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Book 4
The Faroe Plateau Ecosystem

International Council for the Exploration of the Sea

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BOOK 4

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4 THE FAROE PLATEAU ECOSYSTEM

4.1 Ecosystem overview

4.1.1 Ecosystem Components

Sea bed topography and substrates, circulation patterns

The Faroes are situated on a submarine ridge, which extends from Greenland, over Iceland, to Scotland (Figure 4.1.1.1, left panels). This ridge separates the Atlantic Ocean southwest of the ridge from the Norwegian Sea to the northeast. The sill of the ridge reaches different depths in different areas. Most of it is shallower than 500 m, but a small part is deeper with the Faroe Bank Channel being the deepest passage across the ridge.

The upper layers of the waters surrounding the Faroes are dominated by 'Modified North Atlantic Water' which derives from the North Atlantic Current flowing towards the east and north-east (Hansen and Østerhus, 2000) (Figure 4.1.1.1, upper left panel). This water is typically around 8°C and salinities around 35.25.

Deeper than 500–600 m (Figure 4.1.1.1, lower left panel) the water in most areas is dominated by cold (T<0°C) with salinities close to 34.9.

In shallow regions, there are strong tidal currents which mix the shelf water very efficiently. This results in homogeneous water masses in the shallow shelf areas. The well-mixed shelf water is separated relatively well from the offshore water by a persistent tidal front, which surrounds the shelf at about the 100- to 130-m bottom depth. In addition, residual currents have a persistent clockwise circulation around the islands.

The Shelf-front provides a fair, although variable, degree of isolation between the on-shelf and the off-shelf areas. This allows the on-shelf areas to support a relatively uniform shelf ecosystem, which in many ways is distinct from off-shelf waters. The ecosystem has distinct planktonic communities, benthic fauna, and several fish stocks. Furthermore, about 1.7 million pairs of seabirds breed on the Faroe Islands and take most of their food from the shelf water.

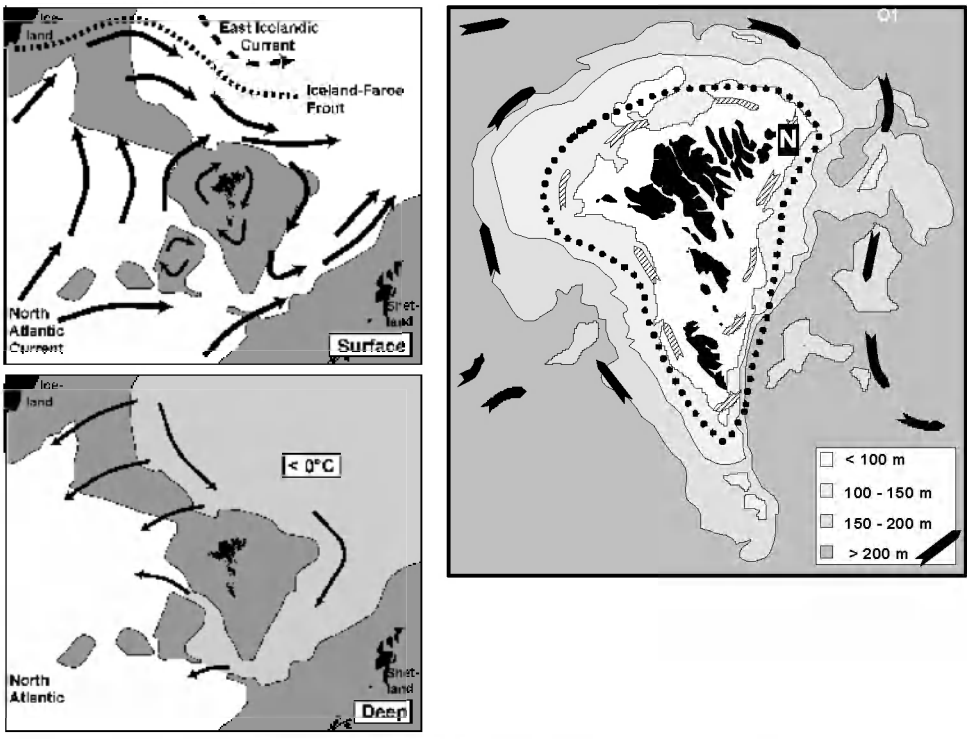

Figure 4.1.1.1 Bottom topography, circulation and water masses at the surface (top left panel), at depths greater than about 500 m (bottom left panel) in the area around the Faroes and on the Faroe shelf (right panel). Dashed lines indicate fronts.

Phytoplankton

The three oceanographic regimes (well-mixed shelf, frontal and stratified off-shelf) give different conditions for primary production. While the shallow well-mixed part is relatively well studied, little is known about production cycles, and their dependence on the variable weather conditions in the two other regimes in the region.

One distinguishing feature is a typical earlier establishment of the spring bloom on the shelf than offshelf. However, timing and intensity of the bloom can vary very much from one year to another. This variability has pronounced effects on the ecosystem.

Most of the primary production usually is from May to August. Timing of the onset of primary production in spring is, however, highly variably between years (Figure 4.1.1.2). This variability affects production of food for fish larvae in spring (Gaard 2000, 2003, Debes et al. 2005), which mainly consists of copepod eggs and nauplii and small copepodites (Gaard and Steingrund 2001).

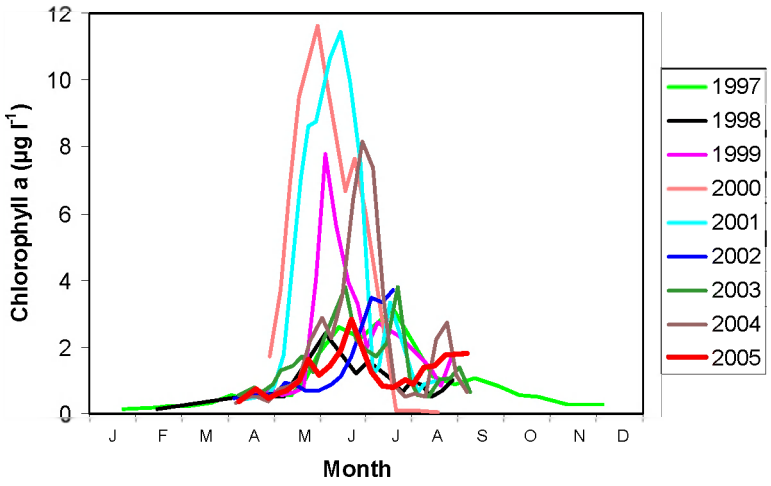

Figure 4.1.1.2 Chlorophyll a concentrations on the central shelf since 1997.

There is also a very high interannual variability primary production (Gaard 2003, Eliasen et al 2005). From 1990 to 2005 this new primary production (from spring to mid summer) has fluctuated by a factor ~5. The new primary production index for 2005 is below the 1990-2005 average (Figure 4.1.1.3).

The mechanisms controlling the primary production on the shelf are not well understood. However, recent modelling studies indicate that variable exchange rates between on-shelf and off-shelf waters may be a main controlling factor for the timing and intensity of the spring bloom (Eliasen et al. 2005, Hansen et al. 2005).

The variability in primary production between years (Figure 4.1.1.3) highly affects production in higher trophic levels in the ecosystem. The primary production is identified as a main driver for biological productivity in the in the shelf ecosystem, including fish and seabirds (Gaard et al. 2002, 2006, Steingrund and Gaard 2005). Below is described observed affects on fish growth, recruitment, and production, behaviour and catchability.

Primary production variability thus can be used as the first indicator for productive status in the system 1-2 years ahead.

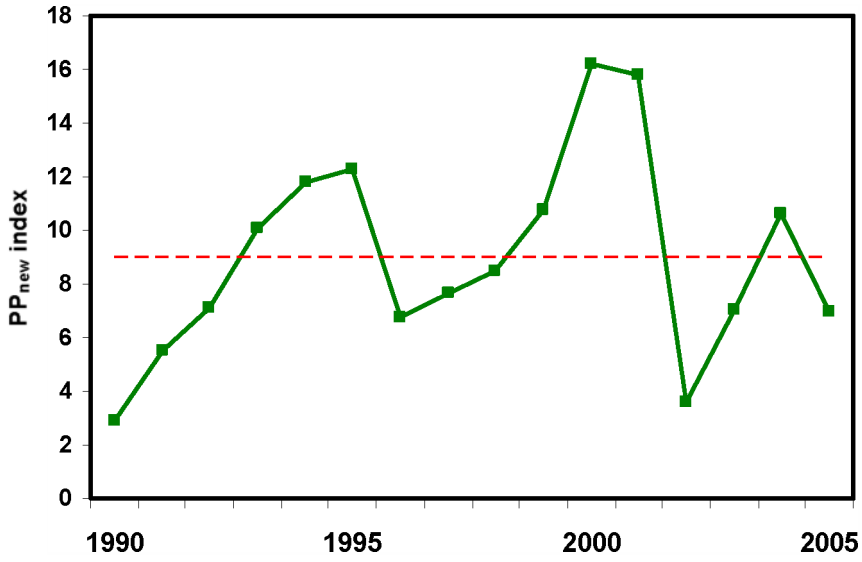

Figure 4.1.1.3 Index of new primary production from spring to mid-summer on the Faroe shelf since 1990. The horizontal line represents the average index during the 1990-2005 period.

Zooplankton

While the zooplankton community outside the shelf front is largely dominated by the copepod Calanus finmarchicus, the shelf zooplankton community is basically neritic (shelf related species). During spring and summer the zooplankton in the Shelf water is largely dominated by the copepods Temora longicornis and Acartia longiremis. C. finmarchicus, is advected from offshelf and occurs in the shelf water in highly variable abundance between years. Usually the abundance of C. finmarchicus is highest in spring and early summer. Meroplanktonic larvae (mainly barnacle larvae) may also be abundant, and decapod larvae and fish larvae and juveniles are common on the Shelf during spring and summer (Gaard 1999, 2003).

Reproduction rates of copepods depend largely on their feeding conditions and co-occurring fluctuations have been observed between phytoplankton timing and abundance, and copepod egg production rates, abundance and composition (Gaard 1999, Debes et al. 2005). This variability seems to affect feeding conditions for fish larvae in general on the shelf.

Fish community

A total of 225 fish species are recorded in Faroese waters. Most of these species are, however, rare and are not exploited. The number of commercially exploited species on the Faroe Plateau is about 25. An overview of typical depth distribution of the main species in offshore and shelf areas (deeper then 65 m bottom depth) is shown in Figure 4.1.1.4. Most of these species spawn locally, however, some species (e.g. redfish and Greenland halibut have their spawning grounds outside Faroese area and apparently are common stocks over large parts of the Northeast Atlantic.

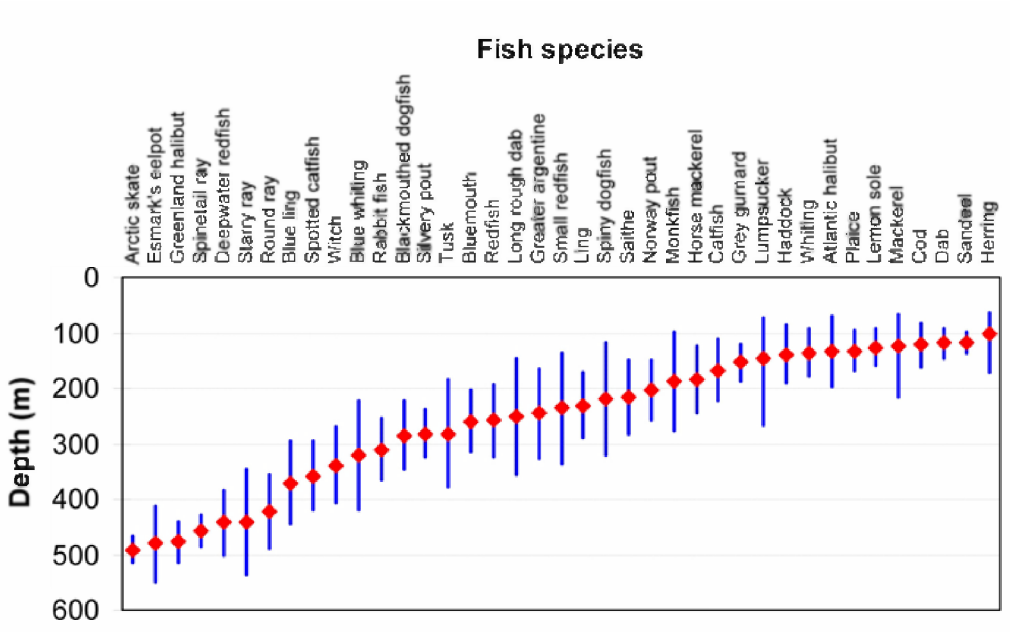

Figure 4.1.1.4 Typical depth distribution of fish in areas deeper than ~65 m on the Faroe shelf and in the ocean around the Faroes.

Of pelagic fish blue whiting is the most abundant. After spawning to the west of the British Isles in early spring, they start their feeding migration further north into the Norwegian Sea. They usually enter the Faroe eco-region in late April. They feed mainly on krill, amphipods, and other large zooplankton at depths between 300 and 500 meters and partly also on the copepod Calanus finmarchicus closer to the surface. In late summer and autumn mature individuals migrate southwards again towards the spawning area while juveniles stay in Faroese water and the Norwegian Sea. Mackerel make a similar migration, although is has a more eastern and shallower distribution. Their main food items are C. finmarchicus and krill. Norwegian spring spawning herring may migrate after spawning on the Norwegian shelf in March into the northernmost part of the Faroe eco-region to feed. Later the herring distribution is further north in the Norwegian Sea.

Faroe Plateau cod, haddock and saithe are the most commercially important demersal stocks in Faroese waters. Their spawning takes place on the shelf in spring. The saithe spawns mainly in the north-eastern and northern part of the shelf slope in second half of February, and the offspring is found close to the shores already in May. At an age of about 3 years they migrate into deep habitats, mainly on the upper slope. The spawning grounds of Faroe Plateau cod are mainly to the North and west of the islands, whereas the spawning grounds of the haddock are more disperse all over the shelf. The cod spawns in second half of March, and the haddock in the first half of April. Their offspring is dispersed by the strong currents throughout the shelf area. As they grow they predate on progressively larger zooplankton prey items on the shelf (Gaard and Steingrund, 2001; Gaard and Reinert, 2002). In July, at lengths of about 4 cm, the cod juveniles migrate into the littoral zone of the fjords and sounds, while the haddock make the transition to a predominant demersal habit on the plateau and the banks at depths of 90–200 m.

Two ecologically important fish species in the ecosystem are sandeel and Norway pout. After spawning in spring their offspring too is dispersed by the tidal currents throughout the shelf area where they feed on zooplankton. Both species are important food items for demersal fish and seabirds on the shelf and the upper slope, and are important links between zooplankton and higher trophic levels. Especially sandeels occur in variable abundances between years. When abundant, they are key food species for cod, haddock and seabirds, and the predation pressure is high. They are not commercially exploited but serve as food for fish and seabirds.

Detailed knowledge about variability in food consumption of demersal cod, haddock and saithe in Faroese waters is not conclusive. Saithe feeds on the shelf slope largely on fish (mainly blue whiting and Norway pout) and euphasids. Cod and haddock show higher diversity in prey items, and predate on benthic fauna as well as fish, with fish being a more prevalent prey item for cod than for haddock. Of the fish prey, sandeel appear to be a key species in the shallow areas. When abundant they are a preferred food item for cod on the shelf and hence, already as 0-group sandeels, affecting the feeding conditions for demersal cod on the shelf. Years with high cod production seem to be associated with a high abundance of sandeels. In deeper areas on the plateau other species (mainly Norway pout and blue whiting) are more important as prey item for cod.

Despite a marked increase in fishing effort on cod and haddock, the landings have not increased correspondingly. The long-term landings of the cod usually have fluctuated between 20,000 and 40,000 tonnes during the 20th century and of haddock between 12,000 and 25,000 tonnes since the 1950s. The catches of these two main fish stocks therefore have for a long time reached the limit for long-term production within the ecosystem. Variability between years in catches of these species reflects variability in production of the fish stocks.

During the early 1990s the catches of cod and haddock decreased to the lowest on record. The decrease coincided with a severe decrease in productivity in the ecosystem in general, covering all trophic levels, from primary production to fish and seabird feeding conditions, reproduction and growth rates. The ecosystem productivity increased markedly during the first half of 1990s, and the cod and haddock stocks recovered rapidly, due to increased recruitment success, individual growth rates, and due to low fishing mortality (Gaard *et al.* 2002; Steingrund *et al.* 2003, Steingrund and Gaard, 2005).

Since monitoring of environmental parameters started in 1990 there has been observed a clear relationship, from primary production to the higher trophic levels, which seem to respond quickly to variability in primary production in the ecosystem (Figure 4.1.1.5).

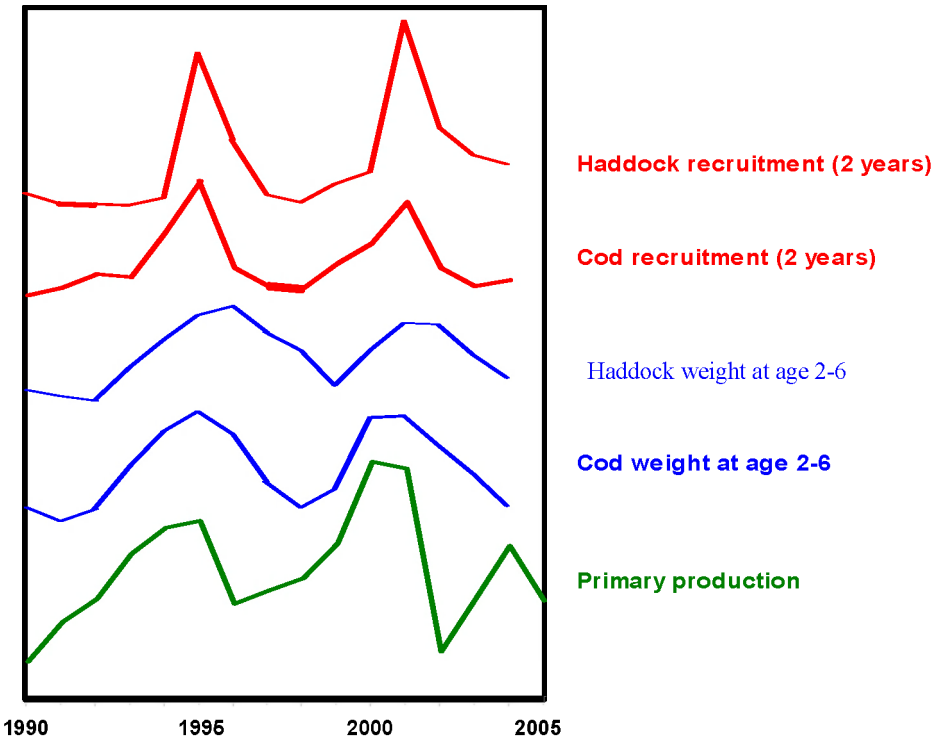

Figure 4.1.1.5 Relative variability in new primary production, recruitment of 2-years old cod and haddock, and mean weight of 2-6 years old cod and haddock since 1990 (Updated from Gaard *et al.* 2002).

Benthos

Due to strong tidal currents on the shelf, the seabed consists mainly of sand on stones. In deeper areas is mort silt and organic material. The benthic fauna on the shelf is diverse with e.g. decapods and echinoderms and bivalves as important groups. On the slope coral and sponge areas occur. The coral areas have been reduced due to trawling and therefore the authorities recently have closed three areas for trawling. On the shelf there is local fishery (dredging) for scallops and in inshore areas there is lobster (*Nephrops*) fishery for pots.

4.1.2 Major environmental influences on ecosystem dynamics

Fish migration versus age and feeding conditions

After the pelagic phase juvenile cod and saithe migrate into shallow areas while the haddock juveniles are dispersing all over the shelf area. At an age of about 2 years cod gradually migrate into deeper habitats on the shelf. Saithe migrates into deeper waters on the upper shelf slope at an age of about 3 years (Figure 4.1.2.1).

For cod there is, however, observed high variability in distribution between years. During years with poor feeding conditions adult cod tend to migrate into shallow areas. This seems to affect cod recruitment negatively.

Tagging experiments have shown that migration between Faroe Plateau and neighbouring areas is negligible (Joensen et al. 2005).

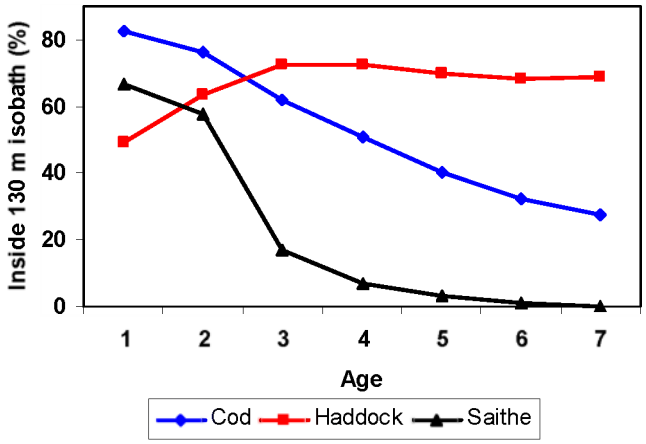

Figure 4.1.2.1 Proportion of cod, haddock and saithe caught inside the 130 m isobath during summer groundfish surveys 1996-2003. (From Steingrund and Gaard 2005).

Cod and haddock recruitment

Data series for cod since 1961 and since 1970 for haddock show no direct relationship between SSB and recruitment fluctuations on the Faroe plateau. On the other hand, long-term relations between cod and haddock recruitment and weight-at-age have demonstrated that periods with high weight-at-age occur simultaneously with good recruitment of 2-years old fish and vice versa (Figure 4.1.2.2) (Gaard *et al.*, 2002; 2006). This underlines strong simultaneous environmental affects on cod and haddock recruitment and growth rates.

Environmental conditions on the Faroe plateau are highly variable and their effects on cod and haddock are so strong that they overshadow spawning stock effects.

The cod and haddock stocks have proven that when environmental conditions are favourable, they are, even with very small SSB, able to recover quickly. It is, however, when the environmental conditions are poor, that the spawning stock influence on recruitment success most likely is highest. Therefore the importance of spawning stocks should not be underestimated – although it is no guarantee for recruitment success.

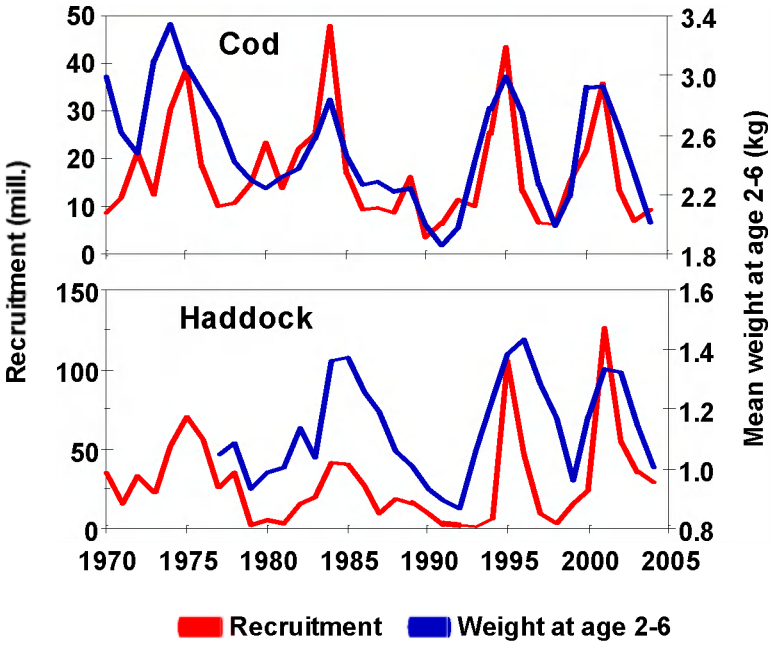

Figure 4.1.2.2 Relationship between recruitment of 2 years old cod and haddock and the mean weight of 2–6 years old cod during 1970–2004 and haddock during 1976–2004 on the Faroe shelf.

Since 1990, when monitoring of environmental parameters in the Faroe shelf ecosystem started, clear co-occurring fluctuations can be observed in primary production and recruitment of cod and haddock (Figure 4.1.2.3). However, the abundance of older cod in shallow areas also affects cod recruitment negatively. During periods with low food abundance (low primary production) adult cod (mainly those with low condition factor) furthermore tend to migrate into shallow areas, and this affects cod recruitment negatively. When comparing cod recruitment with a combined positive effect from primary production and a negative effect from abundance of adult cod in shallow areas, a very good correlation ($R2 > 0.8$) is obtained (Steingrund unpubl. data). It should be kept in mind that the available time series is rather short (since 1998), however, the correlation is very strong and seems convincing.

The year-class strength of cod seems to be determined rather late in live: Recruitment estimates of 2 years old cod co-fluctuates positively with primary production the year before. These fluctuations indicate that year-class strength is mainly determined when the cod is 1 year old. (Steingrund and Gaard, 2005; Steingrund unpublished data).

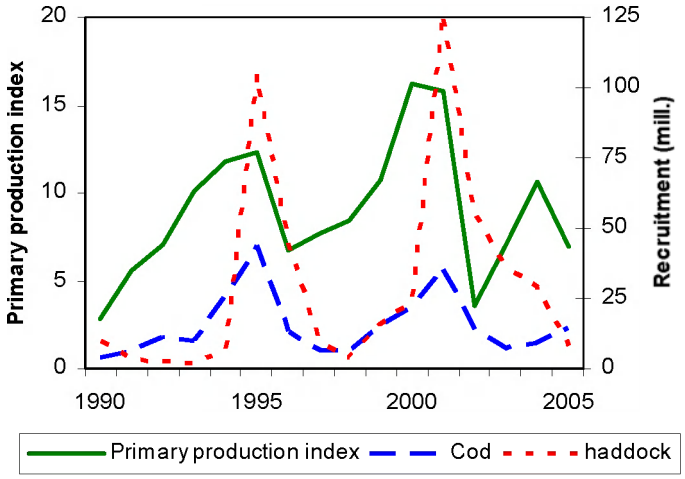

Figure 4.1.2.3 Primary production and recruitment of 2 years old cod and haddock during the 1990-2005 period.

Cod and haddock growth

Growth rates on cod and haddock on the Faroe plateau are highly variable. Since 1990 the mean growth rates of 2-7 years old cod have fluctuated between 0.2 and 1.4 kg individual-1 year-1 and the mean growth rates of 2-7 years haddock between 0.1 and 0.5 kg individual-1 year-1. No correlation is between the growth rates and the in situ temperature, but good relationship is found between primary production and growth variability of both species (Figure 4.1.2.4). The growth rates are mainly affected by the highly variable food production. The causal mechanism seems to be a positive relationship between phytoplankton production, zooplankton production and production of food organisms for cod and haddock (e.g., benthic crustaceans, polychaets, Norway pout and especially sandeels).

Since primary production is rapidly transferred to cod and haddock, they obviously eat young prey items, at least during periods with high growth rates. Detailed analysis of interannual variability in food items for cod and haddock are not available at the present, but the available information indicates that sandeel is the main food item during productive years. In low-productive years they seem to predate more on benthic fauna. Fish furthermore seems to be a much more prevalent prey item for cod than for haddock. This may be a reason for why haddock growth variability often is lagging one year behind cod growth variability, especially during low productive periods (Figure 4.1.2.4).

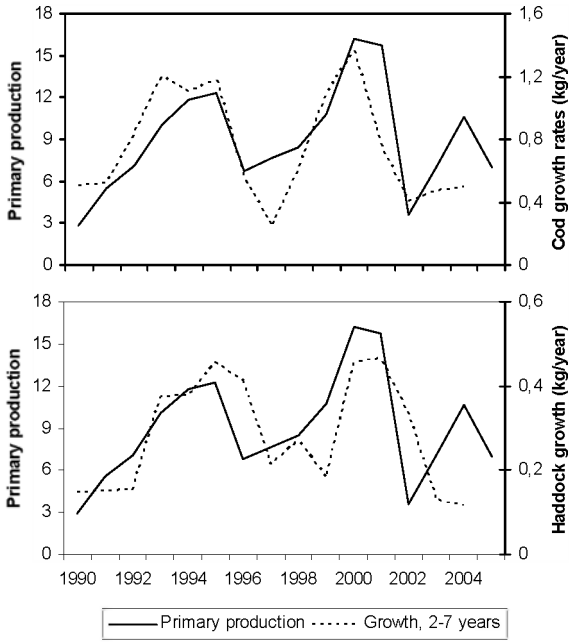

Figure 4.1.2.4 Index of new primary production and cod growth rates (upper panel) and haddock growth rates (lower panel) during the 1990-2005 period.

Fish production

Fish production in the ecosystem is clearly food limited. Mainly cod production (numbers x individual growth summed up for all age groups) fluctuates well with primary production (Figure 4.1.2.5). When comparing primary production with production of cod haddock and saithe combined, the correlation is even better.

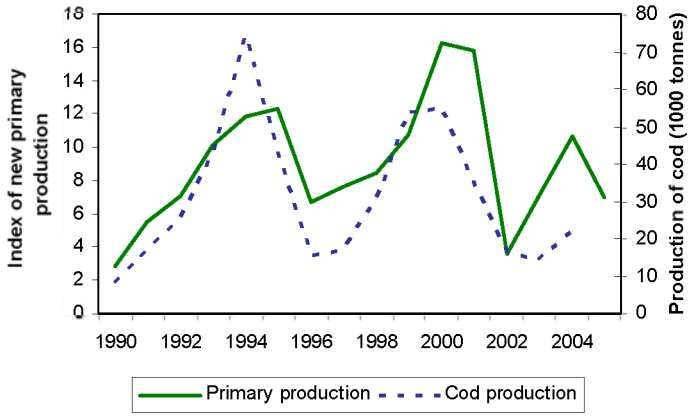

Figure 4.1.2.5 Index of new primary production on the Faroe shelf and corresponding production of Faroe Plateau cod older than 1.5 years.

Since young age groups are the most numerous (mainly in the productive years) the observed variability in cod production in Figure 4.1.2.5 largely is due to variable abundances of recruits (Figure 4.1.2.6). The figure furthermore illustrates, that in the 1960s and 1970s the proportion of production of older age classes was clearly higher than in recent times. The reason most likely is higher fishing mortalities in the later years.

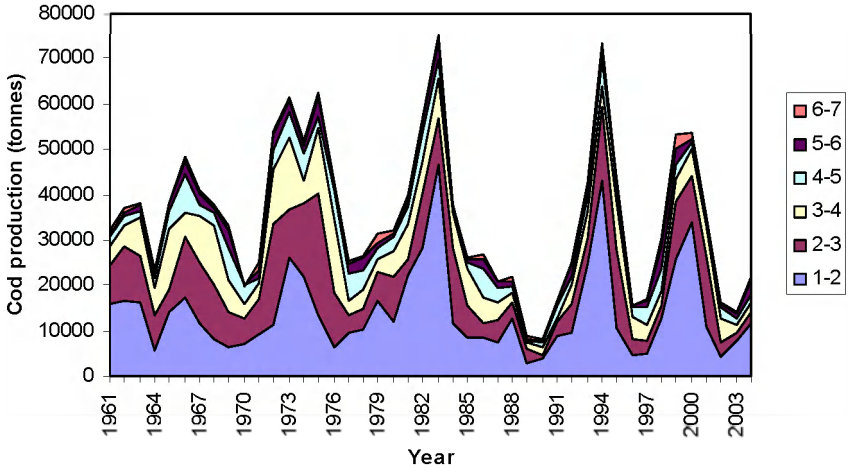

Figure 4.1.2.6 Production of Faroe Plateau cod split into age groups.

As cod grow older, they tend to move into deeper areas, a part of them feeding on the slope outside the shelf front (Figure 4.1.2.1). Since fish production in the shelf system is food limited, a higher proportion of individual that feed in deeper areas may be a possibility for increased fish production. It is likely that a reduced fishing mortality, allowing a higher fraction of older individuals in the stock, would allow a higher total cod production, and would possible also have a smoothing affect on the stock production variability.

There is, at present, not sufficient available information to quantify this potential effect. However it is the goal of an ongoing ecosystem modelling work at the Faroese Fisheries Laboratory to reveal this and other effects, such as CPUE, fish sizes, and individual competition.

Conclusions

The primary production decreased from slightly above average in 2004 to below average in 2005 (Figure 4.1.1.3). Although neither of the two years was dramatically different from average years, the decrease it is expected to affect longline catchability for cod and haddock, and also recruitment and growth rates of the two species.

The following environmental information is considered useful in assessment and management advice of the Faroe plateau cod stock and the Faroe haddock stock:

- In effort regulation, variable longline catchability for cod and haddock seems to be affected by variable feeding conditions. Knowledge on variability in environmental effects on this catchability is therefore important in management advice.
- Assumed environmental effects on longline catchability for cod and haddock were included in the advice for 2005. However, estimated variability in cod and haddock catchability (and fishing mortality), based on environmental information and growth rates, should be considered implemented (quantitatively) even further.
- The very clear co-fluctuation between plankton productivity and cod and haddock recruitment and growth rates (weight at age) since 1990 should be used to improve predictions for recruitment and weight for cod and haddock.

4.2 Human impacts on the ecosystem

4.2.1 Fishery effects on benthos and fish communities

General

Trawling activity has caused a significantly reduce the distribution areas of corals (Lophelia pertusa) on the shelf and bank slopes. Therefore the Faroese authorities in 2004 have closed three coral areas for trawling.

Since fishery on the Faroe Plateau is effort regulated, discard of commercially fish most likely is small. The level of by-catch of non-commercial species and of non-commercial size in unknown and may be higher, especially during periods of high recruitment.

In addition to effort regulation (limited number of fishing days), spawning grounds are closed for fishing activity, and large areas on the shelf are permanently or periodically closed for trawling. Furthermore, trawling is regulated by mesh sized. The current management regime which limits effort and spatial access for certain gear is likely to be effective for demersal fish stocks (Zeller and Reinert 2004).

The total demersal catches decreased from 120 000 t in 1985 to 65 000 t in 1993, but have since increased again to above 150 000 t in 2002; the demersal catches in 2005 were about 140 000 t. The three most important demersal species are cod, haddock and saithe. The decrease up to 1993 was mainly due to lower catches of all three species and the increase thereafter also was due to higher catches of all three species. The most recent decrease are due to lower catches of cod.

Part of the catches of mackerel, Norwegian spring-spawning herring and blue whiting are taken around the Faroe Islands. The catches of these species are reported together with the catches from other areas in the section on widely migrating stocks, see Volume 9.

The main fisheries in Faroese waters are mixed-species, demersal fisheries and single-species, pelagic fisheries. The demersal fisheries are mainly conducted by Faroese fishermen, whereas the major part of the pelagic fisheries are conducted by foreign fishermen licensed through bilateral and multilateral fisheries agreements.

Pelagic Fisheries. Three main species of pelagic fish are fished in Faroese waters: blue whiting, herring and mackerel; several nations participate. The Faroese pelagic fisheries are almost exclusively conducted by purse seiners and larger purse seiners also equipped for pelagic trawling. The pelagic fishery by Russian vessels is conducted by large factory trawlers. Other countries use purse seiners and factory trawlers.

Demersal Fisheries. Although they are conducted by a variety of different vessels, the demersal fisheries can be grouped into fleets of vessels operating in a similar manner. Some vessels change between longlining, jigging and trawling, and they therefore can appear in different fleets. In the following there is first a description of the Faroese fleets followed by the fleets of foreign nations. Number of licenses can be found in the table text to Table 4.3.2.1.

Open boats. These vessels are below 5 GRT. They use longline and to some extent automatic, jigging engines and operate mainly on a day-to-day basis, targeting cod, haddock and to a lesser degree saithe. The large number of open boats participating in the fisheries are often operated by part-time fishermen.

Smaller vessels using hook and line. This category includes all the smaller vessels, between 5 and 110 GRT operating mainly on a day-to-day basis, although the larger vessels behave almost like the larger longliners above 110 GRT with automatic baiting systems and longer trips. The area fished is mainly nearshore, using longline and to some extent automatic, jigging engines. The target species are cod and haddock.

Longliners > 110 GRT. This group refers to vessels with automatic baiting systems. The main species fished are cod, haddock, ling and tusk. The target species at any one time is dependent on season, availability and market price. In general, they fish mainly for cod and haddock from autumn to spring and for ling and tusk during the summer. The spatial distribution is concentrated mainly in the year around closed areas to trawling (Figure 4.3.2.2). On average 92% of their catch is taken within the permanent exclusion zone for trawlers. During summer they also make a few trips to Icelandic waters.

Otter board trawlers < 500 HP. This refers to smaller fishing vessels with engine powers up to 500 Hp. The main areas fished are on the banks outside the areas closed for trawling. They mainly target cod and haddock. Some of the vessels are licensed during the summer to fish within the twelve nautical mile territorial fishing limit, targeting lemon sole and plaice.

Otter board trawlers 500-1000 HP. These vessels fish mainly for cod and haddock. They fish primarily in the deeper parts of the Faroe Plateau and the banks to the southwest of the islands.

Otter board trawlers >1000 HP. This group, also called the deep-water trawlers, target several deep-water fish species, especially redfish, blue ling, Greenland halibut, grenadier and black scabbard fish. Saithe is also a target species and in recent years they have been allocated individual quotas for cod and haddock on the Faroe Plateau. The distribution of hauls by this fleet in 2000-2005 is shown in Figure 4.3.2.2.

Pair trawlers <1000 HP. These vessels fish mainly for saithe, however, they also have a significant by-catch of cod and haddock. The main areas fished are the deeper parts of the Faroe Plateau and the banks to the southwest of the islands.
Pair trawlers >1000 HP. This category targets mainly saithe, but their by-catch of cod and haddock is important to their profit margin. In addition, some of these vessels during the summers have special licenses to fish in deep water for

greater silver smelt. The areas fished by these vessels are the deeper parts of the Faroe Plateau and the banks to the southwest of the islands (Figure 4.3.2.2).

Gill netting vessels. This category refers to vessels fishing mainly Greenland halibut and monkfish. They operate in deep waters off the Faroe Plateau, Faroe Bank, Bill Bailey's Bank, Lousy Bank and the Faroe-Iceland Ridge. This fishery is regulated by the number of licensed vessels (8) and technical measures like depth and gear specifications.

Jiggers. Consist of a mixed group of smaller and larger vessels using automatic jigging equipment. The target species are saithe and cod. Depending on availability, weather and season, these vessels operate throughout the entire Faroese region. Most of them can change to longlines and in recent years jigging effort has decreased as compared to longlines.
Foreign longliners. These are mainly Norwegian vessels of the same type as the Faroese longliners larger than 110 GRT. They target mainly ling and tusk with by-catches of cod, haddock and blue ling. Norway has in the bilateral fishery agreement with the Faroes achieved a total quota of these species; numbers of vessels can vary from year to year.

Foreign trawlers. These are mainly otter board trawlers of the same type as the Faroese otter board trawlers larger than 1 000 HP. Participating nations are United Kingdom, France, Germany and Greenland. The smaller vessels, mainly from the United Kingdom and Greenland, target cod, haddock and saithe, whereas the larger vessels, mainly French and German trawlers, target saithe and deep-see species like redfish, blue ling, grenadier and black scabbardfish. As for the foreign longliners, the different nations have in their bilateral fishery agreement with the Faroes achieved a total quota of these species; numbers of vessels can vary from year to year

Catchability analysis

In an effort management regime with a limited numbers of fishing days, it is expected that vessels will try to increase their efficiency (catchability) as much as possible in order to optimise the catch and its value within the number of days allocated. "Technological creeping" should therefore be monitored closely in such a system. However, catchability of the fleets can change for other reasons, e.g. availability of the fish to the gears. If such effects are known or believed to exist, catchability changes may need to be incorporated in the advice on fisheries.

The primary production of the Faroe Shelf ecosystem may vary by as much as a factor of five and given the link between primary production and recruitment and growth (production) of cod as demonstrated by Steingrund & Gaard (2005), this could have pronounced effects on catchability and stock assessment as a whole. Below are the results from an analysis regarding Faroe Plateau cod, Faroe haddock and Faroe saithe.

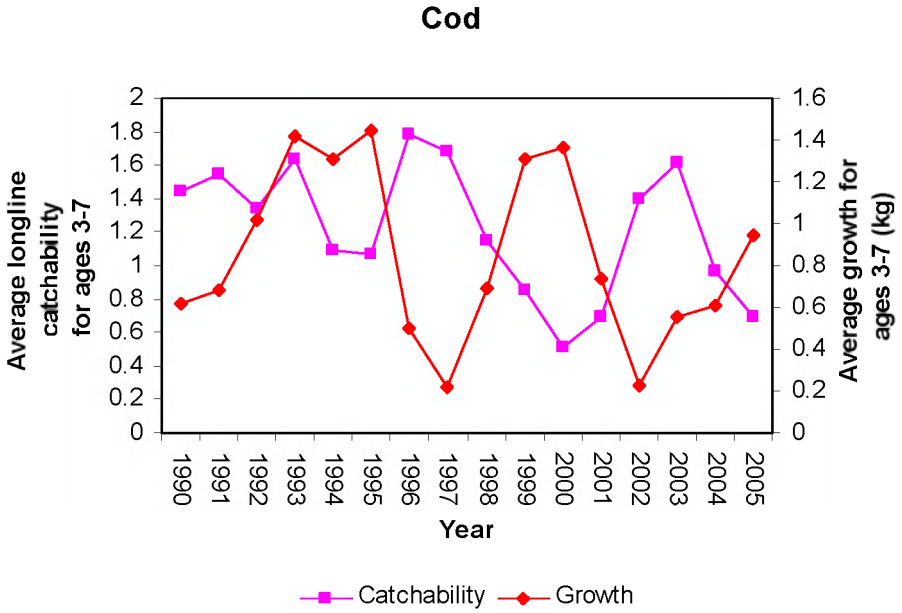

Figure 4.2.1.1 Faroe Plateau Cod. Relationship between long line catchability and growth of cod during the last 12 months.

For cod and haddock there seems to be a link between the primary production and growth of cod (Figure 4.2.1.2). The growth of cod seems to be negatively correlated with the catchability of longlines (Figure 4.2.1.1), suggesting that cod attack longline baits to a higher degree when natural food abundance is low. Since longliners usually take a large

proportion of the cod catch, the total fishing mortality fluctuates in the same way as the long line catchability and thus there is a negative relationship between cod growth and fishing mortality (Figure. 4.2.1.2).

Also for haddock there seems to be similar relationship between primary production, growth, catchability and fishing mortality as for cod. The negative relationship between growth and fishing mortality as shown in Figure 4.2.1.2 suggests, that the same mechanism is valid for haddock as for cod.

It is, however, important to note that the relationship between the productivity of the ecosystem and the catchability of long lines depends on the age of the fish. For cod, the relationship is most clear for age 5; for age 3 and 4, the relationship is less clear. For young haddock there apparently is no such relationship between productivity and catchability.

For saithe no clear relationship was observed between the catchability for the Cuba pair trawlers (pair trawlers take the majority of the catch) and other variables such as primary production, growth and stock size.

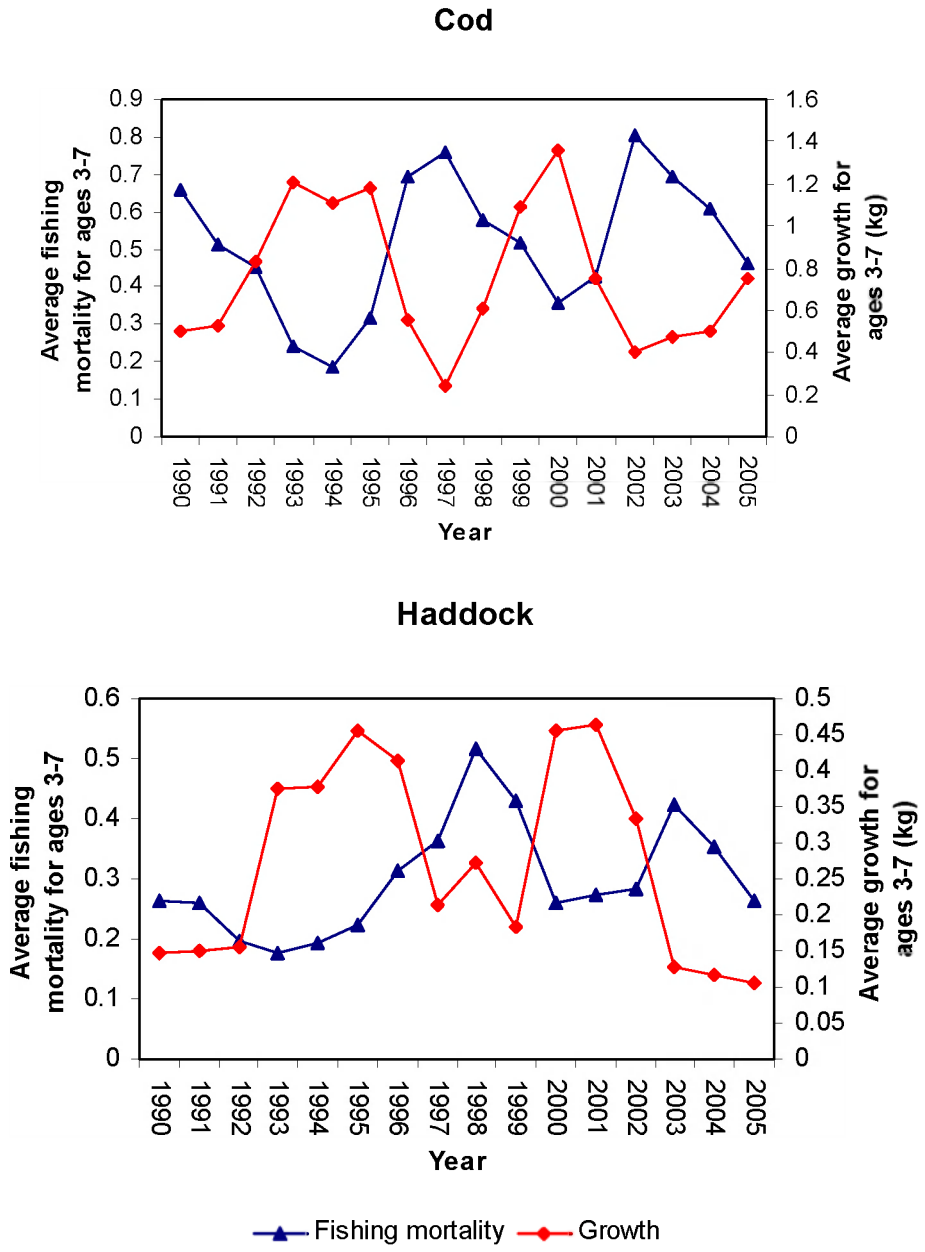

Figure 4.2.1.2. Faroe Plateau Cod (top) and Faroe haddock (bottom). Relationship between fishing mortality and growth of cod during the last 12 months.

The analysis reported above suggests that natural factors may have a larger influence than technological ones, at least for Faroe Plateau cod and Faroe haddock on changes in catchability. In addition, the available data indicate that there has not been sufficient time since the implementation of the effort management system in 1996 to detect convincing changes in catchability. However, from a management perspective, if the hypothesis that catchability is related to

productivity is true, and if productivity in 2005 and 2006 is low, there is the potential for very high fishing mortality to be exerted on cod. It could therefore be prudent to consider substantial reductions in fishing effort for the next fishing season.

Concluding remarks

The Faroe Islands utilize an effort- and spatial-based system of fisheries management. Successful management of such a system is among other things depending on information on influences from environmental variables on the fish stocks, individual behaviour and catchability.

Environmental effects in the Faroe shelf ecosystem are strong may be useful in prediction of cod and haddock recruitment and growth rates as well as in management regulations.

The highly variable environmental conditions on the Faroe plateau have very strong influences on cod and haddock recruitment. Recruitment of 2-years old cod correlates positively with primary production and negatively with abundance of adult cod in shallow areas the year before. In years with low food abundance cod tend to migrate into shallow areas, affecting cod recruitment negatively. There is a high correlation between recruitment of 2 years old cod and environmental conditions for cod (primary production combined with abundance of adult cod in shallow areas) one year before, indicating that recruitment mainly is determined as 1 years old cod.

Growth rates of cod and haddock are also highly affected by feeding conditions. Since 1990 the annual mean growth rates of age 2-7 have (average for age 2-7) have varied by a factor of 4 and 6 for cod and haddock, respectively.

Relationship between environmental conditions for cod and haddock (food abundance) and longline catchability may also be useful information from a management perspective. In and effort management regime with a limited number of fishing days, expected catchability changes may need to be incorporated in the advice on fisheries. For cod there is observed a link between primary production and individual growth rates (Figure 4.2.1.2). The cod growth rates seem to be negatively correlated with the catchability of longlines, suggesting that cod prefer longline baits when natural food abundance is low. Since longliners usually take a large proportion of cod catch, the total fishing mortality fluctuates in the same was as the longline catchability and there is thus a negative relationship between cod growth and mortality.

For haddock there seems a similar mechanism as for cod. Although the catchability for longliners (which take the majority of the catch) as estimated for the longliners logbooks does not follow the expected pattern for the first time of the series (1986-1995), it may be a result of very small catches in that period when the stock biomass was low. The fact that a negative relationship is observed between growth rates and fishing mortality suggests that the same mechanism is valid for haddock as for cod.

It is, however, important to note that the relationship between productivity of the ecosystem and the catchability of longlines depends on age of the fish. The relationship is most clear for fish age 5. For cod age 3 and 4 the relationship is less clear, and for young haddock there apparently is no such relationship between productivity and catchability.

For saithe no clear relationship is observed between catchability for pair trawlers (which take the majority of the catches) and other variables such as primary production, growth and stock size.

The analysis reported above suggests that natural factors may have a large influence on longline catchability for cod and haddock. Based on information on primary production in 2005, which is below average (Figure 4.1.1.3) there is a potential for increased longline catchability.

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4.3 Assessments and advice

4.3.1 Assessments and advice regarding protection of biota and habitats

ICES has not in 2006 provided advice regarding protection of biota and habitats.

4.3.2 Assessments and advice regarding fisheries

Mixed fisheries and fisheries interactions

The pelagic fisheries exploit stocks that occur widely in the Northeast Atlantic. Since these fisheries are single-species fisheries, management of these stocks should be done based on single-species upper boundary considerations and should consider exploitation in all areas where these stocks are fished, see Volume 9.

Most demersal fisheries are mixed-species fisheries; exceptions are gillnet fisheries for Greenland halibut and gillnet fisheries for anglerfish where bycatches are small.

Some of the demersal stocks are local, whereas others like Greenland halibut, anglerfish, redfish, and most deep-sea stocks occur over a wider area than the Faroese waters, and management of them should consider exploitation in all areas where these stocks are fished.

At present, only a few stocks are assessed among those currently exploited in Faroese waters. Proper mixed fisheries considerations should include several other species that are not currently assessed. If proper fishery-based advice taking mixed fisheries issues into account should be given for the fishery in Vb, ICES would need to evaluate the status of these stocks.

In the present management regime, the stocks of cod, haddock, and saithe are regulated by gear and fleet specifications, area closures, and number of fishing days. Consequently, the status of each of the stocks must be taken into account in the regulation. Several of the fisheries could be described as mixed cod-haddock fisheries (i.e. the longline fisheries), whereas others (i.e. pairtrawlers and occasionally single trawlers) are saithe fisheries with bycatches of cod and haddock.

Single-stock exploitation boundaries and critical stocks

The state of stocks and single-stock exploitation boundaries are summarised in the table below.

Species	State of the stock				ICES considerations in relation to single-stock exploitation boundaries			Upper limit corresponding to single-stock exploitation boundary
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	In relation to agreed management plan	In relation to precautionary limits	In relation to high long-term yield	
Faroe Plateau Cod	Increased risk	Increased risk	Overexploited	Appropriate	No change in effort	Rebuilding plan F = Fpa Reduce effort by more than 24%		-24% effort
Faroe Bank Cod						Effort not to exceed that of 1996–2002		Effort as in 1996–2002.
Faroe Haddock	Full reproductive capacity	Increased risk	Overexploited	Below agreed target	The current F estimate is below the management target	F = Fpa. Reduce effort by about 24%		-24% effort.
Faroe Saithe						Effort should not increase. Maximum catch 40 000 t.		0% effort 40 000 t.

The advice for Ling appears in Section 9.4.10 on Widely distributed stocks.

Advice for fisheries management

The Faroese effort management system links fishing mortality on the demersal stocks, i.e. that the effort level (number of fishing days) concurrently determines the fishing mortality on all three demersal stocks. The longline fisheries for cod and haddock are closely linked. The fishery for saithe is a more directed fishery, albeit with bycatch of cod and haddock.

Fishing mortality for the Faroe Plateau cod in 2006 is about 30% higher than the level that is recommended based on precautionary principles. For haddock the present fishing mortality is slightly above the precautionary level, and although it was not possible to estimate fishing mortality for saithe in 2006, biomass indices indicate that the exploitable biomass may be higher now than in the 1990s.

Therefore, ICES recommends a reduction of the fishing effort directed at the Faroe Plateau cod and haddock in the neighbourhood of 25%. For the saithe fisheries ICES recommends that effort should not be allowed to increase. If the bycatch of cod or haddock is observed to increase in the saithe fishery, then effort will have to be reduced proportionally to the increase in the bycatch rate. For Faroe Bank cod effort should be reduced to the 1996–2002 level.

Regulations in force and their effects

The catch quota management system introduced in the Faroese fisheries in 1994 was met with considerable criticism and resulted in discarding and in substantial misreporting of the catches. Reorganisation of enforcement and control did not solve the problems. As a result of the dissatisfaction with the catch quota management system, the Faroese Parliament discontinued the system as from 31 May 1996. In close cooperation with the fishing industry, the Faroese government has developed a system based on individual transferable effort quotas in days within fleet categories. The system entered into force on 1 June 1996. The fishing year from 1 September to 31 August, as introduced under the catch quota system, has been maintained.

The key elements in the Faroese fisheries management of the demersal stocks are:

1. A separation of the fishing vessels into fleet segments that are based on physical vessel attributes, mainly size (GRT and HP) and vessel types (trawlers, longliners, etc.). The fleet segmentation is a central element in controlling capacity, effort, and the fishing pattern.
2. A capacity policy aimed at maintaining the fleet capacity at the 1997 level. The capacity is in principle maintained within each fleet segment, but there are rules for allowing vessel transfers between groups (e.g. in conjunction with vessel replacement). The capacity policy is based on vessel licenses.
3. An effort system that allots a total number of fishing days for the coming fishing year to each of the fleet segments. The total fleet segment effort is subsequently divided between the individual vessels. Except for the small-scale coastal fishery the general rule is that all vessels within the fleet segment get an equal share. The small-scale coastal fishery (fleet segment 5B) fishes on a common effort quota. The fishing days may be traded within fleet segments and with some restrictions between segments. The effort regulation is maintained through a fishing license system.
4. A complex system of area closures that regulates access to the fishing grounds for the various fleet segments. The main restrictions are: The trawlers are generally not allowed to fish within the 12 nautical mile limit and within other areas closed to trawlers, implying that large areas shallower than 200 m are closed to trawling. There are exceptions for small trawlers that are allowed a summer fishery for flatfish on the plateau. The near-shore area (inside the 6 nm line) is closed to the larger longliners. Gillnetters are only allowed to fish at depths deeper than 350 m.
5. A number of supplementary technical regulations such as: Spawning area closures, minimum mesh sizes, sorting grids, real-time closures to protect small fish, and minimum landing sizes. The Faroe Bank shallower than 200 m is closed to trawling.

The fleet segmentation used to regulate the demersal fisheries in the Faroe Islands and the regulations applied are summarised in Table 4.3.2.1.

The different area and season regulations are shown in Figure 4.3.2.1.

The single trawlers that target deepwater resources (redfish, saithe, blue ling, Greenland halibut, and others) are not covered by the effort regulation, and catches of cod and haddock are limited by maximum bycatch allocation. Similarly, the gillnetters that target monkfish and Greenland halibut are not included in the effort system – their catch of cod, haddock, and saithe is almost nil due to the depth of fishing and the large mesh sizes. One fishing day by longliners is considered equivalent to two fishing days for jiggers in the same size category. Longliners could therefore double their allocation by converting to jigging. Holders of individual transferable effort quotas who fish outside this line can fish

for 3 days outside for each day allocated inside the line. The effort history and allocation of effort is summarised in Tables 4.3 2.2 and 4.3.2.3.

The allocations of number of fishing days by fleet categories was made such that together with other regulations of the fishery they should result in average fishing mortalities on each of the 3 stocks of 0.45, corresponding to average annual catches of 33% of the exploitable stocks in numbers. Built into the system is also an assumption that the day system is self-regulatory, because the fishery will move between stocks according to the relative availability of each of them and no stock will be overexploited.

The management system with individual transferable days introduced in 1996 had as an objective to maintain the fishing mortality at an average of 0.45 for both plateau cod, haddock, and saithe. The current assessment shows that saithe and haddock have on average been harvested within this objective, whereas for cod the fishing mortality has exceeded the objective.

The fishing law also prescribes the percentage of total catches of cod, haddock, saithe, and redfish, which each fleet category on average is allowed to fish. However, these percentages are of little practical importance since they have not been used directly in the regulations since the abolishment of the quota system after the fishing year 1995–96. These percentages are as follows:

Fleet category	Cod	Haddock	Saithe	Redfish
Longliners < 110 GRT, jiggers, single trawlers < 400 HP	51%	58%	17.5%	1%
Longliners > 110 GRT	23%	28%		
Pairtrawlers	21%	10.25%	69%	8.5%
Single trawlers > 400 HP	4%	1.75%	13%	90.5%
Others	1%	2%	0.5%	0.5%

An overview of the average catchability of the principal fleets for the three major stocks in Division Vb does not indicate any long-term positive or negative trends in catchability for the period 1985 to 2003. Natural factors may have a larger influence than technological, at least for Faroe cod and haddock, where the longline fishing constitutes a large part of the catch. Hence the short-term trends in the catchability of both cod and the haddock may be a result of variability in the productivity in the ecosystem as explained above.

Under effort management there are incentives for vessels to optimise their catch and its value per effort unit through an increase of efficiency (catchability). This introduces "Technological creeping" which has been demonstrated for many fishing fleets. Such "creeping" needs therefore to be monitored closely and accounted for in the regulations.

The relative prices for the three commercial fish species (cod, haddock, and saithe) are important. In 2003–2005, the price for cod has been substantially higher than for haddock and saithe which may have contributed to an increased targeting and high fishing mortality for this species in these years. The relative prices will shift fishing focus from one stock to the other.

Quality of assessments and uncertainties

The resources in the area have in general been managed on the basis of long time-series of commercial catch-at-age information. There are two annual ground fish surveys available from the mid-1990s. Several commercial CPUE series are available. The commercial cpue series include larger vessels (fleet segments 1–3) only and are based on logbooks from a few selected vessels that are considered representative for the fleets. Detailed CPUE statistics that cover all vessels in these segments as well as the gillnetters exist but are not at present available for assessment. No detailed cpue information is available for segments 4 and 5 since these vessels are not obliged to keep logbooks. This impedes a comprehensive analysis of the development in catchabilities that is necessary to evaluate the implementation of the effort system used in the Faroes.

Except for some selected fisheries, no estimates of discards are available. However, since almost no quotas are used in the management of the demersal fisheries, the incentives to discard in order to highgrade the catches should be low. Moreover, according to Faroese legislation, all discarding is banned. The landings statistics are therefore regarded as being adequate for assessment purposes.

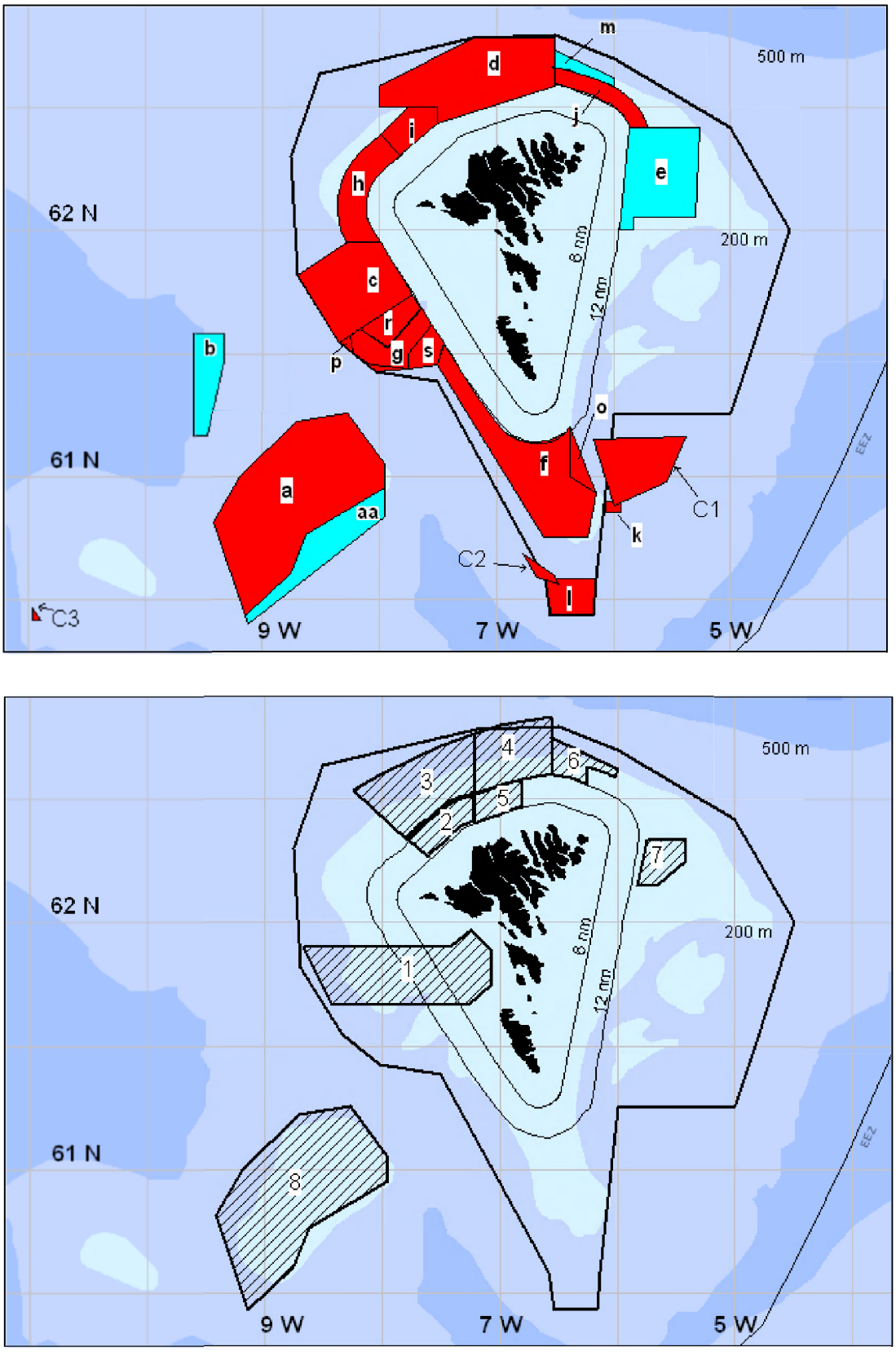


Figure 4.3.2.1 **Continued next page with figure text.**

Exclusion zones for trawling

Area	Period
a	1 jan - 31 des
aa	1 jun - 31 aug
b	20 jan - 1 mar
c	1 jan - 31 des
d	1 jan - 31 des
e	1 apr - 31 jan
f	1 jan - 31 des
g	1 jan - 31 des
h	1 jan - 31 des
i	1 jan - 31 des
j	1 jan - 31 des
k	1 jan - 31 des
l	1 jan - 31 des
m	1 feb - 1 jun
n	31 jan - 1 apr
o	1 jan - 31 des
p	1 jan - 31 des
r	1 jan - 31 des
s	1 jan - 31 des
C1	1 jan - 31 des
C2	1 jan - 31 des
C3	1 jan - 31 des

Spawning closures

Area	Period
1	15 feb - 31 mar
2	15 feb - 15 apr
3	15 feb - 15 apr
4	1 feb - 1 apr
5	15 jan - 15 mai
6	15 feb - 15 apr
7	15 feb - 15 apr
8	1 mar - 1 may

Figure 4.3.2.1 (Cont'd) Fishing area regulations in Division Vb. Allocation of fishing days applies to the area inside the outer thick line on the Faroe Plateau. Holders of effort quotas who fish outside this line can triple their numbers of days. Longliners larger than 110 GRT are not allowed to fish inside the inner thick line on the Faroe Plateau. If longliners change from longline to jigging, they can double their number of days. The Faroe Bank shallower than 200-m depth (a, aa) is regulated separate from the Faroe Plateau. It is closed to trawling and the longline fishery is regulated by individual day quotas.

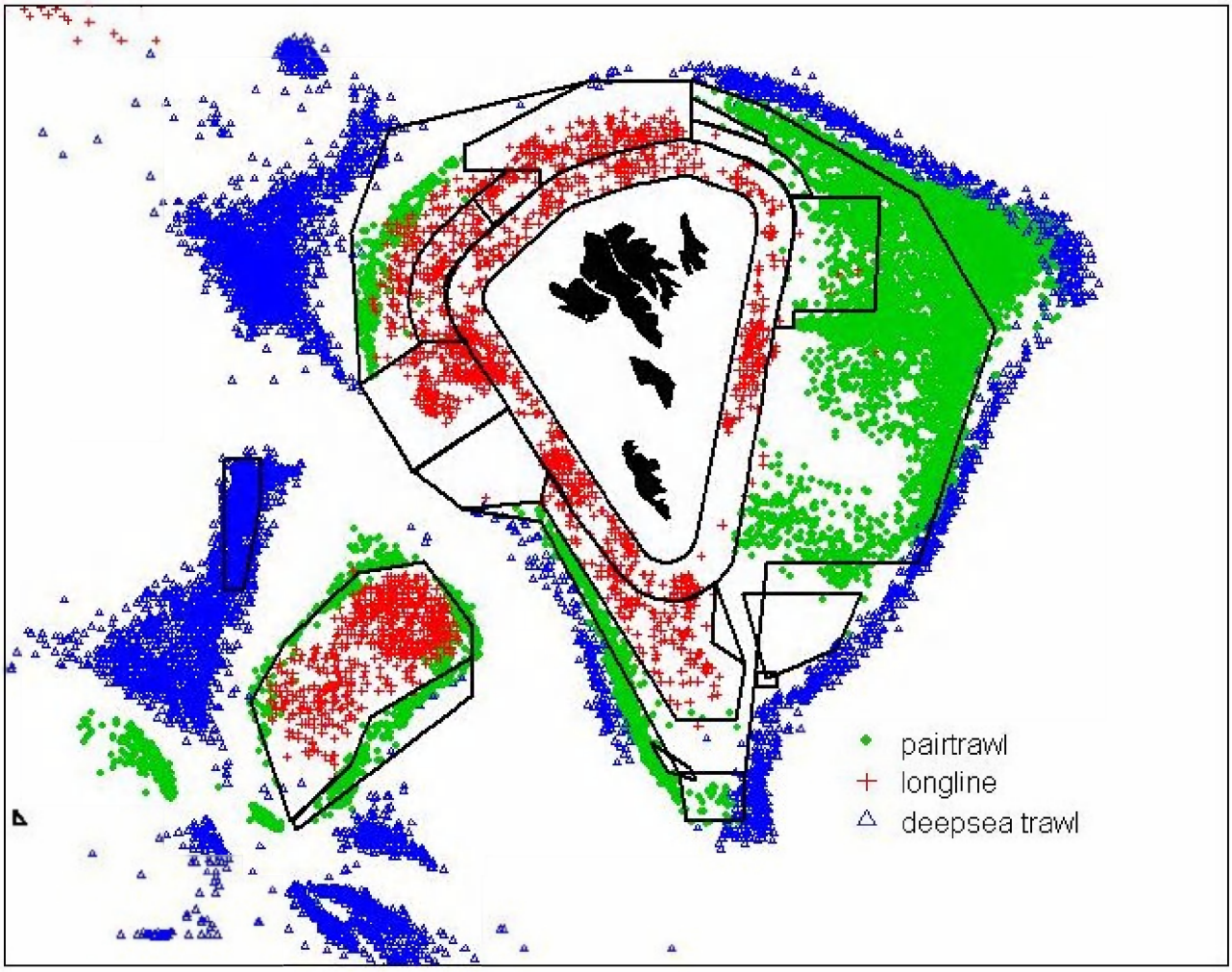


Figure 4.3.2.2 The 2000–2005 distribution of fishing activities by some major demersal fleets.

Table 4.3.2.1 Main regulatory measures by fleet in the Faroese fisheries in Vb. The fleet capacity is fixed, based on among other things no. of licences. The number of licenses within each group (by May 2006) are as follows: 1: 12; 2: 29; 3: 25; 4A: 25; 4B: 21; 4T: 19; 5A: 140; 5B: 453; and 6: 8. These licenses have been fixed in 1997, but in group 5B a large number of additional licenses can be issued upon request.

Fleet segment		Sub groups		Main regulation tools
1	Single trawlers > 400 HP	*none*		Bycatch quotas, area closures
2	Pair trawlers > 400 HP	*none*		Fishing days, area closures
3	Longliners > 110 GRT	*none*		Fishing days, area closures
4	Coastal vessels>15 GRT	4A	Longliners 15–40 GRT	Fishing days
		4B	Longliners>40 GRT	Fishing days
		4T	Trawlers>40 GRT	Fishing days
5	Coastal vessels <15 GRT	5A	Full-time fishers	Fishing days
		5B	Part-time fishers	Fishing days
6	Others		Gillnetters	Bycatch limitations, fishing depth, no. of nets
			Others	Bycatch limitations

Table 4.3.2.2 Number of fishing days used by various fleet groups in Vb1 1985–1995 and 1998–2005. For other fleets there are no effort limitations. Catches of cod, haddock, saithe, and redfish are also regulated by the bycatch percentages given in the text. In addition there are special fisheries regulated by licenses. (This is the real number of days fishing not affected by doubling or tripling of days by changing areas/gears).

Year	Longliner 0-110 GRT, jiggers, trawlers < 400 HP	Longliners > 110 GRT	Pairtrawlers > 400 HP
1985	13449	2973	8582
1986	11399	2176	11006
1987	11554	2915	11860
1988	20736	3203	12060
1989	28750	3369	10302
1990	28373	3521	12935
1991	29420	3573	13703
1992	23762	2892	11228
1993	19170	2046	9186
1994	25291	2925	8347
1995	33760	3659	9346
Average(85-95)	22333	3023	10778
1998	23971	2519	6209
1999	21040	2428	7135
2000	24820	2414	7167
2001	29560	2512	6771
2002	30333	2680	6749
2003	27642	2196	6624
2004	22211	2728	7059
2005	21829	3123	6377
Average(98-05)	25176	2575	6761

Table 4.3.2.3 Number of allocated days inside the outer thick line in Figure 4.3.1 for each fleet group since the new management scheme was adopted.

Fishing year	Group 1 Single trawlers > 400 HP	Group 2 Pair trawlers > 400 HP	Group 3 Longliners > 110 GRT	Group 4 Longliners and jiggers 15-110 GRT, single trawlers < 400 HP	Group 5 Longliners and jiggers < 15 GRT
1996/1997		8225	3040	9320	22000
1997/1998		7199	2660	9328	23625
1998/1999		6839	2527	8861	22444
1999/2000	Regulated by area	6839	2527	8861	22444
2000/2001	and by-catch	6839	2527	8861	22444
2001/2002	limitations	6839	2527	8861	22444
2002/2003		6771	2502	8772	22220
2003/2004		6636	2452	8597	21776
2004/2005		6536	2415	8468	21449
2005/2006		5752	3578	5603	21335
No. of licenses	13	28	19	106	> 1400 (696)

4.4 Stock Summaries (The Faroe Plateau Ecosystem)

4.4.1 Faroe Plateau cod (Subdivision Vb_1)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Increased risk	Increased risk	Overexploited	Appropriate	

Based on the most recent estimates of SSB, ICES classifies the stock as being at risk of reduced reproductive capacity. SSB in 2006 is at the same level as prior to the collapse in 1990. Based on the most recent estimates of fishing mortality, ICES classifies the stock as being at risk of being harvested unsustainably (Figure 4.4.1.3). The estimate of fishing mortality has been above the proposed $\mathbf{F}_{pa}$ since 1996. Historically, the spawning stock biomass had been well above $\mathbf{B}_{pa}$ for a number of the early years in the time-series, but has been below $\mathbf{B}_{pa}$ since 2004. The recruitment after the 2000 year class has been at or below average.

Management objectives

The management objective is to achieve sustainable fisheries. An effort management system was implemented in the Faroese demersal fisheries in Division Vb in 1996. From the outset the aim of the effort management system was to harvest on average 33% in numbers of the exploitable stock of cod. This translates into an average F of approximately 0.45, above the $\mathbf{F}_{pa}$ of 0.35. ICES considers this to be inconsistent with the Precautionary Approach.

Reference points

	ICES considers that:	ICES proposed that:
Precautionary Approach reference points	$\mathbf{B}_{lim}$ is 21 000 t.	$\mathbf{B}_{pa}$ be set at 40 000 t.
	$\mathbf{F}_{lim}$ is 0.68.	$\mathbf{F}_{pa}$ be set at 0.35.

Technical basis

$\mathbf{B}_{lim}$: $\mathbf{B}_{lim} = \mathbf{B}_{loss}$ (98).	$\mathbf{B}_{pa}$: $\mathbf{B}_{pa} = \mathbf{B}_{lim} e^{1.645\sigma}$, assuming a σ of about 0.40 to account for the relatively large uncertainties in the assessment.
$\mathbf{F}_{lim}$: $\mathbf{F}_{lim} = \mathbf{F}_{pa} e^{1.645\sigma}$, assuming a σ of about 0.40 to account for the relatively large uncertainties in the assessment.	$\mathbf{F}_{pa}$: Close to $\mathbf{F}_{max}$ (0.34) and $\mathbf{F}_{med}$ (0.38) values from the 1998 assessment.

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 3–7	Yield/R	SSB/R
Average last 3 years	0.589	1.380	2.945
$\mathbf{F}_{max}$	0.340	1.423	4.659
$\mathbf{F}_{0.1}$	0.155	1.290	8.128
$\mathbf{F}_{med}$	0.360	1.423	4.443

Single-stock exploitation boundaries

Exploitation boundaries in relation to existing management plans

The management objective implied in the effort management scheme is to achieve an average exploitation rate equivalent to a fishing mortality of 0.45, compared to the current estimate 0.46 in 2005. Assuming proportionality between effort and F and adherence to the management plan would imply no change in effort for 2007.

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

The current fishing mortality estimated as 0.46 is above rates that would support optimal long-term yield and low risk of stock depletion ($\mathbf{F}_{0.1}$ and $\mathbf{F}_{max}$).

Exploitation boundaries in relation to precautionary limits

In the short term a reduction of 50% in fishing mortality in 2007 is required to rebuild this stock above $\mathbf{B}_{pa}$ (=40 000 t). The present management system has led to fishing mortalities that do not appear sustainable. ICES recommends a rebuilding plan including an adaptive approach on fishing effort and monitoring the development of the stock with reference to rebuilding to above $\mathbf{B}_{pa}$. The reduction in fishing effort in 2007 should be in the order of 25% which corresponds to fishing at $\mathbf{F}_{pa}$.

Short-term implications

Outlook for 2007

Basis: F(2006) =0.46; SSB(2007) = 30; catch (2006) = 12.
The fishing mortality according to the management plan (F(management plan)) is 0.45.
The maximum fishing mortality which would be in accordance with precautionary limits (F (precautionary limits)) is 0.35.

Rationale	F (2007)	Basis	SSB (2007)	Landings (2007)	SSB (2008)	% change SSB [1]
Zero catch	0	F=0	30	0	47	57
Target ref. point	0.45	F(management plan)	30	11.1	35	17
Status quo	0.46	$\mathbf{F}_{sq}$	30	11.1	35	17
Management plan	0.05	F(management plan) * 0.1	30	1.5	45	50
	0.11	F(management plan) * 0.25	30	3	44	47
	0.23	F(management plan) * 0.50	30	6	39	30
	0.34	F(management plan) * 0.75	30	9	37	23
	0.41	F(management plan) * 0.90	30	10	36	20
	0.45	F(management plan)	30	11	35	17
	0.50	F(management plan) * 1.1	30	12	34	13
	0.56	F(management plan) * 1.25	30	13	33	10
Precautionary limits	0.04	$\mathbf{F}_{pa}$ * 0.1	30	1.2	46	53
	0.09	$\mathbf{F}_{pa}$ * 0.25	30	3	44	47
	0.18	$\mathbf{F}_{pa}$ * 0.5	30	5	42	40
	0.26	$\mathbf{F}_{pa}$ * 0.75	30	7	39	30
	0.32	$\mathbf{F}_{pa}$ * 0.90	30	8	38	27
	0.35	$\mathbf{F}_{pa}$	30	9	37	23
	0.39	$\mathbf{F}_{pa}$ * 1.1	30	10	36	20
	0.44	$\mathbf{F}_{pa}$ * 1.25	30	11	35	17

Weights in '000 t. Shaded scenarios are not considered consistent with the Precautionary Approach.
[1)] SSB 2008 relative to SSB 2007.

Management considerations

An expected benefit of the effort management system was more stability for the fishing fleet. The fleets were expected to target the most abundant fish species, thus reducing the fishing mortality on stocks that are in bad shape. However, low prices on saithe and haddock and high prices for cod have kept the fishing mortality high on cod. Targeting of cod

appears to be more influenced by economic factors than relative abundance of the stocks. Management should include measures that avoid a disproportionate targeting of depleted stocks.

Management plan evaluations

The effort management system translates to an average F of 0.45. Preliminary analyses by ICES indicate that there is a low probability that the SSB will fall below $\mathbf{B}_{lim}$ in the long term with this F, but a full evaluation needs to be undertaken that incorporates the relationship between fishing mortality and fishing days.

Ecosystem considerations

The effort management system needs to consider changes in catchability of the fishery. For baited hook gear, catchability is related to the amount of food available in the ecosystem. Therefore, low ecosystem production may decrease cod production and increase the catchability of longline gear. Since the majority of cod catches are taken by longlines, fishing mortality will increase. Primary productivity of the Faroe ecosystem in 2006 appears to be about average, but may vary by a factor of five which has profound effects on fish stocks. Extended periods of low ecosystem production may require a reconsideration of the effort management system.

The productivity of the Faroe Shelf ecosystem has been shown to be of ultimate importance to the cod stock (Steingrund and Gaard, 2005). The spawning stock biomass depends heavily upon the recruitment which in turn depends heavily upon the productive state of the Faroe Shelf ecosystem. The index of primary production was low in 2002, 2003, and 2005, above average in 2004, and appears to be about average in 2006; the final estimate of the primary production will, however, not be available until late June. In order to get a recovery of the cod stock in the near future the productive state of the Faroe Shelf ecosystem must improve considerably in 2006 and 2007.

Factors affecting the fisheries and the stock

Regulations and their effects

An effort management system was implemented 1st of June 1996. Fishing days are allocated to all fleets fishing in shallow waters (< 380-m depth) for the period 1 September–31 August. In addition the majority of the shallow areas (< ca. 200 m) are closed for trawling, and are mainly utilised by longliners. The main spawning areas for cod are closed for nearly all fishing gears during spawning time.

Changes in fishing technology and fishing patterns

The effort management system invites improvement of fishing technology and fishing patterns. Some improvements were evident just after the introduction of the system, but no major improvements have been evident in subsequent years.

Scientific basis

Data and methods

The stock is assessed by an analytical method using survey and catch-at-age data. The technique was the same as the one used for last year's assessment, XSA calibrated by two research surveys. The Faroese catches on the Faroe-Iceland ridge, within the Vb1 area, were removed from the current assessment for the years 1999–2005. This was done because evaluation of tagging data indicated that the cod fished in this area was more likely to be of Icelandic origin than Faroese.

Comparison with previous assessment and advice

This year's assessment confirms the recent trends in fishing mortality and SSB. The advice is consistent with that in previous years.

Source of information

Report of the North-Western Working Group, 25 April–4 May 2006 (ICES CM 2006/ACFM:26).

Gaard, E., Hansen B., and Heinesen, S. P. 1998. Phytoplankton variability on the Faroe shelf. *ICES Journal of Marine Science*, Vol. 55: 688-696.

Steingrund, P., and Gaard, E. 2005. Relationship between phytoplankton production and cod production on the Faroe Shelf. *ICES Journal of Marine Science*, Vol. 62: 163-176.

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	No increase in F	<31		21.4
1988	No increase in F (Revised estimate)	<29 (23)		23.2
1989	No increase in F	<19		22.1
1990	No increase in F	<20		13.5
1991	TAC	<16		8.8
1992	No increase in F	<20		6.4
1993	No fishing	0		6.1
1994	No fishing	0	8.5/12.5[1,2]	9.0
1995	No fishing	0	12.5[1]	23.0
1996	F at lowest possible level	-	20[2]	40.4
1997	80% of F(95)	<24	-	34.3
1998	30% reduction in effort from 1996/97	-	-	24.0
1999	F less than proposed $\mathbf{F}_{pa}$ (0.35)	<19		18.3
2000	F less than proposed $\mathbf{F}_{pa}$ (0.35)	<20		21.0
2001	F less than proposed $\mathbf{F}_{pa}$ (0.35)	<16		28.1
2002	75% of F(2000)	<22		38.5
2003	75% of F(2001)	<32		24.6
2004	25% reduction in effort	-		13.2
2005	Rebuilding plan involving large reduction	-		10.5
2006	Rebuilding plan involving large reduction	-		
2007	Rebuilding plan involving large reduction in effort	-		

Weights in '000 t.

[1] In the quota year 1 September–31 August the following year. [2] The TAC was increased during the quota year.

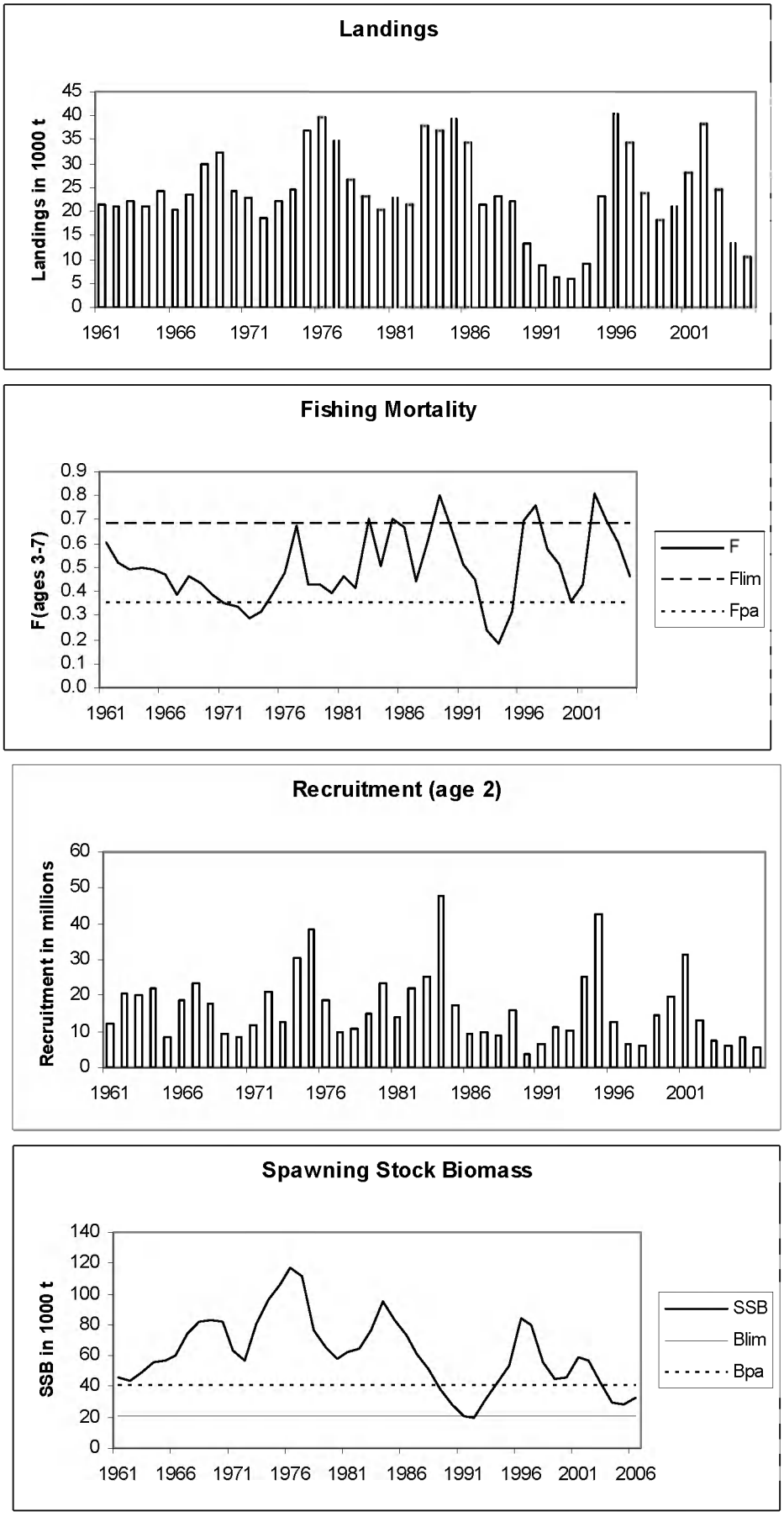


Figure 4.4.1.1 Faroe Plateau cod (Subdivision Vb1). Landings, fishing mortality, recruitment and SSB.

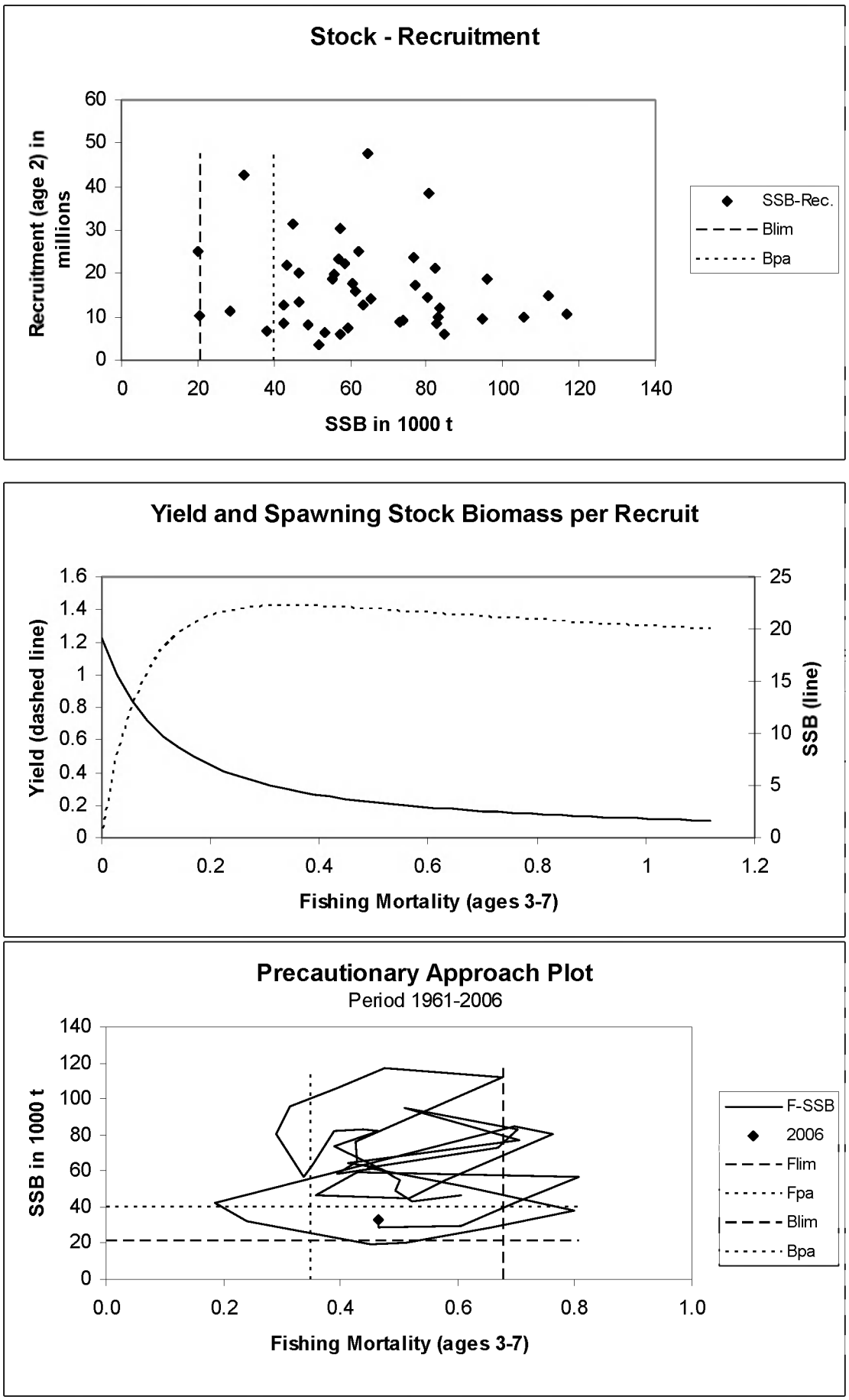


Figure 4.4.1.2 Faroe Plateau cod (Subdivision Vb1). Stock and recruitment; Yield and SSB per recruit.

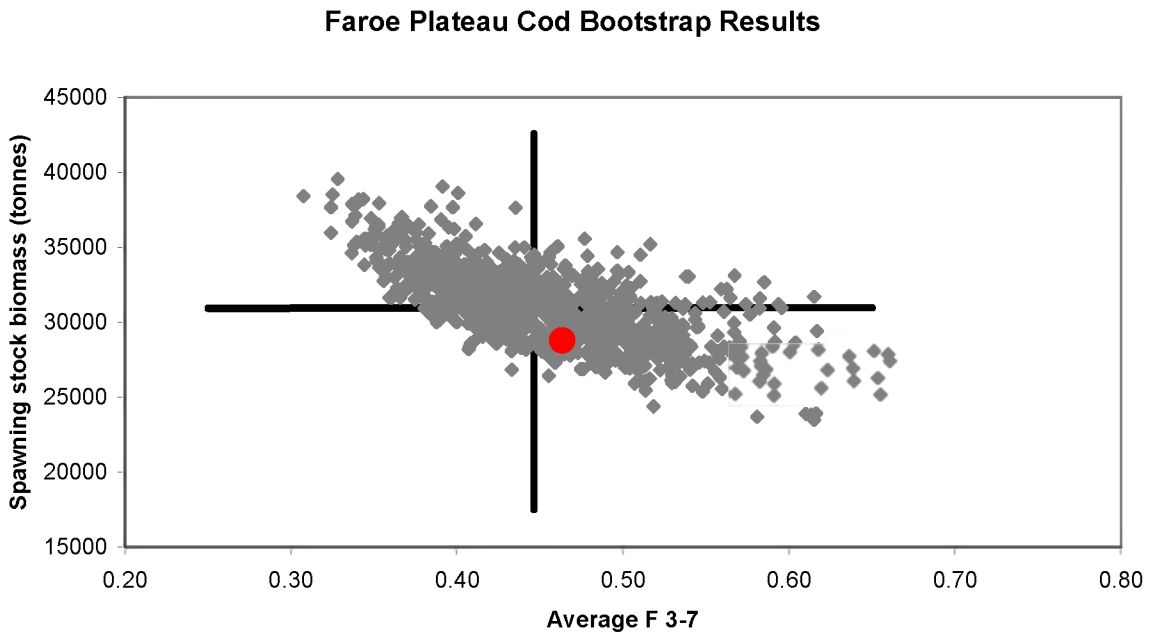


Figure 4.4.1.3 Faroe Plateau cod (Subdivision Vb1).

Table 4.4.1.1 Faroe Plateau (Subdivision Vb1) COD. Nominal catches (tonnes) by countries, 1986–2005, as officially reported to ICES.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Denmark	8	30	10	-	-	-	-	-	-	-	-	-	-
Faroe Islands	34,492	21,303	22,272	20,535	12,232	8,203	5,938	5,744	8,724	19,079	39,406	33,556	23,308
France	4	17	17	-	-	- [1]	3 [2]	1 [2]	-	2 [2]	1 [2]	-	- *
Germany	8	12	5	7	24	16	12	+	2 [2]	2	+	+	-
Norway	83	21	163	285	124	89	39	57	36	38	507	410	405
Greenland	-	-	-	-	-	-	-	-	-	-	-	-	-
UK (E/W/NI)	-	8	-	-	-	1	74	186	56	43	126	61 [2]	27 [2]
UK (Scotland)	-	-	-	-	-	-	-	-	-	-	-	-	-
United Kingdom	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	34,595	21,391	22,467	20,827	12,380	8,309	6,066	5,988	8,818	19,164	40,040	34,027	23,740

	1999	2000	2001	2002	2003	2004	2005 *
Denmark	-						
Faroe Islands	19,156		29,762	40,602	30,259	17,540	15,063
France	- *	1	9 [2]	20	14	2	0
Germany	39	2	9	6	7	3 [2]	
Iceland	-	-	-	5	-		
Norway	450	374	531 *	573	527	414	201
Greenland	-	-	-	29 [2]	-		
Portugal						1	
UK (E/W/NI) [2]	51	18	50	42	15	15	
UK (Scotland) [1]	-	-	-	-	-	-	-
United Kingdom							[1]
Total	19,696	395	30,361	41,277	30,822	17,975	15,264

* Preliminary

[1)] Included in Vb2.

[2)] Reported as Vb.

Table 4.4.1.2 Nominal catch (tonnes) of COD in Subdivision Vb1 (Faroe Plateau) 1986–2005, as used in the assessment.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Officially reported	34,595	21,391	22,467	20,827	12,380	8,309	6,066	5,988	8,818	19,164	40,040	34,027	23,740
Faroese catches in IIA within Faroe area jurisdiction			715	1,229	1,090	351	154						
Expected misreporting/discard										3330			
French catches as reported to Faroese authorities				12	17								
Catches reported as Vb2:													
UK (E/W/NI)					-	-	+	1	1	-	-	-	-
UK (Scotland)					205	90	176	118	227	551	382	277	265
Used in the assessment	34,595	21,391	23,182	22,068	13,487	8,750	6,396	6,107	9,046	23,045	40,422	34,304	24,005

	1999	2000	2001	2002	2003	2004	2005 *
Officially reported	19,696	395	30,361	41,277	30,822	17,975	15,264
Faroese catches in Vb1		21,793 *					
Correction of Faroese catches in Vb1 [1]			-1,766	-2,409	-1,795	-1,041	-894
Faroese catch on the Faroe-Icelandic ridge	-1,600	-1,400	-700	-600	-4,700	-4,000	-4,200
Greenland [2]						35	
France [2]						2	
Catches reported as Vb2:							
UK (E/W/NI)	-	-	-	-	-	-	
UK (Scotland)	210	245	288	218	254	244	
United Kingdom				-	-	-	329
Used in the assessment	18,306	21,033	28,183	38,486	24,581	13,215	10,499

[*)] Preliminary

[1)] In order to be consistent with procedures used previous years.

[2)] Reported to Faroese Coastal Guard.

Table 4.4.1.3 Faroe Plateau cod (Subdivision Vb1).

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-7
1961	12019	46439	21598	0.6059
1962	20654	43326	20967	0.5226
1963	20290	49054	22215	0.4944
1964	21834	55362	21078	0.5017
1965	8269	57057	24212	0.4909
1966	18566	60629	20418	0.4743
1967	23451	73934	23562	0.3900
1968	17582	82484	29930	0.4642
1969	9325	83487	32371	0.4375
1970	8608	82035	24183	0.3882
1971	11928	63308	23010	0.3526
1972	21320	57180	18727	0.3358
1973	12573	80516	22228	0.2886
1974	30480	95831	24581	0.3139
1975	38319	105676	36775	0.3947
1976	18575	116736	39799	0.4749
1977	9995	111863	34927	0.6757
1978	10748	76608	26585	0.4259
1979	14997	65380	23112	0.4273
1980	23582	58386	20513	0.3945
1981	14000	62058	22963	0.4648
1982	22127	64695	21489	0.4138
1983	25157	76931	38133	0.7057
1984	47755	94846	36979	0.5082
1985	17315	83164	39484	0.7015
1986	9506	72949	34595	0.6694
1987	9914	61522	21391	0.4456
1988	8673	51640	23182	0.6084
1989	16032	38173	22068	0.7988
1990	3675	28631	13487	0.6581
1991	6681	20613	8750	0.5107
1992	11412	19886	6396	0.4519
1993	10124	32180	6107	0.2393
1994	25208	42324	9046	0.1861
1995	42748	53448	23045	0.3179
1996	12870	84752	40422	0.6961
1997	6460	80264	34304	0.7613
1998	5944	55560	24005	0.5800
1999	14393	45008	18306	0.5163
2000	19793	46369	21033	0.3575
2001	31439	59387	28183	0.4292
2002	13291	57199	38486	0.8064
2003	7426	42489	24581	0.6962
2004	5951	29498	13215	0.6062
2005	8538	28754	10499	0.4635
2006	5682	32822		0.4635
Average	16418	61532	24243	0.4980

4.4.2 Faroe Bank cod (Subdivision Vb_2)

State of the stock

In the absence of defined reference points the state of the stock cannot be fully evaluated. The available information is inadequate to evaluate spawning stock or fishing mortality relative to risk; however, the exploitation rate might not be sustainable.

Management objectives

There are no explicit management objectives for this stock.

Reference points

No reference points have been defined for the stock

Single-stock exploitation boundaries

ICES advises that fishing effort of the Faroe Bank should not exceed that exerted annually from 1996 to 2002 and that the current spawning closure introduced in 2005 be maintained.

Short-term implications

The ratio of landings to the survey cpue index provides an exploitation ratio, which can be used as a proxy to relative changes in fishing mortality. The exploitation ratio has been higher than average in the last three years.

Management considerations

The landing estimates are uncertain because since 1996 the vessels are allowed to fish both on the Faroe Plateau and on the Faroe Bank during the same trip, making it difficult to assign landings to area. Given the relative size of the two fisheries, this causes greater uncertainty regarding catches of Faroe Bank cod than for Faroe Plateau cod, but the magnitude remains unquantified for both. The ability to provide advice depends on the reliability of the input data. Because the cod landings from the Faroe Bank are not known exactly, it is very difficult to provide reliable advice on effort and/or catches. If the fishery management agency intends to manage the two fisheries to protect the productive capacity of each individual unit, then it is necessary to monitor and regulate the catch removed from each stock.

The CPUE of the spring survey was low during 1988 to 1995 varying between 73 and 95 kg per tow. Though the data is noisy, the survey suggests a higher, possibly increasing biomass during 1995–2002. The summer and the spring survey both indicate that the biomass has declined since 2003 and is low at present. Hence, the present exploitation rate may not be sustainable.

The effort has been extremely high in 2003 and was still fairly high in 2005.

Factors affecting the fisheries and the stock

Regulations and their effects

Fishing on the bank is restricted to longliners and jiggers, which are regulated through individual vessel effort quotas. For the fishing year 1 September 2004 to 31 August 2005 the number of allocated fishing days has been reduced by 10%. However, the reduction did not materialise in a decrease of realised fishing days. In 2005 the authorities introduced a total fishing ban during the spawning period, i.e. 1 March to 1 May.

Scientific basis

Data and methods

The assessment is based on trends in catch rates in two research surveys.

Uncertainties in assessment and forecast

The landing estimates are uncertain because since 1996 the vessels have been allowed to fish both on the Faroe Plateau and on the Faroe Bank during the same trip, making it difficult to assign landings to area. Given the relative size of the

two fisheries, this causes greater uncertainty regarding catches for Faroe Bank cod than for Faroe Plateau cod, but the magnitude remains unquantified for both.

Comparison with previous assessment and advice

This advice is the same as that given by ICES since 2004.

Source of information

Report of the North-Western Working Group, 25 April–4 May 2006 (ICES CM 2006/ACFM:26).

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official Landings
1987	No assessment	-		3.5
1988	No assessment	-		3.1
1989	Addition to Faroe Plateau TAC	~2.0		1.4
1990	Access limitation may be required	-		0.6
1991	Access limitation may be required	-		0.4
1992	No fishing	0.3		0.3
1993	TAC	0.5		0.4
1994	TAC	0.5		1.0
1995	Precautionary TAC	0.5		1.2
1996	Precautionary TAC	0.5	1.0	2.5
1997	Effort at present levels	0.7	Not applicable	3.9
1998	Effort at present levels	-		3.5
1999	Effort not to exceed that exerted in 1996–1997	-		1.3
2000	Effort not to exceed that of 1996–1998	-		1.2[1]
2001	Effort not to exceed that of 1996–1999	-		1.1[1]
2002	Effort not to exceed that of 1996–2000	-		1.8[1]
2003	Effort not to exceed that of 1996–2001	-		5.7[1]
2004	Effort not to exceed that of 1996–2002	-		3.4[1]
2005	Effort not to exceed that of 1996–2002	-		1.1[1]
2006	Effort not to exceed that of 1996–2002	-		
2007	Effort not to exceed that of 1996–2002	-		

Weights in '000 t.
[1)] Working group estimates.

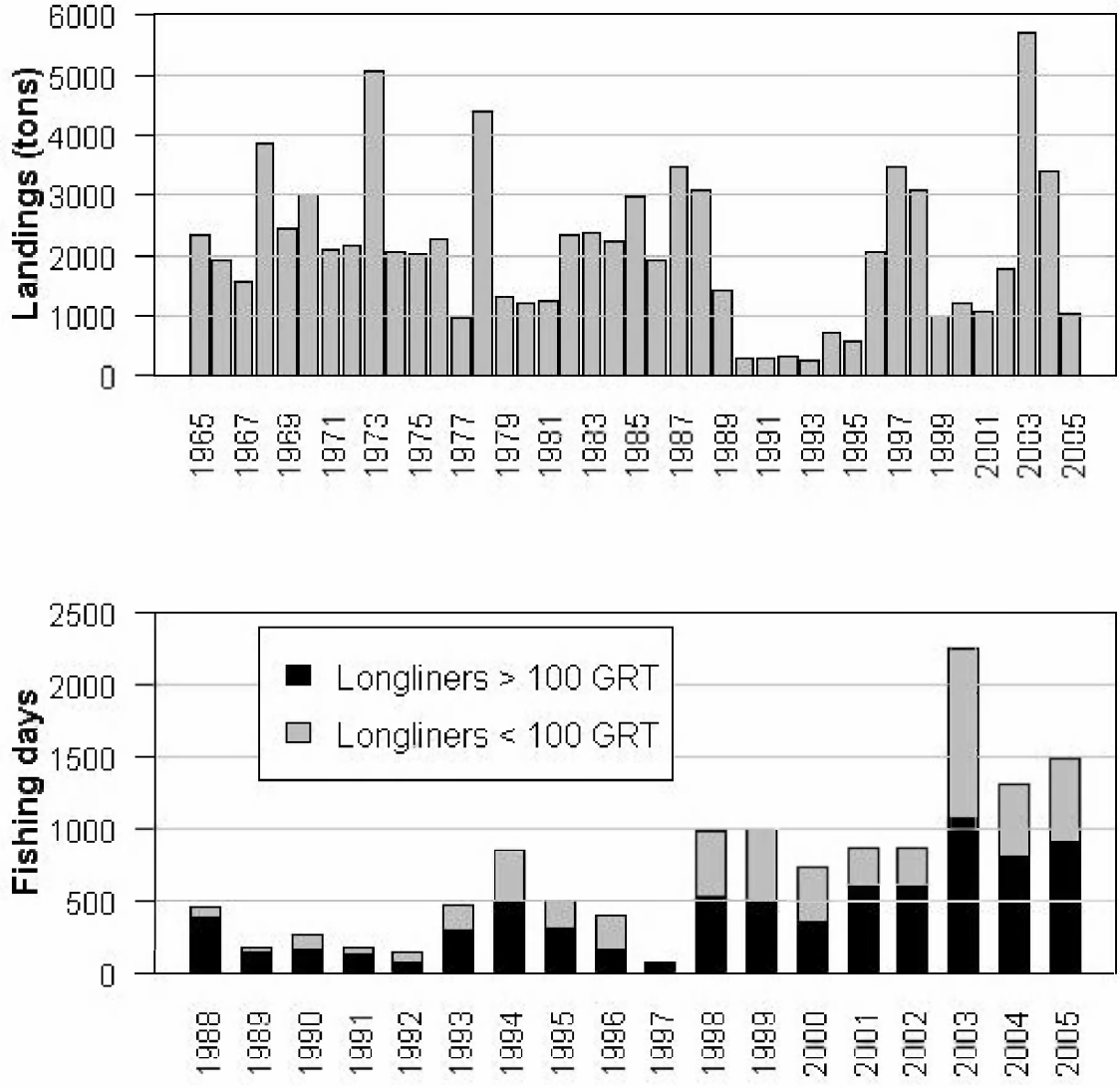


Figure 4.4.2.1. Upper plot: Reported landings 1965–2005. Since 1992 only catches from Faroese and Norwegian vessels are considered to be taken on the Faroe Bank. Lower plot: fishing days 1988–2005 for longline gear type on the Faroe Bank.

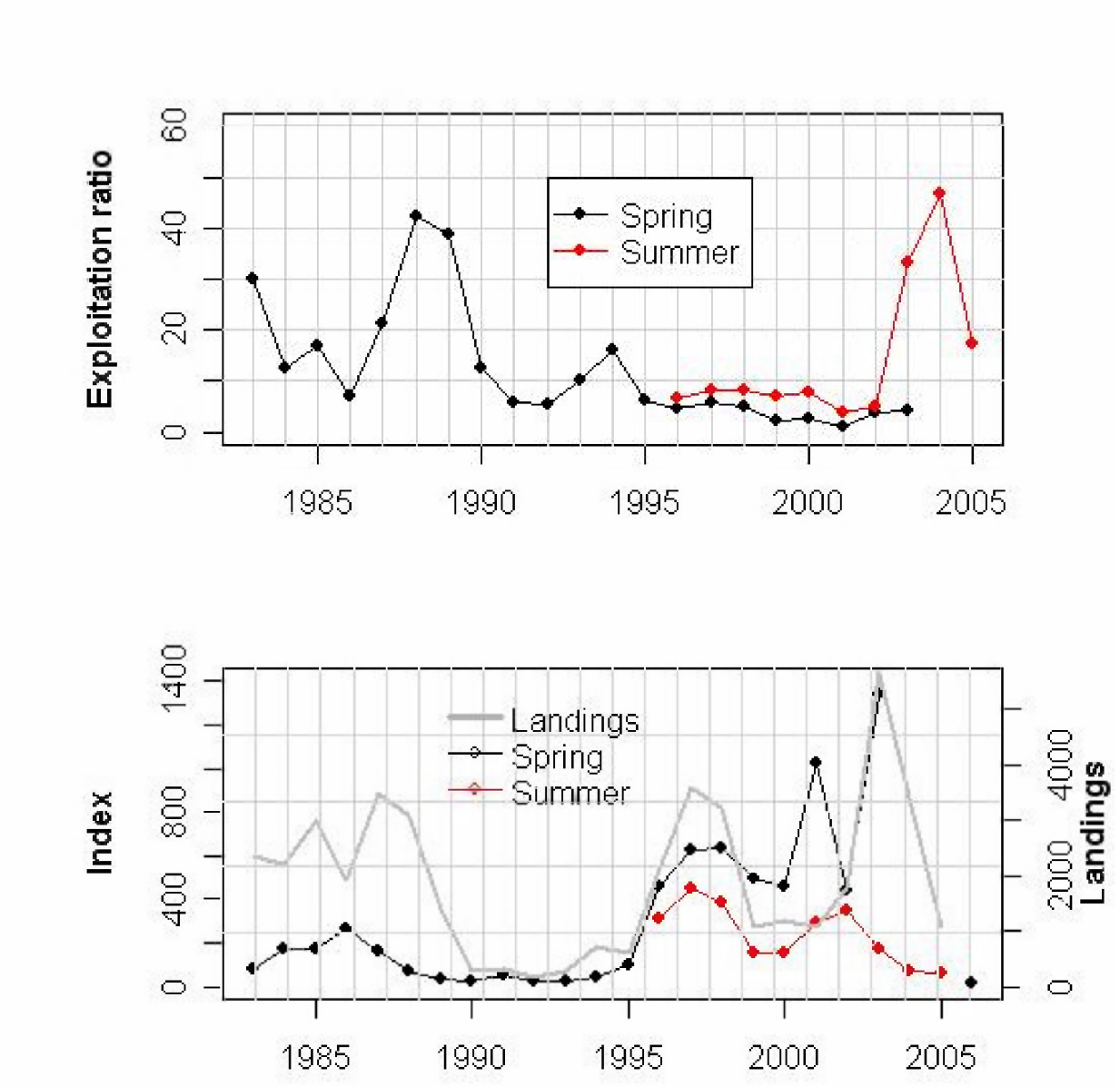


Figure 4.4.2.2. Faroe Bank (Subdivision Vb_2) cod. Exploitation ratio (ratio of landings to survey interpreted as an index of exploitation rate). Lower plot: Landings and cpue (kg/hr) in spring and summer survey.

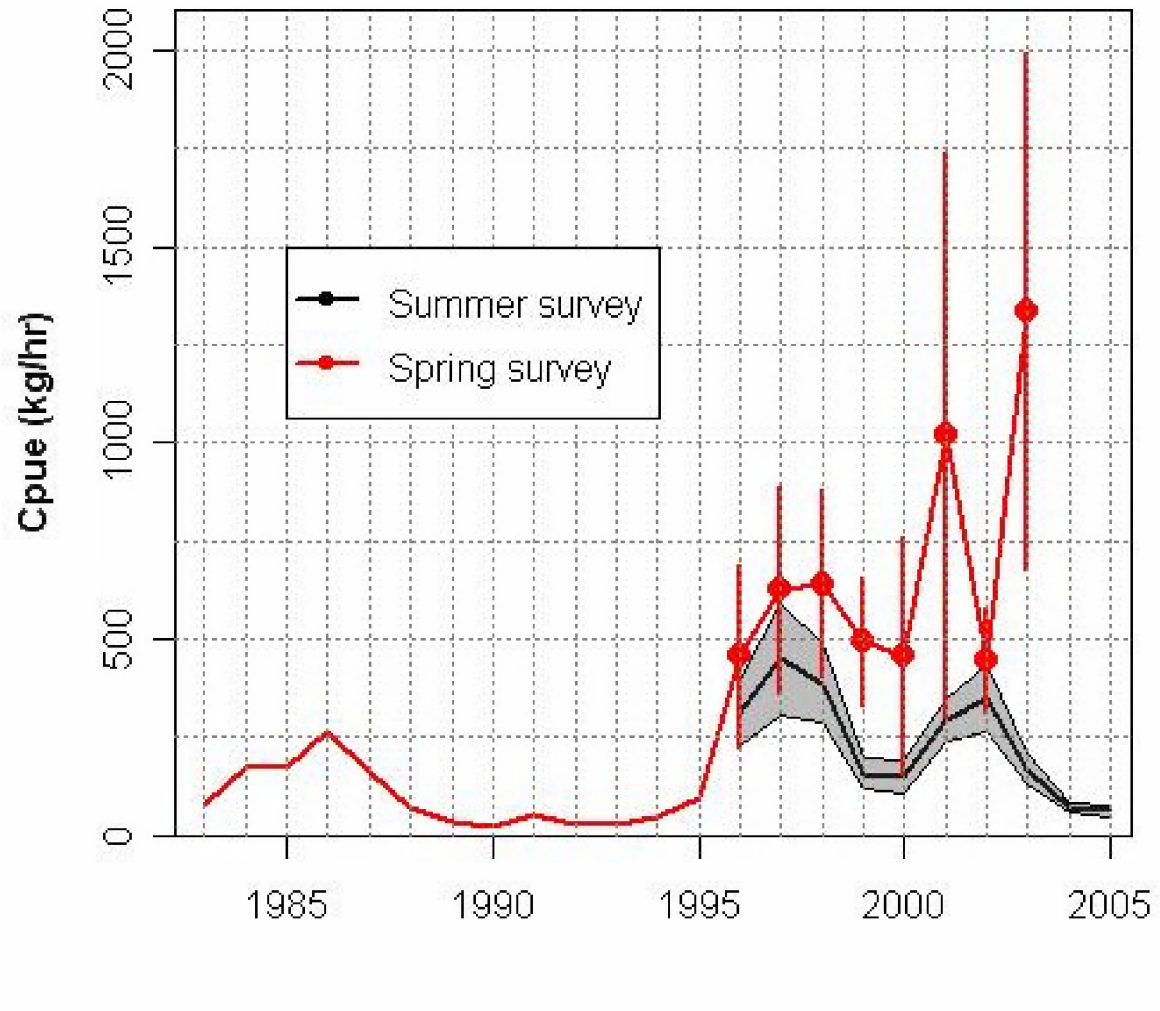


Figure 4.4.2.3 Faroe Bank (Subdivision Vb2) cod. Catch per unit of effort in the spring groundfish survey and summer survey. Vertical bars and shaded areas show the standard error in the estimation of indexes.

Table 4.4.2.1 Faroe Bank (Subdivision Vb2) cod. Nominal catches (tonnes) by countries 1986–2005 as officially reported to ICES. From 1992 the catches by Faroe Islands and Norway are used in the assessment.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Faroe Islands	1836	3409	2960	1270	289	297	122	264	717	561
Norway	6	23	94	128	72	38	32	2	8	40
UK (E/W/NI)	-	-	-	-	-	-	+	1	1	- [2]
UK (Scotland) [1]	63	47	37	14	205	90	176	118	227	551 [3]
United Kingdom										
Total	1905	3479	3091	1412	566	425	330	385	953	1152
Used in assessment					289	297	154	266	725	601

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005 *
Faroe Islands	2051	3459	3092	1001		1094	1840	5957	3607	1106
Norway	55	135	147	88	49	51	25	72	18	37 *
UK (E/W/NI)	- [2]	- [2]	- [2]	-	-	-	-	-	-	
UK (Scotland)	382	277	265	210	245	288	218	254	-	
United Kingdom				-	-	-	-	-	259 [3]	329 [3]
Total	2488	3871	3504	1299	294	1433	2083	6283	3884	1472
Correction of Faroese catches in Vb2						-65	-109	-353	-214	-66
Used in assessment	2106	3594	3239	1089	1194	1080	1756	5676	3411	1077

*) Preliminary

1) Includes Vb1

2) Included in Vb1

3) Reported as Vb

4.4.3 Faroe Haddock ICES Division Vb

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Full reproductive capacity	Increased risk	Overexploited	Below agreed target	

Based on the most recent estimates of SSB and fishing mortality, ICES classifies the stock as having full reproductive capacity and at increased risk of being harvested unsustainably. The 2005 estimate of fishing mortality is just above $\mathbf{F}_{pa}$. SSB has increased in recent years as a result of strong recruitments, including the record high 1999 year class. Recent year classes are estimated to be small and combined with low individual growth, and SSB is now declining.

Management objectives

The effort management system implemented in the Faroese demersal fisheries in Vb since 1996 aims at harvesting on average 33% of the haddock exploitable stock in numbers. This translates into an average F of 0.45, above the $\mathbf{F}_{pa}$ of 0.25. ICES considers this to be inconsistent with the Precautionary Approach.

Reference points

	ICES considers that:	ICES proposed that:
Precautionary Approach reference points	$\mathbf{B}_{lim}$ is 40 000 t.	$\mathbf{B}_{pa}$ be set at 55 000 t.
	$\mathbf{F}_{lim}$ is 0.40.	$\mathbf{F}_{pa}$ be set at 0.25.

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 3–7	Yield/R	SSB/R
Average last 3 years	0.347	0.663	2.407
$\mathbf{F}_{max}$	0.648	0.679	1.718
$\mathbf{F}_{0.1}$	0.164	0.580	3.531
$\mathbf{F}_{med}$	0.412	0.671	2.195

Technical basis:

$\mathbf{B}_{lim}$: Former MBAL.	$\mathbf{B}_{pa}$: based on inspection of the SSB-R scatter plot.
$\mathbf{F}_{lim}$: 2 *std. Dev. Above $\mathbf{F}_{pa}$.	$\mathbf{F}_{pa}$: $\mathbf{F}_{med}$ (1998) = 0.25.

Single-stock exploitation boundaries

Exploitation boundaries in relation to existing management plans

No management plan is available for this stock, but the management objectives are an exploitation rate equivalent to a fishing mortality of 0.45 on average. The current F estimate (0.26) is below the management target.

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

The current fishing mortality estimated as 0.26 is above $\mathbf{F}_{0.1}$ (0.16).

Exploitation boundaries in relation to precautionary limits

To maintain SSB above $\mathbf{B}_{pa}$ in 2008, requires a reduction in the current fishing mortality to 0.20 in 2007, corresponding to an effort reduction of about 24% assuming linearity in the relationship between fishing effort and fishing mortality.

Short-term implications

Outlook for 2007

Basis: F(2006) =0.26; SSB(2007) = 67; catch (2006) = 22.
The fishing mortality applied according to the agreed management plan (F(management plan)) is 0.45.
The maximum fishing mortality which would be in accordance with precautionary limits (F (precautionary limits)) is 0.25.

Rationale	**F (2007)**	**Basis**	**SSB 2007**	**Landings** 2007	**SSB (2008)**	**%SSB change** [1)]
Zero catch	0	F=0	67	0	72	3
Target reference point	0.45	$\mathbf{F}_{target}$	67	30	40	-40
Status quo	0.26	$\mathbf{F}_{sq}$	67	20	51	-24
High long-term yield	0.16	F(long-term yield) $\mathbf{F}_{0.1}$	67	13	58	-13
Agreed management plan	0.05	F(man. plan) * 0.1	67	5	67	0
	0.11	F(man. plan) * 0.25	67	9	62	-7
	0.23	F(man. plan) * 0.50	67	18	53	-21
	0.34	F(man. plan) * 0.75	67	24	46	-31
	0.41	F(man. plan) * 0.90	67	28	42	-37
	0.45	F(man. plan)	67	30	40	-40
	0.50	F(man. plan) * 1.1	67	32	38	-43
	0.56	F(man. plan) * 1.25	67	35	34	-49
Precautionary limits	0.03	F($\mathbf{F}_{pa}$)* 0.1	67	2	70	4
	0.06	F($\mathbf{F}_{pa}$)* 0.25	67	5	66	1
	0.13	F($\mathbf{F}_{pa}$)* 0.5	67	11	60	-10
	0.19	F($\mathbf{F}_{pa}$)* 0.75	67	15	56	-16
	0.23	F($\mathbf{F}_{pa}$)* 0.90	67	18	53	-21
	0.25	$\mathbf{F}_{pa}$ (=$\mathbf{F}_{sq}$ *0.96)	67	19	51	-24
	0.28	F($\mathbf{F}_{pa}$)* 1.1	67	20	50	-25
	0.31	F($\mathbf{F}_{pa}$)* 1.25	67	22	48	-28
Mixed fisheries	0.20	Coupling with cod; $\mathbf{F}_{sq}$ * 0.76	67	16	55	-18

Weights in '000 t. Shaded scenarios are not considered consistent with the Precautionary Approach.
[1)] SSB 2008 relative to SSB 2007.

Management considerations

An expected benefit of the effort management system was more stability for the fishing fleet. The fleets were expected to target the most abundant fish species, thus reducing the fishing mortality on stocks that are in bad shape. However, low prices on saithe and haddock and high prices for cod have kept the fishing mortality lower than expected for haddock. Targeting of haddock appears to be more influenced by economic factors than relative abundance of the stocks. Management should include measures that avoid a disproportionate targeting of depleted stocks.

The exploitation boundary indicated above is consistent with that suggested for cod.

Management plan evaluations

The effort management system translates to an average F of 0.45. Preliminary analyses by ICES indicate that there is a moderate probability that the SSB will fall below $\mathbf{B}_{lim}$ in the long term with this F, but a full evaluation needs to be undertaken that incorporates the relationship between fishing mortality and fishing days.

Ecosystem considerations

The effort management system needs to consider changes in fishery catchability. For baited hook gear, catchability is related to the amount of other food available. Therefore, low ecosystem production may decrease haddock production and increase the catchability of longline gear. Primary productivity of the Faroe ecosystem in 2005 appears to be about average, but may vary by a factor of five and has profound effects on fish stocks. Extended periods of low ecosystem production may require a reconsideration of the effort management system.

Factors affecting the fisheries and the stock

Regulations and their effects

An effort management system was implemented 1st of June 1996. Fishing days are allocated to all fleets fishing in shallow waters (< 380-m depth) for the period 1 September–31 August. In addition the majority of the shallow areas (< ca. 200 m) are closed for trawling, and are mainly utilised by longliners.

Changes in fishing technology and fishing patterns

The effort management system invites improvement of fishing technology and fishing patterns. Some improvements were evident just after the introduction of the system, but no major improvements have been evident in subsequent years.

Scientific basis

Data and methods

The advice is based on an analytical assessment (XSA) using age-disaggregated indices from two research surveys. Recruitment estimates were available from the surveys.

No estimates of discards of haddock are available, but there is no incentive to discard in order to high-grade landings as quotas are not used in the management of this stock. Additionally, there is a ban on discarding. Hence, the landings statistics are regarded as reflecting the true level of catch and are considered to be appropriate for assessment purposes.

Uncertainties in assessment and forecast

The differences between this year's and last year's assessments are small.

Comparison with previous assessment and advice

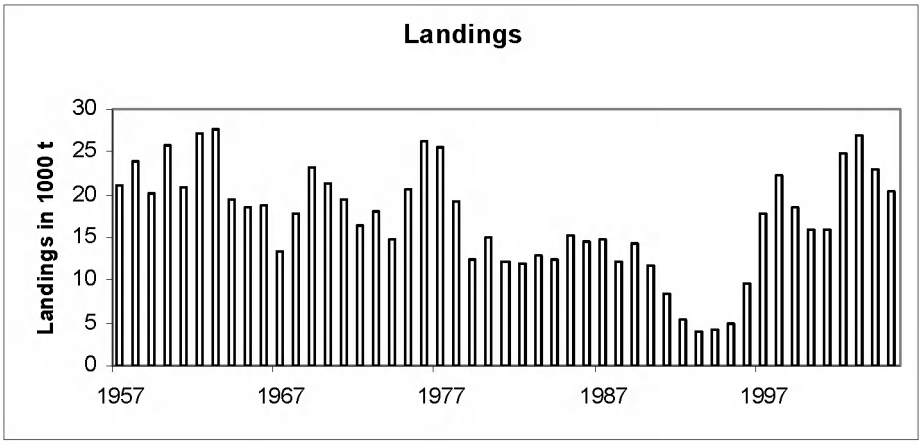
This year the input data series for the assessment have been extended back in time and additional ages have been added to the analysis. The survey data have also been slightly revised. This year's assessment confirms the historical trends in fishing mortality and SSB. The basis of the advice is the same.

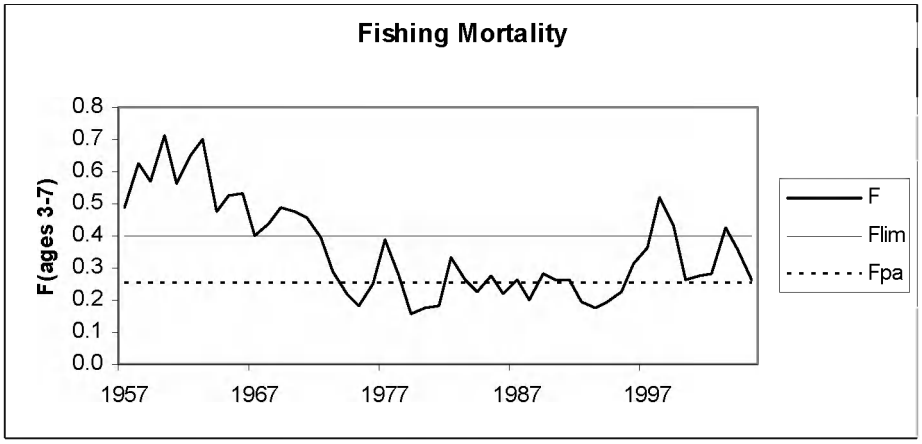
Source of information

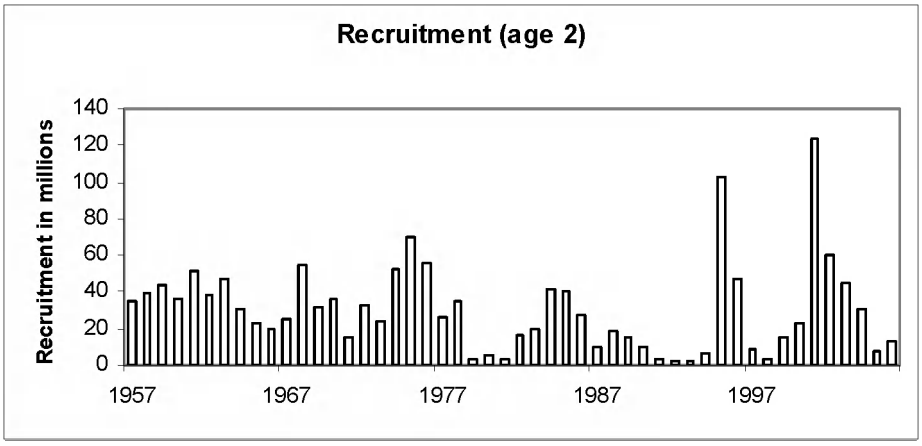
Report of the North-Western Working Group, 25 April–4 May 2006 (ICES CM 2006/ACFM:26).

Year	ICES Advice	Predicted catch Corresp. to advice	Agreed TAC	ACFM Catch
1987	No increase in F	17		14.9
1988	No increase in F	18		12.2
1989	No increase in F	11		14.3
1990	No increase in F	11		11.7
1991	TAC	11		8.4
1992	TAC	13-15		5.5
1993	Reduction in F	8		4.0
1994	No fishing	0	6.2	4.3
1995	No fishing	0	6.2	4.9
1996	TAC	8.3	12.6	9.6
1997	F= F(95)	9.3		17.9
1998	F =F(96)	16		22.2
1999	F < proposed $\mathbf{F}_{pa}$ (0.25)	9		18.5
2000	F < proposed $\mathbf{F}_{pa}$ (0.25)	22		15.8
2001	F < proposed $\mathbf{F}_{pa}$ (0.25)	20		15.9
2002	No fishing	0		25.0
2003	F<proposed $\mathbf{F}_{pa}$ (0.25)	12		27.0
2004	F<proposed $\mathbf{F}_{pa}$ (0.25)	21		23.0
2005	F<proposed $\mathbf{F}_{pa}$ (0.25)	19		20.3
2006	F<proposed $\mathbf{F}_{pa}$ (0.25)	18		
2007	F < 0.20	16		

Weights in '000 t.







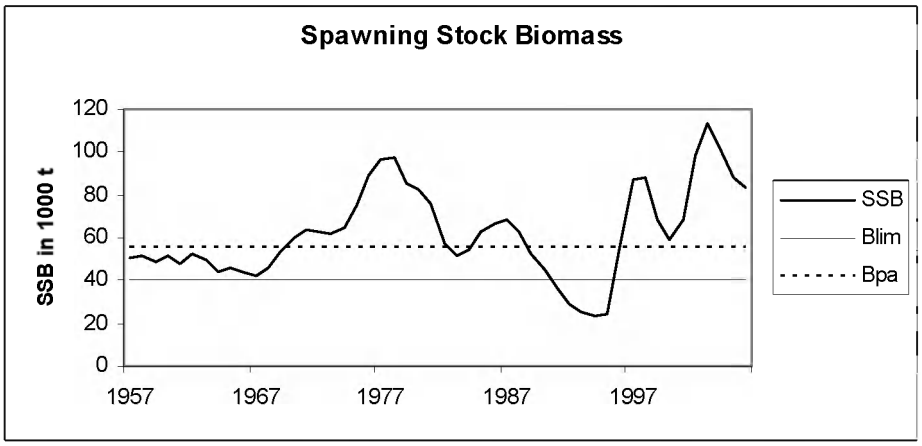
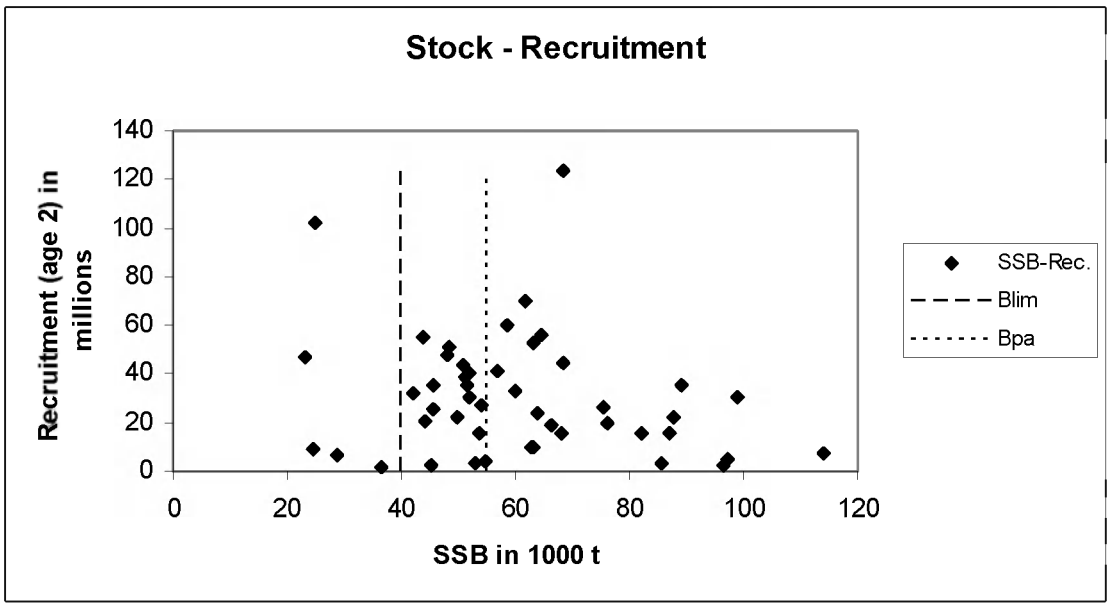
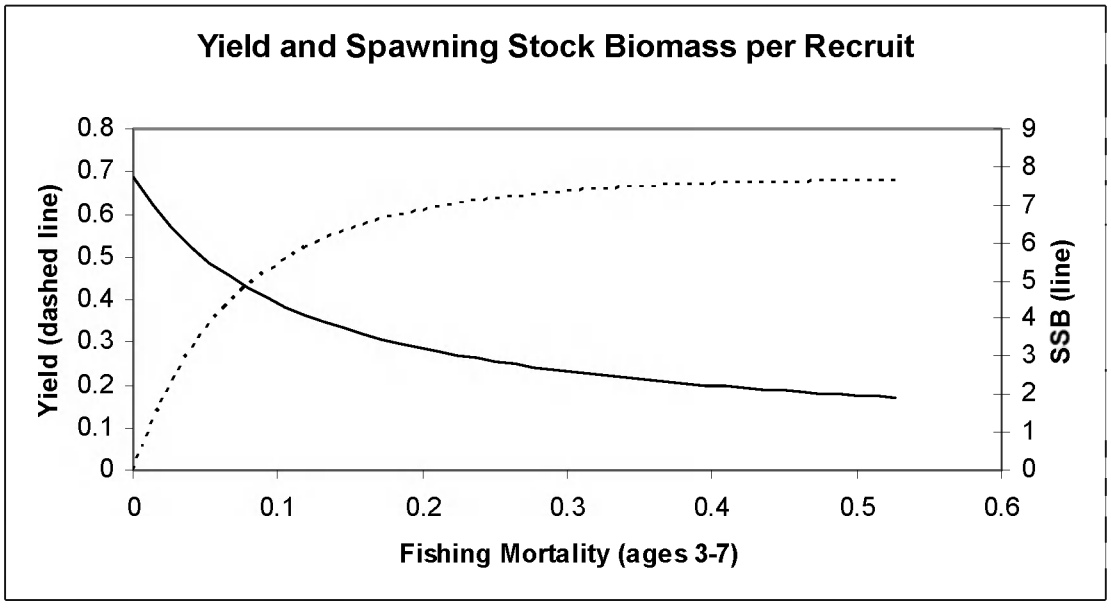


Figure 4.4.3.1 Faroe haddock (Division Vb). Landings, fishing mortality, recruitment and SSB.





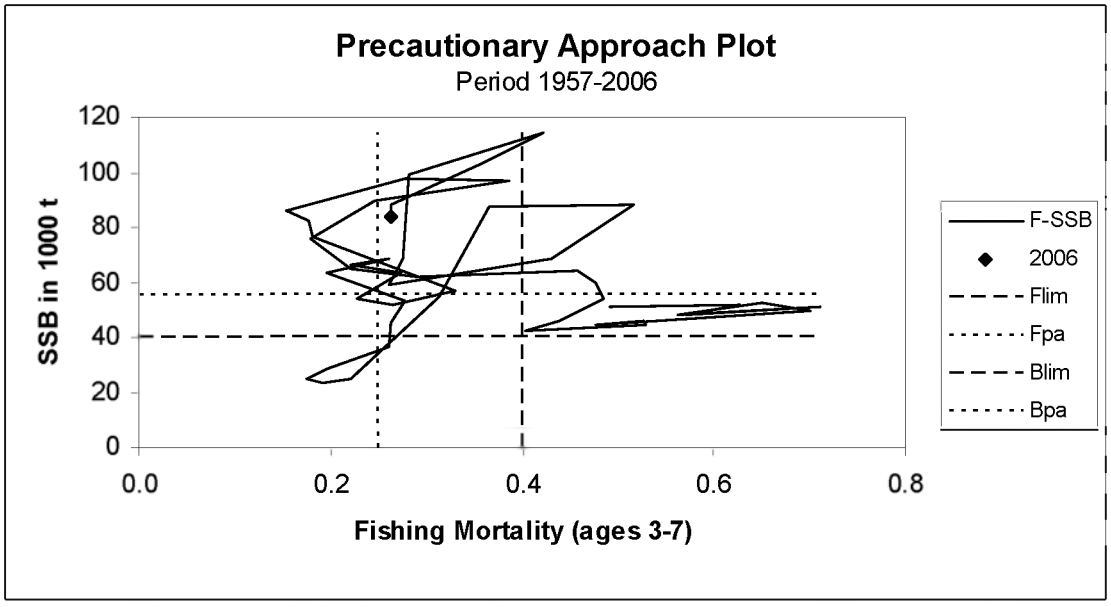


Figure 4.4.3.2 Faroe haddock (Division Vb). Stock and recruitment; Yield and SSB per recruit.

Table 4.4.3.1 Faroe Plateau (Sub-division Vb1) HADDOCK. Nominal catches (tonnes) by countries 1982-2005, I.e. Working Group estimates in Vb1.

Country	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Denmark	-	-	-	-	1	8	4	-	-	-	4,655	
Faroe Islands	10,319	11,898	11,418	13,597	13,359	13,954	10,867	13,506	11,106	8,074	164	3,622
France[1]	2	2	20	23	8	22	14	-	-	-	-	-
Germany	1	+	+	+	1	1	-	+	+	+		-
Norway	12	12	10	21	22	13	54	111	94	125	71	28
UK (Engl. and Wales)	-	-	-	-	-	2	-	-	7	-	54	81
UK (Scotland)[3]	1	-	-	-	-	-	-	-	-	-	-	-
United Kingdom												
Total	10,335	11,912	11,448	13,641	13,391	14,000	10,939	13,617	11,207	8,199	4,944	3,731
Working Group estimate[4,5]	11,937	12,894	12,378	15,143	14,477	14,882	12,178	14,325	11,726	8,429	5,476	4,026

Country	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004 #	2005 [2]
Faroe Islands	3,675	4,549	9,152	16,585	19,135	16,643	13,620 [8]	13,457 [8]	20,776 [8]	21,615	18,995	18,022
France[1]					2 [2,]	- [2]	6	8 [7]	2	4	1	+
Germany		5	-	-		33	1	2	6	1	6	
Greenland						*30* [6]	*22* [6]	*0* [6]	*4* [6]			
Iceland									4			
Norway	22	28	45	45 [2]	71	411	355	257 [2]	227	292	229	212
UK (Engl. and Wales)	31	23	5	22	30 [1]	59 [7]	19 [7]	4 [7]	11 [7]	14 [7]	8	
UK (Scotland)[11]	-	-	…	…	…							
United Kingdom												127 [4]
Total	3,728	4,605	9,202	16,652	19,238	17,176	14,023	13,728	21,030	21,926	19,239	18,361
Working Group estimate[4,5,8]	4,252	4,948	9,642	17,924	22,210	18,482	15,821	15,890	24,933	26,970	23,036	20,305

1) Including catches from Sub-division Vb2. Quantity unknown 1989-1991, 1993 and 1995-2001.

2) Preliminary data

3)From 1983 to 1996 catches included in Sub-division Vb2.

4) Includes catches from Sub-division Vb2 and Division IIa in Faroese waters.

5)Includes French and Greenlandic catches from Division Vb, as reported to the Faroese coastal guard service

6) Reported as Division Vb, to the Faroese coastal guard service.

7) Reported as Division Vb.

8) Includes Faroese landings reported to the NWWG by the Faroese Fisheries Laboratory

9) Included in Vb2

10) Includes 14 reported as Vb

Table 4.4.3.2 Faroe Bank (Sub-division Vb2) HADDOCK. Nominal catches (tonnes) by countries, 1982-2005, I.e. Working Group estimates in Vb2.

Country	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Faroe Islands	1,533	967	925	1,474	1,050	832	1,160	659	325	217	338	185
France[1]	-	-	-	-	-	-	-	-	-	-	-	-
Norway	1	2	5	3	10	5	43	16	97	4	23	8
UK (Engl. and Wales)	-	-	-	-	-	-	-	-	-	-	+	+
UK (Scotland)[3]	48	13	+	25	26	45	15	30	725	287	869	102
Total	1,582	982	930	1,502	1,086	882	1,218	705	1,147	508	1,230	295

Country	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004 [2]	2005
Faroe Islands	353	303	338	1,133	2,810	1,110	1,565 [5]	1,948	3,698	4,804	3,594	1899
France[1]	-	-	-	-								+
Norway	1	1	40	4	60	3	48	66	28	55	17	45
UK (Engl. and Wales)	+	... [1]	... [1]	... [1]	... [1]	[1]	[1]	[1]		[1]	[1]	[1]
UK (Scotland)[3]	170	39	62	135	102	193	185	148	177	185 [4]	186 [1]	[4]
Total	524	343	440	1,272	2,972	1,306	1,798	2,162	3,903	5,044	3,797	1,944

1) Catches included in Sub-division Vb1.

2) Provisional data

3)From 1983 to 1996 includes also catches taken in Sub-division Vb1 (see Table 2.4.1)

4) Reported as Division Vb.

5) Provided by the NWWG

Table 4.4.3.3 Faroe haddock (Division Vb).

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-7
1957	35106	51049	20995	0.4900
1958	39212	51409	23871	0.6270
1959	43417	48340	20239	0.5696
1960	35763	51101	25727	0.7101
1961	51279	47901	20831	0.5624
1962	38537	52039	27151	0.6506
1963	47362	49706	27571	0.7002
1964	30110	44185	19490	0.4753
1965	22644	45605	18479	0.5260
1966	20203	44027	18766	0.5288
1967	25356	42086	13381	0.4031
1968	54856	45496	17852	0.4377
1969	31977	53585	23272	0.4853
1970	35605	59962	21361	0.4762
1971	15460	63928	19393	0.4564
1972	33218	63144	16485	0.3961
1973	23706	61635	18035	0.2901
1974	52345	64648	14773	0.2205
1975	70116	75429	20715	0.1798
1976	56027	89263	26211	0.2474
1977	26224	96452	25555	0.3871
1978	35155	97344	19200	0.2778
1979	2794	85524	12424	0.1549
1980	4952	82042	15016	0.1776
1981	3497	76008	12233	0.1809
1982	15879	56947	11937	0.3299
1983	19742	51980	12894	0.2644
1984	41050	54076	12378	0.2273
1985	39972	63009	15143	0.2742
1986	26856	66222	14477	0.2215
1987	9641	68175	14882	0.2607
1988	19110	62932	12178	0.1973
1989	15581	52837	14325	0.2783
1990	9561	45139	11726	0.2623
1991	3046	36433	8429	0.2604
1992	2693	28690	5476	0.1965
1993	1827	24913	4026	0.1759
1994	6458	23324	4252	0.1922
1995	102308	24559	4948	0.2224
1996	46717	54606	9642	0.3134
1997	9276	87179	17924	0.3645
1998	3747	87693	22210	0.5165
1999	15363	68496	18482	0.4298
2000	22559	58616	15821	0.2601
2001	123868	68472	15890	0.2750
2002	60340	98849	24933	0.2817
2003	44507	113889	26970	0.4220
2004	30717	102654	23036	0.3541
2005	7291	87933	20305	0.2636
2006	12752	83380		
Average	30516	62258	17170	0.3544

4.4.4 Faroe saithe in Division Vb

State of the stock

The available information is inadequate to evaluate stock trends relative to reference points. Therefore, the state of the stock is unknown. However, the two survey-based biomass indices indicate that the exploitable biomass may be higher than at the start of the survey time-series. This can also be seen in the commercial cpue series.

Management objectives

The management objective is to achieve sustainable fisheries. An effort management system was implemented in the Faroese demersal fisheries (Division Vb) in 1996 and aims at harvesting, on average, 33% of the saithe stock in numbers. This translates into an average F of 0.45, above the $\mathbf{F}_{pa}$ of 0.28. ICES considers this to be inconsistent with the Precautionary Approach.

Reference points

	ICES considers that:	ICES proposed that:
Precautionary Approach reference points	$\mathbf{B}_{lim}$ is 60 000 t.	$\mathbf{B}_{pa}$ be set at 85 000 t.
	$\mathbf{F}_{lim}$ is 0.40.	$\mathbf{F}_{pa}$ be set at 0.28.

Technical basis

$\mathbf{B}_{lim}$: lowest observed SSB established in 1999 and corresponding to SSB in 1992.	$\mathbf{B}_{pa}$: former MBAL.
$\mathbf{F}_{lim}$: consistent with $\mathbf{B}_{lim}$ of 60 000 t.	$\mathbf{F}_{pa}$: consistent with $\mathbf{F}_{lim}$ and previous estimate of $\mathbf{F}_{med}$.

Single-stock exploitation boundaries

Exploitation boundaries in relation to existing management plans

Existing management plans are inconsistent with the Precautionary Approach.

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

Long-term yield reference points are not available as there is no accepted assessment [see 2005 advice].

Exploitation boundaries in relation to precautionary considerations

The stock cannot be evaluated with regard to PA limits. However, effort should not be allowed to increase compared to the present level. Furthermore, at landings in the range of 30–40 000 t, the biomass indices have increased. With landings above this level, biomass indices are fluctuating. Therefore, ICES suggests a level of exploitation corresponding to about 40 000 t. The stock seems to be sustained at a constant level in the short term.

Conclusion on exploitation boundaries

In the absence of an agreed management plan that is consistent with the precautionary approach, ICES concludes that the exploitation boundaries for this stock should be based on the precautionary considerations.

Management considerations

Given the uncertainties regarding stock size, the present spawning closures should be maintained.

The routine collection of information of the bycatch of saithe in the blue whiting fishery in ICES Division Vb should be undertaken. In the meantime, it is advised that sorting grids in the blue whiting fisheries become mandatory.

Management plan evaluations

The effort management system translates to an average F of 0.45. The management system has not been fully evaluated by ICES in relation to the defined $\mathbf{B}_{lim}$. A full evaluation should take into account the relationship between fishing mortality and fishing days.

Ecosystem considerations

Blue whiting is a forage species for saithe. A proportion of the saithe stock is far off the shelf, probably preying on blue whiting. The blue whiting fishery thus also affects saithe by removing blue whiting.

Factors affecting the fisheries and the stock

Regulations and their effects

Limited measurements in the blue whiting fishery in Faroe waters indicate that bycatch of saithe may be significant.

Changes in fishing technology and fishing patterns

Development in gear technology and optimizing fishing operations has resulted in an increase in the catchability since the early 1990s, preliminarily estimated in the order of 20% in the last decade.

Scientific basis

Data and methods

The commercial cpue used for stock evaluation have been standardized, taking into account season, fishing area, and boat factors. The survey biomass indices are based on stratified age-disaggregated stock in numbers multiplied by catch weight-at-age.

There are no recruitment indices available for ages younger than 3 in the terminal year. Existing research surveys may be of use in tuning, but this has not been fully evaluated.

Comparison with previous assessment and advice

An update of previous year's assessment model was unreliable because of major reduction in growth since 1996. Because of these changes the 2005 assessment cannot be used as an indication of current status and, e.g. the yield-per-recruit cannot be used. Various probable assumptions lead to very different perceptions of the status of the stock.

The basis for the advice has consequently changed as no analytical assessment is available. The advice is now based on average catch considerations.

Source of information

Report of the North-Western Working Group, 25 April–4 May 2006 (ICES CM 2006/ACFM:26).

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Landings
1987	No increase in F	<32		40
1988	No increase in F	<32		45
1989	Reduction in F	<40		44
1990	Reduction in F	<41		62
1991	TAC	<30		55
1992	Reduction in F	<27		36
1993	Reduction in F	<37		34
1994	TAC	<26	42[1]	33
1995	TAC	<22	39[1]	27
1996	TAC	<39	-	20
1997	20% reduction in F from 1995 level	<21	-	22
1998	30% reduction in effort from 1996/97 level	-	-	26
1999	F below $\mathbf{F}_{pa}$ (0.28)	<14		33
2000	F below than $\mathbf{F}_{pa}$ (0.28)	<15		39
2001	Reduce fishing effort to generate F well below $\mathbf{F}_{pa}$ (0.28)	<17		52
2002	Reduce fishing effort to generate F below $\mathbf{F}_{pa}$ (0.28)	<28		54
2003	Reduce fishing effort to generate F below $\mathbf{F}_{pa}$ (0.28)	<47		47
2004	Reduce fishing effort to generate F below Fpa (0.28)	<48		46
2005	Reduce fishing effort to generate F below $\mathbf{F}_{pa}$ (0.28)	<32		61
2006	Reduce fishing effort to generate F below $\mathbf{F}_{pa}$ (0.28)	<24		
2007	Average catch considerations	40		

Weights in '000 t.

[1] In the quota year 1 September–31 August the following year.

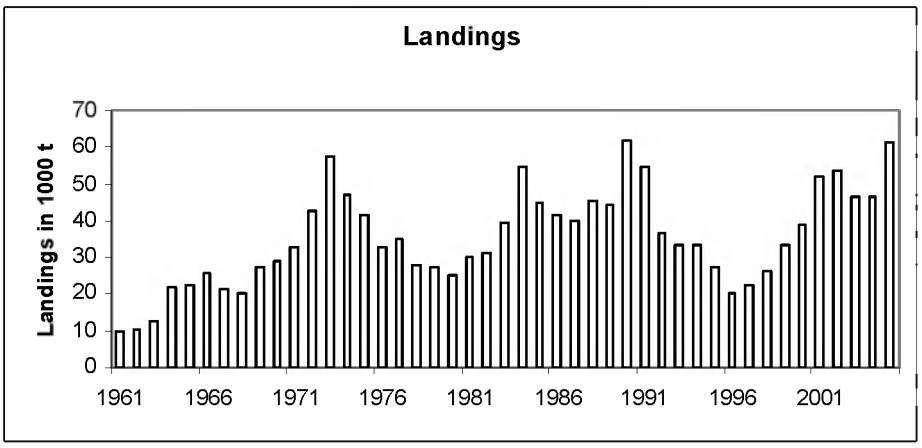


Figure 4.4.4.1. Saithe in the Faroes (Division Vb). Landings in '000 t.

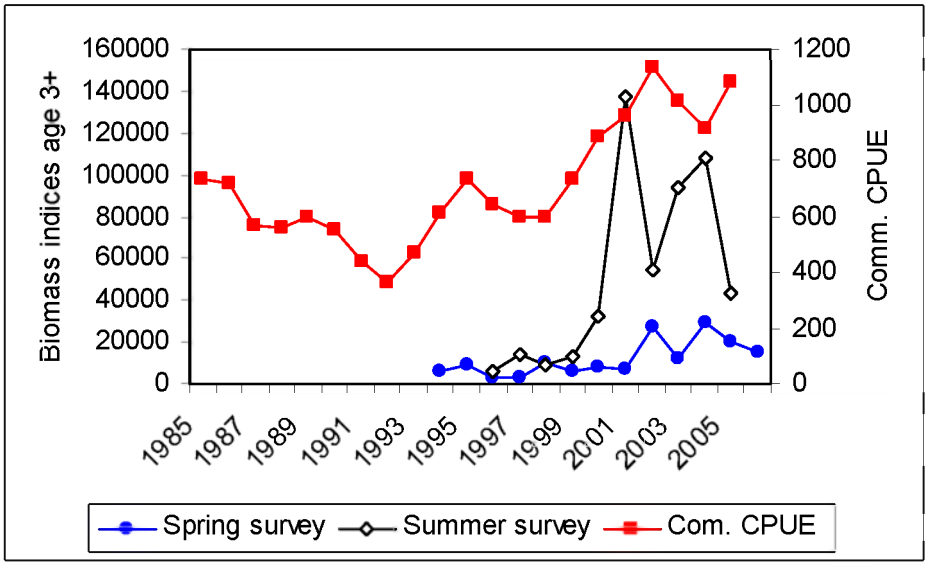


Figure 4.4.4.2 Saithe in the Faroes (Division Vb). CPUE series.

Table 4.4.4.1 Saithe in the Faroes (Division Vb). Nominal catches (tonnes) by countries, 1989–2005, as officially reported to ICES, and the Working Group estimate.

Country	1989	1990	1991	1992	1993	1994	1995	1996
Denmark	-	2	-	-	-	-	-	-
Faroe Islands	43,624	59,821	53,321	35,979	32,719	32,406	26,918	19,267
France [3]	-	-	-	120	75	19	10	12
Germany	-	-	32	5	2	1	41	3
German Dem.Rep.	9	-	-	-	-	-	-	-
German Fed. Rep.	20	15	-	-	-	-	-	-
Netherlands	22	67	65	-	-	-	-	-
Norway	51	46	103	85	32	156	10	16
UK (Eng. & W.)	-	-	5	74	279	151	21	53
UK (Scotland)	9	33	79	98	425	438	200	580
USSR/Russia [2]	-	30	-	12	-	-	-	18
Total	43,735	60,014	53,605	36,373	33,532	33,171	27,200	19,949
Working Group estimate [4,5]	44,477	61,628	54,858	36,487	33,543	33,182	27,209	20,029

Country	1997	1998	1999	2000	2001	2002	2003	2004	2005 [1]
Estonia	16	-	-	-	-	-	-	-	-
Faroe Islands	21,721	25,995	32,439		49,676	55,165	47,933	48,222	
France	9	17	-	273	934	607	370	147	100
Germany	5	-	100	230	667	422	281	186	1
Greenland	-	-	-	-		442			
Irland	-	-	-	-	5	-	-	-	-
Norway	67	53	160	72	60	77	94	82	82
Portugal	-	-	-	-	-	-	-	5	-
Russia	28	-	-	20	1	10	32	71	210
UK (E/W/NI)	-	19	67	32	80	58	89	85	
UK (Scotland)	460	337	441	534	708	540	610	748	
United Kingdom									940
Total	22,306	26,421	33,207	1,161	52,131	57,321	49,409	49,546	1,333
Working Group estimate [4,5,6,7]	22,306	26,421	33,207	39,020	51,786	53,546	46,555	46,355	61,372

[1] Preliminary.

[2] As from 1991.

[3] Quantity unknown 1989-91.

[4] Includes catches from Sub-division Vb2 and Division IIa in Faroese waters.

[5] Includes French, Greenlandic, Russian catches from Division Vb, as reported to the Faroese coastal guard service.

[6] Includes Faroese, French, Greenlandic catches from Division Vb, as reported to the Faroese coastal guard service.

[7] The 2001-2005 catches from Faroe Islands, as stated from Faroese coastal guard service, are corrected in order to be consistent with procedures used previous years.

Table 4.4.4.2 Saithe in the Faroes (Division Vb).

Year	Landings
	tonnes
1961	9592
1962	10454
1963	12693
1964	21893
1965	22181
1966	25563
1967	21319
1968	20387
1969	27437
1970	29110
1971	32706
1972	42663
1973	57431
1974	47188
1975	41576
1976	33065
1977	34835
1978	28138
1979	27246
1980	25230
1981	30103
1982	30964
1983	39176
1984	54665
1985	44605
1986	41716
1987	40020
1988	45285
1989	44477
1990	61628
1991	54858
1992	36487
1993	33543
1994	33182
1995	27209
1996	20029
1997	22306
1998	26421
1999	33207
2000	39020
2001	51786
2002	53546
2003	46555
2004	46355
2005	61372
2006	
Average	35316