 |
| 1993 | 51 221 | 0 | 51 221 |
| 1994 | 56 674 | 46 | 56 720 |
| 1995 | 48 479 | 229 | 48 708 |
| 1996 | 34 508 | 233 | 34 741 |
| 1997 | 37 876 | 0 | 37 876 |
| 1998 | 32 841 | 284 | 33 125 |
| 1999 | 27 475 | 1 115 | 28 590 |
| 2000 | 30 185 | 1 208 | 31 393 |
| 2001 | 15 415 | 1 815 | 17 230 |
| 2002 | 17 870 | 1 175 | 19 045 |
| 2003 | 26 295 | 2 183 | 28 478 |
| 2004 | 16 226 | 1 338 | 17 564 |
| 2005 | 19 109 | 1 454 | 20 563 |
| 2006 | 16 339 | 869 | 17 208 |
| 2007 | 17 091 | 282 | 17 373 |
| 2008 | 24 123 | 0 | 24 123 |
| 2009 | 19 430 | 0 | 19 430 |
| 2010 | 17 668 | 0 | 17 668 |
| 2011[1)] | 12 922 | 0 | 12 922 |

[1)] Preliminary.

# ECOREGION Iceland and East Greenland
# STOCK Beaked redfish (*Sebastes mentella)* in Subareas V, XII, and XIV and NAFO Subareas 1+2 (Shallow pelagic stock < 500 m)

## Advice for 2013

The advice for the fishery in 2013 is the same as the advice given in 2011 for the 2012 fishery: *"ICES advises on the basis of precautionary considerations that no directed fishery should be conducted and bycatch of this stock in non-directed fisheries should be kept as low as possible."*

## Stock status

| F (Fishing Mortality) | | |
|---|---|---|
| | | 2009–2011 |
| **MSY ($F_{MSY}$)** | ? | Unknown |
| **Precautionary approach** ($F_{pa}$,$F_{lim}$) | ? | Unknown |
| **SSB (Spawning-Stock Biomass)** | | |
| | | 2010–2012 |
| **MSY** ($B_{trigger}$) | ? | Unknown |
| **Precautionary approach** ($B_{pa}$,$B_{lim}$) | ? | Unknown |
| **Qualitative evaluation** | ✗ | Stable at very low |

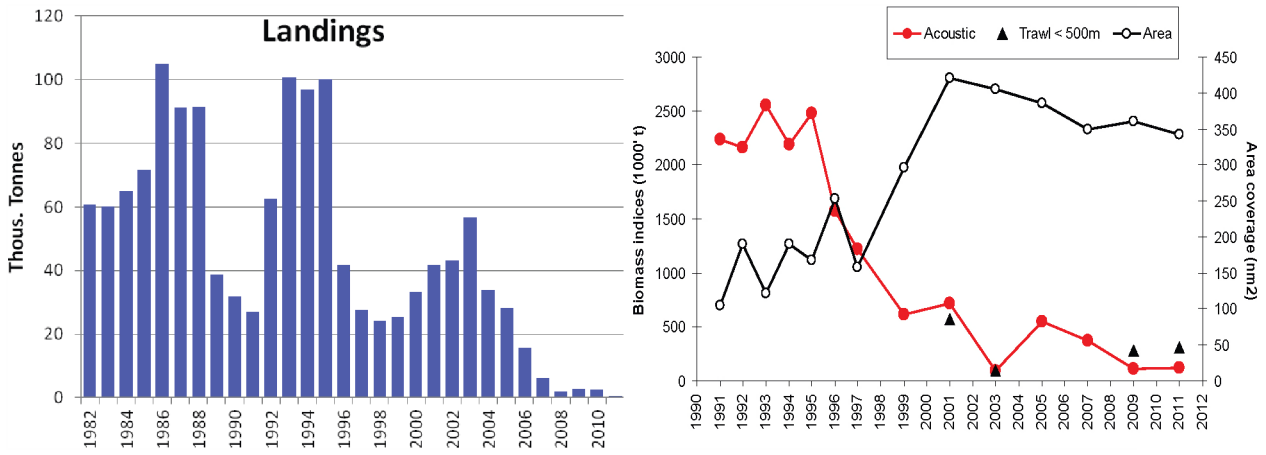



**Figure 2.4.9.1** Beaked redfish (*Sebastes mentella)* in Subareas V, XII, and XIV and NAFO Subareas 1+2 (Shallow pelagic stock < 500 m). Left: Landings (tonnes), Right: Overview of acoustic survey indices (thousand tonnes) from above the scattering layer (red filled circle), trawl estimates within the scattering layer and shallower than 500 m (black triangle), and aerial coverage ($NM^2$) of the survey (black open circle) in the Irminger Sea and adjacent waters.

The biomass index from the acoustic survey in 2011 indicates that the stock has declined to roughly 5% of the estimates at the beginning of the survey time-series in the early 1990s. The exploitation rate for this stock is unknown.

## Management plans

There are no explicit management objectives for this stock.

**Biology**

*Sebastes mentella* is a species characterized by slow growth, late maturation (matures between 10 and 14 years old), a long lifespan (> 50 years), and a schooling behaviour. Hence it is considered to be vulnerable to overexploitation. It can therefore only sustain low exploitation rates and management should be based on that consideration.

**The fisheries**

Nursery areas for the stock are found at the continental slope off East Greenland. Technical conservation measures such as mandatory sorting grids in the shrimp fishery that have been in place for several years should be continued in order to protect the juvenile redfish.

| | |
|---|---|
| **Catch distribution** | Total catches (2011) = 568 t, where 100% are landings (100% pelagic trawl). No discards, industrial bycatch, or unaccounted removals. |

**Effects of the fisheries on the ecosystem**

These fisheries have no effect on the ecosystem apart from the removal of the target species. The pelagic fisheries on *S. mentella* generally have little or no bycatch.

**Quality considerations**

Several data improvements are needed – better catch and landings data, better survey information particularly within the deep-scattering layer, and a recruitment index. However, the acoustic index shows a sharp decline of the stock during the 1990s and the stock remains low.

ICES again had difficulties in obtaining catch estimates and landing data from some ICES member countries, and specially data disaggregated by depth. The Russian Federation has decided for the years 2011 and 2012 on an unilateral quota that considers both redfish management units as a single stock. This unilateral quota nearly equals the total quota recommended by NEAFC. The Russian Federation so far has not facilitated depth disaggregated catch data to the NWWG, and this may affect the assessment. In February 2011 ICES launched a data call requiring better data from the countries participating in the redfish fishery, but the response was very limited. There is a need for special action through NEAFC and NAFO to provide ICES with timely and complete information that might lead to more reliable catch statistics. Furthermore, ICES recommends that all nations should report depth information on a haul basis in accordance with the NEAFC logbook format.

**Scientific basis**

| | |
|---|---|
| **Assessment type** | No analytical assessment, qualitative assessment. |
| **Input data** | Biomass and abundance survey indices obtained in biennial acoustic and trawling survey; biological data collected on this and other surveys and from commercial catches. Commercial indices (cpue, landings). |
| **Discards and bycatch** | Not included in the assessment. |
| **Indicators** | None. |
| **Other information** | Stock benchmarked in 2012. |
| **Working group report** | NWWG |

# ECOREGION Iceland and East Greenland
# STOCK Beaked redfish (*Sebastes mentella)* in Subareas V, XII, and XIV and NAFO Subareas 1+2 (Shallow pelagic stock < 500 m)

**Reference points**

No reference points have been set for this stock.

**Outlook for 2013**

No reliable assessment can be presented for this stock due to the insufficient commercial dataset and short time-series of suitable survey data. Therefore, fishing possibilities cannot be projected.

***Precautionary approach***

ICES advises on the basis of precautionary considerations that no directed fishery should be conducted and bycatch of this stock in non-directed fisheries should be kept as low as possible. A recovery plan should be developed.

The acoustic survey biomass index shows that the stock has declined to 5% of that observed in the early 1990s and the exploitation status is unknown. The stock is considered to be vulnerable to overexploitation because of its biological characteristics (slow-growing, late-maturing, and schooling behaviour).

**Additional considerations**

*Management considerations*

ICES is concerned about the lack of agreed management and TAC allocation schemes. This increases the risk of over-exploitation. The autonomous quotas that have been set are insufficient to constrain catches.

ICES has advised that an adaptive management plan be implemented and ICES provided a list of potential elements of such a management plan. The main management organization concerned with pelagic redfish in the Irminger Sea – NEAFC – has further requested ICES to specify these elements and also to estimate possible candidates for reference points. However, ICES has not yet been able to address this issue.

ICES has previously advised that most deep-water species like redfish can only sustain low rates of exploitation, since slow-growing, long-lived species that are depleted have a long recovery period. Fisheries should only be allowed to expand when indicators have been identified and a management strategy including appropriate monitoring requirements has been decided and is implemented. ICES therefore, stresses the need to develop and implement a recovery plan which takes into account the uncertainties in science and the properties of the fisheries.

The relationship of the shallow pelagic component with *S. mentella* from the Greenlandic shelf remains unclear.

*Changes in fishing technology and fishing patterns*

Russian trawlers started fishing on the shallow pelagic *S. mentella* stock in 1982 and covered wide areas of the Irminger Sea. Vessels from other nations soon joined this fishery. The main fishing area in the last decade has been south and southeast of Cape Farewell, Greenland, the so-called southwestern area (south of 60°N and west of about 32°W), and the area is almost entirely shallower than 500 m. Since 2000, the southwestern fishing ground extended also into the NAFO Convention Area, but in later years the fishing area has been limited to the border area between NAFO and ICES south of Greenland. Catches have declined substantially in parallel with this reduction in the fishing areas (Figure 2.4.9.1). In the period 1982–1992, the fishery was carried out mainly from April to August but since then it has been conducted from July to October. The trawlers participating in this fishery use large pelagic trawls (*Gloria*-type) with vertical openings of 80–150 m.

The shallow pelagic stock fishery in the Irminger Sea only exploits the mature part of the stock.

*Data and methods*

Survey indices, catches, cpue, and biological data are available for the stock, but the assessment is mainly based on surveys (Figures 2.4.9.2–2.4.9.4, Tables 2.4.9.2–2.4.9.3).

Despite the best of efforts, ICES again had difficulties in obtaining landings data from some ICES member countries. There is a need for a special action through NEAFC and NAFO to provide ICES, in a timely manner, with all information that might lead to more reliable catch statistics. Furthermore, ICES recommends that all nations should report depth information in accordance with the NEAFC logbook format.

Acoustic surveys conducted since 1991 in the Irminger Sea and adjacent waters are available for estimation of the stock biomass above the deep-scattering layer or down to ca. 350 m depth. Trawl information from within this layer and shallower than 500 m is available for 2001, 2003, 2009, and 2011.

*Uncertainties in assessment and forecast*

Commercial cpue series were previously used to determine stock sizes for pelagic *S. mentella*. However, the fishery targets pelagic aggregating fish and therefore stable or increasing cpues are not considered to reflect the stock status reliably, although declining cpues likely indicate a decreasing stock. Overall cpues declined between 1994 and 1999 and have since then fluctuated without a clear trend until 2010, when they increased (Figure 2.4.9.4). Table 2.4.9.1 shows the catch data. The new data available to the NWWG were insufficient to estimate the cpue for 2011.

The acoustic estimates for pelagic redfish only provide stock estimates for redfish distributed shallower than the deep-scattering layer (DSL), and the indices of stock size are approximate due to the varying coverage of the stock distribution area.

The quality of the trawl biomass estimate within the DSL and shallower than 500 m cannot be verified, as the data series is relatively short and only conducted every second year. Therefore, the abundance estimates by the trawl method must be considered as a rough attempt only to measure the abundance within the DSL and shallower than 500 m.

**Sources**

ICES. 2011a. Report of the North-Western Working Group, 26 April–3 May 2011. ICES CM 2011/ACOM:07.
ICES. 2011b. Report of the Working Group on Redfish Surveys, 2–4 August 2011. ICES CM 2011/SSGESST:21.
ICES 2012a. Report of the Benchmark Workshop on Redfish Stocks, 1–8 February 2012. ICES CM 2012/ACOM:48.
ICES. 2012b. Report of the North-Western Working Group, 26 April–3 May 2012. ICES CM 2012/ACOM:07

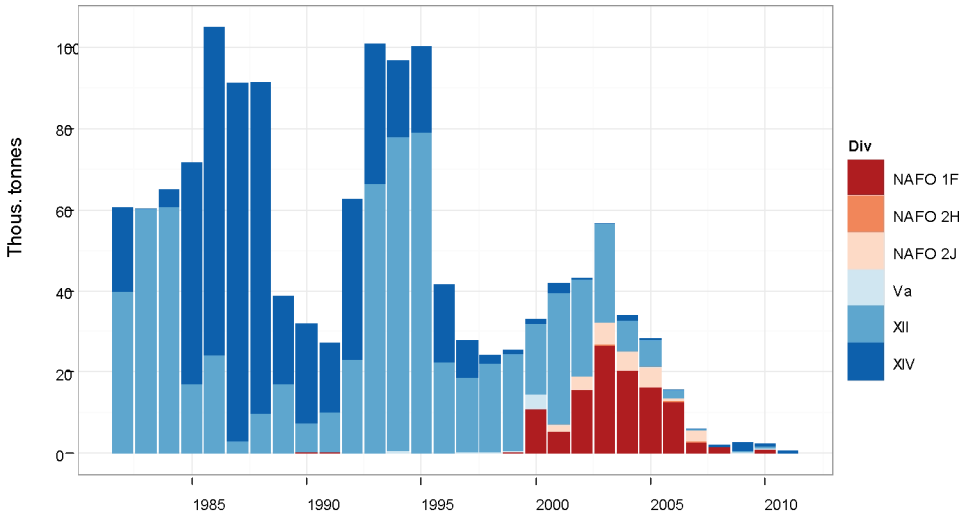



**Figure 2.4.9.2** Beaked redfish (*Sebastes mentella)* in Subareas V, XII, and XIV and NAFO Subareas 1+2 (Shallow pelagic stock < 500 m). Landings by area (weights in thousand tonnes).

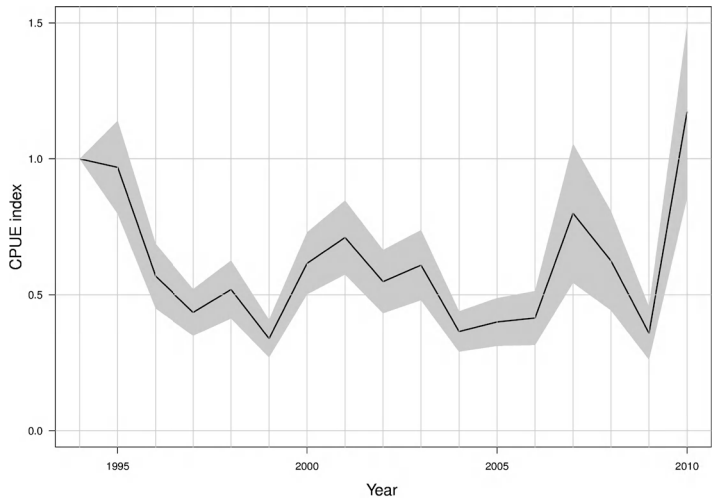



**Figure 2.4.9.3** Beaked redfish (*Sebastes mentella)* in Subareas V, XII, and XIV and NAFO Subareas 1+2 (Shallow pelagic stock < 500 m). Trends in standardized cpue, based on logbook data from several nations.

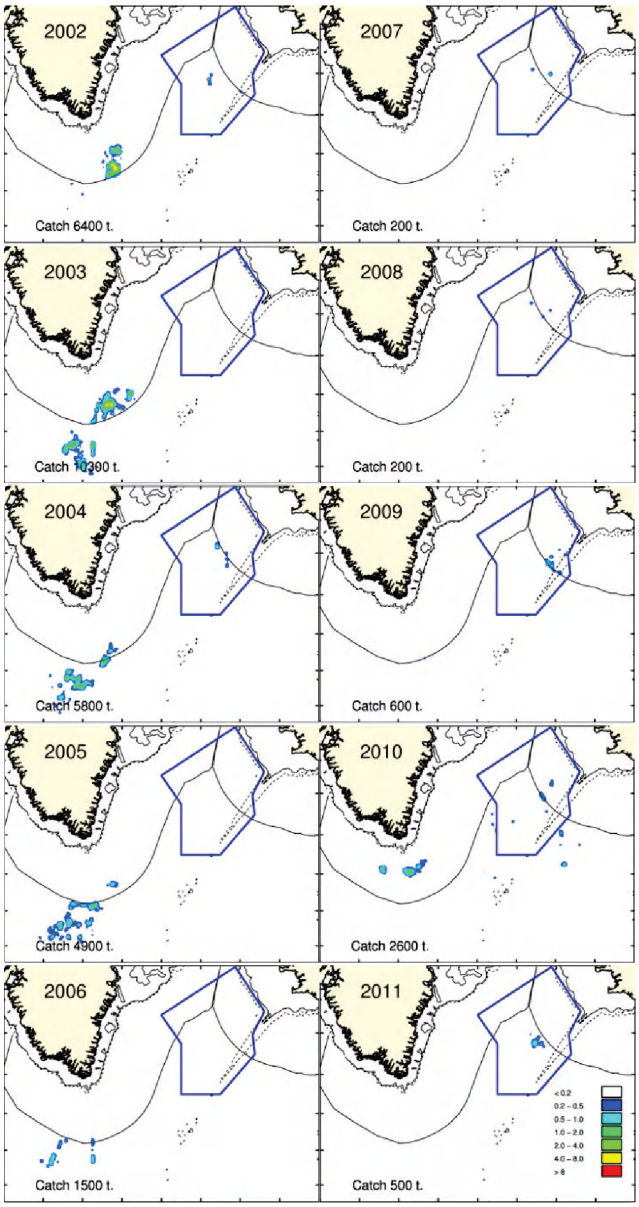



**Figure 2.4.9.4** Beaked redfish (*Sebastes mentella)* in Subareas V, XII, and XIV and NAFO Subareas 1+2 (Shallow pelagic stock < 500 m). Fishing areas and total catch of pelagic redfish (*S. mentella*) in the Irminger Sea and adjacent waters 2000–2011. This is a geographic proxy for the shallow pelagic stock. Data are from the Faroe Islands (2000–2011), Greenland (2000–2003 and 2009–2010), Iceland (2000–2011), Germany (2011), and Norway (2000–2003 and 2008–2011). The catches in the legend are given as tonnes per square nautical mile. The blue box represents the proposed management unit.

**Table 2.4.9.1** Beaked redfish (*Sebastes mentella)* in Subareas V, XII, and XIV and NAFO Subareas 1+2 (Shallow pelagic stock < 500 m). ICES advice, management, and catches.

| Year | ICES Advice[1)] | Predicted catch corresponds to advice[1)] | TAC[1)] | ICES Catch[1)] Total | ICES Catch Shallow pelagic stock |
|---|---|---|---|---|---|
| 1987 | No assessment | - | | 91 | 91 |
| 1988 | No assessment | - | | 91 | 91 |
| 1989 | TAC | 90–100 | | 39 | 39 |
| 1990 | TAC | 90–100 | | 32 | 32 |
| 1991 | TAC | 66 | | 28 | 27 |
| 1992 | Preference for no major expansion of the fishery | - | | 66 | 63 |
| 1993 | TAC | 50 | | 116 | 100 |
| 1994 | TAC | 100 | | 148 | 97 |
| 1995 | TAC | 100 | | 176 | 97 |
| 1996 | No specific advice | - | 153 | 180 | 41 |
| 1997 | No specific advice | - | 153–158 | 123 | 28 |
| 1998 | TAC not over recent (1993–1996) levels of 150 000 t | | 153 | 117 | 24 |
| 1999 | TAC to be reduced from recent (1993–1996) levels of 150 000 t | | 153 | 110 | 26 |
| 2000 | TAC set lower than recent (1997–1998) catches of 120 000 t | 85 | 120 | 126 | 33 |
| 2001 | TAC less than 75% of catch 1997–1999 | <85 | 95 | 129 | 41 |
| 2002 | TAC less than 75% of catch 1997–1999 – Revised to be below current catch levels | <85 | Not agreed NEAFC proposal (95) | 146 | 43 |
| 2003 | TAC not exceed current catch levels | 119 | Not agreed NEAFC proposal (119) | 161 | 57 |
| 2004 | TAC not exceed current catch levels | 120 | Not agreed NEAFC proposal (120) | 126 | 34 |
| 2005 | Limit catch to 41 kt | 41 | Not agreed NEAFC proposal (75) / (116[2)]) | 74 | 28 |
| 2006 | Catch less than 41 kt | 41 | Not agreed NEAFC proposal (62) / (99[2)]) | 83 | 16 |
| 2007 | No fishery until clear indications of recovery of the stock | 0 | Not agreed NEAFC proposal (46) / (73[2)]) | 64 | 6 |
| 2008 | Starting point for adaptive management strategy | 20 | Not agreed NEAFC proposal (46) / (64[2)]) | 32 | 2 |
| 2009 | Starting point for adaptive management strategy | 20 | Not agreed NEAFC proposal (0) / (72[2)]) | 54 | 2.7 |
| 2010[1)] | No directed fishery and bycatch as low as possible | - | Not agreed NEAFC proposal (0) / (72[2)]) | 59 | 2.4 |
| 2011 | Same advice as last year | - | Not agreed NEAFC proposal (0)/(60[2)] /(30)[3)]) | 48 | 0.5 |
| 2012 | Same advice as last year | - | Not agreed NEAFC proposal (0)/(56[2)] /(30)[3)]) | | |
| 2013 | Same advice as last year | - | | | |

Weights in thousand tonnes.

1) Up to 2009 advice and TAC were given for both shallow and deep stocks.

2) Sum of all quotas in force for both shallow and deep pelagic.

3) Unilateral Russian Federation TAC for both sShallow and deep pelagic stocks.

**Table 2.4.9.2** Beaked redfish (*Sebastes mentella)* in Subareas V, XII, and XIV and NAFO Subareas 1+2 (Shallow pelagic stock < 500 m). Catches (in tonnes) by area as used by the Working Group.

| Year | Va | XII | XIV | NAFO 1F | NAFO 2J | NAFO 2H | Total |
|---|---|---|---|---|---|---|---|
| 1982 | | 39,783 | 20,798 | | | | 60,581 |
| 1983 | | 60,079 | 155 | | | | 60,234 |
| 1984 | | 60,643 | 4,189 | | | | 64,832 |
| 1985 | | 17,300 | 54,371 | | | | 71,671 |
| 1986 | | 24,131 | 80,976 | | | | 105,107 |
| 1987 | | 2,948 | 88,221 | | | | 91,169 |
| 1988 | | 9,772 | 81,647 | | | | 91,419 |
| 1989 | | 17,233 | 21,551 | | | | 38,784 |
| 1990 | | 7,039 | 24,477 | 385 | | | 31,901 |
| 1991 | | 9,689 | 17,048 | 458 | | | 27,195 |
| 1992 | 106 | 22,976 | 38,709 | | | | 62,564 |
| 1993 | 0 | 66,458 | 32,500 | | | | 100,771 |
| 1994 | 665 | 77,174 | 18,679 | | | | 96,869 |
| 1995 | 77 | 78,895 | 17,895 | | | | 100,136 |
| 1996 | 16 | 22,474 | 18,566 | | | | 41,770 |
| 1997 | 321 | 18,212 | 8,245 | | | | 27,746 |
| 1998 | 284 | 21,976 | 1,598 | | | | 24,150 |
| 1999 | 165 | 23,659 | 827 | 534 | | | 25,512 |
| 2000 | 3,375 | 17,491 | 687 | 11,052 | | | 33,216 |
| 2001 | 228 | 32,164 | 1,151 | 5,290 | 8 | 1,751 | 41,825 |
| 2002 | 10 | 24,004 | 222 | 15,702 | | 3,143 | 43,216 |
| 2003 | 49 | 24,211 | 134 | 26,594 | 325 | 5,377 | 56,688 |
| 2004 | 10 | 7,669 | 1,051 | 20,336 | | 4,778 | 33,951 |
| 2005 | 0 | 6,784 | 281 | 16,260 | 5 | 4,899 | 28,229 |
| 2006 | 0 | 2,094 | 94 | 12,692 | 260 | 593 | 15,734 |
| 2007 | 71 | 378 | 98 | 2,843 | 175 | 2,561 | 6,126 |
| 2008 | 32 | 25 | 422 | 1,580 | | | 2,059 |
| 2009 | 400 | 210 | 2 170 | | | | 2,780 |
| 2010 | 160 | 686 | 498 | 1,074 | | | 2,419 |
| 2011 | | 0 | 568 | | | | 568 |

1982–1991 All pelagic catches assumed to be of the shallow pelagic stock.
1992–1996 Guesstimates based on different sources (see text).
1997–2010 Catches from calculations based on combined catch database and total landings.

**Table 2.4.9.3** Beaked redfish (*Sebastes mentella)* in Subareas V, XII, and XIV and NAFO Subareas 1+2 (Shallow pelagic stock < 500 m). Results for the acoustic survey indices from shallower than the scattering layer, trawl estimates within the deep-scattering layer and shallower than 500 m, and area coverage of the survey in the Irminger Sea and adjacent waters.

| Year | Area covered (1000 $NM^2$) | Acoustic estimates 1000 t | Trawl estimates 1000 t |
|---|---|---|---|
| 1991 | 105 | 2235 | |
| 1992 | 190 | 2165 | |
| 1993 | 121 | 2556 | |
| 1994 | 190 | 2190 | |
| 1995 | 168 | 2481 | |
| 1996 | 253 | 1576 | |
| 1997 | 158 | 1225 | |
| 1999 | 296 | 614 | |
| 2001 | 420 | 716 | 565 |
| 2003* | 405 | 89* | 92* |
| 2005 | 386 | 550 | |
| 2007 | 349 | 372 | |
| 2009 | 360 | 108 | 278 |
| 2011 | 343 | 123 | 309 |

* The 2003 biomass estimate is considered inconsistent as the survey was carried out about one month earlier than usual, and a marked seasonal effect was observed.

# ECOREGION Iceland and East Greenland
# STOCK Beaked redfish (*Sebastes mentella)* in Subareas V, XII, and XIV and NAFO Subareas 1+2 (Deep pelagic stock > 500 m)

## Advice for 2013

The advice for the fishery in 2013 is the same as the advice given in 2011 for the 2012 fishery:
*"ICES advises on the basis of the precautionary considerations that catches should be reduced to less than 20 000 t and a management plan should be developed and implemented."*

## Stock status

| F (Fishing Mortality) | | |
|---|---|---|
| | | 2009–2011 |
| **MSY ($F_{MSY}$)** | ? | Unknown |
| **Precautionary approach ($F_{pa}$,$F_{lim}$)** | ? | Unknown |
| **SSB (Spawning-Stock Biomass)** | | |
| | | 2010–2012 |
| **MSY ($B_{trigger}$)** | ? | Unknown |
| **Precautionary approach ($B_{pa}$,$B_{lim}$)** | ? | Unknown |
| **Qualitative evaluation** | → | Stable |

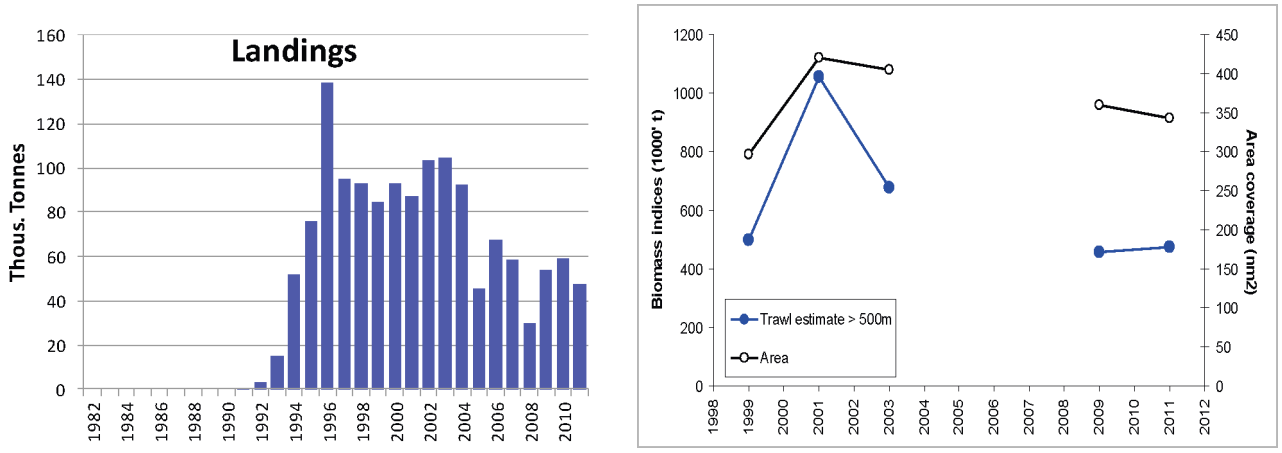



**Figure 2.4.10.1** Beaked redfish in Subareas V, XII, and XIV and NAFO Subareas 1+2 (Deep pelagic stock > 500 m). Left: Landings (thousand tonnes). Right: Overview of survey indices from trawl estimates deeper than 500 m (blue line) and aerial coverage of the survey (black open circle) in the Irminger Sea and adjacent waters.

Trawl survey estimates in 2009 and 2011 are lower than the average for 1999–2003 and near the lowest observed. These indices in combination with a marked decrease in landings since 2004 suggest that the stock has been reduced in the past decade. The exploitation rate for this stock is unknown.

## Management plans

There are no explicit management objectives for this stock.

**Biology**

*S. mentella* is a species characterized by slow growth, late maturation (matures between 10 and 14 years old), a long lifespan (> 50 years), and a schooling behaviour. These characteristics make the species vulnerable to overexploitation. It can therefore only sustain low exploitation rates and management should be based on that consideration.

**The fisheries**

Nursery areas for the stock are found on the continental slope off East Greenland. Technical conservation measures such as mandatory sorting grids in the shrimp fishery that have been in place for several years should be continued in order to protect the juvenile redfish.

| | |
|---|---|
| **Catch distribution** | Total catches (2011) are 47.5 kt, all landings (100% pelagic trawl). No discards, industrial bycatch, or unaccounted removals. |

**Effects of the fisheries on the ecosystem**

These fisheries are not considered to have an effect on the ecosystem apart from the removal of the target species. The pelagic fisheries on *S. mentella* generally have little or no bycatch.

**Quality considerations**

Several data improvements are needed – better catch and landings data, better survey information, particularly within the deep scattering layer, and a recruitment index. However, the few available indices indicate a declining stock.

ICES again had difficulties in obtaining catch estimates and landing data from some ICES member countries, and specially data disaggregated by depth. For the years 2011 and 2012 the Russian Federation has decided on an unilateral quota that considers both redfish management units as a single stock. This unilateral quota nearly equals the total quota recommended by NEAFC. The Russian Federation so far has not facilitated depth disaggregated catch data to the NWWG, and this may affect the assessment. In February 2011 ICES launched a data call requiring better data from the countries participating in the redfish fishery, but the response was very limited. In spite of the best efforts there is a need for a special action through NEAFC and NAFO to provide ICES with timely and reliable catch statistics. Furthermore, ICES recommends that all nations should report depth information in accordance with the NEAFC logbook format.

**Scientific basis**

| | |
|---|---|
| **Assessment type** | Non-analytical. |
| **Input data** | Biomass and abundance survey indices obtained in biennial acoustic and trawling survey. |
| **Discards and bycatch** | Not included in the assessment. |
| **Indicators** | Biological data collected on this and other surveys and from commercial catches. |
| **Other information** | Stock benchmarked in 2012. |
| **Working group report** | NWWG |

# ECOREGION Iceland and East Greenland
# STOCK Beaked redfish (*Sebastes mentella)* in Subareas V, XII, and XIV and NAFO Subareas 1+2 (Deep pelagic stock > 500 m)

**Reference points**

No reference points have been set for this stock.

**Outlook for 2013**

No assessment can be presented for this stock due to the insufficient commercial dataset and short time-series of suitable survey data. Therefore, fishing possibilities cannot be projected.

***Precautionary approach***

ICES advises on the basis of the precautionary considerations that catches should be reduced to less than 20 000 t and a management plan should be developed and implemented. The stock is considered to have decreased over the last decade while the exploitation status is unknown. The stock is considered to be vulnerable to overexploitation because of its biological characteristics (slow-growing, late-maturing, and schooling behaviour).

**Additional considerations**

*Management considerations*

ICES has previously advised that most deep-water and long-living species like redfish can only sustain low rates of exploitation, since slow-growing, and long-lived species that are depleted have a long recovery period. Fisheries should only be allowed to expand when indicators have been identified and a management strategy including appropriate monitoring requirements has been decided and implemented.

ICES is concerned about the lack of agreed upon management and TAC allocation schemes. Although most nations conducting fisheries have agreed on management measures to reduce catches stepwise over the next three years, the total quotas that have been set are insufficient to constrain catches. This increases the risk of overexploitation. The autonomous quotas that have been set are insufficient to constrain catches, even though ICES acknowledges that some parties have agreed on a step-wise reduction of catches. Therefore, ICES has for the past two years advised that an adaptive management plan be implemented. ICES provided a list of potential elements that could be contained in such a management plan.

*Changes in fishing technology and fishing patterns*

The fishery started around 1991–1992 when the commercial fleet of the shallow pelagic redfish moved into deeper waters. Since 1997, the main fishing season occurred from late April to August in the so-called northwest fishing area near the Greenland and Icelandic EEZ and within the Icelandic EEZ, i.e. in the area east of 32°W and north of 61°N. The trawlers participating in this fishery use large pelagic trawls (*Gloria*-type) with vertical openings of 80–150 m. The vessels have operated at a depth range of 600 to 950 m in 1998–2011. Discarding is at present not considered to be significant in this fishery. The deep pelagic fishery in the Irminger Sea only exploits the mature part of the stock.

*Data and methods*

Survey indices, catches, cpue, and biological data are available for the stock, but the assessment is mainly based on surveys (Figures 2.4.10.1–2.4.10.4 and Table 2.4.10.1).

Data from most fishing nations have been compiled since this fishery started, although some ICES member nations do not supply the required depth information. There is a need for a special action through NEAFC and NAFO to provide ICES, in a timely manner, with all information that might lead to more reliable catch statistics. Furthermore, ICES recommends that all nations should report depth information in accordance with the NEAFC logbook format. Figure 2.4.10.4 shows detailed charts of the area distribution of the fisheries.

*Uncertainties in assessment and forecast*

The quality of the trawl biomass estimate from the international trawl–acoustic surveys since 1999 cannot be verified as the data series is relatively short and the survey is only conducted every second year. Therefore, the abundance estimates by the trawl method must only be considered as a rough attempt to measure the abundance of the deep pelagic stock.

It is not known to what extent cpue reflect changes in the stock status of deep pelagic *S. mentella* stock. The fishery targets pelagic aggregating fish. Therefore, stable or increasing cpues are not considered to reflect the stock status reliably, but decreasing cpues likely indicate a decreasing stock (Figure 2.4.10.3).

**Sources**

ICES. 2011a. Report of the North-Western Working Group, 26 April–3 May 2011. ICES CM 2011/ACOM:07.
ICES. 2011b. Report of the Working Group on Redfish Surveys, 2–4 August 2011. ICES CM 2011/SSGESST:21.
ICES. 2012a. Report of the Benchmark Workshop on Redfish Stocks, 1–8 February 2012. ICES CM 2012/ACOM:48.
ICES. 2012b. Report of the North-Western Working Group, 26 April–3 May 2012. ICES CM 2012/ACOM:07.

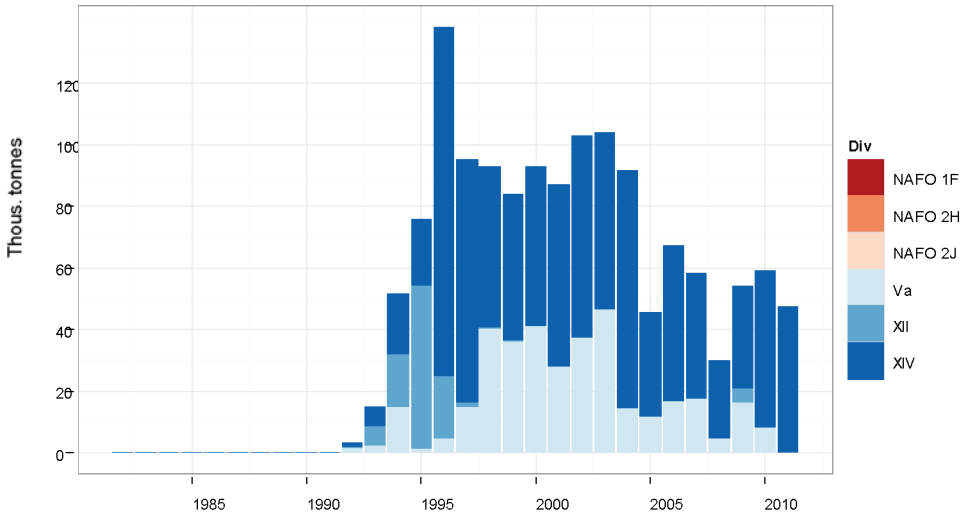



**Figure 2.4.10.2** Beaked redfish in Subareas V, XII, and XIV and NAFO Subareas 1+2 (Deep pelagic stock >500 m). Landings by area (thousand tonnes).

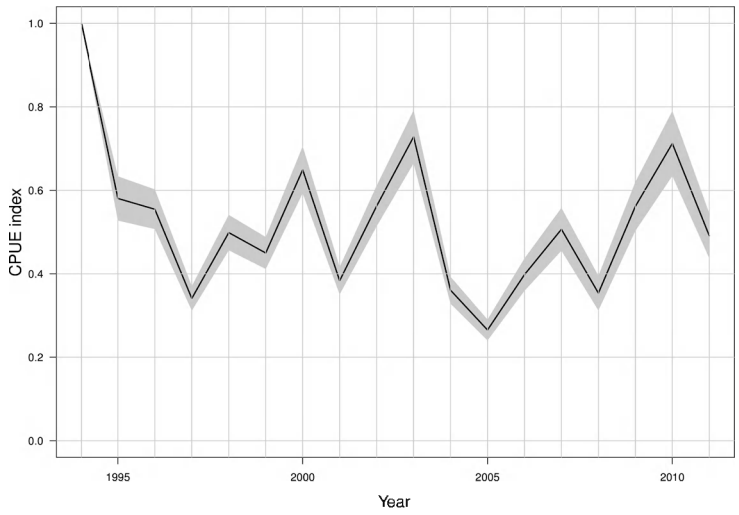



**Figure 2.4.10.3** Beaked redfish in Subareas V, XII, and XIV and NAFO Subareas 1+2 (Deep pelagic stock >500 m). Trends in standardized cpue of the deep pelagic *S. mentella* fishery in the Irminger Sea and adjacent waters, based on logbook data from several nations.

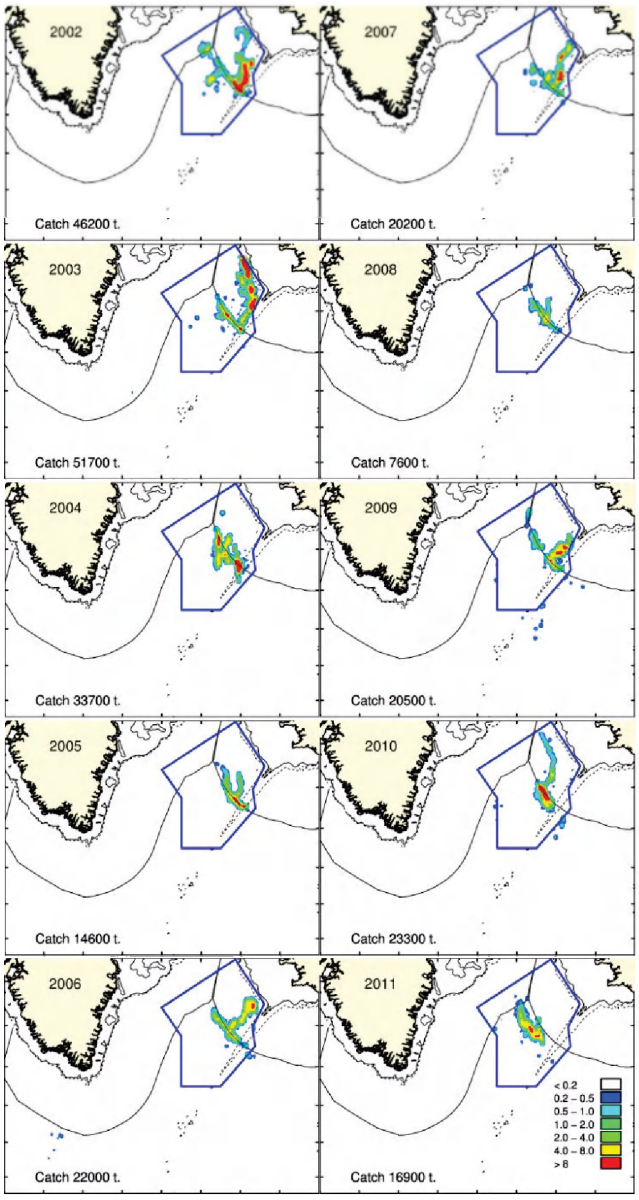



**Figure 2.4.10.4** Beaked redfish in Subareas V, XII, and XIV and NAFO Subareas 1+2 (Deep pelagic stock >500 m). Fishing areas and total catch of pelagic *S. mentella* from the recommended northeast management unit in the Irminger Sea and adjacent waters 2002–2011. This is a geographic proxy for the deep pelagic stock. Data are from the Faroe Islands (2002–2011), Germany (2002–2007 and 2011), Greenland (2002–2003 and 2009–2010), Iceland (2002–2011), and Norway (2002, 2003, and 2008–2011). The scale given is tonnes per square nautical mile.

**Table 2.4.10.1** Beaked redfish (*Sebastes mentella)* in Subareas V, XII, and XIV and NAFO Subareas 1+2 (Deep pelagic stock >500 m). ICES advice, management, and catches.

| Year | ICES Advice[1)] | Predicted catch corresponds to advice[1)] | TAC[1)] | ICES Catch[1)] Total | ICES Catch deep pelagic stock |
|---|---|---|---|---|---|
| 1991 | TAC | 66 | | 28 | 0 |
| 1992 | Preference for no major expansion of the fishery | - | | 66 | 3 |
| 1993 | TAC | 50 | | 116 | 16 |
| 1994 | TAC | 100 | | 148 | 52 |
| 1995 | TAC | 100 | | 176 | 78 |
| 1996 | No specific advice | - | 153 | 180 | 139 |
| 1997 | No specific advice | - | 153–158 | 123 | 95 |
| 1998 | TAC not over recent (1993–1996) levels of 150 000 t | | 153 | 117 | 93 |
| 1999 | TAC to be reduced from recent (1993–1996) levels of 150 000 t | | 153 | 110 | 84 |
| 2000 | TAC set lower than recent (1997–1998) catches of 120 000 t | 85 | 120 | 126 | 93 |
| 2001 | TAC less than 75% of catch 1997–1999 | <85 | 95 | 129 | 88 |
| 2002 | TAC less than 75% of catch 1997–1999 – Revised to be below current catch levels | <85 | No agreed NEAFC proposal (95) | 146 | 103 |
| 2003 | TAC not exceed current catch levels | 119 | - ,, - (119) | 161 | 104 |
| 2004 | TAC not exceed current catch levels | 120 | - ,, - (120) | 126 | 92 |
| 2005 | Limit catch to 41 kt | 41 | - ,, - (75) / (116[2)]) | 74 | 45 |
| 2006 | Catch less than 41 kt | 41 | - ,, - (62) / (99[2)]) | 83 | 67 |
| 2007 | No fishery until clear indications of recovery of the stock | 0 | - ,, - (46) / (73[2)]) | 64 | 59 |
| 2008 | Starting point for adaptive management strategy | 20 | - ,, - (46) / (73[2)]) | 32 | 30 |
| 2009 | Starting point for adaptive management strategy | 20 | - ,, - (46) / (78[2)]) | 54 | 52 |
| 2010[1] | Reducing fishing: Starting point for adaptive management strategy | 20 | No agreed NEAFC proposal (46) / (78[2)]) | 59 | 57 |
| 2011 | Reducing fishing: Starting point for adaptive management strategy | 20 | - ,, - (38) / (60[2)] / (30[3)]) | 48 | 47 |
| 2012 | Reducing fishing: Starting point for adaptive management strategy | 20 | (32) / (54[2)] / (30[3)]) | | |
| 2013 | Precautionary considerations. Management Plan to be developed and implemented | 20 | | | |

Weights in thousand tonnes.

1) Up to 2009 advice and TAC was given for shallow and deep stocks combined.

2) Sum of all quotas in force, for both shallow and deep pelagic.

3) Unilateral Russian Federation TAC for both shallow and deep pelagic.

**Table 2.4.10.2** Beaked redfish in Subareas V, XII, and XIV and NAFO Subareas 1+2 (Deep pelagic stock >500 m). Catches (in tonnes) by area as used by the Working Group.

| Year | Va | XII | XIV | NAFO 1F | NAFO 2H | NAFO 2J | Total |
|---|---|---|---|---|---|---|---|
| 1982 | | 0 | 0 | | | | 0 |
| 1983 | | 0 | 0 | | | | 0 |
| 1984 | | 0 | 0 | | | | 0 |
| 1985 | | 0 | 0 | | | | 0 |
| 1986 | | 0 | 0 | | | | 0 |
| 1987 | | 0 | 0 | | | | 0 |
| 1988 | | 0 | 0 | | | | 0 |
| 1989 | | 0 | 0 | | | | 0 |
| 1990 | | 0 | 0 | 0 | | | 0 |
| 1991 | | 7 | 52 | 0 | | | 59 |
| 1992 | 1 862 | 280 | 1 257 | | | | 3 398 |
| 1993 | 2 603 | 6 068 | 6 393 | | | | 15 064 |
| 1994 | 14 807 | 16 977 | 20 036 | | | | 51 820 |
| 1995 | 1 466 | 53 141 | 21 100 | | | | 75 707 |
| 1996 | 4 728 | 20 060 | 113 765 | | | | 138 552 |
| 1997 | 14 980 | 1 615 | 78 485 | | | | 95 079 |
| 1998 | 40 328 | 444 | 52 046 | | | | 92 818 |
| 1999 | 36 359 | 373 | 47 421 | 0 | | | 84 153 |
| 2000 | 41 302 | 0 | 51 811 | 0 | | | 93 113 |
| 2001 | 27 920 | 0 | 59 073 | 0 | 0 | 0 | 86 993 |
| 2002 | 37 269 | 2 | 65 858 | 0 | | 0 | 103 128 |
| 2003 | 46 627 | 21 | 57 648 | 0 | 0 | 0 | 104 296 |
| 2004 | 14 446 | 0 | 77 508 | 0 | | 0 | 91 954 |
| 2005 | 11 726 | 0 | 33 759 | 0 | 0 | 0 | 45 485 |
| 2006 | 16 452 | 51 | 50 531 | 254 | 0 | 0 | 67 288 |
| 2007 | 17 769 | 0 | 40 748 | 0 | 0 | 0 | 58 516 |
| 2008 | 4 602 | 0 | 25 443 | 0 | | | 30 045 |
| 2009 | 16 428 | 4 658 | 32 920 | | | | 54 006 |
| 2010 | 8 407 | 0 | 50 661 | 0 | | | 59 067 |
| 2011 | | 7 | 47 490 | | | | 47 497 |

1992–1996 Estimates based on different sources.
1997–2010 Catches from calculations based on the joint catch database and total landings.

# ECOREGION Iceland and East Greenland
# STOCK Beaked redfish (*Sebastes mentella)* in Division XIVb (Demersal)

## Advice for 2013

Based on the precautionary approach catches should be reduced from the current level to no more than 3500 t.

The stock is not yet evaluated as being a biological entity separated from the adjacent *Sebastes mentella* stocks. Until this has been clarified, demersal *S. mentella* on the East Greenland shelf is assessed as a separate biological unit.

## Stock status

| F (Fishing Mortality) | | |
|---|---|---|
| | | 2009–2011 |
| **MSY ($F_{MSY}$)** | ? | Unknown |
| **Precautionary approach ($F_{pa}$,$F_{lim}$)** | ? | Unknown |
| **SSB (Spawning-Stock Biomass)** | | |
| | | 2010–2012 |
| **MSY ($B_{trigger}$)** | ? | Unknown |
| **Precautionary approach ($B_{pa}$,$B_{lim}$)** | ? | Unknown |
| **Qualitative evaluation** | ↘ | Declining |

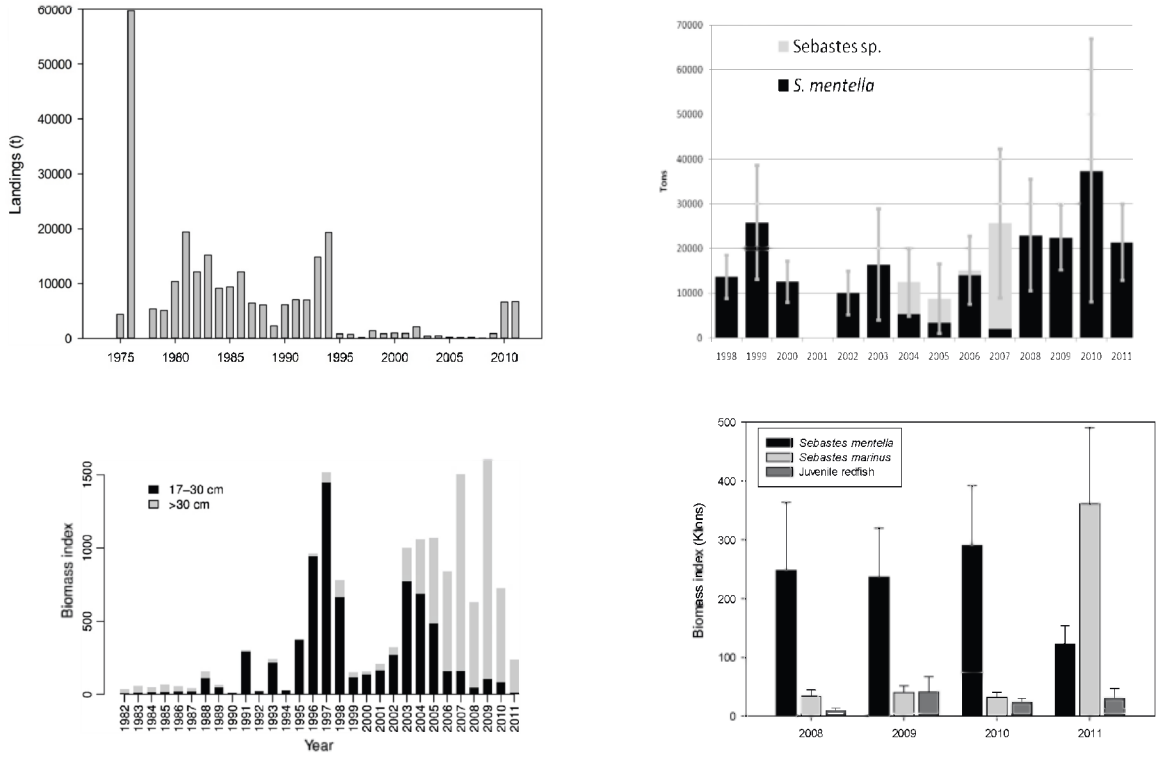



**Figure 2.4.11.1** Beaked redfish (*S. mentella*) in Division XIVb (Demersal). Landings and biomass indices. Top right: Greenland deep-water survey (400–1500 m). Lines indicate 2*standard error (SE) of the estimates. Below left: German survey in Division XIVb (0–400 m). Black: fish 17–30 cm, grey: fish >30 cm. Below right: Greenland shallow water survey (0–600 m), bars represent SE.

A directed fishery started in 2009 and catches have increased from less than 100 t to nearly 7000 t in 2010–2011. Survey indices suggest that, following a stable period the biomass of the demersal *S. mentella* has been declining since 2003. The biomass found in the recent years is most likely due to one or only few year classes.

**Management plans**

There is presently no management plan for this fishery.

**Biology**

Beaked redfish is a slow-growing, late-maturing, and aggregating deep-sea species and is therefore considered to be vulnerable to overexploitation. East Greenland is considered a common nursery ground for most redfish stocks in Subareas XIV and V, thus comprising both *S. marinus* and *S. mentella* (demersal and pelagic stocks). Some migration between this stock and the other NW redfish stocks (shallow and deep pelagic and Icelandic slope) is likely to take place.

**The fisheries**

Historically, the fishery for *S. mentella* on the slopes in Division XIVb was an international fishery that was mainly conducted by factory trawlers operating with bottom trawl. From 2002 to 2008 *S. mentella* has mainly been caught as a valuable bycatch in the fishery for Greenland halibut. A directed fishery was initiated by Greenland in 2009, with catches increasing to approximately 7000 t in 2010 and 2011.

| | |
|---|---|
| **Catch distribution** | Total catches (2011) = 6705 t, where 99.96% are landings (100% bottom trawl, 0% longlines) and 0.04% discards. |

**Quality considerations**

The present catch statistics prevent separation of *S. mentella* from *S. marinus*. German and Greenlandic surveys and samples from the commercial fishery are used to estimate a split of the catches, but the quality of this split is unknown. The haul-by-haul logbook information is considered good.

The German survey is designed to estimate the biomass of cod while the Greenland deep-water survey is designed for Greenland halibut. Both surveys therefore do not cover the entire depth distribution of *S. mentella*. The Greenlandic shallow water survey with better coverage regarding depth was initiated in 2008. The time-series is however short, but the survey biomass index shows a decrease in 2011, in agreement with the German survey.

**Scientific basis**

| | |
|---|---|
| **Assessment type** | Qualitative assessment. |
| **Input data** | Three survey indices (German groundfish survey, Greenland shallow water survey, and Greenland deep-water survey). |
| **Discards and bycatch** | Not considered relevant in the assessment. |
| **Indicators** | None. |
| **Other information** | Stock benchmarked in 2012 with no assessment method agreed |
| **Working group report** | NWWG |

## ECOREGION Iceland and East Greenland
## STOCK Beaked redfish (*Sebastes mentella)* in Division XIVb (Demersal)

**Reference points**

No reference points have been set for this stock.

**Outlook for 2013**

No reliable assessment can be presented for this stock due to the insufficient commercial dataset and the short time-series of suitable survey data. Therefore, fishing possibilities cannot be projected.

***Precautionary approach***

The stock size is expected to decrease due to low recruitment. ICES advises that catch should be reduced by at least 50%, corresponding to catches of less than 3500t.

**Additional considerations**

Indices indicate that stock sizes are declining. The large increase in the fishery in a limited area containing large aggregations of fish occurred from 2009 to 2010 and was maintained at this level in 2011. *S. mentella* is a slow-growing, late-maturing, and aggregating species, and it is considered vulnerable to overexploitation. The effects of these biological characteristics are difficult to predict, especially as little is known on migration, stock affiliation, spawning areas, etc. The stock could therefore be composed of various stock components which demands extra precaution. Given current catches (2009–2011), a fishery conducted on a local high-density aggregation, and the fact that surveys have shown declining trends, catches should be reduced from the current level to avoid local depletion.

*Management considerations*

The recently developed directed redfish fishery (since 2009) should be reduced from the current level until stock structure and the impact of the fishery on the biomass is better understood. The rate of reduction should be re-evaluated to allow further decrease if the stock trend continues to decline.

This is the third year advice is given separately for *S. mentella* in East Greenland. Formerly, the advice of demersal *S. mentella* was provided for all demersal *S. mentella* in Subareas XIV and V. A TAC of 6000 t for demersal redfish in Division XIVb was set by Greenland in 2010. The TAC for 2011 and 2012 was set at 8500 t demersal redfish on the basis of a 70:30 *S. mentella*:*S. marinus* ratio obtained from one single sample from the commercial fishery, thus intending to end up with 6000 t *S. mentella* and 2500 t *S. marinus*. The TAC set for 2012 followed the same approach. The fishery is a mixed fishery for *S. mentella* and *S. marinus*. Survey catches suggest that at least 80% are *S. mentella*. The state of the *S. marinus* stock should therefore be considered in the management of this fishery.

The population structure of demersal *S. mentella* in Division XIVb is uncertain and the separate advice for *S. mentella* in East Greenland is considered a pragmatic solution to provide advice for a new fishery. The stock structure of demersal *S. mentella* is being investigated and results should be available in 2013.

Given the intense fishery in a limited, high abundance area and the declining stock trends in especially this area, this area could be protected by limiting the catch, or the area could be closed until more information is available.

Since none of the long-term surveys in the area target *S. mentella* it should be ensured that information from the fishery is available to ICES. Important information should include additional information to the official logbooks such as length samples of target species and bycatch, and samples to be used for species split between both species. This sampling was adequate in 2011. Knowledge of the species split is important particularly as there is evidence that the *S. marinus* stock has been relatively abundant off Greenland in recent years.

*Regulations and their effects*

*S. mentella* in Division XIVb is found in the same areas as other species of economical interest, e.g. *S. marinus*, cod, and Greenland halibut (Figure 2.4.11.2). If cod are present in years with fisheries directed towards *S. mentella,* some bycatch of cod must be expected. In 2011 this led to a bycatch of 510 t cod from the zone north of 62°N, an area that

has been closed to fishery directed towards cod until 1 July to ensure only little fishing on spawning aggregations of cod.

Sorting grids in the shrimp fishery devised to protect juvenile redfish have been used for a number of years, and this is considered to have reduced bycatch of juvenile redfish substantially.

*Uncertainties in the assessment*

The mixed nature of the fishery, e.g. the possibility of targeting other species such as cod and Greenland halibut, and the lack of catches being split by species when targeting redfish, contributes to uncertainty. Without information on the catch split by species it is not possible to use logbook information as a biomass indicator for *S. mentella*.

The two surveys that presently constitute the main basis for the qualitative assessment do not entirely cover the depth distribution of adult *S. mentella* on the East Greenland continental slope. The two surveys are designed as groundfish surveys, mainly targeting cod and Greenland halibut. The Greenland shallow water survey (0–600 m), designed to estimate the cod biomass, has a better coverage of the depths where *S. mentella* is found; however, this survey only goes back to 2008.

*Comparison with previous assessment and advice*

The advice basis is the same as last year, to reduce the catches.

**Sources**

ICES. 2012a. Report of the Benchmark Workshop on Redfish Stocks, 1–8 February 2012. ICES CM 2012/ACOM:48.
ICES. 2012b. Report of the North-Western Working Group, 26 April–3 May 2012. ICES CM 2012/ACOM:07.

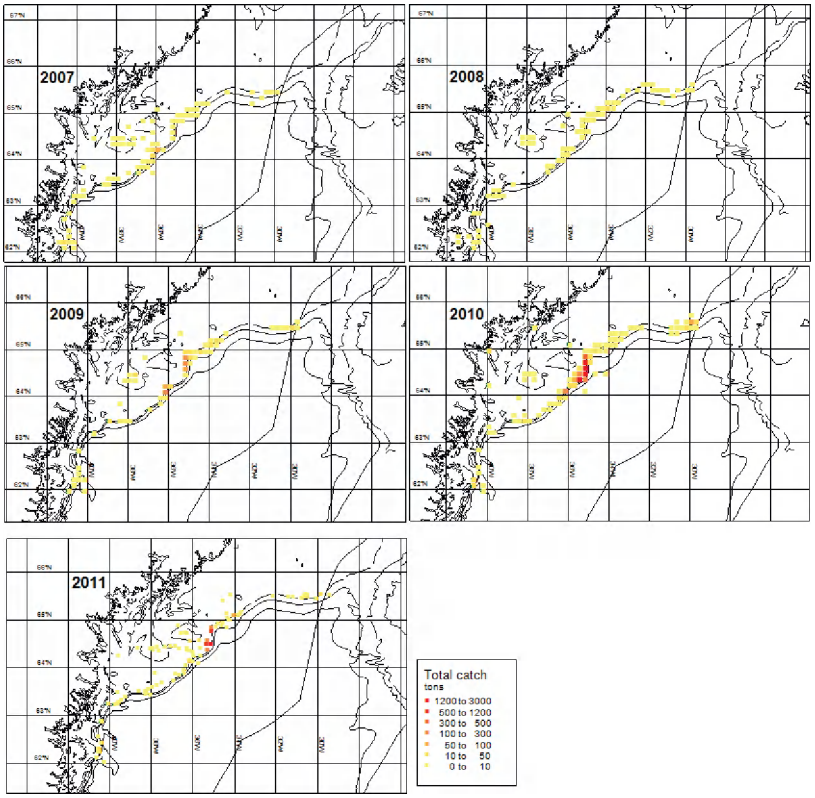



**Figure 2.4.11.2** Beaked redfish (*S. mentella*) in Division XIVb (Demersal). Annual distribution of catches of demersal redfish (2007–2011).

**Table 2.4.11.1** Beaked redfish (*Sebastes mentella*) in Division XIVb. ICES advice, management, and landings.

| Year | ICES Advice | Predicted catch corresp. to advice | Agreed TAC for demersal redfish in Greenland EEZ | Official landings |
|---|---|---|---|---|
| 2011 | No expansion of fishery | - | 6 | 6.7 |
| 2012 | No expansion of fishery | <1 | 6.8* | |
| 2013 | Precautionary approach | <3.5 | | |

Weights in thousand tonnes.
Advice prior to 2011 was given for beaked redfish (*S. mentella*) in Division Va and Subarea XIV (Icelandic slope stock).
* A total TAC of 8.5 kT was set for redfish (both *S. marinus* and *S. mentella*). 6.8 is 80% of this, and the split is based on expected catch composition.

**Table 2.4.11.2** Beaked redfish (*S. mentella*) in Subarea XIVb (Demersal). Nominal landings (tonnes) of beaked redfish. The 2008–2011 values are based on a percentage split of 80:20 between *S. mentella*:*S. marinus*. Splitting in earlier years is based on the same approach, but with varying ratios based on surveys.

| Demersal redfish | |
|---|---|
| 1974 | 0 |
| 1975 | 4 400 |
| 1976 | 59 700 |
| 1977 | 0 |
| 1978 | 5 403 |
| 1979 | 5 131 |
| 1980 | 10 406 |
| 1981 | 19 391 |
| 1982 | 12 140 |
| 1983 | 15 207 |
| 1984 | 9 126 |
| 1985 | 9 376 |
| 1986 | 12 138 |
| 1987 | 6 407 |
| 1988 | 6 065 |
| 1989 | 2 284 |
| 1990 | 6 097 |
| 1991 | 7 057 |
| 1992 | 7 022 |
| 1993 | 14 828 |
| 1994 | 19 305 |
| 1995 | 819 |
| 1996 | 730 |
| 1997 | 199 |
| 1998 | 1 376 |
| 1999 | 853 |
| 2000 | 982 |
| 2001 | 901 |
| 2002 | 2109 |
| 2003 | 446 |
| 2004 | 482 |
| 2005 | 267 |
| 2006 | 202 |
| 2007 | 226 |
| 2008 | 92 |
| 2009 | 895 |
| 2010 | 6 613 |
| 2011 | 6 705 |

## ECOREGION Iceland and East Greenland
## STOCK Capelin in Subareas V and XIV and Division IIa west of 5°W (Iceland–East Greenland–Jan Mayen area)

### Advice for 2013

ICES advises on the basis of precautionary considerations that there should be no fishery until new information on stock size becomes available that proves SSB to be above the escapement threshold.

### State of the stock

| F (Fishing Mortality) | | |
|---|---|---|
| | | 2011 |
| **MSY ($F_{MSY}$)** | ? | Undefined |
| **Precautionary approach ($F_{pa}$,$F_{lim}$)** | ? | Undefined |

| SSB (Spawning-Stock Biomass) | | |
|---|---|---|
| | | 2012 |
| **MSY ($B_{trigger}$)** | ? | Undefined |
| **Precautionary approach ($B_{pa}$,$B_{lim}$)** | ? | Undefined |
| **Qualitative evaluation** | → | Stable above average |

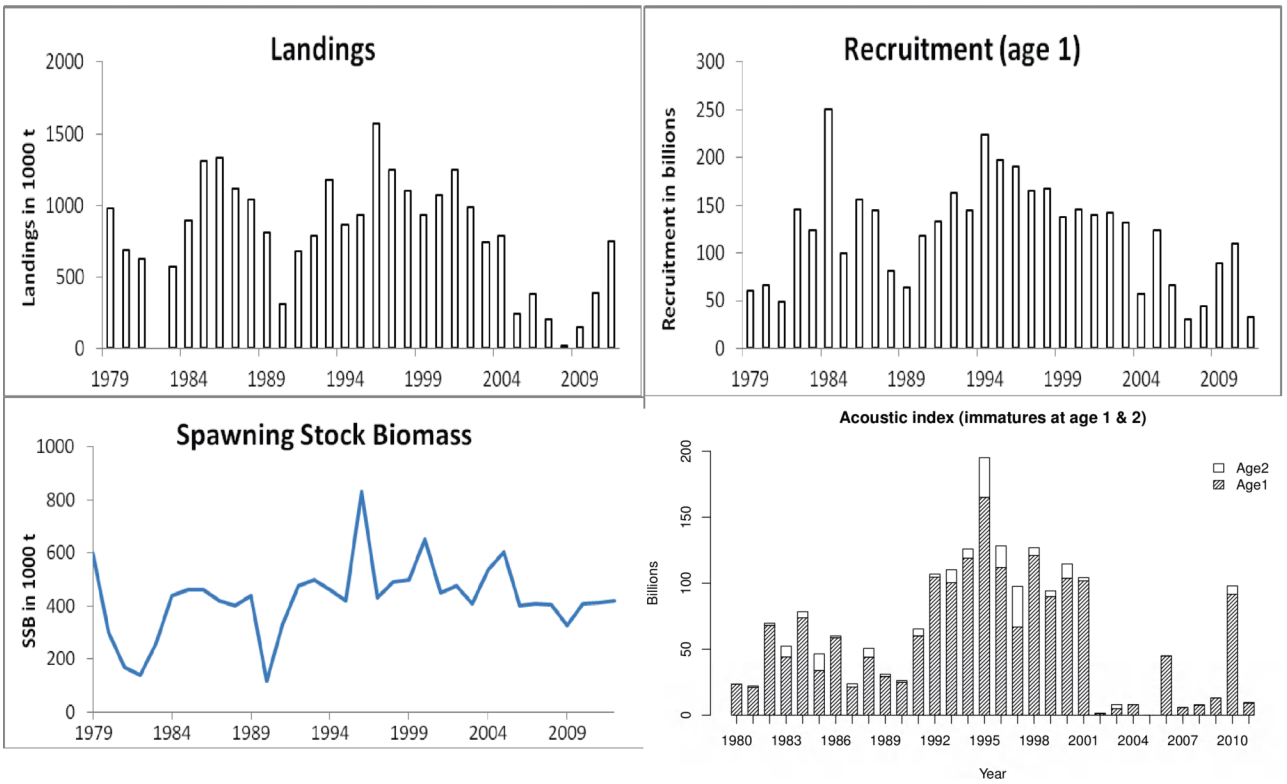



**Figure 2.4.12.1** Capelin in Subareas V and XIV and Division IIa west of 5°W (Iceland–East Greenland–Jan Mayen area). Landings and assessment results (weights in thousand tonnes). Acoustic index of immature capelin at ages 1 and 2 (numbers in billions) from autumn surveys.

It is estimated that 418 000 t was left for spawning in spring 2012, which is just above the management target. In autumn 2011, the annual survey on young capelin was not conducted due to a strike. Two surveys, aimed at young capelin, conducted in November 2011 and February 2012, only covered part of the potential distribution area. The index of abundance from those surveys of young capelin was very low.

**Management plans**

A management plan has been agreed between Iceland, Greenland, and Norway, which aims at a spawning-stock biomass at minimum 400 000 t by the end of the fishing season.

ICES has not evaluated the management plan.

**Biology**

Capelin is a short-lived species that dies after spawning (aged 3–4). The SSB is comprised of only one or two age groups and is therefore highly dependent on recruitment. Before the spawning migration starts, adult capelin are mostly found in Arctic seawater where the temperature is usually lower than 3°C. Juveniles can be found on the Icelandic continental shelf.

**Environmental influence on the stock**

In the years 2002–2005 and 2007–2009 it is likely that the juveniles did not occupy the conventional areas on the Icelandic continental shelf. In this period, the quarterly monitoring of environmental conditions of Icelandic waters shows a rise in sea temperatures north and east of Iceland, which probably also reaches farther north and northwest. A northward shift in the distribution may have affected the productivity of the Icelandic shelf system.

**The fisheries**

The fishery in recent years has largely been confined to the period January–March which coincides with the last 3 months of the capelin lifespan. In 2011 a summer fishery took place, for the first time since 2004.

| | |
|---|---|
| **Catch distribution** | Total landings (2011/12) = 747 kt (75% purse-seine, 25% pelagic trawl). Discards are negligible. |

**Effects of the fisheries on the ecosystem**

Capelin is an important forage fish and declines in stock may be expected to have implications on the productivity of their predators.

**Quality considerations**

Searching time in the scientific survey varies depending on initial estimates, with longer survey time when estimates are low. This may result in a biased acoustic assessment of stock size. Natural mortality used in the projection model is lower than the estimates from consumption by cod.

**Scientific basis**

| | |
|---|---|
| **Assessment type** | Biomass estimate based on acoustic surveys. VPA regression-type forecast. |
| **Input data** | Two acoustic surveys (juvenile and adult) and catch-at-age information. |
| **Discards and bycatch** | Not included in the assessment – considered to be negligible. |
| **Indicators** | None. |
| **Other information** | The assessment was benchmarked at WKSHORT 2009 (ICES, 2009). WKSHORT was unable to approve the assessment of the Icelandic capelin stock. The workshop recommended further work, which is ongoing. |
| **Working group report** | NWWG |

# ECOREGION Iceland and East Greenland
# STOCK Capelin in Subareas V and XIV and Division IIa west of 5°W (Iceland–East Greenland–Jan Mayen area)

**Reference points**

Reference points have not been defined for this stock. An escapement target of 400 000 t can be considered as preliminary precautionary. However, this should be evaluated.

**Outlook for 2012/2013**

There should be no fishery until new information on stock size becomes available, showing a predicted SSB of at least 400 000 t in March 2013 in addition to a sizeable amount for fishing.

A survey of the Denmark Strait and the Greenland plateau west of there is being planned. However, the timing of this survey depends on the ice coverage in the Strait and therefore it is impossible to say if or when it will be conducted.

***Management plan***

The fishery is managed according to a two-step management plan which requires a spawning-stock biomass of no less than 400 000 t by the end of the fishing season. The first step in this plan is to set a preliminary TAC, based on the results of an acoustic survey carried out to evaluate the immature 1-group and immature part of the 2-group of the capelin stock about a year before it enters the fishable stock. The initial quota is set at two thirds of the predicted TAC, calculated on the condition that 400 000 t of the SSB should be left for spawning. The second step is based on the results of another survey conducted during the fishing season for the same year classes. This result is used to revise the TAC, still based on the condition that 400 000 t of the SSB should be left for spawning.

***Precautionary approach***

There should be no quota until new survey estimates have proven SSB to be above the escapement threshold.

**Additional considerations**

*Management considerations*

Historically, the fishing season for capelin has started in the period from late June to July/August. At that time the availability of plankton is at its highest and the fishable stock of capelin is feeding very actively over large areas north of Iceland between Greenland and Jan Mayen, increasing rapidly in size, weight, and fatness.

*Regulations and their effects*

Discards are allowed when catches are beyond the carrying capacity of the vessel. Methods of transferring catches from the purse-seine of one vessel to another vessel were invented long ago, and since this is a common practice and skippers of purse-seine vessels prefer to operate in groups, discards are considered to be negligible. In the pelagic trawl fishery, such large catches of capelin rarely occur.

A regulation calling for immediate, temporary area closures when a high abundance of juveniles is measured in the catch (i.e. more than 20% of the catch is composed of fish less than 13 cm) is enforced, using on-board observers.

*Information from the fishing industry*

In January 2012, eleven scouting vessels mapped the distribution of capelin to aid the planning of the scientific survey.

*Comparison with previous assessment and advice*

The basis for the assessment and advice has not changed.

**Sources**

ICES. 2009. Report of the Benchmark Workshop on Short-lived Species (WKSHORT), 31 August–4 September 2009, Bergen, Norway. ICES CM 2009/ACOM:34. 166 pp.
ICES. 2012. Report of the North-Western Working Group, 26 April–03 May 2012. ICES CM 2012/ACOM:07.

**Table 2.4.12.1** Capelin in Subareas V and XIV and Division IIa west of 5°W (Iceland–East Greenland–Jan Mayen area). ICES advice, management, and landings.

| Year | ICES Advice | Predicted catch[1] corresp. to advice | Agreed [2] TAC | ICES landings[3] |
|---|---|---|---|---|
| 1986 | TAC | 1100 | 1290 | 1333 |
| 1987 | TAC[1] | 500 | 1115 | 1116 |
| 1988 | TAC[1] | 900 | 1065 | 1036 |
| 1989 | TAC[1] | 900 | * | 808 |
| 1990 | TAC[1] | 600 | 250 | 314 |
| 1991 | No fishery pending survey results[1] | 0 | 740 | 677 |
| 1992 | Precautionary TAC[1] | 500 | 900 | 788 |
| 1993 | TAC[1] | 900 | 1250 | 1179 |
| 1994 | Apply the harvest control rule | 950 | 850 | 864 |
| 1995 | Apply the harvest control rule | 800 | 1390 | 930 |
| 1996 | Apply the harvest control rule | 1100 | 1600 | 1571 |
| 1997 | Apply the harvest control rule | 850 | 1265 | 1245 |
| 1998 | Apply the harvest control rule | 950 | 1200 | 1100 |
| 1999 | Apply the harvest control rule | 866 | 1000 | 934 |
| 2000 | Apply the harvest control rule | 650 | 1090 | 1071 |
| 2001 | Apply the harvest control rule | 700 | 1300 | 1250 |
| 2002 | Apply the harvest control rule | 690 | 1000 | 988 |
| 2003 | Apply the harvest control rule | 555 | 900 | 741 |
| 2004 | Apply the harvest control rule | *335 | 985 | 784 |
| 2005 | Apply the harvest control rule | *No fishery | 235 | 238 |
| 2006/07 | Apply the harvest control rule | *No fishery | 385 | 377 |
| 2007/08 | Apply the harvest control rule | *207 | 207 | 202 |
| 2008/09 | Apply the harvest control rule | *No fishery | | 15** |
| 2009/10 | Apply the harvest control rule | *No fishery | 150 | 151 |
| 2010/11 | Apply the harvest control rule | *No fishery | 390 | 391 |
| 2011/12 | Set the TAC at 50% of the initial quota in the HCR | 366 | 765 | 747 |
| 2012/13 | Precautionary approach | *No fishery | | |

Weights in thousand tonnes.
[1)]TAC advised for the July–December part of the season.
[2)]Final TAC recommended by national scientists for the whole season.
[3)]July–March of following year.
*Preliminary TAC set according to the results of a preliminary assessment.
** Only scouting quota was allocated in the latter half of February 2009.

**Table 2.4.12.2** Capelin in Subareas V and XIV and Division IIa west of 5°W (Iceland–East Greenland–Jan Mayen area). Summary of assessment results (a fishing season, e.g. 1978/79, starts in summer 1978 and ends in March 1979). Recruitment of 1-year-old fish (in billions at 1 August); spawning-stock biomass (thousand tonnes at spawning time in March next year, at the end of a fishing season); landings (thousand tonnes) are the sum of the total landings in the season that starts in the summer/autumn of the year indicated and ends in March of the following year.

| Season (Summer/winter) | Recruitment | Landings | Spawning-stock biomass |
|---|---|---|---|
| 1978/79 | 164 | 1195 | 600 |
| 1979/80 | 60 | 980 | 300 |
| 1980/81 | 66 | 684 | 170 |
| 1981/82 | 49 | 626 | 140 |
| 1982/83 | 146 | 0 | 260 |
| 1983/84 | 124 | 573 | 440 |
| 1984/85 | 251 | 897 | 460 |
| 1985/86 | 99 | 1312 | 460 |
| 1986/87 | 156 | 1333 | 420 |
| 1987/88 | 144 | 1116 | 400 |
| 1988/89 | 81 | 1037 | 440 |
| 1989/90 | 64 | 808 | 115 |
| 1990/91 | 118 | 314 | 330 |
| 1991/92 | 133 | 677 | 475 |
| 1992/93 | 163 | 788 | 499 |
| 1993/94 | 144 | 1179 | 460 |
| 1994/95 | 224 | 864 | 420 |
| 1995/96 | 197 | 929 | 830 |
| 1996/97 | 191 | 1571 | 430 |
| 1997/98 | 165 | 1245 | 492 |
| 1998/99 | 168 | 1100 | 500 |
| 1999/00 | 138 | 933 | 650 |
| 2000/01 | 146 | 1071 | 450 |
| 2001/02 | 140 | 1249 | 475 |
| 2002/03 | 142 | 988 | 410 |
| 2003/04 | 132 | 741 | 535 |
| 2004/05 | 57 | 783 | 602 |
| 2005/06 | 124 | 238 | 400 |
| 2006/07 | 66 | 377 | 410 |
| 2007/08 | 31 | 202 | 406 |
| 2008/09 | 44 | 15 | 328 |
| 2009/10 | 89 | 151 | 410 |
| 2010/11 | 110* | 391 | 411 |
| 2011/12 | 33* | 747 | 418 |

* Preliminary.

# ECOREGION Iceland and East Greenland
# STOCK Herring in Division Va (Icelandic summer-spawning herring)

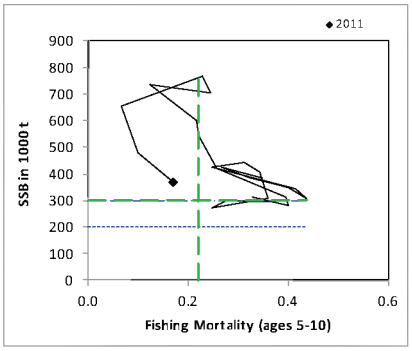
## Advice for 2012/2013

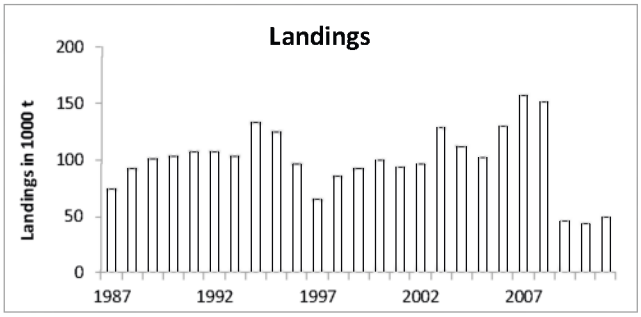
ICES advises on the basis of the MSY approach that catches in 2012/2013 should be no more than 67 000 t.

## Stock status

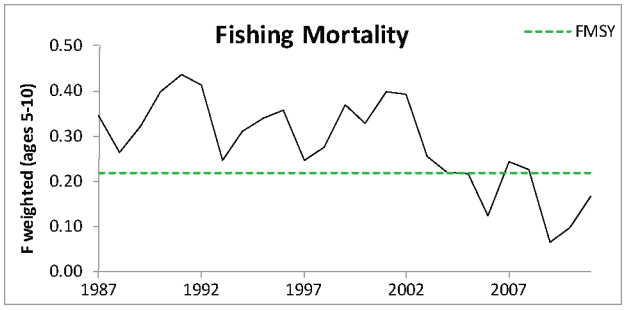
| F (Fishing Mortality) | 2009 | 2010 | 2011 | |
|---|---|---|---|---|
| **MSY ($F_{MSY}$)** | ✓ | ✓ | ✓ | Appropriate |
| **Precautionary approach** ($F_{pa}$,$F_{lim}$) | ✓ | ✓ | ✓ | Harvested sustainably |

| SSB (Spawning-Stock Biomass) | 2010 | 2011 | 2012 | |
|---|---|---|---|---|
| **MSY** ($B_{trigger}$) | ✓ | ✓ | ✓ | Above trigger |
| **Precautionary approach** ($B_{pa}$,$B_{lim}$) | ✓ | ✓ | ✓ | Full reproductive capacity |







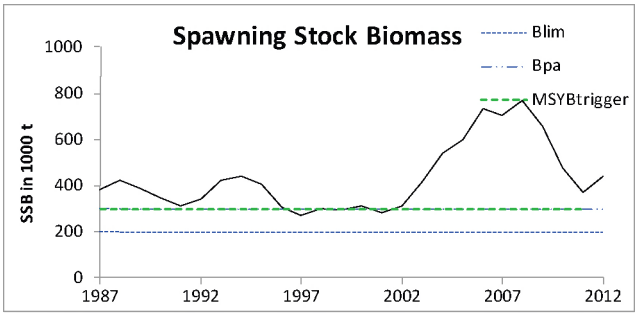




**Figure 2.4.13.1** Herring in Division Va (Icelandic summer-spawning herring). Summary of stock assessment (weights in thousand tonnes). Top right: SSB/F for the time-series used in the assessment.

The SSB had been declining, likely related to the *Ichthyophonus* infection in recent years, but the decline seems to have stopped and the SSB is above reference points. Strong year classes, which show no signs of infection, are entering the fishable stock. Fishing mortality is currently below $F_{MSY}$.

## Management plans

There is no formal management plan for this stock. For more than 20 years, the practice has been to manage fisheries at $F = F_{0.1}$ (= 0.22) and this target is considered to be consistent with MSY approach.

**Biology**

Icelandic herring is a long-lived species with age groups 4 to 6 generally most abundant in the catches, but it first appears in catches at age 3. Since 2006 the overwintering has mainly taken place in a small coastal area west of Iceland, as compared to the more easterly and/or offshore areas of the three previous decades. Younger year classes (2007 and later) and recruits to the fishable stock have only to a small degree joined the older part of the stock during its overwintering west of Iceland. Instead, they have been found off the south coast. Thus, changes in location of the overwintering of the stock can be expected to occur again in the coming years.

**Environmental influence on the stock**

The outbreak of *Ichthyophonus* infection in the herring stock started in 2008. Infection of the herring occurs by oral intake of the *Ichthyophonus* spores in the environment. The infection rate for age 4+ was estimated to be 32% in the SSB in the winter 2008/2009, 43% in 2009/2010, 34% in 2010/2011, and 27% in 2011/2012. The impact of the infection on the stock size is apparent, but cannot be fully quantified at present. On the basis of knowledge from other herring stocks and indications from studies conducted in the winter 2010/2011 and again in 2011/2012, the infection is likely abating and is hardly observed in herring at age 3 and younger but is still observed in older herring to a similar degree as in preceding years.

**The fisheries**

The Icelandic TACs for herring apply from 1 September to 1 May the following year. The catch is normally taken from September to February.

| | |
|---|---|
| **Catch distribution** | Total catch (2011/2012) is 49 kt, where 88% are landings (99.5% purse seine, 0.5% gill nets) and 12% industrial bycatch (in mackerel fishery with pelagic trawls). There were no discards or unaccounted removals. |

**Quality considerations**

The results of the NFT-Adapt model show a retrospective pattern in SSB during the recent four years with a constant underestimation. The reason for the pattern is likely related to the *Ichthyophonus* infection and new more optimistic information from surveys regarding strength of incoming year classes to the fishable stock.

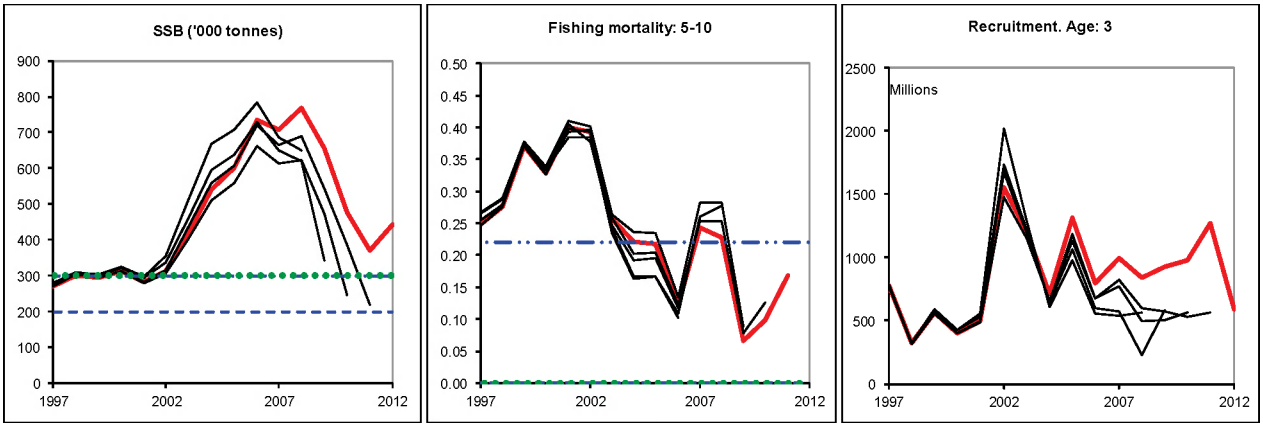



**Figure 2.4.13.2** Herring in Division Va (Icelandic summer-spawning herring). Historical assessment results (final-year recruitment estimates included).

**Scientific basis**

| | |
|---|---|
| **Assessment type** | Age-based analytical (NFT-ADAPT). |
| **Input data** | The data used in the assessment are catch-at-age and one age-structured acoustic survey index. |
| **Discards and bycatch** | Not relevant for this assessment. |
| **Indicators** | None. |
| **Other information** | Estimates of infection prevalence are used to quantify M in the most recent three years in the assessment. The stock was benchmarked in 2011. |
| **Working group report** | NWWG |

## ECOREGION Iceland and East Greenland
## STOCK Herring in Division Va (Icelandic summer-spawning herring)

**Reference points**

| | *Type* | *Value* | *Technical basis* |
|---|---|---|---|
| MSY Approach | MSY $B_{trigger}$ | 300 000 t | $B_{pa}$. |
| | $F_{MSY}$ | 0.22 | HCS model for simulated harvest rules. |
| Precautionary Approach | $B_{lim}$ | 200 000 t | SSB with a high probability of impaired recruitment. |
| | $B_{pa}$ | 300 000 t | $B_{pa} = B_{lim}\, e^{1.645\sigma}$, where $\sigma = 0.25$. |
| | $F_{lim}$ | Not defined | |
| | $F_{pa}$ | 0.22 | $F_{pa} = F_{0.1} = 0.22$ (based on a weighted average) and used as a target. |

*(unchanged since: 2011)*

**Outlook for 2012/2013**

Basis: F(2011/2012) = 0.17; Landings (2011/2012) = 49 kt; SSB(2012) = 377 kt; B3+(2012) = 513 kt.

| Rationale | Landings (2012/13) | Basis | F (2012/2013) | SSB (2013) | %SSB change [1] | % TAC change [2] |
|---|---|---|---|---|---|---|
| MSY approach | 67 | $F_{msy}$ | 0.22 | 421 | 12% | 36% |
| | 40 | | 0.13 | 447 | 19% | -19% |
| | 50 | | 0.19 | 437 | 16% | 1% |
| | 80 | | 0,27 | 409 | 8% | 62% |

Weights in thousand tonnes.
[1] SSB 2013 relative to SSB 2012.
[2] Landings 2012/13 relative to TAC 2011/12.

**Additional considerations**

*Management considerations*

For the fishing season 2011/2012, a regulation was enforced that prohibited fishery on the stock outside of the area of Breiðafjörður. This was because small herring were mixed with adults in the other areas and there was a lower prevalence of infection there. If similar conditions are observed in the fishing season 2012/2013 such a regulation would contribute to the protection of small fish (<27 cm). Furthermore, because of higher infection rates in the Breiðafjörður area, the fishery would target a greater proportion of fish already subjected to infection mortality.

*Ecosystem considerations*

Since it was first observed in the stock in the autumn 2008, *Ichthyophonus* outbreaks have had significant effects on the stock development, with a prevalence of infection and corresponding mortality ranging from 32% to 43% in the last three winters. The state of the *Ichthyophonus* infection in this stock in the winter 2011/2012 is different from previous years in two important aspects. Firstly, younger and smaller herring were almost without infection (Figure 2.4.13.4). Secondly, the development of the infection within the infected part of the stock in Breiðafjörður appeared to have slowed down. These findings might be the result of younger herring utilizing different feeding grounds with no source of *Ichthyophonus* spores and thus remaining uninfected, and/or simply that no or only little new infection occurred during 2011. The remaining infected herring are those individuals that have more resistance power against the infection, acquired or inherited, that were infected as late as in the summer 2010 and will continue to live infected for months or years. Ongoing studies are examining whether currently infected fish will die because of the infection or whether they will survive and be part of the spawning stock in the summer 2012 and the fishable stock in the fishing season 2012/2013.

*Changes in fishing technology and fishing patterns*

The fishing pattern in 2010/11 was similar to the pattern of the last five seasons, which differed from previous seasons because most of the catches now were taken from a small area off the west coast. Pelagic trawl fisheries were introduced in 1997/98 and have generally contributed approximately 20–60% of the catches, but since 2008 their contribution has been reduced to <5%. The relative increase in the pelagic trawl catches in 2010/2011 and 2011/2012 (10% and 12% of the total catch) is due to bycatch of the stock in the fisheries for mackerel and Norwegian spring-spawning herring in the summers of 2010 and 2011. The fishing pattern varies annually and is related to variation in distribution and catchability of the different age classes of the stock. This variation in distribution and catchability can have consequences for the catch composition, but it is still impossible to provide a forecast about this variation.

*Uncertainties in assessment and forecast*

The effects of *Ichthyophonus* infection on the stock, particularly the assumptions whether all infected fish die because of it within a year is not fully clear. The high estimate of the 2008 year class is still relatively uncertain, which adds uncertainty to the assessment, as well as to the forecast.

*Comparison with previous assessment and advice*

The assessment was conducted in the same way as last year. The overall perception of the stock size is more optimistic now. In the current assessment, SSB in 2011 is 70% higher, the abundance of the 2007 year class 84% higher, the abundance of the 2009 year class 124% higher, and $F_{5\text{-}10}$ in 2010 is 28% lower, compared to the 2011 assessment.

No initial advice was provided last year because of the *Ichthyophonus* infection. As last year, this year's advice is based on the MSY approach ($F_{MSY}$).

**Source**

ICES. 2012. Report of the North-Western Working Group, 26 April–3 May 2012. ICES CM 2012/ACOM:07.

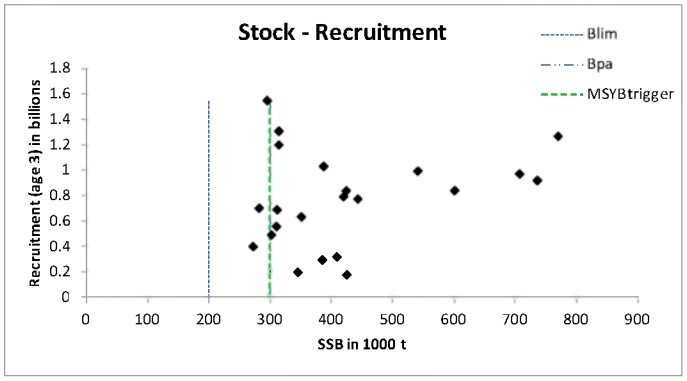



**Figure 2.4.13.3** Herring in Division Va (Icelandic summer-spawning herring). Stock–recruitment relationship.

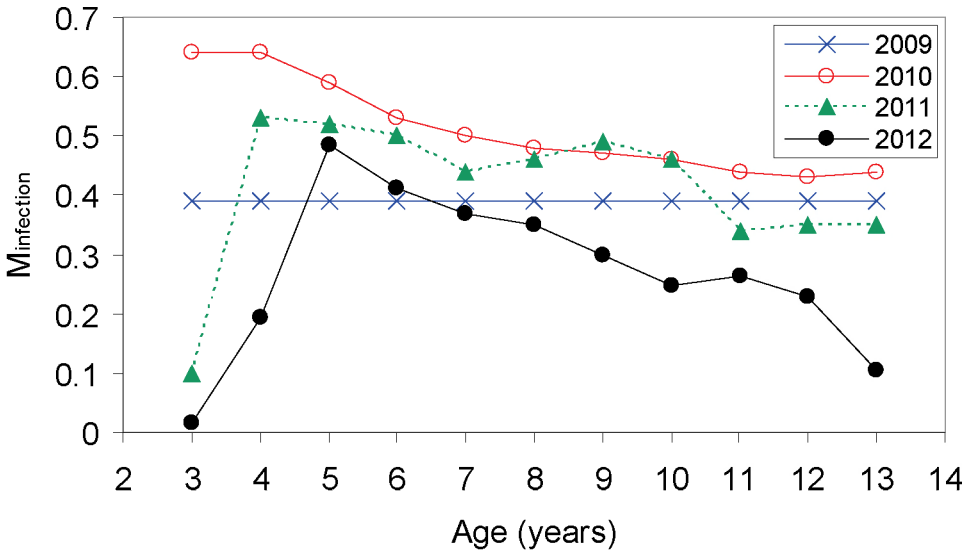



**Figure 2.4.13.4** Herring in Division Va (Icelandic summer-spawning herring). Estimated natural mortality because of *Ichthyophonus* infection ($M_{infection}$) during the winters 2009–2012.

**Table 2.4.13.1** Herring in Division Va (Icelandic summer-spawning herring). ICES advice, management, and landings.

| Year | ICES Advice | Predicted catch corresp. to advice | Agreed TAC | ICES landings[4)] |
|---|---|---|---|---|
| 1984 | | 50 | - | 50.3 |
| 1985 | | 50 | - | 49.4 |
| 1986 | | 65 | - | 65.5 |
| 1987 | $F_{0.1}$ | 70 | 72.9 | 75.4 |
| 1988 | $F_{0.1}$ | ~100 | 90 | 92.8 |
| 1989 | $F_{0.1}$ | 95 | 90 | 97.3 |
| 1990/1991[2] | *Status quo* F | 90 | 100 | 101.6 |
| 1991/1992[2] | $F_{0.1}$ | 79 | 110 | 98.5 |
| 1992/1993[2] | $F_{0.1}$ | 86 | 110 | 106.7 |
| 1993/1994[2] | No gain in yield by fishing higher than $F_{0.1}$ | 110[1] | 110 | 101.5 |
| 1994/1995[2] | No gain in yield by fishing higher than $F_{0.1}$ | 83[1] | 130 | 132 |
| 1995/1996[2] | No gain in yield by fishing higher than $F_{0.1}$ | 120[1] | 110 | 125 |
| 1996/1997[2] | No gain in yield by fishing higher than $F_{0.1}$ | 97[1] | 110 | 95.9 |
| 1997/1998 | No gain in yield by fishing higher than $F_{0.1}$ | 90[1] | 100 | 64.7 |
| 1998/1999 | No gain in yield by fishing higher than $F_{0.1}$ | 90[1] | 90 | 87.0 |
| 1999/2000 | Current F is sustainable | 100[1] | 100 | 92.9 |
| 2000/2001 | Current F is sustainable | 110[1] | 110 | 100.3 |
| 2001/2002 | Current F is sustainable | 125[1] | 125 | 95.3 |
| 2002/2003 | Current F is sustainable | 113[1] | 105 | 97 |
| 2003/2004 | Current F is sustainable | 113[1] | 110 | 131 |
| 2004/2005 | F=0.22 | 106 | 110 | 114.2 |
| 2005/2006 | *Status quo* catch | 110 | 110 | 103 |
| 2006/2007 | *Status quo* catch | 110 | 130 | 135 |
| 2007/2008 | *Average of the last 3 years catch* | 117 | 150 | 159 |
| 2008/2009 | $F_{pa}$ = 0.22 | 131 | 130 | 152 |
| 2009/2010 | $F_{pa}$=0.22 | 75 | 40 | 46 |
| 2010/2011[3] | Domestic advice autumn 2010 | 40 | 40 | 44 |
| 2011/2012[3] | Domestic advice autumn 2011, no fishery until then | 40 | 45 | 49 |
| 2012/2013 | $F_{MSY}$ =0.22 | <67 | | |

Weights in thousand tonnes.

[1)] Catch at $F_{0.1}$.

[2)] Season starting in October of first year.

[3)] In early autumn 2011 new information on *Ichthyophonus* infection and the stock size will be available from survey monitoring, and ICES cannot give advice until this information is available.

[4)] Official landings and ICES landings are the same in all fishing season and are used for the assessment.

**Table 2.4.13.2** Herring in Division Va (Icelandic summer-spawning herring). Summary of the assessment.

| Year | Recruits $_{age\ 3}$ (millions) | Biomass age 3+ (kt) | SSB (kt) | Landings age 3+ (kt) | Yield/SSB | WF 5–10 |
|---|---|---|---|---|---|---|
| 1987 | 530 | 504 | 384 | 75 | 0.20 | 0.35 |
| 1988 | 271 | 495 | 423 | 93 | 0.22 | 0.27 |
| 1989 | 448 | 459 | 386 | 101 | 0.26 | 0.32 |
| 1990 | 301 | 410 | 350 | 104 | 0.30 | 0.40 |
| 1991 | 842 | 424 | 310 | 107 | 0.34 | 0.44 |
| 1992 | 1035 | 503 | 344 | 107 | 0.31 | 0.41 |
| 1993 | 638 | 547 | 424 | 103 | 0.24 | 0.25 |
| 1994 | 694 | 555 | 442 | 134 | 0.30 | 0.31 |
| 1995 | 204 | 464 | 408 | 125 | 0.31 | 0.34 |
| 1996 | 183 | 350 | 309 | 96 | 0.31 | 0.36 |
| 1997 | 778 | 371 | 271 | 65 | 0.24 | 0.25 |
| 1998 | 324 | 370 | 301 | 86 | 0.29 | 0.28 |
| 1999 | 564 | 378 | 294 | 93 | 0.32 | 0.37 |
| 2000 | 405 | 395 | 313 | 100 | 0.32 | 0.33 |
| 2001 | 496 | 360 | 281 | 94 | 0.33 | 0.40 |
| 2002 | 1551 | 542 | 313 | 96 | 0.31 | 0.39 |
| 2003 | 1203 | 628 | 419 | 129 | 0.31 | 0.26 |
| 2004 | 707 | 680 | 540 | 112 | 0.21 | 0.22 |
| 2005 | 1310 | 829 | 600 | 102 | 0.17 | 0.22 |
| 2006 | 797 | 934 | 735 | 130 | 0.18 | 0.12 |
| 2007 | 997 | 888 | 706 | 158 | 0.22 | 0.24 |
| 2008 | 844 | 955 | 769 | 151 | 0.20 | 0.23 |
| 2009 | 924 | 1003 | 655 | 46 | 0.07 | 0.07 |
| 2010 | 976 | 838 | 478 | 43 | 0.09 | 0.10 |
| 2011 | 1271 | 692 | 371 | 49 | 0.13 | 0.17 |
| 2012* | 593 | 596 | 444 | | | |

* The expected mortality because of the observed infection in 2011/12 has not been accounted for.