2 Demersal Stocks in the Faroe Area (Division Vb and Subdivision IIa4)

2.1 Overview

2.1.1 Fisheries

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 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. The following describes the Faroese fleets first followed by the fleets of foreign nations. The number of licenses can be found in Table 2.1.3.

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. A majority of open boats participating in the fisheries are 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. During summer the larger vessels also make a few trips to Icelandic waters.

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 around the areas closed to trawling (Figure 2.1.2). 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 miles territorial fishing limit, targeting lemon sole, plaice and monkfish.

Otter board trawlers 500-1000 HP. These vessels fish mainly for cod and haddock, but monkfish also is important for them. 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 the fiscal year 2010-2011 several of these vessels have changed from single trawlers to pairtrawlers. Cod and haddock are taken as bycatch in this fishery. The distribution of hauls by this fleet in 2000-2005 is shown in Figure 2.1.1.

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 2.1.1).

Gill netting vessels. This category refers to vessels fishing mainly for 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.

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. During summer some of the larger vessels also make a few trips to Icelandic waters.

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 bycatches of cod, haddock and blue ling. Norway has a bilateral fishery agreement with the Faroes for a total quota of these species while the number 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 a total quota of these species while the number of vessels can vary from year to year

2.1.2 Fisheries and management measures

The fishery around the Faroe Islands was for centuries an almost free international fishery involving several countries. Apart from a local fishery with small wooden boats, the Faroese offshore fishery started in the late 19th century. The Faroese fleet had to compete with other fleets, especially from the United Kingdom with the result that a large part of the Faroese fishing fleet became specialised in fishing in other areas. So except for a small local fleet most of the Faroese fleet were fishing around Iceland, at Rockall, in the North Sea and in more distant waters like the Grand Bank, Flemish Cap, Greenland, the Barents Sea and Svalbard.

Up to 1959, all vessels were allowed to fish around the Faroes outside the 3 nm zone. During the 1960s, the fisheries zone was gradually expanded, and in 1977 an EEZ of 200 nm was introduced in the Faroe area. The demersal fishery by foreign nations has

since decreased and Faroese vessels now take most of the catches. The fishery may be considered a multi-fleet and multi-species fishery as described below.

During the 1980s and 1990s the Faroese authorities have regulated the fishery and the investment in fishing vessels. In 1987 a system of fishing licenses was introduced. The demersal fishery at the Faroe Islands has been regulated by technical measures (minimum mesh sizes and closed areas). In order to protect juveniles and young fish, fishing is temporarily prohibited in areas where the number of small cod, haddock and saithe exceeds 30% (in numbers) in the catches; after 1–2 weeks the areas are again opened for fishing. A reduction of effort has been attempted through banning of new licenses and buy-back of old licenses.

A quota system, based on individual quotas, was introduced in 1994. The fishing year started on 1 September and ended on 31 August the following year. The aim of the quota system was, through restrictive TACs for the period 1994–1998, to increase the SSBs of Faroe Plateau cod and haddock to 52 000 t and 40 000 t, respectively. The TAC for saithe was set higher than recommended scientifically. It should be noted that cod, haddock and saithe are caught in a mixed fishery and any management measure should account for this. Species under the quota system were Faroe Plateau cod, haddock, saithe, redfish and Faroe Bank cod.

The catch quota management system introduced in the Faroese fisheries in 1994 was met with considerable criticism and resulted in discarding and in misreporting of substantial portions 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 new system based on individual transferable effort quotas in days within fleet categories. The new 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.

From the establishment of the present effort system, the individual within fleet transferable effort quotas have applied to 1) the longliners less than 110 GRT, the jiggers, and the single trawlers less than 400 HP (Groups 4,5), 2) the pair trawlers (Group 2) and 3) the longliners greater than 110 GRT (Group 3). However, in the present fiscal year the single trawlers greater than 400 HP have been included. The single trawlers less than 400 HP are given special licenses to target flatfishes inside 12 nautical miles with a by-catch allocation of 30% cod and 10% haddock. In addition, they are obliged to use sorting devices in their trawls in order to minimize their by-catches. One fishing day by longliners less than 110 GRT is considered equivalent to two fishing days for jiggers in the same gear category. Longliners less than 110 GRT could therefore double their allocation by converting to jigging. Table 2.1.1 shows the number of fishing days used by fleet category for 1985–1995 and 1998–2008 and Table 2.1.2 shows the number of allocated days inside the outer thick line (the "ring") in Figure 2.1.2. Holders of individual transferable effort quotas who fish outside this line can fish for 3 days for each day allocated inside the line. Trawlers are generally not allowed to fish inside the 12 nautical mile limit. Inside the innermost thick line only longliners less than 100 GRT and jiggers less than 110 GRT are allowed to fish. The Faroe Bank shallower than 200 m is closed to trawling. Due to the serious decline of the Faroe Bank cod, the Bank has been closed since 1 January 2009 for all gears.

The fleet segmentation used to regulate the demersal fisheries in the Faroe Islands and the regulations applied are summarized in Table 2.1.3.

There is no explicit management plan for the demersal fisheries in Vb. The allocations of number of fishing days by fleet categories was originally 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 was 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. These target fishing mortalities have been evaluated during the 2005 and 2006 NWWG meetings (2.1.6) The realized fishing mortalities have been substantially higher than the target for cod, appear to have exceeded the target for saithe in recent years, while for haddock, fishing mortality remains below the target. There is ongoing work to move away from the target F of 0.45 and to formulate a management plan for cod, haddock and saithe based on the recent adviced reference points by ICES but it is presently not known, when this work will be finished.

As can been seen in Table 2.1.2 and Table 2.1.4, there have been a big reduction in the number of allocated fishing days since the onset in 1996/1997, in order to reduce the fishing mortality. For the present fishing year the overall number of days were reduced by almost 10%, but not equally distributed upon fleets. Group 5B was reduced by almost 50%, groups 2 and 3 by 3%, whereas the days for groups 4 and 5A were increased; and for the first time group 1 has been included. From Table 2.1.1 it can be seen that the actual number of fishing days used by the fleets have been reduced in recent years. Reasons are small catch rates combined with high costs of fishing and low fish prices. For the fishing years 2008/09 and 2009/10, a considerable number of fishing days have not been used of the same reasons as mentioned above.

In addition to the number of days allocated in the law, it is also stated in the law what percentage of total catches of cod, haddock, saithe and redfish, each fleet category on average is expected to fish. These percentages are as follows:

Fleet category	Cod	Haddock	Saithe	Redfish
Longliners < 110GRT,				
jiggers, single trawl. < 400HP	51 %	58 %	17.5 %	1 %
Longliners > 110GRT	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 %

The technical measures as mentioned above are still in effect.

2.1.3 The marine environment

The waters around the Faroe Islands are in the upper 500 m dominated by the North Atlantic current, which to the north of the islands meets the East Icelandic current. Clockwise current systems create retention areas on the Faroe Plateau (Faroe shelf) and on the Faroe Bank. In deeper waters to the north and east and in the Faroe Bank channel is deep Norwegian Sea water, and to the south and west is Atlantic water. From the late 1980s the intensity of the North Atlantic current passing the Faroe area decreased, but it has increased again in the most recent years. The productivity of the Faroese waters was very low in the late 1980s and early 1990s. This applies also to the recruitment of many fish stocks, and the growth of the fish was poor as well. From

1992 onwards the conditions have returned to more normal values which also is reflected in the fish landings. There has been observed a very clear relationship, from primary production to the higher trophic levels (including fish and seabirds), in the Faroe shelf ecosystem, and all trophic levels seem to respond quickly to variability in primary production in the ecosystem (Gaard, E. *et al*. 2002). A positive relationship has been demonstrated between primary production and the cod and haddock individual fish growth and recruitment 1-2 years later. The primary production indices have been below average since 2002 except for 2004 and 2008-2010 when it was above average (Figure 2.1.3). All haddock year classes since 2003 have been estimated well below average, however, which possibly could be related to the very low spawning stock in recent years. The estimate of primary production in 2011 will not be available until July, but preliminary estimates suggest it to be lower than the ones in 2008-2010. The primary production has also an effect on the catchability of long lines in the cod and haddock fishery, where the catchability is high when primary productivity is low and vice versa; this seems to be connected to the availability to the fish of natural food (see former reports, e.g. NWWG 2010).

The index of primary production applies to the shallow waters around Faroe Island (Faroe Shelf, depth < 130 m) whereas little has been known about the primary production or food availability over the deeper areas. In 2008 new information became available on the productivity over the deep areas and is outlined in Working Document 20 presented to the 2010 NWWG (Steingrund and Hátún, 2008). The working document describes an empirical relationship between the strength of the subpolar gyre (SPG) and the biomass of saithe in Faroese waters four years later. An index was developed that described the strength of the gyre. The gyre index was given the opposite sign of the strength/extension of the SPG so that the index was positively related to temperature and phytoplankton/zooplankton abundance in a large area south-west of the Faroe Islands and saithe biomass at the Faroes. There was a strong positive relationship between the gyre index and the total biomass of saithe in Faroese waters four years later over a 40-year period, the causal link hypothesized to be food availability.

The temporal development of the gyre index was different from the phytoplankton index over the shallow areas, these two indices often showing opposite trends, especially during recent years when phytoplankton production has been low whereas the gyre index has been high (Figure 2.1.3). This means that the conditions are poor for cod and haddock, which are strongly influenced by the phytoplankton index whereas the conditions for saithe are good. The overall situation for the Faroese fisheries in 2009 seems therefore not as bad as in the beginning of the 1990s when both these indices were low and the three species had low biomasses.

2.1.4 Summary of the 2011 assessment of Faroe Plateau cod, haddock and saithe

A summary of selected parameters from the 2011 assessment of Faroe Plateau cod, Faroe haddock and Faroe saithe is shown in Figure 2.1.4. As mentioned in previous reports of this WG, landings of cod, haddock and saithe on the Faroes appear to be closely linked with the total biomass of the stocks. For cod, the exploitation ratio and fishing mortality has remained relatively stable over time, although they have been more fluctuating in recent years. For haddock, the exploitation rate was decreasing from the 1950s and 1960s, while it would have been relatively steady since the mid 1970s. For saithe, there is a suggestion that the exploitation rate was increasing at the

beginning of the period, it decreased from the early 1990s to 1998 and has increased since to close to the highest values observed.

Another main feature of the plots of landings, biomasses, mortalities and recruitment is the apparent periodicity during the time series with cod and haddock showing almost the same trends.

2.1.5 Reference points for Faroese stocks and evaluation of the Faroese management system

The NWWG has evaluated the relevance of existing PA reference points for Faroese demersal stocks on several occasions in recent years, and revised values for biomass have been applied for cod and haddock, but not for saithe because the assessment was not accepted due to retrospective pattern where biomass was consistently underestimated (NWWG 2010). This problem has been solved since the assessment was accepted last year. The 2011 NWWG reiterates its former suggestion to set B_{pa} at the B_{loss} level, which in this years is estimated at 55 000 t; this correspond to the break point in the SSB-R analysis used to estimate F_{MSY} for saithe (see chapter 5); B_{lim} is left undefined. There is also a need to revise existing PA fishing mortalities for cod and saithe but this was not done this year.

MSY reference points. The NWWG has done some preliminary work aiming at coming up with MSY reference points for Faroe Plateau cod, Faroe haddock and Faroe saithe including F_{msy} and $B_{trigger}$. The results so far have been presented under the different stock sections but should be regarded as very preliminary since much more work is needed for the Faroese stocks. For all three stocks it was decided to use B_{pa} as the $B_{trigger}$. Several slightly different approaches mainly following the guidelines in the WKFRAME 2 report were applied to all stocks. In addition, an ecological model was applied to all three stocks at the same time. This model is still under development and it is premature to draw firm conclusions from it. But when optimizing cod and haddock catches and at the same time allow for average catches of saithe this model gives F_{MSY} values at the same level as the other approaches; (See individual Faroese stock chapters for details). The ecological model is described below:

A preliminary ecological model was developed to simultaneously estimate the MSY-reference points for cod, haddock and saithe, including interactions between the species. See technical description of the ecological model in Working Document 22. The drivers were: 1) Yearly primary production on the Faroe Shelf (bottom depth < 130 m), 2) yearly primary production over the outer areas on the Faroe Plateau (bottom depth > 130 m), as well as fishing mortality on 3) cod, 4) haddock and 5) saithe. All other processes, i.e., recruitment, growth (weights-at-age) and fishing mortality, were modelled (based on the 2010 assessments).

The inner primary production was measured directly from 1990 and onwards. An estimate of the primary production back to 1960 was obtained from a correlation between *Arctica islandica*-growth and measured primary production during the period 1990 to 2005. The food availability was considered to be influenced by two years of primary production, i.e. the average of year t-1 and year t was used as a measure of food availability in year t. The outer primary production was obtained from Hátún *et al*. (2005) as a principal component reflecting sea-surface height of the North Atlantic Ocean (1960 to 2003) combined with direct satellite estimates of sea-surface height 1993-2010. The index was converted to an index of primary production by the method used in Steingrund *et al*. (2010), e.g., the primary production was lagged by one year in order to account for the time it takes the water masses to move

from the Irminger sea to the areas around Faroe Islands. The inner and outer primary production were added to get the total production (TP).

Food availability, competition and predation were used as explanatory factors when modelling recruitment and growth. There was an up-and-down pattern in the recruitment of saithe, which indicates density-dependent effects between consecutive year classes of saithe. When taking an average of the population numbers at ages 3 and 4, a much smoother curve was obtained. The averaged recruitment was modelled as a function of the outer primary production, which was lagged by 3 years. This indicates either an immediate effect of food availability on the survival of 0-1 year-old saithe or a lagged response by some prey of e.g. 2 years on 2-3 year-old saithe. Saithe recruitment was furthermore regarded to be density dependent, i.e., the recruitment was hampered at high saithe B7+ biomasses. The weights-at-age of saithe were modelled from the numbers-at-age. The relationships were strongly negative for ages 3 to 6, but less so for older ages, again indicating density-dependence for the relatively stationary small saithe.

Cod and haddock growth were quantified as the annual weight increase over two years ($G_{age,year} = W_{age+1,year+1} - W_{age-1,year-1}$) and averaged for the most important ages in the stock. There was positive correlation between cod growth and TP/SumN. SumN equals the sum of cod age 2+ individuals, haddock age 3+ individuals and saithe age 3-5 individuals in the stock. These ages of fish prey on sandeels. Saithe older than 5 years were not included because they were assumed to be distributed outside the main distributional area of cod and haddock. There was also a positive correlation between haddock growth and TP/SumN, but lagged by one year (it may take some time for the benthic invertebrates like polychaet worms to respond to variations in the TP). In addition, haddock growth was slow when there was a high abundance of Norway pout (biomass indices from the spring bottom trawl surveys 2005-2011), indicating competition or some other processes. The abundance of Norway pout was negatively related to the biomass of age 5+ cod (by that age, they prey massively on Norway pout of all sizes). Hence, haddock growth was modelled by TP/SumN (lagged one year) and the biomass of age 5+ cod. It remains to be found out why saithe biomass (they also prey on Norway pout) seemed to have little effect on the biomass of Norway pout, although it is known that saithe prey on smaller individuals than cod. The weighs-at-age for cod and haddock were then modelled from the growth rates.

The recruitment of age 2 cod was modelled from TP/SumN (the previous year) and the biomass of age 3+ cod. The recruitment was downweighted at very large stock sizes of cod (Steingrund *et al*., 2010). The recruitment of age 2 haddock was modelled from TP/SumN (two years before), and the biomass of age 5+ cod (to take the abundance of Norway pout into account). The recruitment was downweighted at very large stock sizes of haddock.

The fishing mortality of saithe was not modelled, since no obvious relationship was found with stock size or growth. The fishing mortality of cod was modelled from cod growth, since there is (at least for some time periods) a negative relationship between cod-growth and the catchability with longlines (Steingrund and Clementsen, 2009). The fishing mortality of haddock was modelled from haddock growth. Only the period under the effort management system (1997-2009) was considered.

The ecological model was run into the future until the year 2209. The primary productivity for the period 1961 to 2011 was repeated again and again, i.e., the productivity in year 2012 was set to the 1961 productivity etc. Another option was to

use the productivity in the period 1991 to 2011 since it is measured directly in this period. This was not done because the outer productivity was much higher than during the long period (1961 to 2011).

Random fluctiations (stochasticity) were applied to the recruitment and fishing mortalities of cod, haddock and saithe, causing oscillations in all variables in the model. The relationships themselves (e.g. the coefficients in the recruitment functions) were not subjected to errors, since it then might be difficult to know what happens in the model. 100 simulations were performed for each setting.

The results of the ecological model clearly show that it is not possible to optimize the catch of all three species at the same time. It also shows that the F_{msy} estimates for cod and haddock depend much on the fishing mortality on saithe. At low fishing mortalities on saithe the F_{msy} values for cod and haddock are considerably higher than in situations when the fishing mortality on saithe is high, see Table 4.8.2 in the cod section.

2.1.6 Review of the management system

The Faroese authorities have on several occasions set up committees to investigate the performance of and to review the effort management system implemented in 1996, consistent with a NWWG 2007 recommendation. The results are, however, not very conclusive and have not be used directly by this WG. The authorities have now initiated a work with the purpose of moving away from the originally target F of 0.45 for cod, haddock and saithe, respectively, towards recent reference points for biomass and fishing mortality adviced by ICES. The NWWG is presently not aware of the status of that work but when/if they come up with a proposal, this proposal will need to be accepted by the Parliament before it enters into force.

2.1.7 References:

Gaard. E., Hansen, B., Olsen, B and Reinert, J. 2002. Ecological features and recent trends in physical environment, plankton, fish stocks and sea birds in the Faroe plateau ecosystem. In: K- Sherman and H-R Skjoldal (eds). Changing states of the Large Marine Ecosystems of the North Atlantic.

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

Steingrund, P., and Hátún, H. 2008. Relationship between the North Atlantic subpolar gyre and fluctuations of the saithe stock in Faroese waters. NWWG 2008 Working Document 20.

Table 2.1.1. Number of fishing days used by various fleet groups in Vb1 1985-95 and 1998-08. For other fleets there are no effort limitations. Catches of cod, haddock saithe and redfish are regulated by the by-catch percentages given in section 2.1.1. In addition there are special fisheries regulated by licenses and gear restrictions. (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
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
2006	14094	2764	5411
2007	10653	3279	5971
2008	10212	2827	3722
Average(98-08)	21488	2679	6290

Table 2.1.2. Number of allocated days for each fleet group since the new management scheme was adopted and number of licenses per fleet (by May 2006).

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
2006/2007		5752	3471	5435	20598
2007/2008		5637	3402	5327	20186
2008/2009		5073	3062	4795	18167
No. of licenses	12	29	25	65	593

Fleet segment		Sub groups		Main regulation tools
1	Single trawlers > 400 HP	*none*		Fishing days, 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	Trawlers 15-40 GRT	Fishing days
		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 2.1.3. Main regulatory measures by fleet in the Faroese fisheries in Vb. The fleet capacity is fixed, based on among other things no. of licenses. 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; 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	Allocated days 2008/09	Used days 2008/09	% used days 2008/09	Allocated days 2009/10	Used days 2009/10	% used days 2009/10	Allocated days 2010/11
Group 1							900
Group 2	5073	4065	80	4759	3323	70	4274
Group 3	3062	2273	74	2697	1663	62	2852
Group 4A		415		882	335	38	1323
Group 4B	4795	1016	60	1630	934	57	1756
Group 4T		1434		1481	1382	93	1540
Group 5A	7267	3256	45	6904	3588	52	7955
Group 5B	10900	3803	35	10335	6160	60	5304
Total	31097	16262	52	28688	17385	61	25904

Table 2.1.4. Allocated and used number of fishing days by fleet group under the fishing days system, i.e. inside the "ring" (see the text). Allocated number of days in 2008/09 for Groups 4A, 4B and 4T are here added together. Group 1 has now been included, and in addition they have been allocated 1700 days outside the "ring".

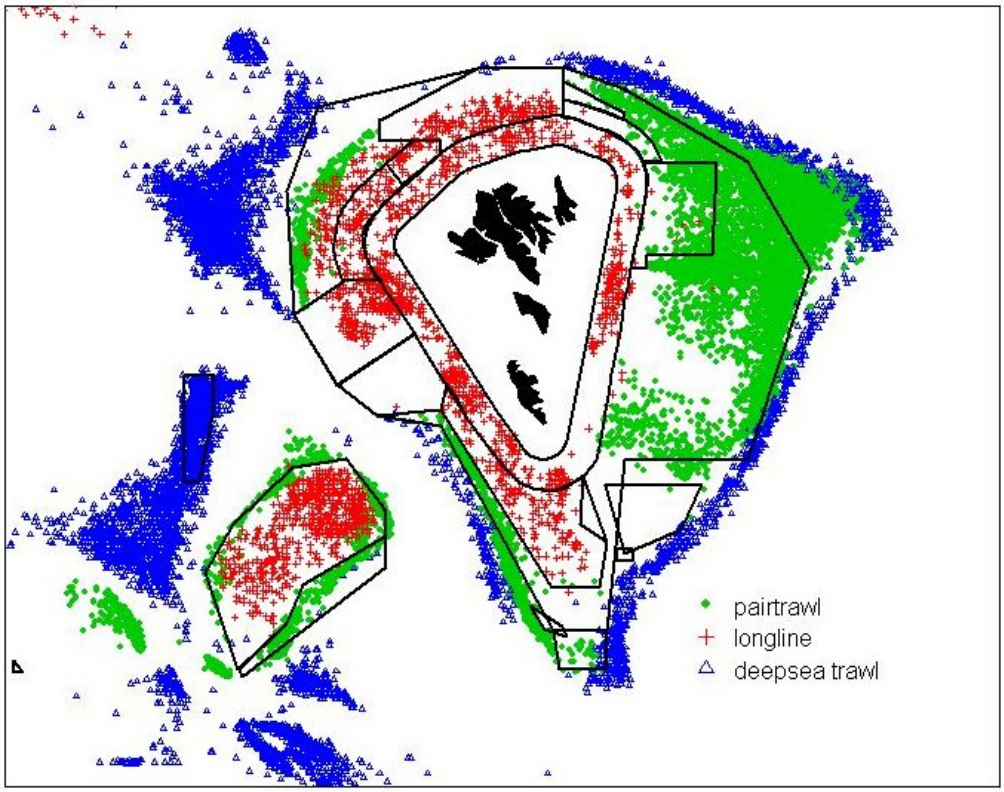
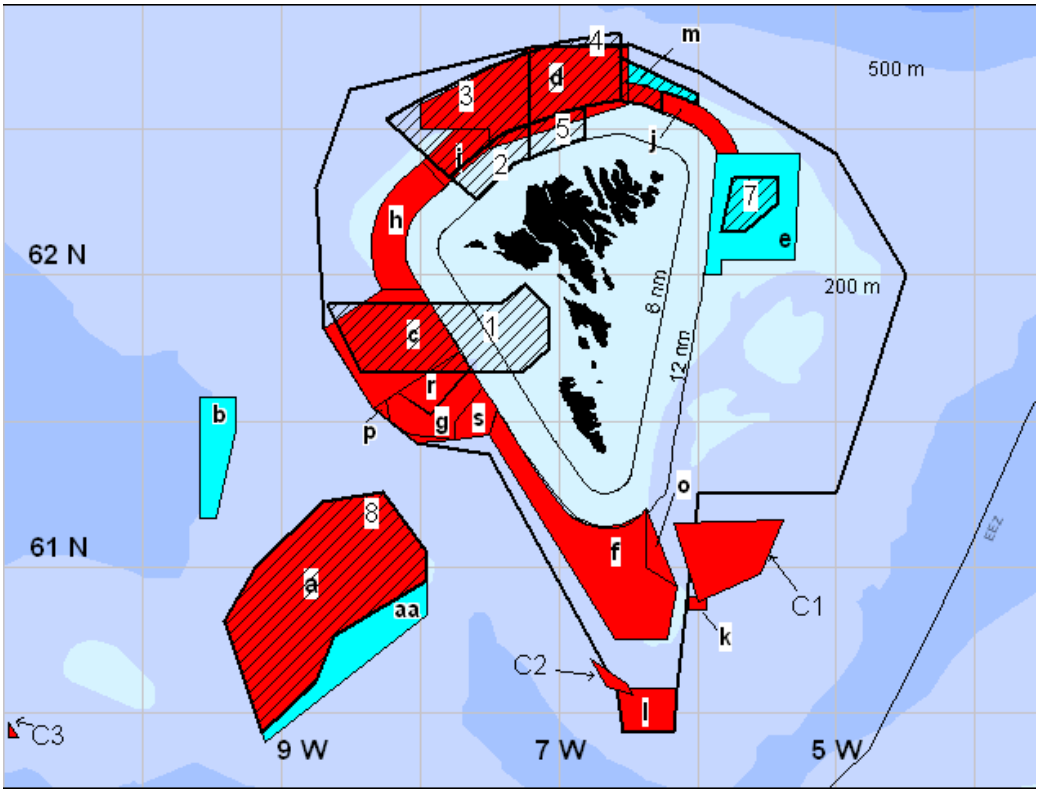


Figure 2.1.1. The 2000-2005 distribution of fishing activities by some major fleets.



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 2.1.2. 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 depths (a, aa) is regulated separate from the Faroe Plateau. It is closed to trawling and the longline fishery is regulated by individual day quotas.

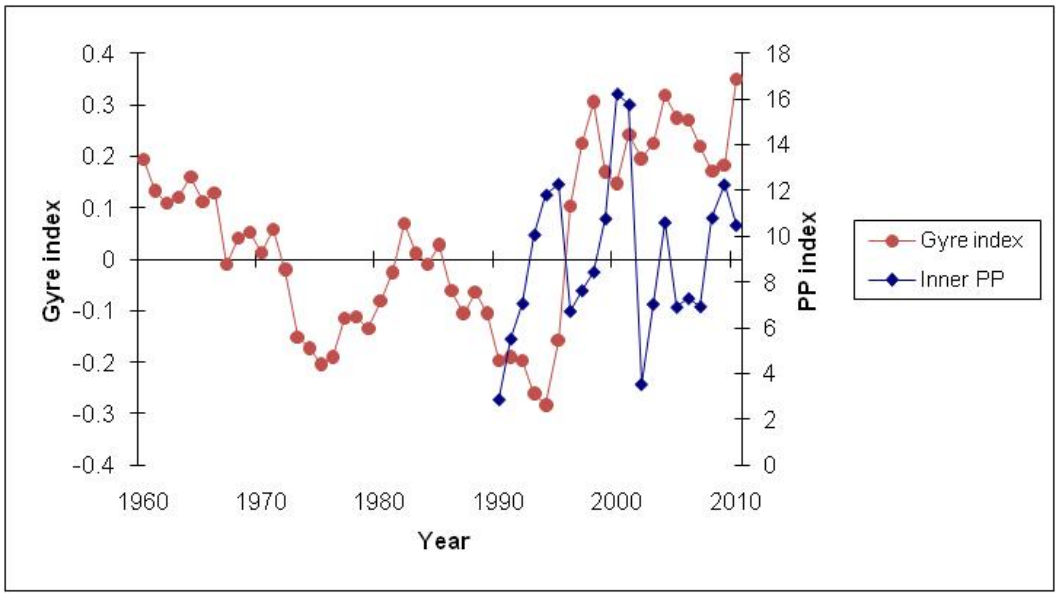


Figure 2.1.3. Temporal development of the phytoplankton index over the Faroe Shelf area (< 130 m) and the subpolar gyre index which indicates productivity in deeper water.

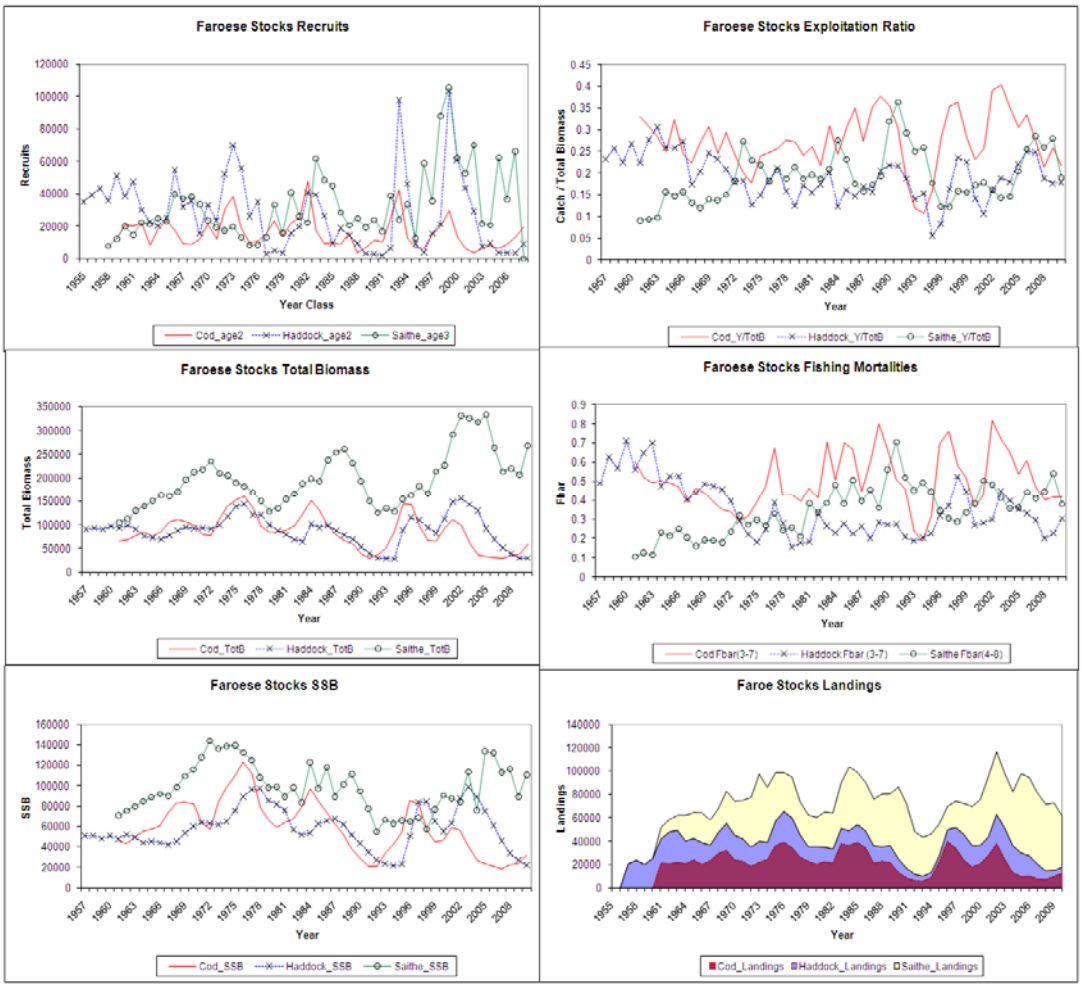


Figure 2.1.4. Faroe Plateau cod, Faroe haddock and Faroe saithe. 2011 stock summary.

3 Faroe Bank Cod

Summary

- The total reported landings in 2010 were 105 tonnes the second lowest observed since 1965.
- The summer and spring index suggest the stock is well below average while there is no indication of strong incoming year classes.
- The exploitation ratio has sharply decreased since 2006. Since 2009 it is estimated to levels comparable to those in the 1990's for both survey indices.

3.1 State of the stock – historical and compared to what is now.

Total nominal catches of the Faroe Bank cod from 1987 to 2010 as officially reported to ICES are given in Table 3.7.1 and since 1965 in Figure 3.7.1 UK catches reported to be taken on the Faroe Bank are all assumed to be taken on the Faroe Plateau and are therefore not used in the assessment. Landings have been highly variable from 1965 to the mid-1980s, reflecting the opportunistic nature of the cod fishery on the Bank, with peak landings slightly exceeding 5 000t in 1973 and 2003. The trend of landings has been smoother since 1987, declining from about 3 500t in 1987 to only 330 t in 1992 before increasing to 3 600t in 1997. In 2010 landings were estimated at 105t which is the second lowest in the history of the fisheries (Figure 3.7.1). Longline fishing effort increased substantially in 2003 and although it decreased in 2004 and 2005 the latter remains the second highest fishing effort observed since 1988 (Figure 3.7.1). From 2005 to 2007 the effort has been reduced substantially. Since 2008 no fishing days have been allocated on the Bank.

The Faroese groundfish surveys (spring and summer) cover the Faroe Bank and cod is mainly taken within the 200 m depth contour. The catches of cod per trawl hour in depths shallower than 200 meter are shown in Figure 3.7.2.

The spring survey was initiated in 1983 and discontinued in 2004 and 2005. The summer survey has been carried out since 1996. The CPUE of the spring survey was low during 1988 to 1995 varying between 73 and 95 kg per tow. Although noisy, the survey suggests higher, possibly increasing biomass during 1995 - 2003. The 2011 index is around 120 kg per tow, which is slightly above average level since 2006.. The 2010 summer index is estimated at 43 kg per tow which is very close to the observed average since 2004. The agreement between the summer and spring index is good during 1996 to 2001 and since 2006, but they diverged in 2002 and 2003.

The figure of length distributions (figure 3.7.3 and figure 3.7.4) show in general good recruitment of 1 year old in the summer survey from 2000 – 2002 (lengths 26 – 45 cm), corresponding to good recruitment of 2 years old in the spring surveys from 2001 to 2003 (40 – 60 cm). The spring index shows poor recruitment from 2006 to 2011 reflecting the weak year classes observed in the summer survey since 2004.

The recruitment is estimated by simply counting the number of fish in length groups in the surveys. In the spring index, recruitment was estimated as total number of fish below 60 cm (2-year old) and in the summer index as number of fish below 45 cm (1-year old). According to the summer index the recruitment of 1 year old has been good from 2000 to 2003, while the recruitment has been relatively poor since 2004 (Figure 3.7.5) The spring recruitment index in 2011 shows no sign of incoming year

classes. Correlation between the spring and summer survey recruitment indices is fairly good (r^2=0.84)

Figure 3.7.6 shows a positive correlation between the survey indices and the landings in the same year, but the relationship between the summer survey and the landings deteriorates in 2003. The ratio of landings to the survey indices provides an exploitation ratio, which can be used as a proxy to relative changes in fishing mortality. For the summer survey, the results suggest that fishing mortality has been reasonably stable during 1996 to 2002, but that it increased steeply in 2003, consistent with the 160% increase in longline fishing days in that year (Figure 3.7.1). The exploitation ratio has decreased since 2006 and in 2010 it is estimated to levels close to those in the 1996-2002.

3.2 Comparison with previous assessment and forecast

The status of the stock remains almost unchanged with respect to last year assessment. Both the spring and the summer indexes suggest the stock is well below average while there are no indications of incoming recruitment.

3.3 Management plans and evaluations (Could just be a reference to the year when the plan was agreed/evaluated. Include proposed/agreed management plan.)

None

3.4 Management considerations

The landing estimates are uncertain because since 1996 vessels are allowed to fish both on the Plateau and on Faroe Bank during the same trip, rendering landings from both areas uncertain. Given the relative size of the two fisheries, this is a bigger problem for 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 input data. If the cod landings from Faroe Bank are not known, it is difficult to provide advice. 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 identify the catch removed from each stock. Simple measures should make it possible to identify if the catch is originating from the Bank or from the Plateau e.g. by storing in different section of the hold and/or by tagging of the different boxes.

Consistent with the advice given in 2010 the WG suggests the closure of the fishery until the recovery of the stock is confirmed. The reopening of the fishery should not be considered until both surveys indicate a biomass at or above the average that of the period 1996-2002.

3.5 Regulations and their effects

In 1990, the decreasing trends in cod landings from Faroe Bank lead ACFM to advise the Faroese authorities to close the bank to all fishing. This advice was followed for depths shallower than 200 meters. In 1992 and 1993 longliners and jiggers were allowed to participate in an experimental fishery inside the 200 meters depth contour. For the quota year 1 September 1995 to 31 August 1996 a fixed quota of 1 050 t was set. The new management regime with fishing days was introduced on 1 June 1996 allowing longliners and jiggers to fish inside the 200 m contour. The trawlers are allowed to fish outside the 200 m contour.

A total fishing ban during the spawning period (1 March to 1 May) has been enforced since 2005. In 2009 fishing was restricted to all fishing gears from 1 January to 31 August. No fishing days are allocated in the 2010-2011 fishing year.

3.6 Changes in fishing technology and fishing patterns

None

3.7 Changes in the environment

None

Table 3.7.1. Faroe Bank (sub-division Vb2) cod. Nominal catches (tonnes) by countries 1986-2010 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	1996	1997
Faroe Islands	1836	3409	2966	1270	289	297	122	264	717	561	2051	3459
Norway	6	23	94	128	72	38	32	2	8	40	55	135
UK (E/W/NI)	-	-	-	-	2 [2]	1 [2]	74 [2]	186 [2]	56 [2]	43 [2]	126 [3]	61 [3]
UK (Scotland)	63 [3]	47 [3]	37 [3]	14 [3]	205 [3]	90 [3]	176 [3]	118 [3]	227 [3]	551 [3]	382 [3]	277 [3]
Total	1905	3479	3097	1412	568	426	404	570	1008	1195	2614	3932
Used in assessment					289	297	154	266	725	601	2106	3594

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010 [*]
Faroe Islands	3092	1001		1094	1840	5957	3607	1270	1005	471	231	81	111
Norway	147	88	49	51	25	72	18	37	10	7	1	4	1
UK (E/W/NI)	27 [3]	51 [3]	18 [3]	50 [3]	42 [3]	15 [3]	15 [3]	24 [3]	1 [3]				366 [3]
UK (Scotland)	265 [3]	210 [3]	245 [3]	288 [3]	218 [3]	254 [3]	244 [3]	1129 [3]	278 [3]	53	32	38	
Total	3531	1350	312	1483	2125	6298	3884	2460	1294	531	264	123	478
Correction of Faroese catches in Vb2				-65	-109	-353	-214	-75	-60	-28	-14	-5	-7
Used in assessment	3239	1089	1194	1080	1756	5676	3411	1232	955	450	218	80	105

[*] Preliminary

[1] Includes Vb1.

[2] Included in Vb1.

[3] Reported as Vb.

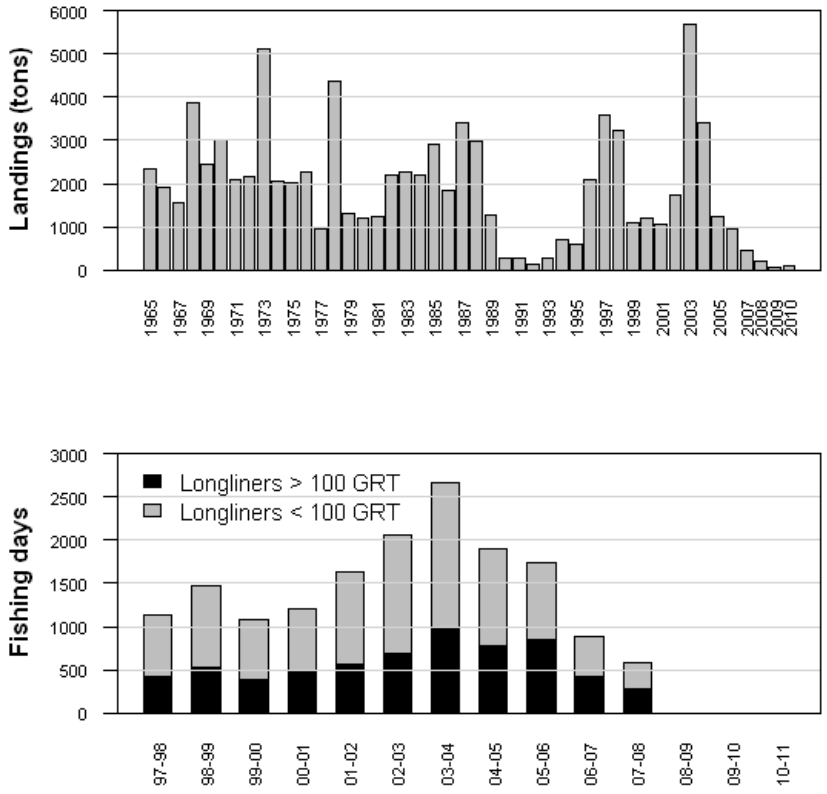


Figure 3.7.1. Faroe Bank (sub-division Vb2) cod. Reported landings 1965-2010. Since 1992 only catches from Faroese and Norwegian vessels are considered to be taken on Faroe Bank. Lower plot: fishing days (fishing year) 1997-2011 for long line gear type in the Faroe Bank.

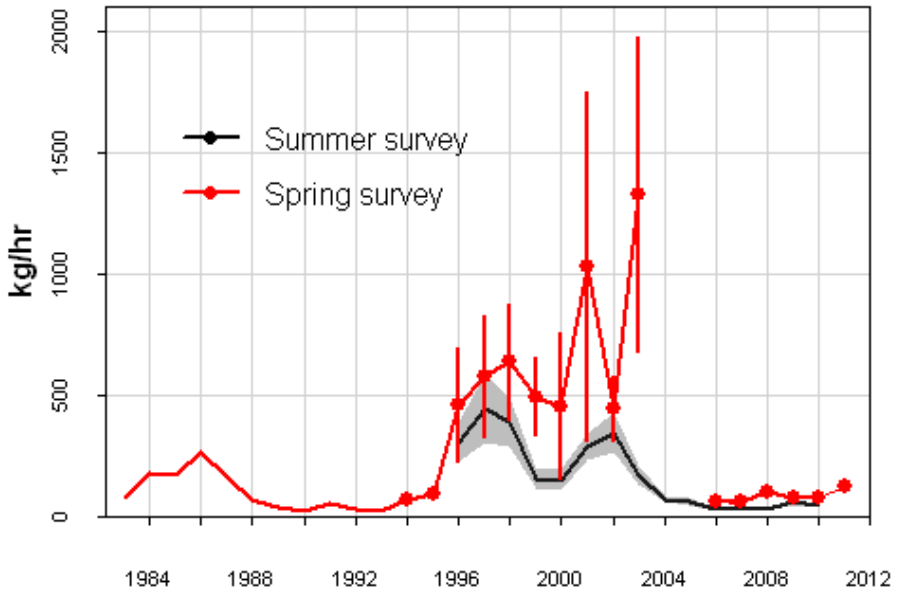


Figure 3.7.2. Faroe Bank (subdivision Vb2) cod. Catch per unit of effort in the spring groundfish survey and summer survey. Vertical bars and shaded areas show the standard error in the estimation of indexes.

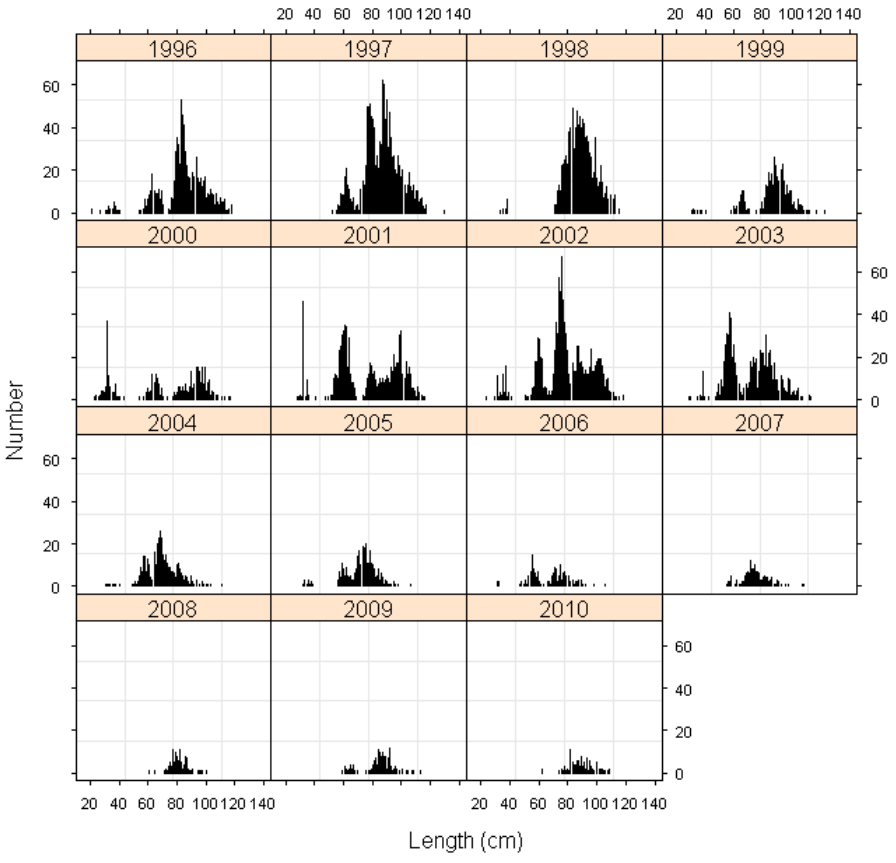


Figure 3.7.3. Faroe Bank (sub-division Vb2) cod. Length distributions in summer survey (1996-2010)

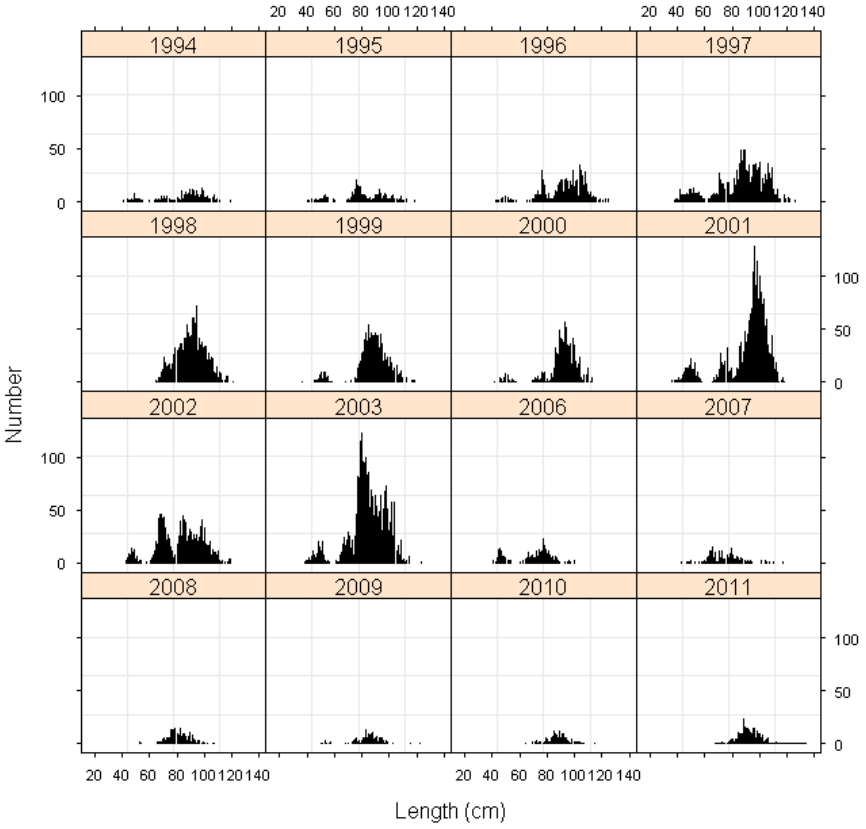


Figure 3.7.4. Faroe Bank (sub-division Vb2) cod. Length distributions in spring survey (1994-2003, 2006-2011)

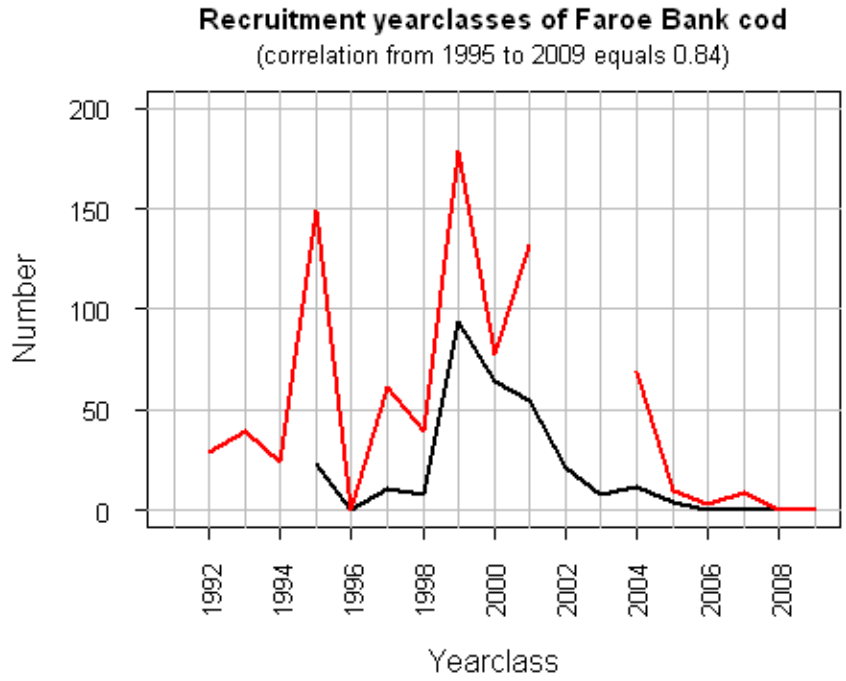


Figure 3.7.5. Faroe Bank (sub-division Vb2) cod. Correlation between recruitment year classes.

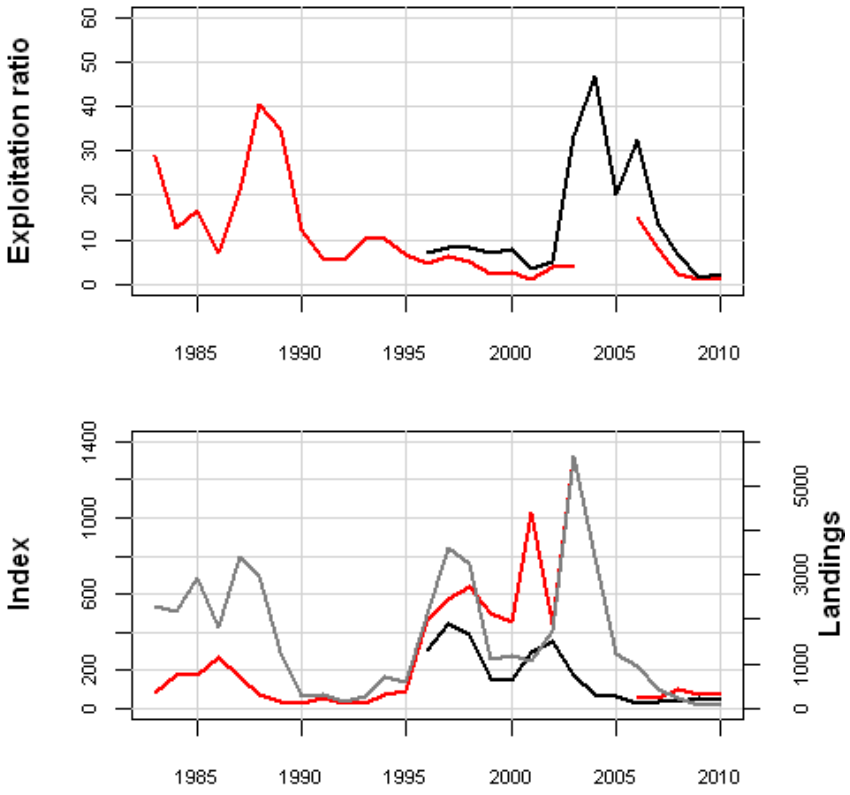


Figure 3.7.6. Faroe Bank (Subdivision Vb2) cod. Exploitation ratio (ratio of landings to survey interpreted as an index of exploitation rate). Lower plot: Landings and cpue (kg/hr) in spring and summer survey.

4 Faroe Plateau cod

Summary

The input data consisted of the catch-at-age matrix (ages 2-10+ years) for the period 1961-2010 and two age-disaggregated abundance indices obtained from the two Faroese groundfish surveys: the spring survey 1994-2011 (shifted back to the previous year) and the summer survey 1996-2010. The maturities were obtained from the spring survey 1983-2011.

The assessment settings were the same as in the 2010 assessment. An XSA was run and tuned with the two survey indices. The fishing mortality in 2010 (average of ages 3-7 years) was estimated at 0.41, which was higher than the preliminary Fmsy of 0.32 but lower than the limit fishing mortality (when 'bad things' may happen) of 0.68. The total stock size (age 2+) in the beginning of 2010 was estimated at 59 000 tonnes and the spawning stock biomass at 31 000 tonnes, which was above the limit biomass (which should be avoided) of 21 000 tonnes.

The short term prediction until year 2013 showed an increasing trend with a stock size in 2013 of around 83 000 tonnes and a spawning stock biomass of around 56 000 tonnes.

The recruitment seems to be positively correlated with the total stock size of cod. It is, therefore, advised to reduce the fishing mortality so that the stock increases. It will therefore be necessary to extend area-closures, preferably for all fishing. Candidate areas are parts of Mýlingsgrunnur (north of the Faroes), Mykinesgrunnur (west of the Faroes) as well as areas east of Faroe Islands.

4.1 Stock description and management units

Both genetic and tagging data suggest that there are three cod stocks present in Faroese waters: on the Faroe Bank, on the Faroe Plateau and on the Faroe-Iceland Ridge. Cod on the Faroe-Iceland Ridge seem to belong to the cod stock at Iceland, and the WG in 2005 decided to exclude these catches from the catch-at-age calculations. The annex provides more information.

4.2 Scientific data

The landing figures were obtained from the Fisheries Ministry and Statistics Faroe Islands (Table 4.2.1) and the working group estimates are presented in Table 4.2.2. The catches on the Faroe-Iceland ridge, i.e. for the large single trawlers (Table 4.2.3) and the large longliners were not included in the catch-at-age calculations. In recent years the longliners have taken the majority of the cod catches (Table 4.2.4). The catch-at-age was updated to account for a change in the nominal landings for 2007 and 2009. Landings-at-age for 2010 are provided for the Faroese fishery in Table 4.2.5. Faroese landings from most of the fleet categories were sampled (see text table below). Catch-at-age from 1961 to 2010 are shown in Table 4.2.6. Catch curves are shown in Fig. 4.2.1. They show atypical patterns in 1996 and to some extent in 2001-2002 when there appears to be an increase over the previous year for ages where a decrease would normally have been expected. This could be due to catchability for longliners depending on fish growth, causing atypical catch curves for longliners.

Samples from commercial fleets in 2010.

Fleet	Size	Samples	Lengths	Otoliths	Weights
Open boats		18	0	536	3,251
Longliners	<100 GRT	34	0	840	6,580
Longliners	>100 GRT	23	0	480	4,617
Jiggers		6	0	60	1,085
Gillnetters		0	0	0	0
Sing. trawlers	<400 HP	0	0	0	0
Sing. trawlers	400-1000 HP	6	0	60	1,325
Sing. trawlers	>1000 HP	0	0	0	0
Pair trawlers	<1000 HP	8	0	240	1,497
Pair trawlers	>1000 HP	35	1,888	540	5,101
Total		112	1,888	2,220	20,205

Mean weight-at-age data for 1961-2010 are provided for the Faroese fishery in Table 4.2.7. These were calculated using the length/weight relationship based on individual length/weight measurements of samples from the landings. The sum-of-products-check for 2010 showed a discrepancy of 0 %.

Figure 4.2.2 shows the mean weight-at-age for 1961 to 2010. For 2011-2013 the values used in the short term predictions are shown on this graph in order to put them in perspective with previous observations. The weights increased from 1998 to 2000, but have decreased since, although they appear to have increased since 2008.

The proportion of mature cod by age during the Faroese groundfish surveys carried out during the spawning period (March) are given in Table 4.2.8 (1961 - 2010) and shown in Figure 4.2.3 (1983 - 2010). The observed values in 2011 and the estimated values in 2012-2013 are also shown in order to put them in perspective with previous observations. Full maturity is generally reached at age 5 or 6, but considerable changes have been observed in the proportion mature for younger ages between years.

The spring groundfish surveys in Faroese waters with the research vessel *Magnus Heinason* is used as a tuning series. The catch curves showed a normal pattern (Figure 4.2.4). The stratified mean catch of cod per unit effort in 1994-2011 is given in Figure 4.2.5. The CPUE increased substantially in 1995 and remained high up to 1998. The CPUE decreased from 2002 to 2004 and was low in 2006-2008 and were considerably higher since 2009. Normally the stratified mean catch per trawl hour increases for the first 3-4 years of life of a year class, and decreases afterwards (Figure 4.2.4). From 1994 to 1995, however, there was an increase for all year classes, possibly because of increased availability. A more normal pattern was observed from 1996-2011.

The other tuning series used is the Summer Groundfish Survey. The stratified mean catch of cod per unit effort (kg/trawl hour) 1996-2010 is shown in Figure 4.2.5, and catch curves in Figure 4.2.6. The catch curves show that the fish are fully recruited to the survey gear at an age of 4 or 5 years. Both tuning series are presented in Table 4.2.9.

Two commercial cpue series (longliners and pairtrawlers) are also presented (Tables 4.2.10 and 4.2.11, as well as Figure 4.2.7), although they are not used as tuning series.

4.3 Information from the fishing industry

The sampling of the catches is included in the 'scientific data'. The fishing industry has since 1996 gathered data on the size composition of the landings but this information has not been used in this assessment.

4.4 Methods

This is an update assessment and the results of the assessment is mostly data-driven implying that there may be limited need to use other assessment methods.

4.5 Reference points

The reference points are dealt with in the general section of Faroese stocks. The PA reference points for Faroe Plateau cod are the following: B_{pa} = 40kt, B_{lim} = 21kt, $F_{p}a$ = 0.35 and F_{lim} = 0.68.

The reference points based on the yield-per-recruit curve are the following: F_{max} = 0.24, F0.1 = 0.11, F35%SPR = 0.17, F_{med} = 0.41, Flow = 0.10, F_{high} = 1.18.

The group adopted following preliminary MSY reference points: Fmsy = 0.32, see section 4.8. The $B_{trigger}$ was set at B_{pa} = 40 kt.

4.6 State of the stock – historical and compared to what is now

Since the current assessment is an update assessment, the same procedure is followed as in the 2010 assessment: to use the two surveys for tuning and not the commercial series. The commercial series showed a similar overall tendency as the surveys (Figure 4.2.7). The XSA-run is presented in Table 4.6.1 and the results are shown in Table 4.6.2 (fishing mortality at age), Table 4.6.3 (population numbers at age) and Table 4.6.4 (summary table).

The log catchability residuals from the adopted XSA run are shown in Figure 4.6.1. There were year effects in both surveys since 2005. The stock estimates for 2010 seemed to be determined a little more by the spring survey than the summer survey.

The estimated fishing mortalities are shown in Tables 4.6.2 and 4.6.4 and Figures 4.6.2 and 4.6.3. The average F for age groups 3 to 7 in 2010 (F3-7) is estimated at 0.41, somewhat higher than F_{pa} = 0.35.

The F3-7 (Figure 4.6.3) seems to be a problematic measure of fishing mortality for two reasons. Firstly, the fishing mortalities for ages 6-7 are generally overestimated in the terminal year leading to an overestimation of F3-7 for the terminal year. Secondly, the proportion of 6-7 year old cod in the stock or catch is small (normally less than 20%) and therefore get a disproportionate influence on the F3-7. The yield over exploitable biomass (3 years and older) was introduced in the 2004 assessment, but has the drawback not being proportional to fishing effort. Another approach is to weight the fishing mortalities, and three weighting procedures are presented in Figure 4.6.4: weighting by stock numbers, stock biomasses or catch weights. The fishing mortality may have increased slightly since 1996, but there have been oscillations that may be determined by the food availability in the ecosystem.

The stock size in numbers is given in Table 4.6.3. A summary of the XSA, with recruitment, biomass and fishing mortality estimates is given in Table 4.6.4 and in Figure 4.6.2. The stock-recruitment relationship is presented in Figure 4.6.5. The stock trajectory with respect to existing reference points is illustrated in Figure 4.6.6.

The assessment shows the poor recruitment for the 1984 to 1991 year classes, and the strong 1992 and 1993 year classes. Due to the continuous poor recruitment from 1984 to 1991 and the high fishing mortalities, the spawning stock biomass declined steadily from 1983 to 1992 when it was the lowest on record at 21 000 t. It increased sharply to above 80 000 t in 1996 and 1997 before declining to about 45 000 t in 1999. The spawning stock biomass increased to 59 000 t in 2001 but dropped to about 18 000 t in

2007 which is the lowest value observed during the assessment period from 1961-2010. The 2002 year class is likely the lowest observed and the 2003-2006 year classes are also weak according to the XSA run. The 2007 year class seems to be at bit stronger (13 millions), and the 2008 year class seems to be above average strength (19 millions). The 2009 year class may be weak (10 millions), but relies solely on the spring survey estimate in 2011 (shifted to 2010 in the tuning). This value was adjusted to 22 millions (see later).

In order to put the stock estimates in 2010 into a wider perspective, we have estimated the stock biomass back to 1906. A cpue series (tonnes per million tonn-hours) for British trawlers 1924-1972 was available from the data presented in Jákupsstovu and Reinert (1994). The cpue series was also used, and explained, in Jones (1966). There was an overlap between the cpue series and the stock assessment for the years 1961-1972. Another cpue series (cwts per day of absence from port) was available for British steam trawlers 1906-1925. The overlap was two years (1924 and 1925) and the 1906-1925 series was scaled to the 1924-1972 series. The results are presented in Figure 4.6.7. There was a decreasing trend in biomass from around 100 thousand tonnes to around 80 tonnes prior to World War II, and since then a decreasing trend from around 100 thousand tonnes to around 50 thousand tonnes. The biomass in 2010 was low compared with the entire period.

4.7 Short term forecast

The input data for the short term prediction are given in Table 4.7.1. The strength of the 2009 year class was estimated as the average of 15 and 28 millions. The higher value was obtained from a regression of recruitment versus the number of 2-year-old cod caught deeper than 200 m in the spring survey. The lower number was obtained from a regression between log(B/C) and recruitment, where "B" is the age 3+ biomass in the recruitment year and "C" is the biomass of predatory age 3+ biomass *close to land* the year before the recruitment year. "C" was itself obtained from a regression between age 3+ biomass on the Faroe Plateau and the condition factor of cod within the 120 m contour (low condition factor: higher proportion close to land), see also Steingrund *et al*., 2010. The strength of the 2010 and 2011 year classes was set at the average of yc 2006 to yc 2008. If the procedure in the Annex is followed (the 2009 year class = the XSA value of 10 millions), a much more pessimistic forecast is obtained (spawning biomass in 2013 = 36000 t compared with 56000 t).. Estimates of stock size (ages 3+) were taken directly from the XSA stock numbers. The exploitation pattern was estimated as the average fishing mortality for 2008-2010. The weights at age in the catches in 2011 were estimated from the commercial catches in January-February or the spring survey (ages 2 and 4-6 years). The weights in the catches in 2012 were set to the values in 2011, i.e., rather high values, whereas a lower value (average 2009-2011) was expected in 2013. The proportion mature in 2011 was set to the 2011 values from the spring groundfish survey, and for 2012-2013 to the average values for 2009-2011.

Table 4.7.2 shows that the landings in 2011 are expected to be 17 000 tonnes (the landings from the Faroe-Icelandic ridge should be added to this figure in order to get the total Faroese landings within the Vb1 area). The spawning stock biomass is expected to be 40 000 tonnes in 2011, 56 000 tonnes in 2012 and eventually 56 000 tonnes in 2013. The current short term prediction is therefore somewhat optimistic. The contribution of the various year-classes to the SSB in 2012 and 2013 is shown in Figure 4.7.1. It shows that the incoming year-classes (YC 2007-YC 2010) dominate the SSB.

A short term projection using the Annex procedures is presented in Table 4.7.3 and Table 4.7.4. It shows that the SSB in 2013 (35000 t) will be below $B_{trigger}$ of 40000 t.

4.8 Long term forecast

The input to the traditional long term forecast is presented in Table 4.8.1 and the result is presented in Table 4.8.2 and Figure 4.8.1.

Single species long term forecasts for Faroe Plateau cod indicated F_{msy} values lower than F_{pa}. An FLR procedure (MSE, Management strategy evaluations using FLR standard packages; a simulation of management and stock response over a 20 yr period) for Faroe Plateau cod indicates that F_{msy} is 0.32. This value (0.32) was adopted by the group as a preliminary F_{msy}.

Multispecies models may give very different perception of Fmsy reference points than single-species models. Therefore, a long-term simulation was performed to evaluate MSY reference points for cod, haddock and saithe, all in the same ecological model (see working document 22). The model settings and the results are presented in the Overview section for the Faroese stocks, but a brief introduction is presented here.

The ecological model has following drivers: 1) Yearly primary production on the Faroe Shelf (<130 m bottom depth), 2) yearly primary production over the outer areas on the Faroe Plateau (130-500 m bottom depth), as well as the fishing mortality of 3) cod, 4) haddock and 5) saithe. All the other dynamics, e.g. recruitment and growth, were modelled.

The main results from the ecological model are shown in Table 4.8.3. It shows that the Fmsy depends heavily on the F-factor on saithe. If the F-factor on saithe is below 0.6, then the Fmsy on cod is higher than the fishing mortality experienced since 1997 (F-factor = 1.1). If the F-factor on saithe increases, the Fmsy on cod decreases down to 0.6. A similar, but less dramatic, feature is seen for haddock. Saithe Fmsy is not affected by the F-factors on cod/haddock, and seems to be above an F-factor of 1 (applying the model to F-factors outside the historical range of below 1.1 is not done). Very similar results were obtained with the model when uncertainty was included. The results from this, very preliminary, ecological model indicate that defining fixed MSY-reference points for single species may be problematic unless the fish species in question is little influenced by other fish species. In case of Faroe Plateau cod, the F-factor on saithe has to be defined before the Fmsy on cod can be derived. Over all F-factors of saithe, the Fmsy for cod may range from 0.3 (high F-factor on saithe) to 0.6 (low F-factor on saithe).

If the F-factor on saithe is set at 0.7 (absolute F = 0.28) then an F-factor on cod of 0.7 (absolute F = 0.42, long term catch = 24.9 kt), and an F-factor on haddock of 0.7 (absolute F = 0.26, catch = 14.5 kt) would optimize the cod and haddock catches (Table 4.8.3), according to the deterministic version of the model.

The ecological model indicated no abrupt decline in cod biomass at F-factors of around 0.9 of the 1997-2006 level (as the cod MSY model in the last years report indicated). The reason may be that as fishing mortality increases, the recruitment of cod (and haddock) decreases, but this leads to a higher food per fish and counteracts the reduction in recruitment. The cod MSY model from last year had the growth rate itself as a major driver, which was not influenced by the reduction in the recruitment of cod. This also shows that it is important to include interactions in MSY models.

The fishing mortality in 2007-2010 (0.41) has been above the preliminary F_{msy} of 0.32.. Given the fact that the assessment tends to overestimate fishing mortality, it might be that the cod fishing mortality since 2007 has been closer to the preliminary Fmsy. However, during slow-growth periods the fishing mortality tends to increase substantially (e.g. to 0.76 in 1997 and to 0.81 in 2002), i.e., far above MSY levels. Hence, the number of fishing days has to be decreased, and more temporary and permanent area closures may also be necessary, especially when above-average cod year classes are entering the fishery. Figures 4.8.2 and 4.8.3 show the average abundance of cod in March (1998-2006) and August (1997-2005) and provide a basis which areas should be closed for the fishery..

4.9 Uncertainties in assessment and forecast

The results from the retrospective analysis of the XSA (Figure 4.9.1) show that there has been a tendency to underestimate the recruitment and total stock/spawning stock biomass slightly, and to overestimate the fishing mortality.

Misreporting is not believed to be a problem under the current effort management system. The total catch figures (in sub-divisions Vb1+Vb2) are believed to be accurate, although there may be some minor problems when allocating the catches between the two sub-divisions.

The sampling of the catches for length measurements and length-weight relationships is considered to be adequate but the number of otoliths could be higher.

The quality of the tuning data is considered to be adequate. The same research vessel has been used all the time and the gear as well as sampling procedures of the catch have remained the same. The only exception may be the otolith sampling during 1994-1996 when larger otolith samples were collected from fewer hauls than during the other years (1997 to present). There was a good agreement between the survey indices and when compared to the commercial tuning series.

4.10 Comparison with previous assessment and forecast

The assessment settings were the same as last year. The estimates of the incoming year classes in the short term projection were obtained in a slightly different way (see section 4.7) than described in the Annex. The Annex procedure estimated the strength of the 2009 year class to be 12 millions at age 1 (Figure 4.9.1), corresponding to 10 millions at age 2, whereas the alternative procedure gave 22 millions at age 2.

Recruitment, total stock biomass, spawning stock biomass, and fishing mortality in 2010 were estimated slightly lower in the current assessment compared to what was predicted last year (Table 4.10.1).

4.11 Management plans and evaluations

There is no explicit management plan for this stock. A management system based on number of fishing days, closed areas and other technical measures was introduced in 1996 with the purpose to ensuring sustainable demersal fisheries in Vb. This was before ICES introduced PA and MSY reference values and at the time it was believed that the purpose was achieved, if the total allowable number of fishing days was set such, that on average 33% of the cod exploitable stock in numbers would be harvested annually. This translates into an average F of 0.45, above the F_{pa} of 0.35. ICES considers this to be inconsistent with the PA and MSY approaches. Work is ongoing

in the Faroes to move away from the Ftarget of 0.45 to be more consistent with the ICES advice.

4.12 Management considerations

The current assessment shows that the spawning cod stock was below B_{lim} of 21 000 tonnes in 2007-2008, but will likely increase to around 55 000 tonnes in 2013. The primary production was high in 2008-2010, and is expected to decrease to below-average (no more than 3 consecutive years of high primary production have occurred in the 1990-2010 timeseries). However, it has to be born in mind that it is very difficult to predict the strength of incoming large year classes in periods when the cod stock recovers. Hence, the short term prediction should be regarded as the best estimate that is at hand for the moment, but the perception may change in the next years' assessments.

Biomass estimates of Faroe Plateau cod reconstructed back in time (Figure 4.6.7) show that the biomass fluctuated around 100 000 tonnes during the period 1906-1957, around 80 000 tonnes during 1958-1987 and eventually around 60 000 tonnes since 1988. The catches fluctuated between 20 000 and 40 000 tonnes, except in 1990-1994 and 2004-2010 when they fluctuated around 10 000 tonnes. Similar catches from smaller biomasses imply that the exploitation rates have increased over time.

There has been a long held view on the Faroe Islands that the cod stock is very resilient to exploitation and that a collapse in the fishery is nearly impossible – people bear in mind the rapid recovery of the cod stock during 1994-1996. The collapse in the fisheries during 1991-1994 has been regarded as an exceptional event. Figure 4.6.7 indicates that, although more resilient than some other cod stocks in the North Atlantic, Faroe Plateau cod does show a decreasing trend since World War II. This trend is likely caused by a combination of environmental factors and fishing effort, but there are reasons to believe that the fishing effort has increased during the period.

The catchability hypothesis presented in the overview section for Faroese stocks, see last year's report, states that the fishing mortality is high when the primary production is low and *vice versa*. The primary production was low, or average, during 2002-2007 and the high fishing mortalities in 2002-2005 were therefore not unexpected. The primary production in 2008 to 2010 was above average, and it is expected that it will be below average in 2011 and some years to come. Hence, it is expected that the fishing mortality will increase in 2011 and onwards.

A note on nominal and actual fishing days is worthwhile. The assessment F provides the result of the actual fishing days used at sea, and the simulations providing Fmsy, as well as reductions in F (by e.g. 35%), apply to the actual fishing days used. One reason why the fishing mortality has been so low the last years is the fact that as many as 40% of the nominal fishing days have not been used. Hence, in order to obtain the maximal sustainable yield in the future, the nominal fishing days have to be reduced considerably more than the actual fishing days.

Up to 40% of the allocated days have not been used the last 3-4 years, which may have contributed to the comparatively low fishing mortality. However, these un-utilized fishing days seem to represent a major obstacle in rebuilding the cod stock to levels where it is able to produce the maximum long-term yield, because they will likely be activated when more cod can be fished. The number of un-utilized fishing days is largest for the small boats (less than half of the days used).

4.13 Ecosystem considerations

The effects of the cod-fishery on the ecosystem (e.g. damage on the bottom) are expected to be small since the majority of the cod catch is taken by longlines. Regarding the ecosystem effects on fishing, this issue is addressed in the ecological MSY-model presented in the Overview section for Faroese stocks.

4.14 Regulations and their effects

As mentioned earlier, there seems to be a poor relationship between the number of fishing days and the fishing mortality because of large fluctuations in catchability. Area restrictions may be the only alternative that may reduce fishing mortality.

4.15 Changes in fishing technology and fishing patterns

Fishing effort per fishing day may have increased gradually since the effort management system was introduced in 1996, although little direct quantitative information exists. There also seems to have been substantial increases in fishing power when new vessels are replacing old vessels.

The fishing pattern in 2006-2010 has changed in comparison to previous years. The large longliners seem to have exploited the deep areas (> 200 m) to a larger extent (ling and tusk) because the catches in shallower waters of cod and haddock have been so poor – which was also observed in the beginning of the 1990s. This could reduce the fishing mortality on cod and haddock, but the small longliners still exploit the shallow areas.

4.16 Changes in the environment

The primary production has been low for a number of years, albeit high in 2008 to 2010, but it is not believed that this has any relationship with a change in the environment.

4.17 References

Jákupsstovu, S. H. and Reinert, J. 1994. Fluctuations in the Faroe Plateau cod stock. ICES Marine Science Symposia, 198:194-211.

Jones, B. W. 1966. The cod and the cod fishery at the Faroe. Fishery Investigations, London, 24.

Steingrund, P., Mouritsen, R., Reinert, J., Gaard, E., and Hátún, H. 2010. Total stock size and cannibalism regulate recruitment in cod (*Gadus morhua*) on the Faroe Plateau. ICES Journal of Marine Science, 67: 111-124.

Table 4.2.1. Faroe Plateau (Sub-division Vb1) COD. Nominal catches (tonnes) by countries, 1986-2010, 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	2006	2007	2008	2009	2010 *
Denmark	-											
Faroe Islands	19,156		29,762	40,602	30,259	17,540	13,556	11,629	9,905	9,394	10,736	13,873
France	- *	1	9 [2]	20	14	2	-	7	1 [2]	1	1	1
Germany	39	2	9	6	7	3 [2]		1 [2]				
Iceland	-	-	-	5	-							
Norway	450	374	531 *	573	447	414	201	49	71	40	14	10
Greenland	-	-	-		-			5	7		7	
Portugal						1						
UK (E/W/NI)[2]	51	18	50	42	15	15	24	1	3			
UK (Scotland)[1]	-	-	-	-	-	-	-	-	358	383	300	
United Kingdom												
Total	19,696	395	30,361	41,248	30,742	17,975	13,781	11,692	10,345	9,818	11,058	13,884

* Preliminary

1) Included in Vb2.

2) Reported as Vb.

Table 4.2.2. Nominal catch (tonnes) of COD in sub-division Vb1 (Faroe Plateau) 1986-2010, 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	2006	2007	2008	2009	2010 *
Officially reported	19,696	395	30,361	41,248	30,742	17,975	13,781	11,692	10,345	9,818	11,058	13,884
Faroese catches in Vb1		21,793 *										
Correction of Faroese catches in Vb1 [1]			-1,766	-2,409	-1,795	-1,041	-804	-690	-588	-557	-637	-823
Faroese catch on the Faroe-Iceland ridge	-1,600	-1,400	-700	-600	-4,700	-4,000	-4,200	-800	-1,800	-1,828	-487	-680
Greenland[2]									6		26	5
Russia[2]											4	
United Kingdom[2]												351
Catches reported as Vb2:												
UK (E/W/NI)	-	-	-	-	-	-						
UK (Scotland)	210	245	288	218	254	244	1,129	278	53	32	38	
United Kingdom				-	-	-	-					
Used in the assessment	18,306	21,033	28,183	38,457	24,501	13,178	9,906	10,480	8,016	7,465	10,002	12,737

*) Preliminary

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

2) Reported to Faroese Coastal Guard.

Table 4.2.3. Faroe Plateau (sub-division Vb1) COD. Estimate of the landings from the Faroe-Icelandic ridge. The landings were estimated from total landings by the single trawlers larger thant 1000 HP (ST>1000 HP) and the proportion of the catch taken on the Faroe-Icelandic ridge (obtained from logbooks). Not updated since the 2009 assessement..

	ST>1000HP			
Year	Landings	Round weight	Ratio Icelandic ridge	Tonnes Icelandic ridge (rounded)
1991	329	365	0.23	100
1992	196	218	0.51	100
1993	179	199	0.38	100
1994	449	498	0.02	0
1995	862	957	0.05	0
1996	667	740	0.06	0
1997	985	1093	0.15	200
1998	1359	1508	0.13	200
1999	2074	2302	0.7	1600
2000	2515	2792	0.49	1400
2001	1649	1831	0.37	700
2002	2267	2516	0.26	600
2003	4492	4986	0.94	4700
2004	3826	4247	0.94	4000
2005	3933	4365	0.95	4200
2006	1097	1217	0.63	800
2007	1335	1482	0.25	400

Table 4.2.4. Faroe Plateau (sub-division Vb1) COD. The landings of Faroese fleets (in percents) of total catch. Note that the catches on the Faroe-Iceland ridge (mainly belonging to single trawlers > 1000 HP) are included in this table, but excluded in the XSA-run.

Year	Open boats	Longliners <100 GRT	Singletrawl <400 HP	Gill net	Jiggers	Singletrawl 400-1000 HP	Singletrawl >1000 HP	Pairtrawl <1000 HP	Pairtrawl >1000 HP	Longliners >100 GRT	Industrial trawlers	Others	Faroe catch Round.weight
1986	9.5	15.1	5.1	1.3	2.9	6.2	8.5	29.6	14.9	5.1	0.4	1.3	34,492
1987	9.9	14.8	6.2	0.5	2.9	6.7	8.0	26.0	14.5	9.9	0.5	0.1	21,303
1988	2.6	13.8	4.9	2.6	7.5	7.4	6.8	25.3	15.6	12.7	0.6	0.2	22,272
1989	4.4	29.0	5.7	3.2	9.3	5.7	5.5	10.5	8.3	17.7	0.7	0.0	20,535
1990	3.9	35.5	4.8	1.4	8.2	3.7	4.3	7.1	10.5	19.6	0.6	0.2	12,232
1991	4.3	31.6	7.1	2.0	8.0	3.4	4.7	8.3	12.9	17.2	0.6	0.1	8,203
1992	2.6	26.0	6.9	0.0	7.0	2.2	3.6	12.0	20.8	13.4	5.0	0.4	5,938
1993	2.2	16.0	15.4	0.0	9.0	4.1	3.6	14.2	21.7	12.6	0.8	0.4	5,744
1994	3.1	13.4	9.6	0.5	19.2	2.7	5.3	8.3	23.7	13.7	0.5	0.1	8,724
1995	4.2	17.9	6.5	0.3	24.9	4.1	4.7	6.4	12.3	18.5	0.1	0.0	19,079
1996	4.0	19.0	4.0	0.0	20.0	3.0	2.0	8.0	19.0	21.0	0.0	0.0	39,406
1997	3.1	28.4	4.4	0.5	9.8	5.1	2.9	4.8	11.3	29.7	0.0	0.1	33,556
1998	2.4	31.2	6.0	1.3	6.5	6.3	5.5	3.1	8.6	29.1	0.1	0.0	23,308
1999	2.7	24.0	5.4	2.3	5.4	5.2	11.8	6.4	14.5	21.9	0.4	0.1	19,156
2000	2.3	19.3	9.1	0.9	10.5	9.6	12.7	5.7	13.9	15.7	0.1	0.1	21,793
2001	3.7	28.3	7.4	0.2	15.6	6.4	6.4	5.2	9.2	17.8	0.0	0.0	28,838
2002	3.8	32.9	5.8	0.3	9.9	6.7	6.6	2.5	7.2	24.4	0.0	0.0	38,347
2003	4.9	28.7	4.0	1.5	7.4	3.0	14.4	2.2	7.4	26.5	0.0	0.0	29,382
2004	4.4	31.1	2.1	0.5	6.6	1.6	12.9	2.2	11.7	26.8	0.0	0.0	16,772
2005	3.7	27.5	5.1	0.8	5.4	2.4	28.1	1.7	6.4	18.8	0.0	0.0	15,472
2006	6.2	35.0	3.2	0.2	7.1	1.6	12.9	2.5	6.6	24.7	0.0	0.0	8,636
2007	5.1	28.2	2.6	0.3	6.1	1.7	17.5	1.7	4.8	32.0	0.0	0.0	8,866
2008	5.1	32.7	4.7	0.7	6.4	3.2	14.6	1.0	3.1	28.6	0.0	0.0	7,666
2009	6.9	41.6	4.3	0.3	10.1	2.5	1.9	2.8	6.5	23.0	0.0	0.0	7,146
2010	6.2	31.9	2.7	0.0	12.6	1.3	1.4	3.4	9.6	30.8	0.0	0.0	10,258
Average	**4.4**	**26.1**	**5.7**	**0.9**	**9.5**	**4.2**	**8.3**	**8.0**	**11.8**	**20.4**	**0.4**	**0.1**	

Table 4.2.5. Faroe Plateau COD. Catch in numbers at age per fleet in 2010. Numbers are in thousands and the catch is in tonnes, round weight.

Age\Fleet	Open boats	Longliners < 100 GRT	Jiggers	Single trwl 0-399HP	Single trwl 400-1000H	Single trwl > 1000 HP	Pair trwl 700-999 HI	Pair trwl > 1000 HP	Longliners > 100 GRT	Gillnetters	Others (scaling)	Catch-at-age
2	242	944	437	62	28	28	23	68	316	0	-38	2110
3	171	821	302	155	69	59	40	122	327	0	-36	2030
4	57	325	101	75	36	42	24	72	143	0	-16	859
5	30	179	68	48	23	20	11	30	67	0	-9	467
6	24	183	71	54	26	12	7	20	92	0	-9	480
7	14	53	25	16	7	5	4	8	50	0	-4	178
8	2	11	5	6	3	3	1	4	22	0	1	58
9	2	8	2	3	1	2	1	3	11	0	0	33
10+	1	4	0	1	0	2	1	2	26	0	1	38
Sum	543	2528	1011	420	193	173	112	329	1054	0	-110	6253
G.weight	576	2949	1164	246	120	126	316	890	2849	5	2234	11475

Others include industrial bottom trawlers, longlining for halibut, foreign fleets, **and scaling to correct catch.**
Gutted total catch is calculated as round weight divided by 1.11.

Table 4.2.6. Faroe Plateau COD. Catch in numbers at age 1961-2010.

year	age 1	2	3	4	5	6	7	8	9	10
1961	0	3093	2686	1331	1066	232	372	78	29	0
1962	0	4424	2500	1255	855	481	93	94	22	0
1963	0	4110	3958	1280	662	284	204	48	30	0
1964	0	2033	3021	2300	630	350	158	79	41	0
1965	0	852	3230	2564	1416	363	155	48	63	0
1966	0	1337	970	2080	1339	606	197	104	33	0
1967	0	1609	2690	860	1706	847	309	64	27	0
1968	0	1529	3322	2663	945	1226	452	105	11	0
1969	0	878	3106	3300	1538	477	713	203	92	0
1970	0	402	1163	2172	1685	752	244	300	44	0
1971	0	328	757	821	1287	1451	510	114	179	0
1972	0	875	1176	810	596	1021	596	154	25	0
1973	0	723	3124	1590	707	384	312	227	120	97
1974	0	2161	1266	1811	934	563	452	149	141	91
1975	0	2584	5689	2157	2211	813	295	190	118	150
1976	0	1497	4158	3799	1380	1427	617	273	120	186
1977	0	425	3282	6844	3718	788	1160	239	134	9
1978	0	555	1219	2643	3216	1041	268	201	66	56
1979	0	575	1732	1673	1601	1906	493	134	87	38
1980	0	1129	2263	1461	895	807	832	339	42	18
1981	0	646	4137	1981	947	582	487	527	123	55
1982	0	1139	1965	3073	1286	471	314	169	254	122
1983	0	2149	5771	2760	2746	1204	510	157	104	102
1984	0	4396	5234	3487	1461	912	314	82	34	66
1985	0	998	9484	3795	1669	770	872	309	65	80
1986	0	210	3586	8462	2373	907	236	147	47	38
1987	0	257	1362	2611	3083	812	224	68	69	26
1988	0	509	2122	1945	1484	2178	492	168	33	25
1989	0	2237	2151	2187	1121	1026	997	220	61	9
1990	0	243	2849	1481	852	404	294	291	50	26
1991	0	192	451	2152	622	303	142	93	53	24
1992	0	205	455	466	911	293	132	53	30	34
1993	0	120	802	603	222	329	96	33	22	25
1994	0	573	788	1062	532	125	176	39	23	16
1995	0	2615	2716	2008	1012	465	118	175	44	49
1996	0	351	5164	4608	1542	1526	596	147	347	47
1997	0	200	1278	6710	3731	657	639	170	51	120
1998	0	455	745	1558	5140	1529	159	118	28	25
1999	0	1185	993	799	1107	2225	439	59	17	7
2000	0	2091	2637	782	426	674	809	104	7	1
2001	0	3912	3759	2101	367	367	718	437	36	6
2002	0	2079	7283	3372	1671	470	533	413	290	7
2003	0	678	2128	4572	1927	640	177	91	115	20
2004	0	100	691	1263	2105	736	240	65	42	37
2005	0	494	592	877	1122	823	204	41	19	30
2006	0	1182	1168	499	706	852	355	81	11	3
2007	0	540	1308	771	337	308	273	91	21	3
2008	0	293	776	799	439	191	160	159	58	20
2009	0	875	2267	863	619	297	85	55	43	17
2010	0	2110	2030	859	467	480	178	58	33	38

Table 4.2.7. Faroe Plateau COD. Catch weight at age 1961-2010.

year	age 1	2	3	4	5	6	7	8	9	10
1961	0	1.080	2.220	3.450	4.690	5.520	7.090	9.910	8.030	0.000
1962	0	1.000	2.270	3.350	4.580	4.930	9.080	6.590	6.660	0.000
1963	0	1.040	1.940	3.510	4.600	5.500	6.780	8.710	11.720	0.000
1964	0	0.970	1.830	3.150	4.330	6.080	7.000	6.250	6.190	0.000
1965	0	0.920	1.450	2.570	3.780	5.690	7.310	7.930	8.090	0.000
1966	0	0.980	1.770	2.750	3.510	4.800	6.320	7.510	10.340	0.000
1967	0	0.960	1.930	3.130	4.040	4.780	6.250	7.000	11.010	0.000
1968	0	0.880	1.720	3.070	4.120	4.650	5.500	7.670	10.950	0.000
1969	0	1.090	1.800	2.850	3.670	4.890	5.050	7.410	8.660	0.000
1970	0	0.960	2.230	2.690	3.940	5.140	6.460	10.310	7.390	0.000
1971	0	0.810	1.800	2.980	3.580	3.940	4.870	6.480	6.370	0.000
1972	0	0.660	1.610	2.580	3.260	4.290	4.950	6.480	6.900	0.000
1973	0	1.110	2.000	3.410	3.890	5.100	5.100	6.120	8.660	7.570
1974	0	1.080	2.220	3.440	4.800	5.180	5.880	6.140	8.630	7.620
1975	0	0.790	1.790	2.980	4.260	5.460	6.250	7.510	7.390	8.170
1976	0	0.940	1.720	2.840	3.700	5.260	6.430	6.390	8.550	13.620
1977	0	0.870	1.790	2.530	3.680	4.650	5.340	6.230	8.380	10.720
1978	0	1.112	1.385	2.140	3.125	4.363	5.927	6.348	8.715	12.229
1979	0	0.897	1.682	2.211	3.052	3.642	4.719	7.272	8.368	13.042
1980	0	0.927	1.432	2.220	3.105	3.539	4.392	6.100	7.603	9.668
1981	0	1.080	1.470	2.180	3.210	3.700	4.240	4.430	6.690	10.000
1982	0	1.230	1.413	2.138	3.107	4.012	5.442	5.563	5.216	6.707
1983	0	1.338	1.950	2.403	3.107	4.110	5.020	5.601	8.013	8.031
1984	0	1.195	1.888	2.980	3.679	4.470	5.488	6.466	6.628	10.981
1985	0	0.905	1.658	2.626	3.400	3.752	4.220	4.739	6.511	10.981
1986	0	1.099	1.459	2.046	2.936	3.786	4.699	5.893	9.700	8.815
1987	0	1.093	1.517	2.160	2.766	3.908	5.461	6.341	8.509	9.811
1988	0	1.061	1.749	2.300	2.914	3.109	3.976	4.896	7.087	8.287
1989	0	1.010	1.597	2.200	2.934	3.468	3.750	4.682	6.140	9.156
1990	0	0.945	1.300	1.959	2.531	3.273	4.652	4.758	6.704	8.689
1991	0	0.779	1.271	1.570	2.524	3.185	4.086	5.656	5.973	8.147
1992	0	0.989	1.364	1.779	2.312	3.477	4.545	6.275	7.619	9.725
1993	0	1.155	1.704	2.421	3.132	3.723	4.971	6.159	7.614	9.587
1994	0	1.194	1.843	2.613	3.654	4.584	4.976	7.146	8.564	8.796
1995	0	1.218	1.986	2.622	3.925	5.180	6.079	6.241	7.782	8.627
1996	0	1.016	1.737	2.745	3.800	4.455	4.978	5.270	5.593	7.482
1997	0	0.901	1.341	1.958	3.012	4.158	4.491	5.312	6.172	7.056
1998	0	1.004	1.417	1.802	2.280	3.478	5.433	5.851	7.970	8.802
1999	0	1.050	1.586	2.350	2.774	3.214	5.496	8.276	9.129	10.652
2000	0	1.416	2.170	3.187	3.795	4.048	4.577	8.182	11.895	13.009
2001	0	1.164	2.076	3.053	3.976	4.394	4.871	5.563	7.277	12.394
2002	0	1.017	1.768	2.805	3.529	4.095	4.475	4.650	6.244	7.457
2003	0	0.820	1.362	2.127	3.329	4.092	4.670	6.000	6.727	6.810
2004	0	1.037	1.154	1.693	2.363	3.830	5.191	6.326	7.656	9.573
2005	0	0.986	1.373	1.760	2.293	3.138	5.287	8.285	8.703	9.517
2006	0	0.839	1.304	1.988	2.386	3.330	4.691	7.635	9.524	11.990
2007	0	0.937	1.324	1.970	3.076	3.529	4.710	6.464	9.461	9.509
2008	0	1.209	1.478	2.104	2.714	3.804	4.669	5.915	7.233	9.559
2009	0	0.805	1.431	2.287	2.723	3.435	5.081	6.281	8.312	9.959
2010	0	1.049	1.642	2.400	3.212	3.678	4.774	5.973	7.094	9.800

Table 4.2.8. Faroe Plateau (sub-division Vb1) COD. Proportion mature at age 1983-2010. From 1961-1982 the average from 1983-1996 is used (as it was used in the 1990s).

	age									
year	1	2	3	4	5	6	7	8	9	10
1961	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1962	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1963	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1964	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1965	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1966	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1967	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1968	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1969	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1970	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1971	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1972	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1973	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1974	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1975	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1976	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1977	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1978	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1979	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1980	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1981	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1982	0	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1	1
1983	0	0.03	0.71	0.93	0.94	1.00	1.00	1.00	1	1
1984	0	0.07	0.96	0.98	0.97	1.00	1.00	1.00	1	1
1985	0	0.00	0.50	0.96	0.96	1.00	1.00	1.00	1	1
1986	0	0.00	0.38	0.93	1.00	1.00	0.96	0.94	1	1
1987	0	0.00	0.67	0.91	1.00	1.00	1.00	1.00	1	1
1988	0	0.06	0.72	0.90	0.97	1.00	1.00	1.00	1	1
1989	0	0.05	0.54	0.98	1.00	1.00	1.00	1.00	1	1
1990	0	0.00	0.68	0.90	0.99	0.96	0.98	1.00	1	1
1991	0	0.00	0.72	0.86	1.00	1.00	1.00	1.00	1	1
1992	0	0.06	0.50	0.82	0.98	1.00	1.00	1.00	1	1
1993	0	0.03	0.73	0.78	0.91	0.99	1.00	1.00	1	1
1994	0	0.05	0.33	0.88	0.96	1.00	0.96	1.00	1	1
1995	0	0.09	0.35	0.33	0.66	0.97	1.00	1.00	1	1
1996	0	0.04	0.43	0.74	0.85	0.94	1.00	1.00	1	1
1997	0	0.00	0.64	0.91	0.97	1.00	1.00	1.00	1	1
1998	0	0.00	0.62	0.90	0.99	0.99	1.00	1.00	1	1
1999	0	0.02	0.43	0.88	0.98	1.00	1.00	1.00	1	1
2000	0	0.02	0.39	0.69	0.92	0.99	1.00	1.00	1	1
2001	0	0.07	0.47	0.86	0.94	1.00	1.00	1.00	1	1
2002	0	0.04	0.37	0.76	0.97	0.93	0.97	1.00	1	1
2003	0	0.00	0.29	0.79	0.88	0.98	1.00	1.00	1	1
2004	0	0.00	0.51	0.78	0.92	0.89	0.87	1.00	1	1
2005	0	0.05	0.66	0.90	0.93	0.98	0.92	1.00	1	1
2006	0	0.04	0.59	0.80	0.99	0.99	1.00	1.00	1	1
2007	0	0.00	0.47	0.78	0.91	0.99	0.97	1.00	1	1
2008	0	0.10	0.78	0.91	0.90	0.95	1.00	1.00	1	1
2009	0	0.09	0.61	0.81	0.96	0.94	0.96	1.00	1	1
2010	0	0.08	0.61	0.77	0.94	0.97	1.00	1.00	1	1

Table 4.2.9. Faroe Plateau (sub-division Vb1) COD. Summer survey tuning series (number of individuals per 200 stations) and spring survey tuning series (number of individuals per 100 stations).

```
FAROE PLATEAU COD (ICES SUBDIVISION VB1)        Surveys.TXT
102
SUMMER SURVEY
1996 2010
1 1 0.6 0.7
2 8
 200  707.3   6614.6   3763     1322.2   714    236.2   49
 200  513.1   1502.1   6771     1479.9   180.8  139.5   30.4
 200  527      509.1    989.1   3723.7   915.6   50.5   37.2
 200  373.4   1257.4    753.8    676.1  1424.8  239.1   40.5
 200 1364.1   1153.3    673.8    309.6   436.9  600.8   35.4
 200 3422.1   2458.7   1537.8    415.9   234.8  283    242
 200 2326     5562.9   1816.5    810.8   147.7   83.3   69.5
 200  354     1038.8   2209.2    565.9   123.4   17.6   11.9
 200  437      839.9   1080.2   1550.2   344.2   80.2   25.7
 200  616.5    735.1    872.1   1166.3   756    142.5   44.8
 200  978.4    684.2    349.3    312     256.6  123     28.2
 200  234.1    448.7    314.2    179.7   134.5   75.9   30.9
 200   68.8    370.1    328      401.2   160.1   52.4   27.5
 200  428.2   1980.6    817.7    551.4   393.1  132.1   47.8
 200 1239.3   1543.9   1012      363.4   243.6  148.9   41.5

SPRING SURVEY (shifted back to december)
1993 2010
1 1 0.9 1.0
1 8
 100   567.8    335.1     906.5     504.7     128.9    186.1    28.5     0.1
 100   706      785.9    1453.4    1480.1    1179      284     349      48.6
 100   393.6   3975      3606.1    1768.2    1314.2    403.6    79.6   161.3
 100    90.7    935.7    5474      2309.5     328.8    223.9    57.8     5.2
 100    76.2    424.4    1548.5    4857.6    1126.2     81.7    40.5    34.8
 100   530.1    644.9     972.5    1204.4    2047.4    250      25.1    13.3
 100   288.8   1402.2     735.7     436.6     502.1    829.6    63.4     3.1
 100   874.1   2282.9    1953.5     448.8     320.4    572.5   128       3.9
 100   345.9   4193.7    2789.9    1544.1     323.2    225.7   174.1   128.1
 100   79.1     720.2    4343.4    1350.6     548.9     63.3    48.2    36.9
 100   426.8    450.2     786.3    1198.8     297.7     65.8    21.9    11.8
 100   293.4    400.4    1100.5    1409.9     837.9    139.7    14       3.8
 100   129.7    144.5     166.1     340.7     281.1     92.1    15.2     3.9
 100    40.5    255.7     270.6     148.3     164.1    102.9    37.5    14.3
 100   147.2    411.3     764.3     445.6     144.4     80.9    38.5    13.3
 100   266.8    464       968.1    1151.1     425.1     73.4    31.4    24.8
 100   734.6   1285       737       534.9     378.8     98.4    40.8    17.1
 100   152.2   1305.1    1229.7     559.7     299.3    237.3    85      21.9
```

Table 4.2.10. Faroe Plateau (sub-division Vb1) COD. Pairtrawler abundance index (number of individuals per 1000 fishing hours). This series was not used in the tuning of the XSA. The season is June – December. The otoliths are selected from deep (> 150 m) locations.

	2	3	4	5	6	7	8	9
1989	1200	1638	1783	1381	928	719	297	194
1990	116	2856	2057	834	465	419	200	0
1991	8	148	1401	869	329	225	65	93
1992	84	487	696	1234	760	353	129	62
1993	51	1081	2192	746	1062	398	67	107
1994	1314	2129	1457	2208	697	1241	461	53
1995	577	3645	5178	4199	2769	543	539	106
1996	242	10608	16683	7985	4410	194	0	723
1997	28	674	6038	9375	2413	944	113	0
1998	80	731	1805	5941	4904	801	286	0
1999	444	2082	1933	3008	5136	2220	218	4
2000	3478	3956	1737	956	1003	1694	382	0
2001	3385	6700	3009	555	415	797	862	25
2002	571	6409	5019	1235	432	400	41	228
2003	63	1341	4450	3630	870	270	152	145
2004	23	0	278	2534	2831	1733	274	184
2005	42	399	655	1766	2171	860	148	70
2006	93	135	699	755	1580	612	787	71
2007	64	916	1767	1392	802	656	206	46
2008	54	295	418	573	387	456	487	182
2009	11	734	801	756	448	247	147	105
2010	1667	3084	1867	567	544	179	0	63

Table 4.2.11. Faroe Plateau (sub-division Vb1) COD. Longliner abundance index (number of individuals per 100000 hooks). This series was not used in the tuning of the XSA. The age composition was obtained from all longliners > 100 GRT. The area was restricted to the area west of Faroe Islands at depths between 100 and 200 m.

	1	2	3	4	5	6	7	8
1993	405	2610	9306	3330	806	2754	847	258
1994	101	8105	14105	7863	4659	962	1187	71
1995	0	15249	23062	2895	2505	1568	708	1073
1996	0	2269	18658	13265	4153	8435	4513	1147
1997	0	1738	5837	26368	18089	2805	2807	402
1998	1892	4490	2025	2565	11738	2732	131	19
1999	849	10968	3811	985	1891	3759	548	109
2000	2695	10983	6710	998	780	1473	2136	109
2001	287	12999	7409	2660	515	1135	1808	2545
2002	105	6862	20902	10819	7759	1561	1945	1265
2003	16	2099	6057	15910	7778	1830	708	650
2004	59	510	1773	2438	3214	1059	293	71
2005	297	2169	1543	2313	2327	1360	170	13
2006	151	5813	5319	674	2205	2352	1148	56
2007	274	3578	6383	2778	1927	1159	1118	134
2008	1270	2243	4449	4773	2564	1133	816	716
2009	294	2670	15107	6308	3028	2491	683	132
2010	23	20287	16914	8733	2595	4780	1878	864

Table 4.6.1. Faroe Plateau (sub-division Vb1) COD. The XSA-run.

```
Lowestoft VPA Version 3.1

  18/04/2011  12:29

Extended Survivors Analysis

COD FAROE PLATEAU (ICES SUBDIVISION Vb1)                COD_ind_Surveys10.txt

CPUE data from file Surveys.TXT

Catch data for  50 years. 1961 to 2010. Ages  1 to  10.

     Fleet,            First, Last, First, Last, Alpha,  Beta
                     ,    year, year,  age ,  age
SUMMER SURVEY        ,   1996, 2010,   2,     8,   .600,   .700
SPRING SURVEY (shift,   1993, 2010,   1,     8,   .900,  1.000


Time series weights :

     Tapered time weighting not applied


Catchability analysis :

     Catchability dependent on stock size for ages <    3

        Regression type = C
        Minimum of   5 points used for regression
        Survivor estimates shrunk to the population mean for ages <  3


     Catchability independent of age for ages >=    6


Terminal population estimation :

     Survivor estimates shrunk towards the mean F
     of the final   5 years or the   5 oldest ages.

     S.E. of the mean to which the estimates  are shrunk =   2.000

     Minimum standard error for population
     estimates derived from each fleet =    .300

     Prior weighting not applied

Tuning had not converged after   40 iterations


Total absolute residual between iterations
39 and  40 =     .00014

Final year F values
Age         ,      1,      2,      3,      4,      5,      6,      7,      8,      9
Iteration 39,  .0000,  .1277,  .2664,  .3086,  .3937,  .6072,  .4983,  .5194,  .7418
Iteration 40,  .0000,  .1277,  .2664,  .3086,  .3937,  .6072,  .4983,  .5194,  .7417

Regression weights
      , 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000


Fishing mortalities
   Age,  2001,  2002,  2003,  2004,  2005,  2006,  2007,  2008,  2009,  2010

     1,  .000,  .000,  .000,  .000,  .000,  .000,  .000,  .000,  .000,  .000
     2,  .157,  .190,  .127,  .031,  .090,  .173,  .106,  .038,  .079,  .128
     3,  .344,  .490,  .304,  .185,  .255,  .316,  .294,  .217,  .453,  .266
     4,  .454,  .598,  .663,  .297,  .378,  .355,  .356,  .295,  .400,  .309
     5,  .307,  .815,  .848,  .754,  .471,  .602,  .434,  .352,  .392,  .394
     6,  .350,  .824,  .890,  .975,  .771,  .817,  .579,  .471,  .429,  .607
     7,  .696, 1.364,  .887, 1.070,  .819,  .946,  .683,  .689,  .396,  .498
     8,  .605, 1.227,  .935, 1.024,  .510,  .956,  .680, 1.192,  .539,  .519
     9,  .718, 1.119, 1.712, 2.054, 1.014,  .246,  .707, 1.421, 1.416,  .742
```

XSA population numbers (Thousands)

YEAR	AGE 1	2	3	4	5	6	7	8	9
2001	1.62E+04	2.97E+04	1.43E+04	6.37E+03	1.54E+03	1.37E+03	1.58E+03	1.06E+03	7.76E+01
2002	7.66E+03	1.33E+04	2.08E+04	8.28E+03	3.31E+03	9.26E+02	7.91E+02	6.46E+02	4.76E+02
2003	4.47E+03	6.27E+03	8.98E+03	1.04E+04	3.72E+03	1.20E+03	3.33E+02	1.66E+02	1.55E+02
2004	7.78E+03	3.66E+03	4.52E+03	5.43E+03	4.39E+03	1.31E+03	4.04E+02	1.12E+02	5.32E+01
2005	1.01E+04	6.37E+03	2.91E+03	3.08E+03	3.30E+03	1.69E+03	4.03E+02	1.13E+02	3.29E+01
2006	7.28E+03	8.23E+03	4.77E+03	1.84E+03	1.73E+03	1.69E+03	6.41E+02	1.45E+02	5.57E+01
2007	1.06E+04	5.96E+03	5.67E+03	2.85E+03	1.06E+03	7.74E+02	6.10E+02	2.04E+02	4.58E+01
2008	1.55E+04	8.72E+03	4.39E+03	3.46E+03	1.63E+03	5.62E+02	3.55E+02	2.52E+02	8.45E+01
2009	2.38E+04	1.27E+04	6.87E+03	2.89E+03	2.11E+03	9.40E+02	2.87E+02	1.46E+02	6.27E+01
2010	1.25E+04	1.95E+04	9.59E+03	3.58E+03	1.59E+03	1.17E+03	5.01E+02	1.58E+02	6.96E+01

Estimated population abundance at 1st Jan 2011

	0.00E+00	1.02E+04	1.40E+04	6.02E+03	2.15E+03	8.76E+02	5.20E+02	2.49E+02	7.71E+01

Taper weighted geometric mean of the VPA populations:

	1.64E+04	1.35E+04	9.97E+03	6.15E+03	3.36E+03	1.65E+03	7.45E+02	2.98E+02	1.21E+02

Standard error of the weighted Log(VPA populations) :

	.5908	.5896	.5819	.5786	.5656	.5766	.6201	.6955	.8088

1

Log catchability residuals.

Fleet : SUMMER SURVEY

Age	1993	1994	1995	1996	1997	1998	1999	2000
1	No data for this fleet at this age							
2	99.99	99.99	99.99	-.16	.21	.36	-.87	.13
3	99.99	99.99	99.99	.19	-.16	-.53	.58	-.36
4	99.99	99.99	99.99	.29	.40	-.50	-.04	.16
5	99.99	99.99	99.99	.77	.05	.35	-.59	-.68
6	99.99	99.99	99.99	.26	-.11	.69	.19	-.55
7	99.99	99.99	99.99	.37	.03	-.34	.61	.10
8	99.99	99.99	99.99	-.10	-.23	.11	.38	-.21

Age	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1	No data for this fleet at this age									
2	.67	1.11	-.08	.61	.44	.71	-.45	-2.11	-.62	.05
3	.12	.66	-.30	.09	.45	-.08	-.69	-.67	.71	.00
4	.19	.19	.19	-.11	.30	-.12	-.66	-.85	.31	.25
5	-.01	.22	-.23	.55	.37	-.22	-.39	-.08	.01	-.12
6	-.49	-.25	-.65	.35	.75	-.30	-.32	.10	.46	-.12
7	-.22	-.31	-1.31	.13	.54	.01	-.59	-.41	.53	.16
8	-.04	-.38	-.98	.24	.45	.03	-.39	-.39	.29	.05

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	3	4	5	6	7	8
Mean Log q	-6.8258	-6.4811	-6.2673	-6.2190	-6.2190	-6.2190
S.E(Log q)	.4627	.3834	.4042	.4409	.5098	.3800

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
2	1.01	-.016	7.88	.35	15	.82	-7.89

Ages with q independent of year class strength and constant w.r.t. time.

Age,	Slope ,	t-value ,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Q
3,	.89,	.645,	7.06,	.72,	15,	.42,	-6.83,
4,	.84,	1.344,	6.81,	.84,	15,	.31,	-6.48,
5,	.81,	1.492,	6.59,	.82,	15,	.31,	-6.27,
6,	.86,	.762,	6.37,	.71,	15,	.39,	-6.22,
7,	.88,	.564,	6.28,	.65,	15,	.46,	-6.27,
8,	1.26,	-1.336,	6.54,	.67,	15,	.46,	-6.30,

Fleet : SPRING SURVEY (shift

Age ,	1993,	1994,	1995,	1996,	1997,	1998,	1999,	2000
1 ,	.06,	-.24,	.35,	-.47,	-.57,	.55,	-.39,	.34
2 ,	-.65,	-.81,	.10,	.02,	.03,	.52,	.31,	.44
3 ,	-.51,	.09,	.15,	.11,	-.04,	.22,	.18,	.31
4 ,	-.47,	.07,	.63,	.03,	.29,	-.12,	-.40,	-.04
5 ,	-.54,	.79,	.39,	-.10,	.30,	.22,	-.52,	-.29
6 ,	-.58,	.86,	.47,	-.12,	-.09,	.22,	.36,	.33
7 ,	-.35,	.41,	.11,	-.18,	-.28,	-.29,	.11,	-.78
8 ,	-4.66,	.71,	.08,	-1.56,	.81,	-.07,	-1.46,	-1.67

Age ,	2001,	2002,	2003,	2004,	2005,	2006,	2007,	2008,	2009,	2010
1 ,	.19,	-.58,	1.69,	.75,	-.35,	-1.23,	-.27,	-.03,	.59,	-.40
2 ,	.58,	-.11,	.18,	.54,	-.85,	-.54,	.14,	-.20,	.34,	-.03
3 ,	.41,	.61,	-.44,	.47,	-.91,	-.86,	-.01,	.41,	-.09,	-.09
4 ,	.42,	.16,	-.12,	.34,	-.43,	-.78,	-.11,	.59,	.10,	-.15
5 ,	.11,	.35,	-.35,	.43,	-.64,	-.41,	-.21,	.36,	.03,	.08
6 ,	.09,	-.34,	-.49,	.26,	-.61,	-.46,	-.14,	-.02,	-.28,	.55
7 ,	.02,	.06,	-.31,	-.78,	-.93,	-.38,	-.55,	-.21,	-.01,	.26
8 ,	.02,	-.13,	-.19,	-.85,	-1.32,	.15,	-.52,	.38,	-.07,	.08

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age ,	3,	4,	5,	6,	7,	8
Mean Log q,	-6.1251,	-5.8227,	-5.7887,	-5.9802,	-5.9802,	-5.9802,
S.E(Log q),	.4323,	.3753,	.4043,	.4216,	.4380,	1.3973,

Regression statistics :

Ages with q dependent on year class strength

Age,	Slope ,	t-value ,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Log q
1,	1.03,	-.132,	8.40,	.50,	18,	.68,	-8.44,
2,	.86,	.783,	7.36,	.68,	18,	.47,	-7.05,

Ages with q independent of year class strength and constant w.r.t. time.

Age,	Slope ,	t-value ,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Q
3,	.80,	1.575,	6.70,	.80,	18,	.33,	-6.13,
4,	.80,	1.923,	6.37,	.85,	18,	.28,	-5.82,
5,	.85,	1.151,	6.11,	.79,	18,	.34,	-5.79,
6,	.97,	.186,	6.02,	.65,	18,	.42,	-5.98,
7,	.93,	.513,	6.22,	.76,	18,	.35,	-6.21,
8,	.58,	1.777,	6.06,	.53,	18,	.69,	-6.55,

Terminal year survivor and F summaries :

Age 1 Catchability dependent on age and year class strength

Year class = 2009

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
SUMMER SURVEY ,	1.,	.000,	.000,	.00,	0,	.000,	.000
SPRING SURVEY (shift,	6871.,	.701,	.000,	.00,	1,	.415,	.000
P shrinkage mean ,	13494.,	.59,,,,				.585,	.000
F shrinkage mean ,	0.,	2.00,,,,				.000,	.000

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
10200.,	.45,	.52,	2,	1.145,	.000

Age 2 Catchability dependent on age and year class strength

Year class = 2008

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
SUMMER SURVEY ,	14790.,	.865,	.000,	.00,	1,	.120,	.121
SPRING SURVEY (shift,	16476.,	.403,	.285,	.71,	2,	.553,	.110
P shrinkage mean ,	9966.,	.58,,,,				.302,	.175
F shrinkage mean ,	18676.,	2.00,,,,				.026,	.097

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
14020.,	.31,	.17,	5,	.558,	.128

Age 3 Catchability constant w.r.t. time and dependent on age

Year class = 2007

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
SUMMER SURVEY ,	5251.,	.417,	.260,	.62,	2,	.335,	.300
SPRING SURVEY (shift,	6491.,	.297,	.143,	.48,	3,	.646,	.249
F shrinkage mean ,	5074.,	2.00,,,,				.019,	.309

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
6018.,	.24,	.11,	6,	.455,	.266

Age 4 Catchability constant w.r.t. time and dependent on age

Year class = 2006

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
SUMMER SURVEY ,	2704.,	.298,	.457,	1.53,	3,	.409,	.253
SPRING SURVEY (shift,	1836.,	.242,	.029,	.12,	4,	.577,	.353
F shrinkage mean ,	1799.,	2.00,,,,				.014,	.359

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
2150.,	.19,	.17,	8,	.921,	.309

Age 5 Catchability constant w.r.t. time and dependent on age

Year class = 2005

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
SUMMER SURVEY	797.,	.245,	.201,	.82,	4,	.444,	.426
SPRING SURVEY (shift,	951.,	.215,	.163,	.76,	5,	.543,	.368
F shrinkage mean ,	736.,	2.00,,,,				.013,	.454

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
876.,	.16,	.12,	10,	.713,	.394

Age 6 Catchability constant w.r.t. time and dependent on age

Year class = 2004

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
SUMMER SURVEY	388.,	.224,	.198,	.88,	5,	.453,	.751
SPRING SURVEY (shift,	667.,	.202,	.164,	.81,	6,	.533,	.501
F shrinkage mean ,	507.,	2.00,,,,				.015,	.619

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
520.,	.15,	.14,	12,	.927,	.607

Age 7 Catchability constant w.r.t. time and age (fixed at the value for age) 6

Year class = 2003

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
SUMMER SURVEY	260.,	.219,	.163,	.74,	6,	.443,	.483
SPRING SURVEY (shift,	244.,	.199,	.169,	.85,	7,	.543,	.506
F shrinkage mean ,	155.,	2.00,,,,				.014,	.714

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
249.,	.15,	.11,	14,	.742,	.498

Age 8 Catchability constant w.r.t. time and age (fixed at the value for age) 6

Year class = 2002

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
SUMMER SURVEY	85.,	.214,	.109,	.51,	7,	.570,	.480
SPRING SURVEY (shift,	69.,	.203,	.178,	.88,	8,	.413,	.568
F shrinkage mean ,	44.,	2.00,,,,				.016,	.783

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
77.,	.15,	.10,	16,	.655,	.519

Age 9 Catchability constant w.r.t. time and age (fixed at the value for age) 6

Year class = 2001

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
SUMMER SURVEY	29.,	.242,	.122,	.50,	7,	.598,	.711
SPRING SURVEY (shift,	23.,	.224,	.086,	.38,	8,	.357,	.839
F shrinkage mean ,	50.,	2.00,,,,				.046,	.469

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
27.,	.19,	.08,	16,	.438,	.742

Table 4.6.2. Faroe Plateau (sub-division Vb1) COD. Fishing mortality at age.

YEAR	2	3	4	5	6	7	8	9	10+	FBAR 3- 7
1961	0.3346	0.5141	0.4986	0.5737	0.4863	0.9566	0.8116	0.6715	0.6715	0.6059
1962	0.2701	0.4982	0.4838	0.7076	0.5569	0.3662	0.6826	0.5641	0.5641	0.5226
1963	0.2534	0.4138	0.5172	0.5124	0.5405	0.4879	0.3269	0.4806	0.4806	0.4944
1964	0.1086	0.2997	0.4523	0.5229	0.5659	0.6677	0.3531	0.5164	0.5164	0.5017
1965	0.1209	0.2518	0.4498	0.5622	0.6604	0.5305	0.4345	0.5318	0.5318	0.4909
1966	0.0829	0.1969	0.2552	0.4499	0.5016	0.968	0.852	0.6106	0.6106	0.4743
1967	0.0789	0.2389	0.2687	0.3442	0.5779	0.5203	1.0438	0.5556	0.5556	0.39
1968	0.101	0.2318	0.3949	0.5339	0.4472	0.7132	0.3331	0.4882	0.4882	0.4642
1969	0.1099	0.3063	0.3806	0.418	0.5709	0.5118	0.8457	0.5499	0.5499	0.4375
1970	0.053	0.2081	0.3654	0.3409	0.3709	0.6559	0.4208	0.4339	0.4339	0.3882
1971	0.0309	0.1337	0.2225	0.3845	0.5572	0.4651	0.7528	0.48	0.48	0.3526
1972	0.0464	0.1476	0.207	0.2497	0.6058	0.4686	0.2464	0.3578	0.3578	0.3358
1973	0.0657	0.2322	0.3048	0.2813	0.2526	0.3722	0.3259	0.3091	0.3091	0.2886
1974	0.0816	0.1568	0.2046	0.2953	0.3797	0.533	0.3052	0.3457	0.3457	0.3139
1975	0.0774	0.3193	0.4359	0.4134	0.4544	0.3504	0.4485	0.4235	0.4235	0.3947
1976	0.0933	0.1723	0.3665	0.5568	0.5167	0.7619	0.6429	0.5738	0.5738	0.4749
1977	0.0481	0.3036	0.4748	0.7532	0.7333	1.1138	0.7776	0.7783	0.7783	0.6757
1978	0.0588	0.1896	0.4291	0.4289	0.4851	0.5968	0.5674	0.5054	0.5054	0.4259
1979	0.0433	0.2623	0.4309	0.5049	0.4906	0.448	0.6903	0.517	0.517	0.4273
1980	0.0544	0.2391	0.3695	0.4337	0.5182	0.4119	0.6437	0.479	0.479	0.3945
1981	0.0523	0.2877	0.3409	0.4369	0.5644	0.694	0.5015	0.5115	0.5115	0.4648
1982	0.0586	0.2227	0.3602	0.3887	0.4047	0.6926	0.5526	0.4834	0.4834	0.4138
1983	0.0992	0.4673	0.5585	0.6411	0.7836	1.078	0.9417	0.8088	0.8088	0.7057
1984	0.1073	0.3713	0.5791	0.661	0.4534	0.4762	0.4792	0.5341	0.5341	0.5082
1985	0.0658	0.3545	0.5077	0.6136	0.9237	1.1085	1.3206	0.9045	0.9045	0.7016
1986	0.0247	0.3547	0.6229	0.7036	0.8261	0.8404	0.5412	0.7136	0.7136	0.6695
1987	0.0291	0.2211	0.4759	0.4856	0.5563	0.4901	0.6229	0.5304	0.5304	0.4458
1988	0.067	0.3538	0.565	0.5501	0.7751	0.8003	0.8659	0.7181	0.7181	0.6089
1989	0.1676	0.4424	0.7645	0.765	0.9659	1.0633	1.1078	0.9436	0.9436	0.8002
1990	0.076	0.3339	0.631	0.79	0.7047	0.8427	1.1265	0.8275	0.8275	0.6605
1991	0.0323	0.1971	0.4552	0.5999	0.7398	0.5785	0.7155	0.6232	0.6232	0.5141
1992	0.02	0.0998	0.3216	0.3539	0.6404	0.8743	0.4418	0.5307	0.5307	0.458
1993	0.0132	0.1017	0.1862	0.2494	0.2074	0.4448	0.5563	0.3308	0.3308	0.2379
1994	0.0255	0.1125	0.1902	0.2491	0.2167	0.1632	0.3257	1.0038	1.0038	0.1863
1995	0.0701	0.1617	0.4631	0.2795	0.3595	0.327	0.2424	0.756	0.756	0.3182
1996	0.0306	0.1924	0.4521	0.8041	0.9011	1.1308	0.8882	1.092	1.092	0.6961
1997	0.0348	0.1487	0.4106	0.8332	1.0286	1.378	1.3129	0.932	0.932	0.7598
1998	0.0886	0.1759	0.2729	0.6445	1.053	0.7576	1.1063	0.7909	0.7909	0.5808
1999	0.0956	0.2836	0.2903	0.3178	0.6511	1.0625	0.7206	0.44	0.44	0.521
2000	0.1246	0.3182	0.3789	0.2476	0.326	0.5234	0.7939	0.166	0.166	0.3588
2001	0.1573	0.3443	0.4535	0.3066	0.3504	0.6961	0.6047	0.7184	0.7184	0.4302
2002	0.1902	0.4901	0.5984	0.8152	0.8237	1.3641	1.2266	1.1186	1.1186	0.8183
2003	0.1272	0.3037	0.6635	0.8481	0.8898	0.8875	0.9347	1.712	1.712	0.7185
2004	0.0306	0.185	0.2974	0.7539	0.9753	1.0702	1.0242	2.0539	2.0539	0.6563
2005	0.0896	0.255	0.3784	0.4712	0.7707	0.8194	0.5104	1.0141	1.0141	0.5389
2006	0.1728	0.3156	0.3552	0.6018	0.8171	0.9464	0.9557	0.2462	0.2462	0.6072
2007	0.1056	0.2944	0.3556	0.4335	0.5795	0.6825	0.6803	0.7068	0.7068	0.4691
2008	0.0378	0.2174	0.2949	0.3523	0.4711	0.6895	1.1918	1.4213	1.4213	0.4051
2009	0.0793	0.4534	0.4004	0.3924	0.4292	0.3962	0.5392	1.4164	1.4164	0.4143
2010	**0.1277**	**0.2664**	**0.3086**	**0.3937**	**0.6072**	**0.4983**	**0.5194**	**0.7417**	**0.7417**	**0.4148**

Table 4.6.3. Faroe Plateau (sub-division Vb1) COD. Stock number at age.

YEAR	2	3	4	5	6	7	8	9	10+	TOTAL
1961	12019	7385	3747	2699	666	668	155	66	0	52630
1962	20654	7042	3616	1863	1245	335	210	56	0	59804
1963	20290	12907	3503	1825	752	584	190	87	0	66807
1964	21834	12893	6986	1710	895	358	294	112	0	55183
1965	8269	16037	7823	3639	830	416	151	169	0	60009
1966	18566	5999	10207	4085	1698	351	200	80	0	69829
1967	23451	13990	4034	6475	2133	842	109	70	0	72579
1968	17582	17744	9020	2525	3757	980	410	31	0	63439
1969	9325	13012	11522	4976	1212	1967	393	240	0	53161
1970	8608	6840	7843	6447	2682	561	965	138	0	48654
1971	11928	6684	4548	4456	3754	1516	238	519	0	59683
1972	21320	9469	4788	2981	2483	1760	779	92	0	59029
1973	12573	16664	6689	3187	1901	1109	902	499	400	81153
1974	30480	9639	10816	4037	1969	1209	626	533	342	106456
1975	38319	23000	6747	7217	2460	1103	581	378	476	102968
1976	18575	29035	13683	3572	3908	1279	636	304	466	83665
1977	9995	13853	20010	7765	1676	1909	489	274	18	69116
1978	10748	7799	8372	10190	2993	659	513	184	154	59930
1979	14997	8298	5282	4463	5433	1509	297	238	103	69423
1980	23582	11759	5226	2811	2206	2723	789	122	52	66369
1981	14000	18286	7579	2957	1491	1076	1477	339	150	74381
1982	22127	10878	11228	4413	1564	694	440	732	348	83150
1983	25156	17085	7128	6412	2449	854	284	207	200	118102
1984	47752	18652	8766	3339	2765	916	238	91	174	103837
1985	17311	35119	10535	4022	1411	1439	466	121	146	82172
1986	9500	13270	20171	5191	1783	459	389	102	81	63032
1987	9896	7588	7620	8858	2103	639	162	185	69	47727
1988	8684	7869	4980	3876	4463	987	320	71	53	50873
1989	16021	6650	4523	2317	1831	1683	363	110	16	37998
1990	3671	11093	3498	1724	883	571	476	98	50	30222
1991	6679	2786	6504	1524	641	357	201	126	57	32821
1992	11418	5295	1873	3378	685	250	164	81	90	35603
1993	10127	9163	3923	1112	1941	296	85	86	97	57594
1994	25186	8183	6776	2667	709	1292	155	40	27	97203
1995	42711	20102	5987	4587	1702	468	898	92	101	92367
1996	12870	32603	14001	3085	2840	973	276	577	77	75185
1997	6456	10220	22020	7293	1130	944	257	93	215	55873
1998	5931	5104	7211	11957	2595	331	195	57	50	50982
1999	14370	4445	3505	4494	5139	741	127	53	22	56994
2000	19731	10693	2740	2147	2678	2194	210	51	7	76724
2001	29699	14262	6368	1536	1372	1582	1064	78	13	72177
2002	13265	20775	8276	3313	926	791	646	476	11	56140
2003	6272	8980	10420	3725	1200	333	166	155	26	35748
2004	3661	4522	5426	4394	1306	404	112	53	45	27705
2005	6371	2907	3077	3300	1693	403	113	33	51	28000
2006	8230	4769	1845	1726	1687	641	145	56	15	26389
2007	5957	5668	2848	1059	774	610	204	46	6	27820
2008	8718	4389	3457	1634	562	355	252	84	28	34974
2009	12685	6873	2891	2108	940	287	146	63	24	49780
2010	19456	9594	3576	1586	1166	501	158	70	79	48643
2011	10200	14020	6018	2150	876	520	249	77	58	34168

Table 4.6.4. Faroe Plateau (sub-division Vb1) COD. Summary table (1961-2010) and results from the short term prediction (2011-2013) are shown in bold.

	RECRUITS Age 2	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 3-7
1961	12019	65428	46439	21598	0.4651	0.6059
1962	20654	68225	43326	20967	0.4839	0.5226
1963	20290	77602	49054	22215	0.4529	0.4944
1964	21834	84666	55362	21078	0.3807	0.5017
1965	8269	75043	57057	24212	0.4244	0.4909
1966	18566	83919	60629	20418	0.3368	0.4743
1967	23451	105289	73934	23562	0.3187	0.39
1968	17582	110433	82484	29930	0.3629	0.4642
1969	9325	105537	83487	32371	0.3877	0.4375
1970	8608	98398	82035	24183	0.2948	0.3882
1971	11928	78218	63308	23010	0.3635	0.3526
1972	21320	76439	57180	18727	0.3275	0.3358
1973	12573	110713	83547	22228	0.2661	0.2886
1974	30480	139266	98434	24581	0.2497	0.3139
1975	38319	153663	109565	36775	0.3356	0.3947
1976	18575	161260	123077	39799	0.3234	0.4749
1977	9995	136211	112057	34927	0.3117	0.6757
1978	10748	96227	78497	26585	0.3387	0.4259
1979	14997	85112	66722	23112	0.3464	0.4273
1980	23582	85037	58886	20513	0.3484	0.3945
1981	14000	88409	63560	22963	0.3613	0.4648
1982	22127	98959	67031	21489	0.3206	0.4138
1983	25156	123244	78538	38133	0.4855	0.7057
1984	47752	152128	96758	36979	0.3822	0.5082
1985	17311	131197	84763	39484	0.4658	0.7016
1986	9500	99214	73657	34595	0.4697	0.6695
1987	9896	78277	62182	21391	0.344	0.4458
1988	8684	66040	52041	23182	0.4455	0.6089
1989	16021	58734	38278	22068	0.5765	0.8002
1990	3671	38009	29027	13487	0.4646	0.6605
1991	6679	28654	21030	8750	0.4161	0.5141
1992	11418	35695	20713	6396	0.3088	0.458
1993	10127	51105	33068	6107	0.1847	0.2379
1994	25186	83975	42530	9046	0.2127	0.1863
1995	42711	144492	54299	23045	0.4244	0.3182
1996	12870	142610	85267	40422	0.4741	0.6961
1997	6456	97001	81711	34304	0.4198	0.7598
1998	5931	66298	55932	24005	0.4292	0.5808
1999	14370	65193	45151	18306	0.4054	0.521
2000	19731	91316	46314	21033	0.4541	0.3588
2001	29699	110109	59179	28183	0.4762	0.4302
2002	13265	98518	56132	38457	0.6851	0.8183
2003	6272	60615	40548	24501	0.6042	0.7185
2004	3661	37232	27204	13178	0.4844	0.6563
2005	6371	32411	23738	9906	0.4173	0.5389
2006	8230	31354	21345	10480	0.491	0.6072
2007	5957	29369	18169	8016	0.4412	0.4691
2008	8718	34906	22787	7465	0.3276	0.4051
2009	12685	38766	23900	10002	0.4185	0.4143
2010	19456	58732	31404	12737	0.4056	0.4148
2011	**21651**	**78779**	**39754**	**17453**	**0.4390**	**0.4114**
2012	**13620**	**86724**	**55817**	**21313**	**0.3818**	**0.4114**
2013	**13620**	**82639**	**56047**			
Avg.61-10	15941	85385	58827	22778	0.3983	0.4987

Table 4.7.1. Faroe Plateau (sub-division Vb1) COD. Input to management option table.

	Recr.	Source
YC2008	19456	XSA-output
YC2009	21651	Regressions
YC2010	13620	Average R 2008-10
YC2011	13620	Average R 2008-10

	Stock size	
Age	2010	Source
2	21651	Regressions
3	14020	XSA-output
4	6018	XSA-output
5	2150	XSA-output
6	876	XSA-output
7	520	XSA-output
8	249	XSA-output
9	77	XSA-output
10+	58	XSA-output

	Maturity			Exploitation pattern (not rescaled)			Weights		
	Observed	Av. 09-11	Av. 09-11	Av. 07-09	Av. 07-09	Av. 07-09		As 2011	Av.09-11
Age	2011	2012	2013	2011	2012	2013	2011	2012	2013
2	0.06	0.08	0.08	0.0816	0.0816	0.0816	1.077	1.077	0.977
3	0.51	0.58	0.58	0.3124	0.3124	0.3124	1.463	1.463	1.512
4	0.69	0.76	0.76	0.3346	0.3346	0.3346	2.892	2.892	2.526
5	0.84	0.91	0.91	0.3795	0.3795	0.3795	3.839	3.839	3.258
6	0.93	0.95	0.95	0.5025	0.5025	0.5025	4.71	4.71	3.941
7	0.98	0.98	0.98	0.5280	0.5280	0.5280	4.868	4.868	4.908
8	1.00	1.00	1.00	0.7501	0.7501	0.7501	6.104	6.104	6.119
9	1.00	1.00	1.00	1.1931	1.1931	1.1931	7.094	7.094	7.5
10+	1.00	1.00	1.00	1.1931	1.1931	1.1931	9.8	9.8	9.853

Table 4.7.2. Faroe Plateau (sub-division Vb1) COD. Management option table.

2011 Biomass	SSB	FMult	FBar	Landings
78779	39754	1.0000	0.4114	17453

2012 Biomass	SSB	FMult	FBar	Landings	2013 Biomass	SSB
86724	55817	0.0000	0.0000	0	107336	77222
.	55817	0.1000	0.0411	2511	104421	74706
.	55817	0.2000	0.0823	4927	101617	72290
.	55817	0.3000	0.1234	7252	98920	69970
.	55817	0.4000	0.1646	9491	96325	67741
.	55817	0.5000	0.2057	11647	93826	65598
.	55817	0.6000	0.2468	13725	91420	63538
.	55817	0.7000	0.2880	15727	89101	61556
.	55817	0.8000	0.3291	17657	86868	59649
.	55817	0.9000	0.3703	19518	84715	57814
.	55817	1.0000	0.4114	21313	82639	56047
.	55817	1.1000	0.4525	23046	80637	54345
.	55817	1.2000	0.4937	24718	78706	52706
.	55817	1.3000	0.5348	26332	76843	51127
.	55817	1.4000	0.5760	27890	75045	49605
.	55817	1.5000	0.6171	29396	73309	48138
.	55817	1.6000	0.6582	30850	71633	46724
.	55817	1.7000	0.6994	32255	70015	45360
.	55817	1.8000	0.7405	33613	68452	44044
.	55817	1.9000	0.7817	34926	66942	42775
.	55817	2.0000	0.8228	36196	65483	41550

Input units are thousands and kg - output in tonnes

Table 4.7.3. Faroe Plateau (sub-division Vb1) COD. Input to management option table. Procedures according to the Annex.

	Recr.	Source
YC2008	19456	XSA-output
YC2009	10200	XSA-output
YC2010	11403	Average R in 2006-10
YC2011	11403	Same as YC2010

	Stock size	
Age	2010	Source
2	10200	XSA-output
3	9594	XSA-output
4	3576	XSA-output
5	1586	XSA-output
6	1166	XSA-output
7	501	XSA-output
8	158	XSA-output
9	70	XSA-output
10+	79	XSA-output

	Maturity			Exploitation pattern (not rescaled)			Weights		
	Observed	Av. 09-11	Av. 09-11	Av. 07-09	Av. 07-09	Av. 07-09		As 2010	Av.08-10
Age	2011	2012	2013	2011	2012	2013	2011	2012	2013
2	0.06	0.08	0.08	0.0816	0.0816	0.0816	1.077	1.077	1.035
3	0.51	0.58	0.58	0.3124	0.3124	0.3124	1.463	1.463	1.504
4	0.69	0.76	0.76	0.3346	0.3346	0.3346	2.892	2.892	2.421
5	0.84	0.91	0.91	0.3795	0.3795	0.3795	3.839	3.839	3.122
6	0.93	0.95	0.95	0.5025	0.5025	0.5025	4.71	4.71	3.907
7	0.98	0.98	0.98	0.5280	0.5280	0.5280	4.868	4.868	4.848
8	1.00	1.00	1.00	0.7501	0.7501	0.7501	6.104	6.104	6.068
9	1.00	1.00	1.00	1.1931	1.1931	1.1931	7.094	7.094	7.433
10+	1.00	1.00	1.00	1.1931	1.1931	1.1931	9.8	9.8	9.78

Table 4.7.4. Faroe Plateau (sub-division Vb1) COD. Management option table. Procedures according to the Annex.

2011 Biomass	SSB	FMult	FBar	Landings
51618	29801	1.0000	0.4114	12829

2012 Biomass	SSB	FMult	FBar	Landings	2013 Biomass	SSB
57475	36468	0.0000	0.0000	0	71145	49001
.	36468	0.1000	0.0411	1668	69314	47389
.	36468	0.2000	0.0823	3269	67557	45846
.	36468	0.3000	0.1234	4806	65870	44368
.	36468	0.4000	0.1646	6284	64250	42951
.	36468	0.5000	0.2057	7705	62694	41592
.	36468	0.6000	0.2468	9071	61198	40288
.	36468	0.7000	0.2880	10386	59760	39037
.	36468	0.8000	0.3291	11651	58376	37836
.	36468	0.9000	0.3703	12870	57045	36682
.	36468	1.0000	0.4114	14043	55763	35573
.	36468	1.1000	0.4525	15174	54530	34508
.	36468	1.2000	0.4937	16264	53341	33483
.	36468	1.3000	0.5348	17315	52196	32498
.	36468	1.4000	0.5760	18328	51092	31550
.	36468	1.5000	0.6171	19306	50029	30638
.	36468	1.6000	0.6582	20249	49002	29760
.	36468	1.7000	0.6994	21160	48013	28914
.	36468	1.8000	0.7405	22039	47058	28100
.	36468	1.9000	0.7817	22888	46136	27315
.	36468	2.0000	0.8228	23708	45247	26559

Input units are thousands and kg - output in tonnes

Table 4.8.1. Faroe Plateau (sub-division Vb1) COD. Input to yield per recruit calculations (long term prediction).

	Expl. pattern	Weight at age	Prop mature
Age	Average 2000-2010	Average 1978-2010	Average 1983-2011
	Not rescaled		
2	0.113	1.0463	0.08
3	0.313	1.5707	0.56
4	0.4077	2.2661	0.83
5	0.5106	3.0508	0.94
6	0.64	3.8171	0.98
7	0.7794	4.8558	0.99
8	0.8164	6.0774	1.00
9	1.0287	7.6485	1.00
10+	1.0287	9.5408	1.00

Table 4.8.2. Faroe Plateau (sub-division Vb1) COD. Output from yield per recruit calculations (long term prediction).

Reference point	F multiplier	Absolute F
Fbar(3-7)	1.0000	0.5301
FMax	0.4564	0.242
F0.1	0.2069	0.1097
F35%SPR	0.3227	0.1711
Flow	0.1864	0.0988
Fmed	0.7764	0.4116
Fhigh	2.2236	1.1788

Weights in kilograms

Table 4.8.3. Faroe Plateau (sub-division Vb1) COD. Output from the ecological model for cod, haddock and saithe in Faroese waters. Average catch (years 2110 to 2209) from the deterministic model by various F-factors of cod/haddock and saithe. The reference period for cod was 1997-2006, for haddock 1997-2007, and saithe 1997-2009. Highest catches are indicated in bold.

	F-factors, cod and haddock						
F-factors	0.5	0.6	0.7	0.8	0.9	1	1.1
Saithe		Cod	catch ('000 t)				
0.3	25.6	27.0	27.8	28.3	28.5	**28.7**	28.6
0.4	25.2	26.4	27.1	27.4	27.6	**27.7**	27.6
0.5	24.9	25.8	26.3	26.5	**26.6**	26.5	26.5
0.6	24.5	25.3	25.6	**25.6**	25.5	25.4	25.2
0.7	24.2	24.7	**24.9**	24.7	24.5	24.3	24.0
0.8	23.8	24.2	**24.2**	23.9	23.6	23.3	22.9
0.9	23.5	**23.8**	23.6	23.2	22.8	22.3	22.0
1	23.2	**23.3**	23.0	22.5	22.0	21.5	22.3
		Haddock	catch ('000 t)				
0.3	15.8	16.5	16.9	17.1	**17.1**	17.0	16.8
0.4	15.3	15.9	16.2	**16.3**	16.2	16.0	15.7
0.5	14.8	15.4	**15.6**	15.5	15.3	15.1	14.7
0.6	14.5	14.9	**15.0**	14.9	14.6	14.3	13.9
0.7	14.1	**14.5**	14.5	14.3	14.0	13.6	13.1
0.8	13.8	**14.1**	14.0	13.8	13.4	12.9	12.4
0.9	13.5	**13.7**	13.6	13.3	12.9	12.4	11.9
1	13.3	**13.4**	13.2	12.9	12.4	11.9	11.3
		Saithe	catch ('000 t)				
0.3	23.9	23.9	23.9	23.9	23.9	23.9	23.9
0.4	29.3	29.3	29.3	29.3	29.3	29.3	29.3
0.5	34.0	34.0	34.0	34.0	34.0	34.0	34.0
0.6	38.0	38.0	38.0	38.0	38.0	38.0	38.0
0.7	41.4	41.4	41.4	41.4	41.4	41.4	41.4
0.8	44.5	44.5	44.5	44.5	44.5	44.5	44.5
0.9	47.2	47.2	47.2	47.2	47.2	47.2	47.2
1	**49.6**	**49.6**	**49.6**	**49.6**	**49.6**	**49.6**	**49.6**
		Sum					
0.3	65.3	67.4	68.6	69.3	69.5	**69.6**	69.3
0.4	69.8	71.6	72.6	73.0	**73.1**	73.0	72.6
0.5	73.7	75.2	75.9	**76.0**	75.9	75.6	75.2
0.6	77.0	78.2	**78.6**	78.5	78.1	77.7	77.1
0.7	79.7	80.6	**80.8**	80.4	79.9	79.3	78.5
0.8	82.1	**82.8**	82.7	82.2	81.5	80.7	79.8
0.9	84.2	**84.7**	84.4	83.7	82.9	81.9	81.1
1	86.1	**86.3**	85.8	85.0	84.0	83.0	83.2

Table 4.10.1. Faroe Plateau (sub-division Vb1) COD. Population variables the terminal year, as observed in the current assessment, compared with what was predicted last year.

	2010 assessment	2011 assessment	% change
Year	2010	2010	
Recruitment	22675	19456	-14
Total biomass	64081	58732	-8
SSB	32273	31404	-3
Catch	14048	12737	-9
F3-7	0.46	0.41	-10

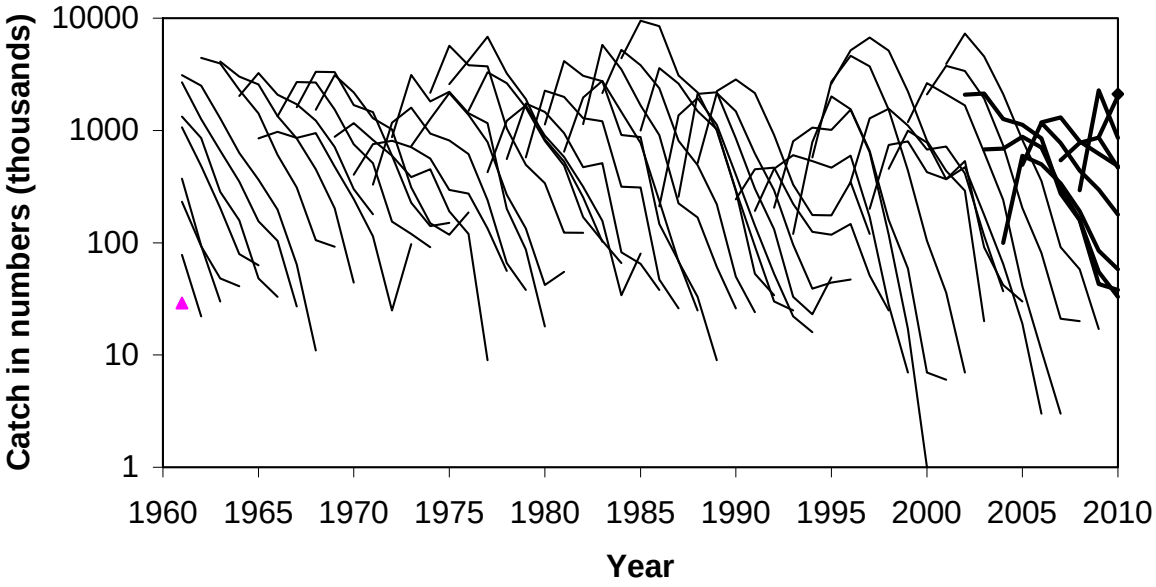


Figure 4.2.1. Faroe Plateau (sub-division VB1) COD. Catch in numbers at age shown as catch curves.

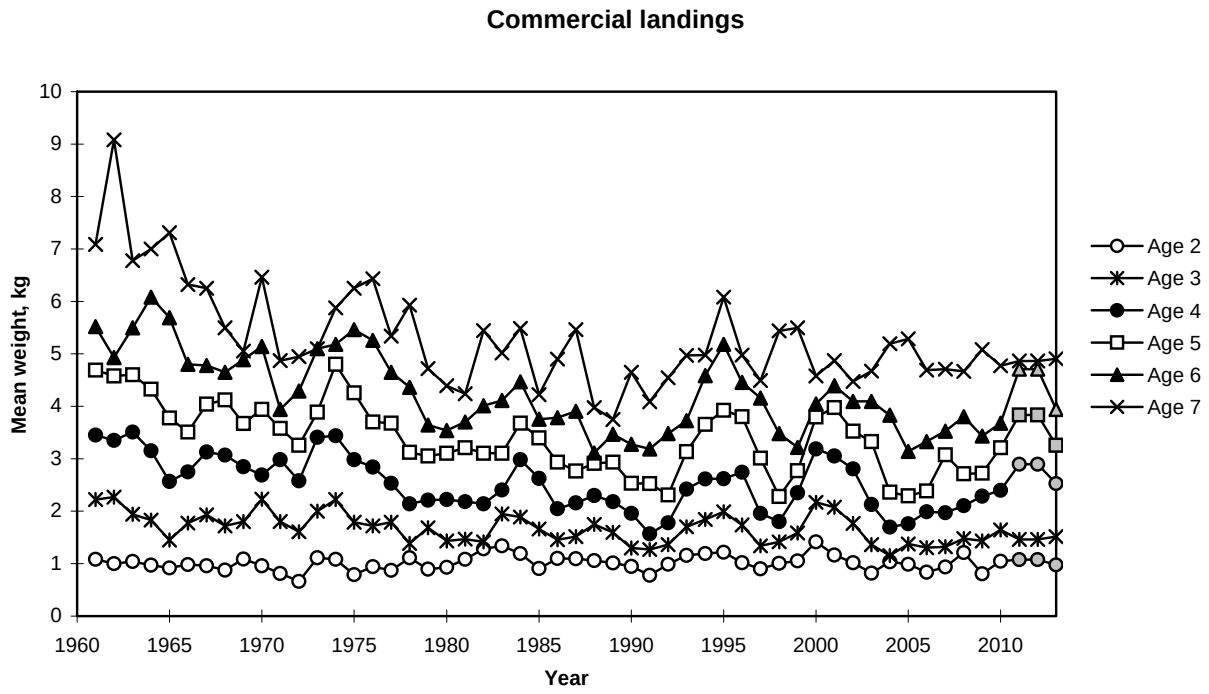


Figure 4.2.2. Faroe Plateau (sub-division VB1) COD. Mean weight at age 1961-2010. The estimated weights in 2011 are also shown. The weights in 2012 are set to the 2011 values. The weights in 2013 are set to the average values for 2009-2011.

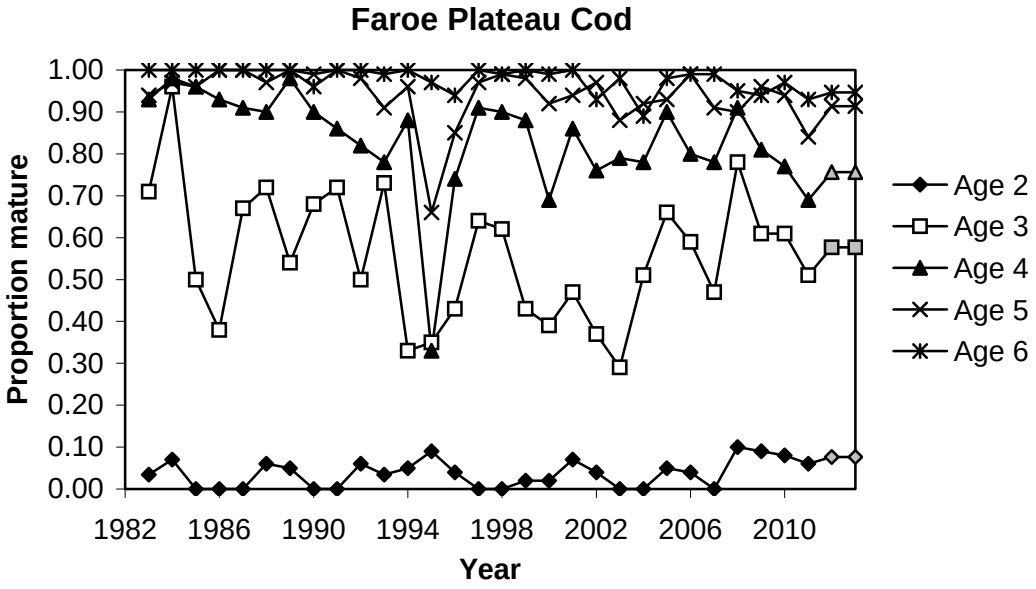


Figure 4.2.3. Faroe Plateau (sub-division VB1) COD. Proportion mature at age as observed in the spring groundfish survey. The values in 2012 and 2013 are estimated as the average of the 2009-2011 values.

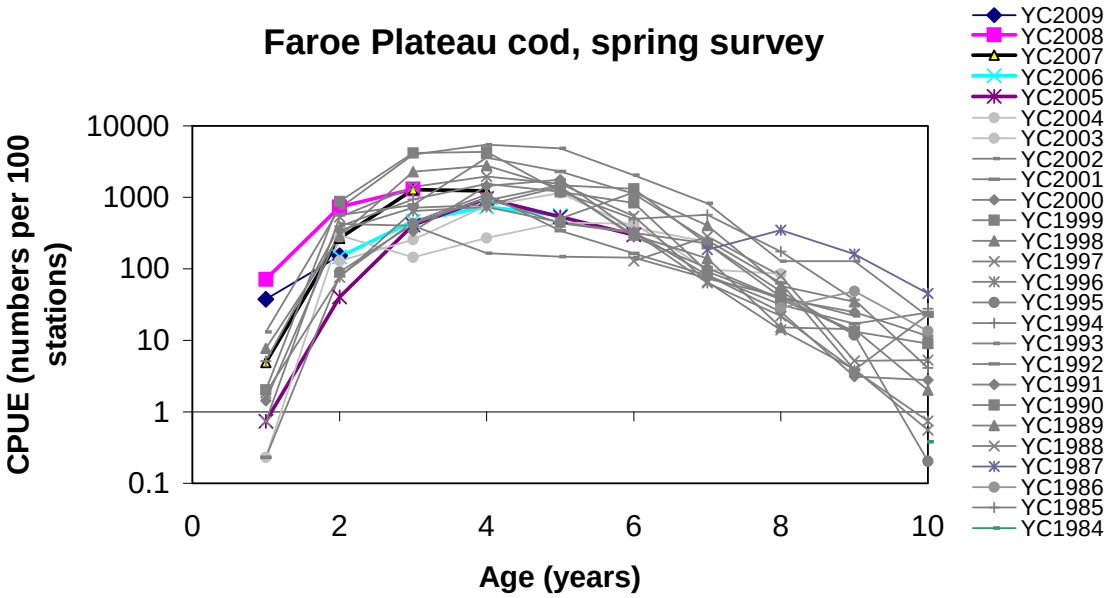


Figure 4.2.4. Faroe Plateau (sub-division VB1) COD. Catch curves from the spring groundfish survey.

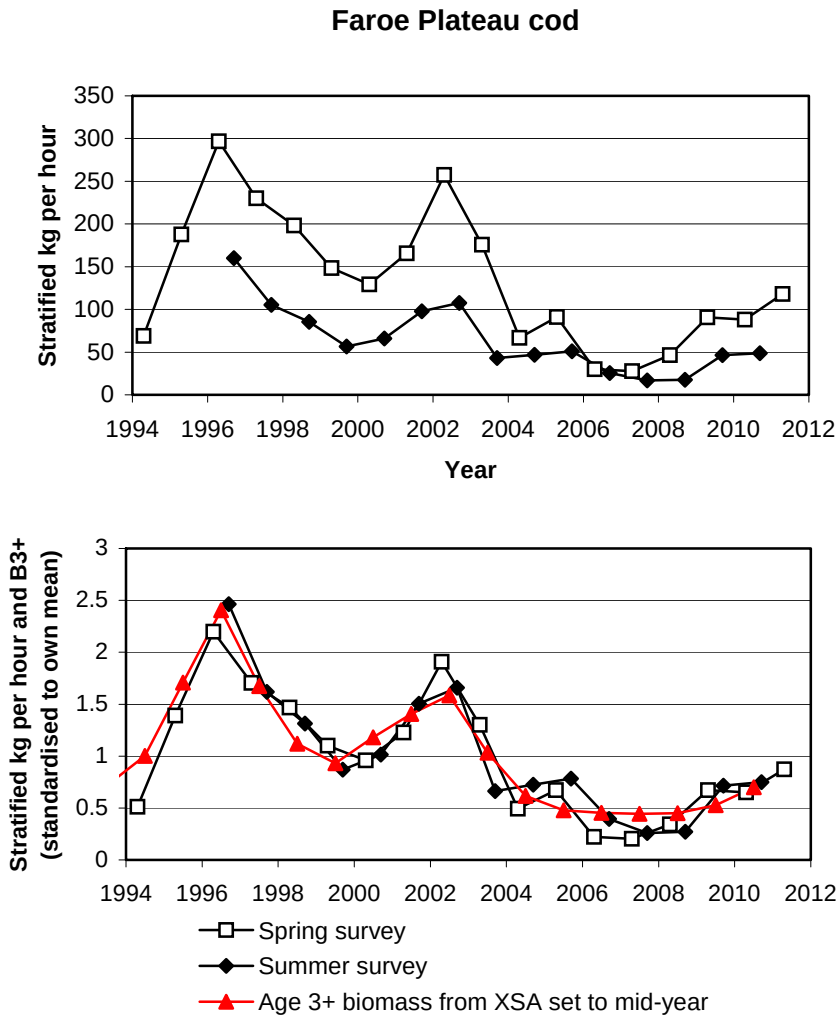


Figure 4.2.5. Faroe Plateau (sub-division VB1) COD. Stratified kg/hour in the spring and summer surveys. The age 3+ biomass obtained from the assessment is also included as an index.

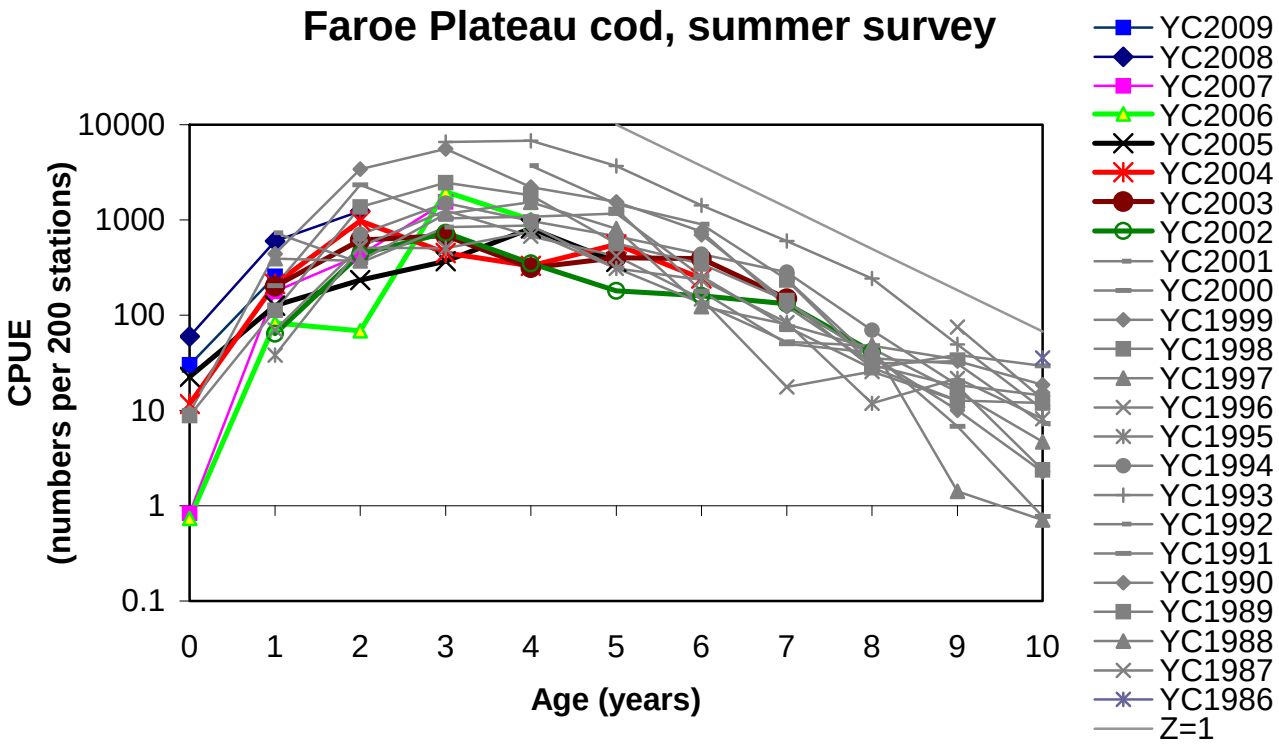


Figure 4.2.6. Faroe Plateau (sub-division VB1) COD. Catch curves from the summer groundfish survey.

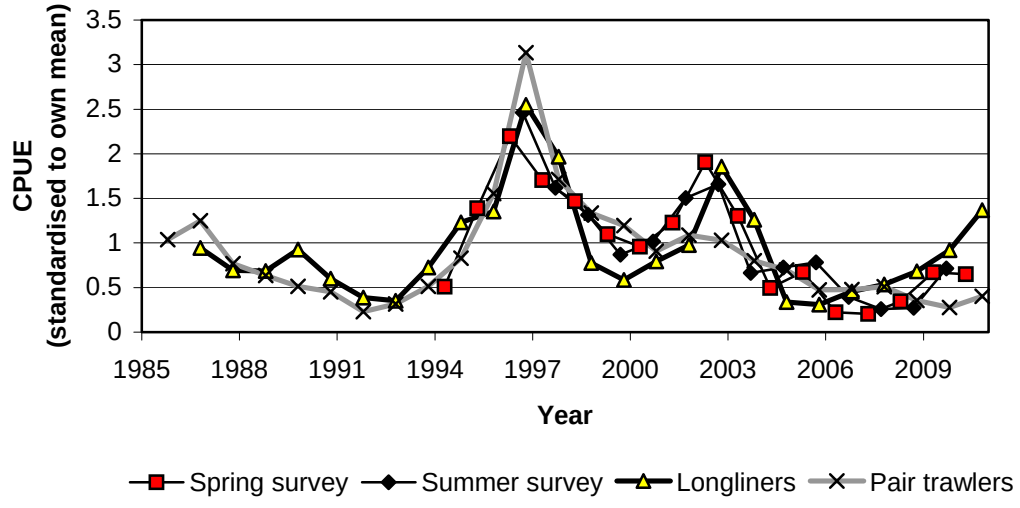


Figure 4.2.7. Faroe Plateau (sub-division VB1) COD. Standardised catch per unit effort for pair trawlers and longliners. The two surveys are shown as well.

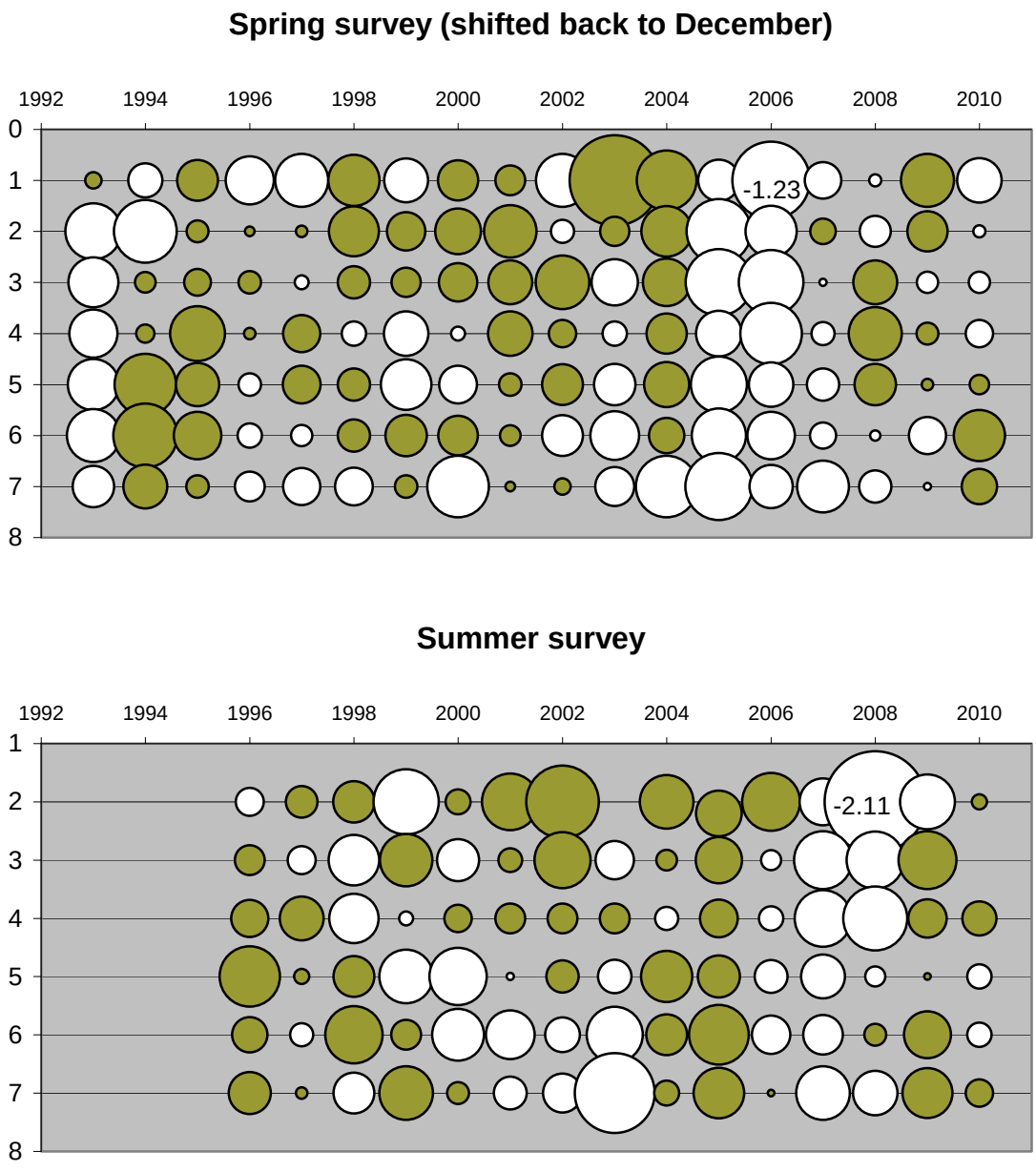


Figure 4.6.1. Faroe Plateau (sub-division VB1) COD. Log catchability residuals for the spring and summer survey. The residuals for age 8 are not presented because some values were off scale. White bubbles indicate negative residuals.

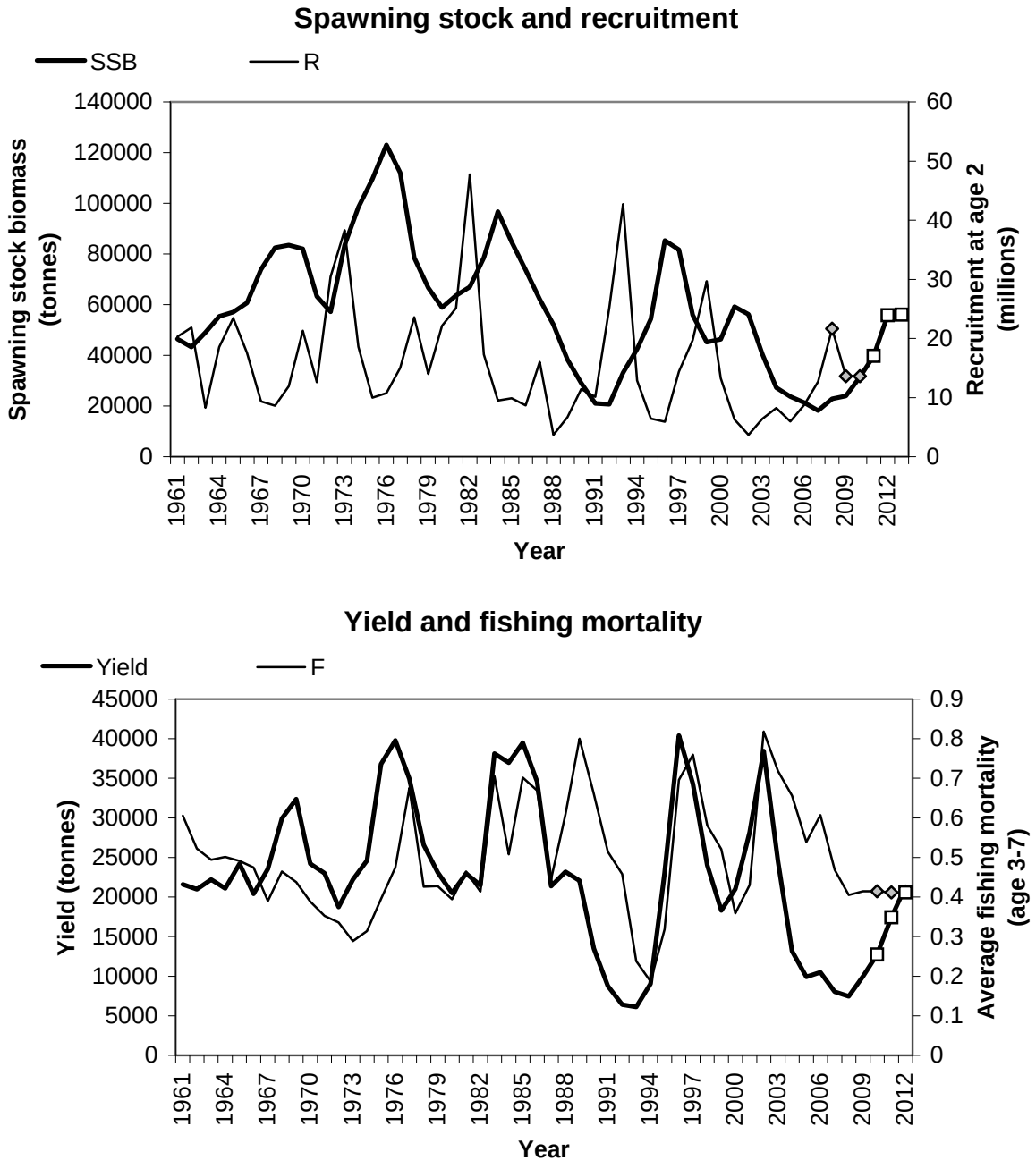


Figure 4.6.2. Faroe Plateau (sub-division VB1) COD. Yield and fishing versus year. Spawning stock biomass (SSB) and recruitment (year class) versus year. Points (white and grey) are taken from the short term projections.

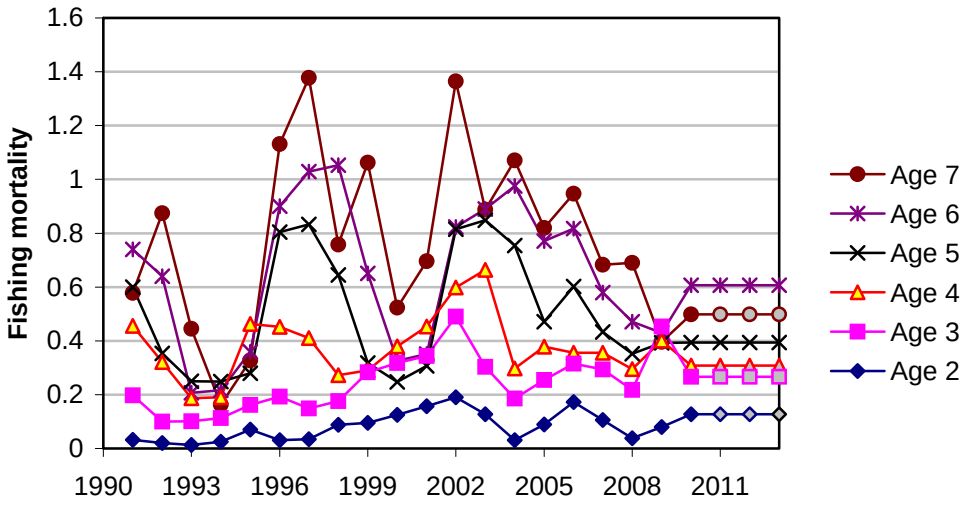


Figure 4.6.3. Faroe Plateau (sub-division VB1) COD. Fishing mortalities by age. The F-values in 2011-2013 are set to the average values in 2008-2010.

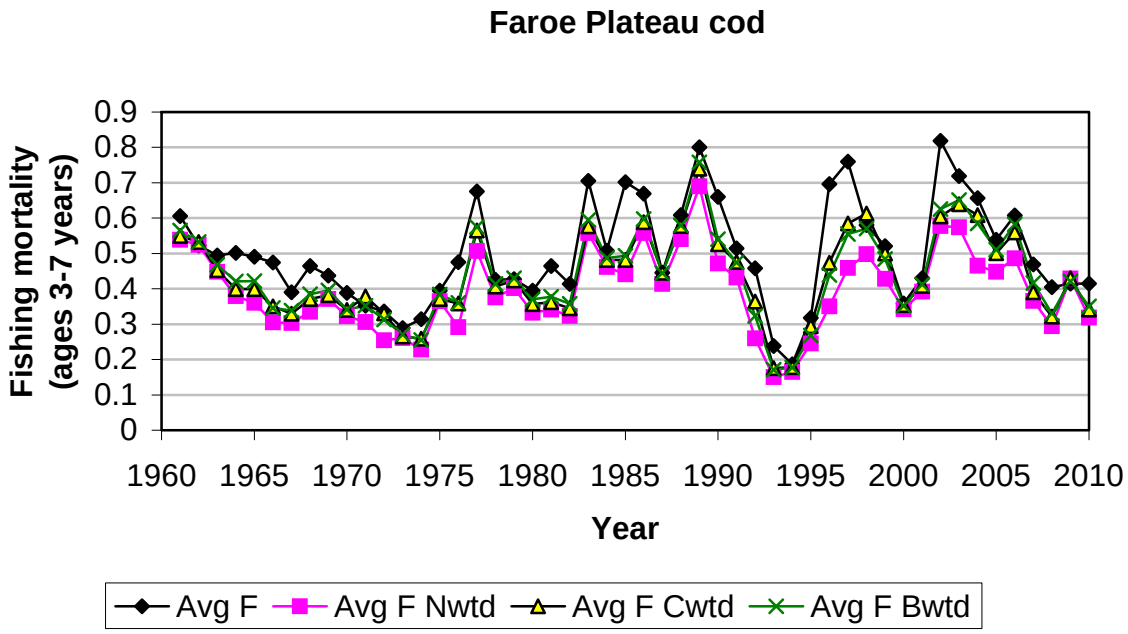


Figure 4.6.4. Faroe Plateau (sub-division VB1) COD. Different measures of fishing mortality: straight arithmetic average (Avg F), weighted by stock numbers (Nwtd), weighted by stock biomass (Bwtd) or weighted by catch (Cwtd).

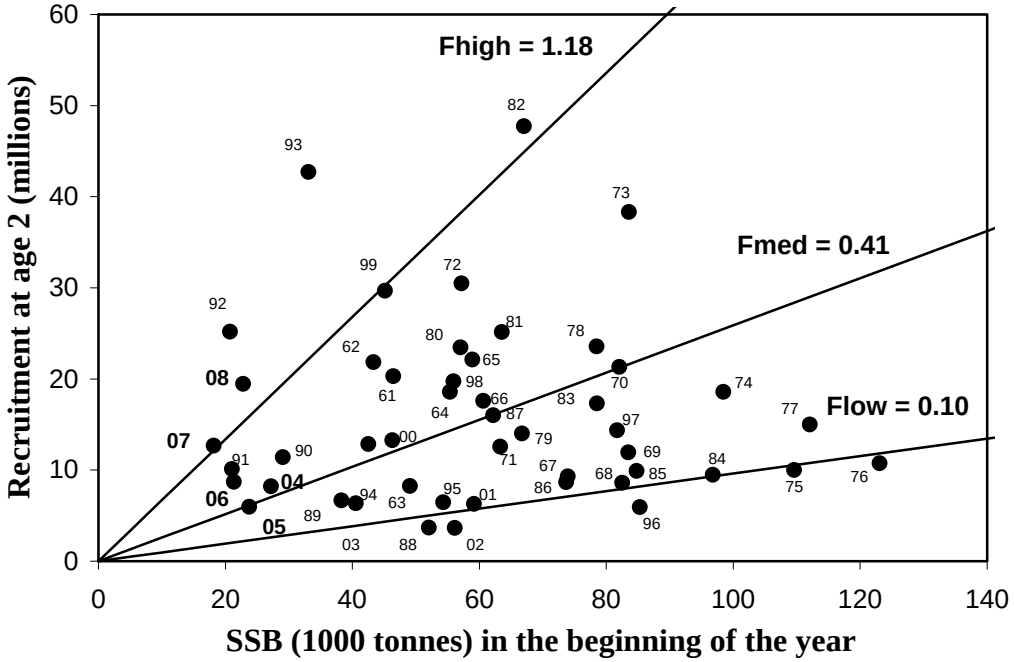


Figure 4.6.5. Faroe Plateau (sub-division VB1) COD. Spawning stock – recruitment relationship 1961-2008. Years are shown at each data point.

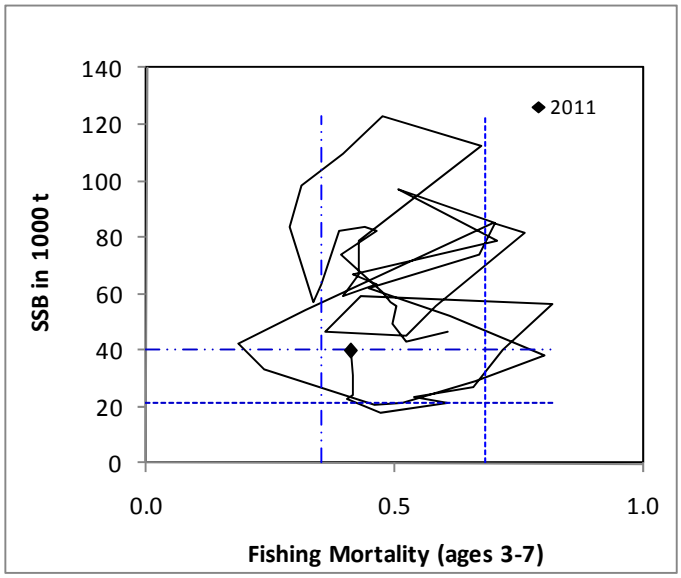


Figure 4.6.6. Faroe Plateau (sub-division VB1) COD. Spawning stock biomass versus fishing mortality 1961-2011.

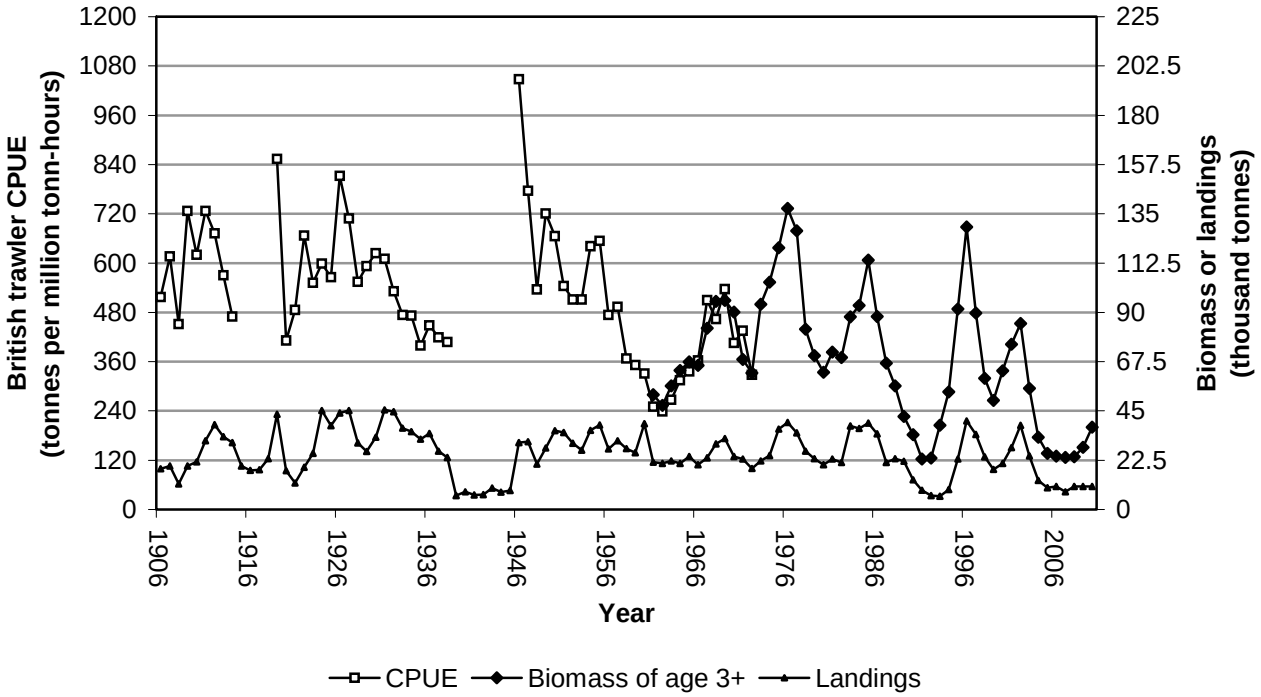


Figure 4.6.7. Faroe Plateau Cod. Stock development 1906-2010 based on cpues from british steam trawlers (1906-1925: cwts per days of absence from port), cpues from british trawlers (1924-1972: tonnes per million tonn hours) and the XSA-estimates (1961-2010: absolute biomass). The 1906-1925 series was scaled to the 1924-1972 series and the CPUEs refer to the first (left) axis while the XSA-estimates refer to the second axis.

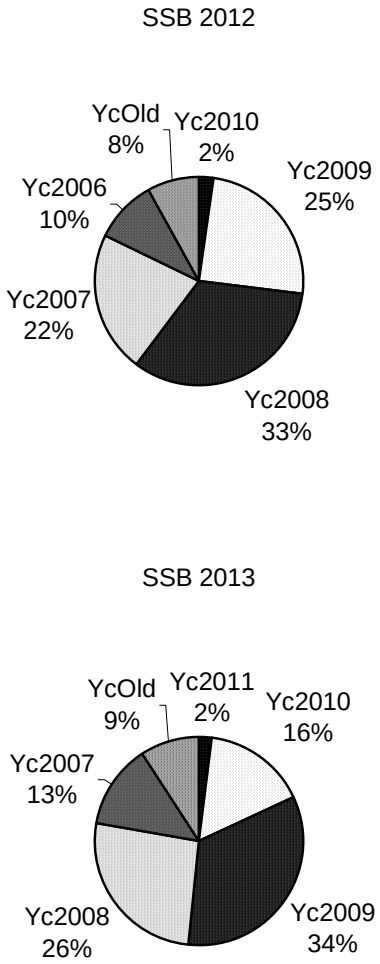
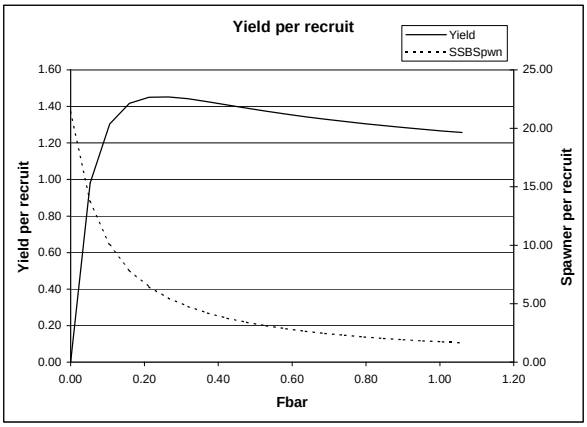
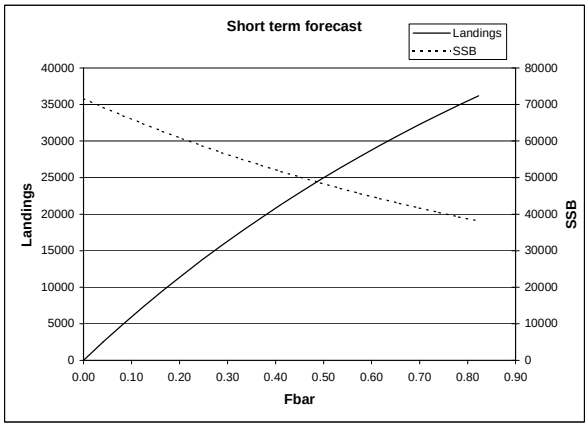


Figure 4.7.1. Contribution of various year classes to the spawning stock biomass in 2012 and 2013.





MFYPR version 1
Run: YR2
Time and date: 10:24 02/05/2011

Reference point	F multiplier	Absolute F
Fbar(3-7)	1.0000	0.5301
FMax	0.4564	0.2420
F0.1	0.2069	0.1097
F35%SPR	0.3227	0.1711
Flow	0.1864	0.0988
Fmed	0.7764	0.4116
Fhigh	2.2236	1.1788

Weights in kilograms

MFDP version 1
Run: Short1
Index file 2/5-2011
Time and date: 10:07 02/05/2011
Fbar age range: 3-7

Input units are thousands and kg - output in tonnes

Figure 4.8.1. Faroe Plateau (sub-division VB1) COD. Yield per recruit and spawning stock biomass (SSB) per recruit versus fishing mortality (left figure). Landings and SSB versus Fbar (3-7).

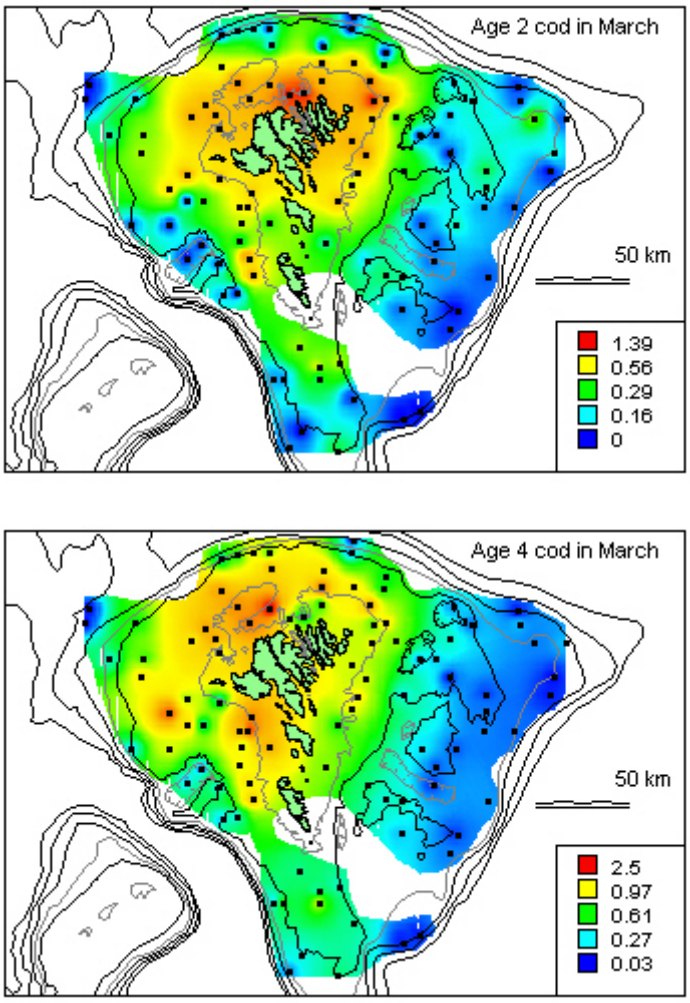


Figure 4.8.2. Mean abundance (log_{10}(numbers+1)) of 2 and 4 year-old cod in March 1998-2006 as observed in the spring groundfish survey. 100 m depth contours are shown.

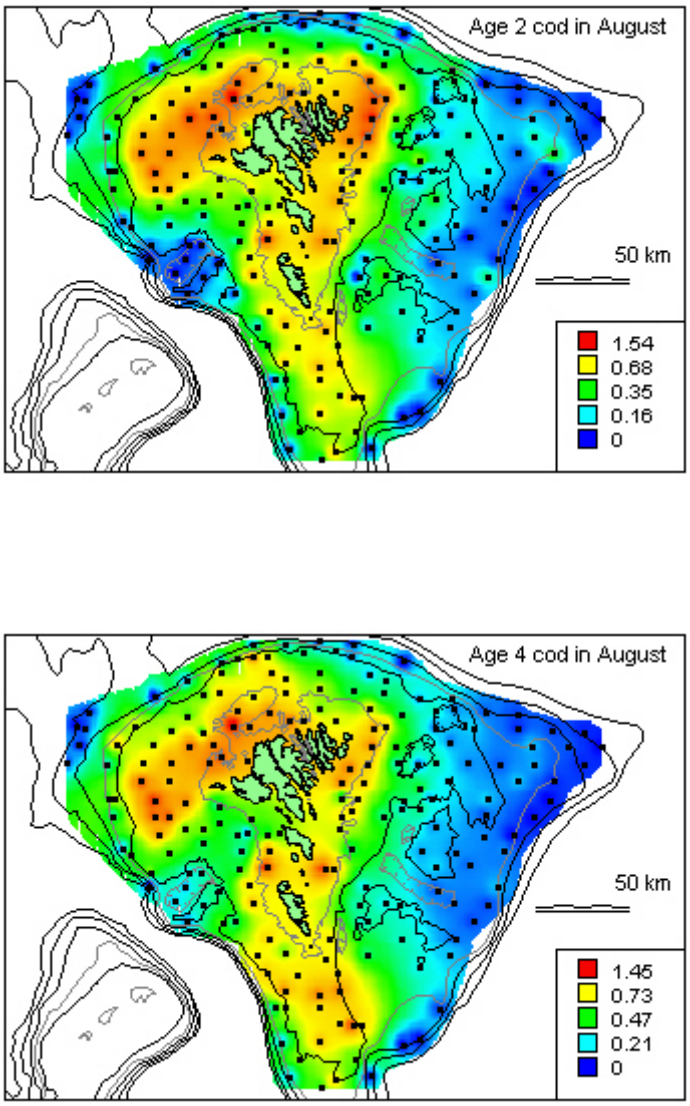


Figure 4.8.3. Mean abundance (log_{10}(numbers+1)) of 2 and 4 year-old cod in August 1997-2005 as observed in the summer groundfish survey. 100 m depth contours are shown.

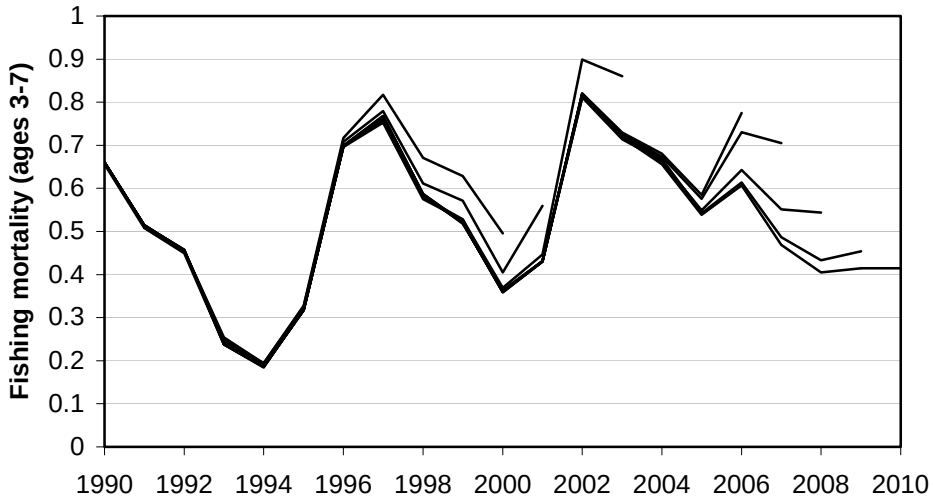


Figure 4.9.1. Faroe Plateau (sub-division VB1) COD. Results from the XSA retrospective analysis.

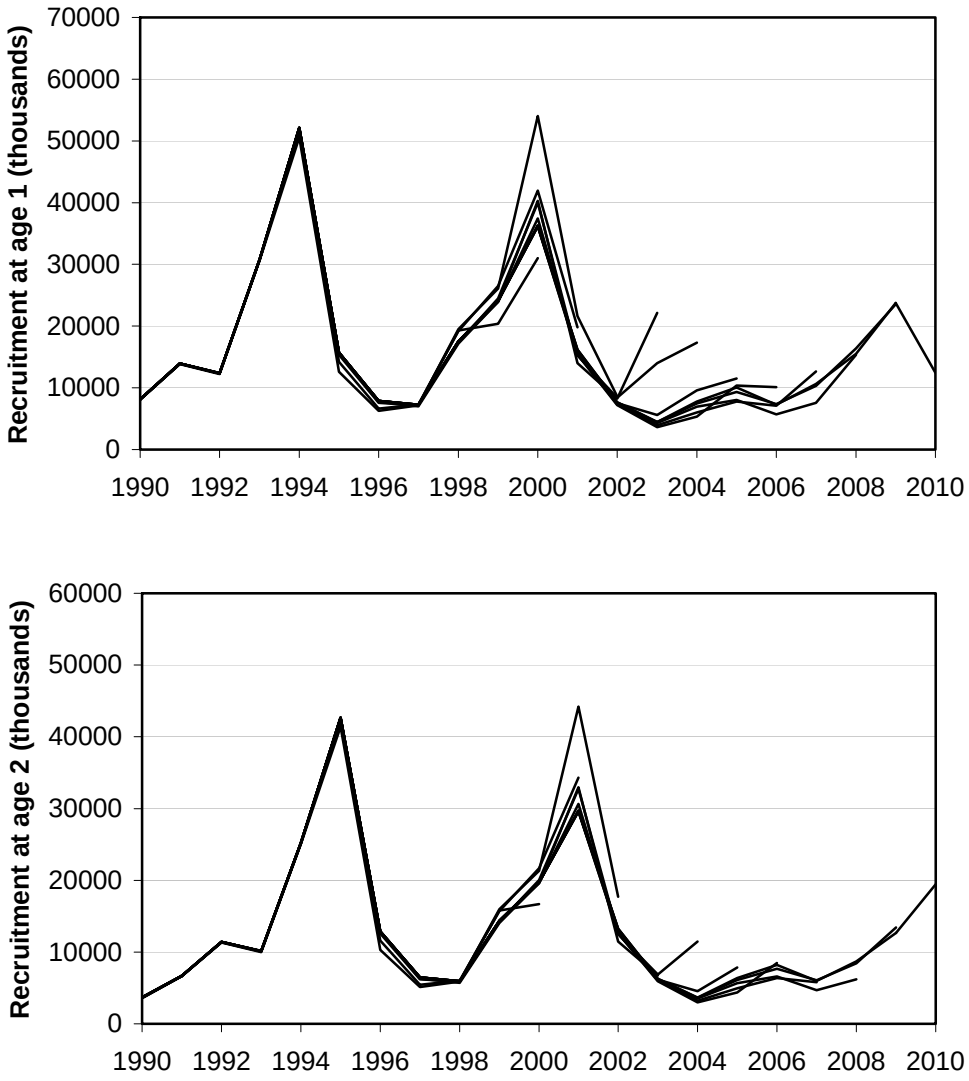


Figure 4.9.1. Faroe Plateau (sub-division VB1) COD. Results from the XSA retrospective analysis (continued).

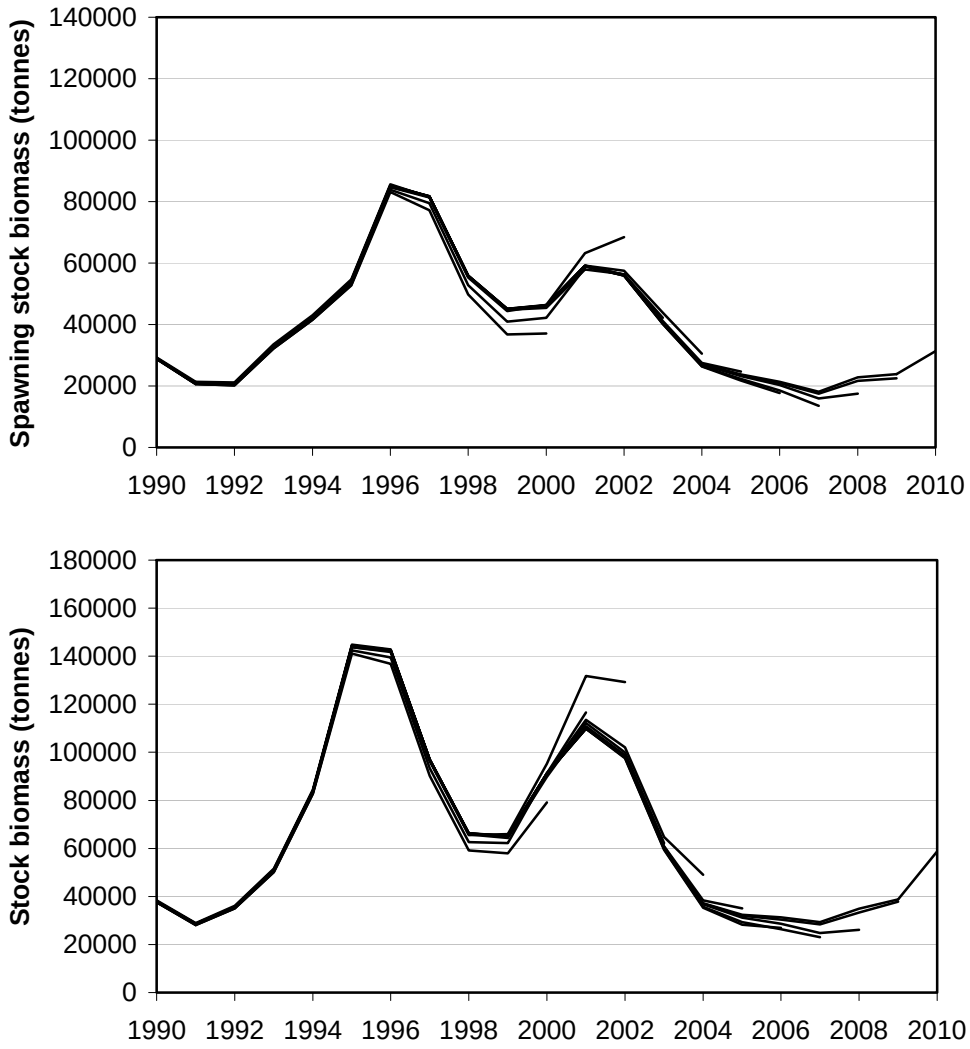


Figure 4.9.1. Faroe Plateau (sub-division VB1) COD. Results from the XSA retrospective analysis (continued).

5 Faroe haddock

Executive summary

Being an update assessment, the changes compared to last year are additions of new data from 2010 and some minor revisions of recent landings data with corresponding revisions of the catch at age data. The main assessment tool is XSA tuned with 2 research vessel bottom trawl surveys. The results are in line with those from 2010, showing a declining SSB mainly due to poor recruitment. SSB is now estimated just above B_{lim} and is predicted to stay at or just below B_{lim} in 2011-2013 with status quo fishing mortality. Fishing mortality in 2010 is estimated at 0.30 (F_{MSY} and F_{pa} = 0.25) and landings in 2010 were only 5 200 t. This years assessment indicates that the 2010 assessment overestimated the 2009 recruitment and fishing mortality by 19% and 13%, respectively and underestimated the 2009 total- and spawning stock biomasses by 14% and 13%, respectively.

5.1 Stock description and management units

Haddock in Faroese Waters, i.e. ICES Subdivisions Vb1 and Vb2 and in the southern part of ICES Division IIa, close to the border of Sub-Division Vb1, are generally believed to belong to the same stock and are treated as one management unit named Faroe haddock. Haddock is distributed all over the Faroe Plateau and the Faroe Bank from shallow water down to more than 450 m. A more detailed description of haddock in Farose waters is given in the stock annex. Figures 5.8-5.9 show the age-aggregated distribution by year as seen in the two regular groundfish surveys in the area.

5.2 Scientific data

5.2.1 Trends in landings and fisheries

Nominal landings of Faroe haddock have in recent years increased very rapidly from only 4 000 t in 1993 to 27 000 t in 2003; they have declined since and amounted in 2009and 2010 to about 5 200 t. Most of the landings are taken from the Faroe Plateau; the 2010 landings from the Faroe Bank (Sub-Division Vb2), where the area shallower than 200 m depths has been closed to all fishing since the fiscal year 2008-2009, amounted to only about 180 t (Tables 5.1 and 5.2). As can be seen from Figure 5.1, landings in 2002-2004 reached historical highs. The cumulative landings by month (Figure 5.2) suggest that landings in 2011 may be even lower than those in 2010.

Faroese vessels have taken almost the entire catch since the late 1970s (Figure 5.1). Table 5.3 shows the proportion of the Faroese landings taken by each fleet category since 1985. The longliners have taken most of the catches in recent years followed by the trawlers. This was also the case in 2010, where the share by longliners was 79% and that by trawlers 21% (Figure 5.3).

5.2.2 Catch-at-age

For the Faroese landings, catch-at-age data were provided for fish taken from the Faroe Plateau. The sampling intensity in 2010 is shown in Table 5.4 and it was somewhat lower than last year. This is partially caused by shortage of resources (people, money) but also because the total catches are so small that it is difficult to obtain enough samples. There is a need to improve the sampling level.

The normal procedure has been to disaggregate samples from each fleet category by season (Jan-Apr, May-Aug and Sep-Dec) and then raise them by the corresponding catch proportions to give the annual catch-at-age in numbers for each fleet; this year, the samples from some minor fleets had to be treated by using 2 seasons only (Jan-Jun, Jul-Dec., and all otterboard trawlers and all pairtrawlers, respectively, had to be treated as one fleet. The results are given in Table 5.4. Catches of some minor fleets have been included under the "Others" heading and all fleets from the Faroe Bank have been treated as one unit. No catch-at-age data were available from other nations fishing in Faroese waters. Therefore, catches by trawlers from France, Russia and UK were assumed to have the same age composition as the Faroese otter board trawlers larger than 1 000 HP. The Norwegian longliners were assumed to have the same age distribution as the Faroese longliners greater than 100 GRT. The most recent data were revised according to the final catch figures. The resulting total catch-at-age in numbers is given in Tables 5.4 and 5.5, and in Figure 5.4 the LN(catch-at-age in numbers) is shown for the whole period of analytical assessments.

In general the catch-at-age matrix in recent years appears consistent although from time to time a few very small year classes are disturbing this consistency, both in numbers and mean weights at age. Also there are some problems with what ages should be included in the plus group; there are some periods where only a few fishes are older than 9 years, and other period with a quite substantial plus group (10+). These problems have been addressed in former reports of this WG and will not be further dealt with here (See the 2005 NWWG report). No estimates of discards of haddock are available. However, since almost no quotas are used in the management of the fisheries on this stock, the incentive to discard in order to high grade the catches should be low. The landings statistics is therefore regarded as being adequate for assessment purposes. The ban on discarding as stated in the law on fisheries should also – in theory – keep the discarding at a low level.

5.2.3 Weight-at-age

Mean weight-at-age data are provided for the Faroese fishery (Table 5.4). Figure 5.5 shows the mean weights-at-age in the landings for age groups 2-7 since 1976. During the period, weights have shown cyclical changes, and have decreased during the most recent years to very low values in 2006; since then the mean weights have increased again. The mean weight at age in the stock are assumed equal to those in the landings.

5.2.4 Maturity-at-age

Maturity-at-age data is available from the Faroese Spring Groundfish Surveys 1982–2011. The survey is carried out in February-March, so the maturity-at-age is determined just prior to the spawning of haddock in Faroese waters and the determinations of the different maturity stages is relatively easy.

In order to reduce year-to-year effects due to possible inadequate sampling and at the same time allow for trends in the series, the routine by the WG has been to use a 3-year running average in the assessment. For the years prior to 1982, average maturity-at-age from the surveys 1982–1995 was adopted (Table 5.7 and Figure 5.6).

5.3 Information from the fishing industry

There exists a considerable amount of data on fish size in the fishing industry. No such information was used in the 2011 assessment but catch per unit effort for some selected fleets (logbook data) is used as additional information on the status of the stock (see section 5.4.1.1).

5.4 Methods

This assessment is an update of the 2010 assessment, with exactly the same settings of the XSA. The only changes are minor revisions of recent landings according to revised data and corresponding revisions of the c@age input file. All other input files (VPA) are the same except for the addition of the 2010 data.

5.4.1 Tuning and estimates of fishing mortality

Commercial cpue series. Several commercial catch per unit effort series are updated every year, but as discussed in previous reports of this WG they are not used directly for tuning of the VPA but as additional information on stock trends (for details see the stock annex). The age-aggregated cpue series for longliners and pair trawlers are presented in Figure 5.7. In general the two series show the same trends although in some periods the two series are conflicting; this has been explained by variations in catchability of the longlines due to the above mentioned changes in productivity of the ecosystem (see chapter 2).

Fisheries independent cpue series. Two annual groundfish surveys are available, one carried out in February-March since 1982 (100 stations per year down to 500 m depth), and the other in August-September since 1996 (200 stations per year down to 500 m depth). The distribution of haddock catches in the surveys are shown in Figure 5.9 (spring surveys 1994-2011) and Figure 5.10 (summer surveys 1996-2010). Biomass estimates (kg/hour) are available for both series since they were initiated (Figure 5.8), and in general, there is a good agreement between them. Age disaggregated data are available for the whole summer series, but due to problems with the database (see earlier reports), age disaggregated data for the spring survey are only available since 1994. The calculation of indices at age is based on age-length keys with a smoother applied. This is a useful method but by analyzing the number of otoliths for the youngest ages and comparing it with the length distributions some artifacts may be introduced because the smoothing can assign wrong ages to some lengths, especially for the youngest and oldest specimen. As in recent years, the length distributions have been used more directly for calculation of indices at age (ages 0-2). LN(numbers at age) for the surveys are presented in Figures 5.11-5.12 and show consistent patterns. Further analyses of the performances of the two series are shown in figures 5.13 – 5.15. In general there is a good relationship between the indices for one year class in two successive years (Figures 5.13-5.14). The same applies when comparing the corresponding indices at age from the two surveys (Figure 5.15).

A SPALY (same procedure as last year) run, with the same settings of the XSA as in 2010 and tuned with the two surveys combined (Table 5.8), with 2010 data included and some minor revisions of recent catch figures, gave similar 2009 estimates as the 2010 assessment (Table 5.9), although this years assessment indicates that the 2010 assessment overestimated the 2009 recruitment and fishing mortality by 19% and 13%, respectively and underestimated the 2009 total- and spawning stock biomasses by 14% and 13%, respectively.

(Section 5.10). The log q residuals for the two surveys are shown in Figure 5.16.

The retrospective analysis of fishing mortality, recruitment and spawning stock biomass of this XSA is shown in Figure 5.17. The retrospective pattern of the fishing mortality is hampered by strange values of some small poorly sampled year classes which in some years are included in the FBAR reference ages and consequently they will create problems for estimation of the stock (see the 2005 NWWG report); this is not a problem for the time being but the development of recent small year classes should be carefully inspected.

It has been questioned if a rather heavy shrinkage of 0.5 is the most appropriate for a stock like Faroe haddock where biological parameters and fishing mortality (catchability) are closely linked to productivity changes in the ecosystem. In order to investigate the possible effect of the shrinkage, the 2010 NWWG carried out an exploratory XSA without shrinkage (Shr. 2.0). Based on that it was concluded to carry on with a shrinkage of 0.5 and this shrinkage was also applied this year.

Results. The fishing mortalities from the final XSA run are given in Table 5.10 and in Figure 5.18. According to this the fishing mortality showed an overall decline since the early 1960s and has been estimated to be below or at the natural mortality of 0.2 in several years from the late 1970s. It increased again in the years 1993-1998 to reach more than 0.5 in 1998. After that there was a drop to below 0.3 in 2000-2002 followed by an increase in 2003 to about 0.45. Since then the fishing mortality has decreased to below the F_{pa} in 2008 and 2009 but in this years assessment the 2010 point value is estimated at 0.3 above the F_{pa} of 0.25 and the proposed F_{MSY} of 0.25).

5.5 Reference points

The yield- and spawning stock biomass per recruit (age 2) based on the long-term data are shown in Table 5.17 and Figure 5.20. From Figure 5.19, showing the recruit/spawning stock relationship, and from Table 5.17, $\mathbf{F}_{med}$, and $\mathbf{F}_{high}$ were calculated at 0.25 (0.24) and 0.94, respectively. The F_{max} of 0.61 should not be used since it is very poorly determined due to the flat YPR curve. $F_{0.1}$ is estimated at 0.22. The F35%SPR was estimated at 0.25.

The precautionary reference fishing mortalities were set in 1998 by ACFM with F_{pa} as the $\mathbf{F}_{med}$ value of 0.25 and F_{lim} two standard deviations above $\mathbf{F}_{pa}$ equal to 0.40. The precautionary reference spawning stock biomass levels were changed by ACFM in 2007. B_{lim} was set at 22 000 t (B_{loss}) and B_{pa} at 35 000 t based on the formula $B_{pa} = B_{lim}e^{1.645\sigma}$, assuming a σ of about 0.3 to account for the uncertainties in the assessment.

The working group have investigated possible candidates for F_{MSY}. Two of these approaches were in line with the suggestions from the WKFRAME 2. However, an attempt to use the same procedure as for Faroe Saithe (chapter 5) failed, it was simply not possible to run the software due to technical problems.

The medium term forecast presented here is to a large degree based on an similar methodology as used in the stochastic forecast for Icelandic cod (see section 9). The weight at age, maturity at age and selection at age are the same used in the long term (yield per recruit) deterministic analysis (Table 5.16)

Starting condition (2011):

- Na,2011 are based on point values from the final stock esimates in the assessment (Table 5.13). Error in the stock in numbers in the first year are

ignored. The fishing mortality in the assment and advisory year set to 0.30 equivalent to the F_{sq} in the short term deterministic predictions (table 5.15).

Simulation:

- No stochasicity is modelled for catch weights, stock weights, maturity nor selection pattern.
- Recruitment: Year classes 2010 and later. Deviations series from the mean recruitment from 1957-2010 year classes (27.8 millions) is applied to a hockey stick model with $SSB_{break}=B_{loss}$=22 kt and $R_{break}=R_{mean}$=17.5 millions. No error is assumed in the breakpoints. The time series of the recruitment deviation sinces 1961 is kept, with randomly drawn starting year in each iteration, looped continuously by repeating the time series. Effectively this means that when SSB is above 22 kt the historical time series of recruitment in absoluted values is repeated, while SSB being below 22 kt results in proportional reduction in the absolute recruitment values while the historical deviation is maintained. This formulation is largely set up so as to test the robustness of fishing mortality applied againts a series of years with very poor recruitment.
- Assessment error: Assessment error is modeled on the fishing mortality in the advisory year upon which the annual removal is taken: cv=0.20, rho=0.15. When setting up the starting value in the simulation (2011), the first 100 values in the error series are ignored in order to apply a potential assessment bias (as manifested in the rho) already in the starting year.
- Other parameters, such as natural mortality are kept the same as in the assessment with no stochastic errors applied in the simulations.

The analysis indicate that F_{msy} is in the range of 0.2-0.4 with a maximum close to 0.3 (Figure 5.21). A target fishing mortality of F=0.3 would result in a low probability of the stock going below B_{lim} but around 30% probability in going below B_{pa} (Figure 5.22). At target fishing mortality of F=0.25 there is only a slight loss in yield (Figure 5.21) but the probability of going below B_{pa} is only around 10% (Figure 5.22). The stock development when applying a target of F=0.25 (Figure 5.23) indicate that variability in catch and spawnings stock is within the range of historical observations. The realized fishing mortality when applying a target of F=0.25 is in the range of 0.17-0.32.

The evaluation are done without taking default action when SSB is below B_{pa}, a default canditate for $B_{trigger}$. Such action would result in lower probability of the SSB going below B_{lim}. The default ICES MSY rule dictates that action dictating a lower fishing mortality than F_{msy} is when the SSB in the assessment year is below $B_{trigger}$. However, given the nature of the recruitment in haddock, where very low recruitment can be observed for a number of years a the trigger action could potentially be applied to estimates of spawning stock biomass 1-3 years into the future, based on available recruitment estimates from survey measurements. I.e. instead of:

$$F_{\text{target},y+1} = f(F_{MSY}, SSB_y, SSB_{TRIGGER})$$

where y refers to the assessment year the action would be based on:

$$F_{\text{target},y+1} = f(F_{MSY}, SSB_{y+3}, SSB_{TRIGGER})$$

Here the SSB in year y+3 (or y+2) would be largely a function of the recruitments already estimated from available survey indices. In cases where the indices were low,

action in term of lower target would thus be taken "ahead of time". If the recruitment indices are however averages or above average size no action in the form of reducing F in the advisory years is requied.

Further evaluation of a suitable F_{msy} harvest rate mechanims is pending and will be presented in the next NWWG report. The WG proposes, based on the preliminary analysis presented here that the F_{msy} target be set provisionally at 0.25 and that this value be used as the basis for deriving an MSY advice for upcoming fishing year.

The third approach uses the very preliminary ecological model described in chapters 2 and 3, where F_{MSY} is estimated for the cod, haddock and saithe simultaneously. When optimizing the cod and haddock catches and at the same time allowing for about average catches of saithe, the F_{MSY} for haddock is indicated to be in the range of 0.20-0.25, consistent with the suggested F_{MSY} of 0.25.

Last year the NWWG stated that simulation studies taking into account the productivity (cyclic) of the ecosystem are necessary to come up with reliable candidates for F_{MSY}. This still is needed before a more final F_{MSY} can be set, so the present F_{MSY} suggestion should be regarded as very preliminary. The ecological model includes productivity of the ecosystem, but also this need to be further developed.

5.6 State of the stock – historical and compared to what is now.

The stock size in numbers is given in Table 5.11 and a summary of the VPA with the biomass estimates is given in Table 5.12 and in Figure 5.18. According to this assessment, the period up to the mid 1970s was characterized by relative high and stable landings, recruitment and spawning stock biomass and the stock was able to withstand relatively high fishing mortalities. Since then the spawning stock biomass has shown large fluctuations due to cyclical changes in recruitment, growth and maturity (Figures 5.5 and 5.6). The fishing mortality seem not to be the decisive factor in this development since it most of the period has fluctuated around the F_{pa}

The most recent increase in the spawning stock is due to new strong year classes entering the fishery of which the 1999 year class is the highest on record (103 mio. at age 2). Also the YC's from 2000 and 2001 are estimated well above average and the 2002 YC as average, but the more recent YC's are all estimated or predicted to be very small except the 2009 YC, which is estimated to be half of the average for the whole series back to 1957 and the 2008 YC which is estimated as one third of the average During the last decade or so, the fishing mortality has increased in years with high stock biomass, even above F_{lim}.

5.7 Short term forecast

Input data

The input data for the short-term predictions are estimated in accordance with the procedures last year and given in Tables 5.13-14. All year classes up to 2009 are taken directly from the 2011 final XSA, the 2010 year class at age 2 is estimated from the 2011 XSA age 1 applying a natural mortality of 0.2 in a forward calculation of the numbers using basic VPA equations. The YC 2011 at age 2 in 2013 is estimated as the geometric mean of the 2-year-olds since 2005. This is a change as compared to the last few years, when the period since 1980 was used. All available information suggests that using the recent shorter series with poor recruitment is more appropriate than the longer period. However, the choice of recruitment in 2013 has little effect on the short term prediction. The exploitation pattern used in the prediction was derived

from averaging the 2008–2010 fishing mortality matrices from the final VPA and re-scalied to 2010. The same exploitation pattern was used for all three years.

The mean weight@age have been declining in recent years to low values but from inspection of Figure 5.5 and Table 5.6, most ages have increased again since 2007. After inspection of the mean weights at age since 1976, the mean weight-at-age for ages 4-10 in 2011-2013 was set equal to the weights for 2010 .The maturity ogive for 2011 is estimated as the average of the observed maturities in the Faroese Groundfish Spring Survey 2010- 2011, and the ogives in 2012-2013 are estimated as the average of the 2009-2011 values.

5.7.1 Results

Although the allocated number of fishing days for the fishing year 2010-2011 was reduced for some fleets 3as compared to the year before (see section 2), it should not be unrealistic to assume fishing mortalities in 2011 as the average of some recent years, here the average of F(2008-2010), since not all allocated days were actually used; however, possible changes in the catchability of the fleets (which seems to be linked to productivity changes in the environment) could undermine this assumption; price differences between cod and haddock may also influence this assumption. The landings in 2011 are then predicted to be about 5 000 t, and continuing with this fishing mortality will result in 2012 landings of about 5 300 t. The SSB will decrease to 20 000 t in 2011, increase to 23 000 t in 2012 but decrease again in 2013 to 20 000 t, i.e. fluctuate around the B_{lim} (22 000t) the next few years. The results of the short-term prediction are shown in Table 5.15 and in Figure 5.20. The contribution by year-classes to the age composition of the predicted 2012 and 2013 SSB's is shown in Figure 5.24.

5.8 Medium term forecasts and yield per recruit

Medium term projections are presented in section 5.5 of this years report.

The input data for the long-term yield and spawning stock biomass (yield-per-recruit calculations) are listed in Table 5.16. Mean weights-at-age (stock and catch) are averages for the 1977–2010 period. The maturity o-gives are averages for the years 1982-2010. The exploitation pattern is the same as in the short term prediction.

The results are given in Table 5.17, Figure 5.20 and under Reference points (section 5.5).

5.9 Uncertainties in assessment and forecast

Retrospective analysis indicate period with tendencies to overestimate spawning stock biomass and underestimate fishing mortality and vice versa. Similar things can be seen with the recruitment. This years assessment indicates that the 2010 assessment overestimated the 2009 recruitment and fishing mortality by 19% and 13%, respectively and underestimated the 2009 total- and spawning stock biomasses by 14% and 13%, respectively.

Recruitment estimates from surveys are not very consistent for small cohorts..

The sampling of the catches in 2009 for length measurements, otolith readings and length-weight relationships improved as compared to the last 3 years and was considered to be adequate; in 2010, however, the level of sampling decreased again.

5.10 Comparison with previous assessment and forecast

As explained previously in the report, this assessment is an update of the 2010 assessment. The only changes are minor revisions of recent landings according to revised data and corresponding revisions of the c@age input file. All other input files (VPA and tuning fleets) are the same except for the addition of the 2010 data.

Following differences in the 2009 estimates were observed as compared to last year:

Comparisons between 2010 and 2011 assessment of 2009 data
The year of comparison is 2009

	R at age 2 (thousands)	Total B (tonnes)	SSB (tonnes)	Landings (tonnes)	F (3-7)
2010 spaly	8461	25273	23400	5183	0.2531
2011 spaly	7113	29507	26968	5197	0.2248
%-change	19	-14	-13	0	13

5.11 Management plans and evaluations

There is no explicit management plan for this stock. A management system based on number of fishing days, closed areas and other technical measures was introduced in 1996 with the purpose to ensuring sustainable fisheries. See overview in section 2 for details.

5.12 Management considerations

Management of fisheries on haddock also needs to take into account measures for cod and saithe.

5.13 Ecosystem considerations

Since on average about 80% of the catches are taken by longlines and the remaining by trawls, effects of the haddock fishery on the bottom is moderate.

5.14 Regulations and their effects

As explained in the overview (section 2), the fishery for haddock in Vb is regulated through a maximum number of fishing days, gear specifications, closed areas during spawning times and large areas closed to trawling. As a consequence, around 80% of the haddock landings derive from long line fisheries. Since the minimum mesh size in the trawls (codend) is 145 mm, the trawl catches consist of fewer small fish than the long line fisheries. Other nations fishing in Faroese waters are regulated by TAC's obtained during bilateral negotiations; their total landings are minimal, however. Discarding of haddock is considered minimal and there is a ban to discarding.

5.15 Changes in fishing technology and fishing patterns

See section 2.

5.16 Changes in the environment

See section 2.

Table 5.1 Faroe Plateau (Sub-division Vb1) HADDOCK. Nominal catches (tonnes) by countries 1982-2010, I.e. Working Group estimates in Vb1.

Country	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Denmark	-	-	-	-	1	8	4	-	-	-			
Faroe Islands	10,319	11,898	11,418	13,597	13,359	13,954	10,867	13,506	11,106	8,074	4,655	3,622	3,675
France[1]	2	2	20	23	8	22	14	-	-	-	164	-	
Germany	1	+	+	+	1	1	-	+	+	+		-	
Norway	12	12	10	21	22	13	54	111	94	125	71	28	22
UK (Engl. and Wales)	-	-	-	-	-	2	-	-	7	-	54	81	31
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	5,722
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	4,252

Country	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010 [2]
Faroe Islands	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	15,600	11,689	6,628	4,895	4928
France[1]				2 [2,7]	- [2]	6	8 [7]	2	4	1 [5]	+	12 [7]	4 [7]	3 [7]	2 [7]	1 [7]
Germany	5	-	-		33	1	2	6	1	6		1				
Greenland					30 [6]	22 [6]	0 [6]	4 [6]				1	9 [5]		6 [7]	12 [6]
Iceland								4								
Norway	28	45	45	71	411	355	257 [2]	227	265	229	212	57	61	26	8	5
Russia										16				10		
Spain										49						
UK (Engl. and Wales)	23	5	22	30 [1]	59 [7]	19 [7]	4 [7]	11 [7]	14	8	1	1				
UK (Scotland)[11]	-	...	...	...					185	186	126	106	35	60	64	
United Kingdom																73 [7]
Total	4,605	9,202	16,652	19,238	17,176	14,023	13,728 #	21,030	22,084	19,490	18,361	15,778	11,798	6,727	4,975	5,019
Working Group estimate[4,5,8]	4,948	9,642	17,924	22,210	18,482	15,821	15,890	24,933	26,942	23,101	20,305	17,154	12,631	7,288	5,197	5,198

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 Faroe Marine Research Institute

9) Included in Vb2

10) Includes 14 reported as Vb

Table 5.2 Faroe Bank (Sub-division Vb2) HADDOCK. Nominal catches (tonnes) by countries,
1982-2010, I.e. Working Group estimates in Vb2.

Country	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Faroe Islan	1,533	967	925	1,474	1,050	832	1,160	659	325	217	338	185	353
France1	-	-	-	-	-	-	-	-	-	-	-	- -	
Norway	1	2	5	3	10	5	43	16	97	4	23	8	1
UK (Engl. a	-	-	-	-	-	-	-	-	-	-	+	+	+
UK (Scotla	48	13	+	25	26	45	15	30	725	287	869	102	170
Total	1,582	982	930	1,502	1,086	882	1,218	705	1,147	508	1,230	295	524

Country	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010 [2]
Faroe Islan	303	338	1,133	2,810	1,110	1,565 [5]	1,948	3,698	4,804	3,594	1,899	1,375	810	556	192	178
France1	-	-	-								+					
Norway	1	40	4	60	3	48	66	28	54	17	45	1	8		3	1
UK (Engl. a	... [1]	... [1]	... [1]	... [1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[4]	[4]			
UK (Scotla	39	62	135	102	193	185	148	177	[4]	[1]	[4]	[4]	15	5	27 [4]	
Total	343	440	1,272	2,972	1,306	1,798	2,162 [1]	3,903	4,858	3,611	1,944	1,376	833	561	222	179

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 5.3 Total Faroese landings of haddock from Division Vb 1985-2010 by each fleet category (%).

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Open boats	7	7	11	2	3	2	3	2	1	1	1	2	2	2	2	1	2	3	4	4	4	6	6	6	4	6
Longliners < 100GRT	39	39	39	49	58	60	56	46	24	18	23	28	31	30	23	24	29	31	34	40	41	47	35	34	27	27
Longliners > 100GRT	13	12	13	19	18	18	18	22	25	25	38	36	38	40	40	36	38	34	42	42	43	36	39	41	30	47
Otter board trawlers < 1000HP	7	5	7	6	4	4	3	3	11	10	12	13	9	8	7	9	7	6	4	3	3	1	4	7	13	4
Otterboard trawlers > 1000HP	8	5	2	2	2	2	2	1	1	3	2	2	3	3	7	5	5	11	3	1	1	2	8	2	2	2
Pairtrawlers < 1000HP	19	20	17	11	7	5	7	11	13	10	8	7	6	5	6	7	6	4	4	2	2	2	3	3	5	3
Pairtrawlers > 1000HP	6	10	9	9	6	8	11	14	22	29	16	13	12	12	14	19	12	10	8	7	4	5	6	7	18	11
Nets	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jigging	1	0	0	0	1	1	1	0	0	0	0	1	1	0	0	0	1	2	1	1	1	0	1	0	0	+
Other gears	0	1	1	2	1	1	1	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 5.4

Catch at age 2010

Age	Vb1 Open Boats	Vb1 LLiners < 100GRT	Vb1 LLiners > 100GRT	Vb1 OB. trawl.	Vb1 Pair trawl.	Vb1 Sampled Fleets	Vb1 Others	Vb1 All fleets	Vb2 All fleets	Vb Foreign Trawlers	Vb Foreign LLiners	Vb Total All fleets
1	0	0	0	0	0	0	0	0	0	0	0	0
2	72	260	49	4	2	388	1	388	0	1	0	389
3	58	226	86	42	24	434	1	435	1	8	0	445
4	25	130	117	63	75	409	1	410	2	13	0	426
5	13	89	111	26	29	269	0	270	4	5	0	279
6	17	131	203	49	68	468	1	469	4	10	1	484
7	17	149	213	65	86	529	1	530	9	13	1	553
8	14	173	287	83	125	682	1	683	16	17	1	717
9	11	114	216	25	42	409	1	410	28	5	1	444
10	4	30	68	6	8	116	0	116	27	1	0	144
11	0	3	2	0	0	5	0	5	9	0	0	15
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
Total no.	230	1305	1352	364	458	3710	7	3716	101	74	4	3896
Catch, t.	195	1363	1852	424	572	4406	8	4414	177	86	6	4683

Notes: Numbers in 1000'
Catch, gutted weight in tonnes
Others includes netters, jiggers, other small categories and catches not otherwise accounted for
LLiners = Longliners OB.trawl. = Otterboard tı Pair Trawl. = Pair trawlers

Comm. Sampling 2010	Vb1 Open Boats	Vb1 LLiners < 100GRT	Vb1 LLiners > 100GRT	Vb1 OB. trawl. < 1000HP	Vb1 OB. trawl. > 1000HP	Vb1 Pair trawl. < 1000HP	Vb1 Pair trawl. > 1000HP	Vb 1 Others	Vb1 All Faroese Fleets	Vb2 All Faroese LLiners	Vb2 All Faroese trawlers	Vb2 Others	Vb2 All Faroese Fleets	Vb Foreign Trawlers	Vb1 Foreign LLiners
No. samples	6	26	26	6	0	7	33	0	104	1	3	0	4	0	0
No. lengths	1043	5085	5081	1143	0	1484	7181	0	21017	204	617	0	821	0	0
No. weights	1043	5085	5081	1143	0	1484	6703	0	20539	204	617	0	821	0	0
No. ages	120	795	540	120	0	180	717	0	2472	0	0	0	0	0	0

Table 5.5 Faroe haddock. Catch number-at-age

```
Run title : FAROE HADDOCK (ICES DIVISION Vb)                HAD_IND

At 27/04/2011  14:07


   Table  1    Catch numbers at age                          Numbers*10**-3
   YEAR,       1957,    1958,    1959,    1960,

   AGE
     0,           0,       0,       0,       0,
     1,          45,     116,     525,     854,
     2,        4133,    6255,    3971,    6061,
     3,        7130,    8021,    7663,   10659,
     4,        8442,    5679,    4544,    6655,
     5,        1615,    3378,    2056,    2482,
     6,         894,    1299,    1844,    1559,
     7,         585,     817,     721,    1169,
     8,         227,     294,     236,     243,
     9,          94,     125,      98,      85,
    +gp,         58,     105,      47,      28,
 TOTALNUM,    23223,   26089,   21705,   29795,
 TONSLAND,    20995,   23871,   20239,   25727,
 SOPCOF %,       89,      90,      90,      88,


   Table  1    Catch numbers at age                          Numbers*10**-3
 YEAR,       1961,    1962,    1963,    1964,    1965,    1966,    1967,    1968,    1969,    1970,

 AGE
   0,           0,       0,       0,       0,       0,       0,       0,       0,       0,       0,
   1,         941,     784,     356,      46,      39,      90,      70,      49,      95,      57,
   2,        7932,    9631,   13552,    2284,    1368,    1081,    1425,    5881,    2384,    1728,
   3,        7330,   13977,    8907,    7457,    4286,    3304,    2405,    4097,    7539,    4855,
   4,        5134,    5233,    7403,    3899,    5133,    4804,    2599,    2812,    4567,    6581,
   5,        1937,    2361,    2242,    2360,    1443,    2710,    1785,    1524,    1565,    1624,
   6,        1305,    1407,    1539,    1120,    1209,    1112,    1426,    1526,    1485,    1383,
   7,         838,     868,     860,     728,     673,     740,     631,     923,    1224,    1099,
   8,         236,     270,     257,     198,    1345,     180,     197,     230,     378,     326,
   9,          59,      72,      75,      49,      43,      54,      52,      68,     114,      68,
  +gp,         13,      22,      23,       7,       8,       9,      13,      12,      20,      10,
TOTALNUM,   25725,   34625,   35214,   18148,   15547,   14084,   10603,   17122,   19371,   17731,
TONSLAND,   20831,   27151,   27571,   19490,   18479,   18766,   13381,   17852,   23272,   21361,
SOPCOF %,      88,      89,      89,     101,      94,     109,     101,     102,     108,     102,


   Table  1    Catch numbers at age                          Numbers*10**-3
   YEAR,       1971,    1972,    1973,    1974,    1975,    1976,    1977,    1978,    1979,    1980,

   AGE
     0,           0,       0,       0,       0,       0,       0,       0,       0,       0,       0,
     1,          55,      43,     665,     253,      94,      40,       0,       0,       1,       0,
     2,         717,     750,    3311,    5633,    7337,    4396,     255,      32,       1,     143,
     3,        4393,    3744,    8416,    2899,    7952,    7858,    4039,    1022,    1162,      58,
     4,        4727,    4179,    1240,    3970,    2097,    6798,    5168,    4248,    1755,    3724,
     5,        3267,    2706,    2795,     451,    1371,    1251,    4918,    4054,    3343,    2583,
     6,        1292,    1171,     919,     976,     247,    1189,    2128,    1841,    1851,    2496,
     7,         864,     696,    1054,     466,     352,     298,     946,     717,     772,    1568,
     8,         222,     180,     150,     535,     237,     720,     443,     635,     212,     660,
     9,         147,     113,      68,      68,     419,     258,     731,     243,     155,      99,
    +gp,        102,      95,      11,     147,     187,     318,     855,     312,      74,      86,
 TOTALNUM,   15786,   13677,   18629,   15398,   20293,   23126,   19483,   13104,    9326,   11417,
 TONSLAND,   19393,   16485,   18035,   14773,   20715,   26211,   25555,   19200,   12424,   15016,
 SOPCOF %,      97,      96,      97,      97,     117,     107,      98,      99,     104,     100,
```

Table 5.5 Faroe haddock. Catch number-at-age (cont.)

Table 1 Catch numbers at age								Numbers*10**-3		
YEAR,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,
AGE										
0,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
1,	0,	0,	0,	25,	0,	0,	0,	0,	0,	0,
2,	74,	539,	441,	1195,	985,	230,	283,	655,	63,	105,
3,	455,	934,	1969,	1561,	4553,	2549,	1718,	444,	1518,	1275,
4,	202,	784,	383,	2462,	2196,	4452,	3565,	2463,	658,	1921,
5,	2586,	298,	422,	147,	1242,	1522,	2972,	3036,	2787,	768,
6,	1354,	2182,	93,	234,	169,	738,	1114,	2140,	2554,	1737,
7,	1559,	973,	1444,	42,	91,	39,	529,	475,	1976,	1909,
8,	608,	1166,	740,	861,	61,	130,	83,	151,	541,	885,
9,	177,	1283,	947,	388,	503,	71,	48,	18,	133,	270,
+gp,	36,	214,	795,	968,	973,	712,	334,	128,	81,	108,
TOTALNUM,	7051,	8373,	7234,	7883,	10773,	10443,	10646,	9510,	10311,	8978,
TONSLAND,	12233,	11937,	12894,	12378,	15143,	14477,	14882,	12178,	14325,	11726,
SOPCOF %,	109,	92,	106,	106,	106,	101,	102,	97,	100,	102,

Table 1 Catch numbers at age								Numbers*10**-3		
YEAR,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	1998,	1999,	2000,
AGE										
0,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
1,	0,	0,	43,	1,	0,	1,	0,	0,	9,	73,
2,	77,	40,	113,	277,	804,	326,	77,	106,	174,	1461,
3,	1044,	154,	298,	191,	452,	5234,	2913,	1055,	1142,	3061,
4,	1774,	776,	274,	307,	235,	1019,	10517,	5269,	942,	210,
5,	1248,	1120,	554,	153,	226,	179,	710,	9856,	4677,	682,
6,	651,	959,	538,	423,	132,	163,	116,	446,	6619,	2685,
7,	1101,	335,	474,	427,	295,	161,	123,	99,	226,	2846,
8,	698,	373,	131,	383,	290,	270,	93,	87,	26,	79,
9,	317,	401,	201,	125,	262,	234,	220,	95,	20,	1,
+gp,	32,	162,	185,	301,	295,	394,	516,	502,	192,	71,
TOTALNUM,	6942,	4320,	2811,	2588,	2991,	7981,	15285,	17515,	14027,	11169,
TONSLAND,	8429,	5476,	4026,	4252,	4948,	9642,	17924,	22210,	18482,	15821,
SOPCOF %,	106,	106,	103,	100,	103,	100,	103,	101,	100,	103,

Table 1 Catch numbers at age								Numbers*10**-3		
YEAR,	2001,	2002,	2003,	2004,	2005,	2006,	2007,	2008,	2009,	2010,
AGE										
0,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
1,	19,	0,	0,	3,	0,	0,	0,	6,	0,	0,
2,	4380,	1515,	132,	243,	84,	247,	76,	65,	27,	389,
3,	3128,	14039,	3419,	2007,	1659,	446,	982,	201,	329,	445,
4,	2423,	2879,	13486,	4802,	3824,	2566,	547,	905,	402,	426,
5,	173,	1200,	2214,	10426,	6703,	3949,	2732,	418,	555,	279,
6,	451,	133,	944,	1163,	6082,	5423,	3309,	1451,	514,	484,
7,	1151,	239,	162,	409,	538,	3278,	2758,	1683,	1133,	553,
8,	1375,	843,	333,	89,	146,	136,	1117,	1237,	739,	717,
9,	17,	1095,	854,	166,	28,	63,	89,	315,	285,	444,
+gp,	18,	33,	920,	811,	153,	70,	9,	38,	48,	159,
TOTALNUM,	13135,	21976,	22464,	20119,	19217,	16178,	11619,	6319,	4032,	3896,
TONSLAND,	15890,	24933,	26942,	23101,	20305,	17154,	12631,	7288,	5197,	5198,
SOPCOF %,	100,	100,	100,	99,	100,	100,	100,	101,	100,	101,

Table 5.6 Faroe haddock. Catch weight-at-age.

```
 Run title : FAROE HADDOCK (ICES DIVISION Vb)                HAD_IND

    At 27/04/2011  14:07


       Table  2    Catch weights at age (kg)
       YEAR,       1957,    1958,    1959,    1960,

       AGE
         0,        .0000,   .0000,   .0000,   .0000,
         1,        .2500,   .2500,   .2500,   .2500,
         2,        .4700,   .4700,   .4700,   .4700,
         3,        .7300,   .7300,   .7300,   .7300,
         4,       1.1300,  1.1300,  1.1300,  1.1300,
         5,       1.5500,  1.5500,  1.5500,  1.5500,
         6,       1.9700,  1.9700,  1.9700,  1.9700,
         7,       2.4100,  2.4100,  2.4100,  2.4100,
         8,       2.7600,  2.7600,  2.7600,  2.7600,
         9,       3.0700,  3.0700,  3.0700,  3.0700,
       +gp,       3.5500,  3.5500,  3.5500,  3.5500,
     SOPCOFAC,     .8937,   .8983,   .9034,   .8832,
```

```
  Table  2    Catch weights at age (kg)
  YEAR,       1961,    1962,    1963,    1964,    1965,    1966,    1967,    1968,    1969,    1970,

  AGE
    0,        .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,
    1,        .2500,   .2500,   .2500,   .2500,   .2500,   .2500,   .2500,   .2500,   .2500,   .2500,
    2,        .4700,   .4700,   .4700,   .4700,   .4700,   .4700,   .4700,   .4700,   .4700,   .4700,
    3,        .7300,   .7300,   .7300,   .7300,   .7300,   .7300,   .7300,   .7300,   .7300,   .7300,
    4,       1.1300,  1.1300,  1.1300,  1.1300,  1.1300,  1.1300,  1.1300,  1.1300,  1.1300,  1.1300,
    5,       1.5500,  1.5500,  1.5500,  1.5500,  1.5500,  1.5500,  1.5500,  1.5500,  1.5500,  1.5500,
    6,       1.9700,  1.9700,  1.9700,  1.9700,  1.9700,  1.9700,  1.9700,  1.9700,  1.9700,  1.9700,
    7,       2.4100,  2.4100,  2.4100,  2.4100,  2.4100,  2.4100,  2.4100,  2.4100,  2.4100,  2.4100,
    8,       2.7600,  2.7600,  2.7600,  2.7600,  2.7600,  2.7600,  2.7600,  2.7600,  2.7600,  2.7600,
    9,       3.0700,  3.0700,  3.0700,  3.0700,  3.0700,  3.0700,  3.0700,  3.0700,  3.0700,  3.0700,
  +gp,       3.5500,  3.5500,  3.5500,  3.5500,  3.5500,  3.5500,  3.5500,  3.5500,  3.5500,  3.5500,
SOPCOFAC,     .8832,   .8929,   .8915,  1.0111,   .9383,  1.0885,  1.0117,  1.0246,  1.0787,  1.0249,
```

```
  Table  2    Catch weights at age (kg)
  YEAR,       1971,    1972,    1973,    1974,    1975,    1976,    1977,    1978,    1979,    1980,

  AGE
    0,        .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,
    1,        .2500,   .2500,   .2500,   .2500,   .2500,   .2500,   .0000,   .0000,   .3000,   .0000,
    2,        .4700,   .4700,   .4700,   .4700,   .4700,   .4700,   .3110,   .3570,   .3570,   .6430,
    3,        .7300,   .7300,   .7300,   .7300,   .7300,   .7300,   .6330,   .7900,   .6720,   .7130,
    4,       1.1300,  1.1300,  1.1300,  1.1300,  1.1300,  1.1300,  1.0440,  1.0350,   .8940,   .9410,
    5,       1.5500,  1.5500,  1.5500,  1.5500,  1.5500,  1.5500,  1.4260,  1.3980,  1.1560,  1.1570,
    6,       1.9700,  1.9700,  1.9700,  1.9700,  1.9700,  1.9700,  1.8250,  1.8700,  1.5900,  1.4930,
    7,       2.4100,  2.4100,  2.4100,  2.4100,  2.4100,  2.4100,  2.2410,  2.3500,  2.0700,  1.7390,
    8,       2.7600,  2.7600,  2.7600,  2.7600,  2.7600,  2.7600,  2.2050,  2.5970,  2.5250,  2.0950,
    9,       3.0700,  3.0700,  3.0700,  3.0700,  3.0700,  3.0700,  2.5700,  3.0140,  2.6960,  2.4650,
  +gp,       3.5500,  3.5500,  3.5500,  3.5500,  3.5500,  3.5500,  2.5910,  2.9200,  3.5190,  3.3100,
SOPCOFAC,     .9688,   .9597,   .9690,   .9678,  1.1696,  1.0741,   .9784,   .9947,  1.0380,  1.0017,
```

Table 5.6 Faroe haddock. Catch weight-at-age (cont.).

Table 2 Catch weights at age (kg)

YEAR,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0000,	.0000,	.0000,	.3590,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.4520,	.7000,	.4700,	.6810,	.5280,	.6080,	.6050,	.5010,	.5800,	.4380,
3,	.7250,	.8960,	.7400,	1.0110,	.8590,	.8870,	.8310,	.7810,	.7790,	.6990,
4,	.9570,	1.1500,	1.0100,	1.2550,	1.3910,	1.1750,	1.1260,	.9740,	.9230,	.9390,
5,	1.2370,	1.4440,	1.3200,	1.8120,	1.7770,	1.6310,	1.4620,	1.3630,	1.2070,	1.2040,
6,	1.6510,	1.4980,	1.6600,	2.0610,	2.3260,	1.9840,	1.9410,	1.6800,	1.5640,	1.3840,
7,	2.0530,	1.8290,	2.0500,	2.0590,	2.4400,	2.5190,	2.1730,	1.9750,	1.7460,	1.5640,
8,	2.4060,	1.8870,	2.2600,	2.1370,	2.4010,	2.5830,	2.3470,	2.3440,	2.0860,	1.8180,
9,	2.7250,	1.9610,	2.5400,	2.3680,	2.5320,	2.5700,	3.1180,	2.2480,	2.4240,	2.1680,
+gp,	3.2500,	2.8560,	3.0400,	2.6860,	2.6860,	2.9220,	2.9330,	3.2950,	2.5140,	2.3350,
SOPCOFAC,	1.0870,	.9238,	1.0554,	1.0593,	1.0559,	1.0141,	1.0197,	.9695,	1.0025,	1.0195,

Table 2 Catch weights at age (kg)

YEAR,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	1998,	1999,	2000,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0000,	.0000,	.3600,	.0000,	.0000,	.3600,	.0000,	.0000,	.2780,	.2800,
2,	.5470,	.5250,	.7550,	.7540,	.6660,	.5340,	.5190,	.6220,	.5040,	.6610,
3,	.6930,	.7240,	.9820,	1.1030,	1.0540,	.8580,	.7710,	.8460,	.6240,	.9360,
4,	.8840,	.8170,	1.0270,	1.2540,	1.4890,	1.4590,	1.0660,	1.0160,	.9740,	1.1660,
5,	1.0860,	1.0380,	1.1920,	1.4650,	1.7790,	1.9930,	1.7990,	1.2830,	1.2200,	1.4830,
6,	1.2760,	1.2490,	1.3780,	1.5930,	1.9400,	2.3300,	2.2700,	2.0800,	1.4900,	1.6160,
7,	1.4770,	1.4300,	1.6430,	1.8040,	2.1820,	2.3510,	2.3400,	2.5560,	2.4560,	1.8930,
8,	1.5740,	1.5640,	1.7960,	2.0490,	2.3570,	2.4690,	2.4750,	2.5720,	2.6580,	2.8210,
9,	1.9300,	1.6330,	1.9710,	2.2250,	2.4900,	2.7770,	2.5010,	2.4520,	2.5980,	3.7490,
+gp,	2.1530,	2.1260,	2.2400,	2.4230,	2.6780,	2.5820,	2.6760,	2.7530,	2.9530,	3.1960,
SOPCOFAC,	1.0635,	1.0554,	1.0320,	.9969,	1.0331,	1.0043,	1.0250,	1.0106,	.9973,	1.0349,

Table 2 Catch weights at age (kg)

YEAR,	2001,	2002,	2003,	2004,	2005,	2006,	2007,	2008,	2009,	2010,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.2800,	.0000,	.0000,	.3670,	.0000,	.0000,	.0000,	.4910,	.0000,	.0000,
2,	.6080,	.5840,	.5710,	.5740,	.5380,	.4750,	.6280,	.6360,	.4820,	.6920,
3,	.9400,	.8570,	.7150,	.7700,	.6490,	.6010,	.6690,	.7540,	.7340,	.8700,
4,	1.3740,	1.4050,	1.0080,	.8870,	.7970,	.7680,	.8590,	.8600,	.9850,	1.1490,
5,	1.7790,	1.7990,	1.5370,	1.1590,	1.0200,	.9110,	.9690,	.9910,	1.1300,	1.3080,
6,	1.9710,	1.9740,	1.9110,	1.6380,	1.2450,	1.1260,	1.0600,	1.0820,	1.2640,	1.3860,
7,	2.1190,	2.3010,	2.0910,	1.8700,	1.8430,	1.3740,	1.2450,	1.1510,	1.3570,	1.4290,
8,	2.3730,	2.3700,	2.3010,	2.4380,	2.0610,	2.1580,	1.4750,	1.3790,	1.5450,	1.5680,
9,	2.7500,	2.6260,	2.4060,	2.3570,	2.2630,	2.2110,	2.2660,	1.7270,	1.7920,	1.7400,
+gp,	3.9660,	3.1300,	2.5350,	2.4170,	2.5790,	2.5690,	2.2560,	2.4350,	2.1540,	1.8410,
SOPCOFAC,	.9960,	1.0010,	1.0048,	.9929,	.9988,	.9987,	.9999,	1.0069,	.9955,	1.0071,

Table 5.7 Faroe haddock. Proportion mature-at-age.

```
Run title : FAROE HADDOCK (ICES DIVISION Vb)                HAD_IND

At 27/04/2011  14:07


   Table  5    Proportion mature at age
   YEAR,       1957,    1958,    1959,    1960,

   AGE
     0,        .0000,   .0000,   .0000,   .0000,
     1,        .0000,   .0000,   .0000,   .0000,
     2,        .0600,   .0600,   .0600,   .0600,
     3,        .4800,   .4800,   .4800,   .4800,
     4,        .9100,   .9100,   .9100,   .9100,
     5,       1.0000,  1.0000,  1.0000,  1.0000,
     6,       1.0000,  1.0000,  1.0000,  1.0000,
     7,       1.0000,  1.0000,  1.0000,  1.0000,
     8,       1.0000,  1.0000,  1.0000,  1.0000,
     9,       1.0000,  1.0000,  1.0000,  1.0000,
    +gp,      1.0000,  1.0000,  1.0000,  1.0000,
```

```
Table  5    Proportion mature at age
YEAR,       1961,    1962,    1963,    1964,    1965,    1966,    1967,    1968,    1969,    1970,

AGE
  0,        .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,
  1,        .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,
  2,        .0600,   .0600,   .0600,   .0600,   .0600,   .0600,   .0600,   .0600,   .0600,   .0600,
  3,        .4800,   .4800,   .4800,   .4800,   .4800,   .4800,   .4800,   .4800,   .4800,   .4800,
  4,        .9100,   .9100,   .9100,   .9100,   .9100,   .9100,   .9100,   .9100,   .9100,   .9100,
  5,       1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,
  6,       1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,
  7,       1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,
  8,       1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,
  9,       1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,
+gp,       1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,
```

```
Table  5    Proportion mature at age
YEAR,       1971,    1972,    1973,    1974,    1975,    1976,    1977,    1978,    1979,    1980,

AGE
  0,        .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,
  1,        .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,
  2,        .0600,   .0600,   .0600,   .0600,   .0600,   .0600,   .0600,   .0600,   .0600,   .0600,
  3,        .4800,   .4800,   .4800,   .4800,   .4800,   .4800,   .4800,   .4800,   .4800,   .4800,
  4,        .9100,   .9100,   .9100,   .9100,   .9100,   .9100,   .9100,   .9100,   .9100,   .9100,
  5,       1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,
  6,       1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,
  7,       1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,
  8,       1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,
  9,       1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,
+gp,       1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,  1.0000,
```

Table 5.7 Faroe haddock. Proportion mature-at-age (cont.).

Table 5 Proportion mature at age YEAR,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.0600,	.0800,	.0800,	.0800,	.0300,	.0300,	.0500,	.0500,	.0200,	.0800,
3,	.4800,	.6200,	.6200,	.7600,	.6200,	.4300,	.3200,	.2400,	.2200,	.3700,
4,	.9100,	.8900,	.8900,	.9800,	.9600,	.9500,	.9100,	.8900,	.8700,	.9000,
5,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	.9900,	.9800,	.9800,	.9900,	1.0000,
6,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
7,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
8,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
9,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
+gp,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,

Table 5 Proportion mature at age YEAR,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	1998,	1999,	2000,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.1600,	.1800,	.1100,	.0500,	.0300,	.0300,	.0100,	.0100,	.0100,	.0200,
3,	.5800,	.6500,	.5000,	.4200,	.4700,	.4700,	.4700,	.3600,	.3500,	.3600,
4,	.9300,	.9100,	.8500,	.8600,	.9100,	.9300,	.9100,	.8700,	.8600,	.8700,
5,	1.0000,	1.0000,	.9700,	.9600,	.9600,	.9800,	1.0000,	.9900,	.9900,	.9900,
6,	1.0000,	1.0000,	.9900,	.9900,	.9900,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
7,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
8,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
9,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
+gp,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,

Table 5 Proportion mature at age YEAR,	2001,	2002,	2003,	2004,	2005,	2006,	2007,	2008,	2009,	2010,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.0900,	.0800,	.0700,	.0000,	.0100,	.0100,	.0200,	.0100,	.0100,	.0300,
3,	.5400,	.4900,	.4500,	.3500,	.3400,	.4200,	.5200,	.6400,	.6100,	.6500,
4,	.9300,	.9700,	.9700,	.9400,	.9100,	.9100,	.9100,	.9500,	.9300,	.9600,
5,	1.0000,	1.0000,	.9900,	.9900,	.9900,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
6,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
7,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
8,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
9,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
+gp,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,

Table 5.8 Faroe haddock. 2011 tuning file.

```
FAROE Haddock (ICES SUBDIVISION VB)       COMB-SURVEY-SPALY-11-jr.txt
102
SUMMER SURVEY
1996 2010
1 1 0.6 0.7
1 8
200   42362.00 38050.46 60866.49   1138.05   210.25   286.72  238.48  416.44
200    6851.83 12379.93 24184.20  47016.45   852.22   177.11   81.49  163.30
200   18825.00  2793.18  2545.32  14600.59 18399.09   285.78   89.61   73.64
200   24115.03  9521.26  5553.74   1548.70  8698.75  9829.62  204.06    7.89
200  161583.90 18837.41  7340.20    371.40  1301.41  4638.88 5699.14   85.81
200   98708.03 96675.44 11962.07   4424.74   174.57   629.27 2615.71 3209.95
200   89340.23 52092.34 57922.78   5538.84  1909.63   162.47  395.07 1256.27
200   47450.28 36196.89 22847.00  35941.83  3962.64   621.93  101.63  428.87
200    9049.95 33653.00 15117.67  16561.09 16561.09   885.34  185.66   24.20
200   14574.15  7694.99 12936.61  16513.01 11635.42 11963.56  517.84   36.46
200    3484.57  9591.77  2004.49   8968.12  8908.60  6973.94 3364.52  125.74
200    3908.73  7047.44  1676.69   1520.65  4177.57  5114.12 2491.34  552.65
200    4682.23  1967.06  1153.27   2544.21   995.53  3105.84 3178.90 1379.37
200   10461.67  1394.00   410.40   1336.32  1270.33   933.93 2228.54 1224.04
200   24598.14  3779.02  1315.66   1091.24   571.38   809.59  763.94 1276.77
SPRING SURVEY SHIFTED
1993 2010
1 1 0.95 1.0
0 6
100  16009.60   1958.70    216.70    338.10    172.80   305.30    399.60
100  35395.20  19462.60    702.20    216.60    150.70    48.80    141.10
100   6611.80  33206.50  19338.50    663.10     98.20    73.90     56.00
100    371.70   8095.00  15618.00  25478.90    628.10   146.10     37.00
100   3481.60   1545.80   3353.40  10120.10  12687.60   336.20      9.90
100   4459.50   6739.70    112.20   1517.30   4412.30  3139.20     48.70
100  25964.40   8354.40   4858.70    198.10    443.90  1669.60   1940.70
100  25283.30  36311.20   3384.70   1056.60     26.70   106.60    427.70
100  21111.90  17809.30  25760.60   1934.70    684.90    40.60    101.70
100   9391.10  22335.10  13272.70  12734.40    776.10   230.10     19.30
100   1823.10  16068.30  10327.10   7487.70  11212.50   487.50     79.10
100   5798.80   6022.70   7742.00   6165.00   4565.90  4912.80    238.60
100    705.50   6284.80   1574.60   4457.00   3250.40  3267.40   1577.20
100   1191.70   1873.30   4202.40   1008.90   3511.30  3712.50   2875.00
100    667.90   2182.60    820.20   1694.90    599.50  1665.00   1463.80
100   4119.00   2079.00   1125.10    405.90    916.80   371.50    924.90
100   6945.00   4655.30    638.10    418.70    196.20   280.20    265.90
100    101.10   6320.00   1869.30    449.50    260.30   212.60    244.60
```

Table 5.9 Faroe haddock 2011 xsa.

```
Lowestoft VPA Version 3.1

  27/04/2011  14:05

Extended Survivors Analysis

FAROE HADDOCK (ICES DIVISION Vb)                 HAD_IND

CPUE data from file d:\vpa\vpa2011\input-files\comb-survey-spaly-11-jr.txt

Catch data for  54 years. 1957 to 2010. Ages  0 to  10.

     Fleet,            First, Last, First, Last, Alpha,  Beta
                     ,    year, year,  age ,  age
SUMMER SURVEY         ,   1996, 2010,   1,     8,   .600,   .700
SPRING SURVEY SHIFTE,   1993, 2010,   0,     6,   .950,  1.000

Time series weights :

     Tapered time weighting not applied

Catchability analysis :

     Catchability independent of stock size for all ages

     Catchability independent of age for ages >=    6

Terminal population estimation :

     Survivor estimates shrunk towards the mean F
     of the final   5 years or the   5 oldest ages.

     S.E. of the mean to which the estimates  are shrunk =    .500

     Minimum standard error for population
     estimates derived from each fleet =    .300

     Prior weighting not applied


Tuning converged after   45 iterations



Regression weights
      , 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000


Fishing mortalities
   Age,  2001,  2002,  2003,  2004,  2005,  2006,  2007,  2008,  2009,  2010

     0,  .000,  .000,  .000,  .000,  .000,  .000,  .000,  .000,  .000,  .000
     1,  .000,  .000,  .000,  .000,  .000,  .000,  .000,  .002,  .000,  .000
     2,  .048,  .028,  .003,  .009,  .012,  .029,  .024,  .021,  .009,  .048
     3,  .241,  .214,  .081,  .064,  .080,  .083,  .155,  .080,  .139,  .201
     4,  .443,  .367,  .328,  .157,  .168,  .171,  .139,  .209,  .227,  .270
     5,  .226,  .412,  .538,  .457,  .341,  .262,  .278,  .150,  .191,  .244
     6,  .271,  .272,  .672,  .610,  .532,  .513,  .366,  .233,  .278,  .255
     7,  .224,  .224,  .624,  .708,  .644,  .620,  .539,  .321,  .288,  .546
     8,  .199,  .254,  .559,  .871,  .597,  .328,  .442,  .496,  .227,  .299
     9,  .260,  .241,  .443,  .609,  .764,  .562,  .371,  .213,  .199,  .207
```

Table 5.9 Faroe haddock 2011 xsa (cont.)

XSA population numbers (Thousands)

YEAR	AGE 0	1	2	3	4	5	6	7	8	9
2001	6.52E+04	7.44E+04	1.03E+05	1.61E+04	7.48E+03	9.46E+02	2.10E+03	6.34E+03	8.42E+03	8.21E+01
2002	4.39E+04	5.33E+04	6.09E+04	8.06E+04	1.04E+04	3.93E+03	6.18E+02	1.31E+03	4.15E+03	5.65E+03
2003	1.14E+04	3.59E+04	4.37E+04	4.85E+04	5.33E+04	5.88E+03	2.13E+03	3.86E+02	8.59E+02	2.64E+03
2004	1.42E+04	9.35E+03	2.94E+04	3.56E+04	3.66E+04	3.14E+04	2.81E+03	8.91E+02	1.69E+02	4.02E+02
2005	5.39E+03	1.16E+04	7.65E+03	2.39E+04	2.74E+04	2.56E+04	1.63E+04	1.25E+03	3.59E+02	5.79E+01
2006	5.20E+03	4.42E+03	9.51E+03	6.19E+03	1.80E+04	1.89E+04	1.49E+04	7.84E+03	5.38E+02	1.62E+02
2007	4.97E+03	4.26E+03	3.62E+03	7.56E+03	4.66E+03	1.24E+04	1.19E+04	7.32E+03	3.45E+03	3.17E+02
2008	1.36E+04	4.07E+03	3.49E+03	2.89E+03	5.30E+03	3.32E+03	7.71E+03	6.78E+03	3.49E+03	1.82E+03
2009	2.38E+04	1.11E+04	3.33E+03	2.80E+03	2.19E+03	3.52E+03	2.34E+03	5.00E+03	4.03E+03	1.74E+03
2010	4.82E+02	1.95E+04	9.12E+03	2.70E+03	1.99E+03	1.43E+03	2.38E+03	1.45E+03	3.07E+03	2.63E+03

Estimated population abundance at 1st Jan 2011

0.00E+00, 3.95E+02, 1.60E+04, 7.11E+03, 1.81E+03, 1.24E+03, 9.14E+02, 1.51E+03, 6.89E+02, 1.86E+03,

Taper weighted geometric mean of the VPA populations:

2.47E+04, 2.21E+04, 1.83E+04, 1.44E+04, 9.92E+03, 6.09E+03, 3.68E+03, 2.03E+03, 9.86E+02, 4.51E+02,

Standard error of the weighted Log(VPA populations) :

1.1738, 1.0447, 1.0470, 1.0192, .9914, .9591, .9361, .9716, 1.1380, 1.4050,

Log catchability residuals.

Fleet : SUMMER SURVEY

Age	1993	1994	1995	1996	1997	1998	1999	2000
0	No data for this fleet at this age							
1	99.99	99.99	99.99	1.12	.20	-.22	-.29	.04
2	99.99	99.99	99.99	-.03	.48	-.10	-.31	.09
3	99.99	99.99	99.99	.39	.22	-.35	1.60	.28
4	99.99	99.99	99.99	-.36	.47	.07	-.46	-.62
5	99.99	99.99	99.99	-.05	.10	.13	.17	-.08
6	99.99	99.99	99.99	.23	.44	-.26	.03	.04
7	99.99	99.99	99.99	-.01	-.34	.99	.29	-.02
8	99.99	99.99	99.99	-.07	.17	.62	.44	.29

Age	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	No data for this fleet at this age									
1	.07	.30	.07	-.24	.02	-.45	-.30	-.07	-.27	.02
2	.13	.03	-.02	.31	.18	.19	.85	-.39	-.70	-.69
3	.46	.41	-.10	-.21	.04	-.47	-.80	-.26	-1.22	.02
4	.34	.19	.40	-.11	.18	-.01	-.45	-.02	.23	.15
5	-.85	.24	.65	.35	.13	.11	-.22	-.41	-.20	-.06
6	-.36	-.49	-.13	-.09	.70	.24	.06	-.09	-.07	-.25
7	-.07	-.39	-.26	-.44	.20	.22	-.06	.12	.05	.38
8	-.17	-.36	.34	-.71	-1.23	-.57	-.88	.06	-.38	-.02

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	1	2	3	4	5	6	7	8
Mean Log q	-4.9568	-5.3325	-5.7725	-5.7468	-5.8624	-5.8363	-5.8363	-5.8363
S.E(Log q)	.3747	.4103	.6445	.3378	.3457	.3103	.3634	.5496

Table 5.9 Faroe haddock 2011 xsa (cont.)

```
Regression statistics :

 Ages with q independent of year class strength and constant w.r.t. time.

 Age, Slope , t-value , Intercept, RSquare, No Pts, Reg s.e,  Mean Q

  1,     .94,     .688,      5.24,     .91,     15,     .36,   -4.96,
  2,     .95,     .517,      5.54,     .90,     15,     .40,   -5.33,
  3,     .90,     .772,      6.14,     .83,     15,     .59,   -5.77,
  4,     .87,    2.333,      6.19,     .96,     15,     .26,   -5.75,
  5,     .89,    1.996,      6.17,     .96,     15,     .28,   -5.86,
  6,     .94,    1.014,      5.97,     .96,     15,     .29,   -5.84,
  7,    1.04,    -.604,      5.72,     .93,     15,     .39,   -5.79,
  8,    1.10,   -1.096,      5.93,     .89,     15,     .57,   -6.00,


 Fleet : SPRING SURVEY SHIFTE

  Age  ,  1993,  1994,  1995,  1996,  1997,  1998,  1999,  2000
     0 ,  -.65,   .90,   .84, -1.14,  -.33,  -.40,  -.22,   .28
     1 ,  -.45,  -.88,   .41,   .62,  -.14,  -.09,  -.20,  -.31
     2 ,  -.51,  -.61,  -.06,   .48,   .56, -1.92,   .41,  -.21
     3 ,  -.01,  -.02,  -.24,   .62,   .46,   .26,  -.48,  -.48
     4 ,  -.24,  -.11,  -.05,   .52,   .58,   .31,  -.28, -1.84
     5 ,  -.23, -1.02,  -.19,  1.09,   .68,  -.17,  -.01, -1.13
     6 ,   .36,  -.38,  -.29,  -.09,  -.66,  -.22,   .13,  -.63
     7 , No data for this fleet at this age
     8 , No data for this fleet at this age


  Age  ,  2001,  2002,  2003,  2004,  2005,  2006,  2007,  2008,  2009,  2010
     0 ,   .44,   .02,  -.27,   .67,  -.47,   .09,  -.45,   .37,   .33,   .00
     1 ,  -.49,   .07,   .13,   .50,   .33,   .08,   .27,   .27,   .07,  -.19
     2 ,   .21,   .06,   .12,   .23,  -.01,   .77,   .10,   .45,  -.09,   .02
     3 ,  -.20,   .04,  -.11,  -.01,   .08,  -.05,   .34,  -.20,  -.08,   .08
     4 ,  -.02,  -.30,   .69,   .00,  -.03,   .46,   .02,   .38,  -.26,   .16
     5 ,  -.87,  -.37,   .09,   .65,   .33,   .69,   .32,   .02,  -.28,   .40
     6 ,  -.49,  -.92,  -.36,   .40,   .46,  1.13,   .54,   .38,   .37,   .25
     7 , No data for this fleet at this age
     8 , No data for this fleet at this age


 Mean log catchability and standard error of ages with catchability
 independent of year class strength and constant w.r.t. time


    Age ,         0,         1,         2,         3,         4,         5,
6
 Mean Log q,   -5.9726,   -5.3490,   -5.9659,   -6.0916,   -6.3437,   -6.4714,
-6.6878,
 S.E(Log q),     .5433,     .3830,     .5933,     .2885,     .5564,     .6110,
.5299,
```

Table 5.9 Faroe haddock 2011 xsa (cont.)

```
Regression statistics :

 Ages with q independent of year class strength and constant w.r.t. time.

 Age, Slope , t-value , Intercept, RSquare, No Pts, Reg s.e,  Mean Q

  0,     .94,     .662,      6.20,     .89,     18,     .52,   -5.97,
  1,    1.19,   -2.160,      4.51,     .89,     18,     .41,   -5.35,
  2,     .87,    1.380,      6.44,     .87,     18,     .50,   -5.97,
  3,     .92,    1.740,      6.34,     .97,     18,     .25,   -6.09,
  4,     .82,    2.465,      6.79,     .92,     18,     .40,   -6.34,
  5,     .91,     .921,      6.66,     .86,     18,     .56,   -6.47,
  6,     .80,    3.147,      6.96,     .94,     18,     .34,   -6.69,


 Terminal year survivor and F summaries :

 Age  0   Catchability constant w.r.t. time and dependent on age

 Year class = 2010

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Esti-
mated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 SUMMER SURVEY       ,         1.,   .000,       .000,    .00,   0,  .000,     .000
 SPRING SURVEY SHIFTE,       395.,   .558,       .000,    .00,   1, 1.000,     .000

   F shrinkage mean  ,         0.,    .50,,,,                        .000,     .000

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       395.,       .56,      .00,    1,    .000,   .000


 Age  1   Catchability constant w.r.t. time and dependent on age

 Year class = 2009

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Esti-
mated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 SUMMER SURVEY       ,     16300.,   .387,       .000,    .00,   1,  .408,     .000
 SPRING SURVEY SHIFTE,     15713.,   .322,       .244,    .76,   2,  .592,     .000

   F shrinkage mean  ,         0.,    .50,,,,                        .000,     .000

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
     15950.,       .25,      .13,    3,    .539,   .000
```

Table 5.9 Faroe haddock 2011 xsa (cont.)

```
 Age  2   Catchability constant w.r.t. time and dependent on age

 Year class = 2008

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
      ,                 Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 SUMMER SURVEY       ,      4486.,   .286,       .205,    .72,   2,  .425,     .076
 SPRING SURVEY SHIFTE,      8135.,   .284,       .099,    .35,   3,  .429,     .042

   F shrinkage mean  ,     18376.,    .50,,,,                          .146,     .019

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      7113.,       .19,      .24,    6,   1.270,   .048


 Age  3   Catchability constant w.r.t. time and dependent on age

 Year class = 2007

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
      ,                 Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 SUMMER SURVEY       ,      1341.,   .263,       .225,    .86,   3,  .337,     .263
 SPRING SURVEY SHIFTE,      1888.,   .206,       .128,    .62,   4,  .548,     .193

   F shrinkage mean  ,      3537.,    .50,,,,                          .115,     .108

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      1808.,       .15,      .15,    8,    .951,   .201


Age  4   Catchability constant w.r.t. time and dependent on age

 Year class = 2006

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
      ,                 Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 SUMMER SURVEY       ,       990.,   .210,       .231,   1.10,   4,  .420,     .329
 SPRING SURVEY SHIFTE,      1384.,   .194,       .091,    .47,   5,  .474,     .246

   F shrinkage mean  ,      1912.,    .50,,,,                          .107,     .184

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      1245.,       .14,      .12,   10,    .876,   .270
```

Table 5.9 Faroe haddock 2011 xsa (cont.)

```
 Age  5   Catchability constant w.r.t. time and dependent on age

 Year class = 2005

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Esti-
mated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 SUMMER SURVEY       ,       985.,   .183,       .206,   1.13,   5,  .478,     .228
 SPRING SURVEY SHIFTE,       842.,   .186,       .109,    .58,   6,  .424,     .262

   F shrinkage mean  ,       907.,    .50,,,,                        .098,     .246

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       914.,       .13,      .10,   12,    .789,   .244


  Age  6   Catchability constant w.r.t. time and dependent on age

 Year class = 2004

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Esti-
mated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 SUMMER SURVEY       ,      1314.,   .162,       .090,    .56,   6,  .535,     .288
 SPRING SURVEY SHIFTE,      2086.,   .180,       .102,    .57,   7,  .373,     .191

   F shrinkage mean  ,       927.,    .50,,,,                        .092,     .387

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      1511.,       .12,      .10,   14,    .805,   .255


 Age  7   Catchability constant w.r.t. time and age (fixed at the value for age)  6

 Year class = 2003

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Esti-
mated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 SUMMER SURVEY       ,       628.,   .150,       .129,    .86,   7,  .559,     .586
 SPRING SURVEY SHIFTE,       765.,   .177,       .102,    .57,   7,  .319,     .503

   F shrinkage mean  ,       799.,    .50,,,,                        .122,     .486

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       689.,       .12,      .08,   15,    .669,   .546
```

Table 5.9 Faroe haddock 2011 xsa (cont.)

```
 Age  8   Catchability constant w.r.t. time and age (fixed at the value for age)  6

 Year class = 2002

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Esti-
mated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 SUMMER SURVEY       ,      1841.,   .150,       .048,    .32,   8,  .592,     .302
 SPRING SURVEY SHIFTE,      2284.,   .179,       .060,    .33,   7,  .285,     .250

   F shrinkage mean  ,      1240.,    .50,,,,                        .123,     .421

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      1864.,       .12,      .06,   16,    .489,   .299




 Age  9   Catchability constant w.r.t. time and age (fixed at the value for age)  6

 Year class = 2001

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Esti-
mated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 SUMMER SURVEY       ,      1827.,   .153,       .071,    .47,   8,  .578,     .199
 SPRING SURVEY SHIFTE,      2138.,   .178,       .105,    .59,   7,  .269,     .172

   F shrinkage mean  ,      1048.,    .50,,,,                        .153,     .324

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      1751.,       .13,      .08,   16,    .644,   .207
```

Table 5.10 Faroe haddock. Fishing mortality (F) at age.

```
Run title : FAROE HADDOCK (ICES DIVISION Vb)                HAD_IND

At 27/04/2011  14:07

               Terminal Fs derived using XSA (With F shrinkage)

   Table  8    Fishing mortality (F) at age
   YEAR,       1957,    1958,    1959,    1960,

   AGE
     0,        .0000,   .0000,   .0000,   .0000,
     1,        .0010,   .0024,   .0132,   .0150,
     2,        .1394,   .1939,   .1066,   .2074,
     3,        .3707,   .4378,   .3860,   .4599,
     4,        .6163,   .5737,   .4782,   .6926,
     5,        .3909,   .5386,   .4195,   .5260,
     6,        .4380,   .6346,   .6458,   .6591,
     7,        .6340,   .9504,   .9184,  1.2130,
     8,        .5599,   .7839,   .8206,   .9667,
     9,        .5321,   .7028,   .6625,   .8198,
   +gp,        .5321,   .7028,   .6625,   .8198,
FBAR  3- 7,    .4900,   .6270,   .5696,   .7101,
```

```
   Table  8    Fishing mortality (F) at age
   YEAR,       1961,    1962,    1963,    1964,    1965,    1966,    1967,    1968,    1969,    1970,

   AGE
     0,        .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,
     1,        .0219,   .0149,   .0106,   .0018,   .0017,   .0032,   .0012,   .0014,   .0024,   .0033,
     2,        .1875,   .3232,   .3801,   .0876,   .0691,   .0610,   .0641,   .1261,   .0860,   .0551,
     3,        .4162,   .5866,   .5639,   .3723,   .2354,   .2370,   .1873,   .2647,   .2363,   .2528,
     4,        .4209,   .5980,   .7261,   .5193,   .4767,   .4515,   .2971,   .3483,   .5320,   .3344,
     5,        .4387,   .3480,   .5591,   .5369,   .3678,   .5006,   .2997,   .2847,   .3330,   .3639,
     6,        .5879,   .6706,   .4026,   .6107,   .5882,   .5421,   .5406,   .4540,   .4975,   .5561,
     7,        .9483,  1.0499,  1.2493,   .3375,   .9618,   .9128,   .6906,   .8367,   .8277,   .8740,
     8,        .8742,   .9736,  1.1139,  1.2027,  2.3618,   .7509,   .6634,   .5851,  1.0631,   .5430,
     9,        .6600,   .7351,   .8185,   .6472,   .9619,   .6373,   .5022,   .5057,   .6566,   .5386,
   +gp,        .6600,   .7351,   .8185,   .6472,   .9619,   .6373,   .5022,   .5057,   .6566,   .5386,
FBAR  3- 7,    .5624,   .6506,   .7002,   .4753,   .5260,   .5288,   .4031,   .4377,   .4853,   .4762,
```

```
   Table  8    Fishing mortality (F) at age
   YEAR,       1971,    1972,    1973,    1974,    1975,    1976,    1977,    1978,    1979,    1980,

   AGE
     0,        .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,   .0000,
     1,        .0015,   .0016,   .0114,   .0033,   .0015,   .0014,   .0000,   .0000,   .0002,   .0000,
     2,        .0526,   .0253,   .1677,   .1266,   .1230,   .0908,   .0108,   .0010,   .0004,   .0325,
     3,        .1936,   .4225,   .4320,   .2172,   .2650,   .1878,   .1128,   .0547,   .0458,   .0285,
     4,        .4186,   .2853,   .2392,   .3730,   .2412,   .3810,   .1814,   .1665,   .1255,   .2024,
     5,        .2754,   .4517,   .3143,   .1279,   .2116,   .2216,   .5273,   .2115,   .1913,   .2749,
     6,        .5560,   .1495,   .2703,   .1714,   .0957,   .2871,   .7246,   .3819,   .1408,   .2135,
     7,        .8385,   .6720,   .1951,   .2134,   .0859,   .1601,   .3904,   .5759,   .2721,   .1701,
     8,        .4224,   .4066,   .2907,   .1433,   .1599,   .2538,   .3788,   .4968,   .3302,   .3953,
     9,        .5061,   .3957,   .2633,   .2067,   .1595,   .2621,   .4437,   .3689,   .2130,   .2525,
   +gp,        .5061,   .3957,   .2633,   .2067,   .1595,   .2621,   .4437,   .3689,   .2130,   .2525,
FBAR  3- 7,    .4564,   .3962,   .2902,   .2206,   .1799,   .2475,   .3873,   .2781,   .1551,   .1779,
```

Table 5.10 Faroe haddock. Fishing mortality (F) at age (cont.).

Table 8	Fishing mortality (F) at age									
YEAR,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0000,	.0000,	.0000,	.0006,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.0237,	.0383,	.0251,	.0329,	.0279,	.0096,	.0336,	.0392,	.0049,	.0124,
3,	.1373,	.4616,	.1916,	.1166,	.1692,	.0938,	.0924,	.0677,	.1202,	.1290,
4,	.1313,	.3707,	.3478,	.3893,	.2389,	.2487,	.1840,	.1857,	.1356,	.2199,
5,	.2111,	.2915,	.3496,	.2169,	.3471,	.2593,	.2617,	.2359,	.3313,	.2320,
6,	.2263,	.2774,	.1381,	.3333,	.4158,	.3583,	.3074,	.3052,	.3193,	.3553,
7,	.2004,	.2523,	.2989,	.0852,	.2081,	.1570,	.4736,	.2075,	.5150,	.4207,
8,	.0919,	.2265,	.3100,	.2926,	.1718,	.5170,	.5834,	.2372,	.3869,	.4597,
9,	.1729,	.2852,	.2905,	.2649,	.2778,	.3099,	.3643,	.2355,	.3397,	.3396,
+gp,	.1729,	.2852,	.2905,	.2649,	.2778,	.3099,	.3643,	.2355,	.3397,	.3396,
FBAR 3- 7,	.1813,	.3307,	.2652,	.2283,	.2758,	.2234,	.2638,	.2004,	.2843,	.2714,

Table 8	Fishing mortality (F) at age									
YEAR,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	1998,	1999,	2000,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0000,	.0000,	.0060,	.0000,	.0000,	.0001,	.0000,	.0000,	.0004,	.0006,
2,	.0289,	.0167,	.0709,	.0488,	.0091,	.0078,	.0094,	.0319,	.0125,	.0788,
3,	.1644,	.0742,	.1658,	.1644,	.1050,	.0756,	.0896,	.1716,	.5566,	.3151,
4,	.2665,	.1770,	.1832,	.2574,	.3126,	.3638,	.2141,	.2320,	.2284,	.1830,
5,	.2171,	.2685,	.1850,	.1475,	.3065,	.4177,	.4675,	.3192,	.3328,	.2573,
6,	.3152,	.2583,	.1993,	.2101,	.1832,	.3797,	.5283,	.6112,	.3689,	.3242,
7,	.4009,	.2651,	.1959,	.2406,	.2221,	.3561,	.5546,	1.2933,	.7372,	.2669,
8,	.2660,	.2282,	.1567,	.2403,	.2557,	.3257,	.3592,	1.0228,	1.8862,	.6263,
9,	.2948,	.2406,	.1848,	.2202,	.2574,	.3385,	.4831,	.7749,	.6933,	.3049,
+gp,	.2948,	.2406,	.1848,	.2202,	.2574,	.3385,	.4831,	.7749,	.6933,	.3049,
FBAR 3- 7,	.2728,	.2086,	.1858,	.2040,	.2259,	.3186,	.3708,	.5255,	.4448,	.2693,

Table 8	Fishing mortality (F) at age									
YEAR,	2001,	2002,	2003,	2004,	2005,	2006,	2007,	2008,	2009,	2010,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0003,	.0000,	.0000,	.0004,	.0000,	.0000,	.0000,	.0016,	.0000,	.0000,
2,	.0480,	.0279,	.0033,	.0092,	.0122,	.0291,	.0235,	.0208,	.0090,	.0483,
3,	.2414,	.2138,	.0811,	.0643,	.0800,	.0830,	.1550,	.0799,	.1393,	.2011,
4,	.4434,	.3665,	.3281,	.1565,	.1678,	.1711,	.1389,	.2091,	.2273,	.2698,
5,	.2258,	.4118,	.5376,	.4567,	.3409,	.2619,	.2780,	.1497,	.1914,	.2438,
6,	.2705,	.2716,	.6725,	.6101,	.5318,	.5132,	.3658,	.2331,	.2778,	.2545,
7,	.2238,	.2245,	.6241,	.7083,	.6444,	.6201,	.5389,	.3207,	.2882,	.5460,
8,	.1991,	.2541,	.5591,	.8712,	.5966,	.3276,	.4424,	.4962,	.2266,	.2986,
9,	.2599,	.2412,	.4430,	.6090,	.7636,	.5622,	.3708,	.2128,	.1994,	.2066,
+gp,	.2599,	.2412,	.4430,	.6090,	.7636,	.5622,	.3708,	.2128,	.1994,	.2066,
FBAR 3- 7,	.2810,	.2976,	.4487,	.3992,	.3530,	.3299,	.2953,	.1985,	.2248,	.3030,

Table 5.11 Faroe haddock. Stock number (N) at age.

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Run title : FAROE HADDOCK (ICES DIVISION Vb)                HAD_IND

At 27/04/2011  14:07

               Terminal Fs derived using XSA (With F shrinkage)

   Table 10    Stock number at age (start of year)              Numbers*10**-3
   YEAR,       1957,    1958,    1959,    1960,

   AGE
     0,        64927,   54061,   77651,   58761,
     1,        47944,   53158,   44261,   63576,
     2,        35106,   39212,   43417,   35763,
     3,        25440,   25003,   26445,   31954,
     4,        20280,   14377,   13213,   14717,
     5,         5517,    8965,    6632,    6706,
     6,         2786,    3055,    4284,    3570,
     7,         1377,    1472,    1326,    1839,
     8,          585,     598,     466,     433,
     9,          252,     274,     224,     168,
   +gp,          154,     227,     106,      54,
    TOTAL,    204367,  200401,  218024,  217540,
```

Table 10 Stock number at age (start of year) Numbers*10**-3										
YEAR,	1961,	1962,	1963,	1964,	1965,	1966,	1967,	1968,	1969,	1970,
AGE										
0,	71715,	45400,	33843,	30192,	37948,	81924,	47768,	53238,	23137,	49623,
1,	48109,	58715,	37170,	27709,	24719,	31069,	67074,	39109,	43588,	18943,
2,	51279,	38537,	47362,	30110,	22644,	20203,	25356,	54852,	31976,	35601,
3,	23796,	34806,	22837,	26515,	22585,	17302,	15563,	19470,	39588,	24022,
4,	16517,	12850,	15850,	10638,	14961,	14613,	11176,	10566,	12234,	25590,
5,	6028,	8877,	5786,	6278,	5182,	7604,	7617,	6798,	6106,	5884,
6,	3245,	3182,	5132,	2708,	3005,	2937,	3774,	4622,	4187,	3583,
7,	1512,	1476,	1332,	2809,	1204,	1366,	1398,	1800,	2403,	2084,
8,	448,	480,	423,	313,	1641,	377,	449,	574,	638,	860,
9,	135,	153,	148,	114,	77,	127,	146,	189,	262,	180,
+gp,	29,	46,	45,	16,	14,	21,	36,	33,	45,	26,
TOTAL,	222811,	204522,	169929,	137402,	133981,	177544,	180357,	191251,	164163,	166397,

Table 10 Stock number at age (start of year) Numbers*10**-3										
YEAR,	1971,	1972,	1973,	1974,	1975,	1976,	1977,	1978,	1979,	1980,
AGE										
0,	35419,	78973,	104865,	83640,	39136,	52375,	4155,	7379,	5209,	23633,
1,	40628,	28998,	64658,	85856,	68479,	32042,	42881,	3402,	6041,	4265,
2,	15457,	33213,	23703,	52335,	70064,	55981,	26197,	35108,	2785,	4945,
3,	27584,	12007,	26514,	16410,	37752,	50725,	41856,	21218,	28715,	2280,
4,	15275,	18609,	6442,	14093,	10813,	23713,	34420,	30614,	16447,	22459,
5,	14997,	8229,	11454,	4153,	7946,	6955,	13264,	23504,	21221,	11878,
6,	3348,	9322,	4289,	6849,	2992,	5265,	4562,	6409,	15575,	14349,
7,	1682,	1572,	6573,	2680,	4724,	2226,	3235,	1810,	3582,	11077,
8,	712,	595,	657,	4428,	1772,	3549,	1553,	1793,	833,	2234,
9,	409,	382,	325,	402,	3141,	1237,	2255,	871,	893,	490,
+gp,	281,	319,	52,	865,	1396,	1515,	2613,	1109,	424,	423,
TOTAL,	155791,	192219,	249532,	271712,	248214,	235583,	176991,	133216,	101726,	98033,

Table 5.11 Faroe haddock. Stock number (N) at age (cont.).

Table 10	Stock number at age (start of year)									Numbers*10**-3
YEAR,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,
AGE										
0,	29291,	60871,	58964,	39584,	14122,	28070,	21323,	14040,	4463,	3993,
1,	19349,	23981,	49837,	48275,	32408,	11562,	22982,	17458,	11495,	3654,
2,	3492,	15842,	19634,	40803,	39502,	26534,	9466,	18816,	14293,	9411,
3,	3919,	2792,	12482,	15676,	32325,	31450,	21516,	7494,	14813,	11645,
4,	1814,	2797,	1441,	8438,	11422,	22346,	23443,	16061,	5734,	10754,
5,	15018,	1302,	1581,	833,	4681,	7365,	14267,	15968,	10921,	4099,
6,	7387,	9956,	797,	912,	549,	2709,	4652,	8992,	10326,	6420,
7,	9490,	4823,	6177,	568,	535,	297,	1550,	2801,	5425,	6143,
8,	7650,	6359,	3068,	3750,	427,	356,	208,	790,	1864,	2654,
9,	1232,	5714,	4151,	1843,	2292,	294,	174,	95,	510,	1036,
+gp,	249,	947,	3462,	4569,	4405,	2933,	1200,	671,	309,	411,
TOTAL,	98892,	135383,	161594,	165252,	142668,	133915,	120780,	103185,	80153,	60222,

Table 10	Stock number at age (start of year)									Numbers*10**-3
YEAR,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	1998,	1999,	2000,
AGE										
0,	2724,	9643,	146075,	68992,	13601,	5563,	23091,	31796,	154192,	90926,
1,	3269,	2230,	7895,	119596,	56486,	11135,	4554,	18905,	26032,	126242,
2,	2992,	2677,	1826,	6425,	97916,	46246,	9116,	3729,	15478,	21305,
3,	7610,	2380,	2155,	1393,	5010,	79440,	37568,	7394,	2957,	12515,
4,	8381,	5286,	1809,	1495,	967,	3692,	60304,	28123,	5099,	1388,
5,	7066,	5256,	3626,	1233,	946,	579,	2101,	39856,	18257,	3322,
6,	2661,	4656,	3290,	2467,	871,	570,	312,	1078,	23714,	10716,
7,	3684,	1590,	2944,	2207,	1637,	594,	319,	151,	479,	13426,
8,	3302,	2020,	998,	1982,	1421,	1074,	341,	150,	34,	188,
9,	1372,	2072,	1317,	699,	1276,	901,	635,	195,	44,	4,
+gp,	138,	832,	1206,	1674,	1428,	1505,	1474,	1014,	419,	297,
TOTAL,	43200,	38643,	173142,	208163,	181559,	151299,	139816,	132390,	246705,	280328,

Table 10	Stock number at age (start of year)									Numbers*10**-3
YEAR,	2001,	2002,	2003,	2004,	2005,	2006,	2007,	2008,	2009,	2010,	2011,
AGE											
0,	65160,	43866,	11418,	14182,	5393,	5201,	4972,	13602,	23794,	482,	0,
1,	74444,	53349,	35914,	9348,	11611,	4416,	4258,	4071,	11136,	19481,	395,
2,	103292,	60933,	43678,	29404,	7651,	9506,	3615,	3486,	3328,	9117,	15950,
3,	16121,	80605,	48516,	35641,	23854,	6188,	7560,	2891,	2795,	2700,	7113,
4,	7477,	10369,	53291,	36628,	27364,	18029,	4663,	5301,	2185,	1991,	1808,
5,	946,	3929,	5884,	31428,	25644,	18944,	12439,	3323,	3521,	1425,	1245,
6,	2103,	618,	2131,	2814,	16297,	14930,	11937,	7712,	2342,	2381,	914,
7,	6344,	1314,	386,	891,	1252,	7840,	7317,	6779,	5001,	1453,	1511,
8,	8417,	4152,	859,	169,	359,	538,	3453,	3495,	4027,	3070,	689,
9,	82,	5647,	2637,	402,	58,	162,	317,	1816,	1742,	2629,	1864,
+gp,	86,	169,	2815,	1942,	312,	178,	32,	218,	292,	937,	2374,
TOTAL,	284473,	264950,	207530,	162850,	119796,	85932,	60562,	52693,	60164,	45665,	33863,

Table 5.12. Faroe haddock. Stock summary of the 2011 VPA.

At 16/04/2011 16:57 HAD_IND

Table 16 Summary (without SOP correction)

TerminalFs derived using XSA (With F shrinkage)

	RECRUITS Age 0	RECRUITS Age 2	TOTAL BIO	TOTSP BIO	LANDINGS	YIELD/SSB	FBAR (3-7)
1957	64927	35106	90264	51049	20995	0.4113	0.4900
1958	54061	39212	92975	51409	23871	0.4643	0.6270
1959	77651	43417	89969	48340	20239	0.4187	0.5696
1960	58761	35763	96422	51101	25727	0.5035	0.7101
1961	71715	51279	93296	47901	20831	0.4349	0.5624
1962	45400	38537	98262	52039	27151	0.5217	0.6506
1963	33843	47362	90204	49706	27571	0.5547	0.7002
1964	30192	30110	75561	44185	19490	0.4411	0.4753
1965	37948	22644	71884	45605	18479	0.4052	0.5260
1966	81924	20203	68774	44027	18766	0.4262	0.5288
1967	47768	25356	77101	42086	13381	0.3179	0.4031
1968	53238	54852	87972	45495	17852	0.3924	0.4377
1969	23137	31976	94879	53583	23272	0.4343	0.4853
1970	49623	35601	92144	59958	21361	0.3563	0.4762
1971	35419	15457	92932	63921	19393	0.3034	0.4564
1972	78973	33213	91508	63135	16485	0.2611	0.3962
1973	104865	23703	98979	61623	18035	0.2927	0.2902
1974	83640	52335	116881	64633	14773	0.2286	0.2206
1975	39136	70064	138912	75408	20715	0.2747	0.1799
1976	52375	55981	143635	89226	26211	0.2938	0.2475
1977	4155	26197	121055	96386	25555	0.2651	0.3873
1978	7379	35108	120596	97247	19200	0.1974	0.2781
1979	5209	2785	99521	85416	12424	0.1455	0.1551
1980	23633	4945	87658	81921	15016	0.1833	0.1779
1981	29291	3492	78986	75869	12233	0.1612	0.1813
1982	60871	15842	68331	56825	11937	0.2101	0.3307
1983	58964	19634	63995	51835	12894	0.2487	0.2652
1984	39584	40803	100767	53857	12378	0.2298	0.2283
1985	14122	39502	94073	62654	15143	0.2417	0.2758
1986	28070	26534	98664	65682	14477	0.2204	0.2234
1987	21323	9466	87807	67415	14882	0.2208	0.2638
1988	14040	18816	77600	62040	12178	0.1963	0.2004
1989	4463	14293	69826	51882	14325	0.2761	0.2843
1990	3993	9411	53821	43891	11726	0.2672	0.2714
1991	2724	2992	38973	34865	8429	0.2418	0.2728
1992	9643	2677	29306	27161	5476	0.2016	0.2086
1993	146075	1826	28978	23397	4026	0.1721	0.1858
1994	68992	6425	27646	21779	4252	0.1952	0.2040
1995	13601	97916	89229	22961	4948	0.2155	0.2259
1996	5563	46246	115169	50681	9642	0.1902	0.3186
1997	23091	9116	109592	83771	17924	0.214	0.3708
1998	31796	3729	94565	84040	22210	0.2643	0.5255
1999	154192	15478	82074	64997	18482	0.2844	0.4448
2000	90926	21305	111914	55009	15821	0.2876	0.2693
2001	65160	103292	148886	63202	15890	0.2514	0.2810
2002	43866	60933	155743	87338	24933	0.2855	0.2976
2003	11418	43678	142728	98753	26942	0.2728	0.4487
2004	14182	29404	128997	88536	23101	0.2609	0.3992
2005	5393	7651	91837	75320	20305	0.2696	0.3530
2006	5201	9506	68898	61025	17154	0.2811	0.3299
2007	4972	3615	51033	46020	12631	0.2745	0.2953
2008	13602	3486	38881	33675	7288	0.2164	0.1985
2009	23794	3328	29507	26968	5197	0.1927	0.2248
2010	482	9117	29296	22262	5198	0.2335	0.3030
Arith. Mean	40266	27976	87750	57946	16460	0.2890	0.3539
Units	(Thousands)	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)		

Table 5.13. Management options table - INPUT DATA descriptions.

Stock size

The stock in numbers 2011 is taken directly from the 2011 XSA. The year class 2010 at age 2 (in 2012) is estimated from the 2011 XSA age 1 applying a natural mortality of 0.2 in foreward calculation of the number using the standard VPA equation. The yearclass 2011 at age 2 (in 2013) is estimated as the geomean of the yearclasses since 2005.

Age	2011	2012	2013
2	15950	325	4400
3	7113		
4	1808		
5	1245		
6	914		
7	1511		
8	689		
9	1864		
10+	2374		

Numbers in thousands (predicted values rounded).

Proportion mature at age

The proportion mature at age in 2011 is estimated as the average of the observed data in 2010 and 2011. For 2012 and 2013, the average for 2009 to 2011 is used.

Age	2011	2012	2013
2	0.04	0.03	0.03
3	0.70	0.65	0.65
4	0.95	0.95	0.95
5	1.00	1.00	1.00
6	1.00	1.00	1.00
7	1.00	1.00	1.00
8	1.00	1.00	1.00
9	1.00	1.00	1.00
10+	1.00	1.00	1.00

Catch&Stock weights at age

Catch and stock weights at age 2011-2013 for all ages are simply the estimated point-values for 2010 since no model was available to predict future mean weights at age and mean weights have shown an increasing trend in recent years (Figure xx).

Age	2011	2012	2013
2	0.692	0.692	0.692
3	0.870	0.870	0.870
4	1.149	1.149	1.149
5	1.308	1.308	1.308
6	1.386	1.386	1.386
7	1.429	1.429	1.429
8	1.568	1.568	1.568
9	1.740	1.740	1.740
10+	1.841	1.841	1.841

Exploitation pattern

The exploitation pattern is estimated like last year as the average fishing mortality matrix in 2008-2010 from the final VPA in 2011, re-scaled to 2010, and kept constant for all 3 years.

Age	2011	2012	2013
2	0.0326	0.0326	0.0326
3	0.1753	0.1753	0.1753
4	0.2946	0.2946	0.2946
5	0.2440	0.2440	0.2440
6	0.3193	0.3193	0.3193
7	0.4818	0.4818	0.4818
8	0.4261	0.4261	0.4261
9	0.2581	0.2581	0.2581
10+	0.2581	0.2581	0.2581

Table 5.14 Faroe haddock. Management option table - Input data

MFDP version 1
Run: jak
Time and date: 19:58 22/04/2011
Fbar age range: 3-7

2011

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
2	15950	0.2	0.04	0	0	0.692	3.26E-02	0.692
3	7113	0.2	0.7	0	0	0.87	0.1753	0.87
4	1808	0.2	0.95	0	0	1.149	0.294637	1.149
5	1245	0.2	1	0	0	1.308	0.244029	1.308
6	914	0.2	1	0	0	1.386	0.319336	1.386
7	1511	0.2	1	0	0	1.429	0.481842	1.429
8	689	0.2	1	0	0	1.568	0.426143	1.568
9	1864	0.2	1	0	0	1.74	0.2581	1.74
10	2374	0.2	1	0	0	1.841	0.2581	1.841

2012

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
2	323	0.2	0.03	0	0	0.692	3.26E-02	0.692
3	.	0.2	0.65	0	0	0.87	0.1753	0.87
4	.	0.2	0.95	0	0	1.149	0.294637	1.149
5	.	0.2	1	0	0	1.308	0.244029	1.308
6	.	0.2	1	0	0	1.386	0.319336	1.386
7	.	0.2	1	0	0	1.429	0.481842	1.429
8	.	0.2	1	0	0	1.568	0.426143	1.568
9	.	0.2	1	0	0	1.74	0.2581	1.74
10	.	0.2	1	0	0	1.841	0.2581	1.841

2013

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
2	4411	0.2	0.03	0	0	0.692	3.26E-02	0.692
3	.	0.2	0.65	0	0	0.87	0.1753	0.87
4	.	0.2	0.95	0	0	1.149	0.294637	1.149
5	.	0.2	1	0	0	1.308	0.244029	1.308
6	.	0.2	1	0	0	1.386	0.319336	1.386
7	.	0.2	1	0	0	1.429	0.481842	1.429
8	.	0.2	1	0	0	1.568	0.426143	1.568
9	.	0.2	1	0	0	1.74	0.2581	1.74
10	.	0.2	1	0	0	1.841	0.2581	1.841

Input units are thousands and kg - output in tonnes

Table 5.15 Faroe haddock. Management option table - Results

MFDP version 1
Run: jak
Index file 16/04/2011
Time and date: 19:58 22/04/2011
Fbar age range: 3-7

2011 Biomass	SSB	FMult	FBar	Landings
33052	20496	1	0.303	5018

2012 Biomass	SSB	FMult	FBar	Landings	2013 Biomass	SSB
26936	22589	0	0	0	28974	25339
.	22589	0.1	0.0303	592	28360	24735
.	22589	0.2	0.0606	1169	27762	24147
.	22589	0.3	0.0909	1731	27180	23575
.	22589	0.4	0.1212	2279	26612	23018
.	22589	0.5	0.1515	2812	26060	22475
.	22589	0.6	0.1818	3332	25521	21946
.	22589	0.7	0.2121	3839	24997	21432
.	22589	0.8	0.2424	4333	24486	20930
.	22589	0.9	0.2727	4815	23988	20441
.	22589	1	0.303	5284	23503	19965
.	22589	1.1	0.3333	5742	23031	19502
.	22589	1.2	0.3636	6188	22570	19050
.	22589	1.3	0.3939	6623	22121	18610
.	22589	1.4	0.4242	7048	21683	18180
.	22589	1.5	0.4545	7461	21257	17762
.	22589	1.6	0.4848	7865	20841	17355
.	22589	1.7	0.5151	8259	20436	16958
.	22589	1.8	0.5455	8643	20041	16570
.	22589	1.9	0.5758	9017	19655	16193
.	22589	2	0.6061	9383	19280	15825

Input units are thousands and kg - output in tonnes

Table 5.16 Faroe haddock. Long-term Prediction - Input data

MFYPR version 1
Run: jr
Index file 16/04/2011
Time and date: 20:29 22/04/2011
Fbar age range: 3-7

Age	M	Mat	PF	PM	SWt	Sel	CWt
2	0.2	0.05	0	0	0.562	0.0326	0.562
3	0.2	0.48	0	0	0.799	0.1754	0.799
4	0.2	0.91	0	0	1.061	0.2946	1.061
5	0.2	0.99	0	0	1.369	0.2440	1.369
6	0.2	1.00	0	0	1.659	0.3193	1.659
7	0.2	1.00	0	0	1.933	0.4818	1.933
8	0.2	1.00	0	0	2.167	0.4261	2.167
9	0.2	1.00	0	0	2.408	0.2582	2.408
10	0.2	1.00	0	0	2.721	0.2582	2.721

Weights in kilograms

Table 5.17 Faroe haddock. Long-term Prediction - Results

MFYPR version 1
Run: jr
Time and date: 20:29 22/04/2011
Yield per results

FMult	Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJ	SSBJan	SpwnNosS	SSBSpwn
0	**0**	**0**	**0**	**5.5167**	**8.412**	**4.076**	**7.4682**	**4.076**	**7.4682**
0.1	0.0303	0.1034	0.1755	5.0016	7.1764	3.5638	6.2353	3.5638	6.2353
0.2	0.0606	0.1831	0.2983	4.6049	6.2491	3.1699	5.3107	3.1699	5.3107
0.3	0.0909	0.2463	0.3858	4.2912	5.5355	2.8589	4.5997	2.8589	4.5997
0.4	0.1212	0.2974	0.4491	4.0375	4.9744	2.6079	4.0413	2.6079	4.0413
0.5	0.1515	0.3396	0.4956	3.8284	4.5251	2.4015	3.5945	2.4015	3.5945
0.6	0.1818	0.375	0.53	3.6532	4.1594	2.2289	3.2313	2.2289	3.2313
0.7	0.2121	0.4051	0.5557	3.5042	3.8573	2.0826	2.9316	2.0826	2.9316
0.8	0.2424	0.4311	0.575	3.3759	3.6044	1.9569	2.6812	1.9569	2.6812
0.9	0.2727	0.4538	0.5895	3.2642	3.3903	1.8476	2.4694	1.8476	2.4694
1	0.303	0.4738	0.6005	3.1659	3.2069	1.7518	2.2884	1.7518	2.2884
1.1	0.3333	0.4916	0.6088	3.0786	3.0484	1.667	2.1322	1.667	2.1322
1.2	0.3636	0.5075	0.6151	3.0005	2.91	1.5913	1.9961	1.5913	1.9961
1.3	0.394	0.5219	0.6198	2.9301	2.7883	1.5233	1.8766	1.5233	1.8766
1.4	0.4243	0.535	0.6233	2.8662	2.6803	1.4618	1.7708	1.4618	1.7708
1.5	0.4546	0.5469	0.6258	2.8079	2.584	1.4058	1.6767	1.4058	1.6767
1.6	0.4849	0.5579	0.6277	2.7544	2.4974	1.3546	1.5923	1.3546	1.5923
1.7	0.5152	0.568	0.6289	2.7051	2.4192	1.3076	1.5162	1.3076	1.5162
1.8	0.5455	0.5774	0.6297	2.6595	2.3482	1.2643	1.4472	1.2643	1.4472
1.9	0.5758	0.5862	0.6302	2.6172	2.2834	1.2241	1.3844	1.2241	1.3844
2	0.6061	0.5943	0.6304	2.5777	2.2239	1.1868	1.327	1.1868	1.327

Reference	F multipli	Absolute F
Fbar(3-7)	**1**	**0.303**
FMax	2.0271	0.6143
F0.1	0.7184	0.2177
F35%SPR	0.8301	0.2515
Flow	-99	
Fmed	0.7933	0.2404
Fhigh	3.0873	0.9356

Weights in kilograms

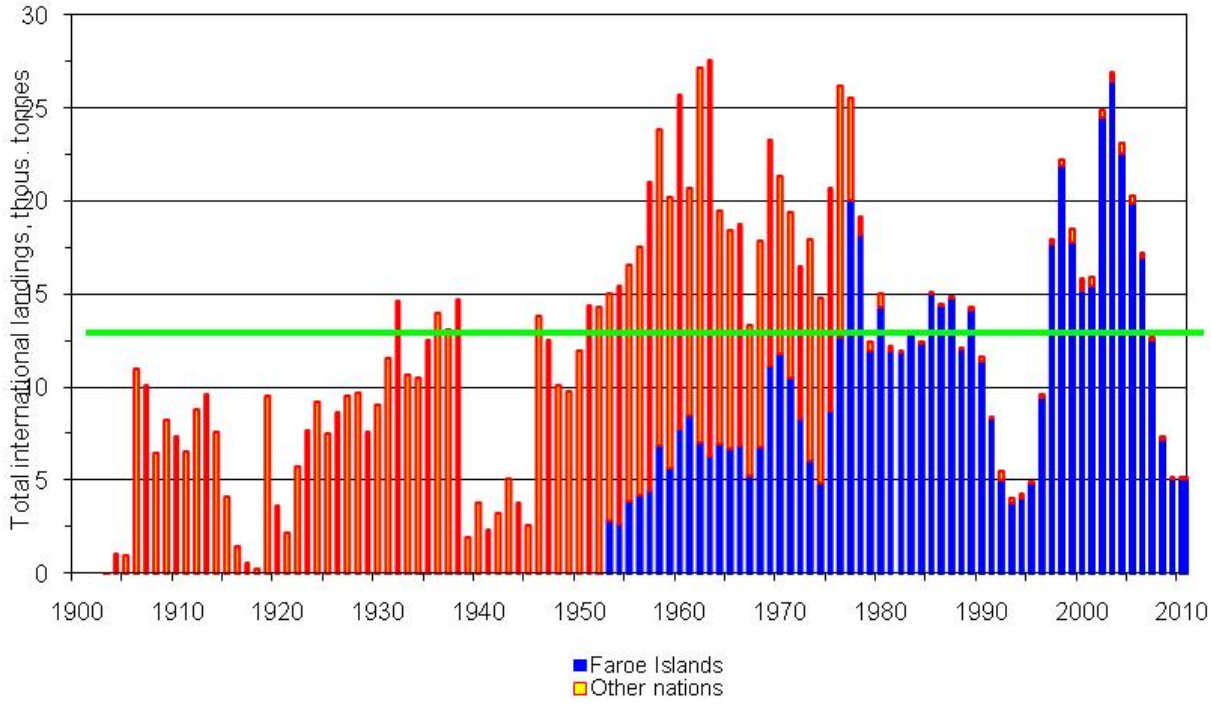


Figure 5.1. Haddock in ICES Division Vb. Landings by all nations 1904-2010. Horisontal line average for the whole period.

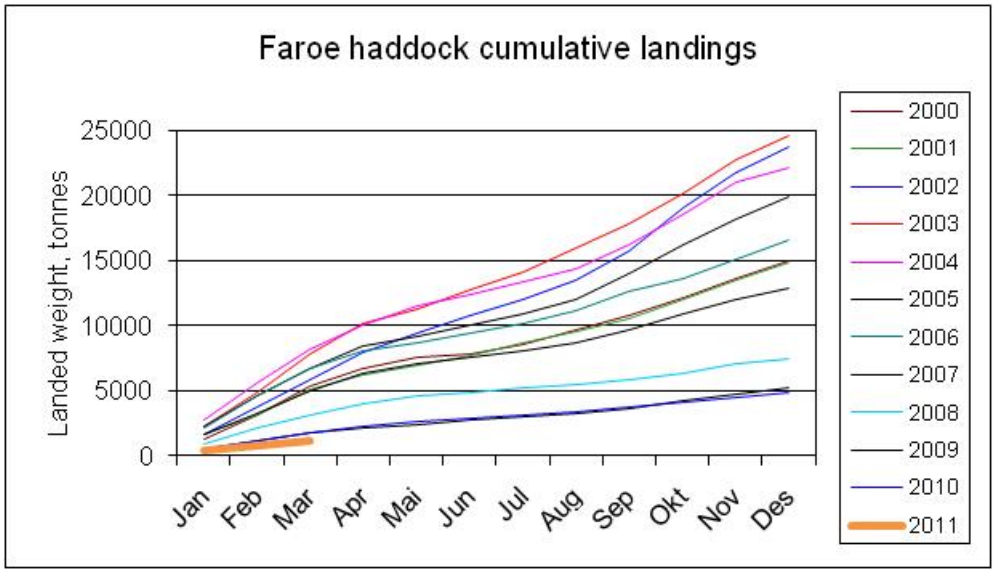


Figure 5.2. Faroe haddock. Cumulative Faroese landings from Vb.

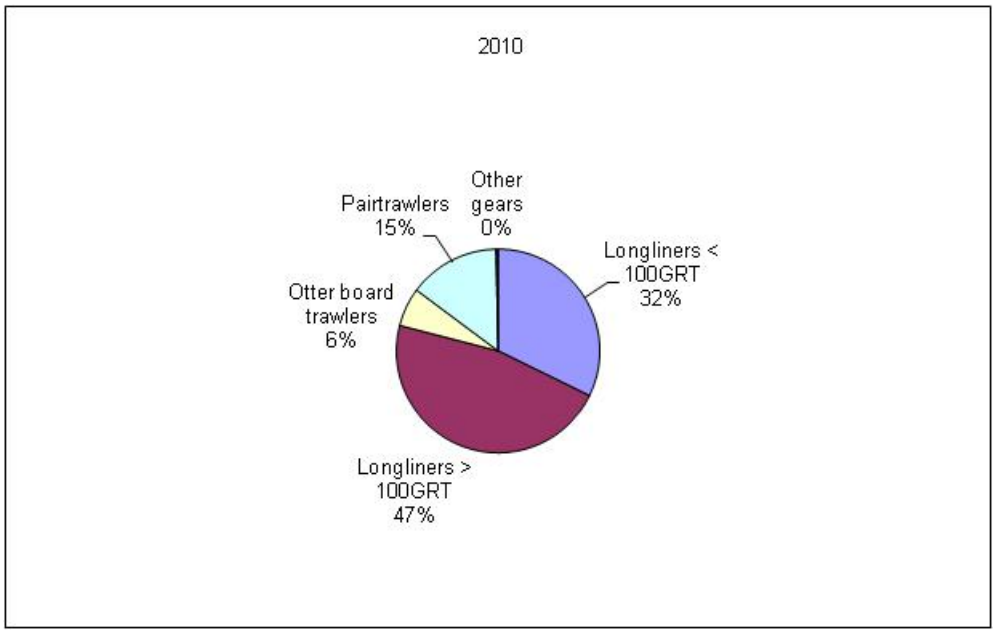


Figure 5.3. Faroe haddock. Contribution (%) by fleet to the total Faroese landings 2010.

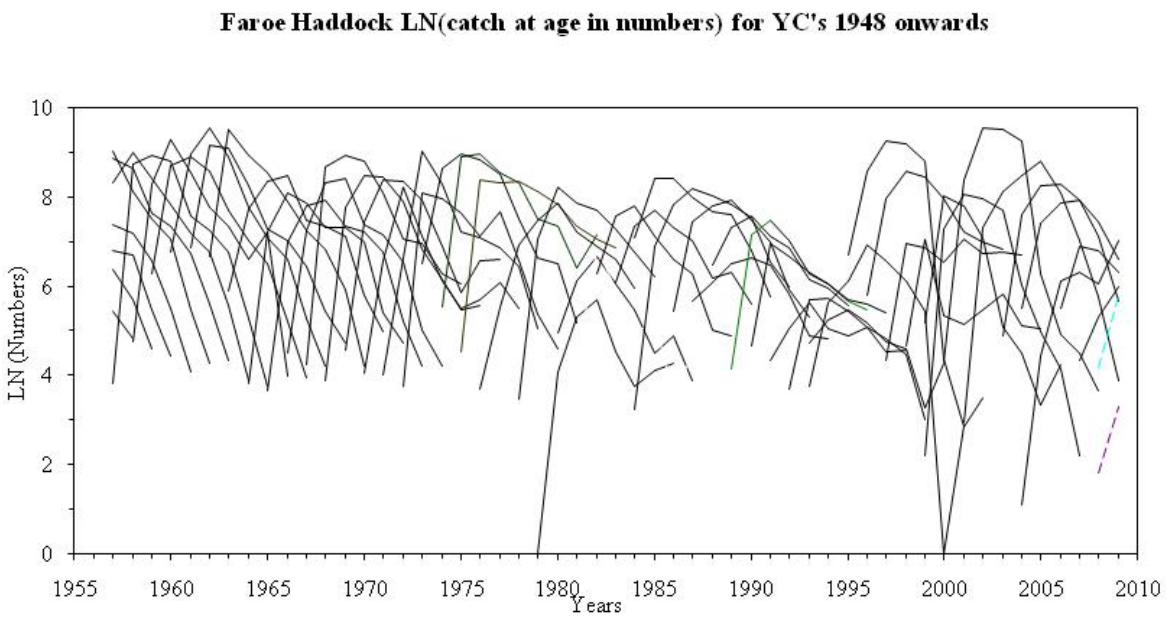

Faroe Haddock LN(catch at age in numbers) for YC's 1948 onwards
LN (Numbers)
Years
0
2
4
6
8
10
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010

Figure 5.4.

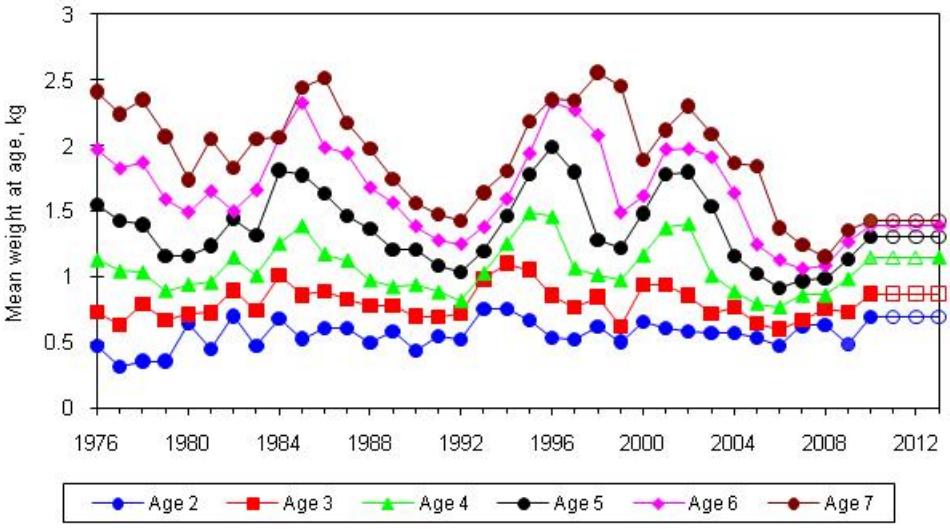


Figure 5.5. Faroe haddock. Mean weight at age (2-7). 2011-2013 are predicted values used in the short term prediction (open symbols).

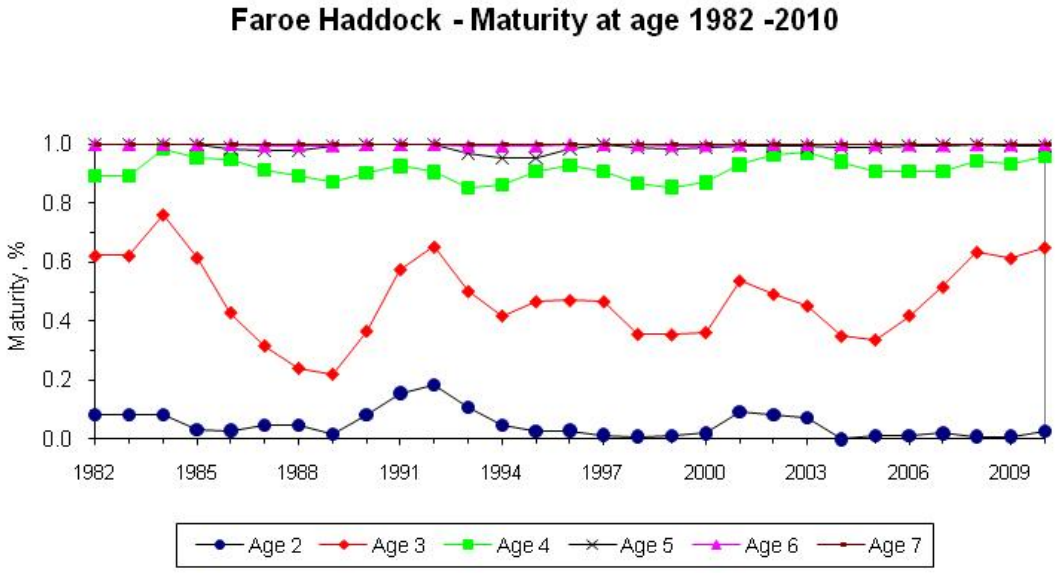


Figure 5.6. Faroe haddock. Maturity at age since 1982. Running 3-years average of survey observations.

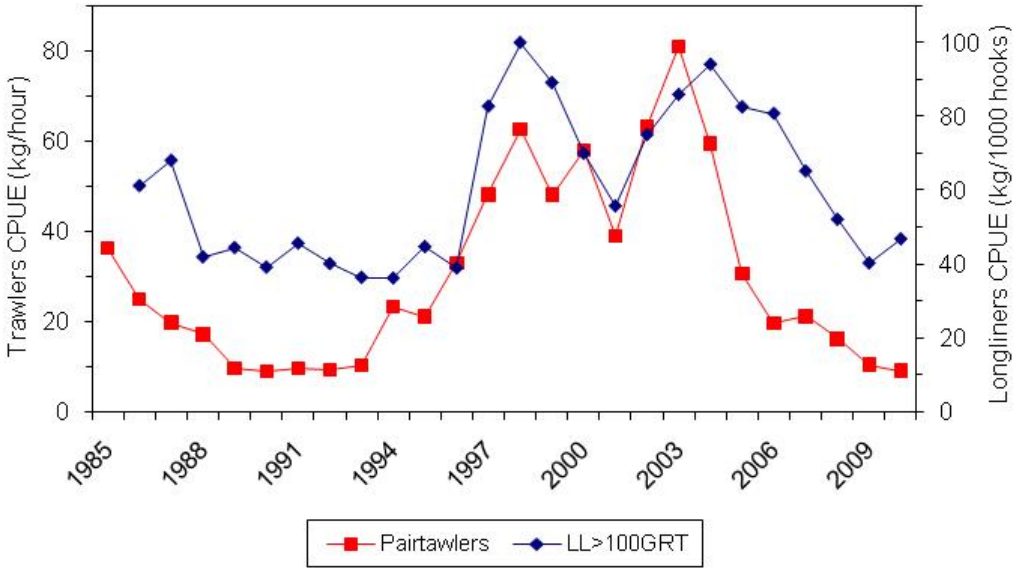


Figure 5.7. Commercial Cpue's for Pairtrawlers > 1000 HP and longliners > 100 HP.

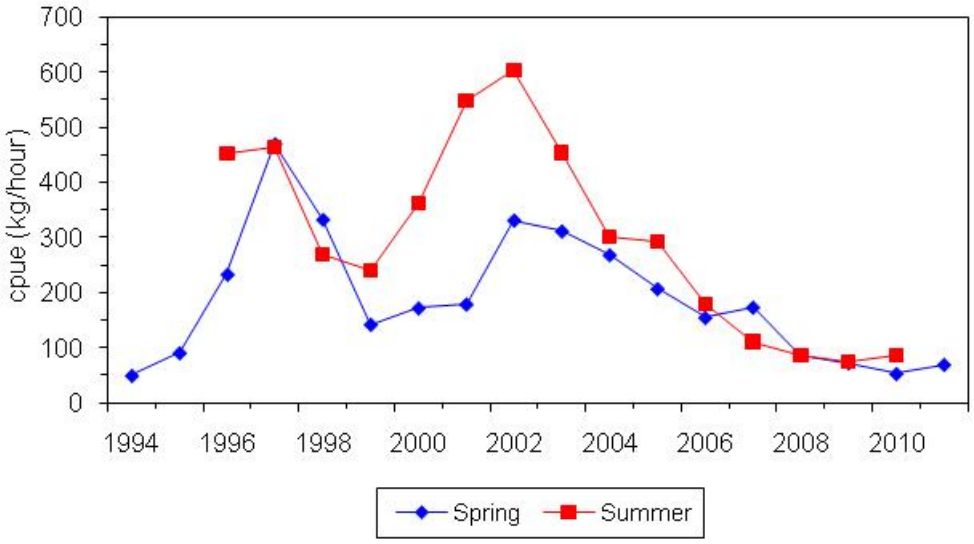


Figure 5.8. Faroe haddock. CPUE (kg/trawlhour) in the spring and summer surveys.

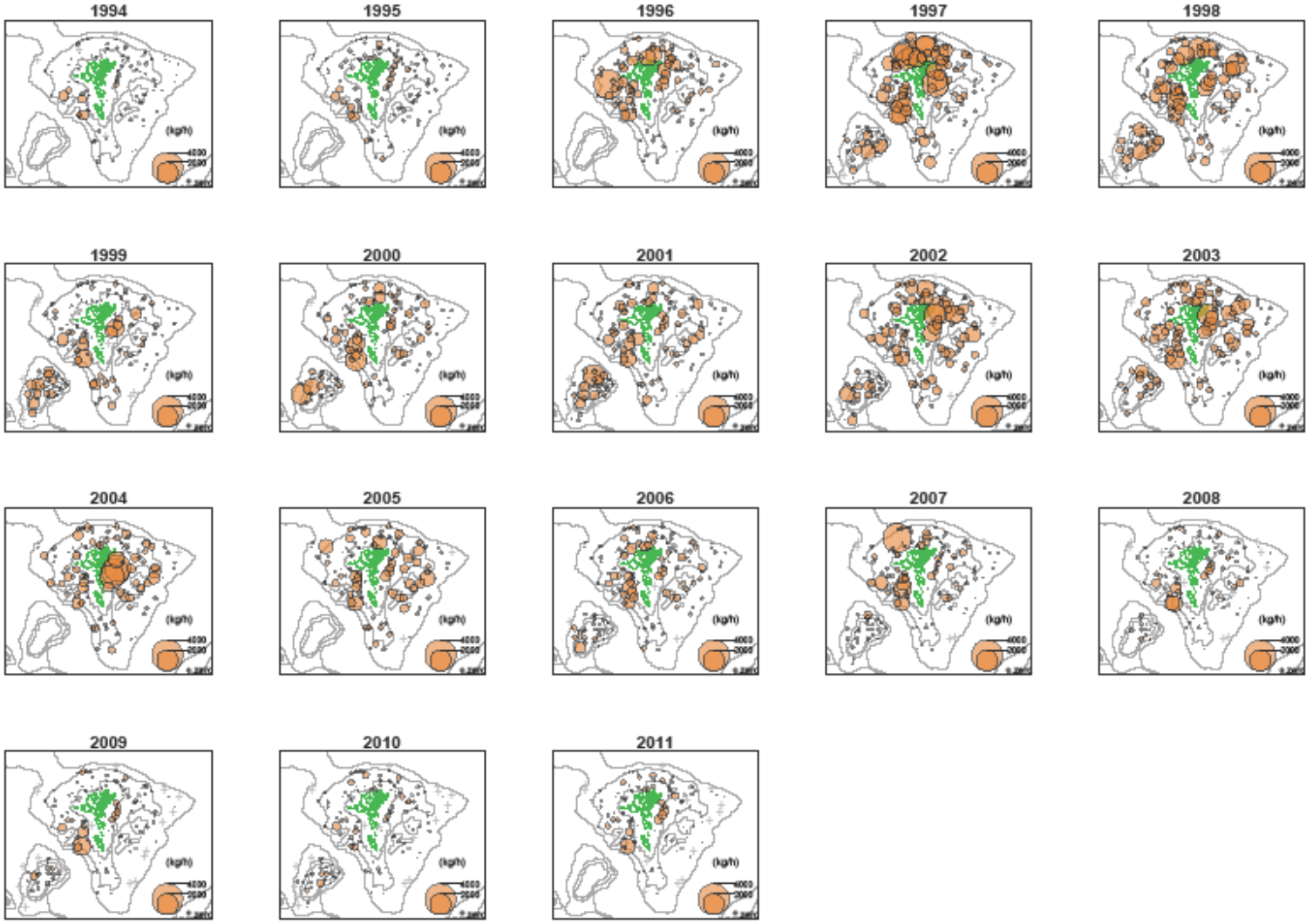


Figure 5.9. Distribution of Faroe haddock catches by year in the spring surveys 1994-2011.

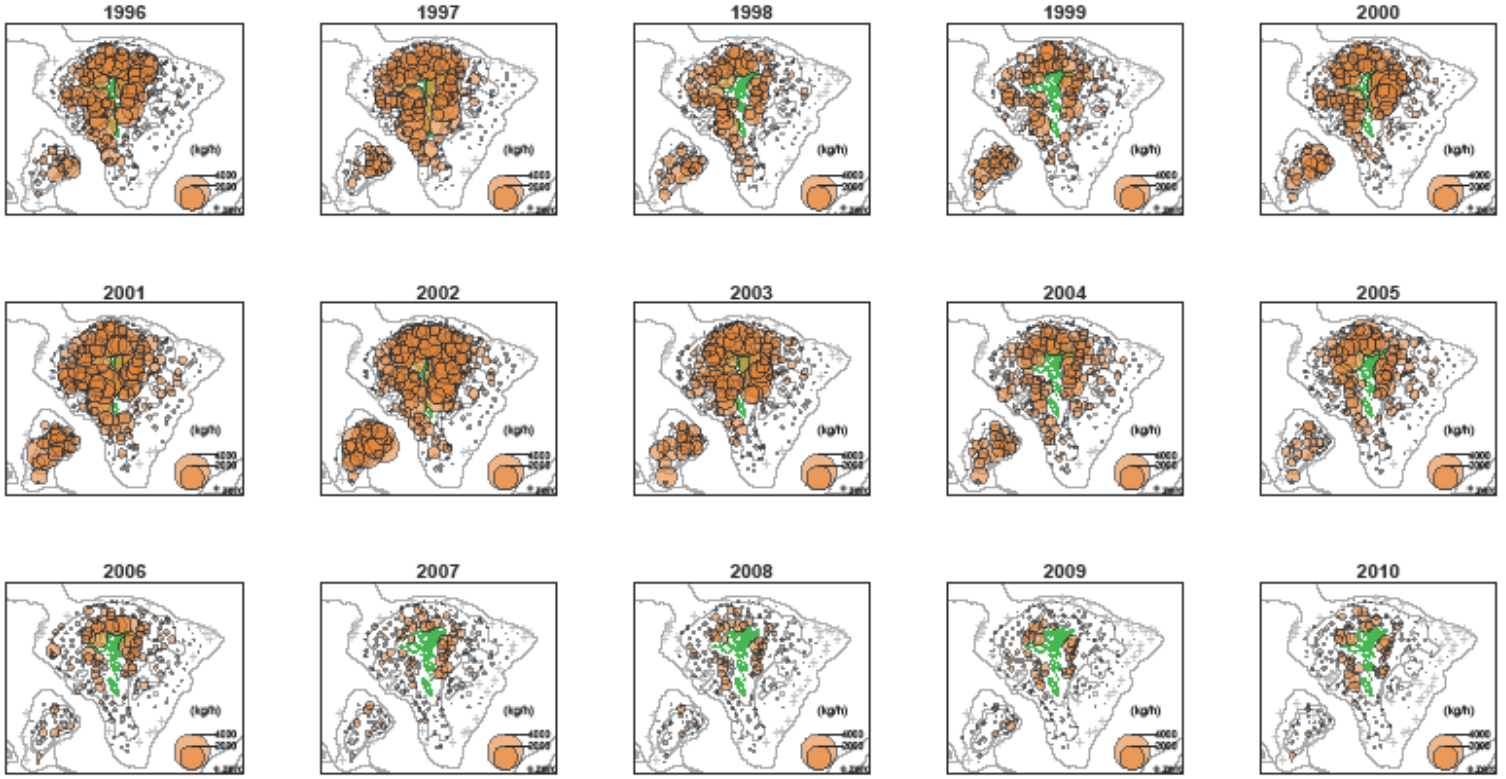


Figure 5.10. Distribution of Faroe haddock catches by year in the summer surveys 1996-2010.

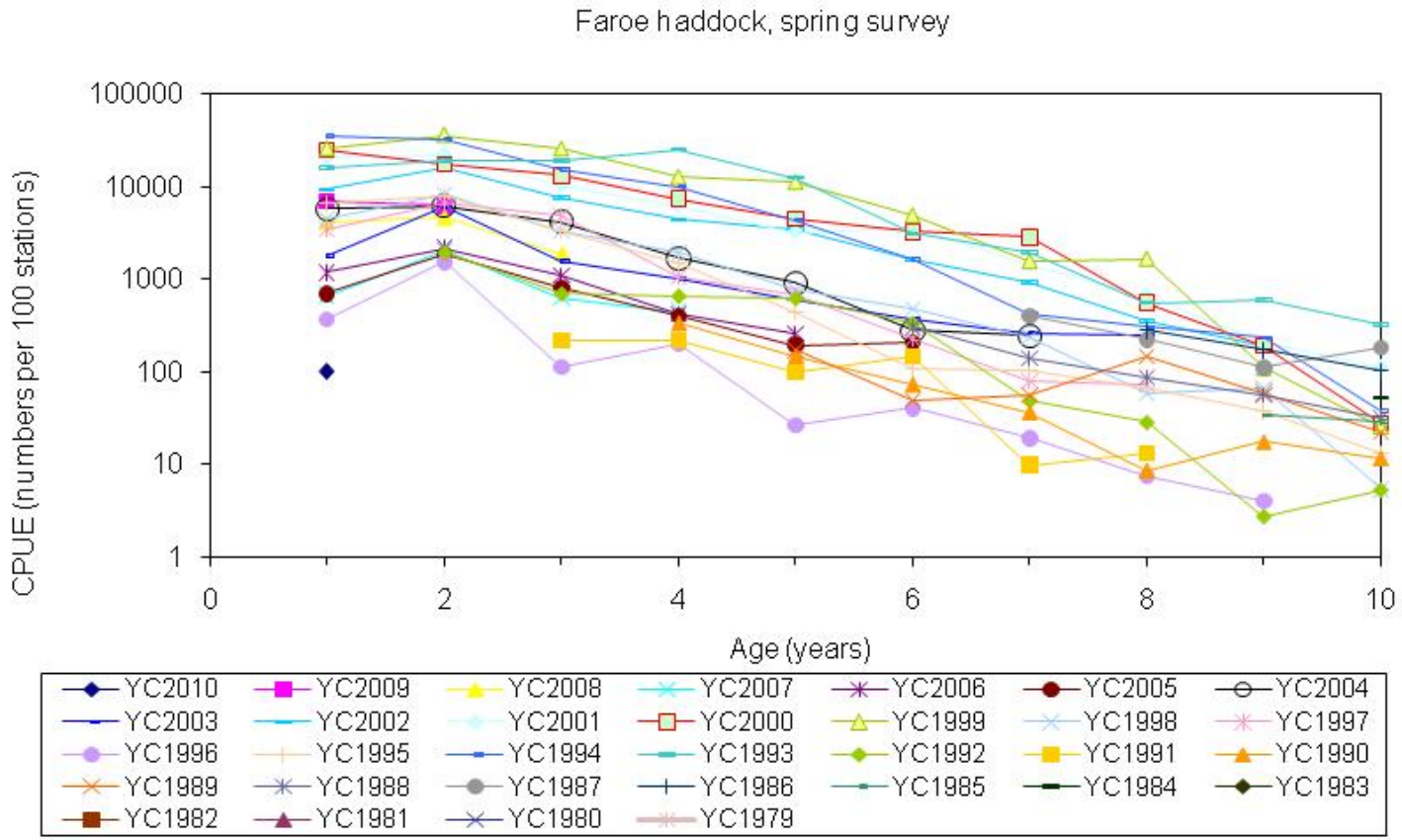


Figure 5.11. Faroe haddock. LN (c@age in numbers) in the spring survey.

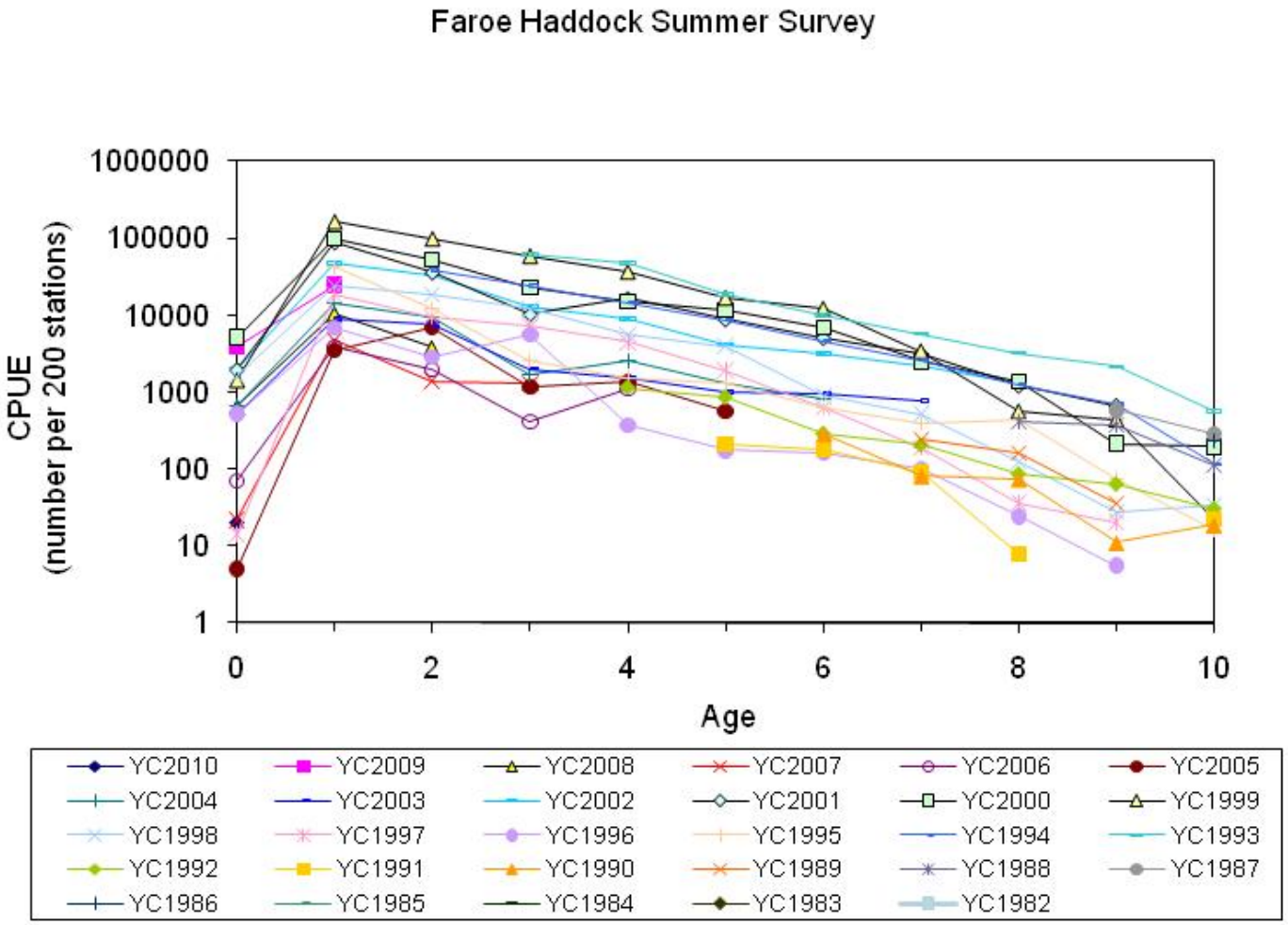


Figure 5.12. Faroe haddock. LN (c@age in numbers) in the summer survey.

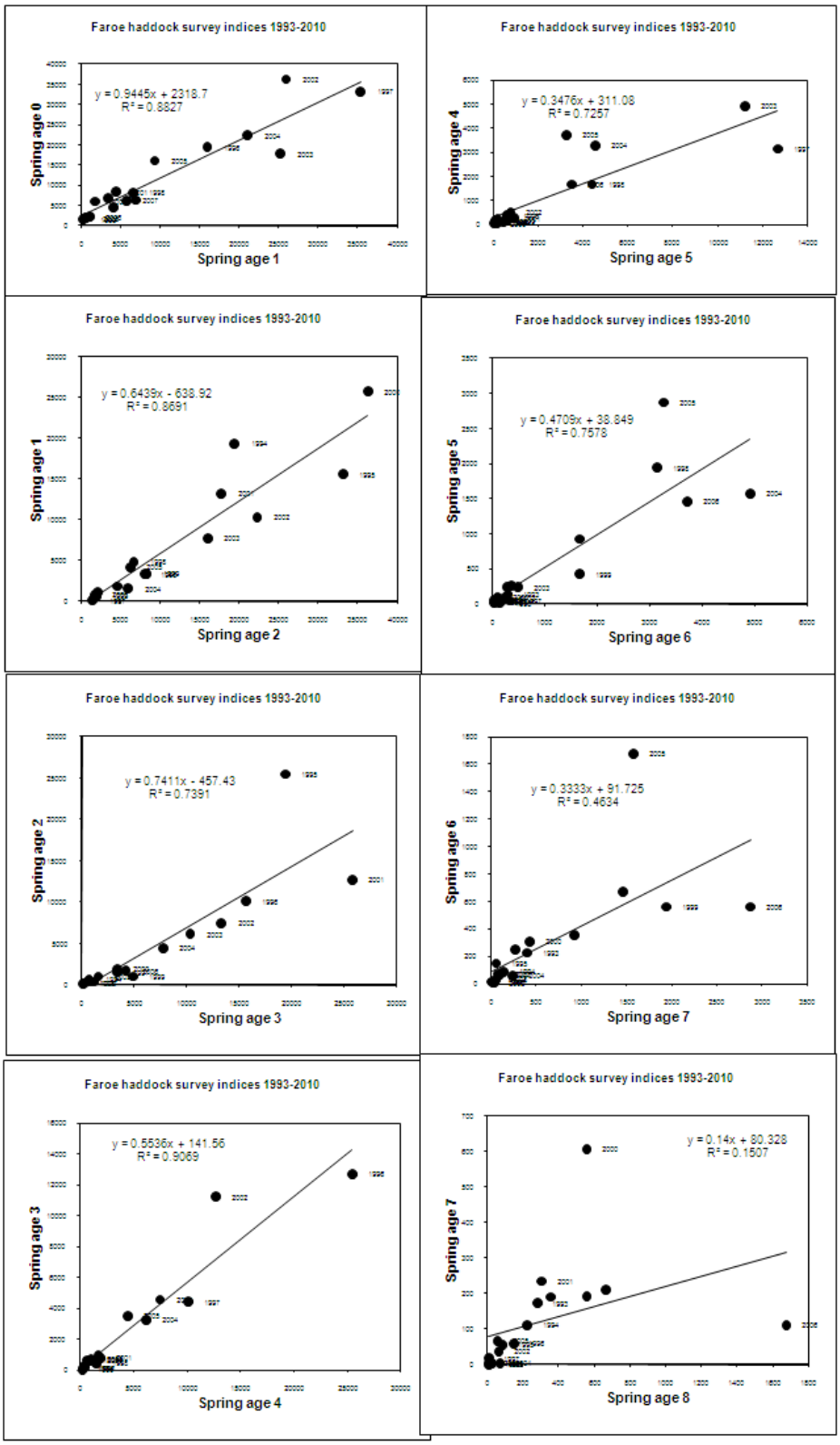


Figure 5.13. Faroe haddock. Comparison between spring survey indices (shifted) at age and the indices of the same YC one year later.

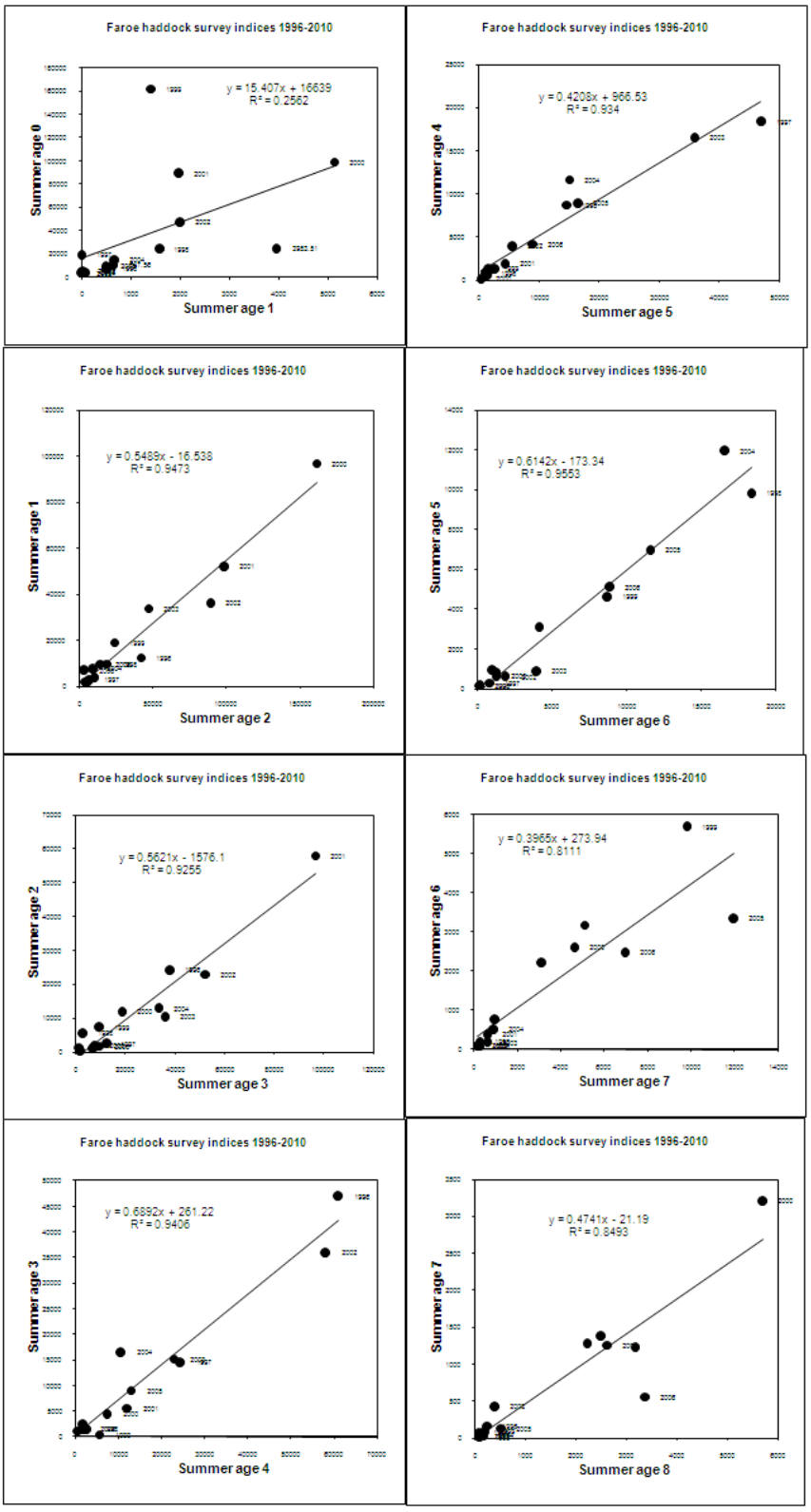


Figure 5.14. Faroe haddock. Comparison between summer survey indices at age and the indices of the same YC one year later.

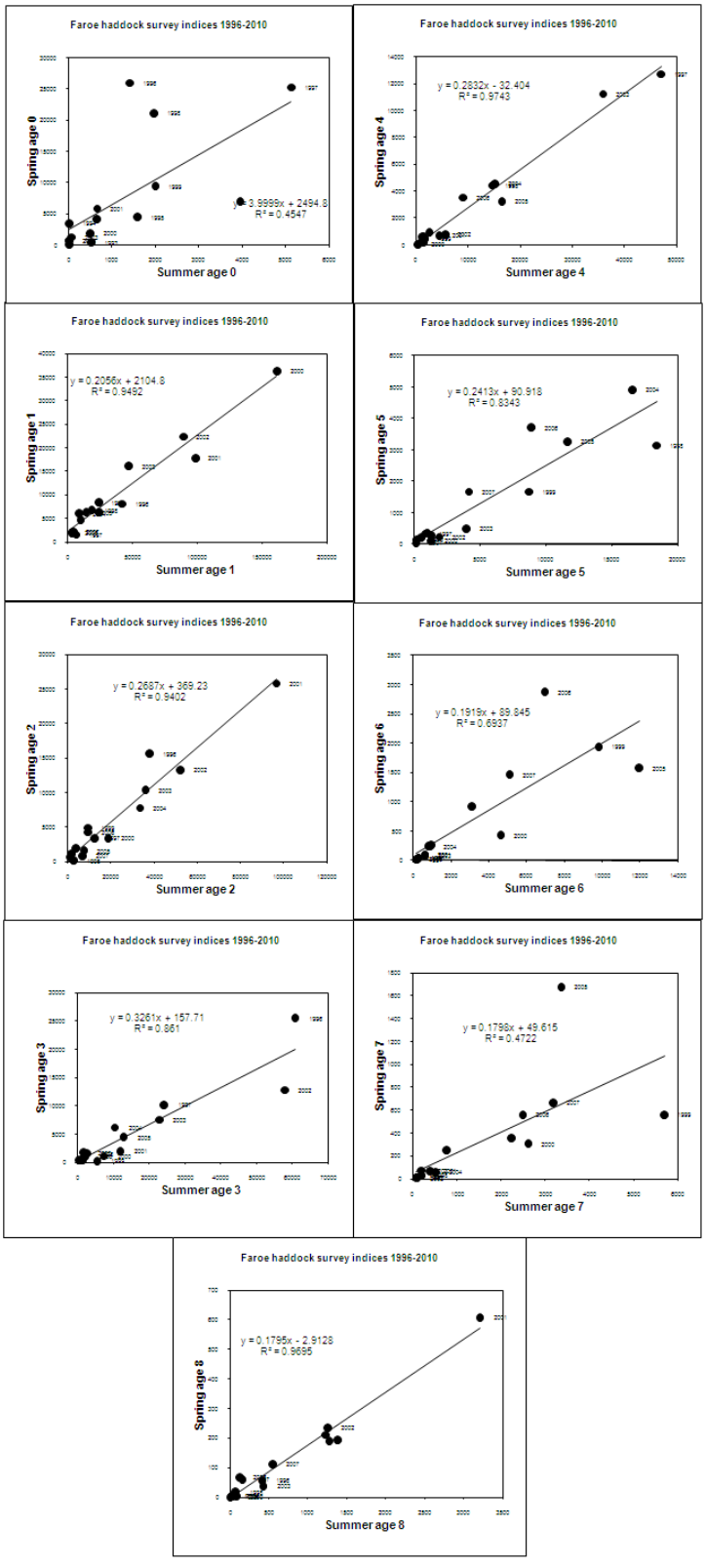


Figure 5.15. Faroe haddock. Comparison between indices at age from the spring survey (shifted) and the summer survey.

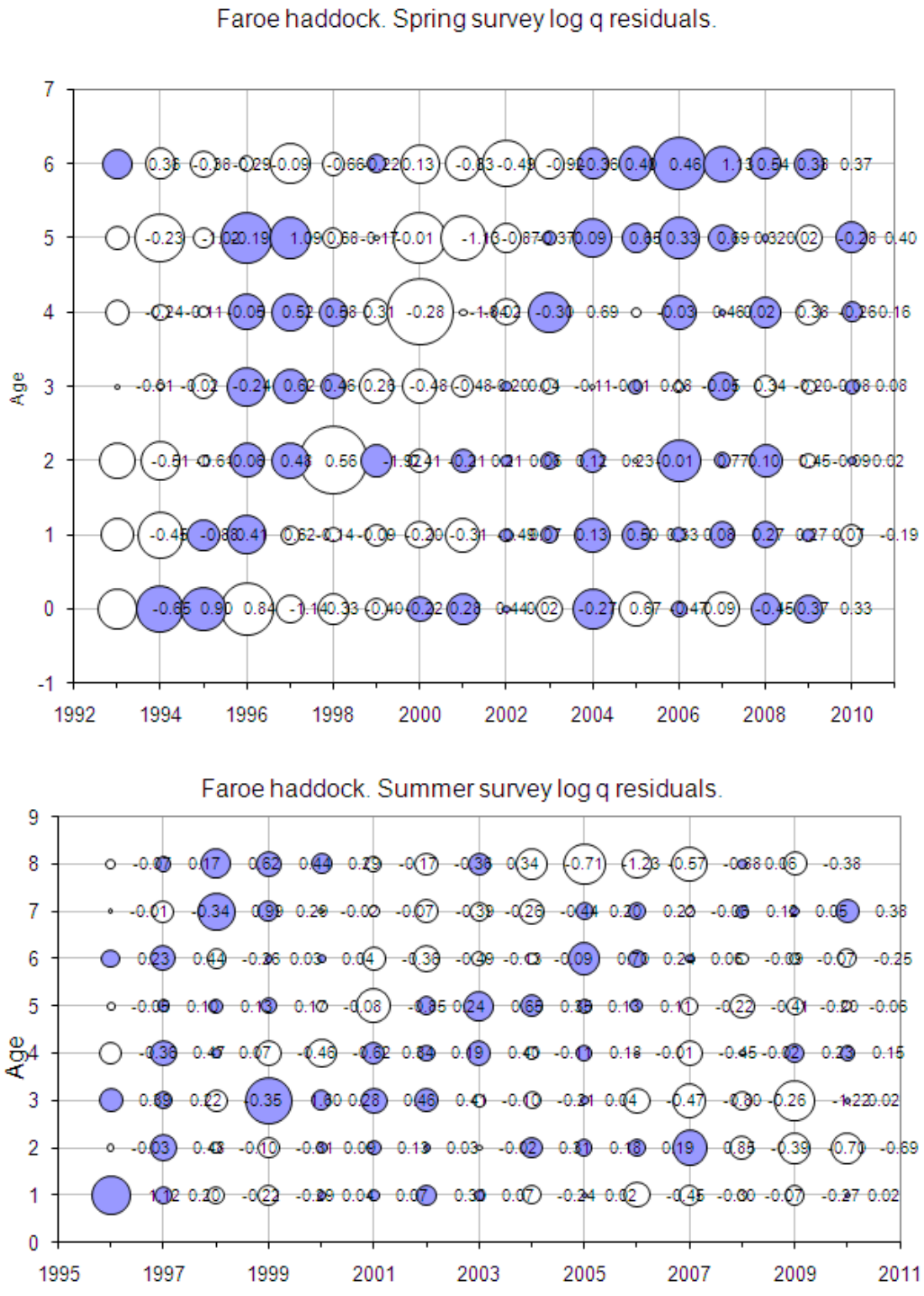


Figure 5.16. Faroe haddock survey log q residuals.

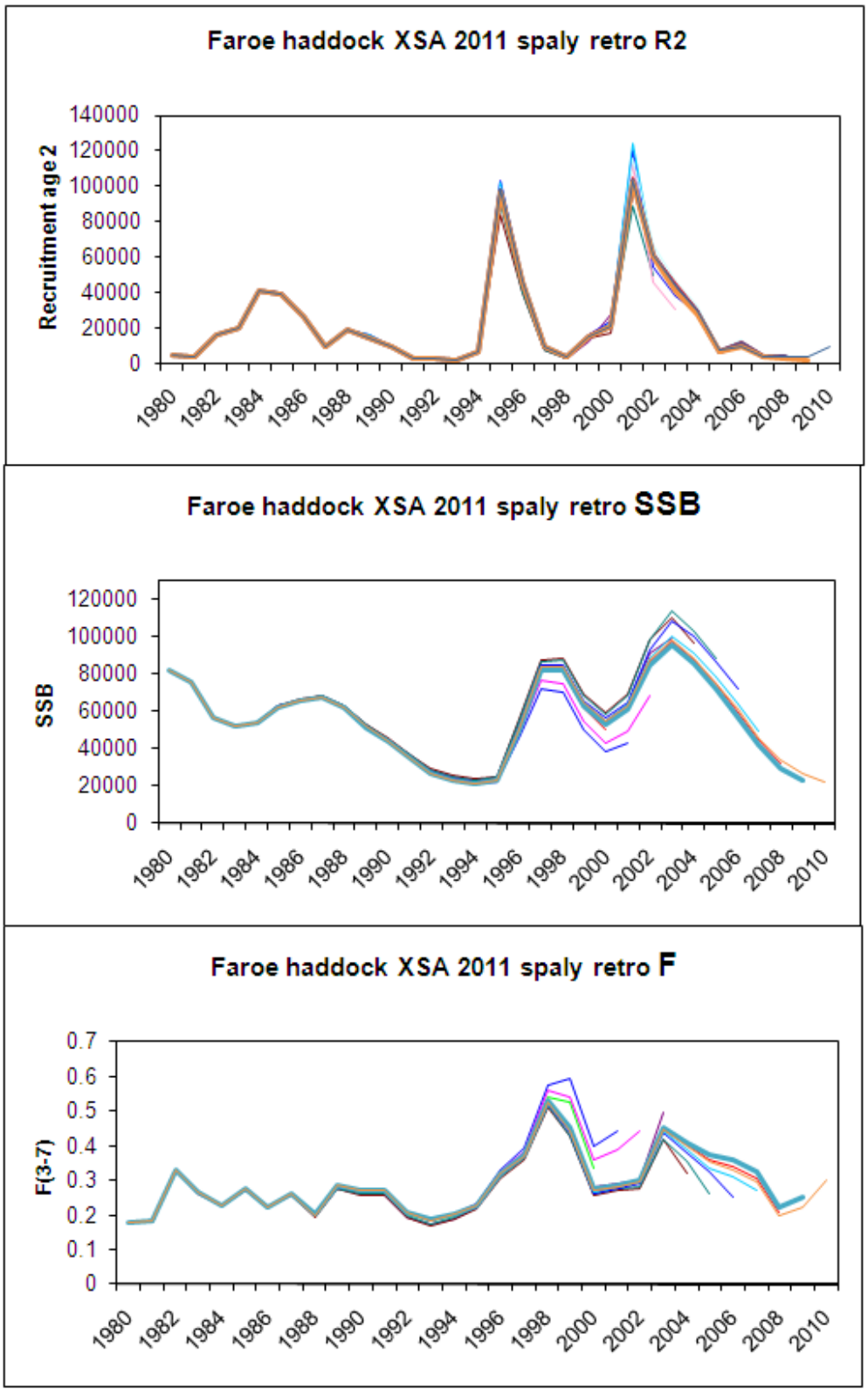


Figure 5.17. Faroe haddock. Retrospective analysis of the 2011 XSA.

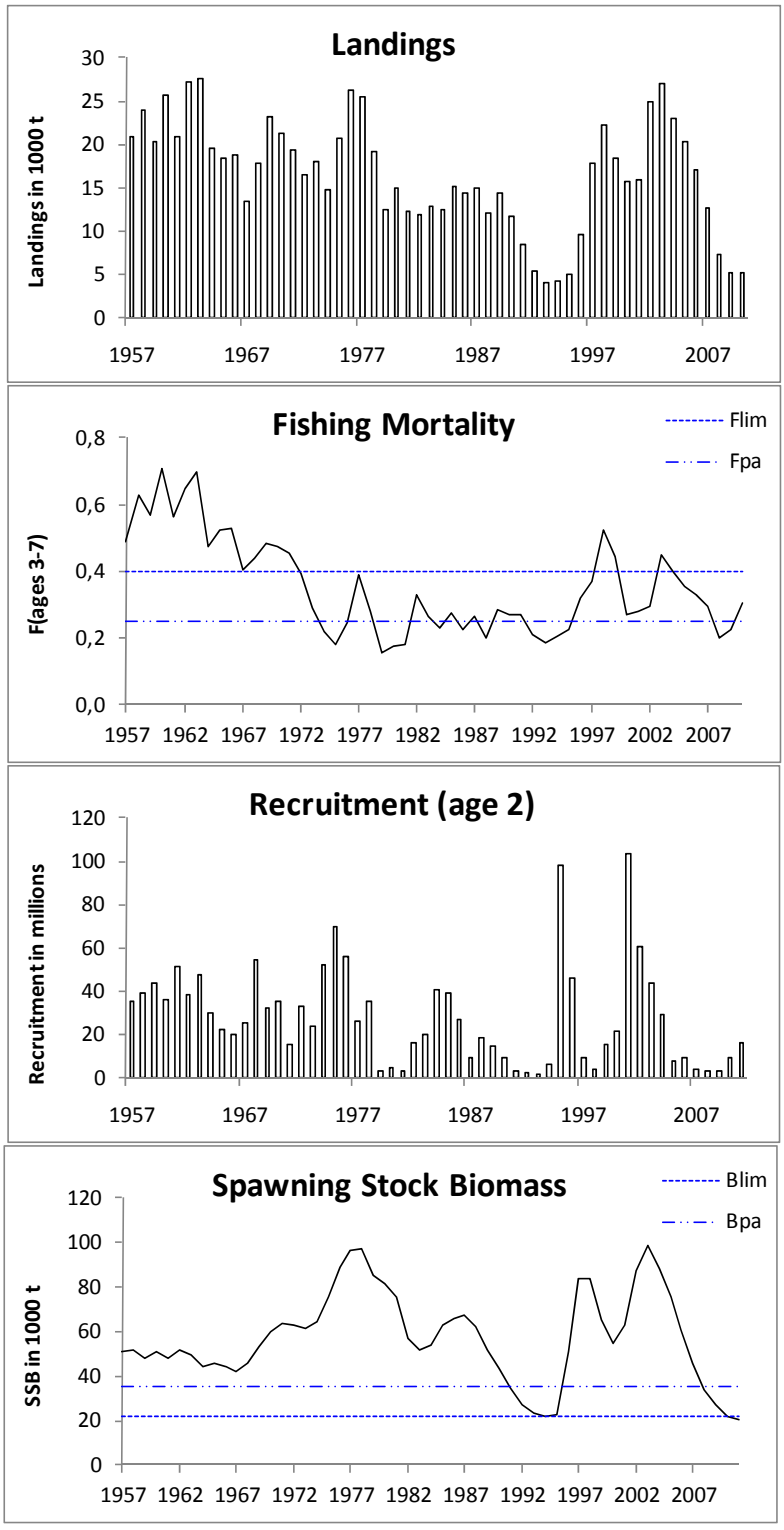


Figure 5.18. Faroe haddock (Division Vb) standard graphs from the 2011 assessment.

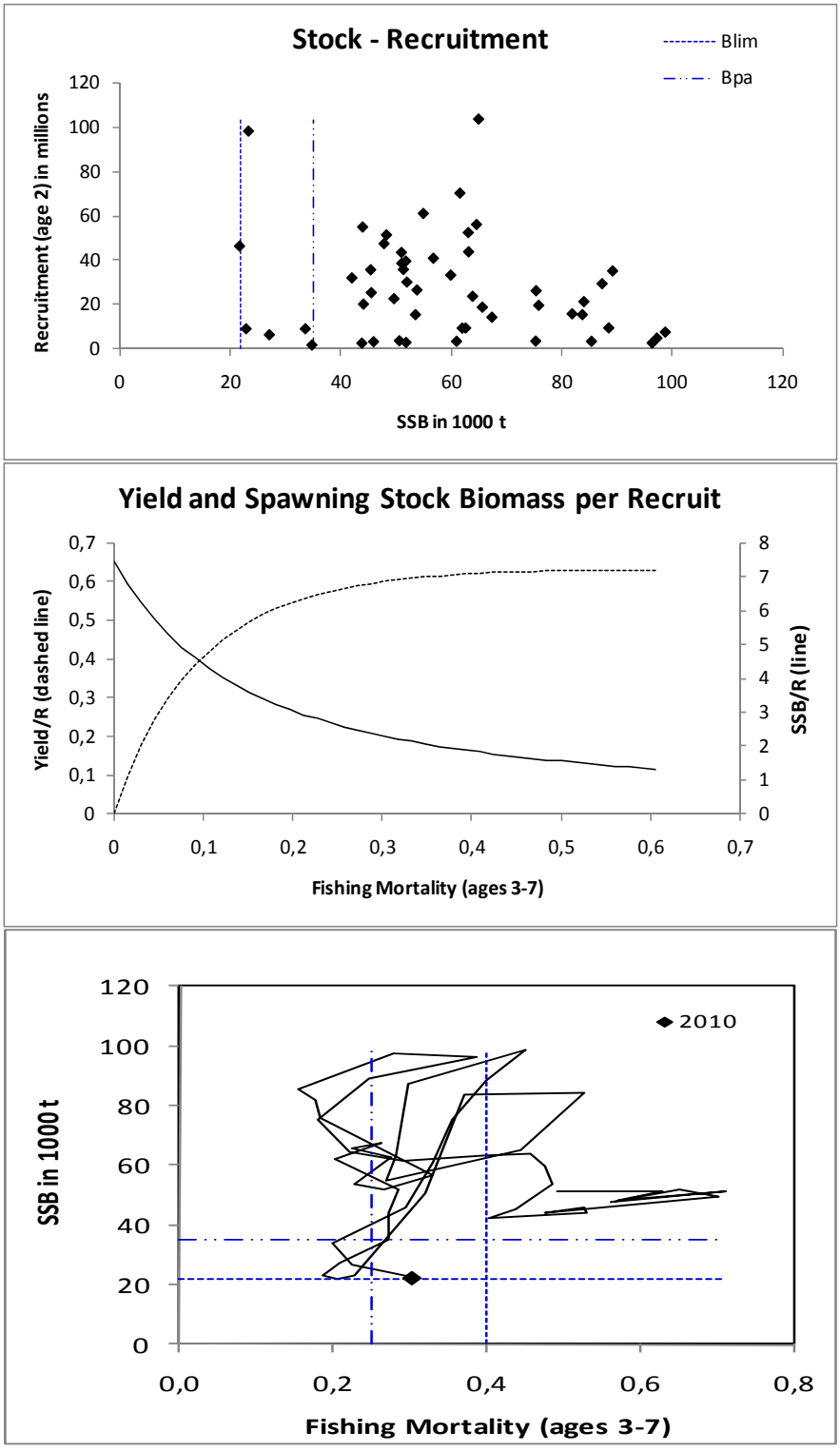


Figure 5.18 (cont.). Faroe haddock (Division Vb) standard graphs from the 2011 assessment.

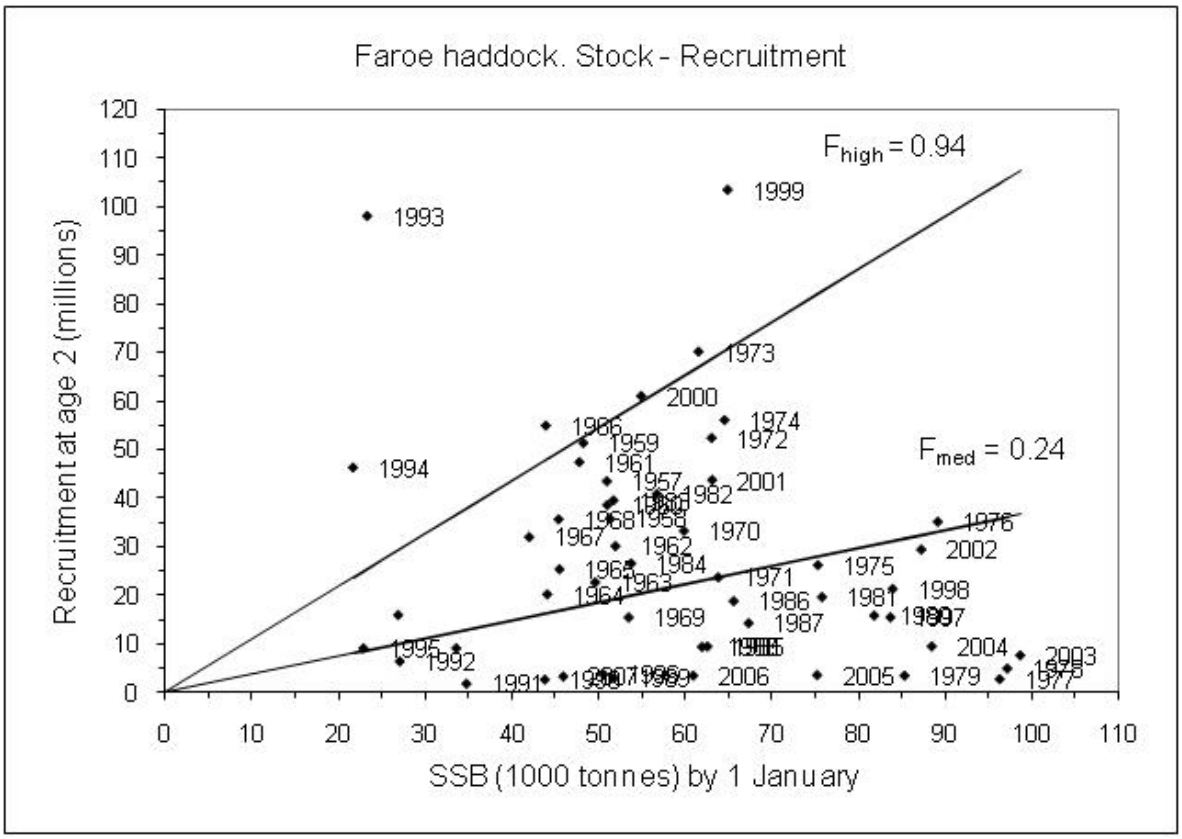
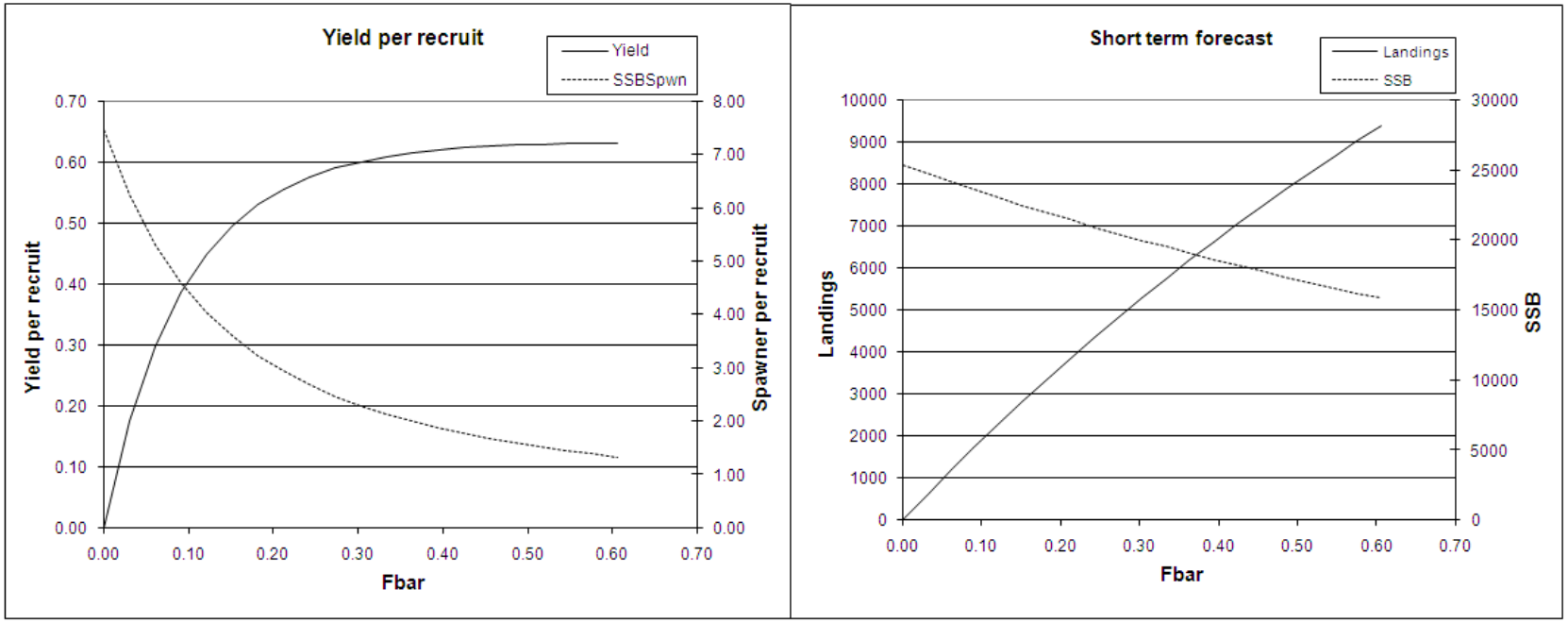


Figure 5.19. Faroe haddock. SSB-R plot.



MFYPR version 1
Run: jr
Time and date: 20:29 22/04/2011

Reference point	F multiplier	Absolute F
Fbar(3-7)	1	0.303
FMax	2.0271	0.6143
F0.1	0.7184	0.2177
F35%SPR	0.8301	0.2515
Fhigh	3.0873	0.9356
Fmed	0.7933	0.2404
Flow	-99	

Weights in kilograms

MFDP version 1
Run: jak
Index file 16/04/2011
Time and date: 19:58 22/04/2011
Fbar age range: 3-7

Figure 5.20. Faroe haddock. Prediction output.

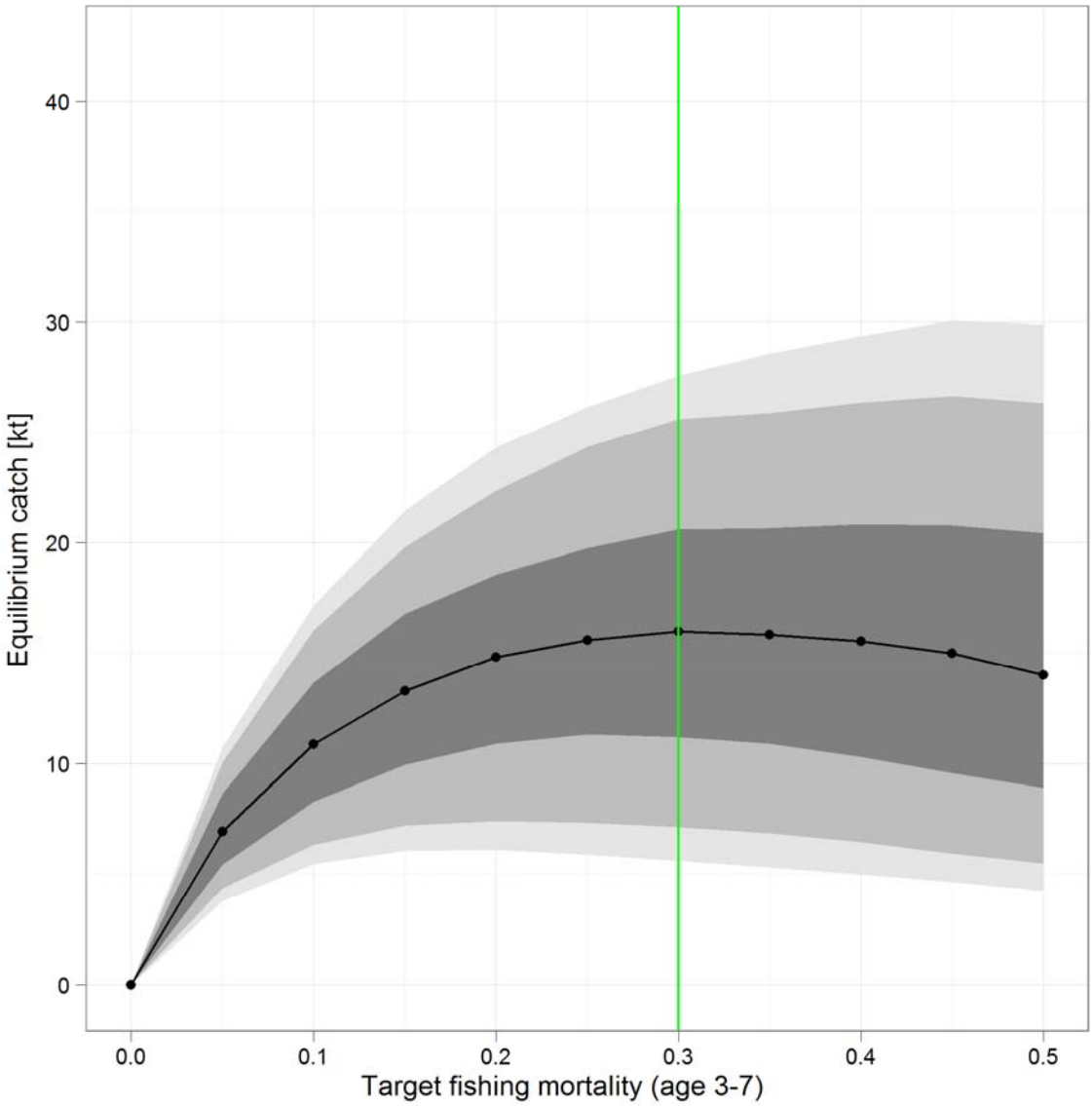


Figure 5.21. Equilibrium yield, vertical line showing F_{msy} = 0.3. The different shades of grey refer to 90%, 80% and 50% pseudo-confidence intervals.

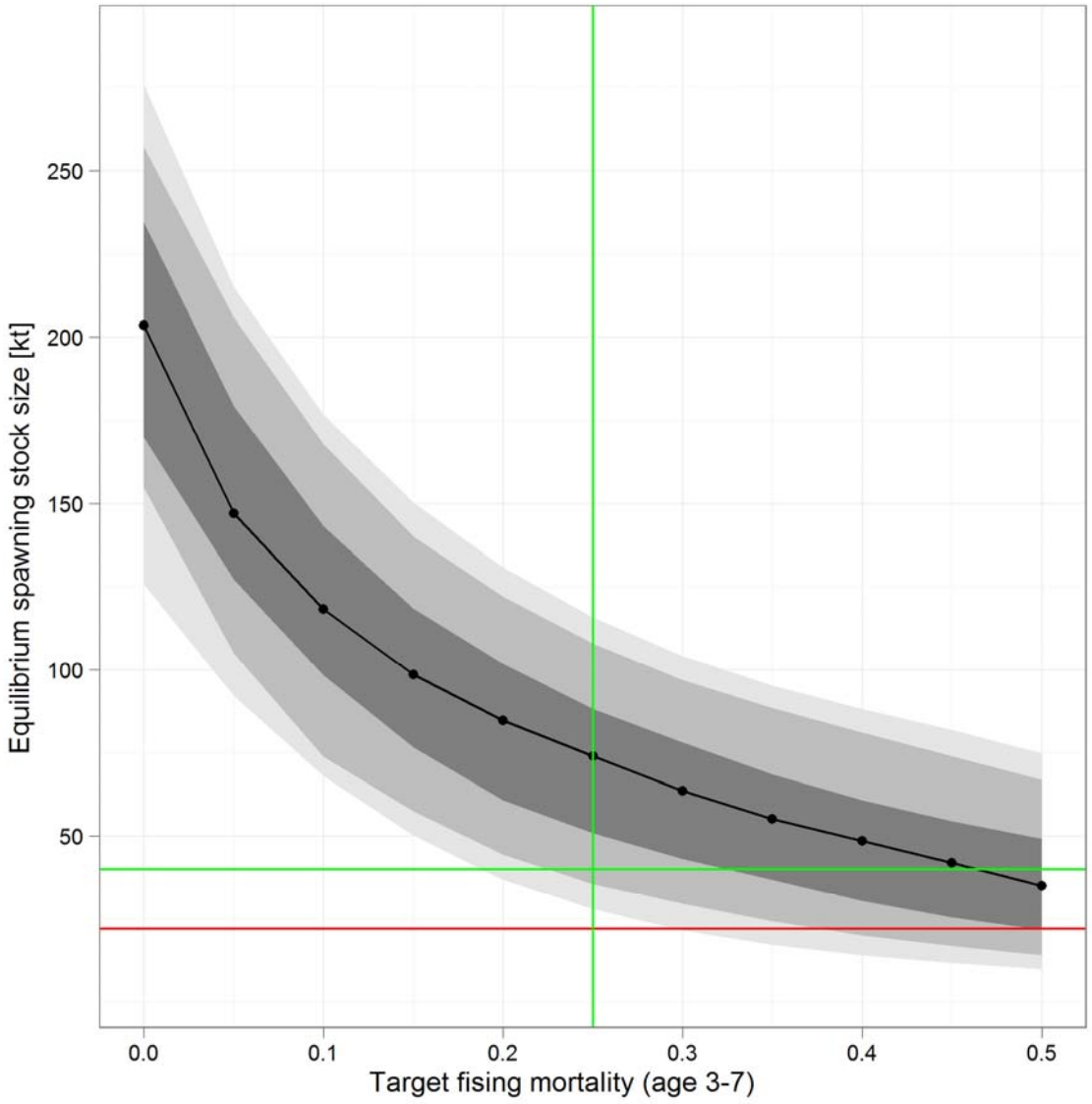


Figure 5.22. Spawning stock size as a function of target fishing mortality. B_{lim}: horizontal red line, B_{pa}: horizontal green line. Vertical line: Proposed preliminary F_{msy} of 0.25. The different shades of grey refer to 90%, 80% and 50% pseudo-confidence intervals.

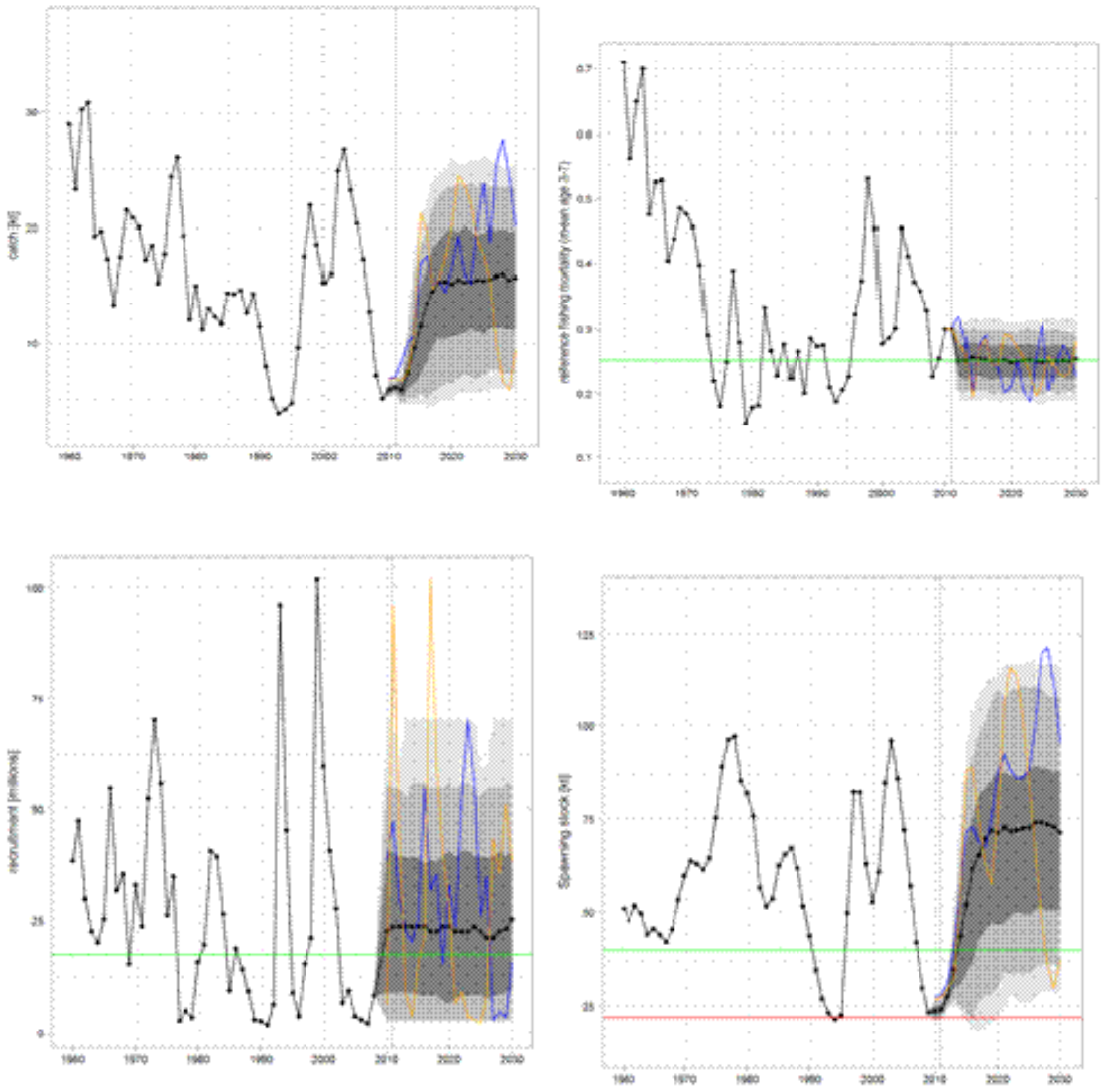


Figure 5.23. Medium term simulation based on F_{target} = 0.25. Top left corner shows development of catch, top right recruitment, bottom left fishing mortality and bottom right spawning stock size. The different shades of grey refer to 90%, 80% and 50% pseudo-confidence intervals. Note that the *x*-axis does not cross the y-axis at zero.

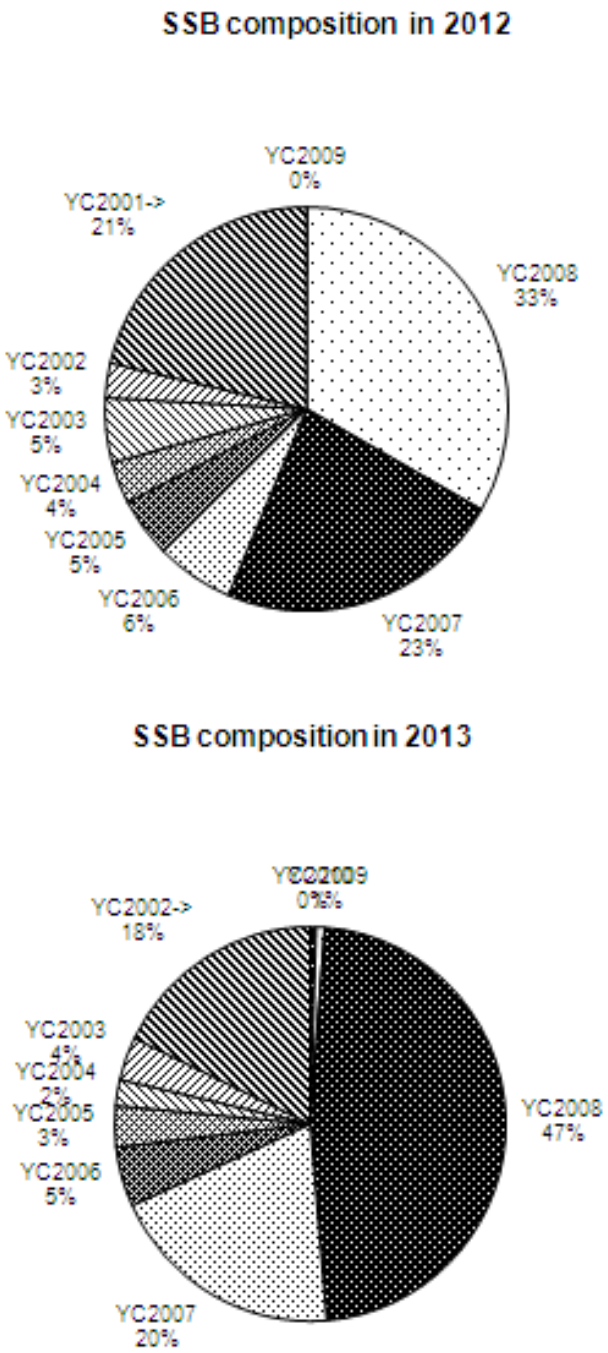


Figure 5.24. Faroe haddock. Projected composition of the number by year-classes in the SSB's in 2012 and 2013

6 Faroe Saithe

Executive summary

The most recent benchmark assessment was completed in 2010.

The 2010 benchmark workshop explored the XSA model as well as ADAPT, TSA, separable statistical age-based and length-based models in association with updated catch-at-age data. The commercial CPUE series was also updated, standardized and the density indices were multiplied by an area expansion factor to better represent a measure of total stock abundance. These data updates were found to significantly reduce the retrospective pattern previously observed in the assessment. The SSB, F and recruitment estimates generated by both models were comparable and the XSA assessment was adopted as the benchmark assessment because it had been the model historically used for this stock.

Nominal landings decreased from 58 000 t. in 2009 to 44 000 t. in 2010. The corresponding estimate of fishing mortality in 2010 (average of ages 4-8 years) dropped to F=0.38 which is the lowest in the last 5 years and very close to the historical average (F=0.34). In 2010 the spawning stock biomass is estimated around 110 000 t. which is an increase of more than 20 000 t. with respect to 2009. Recruitment (numbers in the stock at age 3) in 2010 is predicted at 60 millions while total stock biomass is estimated at 268 000 t.

For Faroe saithe, the highest recruitment has been observed at lower levels of SSB.

6.1 Stock description and management units.

See the stock annex.

6.2 Scientific data

6.2.1 Trends in landings and fisheries

Nominal landings of saithe from Faroese grounds (Division Vb) have varied cyclically between 10 000 t and 68 000 t since 1961. After a third high of about 60 000 t in 1990, landings declined steadily to 20 000 t in 1996. Since then landings have increased to 68 000 tonnes in 2005 (Table 6.2.1.1, Figure 6.2.1.1) but has declined to 57 000 tonnes in 2008 and 2009. Landings have dropped to 44 000 t. in 2010 which is a 25% reduction compared to 2009 and very close to average historical catches (38 000 t.)

Since the introduction of the 200 miles EEZ in 1977, the saithe fishery has been prosecuted mostly by Faroese vessels. The principal fleet consists of large pair trawlers (>1000 HP), which have a directed fishery for saithe, about 50 - 68% of the reported landings in 1992-2010 (Table 6.2.1.2). The smaller pair trawlers (<1000 HP) and single trawlers (400-1000HP) have a more mixed fishery and they have accounted for about 10-20% of the total landings of saithe in the 1997—2010 period while the percentage of total landings by large single trawlers (>1000 HP) has declined to 8.3% which is half the average since 2004 (16.6%). The share of catches by the jigger fleet has steadily increased from 2007 to 2009 although it accounted to only 4% of total landings in 2010.

Cumulative landings of saithe for the domestic fleets since 2000 are shown in Figure 6.2.1.2. In the first quarter of 2010 monthly landings were higher than average for the

2000-2010 period but by the end of the year they decreased 10 000 t. this average. Landings in the first two months of 2011 are among the lowest recorded since 2000. Foreign catches that have been reported to the Faroese Authorities but not officially reported to ICES are also included in the Working Group estimates. Catches in Subdivision IIa, which lies immediately north of the Faroes, have also been included. Little or no discarding is thought to occur in this fishery.

6.2.2 Catch at age

Catch at age is based on length, weight and otoliths samples from Faroese landings of small and large single and pair trawlers, and landing statistics by fleet provided by the Faroese Authorities. Catch at age is calculated for each fleet by four-month periods and the total was raised by the foreign catches. The catch-at-age data for previous years were also revised according to the final catch statistics (Tables 6.2.2.1 and 6.2.2.2). Sampling intensity in 2010 was 2% higher than that of 2009 (4.1%) (Table 6.2.2.3.) The number of 3-years old saithe in the catch has increased five-folded with respect to that in 2009 (459 th.)

6.2.3 Weight at age

Mean weights at age have varied by a factor of about 2 during the 1961—2010 period. Mean weights at age were generally high during the early 1980s and they subsequently decreased from the mid 1980s to the early 1990s (Table 6.2.3.1 and Figure 6.2.3.1). Mean weights increased again in the period 1992-96 but have shown a general decrease thereafter. With the exception of the 2006 year class (age 3 in 2009) weights for age groups 3 to 10 have showed an increase since 2006. Mean weight of the 2007 year-class (age 3 in 2010) is estimated at 1.43 kg. which is a substantial increase with respect to 2009 (0.94 kg.) and has not been observed since 1997.

6.2.4 Maturity at age

Maturity at age data from the spring survey is available from 1983 onward (Steingrund, 2003.) Due to poor sampling in 1988 the proportion mature for that year was calculated as the average of the two adjacent years. At the benchmark assessment working group the maturity ogives from 1983 to 2010 were predicted according to a logistic model (Ridao, 2010 WD06). For 1962 to 1982 the average maturity of predicted ogives of the 1983-2010 period was used (Table 6.2.4.1 and Figure 6.2.4.1.) Proportion matures for most age groups show an upward trend since 2004.

6.2.5 Indices of stock size

6.2.5.1 Surveys

There are two annual groundfish surveys conducted in Faroese waters. The spring survey was initiated in 1983, while the summer survey began in 1996. The two surveys are not considered reliable indices of saithe abundance in Vb (Stock Annex B.3 and Benchmark report WKROUND 2010.) Trends in catch rates (CPUE) from both surveys are presented in Figure 6.2.5.1.1.

6.2.5.2 Commercial CPUE

The CPUE series that has been used in the assessment since 2000 was introduced in 1998 (ICES C.M. 1998/ACFM:19), and consists of saithe catch at age and effort in hours, referred to as the pair trawler series. A GLM model and a survey spatial scaling factor is used to standardised the CPUE series (Stock Annex B.4., Benchmark re-

port, WKROUND 2010.) The benchmark working group regarded this novel approach to developing the commercial series as reasonable (Benchmark report, WKROUND 2010.) Observed and predicted annual CPUEs (1995-2010) derived from this approach indicate a downwards stock trend since 2006 (Figure 6.2.5.2.1.)

6.2.5.3 Information from the fishing industry

No additional information beyond the landings from the commercial fleet was presented for incorporation in the assessment.

6.3 Methods

The assessment model adopted at the benchmark assessment in 2010 is described in the Stock annex (Sec. C) and in the benchmark report (WKROUND 2010.) The 2010 XSA is calibrated with the standardized pair trawlers with catchability independent of stock size for all ages, catchability independent of age for ages ≥ 8, the shrinkage of the SE of the mean = 2.0, and no time tapered weighting. The tunings series used are shown in Table 6.3.1. The age-disaggregated index for age 3 in the tunning fleet was adjusted with the age-disaggregated index in the catches ($y=0.14x+128.1$, $R^2=0.62$, $p= 0.0004$) due to an unrealistic increase in the former (Figure 6.3.1). The adjustment causes a substantial reduction in the recruitment estimate of the 2007 year class (age 3 in 2010) from 150 mills. to around 66 mills (Figure 6.3.2) At the same time survey indices for saithe suggest that number of 3-years old in 2010 is inconsistent with the predicted value of the spaly run. Diagnostics are presented in Table 6.3.2 and model outputs in Tables 6.3.3-5. Patterns in log-catchability residuals from the XSA model are relatively random in recent years (Figure 6.3.3).

The 2011 assessment indicates that the point estimator of SSB in 2010 is 110 000 t and average fishing mortality (Fbar) is estimated to F=0.38 (Figures 6.3.4 and 6.3.5). The assessment model suggests that fishing mortality has remained reasonably stable from 2006 to 2008 at around 0.43 but increased in 2009 to 0.54 and declined sharply to 0.38 in 2010 caused by a decline in landings of around 25%. Predicted number of recruits in 2010 is 66 millions which is on the high level values observed since 1998 (Figure 6.3.6) Retrospective patterns show a period of overestimation in average fishing mortality (2005-2008) while the assessment tends to underestimate F prior to 2005 (Figure 6.3.7) This implies that biomass was correspondingly underestimated from 2005 to 2008 and overestimated before 2005. This could be explained by changes in the vertical distribution of the stock or changes in the selection pattern that have been observed in recent years. With respect to recruitment the retrospective trend is very similar to that of F and SSB. The 2005 year-class was predicted at a historic high in 2008 but it is showing much weaker in 2010.

6.4 Reference points

6.4.1 Biological reference points and MSY framework

In the 2011 assessment for Faroe saithe a Management Strategy Evaluation (MSE) is performed using a harvest control rule in the FLR environment.

The MSE approach requires mathematical representations of two systems: a 'true' system and an 'observed' one. The 'true' system is represented by the operating model (OM) that simulates the real world. In contrast, the 'observed' system represents the conventional management procedure (MP), from the data collection through stock assessment to the management implementation. The present MSE

evaluation uses the working group stock assessment as the basis for the Operating Model and makes assumptions about the selection pattern of the fishing fleet and its dynamics.The model comprises a single stock that is fished by a single fleet. It implements a harvest control rule through a management procedure that explicitly models the stock assessment process and time lag in implementing the management advice (delay between the gathering of data and making a management decision, i.e. setting the current fishing effort) which explicitly address uncertainty in recent parameter estimates. The stock recruitment relation used is the Hockey-stick or segmented regression with random noise on top of it reflecting the high variability in historical recruitment estimates (CV=0.5). Fishing mortality is estimated from effort, catchability (constant) and the selection pattern. The observed selection pattern since 1996 is used in the simulations which correspond with the implementation of the fishing days quota in the Faroese management system. Maturity-at-age is fixed while stochasticity is included in weights-at-age with a CV=0.18 applied to all age groups to somehow replicate the observed fluctuations pattern. The data sampling of catches and tuning fleets is carried out by multiplying by random errors. Natural mortality is fixed to M=0.2. Simulations were performed 1000 times on a 40-year forward period with the historical period being replicated in the OM.

Unlike the flat curves obtained from traditional yield-per-recruit calculations simulations curve show a relatively well defined maximum at F_{msy} =0.28. The reason for this difference is that when fishing mortality is above certain level (>0.3) some of the stochastic runs will lead to spawning stock being below the break point in the stock-recruitment function so recruitment and subsequent landing s will be reduced. The breakpoint of 55 kt. in the segmented regression or the revised B_{pa}=60 000 t. (see Section 2. Demersal stocks in the Faroe Area, Subsection 2.1.7 Faroe saithe) could be candidates for $B_{trigger}$ the point at which fishing mortality should be reduced according to the MSY framework. The results of the simulations are shown in Figures 6.4.1.1 and 6.4.1.2.

MSY and revised precautionary reference points (Section 2. Demersal stocks in the Faroe Area, Subsection 2.1.7 Faroe saithe) for faroe saithe are listed below:

Biological reference points	
Blim	45 000 t.
Bpa	60 000 t.
Flim	0.4
Fpa	0.28
Fmsy	0.28

Yield and spawning biomass per recruit estimates:

	Fish Mort Ages 4-8	Yield/R	SSB/R
Average last 3 years	0.46	1.30	2.32
Fmax	0.43	1.30	2.48
F0.1	0.17	1.17	5.66
Fmed	0.30	1.28	3.41

The SSB-R relation with respect to reference fishing mortalities (Fhigh, Fmed and Flow) is presented in Figure 6.5.1.3 while the history of the stock/fishery in relation to the existing four reference points can be seen in Figure 6.5.1.4.

6.5 State of the stock – historical and compared to what is now

Recruitment in the 1980s was close to the historical average (32 millions). The strongest year class since 1986 was produced in the 1990s and the average for that decade was about 28 millions (Figure 6.5.1). The 1998 (88 millions) 1999 (104 millions) and 2005 year classes (103 millions) are the largest observed in the time series. Predicted number of 3-years old saithe in 2008 and 2010 are probably much lower than expected and it will probably diminish in subsequent years and might be explained by changes in selection pattern for young saithe. In addition although groundfish surveys are in general unreliable to establish year-class strength for species like saithe both Faroese annual surveys do suggest that the 2005 and 2007 year-classes is not as strong as the assessment predicts. Relatively low Fs during the 1960s and recruitment above average in early-1970s caused an increase in SSB well above the historical average around the mid-1970s while landings peaked to almost 58 000 t. in 1973. Increasing Fs since 1980 lead to a decrease in the spawning stock biomass of saithe throughout the mid-1980s although recruitment of the 1983 year class rose to 61 000 millions, i.e. double the average from 1961 to 2010. The historically low SSB persisted in 1992-1998 (Figure 6.5.2.) and this along with low Fs caused landings to steeply decline to around 20 000 tonnes in 1996. The SSB has increased since 1999 to above 133 000t in 2005 with the maturation of the 1995, 1996, 1997 and 1999 year classes and decreased to 89 000 t in 2009.. The 2010 point estimate of SSB (110 000t) is above B_{pa} while fishing mortality F=0.38 is close to long-term average (F=0.34)(Figure 6.5.1.) Precautionary reference points are revised according to the following report section (Section 2. Demersal stocks in the Faroe Area, Subsection 2.1.7 Faroe saithe)

The relation between stock and recruitment (Figure 6.5.2) shows that the highest recruitment has been observed at lower levels of SSBs. Trends in total biomass are characterised by three distinctive cycles of around 15 years in amplitude comparable to those in recruitment estimates since 1961 (Figure 6.5.3)

6.6 Short term forecast

6.6.1 Input data

Input data for prediction with management options are presented in Table 6.6.1.1.

Population numbers at age 3 for the base short term prediction is calculated as the geometric mean of estimated recruitment strength from 1995 to 2009. Natural mortality is set to constant 0.2. In the 2011 assessment weights-at-age for 3-year old saithe is predicted by the year class strength (number of 3-years old in the stock) with a 3 year time lag (Eq. 1) whereas weight for ages 4 to 10 is estimated by weight-at-age the previous year from the same year class (Eq. 2) Diagnostics and results of the models are shown in Figures 6.6.1.1 to 6.6.1.3. For older age groups (11 to 14+) the status quo weights for 2010 are used.

$$W3,y = \alpha N3,y-3 + \beta \quad for\ a = 3 \qquad \text{(Eq. 1)}$$

$$Wa+1,y+1 = \alpha Wa,y + \beta \quad for\ 4 \leq a \leq 10 \qquad \text{(Eq. 2)}$$

Proportion mature for 2011 is taken as the average of predicted maturity ogives from 2010 and 2011 while for 2012 and 2013 it is calculated as the mean of 2009-2011. The exploitation pattern for short term prognosis is set to the unscaled three year average from 2008 to 2010 (as suggested by ACFM, 2004).

6.6.2 Projection of catch and biomass

Results from predictions with management option are presented in Table 6.6.2.1.

At status quo F=0.45 landings would reach 55 900 t in 2011 and 60 400 t in 2012 while spawning stock biomass is expected to around 110 000 tonnes in 2011 and decreased slightly to 106 800 tonnes in 2012. Landings in 2011 are predicted to rely on the three most recent year classes (76%) while in the SSB these year-classes will contribute to around 79% of the spawning biomass in 2011 (Figure 6.6.2.1.)

6.7 Yield per recruit and medium term forecasts

No medium term projections were performed for faroe saithe.

Input data to yield per recruit

The input data to long term prediction are shown in Table 6.7.1.1.

Mean weights-at-age for 1961-2010 were used for the long term projection. Natural mortality is set to constant 0.2. Proportion mature-at-age is taken as the average from 1983-2011.

The exploitation pattern was set equal to the average of the last five years (2006-2010) (as suggested from ACFM, 2004). Results from the yield per recruit analysis are shown in Table 6.7.1.2 and Figure 6.7.1.1.

6.8 Uncertainties in assessment and forecast

Although some retrospective pattern still remains, updating the data input to the model, specifically with regard to catch at age and the commercial CPUE tuning index, has significantly improved the magnitude of the pattern and would appear to facilitate reasonable application of model findings to management actions (Benchmark report 2010.) Retrospective patterns show a period of overestimation in average fishing mortality (2005-2008) while the assessment tends to underestimate F prior to 2005 (Figure 6.3.7) This implies that biomass was correspondingly underestimated from 2005 to 2008 and overestimated before 2005. With respect to recruitment the retrospective trend is very similar to that of F and SSB. The 2005 year-class was predicted at a historic high in 2008 but it is showing much weaker in 2009 and it might be expected to become even weaker in coming years. Although recruitment in 2010 was adjusted (see Section 6.3) the point estimate of 66 000 m. seems to be the result of changes in selection pattern for young saithe. Additionally observed survey indexes do not suggest that the 2007 year class is as large as that predicted by the adopted XSA model.

6.8.1 Assessment quality

The assessment is tuned with commercial CPUE data. Problems associated with the use of commercial CPUE data (e.g. increased efficiency due to technological creep etc.) may affect the assessment. The standardisation of commercial CPUE data carried out at the 2010 benchmark assessment (Sec. 6.2.5.2 and Stock Annex Sec. B.4) has resulted in a substantial reduction in the bias observed in the retrospective pattern.

6.9 Comparison with previous assessment and forecast

In previous assessment there was a consistent bias to over- and under-estimate F and SSB respectively. The current adopted assessment shows two different periods of

overestimation in F from 2005-2008 and underestimation before up to 2005 implying underestimation and overestimation of SSB respectively. These biases are less pronounced in the current accepted assessment. Various factors could explain this pattern, e.g. by changes in the vertical distribution of saithe which might have also affect the selection pattern. The retrospective trend in recruitment of three-year old saithe is very similar to that observed for F and SSB.

6.10 Management plans and evaluations

No management plan exists for saithe in Division Vb

6.11 Management considerations

Management consideration for saithe is under the general section for Faroese stocks.

Unlike the traditional yield-per-recruit curves the simulations carried out at the 2011 assessment (Sec. 6.4.1) show a relatively well defined maximum at F_{msy} =0.28. Candidates for $B_{trigger}$ might be set to the breakpoint of 55 kt. in the segmented regression or the revised B_{pa}=60 000 t. the point at which fishing mortality should be reduced according to the MSY framework (for more details see Section 6.4.1)

6.12 Ecosystem considerations

No evidence is available to indicate that the fishery is impacting the marine environment. A Ph.D. project was launched in 2008, with the aim of investigate the role of enviromental indicators in the dynamics of Faroe saithe.

6.13 Regulations and their effects

It seems to be no relationship between number of fishing days and fishing mortality, probably because of large fluctuations in catchability. Area restriction is an alternative to reduce fishing mortality- and this is used to protect small saithe in Faroese area.

6.14 Changes in fishing technology and fishing patterns

See section 6.2.

6.15 Changes in the environment

According to existing literature the productivity of the ecosystem clearly affects both cod and haddock recruitment and growth (Gaard *et al*., 2002), a feature outlined in Steingrund and Gaard (2005). The primary production on the Faroe Shelf (< 130 m depth), over the period May through June, varied interannually by a factor of five, giving rise to low- or high-productive periods of 2-5 years duration (Steingrund and Gaard, 2005). The productivity over the outer areas seems to be negatively correlated with the strength of the Subpolar Gyre (Hátún et al., 2005; Hátún *et al*., 2009; Steingrund *et al*., 2010), which may regulate the abundance of saithe in Faroese waters (Steingrund and Hátún, 2008). When comparing a gyre index (GI) to saithe in Faroese waters there was a marked positive relationship between annual variations in GI and the total biomass of saithe lagged 4 years (Figure 6.15.1.)

There is a negative relationship between mean weight-at-age and the stock size of saithe in Faroese waters. This could be due to simple density-dependence, where there is a competition for limited food resources. Stomach content data show that the food of saithe is dominated by blue whiting, Norway pout, and krill, and the annual

variations in the stomach fullness are mainly attributable to variations in the feeding on blue whiting. There seems to be no relationship between stomach fullness and weights-at-age for saithe (í Homrum *et al*. WD 2009).

6.16 References

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Table 6.2.1.1. Faroe saithe (Division Vb). Nominal catches (tonnes round weight) by countries, 1988-2010, as officially reported to ICES.

Country	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	
Denmark	94	-	2	-	-	-	-	-	-	-	-	
Estonia	-	-	-	-	-	-	-	-	-	16	-	
Faroe Islands	44402	43,624	59,821	53,321	35,979	32,719	32,406	26,918	19,267	21,721	25,995	
France [3]	313	-	-	-	120	75	19	10	12	9	17	
Germany	-	-	-	32	5	2	1	41	3	5	-	
German Dem.Rep.	-	9	-	-	-	-	-	-	-	-	-	
German Fed. Rep.	74	20	15	-	-	-	-	-	-	-	-	
Greenland	-	-	-	-	-	-	-	-	-	-	-	
Ireland	-	-	-	-	-	-	-	-	-	-	-	
Netherlands	-	22	67	65	-	-	-	-	-		-	
Norway	52	51	46	103	85	32	156	10	16	67	53	
Portugal	-	-	-	-	-	-	-	-	-	-	-	
UK (Eng. & W.)	-	-	-	5	74	279	151	21	53	-	19	
UK (Scotland)	92	9	33	79	98	425	438	200	580	460	337	
USSR/Russia [2]	-	-	30	-	12	-	-	-	18	28	-	
Total	45027	43,735	60,014	53,605	36,373	33,532	33,171	27,200	19,949	22,306	26,065	
Working Group estimate [4,5]	45285	44,477	61,628	54,858	36,487	33,543	33,182	27,209	20,029	22,306	26,421	
Country	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010 [1]
Denmark	-	-	-	-	-	-	-	34	-			
Estonia	-	-	-	-	-	-	-	-	-			
Faroe Islands	32,439		49,676	55,165	47,933	48,222	71,496	70,696	64,552	61,116	61,889	46,727
France	-	273	934	607	370	147	123	315	108	97	46	26
Germany	100	230	667	422	281	186	1	49	3	3		
Greenland	-	-	-	125	-			73	239	0	1	
Irland	-	-	5	-	-	-	-	-	-	-	-	
Netherlands	0	0	0	0	0	0	0	0	3	0	0	0
Norway	160	72	60	77	62	82	82	35	81	38	23	2
Portugal	-	-	-	-	-	5	-	-	-	-	-	
Russia	-	20	1	10	32	71	210	104		38	44	3
UK (E/W/NI)	67	32	80	58	89	85	32	88	4	-	-	
UK (Scotland)	441	534	708	540	610	748	4,322	1,011	408	400	684	
United Kingdom	-	-	-	-	-	-	-	-	-	-	-	705
Total	33,207	1,161	52,131	57,004	49,377	49,546	76,266	72,405	65,398	61,692	62,687	47,463
Working Group estimate [4,5,6,7]	33,207	39,020	51,786	53,546	46,555	46,355	67,997	67,103	60,716	57,043	57,950	43,959

[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 2001-2008 catches from Faroe Islands, as stated from Faroese coastal guard service, are corrected in order to be consistent with procedures used previous years.

Table 6.2.1.2. Faroe saithe (Division Vb). Total Faroese landings (rightmost column) and the contribution (%) by each fleet category. Averages for 1985-2010 are given at the bottom.

Year	Open boats	Long-liners <100 GRT	Single trawl <400 HP	Gillnets	Jiggers	Single trawl 400-1000 HP	Single trawl >1000 HP	Pair trawl <1000 HP	Pair trawl >1000 HP	Long-liners >100 GRT	Indust-rial trawlers	Others	Total round weight (tonnes)
1985	0.2	0.1	0.1	0.0	2.6	6.6	33.7	28.2	28.2	0.1	0.2	0.2	42598
1986	0.3	0.2	0.1	0.1	3.6	2.8	27.3	27.5	36.5	0.1	0.7	0.9	40107
1987	0.7	0.1	0.3	0.4	5.6	4.1	20.4	22.8	44.2	0.1	1.1	0.0	39627
1988	0.4	0.3	0.1	0.3	6.5	6.8	20.8	19.6	43.6	0.1	1.3	0.1	43940
1989	0.9	0.1	0.3	0.2	9.3	5.4	17.7	23.5	41.1	0.1	1.3	0.0	43624
1990	0.6	0.2	0.2	0.2	7.4	3.9	19.6	24.0	42.8	0.2	0.9	0.0	59821
1991	0.6	0.1	0.1	0.6	9.8	1.3	13.9	26.5	46.2	0.1	0.8	0.0	53321
1992	0.4	0.4	0.0	0.0	10.5	0.5	7.1	24.4	55.6	0.1	1.0	0.0	35979
1993	0.6	0.2	0.1	0.0	9.3	0.6	6.5	21.4	60.6	0.1	0.7	0.0	32719
1994	0.4	0.4	0.1	0.0	12.6	1.1	6.8	18.5	59.1	0.2	0.7	0.0	32406
1995	0.2	0.1	0.4	0.0	9.6	0.9	9.9	17.7	60.9	0.3	0.0	0.0	26918
1996	0.0	0.0	0.1	0.0	9.2	1.2	6.8	23.7	58.6	0.2	0.0	0.0	19267
1997	0.0	0.1	0.1	0.0	8.9	2.5	10.7	17.8	58.9	0.4	0.4	0.0	21721
1998	0.1	0.4	0.1	0.0	8.1	2.8	13.8	16.5	57.6	0.3	0.4	0.0	25995
1999	0.0	0.1	0.1	0.0	5.7	1.2	12.6	18.5	60.0	0.2	1.6	0.0	32439
2000	0.1	0.1	0.2	0.0	3.7	0.3	15.0	17.5	62.3	0.1	0.7	0.0	39020
2001	0.1	0.1	0.1	0.0	2.8	0.3	20.2	16.5	58.8	0.2	0.8	0.1	51786
2002	0.1	0.2	0.1	0.0	1.6	0.1	26.5	10.5	60.8	0.1	0.0	0.0	53546
2003	0.0	0.0	1.9	0.0	0.9	0.4	17.4	14.7	64.7	0.1	0.0	0.0	46555
2004	0.1	0.2	3.7	0.0	1.9	0.4	15.1	14.4	63.8	0.2	0.0	0.0	44605
2005	0.2	0.1	4.4	0.0	2.4	0.2	12.7	20.6	59.2	0.2	0.0	0.0	66394
2006	0.2	0.4	0.3	0.0	3.9	0.1	19.8	20.6	54.1	0.6	0.0	0.0	65394
2007	0.2	0.2	0.2	0.0	2.0	0.1	30.4	16.0	50.6	0.3	0.0	0.0	59711
2008	0.2	0.3	1.5	0.0	3.2	0.2	20.4	16.0	57.7	0.5	0.0	0.0	56532
2009	0.4	0.2	3.3	0.0	4.3	0.1	9.6	15.1	66.8	0.2	0.0	0.0	57247
2010	0.1	0.1	1.2	0.0	3.9	2.4	8.3	15.1	68.3	0.6	0.0	0.0	43223
Average	0.3	0.2	0.7	0.1	5.7	1.8	16.3	19.5	54.7	0.2	0.5	0.1	43651

Table 6.2.2.1. Faroe saithe (Division Vb). Catch number at age by fleet categories in 2010 (calculated from gutted weights).

Age	Jiggers	Single trawlers >1000 HP	Pair trawlers <1000 HP	Pair trawlers >1000HP	Others	Total Faroese fleet	Foreign fleet	Total Division Vb
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
2	1	5	3	18	0	27	1	28
3	76	405	213	1634	39	2367	46	2413
4	113	452	295	2019	56	2934	51	2986
5	198	766	657	3586	101	5307	87	5394
6	45	164	158	737	22	1126	19	1145
7	35	155	152	657	18	1017	18	1034
8	67	307	375	1325	36	2109	35	2144
9	44	173	198	814	22	1250	20	1270
10	31	114	155	518	15	832	13	845
11	15	49	60	245	7	375	6	380
12	2	6	12	31	1	51	1	52
13	1	4	3	14	0	23	0	23
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
Total No.	626	2598	2280	11597	317	17418	295	17713
Catch, t.	1564	6472	6385	28871	790	44082	663	44745

Table 6.2.2.2. Faroe saithe (Division Vb). Catch number at age (thousands) from the commercial fleet(1961-2010)

CN	3	4	5	6	7	8	9	10	11	12	13	14	15
1961	183	379	483	403	216	129	116	82	45	27	6	1	48
1962	562	542	617	495	286	131	129	113	71	29	13	16	47
1963	614	340	340	415	406	202	174	158	94	169	61	8	36
1964	684	1908	1506	617	572	424	179	150	100	83	47	30	14
1965	996	850	1708	965	510	407	306	201	156	120	89	30	46
1966	488	1540	1201	1686	806	377	294	205	156	94	52	34	45
1967	595	796	1364	792	1192	473	217	190	97	75	38	11	16
1968	614	1689	1116	1095	548	655	254	128	89	59	40	29	59
1969	1191	2086	2294	1414	1118	589	580	239	115	100	36	30	24
1970	1445	6577	1558	1478	899	730	316	241	86	48	46	15	23
1971	2857	3316	5585	1005	828	469	326	164	100	54	13	18	15
1972	2714	1774	2588	2742	1529	1305	1017	743	330	133	28	28	21
1973	2515	6253	7075	3478	1634	693	550	403	215	103	25	21	37
1974	3504	4126	4011	2784	1401	640	368	340	197	124	45	44	52
1975	2062	3361	3801	1939	1045	714	302	192	193	126	64	41	67
1976	3178	3217	1720	1250	877	641	468	223	141	96	60	54	77
1977	1609	2937	2034	1288	767	708	498	338	272	129	80	57	64
1978	611	1743	1736	548	373	479	466	473	407	211	146	95	83
1979	287	933	1341	1033	584	414	247	473	368	206	136	98	251
1980	996	877	720	673	726	284	212	171	196	156	261	133	236
1981	411	1804	769	932	908	734	343	192	92	128	176	310	407
1982	387	4076	994	1114	380	417	296	105	88	56	49	110	687
1983	2483	1103	5052	1343	575	339	273	98	98	99	25	127	289
1984	368	11067	2359	4093	875	273	161	52	65	59	18	25	151
1985	1224	3990	5583	1182	1898	273	103	38	26	72	41	8	154
1986	1167	1997	4473	3730	953	1077	245	104	67	33	56	7	62
1987	1581	5793	3827	2785	990	532	333	81	43	5	11	15	66
1988	866	2950	9555	2784	1300	621	363	159	27	43	15	1	1
1989	451	5981	5300	7136	793	546	185	83	55	10	2	11	16
1990	294	3833	10120	9219	5070	477	123	61	60	18	19	9	33
1991	1030	5125	7452	5544	3487	1630	405	238	128	77	22	8	11
1992	521	4067	3667	2679	1373	894	613	123	63	37	52	8	11
1993	1316	2611	4689	1665	858	492	448	245	54	34	10	6	2
1994	690	3961	2663	2368	746	500	307	303	150	28	19	1	1
1995	398	1019	3468	1836	1177	345	241	192	104	73	25	14	5
1996	297	1087	1146	1449	1156	521	132	77	64	45	29	1	7
1997	344	832	2440	1767	1335	624	165	71	29	48	29	15	8
1998	163	1689	1934	3475	1379	683	368	77	32	28	24	14	7
1999	322	655	3096	2551	4113	915	380	147	24	27	5	23	14
2000	811	2830	1484	4369	2226	2725	348	186	56	18	2	3	2
2001	1125	2452	8437	2155	3680	1539	1334	293	90	24	19	13	0
2002	302	8399	5962	9786	862	1280	465	362	33	36	8	1	0
2003	330	2432	11152	3994	4287	417	419	304	91	40	3	0	0
2004	76	2011	8544	8762	2125	1807	265	293	146	100	10	2	0
2005	454	2949	9490	16613	7102	843	810	32	102	27	3	0	0
2006	1479	5060	7804	7735	10327	3771	642	283	32	12	12	5	0
2007	830	3316	11292	6466	3777	4289	1536	406	81	11	9	3	0
2008	4784	3108	3598	9370	3594	2223	2048	444	159	12	6	0	0
2009	459	7412	4978	1842	5167	2009	1696	1069	292	41	3	1	0
2010	2289	2872	5218	1108	994	2066	1229	820	371	51	22	0	0

Table 6.2.2.3. Faroe saithe (Division Vb). Sampling intensity in 2000-2010.

Year		Jiggers	Single trawlers >1000 HP	Pair trawlers <1000 HP	Pair trawlers >1000 HP	Others	Total	Amount sampled pr tonnes landed (%)
2000	**Lengths**	2443	2429	9910	28724		43506	10.7
	Otoliths	300	301	1019	2816		4436	
	Weights	300	241	959	2816		4316	
2001	**Lengths**	1788	4388	5613	30341		42130	7.7
	Otoliths	180	450	480	3237		4347	
	Weights	180	420	420	3177		4197	
2002	**Lengths**	1197	9235	5049	30761		46242	5.8
	Otoliths	120	1291	422	3001		4834	
	Weights	120	420	240	2760		3540	
2003	**Lengths**		4959	6393	34812	1388	47552	7.0
	Otoliths		719	960	3719	180	5578	
	Weights		420	239	2999		3658	
2004	**Lengths**	916	2665	3455	35609	1781	44426	6.1
	Otoliths	180	180	240	3537	240	4377	
	Weights	180	120	120	3357	1364	5141	
2005	**Lengths**	1048	4266	6183	32046	1564	45107	3.7
	Otoliths	120	413	690	2760	240	4223	
	Weights	340	385	791	3533	1564	6613	
2006	**Lengths**	1059	7979	8115	23082	1139	41374	3.6
	Otoliths	180	598	1138	2096	60	4072	
	Weights	180	60	1620	5678	812	8350	
2007	**Lengths**	683	10525	10593	18045	381	40227	4.2
	Otoliths	120	748	960	1977	0	3805	
	Weights	120	697	5603	9884	120	16424	
2008	**Lengths**	0	6892	3694	13995	234	24815	2.6
	Otoliths	0	690	600	1500	0	2790	
	Weights	0	0	2517	12914	234	15665	
2009	**Lengths**	511	5273	3695	23352	0	32831	4.1
	Otoliths	97	301	599	2519	0	3516	
	Weights	511	0	3494	19060	0	23065	
2010	**Lengths**	209	1442	3663	25793	151	31258	6.1
	Otoliths	5	119	480	2459	0	3063	
	Weights	5	0	3060	18749	151	21965	

Table 6.2.3.1. Faroe saithe (Division Vb). Catch weights at age (kg) from the commercial fleet (1961-2010)

year	3	4	5	6	7	8	9	10	11	12	13	14+
1961	1.43	2.30	3.35	4.29	5.13	6.16	7.06	7.27	7.50	8.20	9.15	9.99
1962	1.27	2.05	3.29	4.19	5.15	5.66	6.47	6.71	7.15	7.90	8.45	9.66
1963	1.28	2.20	3.21	4.57	5.06	5.93	6.26	8.00	7.27	8.55	9.02	9.82
1964	1.18	2.06	3.27	4.26	5.04	5.69	6.66	6.84	7.69	8.35	8.12	9.42
1965	1.18	2.13	2.94	4.10	4.88	5.93	6.32	7.29	8.07	7.88	9.48	9.85
1966	1.36	2.03	3.06	3.66	4.59	5.52	6.84	7.27	7.66	8.12	10.21	9.88
1967	1.27	1.78	2.53	3.57	4.37	5.31	5.81	6.55	7.81	7.59	8.55	9.14
1968	1.30	1.74	2.04	3.12	4.05	5.18	6.24	7.52	8.05	8.65	8.30	9.75
1969	1.19	1.67	2.30	2.85	3.67	5.00	5.71	6.41	6.55	7.59	7.95	9.10
1970	1.24	1.45	2.25	2.85	3.52	4.42	5.44	5.73	6.66	7.31	9.05	9.63
1971	1.10	1.32	1.82	2.98	3.70	4.27	5.39	5.97	6.49	7.17	7.38	9.61
1972	1.04	1.49	2.06	2.83	3.79	4.18	4.81	5.29	6.95	6.73	7.59	9.61
1973	1.31	1.75	1.90	2.70	4.43	5.26	6.16	6.33	8.08	8.78	9.78	11.12
1974	1.62	1.72	2.49	2.82	3.52	5.20	6.28	6.45	7.07	7.77	8.76	10.83
1975	1.29	1.92	2.62	3.62	4.13	4.75	5.95	7.07	8.35	9.03	9.98	11.08
1976	1.16	1.79	3.07	3.29	4.58	4.65	5.12	6.31	7.07	7.07	7.81	9.71
1977	1.22	1.64	2.66	3.79	4.24	5.60	5.35	5.91	6.84	6.73	6.95	9.26
1978	1.49	2.32	3.07	3.75	4.91	4.37	5.28	5.83	6.05	6.71	7.69	8.52
1979	1.22	1.88	2.62	3.40	4.18	4.95	5.69	6.38	7.02	7.26	8.15	9.62
1980	1.23	2.12	3.32	4.28	5.16	6.42	6.87	7.09	7.93	8.07	8.59	10.14
1981	1.31	2.13	3.00	3.81	4.75	5.25	5.95	6.43	7.00	7.47	8.14	9.43
1982	1.34	1.85	2.95	3.58	4.93	6.24	7.23	7.24	8.35	8.35	8.96	10.23
1983	1.21	2.03	2.97	4.14	4.72	5.90	6.81	7.05	7.25	8.29	9.48	10.51
1984	1.43	1.95	2.47	3.85	5.18	6.35	7.83	6.75	8.64	8.47	8.56	10.80
1985	1.40	2.03	2.97	3.60	5.34	7.20	6.97	9.86	10.67	10.46	10.20	13.05
1986	1.72	1.99	2.62	3.28	4.19	5.59	6.05	6.15	9.54	9.82	7.30	12.77
1987	1.61	1.84	2.40	3.18	4.07	5.15	5.50	6.63	6.34	10.25	8.49	10.48
1988	1.50	1.98	1.98	2.94	3.80	4.42	5.12	6.71	9.04	9.36	9.14	10.22
1989	1.31	1.74	1.91	2.37	3.81	4.67	5.51	5.97	6.94	8.54	9.51	10.48
1990	1.22	1.63	1.83	2.05	2.87	4.47	5.42	6.47	6.34	8.42	7.38	8.64
1991	1.24	1.57	1.86	2.21	2.65	3.38	4.82	5.52	6.41	7.40	8.08	8.67
1992	1.26	1.60	2.07	2.55	3.06	4.08	5.01	6.77	7.75	8.30	7.79	9.30
1993	1.41	1.86	2.32	3.13	3.73	4.39	5.21	6.54	8.40	7.28	9.41	9.64
1994	1.50	1.95	2.27	2.94	4.21	4.97	5.66	5.95	6.89	8.75	9.75	7.99
1995	1.46	2.18	2.42	2.90	3.65	5.06	5.44	6.17	7.08	7.74	7.30	7.10
1996	1.43	1.88	2.50	3.23	3.74	4.96	6.38	6.75	7.47	7.28	8.47	10.13
1997	1.48	1.78	2.03	2.78	3.60	4.77	5.98	7.66	7.88	8.54	9.49	10.41
1998	1.39	1.71	1.95	2.41	3.30	4.22	5.00	6.39	6.67	8.21	8.49	8.85
1999	1.37	1.71	1.91	2.40	2.85	4.12	5.26	5.53	6.96	8.03	8.35	8.91
2000	1.48	1.61	2.08	2.36	2.98	3.48	4.85	5.27	6.52	4.73	8.81	8.97
2001	1.33	1.59	1.79	2.59	3.06	3.87	4.37	5.57	6.70	5.78	7.75	7.77
2002	1.14	1.46	1.65	1.97	3.13	3.59	4.51	5.14	6.42	8.03	4.76	11.36
2003	1.12	1.30	1.61	1.98	2.53	3.97	4.83	5.50	6.10	6.99	5.96	10.00
2004	1.14	1.33	1.45	1.79	2.56	3.16	4.15	5.17	6.02	6.19	7.06	9.39
2005	1.15	1.33	1.52	1.67	2.09	2.98	3.79	6.09	6.13	6.65	7.42	10.00
2006	1.13	1.22	1.46	1.79	2.04	2.44	3.86	4.22	5.15	6.44	6.91	5.37
2007	1.06	1.39	1.41	1.82	2.36	2.68	3.28	4.10	5.00	6.33	7.84	7.97
2008	1.15	1.31	1.67	1.82	2.40	2.90	3.10	3.73	4.77	6.07	6.45	10.00
2009	0.94	1.49	1.89	2.41	2.60	3.15	3.63	4.02	5.01	5.83	6.31	9.01
2010	1.43	1.71	2.17	2.55	3.17	3.41	3.97	4.35	5.08	4.94	5.31	10.0

Table 6.2.4.1. Faroe saithe (Division Vb). Proportion mature at age

MP	3	4	5	6	7	8	9	10	11	12	13	14
1961	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1962	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1963	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1964	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1965	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1966	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1967	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1968	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1969	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1970	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1971	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1972	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1973	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1974	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1975	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1976	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1977	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1978	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1979	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1980	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1981	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1982	0.08	0.25	0.56	0.82	0.94	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1983	0.00	0.04	0.45	0.94	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1984	0.06	0.40	0.87	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1985	0.04	0.16	0.47	0.80	0.95	0.99	1.00	1.00	1.00	1.00	1.00	1.00
1986	0.08	0.48	0.90	0.98	0.99	0.99	0.99	1.00	1.00	1.00	1.00	1.00
1987	0.08	0.22	0.48	0.75	0.92	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1988	0.09	0.24	0.50	0.75	0.90	0.96	0.99	1.00	1.00	1.00	1.00	1.00
1989	0.09	0.25	0.52	0.77	0.90	0.95	0.97	1.00	1.00	1.00	1.00	1.00
1990	0.09	0.21	0.40	0.63	0.82	0.92	0.97	1.00	1.00	1.00	1.00	1.00
1991	0.07	0.19	0.45	0.74	0.91	0.97	0.99	1.00	1.00	1.00	1.00	1.00
1992	0.01	0.07	0.33	0.76	0.95	0.99	1.00	1.00	1.00	1.00	1.00	1.00
1993	0.06	0.23	0.58	0.86	0.96	0.99	0.99	1.00	1.00	1.00	1.00	1.00
1994	0.03	0.18	0.59	0.90	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1995	0.01	0.17	0.74	0.97	0.99	0.99	0.99	1.00	1.00	1.00	1.00	1.00
1996	0.03	0.16	0.52	0.86	0.97	0.99	0.99	1.00	1.00	1.00	1.00	1.00
1997	0.04	0.14	0.40	0.74	0.93	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1998	0.03	0.09	0.23	0.49	0.75	0.91	0.98	1.00	1.00	1.00	1.00	1.00
1999	0.09	0.18	0.34	0.53	0.72	0.86	0.94	1.00	1.00	1.00	1.00	1.00
2000	0.10	0.21	0.40	0.62	0.80	0.91	0.96	1.00	1.00	1.00	1.00	1.00
2001	0.03	0.12	0.34	0.67	0.89	0.97	0.99	1.00	1.00	1.00	1.00	1.00
2002	0.08	0.17	0.31	0.50	0.69	0.84	0.93	1.00	1.00	1.00	1.00	1.00
2003	0.09	0.21	0.41	0.65	0.83	0.93	0.97	1.00	1.00	1.00	1.00	1.00
2004	0.03	0.08	0.19	0.39	0.65	0.84	0.94	1.00	1.00	1.00	1.00	1.00
2005	0.08	0.19	0.37	0.60	0.79	0.91	0.96	1.00	1.00	1.00	1.00	1.00
2006	0.12	0.23	0.41	0.62	0.79	0.89	0.95	1.00	1.00	1.00	1.00	1.00
2007	0.06	0.16	0.35	0.60	0.81	0.92	0.97	1.00	1.00	1.00	1.00	1.00
2008	0.09	0.23	0.49	0.76	0.91	0.97	0.99	1.00	1.00	1.00	1.00	1.00
2009	0.03	0.11	0.32	0.63	0.86	0.95	0.98	1.00	1.00	1.00	1.00	1.00
2010	0.06	0.23	0.59	0.86	0.96	0.98	0.99	1.00	1.00	1.00	1.00	1.00
2011	0.06	0.21	0.53	0.82	0.95	0.98	0.99	1.00	1.00	1.00	1.00	1.00

Table 6.3.1. Faroe saithe (Division Vb). Effort (hours) and catch in number at age for commercial pair trawlers (1995-2010)

year	effort	3	4	5	6	7	8	9	10	11
1995	11276	47	180	577	236	146	49	24	19	14
1996	48600	310	958	821	1119	503	282	133	127	70
1997	36043	199	533	1488	1013	768	333	73	33	10
1998	35644	107	656	1148	1486	730	325	170	40	13
1999	44446	174	487	1554	2016	2024	817	190	83	12
2000	45197	434	1566	913	2700	1333	1604	192	106	31
2001	43179	611	1438	4946	1165	1855	748	618	127	29
2002	42884	133	3976	3964	6888	520	682	246	177	25
2003	40374	141	1494	6560	2373	2263	197	212	124	35
2004	37370	43	1200	5089	5116	1035	762	113	116	53
2005	34037	188	1189	4039	7266	3130	320	291	7	43
2006	26475	140	1176	2410	2584	3700	1376	268	85	14
2007	25889	204	879	2913	1815	1034	1215	435	110	19
2008	26350	796	762	947	2641	1063	726	611	156	51
2009	71109	154	4082	3377	1283	3612	1402	1153	751	195
2010	53942	459	1830	3250	668	596	1201	737	469	222

Table 6.3.2. Faroe saithe (Division Vb). Diagnostics from XSA with commercial pair trawler tuning series.

```
FLR XSA Diagnostics 2011-04-20 14:15:20

CPUE data from FLIndices(sai.indices_adj2[[1]])

Catch data for 50 years. 1961 to 2010. Ages 3 to 14.

                fleet first age last age first year last year alpha beta
1 PairTrawlers_GLM_SD         3       11       1995      2010     0    1


 Time series weights :

   Tapered time weighting not applied

Catchability analysis :

    Catchability independent of size for all ages

    Catchability independent of age for ages >   8

Terminal population estimation :

    Survivor estimates shrunk towards the mean F
    of the final   5 years or the  3 oldest ages.

    S.E. of the mean to which the estimates are shrunk =   2

    Minimum standard error for population
    estimates derived from each fleet =  0.3

   prior weighting not applied

Regression weights
     year
age   2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
  all    1    1    1    1    1    1    1    1    1    1

 Fishing mortalities
    year
age   2001  2002  2003  2004  2005  2006  2007  2008  2009  2010
  3  0.014 0.003 0.006 0.002 0.007 0.079 0.045 0.089 0.014 0.039
  4  0.100 0.140 0.032 0.045 0.079 0.103 0.254 0.238 0.193 0.114
  5  0.294 0.374 0.279 0.148 0.309 0.308 0.352 0.483 0.746 0.202
  6  0.635 0.663 0.464 0.370 0.478 0.447 0.455 0.557 0.491 0.359
  7  0.769 0.568 0.699 0.483 0.585 0.626 0.409 0.497 0.698 0.540
  8  0.718 0.677 0.601 0.735 0.358 0.726 0.582 0.452 0.578 0.679
  9  1.001 0.491 0.489 1.022 0.903 0.512 0.756 0.617 0.760 0.879
  10 1.215 0.846 0.705 0.774 0.304 0.983 0.728 0.508 0.786 1.115
  11 1.006 0.395 0.525 0.916 0.687 0.570 0.879 0.718 0.760 0.707
  12 0.712 1.877 1.260 2.613 0.414 0.153 0.389 0.294 0.402 0.278
  13 2.035 0.549 0.829 1.473 0.622 0.326 0.164 0.381 0.110 0.391
  14 2.035 0.549 0.829 1.473 0.622 0.326 0.164 0.381 0.110 0.391


 XSA population number (Thousand)
      age
year        3     4     5     6     7     8    9   10  11  12 13 14
  2001  88037 28505 36591  5066  7581  3320 2330  460 157  52 24 16
  2002 105756 71061 21119 22324  2198  2877 1325  701 112  47 21  3
  2003  61960 86313 50580 11896  9423  1020 1197  664 246  62  6  0
  2004  52541 50430 68466 31320  6126  3836  458  601 269 119 14  3
  2005  70116 42948 39469 48324 17715  3093 1505  135 227  88  7  0
  2006  21609 56995 32494 23728 24533  8078 1769  500  81  94 48 20
  2007  20723 16353 42085 19543 12428 10741 3201  868 153  38 66 22
  2008  62346 16216 10389 24239 10150  6757 4913 1231 343  52 21  0
  2009  36461 46716 10464  5250 11367  5058 3521 2170 606 137 32 11
  2010  66252 29436 31541  4063  2632  4631 2323 1348 809 232 75  0
```

```
 Estimated population abundance at 1st Jan  2011
      age
year     3     4     5     6    7    8    9  10  11  12  13 14
  2011 362 52172 21502 21102 2324 1255 1922 790 362 327 144 42


 Fleet:  PairTrawlers_GLM_SD

 Log catchability residuals.

    year
age    1995   1996   1997   1998   1999   2000   2001   2002   2003   2004
  3  -0.153  0.747  0.281  0.638 -0.629  0.776  0.256 -1.451 -0.796 -1.744
  4   0.239 -0.447 -0.254 -0.346  0.103 -0.285  0.208  0.338 -0.827 -0.425
  5   0.572 -0.520 -0.560 -0.307 -0.509 -0.064  0.157  0.528  0.176 -0.364
  6  -0.166 -0.139 -0.060 -0.650 -0.015  0.045  0.368  0.680  0.217  0.053
  7   0.116 -0.422  0.178  0.011 -0.204 -0.061  0.291  0.178  0.310 -0.058
  8   0.047  0.114  0.060 -0.076  0.519  0.223  0.072  0.112 -0.065  0.098
  9  -0.088  0.364 -0.058  0.216 -0.068 -0.165  0.352 -0.214 -0.201  0.433
  10 -0.397  1.029  0.022  0.134  0.199  0.200  0.475  0.247 -0.055  0.085
  11 -0.082  0.135 -0.445 -0.103 -0.601  0.102 -0.007 -0.071 -0.405  0.165
    year
age    2005   2006   2007   2008   2009   2010
  3  -0.461  0.707  1.132  1.395 -0.740  0.043
  4  -0.164 -0.195  0.855  0.696  0.302  0.201
  5   0.123  0.052  0.025  0.342  0.727 -0.380
  6   0.112  0.027 -0.106  0.081 -0.134 -0.313
  7   0.125  0.235 -0.433 -0.181  0.023 -0.107
  8  -0.626  0.285 -0.164 -0.291 -0.280 -0.027
  9   0.234  0.075  0.094 -0.072 -0.035  0.259
  10 -1.341  0.390  0.012 -0.101  0.031  0.446
  11  0.123  0.227  0.055  0.150 -0.053  0.041


 Mean log catchability and standard error of ages with catchability
 independent of year class strength and constant w.r.t. time

                3        4        5        6        7        8        9
Mean_Logq -15.7940 -13.7220 -12.5943 -12.1219 -11.9261 -11.8110 -11.8110
S.E_Logq    0.9091   0.4448   0.4119   0.2909   0.2292   0.2632   0.2134
               10       11
Mean_Logq -11.8110 -11.8110
S.E_Logq    0.4935   0.2396


 Terminal year survivor and F summaries:

 Age 3 Year class =2007

source
                    scaledWts survivors yrcls
PairTrawlers_GLM_SD     0.814     54476  2007
fshk                    0.186     43172  2007

 Age 4 Year class =2006

source
                    scaledWts survivors yrcls
PairTrawlers_GLM_SD     0.944     26298  2006
fshk                    0.056     13667  2006

 Age 5 Year class =2005

source
                    scaledWts survivors yrcls
PairTrawlers_GLM_SD     0.948     14435  2005
fshk                    0.052      8478  2005

 Age 6 Year class =2004

source
                    scaledWts survivors yrcls
PairTrawlers_GLM_SD     0.969      1700  2004
fshk                    0.031      1588  2004
```

```
 Age 7 Year class =2003

source
                     scaledWts survivors yrcls
PairTrawlers_GLM_SD      0.963      1127  2003
fshk                     0.037      1177  2003

 Age 8 Year class =2002

source
                     scaledWts survivors yrcls
PairTrawlers_GLM_SD      0.958      1872  2002
fshk                     0.042      2588  2002

 Age 9 Year class =2001

source
                     scaledWts survivors yrcls
PairTrawlers_GLM_SD      0.949      1023  2001
fshk                     0.051      1062  2001

 Age 10 Year class =2000

source
                     scaledWts survivors yrcls
PairTrawlers_GLM_SD      0.831       565  2000
fshk                     0.169       780  2000

 Age 11 Year class =1999

source
                     scaledWts survivors yrcls
PairTrawlers_GLM_SD      0.956       341  1999
fshk                     0.044       312  1999

 Age 12 Year class =1998

source
     scaledWts survivors yrcls
fshk         1       117  1998

 Age 13 Year class =1997

source
     scaledWts survivors yrcls
fshk         1        19  1997
```

Table 6.3.3. Faroe saithe (Division Vb). Fishing mortality (F) at age.

F	3	4	5	6	7	8	9	10	11	12	13	14	Fbar
1961	0.026	0.058	0.109	0.143	0.120	0.100	0.110	0.106	0.112	0.181	0.134	0.134	0.106
1962	0.052	0.101	0.127	0.156	0.143	0.099	0.138	0.149	0.125	0.098	0.124	0.124	0.125
1963	0.035	0.040	0.085	0.118	0.185	0.142	0.185	0.250	0.178	0.491	0.308	0.308	0.114
1964	0.052	0.144	0.251	0.218	0.236	0.301	0.180	0.241	0.248	0.235	0.243	0.243	0.230
1965	0.050	0.085	0.186	0.253	0.283	0.263	0.370	0.316	0.424	0.532	0.427	0.427	0.214
1966	0.026	0.103	0.167	0.283	0.348	0.350	0.308	0.456	0.433	0.493	0.464	0.464	0.250
1967	0.027	0.053	0.125	0.158	0.332	0.354	0.349	0.335	0.407	0.384	0.378	0.378	0.204
1968	0.030	0.099	0.098	0.140	0.156	0.307	0.326	0.358	0.258	0.467	0.363	0.363	0.160
1969	0.034	0.136	0.189	0.175	0.207	0.250	0.493	0.586	0.639	0.518	0.586	0.586	0.191
1970	0.044	0.262	0.142	0.179	0.160	0.202	0.206	0.390	0.431	0.609	0.480	0.480	0.189
1971	0.086	0.135	0.373	0.128	0.144	0.117	0.130	0.157	0.277	0.534	0.325	0.325	0.179
1972	0.094	0.070	0.148	0.316	0.293	0.354	0.400	0.490	0.541	0.730	0.592	0.592	0.236
1973	0.125	0.325	0.438	0.304	0.315	0.209	0.246	0.272	0.253	0.320	0.283	0.283	0.318
1974	0.222	0.311	0.358	0.307	0.192	0.195	0.164	0.237	0.207	0.227	0.225	0.225	0.272
1975	0.141	0.345	0.528	0.293	0.180	0.141	0.132	0.120	0.205	0.198	0.175	0.175	0.297
1976	0.196	0.340	0.298	0.328	0.208	0.160	0.129	0.137	0.122	0.149	0.136	0.136	0.267
1977	0.146	0.281	0.376	0.382	0.344	0.259	0.179	0.130	0.246	0.156	0.178	0.178	0.328
1978	0.085	0.233	0.267	0.163	0.180	0.375	0.272	0.259	0.228	0.307	0.266	0.266	0.243
1979	0.037	0.180	0.283	0.251	0.261	0.310	0.338	0.490	0.329	0.172	0.333	0.333	0.257
1980	0.088	0.153	0.205	0.224	0.281	0.195	0.258	0.415	0.386	0.226	0.344	0.344	0.211
1981	0.014	0.227	0.194	0.447	0.533	0.512	0.383	0.394	0.412	0.471	0.429	0.429	0.382
1982	0.028	0.184	0.189	0.477	0.329	0.502	0.399	0.191	0.315	0.477	0.330	0.330	0.336
1983	0.070	0.103	0.366	0.419	0.486	0.552	0.736	0.221	0.275	0.711	0.405	0.405	0.385
1984	0.016	0.498	0.332	0.575	0.535	0.451	0.558	0.292	0.224	0.265	0.262	0.262	0.478
1985	0.063	0.236	0.507	0.276	0.579	0.314	0.305	0.243	0.232	0.415	0.298	0.298	0.382
1986	0.021	0.138	0.452	0.774	0.376	0.785	0.518	0.578	0.895	0.518	0.670	0.670	0.505
1987	0.037	0.138	0.423	0.570	0.476	0.372	0.599	0.321	0.503	0.141	0.324	0.324	0.396
1988	0.022	0.089	0.355	0.632	0.577	0.629	0.471	0.650	0.167	1.600	0.814	0.814	0.456
1989	0.018	0.203	0.228	0.492	0.366	0.511	0.384	0.184	0.489	0.086	0.254	0.254	0.360
1990	0.016	0.204	0.628	0.785	0.802	0.393	0.203	0.209	0.197	0.291	0.233	0.233	0.562
1991	0.047	0.415	0.768	0.877	0.801	0.659	0.691	0.758	0.905	0.416	0.700	0.700	0.704
1992	0.030	0.262	0.596	0.707	0.553	0.486	0.560	0.461	0.457	0.733	0.555	0.555	0.521
1993	0.063	0.206	0.547	0.601	0.515	0.390	0.482	0.457	0.377	0.481	0.441	0.441	0.452
1994	0.046	0.274	0.335	0.597	0.600	0.653	0.453	0.717	0.567	0.343	0.547	0.547	0.492
1995	0.011	0.089	0.411	0.408	0.684	0.625	0.781	0.575	0.579	0.605	0.591	0.591	0.443
1996	0.014	0.039	0.137	0.300	0.489	0.758	0.521	0.620	0.380	0.535	0.516	0.516	0.345
1997	0.011	0.048	0.115	0.324	0.500	0.538	0.577	0.595	0.502	0.551	0.815	0.815	0.305
1998	0.014	0.071	0.150	0.238	0.455	0.520	0.720	0.589	0.594	1.466	0.597	0.597	0.287
1999	0.006	0.073	0.181	0.303	0.492	0.628	0.624	0.723	0.364	1.809	1.298	1.298	0.336
2000	0.025	0.068	0.235	0.420	0.474	0.722	0.521	0.729	0.680	0.515	0.619	0.619	0.384
2001	0.014	0.100	0.294	0.635	0.769	0.718	1.001	1.215	1.006	0.712	2.035	2.035	0.503
2002	0.003	0.140	0.374	0.663	0.568	0.677	0.491	0.846	0.395	1.877	0.549	0.549	0.484
2003	0.006	0.032	0.279	0.464	0.699	0.601	0.489	0.705	0.525	1.260	0.829	0.829	0.415
2004	0.002	0.045	0.148	0.370	0.483	0.735	1.022	0.774	0.916	2.613	1.473	1.473	0.356
2005	0.007	0.079	0.309	0.478	0.585	0.358	0.903	0.304	0.687	0.414	0.622	0.622	0.362
2006	0.079	0.103	0.308	0.447	0.626	0.726	0.512	0.983	0.570	0.153	0.326	0.326	0.442
2007	0.045	0.254	0.352	0.455	0.409	0.582	0.756	0.728	0.879	0.389	0.164	0.164	0.410
2008	0.089	0.238	0.483	0.557	0.497	0.452	0.617	0.508	0.718	0.294	0.381	0.381	0.445
2009	0.014	0.193	0.746	0.491	0.698	0.578	0.760	0.786	0.760	0.402	0.110	0.110	0.541
2010	0.039	0.114	0.202	0.359	0.54	0.679	0.879	1.115	0.707	0.278	0.391	0.391	0.379

Table 6.3.4. Faroe saithe (Division Vb). Stock number at age (start of year) (Thousands)(1961-2010)

N	3	4	5	6	7	8	9	10	11	12	13	14+	TOTAL
1961	7827	7422	5158	3352	2114	1494	1233	905	468	180	53	431	30637
1962	12256	6243	5734	3786	2379	1535	1107	904	666	343	123	593	35669
1963	19837	9526	4621	4136	2652	1689	1138	789	638	481	254	182	45945
1964	14812	15686	7492	3476	3011	1804	1200	775	503	437	241	224	49661
1965	22363	11508	11116	4771	2287	1947	1093	821	498	322	283	240	57249
1966	21229	17408	8653	7555	3033	1411	1226	618	490	267	155	233	62279
1967	24898	16939	12859	5998	4660	1754	814	738	321	260	134	94	69468
1968	22879	19846	13149	9294	4194	2737	1008	470	432	175	145	317	74646
1969	39799	18176	14720	9755	6618	2938	1648	595	269	273	90	133	95016
1970	37092	31507	12994	9976	6708	4407	1872	825	271	116	133	109	106010
1971	38447	29061	19844	9229	6831	4678	2948	1247	457	144	52	131	113068
1972	33424	28892	20793	11194	6647	4843	3406	2118	873	284	69	120	112662
1973	23622	24910	22050	14682	6684	4058	2784	1868	1062	416	112	258	102506
1974	19421	17064	14737	11651	8873	3993	2696	1782	1165	675	247	525	82829
1975	17327	12730	10238	8436	7020	5997	2690	1874	1151	776	440	740	69419
1976	19709	12320	7381	4943	5152	4802	4264	1930	1361	768	521	1133	64283
1977	13106	13261	7176	4487	2916	3425	3352	3068	1378	986	542	816	54512
1978	8333	9274	8200	4035	2508	1693	2163	2293	2206	882	691	837	43115
1979	8686	6270	6016	5142	2808	1716	953	1350	1450	1438	531	1354	37712
1980	13074	6852	4289	3712	3276	1770	1030	557	677	854	991	1390	38472
1981	33145	9803	4816	2860	2430	2025	1192	652	301	377	558	2253	60412
1982	15673	26765	6394	3248	1498	1168	994	666	360	163	193	3113	60233
1983	40829	12481	18225	4335	1651	883	579	546	450	215	83	1368	81645
1984	26072	31181	9221	10350	2334	831	416	227	358	280	86	840	82197
1985	22325	21013	15515	5415	4770	1119	434	195	139	234	176	690	72026
1986	61844	17171	13594	7651	3364	2188	669	262	125	90	127	154	107239
1987	48592	49578	12251	7082	2889	1892	817	326	120	42	44	322	123955
1988	44829	38353	35349	6568	3278	1470	1067	368	194	60	30	4	131569
1989	28597	35920	28731	20296	2858	1508	641	546	157	134	10	132	119530
1990	20707	23006	23997	18728	10160	1623	740	358	372	79	101	222	100090
1991	24968	16687	15367	10490	6991	3731	897	495	238	250	48	41	80203
1992	19537	19510	9025	5839	3572	2569	1579	368	190	79	135	49	62451
1993	23777	15524	12294	4071	2356	1682	1294	739	190	98	31	25	62081
1994	16870	18276	10347	5823	1826	1153	932	654	383	107	50	5	56427
1995	38967	13188	11379	6062	2624	820	491	485	261	178	62	47	74566
1996	24276	31544	9875	6179	3302	1084	360	184	224	120	80	22	77248
1997	33434	19607	24842	7048	3747	1657	416	175	81	125	57	45	91236
1998	12743	27062	15300	18131	4172	1860	792	191	79	40	59	51	80481
1999	58764	10285	20628	10777	11700	2168	905	316	87	36	8	55	115728
2000	35712	47821	7828	14088	6515	5858	947	397	125	49	5	12	119357
2001	88037	28505	36591	5066	7581	3320	2330	460	157	52	24	16	172140
2002	105756	71061	21119	22324	2198	2877	1325	701	112	47	21	3	227544
2003	61960	86313	50580	11896	9423	1020	1197	664	246	62	6	0	223367
2004	52541	50430	68466	31320	6126	3836	458	601	269	119	14	3	214183
2005	70116	42948	39469	48324	17715	3093	1505	135	227	88	7	0	223628
2006	21609	56995	32494	23728	24533	8078	1769	500	81	94	48	20	169948
2007	20723	16353	42085	19543	12428	10741	3201	868	153	38	66	22	126221
2008	62346	16216	10389	24239	10150	6757	4913	1231	343	52	21	0	136657
2009	36461	46716	10464	5250	11367	5058	3521	2170	606	137	32	11	121792
2010	66252	29436	31541	4063	2632	4631	2323	1348	809	232	75	0	143343

Table 6.3.5. Faroe saithe (Division Vb). Summary table.

year	Rec	TB	SSB	Land	y_SSB	Fbar
1961	7.827	105.008	70.79	9.592	0.13	0.106
1962	12.256	111.502	75.429	10.454	0.15	0.125
1963	19.837	129.76	79.695	12.693	0.17	0.114
1964	14.811	139.22	84.41	21.893	0.26	0.23
1965	22.362	150.301	88.791	22.181	0.27	0.214
1966	21.229	162.608	91.896	25.563	0.28	0.25
1967	24.897	161.577	90.155	21.319	0.23	0.204
1968	22.879	170.303	98.678	20.387	0.2	0.16
1969	39.798	197.297	109.307	27.437	0.26	0.191
1970	37.091	212.237	115.753	29.11	0.26	0.189
1971	38.446	218.37	127.847	32.706	0.23	0.179
1972	33.424	234.817	143.985	42.663	0.3	0.236
1973	23.621	210.055	135.846	57.431	0.42	0.318
1974	19.42	205.555	138.756	47.188	0.34	0.272
1975	17.327	189.791	139.158	41.576	0.3	0.297
1976	19.709	181.584	132.334	33.065	0.25	0.267
1977	13.105	168.852	125.021	34.835	0.27	0.328
1978	8.332	150.477	108.075	28.138	0.26	0.243
1979	8.686	127.854	98.253	27.246	0.27	0.257
1980	13.074	134.894	98.767	25.23	0.26	0.211
1981	33.144	153.817	88.915	30.103	0.35	0.382
1982	15.672	165.585	98.097	30.964	0.33	0.336
1983	40.828	187.652	83.312	39.176	0.47	0.385
1984	26.071	198.251	122.885	54.665	0.45	0.478
1985	22.325	192.645	97.123	44.605	0.49	0.382
1986	61.844	237.957	118.112	41.716	0.37	0.505
1987	48.591	254.12	89.204	40.02	0.47	0.396
1988	44.829	261.697	101.595	45.285	0.45	0.456
1989	28.597	231.141	111.412	44.477	0.41	0.36
1990	20.706	193.626	94.392	61.628	0.67	0.562
1991	24.968	151.252	77.392	54.858	0.71	0.704
1992	19.536	124.964	54.709	36.487	0.63	0.521
1993	23.777	134.247	66.273	33.543	0.5	0.452
1994	16.87	128.256	62.941	33.182	0.51	0.492
1995	38.967	153.945	66.096	27.209	0.4	0.443
1996	24.276	163.22	64.746	20.029	0.3	0.345
1997	33.433	182.298	68.379	22.306	0.33	0.305
1998	12.742	166.101	57.322	26.421	0.45	0.287
1999	58.764	213.641	76.798	33.207	0.42	0.336
2000	35.712	226.719	90.288	39.02	0.43	0.384
2001	88.036	291.288	87.357	51.786	0.59	0.503
2002	105.756	331.379	83.901	53.546	0.64	0.484
2003	61.96	326.604	113.459	46.555	0.41	0.415
2004	52.54	317.874	75.641	46.355	0.61	0.356
2005	70.116	332.762	133.778	67.997	0.51	0.362
2006	21.608	263.729	131.705	67.103	0.51	0.442
2007	20.723	213.683	112.859	60.716	0.54	0.41
2008	62.346	219.938	116.186	57.043	0.49	0.445
2009	36.46	207.181	88.92	57.95	0.64	0.541
2010	66.251	268.472	110.606	43.959	0.39	0.379
2011	**42680**	**246378**	**110529**	**55976**	**0.51**	**0.46**
2012	**42680**	**243006**	**106853**	**60459**	**0.57**	**0.46**
2013	**42680**	**229251**	**103054**			

Table 6.6.1.1. Faroe saithe (Division Vb). Input data for prediction with management options.

2011								
Age	**N**	**M**	**Mat**	**PF**	**PM**	**SWt**	**Sel**	**CWt**
3	42680	0.2	0.06	0	0	1.340	0.047	1.340
4	52171	0.2	0.22	0	0	1.354	0.182	1.354
5	21502	0.2	0.56	0	0	1.950	0.477	1.950
6	21102	0.2	0.84	0	0	2.394	0.469	2.394
7	2324	0.2	0.96	0	0	2.959	0.578	2.959
8	1255	0.2	0.98	0	0	3.166	0.570	3.166
9	1922	0.2	0.99	0	0	3.760	0.752	3.760
10	790	0.2	1.00	0	0	4.291	0.803	4.291
11	362	0.2	1.00	0	0	5.083	0.728	5.083
12	327	0.2	1.00	0	0	4.941	0.325	4.941
13	144	0.2	1.00	0	0	5.305	0.294	5.305
14	42	0.2	1.00	0	0	10.000	0.294	10.000
2012								
Age	**N**	**M**	**Mat**	**PF**	**PM**	**SWt**	**Sel**	**CWt**
3	42680	0.2	0.05	0	0	1.340	0.047186	1.340
4	-	0.2	0.18	0	0	1.354	0.181641	1.354
5	-	0.2	0.48	0	0	1.950	0.476818	1.950
6	-	0.2	0.77	0	0	2.394	0.468852	2.394
7	-	0.2	0.92	0	0	2.959	0.578247	2.959
8	-	0.2	0.97	0	0	3.166	0.56972	3.166
9	-	0.2	0.99	0	0	3.760	0.752013	3.760
10	-	0.2	1.00	0	0	4.291	0.803402	4.291
11	-	0.2	1.00	0	0	5.083	0.728213	5.083
12	-	0.2	1.00	0	0	4.941	0.324721	4.941
13	-	0.2	1.00	0	0	5.305	0.294294	5.305
14	-	0.2	1.00	0	0	10.000	0.294294	10.000
2013								
Age	**N**	**M**	**Mat**	**PF**	**PM**	**SWt**	**Sel**	**CWt**
3	42680	0.2	0.05	0	0	1.340	0.047	1.340
4	-	0.2	0.18	0	0	1.354	0.182	1.354
5	-	0.2	0.48	0	0	1.950	0.477	1.950
6	-	0.2	0.77	0	0	2.394	0.469	2.394
7	-	0.2	0.92	0	0	2.959	0.578	2.959
8	-	0.2	0.97	0	0	3.166	0.570	3.166
9	-	0.2	0.99	0	0	3.760	0.752	3.760
10	-	0.2	1.00	0	0	4.291	0.803	4.291
11	-	0.2	1.00	0	0	5.083	0.728	5.083
12	-	0.2	1.00	0	0	4.941	0.325	4.941
13	-	0.2	1.00	0	0	5.305	0.294	5.305
14	-	0.2	1.00	0	0	10.000	0.294	10.000
Input units are thousands and kg - output in tonnes								

Table 6.6.2.1. Faroe saithe (Division Vb). Prediction with management option.

2011						
Biomass	**SSB**	**FMult**	**FBar**	**Landings**		
246378	110529	1.000	0.455	55976		
2012					**2013**	
Biomass	**SSB**	**FMult**	**FBar**	**Landings**	**Biomass**	**SSB**
243006	106853	0.0000	0.0000	0	294538	154690
.	106853	0.1000	0.0455	7332	286582	148309
.	106853	0.2000	0.0910	14337	278988	142237
.	106853	0.3000	0.1365	21032	271736	136459
.	106853	0.4000	0.1820	27431	264811	130959
.	106853	0.5000	0.2275	33551	258195	125723
.	106853	0.6000	0.2730	39403	251874	120737
.	106853	0.7000	0.3185	45002	245832	115989
.	106853	0.8000	0.3640	50360	240056	111467
.	106853	0.9000	0.4096	55489	234533	107159
.	106853	1.0000	0.4551	60400	229251	103054
.	106853	1.1000	0.5006	65104	224196	99141
.	106853	1.2000	0.5461	69610	219360	95412
.	106853	1.3000	0.5916	73928	214730	91857
.	106853	1.4000	0.6371	78068	210296	88467
.	106853	1.5000	0.6826	82037	206050	85234
.	106853	1.6000	0.7281	85845	201983	82150
.	106853	1.7000	0.7736	89498	198084	79208
.	106853	1.8000	0.8191	93005	194348	76400
.	106853	1.9000	0.8646	96371	190765	73720
.	106853	2.0000	0.9101	99604	187328	71161
Input units are thousands and kg - output in tonnes						

Table 6.7.1.1. Faroe saithe (Division Vb). Yield per recruit input data.

MFYPR version 2a								
Run: run1								
Index file 2/5/2009								
Time and date: 13:00 21/04/2011								
Fbar age range: 3-14								
	Age	**M**	**Mat**	**PF**	**PM**	**SWt**	**Sel**	**CWt**
	3	0.2	0.060	0	0	1.171	0.024	1.321
	4	0.2	0.191	0	0	1.501	0.106	1.684
	5	0.2	0.463	0	0	1.910	0.288	2.041
	6	0.2	0.727	0	0	2.259	0.434	2.596
	7	0.2	0.879	0	0	2.723	0.552	3.345
	8	0.2	0.949	0	0	3.153	0.618	4.262
	9	0.2	0.980	0	0	3.569	0.693	5.082
	10	0.2	1.000	0	0	4.035	0.748	5.929
	11	0.2	1.000	0	0	4.955	0.646	6.899
	12	0.2	1.000	0	0	5.614	0.885	7.611
	13	0.2	1.000	0	0	6.021	0.715	7.920
	14	0.2	1.000	0	0	6.337	0.715	8.493
Weights in kilograms								

Table 6.7.1.2. Faroe saithe (Division Vb). Yield per recruit, summary table.

MFYPR version 2a									
Run: run2									
Time and date: 09:20 22/04/2011									
Yield per results									
FMult	Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJ	SSBJan	SpwnNosS	SSBSpwn
0	0	0	0	5.5167	20.4708	3.3247	16.6962	3.3247	16.6962
0.1	0.0444	0.1492	0.589	4.7736	15.5322	2.6128	11.8426	2.6128	11.8426
0.2	0.0887	0.2501	0.9097	4.2723	12.4218	2.1404	8.8102	2.1404	8.8102
0.3	0.1331	0.3218	1.0869	3.9167	10.3744	1.812	6.8344	1.812	6.8344
0.4	0.1774	0.3751	1.1855	3.6529	8.9691	1.5737	5.4952	1.5737	5.4952
0.5	0.2218	0.4163	1.2402	3.4495	7.966	1.3941	4.5533	1.3941	4.5533
0.6	0.2661	0.4493	1.2702	3.2872	7.2233	1.2544	3.8675	1.2544	3.8675
0.7	0.3105	0.4764	1.2859	3.154	6.655	1.1426	3.3521	1.1426	3.3521
0.8	0.3548	0.4992	1.2934	3.0422	6.2071	1.0509	2.9537	1.0509	2.9537
0.9	0.3992	0.5188	1.2963	2.9464	5.8449	0.9743	2.638	0.9743	2.638
1	0.4436	0.5358	1.2966	2.8632	5.5456	0.9093	2.3823	0.9093	2.3823
1.1	0.4879	0.5509	1.2954	2.7897	5.2936	0.8532	2.1713	0.8532	2.1713
1.2	0.5323	0.5644	1.2934	2.7243	5.078	0.8044	1.9945	0.8044	1.9945
1.3	0.5766	0.5765	1.291	2.6655	4.891	0.7615	1.8442	0.7615	1.8442
1.4	0.621	0.5875	1.2886	2.6122	4.7271	0.7234	1.715	0.7234	1.715
1.5	0.6653	0.5975	1.2861	2.5636	4.5819	0.6894	1.6029	0.6894	1.6029
1.6	0.7097	0.6068	1.2838	2.519	4.4522	0.6588	1.5046	0.6588	1.5046
1.7	0.7541	0.6153	1.2816	2.4779	4.3355	0.6311	1.4179	0.6311	1.4179
1.8	0.7984	0.6232	1.2795	2.4398	4.2298	0.606	1.3409	0.606	1.3409
1.9	0.8428	0.6306	1.2776	2.4044	4.1336	0.5831	1.2721	0.5831	1.2721
2	0.8871	0.6375	1.2759	2.3713	4.0455	0.5621	1.2102	0.5621	1.2102

Reference	F multiplie	Absolute F
Fbar(4-8)	1	0.4436
FMax	0.9606	0.4261
F0.1	0.3853	0.1709
F35%SPR	0.3703	0.1642
Flow	0.2643	0.1172
Fmed	0.6873	0.3049
Fhigh	1.7478	0.7753

Weights in kilograms

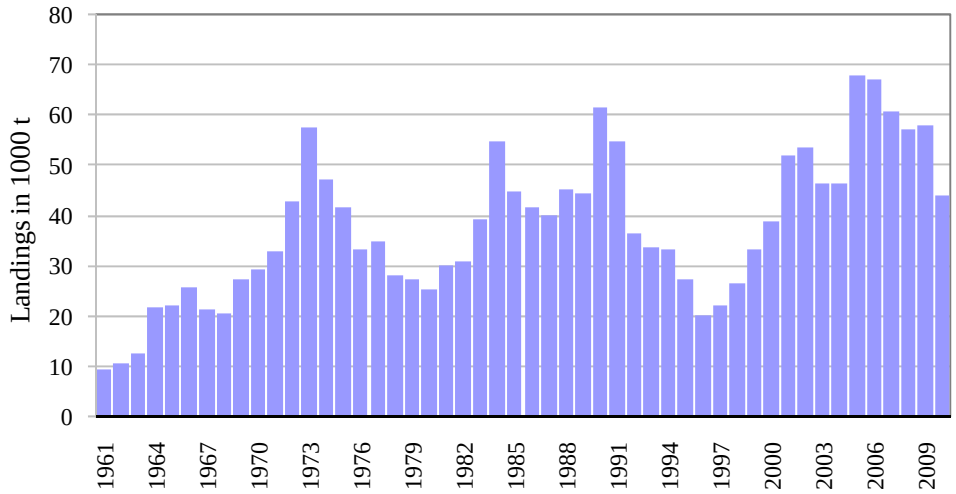

Figure 6.2.1.1. Faroe saithe (Division Vb). Landings in 1000 tonnes.

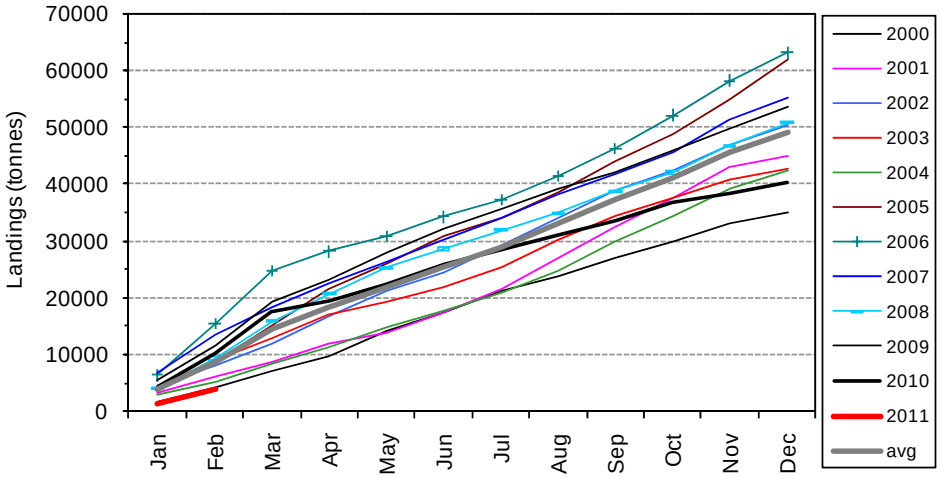

Figure 6.2.1.2. Saithe in the Faroes (Division Vb). Cumulative Faroese landings.

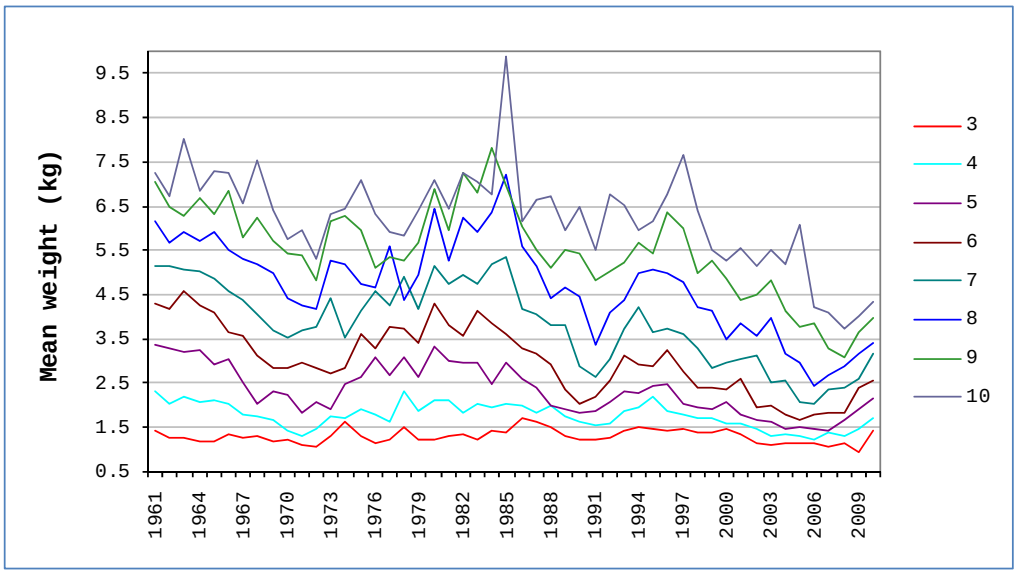

Figure 6.2.3.1. Faroe saithe (Division Vb). Mean weight at age (kg) in commercial catches (ages 3-10) (1961-2010)

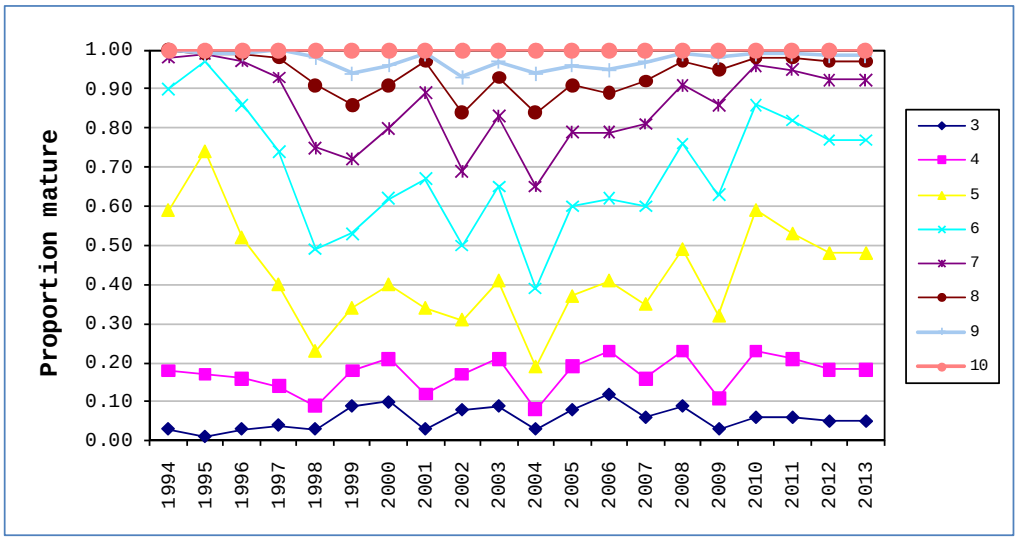

Figure 6.2.4.1. Faroe saithe (Division Vb). Proportion mature at age (ages 3-10) from the spring survey for period 1994-2011. 2012-2013 values are predicted.

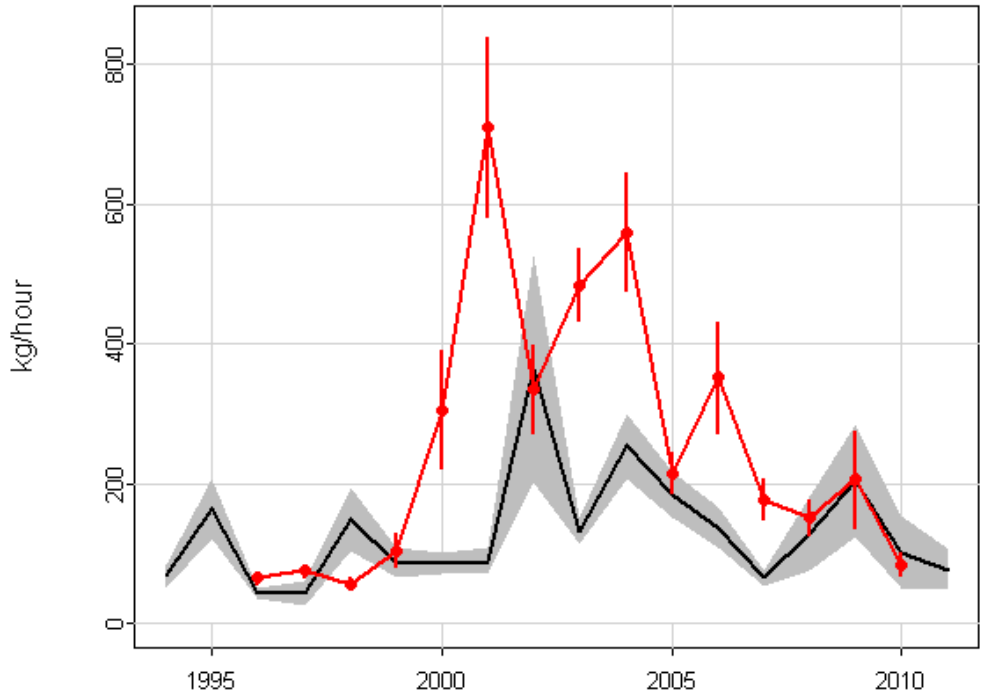

Figure 6.2.5.1.1. Faroe saithe (Division Vb). Catch rates (kg/hour) from the faroese bottom-trawl spring (1994-2011) and summer survey (1996-2010)

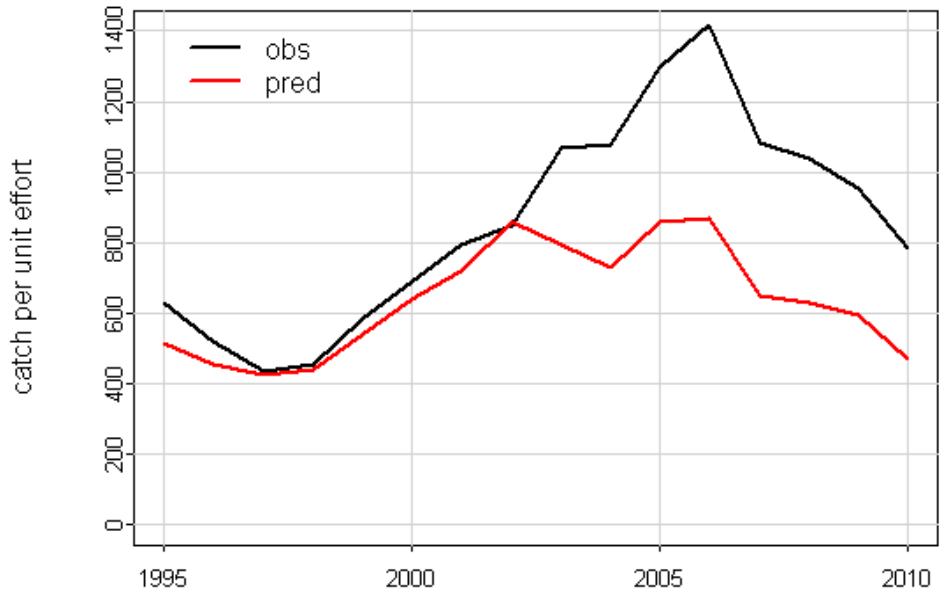

Figure 6.2.5.2.1 Faroe saithe (Division Vb). Observed (black line) and predicted (red line) catch rates (kg per hour) for the commercial fleet (pairtrawlers) used for tunning the assessment (1995-2010)

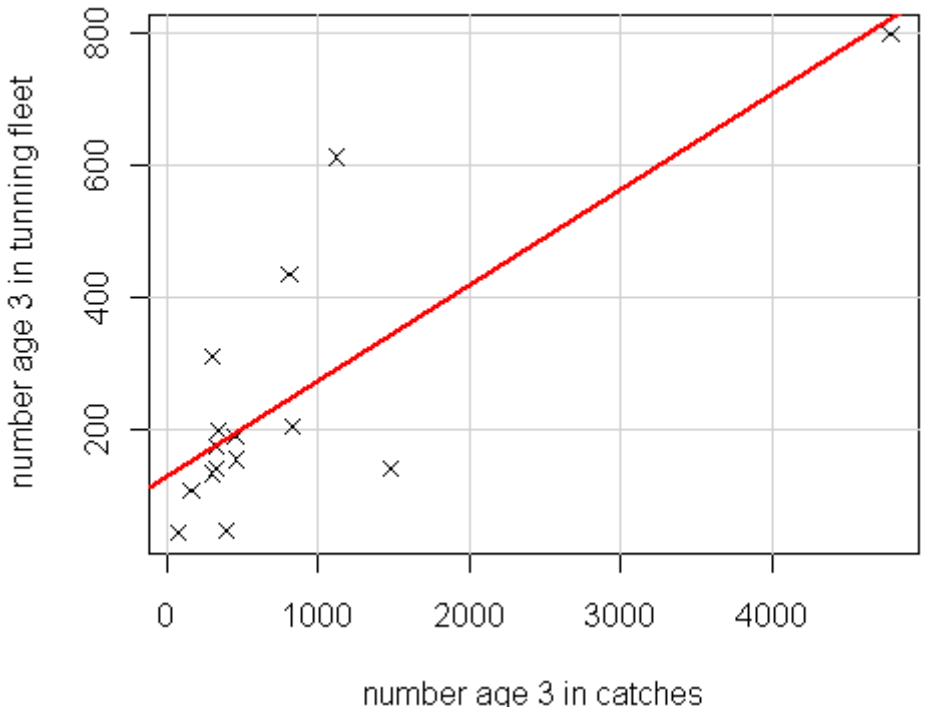

Figure 6.3.1. Relation between number of 3-year old saithe in the commercial catch and in the tunning fleet.

Figure 6.3 2. Faroe saithe (Division Vb). Log-catchability residuals for age groups 3 –11 from the un-adjusted (upper figure) and adjusted (lower figure) XSA model.

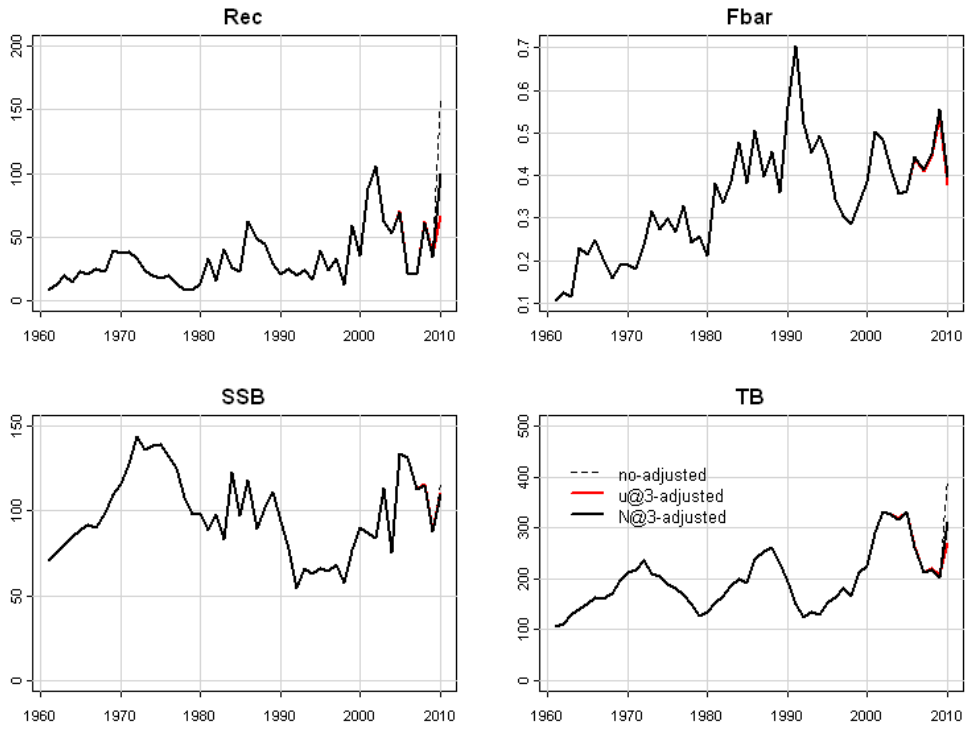

Figure 6.3.2. Faroe saithe (Division Vb). Comparison of the XSA models using the recruitment-based adjustment (black solid line), the catch-based adjustment (red solid line) and the un-adjusted spaly run.

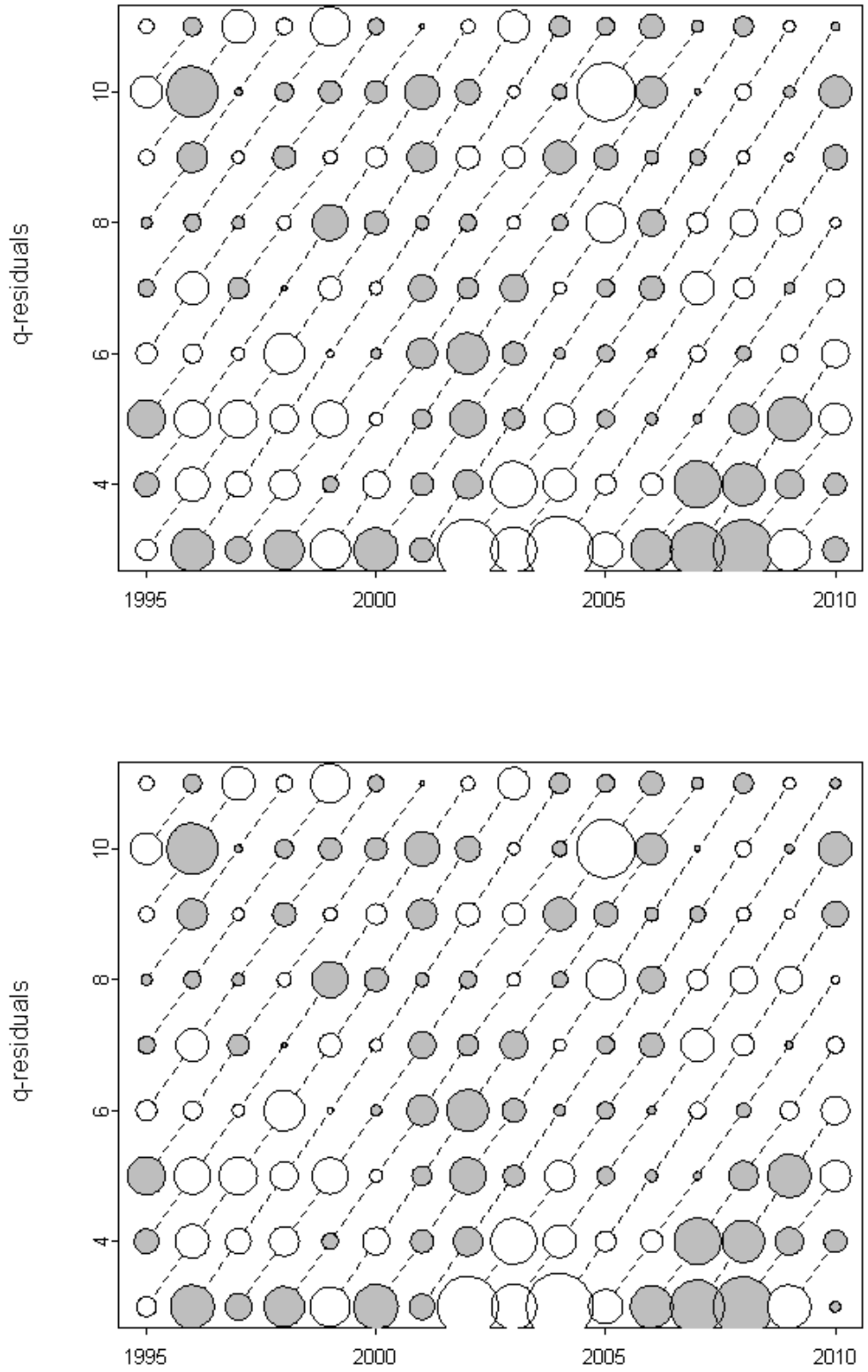

Figure 6.3.3. Faroe saithe (Division Vb). Log-catchability residuals for age groups 3 –11 from the un-adjusted (upper figure) and adjusted (lower figure) XSA model.

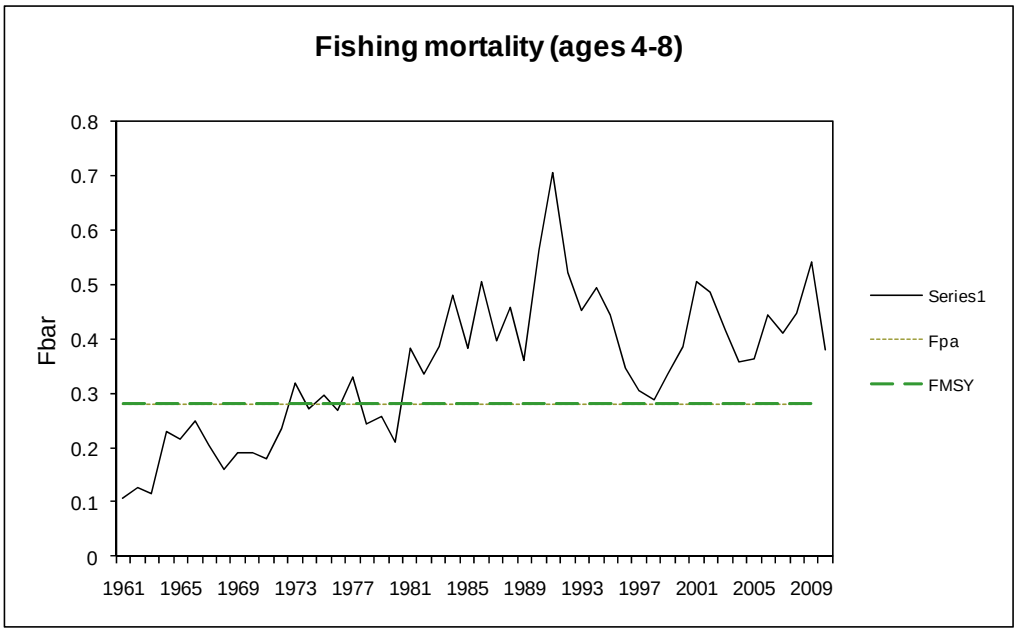

Figure 6.3.4. Faroe saithe (Division Vb). Fishing mortality (average F ages 4-8)(1961-2010.

Figure 6.3.5. Faroe saithe (Division Vb). Recruitment at age 3 (millions)(1961-2010).

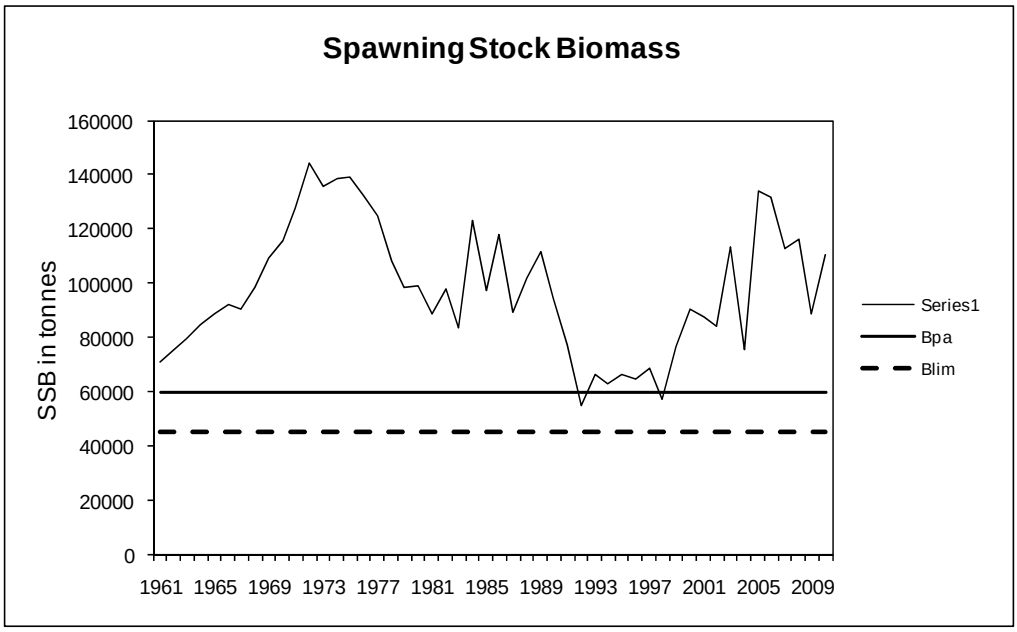

Figure 6.3.6. Faroe saithe (Division Vb). Spawning stock biomass (tonnes)(1961-2010).

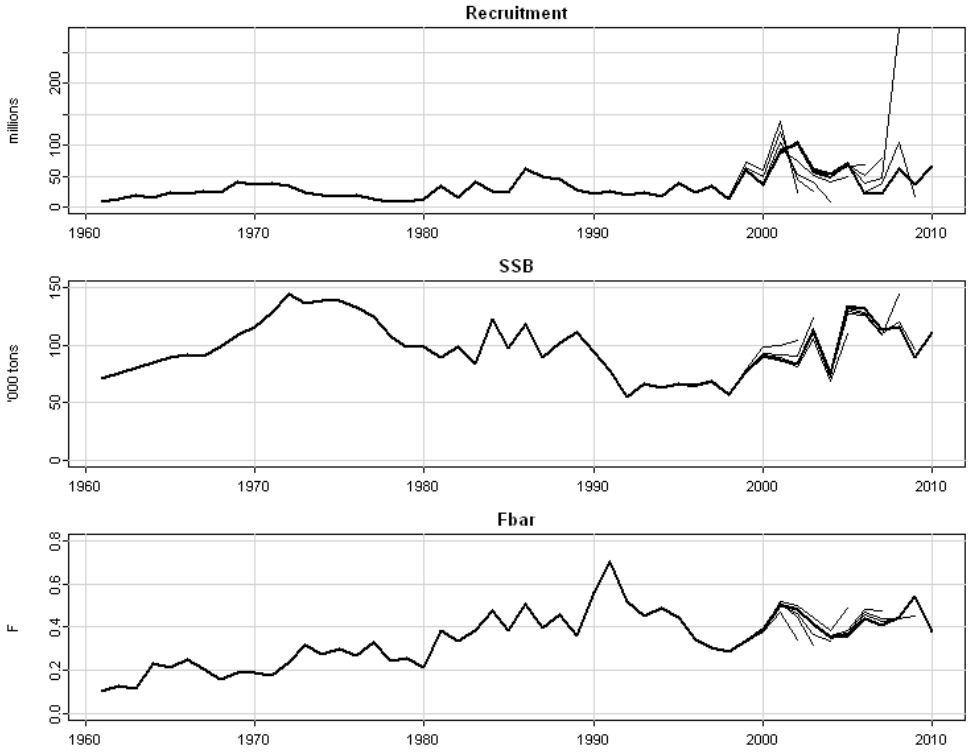

Figure 6.3.7. Faroe saithe (Division Vb). Retrospective analysis of recruitment at age 3, spawning stock biomass and average fishing mortality over age groups 4-8 from the 2011 adopted assessment.

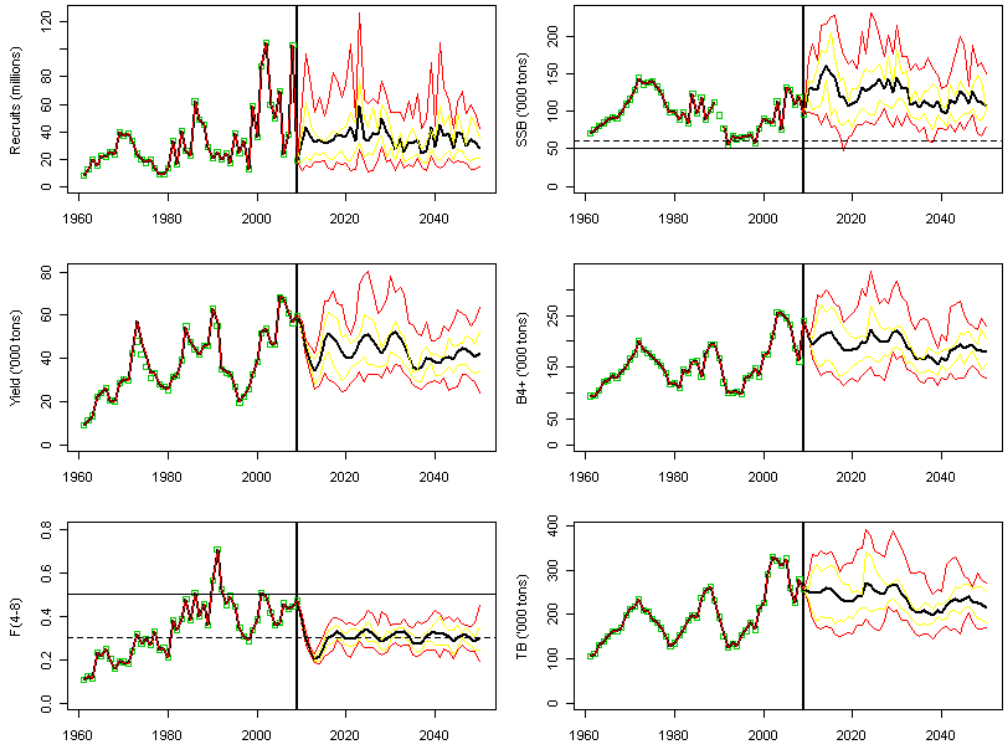

Figure 6.4.1.1. Faroe saithe (Division Vb). Resulsts of the simulations carried out at 2011 assessment. Recruitment (top-left), Yield (middle-left), Fbar (bottom-left), SSB (top-right), B4+ biomass (middle-right) and total biomass (bottom-right)

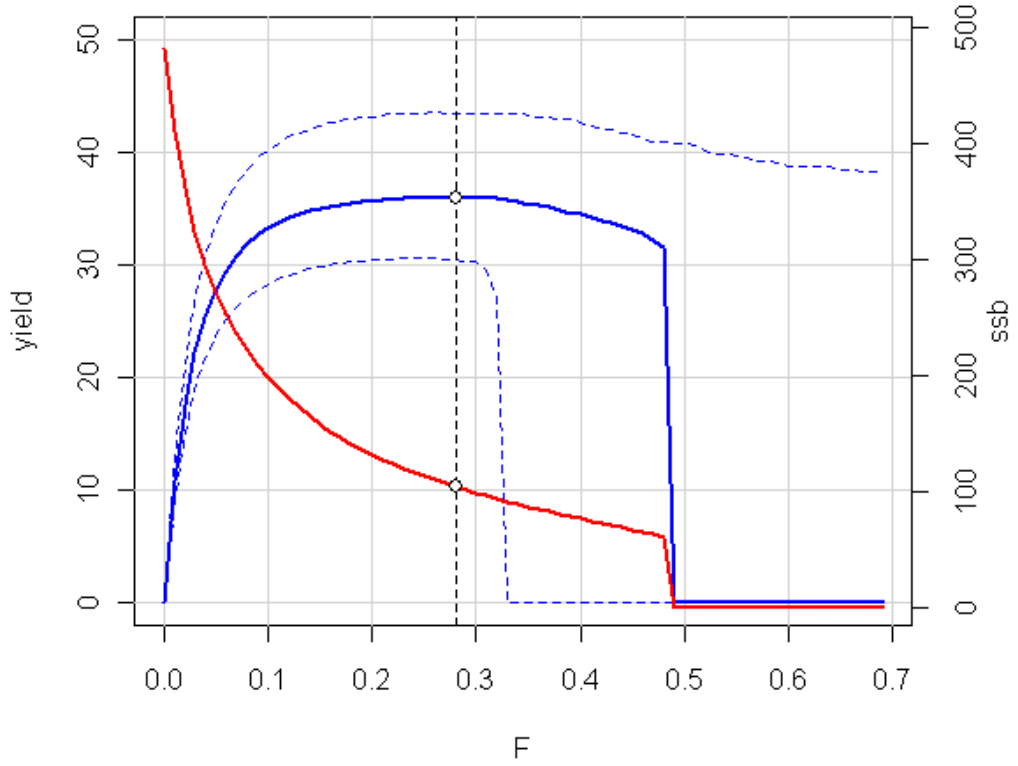

Figure 6.4.1.2. Faroe saithe (Division Vb). Yield and spawning per-recruit from the simulations. Dotted-lines show the uncertainty associated with the curve. Fmsy=0.28, Ymsy=36 kt. and SSBmsy=104 kt.

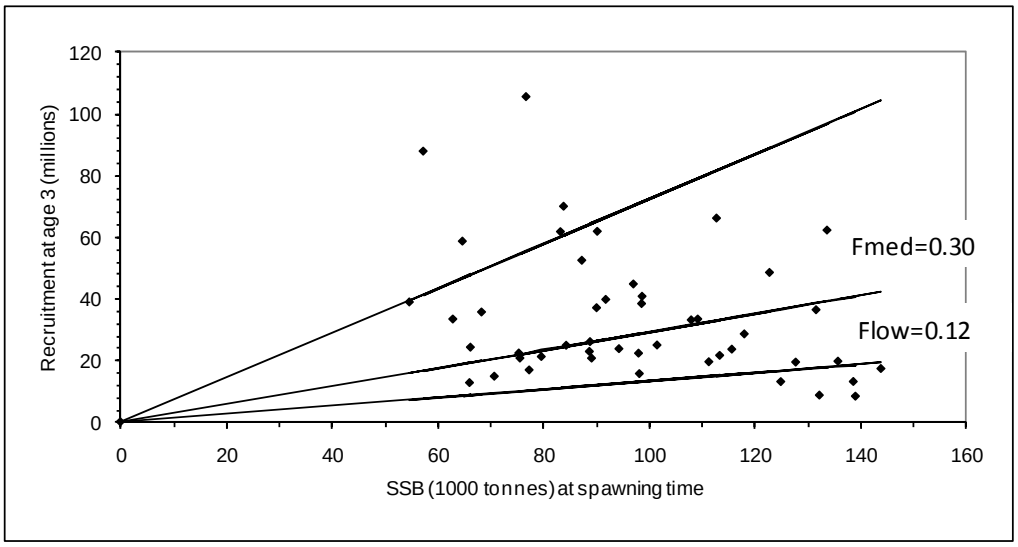

Figure 6.5.1.2. Faroe saithe(Division Vb). Stock-Recruitment ploton relation to Flow,Fmed and Fhigh.

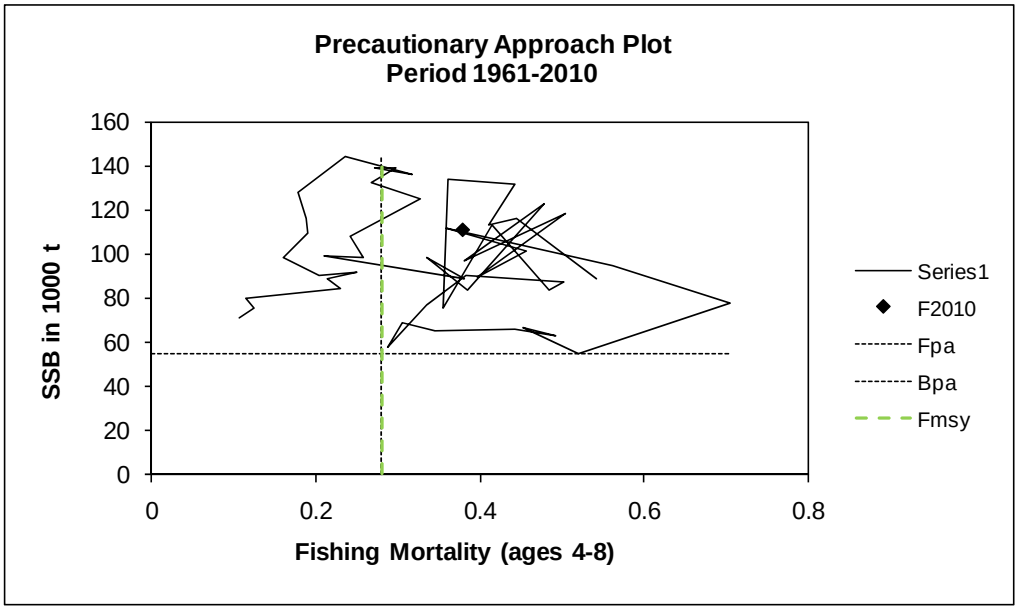

Figure 6.5.1.4. Faroe saithe(Division Vb). Precautionary approach plot, period 1961-2008. The history of the stock/fishery in relation to the four reference points.

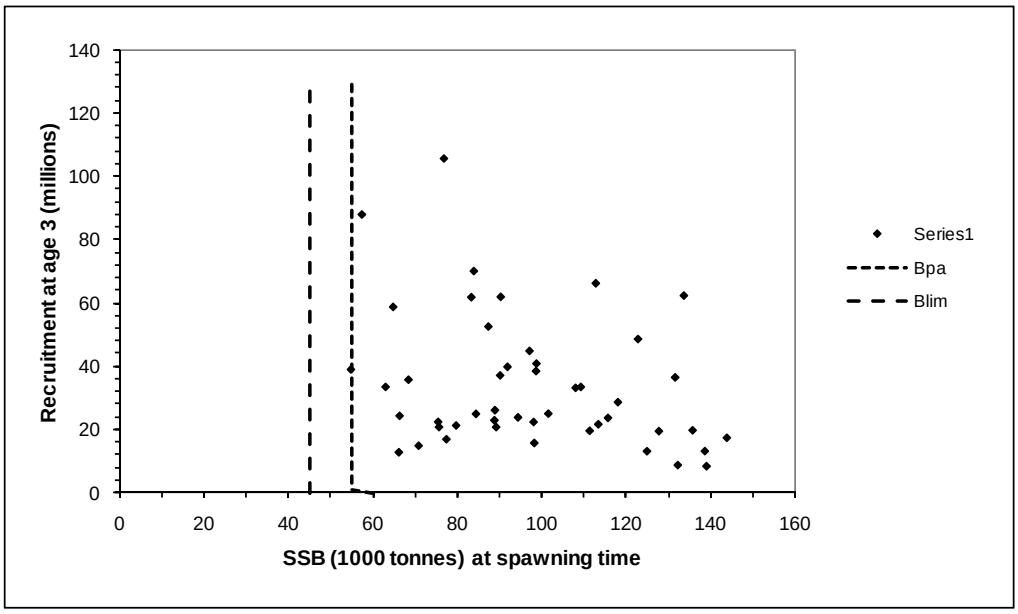

Figure 6.5.2. Faroe saithe (Division Vb). Stock-Recruitment plot.

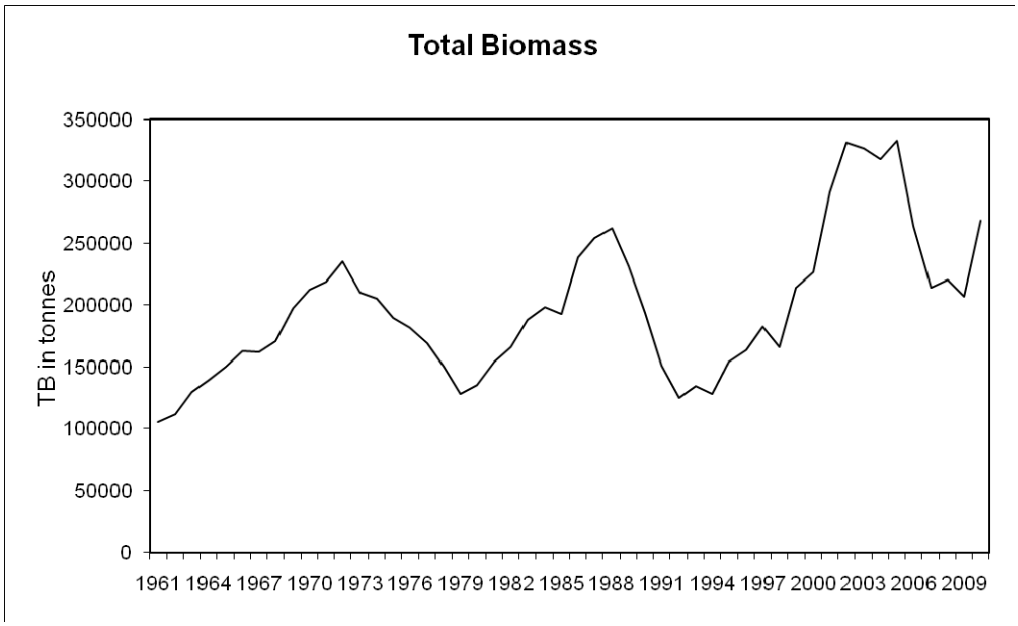

Figure 6.5.3. Faroe saithe (Division Vb). Total biomass (tonnes)(1961-2010)

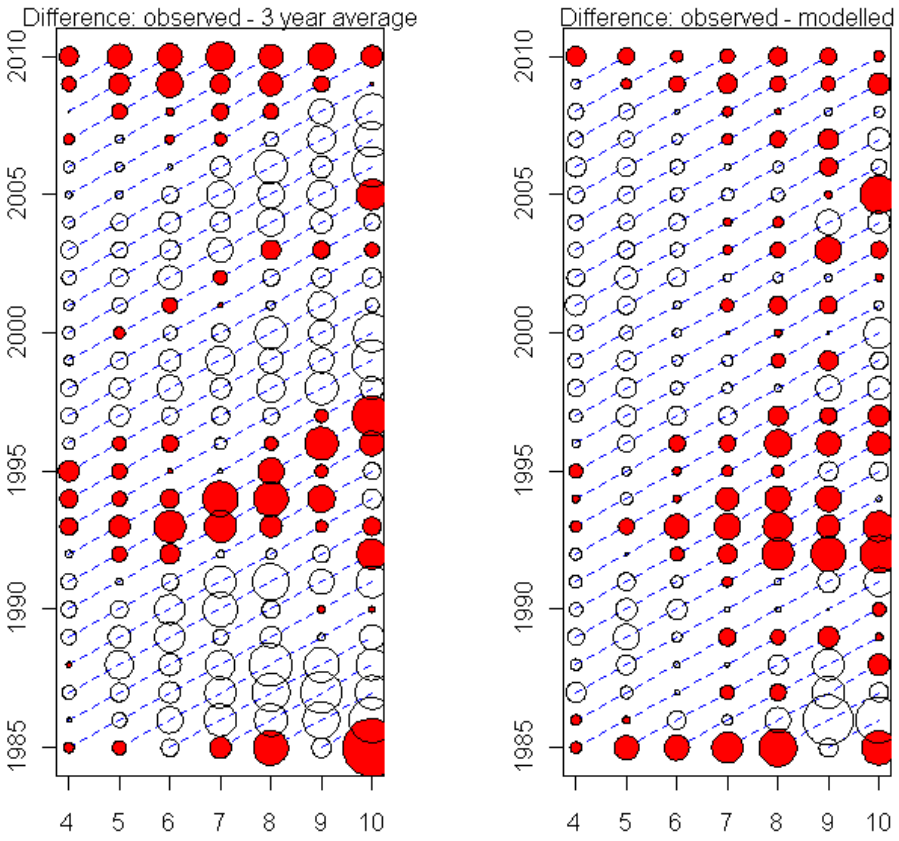

Figure 6.6.1.1 Faroe saithe (Division Vb). Residual plots from a 3-year average weight model and the predicted weight from previous year in the same year class model.

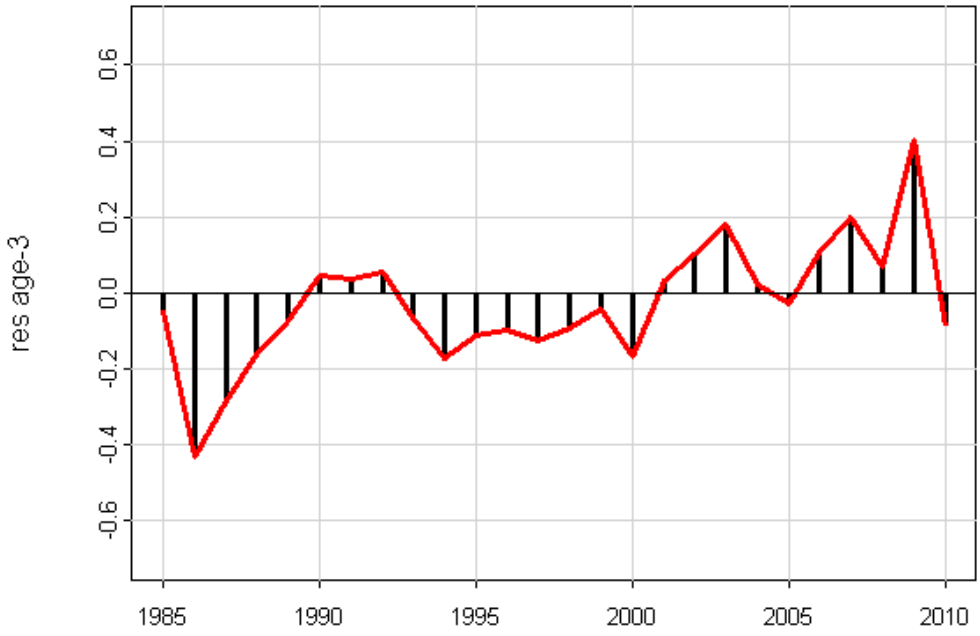

Figure 6.6.1.2 Faroe saithe (Division Vb). Residual plot for the model predicting weights for age 3 by year class strength 3 years before (used in short term prediction)

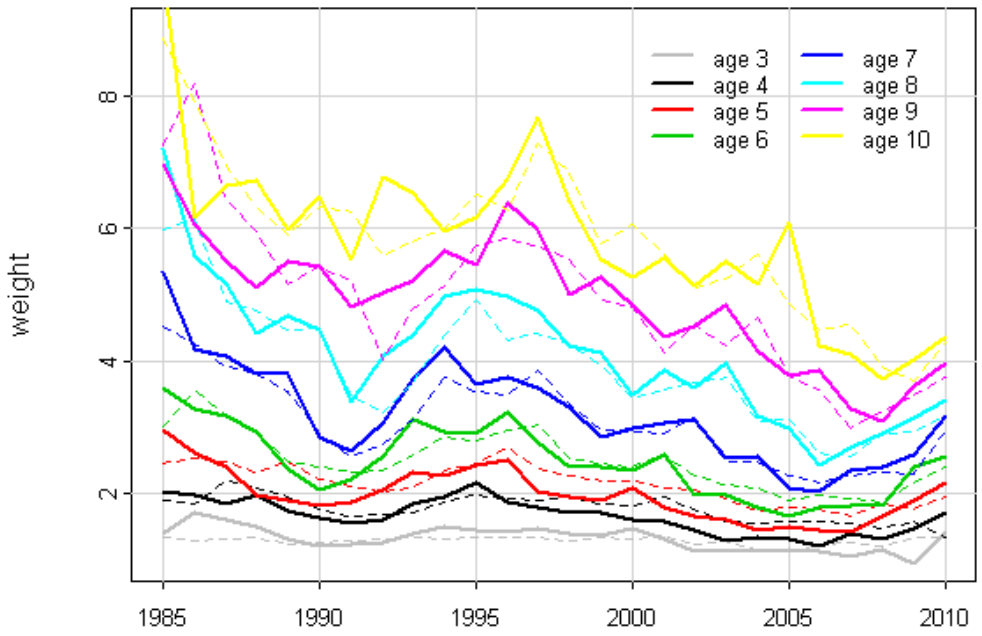

Figure 6.6.1.3. Faroe saithe (Division Vb). Observed and predicted weights-at-age for models used in the short term projection

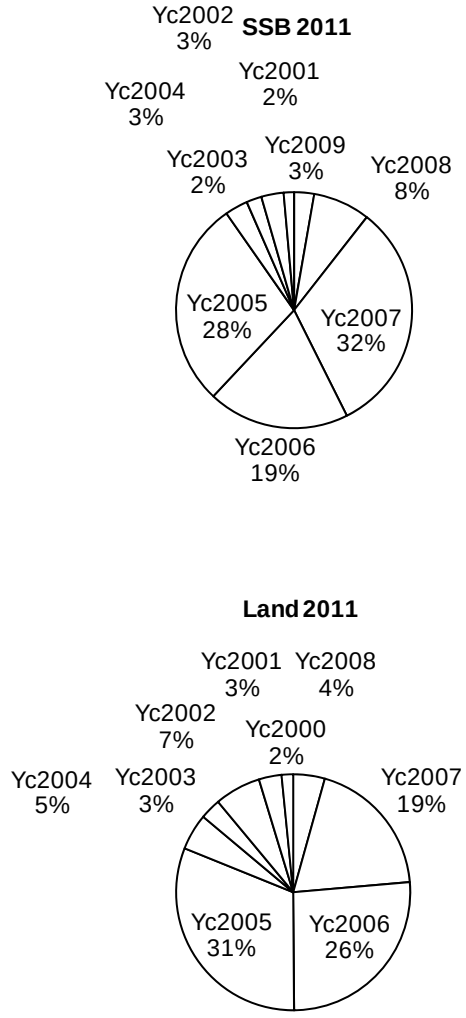

Figure 6.6.2.1. Faroe saithe (Division Vb). Projected composition in landings (upper figure) and SSB (lower figure) by year classes in 2011.

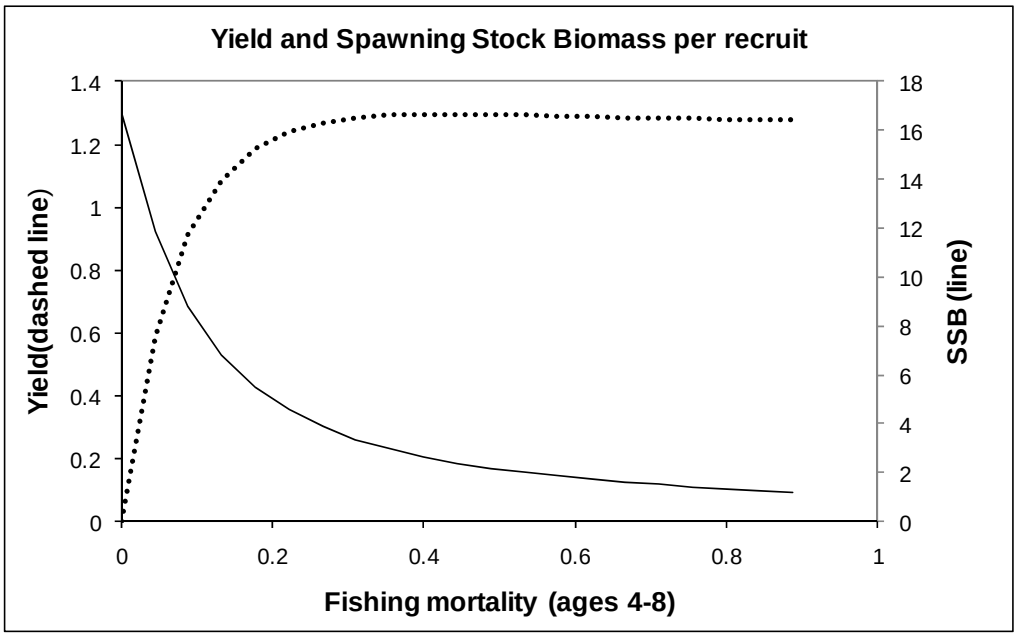

Figure 6.7.1.1. Faroe saithe (Division Vb). Yield- and spawning per recruit analysis.

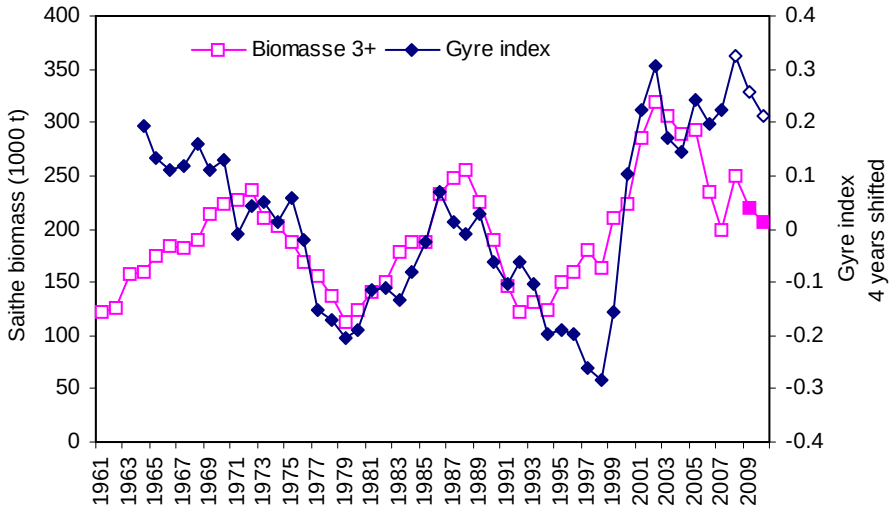

Figure 6.15.1. Faroe saithe (Division Vb). Relationship between the Gyre index (4 years shifted) and saithe biomasse (age 3+) in Faroese waters.

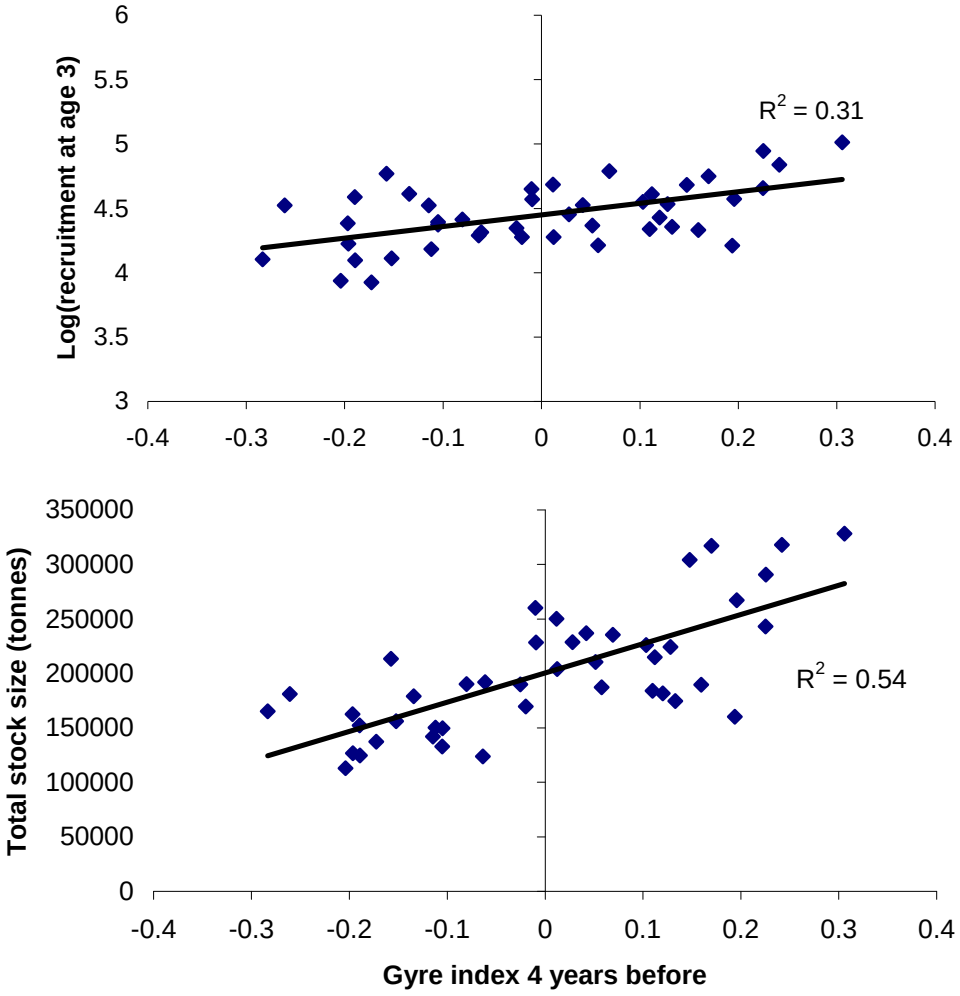

Figure 6.15.2. Relationship between the gyre index and both recruitment (top figure) and total stock biomass estimates (bottom figure.) Note that a large gyre index indicates a small subpolar gyre, and, consequently, a large influx of plankton-rich warmer-than-average water to the outer areas (bottom depth > 150 m) around the Faroes, where saithe typically are found.