Skjal 1.

Report of the North-Western Working Group (NWWG) 2015. ICES C.M. 2015/ACOM:07

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

2.1 Overview Fisheries

The main fisheries in Faroese waters are mixed-species, demersal fisheries and single species pelagic fisheries (Figure 2.1). The demersal fisheries are mainly conducted by Faroese vessels, whereas the pelagic fisheries are conducted both by Faroese vessels and by foreign vessels licensed through bilateral and multilateral fisheries agreements. The usual picture changed in 2011, however, since no mutual agreement could be reached between the Faroe Islands and the EU and Norway, respectively, due to the dispute regarding the share of mackerel. From 2013, the agreement has been re-established.

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 conducted by purse seiners, larger purse seiners also equipped for pelagic trawling and trawlers otherwise performing demersal fisheries. 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 number of licenses can be found in Table 2.3. The grouping of the vessels under the management scheme can be seen in section 2.1.3.

2.1.1 Fisheries and management measures

The fishery around the Faroe Islands has for centuries been 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) of the catches; after 1—2 weeks, sometimes longer, 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 especially cod and haddock but also 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.

The individual transferable effort quotas apply 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). The single trawlers greater than 400 HP were in 2011 included into the fishing days system and were allocated a number of fishing days (Tables 1 and 2). They are not allowed to fish within the 12 nautical mile limit and the areas closed to them, as well as to the pair trawlers, have increased in area and time. Their catch of cod and haddock was before 2011 limited by maximum by-catch allocation. This fleet has now started to pair-trawl, and since the fiscal year 2011/12, merged with the pair-trawlers group. 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 shows the allocated number of fishing days by fleet group since the fiscal year 1996/1997 and in Table 2.2 is a comparison between number of allocated days and number of actually used fishing days. From Table 1 it can been seen that since 1996/1997, the number of days allocated has been reduced considerable and is now 50% of the originally allocated days. Despite this, there still are many unused days in the system (Table 2.2).

Holders of individual transferable effort quotas who fish outside the thick line on Figure 2.2 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 110 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 except for a minor jigging fishery during summer time.

The fleet segmentation used to regulate the demersal fisheries in the Faroe Islands and the regulations applied are summarized in Table 2.3.

The effort quotas are transferable within gear categories. The allocations of number of fishing days by fleet categories was made such that together with other regulations of the fishery they should result in average fishing mortalities on each of the 3 stocks of 0.45, corresponding to average annual catches of 33% of the exploitable stocks in numbers. Built into the system is also an assumption that the day system is self-regulatory, because the fishery will move between stocks according to the relative availability of each of them and no stock will be overexploited. These target fishing mortalities have been evaluated during the 2005 and 2006 NWWG meetings. 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.

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. An additional measure to reduce the fishing mortality on cod and haddock and to especially reduce the mortality on the youngest age groups has been introduced (See the 2013 NWWG report) in July 2011, but was terminated in August 2013.

2.1.2 The marine environment and potential indicators

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 there 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. Since then, there have been several periods with high or low productivity, which has been reflected in the fish landings a couple of years afterwards.

There has been observed a 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). There is a positive relationship between primary production and the cod and haddock individual fish growth and recruitment ½-2 years later. The primary production index has been below average since 2002 except for 2004 and 2008-2010 when it was above average (Figure 2.3). The estimate of primary production in 2014 will not be available until July. The primary production index could therefore be a candidate ecosystem and stock indicator. Another potential indicator candidate is the so-called Sub-polar Gyre Index, which is an index for the primary production in the outer areas (Figure 2.3).

Recent work (Steingrund *et al.*, 2012) shows that there is a moderate positive correlation between primary production on the Faroe Shelf and the subsequent production of cod (Steingrund and Gaard, 2005). There is also a moderate positive correlation for haddock and saithe. However, if all three species are combined, the positive correlation becomes very strong (Figure 2.4). This indicates that a nearly fixed portion of the energy produced by the primary production goes to predatory demersal fish on the Faroe Plateau, but that the portion to each of the fish stocks (to cod, haddock or saithe) may vary much between years. As an example, the last period of high productivity (2008—2010) did not lead to any marked increase in the stock size of cod/haddock, but only in saithe.

2.1.3 Summary of the 2015 assessment of Faroe Plateau cod, haddock and saithe

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 have 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 have been fluctuating 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 close to the highest values observed in 2009. It has since declined again.

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 fluctuations and time-trends.

2.1.4 Reference points for Faroese stocks

As explained elsewhere in this report, MSY reference points have recently been estimated for cod, haddock and saithe in addition to the already existing PA reference points. These reference points are all estimated based on single-species models. Multispecies models may give very different perception of F_{MSY} reference points than single-species models, and for the Faroe area this could be extra true, since there is a close relationship between the environment and the fish stocks and between fish stocks (see section 2.1.3). Adding the recruitment of cod and haddock and relating them to zooplankton concentration shows a strong negative correlation (Figure 2.5), but a potential causal relationship is unknown.

2.1.5 Management plan

In 2011 the Faroese minister of fisheries established a group of experts to formulate a management plan for cod, haddock and saithe including a harvest control rule and a recovery plan. The group consisted of scientists from the Faroe Marine Research Institute of one representative from the industry and 1 from the Ministry of Fisheries. The results of this work was delivered to the Minister of Fisheries in the autumn 2011 but the outcome has not been approved by the authorities so far and not been implemented. Basically, the plan builds on the MSY framework developed by ICES.

2.1.6 References:

Gaard. E., Hansen, B., Olsen, B and Reinert, J. 2001. 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.

Steingrund, P., Gaard, E., Reinert, J., Olsen, B., Homrum, E., and Eliassen, K. 2012. Trophic relationships on the Faroe Shelf ecosystem and potential ecosystem states. In: Homrum, E., 2012. The effects of climate and ocean currents on Faroe Saithe. PhD-thesis, 2012.

Table 2.1. Number of allocated days since the fiscal year 1996/97.

Fleeet	Smb. Ll.:	Serlig viðm.	1 ytri	1 innaru	2 ytri	2 innari	3	4 A	4 B	4 D	4 T	5	(at ráða yvir)	Dagar tils.
1996/97	(50 20/5-96)	(12/15 mdr!)				8225	3040	4700	3080	1540		22000	1000	43585
1996/97	(84 6/6-97)	(12/15mdr!)				8225	3040	5600	3410	1650		27000	660	49585
1997/98	(133 9/8-97)	12 mdr!				7199	2660	4696	4632			23625	577	43389
1998/99	(69 18/8-98)					6839	2527	4461	4400			22444	548	41219
1999/2000	(80 17/8-99)					6839	2527	4461	4400			22444	548	41219
2000/2001	(104 17/8-00)					6839	2527	4461	4400			22,444	548	41219
2001/2002	(115 15/8-01)					6839	2527	4461	4400			22444	0	40671
2002/2003	(76 13/8-02)					6771	2502	4416	4356			22220	0	40265
2003/2004	(100 8/8-03)					6636	2452	4328	4269			21776	0	39461
2004/2005	(49 18/8-04)					6536	2415	4263	4205			21449	0	38868
2005/2006	(98 19/8-05)					5752	3578	1770	2067		1766	21235	0	36168
2006/2007	(81 17/8-06)					5752	3471	1717	2005		1713	20598	0	35256
2007/2008	(80 20/8-07)					5637	3402	1683	1965		1679	20186	0	34552
2008/2009	(76 15/8-08)					5073	3062	1515	1769		1511	18167	0	31097
2008/2009	(62 25/5-09)					4638	3095	1393	1848		1621	18167	0	30762
2009/2010	(106 17/8-09					4406	2940	1323	1756		1540	17259	0	29224
2010/2011	(87 18/8-10)		1700	900		4274	2852	1323	1756		1540	13259	0	25004
2010/2011	sama -		1700	900		4274	2852	1323	1756		1540	13259	0	27604
2011/12	(105 18/8-11) (112 2/9-11)				1530	4657	2567	1058	1405		1386	10607		23210
2012/13	(89 17/8-12)				1530	4626	2567	1011	1533		1386	10607		23260
2013/14	(109 16/8-13)				1530	4441	2387	1011	1533		1386	9865		22153
2014/15	(L89-18/8-14)				1530	4455	2387	1029	1530		1386	9865		22182

Table 2.2. Number of days allocated and the number actually used since the fiscal year 2010/2011

Fleet segment	Allocated days 2010/11	Used days 2010/11	% used days 2010/11	Allocated days 2011/12	Used days 2011/12	% used days 2011/12	Allocated days 2012/13	Used days 2012/13	% used days 012/13	Allocated days 2013/14	Used days pr. Dato	% used days	Allocated days 2014/15	Used days pr. Dato	% used days
Reference:	Ll87 18/8-10(JV)			Ll105 18/8-11 og Ll112 2/9-11(JD)			(89 17/8-12)			Ll105 18/8-11 og Ll112 2/9-11(JD)			(L89-18/8-14)		
Group 1 - innaru leiðir	900	552.39	61%												
Group 1 - ytri leiðir	1700	785.3	46%												
Group 2 - (innaru leiði	4274	3883.23	91%	4657	4758.02	102%	4626	3952.52	85%	4441	3915.82	88%	4455	1915.88	43%
Group 2 - ytri leiðir				1530	894.94	58%	1530	878.57	57%	1530	796.53	52%	1530	367.74	24%
Group 3	2852	2071.16	73%	2567	1985.90	77%	2567	1205.23	47%	2387	1119.66	47%	2387	749.11	31%
Group 4A	1323	405.36	31%	1058	259.5	25%	1011	270.72	27%	1011	272.34	27%	1029	118.5	12%
Group 4B	1756	1015.65	58%	1405	656.61	47%	1533	687.73	45%	1533	518.77	34%	1530	230.77	15%
Group 4T	1540	1411.98	92%	1386	1313.14	95%	1386	1165.71	84%	1386	895.41	65%	1386	243.92	18%
Group 5A	5304	2856	54%	5060	1834	36%	4730	1410	30%	4311	998	23%	2640	1000	38%
Group 5B	7955	4525	57%	5547	3160	57%	5877	2845	48%	5554	2842	51%	7225	1000	14%
Total	27604	17506.07	63%	23210	14862.11	64%	23260	12415.48	53%	22153	11358.53	51%	22182	5625.92	25%

Table 2.3. 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		Sub groups		Main regulation tools
1	Single trawlers > 400 HP	none		Fishing days, have from 2011/12 been merged with the pair trawlers, 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

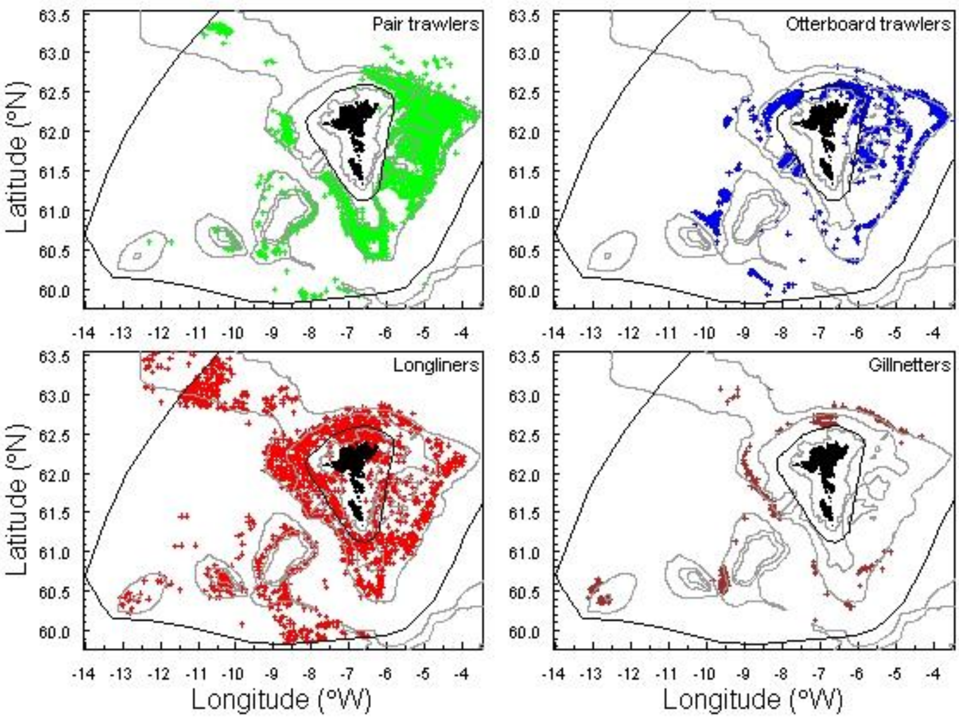
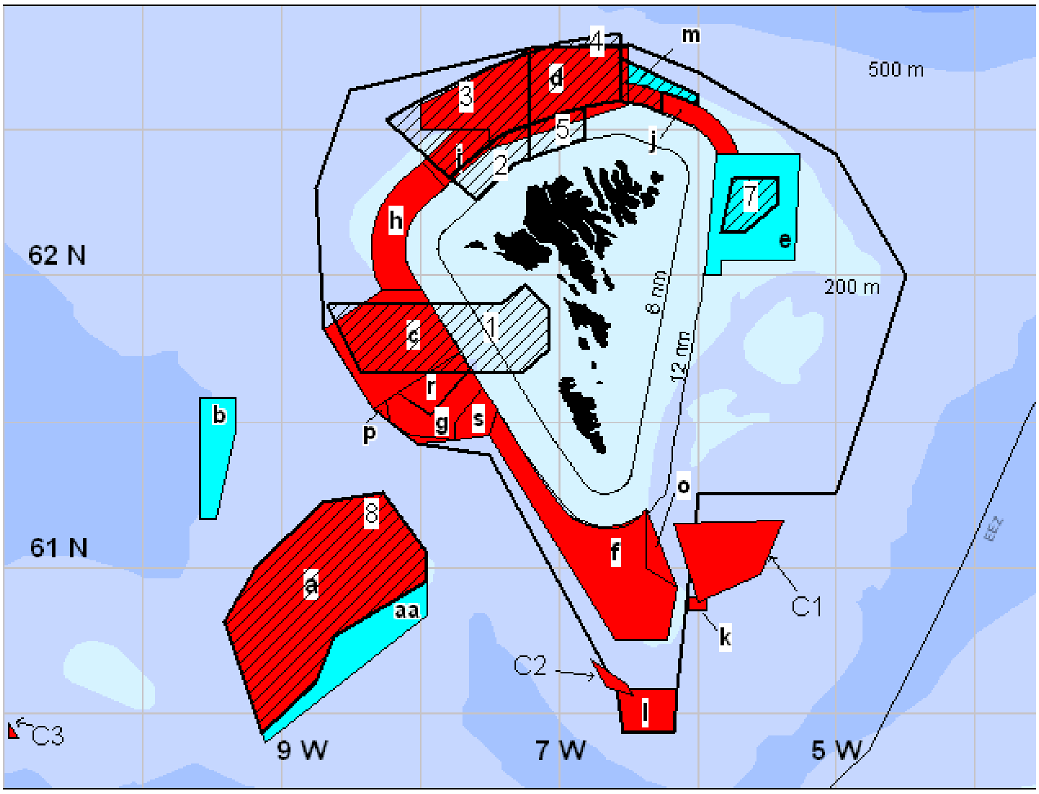


Figure 2.1. The 2012 distribution of fishing activities by some major fleets. The longline fleet below 15 GRT is not shown here since they are not obliged to keep logbooks.



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 2.2. 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.

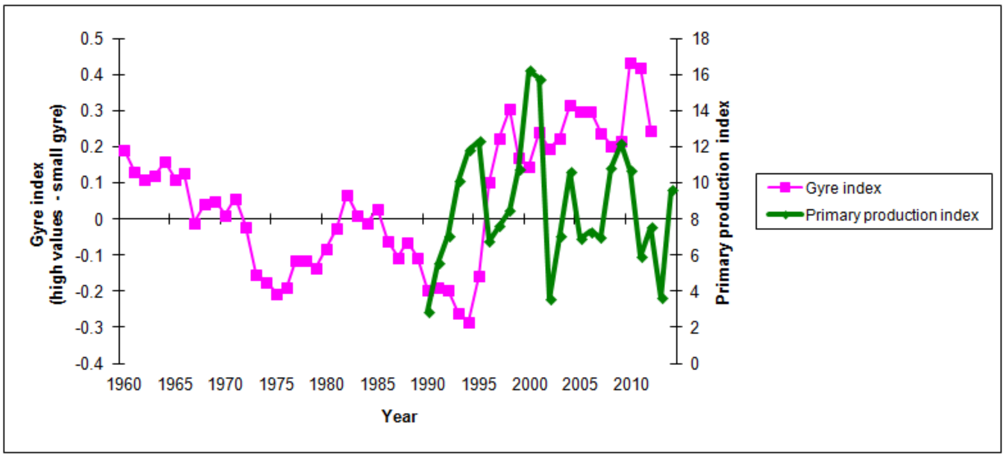


Figure 2.3. Temporal development of the phytoplankton index over the Faroe Shelf area (< 130 m) and the subpolar gyre index which indicates productivity in deeper waters.

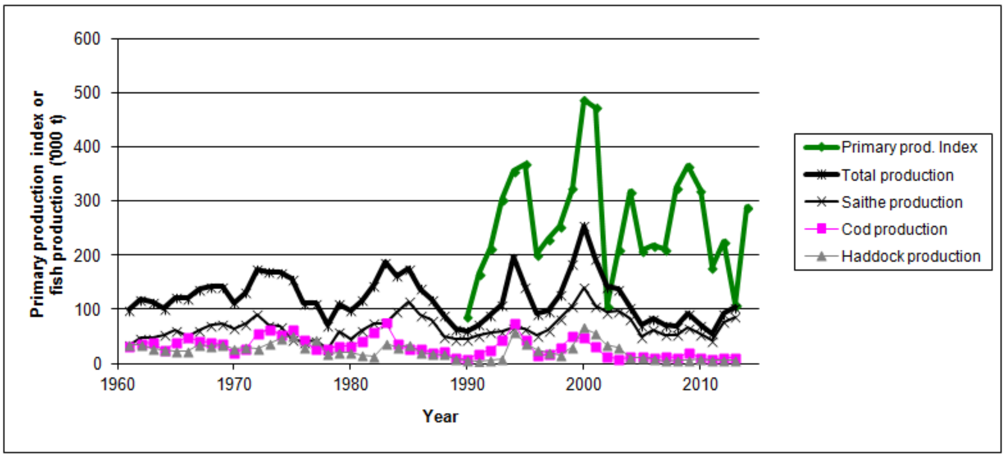


Figure 2.4. Relationship between primary production and production of cod, haddock and saithe.

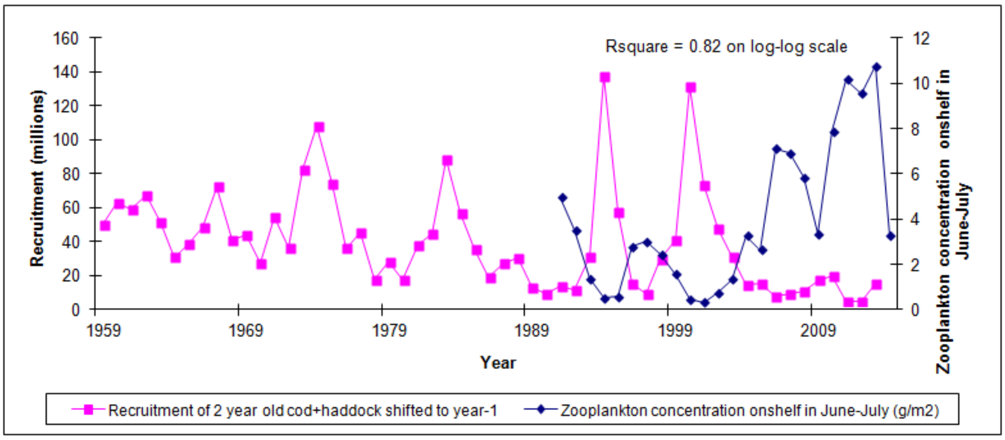


Figure 2.5. Relationship between zooplankton concentration and recruitment of cod+haddock on the Faroe Plateau.

3 Faroe Bank Cod

Summary

The total reported landings in 2014 were the lowest recorded since 1965 (30 tonnes).

The spring index suggests that the stock increased from 2012 to 2014 and declined substantially again in 2015. Nevertheless both the summer and spring index suggest that the stock is well below average and there is no indication of strong incoming year classes.

The results of an exploratory production model based on both surveys indicate a good agreement in the stock biomass index in recent years whereas the observed survey-based exploitation rates correlates reasonably well with estimated fishing mortalities. However the model failed to pick up the large increases in stock biomass observed in the 1996—2003 period. Correlation between modelled F's and summer survey based exploitation rates is R=0.90. The exploitation ratio increased in 2011 as a consequence of the increase in landings and it decreased afterwards reflecting the fall of catches observed since 2012.

3.1 State of the stock

Total nominal catches of the Faroe Bank cod from 1987 to 2014 as officially reported to ICES are given in Table 3.1 and since 1965 in Figure 3.1. 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 3500t in 1987 to only 330 t in 1992 before increasing to 3 600t in 1997. In 2013 landings were estimated at 36t which is the lowest ever recorded since 1965 (Figure 3.1). 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 3.1). From 2005 to 2007 the effort has been reduced substantially. In the 2010/2011 and 2011/2012 fishing years a total of 61 and 100 fishing-days were allocated to the Bank. No days have been allocated since 2012.

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 3.2.

The spring survey was initiated in 1983 and discontinued in 1996, 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 2013 and the 2014 spring point estimates suggest that the stock increased and decreased sharply again in 2015. it is however well below the average of that of the period 1996—2002. The 2014 summer index is estimated at 25 kg per tow, which is the second lowest value in the series. There are conflicting signals between both indices from 2012 to 2014.. The agreement between the summer and spring index is good during 1996 to 2001 and since 2006, but they diverged in the 2002—2003 and 2012—2014 periods.. Both indexes have remained well below average since 2004.

The figure of length distributions (figures 3.3 and 3.5) 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 2015 reflecting the weak year classes observed in the summer survey since 2004. Age-disaggregated indices confirm the pattern observed in the length composition (figure 3.4 and figure 3.6)

A way to estimate recruitment strength is 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 was good from 2000 to 2003, while the recruitment has been relatively poor since 2004 (Figure 3.7) The spring recruitment index in 2014 shows no sign of incoming year classes. Correlation between the spring and summer survey recruitment indices is fairly good (r=0.85). Correlation between numbers of 1-year and 2-years old cod in the age-disaggregated summer and spring surveys respectively is estimated at r=0.79.

The group tried the ASPIC (Prager 1992) stock production model for the stock. The model requires catch data and corresponding effort or CPUE data that are reasonable indices of the stock biomass.

ASPIC requires starting guesses for *r*, the intrinsic rate of increase, MSY, B1/Bmsy ratio and *q*, catchability coefficients. No sensitivity analysis was performed to explore the stability of parameter estimation.

The program was run with the time-series from 1983-2014 including spring survey and 1996—2014 summer CPUE's separately. The result of the runs are presented in tables 3.2 and 3.3 For both runs the model seemed to follow reasonably well survey trends in periods of low stock abundances but it failed to pick up the large increases observed in the 1996-2003 period (figures 3.8 and 3.9).

However estimates of *r*=0.07 and Fmsy=0.035 (using the fall survey series) seem spurious given that the Faroe Bank cod is the fastest growing cod stock in the Atlantic.

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 3.1). The exploitation ratio has decreased since 2006 but increased in 2011 due to the increase in catches and decreased again afterwards reflecting the fall of catches observed since 2011.

3.2 Comparison with previous assessment and forecast

The status of the stock remains almost unchanged with respect to last year's assessment. Both the spring and the summer indexes suggest the stock is well below average while there are no indications of incoming recruitment. The spring index suggests an increasing stock biomass from 2012 to 2014 which it is however not picked up by the summer survey. The exploratory production model performed since 2013 confirms the poor status of the stock.

3.3 Management plans and evaluations

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 2014 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. However, in the 2010/2011 and 2011/2012 fishing years a total of 61 and 100 fishing-days were allocated to the Bank to jiggers in the shallow waters of the Bank. No days have been allocated since 2012.

Table 3.1. Faroe Bank (sub-division Vb2) cod. Nominal catches (tonnes) by countries 1986-2014 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	1998	1999	
Faroe Islands	1836	3409	2966	1270	289	297	122	264	717	561	2051	3459	3092	1001	
Norway	6	23	94	128	72	38	32	2	8	40	55	135	147	88	
UK (E/W/NI)	-	-	-	-	2 [2]	1 [2]	74 [2]	186 [2]	56 [2]	43 [2]	126 [3]	61 [3]	27 [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]	265 [3]	51 [3]	
Total	1905	3479	3097	1412	568	426	404	570	1008	1195	2614	3932	3531	210 [3]	
Used in assessment					289	297	154	266	725	601	2106	3594	3239 0	1350	
														1089	
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Faroe Islands		1094	1840	5957	3607	1270	1005	471	231	81	111	393	115	40	32 *
Norway	49	51	25	72	18	37	10	7	1	4	1		0		
Greenland	-	-	-	-	-	-	-	-	-	-	5		1		
UK (E/W/NI) [3]	18 [3]	50 [3]	42 [3]	15 [3]	15 [3]	24 [3]	1 [3]								
UK (Scotland) [3]	245 [3]	288 [3]	218 [3]	254 [3]	244 [3]	1129 [3]	278 [3]	53	32	38	54				270
Total	312	1483	2125	6298	3884	2460	1294	531	264	123	171	393	116	40	302
Correction of Faroese catches in Vb2		-65	-109	-353	-214	-75	-60	-28	-14	-5	-7	-23	-7	-2	-2
Used in assessment	1194	1080	1756	5676	3411	1232	955	450	218	80	105	370	108	38	30

Table 3.2. Faroe Bank (sub-division Vb2) cod. Surplus production model output using the summer index.

Faroe Bank Cod RV Page 1

14 Apr 2015 at 12:00.44

ASPIC -- A Surplus-Production Model Including Covariates (Ver. 3.82) FIT Mode

Author: Michael H. Prager; NOAA/NMFS/S.E. Fisheries Science Center ASPIC User's Manual

101 Pivers Island Road; Beaufort, North Carolina 28516 USA is available gratis

from the author.

Ref: Prager, M. H. 1994. A suite of extensions to a nonequilibrium

surplus-production model. Fishery Bulletin 92: 374-389.

CONTROL PARAMETERS USED (FROM INPUT FILE)

Number of years analyzed: 50 Number of bootstrap trials: 0

Number of data series: 1 Lower bound on MSY: 5.000E+02

Objective function computed: in effort Upper bound on MSY: 1.000E+09

Relative conv. criterion (simplex): 1.000E-08 Lower bound on r: 7.000E-02

Relative conv. criterion (restart): 3.000E-08 Upper bound on r: 2.500E+00

Relative conv. criterion (effort): 1.000E-04 Random number seed: 2010417

Maximum F allowed in fitting: 8.000 Monte Carlo search mode, trials: 1 10000

PROGRAM STATUS INFORMATION (NON-BOOTSTRAPPED ANALYSIS) code 20

ERROR: Estimate of r is at or near minimum constraint, 7.000E-02

Solution may be trivial--examine carefully.

GOODNESS-OF-FIT AND WEIGHTING FOR NON-BOOTSTRAPPED ANALYSIS

Loss component number and title	Weighted SSE	N	Weighted MSE	Current weight	Suggested weight	R-squared in CPUE
Loss(-1) SSE in yield	0.000E+00					
Loss(0) Penalty for B1R > 2	0.000E+00	1	N/A	1.000E-01	N/A	
Loss(1) Survey CPUE Summer	2.466E+00	19	1.451E-01	1.000E+00	1.000E+00	0.775
TOTAL OBJECTIVE FUNCTION:	2.46625417E+00					

Number of restarts required for convergence: 6

Est. B-ratio coverage index (0 worst, 2 best): 0.7511 < These two measures are defined in Prager

Est. B-ratio nearness index (0 worst, 1 best): 0.7853 < et al. (1996), Trans. A.F.S. 125:729

MODEL PARAMETER ESTIMATES (NON-BOOTSTRAPPED)

Parameter		Estimate	Starting guess	Estimated	User guess
B1R	Starting biomass ratio, year 1965	7.853E-01	1.000E+00	1	1
MSY	Maximum sustainable yield	1.775E+03	3.000E+03	1	1
r	Intrinsic rate of increase	7.000E-02	8.000E-01	1	1
....	Catchability coefficients by fishery:				
q(1)	Survey CPUE Summer	1.712E-02	1.000E-02	1	1

MANAGEMENT PARAMETER ESTIMATES (NON-BOOTSTRAPPED)

Parameter		Estimate	Formula	Related quantity
MSY	Maximum sustainable yield	1.775E+03	Kr/4	
K	Maximum stock biomass	1.014E+05		
Bmsy	Stock biomass at MSY	5.072E+04	K/2	
Fmsy	Fishing mortality at MSY	3.500E-02	r/2	
F(0.1)	Management benchmark	3.150E-02	0.9*Fmsy	
Y(0.1)	Equilibrium yield at F(0.1)	1.757E+03	0.99*MSY	
B-ratio	Ratio of B(2015) to Bmsy	3.807E-02		
F-ratio	Ratio of F(2014) to Fmsy	4.558E-01		
F01-mult	Ratio of F(0.1) to F(2014)	1.975E+00		
Y-ratio	Proportion of MSY avail in 2015	7.469E-02	2*Br-Br^2	Ye(2015) = 1.326E+02
....	Fishing effort at MSY in units of each fishery:			
fmsy(1)	Survey CPUE Summer	2.045E+00	r/2q(1)	f(0.1) = 1.840E+00

Faroe Bank Cod RV Page 2

ESTIMATED POPULATION TRAJECTORY (NON-BOOTSTRAPPED)

Obs	Year or ID	Estimated total F mort	Estimated starting biomass	Estimated average biomass	Observed total yield	Model total yield	Estimated surplus production	Ratio of F mort to Fmsy	Ratio of biomass to Bmsy
1	1965	0.059	3.983E+04	3.950E+04	2.341E+03	2.341E+03	1.688E+03	1.693E+00	7.853E-01
2	1966	0.049	3.918E+04	3.906E+04	1.909E+03	1.909E+03	1.681E+03	1.396E+00	7.725E-01
3	1967	0.040	3.895E+04	3.901E+04	1.569E+03	1.569E+03	1.680E+03	1.149E+00	7.680E-01
4	1968	0.102	3.906E+04	3.794E+04	3.871E+03	3.871E+03	1.662E+03	2.915E+00	7.702E-01
5	1969	0.067	3.685E+04	3.644E+04	2.457E+03	2.457E+03	1.634E+03	1.927E+00	7.266E-01
6	1970	0.085	3.603E+04	3.533E+04	3.002E+03	3.002E+03	1.612E+03	2.428E+00	7.104E-01
7	1971	0.060	3.464E+04	3.439E+04	2.079E+03	2.079E+03	1.591E+03	1.727E+00	6.830E-01
8	1972	0.064	3.415E+04	3.386E+04	2.168E+03	2.168E+03	1.579E+03	1.830E+00	6.734E-01
9	1973	0.161	3.356E+04	3.174E+04	5.101E+03	5.101E+03	1.526E+03	4.592E+00	6.618E-01
10	1974	0.070	2.999E+04	2.969E+04	2.068E+03	2.068E+03	1.470E+03	1.990E+00	5.913E-01
11	1975	0.070	2.939E+04	2.910E+04	2.036E+03	2.036E+03	1.453E+03	1.999E+00	5.795E-01
12	1976	0.080	2.881E+04	2.839E+04	2.258E+03	2.258E+03	1.431E+03	2.272E+00	5.680E-01
13	1977	0.034	2.798E+04	2.821E+04	9.590E+02	9.590E+02	1.426E+03	9.712E-01	5.517E-01
14	1978	0.163	2.845E+04	2.692E+04	4.379E+03	4.379E+03	1.384E+03	4.648E+00	5.609E-01
15	1979	0.051	2.545E+04	2.547E+04	1.306E+03	1.306E+03	1.335E+03	1.465E+00	5.018E-01
16	1980	0.047	2.548E+04	2.555E+04	1.203E+03	1.203E+03	1.338E+03	1.345E+00	5.024E-01
17	1981	0.048	2.562E+04	2.567E+04	1.229E+03	1.229E+03	1.342E+03	1.368E+00	5.050E-01
18	1982	0.086	2.573E+04	2.530E+04	2.184E+03	2.184E+03	1.329E+03	2.467E+00	5.073E-01
19	1983	0.094	2.487E+04	2.437E+04	2.284E+03	2.284E+03	1.296E+03	2.677E+00	4.904E-01
20	1984	0.093	2.389E+04	2.342E+04	2.189E+03	2.189E+03	1.261E+03	2.671E+00	4.709E-01
21	1985	0.132	2.296E+04	2.209E+04	2.913E+03	2.913E+03	1.209E+03	3.767E+00	4.526E-01
22	1986	0.088	2.125E+04	2.091E+04	1.836E+03	1.836E+03	1.162E+03	2.508E+00	4.191E-01
23	1987	0.176	2.058E+04	1.940E+04	3.409E+03	3.409E+03	1.098E+03	5.021E+00	4.058E-01
24	1988	0.172	1.827E+04	1.727E+04	2.966E+03	2.966E+03	1.003E+03	4.908E+00	3.602E-01
25	1989	0.079	1.631E+04	1.614E+04	1.270E+03	1.270E+03	9.503E+02	2.248E+00	3.215E-01
26	1990	0.018	1.599E+04	1.632E+04	2.890E+02	2.890E+02	9.585E+02	5.060E-01	3.152E-01
27	1991	0.017	1.666E+04	1.700E+04	2.970E+02	2.970E+02	9.906E+02	4.991E-01	3.284E-01
28	1992	0.009	1.735E+04	1.778E+04	1.540E+02	1.540E+02	1.027E+03	2.474E-01	3.421E-01
29	1993	0.014	1.822E+04	1.862E+04	2.660E+02	2.660E+02	1.064E+03	4.082E-01	3.593E-01
30	1994	0.038	1.902E+04	1.920E+04	7.250E+02	7.250E+02	1.090E+03	1.079E+00	3.750E-01
31	1995	0.031	1.938E+04	1.964E+04	6.010E+02	6.010E+02	1.108E+03	8.744E-01	3.822E-01
32	1996	0.109	1.989E+04	1.938E+04	2.106E+03	2.106E+03	1.097E+03	3.105E+00	3.922E-01
33	1997	0.205	1.888E+04	1.756E+04	3.594E+03	3.594E+03	1.016E+03	5.848E+00	3.723E-01
34	1998	0.214	1.631E+04	1.510E+04	3.239E+03	3.239E+03	8.995E+02	6.127E+00	3.215E-01
35	1999	0.072	1.397E+04	1.388E+04	1.001E+03	1.001E+03	8.389E+02	2.060E+00	2.754E-01
36	2000	0.088	1.380E+04	1.362E+04	1.194E+03	1.194E+03	8.253E+02	2.505E+00	2.722E-01
37	2001	0.081	1.343E+04	1.330E+04	1.080E+03	1.080E+03	8.088E+02	2.320E+00	2.649E-01

38	2002	0.139	1.316E+04	1.267E+04	1.756E+03	1.756E+03	7.759E+02	3.961E+00	2.595E-01
39	2003	0.603	1.218E+04	9.414E+03	5.676E+03	5.676E+03	5.964E+02	1.723E+01	2.402E-01
40	2004	0.628	7.104E+03	5.435E+03	3.411E+03	3.411E+03	3.595E+02	1.793E+01	1.401E-01
41	2005	0.349	4.052E+03	3.532E+03	1.232E+03	1.232E+03	2.386E+02	9.965E+00	7.990E-02
42	2006	0.360	3.059E+03	2.653E+03	9.550E+02	9.550E+02	1.808E+02	1.029E+01	6.031E-02
43	2007	0.211	2.285E+03	2.129E+03	4.500E+02	4.500E+02	1.459E+02	6.039E+00	4.505E-02
44	2008	0.112	1.981E+03	1.938E+03	2.180E+02	2.180E+02	1.331E+02	3.214E+00	3.905E-02
45	2009	0.042	1.896E+03	1.922E+03	8.000E+01	8.000E+01	1.320E+02	1.189E+00	3.738E-02
46	2010	0.054	1.948E+03	1.963E+03	1.050E+02	1.050E+02	1.347E+02	1.529E+00	3.840E-02
47	2011	0.200	1.977E+03	1.853E+03	3.700E+02	3.700E+02	1.274E+02	5.704E+00	3.899E-02
48	2012	0.062	1.735E+03	1.741E+03	1.080E+02	1.080E+02	1.198E+02	1.773E+00	3.420E-02
49	2013	0.021	1.747E+03	1.789E+03	3.800E+01	3.800E+01	1.230E+02	6.070E-01	3.444E-02
50	2014	0.016	1.832E+03	1.881E+03	3.000E+01	3.000E+01	1.292E+02	4.558E-01	3.611E-02
51	2015		1.931E+03				3.807E-02		

Faroe Bank Cod RV Page 3

RESULTS FOR DATA SERIES # 1 (NON-BOOTSTRAPPED) Survey CPUE Summer

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Data type CC: CPUE-catch series Series weight: 1.000

Obs	Year	Observed CPUE	Estimated CPUE	Estim F	Observed yield	Model yield	Resid in log scale	Resid in yield
1	1965	*	6.761E+02	0.0593	2.341E+03	2.341E+03	0.00000	0.000E+00
2	1966	*	6.686E+02	0.0489	1.909E+03	1.909E+03	0.00000	0.000E+00
3	1967	*	6.676E+02	0.0402	1.569E+03	1.569E+03	0.00000	0.000E+00
4	1968	*	6.494E+02	0.1020	3.871E+03	3.871E+03	0.00000	0.000E+00
5	1969	*	6.237E+02	0.0674	2.457E+03	2.457E+03	0.00000	0.000E+00
6	1970	*	6.047E+02	0.0850	3.002E+03	3.002E+03	0.00000	0.000E+00
7	1971	*	5.887E+02	0.0604	2.079E+03	2.079E+03	0.00000	0.000E+00
8	1972	*	5.795E+02	0.0640	2.168E+03	2.168E+03	0.00000	0.000E+00
9	1973	*	5.432E+02	0.1607	5.101E+03	5.101E+03	0.00000	0.000E+00
10	1974	*	5.081E+02	0.0697	2.068E+03	2.068E+03	0.00000	0.000E+00
11	1975	*	4.980E+02	0.0700	2.036E+03	2.036E+03	0.00000	0.000E+00
12	1976	*	4.859E+02	0.0795	2.258E+03	2.258E+03	0.00000	0.000E+00
13	1977	*	4.829E+02	0.0340	9.590E+02	9.590E+02	0.00000	0.000E+00
14	1978	*	4.607E+02	0.1627	4.379E+03	4.379E+03	0.00000	0.000E+00
15	1979	*	4.359E+02	0.0513	1.306E+03	1.306E+03	0.00000	0.000E+00
16	1980	*	4.373E+02	0.0471	1.203E+03	1.203E+03	0.00000	0.000E+00
17	1981	*	4.394E+02	0.0479	1.229E+03	1.229E+03	0.00000	0.000E+00
18	1982	*	4.330E+02	0.0863	2.184E+03	2.184E+03	0.00000	0.000E+00
19	1983	*	4.172E+02	0.0937	2.284E+03	2.284E+03	0.00000	0.000E+00
20	1984	*	4.008E+02	0.0935	2.189E+03	2.189E+03	0.00000	0.000E+00
21	1985	*	3.781E+02	0.1319	2.913E+03	2.913E+03	0.00000	0.000E+00
22	1986	*	3.580E+02	0.0878	1.836E+03	1.836E+03	0.00000	0.000E+00
23	1987	*	3.320E+02	0.1757	3.409E+03	3.409E+03	0.00000	0.000E+00
24	1988	*	2.955E+02	0.1718	2.966E+03	2.966E+03	0.00000	0.000E+00
25	1989	*	2.763E+02	0.0787	1.270E+03	1.270E+03	0.00000	0.000E+00
26	1990	*	2.793E+02	0.0177	2.890E+02	2.890E+02	0.00000	0.000E+00
27	1991	*	2.910E+02	0.0175	2.970E+02	2.970E+02	0.00000	0.000E+00
28	1992	*	3.044E+02	0.0087	1.540E+02	1.540E+02	0.00000	0.000E+00
29	1993	*	3.187E+02	0.0143	2.660E+02	2.660E+02	0.00000	0.000E+00
30	1994	*	3.287E+02	0.0378	7.250E+02	7.250E+02	0.00000	0.000E+00
31	1995	*	3.361E+02	0.0306	6.010E+02	6.010E+02	0.00000	0.000E+00
32	1996	3.105E+02	3.317E+02	0.1087	2.106E+03	2.106E+03	0.06617	0.000E+00
33	1997	4.492E+02	3.006E+02	0.2047	3.594E+03	3.594E+03	-0.40172	0.000E+00
34	1998	3.871E+02	2.585E+02	0.2145	3.239E+03	3.239E+03	-0.40367	0.000E+00
35	1999	1.495E+02	2.376E+02	0.0721	1.001E+03	1.001E+03	0.46319	0.000E+00
36	2000	1.199E+02	2.331E+02	0.0877	1.194E+03	1.194E+03	0.66472	0.000E+00
37	2001	2.626E+02	2.276E+02	0.0812	1.080E+03	1.080E+03	-0.14292	0.000E+00

38	2002	3.472E+02	2.168E+02	0.1386	1.756E+03	1.756E+03	-0.47080	0.000E+00
39	2003	1.618E+02	1.611E+02	0.6029	5.676E+03	5.676E+03	-0.00396	0.000E+00
40	2004	7.304E+01	9.303E+01	0.6276	3.411E+03	3.411E+03	0.24190	0.000E+00
41	2005	6.188E+01	6.046E+01	0.3488	1.232E+03	1.232E+03	-0.02321	0.000E+00
42	2006	2.927E+01	4.541E+01	0.3600	9.550E+02	9.550E+02	0.43905	0.000E+00
43	2007	3.331E+01	3.644E+01	0.2114	4.500E+02	4.500E+02	0.08977	0.000E+00
44	2008	3.117E+01	3.317E+01	0.1125	2.180E+02	2.180E+02	0.06204	0.000E+00
45	2009	4.927E+01	3.289E+01	0.0416	8.000E+01	8.000E+01	-0.40409	0.000E+00
46	2010	4.164E+01	3.359E+01	0.0535	1.050E+02	1.050E+02	-0.21484	0.000E+00
47	2011	5.854E+01	3.172E+01	0.1996	3.700E+02	3.700E+02	-0.61266	0.000E+00
48	2012	3.425E+01	2.979E+01	0.0620	1.080E+02	1.080E+02	-0.13949	0.000E+00
49	2013	1.737E+01	3.062E+01	0.0212	3.800E+01	3.800E+01	0.56678	0.000E+00
50	2014	2.575E+01	3.219E+01	0.0160	3.000E+01	3.000E+01	0.22324	0.000E+00

* Asterisk indicates missing value(s).

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Faroe Bank Cod RV                                              Page 4

UNWEIGHTED LOG RESIDUAL PLOT FOR DATA SERIES # 1
             -1     -0.75   -0.5    -0.25     0      0.25    0.5     0.75     1
              |  .  |  .  |  .  |  .  |  .  |  .  |  .  |  .  |
Year  Residual  --------------------------------------------------------------------------------
1965    0.0000                                        |
1966    0.0000                                        |
1967    0.0000                                        |
1968    0.0000                                        |
1969    0.0000                                        |
1970    0.0000                                        |
1971    0.0000                                        |
1972    0.0000                                        |
1973    0.0000                                        |
1974    0.0000                                        |
1975    0.0000                                        |
1976    0.0000                                        |
1977    0.0000                                        |
1978    0.0000                                        |
1979    0.0000                                        |
1980    0.0000                                        |
1981    0.0000                                        |
1982    0.0000                                        |
1983    0.0000                                        |
1984    0.0000                                        |
1985    0.0000                                        |
1986    0.0000                                        |
1987    0.0000                                        |
1988    0.0000                                        |
1989    0.0000                                        |
1990    0.0000                                        |
1991    0.0000                                        |
1992    0.0000                                        |
1993    0.0000                                        |
1994    0.0000                                        |
1995    0.0000                                        |
1996    0.0066                                        |===
1997   -0.4017                         ================|
1998   -0.4037                         ================|
1999    0.4632                                        |===================
2000    0.6647                                        |===========================
2001   -0.1429                                  ======|
2002   -0.4708                            ===================|
2003   -0.0040                                        |
2004    0.2419                                        |==========
```

```
2005  -0.0232                 =|
2006   0.4390                  |==================
2007   0.0898                  |====
2008   0.0620                  |==
2009  -0.4041  ================|
2010  -0.2148         =========|
2011  -0.6127 =========================|
2012  -0.1395            ======|
2013   0.5668                  |=======================
2014   0.2232                  |=========
        -------------------------------------------------------------------------------------
```

Faroe Bank Cod RV Page 5

```
          Observed (O) and Estimated (*) CPUE for Data Series # 1 -- Survey CPUE Summer
      :
 900. -:
      :
      :
      :
      :
 750. -:
      :
      :   *
      :    ** *
      :      *
 600. -:       * *
      :        *
      :         *
      :          * *
      :            * *
 450. -:             ** * *              O
      :               * *
      :                **            O
      :                 *               O
      :                  *    ** * *
 300. -:                   *   * *    O*
      :                  * *       *  O
      :                            ** *
      :                              *
      :
 150. -:                            O   2
      :                            O
      :                               *
      :                               O 2*   O  O
      :                                O 2 2* 2 *2 2 2
   0. -:
      :............................................................
       :     :     :     :     :     :     :     :     :     :     :
    1959.  1965.  1971.  1977.  1983.  1989.  1995.  2001.  2007.  2013.  2019.
```

```
                 Time Plot of Estimated F-Ratio and B-Ratio
      :
  18. -:                               F
      :                              F
      :
      :
      :
```

```
15. -:
    :
    :
    :
    :
12. -:
    :
    :
    :                                                   FF
    :
 9. -:
    :
    :
    :
    :
 6. -:                                          F F          F     F
    :
    :                 F       F           FF
    :                                                 F
    :                             F
 3. -:          F                               F                F
    :           F       F       F F F  F    F             F F
    :      F     F  F F  F F                          F              F  F
    :  -- - -- - 22 - -- - -- - -- 2 -2 2 2- - -- - -- - -- - -2 - -- - -- - -- - -- - -2 - -- - -- - -- - -
    :      B BB B BB B BB B BB B BB B BB B BB B BB B 22 B 2B 2 BB B                    F F
 0. -:                                       F         BB B BB B BB B BB B BB B BB
    :......................................................................................................
     :      :      :      :      :      :      :      :      :      :      :
   1959.  1965.  1971.  1977.  1983.  1989.  1995.  2001.  2007.  2013.  2019.
```

Table 3.3. Faroe Bank (sub-division Vb2) cod. Surplus production model output using the spring index.

Faroe Bank Cod RV Page 1

14 Apr 2015 at 12:02.17

ASPIC -- A Surplus-Production Model Including Covariates (Ver. 3.82) FIT Mode

Author: Michael H. Prager; NOAA/NMFS/S.E. Fisheries Science Center ASPIC User's Manual

101 Pivers Island Road; Beaufort, North Carolina 28516 USA is available gratis

from the author.

Ref: Prager, M. H. 1994. A suite of extensions to a nonequilibrium

surplus-production model. Fishery Bulletin 92: 374-389.

CONTROL PARAMETERS USED (FROM INPUT FILE)

Number of years analyzed:	50	Number of bootstrap trials:	0
Number of data series:	1	Lower bound on MSY:	5.000E+02
Objective function computed:	in effort	Upper bound on MSY:	1.000E+09
Relative conv. criterion (simplex):	1.000E-08	Lower bound on r:	7.000E-02
Relative conv. criterion (restart):	3.000E-08	Upper bound on r:	2.500E+00
Relative conv. criterion (effort):	1.000E-04	Random number seed:	2010417
Maximum F allowed in fitting:	8.000	Monte Carlo search mode, trials:	1 10000

PROGRAM STATUS INFORMATION (NON-BOOTSTRAPPED ANALYSIS) code 0

Normal convergence.

GOODNESS-OF-FIT AND WEIGHTING FOR NON-BOOTSTRAPPED ANALYSIS

Loss component number and title	Weighted SSE	N	Weighted MSE	Current weight	Suggested weight	R-squared in CPUE
Loss(-1) SSE in yield	0.000E+00					
Loss(0) Penalty for B1R > 2	0.000E+00	1	N/A	1.000E-01	N/A	
Loss(1) Survey CPUE Spring	1.895E+01	29	7.020E-01	1.000E+00	1.000E+00	0.131
TOTAL OBJECTIVE FUNCTION:	1.89548543E+01					

Number of restarts required for convergence: 18

Est. B-ratio coverage index (0 worst, 2 best): 0.6336 < These two measures are defined in Prager

Est. B-ratio nearness index (0 worst, 1 best): 0.7091 < et al. (1996), Trans. A.F.S. 125:729

MODEL PARAMETER ESTIMATES (NON-BOOTSTRAPPED)

Parameter		Estimate	Starting guess	Estimated	User guess
B1R	Starting biomass ratio, year 1965	5.900E-01	1.000E+00	1	1

MSY	Maximum sustainable yield	2.931E+03	3.000E+03	1	1
r	Intrinsic rate of increase	3.993E-01	8.000E-01	1	1
....	Catchability coefficients by fishery:				
q(1)	Survey CPUE Spring	3.065E-02	1.000E-02	1	1

MANAGEMENT PARAMETER ESTIMATES (NON-BOOTSTRAPPED)

Parameter		Estimate	Formula	Related quantity
MSY	Maximum sustainable yield	2.931E+03	Kr/4	
K	Maximum stock biomass	2.936E+04		
Bmsy	Stock biomass at MSY	1.468E+04	K/2	
Fmsy	Fishing mortality at MSY	1.997E-01	r/2	
F(0.1)	Management benchmark	1.797E-01	0.9*Fmsy	
Y(0.1)	Equilibrium yield at F(0.1)	2.902E+03	0.99*MSY	
B-ratio	Ratio of B(2015) to Bmsy	5.709E-01		
F-ratio	Ratio of F(2014) to Fmsy	2.066E-02		
F01-mult	Ratio of F(0.1) to F(2014)	4.356E+01		
Y-ratio	Proportion of MSY avail in 2015	8.159E-01	2*Br-Br^2	Ye(2015) = 2.392E+03

.... Fishing effort at MSY in units of each fishery:

fmsy(1)	Survey CPUE Spring	6.514E+00	r/2q(1)	f(0.1) = 5.863E+00

Faroe Bank Cod RV Page 2

ESTIMATED POPULATION TRAJECTORY (NON-BOOTSTRAPPED)

Obs	Year or ID	Estimated total F mort	Estimated starting biomass	Estimated average biomass	Observed total yield	Model total yield	Estimated surplus production	Ratio of F mort to Fmsy	Ratio of biomass to Bmsy
1	1965	0.269	8.662E+03	8.716E+03	2.341E+03	2.341E+03	2.447E+03	1.345E+00	5.900E-01
2	1966	0.211	8.768E+03	9.068E+03	1.909E+03	1.909E+03	2.502E+03	1.054E+00	5.972E-01
3	1967	0.159	9.362E+03	9.888E+03	1.569E+03	1.569E+03	2.618E+03	7.947E-01	6.376E-01
4	1968	0.397	1.041E+04	9.746E+03	3.871E+03	3.871E+03	2.598E+03	1.989E+00	7.091E-01
5	1969	0.268	9.138E+03	9.169E+03	2.457E+03	2.457E+03	2.518E+03	1.342E+00	6.224E-01
6	1970	0.336	9.199E+03	8.931E+03	3.002E+03	3.002E+03	2.481E+03	1.684E+00	6.266E-01
7	1971	0.234	8.678E+03	8.877E+03	2.079E+03	2.079E+03	2.473E+03	1.173E+00	5.911E-01
8	1972	0.234	9.072E+03	9.256E+03	2.168E+03	2.168E+03	2.531E+03	1.173E+00	6.179E-01
9	1973	0.643	9.435E+03	7.929E+03	5.101E+03	5.101E+03	2.303E+03	3.222E+00	6.427E-01
10	1974	0.312	6.636E+03	6.627E+03	2.068E+03	2.068E+03	2.049E+03	1.563E+00	4.520E-01
11	1975	0.307	6.618E+03	6.624E+03	2.036E+03	2.036E+03	2.048E+03	1.539E+00	4.508E-01
12	1976	0.347	6.630E+03	6.510E+03	2.258E+03	2.258E+03	2.023E+03	1.737E+00	4.516E-01
13	1977	0.138	6.395E+03	6.969E+03	9.590E+02	9.590E+02	2.121E+03	6.892E-01	4.356E-01
14	1978	0.700	7.557E+03	6.252E+03	4.379E+03	4.379E+03	1.959E+03	3.508E+00	5.148E-01
15	1979	0.244	5.137E+03	5.358E+03	1.306E+03	1.306E+03	1.749E+03	1.221E+00	3.499E-01
16	1980	0.203	5.580E+03	5.920E+03	1.203E+03	1.203E+03	1.887E+03	1.018E+00	3.801E-01
17	1981	0.184	6.264E+03	6.676E+03	1.229E+03	1.229E+03	2.059E+03	9.219E-01	4.266E-01
18	1982	0.309	7.094E+03	7.074E+03	2.184E+03	2.184E+03	2.144E+03	1.546E+00	4.832E-01
19	1983	0.328	7.054E+03	6.972E+03	2.284E+03	2.284E+03	2.123E+03	1.641E+00	4.805E-01
20	1984	0.320	6.893E+03	6.846E+03	2.189E+03	2.189E+03	2.096E+03	1.601E+00	4.695E-01
21	1985	0.461	6.801E+03	6.315E+03	2.913E+03	2.913E+03	1.978E+03	2.310E+00	4.632E-01
22	1986	0.312	5.866E+03	5.888E+03	1.836E+03	1.836E+03	1.880E+03	1.562E+00	3.996E-01
23	1987	0.687	5.910E+03	4.965E+03	3.409E+03	3.409E+03	1.644E+03	3.438E+00	4.025E-01
24	1988	0.951	4.145E+03	3.118E+03	2.966E+03	2.966E+03	1.109E+03	4.764E+00	2.823E-01
25	1989	0.630	2.288E+03	2.015E+03	1.270E+03	1.270E+03	7.492E+02	3.156E+00	1.558E-01
26	1990	0.146	1.767E+03	1.984E+03	2.890E+02	2.890E+02	7.387E+02	7.294E-01	1.204E-01
27	1991	0.118	2.217E+03	2.516E+03	2.970E+02	2.970E+02	9.183E+02	5.911E-01	1.510E-01
28	1992	0.046	2.838E+03	3.327E+03	1.540E+02	1.540E+02	1.177E+03	2.318E-01	1.933E-01
29	1993	0.060	3.861E+03	4.460E+03	2.660E+02	2.660E+02	1.509E+03	2.987E-01	2.630E-01
30	1994	0.129	5.104E+03	5.640E+03	7.250E+02	7.250E+02	1.818E+03	6.438E-01	3.476E-01
31	1995	0.087	6.197E+03	6.937E+03	6.010E+02	6.010E+02	2.113E+03	4.339E-01	4.221E-01
32	1996	0.270	7.709E+03	7.801E+03	2.106E+03	2.106E+03	2.288E+03	1.352E+00	5.251E-01
33	1997	0.504	7.891E+03	7.135E+03	3.594E+03	3.594E+03	2.155E+03	2.523E+00	5.375E-01
34	1998	0.567	6.451E+03	5.712E+03	3.239E+03	3.239E+03	1.835E+03	2.840E+00	4.394E-01
35	1999	0.185	5.047E+03	5.425E+03	1.001E+03	1.001E+03	1.766E+03	9.240E-01	3.438E-01
36	2000	0.193	5.812E+03	6.187E+03	1.194E+03	1.194E+03	1.950E+03	9.665E-01	3.959E-01
37	2001	0.152	6.568E+03	7.097E+03	1.080E+03	1.080E+03	2.148E+03	7.622E-01	4.473E-01
38	2002	0.222	7.635E+03	7.913E+03	1.756E+03	1.756E+03	2.308E+03	1.111E+00	5.201E-01

39	2003	0.932	8.187E+03	6.087E+03	5.676E+03	5.676E+03	1.911E+03	4.670E+00	5.577E-01
40	2004	1.092	4.422E+03	3.123E+03	3.411E+03	3.411E+03	1.109E+03	5.469E+00	3.012E-01
41	2005	0.672	2.120E+03	1.832E+03	1.232E+03	1.232E+03	6.857E+02	3.367E+00	1.444E-01
42	2006	0.714	1.574E+03	1.338E+03	9.550E+02	9.550E+02	5.099E+02	3.574E+00	1.072E-01
43	2007	0.402	1.129E+03	1.118E+03	4.500E+02	4.500E+02	4.296E+02	2.015E+00	7.688E-02
44	2008	0.177	1.108E+03	1.231E+03	2.180E+02	2.180E+02	4.708E+02	8.871E-01	7.549E-02
45	2009	0.050	1.361E+03	1.612E+03	8.000E+01	8.000E+01	6.079E+02	2.486E-01	9.271E-02
46	2010	0.047	1.889E+03	2.230E+03	1.050E+02	1.050E+02	8.224E+02	2.358E-01	1.287E-01
47	2011	0.126	2.606E+03	2.938E+03	3.700E+02	3.700E+02	1.055E+03	6.307E-01	1.775E-01
48	2012	0.028	3.292E+03	3.882E+03	1.080E+02	1.080E+02	1.344E+03	1.393E-01	2.242E-01
49	2013	0.007	4.527E+03	5.345E+03	3.800E+01	3.800E+01	1.743E+03	3.561E-02	3.084E-01
50	2014	0.004	6.232E+03	7.271E+03	3.000E+01	3.000E+01	2.179E+03	2.066E-02	4.245E-01
51	2015		8.381E+03				5.709E-01		

Faroe Bank Cod RV Page 3

RESULTS FOR DATA SERIES # 1 (NON-BOOTSTRAPPED) Survey CPUE Spring

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Data type CC: CPUE-catch series Series weight: 1.000

Obs	Year	Observed CPUE	Estimated CPUE	Estim F	Observed yield	Model yield	Resid in log scale	Resid in yield
1	1965	*	2.671E+02	0.2686	2.341E+03	2.341E+03	0.00000	0.000E+00
2	1966	*	2.779E+02	0.2105	1.909E+03	1.909E+03	0.00000	0.000E+00
3	1967	*	3.031E+02	0.1587	1.569E+03	1.569E+03	0.00000	0.000E+00
4	1968	*	2.987E+02	0.3972	3.871E+03	3.871E+03	0.00000	0.000E+00
5	1969	*	2.810E+02	0.2680	2.457E+03	2.457E+03	0.00000	0.000E+00
6	1970	*	2.737E+02	0.3361	3.002E+03	3.002E+03	0.00000	0.000E+00
7	1971	*	2.721E+02	0.2342	2.079E+03	2.079E+03	0.00000	0.000E+00
8	1972	*	2.837E+02	0.2342	2.168E+03	2.168E+03	0.00000	0.000E+00
9	1973	*	2.430E+02	0.6433	5.101E+03	5.101E+03	0.00000	0.000E+00
10	1974	*	2.031E+02	0.3121	2.068E+03	2.068E+03	0.00000	0.000E+00
11	1975	*	2.030E+02	0.3074	2.036E+03	2.036E+03	0.00000	0.000E+00
12	1976	*	1.995E+02	0.3468	2.258E+03	2.258E+03	0.00000	0.000E+00
13	1977	*	2.136E+02	0.1376	9.590E+02	9.590E+02	0.00000	0.000E+00
14	1978	*	1.916E+02	0.7004	4.379E+03	4.379E+03	0.00000	0.000E+00
15	1979	*	1.642E+02	0.2437	1.306E+03	1.306E+03	0.00000	0.000E+00
16	1980	*	1.814E+02	0.2032	1.203E+03	1.203E+03	0.00000	0.000E+00
17	1981	*	2.046E+02	0.1841	1.229E+03	1.229E+03	0.00000	0.000E+00
18	1982	*	2.168E+02	0.3088	2.184E+03	2.184E+03	0.00000	0.000E+00
19	1983	7.899E+01	2.137E+02	0.3276	2.284E+03	2.284E+03	0.99524	0.000E+00
20	1984	1.752E+02	2.098E+02	0.3198	2.189E+03	2.189E+03	0.18032	0.000E+00
21	1985	1.735E+02	1.936E+02	0.4613	2.913E+03	2.913E+03	0.10958	0.000E+00
22	1986	2.661E+02	1.805E+02	0.3118	1.836E+03	1.836E+03	-0.38823	0.000E+00
23	1987	1.640E+02	1.522E+02	0.6865	3.409E+03	3.409E+03	-0.07495	0.000E+00
24	1988	7.311E+01	9.558E+01	0.9511	2.966E+03	2.966E+03	0.26800	0.000E+00
25	1989	3.655E+01	6.176E+01	0.6302	1.270E+03	1.270E+03	0.52465	0.000E+00
26	1990	2.324E+01	6.082E+01	0.1456	2.890E+02	2.890E+02	0.96212	0.000E+00
27	1991	5.097E+01	7.713E+01	0.1180	2.970E+02	2.970E+02	0.41426	0.000E+00
28	1992	2.843E+01	1.020E+02	0.0463	1.540E+02	1.540E+02	1.27735	0.000E+00
29	1993	2.576E+01	1.367E+02	0.0596	2.660E+02	2.660E+02	1.66894	0.000E+00
30	1994	8.674E+01	1.729E+02	0.1286	7.250E+02	7.250E+02	0.68956	0.000E+00
31	1995	9.017E+01	2.126E+02	0.0866	6.010E+02	6.010E+02	0.85789	0.000E+00
32	1996	*	2.391E+02	0.2700	2.106E+03	2.106E+03	0.00000	0.000E+00
33	1997	5.934E+02	2.187E+02	0.5037	3.594E+03	3.594E+03	-0.99817	0.000E+00
34	1998	6.074E+02	1.751E+02	0.5671	3.239E+03	3.239E+03	-1.24403	0.000E+00
35	1999	4.210E+02	1.663E+02	0.1845	1.001E+03	1.001E+03	-0.92888	0.000E+00
36	2000	3.645E+02	1.896E+02	0.1930	1.194E+03	1.194E+03	-0.65339	0.000E+00
37	2001	1.022E+03	2.175E+02	0.1522	1.080E+03	1.080E+03	-1.54755	0.000E+00

38	2002	4.439E+02	2.425E+02	0.2219	1.756E+03	1.756E+03	-0.60439	0.000E+00
39	2003	8.671E+02	1.866E+02	0.9325	5.676E+03	5.676E+03	-1.53632	0.000E+00
40	2004	*	9.574E+01	1.0921	3.411E+03	3.411E+03	0.00000	0.000E+00
41	2005	*	5.616E+01	0.6724	1.232E+03	1.232E+03	0.00000	0.000E+00
42	2006	6.051E+01	4.102E+01	0.7136	9.550E+02	9.550E+02	-0.38875	0.000E+00
43	2007	5.206E+01	3.428E+01	0.4023	4.500E+02	4.500E+02	-0.41779	0.000E+00
44	2008	6.402E+01	3.772E+01	0.1771	2.180E+02	2.180E+02	-0.52893	0.000E+00
45	2009	5.550E+01	4.940E+01	0.0496	8.000E+01	8.000E+01	-0.11647	0.000E+00
46	2010	5.808E+01	6.836E+01	0.0471	1.050E+02	1.050E+02	0.16300	0.000E+00
47	2011	1.224E+02	9.006E+01	0.1259	3.700E+02	3.700E+02	-0.30687	0.000E+00
48	2012	4.454E+01	1.190E+02	0.0278	1.080E+02	1.080E+02	0.98270	0.000E+00
49	2013	1.390E+02	1.638E+02	0.0071	3.800E+01	3.800E+01	0.16444	0.000E+00
50	2014	2.092E+02	2.229E+02	0.0041	3.000E+01	3.000E+01	0.06331	0.000E+00

* Asterisk indicates missing value(s).

Faroe Bank Cod RV Page 4

UNWEIGHTED LOG RESIDUAL PLOT FOR DATA SERIES # 1

```
                -2        -1.5      -1        -0.5      0         0.5       1         1.5       2
                |    .    |    .    |    .    |    .    |    .    |    .    |    .    |    .    |
Year  Residual  ---------------------------------------------------------------------------------
1965   0.0000                                           |
1966   0.0000                                           |
1967   0.0000                                           |
1968   0.0000                                           |
1969   0.0000                                           |
1970   0.0000                                           |
1971   0.0000                                           |
1972   0.0000                                           |
1973   0.0000                                           |
1974   0.0000                                           |
1975   0.0000                                           |
1976   0.0000                                           |
1977   0.0000                                           |
1978   0.0000                                           |
1979   0.0000                                           |
1980   0.0000                                           |
1981   0.0000                                           |
1982   0.0000                                           |
1983   0.9952                                           |====================
1984   0.1803                                           |====
1985   0.1096                                           |==
1986  -0.3882                                   ========|
1987  -0.0750                                          =|
1988   0.2680                                           |=====
1989   0.5246                                           |==========
1990   0.9621                                           |===================
1991   0.4143                                           |========
1992   1.2774                                           |==========================
1993   1.6689                                           |=================================
1994   0.6896                                           |==============
1995   0.8579                                           |=================
1996   0.0000                                           |
1997  -0.9982                       ====================|
1998  -1.2440                  =========================|
1999  -0.9289                        ===================|
2000  -0.6534                              =============|
2001  -1.5476            ===============================|
2002  -0.6044                               ============|
2003  -1.5363            ===============================|
2004   0.0000                                           |
```

```
2005   0.0000                         |
2006  -0.3887                 ========|
2007  -0.4178                 ========|
2008  -0.5289              ===========|
2009  -0.1165                       ==|
2010   0.1630                         |===
2011  -0.3069                   ======|
2012   0.9827                         |====================
2013   0.1644                         |===
2014   0.0633                         |=
            --------------------------------------------------------------------------------------
```

```
Faroe Bank Cod RV                                              Page  5

          Observed (O) and Estimated (*) CPUE for Data Series # 1 -- Survey CPUE Spring
      :
 1200. -:
      :
      :
      :
      :                                       O
 1000. -:
      :
      :
      :                                         O
      :
  800. -:
      :
      :
      :
      :
  600. -:                                    O O
      :
      :
      :
      :                                      O    O
  400. -:
      :                                       O
      :       *
      :     * *  * ** * *           O
      :            *                  *      *         *
  200. -:             * ** * *  * ** * ** *        *  *    * *  *         O
      :                *     OO   2      *     * *         *
      :                         * *              O* O
      :                   O     2 * **   O O      *  O   O  * *
      :                         O OO O O          ** 2 *2 O  O
   0. -:
      :..............................................................................................
      :      :      :      :      :      :      :      :      :      :      :
    1959.  1965.  1971.  1977.  1983.  1989.  1995.  2001.  2007.  2013.  2019.



                 Time Plot of Estimated F-Ratio and B-Ratio
      :
    6. -:
      :
      :
```

```
    :                                                  F
    :
5. -:
    :                                   F
    :                                                 F
    :
    :
4. -:
    :
    :                        F                                  F
    :                                   F                     F
    :                  F                    F
3. -:
    :                                              F
    :                                             F
    :                                  F
    :
2. -:          F                                               F
    :                       F
    :            F     F F       F F F  F
    :       F     F                              F
    :             F F       F                         F
1. -:  -- - -- - 2- - -- - -- - -- - -- 2 2- - -- - -- - -- - -- - -- - 22 - -- - -- - -- - -- - -- - -- - -
    :         F B                          F               F          F
    :       B BB   BB B BB      F B                  F    F   BB       BB           F     B
    :                   B BB B  B B BB B BB B B        B 2    B BB B    B            B B
    :                                 B B BB 2 2                BB    F 2 B2
0. -:                                                     B BB      F F
    :.............................................................................................
     :       :       :       :       :       :       :       :       :       :       :
  1959.   1965.   1971.   1977.   1983.   1989.   1995.   2001.   2007.   2013.   2019.
```

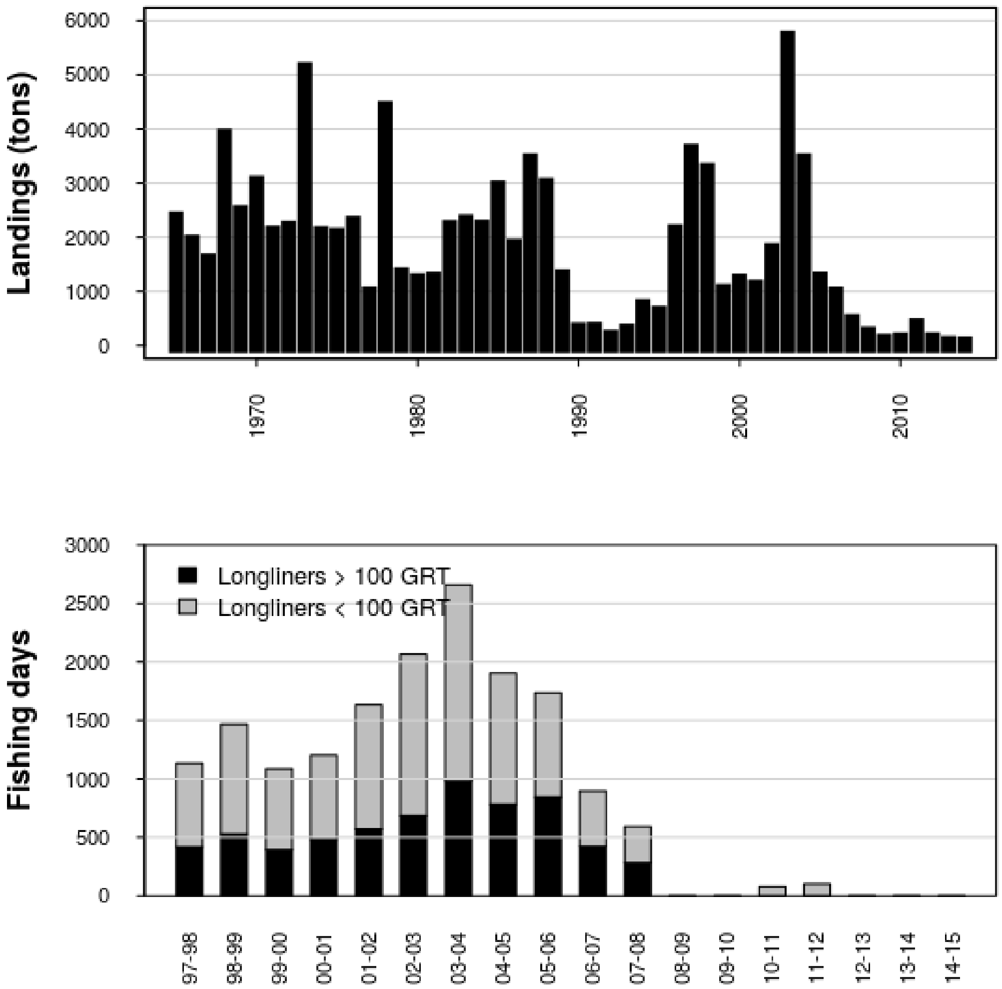

Figure 3.1. Faroe Bank (sub-division Vb2) cod. Reported landings 1965-2014. Since 1992 only catches from Faroese and Norwegian vessels are considered to be taken on Faroe Bank. Lower plot: fishing days (fishing year) 1997-2015 for long line gear type in the Faroe Bank.

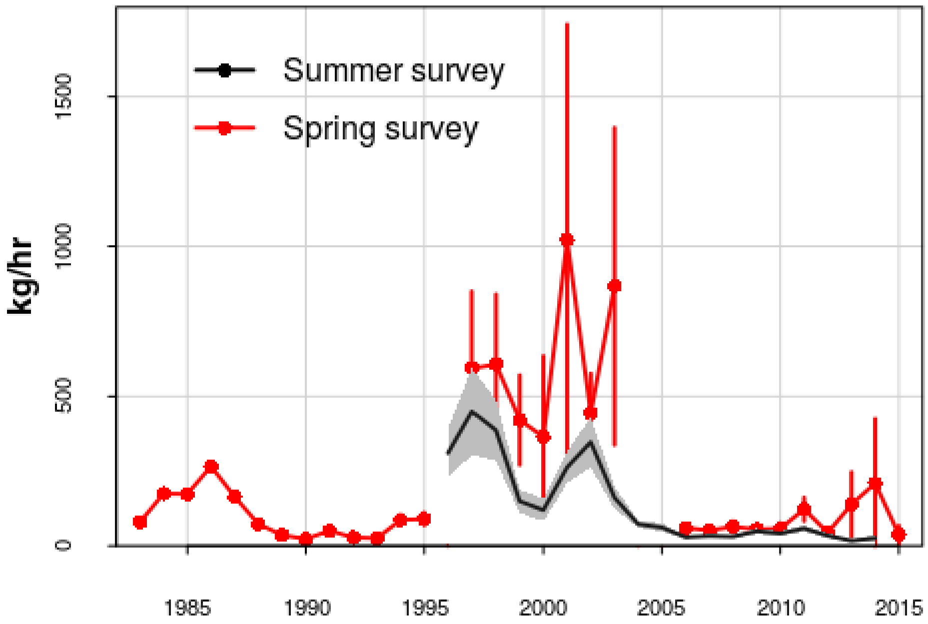

Figure 3.2. Faroe Bank (subdivision Vb2) cod. Catch per unit of effort in the spring groundfish survey (1983-2015)(red line) and summer survey (1996-2014)(black line). Vertical bars and shaded areas show the standard error in the estimation of indexes.

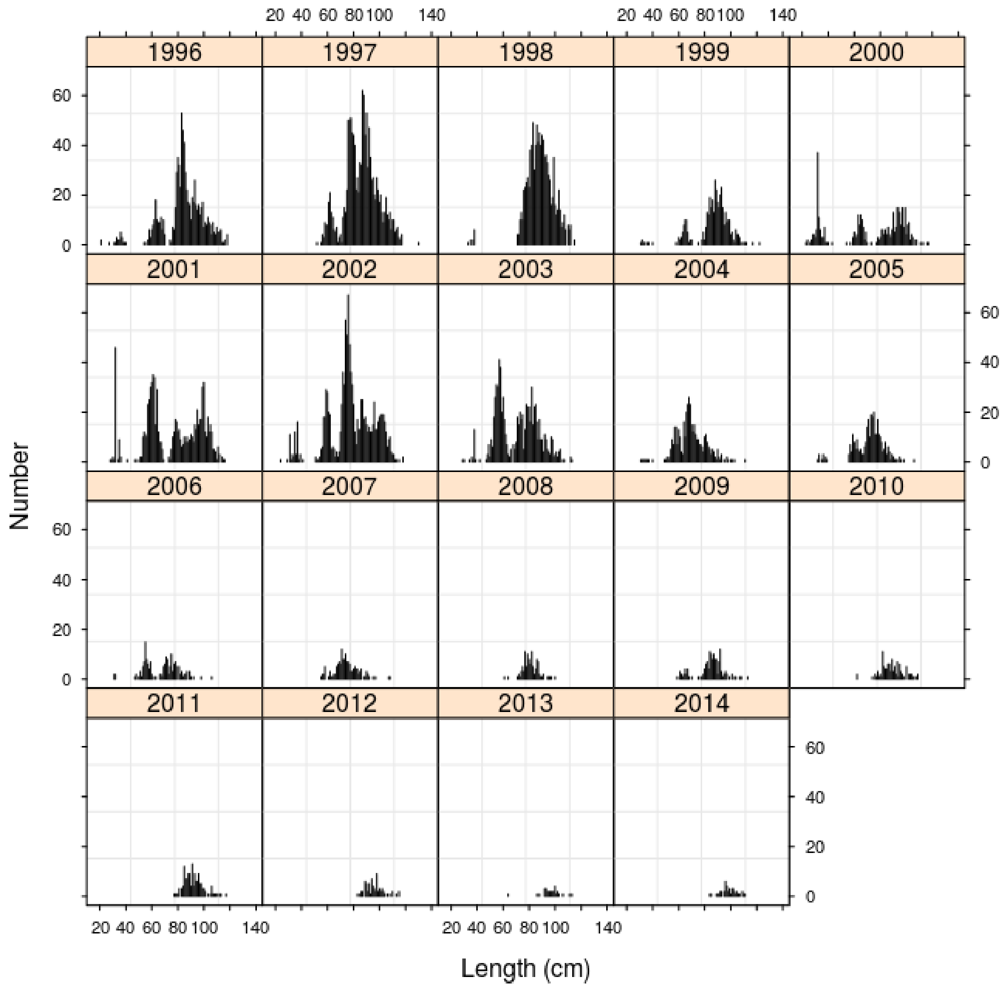

Figure 3.3. Faroe Bank (sub-division Vb2) cod. Length distributions in summer survey (1996-2014)

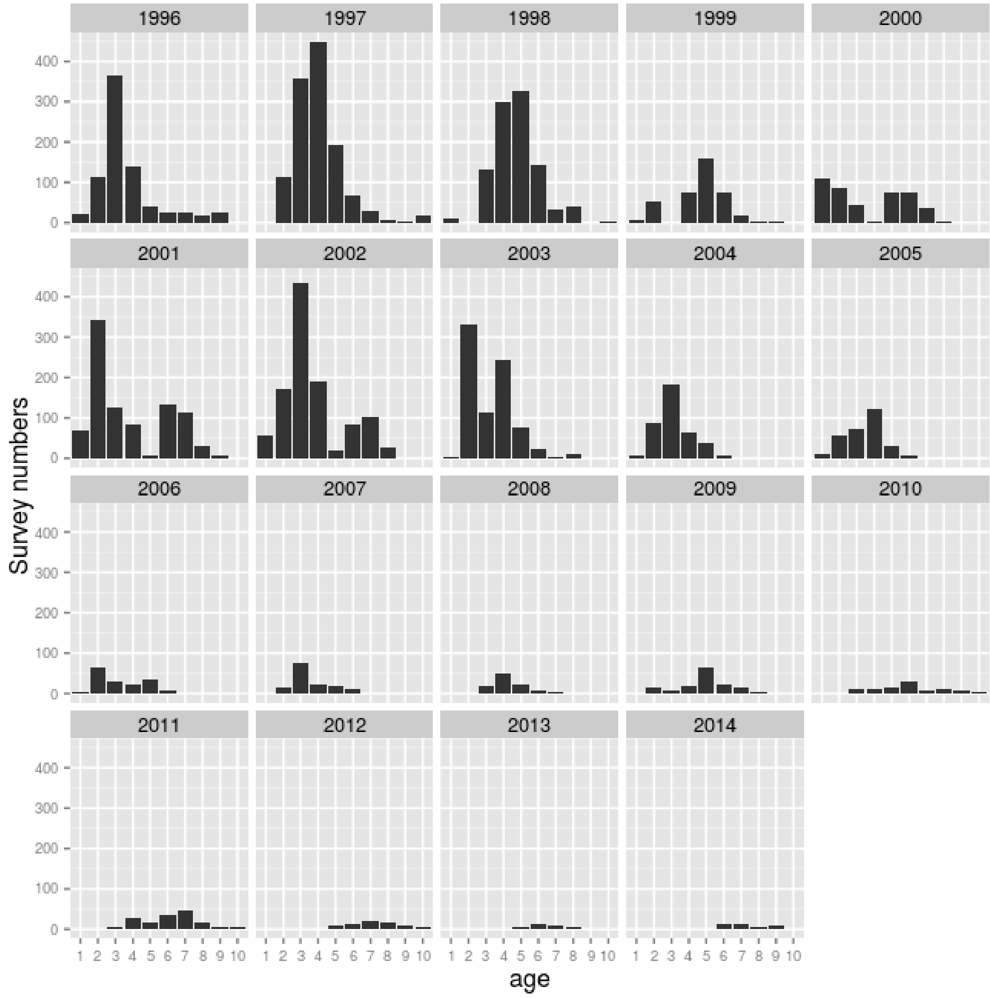

Figure 3.4. Faroe Bank (sub-division Vb2) cod. Age-disaggregated indices in the summer survey (ages 1-11)(1996-2014)

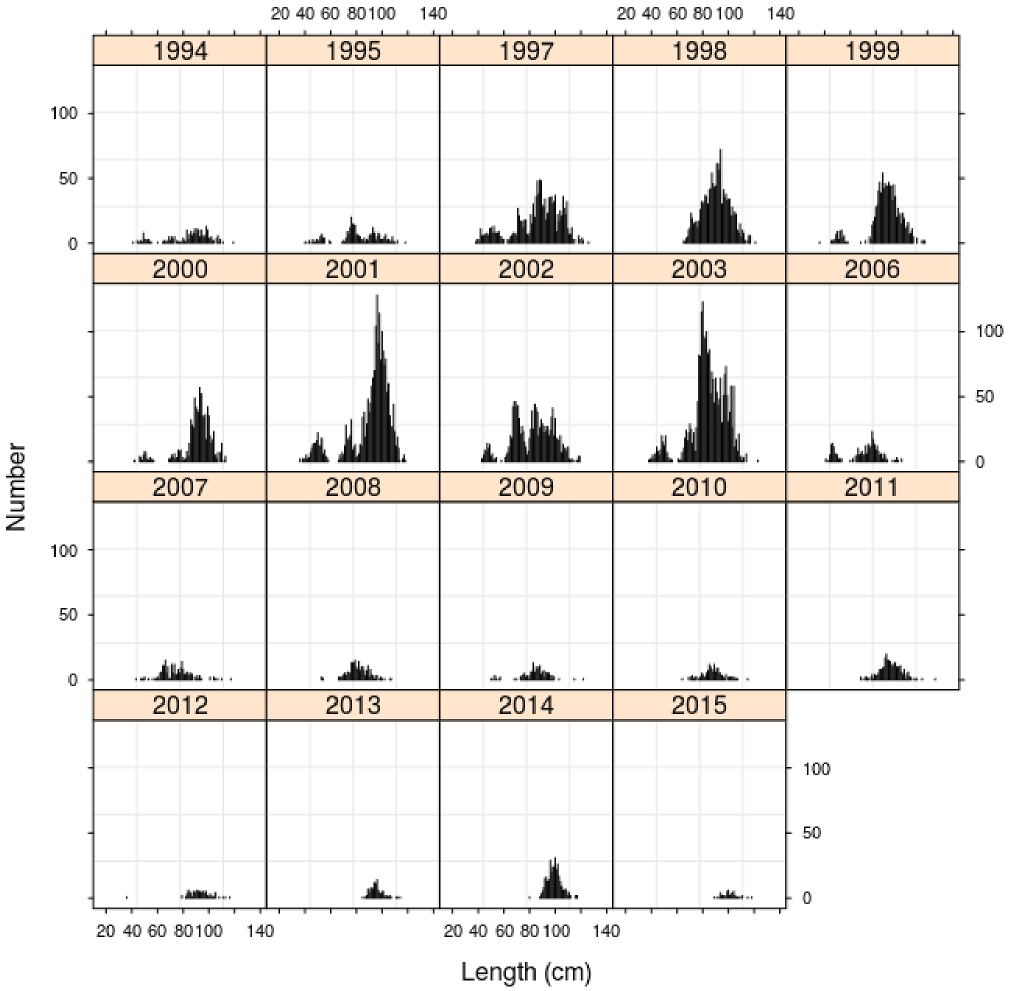

Figure 3.5. Faroe Bank (sub-division Vb2) cod. Length distributions in spring survey (1994-2015). No surveys were conducted in 1996, 2004 and 2005.

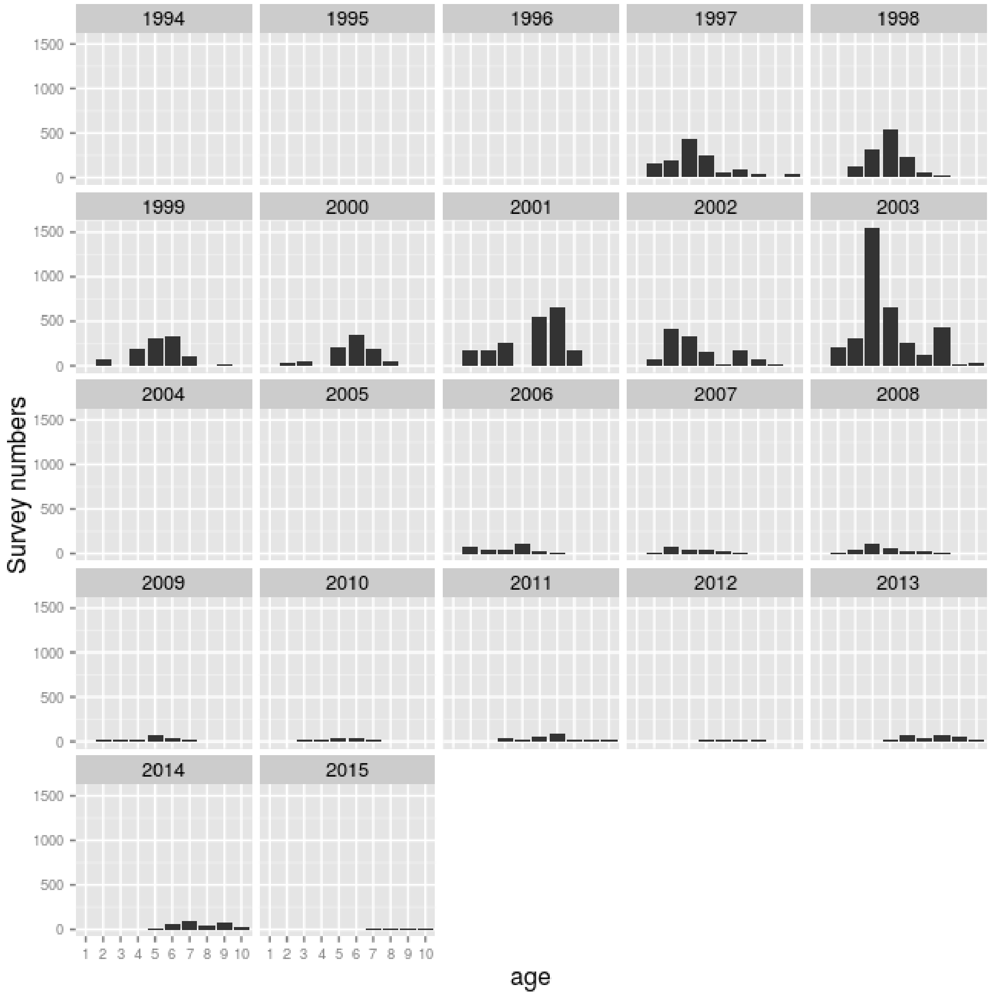

Figure 3.6. Faroe Bank (sub-division Vb2) cod. Age-disaggregated indices in the spring survey (ages 1-11) (1994-2015). No surveys were conducted in 1996, 2004 and 2005.

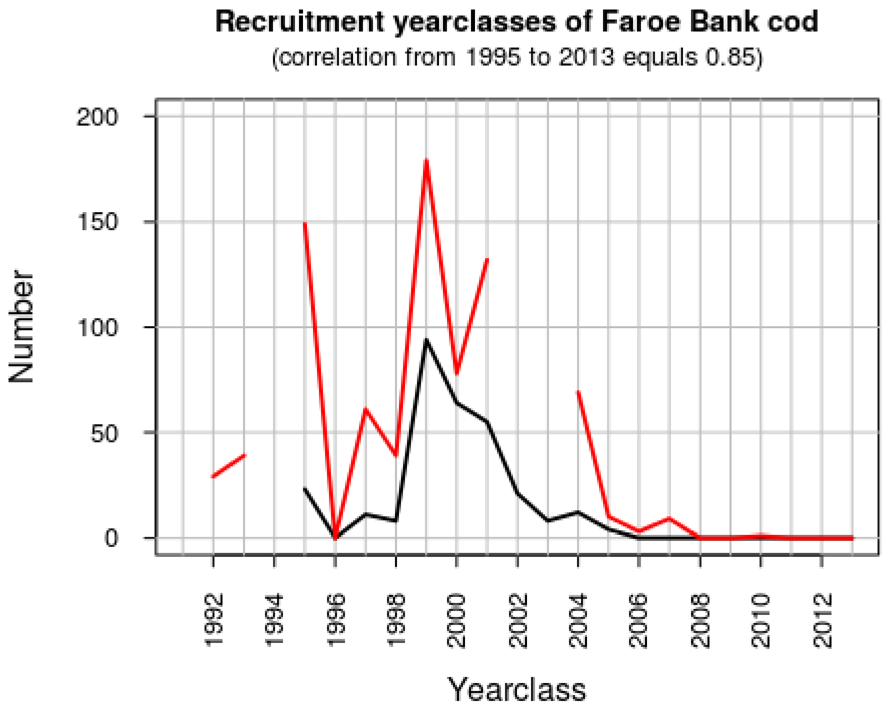

Figure 3.7. Faroe Bank (sub-division Vb2) cod. Correlation between recruitment year classes in both survey indices.

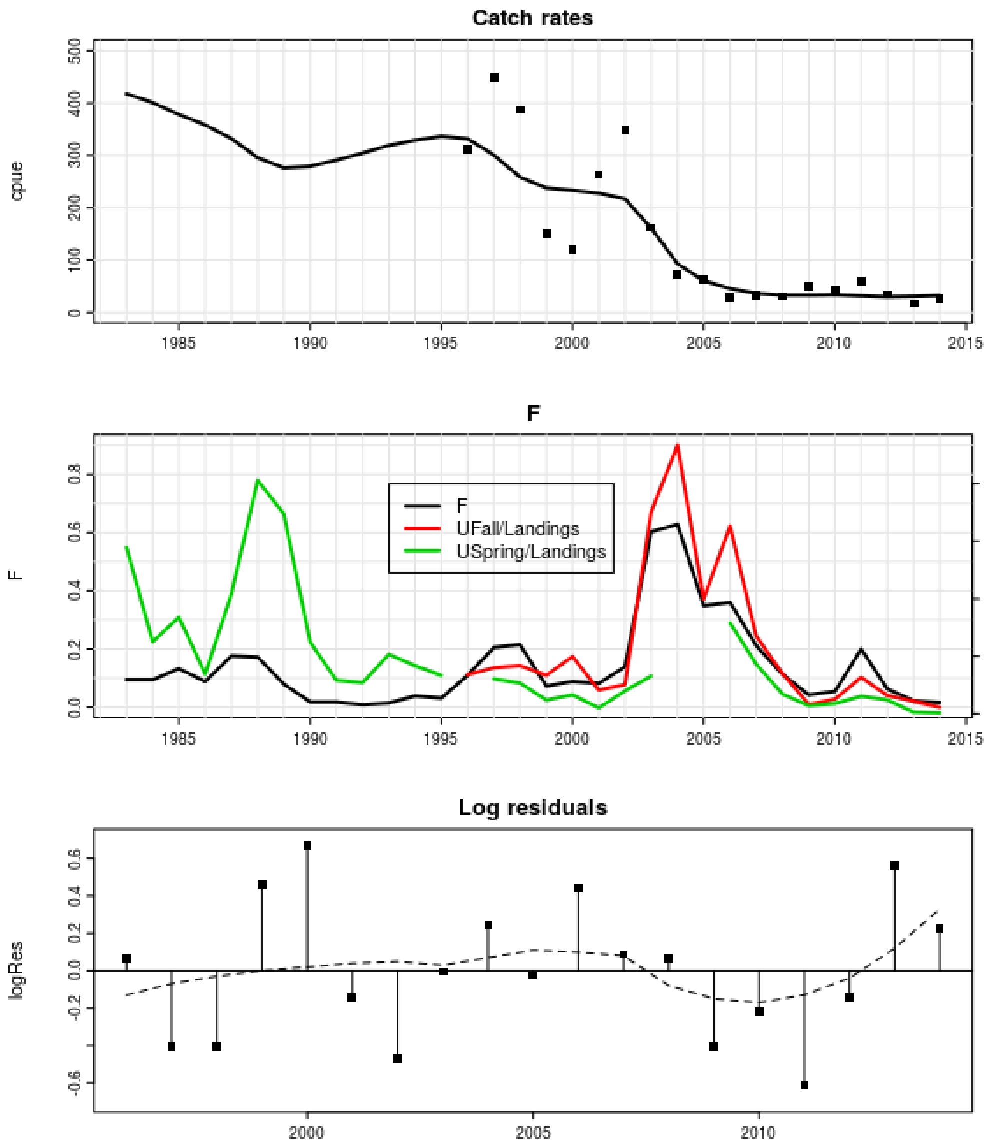

Figure 3.8. Results from the surplus production model using the summer index. Observed (points) and expected catch rates (kg/hour) (top panel). Estimated fishing mortality (black line) and exploitation ratios (ratio of spring index to landings)(green line) (ratio of summer index to landings)(red line)(middle panel). Model residuals in log scale (bottom panel)

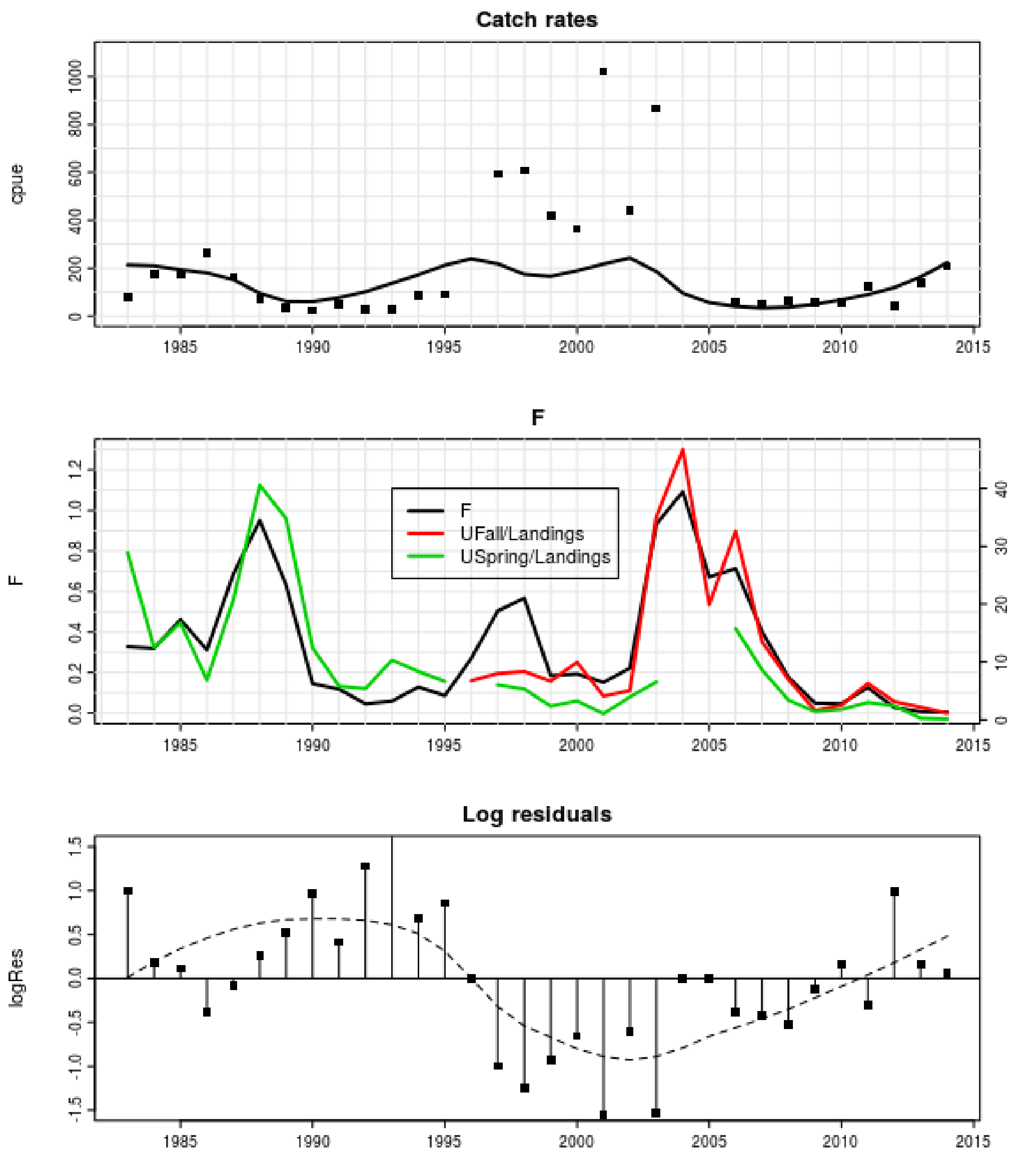

Figure 3.9. Results from the surplus production model using the spring index. Observed (points) and expected catch rates (kg/hour) (top panel). Estimated fishing mortality (black line) and exploitation ratios (ratio of spring index to landings)(green line) (ratio of summer index to landings)(red line)(middle panel). Model residuals in log scale (bottom panel)

4 Faroe Plateau cod

Summary

The input data consisted of the catch-at-age matrix (ages 2-10+ years) for the period 1959-2014 and two age-disaggregated abundance indices obtained from the two Faroese groundfish surveys: the spring survey 1994-2015 (shifted back to the previous year) and the summer survey 1996-2014. The maturities were obtained from the spring survey 1983-2015.

The assessment settings were the same as in the 2014 assessment. An XSA was tuned with the two survey indices. The fishing mortality in 2014 (average of ages 3-7 years) was estimated at 0.41, which was higher than the Fmsy of 0.32. The total stock size (age 2+) in the beginning of 2014 was estimated at 27 700 tonnes and the spawning stock biomass at 21 100 tonnes, which was slightly above the limit biomass of 21 000 tonnes.

The short term prediction until year 2017 showed a slightly decreasing total stock biomass to 24 200 tonnes and a spawning stock biomass to 19 500 tonnes.

It is adviced to reduce the fishing mortality substantially to rebuild the stock

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 (Division Vb2), on the Faroe Plateau (Division Vb1) 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

4.2.1 Trends in landings and fisheries

The landings were obtained from the Fisheries Ministry and Statistics Faroe Islands. The landings are presented in 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 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 4.2.3).

4.2.2 Catch-at-age

Landings-at-age for 2014 are provided for the Faroese fishery in Table 4.2.4. Faroese landings from most of the fleet categories were sampled (Table 4.2.5). The catch-at-age is 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.

4.2.3 Weight-at-age

Mean weight-at-age data 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 2014 showed a discrepancy of 0 %. The weights have increased in recent years (Figure 4.2.2).

4.2.4 Maturity-at-age

The proportion of mature cod by age during the Faroese groundfish surveys carried out during the spawning period (March) is given in Table 4.2.8 and in Figure 4.2.3. 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.

4.2.5 Catch, effort and research vessel data

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), i.e., a decreasing trend after age 5. The stratified mean catch of cod per unit effort (Figure 4.2.5) has been low in the recent years.

The other tuning series used is the Summer Groundfish Survey. The stratified mean catch of cod per unit effort has been low in recent years (Figure 4.2.5). The catch curves (Figure 4.2.6) 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 and they show that there are few small cod in the stock.

Three commercial cpue series (longliners and pairtrawlers) are also presented (Tables 4.2.10, 4.2.11, and 4.2.12 as well as Figure 4.2.7), although they are not used as tuning series. All these series show that the incoming year classes are small. Note that the small boats (0-25 GRT) operating with longlines and jigging reels close to land have had a relatively higher cpue in recent years compared with the other cpue series and the two tuning series (Figure 4.2.8 and Figure 4.2.9), although the larger longliners also have had a high catchability in recent years. When that happens, the recruitment of 2-year old cod tends to be low.

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 using XSA and the procedure is described in stock annex and the results of the assessment is mostly data-driven implying that there may be little difference in the assessment results by using another method.

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: Bpa = 40 kt, Blim = 21 kt, Fpa = 0.35 and Flim = 0.68.

The reference points based on the yield-per-recruit curve are the following: F_{max} = 0.25, $F_{0.1}$ = 0.11, F35%SPR = 0.17, F_{med} = 0.41, F_{low} = 0.10, F_{high} = 0.97.

The group adopted in 2011 following preliminary MSY reference points: F_{msy} = 0.32, see section 4.8. The $B_{trigger}$ was set at B_{pa} = 40 kt.

4.6 State of the stock

Since the current assessment is an update assessment, the same procedure is followed as last year: to use the two surveys for tuning. The commercial series showed a similar overall tendency as the surveys (Figure 4.2.7) but were not used in the tuning. The XSA-run (Table 4.6.1) showed that the fit between the model and the tuning series (logQ residuals, Figure 4.6.1) was rather poor for the young ages and there seemed to be both year class effects and year effects.

The results from the XSA-run shows that fishing mortality (F3-7) has fluctuated in recent years without a trend (Table 4.6.2, Figure 4.6.2), and other measures of fishing mortality have done so as well (Table 4.6.4, Figure 4.6.3). The population numbers, total biomass and spawning stock biomass have been low compared with other years in the series (Table 4.6.3, Table 4.6.4, Figure 4.6.2). The poor state of the stock since 2005 has been due to poor recruitment (not poor individual growth). Prior to that time, extremely weak year classes (< 5 million individuals) were only observed two times, whereas it has happened four times since 2005 (in 2011-2014). In the past there has been a poor relationship between the size of the spawning stock and subsequent recruitment (Figure 4.6.4), but the increasing number of low data points in recent years have strengthened the stock-recruitment relationship. The spawning stock biomass in the terminal year was close to Blim and the fishing mortality above Fmsy (Figure 4.6.5).

During the years 1938-55 a large work was undertaken in ICES ("The North-Western Area Committee", which established the "Sub-Committee on the Faroe Question", sometimes referred to as "The Sub-Committee on a proposed Closure of Certain Extra-territorial Waters off the Faroes") to investigate whether certain areas around the Faroe Islands should be closed to fishing. Although no areas were closed as a result of this work a large amount of data became available. These data, together with other data, are now used to estimate the stock size of Faroe Plateau cod back to 1906, which puts the present stock size into a wider perspective (Working Document no. 32). A cpue series (tonnes per million tonn-hours) for British steam 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 1959-1972. Another cpue series (cwts per day of absence from port, 1 cwt = 50.8 kg) was available for English steam trawlers 1906-1954 (with gaps). In addition there was a record of Faroese boat catches that extended into the war periods. In WD 32 the biomass back in time is estimated in four steps: 1) Extending the British cpue back to 1906 by the use of English steam trawlers. 2-3) Extending the British cpue to the World War 1 period and World War 2 period (with gaps) by the Faroe boat catches. 4) Extending the age 2+ biomass from the age-based assessment back to 1906 by using the raw or constructed British cpue series. The result depended upon whether a regression line (biomass versus cpue) was used or a scaling factor (sum of biomass divided by the sum of cpue), the latter giving a higher biomass estimate back in time. The resulting exploitation ratio of the higher biomass was in better correspondence with tagging returns and a Faroese longliner series (see WD 32) and is probably more reliable. The results are presented in Table 4.6.5 and Figure 4.6.6. The biomass in 2005-2014 was very low compared with the entire period, but it is worth noting that the fishing mortality (exploitation ratio) was high already in the 1930s. The extension of biomass back in time can likely be improved in the future by including the Faroe longliner CPUE series mentioned above and also to include age data prior to 1959.

4.7 Short term forecast

4.7.1 Input data

The input data for the short term prediction are given in Table 4.7.1. Note the extremely weak YC2010, YC2011,YC2012 and YC2013, which were set to the face value from the XSA-run, i.e., according to the Annex. 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 2012-2014. The weights at age in the catches in 2015 were estimated from the spring survey (ages 2 and 6-8 years) whereas the other ages were estimated from the catch weights in January-February 2015. The weights in the catches in 2016 were set to the values in 2015 and the average of 2013-2015 was expected for 2017. The proportion mature in 2014 was set to the 2014 values from the spring groundfish survey, and for 2015-2016 to the average values for 2012-2014.

4.7.2 Results

The landings in 2015 are expected to be 6600 tonnes (Table 4.7.2) (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 18 900 tonnes in 2015, 19 700 tonnes in 2016 and eventually 19 500 tonnes in 2017. The “old” year classes (YC 2008 and YC2009) are still important for the SSB in 2016 and 2017 (Figure 4.7.1).

4.8 Long term forecast

The input to the traditional long term forecast (yield per recruit) 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 Fmsy values lower than Fpa. 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 Fmsy is 0.32. This value (0.32) was adopted by the NWWG 2011 as a preliminary Fmsy.

4.9 Uncertainties in assessment and forecast

Since there is no incentive to discard fish or misreport catches under the effort management system, the catch figures are considered adequate, as well as the catch-at-age, although the number of otoliths should have been higher.

There was a clear retrospective pattern (Figure 4.9.1), indicating uncertainties in the assessment.

Steingrund et al. (2010) found that the recruitment of Faroe Plateau cod (age 2) could be rather precisely estimated as there is a relationship between cod biomass (age 3+) and the amount of cannibalistic cod in nearshore waters in June-October the previous year. This approach showed that the recent year classes were extremely weak (Figure 4.9.2).

4.10 Comparison with previous assessment and forecast

The assessment settings were according to the Stock Annex. The 2015 assessment was much in line with the 2014 assessment and forecast (Figure 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 Fpa of 0.35. ICES considers this to be inconsistent with the PA and MSY approaches. Some work has been done 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 cod stock is assessed to be in a very poor state and is predicted to remain so for the next two years due to poor recruitment. Although the environmental conditions have been rather special since 2007 (lots of mackerel) and may partly be responsible for the poor state of the cod stock, it is certainly necessary to protect the cod stock as much as possible. The reason is not only that it may prevent a total collapse of the stock but also that the stock may recover faster in the future.

Hence, the number of fishing days should be considered and further area closures might be necessary.

The managers should consider changing the management system, or changing the implementation of it, in order to rebuild the cod stock.

4.13 Ecosystem considerations

Regarding the ecosystem effects on fishing, this issue is partly addressed in the ecological modelling work presented in the overview section for Faroese stocks.

4.14 Regulations and their effects

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 help to reduce fishing mortality, but they cause practical problems for the fishing fleets (e.g. high concentrations of vessels in certain areas). Area restrictions may be best suited to protect certain fish species/sizes in certain areas, whereas the number of fishing days remains the only tool to reduce the overall fishing mortality, given the effort management system.

The area closure (for commercial longliners close to land) introduced in July 2011 and ending in August 2013 to protect young fish has not yet resulted in strong recruitment, since the 2008 year class is below average size, and the 2009-2011 year classes either poor or exceptionally poor.

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 recent years 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 and jiggers 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. The temperature has been high in recent years, which may have a negative effect on cod recruitment (Planque and Fredou, 1999).

4.17 References

ICES, 2009. Report of the North Western Working Group. ICES CM 2009/ACOM: 4. 655 pp.

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

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Steingrund, P., Gaard, E., Reinert, J., Olsen, B., Homrum, E., and Eliasen, K. 2012. Trophic relationships on the Faroe Shelf ecosystem and potential ecosystem states. Manuscript in PhD-thesis by Eydna í Homrum, submitted in April 2012.

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 cod (sub-division Vb1). Nominal catch (t) by countries, as officially reported to ICES.

	Denmark	Faroe Islands	France	Germany	Iceland	Norway	Greenland	Portugal	UK (E/W/NI)	UK (Scotland)	United Kingdom	Total
1986	8	34,492	4	8		83	-		-	-	-	34,595
1987	30	21,303	17	12		21	-		8	-	-	21,391
1988	10	22,272	17	5		163	-		-	-	-	22,467
1989	-	20,535	-	7		285	-		-	-	-	20,827
1990	-	12,232	-	24		124	-		-	-	-	12,380
1991	-	8,203	- [1]	16		89	-		1	-	-	8,309
1992	-	5,938	3 [2]	12		39	-		74	-	-	6,066
1993	-	5,744	1 [2]	+		57	-		186	-	-	5,988
1994	-	8,724	-	2		36	-		56	-	-	8,818
1995	-	19,079	2 [2]	2		38	-		43	-	-	19,164
1996	-	39,406	1 [2]	+		507	-		126	-	-	40,040
1997	-	33,556	-	+		410	-		61 [2]	-	-	34,027
1998	-	23,308	- *	-		405	-		27 [2]	-	-	23,740
1999	-	19,156	- *	39	-	450	-		51	-		19,696
2000		0	1	2	-	374	-		18	-		395
2001		29,762	9 [2]	9	-	531 *	-		50	-		30,361
2002		40,602	20	6	5	573			42	-		41,248
2003		30,259	14	7	-	447	-		15	-		30,742
2004		17,540	2	3 [2]		414		1	15	-		17,975
2005		13,556	-			201			24	-		13,781
2006		11,629	7	1 [2]		49	5		1	-		11,691
2007		9,905	1 [2]			71	7		3	358		10,344
2008		9,394	1			40				383		9,818
2009		10,736	1			14	7			300		11,058
2010		13,878	1			10				312		14,201
2011		11,348	-									11,348
2012		8,437	0		28							8,465
2013 *		5,331	0		20		2					5,333
2014		7,037 *				6				270		7,314

* Preliminary, 1) Included in Vb2, 2) Reported as Vb.

Table 4.2.2. Faroe Plateau cod (sub-division Vb1). Nominal catch (t) used in the assessment.

		Faroese catches:				Catches reported as Vb2:			Foreign catches:				Used in the
	Officially reported	in Vb1	Corrections in Vb1	on Faroe-Iceland ridge	in IIA within Faroe area jurisdiction	UK (E/W/NI)	UK (Scotland)	UK	French [2]	Greenland[2]	Russia[2]	UK[2]	assessment
1986	34595												34595
1987	21391												21391
1988	22467				715								23182
1989	20827				1229				12				22068
1990	12380				1090	-	205		17				13692
1991	8309				351	-	90						8750
1992	6066				154	+	176						6396
1993	5988					1	118						6107
1994	8818					1	227						9046
1995	19164	3330 [3]				-	551						23045
1996	40040					-	382						40422
1997	34027					-	277						34304
1998	23740					-	265						24005
1999	19696			-1600		-	210						18306
2000	395	21793 *		-1400		-	245						21033
2001	30361		-1766	-700		-	288						28183
2002	41248		-2409	-600		-	218	-					38457
2003	30742		-1795	-4700		-	254	-					24501
2004	17975		-1041	-4000		-	244	-					13178
2005	13781		-804	-4200			1129	-					9906
2006	11691		-690	-800			278						10479
2007	10344		-588	-1800			53			6			8015
2008	9818		-557	-1828			32						7465
2009	11058		-637	-487			38			26	4		10002
2010	14201		-823	-680			54			5			12757
2011	11348		-673	-918						3			9760
2012	8465		-500	-760						5			7210
2013	5333		-316	-387							0.2		4630
2014	7314 *		-417	-547									6349

*) Preliminary, 1) In order to be consistent with procedures used previous years, 2) Reported to Faroese Coastal Guard, 3) expected misreporting/discard.

Table 4.2.3. Faroe Plateau cod (sub-division Vb1). The landings of Faroese fleets (in percents) of total catch (t). 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
1985	16.0	27.2	6.7	0.6	4.3	7.9	11.2	12.3	5.6	7.5	0.2	0.6	39,422
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
2011	3.6	26.5	3.4	0.1	6.7	1.3	1.4	3.1	21.9	31.9	0.0	0.0	9,502
2012	2.7	23.5	4.9	0.0	5.3	1.1	2.6	5.3	21.5	32.9	0.0	0.0	6,378
2013	4.6	26.3	6.3	0.2	8.0	2.3	2.0	4.0	15.9	30.2	0.0	0.0	4,749
2014	8.7	28.0	6.4	0.4	6.4	1.2	5.2	2.5	12.3	28.7	0.0	0.0	5,699
Average	4.9	26.2	5.7	0.8	9.0	4.0	7.6	7.6	12.4	21.4	0.4	0.1	

Table 4.2.4. Faroe Plateau cod (sub-division Vb1). Catch in numbers at age per fleet in terminal year. Numbers are in thousands and the catch is in tonnes, gutted weight.

Age\Fleet	Open boat:	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	0	346	29	0	8	3	1	11	48	0	-16	430
3	0	342	44	0	16	14	2	50	129	0	-22	575
4	0	160	24	0	16	10	2	37	81	0	-12	318
5	0	234	40	0	38	20	4	87	153	0	-22	554
6	0	111	22	0	30	19	4	88	130	0	-15	389
7	0	23	6	0	8	4	1	21	36	0	-4	95
8	0	5	1	0	1	1	0	4	4	0	-1	15
9	0	3	1	0	0	1	0	2	4	0	-1	10
10+	0	0	0	0	0	0	0	0	0	0	1	1
Sum	0	1224	167	0	117	72	14	300	585	0	-92	2387
G.weight	0	2242	368	0	354	258	49	1105	1565	0	-221	5720

Others include gillnetters, 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 4.2.5. Faroe Plateau cod (sub-division Vb1). Number of samples, lengths, otoliths, and individual weights in terminal year.

Fleet	Size	Samples	Lengths	Otoliths	Weights
Open boats		4	677	20	677
Longliners	<100 GRT	15	2,985	460	2,580
Longliners	>100 GRT	14	2,926	317	2,926
Jiggers		0	0	0	0
Gillnetters		0	0	0	0
Sing. trawlers	<400 HP	0	0	0	0
Sing. trawlers	400-1000 HP	17	3,560	319	3,560
Sing. trawlers	>1000 HP	0	0	0	0
Pair trawlers	<1000 HP	0	0	0	0
Pair trawlers	>1000 HP	30	5,718	479	4,514
Total		80	15,866	1,595	14,257

Table 4.2.6. Faroe Plateau cod (sub-division Vb1). Catch in numbers at age used in the XSA model.

	Age								
Year	1	2	3	4	5	6	7	8	9	10+
1959	0	2002	4239	858	1731	200	207	50	10	0
1960	0	4728	4027	2574	513	876	171	131	61	0
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

	Age									
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10+**
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	1167	499	706	852	355	81	11	3
2007	0	540	1308	771	336	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	2113	2034	861	468	481	178	58	33	38
2011	0	330	2360	1242	367	189	127	50	19	2
2012	0	49	518	1348	556	201	99	69	25	22
2013	0	57	179	344	608	182	40	26	15	6
2014	0	430	575	318	554	389	95	15	10	1

Table 4.2.7. Faroe Plateau cod (sub-division Vb1). Mean weight at age (kg) in the catches.

	Age								
Year	1	2	3	4	5	6	7	8	9	10+
1959	0	0.850	1.730	3.230	4.400	5.800	6.370	7.340	7.880	10.270
1960	0	1.000	2.030	3.370	4.420	6.020	6.650	8.120	11.000	10.270
1961	0	1.080	2.220	3.450	4.690	5.520	7.090	9.910	8.030	10.270
1962	0	1.000	2.270	3.350	4.580	4.930	9.080	6.590	6.660	10.270
1963	0	1.040	1.940	3.510	4.600	5.500	6.780	8.710	11.720	10.820
1964	0	0.970	1.830	3.150	4.330	6.080	7.000	6.250	6.190	14.390
1965	0	0.920	1.450	2.570	3.780	5.690	7.310	7.930	8.090	11.110
1966	0	0.980	1.770	2.750	3.510	4.800	6.320	7.510	10.340	11.650
1967	0	0.960	1.930	3.130	4.040	4.780	6.250	7.000	11.010	10.690
1968	0	0.880	1.720	3.070	4.120	4.650	5.500	7.670	10.950	9.280
1969	0	1.090	1.800	2.850	3.670	4.890	5.050	7.410	8.660	14.390
1970	0	0.960	2.230	2.690	3.940	5.140	6.460	10.310	7.390	9.340
1971	0	0.810	1.800	2.980	3.580	3.940	4.870	6.480	6.370	10.220
1972	0	0.660	1.610	2.580	3.260	4.290	4.950	6.480	6.900	11.550
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

	Age									
Year	1	2	3	4	5	6	7	8	9	10+
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
2011	0	0.815	1.367	2.413	3.493	4.525	5.076	6.631	6.863	10.089
2012	0	1.007	1.315	1.893	3.102	4.279	5.573	5.871	7.482	9.206
2013	0	1.011	1.527	2.528	3.180	4.672	6.776	6.966	9.028	10.324
2014	0	1.099	1.653	2.466	3.000	4.148	6.489	9.394	9.236	12.120

Table 4.2.8. Faroe Plateau cod (sub-division Vb1). Proportion mature at age. From 1961-1982 the average from 1983-1996 is used (as it was used in the 1990s). In 2002, the high maturities for age 2 in 1983 (0.63), 1984 (0.4) and in 1993 (0.25) were revised, but not the maturities back in time.

	Age								
Year	1	2	3	4	5	6	7	8	9	10+
1959	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1960	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1961	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1962	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1963	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1964	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1965	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1966	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1967	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1968	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1969	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1970	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1971	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1972	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1973	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1974	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1975	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1976	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1977	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1978	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1979	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1980	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1981	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1982	0.00	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1983	0.00	0.03	0.71	0.93	0.94	1.00	1.00	1.00	1.00	1.00
1984	0.00	0.07	0.96	0.98	0.97	1.00	1.00	1.00	1.00	1.00
1985	0.00	0.00	0.50	0.96	0.96	1.00	1.00	1.00	1.00	1.00
1986	0.00	0.00	0.38	0.93	1.00	1.00	0.96	0.94	1.00	1.00
1987	0.00	0.00	0.67	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1988	0.00	0.06	0.72	0.90	0.97	1.00	1.00	1.00	1.00	1.00
1989	0.00	0.05	0.54	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1990	0.00	0.00	0.68	0.90	0.99	0.96	0.98	1.00	1.00	1.00
1991	0.00	0.00	0.72	0.86	1.00	1.00	1.00	1.00	1.00	1.00
1992	0.00	0.06	0.50	0.82	0.98	1.00	1.00	1.00	1.00	1.00
1993	0.00	0.03	0.73	0.78	0.91	0.99	1.00	1.00	1.00	1.00
1994	0.00	0.05	0.33	0.88	0.96	1.00	0.96	1.00	1.00	1.00
1995	0.00	0.09	0.35	0.33	0.66	0.97	1.00	1.00	1.00	1.00
1996	0.00	0.04	0.43	0.74	0.85	0.94	1.00	1.00	1.00	1.00
1997	0.00	0.00	0.64	0.91	0.97	1.00	1.00	1.00	1.00	1.00
1998	0.00	0.00	0.62	0.90	0.99	0.99	1.00	1.00	1.00	1.00
1999	0.00	0.02	0.43	0.88	0.98	1.00	1.00	1.00	1.00	1.00

2000	0.00	0.02	0.39	0.69	0.92	0.99	1.00	1.00	1.00	1.00
2001	0.00	0.07	0.47	0.86	0.94	1.00	1.00	1.00	1.00	1.00
2002	0.00	0.04	0.37	0.76	0.97	0.93	0.97	1.00	1.00	1.00
2003	0.00	0.00	0.29	0.79	0.88	0.98	1.00	1.00	1.00	1.00
2004	0.00	0.00	0.51	0.78	0.92	0.89	0.87	1.00	1.00	1.00
2005	0.00	0.05	0.66	0.90	0.93	0.98	0.92	1.00	1.00	1.00
2006	0.00	0.04	0.59	0.80	0.99	0.99	1.00	1.00	1.00	1.00
2007	0.00	0.00	0.47	0.78	0.91	0.99	0.97	1.00	1.00	1.00
2008	0.00	0.10	0.78	0.91	0.90	0.95	1.00	1.00	1.00	1.00
2009	0.00	0.09	0.61	0.81	0.96	0.94	0.96	1.00	1.00	1.00
2010	0.00	0.08	0.61	0.77	0.94	0.97	1.00	1.00	1.00	1.00
2011	0.00	0.06	0.51	0.69	0.84	0.93	0.98	1.00	1.00	1.00
2012	0.00	0.00	0.63	0.85	0.94	0.97	1.00	1.00	1.00	0.83
2013	0.00	0.24	0.82	0.95	0.98	1.00	1.00	1.00	1.00	1.00
2014	0.00	0.24	0.73	0.98	1.00	1.00	1.00	1.00	1.00	1.00

Table 4.2.9. Faroe Plateau cod (sub-division Vb1). Summer survey tuning series (number of individuals per 200 stations) and spring survey tuning series (number of individuals per 100 stations) used as tuning series in the XSA model.

```
FAROE PLATEAU COD (ICES SUBDIVISION VB1)        Surveys_revised.TXT

102

SUMMER SURVEY

1996 2014

1 1 0.6 0.7

2 8

 200  707     6576.5   3705.1   1298.1   701.5  233.1   48.5

 200  512.7   1500.7   6754.6   1466.6   178.4  137.8   30.1

 200  524.9    505.1    979.4   3675.2   902.6   50     37

 200  373.3   1256.8    753.1    675.3  1422.5  238     40.4

 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

 200  301.7   1373.6   1084.2    380.1   160.6  104.6   37.4

 200   22.1    230.8   1081.8    511.7    88.4   35.8   19.5

 200  101.7    205.9    209.3    888.4   542.5  104.2   43.9

 200  642.3    861.2    357.6    358.2   401.5  124.3   36.6

SPRING SURVEY (shifted back to december)

1993 2014

1 1 0.9 1.0

1 8

 100  612.5     336.9      912.8      508.5     129.7     187.2     28.6      0.1

 100  623.2     845.7     1528.4     1525.2    1191.4     285.6    350.8     48.9

 100  215.5    4043.9     3984.4     1892.1    1372       420.8     82.8    169.7

 100   72.5     834.4     5398.3     2359.5     333.9     227       58.8      5.3
```

100	69.7	425.2	1572.1	4919.3	1136	82.3	40.7	35.2
100	704.7	674.9	991.3	1225.2	2079.2	252.1	25.2	13.4
100	316	1432.4	746.1	441	506.7	836.7	63.8	3.1
100	938.4	2387.8	1993.8	456.2	324.4	578.6	128.6	3.9
100	383	4564.1	2892.1	1579.7	331.9	231.8	178.9	131.9
100	90.2	719	3915	1260.4	528.7	67.4	51.7	39.7
100	609.5	575.8	844.6	1175.1	292.9	66	22.2	11.9
100	383.1	438.2	1151.7	1440.2	844.5	140.6	14	3.8
100	167.5	156.7	177.3	360.1	292	95	15.5	4
100	41.1	270.9	286.6	155.2	170.4	105.1	37.8	14.4
100	176.6	474.5	851.9	479.2	151.5	83.9	39.4	13.3
100	307.8	475.5	977.7	1159.1	427.3	73.7	31.6	24.9
100	697.6	1318.8	745.6	538.1	381	98.9	41	17.2
100	148.4	1319	1240.3	562.4	300.2	237.8	85.2	21.9
100	41.1	273.8	1303.8	326.7	73.6	27	23.7	6.2
100	68	377.6	1699.8	2053.2	295.6	32.6	22.4	17.7
100	130.9	113.4	159.6	419.7	333	74.8	22	13.6
100	**22.4**	**533.3**	**225.6**	**193.9**	**305.2**	**138.9**	**32.6**	**8**

Table 4.2.10. Faroe Plateau cod (sub-division Vb1). Pair trawler 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.

	Age							
Year	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	1578	2917	1787	543	603	190	0	81
2011	22	1487	4078	1967	622	441	95	25
2012	0	95	1531	1789	950	223	40	107
2013	35	102	761	1583	670	103	57	36
2014	292	1631	1006	1690	1812	477	94	101

Table 4.2.11. Faroe Plateau cod (sub-division Vb1). Longliner abundance index (number of individuals per 100 000 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.

	Age							
Year	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
2011	160	2817	28218	14391	4295	2207	1252	195
2012	0	1833	9562	8309	2364	1296	403	197
2013	0	52	209	2887	5132	2654	1222	359
2014	93	5898	9602	4695	4398	3475	1289	116

Table 4.2.12. Longliner abundance index (number of individuals per day) for longliners < 25 GRT operating mainly near shore. This series was not used in the tuning of the XSA. The age composition was obtained from all longliners.

	Age							
Year	1	2	3	4	5	6	7	8
1983	0.9	7.5	4.7	3.8	1.6	0.9	0.5	0.2
1984	0.0	33.3	32.1	13.2	5.8	6.3	1.0	0.7
1985	0.0	3.7	50.1	35.0	25.3	14.1	19.6	5.8
1986	0.0	5.6	41.6	24.0	15.3	6.8	6.2	2.2
1987	0.0	6.8	11.3	16.6	27.5	12.4	5.3	0.9
1988	0.0	3.1	6.4	13.0	8.5	19.1	6.5	2.6
1989	0.1	43.7	21.3	20.5	13.9	7.5	16.1	2.2
1990	0.0	7.9	40.3	8.6	12.2	6.5	7.7	4.2
1991	0.0	0.0	5.2	27.0	8.7	3.9	2.4	0.7
1992	0.0	6.2	17.1	6.9	3.9	3.6	1.8	1.4
1993	0.4	4.6	19.2	7.3	1.4	1.3	0.3	1.3
1994	0.1	14.9	18.4	15.4	6.6	2.1	2.6	0.5
1995	0.0	53.6	47.8	12.2	8.4	5.1	2.0	3.1
1996	0.0	5.9	76.2	52.1	13.1	28.8	14.3	4.2
1997	0.0	4.6	16.6	71.8	54.5	7.9	7.6	0.9
1998	5.8	12.1	5.6	8.2	33.1	9.9	0.4	0.4
1999	0.3	29.2	10.0	4.7	7.0	15.9	2.5	0.1
2000	9.6	40.4	23.5	1.3	1.3	2.4	4.2	0.5
2001	0.6	96.6	48.7	17.1	3.0	5.7	12.6	12.9
2002	0.1	47.6	97.2	43.4	30.0	7.3	11.5	6.8
2003	0.0	17.5	37.4	106.4	59.1	12.9	4.1	1.5
2004	0.0	7.0	21.5	21.0	31.1	8.2	0.3	0.0
2005	0.6	14.7	20.5	18.5	32.9	15.6	1.5	0.0
2006	2.0	58.7	47.0	9.1	10.6	13.6	4.1	0.4
2007	0.2	11.2	23.2	8.9	4.2	4.9	3.5	0.6
2008	0.3	3.4	16.2	21.1	14.4	3.3	1.5	2.1
2009	3.1	33.3	154.6	57.5	33.9	23.5	9.6	5.9
2010	2.6	135.7	147.1	62.4	27.3	28.5	8.5	1.8
2011	0.0	19.7	156.5	65.0	25.2	15.6	8.5	1.9
2012	0.3	4.6	39.3	59.0	15.1	5.2	2.6	1.3
2013	1.2	16.6	23.8	63.6	58.0	7.8	2.9	0.0
2014	2.1	103.4	102.0	46.9	27.3	17.1	1.4	0.0

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

Lowestoft VPA Version 3.1

22/04/2015 10:42

Extended Survivors Analysis

COD FAROE PLATEAU (ICES SUBDIVISION Vb1) COD_ind_Surveys_revised

CPUE data from file Surveys_revised_1replacedvalue.TXT

Catch data for 56 years. 1959 to 2014. Ages 1 to 10.

Fleet,	First, year,	Last, year,	First, age ,	Last, age	Alpha,	Beta
SUMMER SURVEY ,	1996,	2014,	2,	8,	.600,	.700
SPRING SURVEY (shift,	1993,	2014,	1,	8,	.900,	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 = 2.000

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

Prior weighting not applied

Tuning converged after 29 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,	2005,	2006,	2007,	2008,	2009,	2010,	2011,	2012,	2013,	2014
1,	.000,	.000,	.000,	.000,	.000,	.000,	.000,	.000,	.000,	.000
2,	.094,	.188,	.124,	.051,	.122,	.211,	.092,	.031,	.026,	.073
3,	.257,	.334,	.328,	.263,	.683,	.459,	.385,	.205,	.151,	.393
4,	.382,	.360,	.385,	.342,	.527,	.606,	.570,	.397,	.203,	.438
5,	.472,	.610,	.441,	.396,	.488,	.614,	.569,	.545,	.313,	.587
6,	.774,	.820,	.594,	.485,	.514,	.907,	.542,	.720,	.342,	.339
7,	.844,	.957,	.687,	.724,	.415,	.676,	.647,	.617,	.296,	.301
8,	.574,	1.031,	.698,	1.212,	.591,	.559,	.403,	.927,	.320,	.172
9,	1.157,	.293,	.846,	1.543,	1.514,	.893,	.357,	.361,	.520,	.195

XSA population numbers (Thousands)

			AGE						
YEAR ,	1,	2,	3,	4,	5,	6,	7,	8,	9,
2005 ,	9.31E+03,	6.10E+03,	2.88E+03,	3.06E+03,	3.30E+03,	1.69E+03,	3.95E+02,	1.04E+02,	3.06E+01,
2006 ,	6.25E+03,	7.62E+03,	4.54E+03,	1.82E+03,	1.71E+03,	1.68E+03,	6.37E+02,	1.39E+02,	4.79E+01,
2007 ,	7.95E+03,	5.12E+03,	5.17E+03,	2.66E+03,	1.04E+03,	7.60E+02,	6.07E+02,	2.00E+02,	4.07E+01,
2008 ,	1.03E+04,	6.51E+03,	3.70E+03,	3.05E+03,	1.48E+03,	5.49E+02,	3.43E+02,	2.50E+02,	8.15E+01,
2009 ,	1.50E+04,	8.43E+03,	5.06E+03,	2.33E+03,	1.77E+03,	8.17E+02,	2.77E+02,	1.36E+02,	6.09E+01,
2010 ,	5.06E+03,	1.23E+04,	6.11E+03,	2.09E+03,	1.13E+03,	8.91E+02,	4.00E+02,	1.50E+02,	6.17E+01,
2011 ,	2.17E+03,	4.14E+03,	8.16E+03,	3.16E+03,	9.34E+02,	4.99E+02,	2.95E+02,	1.67E+02,	7.00E+01,
2012 ,	3.00E+03,	1.77E+03,	3.09E+03,	4.54E+03,	1.46E+03,	4.33E+02,	2.38E+02,	1.26E+02,	9.13E+01,
2013 ,	8.27E+03,	2.45E+03,	1.41E+03,	2.07E+03,	2.50E+03,	6.94E+02,	1.72E+02,	1.05E+02,	4.09E+01,
2014 ,	1.07E+03,	6.77E+03,	1.96E+03,	9.90E+02,	1.38E+03,	1.50E+03,	4.04E+02,	1.05E+02,	6.23E+01,

Estimated population abundance at 1st Jan 2015

, 0.00E+00, 8.74E+02, 5.16E+03, 1.08E+03, 5.23E+02, 6.28E+02, 8.73E+02, 2.45E+02, 7.24E+01,

Taper weighted geometric mean of the VPA populations:

, 1.39E+04, 1.19E+04, 8.96E+03, 5.56E+03, 3.10E+03, 1.52E+03, 6.74E+02, 2.75E+02, 1.11E+02,

Standard error of the weighted Log(VPA populations) :

, .7703, .6870, .6742, .6490, .6085, .6210, .6624, .7089, .8270,

Log catchability residuals.

Fleet : SUMMER SURVEY

Age	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1	No data for this fleet at this age									
2	99.99	-.16	.21	.35	-.87	.13	.66	1.10	-.07	.62
3	99.99	.10	-.25	-.63	.49	-.45	.04	.57	-.39	.01
4	99.99	.19	.31	-.60	-.13	.07	.10	.09	.10	-.20
5	99.99	.65	-.08	.23	-.71	-.80	-.12	.11	-.35	.43
6	99.99	.14	-.21	.59	.11	-.65	-.59	-.35	-.73	.26
7	99.99	.27	-.05	-.39	.53	.04	-.32	-.42	-1.40	.09
8	99.99	-.15	-.29	.10	.40	-.24	-.05	-.47	-1.07	.19

Age	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1	No data for this fleet at this age									
2	.49	.79	-.29	-1.80	-.18	.56	.16	-1.65	-.45	.41
3	.37	-.11	-.66	-.56	1.08	.49	.04	-.89	-.25	1.00
4	.21	-.20	-.67	-.79	.51	.89	.52	.04	-.94	.49
5	.25	-.32	-.49	-.07	.13	.25	.45	.28	.15	.01
6	.65	-.40	-.40	.03	.55	.24	.16	-.17	.92	-.15
7	.47	-.08	-.69	-.46	.48	.40	.33	-.55	.63	-.04
8	.48	.02	-.47	-.47	.28	.03	-.29	-.32	.28	.00

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

Age	2	3	4	5	6	7	8
Mean Log q	-7.8857	-6.7379	-6.3878	-6.1480	-6.1144	-6.1144	-6.1144
S.E(Log q)	.7684	.5560	.4813	.3902	.4676	.5196	.3921

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
2	.70	1.742	8.19	.66	19	.51	-7.89
3	.99	.059	6.76	.67	19	.57	-6.74
4	.99	.067	6.41	.73	19	.49	-6.39
5	.98	.111	6.17	.76	19	.40	-6.15
6	1.04	-.209	6.08	.64	19	.50	-6.11
7	1.04	-.209	6.17	.60	19	.55	-6.17
8	1.31	-1.697	6.53	.64	19	.47	-6.22

Fleet : SPRING SURVEY (shift

Age	1993	1994
1	-.05	-.56
2	-.91	-.89
3	-.65	-.01
4	-.58	-.02
5	-.57	.76
6	-.63	.92
7	-.32	.35
8	-4.57	.74

Age	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1	-.42	-.82	-.78	.65	-.47	.21	.12	-.57	1.88	.90
2	.19	-.23	-.21	.39	.27	.49	.76	-.26	.22	.39
3	.10	-.05	-.17	.09	.05	.19	.29	.36	-.51	.38
4	.58	-.06	.19	-.23	-.51	-.14	.33	-.03	-.27	.24
5	.39	-.12	.26	.21	-.55	-.33	.09	.28	-.41	.39
6	.55	-.06	-.01	.28	.44	.38	.15	-.23	-.43	.32
7	.21	-.11	-.20	-.18	.20	-.68	.09	.17	-.24	-.66
8	.03	-1.43	.94	.10	-1.28	-1.53	.19	-.01	-.14	-.74

Age	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1	-.15	-1.16	.06	.35	.79	.33	-.10	.08	-.28	.00
2	-1.09	-.68	.22	-.09	.74	.45	-.15	.96	-.57	.01
3	-.98	-.89	.07	.48	.29	.40	.09	1.16	-.47	-.23
4	-.49	-.84	-.06	.64	.32	.55	-.44	.87	-.11	.07
5	-.65	-.40	-.18	.46	.25	.59	-.68	.24	-.39	.37
6	-.54	-.40	-.04	.05	-.02	1.14	-.80	-.30	-.30	-.46
7	-.84	-.32	-.48	-.10	.08	.69	-.31	-.18	-.18	-.63
8	-1.11	.31	-.45	.44	.09	.21	-1.31	.51	-.14	-.81

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,  -8.2792,  -6.8938,  -5.9763,  -5.7006,  -5.7402,  -6.0145,  -6.0145,  -6.0145,
S.E(Log q),    .6722,    .5682,    .4868,    .4368,    .4385,    .4933,    .4069,   1.2620,



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,    1.08,    -.456,      8.21,     .62,     22,     .74,   -8.28,
 2,    1.02,    -.092,      6.86,     .65,     22,     .59,   -6.89,
 3,     .92,     .582,      6.19,     .75,     22,     .46,   -5.98,
 4,     .94,     .481,      5.86,     .76,     22,     .42,   -5.70,
 5,     .92,     .584,      5.90,     .74,     22,     .41,   -5.74,
 6,     .90,     .662,      6.13,     .67,     22,     .45,   -6.01,
 7,     .95,     .420,      6.18,     .78,     22,     .36,   -6.18,
 8,     .63,    1.649,      6.02,     .50,     22,     .71,   -6.47,


Terminal year survivor and F summaries :

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

Year class = 2013

Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
    ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
SUMMER SURVEY      ,          1.,   .000,      .000,    .00,   0,  .000,     .000
SPRING SURVEY (shift,       874.,   .687,      .000,    .00,   1, 1.000,     .000

  F shrinkage mean  ,         0.,   2.00,,,,                        .000,     .000

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,    Ratio,
      874.,       .69,      .00,    1,    .000,   .000



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

Year class = 2012

Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
    ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
SUMMER SURVEY      ,       7761.,   .788,      .000,    .00,   1,  .231,     .049
SPRING SURVEY (shift,      4600.,   .444,      .142,    .32,   2,  .730,     .081

  F shrinkage mean  ,      3835.,   2.00,,,,                        .039,     .097

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,    Ratio,
     5155.,       .38,      .15,    4,    .392,   .073


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

Year class = 2011

Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
    ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
SUMMER SURVEY      ,       1807.,   .462,      .687,   1.49,   2,  .332,     .253
SPRING SURVEY (shift,       828.,   .331,      .170,    .51,   3,  .642,     .487

  F shrinkage mean  ,      1128.,   2.00,,,,                        .026,     .379

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,    Ratio,
     1082.,       .27,      .26,    6,    .956,   .393



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

Year class = 2010

Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
    ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
SUMMER SURVEY      ,        469.,   .339,      .538,   1.59,   3,  .382,     .479
SPRING SURVEY (shift,       562.,   .267,      .282,   1.06,   4,  .600,     .413

  F shrinkage mean  ,       487.,   2.00,,,,                        .018,     .464

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
```

```
at end of year,   s.e,      s.e,     ,   Ratio,
      523.,       .21,      .23,    8,   1.102,   .438


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

Year class = 2009

Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
    ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
SUMMER SURVEY       ,       432.,   .262,       .273,   1.04,   4,  .452,     .771
SPRING SURVEY (shift,       860.,   .233,       .227,    .97,   5,  .532,     .459

  F shrinkage mean  ,       754.,   2.00,,,,                        .016,     .510

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,   Ratio,
      628.,       .17,      .19,   10,   1.093,   .587



Age  6   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       ,       902.,   .244,       .081,    .33,   5,  .486,     .330
SPRING SURVEY (shift,       863.,   .230,       .243,   1.06,   6,  .500,     .342

  F shrinkage mean  ,       418.,   2.00,,,,                        .014,     .610

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,   Ratio,
      873.,       .17,      .12,   12,    .739,   .339


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

Year class = 2007

Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
    ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
SUMMER SURVEY       ,       359.,   .247,       .174,    .70,   6,  .446,     .215
SPRING SURVEY (shift,       182.,   .231,       .164,    .71,   7,  .540,     .388

  F shrinkage mean  ,       122.,   2.00,,,,                        .014,     .535

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,   Ratio,
      245.,       .17,      .15,   14,    .862,   .301



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

Year class = 2006

Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
    ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
SUMMER SURVEY       ,        88.,   .243,       .153,    .63,   7,  .587,     .143
SPRING SURVEY (shift,        57.,   .256,       .119,    .47,   8,  .399,     .214

  F shrinkage mean  ,        18.,   2.00,,,,                        .014,     .565

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,   Ratio,
       72.,       .18,      .11,   16,    .642,   .172


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

Year class = 2005

Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
    ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
SUMMER SURVEY       ,        47.,   .249,       .134,    .54,   7,  .604,     .176
SPRING SURVEY (shift,        37.,   .245,       .169,    .69,   8,  .373,     .220

  F shrinkage mean  ,        20.,   2.00,,,,                        .022,     .370

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,   Ratio,
       42.,       .18,      .11,   16,    .579,   .195
```

Table 4.6.2. Faroe Plateau cod (sub-division Vb1). Fishing mortality at age from the XSA model.

	Age								
	2	3	4	5	6	7	8	9	10+	FBAR 3-7
1959	0.1829	0.4853	0.4463	0.6303	0.3909	0.6060	0.3005	0.4784	0.4784	0.5117
1960	0.4570	0.6793	0.6222	0.5290	0.7826	0.6920	1.0328	0.7389	0.7389	0.6610
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	0.9680	0.8520	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	0.3900
1968	0.1010	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	0.4180	0.5709	0.5118	0.8457	0.5499	0.5499	0.4375
1970	0.0530	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	0.4800	0.4800	0.3526
1972	0.0464	0.1476	0.2070	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	0.5330	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	0.4850	0.5968	0.5674	0.5054	0.5054	0.4259
1979	0.0433	0.2623	0.4309	0.5049	0.4906	0.4480	0.6903	0.5170	0.5170	0.4273
1980	0.0544	0.2391	0.3695	0.4337	0.5182	0.4119	0.6437	0.4790	0.4790	0.3945
1981	0.0523	0.2877	0.3409	0.4369	0.5644	0.6940	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	0.0991	0.4672	0.5585	0.6411	0.7835	1.0779	0.9416	0.8087	0.8087	0.7056
1984	0.1073	0.3711	0.5790	0.6609	0.4533	0.4761	0.4791	0.5340	0.5340	0.5081
1985	0.0658	0.3543	0.5075	0.6134	0.9234	1.1081	1.3203	0.9042	0.9042	0.7013
1986	0.0247	0.3544	0.6225	0.7030	0.8256	0.8399	0.5407	0.7131	0.7131	0.6691
1987	0.0291	0.2208	0.4753	0.4849	0.5555	0.4895	0.6221	0.5297	0.5297	0.4452
1988	0.0666	0.3530	0.5637	0.5489	0.7732	0.7979	0.8639	0.7163	0.7163	0.6073
1989	0.1633	0.4395	0.7614	0.7614	0.9611	1.0566	1.0988	0.9381	0.9381	0.7960
1990	0.0778	0.3287	0.6376	0.8014	0.7129	0.8504	1.1337	0.8358	0.8358	0.6662
1991	0.0324	0.1990	0.4365	0.5987	0.7459	0.5797	0.7153	0.6207	0.6207	0.5120
1992	0.0201	0.1001	0.3256	0.3326	0.6381	0.8909	0.4433	0.5304	0.5304	0.4575
1993	0.0132	0.1020	0.1868	0.2535	0.1912	0.4421	0.5779	0.3325	0.3325	0.2351
1994	0.0255	0.1129	0.1907	0.2501	0.2212	0.1481	0.3228	1.0965	1.0965	0.1846
1995	0.0704	0.1619	0.4651	0.2805	0.3615	0.3361	0.2156	0.7443	0.7443	0.3210
1996	0.0306	0.1935	0.4530	0.8107	0.9071	1.1451	0.9361	0.8738	0.8738	0.7019
1997	0.0348	0.1489	0.4138	0.8362	1.0504	1.4087	1.3725	1.0695	1.0695	0.7716
1998	0.0887	0.1760	0.2732	0.6530	1.0628	0.7973	1.1943	0.8977	0.8977	0.5925
1999	0.0958	0.2841	0.2904	0.3183	0.6678	1.0916	0.8046	0.5191	0.5191	0.5304
2000	0.1247	0.3191	0.3799	0.2477	0.3268	0.5479	0.8501	0.1974	0.1974	0.3643
2001	0.1574	0.3448	0.4554	0.3078	0.3506	0.6988	0.6566	0.8359	0.8359	0.4315

2002	0.1903	0.4904	0.5998	0.8219	0.8296	1.3662	1.2399	1.3959	1.3959	0.8216
2003	0.1279	0.3039	0.6642	0.8523	0.9072	0.9026	0.9391	1.8019	1.8019	0.7260
2004	0.0309	0.1862	0.2977	0.7556	0.9873	1.1291	1.0716	2.1045	2.1045	0.6712
2005	0.0938	0.2575	0.3816	0.4720	0.7745	0.8443	0.5739	1.1569	1.1569	0.5459
2006	0.1881	0.3339	0.3600	0.6103	0.8196	0.9574	1.0306	0.2931	0.2931	0.6163
2007	0.1239	0.3281	0.3855	0.4407	0.5945	0.6869	0.6982	0.8459	0.8459	0.4871
2008	0.0511	0.2634	0.3420	0.3961	0.4853	0.7241	1.2123	1.5432	1.5432	0.4422
2009	0.1219	0.6832	0.5265	0.4876	0.5136	0.4148	0.5911	1.5140	1.5140	0.5252
2010	0.2106	0.4591	0.6065	0.6145	0.9074	0.6761	0.5594	0.8932	0.8932	0.6527
2011	0.0921	0.3853	0.5701	0.5695	0.5423	0.6474	0.4027	0.3566	0.3566	0.5429
2012	0.0310	0.2045	0.3975	0.5450	0.7201	0.6174	0.9268	0.3607	0.3607	0.4969
2013	0.0260	0.1515	0.2035	0.3132	0.3421	0.2962	0.3202	0.5197	0.5197	0.2613
2014	0.0728	0.3927	0.4384	0.5867	0.3388	0.3012	0.1718	0.1951	0.1951	0.4115

Table 4.6.3. Faroe Plateau cod (sub-division Vb1). Stock number at age from the XSA model.

	Age								
Year	2	3	4	5	6	7	8	9	10+	Total
1959	13238	12185	2634	4092	683	503	213	29	0	50976
1960	14245	9027	6141	1380	1784	378	225	129	0	47989
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	59931
1979	14998	8298	5282	4463	5433	1509	297	238	103	69424
1980	23583	11759	5226	2811	2206	2723	789	122	52	66371
1981	14001	18286	7580	2957	1491	1076	1477	339	150	74384
1982	22128	10878	11228	4413	1564	694	440	732	348	83159
1983	25162	17087	7128	6412	2450	854	284	207	200	118129
1984	47769	18656	8767	3339	2765	916	238	91	174	103874
1985	17323	35132	10538	4023	1412	1439	466	121	146	82219
1986	9513	13280	20182	5194	1784	459	389	102	81	63093
1987	9914	7598	7628	8867	2106	640	162	185	69	47827
1988	8726	7884	4989	3883	4470	989	321	71	53	51427
1989	16408	6684	4535	2324	1836	1689	365	111	16	38422
1990	3646	11410	3526	1734	889	575	481	99	50	30547
1991	6662	2762	6725	1526	637	357	201	127	57	32967
1992	11392	5280	1853	3558	687	247	164	81	90	35685
1993	10097	9142	3911	1096	2089	297	83	86	97	57624
1994	25156	8158	6759	2657	696	1413	156	38	26	96979
1995	42508	20078	5967	4573	1694	457	997	93	102	92173
1996	12858	32437	13981	3068	2828	966	267	658	88	75034
1997	6454	10210	21884	7277	1117	935	252	86	198	55645
1998	5922	5103	7203	11846	2582	320	187	52	46	50773
1999	14338	4437	3504	4487	5048	730	118	46	19	56802
2000	19710	10667	2734	2146	2672	2119	201	43	6	76558
2001	29687	14245	6347	1531	1371	1578	1003	70	12	72038

2002	13258	20766	8262	3295	921	791	642	426	10	55993
2003	6240	8974	10411	3713	1186	329	165	152	26	35631
2004	3631	4496	5422	4387	1296	392	109	53	45	27275
2005	6095	2882	3055	3296	1687	395	104	31	47	26900
2006	7619	4543	1824	1708	1683	637	139	48	13	24469
2007	5120	5169	2664	1042	760	607	200	41	6	23554
2008	6506	3703	3048	1483	549	343	250	82	27	26282
2009	8425	5061	2330	1773	817	277	136	61	23	33923
2010	12297	6106	2093	1127	891	400	150	62	70	28258
2011	4145	8156	3159	934	499	295	167	70	7	19597
2012	1773	3095	4542	1462	433	238	126	91	80	14836
2013	2453	1407	2065	2499	694	172	105	41	16	17724
2014	6772	1957	990	1380	1496	404	105	62	6	14239

Table 4.6.4. Faroe Plateau cod (sub-division Vb1). Summary table from the XSA model. The results from the short term prediction are shown in bold.

	RECRUITS	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 3- 7
	Age 2					
1959	13238	67803	48869	22415	0.4587	0.5117
1960	14245	75862	54447	32255	0.5924	0.661
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	153664	109566	36775	0.3356	0.3947
1976	18575	161260	123077	39799	0.3234	0.4749
1977	9995	136212	112057	34927	0.3117	0.6757
1978	10748	96227	78497	26585	0.3387	0.4259
1979	14998	85112	66723	23112	0.3464	0.4273
1980	23583	85038	58887	20513	0.3483	0.3945
1981	14001	88411	63562	22963	0.3613	0.4648
1982	22128	98964	67033	21489	0.3206	0.4138
1983	25162	123256	78543	38133	0.4855	0.7056
1984	47769	152162	96774	36979	0.3821	0.5081
1985	17323	131245	84789	39484	0.4657	0.7013
1986	9513	99280	73698	34595	0.4694	0.6691
1987	9914	78372	62249	21391	0.3436	0.4452
1988	8726	66185	52134	23182	0.4447	0.6073
1989	16408	59280	38427	22068	0.5743	0.796
1990	3646	38547	29450	13692	0.4649	0.6662
1991	6662	28951	21301	8750	0.4108	0.512
1992	11392	36023	21073	6396	0.3035	0.4575
1993	10097	51491	33502	6107	0.1823	0.2351
1994	25156	84335	42937	9046	0.2107	0.1846
1995	42508	144616	54735	23045	0.421	0.321
1996	12858	142597	85457	40422	0.473	0.7019
1997	6454	96379	81121	34304	0.4229	0.7716
1998	5922	65797	55445	24005	0.4329	0.5925
1999	14338	64613	44611	18306	0.4103	0.5304
2000	19710	90668	45736	21033	0.4599	0.3643

2001	29687	109541	58652	28183	0.4805	0.4315
2002	13258	98034	55679	38457	0.6907	0.8216
2003	6240	60425	40399	24501	0.6065	0.726
2004	3631	37025	27059	13178	0.487	0.6712
2005	6095	31865	23470	9906	0.4221	0.5459
2006	7619	30285	20897	10479	0.5015	0.6163
2007	5120	27367	17387	8015	0.461	0.4871
2008	6506	29800	20433	7465	0.3653	0.4422
2009	8425	29989	19563	10002	0.5113	0.5252
2010	12297	38774	21525	12757	0.5927	0.6527
2011	4145	30826	19114	9760	0.5106	0.5429
2012	1773	24323	19290	7210	0.3738	0.4969
2013	2453	23476	20785	4630	0.2228	0.2613
2014	6772	27720	21142	6349	0.3003	0.4115
2015	874	26110	18781	6648	0.3540	0.3899
2016	3666	24201	19687	6037	0.3066	0.3899
2017	3666	24179	19472			
Avg.59-14	14720	80017	55471	21817	0.41	0.51

Table 4.6.5. Faroe Plateau cod (sub-division Vb1). Results from the back-calculation of the age2+ biomass back to 1906 (in tonnes). The exploitation ratio (catch/biomass, C/B) is also provided. The higher biomass estimate is obtained by using a scaling factor between age 2+ biomass from the age-based assessment and the cpue of British trawlers. The lower estimate is obtained by using a regression line.

		Factor	Regression		
Year	Catch (t)	Biomass (t)	Biomass (t)	C/B	C/B
1906	18510	125162	108644	0.148	0.170
1907	19802	148793	122844	0.133	0.161
1908	11609	108532	98651	0.107	0.118
1909	19825	175051	138622	0.113	0.143
1910	21682	149669	123370	0.145	0.176
1911	31406	175051	138622	0.179	0.227
1912	38718	161922	130733	0.239	0.296
1913	33228	137415	116007	0.242	0.286
1914	30580	112908	101281	0.271	0.302
1915	19810	122391	106979	0.162	0.185
1916	17785	143731	119802	0.124	0.148
1917	18155	171332	136387	0.106	0.133
1918	23160	213691	161841	0.108	0.143
1919	43468	205685	157030	0.211	0.277
1920	17726	98904	92866	0.179	0.191
1921	12088	117284	103911	0.103	0.116
1922	19315	160172	129681	0.121	0.149
1923	25553	133039	113377	0.192	0.225
1924	45197	136895	115694	0.330	0.391
1925	38296	129353	111163	0.296	0.345
1926	44066	185574	144945	0.237	0.304
1927	45172	162034	130800	0.279	0.345
1928	30303	126611	109515	0.239	0.277
1929	26506	135524	114871	0.196	0.231
1930	33022	142608	119128	0.232	0.277
1931	45418	139409	117205	0.326	0.388
1932	44646	121354	106356	0.368	0.420
1933	37087	108327	98529	0.342	0.376
1934	35495	107870	98254	0.329	0.361
1935	32125	91187	88229	0.352	0.364
1936	34758	102385	94958	0.339	0.366
1937	26639	95758	90976	0.278	0.293
1938	23755	93244	89465	0.255	0.266
1939	6399	143439	119627	0.045	0.053
1940	8113	193635	149789	0.042	0.054
1941	6559	216611	163595	0.030	0.040
1942	6791	188465	146682	0.036	0.046
1943	9850	196270	151372	0.050	0.065
1944	7847	210683	160033	0.037	0.049

		Factor	Regression		
Year	Catch (t)	Biomass (t)	Biomass (t)	C/B	C/B
1945	8646	225096	168693	0.038	0.051
1946	30485	239509	177354	0.127	0.172
1947	30993	177346	140001	0.175	0.221
1948	20712	122497	107043	0.169	0.193
1949	28134	164777	132448	0.171	0.212
1950	35973	152207	124895	0.236	0.288
1951	35076	124325	108142	0.282	0.324
1952	30259	116783	103610	0.259	0.292
1953	27055	116783	103610	0.232	0.261
1954	36170	146493	121462	0.247	0.298
1955	38583	149464	123247	0.258	0.313
1956	27628	108327	98529	0.255	0.280
1957	31393	112898	101275	0.278	0.310
1958	27807	84102	83972	0.331	0.331

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

Age	Stock size 2015	Source
2	874	XSA-output
3	6772	XSA-output
4	1082	XSA-output
5	523	XSA-output
6	628	XSA-output
7	873	XSA-output
8	245	XSA-output
9	72	XSA-output
10+	46	XSA-output

		Recr.	Source
2014	YC2012	6772	XSA-output
2015	YC2013	874	XSA-output
2016	YC2014	3666	Average R 2012-14
2017	YC2015	3666	Average R 2012-14

	Maturity			Exploitation pattern (not rescaled)			Weights		
	Observed	Av. 13-15	Av. 13-15	Av. 12-14	Av. 12-14	Av. 12-14		As 2015	Av.13-15
Age	2015	2016	2017	2015	2016	2017	2015	2016	2017
2	0.28	0.25	0.25	0.0433	0.0433	0.0433	1.098	1.098	1.069
3	0.48	0.68	0.68	0.2496	0.2496	0.2496	1.648	1.648	1.609
4	0.70	0.88	0.88	0.3465	0.3465	0.3465	2.098	2.098	2.364
5	0.95	0.98	0.98	0.4816	0.4816	0.4816	2.82	2.82	3
6	0.97	0.99	0.99	0.4670	0.4670	0.4670	4.241	4.241	4.354
7	1.00	1.00	1.00	0.4049	0.4049	0.4049	5.269	5.269	6.178
8	1.00	1.00	1.00	0.4729	0.4729	0.4729	7.182	7.182	7.847
9	1.00	1.00	1.00	0.3585	0.3585	0.3585	9.236	9.236	9.167
10+	1.00	1.00	1.00	0.3585	0.3585	0.3585	12.12	12.12	11.521
			Fbar:	0.3899	0.3899	0.3899			

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

2015						
Biomass	SSB	FMult	FBar	Landings		
26110	18781	1.0000	0.3899	6648		
2016					2017	
Biomass	SSB	FMult	FBar	Landings	Biomass	SSB
24201	19687	0.0000	0.0000	0	31564	26685
.	19687	0.1000	0.0390	710	30677	25817
.	19687	0.2000	0.0780	1394	29824	24983
.	19687	0.3000	0.1170	2053	29003	24181
.	19687	0.4000	0.1560	2688	28214	23409
.	19687	0.5000	0.1950	3299	27455	22667
.	19687	0.6000	0.2340	3888	26725	21954
.	19687	0.7000	0.2729	4455	26022	21267
.	19687	0.8000	0.3119	5002	25346	20607
.	19687	0.9000	0.3509	5529	24695	19973
.	19687	1.0000	0.3899	6037	24069	19362
.	19687	1.1000	0.4289	6526	23466	18774
.	19687	1.2000	0.4679	6998	22886	18209
.	19687	1.3000	0.5069	7453	22328	17665
.	19687	1.4000	0.5459	7891	21790	17142
.	19687	1.5000	0.5849	8314	21272	16638
.	19687	1.6000	0.6239	8722	20774	16154
.	19687	1.7000	0.6629	9115	20294	15687
.	19687	1.8000	0.7019	9495	19832	15238
.	19687	1.9000	0.7408	9861	19387	14806
.	19687	2.0000	0.7798	10214	18958	14390

Input units are thousands and kg - output in tonnes

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

	Expl. pattern	Weight at age	Prop mature
	Average	Average	Average
Age	2002-2014	1978-2014	1983-2015
	Not rescaled		
2	0.105	1.040	0.06
3	0.342	1.559	0.57
4	0.444	2.272	0.83
5	0.574	3.066	0.94
6	0.674	3.881	0.98
7	0.736	4.977	0.99
8	0.749	6.200	1.00
9	0.999	7.703	1.00
10+	0.999	9.638	0.99

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

Reference point	F multiplier	Absolute F
Fbar(3-7)	1.0000	0.554
FMax	0.4513	0.25
F0.1	0.2087	0.1156
F35%SPR	0.3147	0.1743
Flow	0.16	0.0886
Fmed	0.6973	0.3863
Fhigh	1.6044	0.8888
Weights in kilograms		

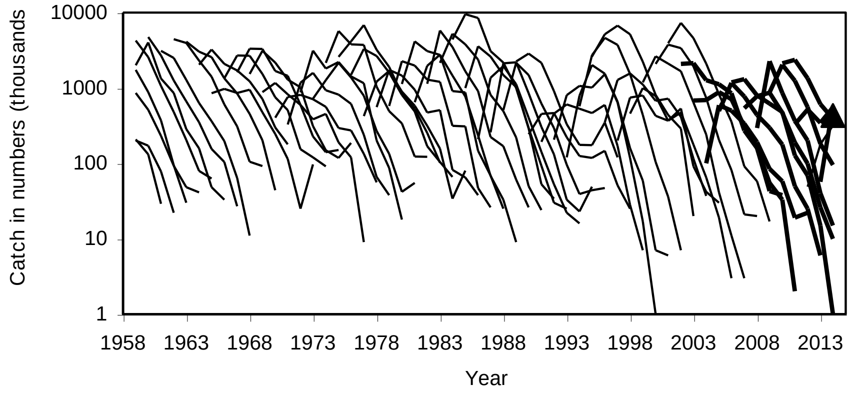


Figure 4.2.1. Faroe Plateau cod (sub-division Vb1). Catch in numbers at age shown as catch curves.

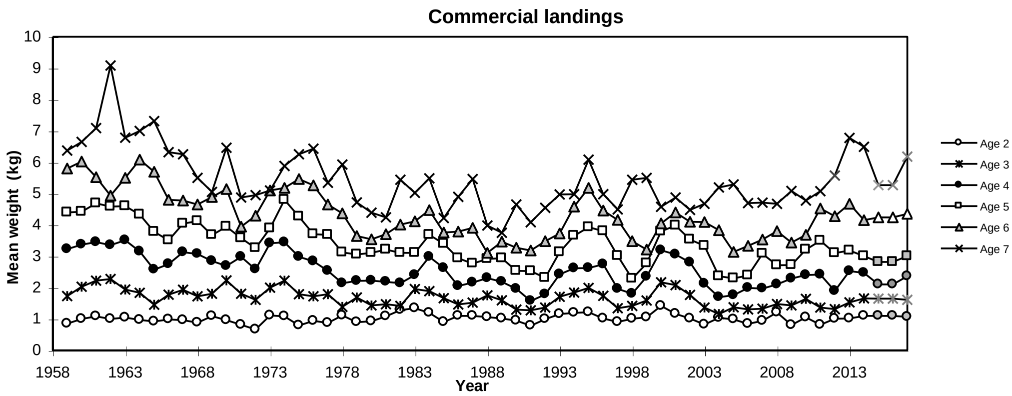


Figure 4.2.2. Faroe Plateau cod (sub-division Vb1). Mean weight at age. The predicted weights are also shown.

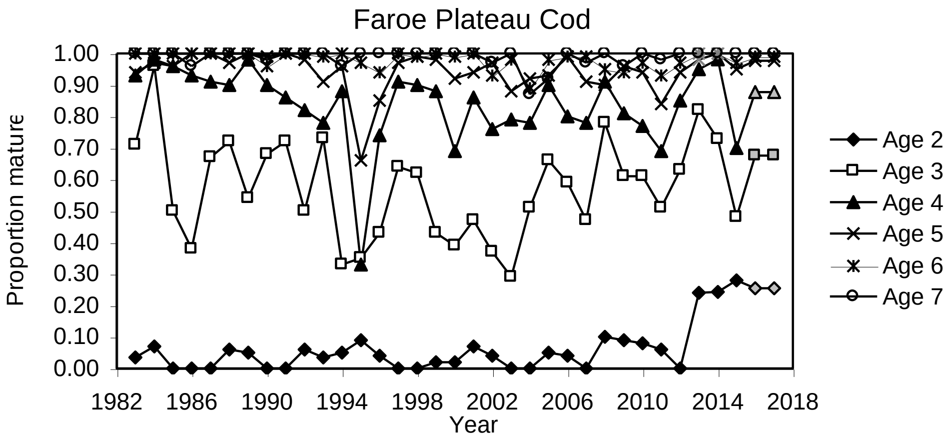


Figure 4.2.3. Faroe Plateau cod (sub-division Vb1). Proportion mature at age as observed in the spring groundfish survey. The predicted values are shown in grey.

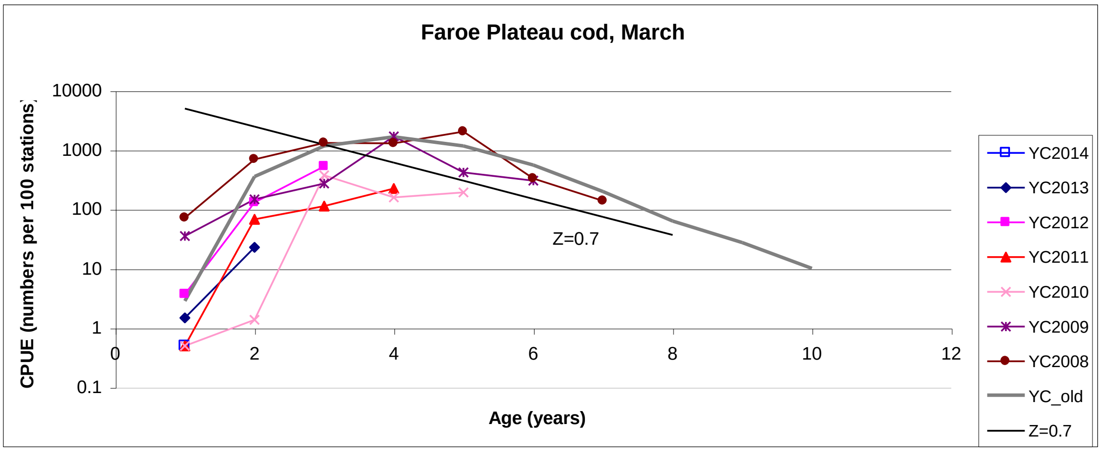


Figure 4.2.4. Faroe Plateau cod (sub-division Vb1). Catch curves from the spring groundfish survey.

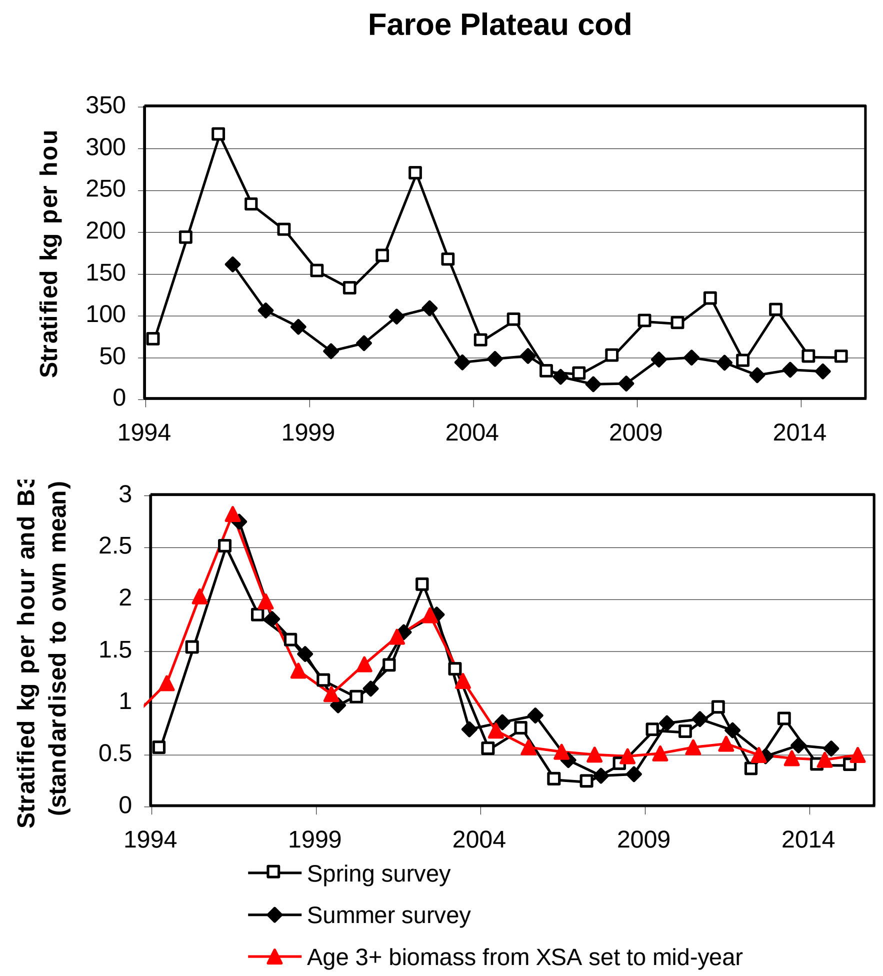


Figure 4.2.5. Faroe Plateau cod (sub-division Vb1). Stratified kg/hour in the spring and summer surveys (upper figure). The age 3+ biomass obtained from the assessment is also included as an index.

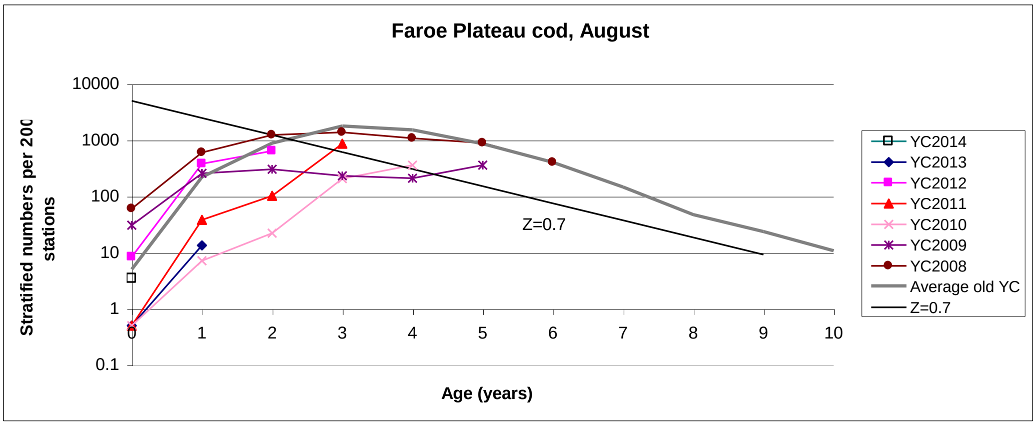


Figure 4.2.6. Faroe Plateau cod (sub-division Vb1). Catch curves from the summer groundfish survey.

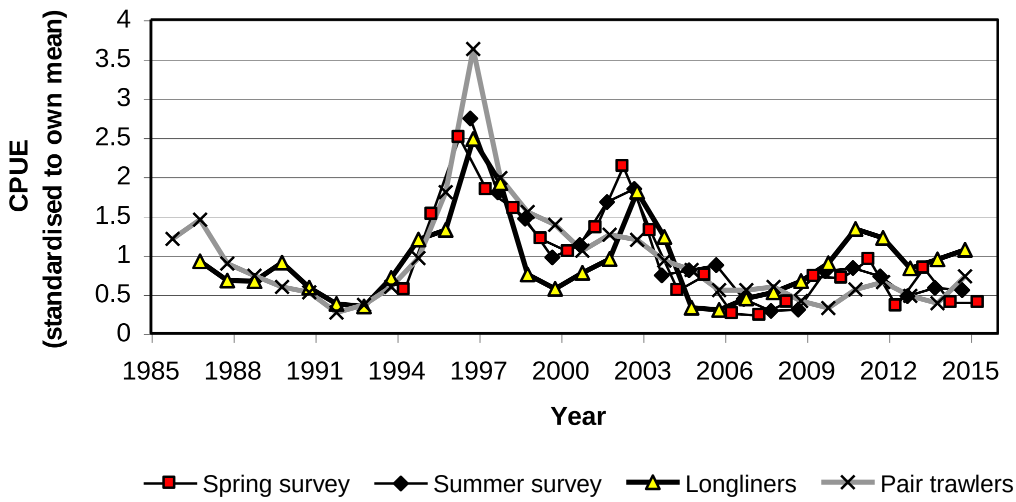


Figure 4.2.7. Faroe Plateau cod (sub-division Vb1). Standardised catch per unit effort for pair trawlers and longliners. The two surveys are shown as well.

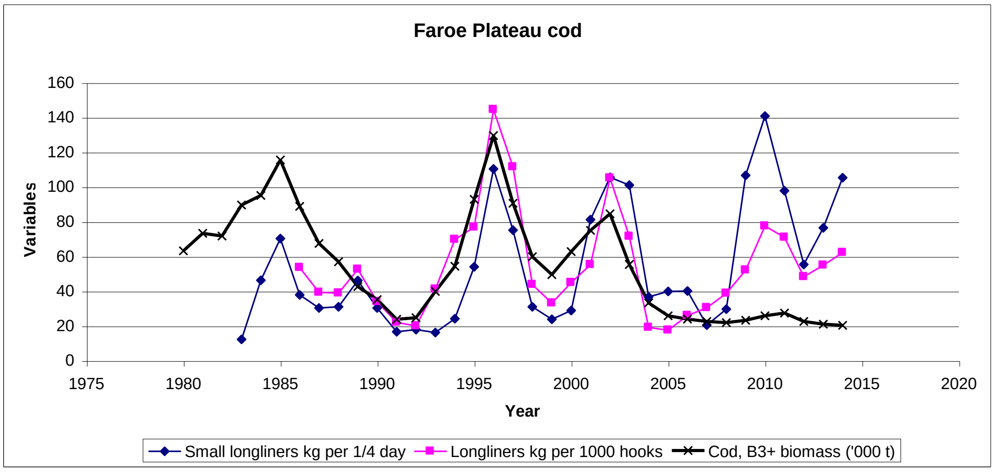


Figure 4.2.8. Faroe Plateau cod (sub-division Vb1). Catch per unit effort for small and large long-liners compared with the fishable (age 3+) biomass.

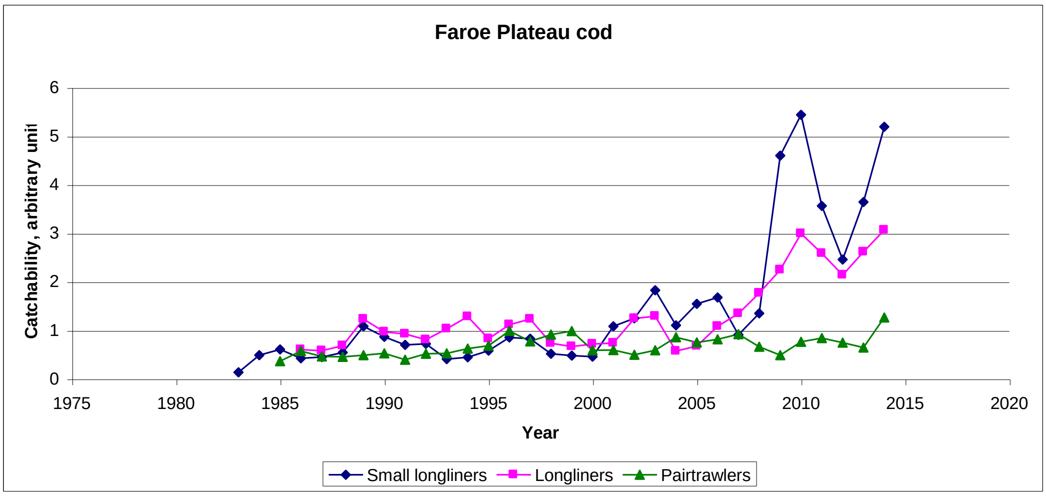


Figure 4.2.9. Faroe Plateau cod (sub-division Vb1). Catchability (cpue divided by age 3+ biomass) for small and large longliners and pair trawlers.

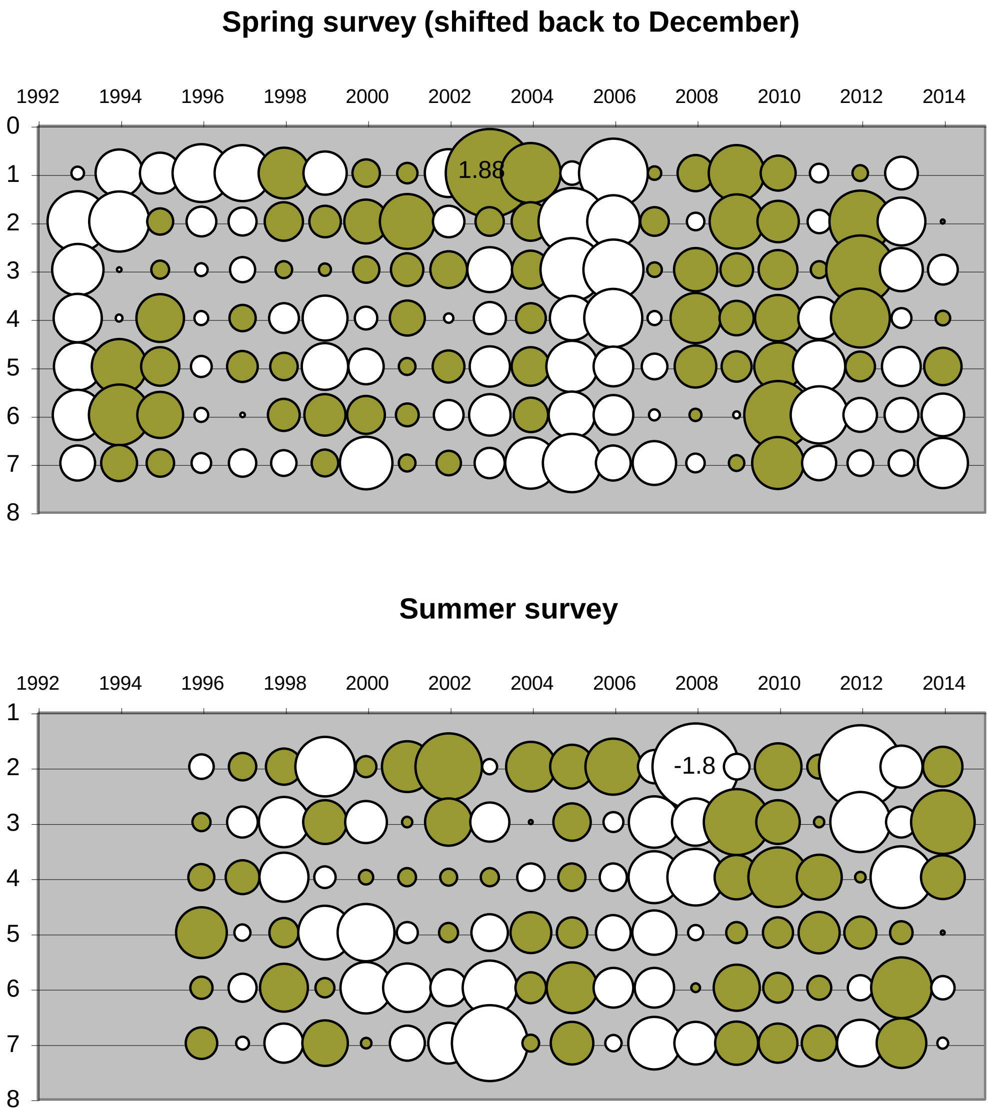
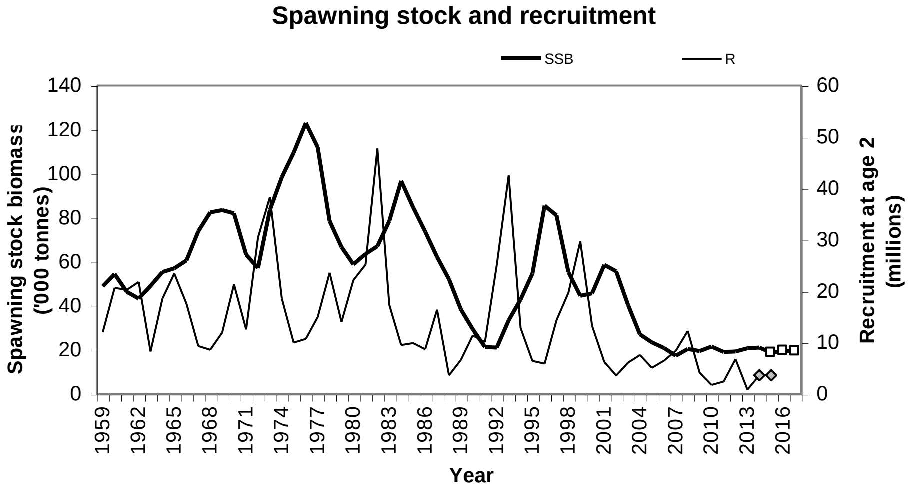


Figure 4.6.1. Faroe Plateau cod (sub-division Vb1). Log catchability residuals for age 2 to 7 for the spring (upper figure) and summer survey. The residuals for age 8 are not presented because some values were off scale. White bubbles indicate negative residuals.



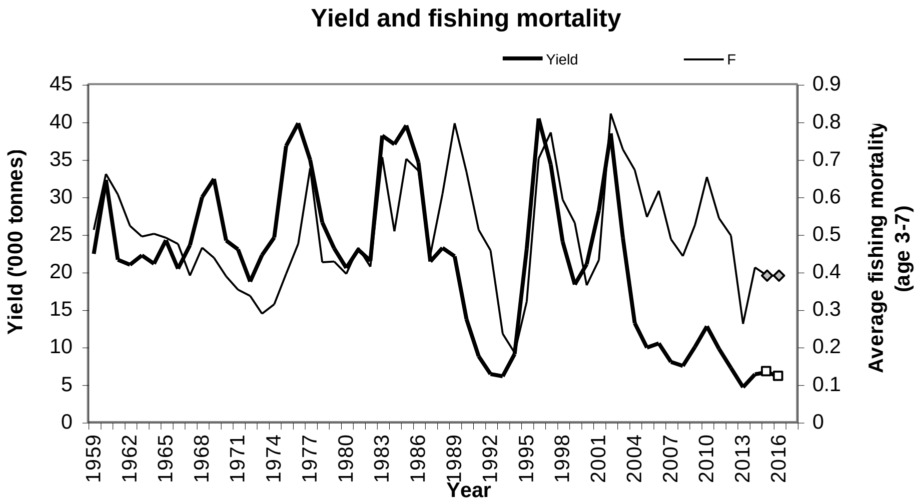


Figure 4.6.2. Faroe Plateau cod (sub-division Vb1). Spawning stock biomass (SSB) and recruitment (year class) versus year (upper figure) and yield and fishing mortality versus year. Points (white and grey) are taken from the short term projections.

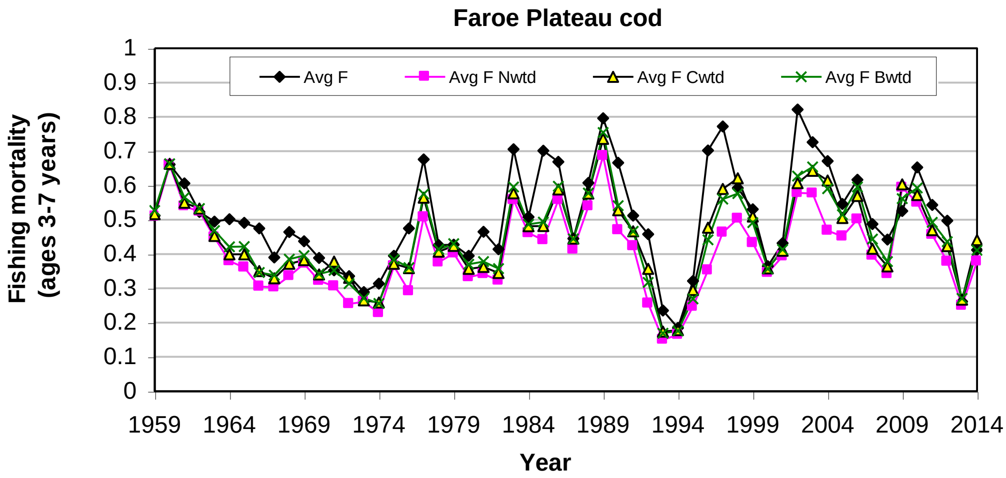


Figure 4.6.3. Faroe Plateau cod (sub-division Vb1). Different measures of fishing mortality: straight arithmetic average (Avg F), weighted by stock numbers (Nwtd), weighted by stock biomass (Bwtd) or weighted by catch (Cwtd).

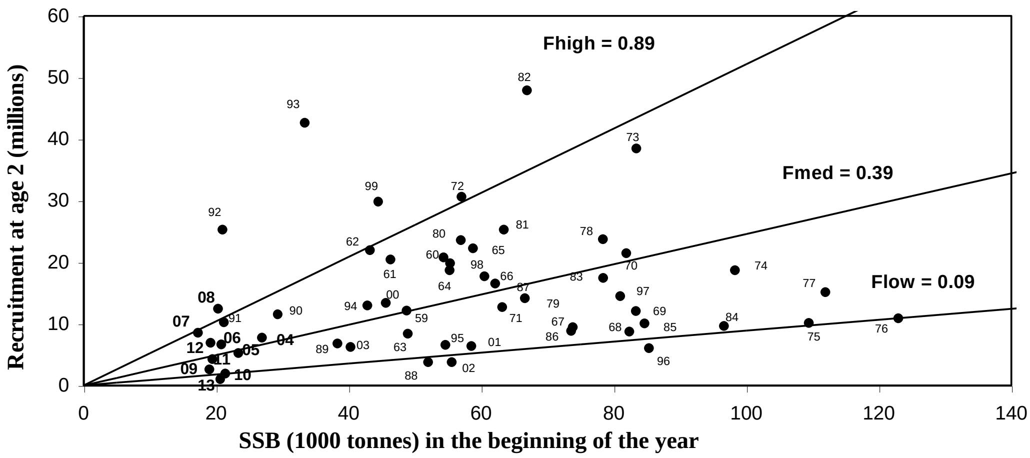


Figure 4.6.4. Faroe Plateau cod (sub-division Vb1). Spawning stock – recruitment relationship. Years are shown at each data point.

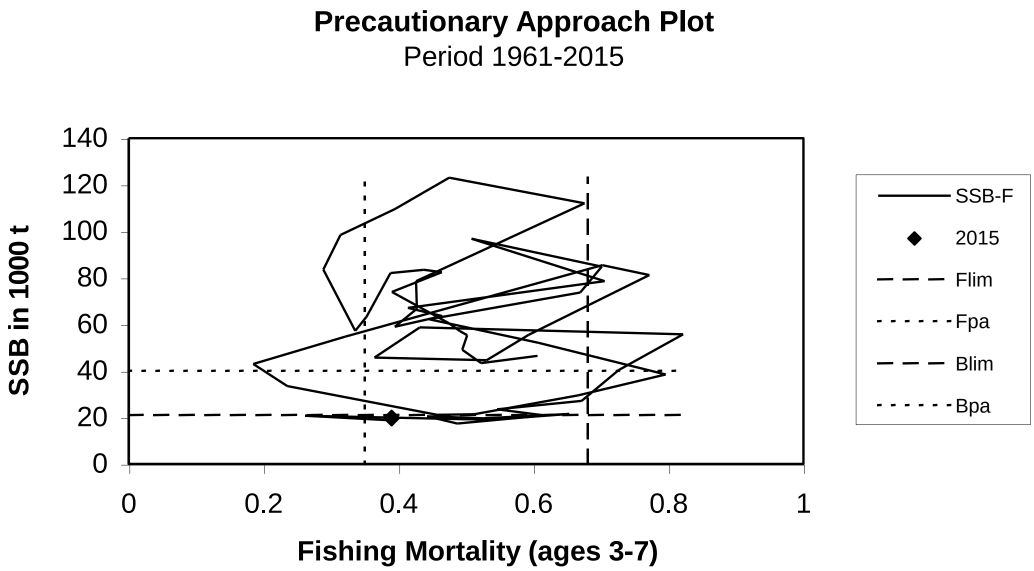


Figure 4.6.5. Faroe Plateau cod (sub-division Vb1). Spawning stock biomass versus fishing mortality.

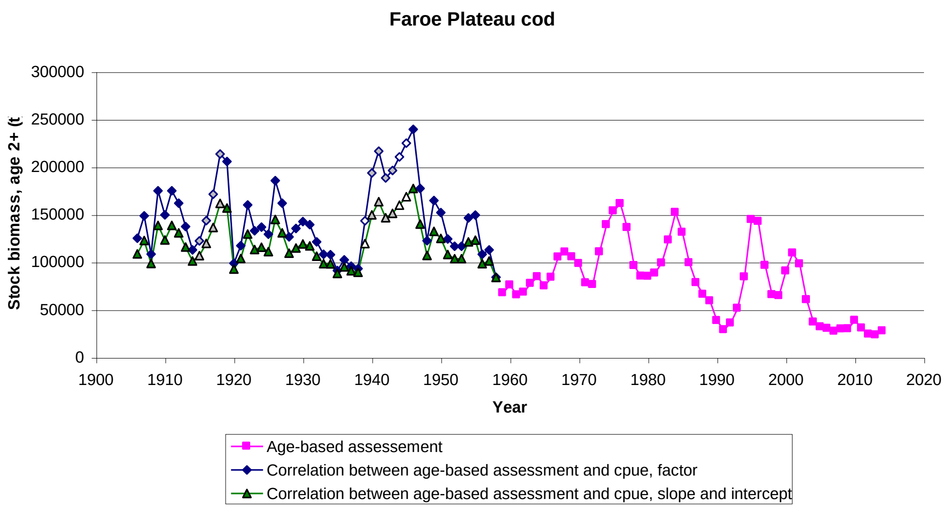


Figure 4.6.6. Faroe Plateau cod (sub-division Vb1). Biomass obtained from the age-based assessment as well as from cpue of British trawlers back in time. There was an overlap between cpue and the age-based assessment in the period 1959-72 and the two versions of the biomass prior to 1959 was whether a regression line was used or a scaling factor. During the wars (grey symbols) catch data from Faroe boats were used as indicative of stock biomass and regressed against cpue of British trawlers for a period prior to the wars. The missing years of data were estimated by linear interpolation (open symbols).

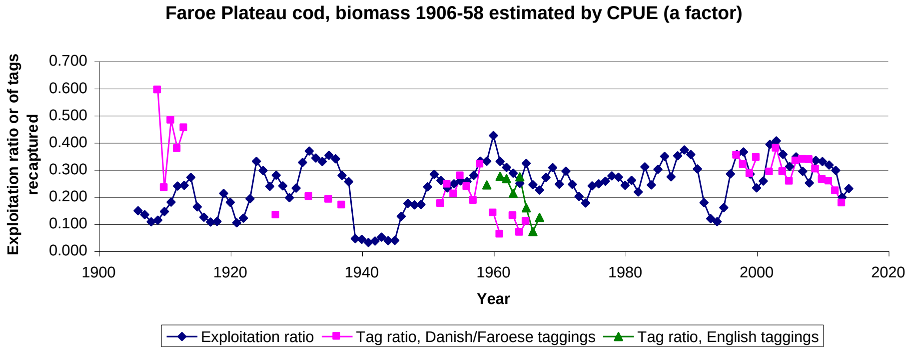
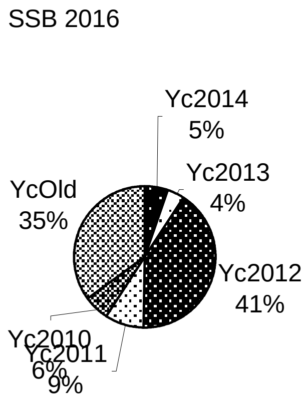


Figure 4.6.7. Faroe Plateau cod (sub-division Vb1). Exploitation ratio (based on the higher biomass) compared with tag returns. The taggings in 1909-13 were on small cod close to land, in 1930s on large spawning cod, in 1950s-60s and in 1997-2013 on cod on the feeding grounds.



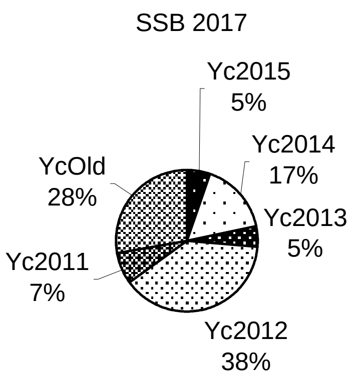


Figure 4.7.1. Faroe Plateau cod (sub-division Vb1). Predictions of the contribution of various year classes to the spawning stock biomass in terminal year +1 (upper figure) and terminal year +2 (lower figure).

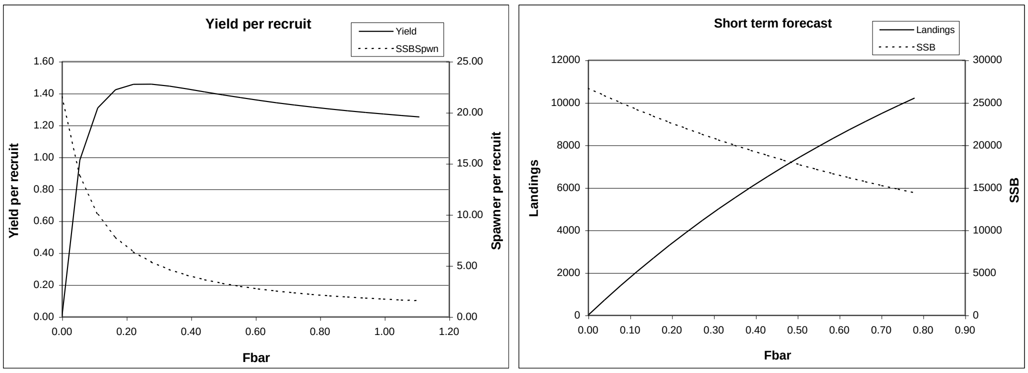


Figure 4.8.1. Faroe Plateau cod (sub-division Vb1). Yield per recruit and spawning stock biomass (SSB) per recruit versus fishing mortality (left figure). Landings and SSB versus Fbar (3-7) (right figure).

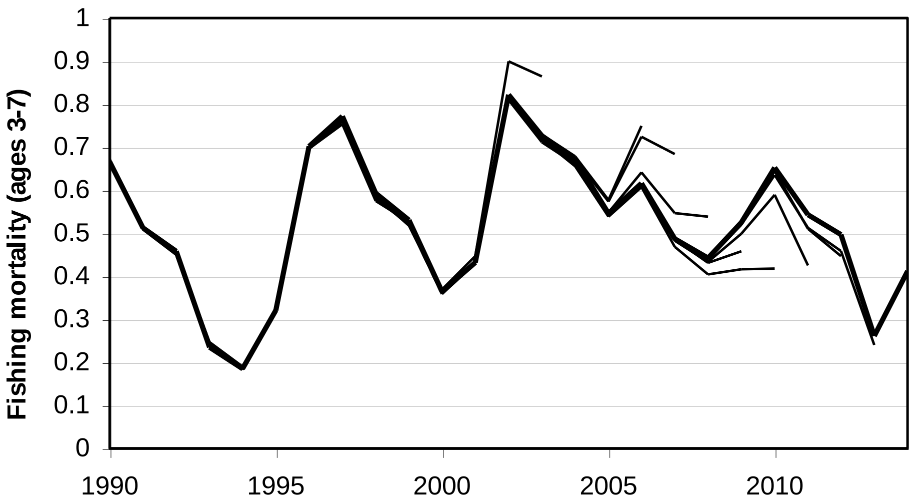


Figure 4.9.1. Faroe Plateau cod (sub-division Vb1). Results from the XSA retrospective analysis of fishing mortality (ages 3-7).

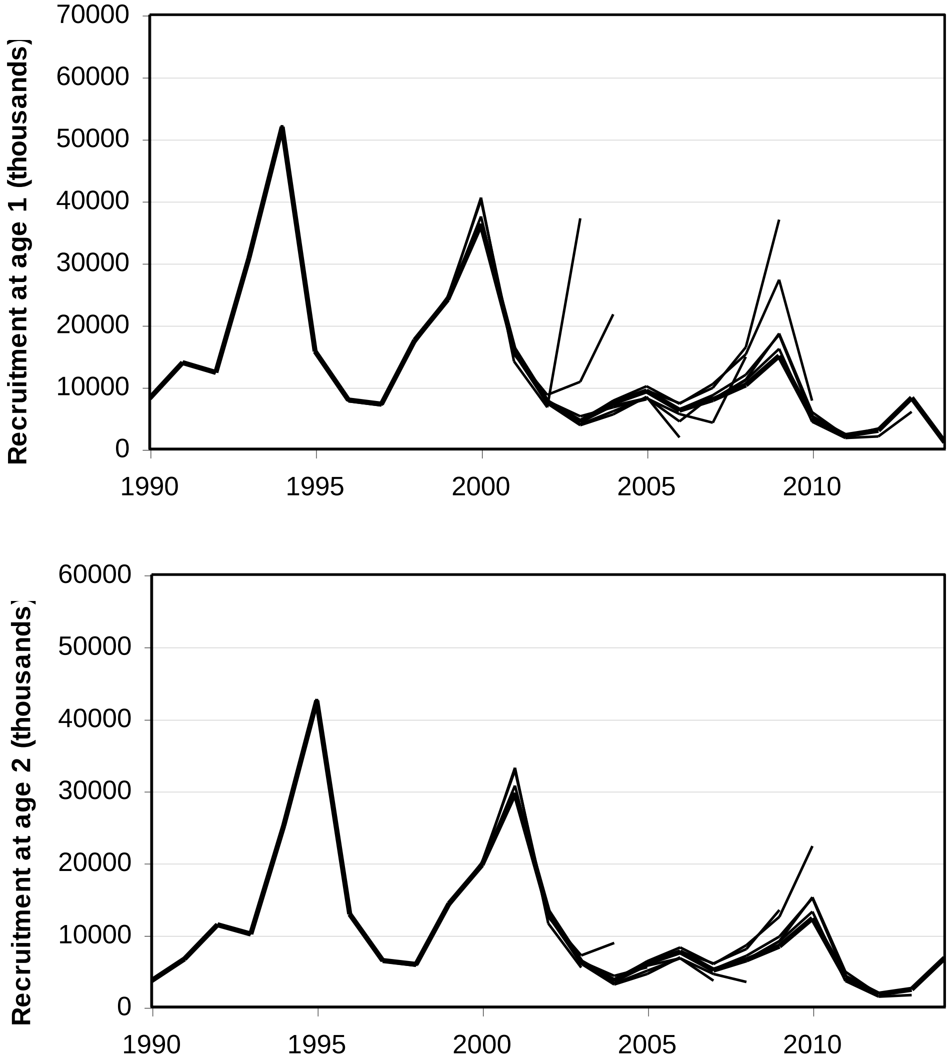


Figure 4.9.1. Faroe Plateau cod (sub-division Vb1). Results from the XSA retrospective analysis (continued). Recruitment at age 1 (upper figure) and at age 2.

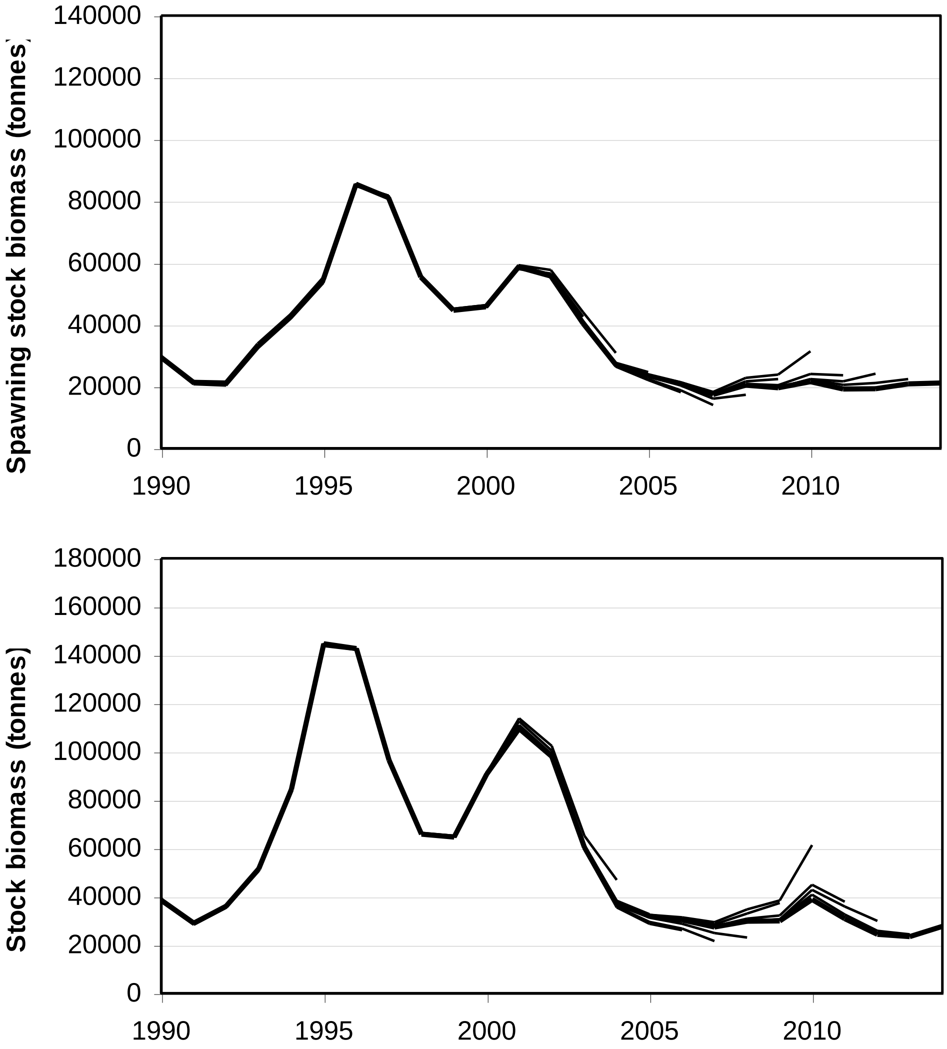


Figure 4.9.1. Faroe Plateau cod (sub-division Vb1). Results from the XSA retrospective analysis (continued). Spawning stock biomass (upper figure) and total stock biomass.

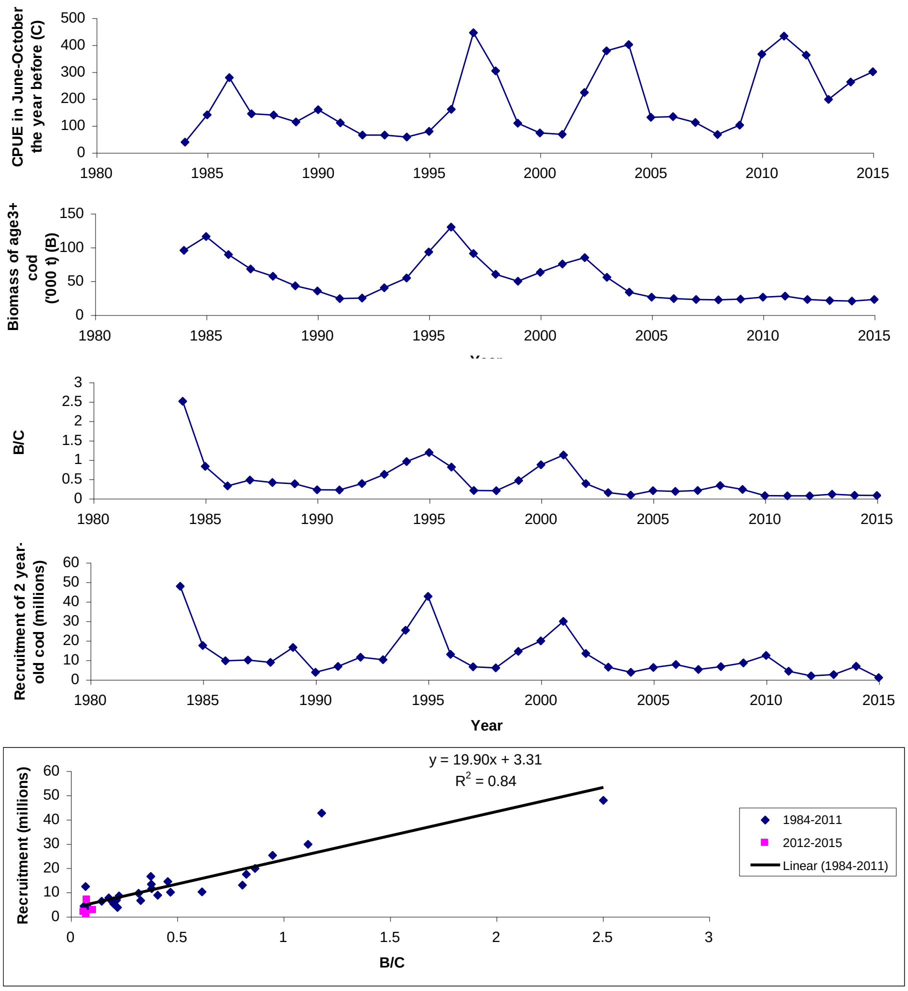


Figure 4.9.2. Faroe Plateau cod (sub-division Vb1). Modelling cod recruitment in three steps. First, the catch-per-unit –effort of cod (C) for small boats operating close to land, as being indicative of the amount of cannibalistic cod. Second, the amount of cod (older than the recruiting cod) (B), as being indicative of e.g. the amount of schools to which recruiting cod can join and hide in. Third, the ratio between B and C, as indicative of recruitment success. Fourth and fifth, a comparison with observed recruitment. Note that the model predicts that the recruitment in recent years is very poor.

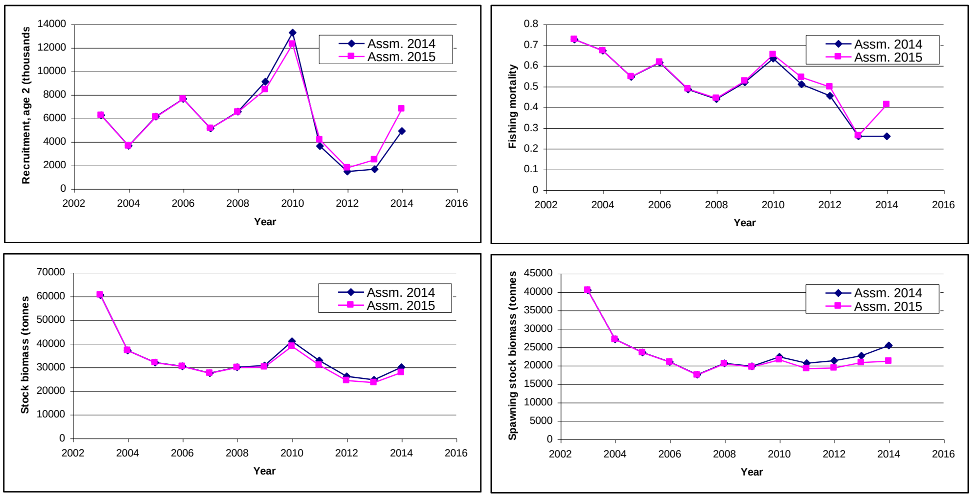


Figure 4.10.1. Faroe Plateau cod (sub-division Vb1). Comparison between the results from the current assessment (Assm. 2015) and the assessment last year (Assm. 2014) for recruitment (upper left), fishing mortality (upper right), stock biomass (lower left) and spawning stock biomass (lower right).

5 Faroe haddock

Executive summary

Being an update assessment, the changes compared to last year are additions of new data from 2014 and 2015 and some minor revisions of recent landings data with corresponding revisions of the catch at age data. The main assessment tool is an XSA tuned with two research vessel bottom trawl surveys. The results are in line with those from 2014, showing a very low SSB mainly due to poor recruitment but also due to higher than recommended fishing mortalities in recent years. SSB is now estimated well below B_{lim} and is predicted to stay below B_{lim} in 2016-2017 with status quo fishing mortality. Fishing mortality in 2014 is estimated at 0.29 and the average fishing mortality from 2012—2014 at 0.28 (F_{MSY} and F_{pa} = 0.25). Landings in 2014 were 3200 t, which is slightly higher than in 2012 and 2013. This years assessment indicates that the 2014 assessment underestimated the 2013 recruitment by 23% (2 million versus 2.6 million, which still is the lowest on record), overestimated the fishing mortality in 2013 by 6% (0.28 versus 0.26) and underestimated the 2013 total- and spawning stock biomasses by 3% and 6%, respectively (20 and 19 thous. t versus 19.6 and 18 thous. t).

5.1 Stock description and management units

Haddock in Faroese Waters, i.e. ICES Sub-Divisions 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. The spatial distribution of the haddock in the summer survey and in the spring survey is shown in figure 5.9. The figure do clearly illustrate the drastic decrease in the stock biomass in recent years.

5.2 Scientific data

5.2.1 Trends in landings and fisheries

Nominal landings of Faroe haddock increased very rapidly from only 4 000 t in 1993 to 27 000 t in 2003, but have declined drastically since and amounted in 2014 to only about 3 200 t. Most of the landings are taken from the Faroe Plateau; the 2014 landings from the Faroe Bank (Sub-Division Vb2), where the area shallower than 200 m depths has been closed to almost all fishing since the fiscal year 2008—2009, amounted to only about 64 t (Tables 5.1 and 5.2). The cumulative landings by month are shown in Figure 5.2.

Faroese vessels have taken almost the entire catch since the late 1970s (Figure 5.1). Due to the dispute on mackerel quota share, there has been no agreement on mutual fishery rights between the Faroe Islands and Norway and EU, respectively, since 2011 and therefore there was no fishery by those parties in Vb in 2012 and 2013; in 2014 the parties happened to make an agreement again. The proportion of the Faroese landings taken by each fleet category since 1985 are shown in the annex. The longliners have taken most of the catches in recent years followed by the trawlers. This was also the case in 2014, where the share by longliners was 82% and that by trawlers 18% (Figure 5.3).

5.2.2 Catch-at-age

Catch-at-age data were provided for fish taken by the Faroese fleets from Vb1 and Vb2. The sampling intensity in 2014 is shown in Table 5.4 showing some decrease in intensity as compared to 2013. There is a need to increase the sampling level. Reasons for the inadequate sampling level are shortage of resources (people, money) but also that the total catches (and stock) are so small that it is difficult to obtain enough samples. From late 2011, a landing site has been established in Tórshavn close to the Marine Research Institute and it is the intention that technicians from the Institute will regularly be sampling the landings there; this will increase the sampling level in coming years. This has also turned out to be difficult of the above mentioned reasons but the outlook is very positive regarding raising enough money to hire a new technician to among other things do the sampling.

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, all longliners were grouped into 2 fleets (larger and smaller than 100 GRT, respectively), and all trawlers were also grouped into 2 fleets (larger and smaller than 1000 Hp, respectively)The longliner samples had to be treated by using 2 seasons only (Jan-Jun, Jul-Dec. The results are given in Table 5.3. No catch-at-age data were available from other nations (Norwegian longliners and British trawlers) and they were assumed to have the same age composition as the Faroese corresponding fleets. The most recent data were revised according to the final catch figures. The resulting total catch-at-age in numbers are given in Tables 5.4 and 5.5, and in Figure 5.4 the LN(catch-at-age in numbers) is shown since 1957.

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. The recent very small year classes need to be very carefully inspected when the FBAR is calculated. 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 periods 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 5.5). Figure 5.5 shows the mean weights-at-age in the landings for age groups 2—7 since 1976. During this period, weights have shown cyclical changes. They were at a minimum in 2007—2009, but have increased again since then In the 3 latest years the weights have been fluctuated without a clear trend and a simple average of these years will be used in the short term predictions (Figure 5.5). The mean weights 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—2014. 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 5.6 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 directly in the 2015 assessment but catch per unit effort for some selected fleets (logbook data) is used as an additional information on the status of the stock (see section 5.4.1.1).

5.4 Methods

This assessment is an update of the 2014 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 catch-at-age input. All other input files (VPA) are the same except for the addition of the 2014 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 changes in productivity of the ecosystem (see chapter 2). Both series, however, indicate that the stock is very low. The longliner cpue's do not decrease as much as the trawler cpue's which in addition to the explanation given above may be attributed to the fact that in the management of the demersal Faroese stocks, large areas have been closed to trawling with the effect that when the haddock stock is small, the distribution of it is mainly outside the "trawl areas".

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 spatial distribution of haddock catches in the surveys Biomass estimates (kg/hour) are available for both series since they were initiated (Figure 5.8). The main trends from the surveys are the same but the summer survey indicates a considerably more depleted stock in recent years than the summer survey. 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, some artefacts 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), since these ages have length distributions almost without overlap. LN(numbers at age) for the surveys are presented in Figures 5.10—5.11. Further analyses of the performances of the two series are shown in the stock annex. In general there is a good relationship between the indices for one year class in two successive years. The same applies when comparing the corresponding indices at age from both surveys .

A SPALY (same procedure as last year) run, with the same settings of the XSA as in 2014 (tuned with the two surveys combined, Table 5.8), with 2015 data included and some minor revisions of recent catch figures, gave in general similar results as last year (Table 5.9), although this years assessment indicates that the 2014 assessment underestimated the 2013 recruitment by 23% (2 million versus 2.6 million, which still is the lowest on record), overestimated the fishing mortality in 2032 by 6% (0.28 versus 0.26) and overestimated the 2013 total- and spawning stock biomasses by 3% and 6%, respectively (20 and 19 thous. t versus 20 and 18 thous. t). The log q residuals for the two surveys are shown in Figure 5.12.

The retrospective analysis of fishing mortality, recruitment and spawning stock biomass of this XSA is shown in Figure 5.13. 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 continue 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 5.9 and in Figure 5.14. The fishing mortality was high (around 0.6) in the 1950s and early 1960s but declined to around 0.2 from 1965—1975. Since then, fishing mortality has usually been low, the exceptions are peaks in 1977, 1982, 1997—1999 and 2003—2006. They occur near the end of relatively high catch periods and some of the highest values (0.32—0.45) are nearly certainly an artefact of the unweighted fishing mortality. Exploitation ratio (Yield/Biomass) is a bit more stable and may be used to indicate the level of fishing mortality.

5.5 Reference points

The yield- and spawning stock biomass per recruit (age 2) based on the long-term data are shown in Table 5.16 and Figure 5.16. $\mathbf{F}_{med}$, and $\mathbf{F}_{high}$ were calculated at 0.23 and 0.89, respectively. The F_{max} of 0.89 should not be used since it is very poorly determined due to the flat YPR curve. $F_{0.1}$ is estimated at 0.18. The F35%SPR was estimated at 0.24.

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 in 2012 investigated possible candidates for $F_{MSY.}$ Based on Medium –term projections, Medium-term projections the NWWG suggested, that FMSY preliminary could be set at 0.25 and the MSY $B_{trigger}$ at 35 thous. t (same as B_{pa}) These values were accepted by ACOM. Some further analyses have indicated that these values are acceptable, but it is anticipated that further work will be untertaken in connection with the next benchmark assessment. See the stock annex for more details.

5.6 State of the stock

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 5.14. 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 does not seem to be the decisive factor in this development since it most of the period has fluctuated around the F_{MSY} and F_{pa}. It must though be remembered that the characteristics of the stock in recent decades with long periods of poor recruitment make it less resilient to high fishing mortality.

The most recent increase in the spawning stock is due to new strong year classes entering the stock of which the 1999 year class is the highest on record (103 million at age 2). Also the YC's from 2000 and 2001 are estimated well above average and the 2002 YC above average, but the more recent YC's are all estimated to be very small except the 2009 YC, which is estimated to be slightly above the half of the average for the whole series back to 1957 and the 2012 and 2013 YC's, which are estimated somewhat higher than the other small year-classes. Fishing mortality has been relatively high since 2003, highest whent the stock was large leading to large variability in catches. Currently fishing mortality is estimated close to F_{MSY} (0.25).

5.7 Short term forecast

5.7.1 Input data

The input data for the short-term predictions are estimated in accordance with the procedures last year and explained in Tables 5.12-13. The YC 2015 at age 2 in 2017 is estimated as the geometric mean of the 2-year-olds since 2005. This procedure was introduced in 2011. All available information suggests that using the recent short series with poor recruitment is more appropriate than the longer period used in the past. However, the choice of recruitment in 2017 has little effect on the short term prediction.

5.7.2 Results

Although the allocated number of fishing days for the fishing year 2014—2015was reduced for some fleets as compared to the year before (see section 2), it should not be unrealistic to assume fishing mortalities in 2015 as the average of some recent years, here the average of F(2012—2014), 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 2015 are then predicted to be about 3800 t, and continuing with this fishing mortality will result in 2016 landings of about 4700 t. The SSB will decline to 19 000 t in 2015, will be 19 000 t in 2016 and decrease to 18 000 t in 2017 i.e. will be below B_{lim} (22 000t) in the next years. The results of the short-term prediction are shown in Table 5.16 and in Figure 5.14. The contribution (%) by year-classes to the age composition of the predicted 2016 and 2017 SSB's is shown in Figure 5.17. It should be noted that young YC's which not have really entered the fishery in 2014/15, will contribute by a heavy proportion of the SSB in 2016/17.

5.8 Medium term forecasts and yield per recruit

No medium term projections were made this year; however, the 2013 projections, which were the basis for suggested MSY reference points, are presented in the stock annex.

The input data for the long-term yield and spawning stock biomass (yield-per-recruit calculations) are listed in Table 5.15. Mean weights-at-age (stock and catch) are averages for the 1977—2014 period. The maturity o-gives are averages for the years 1982—2014. The exploitation pattern is the same as in the short term prediction.

The results are given in Table 5.16, in Figure 5.16 and under Reference points (section 5.5).

5.9 Uncertainties in assessment and forecast

Retrospective analyses indicate periods 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 2014 assessment underestimated the 2013 recruitment 23% (20 millions versus 26 million, which still is the lowest on record), overestimated the fishing mortality in 2013 by 6% (0.28 versus 0.26) and underestimated the 2013 total- and spawning stock biomasses by 3% and 6%, respectively (20 and 19 thous. t versus 19.6 and 18 thous. t), see text table below..

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

The sampling of the catches for length measurements, otolith readings and length-weight relationships has decreased somewhat compared to 2014. Although it is regarded to be adequate for the assessment, there is a need to improve it again (see 5.2).

5.10 Comparison with previous assessment and forecast

As explained previously in the report, this assessment is an update of the 2014 assessment. The only changes are minor revisions of recent landings according to revised data and corresponding revisions of the catch-at-age input. All other input files (VPA and tuning fleets) are the same except for the addition of the 2014 data.

Following differences in the 2013 estimates were observed as compared to last year (see text above):

Comparisons between 2014 and 2015 assessment of 2013 data
The year of comparison is 2013

	R at age 2 (thousands)	Total B (tonnes)	SSB (tonnes)	Landings (tonnes)	F (3-7)
2014 spaly	1992	20183	19017	3105	0.2753
2015 spaly	2596	19643	17931	2950	0.2595
%-change	23	-3	-6	-5	-6

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 of ensuring sustainable fisheries. There has been some work with establishing a management plan with a harvest control rule for cod, haddock and saithe including a recovery plan, but the proposal has not yet been officially accepted. 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, the 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 allocated fishing days, gear specifications, closed areas during spawning times, closed areas for longlining close to land 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, and in 2011-2013 no agreement could be made between the Faroe Islands and EU and Norway, respectively, due to the dispute on mackerel quota sharing. In 2014, however, the parties managed to get an agreement in place again. 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 2000-2014 and Working Group estimates in Vb.

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014 [2]
Faroe Islands	13,620 [8]	13,457 [8]	20,776 [6]	21,615	18,995	18,172	15,600	11,689	6,728	4,895	4,932	3,350	2,490	2,877	2,704
France[1]	6	8 [7]	2	4	1 [5]	+	12 [5]	4 [5]	3 [5]	2 [5]	1 [7]	3			
Germany	1	2	6	1	6		1								
Greenland	22 [6]	0 [6]	4 [4]				1	9 [4]		6 [4]	12 [6]	+	1 [4]		
Iceland			4										2	26 [4]	
Norway	355	257 [2]	227	265	229	212	57	61	26	8	5				2
Russia					16				10						
Spain					49										
UK (Engl. and Wales)	19 [7]	4 [7]	11 [5]	14	8	1	1								
UK (Scotland)[5]				185	186	126	106	35	60	64					
United Kingdom											73 [4]				424
Total	14,023	13,728 #	21,030	22,084	19,490	18,511	15,778	11,798	6,827	4,975	5,023	3,353	2,493	2,903	3,130
Used in the assessmer	15,821 0	15,890	24,933	27,072	23,101	20,455	17,154	12,631	7,388	5,197	5,202	3,540	2,634	2,950	3,194

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) Reported as Division Vb, to the Faroese coastal guard service.
5) Reported as Division Vb.
6) Includes Faroese landings reported to the NWWG by the Faroe Marine Research Institute

Table 5.2 Faroe Bank (Sub-division Vb2) HADDOCK. Nominal catches (tonnes) by countries, 2000-2014.

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014 [2]
Faroe Islands	1,565 [5]	1,948	3,698	4,934	3,594	2,444	1,375	810	556	192	178	194	141	47	63
France1						+									
Norway	48	66	28	54	17	45	1	8		3	1				1
UK (Engl. and Wales)	[1]	[1]	[1]	[1]	[1]	[1]	[4]								
UK (Scotland)3	185	148	177	[4]	[1]	[1]	[4]	15	5	27	33				
Total	1,798	2,162	3,903	4,988	3,611	1,944	1,376	833	561	222	212	194	141	47	64

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

Catch at age 2014

Age	Vb LLiners < 100GRT	Vb LLiners > 100GRT	Vb Trawl < 1000HP	Vb Trawl > 1000HP	Vb Others	Vb All Faroese fleets	Vb Foreign Trawlers	Vb Total All fleets
1	0	0	0	0	0	0	0	0
2	157	35	12	10	0	214	18	232
3	101	30	145	39	0	316	69	385
4	235	122	160	39	0	556	70	626
5	321	251	343	71	1	986	126	1112
6	19	27	26	9	0	82	17	99
7	11	19	16	5	0	51	8	59
8	5	10	8	3	0	26	5	31
9	1	1	7	2	0	11	4	15
10	4	8	3	3	0	18	4	22
11	3	7	3	2	0	15	4	19
12	0	0	1	1	0	2	1	3
13	1	1	0	0	0	2	0	3
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
Total no.	858	513	722	184	2	2279	327	2606
Catch, t.	885	656	738	215	2	2495	382	2877

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 trav Pair Trawl. = Pair trawlers

Comm. Sampling 2014	Vb LLiners < 100GRT	Vb LLiners > 100GRT	Vb Trawl <1000HP	Vb Trawl <1000HP	Vb Others	Vb All Faroese Fleets	Vb Foreign Trawlers	Vb Total
No. samples	10	14	8	37	0	73	0	73
No. lengths	1918	2923	1722	8182	0	16942	0	16942
No. weights	1718	2923	1722	7951	0	16942	0	16942
No. ages	180	360	20	679	0	1379	0	1379

As compared to 2013, the sampling in 2014 was:
no samples - 5%, no of lengths - 13%, no of weights 16%, no of otoliths - 10%.

Tabel 5.4 Faroe haddock. Catch number-at-age

Run title : FAROE HADDOCK (ICES DIVISION Vb) HAD_IND

At 3/05/2015 14:07

Table 1 Catch numbers at age Numbers*10**-3

YEAR,	1957,	1958,	1959,	1960,	1961,	1962,	1963,	1964,
AGE								
0,	0,	0,	0,	0,	0,	0,	0,	0,
1,	45,	116,	525,	854,	941,	784,	356,	46,
2,	4133,	6255,	3971,	6061,	7932,	9631,	13552,	2284,
3,	7130,	8021,	7663,	10659,	7330,	13977,	8907,	7457,
4,	8442,	5679,	4544,	6655,	5134,	5233,	7403,	3899,
5,	1615,	3378,	2056,	2482,	1937,	2361,	2242,	2360,
6,	894,	1299,	1844,	1559,	1305,	1407,	1539,	1120,
7,	585,	817,	721,	1169,	838,	868,	860,	728,
8,	227,	294,	236,	243,	236,	270,	257,	198,
9,	94,	125,	98,	85,	59,	72,	75,	49,
+gp,	58,	105,	47,	28,	13,	22,	23,	7,
TOTALNUM,	23223,	26089,	21705,	29795,	25725,	34625,	35214,	18148,
TONSLAND,	20995,	23871,	20239,	25727,	20831,	27151,	27571,	19490,
SOPCOF %,	89,	90,	90,	88,	88,	89,	89,	101,

Table 1 Catch numbers at age Numbers*10**-3

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
AGE										
0,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
1,	39,	90,	70,	49,	95,	57,	55,	43,	665,	253,
2,	1368,	1081,	1425,	5881,	2384,	1728,	717,	750,	3311,	5633,
3,	4286,	3304,	2405,	4097,	7539,	4855,	4393,	3744,	8416,	2899,
4,	5133,	4804,	2599,	2812,	4567,	6581,	4727,	4179,	1240,	3970,
5,	1443,	2710,	1785,	1524,	1565,	1624,	3267,	2706,	2795,	451,
6,	1209,	1112,	1426,	1526,	1485,	1383,	1292,	1171,	919,	976,
7,	673,	740,	631,	923,	1224,	1099,	864,	696,	1054,	466,
8,	1345,	180,	197,	230,	378,	326,	222,	180,	150,	535,
9,	43,	54,	52,	68,	114,	68,	147,	113,	68,	68,
+gp,	8,	9,	13,	12,	20,	10,	102,	95,	11,	147,
TOTALNUM,	15547,	14084,	10603,	17122,	19371,	17731,	15786,	13677,	18629,	15398,
TONSLAND,	18479,	18766,	13381,	17852,	23272,	21361,	19393,	16485,	18035,	14773,
SOPCOF %,	94,	109,	101,	102,	108,	102,	97,	96,	97,	97,

Table 1 Catch numbers at age Numbers*10**-3

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
0,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
1,	94,	40,	0,	0,	1,	0,	0,	0,	0,	25,
2,	7337,	4396,	255,	32,	1,	143,	74,	539,	441,	1195,
3,	7952,	7858,	4039,	1022,	1162,	58,	455,	934,	1969,	1561,
4,	2097,	6798,	5168,	4248,	1755,	3724,	202,	784,	383,	2462,
5,	1371,	1251,	4918,	4054,	3343,	2583,	2586,	298,	422,	147,
6,	247,	1189,	2128,	1841,	1851,	2496,	1354,	2182,	93,	234,
7,	352,	298,	946,	717,	772,	1568,	1559,	973,	1444,	42,
8,	237,	720,	443,	635,	212,	660,	608,	1166,	740,	861,
9,	419,	258,	731,	243,	155,	99,	177,	1283,	947,	388,
+gp,	187,	318,	855,	312,	74,	86,	36,	214,	795,	968,
TOTALNUM,	20293,	23126,	19483,	13104,	9326,	11417,	7051,	8373,	7234,	7883,
TONSLAND,	20715,	26211,	25555,	19200,	12424,	15016,	12233,	11937,	12894,	12378,
SOPCOF %,	117,	107,	98,	99,	104,	100,	109,	92,	106,	106,

Tabel 5.4 Faroe haddock. Catch number-at-age (cont.)

Table 1 Catch numbers at age Numbers*10**-3

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
0,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
1,	0,	0,	0,	0,	0,	0,	0,	0,	43,	1,
2,	985,	230,	283,	655,	63,	105,	77,	40,	113,	277,
3,	4553,	2549,	1718,	444,	1518,	1275,	1044,	154,	298,	191,
4,	2196,	4452,	3565,	2463,	658,	1921,	1774,	776,	274,	307,
5,	1242,	1522,	2972,	3036,	2787,	768,	1248,	1120,	554,	153,
6,	169,	738,	1114,	2140,	2554,	1737,	651,	959,	538,	423,
7,	91,	39,	529,	475,	1976,	1909,	1101,	335,	474,	427,
8,	61,	130,	83,	151,	541,	885,	698,	373,	131,	383,
9,	503,	71,	48,	18,	133,	270,	317,	401,	201,	125,
+gp,	973,	712,	334,	128,	81,	108,	32,	162,	185,	301,
TOTALNUM,	10773,	10443,	10646,	9510,	10311,	8978,	6942,	4320,	2811,	2588,
TONSLAND,	15143,	14477,	14882,	12178,	14325,	11726,	8429,	5476,	4026,	4252,
SOPCOF %,	106,	101,	102,	97,	100,	102,	106,	106,	103,	100,

Table 1 Catch numbers at age Numbers*10**-3

YEAR,	1995,	1996,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,
AGE										
0,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
1,	0,	1,	0,	0,	9,	73,	19,	0,	0,	3,
2,	804,	326,	77,	106,	174,	1461,	4380,	1515,	133,	243,
3,	452,	5234,	2913,	1055,	1142,	3061,	3128,	14039,	3436,	2007,
4,	235,	1019,	10517,	5269,	942,	210,	2423,	2879,	13551,	4802,
5,	226,	179,	710,	9856,	4677,	682,	173,	1200,	2224,	10426,
6,	132,	163,	116,	446,	6619,	2685,	451,	133,	949,	1163,
7,	295,	161,	123,	99,	226,	2846,	1151,	239,	163,	409,
8,	290,	270,	93,	87,	26,	79,	1375,	843,	334,	89,
9,	262,	234,	220,	95,	20,	1,	17,	1095,	858,	166,
+gp,	295,	394,	516,	502,	192,	71,	18,	33,	924,	811,
TOTALNUM,	2991,	7981,	15285,	17515,	14027,	11169,	13135,	21976,	22572,	20119,
TONSLAND,	4948,	9642,	17924,	22210,	18482,	15821,	15890,	24933,	27072,	23101,
SOPCOF %,	103,	100,	103,	101,	100,	103,	100,	100,	100,	99,

Table 1 Catch numbers at age Numbers*10**-3

YEAR,	2005,	2006,	2007,	2008,	2009,	2010,	2011,	2012,	2013,	2014,
AGE										
0,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
1,	0,	0,	0,	6,	0,	0,	0,	0,	0,	0,
2,	85,	247,	76,	66,	27,	389,	170,	8,	83,	232,
3,	1671,	446,	982,	204,	329,	445,	773,	960,	510,	385,
4,	3852,	2566,	547,	918,	402,	426,	324,	513,	1118,	626,
5,	6753,	3949,	2732,	424,	555,	279,	198,	156,	219,	1112,
6,	6127,	5423,	3309,	1471,	514,	484,	186,	114,	95,	99,
7,	542,	3278,	2758,	1706,	1133,	553,	280,	123,	78,	59,
8,	147,	136,	1117,	1254,	739,	718,	353,	94,	88,	31,
9,	28,	63,	89,	320,	285,	444,	367,	171,	71,	15,
+gp,	154,	70,	9,	39,	48,	159,	187,	114,	119,	47,
TOTALNUM,	19359,	16178,	11619,	6408,	4032,	3897,	2838,	2253,	2381,	2606,
TONSLAND,	20455,	17154,	12631,	7388,	5197,	5202,	3540,	2634,	2950,	3194,
SOPCOF %,	100,	100,	100,	101,	100,	101,	101,	102,	101,	101,

Table 5.5 Faroe haddock. Catch weight-at-age.

Run title : FAROE HADDOCK (ICES DIVISION Vb) HAD_IND

At 3/05/2015 14:07

Table 2 Catch weights at age (kg)

YEAR,	1957,	1958,	1959,	1960,	1961,	1962,	1963,	1964,
AGE								
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.2500,	.2500,	.2500,	.2500,	.2500,	.2500,	.2500,	.2500,
2,	.4700,	.4700,	.4700,	.4700,	.4700,	.4700,	.4700,	.4700,
3,	.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,
5,	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,
7,	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,
9,	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,
SOPCOFAC,	.8937,	.8983,	.9034,	.8832,	.8832,	.8929,	.8915,	1.0111,

Table 2 Catch weights at age (kg)

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
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,	.9383,	1.0885,	1.0117,	1.0246,	1.0787,	1.0249,	.9688,	.9597,	.9690,	.9678,

Table 2 Catch weights at age (kg)

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.2500,	.2500,	.0000,	.0000,	.3000,	.0000,	.0000,	.0000,	.0000,	.3590,
2,	.4700,	.4700,	.3110,	.3570,	.3570,	.6430,	.4520,	.7000,	.4700,	.6810,
3,	.7300,	.7300,	.6330,	.7900,	.6720,	.7130,	.7250,	.8960,	.7400,	1.0110,
4,	1.1300,	1.1300,	1.0440,	1.0350,	.8940,	.9410,	.9570,	1.1500,	1.0100,	1.2550,
5,	1.5500,	1.5500,	1.4260,	1.3980,	1.1560,	1.1570,	1.2370,	1.4440,	1.3200,	1.8120,
6,	1.9700,	1.9700,	1.8250,	1.8700,	1.5900,	1.4930,	1.6510,	1.4980,	1.6600,	2.0610,
7,	2.4100,	2.4100,	2.2410,	2.3500,	2.0700,	1.7390,	2.0530,	1.8290,	2.0500,	2.0590,
8,	2.7600,	2.7600,	2.2050,	2.5970,	2.5250,	2.0950,	2.4060,	1.8870,	2.2600,	2.1370,
9,	3.0700,	3.0700,	2.5700,	3.0140,	2.6960,	2.4650,	2.7250,	1.9610,	2.5400,	2.3680,
+gp,	3.5500,	3.5500,	2.5910,	2.9200,	3.5190,	3.3100,	3.2500,	2.8560,	3.0400,	2.6860,
SOPCOFAC,	1.1696,	1.0741,	.9784,	.9947,	1.0380,	1.0017,	1.0870,	.9238,	1.0554,	1.0593,

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

Table 2 Catch weights at age (kg)

YEAR	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
AGE										
0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.3600	.0000
2	.5280	.6080	.6050	.5010	.5800	.4380	.5470	.5250	.7550	.7540
3	.8590	.8870	.8310	.7810	.7790	.6990	.6930	.7240	.9820	1.1030
4	1.3910	1.1750	1.1260	.9740	.9230	.9390	.8840	.8170	1.0270	1.2540
5	1.7770	1.6310	1.4620	1.3630	1.2070	1.2040	1.0860	1.0380	1.1920	1.4650
6	2.3260	1.9840	1.9410	1.6800	1.5640	1.3840	1.2760	1.2490	1.3780	1.5930
7	2.4400	2.5190	2.1730	1.9750	1.7460	1.5640	1.4770	1.4300	1.6430	1.8040
8	2.4010	2.5830	2.3470	2.3440	2.0860	1.8180	1.5740	1.5640	1.7960	2.0490
9	2.5320	2.5700	3.1180	2.2480	2.4240	2.1680	1.9300	1.6330	1.9710	2.2250
+gp	2.6860	2.9220	2.9330	3.2950	2.5140	2.3350	2.1530	2.1260	2.2400	2.4230
SOPCOFAC	1.0559	1.0141	1.0197	.9695	1.0025	1.0195	1.0635	1.0554	1.0320	.9969

Table 2 Catch weights at age (kg)

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AGE										
0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1	.0000	.3600	.0000	.0000	.2780	.2800	.2800	.0000	.0000	.3670
2	.6660	.5340	.5190	.6220	.5040	.6610	.6080	.5840	.5710	.5740
3	1.0540	.8580	.7710	.8460	.6240	.9360	.9400	.8570	.7150	.7700
4	1.4890	1.4590	1.0660	1.0160	.9740	1.1660	1.3740	1.4050	1.0080	.8870
5	1.7790	1.9930	1.7990	1.2830	1.2200	1.4830	1.7790	1.7990	1.5370	1.1590
6	1.9400	2.3300	2.2700	2.0800	1.4900	1.6160	1.9710	1.9740	1.9110	1.6380
7	2.1820	2.3510	2.3400	2.5560	2.4560	1.8930	2.1190	2.3010	2.0910	1.8700
8	2.3570	2.4690	2.4750	2.5720	2.6580	2.8210	2.3730	2.3700	2.3010	2.4380
9	2.4900	2.7770	2.5010	2.4520	2.5980	3.7490	2.7500	2.6260	2.4060	2.3570
+gp	2.6780	2.5820	2.6760	2.7530	2.9530	3.1960	3.9660	3.1300	2.5350	2.4170
SOPCOFAC	1.0331	1.0043	1.0250	1.0106	.9973	1.0349	.9960	1.0010	1.0049	.9929

Table 2 Catch weights at age (kg)

YEAR	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
AGE										
0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1	.0000	.0000	.0000	.4910	.0000	.0000	.0000	.0000	.0000	.0000
2	.5380	.4750	.6280	.6360	.4820	.6920	.5530	.6190	.5760	.5470
3	.6490	.6010	.6690	.7540	.7340	.8700	.8150	.7860	.8300	.9020
4	.7970	.7680	.8590	.8600	.9850	1.1490	1.0860	1.0690	1.1490	1.1650
5	1.0200	.9110	.9690	.9910	1.1300	1.3080	1.3030	1.4050	1.4650	1.3540
6	1.2450	1.1260	1.0600	1.0820	1.2640	1.3860	1.3870	1.6160	1.7100	1.6930
7	1.8430	1.3740	1.2450	1.1510	1.3570	1.4290	1.4690	1.6560	1.8270	1.8410
8	2.0610	2.1580	1.4750	1.3790	1.5450	1.5680	1.5380	1.6750	1.8860	1.8720
9	2.2630	2.2110	2.2660	1.7270	1.7920	1.7400	1.7020	1.7270	1.8560	1.8560
+gp	2.5790	2.5690	2.2560	2.4350	2.1540	1.8410	1.8620	1.9050	2.0850	1.8230
SOPCOFAC	.9988	.9987	.9999	1.0065	.9955	1.0076	1.0060	1.0190	1.0077	1.0118

Table 5.6 Faroe haddock. Proportion mature-at-age.

Run title : FAROE HADDOCK (ICES DIVISION Vb) HAD_IND

At 3/05/2015 14:07

Table 5 Proportion mature at age

YEAR,	1957,	1958,	1959,	1960,	1961,	1962,	1963,	1964,
AGE								
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.0600,	.0600,	.0600,	.0600,	.0600,	.0600,	.0600,	.0600,
3,	.4800,	.4800,	.4800,	.4800,	.4800,	.4800,	.4800,	.4800,
4,	.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,
6,	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,
8,	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,
+gp,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,

Table 5 Proportion mature at age

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
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,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
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,	.0800,	.0800,	.0800,
3,	.4800,	.4800,	.4800,	.4800,	.4800,	.4800,	.4800,	.6200,	.6200,	.7600,
4,	.9100,	.9100,	.9100,	.9100,	.9100,	.9100,	.9100,	.8900,	.8900,	.9800,
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 5.6 Faroe haddock. Proportion mature-at-age (cont.).

Table 5 Proportion mature at age

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.0300,	.0300,	.0500,	.0500,	.0200,	.0800,	.1600,	.1800,	.1100,	.0500,
3,	.6200,	.4300,	.3200,	.2400,	.2200,	.3700,	.5800,	.6500,	.5000,	.4200,
4,	.9600,	.9500,	.9100,	.8900,	.8700,	.9000,	.9300,	.9100,	.8500,	.8600,
5,	1.0000,	.9900,	.9800,	.9800,	.9900,	1.0000,	1.0000,	1.0000,	.9700,	.9600,
6,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	.9900,	.9900,
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,	1995,	1996,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.0300,	.0300,	.0100,	.0100,	.0100,	.0200,	.0900,	.0800,	.0700,	.0000,
3,	.4700,	.4700,	.4700,	.3600,	.3500,	.3600,	.5400,	.4900,	.4500,	.3500,
4,	.9100,	.9300,	.9100,	.8700,	.8600,	.8700,	.9300,	.9700,	.9700,	.9400,
5,	.9600,	.9800,	1.0000,	.9900,	.9900,	.9900,	1.0000,	1.0000,	.9900,	.9900,
6,	.9900,	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,	2005,	2006,	2007,	2008,	2009,	2010,	2011,	2012,	2013,	2014,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.0100,	.0100,	.0200,	.0100,	.0100,	.0300,	.0900,	.1300,	.1700,	.1600,
3,	.3400,	.4200,	.5200,	.6400,	.6100,	.6500,	.7400,	.7900,	.8300,	.8400,
4,	.9100,	.9100,	.9100,	.9500,	.9300,	.9600,	.9700,	.9900,	.9900,	.9900,
5,	.9900,	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. 2015 tuning file.

```
FAROE Haddock (ICES SUBDIVISION VB)       COMB-SURVEY-SPALY-15-jr.txt
102
SUMMER SURVEY
1996 2014
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
200     642.08 10501.38  1670.76    406.26   355.99   208.31  223.15  290.88
200    2359.69   405.59  5655.72   1081.33   205.64   135.56  147.14   95.56
200    8886.32   215.98  1379.90   5048.56  1039.73   202.49  101.84  157.04
200   13337.55  4051.10   889.30   1042.92  2866.25   393.81   81.02   76.70
SPRING SURVEY SHIFTED
1993 2014
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   1865.90    449.30    260.30   212.60    244.60
100    420.00    367.60   4957.20    908.00    227.80   142.50    293.30
100   3419.90   1232.21    302.60   4022.40    619.60   120.30    103.78
100   3542.60   4099.30    869.80    930.30   2238.40   270.20     90.30
```

100 1534.70 3282.20 3989.20 971.20 1762.60 1113.90 156.70

Table 5.8 Faroe haddock 2015 xsa.

```
Lowestoft VPA Version 3.1

    2/05/2015  23:12

 Extended Survivors Analysis

 FAROE HADDOCK (ICES DIVISION Vb)                 HAD_IND

 CPUE data from file D:\Vpa\vpa2015\input-files\comb-survey-spaly-15-jr.txt

 Catch data for  58 years. 1957 to 2014. Ages  0 to  10.

      Fleet,           First, Last, First, Last, Alpha,  Beta
                   ,    year, year,  age ,  age
 SUMMER SURVEY      ,   1996, 2014,   1,     8,   .600,   .700
 SPRING SURVEY SHIFTE,  1993, 2014,   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   35 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, 2005,  2006,  2007,  2008,  2009,  2010,  2011,  2012,  2013,  2014

      0,  .000,  .000,  .000,  .000,  .000,  .000,  .000,  .000,  .000,  .000
      1,  .000,  .000,  .000,  .002,  .000,  .000,  .000,  .000,  .000,  .000
      2,  .011,  .036,  .028,  .029,  .013,  .089,  .012,  .003,  .036,  .029
      3,  .085,  .074,  .198,  .096,  .194,  .301,  .258,  .087,  .249,  .233
      4,  .178,  .183,  .123,  .287,  .277,  .415,  .374,  .272,  .139,  .550
      5,  .352,  .280,  .302,  .132,  .282,  .316,  .345,  .310,  .178,  .200
      6,  .559,  .535,  .402,  .263,  .235,  .425,  .361,  .342,  .316,  .114
      7,  .671,  .672,  .579,  .373,  .333,  .428,  .469,  .432,  .416,  .330
      8,  .622,  .347,  .509,  .571,  .274,  .366,  .539,  .282,  .638,  .288
      9,  .766,  .600,  .403,  .264,  .241,  .263,  .322,  .550,  .357,  .206
```

Table 5.8 Faroe haddock 2015 xsa (cont.)

XSA population numbers (Thousands)

YEAR	AGE 0	1	2	3	4	5	6	7	8	9
2005	4.62E+03	9.36E+03	8.48E+03	2.26E+04	2.61E+04	2.51E+04	1.58E+04	1.23E+03	3.51E+02	5.78E+01
2006	3.86E+03	3.78E+03	7.67E+03	6.87E+03	1.70E+04	1.79E+04	1.45E+04	7.40E+03	5.13E+02	1.54E+02
2007	3.50E+03	3.16E+03	3.10E+03	6.05E+03	5.22E+03	1.16E+04	1.10E+04	6.94E+03	3.10E+03	2.97E+02
2008	7.49E+03	2.87E+03	2.59E+03	2.47E+03	4.07E+03	3.78E+03	7.02E+03	6.05E+03	3.18E+03	1.52E+03
2009	2.34E+04	6.14E+03	2.34E+03	2.06E+03	1.83E+03	2.50E+03	2.71E+03	4.42E+03	3.41E+03	1.47E+03
2010	4.68E+03	1.92E+04	5.02E+03	1.89E+03	1.39E+03	1.14E+03	1.54E+03	1.75E+03	2.59E+03	2.12E+03
2011	3.87E+03	3.83E+03	1.57E+04	3.76E+03	1.15E+03	7.50E+02	6.79E+02	8.26E+02	9.36E+02	1.47E+03
2012	1.32E+04	3.17E+03	3.14E+03	1.27E+04	2.38E+03	6.46E+02	4.35E+02	3.88E+02	4.23E+02	4.47E+02
2013	1.28E+04	1.08E+04	2.60E+03	2.56E+03	9.52E+03	1.48E+03	3.88E+02	2.53E+02	2.06E+02	2.61E+02
2014	7.58E+03	1.05E+04	8.87E+03	2.05E+03	1.64E+03	6.78E+03	1.02E+03	2.32E+02	1.37E+02	8.91E+01

Estimated population abundance at 1st Jan 2015

0.00E+00	6.20E+03	8.56E+03	7.05E+03	1.33E+03	7.73E+02	4.55E+03	7.43E+02	1.36E+02	8.39E+01

Taper weighted geometric mean of the VPA populations:

2.31E+04	1.96E+04	1.64E+04	1.29E+04	8.88E+03	5.45E+03	3.20E+03	1.79E+03	8.97E+02	4.33E+02

Standard error of the weighted Log(VPA populations) :

1.1032	1.0995	1.0995	1.0746	1.0521	1.0264	1.0194	1.0309	1.1351	1.3687

Log catchability residuals.

Fleet : SUMMER SURVEY

Age	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
0	No data for this fleet at this age									
1	99.99	1.21	.26	-.15	-.22	.11	.15	.41	.18	-.28
2	99.99	.17	.67	.07	-.14	.27	.31	.21	.20	.53
3	99.99	.35	.19	-.39	1.53	.22	.40	.36	-.14	-.23
4	99.99	-.43	.43	.04	-.51	-.69	.27	.12	.34	-.17
5	99.99	-.11	.03	.11	.15	-.10	-.92	.18	.59	.31
6	99.99	.21	.43	-.28	.07	.09	-.33	-.51	-.14	-.09
7	99.99	-.02	-.35	.97	.29	.05	.00	-.35	-.28	-.44
8	99.99	-.07	.16	.63	.44	.29	-.08	-.27	.42	-.73

Age	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
0	No data for this fleet at this age									
1	.29	-.23	.06	.34	.39	.10	-1.93	-.44	-.35	.10
2	.25	.58	1.18	.08	-.17	.11	-.06	-1.71	-2.13	-.43
3	.04	-.64	-.61	-.15	-.94	.37	-.10	-.21	.09	-.14
4	.17	-.01	-.65	.22	.37	.53	-.29	-.11	-.04	.41
5	.09	.12	-.19	-.62	.14	.15	.11	-.31	.39	-.10
6	.73	.27	.14	.01	-.26	.28	-.30	-.29	.20	-.23
7	.22	.30	.00	.25	.18	.10	-.35	-.04	.01	-.19
8	-1.21	-.53	-.74	.18	-.20	.18	-.17	-.66	.79	.26

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	-5.0205	-5.5052	-5.7113	-5.6741	-5.7982	-5.8181	-5.8181	-5.8181
S.E(Log q)	.5965	.7636	.5269	.3751	.3441	.3130	.3288	.5290

Table 5.8 Faroe haddock 2015 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,     .88,    1.049,      5.52,     .83,     19,     .53,   -5.02,
  2,     .82,    1.507,      6.19,     .80,     19,     .60,   -5.51,
  3,     .95,     .527,      5.88,     .87,     19,     .51,   -5.71,
  4,     .94,     .940,      5.86,     .93,     19,     .35,   -5.67,
  5,     .93,    1.398,      5.99,     .95,     19,     .31,   -5.80,
  6,     .93,    1.519,      5.95,     .96,     19,     .28,   -5.82,
  7,     .99,     .220,      5.82,     .95,     19,     .33,   -5.80,
  8,    1.10,   -1.087,      5.83,     .87,     19,     .57,   -5.89,


 Fleet : SPRING SURVEY SHIFTE

  Age  ,  1993,  1994
     0 ,  -.59,   .96
     1 ,  -.45,  -.86
     2 ,  -.63,  -.73
     3 ,  -.21,  -.23
     4 ,  -.50,  -.38
     5 ,  -.38, -1.17
     6 ,   .15,  -.63
     7 , No data for this fleet at this age
     8 , No data for this fleet at this age


  Age  ,  1995,  1996,  1997,  1998,  1999,  2000,  2001,  2002,  2003,  2004
     0 ,   .89, -1.11,  -.29,  -.37,  -.18,   .33,   .51,   .11,  -.34,   .92
     1 ,   .43,   .64,  -.15,  -.09,  -.20,  -.30,  -.48,   .11,   .18,   .39
     2 ,  -.15,   .38,   .46, -2.04,   .29,  -.33,   .10,  -.05,   .04,   .16
     3 ,  -.44,   .44,   .28,   .08,  -.69,  -.69,  -.41,  -.15,  -.30,  -.17
     4 ,  -.32,   .25,   .35,   .08,  -.52, -2.11,  -.29,  -.57,   .44,  -.25
     5 ,  -.34,   .94,   .53,  -.28,  -.11, -1.24, -1.02,  -.53,  -.05,   .53
     6 ,  -.54,  -.34,  -.92,  -.47,  -.06,  -.81,  -.69, -1.18,  -.61,   .17
     7 , No data for this fleet at this age
     8 , No data for this fleet at this age


  Age  ,  2005,  2006,  2007,  2008,  2009,  2010,  2011,  2012,  2013,  2014
     0 ,  -.28,   .42,  -.06,  1.00,   .38, -2.24,  -.62,   .24,   .31,   .00
     1 ,   .54,   .23,   .57,   .62,   .66,  -.17, -1.41,  -.01,  -.04,  -.22
     2 ,  -.24,   .87,   .13,   .63,   .15,   .53,   .29,  -.90,   .38,   .66
     3 ,  -.07,  -.37,   .39,  -.24,   .07,   .33,   .30,   .41,   .70,   .95
     4 ,  -.24,   .27,  -.38,   .45,  -.30,   .40,   .41,   .58,   .35,  2.28
     5 ,   .21,   .61,   .26,  -.28,  -.01,   .54,   .58,   .53,   .38,   .30
     6 ,   .26,   .93,   .39,   .25,  -.07,   .59,  1.53,   .92,   .87,   .26
     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,  -6.0068,   -5.3462,   -5.8437,   -5.8842,   -6.0745,   -6.3176,   -6.4305,
 S.E(Log q),    .7512,     .5191,     .6440,     .4340,     .7748,     .6068,     .7016,
```

Table 5.8 Faroe haddock 2015 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,     .88,    1.025,      6.46,     .78,     22,     .66,   -6.01,
  1,    1.13,   -1.209,      4.81,     .82,     22,     .58,   -5.35,
  2,     .93,     .707,      6.10,     .82,     22,     .60,   -5.84,
  3,    1.04,    -.493,      5.77,     .89,     22,     .46,   -5.88,
  4,     .96,     .286,      6.17,     .76,     22,     .76,   -6.07,
  5,     .99,     .144,      6.34,     .83,     22,     .61,   -6.32,
  6,     .97,     .296,      6.47,     .79,     22,     .69,   -6.43,

 Terminal year survivor and F summaries :

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

 Year class = 2014

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
      ,                 Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 SUMMER SURVEY       ,         1.,   .000,       .000,    .00,   0,  .000,     .000
 SPRING SURVEY SHIFTE,      6202.,   .768,       .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,
      6202.,       .77,      .00,    1,    .000,   .000


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

 Year class = 2013

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
      ,                 Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 SUMMER SURVEY       ,      9419.,   .612,       .000,    .00,   1,  .337,     .000
 SPRING SURVEY SHIFTE,      8150.,   .437,       .251,    .58,   2,  .663,     .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,
      8558.,       .36,      .15,    3,    .429,   .000
```

Table 5.8 Faroe haddock 2015 xsa (cont.)

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

 Year class = 2012

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
      ,                 Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 SUMMER SURVEY       ,      4837.,   .482,       .040,    .08,   2,  .269,     .042
 SPRING SURVEY SHIFTE,      8968.,   .364,       .213,    .58,   3,  .473,     .023

   F shrinkage mean  ,      6736.,    .50,,,,                        .258,     .031

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      7054.,       .25,      .15,    6,    .589,   .029


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

 Year class = 2011

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
      ,                 Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 SUMMER SURVEY       ,       690.,   .360,       .540,   1.50,   3,  .303,     .409
 SPRING SURVEY SHIFTE,      1934.,   .281,       .322,   1.14,   4,  .495,     .166

   F shrinkage mean  ,      1425.,    .50,,,,                        .202,     .219

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      1330.,       .20,      .28,    8,   1.353,   .233


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

 Year class = 2010

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
      ,                 Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 SUMMER SURVEY       ,       603.,   .265,       .556,   2.10,   4,  .410,     .662
 SPRING SURVEY SHIFTE,       646.,   .266,       .715,   2.69,   5,  .367,     .630

   F shrinkage mean  ,      1637.,    .50,,,,                        .223,     .297

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       773.,       .18,      .39,   10,   2.101,   .550
```

Table 5.8 Faroe haddock 2015 xsa (cont.)

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

 Year class = 2009

 Fleet,                Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                 Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 SUMMER SURVEY       ,      4226.,  .212,       .040,    .19,   5,  .515,     .214
 SPRING SURVEY SHIFTE,      5831.,  .245,       .097,    .39,   6,  .360,     .159

   F shrinkage mean  ,      3018.,    .50,,,,                        .126,     .288

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      4548.,       .15,      .08,   12,    .518,   .200


 Age  6   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       ,       754.,  .183,       .120,    .66,   6,  .611,     .112
 SPRING SURVEY SHIFTE,      1174.,  .243,       .083,    .34,   7,  .277,     .074

   F shrinkage mean  ,       223.,    .50,,,,                        .112,     .338

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       743.,       .14,      .15,   14,   1.071,   .114


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

 Year class = 2007

 Fleet,                Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                 Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 SUMMER SURVEY       ,       127.,  .170,       .095,    .56,   7,  .667,     .351
 SPRING SURVEY SHIFTE,       222.,  .251,       .108,    .43,   7,  .183,     .216

   F shrinkage mean  ,       103.,    .50,,,,                        .150,     .419

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       136.,       .14,      .09,   15,    .618,   .330
```

Table 5.8 Faroe haddock 2015 xsa (cont.)

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

 Year class = 2006

 Fleet,                Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
      ,                Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 SUMMER SURVEY       ,        85.,   .171,       .110,    .64,   8,  .665,     .287
 SPRING SURVEY SHIFTE,       141.,   .250,       .115,    .46,   7,  .151,     .181

   F shrinkage mean  ,        53.,    .50,,,,                        .184,     .423

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
        84.,       .15,      .10,   16,    .679,   .288


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

 Year class = 2005

 Fleet,                Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
      ,                Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 SUMMER SURVEY       ,        67.,   .168,       .150,    .89,   8,  .578,     .185
 SPRING SURVEY SHIFTE,        81.,   .240,       .260,   1.08,   7,  .147,     .154

   F shrinkage mean  ,        39.,    .50,,,,                        .275,     .298

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
        59.,       .17,      .13,   16,    .746,   .206
```

Table 5.9 Faroe haddock. Fishing mortality (F) at age.

Run title : FAROE HADDOCK (ICES DIVISION Vb) HAD_IND

At 3/05/2015 14:07

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR,	1957,	1958,	1959,	1960,	1961,	1962,	1963,	1964,
AGE								
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0010,	.0024,	.0132,	.0150,	.0219,	.0149,	.0106,	.0018,
2,	.1394,	.1939,	.1066,	.2074,	.1875,	.3232,	.3801,	.0876,
3,	.3707,	.4378,	.3860,	.4599,	.4162,	.5866,	.5639,	.3723,
4,	.6163,	.5737,	.4782,	.6926,	.4209,	.5980,	.7261,	.5193,
5,	.3909,	.5386,	.4195,	.5260,	.4387,	.3480,	.5591,	.5369,
6,	.4380,	.6346,	.6458,	.6591,	.5879,	.6706,	.4026,	.6107,
7,	.6340,	.9504,	.9184,	1.2130,	.9483,	1.0499,	1.2493,	.3375,
8,	.5599,	.7839,	.8206,	.9667,	.8742,	.9736,	1.1139,	1.2027,
9,	.5321,	.7028,	.6625,	.8198,	.6600,	.7351,	.8185,	.6472,
+gp,	.5321,	.7028,	.6625,	.8198,	.6600,	.7351,	.8185,	.6472,
FBAR 3- 7,	.4900,	.6270,	.5696,	.7101,	.5624,	.6506,	.7002,	.4753,

Table 8 Fishing mortality (F) at age

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0017,	.0032,	.0012,	.0014,	.0024,	.0033,	.0015,	.0016,	.0114,	.0033,
2,	.0691,	.0610,	.0641,	.1261,	.0860,	.0551,	.0526,	.0253,	.1677,	.1266,
3,	.2354,	.2370,	.1873,	.2647,	.2363,	.2528,	.1936,	.4226,	.4320,	.2172,
4,	.4767,	.4515,	.2971,	.3483,	.5320,	.3344,	.4186,	.2853,	.2392,	.3730,
5,	.3678,	.5006,	.2997,	.2847,	.3330,	.3639,	.2754,	.4517,	.3143,	.1279,
6,	.5882,	.5421,	.5406,	.4540,	.4975,	.5561,	.5560,	.1495,	.2703,	.1714,
7,	.9618,	.9128,	.6906,	.8367,	.8277,	.8740,	.8385,	.6721,	.1951,	.2134,
8,	2.3618,	.7509,	.6634,	.5851,	1.0631,	.5430,	.4224,	.4066,	.2907,	.1433,
9,	.9619,	.6373,	.5022,	.5057,	.6566,	.5386,	.5061,	.3957,	.2633,	.2068,
+gp,	.9619,	.6373,	.5022,	.5057,	.6566,	.5386,	.5061,	.3957,	.2633,	.2068,
FBAR 3- 7,	.5260,	.5288,	.4031,	.4377,	.4853,	.4762,	.4564,	.3962,	.2902,	.2206,

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0015,	.0014,	.0000,	.0000,	.0002,	.0000,	.0000,	.0000,	.0000,	.0006,
2,	.1230,	.0908,	.0108,	.0010,	.0004,	.0325,	.0237,	.0383,	.0252,	.0329,
3,	.2650,	.1878,	.1128,	.0547,	.0458,	.0285,	.1374,	.4618,	.1917,	.1167,
4,	.2412,	.3810,	.1815,	.1665,	.1255,	.2025,	.1314,	.3709,	.3481,	.3896,
5,	.2116,	.2216,	.5273,	.2115,	.1913,	.2750,	.2112,	.2918,	.3498,	.2171,
6,	.0957,	.2871,	.7246,	.3820,	.1409,	.2136,	.2264,	.2775,	.1383,	.3336,
7,	.0859,	.1601,	.3904,	.5760,	.2721,	.1702,	.2004,	.2524,	.2991,	.0853,
8,	.1599,	.2539,	.3788,	.4969,	.3303,	.3954,	.0920,	.2266,	.3102,	.2929,
9,	.1595,	.2621,	.4437,	.3690,	.2130,	.2526,	.1730,	.2854,	.2907,	.2651,
+gp,	.1595,	.2621,	.4437,	.3690,	.2130,	.2526,	.1730,	.2854,	.2907,	.2651,
FBAR 3- 7,	.1799,	.2476,	.3873,	.2782,	.1551,	.1780,	.1814,	.3309,	.2654,	.2285,

Table 5.9 Faroe haddock. Fishing mortality (F) at age (cont.).

Run title : FAROE HADDOCK (ICES DIVISION Vb) HAD_IND

At 3/05/2015 14:07

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR,	1957,	1958,	1959,	1960,	1961,	1962,	1963,	1964,
AGE								
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0010,	.0024,	.0132,	.0150,	.0219,	.0149,	.0106,	.0018,
2,	.1394,	.1939,	.1066,	.2074,	.1875,	.3232,	.3801,	.0876,
3,	.3707,	.4378,	.3860,	.4599,	.4162,	.5866,	.5639,	.3723,
4,	.6163,	.5737,	.4782,	.6926,	.4209,	.5980,	.7261,	.5193,
5,	.3909,	.5386,	.4195,	.5260,	.4387,	.3480,	.5591,	.5369,
6,	.4380,	.6346,	.6458,	.6591,	.5879,	.6706,	.4026,	.6107,
7,	.6340,	.9504,	.9184,	1.2130,	.9483,	1.0499,	1.2493,	.3375,
8,	.5599,	.7839,	.8206,	.9667,	.8742,	.9736,	1.1139,	1.2027,
9,	.5321,	.7028,	.6625,	.8198,	.6600,	.7351,	.8185,	.6472,
+gp,	.5321,	.7028,	.6625,	.8198,	.6600,	.7351,	.8185,	.6472,
FBAR 3- 7,	.4900,	.6270,	.5696,	.7101,	.5624,	.6506,	.7002,	.4753,

Table 8 Fishing mortality (F) at age

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0017,	.0032,	.0012,	.0014,	.0024,	.0033,	.0015,	.0016,	.0114,	.0033,
2,	.0691,	.0610,	.0641,	.1261,	.0860,	.0551,	.0526,	.0253,	.1677,	.1266,
3,	.2354,	.2370,	.1873,	.2647,	.2363,	.2528,	.1936,	.4226,	.4320,	.2172,
4,	.4767,	.4515,	.2971,	.3483,	.5320,	.3344,	.4186,	.2853,	.2392,	.3730,
5,	.3678,	.5006,	.2997,	.2847,	.3330,	.3639,	.2754,	.4517,	.3143,	.1279,
6,	.5882,	.5421,	.5406,	.4540,	.4975,	.5561,	.5560,	.1495,	.2703,	.1714,
7,	.9618,	.9128,	.6906,	.8367,	.8277,	.8740,	.8385,	.6721,	.1951,	.2134,
8,	2.3618,	.7509,	.6634,	.5851,	1.0631,	.5430,	.4224,	.4066,	.2907,	.1433,
9,	.9619,	.6373,	.5022,	.5057,	.6566,	.5386,	.5061,	.3957,	.2633,	.2068,
+gp,	.9619,	.6373,	.5022,	.5057,	.6566,	.5386,	.5061,	.3957,	.2633,	.2068,
FBAR 3- 7,	.5260,	.5288,	.4031,	.4377,	.4853,	.4762,	.4564,	.3962,	.2902,	.2206,

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0015,	.0014,	.0000,	.0000,	.0002,	.0000,	.0000,	.0000,	.0000,	.0006,
2,	.1230,	.0908,	.0108,	.0010,	.0004,	.0325,	.0237,	.0383,	.0252,	.0329,
3,	.2650,	.1878,	.1128,	.0547,	.0458,	.0285,	.1374,	.4618,	.1917,	.1167,
4,	.2412,	.3810,	.1815,	.1665,	.1255,	.2025,	.1314,	.3709,	.3481,	.3896,
5,	.2116,	.2216,	.5273,	.2115,	.1913,	.2750,	.2112,	.2918,	.3498,	.2171,
6,	.0957,	.2871,	.7246,	.3820,	.1409,	.2136,	.2264,	.2775,	.1383,	.3336,
7,	.0859,	.1601,	.3904,	.5760,	.2721,	.1702,	.2004,	.2524,	.2991,	.0853,
8,	.1599,	.2539,	.3788,	.4969,	.3303,	.3954,	.0920,	.2266,	.3102,	.2929,
9,	.1595,	.2621,	.4437,	.3690,	.2130,	.2526,	.1730,	.2854,	.2907,	.2651,
+gp,	.1595,	.2621,	.4437,	.3690,	.2130,	.2526,	.1730,	.2854,	.2907,	.2651,
FBAR 3- 7,	.1799,	.2476,	.3873,	.2782,	.1551,	.1780,	.1814,	.3309,	.2654,	.2285,

Table 5.10 Faroe haddock. Stock number (N) at age.

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

  At  3/05/2015  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,	1961,	1962,	1963,	1964,
AGE								
0,	64927,	54061,	77651,	58761,	71715,	45399,	33843,	30192,
1,	47944,	53158,	44261,	63576,	48109,	58715,	37170,	27709,
2,	35106,	39212,	43417,	35763,	51279,	38537,	47362,	30110,
3,	25440,	25003,	26445,	31954,	23796,	34806,	22837,	26515,
4,	20280,	14377,	13213,	14717,	16517,	12850,	15850,	10638,
5,	5517,	8965,	6632,	6706,	6028,	8877,	5786,	6278,
6,	2786,	3055,	4284,	3570,	3245,	3182,	5132,	2708,
7,	1377,	1472,	1326,	1839,	1512,	1476,	1332,	2809,
8,	585,	598,	466,	433,	448,	480,	423,	313,
9,	252,	274,	224,	168,	135,	153,	148,	114,
+gp,	154,	227,	106,	54,	29,	46,	45,	16,
TOTAL,	204367,	200401,	218024,	217540,	222811,	204522,	169929,	137402,

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
AGE										
0,	37948,	81923,	47768,	53237,	23136,	49622,	35418,	78970,	104848,	83625,
1,	24719,	31069,	67073,	39109,	43587,	18942,	40627,	28998,	64655,	85842,
2,	22644,	20203,	25356,	54851,	31975,	35600,	15457,	33213,	23702,	52333,
3,	22585,	17302,	15563,	19470,	39587,	24022,	27583,	12006,	26514,	16410,
4,	14961,	14613,	11176,	10566,	12234,	25590,	15275,	18608,	6442,	14092,
5,	5182,	7604,	7617,	6798,	6106,	5884,	14996,	8229,	11454,	4152,
6,	3005,	2937,	3774,	4622,	4187,	3583,	3348,	9322,	4288,	6849,
7,	1204,	1366,	1398,	1800,	2403,	2084,	1682,	1572,	6573,	2680,
8,	1641,	377,	449,	574,	638,	860,	712,	595,	657,	4427,
9,	77,	127,	146,	189,	262,	180,	409,	382,	325,	402,
+gp,	14,	21,	36,	33,	45,	26,	281,	319,	52,	865,
TOTAL,	133981,	177542,	180355,	191249,	164160,	166393,	155787,	192213,	249510,	271679,

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
0,	39127,	52360,	4153,	7376,	5208,	23621,	29256,	60793,	58813,	39477,
1,	68467,	32035,	42869,	3400,	6039,	4264,	19339,	23953,	49773,	48152,
2,	70053,	55971,	26192,	35098,	2784,	4944,	3491,	15834,	19611,	40751,
3,	37750,	50715,	41847,	21213,	28707,	2278,	3918,	2791,	12476,	15657,
4,	10812,	23712,	34412,	30607,	16443,	22452,	1813,	2796,	1440,	8433,
5,	7946,	6955,	13262,	23498,	21215,	11875,	15012,	1301,	1580,	832,
6,	2992,	5265,	4562,	6408,	15570,	14345,	7385,	9951,	796,	912,
7,	4724,	2226,	3235,	1810,	3581,	11073,	9486,	4821,	6173,	567,
8,	1772,	3549,	1553,	1792,	833,	2233,	7647,	6356,	3067,	3747,
9,	3141,	1237,	2254,	870,	893,	490,	1231,	5711,	4149,	1841,
+gp,	1396,	1515,	2613,	1109,	424,	423,	249,	946,	3460,	4566,
TOTAL,	248179,	235539,	176952,	133182,	101697,	97997,	98827,	135253,	161337,	164936,

Table 5.10 Faroe haddock. Stock number (N) at age (cont.).

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,
AGE										
0,	39519,	14086,	28007,	21061,	14028,	4460,	3992,	2724,	9655,	143943,
1,	48196,	32355,	11532,	22930,	17244,	11485,	3651,	3269,	2230,	7905,
2,	40768,	39437,	26490,	9442,	18773,	14118,	9403,	2990,	2676,	1826,
3,	15664,	32297,	31397,	21480,	7474,	14778,	11502,	7604,	2378,	2155,
4,	8435,	11412,	22323,	23399,	16032,	5718,	10725,	8263,	5281,	1808,
5,	833,	4678,	7356,	14248,	15932,	10897,	4086,	7043,	5160,	3621,
6,	912,	549,	2706,	4646,	8976,	10297,	6400,	2650,	4637,	3211,
7,	568,	535,	296,	1548,	2796,	5413,	6119,	3668,	1581,	2929,
8,	3749,	427,	356,	207,	789,	1859,	2644,	3283,	2007,	991,
9,	1842,	2290,	294,	174,	95,	509,	1033,	1364,	2056,	1306,
+gp,	4567,	4402,	2930,	1198,	669,	308,	410,	137,	826,	1196,
TOTAL,	165051,	142467,	133688,	120333,	102807,	79841,	59966,	42994,	38487,	170891,

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR,	1994,	1995,	1996,	1997,	1998,	1999,	2000,	2001,	2002,	2003,
AGE										
0,	68039,	13476,	5572,	23106,	31815,	153465,	90575,	63864,	42934,	13000,
1,	117851,	55706,	11034,	4562,	18918,	26048,	125647,	74157,	52287,	35151,
2,	6433,	96487,	45608,	9033,	3735,	15488,	21318,	102805,	60697,	42809,
3,	1393,	5016,	78269,	37046,	7326,	2962,	12523,	16132,	80206,	48324,
4,	1495,	967,	3698,	59346,	27695,	5043,	1392,	7484,	10377,	52964,
5,	1232,	946,	579,	2106,	39072,	17907,	3277,	949,	3935,	5891,
6,	2464,	870,	570,	312,	1082,	23071,	10429,	2066,	621,	2136,
7,	2142,	1634,	593,	319,	151,	482,	12900,	6109,	1283,	388,
8,	1969,	1368,	1071,	340,	150,	34,	190,	7986,	3960,	834,
9,	693,	1266,	857,	633,	194,	44,	4,	84,	5295,	2480,
+gp,	1660,	1416,	1433,	1470,	1011,	417,	296,	89,	159,	2645,
TOTAL,	205370,	179153,	149284,	138271,	131147,	244962,	278551,	281724,	261753,	206621,

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR,	2004,	2005,	2006,	2007,	2008,	2009,	2010,	2011,	2012,	2013,	2014,
AGE											
0,	11864,	5112,	4106,	3825,	9030,	23592,	2766,	2972,	11910,	17520,	0,
1,	10644,	9713,	4185,	3361,	3131,	7393,	19315,	2264,	2433,	9751,	14345,
2,	28779,	8711,	7953,	3427,	2752,	2558,	6053,	15814,	1854,	1992,	7984,
3,	34929,	23343,	7055,	6288,	2737,	2194,	2070,	4604,	12793,	1511,	1552,
4,	36455,	26781,	17599,	5373,	4259,	2056,	1498,	1292,	3070,	9606,	751,
5,	31102,	25502,	18441,	12087,	3904,	2657,	1320,	841,	765,	2049,	6800,
6,	2811,	16030,	14769,	11525,	7424,	2813,	1673,	828,	510,	485,	1469,
7,	890,	1249,	7581,	7185,	6442,	4747,	1838,	932,	510,	314,	307,
8,	170,	358,	532,	3240,	3387,	3731,	2862,	1004,	509,	306,	183,
9,	381,	59,	160,	313,	1642,	1638,	2386,	1693,	503,	332,	166,
+gp,	1837,	318,	176,	31,	199,	274,	850,	857,	332,	550,	542,
TOTAL,	159861,	117178,	82558,	56655,	44908,	53652,	42629,	33102,	35189,	44416,	34098,

Table 5.11. Faroe haddock. Stock summary of the 2015 VPA.

Run title : FAROE HADDOCK (ICES DIVISION Vb) HAD_IND

At 15/04/2014 20:12

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUIT Age 0	RECRU Age 2	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 3- 7
1957	64927	35106	90264	51049	20995	0.4113	0.49
1958	54061	39212	92975	51409	23871	0.4643	0.627
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	45399	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	0.526
1966	81923	20203	68774	44027	18766	0.4262	0.5288
1967	47768	25356	77101	42086	13381	0.3179	0.4031
1968	53237	54851	87971	45495	17852	0.3924	0.4377
1969	23136	31975	94878	53583	23272	0.4343	0.4853
1970	49622	35600	92142	59957	21361	0.3563	0.4762
1971	35418	15457	92929	63920	19393	0.3034	0.4564
1972	78970	33213	91506	63133	16485	0.2611	0.3962
1973	104848	23702	98976	61620	18035	0.2927	0.2902
1974	83625	52333	116873	64629	14773	0.2286	0.2206
1975	39127	70053	138899	75403	20715	0.2747	0.1799
1976	52360	55971	143617	89217	26211	0.2938	0.2476
1977	4153	26192	121036	96371	25555	0.2652	0.3873
1978	7376	35098	120569	97226	19200	0.1975	0.2782
1979	5208	2784	99493	85393	12424	0.1455	0.1551
1980	23621	4944	87630	81895	15016	0.1834	0.178
1981	29256	3491	78955	75838	12233	0.1613	0.1814
1982	60793	15834	68299	56798	11937	0.2102	0.3309
1983	58813	19611	63952	51804	12894	0.2489	0.2654
1984	39477	40751	100638	53809	12378	0.23	0.2285
1985	14062	39401	93930	62578	15143	0.242	0.2762
1986	27964	26463	98463	65566	14477	0.2208	0.2238
1987	20979	9426	87580	67252	14882	0.2213	0.2645
1988	13972	18745	77348	61848	12178	0.1969	0.2011
1989	4443	14063	69448	51674	14325	0.2772	0.2856
1990	3985	9366	53449	43625	11726	0.2688	0.2734
1991	2723	2978	38624	34542	8429	0.244	0.2756
1992	9631	2671	28982	26845	5476	0.204	0.2114
1993	142543	1825	28653	23081	4026	0.1744	0.1882
1994	67164	6417	27315	21455	4252	0.1982	0.2069
1995	13338	95548	87331	22596	4948	0.219	0.227
1996	5566	45021	112309	49415	9642	0.1951	0.3203
1997	23069	8940	106913	81745	17924	0.2193	0.3739
1998	31718	3731	91874	81550	22210	0.2723	0.5315
1999	152751	15464	79481	62452	18482	0.2959	0.4545
2000	89573	21253	108826	52293	15821	0.3025	0.2796
2001	62274	102326	145120	60300	15890	0.2635	0.2875
2002	41593	60025	151861	84291	24933	0.2958	0.3011
2003	12660	41743	138708	96072	27072	0.2818	0.454
2004	11437	27881	125339	86212	23101	0.268	0.4069
2005	4618	8484	89258	72930	20455	0.2805	0.3692
2006	3859	7667	65437	58263	17154	0.2944	0.3488
2007	3502	3095	47365	43113	12631	0.293	0.3206
2008	7495	2587	34188	30308	7388	0.2438	0.2304
2009	23404	2342	25128	23295	5197	0.2231	0.2644
2010	4680	5024	22001	17988	5202	0.2892	0.377
2011	3873	15688	21451	12722	3540	0.2783	0.3612
2012	13236	3137	18756	14946	2634	0.1762	0.2886
2013	12767	2596	19643	17931	2950	0.1645	0.2595
2014	7575	8872	20870	16479	3194	0.1938	0.2853
Arith. Mean							
0 Units	37753	26269	82047	54257	15543	0.2875	0.3549
	(Thousands)	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)		

Table 5.12. Management options table INPUT DATA descriptions

Stock size

The stock in numbers 2015 is taken directly from the 2015 XSA. The yearclass 2014 at age 2 (in 2016) is estimated from the 2015 XSA age 1 applying a natural mortality of 0.2 in foreward calculation of the number using the standard VPA equation. The yearclass 2015 at age 2 (in 2017) is estimated as the geomean of the numbers at age 2 since 2005.

Age	2015	2016	2017
2	8558	5078	5089
3	7054		
4	1330		
5	773		
6	4548		
7	743		
8	136		
9	84		
10+	245		

Numbers in thousands (predicted values rounded).

Proportion mature at age

The proportion mature at age in 2015 is estimated as the average of the observed data in 2014 and 2015. For 2016 and 2017, the average of 2013 to 2015 is used.

Age	2015	2016	2017
2	0.17	0.16	0.16
3	0.83	0.83	0.83
4	0.99	0.99	0.99
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

Table 5.12. Management options table INPUT DATA descriptions (cont.).

Catch&Stock weights at age

Catch and stock weights at age for all ages and for each of the years 2015-2017 are simply the average of the estimated point-values for 2012-2014 not re-scaled to 2014 since weights have been fluctuating without any trend during the last 3 years (no model was available to predict future mean weights at age).

Age	2015	2016	2017
2	0.581	0.581	0.581
3	0.839	0.839	0.839
4	1.128	1.128	1.128
5	1.408	1.408	1.408
6	1.673	1.673	1.673
7	1.775	1.775	1.775
8	1.811	1.811	1.811
9	1.813	1.813	1.813
10+	1.938	1.938	1.938

Exploitation pattern

The exploitation pattern 2015 is estimated like last year as the average fishing mortality matrix in the 3 preceding years (2012-2014) from the final VPA in 2015, without re-scaling to the terminal year (2014) since fishing mortalities have been fluctuating without any general trend during the last 3 years; the same exploitation pattern was used for all 3 years.

Age	2015	2016	2017
2	0.0227	0.0227	0.0227
3	0.1895	0.1895	0.1895
4	0.3203	0.3203	0.3203
5	0.2294	0.2294	0.2294
6	0.2570	0.2570	0.2570
7	0.3928	0.3928	0.3928
8	0.4028	0.4028	0.4028
9	0.3709	0.3709	0.3709
10+	0.3709	0.3709	0.3709

Table 5.13 Faroe haddock. Management option table - Input data

MFDP version 1
Run: jak
Time and date: 18:12 24/04/2015
Fbar age range: 3-7

2015

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
2	8558	0.2	0.17	0	0	0.581	0.023	0.581
3	7054	0.2	0.83	0	0	0.839	0.189	0.839
4	1330	0.2	0.99	0	0	1.128	0.320	1.128
5	773	0.2	1	0	0	1.408	0.229	1.408
6	4548	0.2	1	0	0	1.673	0.257	1.673
7	743	0.2	1	0	0	1.775	0.393	1.775
8	136	0.2	1	0	0	1.811	0.403	1.811
9	84	0.2	1	0	0	1.813	0.371	1.813
10	245	0.2	1	0	0	1.938	0.371	1.938

2016

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
2	5078	0.2	0.17	0	0	0.581	0.023	0.581
3	.	0.2	0.83	0	0	0.839	0.189	0.839
4	.	0.2	0.99	0	0	1.128	0.320	1.128
5	.	0.2	1	0	0	1.408	0.229	1.408
6	.	0.2	1	0	0	1.673	0.257	1.673
7	.	0.2	1	0	0	1.775	0.393	1.775
8	.	0.2	1	0	0	1.811	0.403	1.811
9	.	0.2	1	0	0	1.813	0.371	1.813
10	.	0.2	1	0	0	1.938	0.371	1.938

2017

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
2	5089	0.2	0.17	0	0	0.581	0.023	0.581
3	.	0.2	0.83	0	0	0.839	0.189	0.839
4	.	0.2	0.99	0	0	1.128	0.320	1.128
5	.	0.2	1	0	0	1.408	0.229	1.408
6	.	0.2	1	0	0	1.673	0.257	1.673
7	.	0.2	1	0	0	1.775	0.393	1.775
8	.	0.2	1	0	0	1.811	0.403	1.811
9	.	0.2	1	0	0	1.813	0.371	1.813
10	.	0.2	1	0	0	1.938	0.371	1.938

Input units are thousands and kg - output in tonnes

Table 5.14 Faroe haddock. Management option table - Results

MFDP version 1
Run: jak
Index file 24/04/2015
Time and date: 18:12 24/04/2015
Fbar age range: 3-7

2015				
Biomass	SSB	FMult	FBar	Landings
23279	18133	1	0.2778	3820

2016					2017	
Biomass	SSB	FMult	FBar	Landings	Biomass	SSB
22390	18912	0	0	0	25383	22274
.	18912	0.1	0.0278	522	24836	21729
.	18912	0.2	0.0556	1028	24306	21202
.	18912	0.3	0.0833	1518	23791	20690
.	18912	0.4	0.1111	1995	23293	20193
.	18912	0.5	0.1389	2457	22809	19712
.	18912	0.6	0.1667	2905	22340	19245
.	18912	0.7	0.1945	3340	21884	18792
.	18912	0.8	0.2222	3762	21443	18353
.	18912	0.9	0.25	4171	21014	17927
.	18912	1	0.2778	4569	20599	17514
.	18912	1.1	0.3056	4954	20195	17113
.	18912	1.2	0.3334	5329	19804	16723
.	18912	1.3	0.3611	5692	19424	16346
.	18912	1.4	0.3889	6045	19055	15979
.	18912	1.5	0.4167	6388	18697	15624
.	18912	1.6	0.4445	6721	18350	15278
.	18912	1.7	0.4723	7044	18013	14943
.	18912	1.8	0.5001	7358	17685	14618
.	18912	1.9	0.5278	7663	17367	14302
.	18912	2	0.5556	7960	17058	13996

Input units are thousands and kg - output in tonnes

Table 5.15 Faroe haddock. Long-term Prediction - Input data

MFYPR version 1
Run: rei
Index file 24/04/2015
Time and date: 19:23 24/04/2015
Fbar age range: 3-7

Age	M	Mat	PF	PM	SWt	Sel	CWt
2	0.2	0.060	0	0	0.563	0.023	0.563
3	0.2	0.516	0	0	0.803	0.189	0.803
4	0.2	0.923	0	0	1.067	0.320	1.067
5	0.2	0.992	0	0	1.370	0.229	1.370
6	0.2	0.999	0	0	1.653	0.257	1.653
7	0.2	1.000	0	0	1.908	0.393	1.908
8	0.2	1.000	0	0	2.123	0.403	2.123
9	0.2	1.000	0	0	2.342	0.371	2.342
10	0.2	1.000	0	0	2.637	0.371	2.637

Weights in kilograms

Table 5.16 **Faroe haddock. Long-term Prediction - Results**

MFYPR version 1
Run: rei
Time and date: 19:23 24/04/2015
Yield per results

FMult	Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0	0	0	0	5.5167	8.2855	4.1248	7.3771	4.1248	7.3771
0.1	0.0278	0.1081	0.1877	4.978	7.0177	3.5884	6.1115	3.5884	6.1115
0.2	0.0556	0.1883	0.3116	4.5792	6.1066	3.1918	5.2025	3.1918	5.2025
0.3	0.0833	0.2504	0.3967	4.2706	5.4225	2.8853	4.5206	2.8853	4.5206
0.4	0.1111	0.3002	0.4569	4.0236	4.8914	2.6405	3.9916	2.6405	3.9916
0.5	0.1389	0.3411	0.5003	3.8208	4.468	2.4397	3.5703	2.4397	3.5703
0.6	0.1667	0.3755	0.5323	3.6507	4.1231	2.2717	3.2273	2.2717	3.2273
0.7	0.1945	0.4049	0.5561	3.5056	3.8369	2.1286	2.9431	2.1286	2.9431
0.8	0.2222	0.4303	0.5741	3.3801	3.5959	2.005	2.7041	2.005	2.7041
0.9	0.25	0.4526	0.5878	3.2702	3.3903	1.8971	2.5004	1.8971	2.5004
1	0.2778	0.4724	0.5982	3.1731	3.2129	1.8019	2.3248	1.8019	2.3248
1.1	0.3056	0.49	0.6063	3.0864	3.0583	1.7172	2.172	1.7172	2.172
1.2	0.3334	0.5059	0.6125	3.0086	2.9224	1.6412	2.0379	1.6412	2.0379
1.3	0.3611	0.5203	0.6173	2.9382	2.802	1.5727	1.9194	1.5727	1.9194
1.4	0.3889	0.5334	0.6211	2.8742	2.6947	1.5105	1.8138	1.5105	1.8138
1.5	0.4167	0.5454	0.6239	2.8157	2.5984	1.4538	1.7193	1.4538	1.7193
1.6	0.4445	0.5564	0.626	2.762	2.5116	1.4018	1.6341	1.4018	1.6341
1.7	0.4723	0.5666	0.6276	2.7125	2.4329	1.354	1.5571	1.354	1.5571
1.8	0.5001	0.5761	0.6288	2.6667	2.3613	1.3099	1.487	1.3099	1.487
1.9	0.5278	0.5849	0.6296	2.6242	2.2958	1.2691	1.4232	1.2691	1.4232
2	0.5556	0.5931	0.6302	2.5846	2.2357	1.2312	1.3646	1.2312	1.3646

Reference point	F multiplier	Absolute F
Fbar(3-7)	1	0.2778
FMax	2.2382	0.6218
F0.1	0.6571	0.1826
F35%SPR	0.8581	0.2384
Fhigh	3.1887	0.8859
Fmed	0.8397	0.2333
Flow	-99	

Weights in kilograms

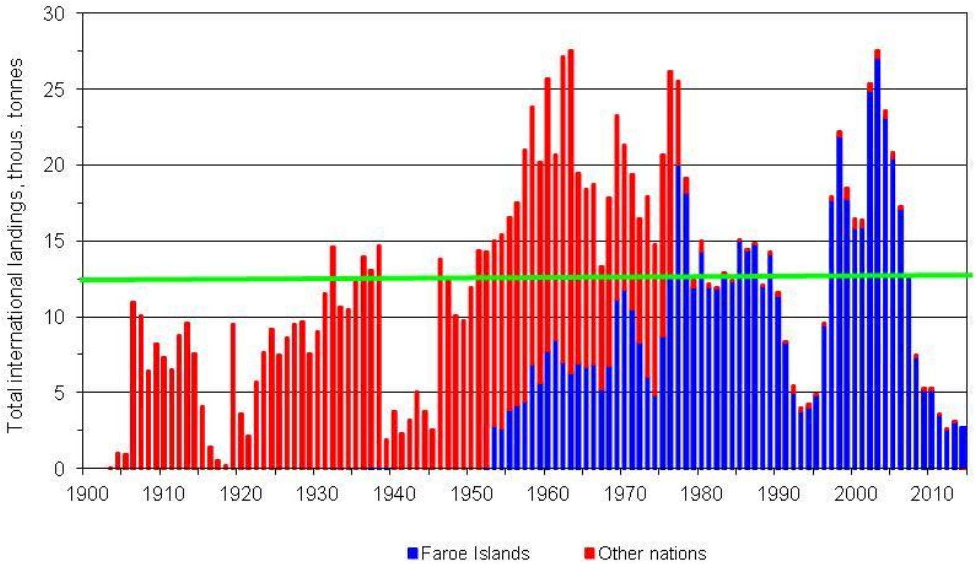


Figure 5.1. Haddock in ICES Division Vb. Landings by all nations 1904-2014. Horisontal line average for the whole period.

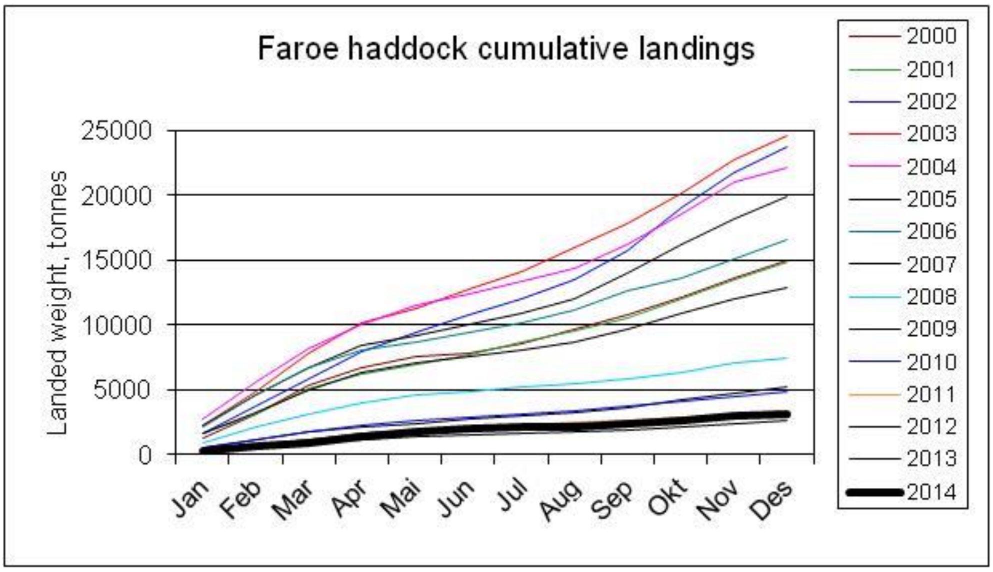


Figure 5.2. Faroe haddock. Cumulative Faroese landings from Vb.

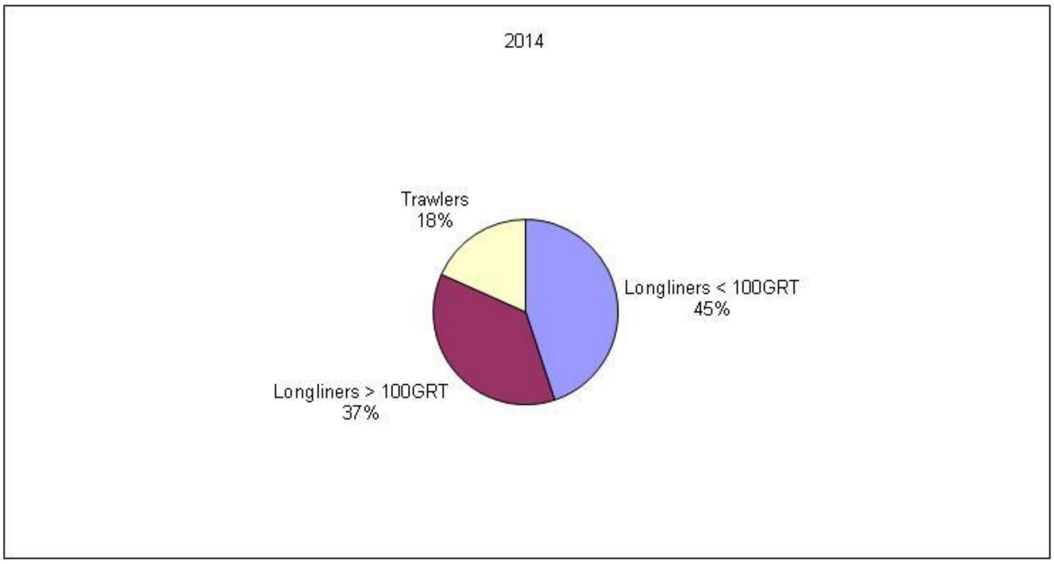


Figure 5.3. Faroe haddock. Contribution (%) by fleet to the total Faroese landings 2014.

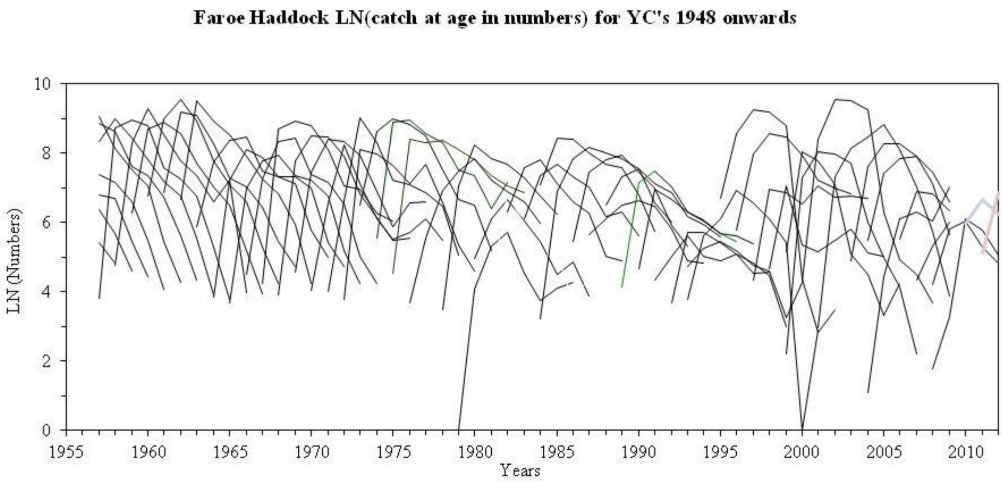


Figure 5.4.

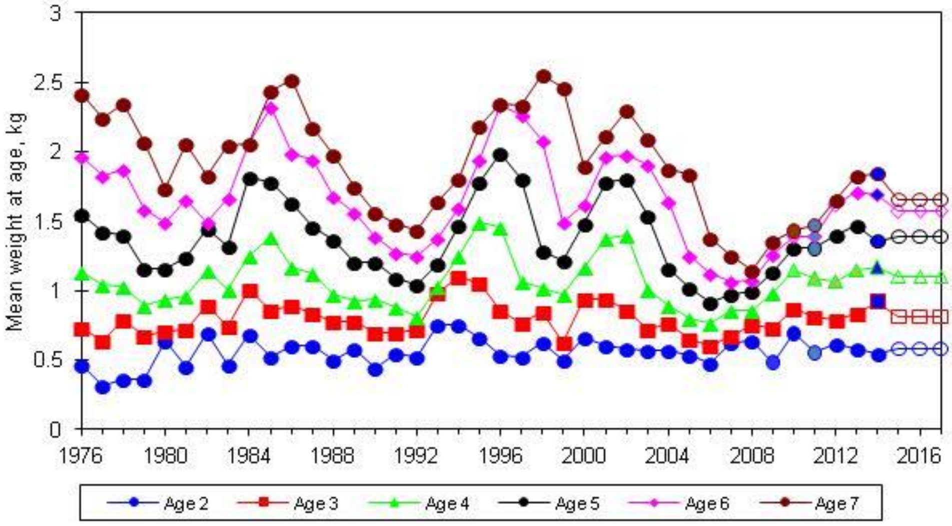


Figure 5.5. Faroe haddock. Mean weight at age (2-7). 2015-2017 are predicted values used in the short term prediction (open symbols).

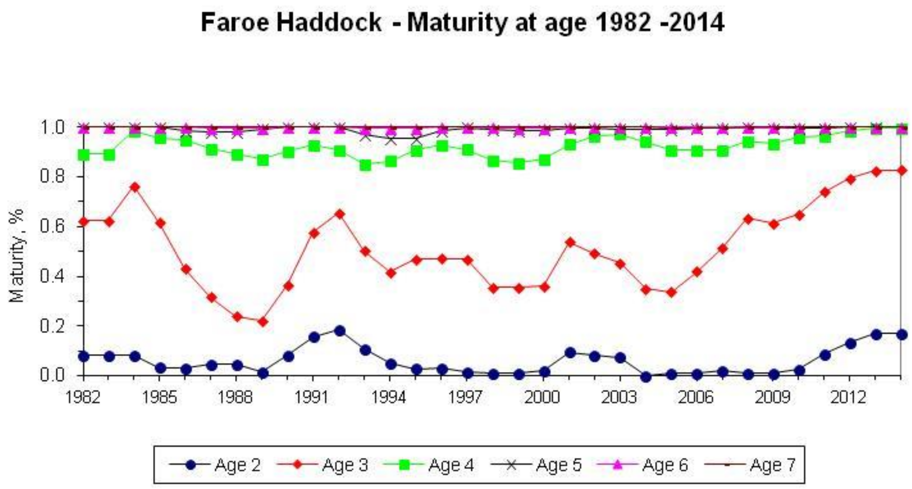


Figure 5.6. Faroe haddock. Maturity at age since 1982. Running 3-years average of survey observations.

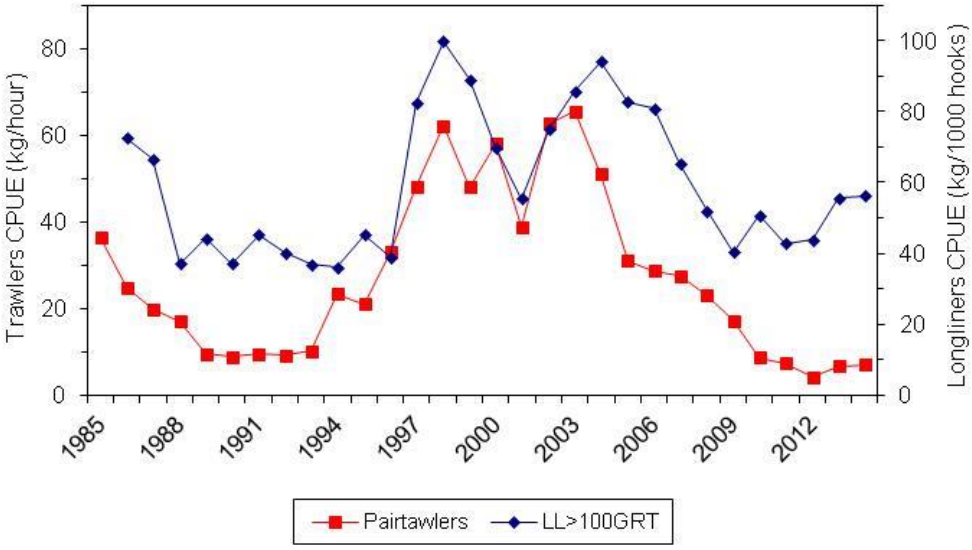


Figure 5.7. Commercial CPUE's for Pairtrawlers > 1000 HP and longliners > 100 HP.

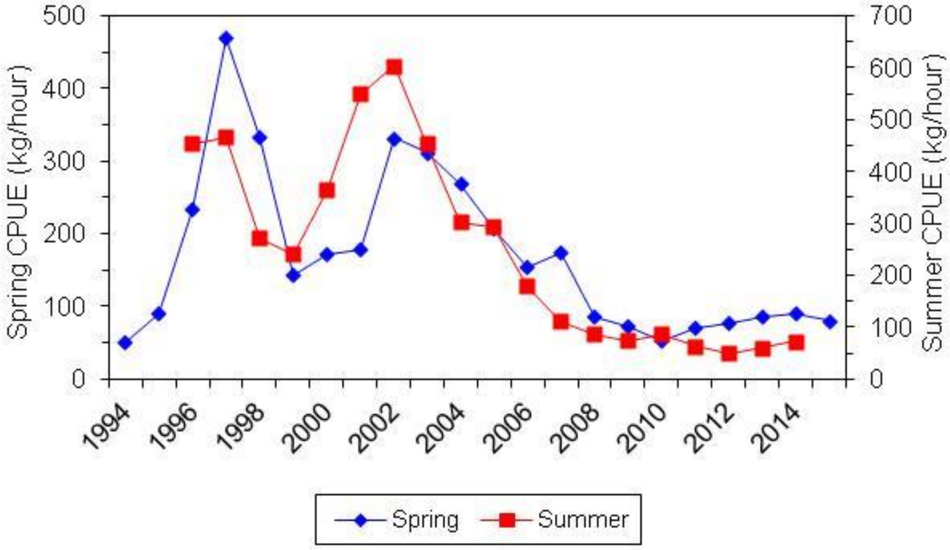
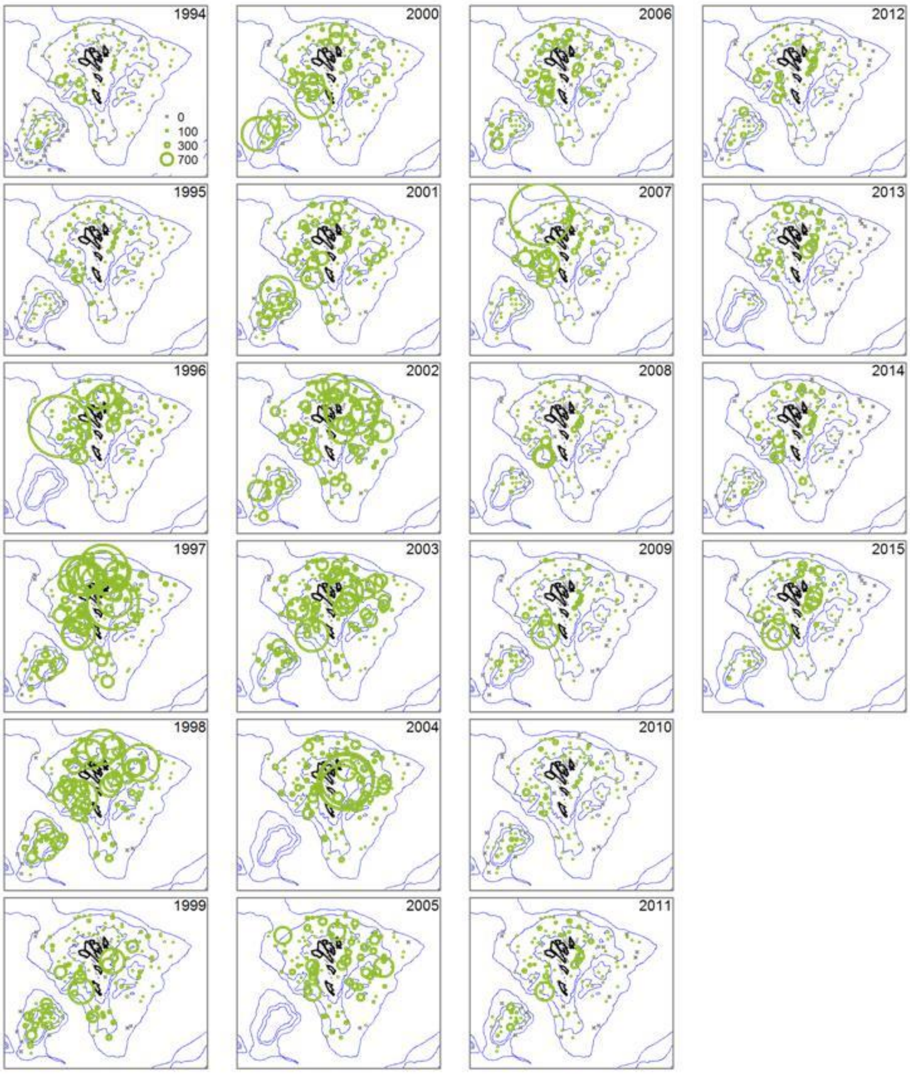


Figure 5.8. Faroe haddock. CPUE (kg/trawlhour) in the spring and summer surveys.


1994
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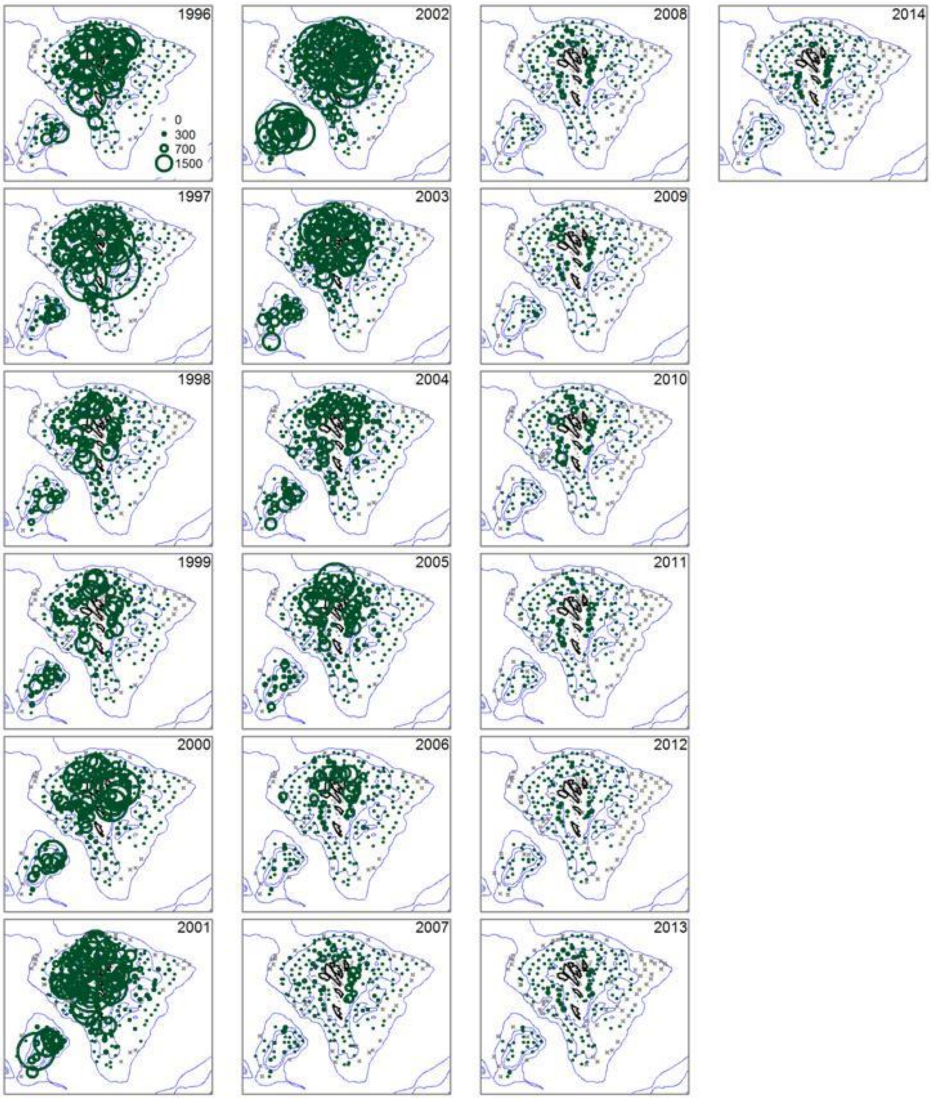


Figure 5.9. Distribution of Faroe haddock catches in the summer survey (upper page) and in the spring survey (this page).

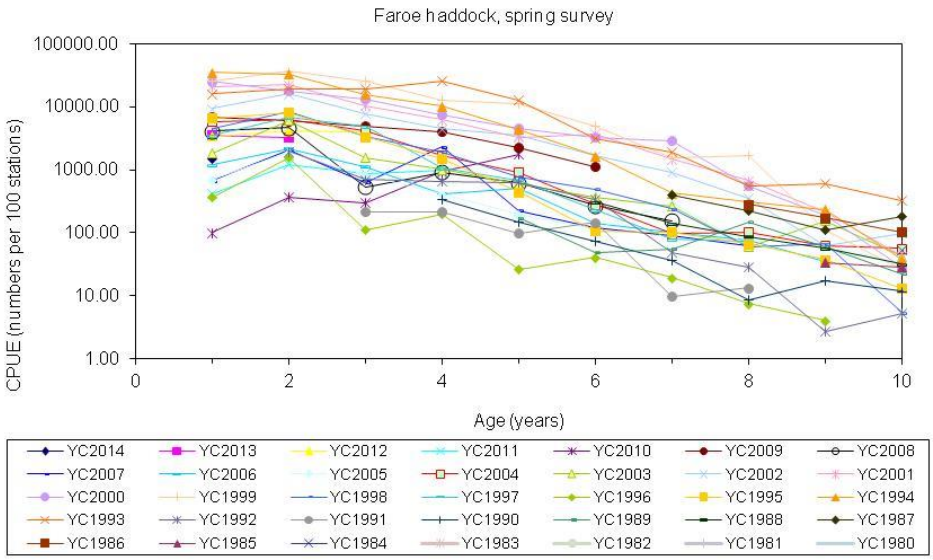


Figure 5.10. Faroe haddock. LN (catch-at-age in numbers) in the spring survey.

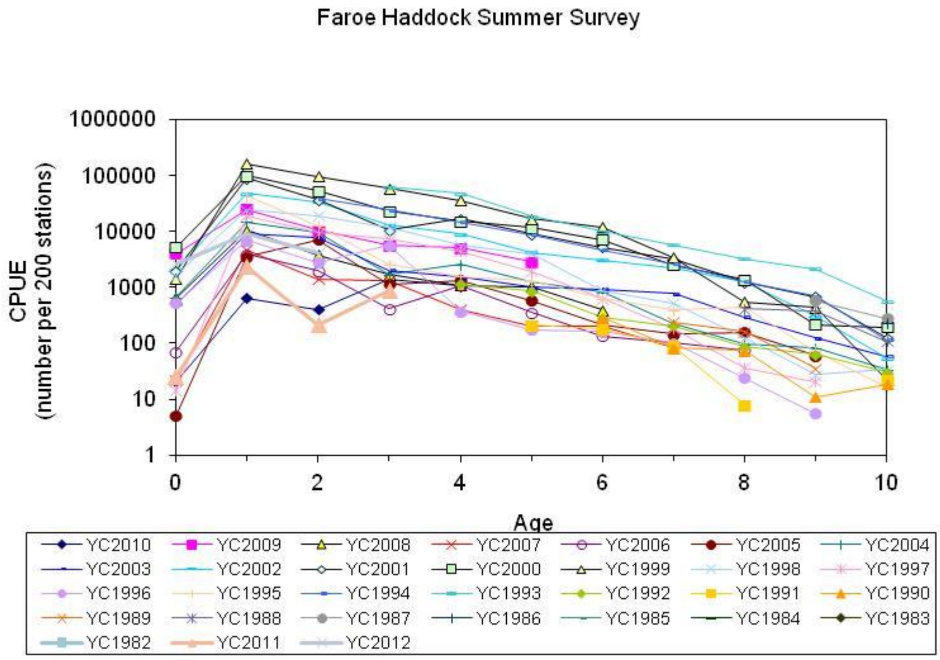


Figure 5.11. Faroe haddock. LN (catch-at-age in numbers) in the summer survey.

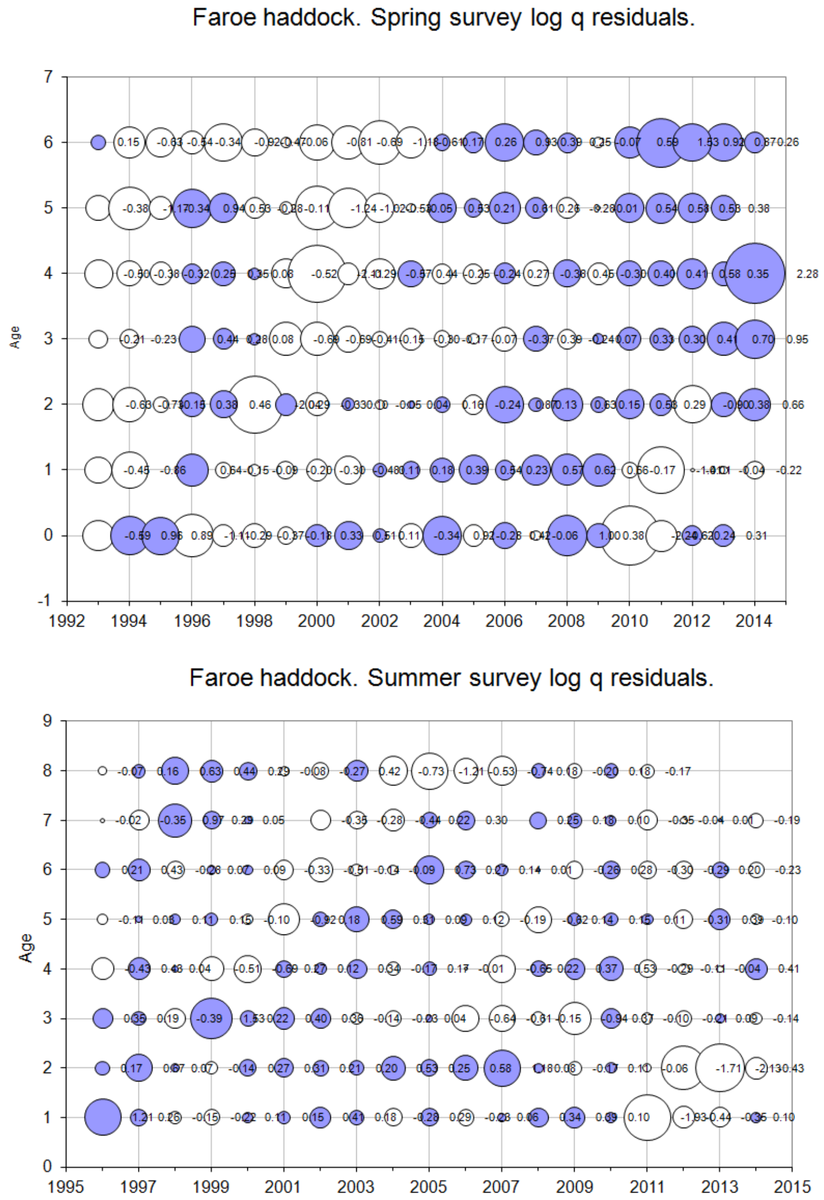


Figure 5.12. Faroe haddock survey log q residuals.

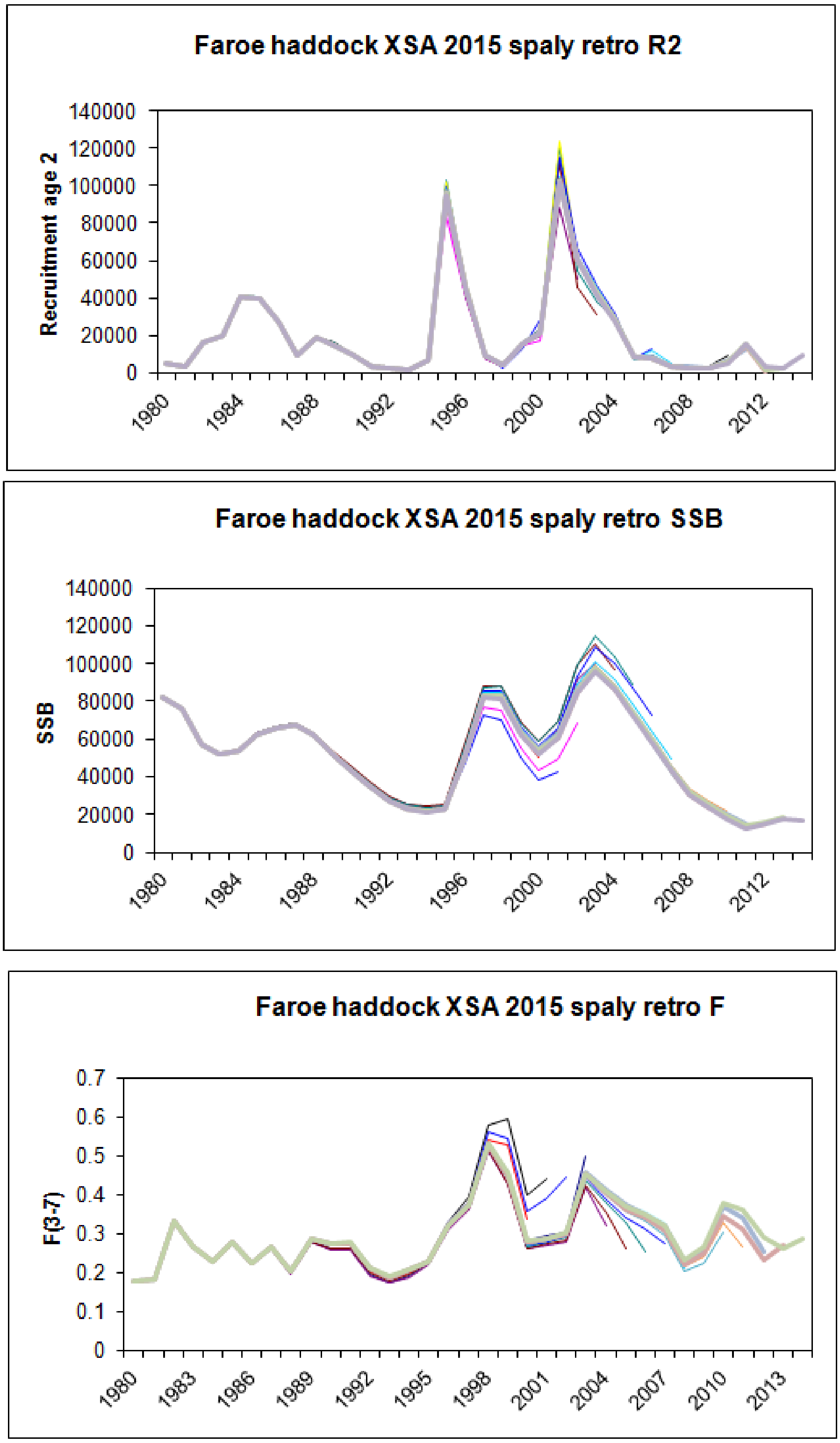


Figure 5.13. Faroe haddock. Retrospective analysis on the 2015 XSA.

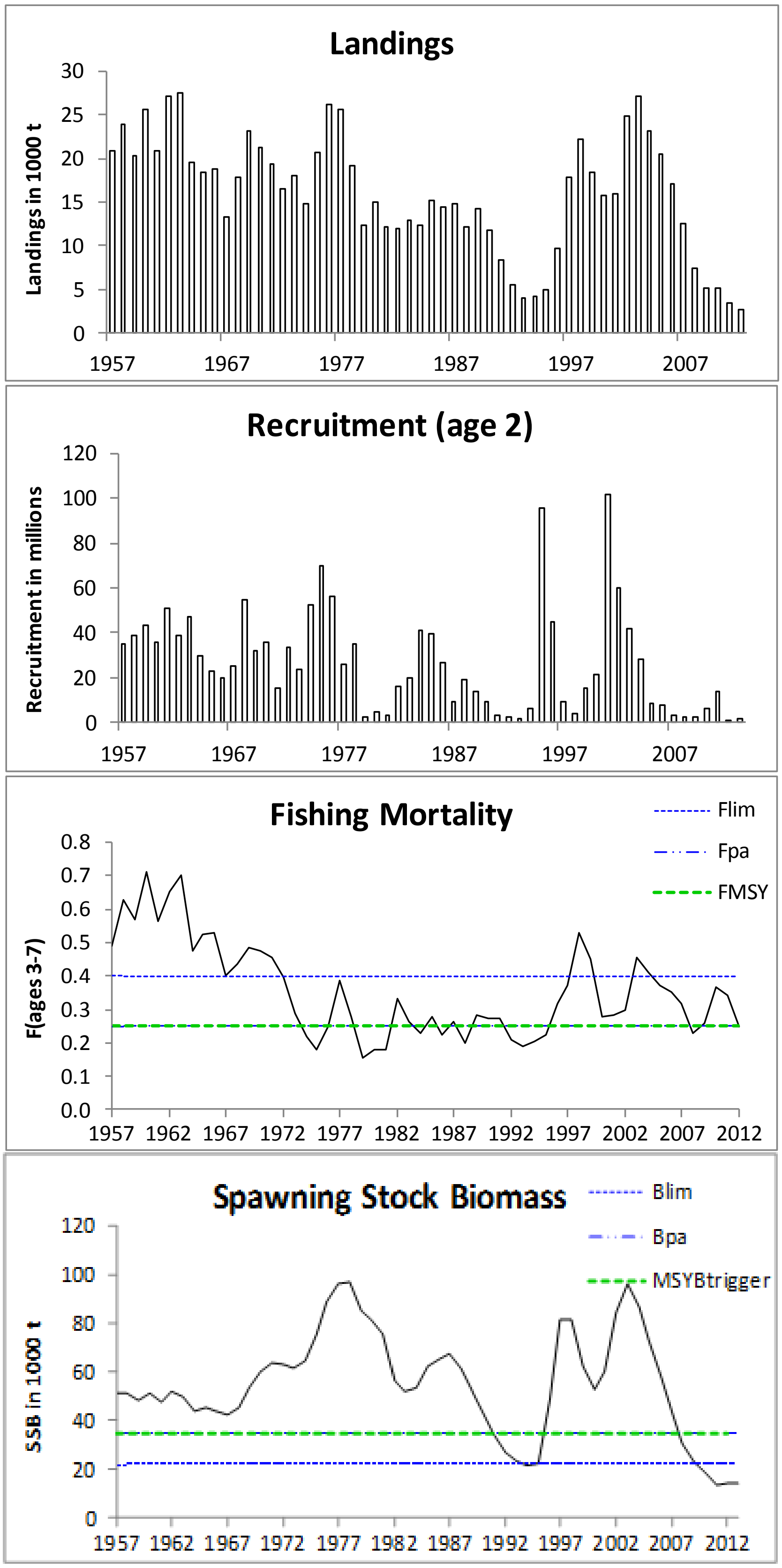
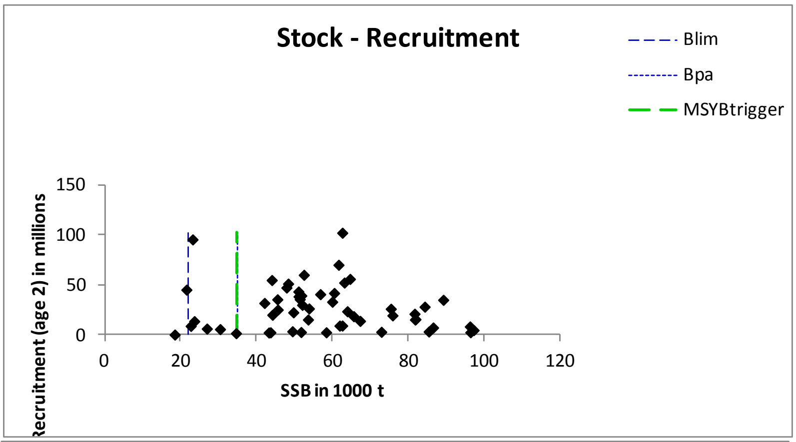
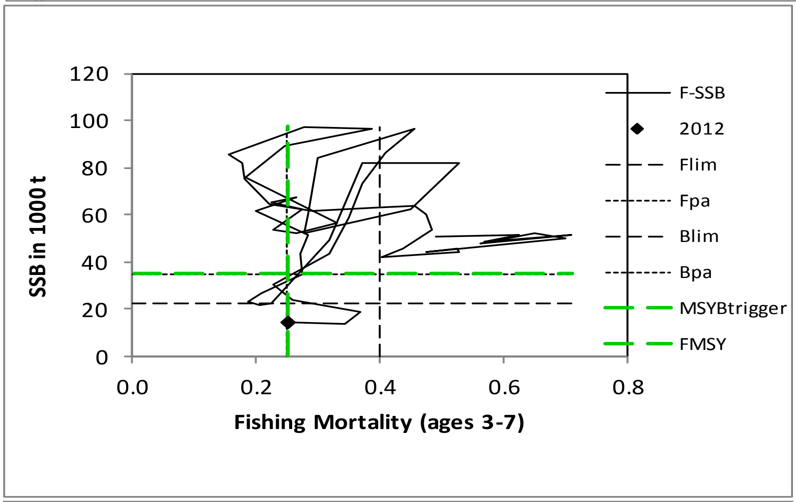


Figure 5.14. Faroe haddock (Division Vb) standard graphs from the 2015 assessment.





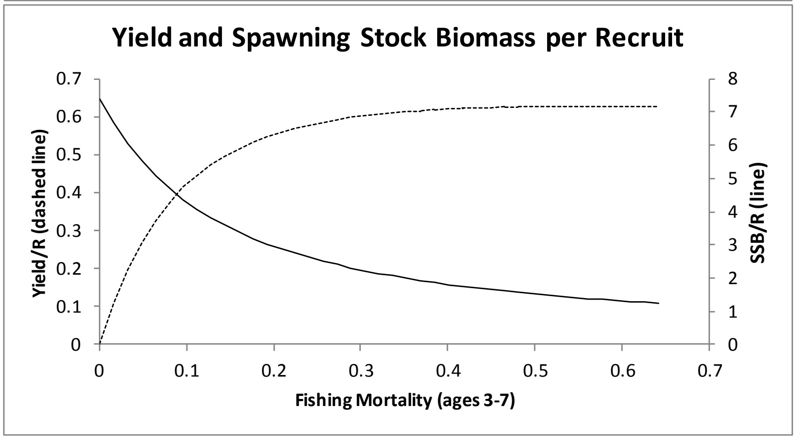
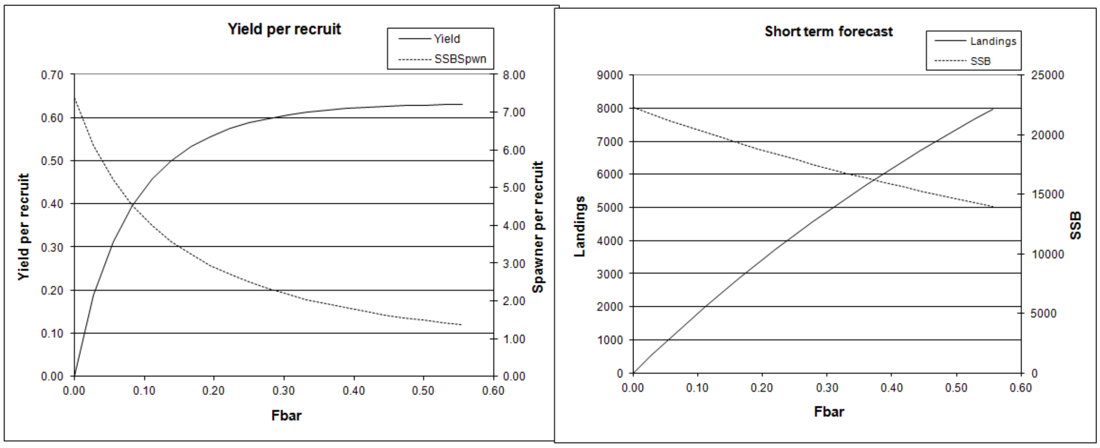


Figure 5.14 (cont.). Faroe haddock (Division Vb) standard graphs from the 2013 assessment.



MFYPR version 1
Run: rei
Time and date: 19:23 24/04/2015

Reference point	F multiplier	Absolute F
Fbar(3-7)	1	0.2778
FMax	2.2382	0.6218
F0.1	0.6571	0.1826
F35%SPR	0.8581	0.2384
Flow	-99	
Fmed	0.8397	0.2333
Fhigh	3.1887	0.8859

Weights in kilograms

MFDP version 1
Run: jak
Index file 24/04/2015
Time and date: 18:12 24/04/2015
Fbar age range: 3-7

Figure 5.16. Faroe haddock. Prediction output.

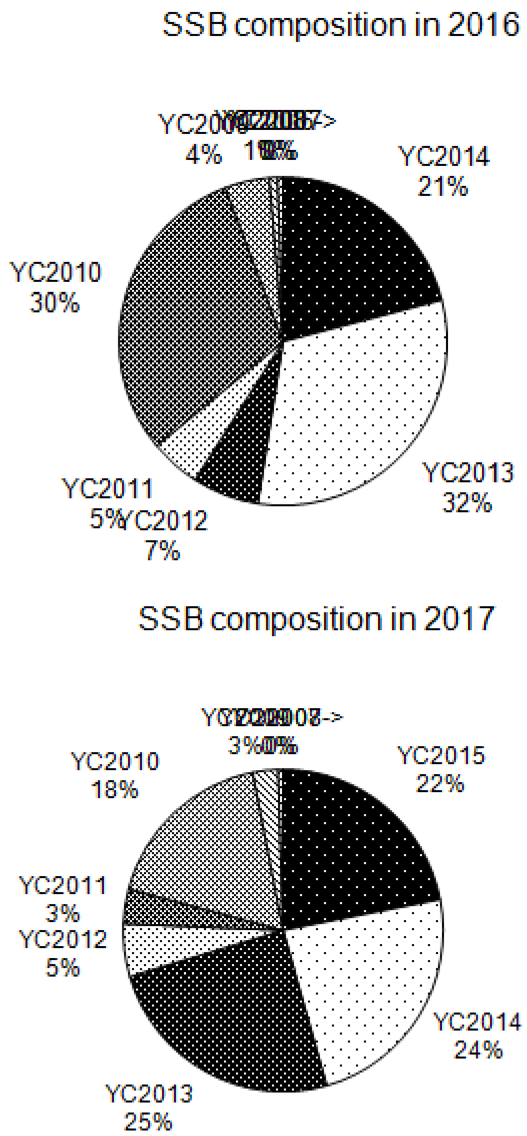


Figure 5.17. Faroe haddock. Projected composition of the number by year-classes in the SSB's in 2016 and 2017.

6 Faroe Saithe

Summary

The most recent benchmark assessment was completed in 2010.

Nominal landings decreased by more than 25% from 35 kt. in 2012 to 24 kt. in 2014. The corresponding estimate of fishing mortality in 2014 (average of ages 4-8 years) decreased to F=0.31 which is lower than the historical average (F=0.36) and very close to F_{msy}=0.30 and F_{pa}=0.28. Due to high fishing mortality SSB decreased substantially from 127 000 t. in 2005 to 48 000 t. in 2013, i.e., below $B_{trigger}$=55kt. but it increased again to 70 000 t. in 2014 as a consequence of improved weights and maturity ogives.

Numbers of the most recent year-class (2011, age 3 in 2014) has increased substantially from 36 mill. in 2013 to 62 million in 2014. However a statistical separable model suggests that the 2011 year-class is not as strong as the spaly assessment estimate and it predicts recruitment for 2014 at 20 mill.

At status-quo F_{bar}(2015)=0.31 and recruitment Rec(2015)=27 mill. the SSB is predicted to increase to 97 kt. in 2016.

Predicted landings for 2014 in the last year assessment were around 38kt while the actual measurement was 24 kt. The estimate of F_{bar} in 2014 was F_{bar}=0.53 in last year's assessment and F_{bar}=0.32 in the 2015 assessment. Recruitment strength for 2014 was predicted at 28 million while the estimate for that year in the present assessment reached 62 million. SSB was predicted exactly in 2014 SSB(2014)= 70 000 t.

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. After a substantial drop in landings in 2011 which was the lowest observed since 1999 (33 000 t) landings increased by 20% in 2012 up to 35 000 t. The total tonnage in 2014 is the lowest observed since 1997. The historical average landings for saithe since 1961 is 37 000 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—77% of the reported landings in 1992—2011 (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—2011 period while the percentage of total landings by large single trawlers (>1000 HP) has declined drastically to just 1%. Historically the catch composition by the pair-trawler fleet has accounted for about 75% of the total tonnage for saithe but since 2007 it has increased gradually up to 96% in 2014 due mainly to the gear-shifting of single-trawlers to pair-trawling. The share of catches by the jigger fleet was about 8% in the 1985—1998 period but has decreased to less than 0.5 % since 2000 and it now accounts for only 2% of the total domestic landings for saithe in 2013. 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. Effort (measured as the ratio of nominal to used fishing days by the pair-trawl fleet segment) has diminished considerably in recent years. In the 2012/2013 fishing year only 85% and 57% of fishing days were utilized in the inner and outer areas respectively while in the 2013/2014 fishing year these ratios went down to 58% and 41%.

Cumulative landings of saithe for the domestic fleets since 2000 are shown in Figure 6.2.1.2. The period from 2011 to 2014 are among the poorest in the time series. The progression of landings in the first two months of 2015 is below monthly averages and suggest a poor fishing year.

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 is raised by the foreign catches. Minor adjustments were made to the catch-at-age matrix for 2013 due to revised final catch statistics (Tables 6.2.2.1 and 6.2.2.2). Most of the age-disaggregated catch matrix is comprised of catches of the pair-trawl fleet. Since 2010 catch numbers is mostly comprised of age-groups 4 to 6 whereas in the period from 2005 to 2009 it is mainly composed of age-groups 4 to 8. Numbers of 4 to 6-years old were higher in 2014 than in 2013. while catches of 3-year old saithe in increased from 721 thous. in 2013 to 878 thous. in 2014.

The sampling program and sampling intensity in 2014 as well as the approach used in compiling catch numbers is the same as in preceding years. Sampling levels of catches in both 2012 and 2013 are quite similar (5.6% and 5.4% respectively) going up to 8.9% in 2014 (Table 6.2.2.3.) The average amount sampled per tonnes landed since 2000 is 5.9%.

6.2.3 Weight at age

Mean weights at age have varied by a factor of about 2 during the 1961—2013 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 3-years old saithe all age groups were showing signs of increasing size since 2006. By 2011 age-classes 4 to 8 were approaching or at long term average. This trend seemed to continue for older age groups (7 and older) whereas weight of 4 to 6 years old individuals appeared to decrease again in 2012 and 2013. Mean weight of the 2011 year-class (age 3 in 2014) is estimated at 1.37 kg. which is an increase with respect to that in 2013 (1.21 kg.). Since 2001 all age groups have remained below the historical average with the only exception of 7-years old saithe, which reached the long-term mean value (3.785 kg.) in 2012 and 3-years old with size above average in 2009. In 2014 all age classes are above or just above the historical average. Mean weights at age in the stock are assumed equal to those in the catch.

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 2012 working group a model using maturity at age from the Faroese groundfish spring survey was implemented to derive smoothed trends in maturity by age and year. The fitting was done locally and the smoothing level was chosen as a trade-off between retaining the trend in maturities and reducing the data noise. For 1962 to 1982 the average maturity of predicted ogives of the 1983-2011 period was used (Table 6.2.4.1 and Figure 6.2.4.1.) Maturity ogives were low from the early and mid-1990s up to 2001 where they began to rise considerably and are above historical average since 2012.

Faroe saithe begins to mature at 3 years old, approximately 20% are mature at age 4, 50% at 5 years old and 100% are mature at age 9 and onwards.

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 series (FGFS1) are available since 1994, while the summer survey (FGFS2) was initiated in 1996. The design for both bottom-trawl surveys is depth stratified with randomised stations covering the Faroe Plateau area. The total number of stations in the summer and spring is 100 and 200 respectively. Effort is recorded in terms of minutes towed approximately 60 min. Large proportion of saithe is caught in relatively few hauls and the inter-annual variability of these hauls is considerable.

Survey catch rates (kg per hour), length composition and age-disaggregated indices are presented in figures 6.2.5.1.1 to 6.2.5.1.5. Both surveys suggest low abundances of saithe in mid- and late 1990’s and increasing numbers from 2001 to 2005 although they differ in the order of this magnitude. Since 2006 the indexes show that the saithe stock is at low levels while there are indications of a slight upward trend since 2011. Both surveys agreed not only in the direction but also in the magnitude of this positive trend. Since 2011 the most recent estimate of the spring survey suggest a slightly decrease in stock biomass for 2015 but given the uncertainty associated with the index the point estimate ought to be taken with caution. Both survey at age numbers agreed in the lack of year classes present in the stock since 2007. The spring index suggest that the 2002 year class (age 3 in 2015) may be relatively strong, which is confirmed by more abundant individuals in the 35-45 cm size range from length distribution data.

Given the extreme schooling behaviour of saithe the internal consistency in the spring survey measured by the correlation of numbers in the data matrix for the same year class is reasonably good, with R^2 close to 0.85 for the best defined age groups and below $R^2 = 0.3$ for other age classes (Figure 6.2.5.1.6). Internal consistency in the age-disaggregated fall survey is displayed in figure 6.2.5.1.7. In terms of internal consistency the spring survey outperforms the fall survey.

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 report, WKROUND 2010.) The benchmark working group regarded this novel approach to developing the commercial series as reasonable (Benchmark report, WKROUND 2010.) Predicted annual CPUEs derived from this approach suggests that stock abundance was low in the 1990s and increased subsequently in the 2000s. and a sharp downward trend from 2006 to 2011. Since 2012 the predicted CPUE has remained remarkably stable at approximately 375 kg/hour (Figure 6.2.5.1.1)

The correlation between predicted CPUE and the spring and summer surveys is R^2=0.56 and R^2=0.68 respectively. The agreement between the survey indices measured by their correlation is estimated at R^2=0.36.

. The age composition indicates that the pair-trawl fleet targets mostly age groups 4 to 6. (Figure 6.2.5.2.1) There is a good agreement between age-disaggregated indices in the commercial index and indices of the same year class one year later (Figure 6.2.5.2.2) as measured by R^2 >0.35 for all age-classes.

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 was 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. Commercial catch-at age data (ages 3-14+, years 1961—2013) were calibrated in the XSA model using the commercial pair-trawl fleet (ages 3—11, years 1995—2013). XSA model diagnostics of the spaly run is presented in Table 6.3.2. Patterns in log-catchability residuals from the XSA model are relatively random but with large positive blocks in 2006—2010 for 3 to 4 age-classes (Figure 6.3.1.). Residuals from a separable statistical model predicting catch numbers at age and survey data and modelling selectivity over 3 distinct periods are also presented (Figure 6.3.3)

6.4 Reference points

6.4.1 Biological reference points and MSY framework

In 2014 at the WKMSYREF2 workshop the EqSim simulation framework was used to explore candidates to Fmsy. The work was presented at the NWWG meeting in 2014 and the results agree with the previous simulations (see above) in that estimates of Fmsy are in the range of Fmsy=0.30 and Fmsy=0.34 and not as the present level of Fmsy=0.28. In the 2014 meeting ACOM adopted the EqSim framework and agreed to set Fmsy=0.30, which agrees with the estimation of Fmed=0.31. Below it is an excerpt from the WKMSYREF2 report:

The EqSim framework fits three stock-recruit functions (Ricker, Beverton-Holt and Hockey-stick) on the bootstrap samples of the stock and recruit pairs from which approximate joint distributions of the model parameters can be made. The result of this is projected forward for a range of F's values and the last 50 years are retained to calculate summaries. Each simulation is run independently from the distribution of model and parameters. Error is introduced within the simulations by randomly generating process error about the constant stock recruit fit, and by using historical variation in maturity, natural mortality, weight at age, etc.

In the EqSim simulations the Hockey-Stick stock-recruit function were used assuming assessment and autocorrelation errors. Figures 6.4.1.1 and 6.4.1.2 illustrate the results of these simulations which suggest that candidates for FMSY are FMSY =0.34 (median yield) and FMSY =0.30 (F that gives the maximum mean yield in the long term) lie above the current FMSY = Fpa = 0.28 if autocorrelation and assessment errors are included in the simulation framework. If errors are ignored then estimates for FMSY are predicted to FMSY =0.38 (median yield), FMSY =0.35 (maximum mean yield). No Blim is defined for faroe saithe but for the purposes of the analysis a value of Blim=Bpa/1.4 was set for the simulations. A more detailed information of the simulations are available under *http://www.ices.dk/community/groups/Pages/WKMSYREF2.aspx* A summary is given in the table below.

	F	SSB	Catch	option
Flim	0.34	87327.43	36479.8	ass. Error
Flim	0.37	79116.87	35447.45	ass. Error
Flim	0.46	38905.3	22023.28	ass. Error
MSY:median	0.34	88565.78	36665.24	ass. Error
Maxmeanland	0.30	101372.9	37109.88	ass. Error
FCrash5	0.41	63312	31637.31	ass. Error
FCrash50	0.52	855.73	550.19	ass. Error
Flim	0.40	78435.72	38526.07	No ass. Error
Flim	0.42	73052.08	37660.27	No ass. Error
Flim	0.50	38910.57	24279.75	No ass. Error
MSY:median	0.38	82329.53	38694.43	No ass. Error
Maxmeanland	0.35	90688.34	39167.13	No ass. Error
FCrash5	0.43	69750.99	37114.99	No ass. Error
FCrash50	0.54	2847.53	1910.51	No ass. Error

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	NWWG 2012	NWWG2014
Btrigger	55 000 t.	55 000 t.
Blim	not defined.	
Bpa	60 000 t.	
Flim	not defined	
Fpa	0.28	
Fmsy	0.32	0.30

The Yield/R and SSB-R calculations with respect to reference fishing mortalities (Fmax, Fmed and F0.1) is presented in the table below. The SSB-R plot in relation to Fhigh, Fmed and Flow is shown in Figure 6.4.1.3.

	Fish Mort Ages 4–8	Yield/R	SSB/R
Average last 3 years	0.44	1.29	2.23
Fmax	0.42	1.29	2.36
F0.1	0.15	1.15	6.10
Fmed	0.31	1.28	3.27

6.5 State of the stock

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 (Figures 6.5.1 to 6.5.4. and Tables 6.5.1 to 6.5.3). The 1998 (88 millions) and 1999 (106 millions) are the largest observed in the time series. Since 2006 estimated recruitment has remained at low levels in comparison with the exceptionally high recruitment pulses observed from 2001 to 2005. However the 2011 year-class (numbers of age-3 saithe in 2014) is estimated at 62 million and therefore far above the historical average of 32 million. Nevertheless the most recent recruitment estimate is highly unreliable and it contradicts with the estimate from a more sophisticated statistical model, which predicts recruitment at N_3(2014)=20 million and thus in line with the present low productivity period.

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 662 000 millions, i.e. double the average from 1961 to 2014. The historically low SSB persisted in 1992-1998 and this along with low Fs caused landings to steeply decline to around 20 000 tonnes in 1996. The SSB increased since 1999 to above 128 000t in 2005 with the maturation of the 1995, 1996, 1997 and 1999 year classes and decreased to 93 000 t in 2009. The 2014 spaly assessment indicates that the point estimator of SSB(2013) is approximately 70 000 t. Since 2005 SSB has been declining sharply and at present is above $B_{trigger}$=55 000 t. Figure 6.5.6 illustrates the numbers of mature fish in the stock forage-groups from 3 to 9 in 2006, 2013 and 2014. It is quite clear that there has been a substantial increase in the numbers of mature fish over the age groups 3 to 6 a phenomenon supported by increased maturity ogives in recent years The separable catch-at-age model predicts SSB(2014)=94 000 t. and is thus at historical average.

In 2014 average fishing mortality over age groups 4 to 8 (Fbar) is estimated at F(2014)=0.32 and therefore very closed to F_{msy}=0.30 and below average for the first time since 2005. On the other hand the statistical model framework suggests that F(2014)=0.23 is even lower than that of the spaly assessment. The assessment model suggests a drop in fishing mortality from 2013 to 2014 reflecting the abrupt decline in landings from 26 kt. to 24 kt. Estimated F's have been above F_{msy}=0.30 and F_{pa}=0.28 since 1998.

The relation between stock and recruitment is presented in figure 6.5.7.

6.6 Short term forecast

6.6.1 Input data

Population numbers at age 3 for the base short term prediction is calculated as the geometric mean of estimated recruitment strength from 2008 to 2012. Natural mortality is set to constant 0.2. Weight-at-age for 3-years 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 8 is estimated by weight-at-age the previous year from the same year class (Eq. 2) Weight for ages 9 to 14+ is an average of the most 3 recent years. Diagnostics and results of the model are shown in Figures 6.6.1.1 and 6.6.1.2. For older age groups (9 to 14+) a 3-year average is used.

W3,y = αN3,y-3 + β for a = 3(Eq. 1)

Wa+1,y+1 = αWa,y + β for $4 \le a \le 8$ (Eq. 2)

Wa,y = (Wa-3,y Wa-2,y Wa-1,y)/3 for $9 \le a \le 14+$ (Eq. 3)

Proportion mature for 2015-2017 is taken as the average of predicted maturity ogives from 2013 and 2015. The exploitation pattern used is a 3 year average rescaled to last year as specified in the stock annex.

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

6.6.2 Projection of catch and biomass

Results from predictions with management option is presented in Table 6.6.2.1 and Figure 6.6.2.1.

At status quo F=0.32 landings would increase to 35 kt. in 2015 and 37 kt. in 2016 while spawning stock biomass is expected to around 82 kt. in 2015 and increase to 96 kt. tonnes in 2016. Landings in 2015 are predicted to rely on the 2009, 2010 and 2011 year classes (79%) while in the SSB these year-classes will contribute to around 73% of the spawning biomass in 2015 (Figure 6.6.2.2.)

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 1981—2013 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—2014.

The exploitation pattern was set equal to the average of the last five years (2005—2013) (as suggested from ACFM, 2004). Results from the yield per recruit analysis is shown in Figure 6.7.1.1.

6.8 Uncertainties in assessment and forecast

In 2014 the amount of catch sampled was 8.9%, which is regarded as adequate.

The assessment of Faroe saithe is relatively uncertain due to lack of good tuning data although the internal consistency in the commercial fleets used to calibrate the XSA model is reasonable considering the nature of the species that is highly schooling, and widely migrating. The retrospective pattern (Figure 6.8.1) reveals some of the assessment uncertainty. It shows periods of over- and underestimation in average fishing mortality and consequently under- and overestimation in spawning stock biomass. Over- and underestimation seem to occur in periods of poor and high abundances respectively. Various factors could explain this phenomenon, e.g., 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 suggests an overestimation of incoming year-classes. To avoid large year-to-year fluctuations in the spawning stock biomass (also dependent on age structure) a locally fitting model was implemented in 2012 to reduce variability in maturities.

6.9 Comparison with previous assessment and forecast

The 2014 assessment predicted recruitment for 2014 to around 28 million while the observed year-class strength was 62 million (Table 6.9.1). Fishing mortality was overestimated from F=0.53 to F=0.32. The spawning stock biomass was predicted exatly. Landings for 2014 were predicted at Land(2014)=38 kt. while actual observed catches in that year reached Land(2014)=24 kt an overestimation of 40%. Landings and F estimates from the statistical model were however closer to the actual measurements F(2014)=0.23, Land(2014)=27 kt. while recruitment Rec(2014)=20 mill. was three times lower than that of the spaly run.

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.

In 2014 ACOM adopted F_{msy}=0.30 presented at the NWWG meeting for the same year and produced in the WKMSYREF2 workshop on reference points. $B_{trigger}$ is set at B_{loss} =55 kt. ($B_{trigger}$=55 kt).

6.12 Ecosystem considerations

No evidence is available to indicate that the fishery is impacting the marine environment. A Ph.D. project was initiated in 2008, with the aim of investigate the role of environmental indicators in the dynamics of Faroe saithe. The results and conclusions of the PhD will be available to the working group in future meetings.

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 1988-2014 as officially reported to ICES.

Country	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Denmark	94	-	2	-	-	-	-	-	-	-	-	-	-	-
Estonia	-	-	-	-	-	-	-	-	-	16	-	-	-	-
Faroe Islands	44 402	43 624	59 821	53 321	35 979	32 719	32 406	26 918	19 267	21 721	25 995	32 439		49 676
France 3	313	-	-	-	120	75	19	10	12	9	17	-	273	934
Germany	-	-	-	32	5	2	1	41	3	5	-	100	230	667
German Dem.Rep.	-	9	-	-	-	-	-	-	-	-	-	-	-	-
German Fed. Rep.	74	20	15	-	-	-	-	-	-	-	-	-	-	5
Greenland	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ireland	-	-	-	-	-	-	-	-	-	-	-	0	0	0
Netherlands	-	22	67	65	-	-	-	-	-		-	160	72	60
Norway	52	51	46	103	85	32	156	10	16	67	53	-	-	-
Portugal	-	-	-	-	-	-	-	-	-	-	-	-	20	1
UK (Eng. & W.)	-	-	-	5	74	279	151	21	53	-	19	67	32	80
UK (Scotland)	92	9	33	79	98	425	438	200	580	460	337	441	534	708
USSR/Russia 2	-	-	30	-	12	-	-	-	18	28	-	-	-	-
Total	45 027	43 735	60 014	53 605	36 373	33 532	33 171	27 200	19 949	22 306	26 065	33 207	1 161	52 131
Working Group estimate 4 5	45 285	44 477	61 628	54 858	36 487	33 543	33 182	27 209	20 029	22 306	26 421	33 207	39 020	51 786

Country	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Denmark	-	-	-	-	34	-	-	-	-	-	-	-	
Estonia	-	-	-	-	-	-	-	-	-	-	-	-	
Faroe Islands	55 165	47 933	48 222	71 496	70 696	64 552	61 117	61 889	46 686	32 056	38 175	28 609	25 440
France	607	370	147	123	315	108	97	68	46	135	40	31	
Germany	422	281	186	1	49	3	3	0					
Greenland	125	-			73	239	0	1			1		
Irland	-	-	-	-	-	-	-	-					
Iceland	-	-	-	-	-	-	-	148	-				
Netherlands	0	0	0	0	0	3	0	0	0				
Norway	77	62	82	82	35	81	38	23	28				165
Portugal	-	-	5	-	-	-	-	-					
Russia	10	32	71	210	104	159	38	44	3			1	
UK (E/W/NI)	58	89	85	32	88	4	-	-					
UK (Scotland)	540	610	748	4 322	1 011	408	400	685					
United Kingdom	-	-	-	-	-	-	-	-	706	19		1	340
Total	57 004	49 377	49 546	76 266	72 405	65 557	61 693	62 858	47 469	32 210	38 216	28 642	25 945
Working Group estimate 4 5 6 7	53 546	46 555	46 355	67 967	66 902	60 785	57 044	57 949	43 885	29 658	35 314	26 463	23 854

Table 6.2.1.2. Faroe saithe (Division Vb). Total Faroese landings (rightmost column) and the contribution (%) by each fleet category (1985-2014). Averages for 1985-2014 are given at the bottom.

year	Open boats	Long– line <100 GRT	Single trawl <400 HP	Gillnet	Jigger	Single trawl 400–1000 HP	Single trawl >1000 HP	Pair trawl <1000 HP	Pair trawl >1000 HP	Long– line >100 GRT	Industrial trawl	Others	Total round weight (tons)
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	41341
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	27475
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	47122
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	38293
2011	0.1	0.1	0.5	0.0	3.6	1.3	2.6	14.1	77.1	0.5	0.0	0.0	26854
2012	0.2	0.1	1.9	0.0	2.4	0.1	2.2	18.6	73.5	1.0	0.0	0.0	31633
2013	0.1	0.3	1.0	0.0	3.2	0.2	0.6	24.9	69.0	0.5	0.0	0.1	22339
2014	0.2	0.3	0.5	0.0	1.9	0.2	0.2	15.6	80.7	0.3	0.0	0.1	20793
Avg.	0.3	0.2	0.8	0.1	5.3	1.6	14.3	19.4	57.4	0.3	0.4	0.0	39121

Table 6.2.2.1. Faroe saithe (Division Vb). Catch number at age by fleet categories in 2014 (calculated from gutted weights).

Age	Jiggers	Single trawlers >1000 HP	Pair trawlers <1000 HP	Pair trawlers >1000HP	Others	Total Division Vb
0	0	0	0	0	0	0
1	0	0	0	0	0	0
2	0	0	2	6	0	8
3	9	8	135	625	10	788
4	37	55	334	1624	30	2081
5	55	90	404	2226	40	2815
6	26	41	218	1200	19	1505
7	13	20	120	613	10	775
8	12	23	40	216	4	295
9	1	1	13	72	2	89
10	0	0	11	70	2	82
11	1	2	8	50	1	63
12	0	0	8	39	1	49
13	0	0	1	13	0	14
14	0	0	0	1	0	1
15	0	0	0	0	0	0
Total No.	155	241	1294	6755	119	8564
Catch t.	411	654	3251	16774	304	21394

Table 6.2.2.2. Faroe saithe (Division Vb). Catch number at age (thousands) from the commercial fleet (1961-2014)

CN	3	4	5	6	7	8	9	10	11	12	13	14+
1961	183	379	483	403	216	129	116	82	45	27	6	49
1962	562	542	617	495	286	131	129	113	71	29	13	63
1963	614	340	340	415	406	202	174	158	94	169	61	44
1964	684	1908	1506	617	572	424	179	150	100	83	47	44
1965	996	850	1708	965	510	407	306	201	156	120	89	76
1966	488	1540	1201	1686	806	377	294	205	156	94	52	79
1967	595	796	1364	792	1192	473	217	190	97	75	38	27
1968	614	1689	1116	1095	548	655	254	128	89	59	40	88
1969	1191	2086	2294	1414	1118	589	580	239	115	100	36	54
1970	1445	6577	1558	1478	899	730	316	241	86	48	46	38
1971	2857	3316	5585	1005	828	469	326	164	100	54	13	33
1972	2714	1774	2588	2742	1529	1305	1017	743	330	133	28	49
1973	2515	6253	7075	3478	1634	693	550	403	215	103	25	58
1974	3504	4126	4011	2784	1401	640	368	340	197	124	45	96
1975	2062	3361	3801	1939	1045	714	302	192	193	126	64	108
1976	3178	3217	1720	1250	877	641	468	223	141	96	60	131
1977	1609	2937	2034	1288	767	708	498	338	272	129	80	121
1978	611	1743	1736	548	373	479	466	473	407	211	146	178
1979	287	933	1341	1033	584	414	247	473	368	206	136	349
1980	996	877	720	673	726	284	212	171	196	156	261	369
1981	411	1804	769	932	908	734	343	192	92	128	176	717
1982	387	4076	994	1114	380	417	296	105	88	56	49	797
1983	2483	1103	5052	1343	575	339	273	98	98	99	25	416
1984	368	11067	2359	4093	875	273	161	52	65	59	18	176
1985	1224	3990	5583	1182	1898	273	103	38	26	72	41	162
1986	1167	1997	4473	3730	953	1077	245	104	67	33	56	69
1987	1581	5793	3827	2785	990	532	333	81	43	5	11	81
1988	866	2950	9555	2784	1300	621	363	159	27	43	15	2
1989	451	5981	5300	7136	793	546	185	83	55	10	2	27
1990	294	3833	10120	9219	5070	477	123	61	60	18	19	42
1991	1030	5125	7452	5544	3487	1630	405	238	128	77	22	19
1992	521	4067	3667	2679	1373	894	613	123	63	37	52	19
1993	1316	2611	4689	1665	858	492	448	245	54	34	10	8
1994	690	3961	2663	2368	746	500	307	303	150	28	19	2
1995	398	1019	3468	1836	1177	345	241	192	104	73	25	19
1996	297	1087	1146	1449	1156	521	132	77	64	45	29	8
1997	344	832	2440	1767	1335	624	165	71	29	48	29	23
1998	163	1689	1934	3475	1379	683	368	77	32	28	24	21
1999	322	655	3096	2551	4113	915	380	147	24	27	5	37
2000	811	2830	1484	4369	2226	2725	348	186	56	18	2	5
2001	1125	2452	8437	2155	3680	1539	1334	293	90	24	19	13
2002	302	8399	5962	9786	862	1280	465	362	33	36	8	1

CN	3	4	5	6	7	8	9	10	11	12	13	14+
2003	330	2432	11152	3994	4287	417	419	304	91	40	3	0
2004	76	2011	8544	8762	2125	1807	265	293	146	100	10	2
2005	454	2948	9486	16606	7099	843	810	32	102	27	3	0
2006	1475	5045	7781	7712	10296	3760	640	282	32	12	12	5
2007	831	3320	11305	6473	3781	4294	1538	406	81	11	9	3
2008	4784	3108	3598	9370	3594	2223	2048	444	159	12	6	0
2009	459	7412	4978	1842	5167	2009	1696	1069	292	41	3	1
2010	2324	2916	5298	1125	1009	2098	1248	832	376	51	22	0
2011	1897	2744	1940	1804	477	530	704	521	439	138	34	4
2012	859	9833	4142	1252	901	304	307	399	229	136	91	21
2013	721	5172	4219	2242	511	209	122	96	146	85	39	36
2014	878	2320	3139	1679	864	329	99	92	70	55	16	1

Table 6.2.2.3. Faroe saithe (Division Vb). Sampling intensity in 2001-2013.

Year		Jiggers	Single trawlers >1000 HP	Pair trawlers <1000 HP	Pair trawlers >1000 HP	Others	Total	Amount sampled pr tons landed (%)
2001	Lengths	1788	4388	5613	30341	0	42130	7.7
	Otoliths	180	450	480	3237	0	4347	
	Weights	180	420	420	3177	0	4197	
2002	Lengths	1197	9235	5049	30761	0	46242	5.8
	Otoliths	120	1291	422	3001	0	4834	
	Weights	120	420	240	2760	0	3540	
2003	Lengths	0	4959	6393	34812	1388	47552	7.0
	Otoliths	0	719	960	3719	180	5578	
	Weights	0	420	239	2999		3658	
2004	Lengths	916	2665	3455	35609	1781	44426	5.9
	Otoliths	180	180	240	3537	240	4377	
	Weights	180	120	120	3357	1364	5141	
2005	Lengths	1048	4266	6183	32046	1564	45107	3.6
	Otoliths	120	413	690	2760	240	4223	
	Weights	340	385	791	3533	1564	6613	
2006	Lengths	1059	7979	8115	23082	1139	41374	3.5
	Otoliths	180	598	1138	2096	60	4072	
	Weights	180	60	1620	5678	812	8350	
2007	Lengths	683	10525	10593	18045	381	40227	4.1
	Otoliths	120	748	960	1977	0	3805	
	Weights	120	697	5603	9884	120	16424	
2008	Lengths	0	6892	3694	13995	234	24815	2.5
	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	6.0
	Otoliths	5	119	480	2459	0	3063	
	Weights	5	0	3060	18749	151	21965	
2011	Lengths	583	18	1874	19990	753	23218	8.5
	Otoliths	60	0	300	2459	60	2879	
	Weights	583	18	1458	14256	753	17068	
2012	Lengths	6	0	1060	24924	211	26201	5.6
	Otoliths	6	0	120	2516	0	2642	
	Weights	6	0	1060	17593	211	18870	
2013	Lengths	0	0	1465	18015	920	20400	5.2
	Otoliths	0	0	360	1979	120	2459	
	Weights	0	0	1465	13544	1325	16334	
2014	Lengths	0	201	0	22131	920	23252	8.9
	Otoliths	0	0	0	2542	120	2662	
	Weights	0	0	0	15448	920	16368	

Table 6.2.3.1. Faroe saithe (Division Vb). Catch weights at age (kg)(equal to stock-weights) from the commercial fleet (1961-2014). The value for 2015 is used for short-term projections.

CW	3	4	5	6	7	8	9	10	11	12	13	14+
1961	1.43	2.302	3.348	4.287	5.128	6.155	7.06	7.265	7.497	8.198	9.154	9.992
1962	1.273	2.045	3.293	4.191	5.146	5.655	6.469	6.706	7.15	7.903	8.449	9.658
1963	1.28	2.197	3.212	4.568	5.056	5.932	6.259	8	7.265	8.551	9.02	9.818
1964	1.175	2.055	3.266	4.255	5.038	5.694	6.662	6.837	7.686	8.348	8.123	9.423
1965	1.181	2.125	2.941	4.096	4.878	5.932	6.321	7.288	8.074	7.878	9.479	9.849
1966	1.361	2.026	3.055	3.658	4.585	5.52	6.837	7.265	7.662	8.123	10.21	9.883
1967	1.273	1.78	2.534	3.572	4.368	5.313	5.812	6.554	7.806	7.591	8.551	9.135
1968	1.302	1.737	2.036	3.12	4.049	5.183	6.238	7.52	8.049	8.654	8.298	9.748
1969	1.188	1.667	2.302	2.853	3.673	5.002	5.714	6.405	6.554	7.591	7.951	9.096
1970	1.244	1.445	2.249	2.853	3.515	4.418	5.444	5.733	6.662	7.31	9.047	9.634
1971	1.101	1.316	1.818	2.978	3.702	4.271	5.388	5.972	6.49	7.173	7.38	9.612
1972	1.043	1.485	2.055	2.829	3.791	4.175	4.808	5.294	6.948	6.727	7.591	9.609
1973	1.306	1.754	1.899	2.7	4.426	5.264	6.156	6.334	8.076	8.777	9.782	11.115
1974	1.615	1.723	2.493	2.824	3.524	5.197	6.279	6.454	7.07	7.773	8.763	10.83
1975	1.293	1.924	2.623	3.621	4.128	4.754	5.952	7.073	8.352	9.032	9.984	11.082
1976	1.162	1.79	3.074	3.291	4.579	4.648	5.116	6.314	7.069	7.069	7.808	9.714
1977	1.223	1.641	2.66	3.79	4.239	5.597	5.35	5.912	6.837	6.727	6.948	9.258
1978	1.493	2.324	3.068	3.746	4.913	4.368	5.276	5.832	6.053	6.706	7.686	8.516
1979	1.22	1.88	2.62	3.4	4.18	4.95	5.69	6.38	7.02	7.26	8.15	9.618
1980	1.23	2.12	3.32	4.28	5.16	6.42	6.87	7.09	7.93	8.07	8.59	10.142
1981	1.31	2.13	3	3.81	4.75	5.25	5.95	6.43	7	7.47	8.14	9.43
1982	1.337	1.851	2.951	3.577	4.927	6.243	7.232	7.239	8.346	8.345	8.956	10.227
1983	1.208	2.029	2.965	4.143	4.724	5.901	6.811	7.051	7.248	8.292	9.478	10.509
1984	1.431	1.953	2.47	3.85	5.177	6.347	7.825	6.746	8.636	8.467	8.556	10.802
1985	1.401	2.032	2.965	3.596	5.336	7.202	6.966	9.862	10.67	10.46	10.202	13.055
1986	1.718	1.986	2.618	3.277	4.186	5.589	6.05	6.15	9.536	9.823	7.303	12.773
1987	1.609	1.835	2.395	3.182	4.067	5.149	5.501	6.626	6.343	10.245	8.491	10.482
1988	1.5	1.975	1.978	2.937	3.798	4.419	5.115	6.712	9.04	9.364	9.142	10.216
1989	1.309	1.735	1.907	2.373	3.81	4.667	5.509	5.972	6.939	8.543	9.514	10.484
1990	1.223	1.633	1.83	2.052	2.866	4.474	5.424	6.469	6.343	8.418	7.383	8.64
1991	1.24	1.568	1.864	2.211	2.648	3.38	4.816	5.516	6.407	7.395	8.079	8.674
1992	1.264	1.602	2.069	2.554	3.057	4.078	5.012	6.768	7.754	8.303	7.786	9.301
1993	1.408	1.86	2.323	3.131	3.73	4.394	5.209	6.54	8.403	7.275	9.414	9.64
1994	1.503	1.951	2.267	2.936	4.214	4.971	5.657	5.95	6.891	8.752	9.752	7.989
1995	1.456	2.177	2.42	2.895	3.651	5.064	5.44	6.167	7.08	7.736	7.295	7.104
1996	1.432	1.875	2.496	3.229	3.744	4.964	6.375	6.745	7.466	7.284	8.47	10.125
1997	1.476	1.783	2.032	2.778	3.598	4.766	5.982	7.658	7.882	8.539	9.488	10.413
1998	1.388	1.711	1.954	2.405	3.3	4.22	4.999	6.391	6.665	8.214	8.485	8.845
1999	1.374	1.712	1.905	2.396	2.845	4.124	5.256	5.526	6.956	8.03	8.349	8.907
2000	1.477	1.606	2.077	2.36	2.977	3.48	4.851	5.268	6.523	4.727	8.807	8.972
2001	1.33	1.59	1.785	2.586	3.059	3.871	4.374	5.565	6.703	5.776	7.745	7.773
2002	1.142	1.46	1.652	1.969	3.13	3.589	4.513	5.138	6.422	8.026	4.759	11.357
2003	1.123	1.304	1.614	1.977	2.532	3.97	4.834	5.499	6.099	6.987	5.961	10
2004	1.143	1.333	1.45	1.789	2.56	3.159	4.154	5.167	6.015	6.186	7.056	9.391
2005	1.148	1.325	1.516	1.672	2.087	2.975	3.79	6.087	6.134	6.651	7.424	10
2006	1.126	1.218	1.462	1.79	2.035	2.436	3.861	4.222	5.149	6.437	6.905	5.365
2007	1.058	1.391	1.413	1.824	2.361	2.682	3.278	4.104	4.998	6.331	7.844	7.971
2008	1.146	1.312	1.672	1.816	2.395	2.902	3.1	3.728	4.769	6.072	6.451	10
2009	0.938	1.485	1.893	2.411	2.601	3.147	3.634	4.024	5.014	5.828	6.308	9.011

CW	3	4	5	6	7	8	9	10	11	12	13	14+
2010	1.429	1.706	2.166	2.551	3.172	3.411	3.972	4.352	5.083	4.941	5.305	10
2011	1.111	1.693	2.253	2.918	3.609	4.204	4.531	5.087	5.416	6.087	6.763	7.916
2012	1.029	1.334	1.626	2.709	3.785	4.448	4.799	5.207	5.562	6.018	7.143	6.247
2013	1.208	1.466	1.778	2.069	3.553	4.292	5.191	5.742	5.919	6.417	7.941	7.138
2014	1.369	1.724	2.163	2.868	3.325	5.903	5.899	6.877	6.784	7.467	7.121	11.31
2015	1.299	1.528	1.850	2.239	2.602	4.451	5.296	5.942	6.088	6.634	7.402	8.232

Table 6.2.4.1. Faroe saithe (Division Vb). Proportion mature at age (1982-2014). Maturities-at-age from 1961 to 1981 are fixed and equal to those in 1982. The value for 2015 is used for short-term prognosis.

Mat	3	4	5	6	7	8	9	10	11	12	13	14+
1982	0.03	0.22	0.52	0.79	0.92	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1983	0.03	0.27	0.61	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1984	0.04	0.28	0.60	0.88	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1985	0.05	0.29	0.59	0.85	0.97	0.99	1.00	1.00	1.00	1.00	1.00	1.00
1986	0.05	0.28	0.57	0.82	0.94	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1987	0.05	0.27	0.55	0.79	0.92	0.97	1.00	1.00	1.00	1.00	1.00	1.00
1988	0.05	0.26	0.53	0.77	0.90	0.96	1.00	1.00	1.00	1.00	1.00	1.00
1989	0.04	0.23	0.51	0.76	0.89	0.96	1.00	1.00	1.00	1.00	1.00	1.00
1990	0.03	0.19	0.49	0.75	0.89	0.96	1.00	1.00	1.00	1.00	1.00	1.00
1991	0.03	0.17	0.48	0.75	0.88	0.96	1.00	1.00	1.00	1.00	1.00	1.00
1992	0.02	0.17	0.48	0.75	0.89	0.97	1.00	1.00	1.00	1.00	1.00	1.00
1993	0.02	0.17	0.49	0.77	0.91	0.99	1.00	1.00	1.00	1.00	1.00	1.00
1994	0.01	0.17	0.49	0.78	0.93	1.00	0.99	1.00	1.00	1.00	1.00	1.00
1995	0.01	0.17	0.49	0.78	0.93	1.00	0.99	1.00	1.00	1.00	1.00	1.00
1996	0.01	0.17	0.47	0.75	0.90	1.00	0.99	1.00	1.00	1.00	1.00	1.00
1997	0.01	0.16	0.44	0.70	0.87	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1998	0.02	0.16	0.41	0.64	0.83	0.96	0.99	1.00	1.00	1.00	1.00	1.00
1999	0.02	0.16	0.38	0.60	0.79	0.94	0.98	1.00	1.00	1.00	1.00	1.00
2000	0.02	0.16	0.37	0.58	0.77	0.92	0.98	1.00	1.00	1.00	1.00	1.00
2001	0.01	0.17	0.37	0.56	0.75	0.91	0.98	1.00	1.00	1.00	1.00	1.00
2002	0.01	0.17	0.37	0.56	0.74	0.89	0.98	1.00	1.00	1.00	1.00	1.00
2003	0.01	0.18	0.37	0.56	0.74	0.88	0.97	1.00	1.00	1.00	1.00	1.00
2004	0.01	0.18	0.38	0.57	0.74	0.88	0.97	1.00	1.00	1.00	1.00	1.00
2005	0.00	0.18	0.39	0.59	0.76	0.89	0.97	1.00	1.00	1.00	1.00	1.00
2006	0.00	0.18	0.40	0.62	0.78	0.90	0.97	1.00	1.00	1.00	1.00	1.00
2007	0.00	0.19	0.42	0.64	0.80	0.91	0.97	1.00	1.00	1.00	1.00	1.00
2008	0.01	0.20	0.43	0.66	0.82	0.92	0.97	1.00	1.00	1.00	1.00	1.00
2009	0.01	0.21	0.45	0.68	0.84	0.94	0.97	1.00	1.00	1.00	1.00	1.00
2010	0.02	0.23	0.47	0.71	0.87	0.95	0.97	1.00	1.00	1.00	1.00	1.00
2011	0.03	0.24	0.49	0.72	0.88	0.96	0.98	1.00	1.00	1.00	1.00	1.00
2012	0.03	0.25	0.50	0.73	0.89	0.97	0.98	1.00	1.00	1.00	1.00	1.00
2013	0.04	0.25	0.50	0.74	0.90	0.97	0.98	1.00	1.00	1.00	1.00	1.00
2014	0.04	0.26	0.51	0.74	0.90	0.98	0.98	1.00	1.00	1.00	1.00	1.00
2015	0.04	0.26	0.51	0.74	0.90	0.98	0.98	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 the commercial pair trawlers (1995-2013)

year	effort	3	4	5	6	7	8	9	10	11
1995	11016	47	180	577	236	146	49	24	19	14
1996	48205	310	958	821	1119	503	282	133	127	70
1997	34828	199	533	1488	1013	768	333	73	33	10
1998	34422	107	656	1148	1486	730	325	170	40	13
1999	43528	174	487	1554	2016	2024	817	190	83	12
2000	44280	434	1566	913	2700	1333	1604	192	106	31
2001	41860	611	1438	4946	1165	1855	748	618	127	29
2002	41914	133	3976	3964	6888	520	682	246	177	25
2003	38489	141	1494	6560	2373	2263	197	212	124	35
2004	35525	43	1200	5089	5116	1035	762	113	116	53
2005	32860	188	1189	4039	7266	3130	320	291	7	43
2006	25334	140	1176	2410	2584	3700	1376	268	85	14
2007	25218	204	879	2913	1815	1034	1215	435	110	19
2008	25259	796	762	947	2641	1063	726	611	156	51
2009	68408	154	4082	3377	1283	3612	1402	1153	751	195
2010	61563	459	2019	3586	737	657	1325	814	518	245
2011	64272	397	1936	1367	1257	323	356	488	366	310
2012	57749	366	5652	2332	756	554	187	189	252	143
2013	43325	424	3047	2462	1295	293	122	71	56	83
2014	48205	625	1624	2226	1200	613	216	72	70	50

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

FLR XSA Diagnostics 2015-04-15 15:45:12

CPUE data from indices

Catch data for 54 years 1961 to 2014. Ages 3 to 14.

	fleet	first age	last age	first year	last year	alpha	beta
1	PairTrawlers_GLM_SD	3	11	1995	2014	<NA>	<NA>

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

age \ year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
all	1	1	1	1	1	1	1	1	1	1

Fishing mortalities

age \ year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
3	0.007	0.076	0.050	0.184	0.038	0.112	0.062	0.028	0.022	0.016
4	0.077	0.103	0.245	0.266	0.481	0.354	0.187	0.522	0.234	0.093
5	0.295	0.297	0.353	0.459	0.907	0.774	0.423	0.476	0.445	0.217
6	0.477	0.417	0.433	0.560	0.453	0.523	0.665	0.535	0.517	0.319
7	0.585	0.621	0.371	0.459	0.703	0.484	0.440	0.858	0.435	0.383
8	0.352	0.722	0.577	0.389	0.507	0.705	0.510	0.563	0.486	0.560
9	0.889	0.496	0.753	0.606	0.587	0.694	0.544	0.635	0.463	0.450
10	0.296	0.939	0.689	0.504	0.757	0.650	0.715	0.695	0.414	0.783
11	0.621	0.545	0.790	0.643	0.747	0.667	0.892	0.823	0.595	0.610
12	0.348	0.132	0.362	0.246	0.335	0.270	0.553	0.787	0.865	0.469
13	0.541	0.257	0.138	0.344	0.089	0.302	0.291	0.905	0.544	0.380
14	0.541	0.257	0.138	0.344	0.089	0.302	0.291	0.905	0.544	0.380

XSA population number (Thousand)

age year	3	4	5	6	7	8	9	10	11	12	13	14
2005	69984	44103	41005	48405	17716	3140	1520	138	244	101	8	0
2006	22222	56888	33441	24988	24605	8081	1808	512	84	107	59	24
2007	18880	16860	42011	20339	13481	10828	3214	901	164	40	77	26
2008	31507	14706	10799	24166	10795	7616	4980	1240	370	61	23	0
2009	13724	21467	9228	5586	11307	5586	4224	2224	613	159	39	13
2010	24291	10821	10869	3051	2907	4582	2756	1924	854	238	93	0
2011	34720	17785	6221	4105	1480	1467	1853	1127	822	359	149	17
2012	34440	26710	12078	3338	1729	780	721	880	451	276	169	38
2013	35951	27420	12971	6141	1600	600	364	313	360	162	103	94
2014	61619	28782	17770	6802	2999	848	302	187	169	162	56	3

Estimated population abundance at 1st Jan 2015

age year	3	4	5	6	7	8	9	10	11	12	13	14
2015	0	49655	21465	11708	4050	1674	396	158	70	75	83	31

Fleet: PairTrawlers_GLM_SD

Log catchability residuals.

year age	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
3	-0.389	0.492	0.054	0.413	-0.868	0.533	0.027	-1.689	-1.044	-1.979	-0.683	0.463	0.994	1.905	0.028	0.690	0.121	0.138	0.527	0.267
4	-0.033	-0.733	-0.518	-0.609	-0.172	-0.560	-0.059	0.066	-1.075	-0.706	-0.451	-0.444	0.552	0.554	0.955	0.985	0.326	1.250	0.763	-0.088
5	0.449	-0.659	-0.672	-0.422	-0.637	-0.190	0.041	0.400	0.078	-0.461	-0.032	-0.083	-0.092	0.189	0.813	0.759	0.157	0.159	0.415	-0.211
6	-0.194	-0.178	-0.074	-0.663	-0.047	0.014	0.349	0.654	0.210	0.056	0.097	-0.042	-0.178	0.079	-0.221	-0.034	0.221	-0.030	0.178	-0.196
7	0.152	-0.407	0.225	0.058	-0.171	-0.034	0.328	0.210	0.367	-0.006	0.173	0.287	-0.492	-0.204	0.083	-0.253	-0.350	0.320	-0.134	-0.154
8	0.096	0.150	0.113	-0.013	0.567	0.272	0.119	0.149	0.005	0.171	-0.580	0.356	-0.119	-0.367	-0.343	-0.010	-0.313	-0.194	-0.106	0.046
9	-0.039	0.395	0.003	0.260	-0.020	-0.118	0.411	-0.185	-0.151	0.498	0.282	0.119	0.144	-0.019	-0.224	0.007	-0.216	-0.074	-0.156	-0.070
10	-0.362	1.060	0.075	0.193	0.210	0.247	0.529	0.295	-0.020	0.115	-1.305	0.421	0.014	-0.038	0.062	-0.104	0.068	0.040	-0.265	0.525
11	-0.058	0.144	-0.393	-0.060	-0.560	0.074	0.046	-0.034	-0.334	0.152	0.088	0.255	0.004	0.113	-0.002	-0.034	0.291	0.195	0.068	0.215

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	10	11
Mean_Logq	-15.5347	-13.4272	-12.4482	-12.0741	-11.9394	-11.8402	-11.8402	-11.8402	-11.8402
S.E_Logq	0.4575	0.4575	0.4575	0.4575	0.4575	0.4575	0.4575	0.4575	0.4575

Terminal year survivor and F summaries:

Age 3 Year class =2011

source

	scaledWts	survivors	yrcls
PairTrawlers_GLM_SD	0.82	64821	2011
fshk	0.18	14726	2011

Age 4 Year class =2010

source

	scaledWts	survivors	yrcls
PairTrawlers_GLM_SD	0.888	19660	2010
fshk	0.112	4881	2010

Age 5 Year class =2009

source

	scaledWts	survivors	yrcls
PairTrawlers_GLM_SD	0.941	9482	2009
fshk	0.059	3377	2009

Age 6 Year class =2008

source

	scaledWts	survivors	yrcls
PairTrawlers_GLM_SD	0.97	3329	2008
fshk	0.03	2106	2008

Age 7 Year class =2007

source

	scaledWts	survivors	yrcls
PairTrawlers_GLM_SD	0.968	1435	2007
fshk	0.032	974	2007

Age 8 Year class =2006

source

	scaledWts	survivors	yrcls
PairTrawlers_GLM_SD	0.962	415	2006
fshk	0.038	398	2006

Age 9 Year class =2005

source

	scaledWts	survivors	yrcls
PairTrawlers_GLM_SD	0.966	147	2005
fshk	0.034	111	2005

Age 10 Year class =2004

source

	scaledWts	survivors	yrcls
PairTrawlers_GLM_SD	0.891	118	2004
fshk	0.109	91	2004

Age 11 Year class =2003

source

	scaledWts	survivors	yrcls
PairTrawlers_GLM_SD	0.96	93	2003
fshk	0.04	56	2003

Age 12 Year class =2002

source

	scaledWts	survivors	yrcls
fshk	1	65	2002

Age 13 Year class =2001

source

	scaledWts	survivors	yrcls
fshk	**1**	**17**	**2001**

Table 6.5.1. Faroe saithe (Division Vb). Fishing mortality at age (1961-2013). The value for 2015 is used for short-term prognosis.

F	3	4	5	6	7	8	9	10	11	12	13	14+
1961	0.026	0.058	0.109	0.143	0.12	0.1	0.11	0.106	0.112	0.181	0.134	0.134
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
1963	0.035	0.04	0.085	0.118	0.185	0.142	0.185	0.25	0.178	0.491	0.308	0.308
1964	0.052	0.144	0.251	0.218	0.236	0.301	0.18	0.241	0.248	0.235	0.243	0.243
1965	0.05	0.085	0.186	0.253	0.283	0.263	0.37	0.316	0.424	0.532	0.427	0.427
1966	0.026	0.103	0.167	0.283	0.348	0.35	0.308	0.456	0.433	0.493	0.464	0.464
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
1968	0.03	0.099	0.098	0.14	0.156	0.307	0.326	0.358	0.258	0.467	0.363	0.363
1969	0.034	0.136	0.189	0.175	0.207	0.25	0.493	0.586	0.639	0.518	0.586	0.586
1970	0.044	0.262	0.142	0.179	0.16	0.202	0.206	0.39	0.431	0.609	0.48	0.48
1971	0.086	0.135	0.373	0.128	0.144	0.117	0.13	0.157	0.277	0.534	0.325	0.325
1972	0.094	0.07	0.148	0.316	0.293	0.354	0.4	0.49	0.541	0.73	0.592	0.592
1973	0.125	0.325	0.438	0.304	0.315	0.209	0.246	0.272	0.253	0.32	0.283	0.283
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
1975	0.141	0.345	0.528	0.293	0.18	0.141	0.132	0.12	0.205	0.198	0.175	0.175
1976	0.196	0.34	0.298	0.328	0.208	0.16	0.129	0.137	0.122	0.149	0.136	0.136
1977	0.146	0.281	0.376	0.382	0.344	0.259	0.179	0.13	0.246	0.156	0.178	0.178
1978	0.085	0.233	0.267	0.163	0.18	0.375	0.272	0.259	0.228	0.307	0.266	0.266
1979	0.037	0.18	0.283	0.251	0.261	0.31	0.338	0.49	0.329	0.172	0.333	0.333
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
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
1982	0.028	0.184	0.188	0.477	0.329	0.502	0.399	0.191	0.315	0.477	0.33	0.33
1983	0.07	0.103	0.366	0.419	0.486	0.552	0.736	0.221	0.275	0.711	0.405	0.405
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
1985	0.062	0.236	0.507	0.276	0.579	0.314	0.304	0.243	0.232	0.415	0.298	0.298
1986	0.021	0.138	0.452	0.774	0.375	0.785	0.518	0.578	0.895	0.518	0.67	0.67
1987	0.037	0.138	0.423	0.57	0.476	0.372	0.598	0.32	0.503	0.141	0.323	0.323
1988	0.022	0.089	0.355	0.631	0.576	0.629	0.471	0.65	0.167	1.599	0.813	0.813
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
1990	0.016	0.203	0.627	0.784	0.801	0.392	0.203	0.209	0.196	0.29	0.233	0.233
1991	0.047	0.414	0.768	0.875	0.799	0.658	0.689	0.756	0.903	0.415	0.698	0.698
1992	0.03	0.262	0.596	0.707	0.551	0.483	0.558	0.459	0.455	0.73	0.552	0.552
1993	0.063	0.205	0.547	0.601	0.514	0.388	0.478	0.454	0.374	0.477	0.438	0.438
1994	0.046	0.274	0.334	0.597	0.599	0.652	0.448	0.706	0.562	0.339	0.54	0.54
1995	0.011	0.089	0.411	0.406	0.684	0.623	0.778	0.565	0.563	0.595	0.579	0.579
1996	0.014	0.039	0.137	0.3	0.486	0.757	0.517	0.616	0.37	0.51	0.502	0.502
1997	0.011	0.048	0.115	0.324	0.5	0.532	0.575	0.589	0.496	0.528	0.741	0.741
1998	0.014	0.071	0.15	0.238	0.454	0.52	0.706	0.586	0.582	1.419	0.552	0.552
1999	0.006	0.073	0.181	0.302	0.492	0.627	0.623	0.694	0.361	1.681	1.151	1.151
2000	0.025	0.068	0.235	0.418	0.471	0.721	0.52	0.727	0.628	0.508	0.503	0.503
2001	0.014	0.1	0.294	0.634	0.763	0.709	1	1.206	0.998	0.612	1.927	1.927
2002	0.003	0.14	0.372	0.661	0.566	0.667	0.479	0.843	0.389	1.815	0.421	0.421
2003	0.006	0.032	0.279	0.46	0.696	0.597	0.476	0.675	0.522	1.216	0.741	0.741
2004	0.002	0.043	0.148	0.37	0.478	0.73	1.006	0.736	0.834	2.518	1.289	1.289
2005	0.007	0.077	0.295	0.477	0.585	0.352	0.889	0.296	0.621	0.348	0.541	0.541
2006	0.076	0.103	0.297	0.417	0.621	0.722	0.496	0.939	0.545	0.132	0.257	0.257
2007	0.05	0.245	0.353	0.433	0.371	0.577	0.753	0.689	0.79	0.362	0.138	0.138
2008	0.184	0.266	0.459	0.56	0.459	0.389	0.606	0.504	0.643	0.246	0.344	0.344
2009	0.038	0.481	0.907	0.453	0.703	0.507	0.587	0.757	0.747	0.335	0.089	0.089

F	3	4	5	6	7	8	9	10	11	12	13	14+
2010	0.112	0.354	0.774	0.523	0.484	0.705	0.694	0.65	0.667	0.27	0.302	0.302
2011	0.062	0.187	0.423	0.665	0.44	0.51	0.544	0.715	0.892	0.553	0.291	0.291
2012	0.028	0.522	0.476	0.535	0.858	0.563	0.635	0.695	0.823	0.787	0.905	0.905
2013	0.022	0.234	0.445	0.517	0.435	0.486	0.463	0.414	0.595	0.865	0.544	0.544
2014	0.016	0.093	0.217	0.319	0.383	0.56	0.45	0.783	0.61	0.469	0.38	0.38
2015	0.016	0.201	0.269	0.324	0.397	0.381	0.366	0.448	0.480	1.00	1.00	1.00

Table 6.3.2. Faroe saithe (Division Vb). Stock number at age (start of year) (Thousands)(1961-2013). The value for 2015 is used for short-term prognosis.

year	3	4	5	6	7	8	9	10	11	12	13	14+
1961	7827.25	7421.86	5158.38	3351.65	2113.91	1494.26	1232.82	904.51	468.22	179.78	53.02	431.33
1962	12256.25	6242.83	5733.57	3786.29	2379.45	1535.28	1106.68	904.39	666.35	342.63	122.76	592.7
1963	19837.07	9526.05	4620.77	4135.96	2652.05	1689.34	1138.44	789.35	638.21	481.32	254.28	182.18
1964	14811.79	15685.65	7491.63	3475.53	3010.73	1803.95	1200.34	774.64	503.3	437.46	241.15	224.48
1965	22362.92	11507.96	11115.89	4770.94	2287.23	1947.41	1093.3	820.79	498.49	321.58	283.06	239.61
1966	21229.27	17407.99	8652.81	7555.46	3032.95	1411.16	1226.14	618.24	490.13	266.98	154.71	232.85
1967	24897.65	16939.49	12859.01	5997.61	4660.33	1753.87	814.24	737.85	320.68	260.13	133.53	94.13
1968	22879.37	19846.09	13148.63	9293.87	4193.8	2736.99	1007.96	470.29	432.19	174.78	145.12	316.81
1969	39798.56	18176.48	14720.33	9755.39	6618.38	2937.74	1648.19	595.42	269.22	273.31	89.71	133.05
1970	37092.13	31506.65	12994.15	9976.29	6707.6	4407.06	1872.27	824.62	271.23	116.37	133.29	109.05
1971	38446.65	29060.97	19844.34	9228.97	6830.55	4678.27	2947.67	1246.96	457.08	144.25	51.84	130.67
1972	33424.45	28892.33	20792.67	11193.66	6646.68	4843.17	3405.87	2118.37	872.53	283.74	69.24	119.79
1973	23621.85	24909.9	22049.86	14681.88	6683.53	4058.35	2784.44	1868.27	1062.08	415.77	111.96	258.1
1974	19420.6	17064.27	14736.55	11651.17	8873.48	3993.51	2695.64	1782.05	1164.96	675.02	247.2	524.53
1975	17327.15	12729.69	10237.68	8435.96	7020.11	5997.32	2690.51	1874.02	1151.37	775.54	440.46	739.88
1976	19709.19	12320.5	7381.03	4942.62	5152.3	4802.02	4264.13	1929.54	1360.59	768.03	520.95	1132.94
1977	13106.08	13260.95	7176.31	4486.76	2915.63	3424.81	3351.56	3067.71	1378	986.38	541.95	815.91
1978	8332.93	9274.47	8199.64	4035.03	2508.02	1693.1	2163.37	2293.42	2205.8	882.09	690.85	837.16
1979	8686.33	6269.57	6016.16	5142.5	2807.75	1715.89	952.78	1349.56	1449.7	1437.68	531.28	1353.59
1980	13075.22	6852.07	4288.88	3712.23	3275.62	1770.37	1030.25	556.58	676.94	853.94	990.68	1390.32
1981	33145.15	9803.87	4816.46	2859.95	2430.36	2024.94	1192.48	651.67	300.96	376.88	557.99	2253.33
1982	15676.15	26765.06	6394.4	3247.57	1498.22	1168.22	993.73	665.96	359.81	163.16	192.75	3112.79
1983	40830.06	12484.37	18225.26	4335.88	1650.89	882.8	579.14	545.77	450.23	214.96	82.91	1368.13
1984	26075.32	31182.12	9223.3	10350.34	2334.72	831.36	416.04	227.14	358.16	279.95	86.42	839.91
1985	22332.2	21015.69	15515.92	5416.89	4770.65	1119.78	433.64	194.94	138.91	234.42	175.82	690.1
1986	61856.33	17176.53	13595.89	7651.66	3365.46	2188.49	669.78	261.83	125.22	90.21	126.78	154.24
1987	48619.31	49587.74	12256	7084.03	2889.6	1893.09	817.28	326.68	120.27	41.9	44	321.7
1988	44855	38375.57	35357.28	6571.55	3279.94	1470.02	1068.56	367.82	194.17	59.56	29.78	3.91
1989	28601.04	35940.58	28749.99	20302.37	2861.26	1509.1	641.64	546.41	157.28	134.54	9.85	132.25
1990	20712.55	23008.47	24013.82	18742.86	10165.26	1625.07	741.51	357.94	372.26	79	101.11	222.27
1991	24971.59	16691.98	15369.5	10503.9	7003.66	3735.08	898.88	495.8	237.86	250.49	48.39	41.25
1992	19572.3	19513.03	9028.95	5840.63	3583.45	2578.95	1583.14	369.49	190.57	78.92	135.41	48.95
1993	23780.38	15553.02	12295.94	4074.24	2357.85	1691.54	1302.54	741.5	191.21	99.02	31.14	24.69
1994	16877.27	18278.96	10371.21	5824.28	1829.15	1154.09	939.73	661.06	385.4	107.69	50.31	5.24
1995	38973.1	13193.6	11381.49	6081.64	2625.86	822.57	492.47	491.6	267.07	179.82	62.83	47.22
1996	24356.89	31548.35	9879.98	6180.4	3317.95	1084.88	361.3	185.14	228.76	124.55	81.17	22.17
1997	33517.36	19673	24846.05	7052.1	3748.97	1670.51	416.81	176.37	81.9	129.38	61.26	47.91
1998	12756.42	27130.43	15354.06	18134.42	4174.92	1861.44	803.08	191.95	80.15	40.82	62.5	54.1
1999	58813.51	10296.59	20684.24	10820.89	11702.9	2170.37	906.01	324.53	87.49	36.67	8.08	58.61
2000	35840.25	47861.07	7837.47	14133.45	6551.15	5859.93	949.02	397.94	132.69	49.91	5.59	13.84
2001	88038.88	28609.69	36624.64	5074	7618.26	3349.46	2332.02	462.11	157.51	57.97	24.58	16.29
2002	105902.44	71062.19	21204.97	22351.6	2204.31	2907.5	1349.76	702.24	113.23	47.52	25.74	3.19

year	3	4	5	6	7	8	9	10	11	12	13	14+
2003	64250.85	86432.32	50581.07	11966.52	9445.21	1024.77	1222.27	684.34	247.4	62.84	6.33	0
2004	53951.7	52305.55	68564.24	31321.53	6183.44	3854.04	461.69	621.58	285.22	120.21	15.26	2.98
2005	69984.38	44103.14	41004.54	48404.72	17715.72	3139.79	1520.38	138.22	243.79	101.41	7.94	0
2006	22222.42	56887.57	33441.14	24988.39	24604.7	8080.96	1807.87	511.87	84.21	107.3	58.6	24.27
2007	18880.03	16859.55	42010.7	20338.75	13480.66	10828.42	3213.94	901.06	163.92	39.99	77	25.56
2008	31507.33	14705.74	10799.37	24166.26	10794.95	7615.84	4980.19	1239.71	370.36	60.91	22.79	0
2009	13723.87	21467.28	9227.81	5586.17	11307.34	5586.17	4223.87	2224.33	613.24	159.36	39.01	12.96
2010	24290.81	10820.83	10869.27	3050.81	2906.86	4582.37	2755.75	1923.6	853.85	237.87	93.37	0
2011	34720.15	17784.79	6220.84	4105.17	1479.85	1466.95	1853.38	1126.98	822.09	358.86	148.6	17.37
2012	34439.89	26709.98	12078.08	3337.81	1728.71	779.99	721.48	880.41	451.27	275.85	168.94	38.35
2013	35951.06	27419.74	12971.02	6140.86	1599.91	600.09	363.53	312.91	359.79	162.26	102.79	93.87
2014	61619.17	28781.85	17769.57	6802.26	2999.07	847.52	302.2	187.24	169.32	162.46	55.94	3.47
2015	26993.00	49649.00	21472.00	11711.00	4048.00	1674.00	396.00	158.00	70.00	75.00	83.00	33.00

Table 6.3.3. Faroe saithe (Division Vb). Summary table (1961-2014). Values for 2015-2017 are estimates.

year	Recruits (age 3)	SSB (tonnes)	Yield (tonnes)	Yield/SSB	Fbar(4-8)
1961	7827	68467	9592	0.13	0.106
1962	12256	72862	10454	0.154	0.125
1963	19837	76441	12693	0.173	0.114
1964	14811	80928	21893	0.272	0.23
1965	22362	84690	22181	0.284	0.214
1966	21229	87313	25563	0.3	0.25
1967	24897	85361	21319	0.241	0.204
1968	22879	93938	20387	0.213	0.16
1969	39798	103452	27437	0.274	0.191
1970	37092	109688	29110	0.275	0.189
1971	38446	121969	32706	0.245	0.179
1972	33424	137956	42663	0.308	0.236
1973	23621	130735	57431	0.439	0.318
1974	19420	134009	47188	0.352	0.272
1975	17327	135484	41576	0.307	0.297
1976	19709	129099	33065	0.256	0.267
1977	13106	122227	34835	0.273	0.328
1978	8332	105216	28138	0.266	0.243
1979	8686	96036	27246	0.277	0.257
1980	13075	96216	25230	0.264	0.211
1981	33145	85056	30103	0.37	0.382
1982	15676	94389	30964	0.341	0.336
1983	40830	98639	39176	0.397	0.385
1984	26075	104707	54665	0.523	0.478
1985	22332	110005	44605	0.431	0.382
1986	61856	91583	41716	0.484	0.505
1987	48619	94297	40020	0.441	0.396
1988	44854	103005	45285	0.443	0.456
1989	28601	107398	44477	0.427	0.36
1990	20712	103216	61628	0.609	0.562
1991	24971	76177	54858	0.725	0.703
1992	19572	59993	36487	0.579	0.52
1993	23780	59260	33543	0.557	0.451
1994	16877	57407	33182	0.564	0.491
1995	38973	55521	27209	0.48	0.442
1996	24356	60584	20029	0.32	0.344
1997	33517	68222	22306	0.327	0.304
1998	12756	74050	26421	0.349	0.287
1999	58813	77635	33207	0.42	0.335
2000	35840	80387	39020	0.478	0.383
2001	88038	83993	51786	0.616	0.5
2002	105902	81692	53546	0.655	0.481

year	Recruits (age 3)	SSB (tonnes)	Yield (tonnes)	Yield/SSB	Fbar(4-8)
2003	64250	97221	46555	0.478	0.413
2004	53951	112980	46355	0.409	0.354
2005	69984	127585	67967	0.533	0.357
2006	22222	127123	66902	0.528	0.432
2007	18880	120818	60785	0.505	0.396
2008	31507	104362	57044	0.542	0.427
2009	13723	93278	57949	0.614	0.61
2010	24290	69401	43885	0.632	0.568
2011	34720	56238	29658	0.527	0.445
2012	34439	49174	35314	0.718	0.591
2013	35951	48637	26463	0.544	0.423
2014	61619	70026	23854	0.341	0.315
2015	26993	82089	35361		0.314
2016	26993	96782	37467		0.314
2017	26993	104194			
Avg.	31662	92151	36994	0.41	0.36

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

2015								
Age	N	M	Mat	PF	PM	SWt	Sel	CWt
3	26993	0.2	0.04	0	0	1.299	0.016	1.299
4	49649	0.2	0.26	0	0	1.528	0.201	1.528
5	21472	0.2	0.51	0	0	1.850	0.269	1.850
6	11711	0.2	0.74	0	0	2.239	0.324	2.239
7	4048	0.2	0.90	0	0	2.602	0.397	2.602
8	1674	0.2	0.98	0	0	4.451	0.381	4.451
9	396	0.2	0.98	0	0	5.296	0.366	5.296
10	158	0.2	1.00	0	0	5.942	0.448	5.942
11	70	0.2	1.00	0	0	6.088	0.480	6.088
12	75	0.2	1.00	0	0	6.634	1.000	6.634
13	83	0.2	1.00	0	0	7.402	1.000	7.402
14	33	0.2	1.00	0	0	8.232	1.000	8.232
2016								
Age	N	M	Mat	PF	PM	SWt	Sel	CWt
3	26993	0.2	0.04	0	0	1.299	0.016	1.299
4	-	0.2	0.26	0	0	1.528	0.201	1.528
5	-	0.2	0.51	0	0	1.850	0.269	1.850
6	-	0.2	0.74	0	0	2.239	0.324	2.239
7	-	0.2	0.90	0	0	2.602	0.397	2.602
8	-	0.2	0.98	0	0	4.451	0.381	4.451
9	-	0.2	0.98	0	0	5.296	0.366	5.296
10	-	0.2	1.00	0	0	5.942	0.448	5.942
11	-	0.2	1.00	0	0	6.088	0.480	6.088
12	-	0.2	1.00	0	0	6.634	1.000	6.634
13	-	0.2	1.00	0	0	7.402	1.000	7.402
14	-	0.2	1.00	0	0	8.232	1.000	8.232
2017								
Age	N	M	Mat	PF	PM	SWt	Sel	CWt
3	26993	0.2	0.04	0	0	1.299	0.016	1.299
4	-	0.2	0.26	0	0	1.528	0.201	1.528
5	-	0.2	0.51	0	0	1.850	0.269	1.850
6	-	0.2	0.74	0	0	2.239	0.324	2.239
7	-	0.2	0.90	0	0	2.602	0.397	2.602
8	-	0.2	0.98	0	0	4.451	0.381	4.451
9	-	0.2	0.98	0	0	5.296	0.366	5.296
10	-	0.2	1.00	0	0	5.942	0.448	5.942
11	-	0.2	1.00	0	0	6.088	0.480	6.088
12	-	0.2	1.00	0	0	6.634	1.000	6.634
13	-	0.2	1.00	0	0	7.402	1.000	7.402
14	-	0.2	1.00	0	0	8.232	1.000	8.232

Input units are thousands and kg - output in tonnes

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

2015						
Biomass	SSB	FMult	FBar	Landings		
199713	82089	1.000	0.314	35361		
2016					2017	
Biomass	SSB	FMult	FBar	Landings	Biomass	SSB
195333	96782	0.0000	0.0000	0	232926	138536
.	96782	0.1000	0.0314	4263	228057	134572
.	96782	0.2000	0.0629	8399	223339	130737
.	96782	0.3000	0.0943	12414	218766	127027
.	96782	0.4000	0.1258	16310	214335	123437
.	96782	0.5000	0.1572	20092	210039	119962
.	96782	0.6000	0.1886	23764	205875	116600
.	96782	0.7000	0.2201	27329	201838	113345
.	96782	0.8000	0.2515	30791	197924	110195
.	96782	0.9000	0.2830	34153	194128	107146
.	96782	1.0000	0.3144	37418	190448	104194
.	96782	1.1000	0.3458	40590	186878	101335
.	96782	1.2000	0.3773	43671	183416	98567
.	96782	1.3000	0.4087	46664	180058	95887
.	96782	1.4000	0.4402	49572	176800	93292
.	96782	1.5000	0.4716	52398	173640	90778
.	96782	1.6000	0.5030	55144	170574	88344
.	96782	1.7000	0.5345	57813	167599	85986
.	96782	1.8000	0.5659	60407	164713	83701
.	96782	1.9000	0.5974	62929	161911	81488
.	96782	2.0000	0.6288	65380	159192	79345

Input units are thousands and kg - output in tonnes

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

Age	M	Mat	PF	PM	WeSt	Sel	WeCa
3	0.2	0.02	0	0	1.304	0.048	1.304
4	0.2	0.21	0	0	1.668	0.278	1.668
5	0.2	0.47	0	0	2.031	0.467	2.031
6	0.2	0.71	0	0	2.602	0.5118	2.602
7	0.2	0.86	0	0	3.373	0.52	3.373
8	0.2	0.95	0	0	4.318	0.5648	4.318
9	0.2	0.99	0	0	5.085	0.5572	5.085
10	0.2	1	0	0	5.904	0.6514	5.904
11	0.2	1	0	0	6.777	0.7174	6.777
12	0.2	1	0	0	7.472	0.5888	7.472
13	0.2	1	0	0	7.835	0.4844	7.835
14	0.2	1	0	0	9.388	0.4844	9.388

Table 6.9.1. Faroe saithe (Division Vb). Comparison between the current assessment (NWWG2015 SPALY) statistical assessment (NWWG2015 ADMB) and predictions from last year in the terminal year (2014).

	NWWG2014 prediction	NWWG2015 (SPALY)	NWWG2015 (ADMB)
Recruitment	28 mill.	62 mill.	20 mill.
SSB	70 000 t.	70 000 t.	94 000 t.
Fbar(4-8)	0.53	0.32	0.23
Landings	38 000 t.	24 000 t.	27 000 t.

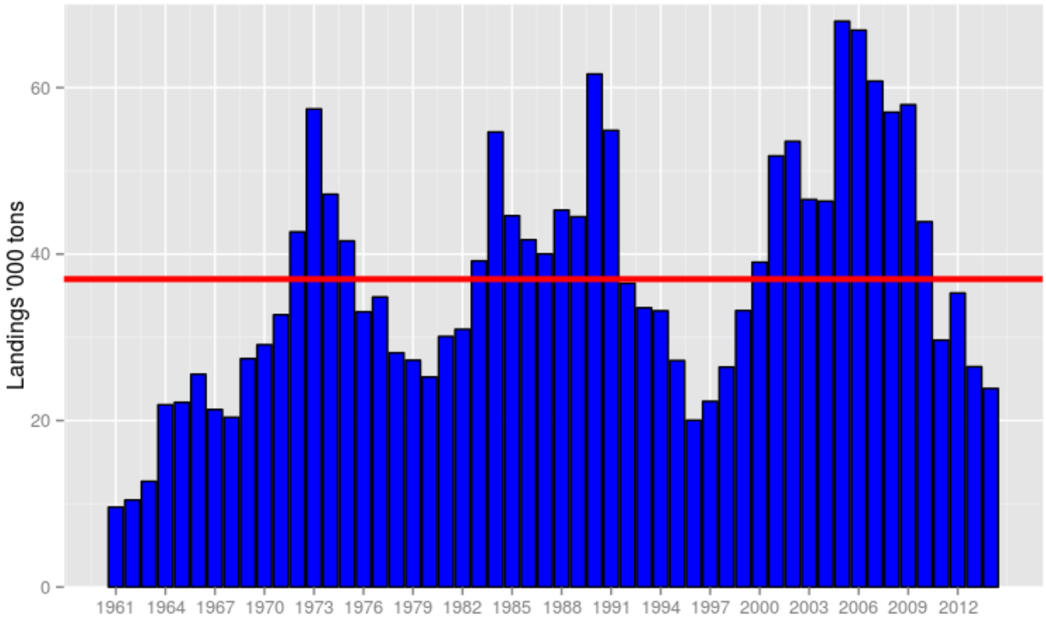


Figure 6.2.1.1. Faroe saithe (Division Vb). Landings in 1000 tonnes (1961-2014). Horizontal red line represents historical average landings.

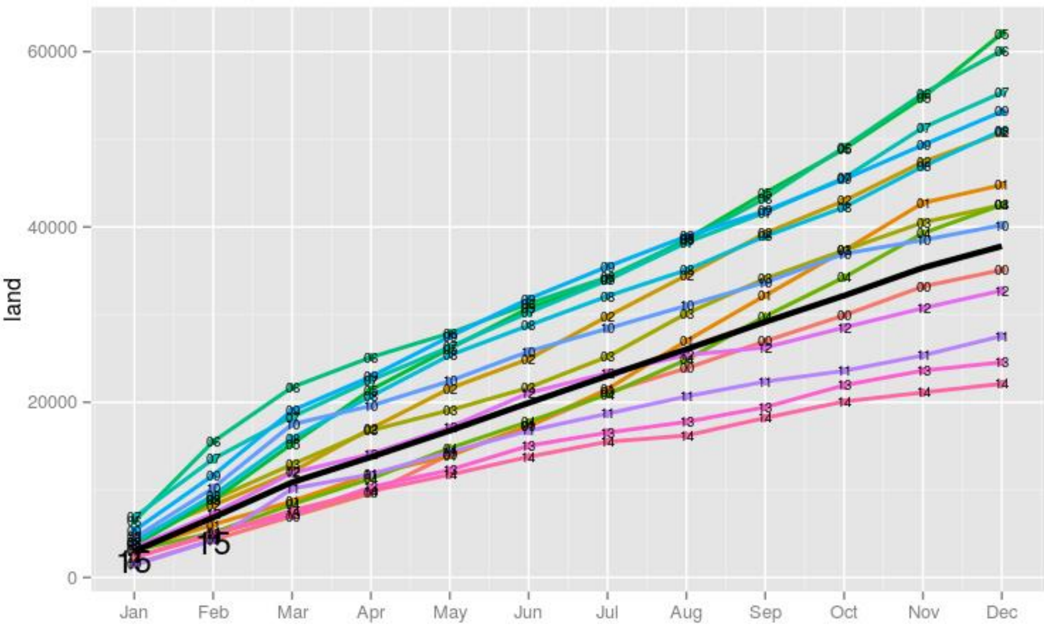


Figure 6.2.1.2. Saithe in the Faroes (Division Vb). Cumulative domestic landings (2000-2015).

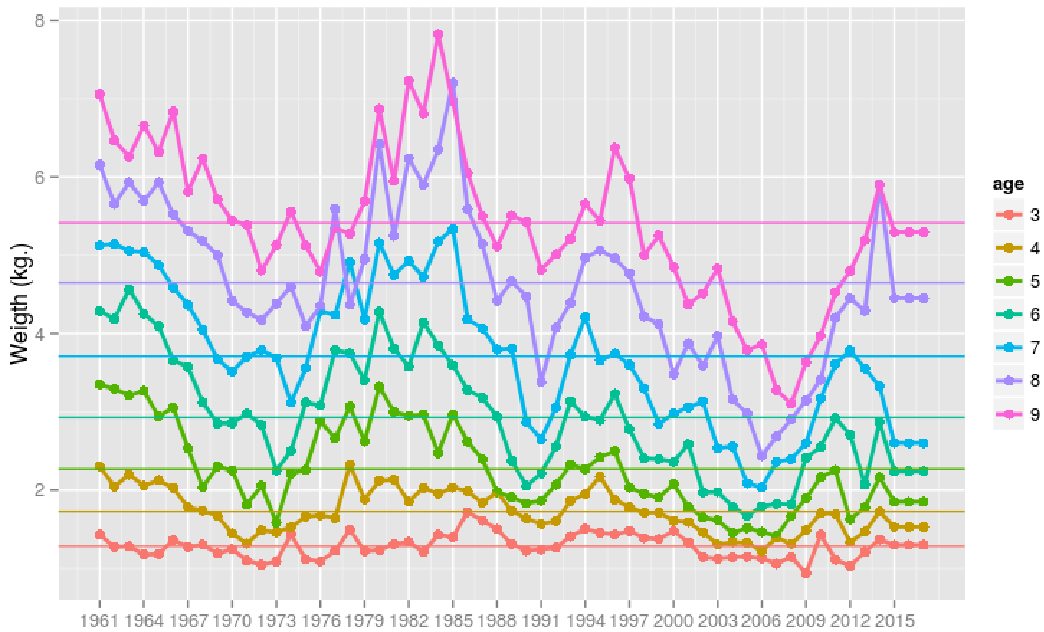


Figure 6.2.3.1. Faroe saithe (Division Vb). Mean weight at age (kg) in commercial catches (ages 3-9) (1961-2017). Weights from 2015 to 2017 are estimates. Horizontal lines show historical average.

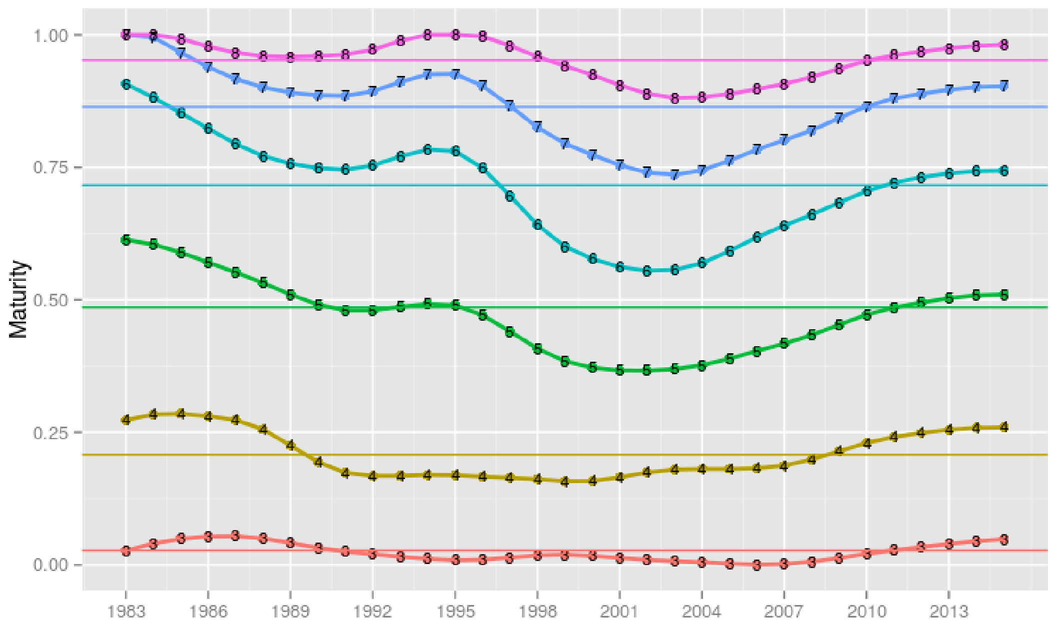


Figure 6.2.4.1. Faroe saithe (Division Vb). Smoothed maturity ogives (ages 3-8)(1983-2015) from FGFS1 (spring survey). Horizontal lines show historical average.

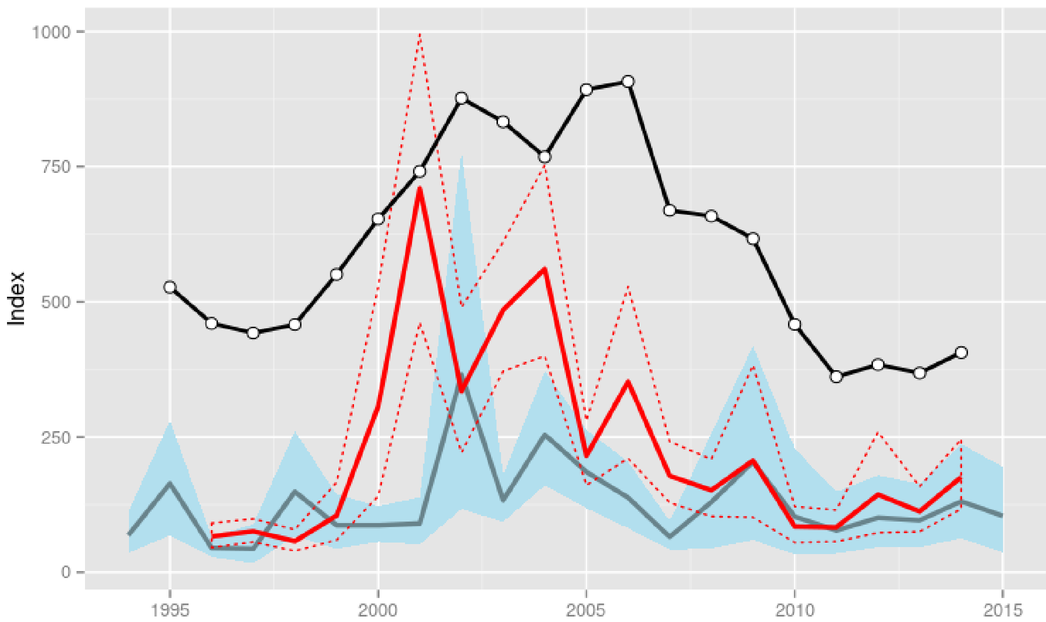


Figure 6.2.5.1.1. Faroe saithe (Division Vb). Predicted catch rates from the commercial fleet (pair-trawlers) used for tuning the assessment (black line). Catch rates (kg/hour) from the Faroese bottom-trawl fall FGFS2 (1996-2014)(red line) and spring survey FGFS1 (1994-2015)(blue line). Dotted lines and shade areas show standard errors in the estimation of indices.

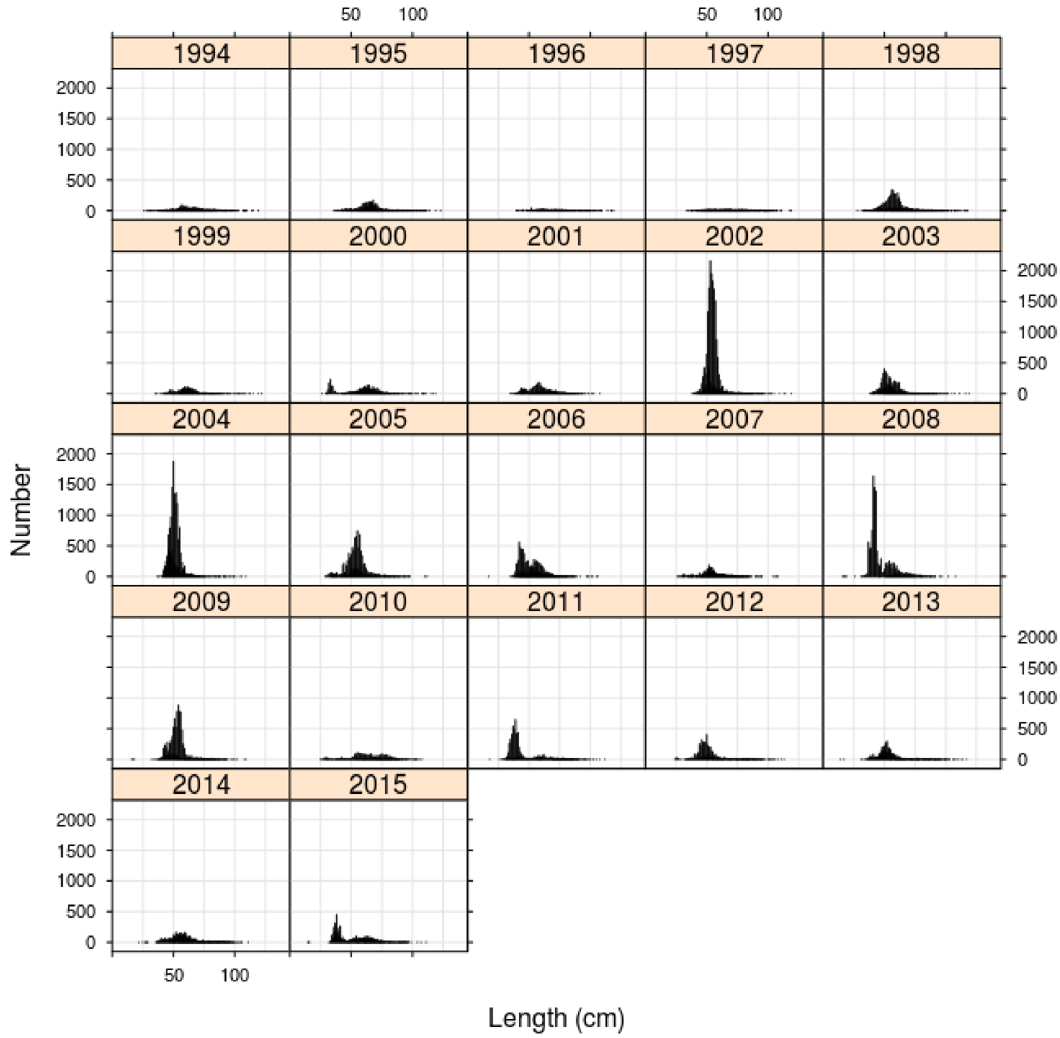


Figure 6.2.5.1.2. Faroe saithe (Division Vb). Length composition from the Faroese bottom-trawl spring survey FGFS1 (1994-2015)

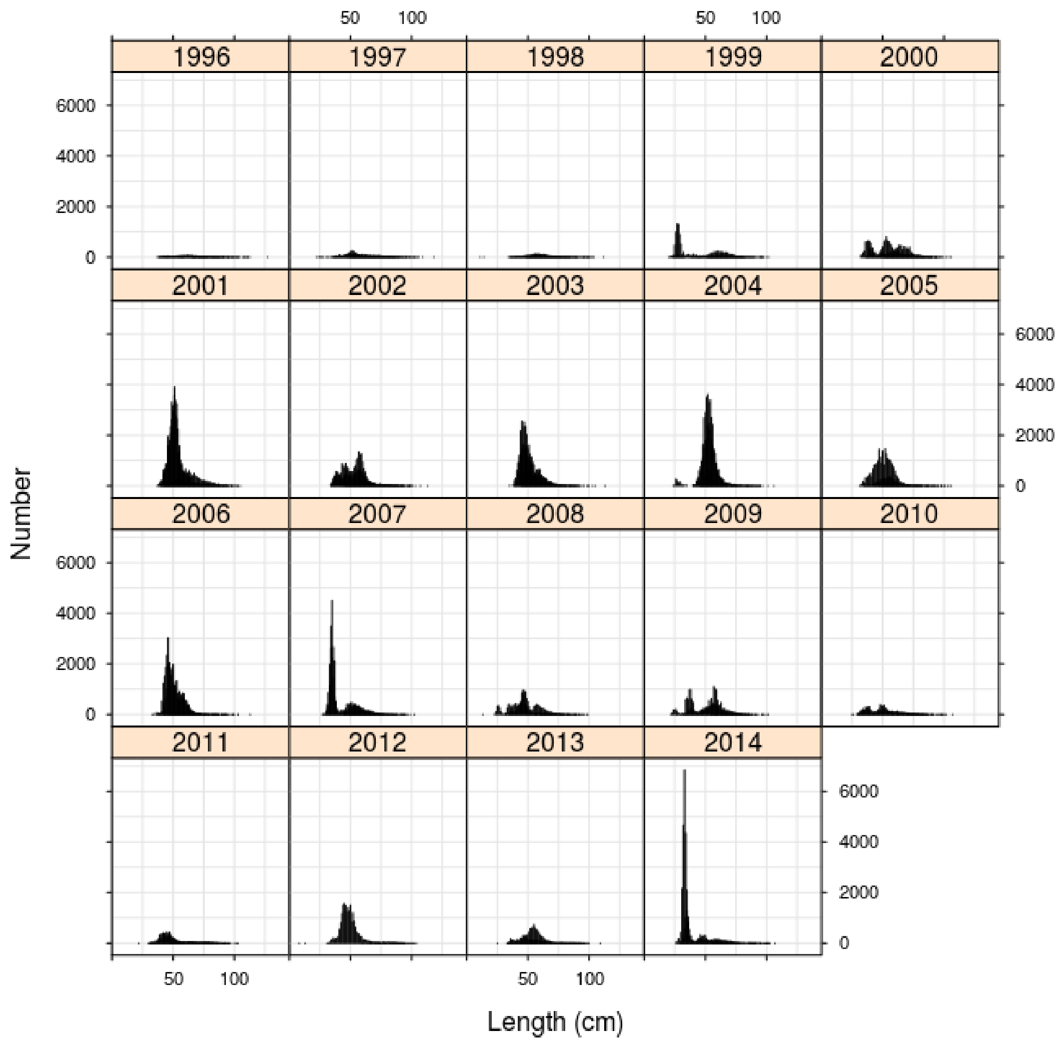


Figure 6.2.5.1.3. Faroe saithe (Division Vb). Length composition from the Faroese bottom-trawl summer survey FGFS2 (1996-2014)

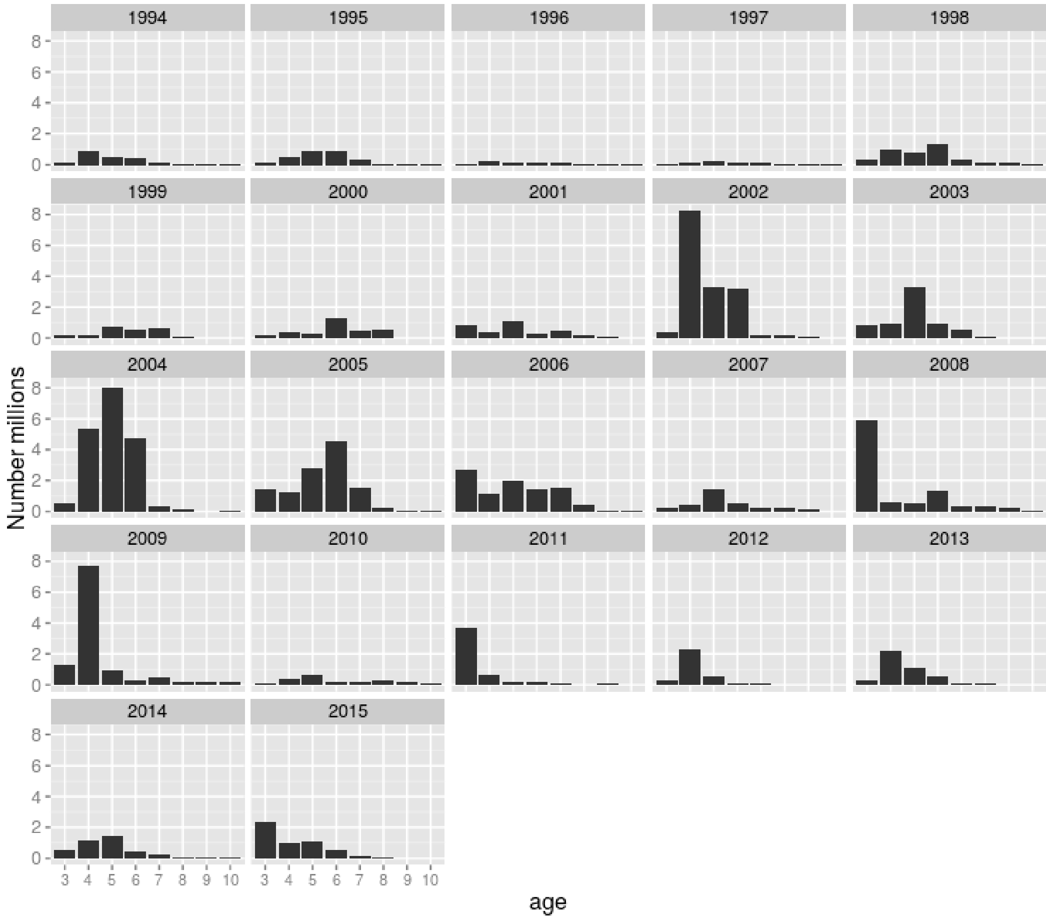


Figure 6.2.5.1.4. Faroe saithe (Division Vb). Age-disaggregated indices in the Faroese bottom-trawl spring survey FGFS1 (ages 3-10, years 1994-2015)

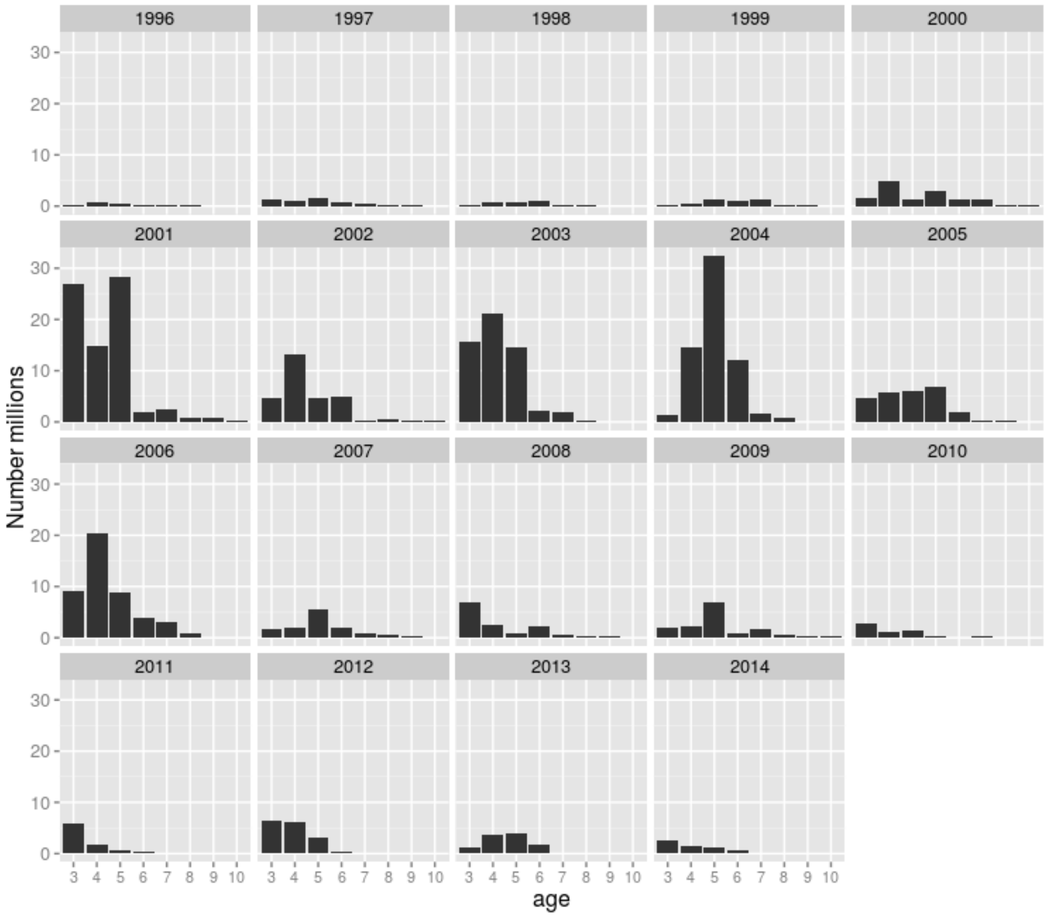


Figure 6.2.5.1.5. Faroe saithe (Division Vb). Age-disaggregated indices in the Faroese bottom-trawl fall survey FGFS2 (ages 3-10, years 1996-2014)

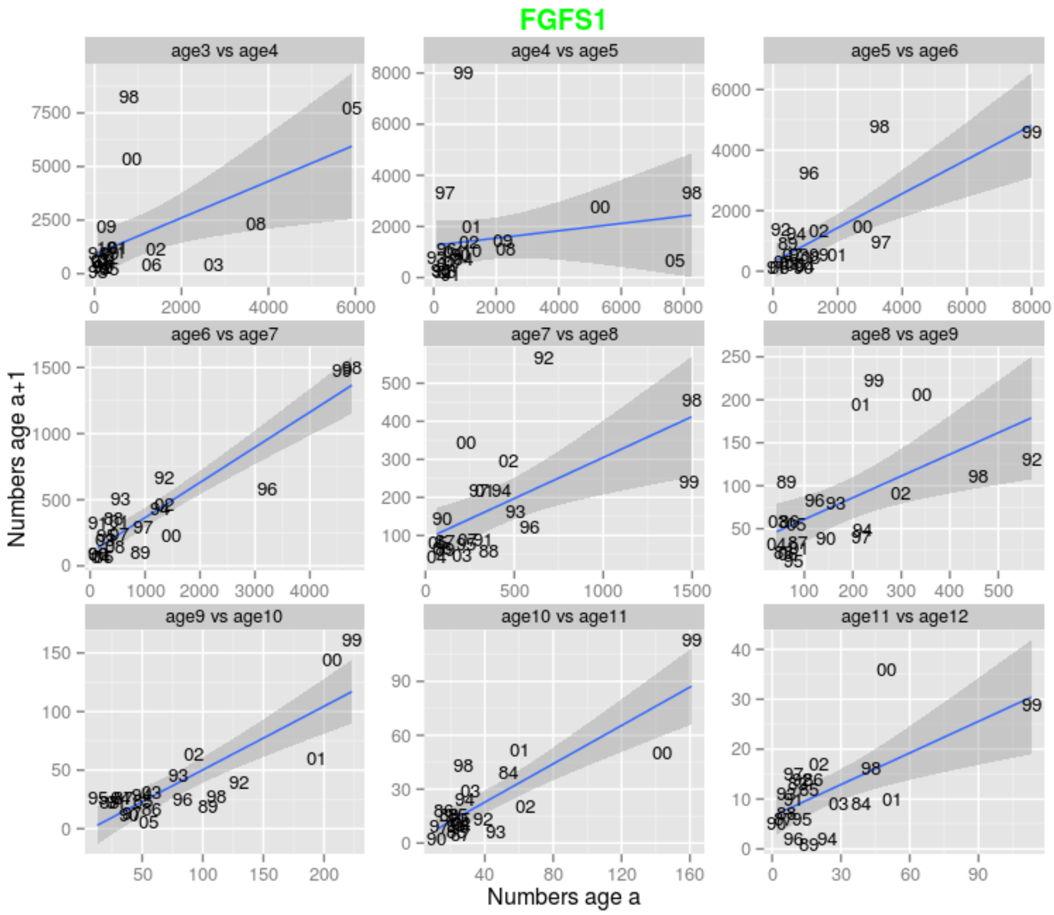


Figure 6.2.5.1.6. Faroe saithe (Division Vb). Numbers from spring survey (FGFS1) plotted against numbers of the same year class one year later. Letters in the figures represent year classes.

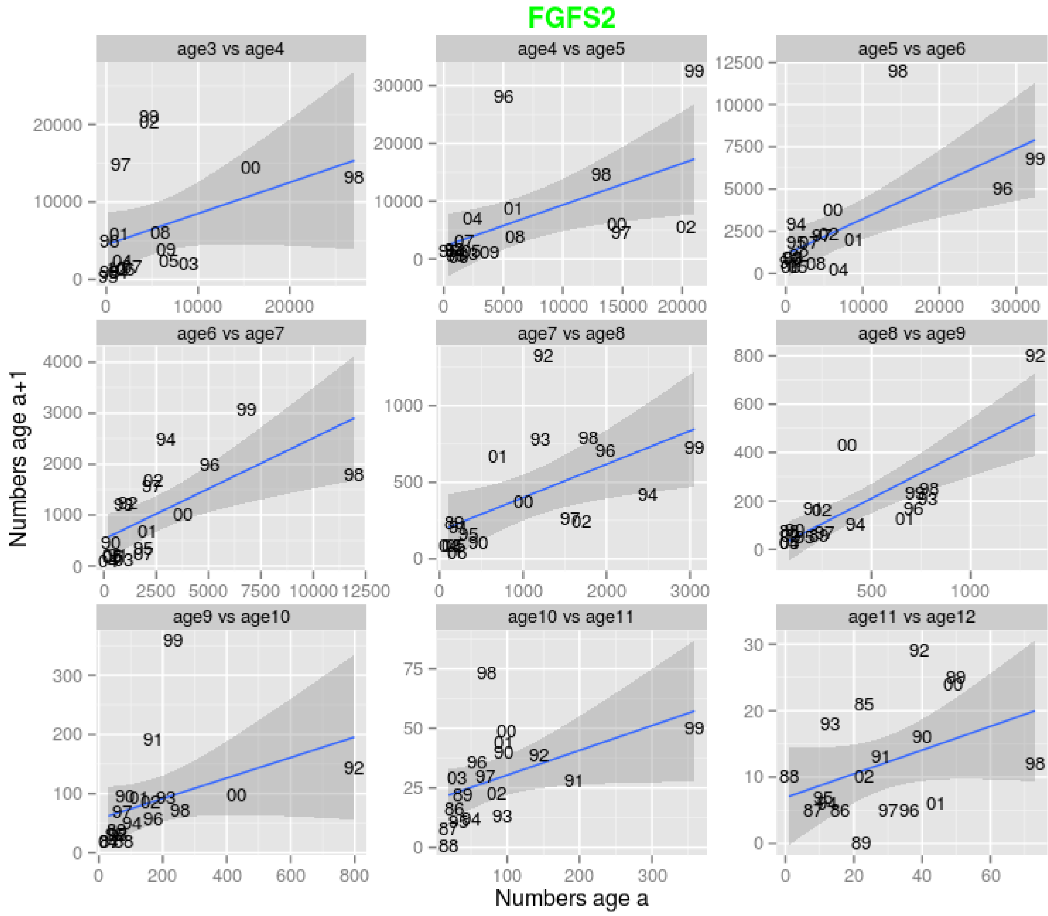


Figure 6.2.5.1.7. Faroe saithe (Division Vb). Numbers from summer survey (FGFS2) plotted against numbers of the same year class one year later. Letters in the figures represent year classes.

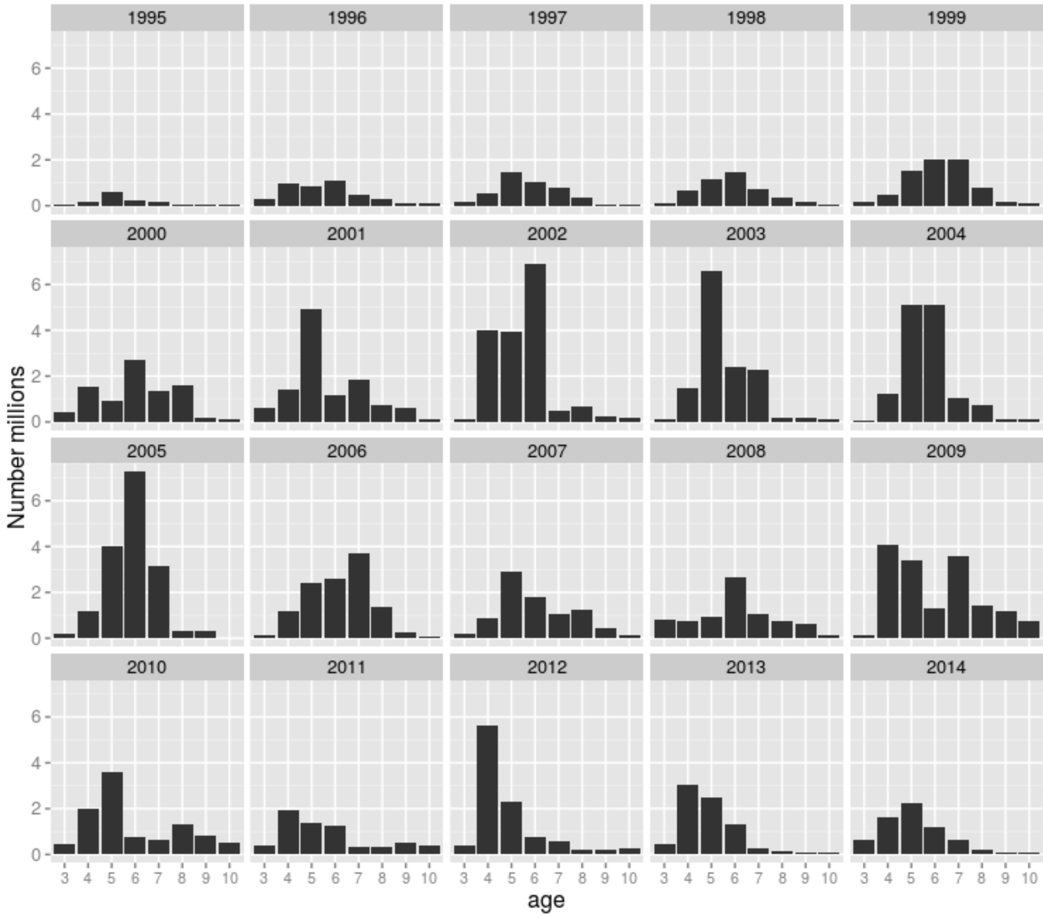


Figure 6.2.5.2.1. Faroe saithe (Division Vb). Age-disaggregated indices in the commercial pair-trawl fleet (ages 3-10, years 1995-2014)

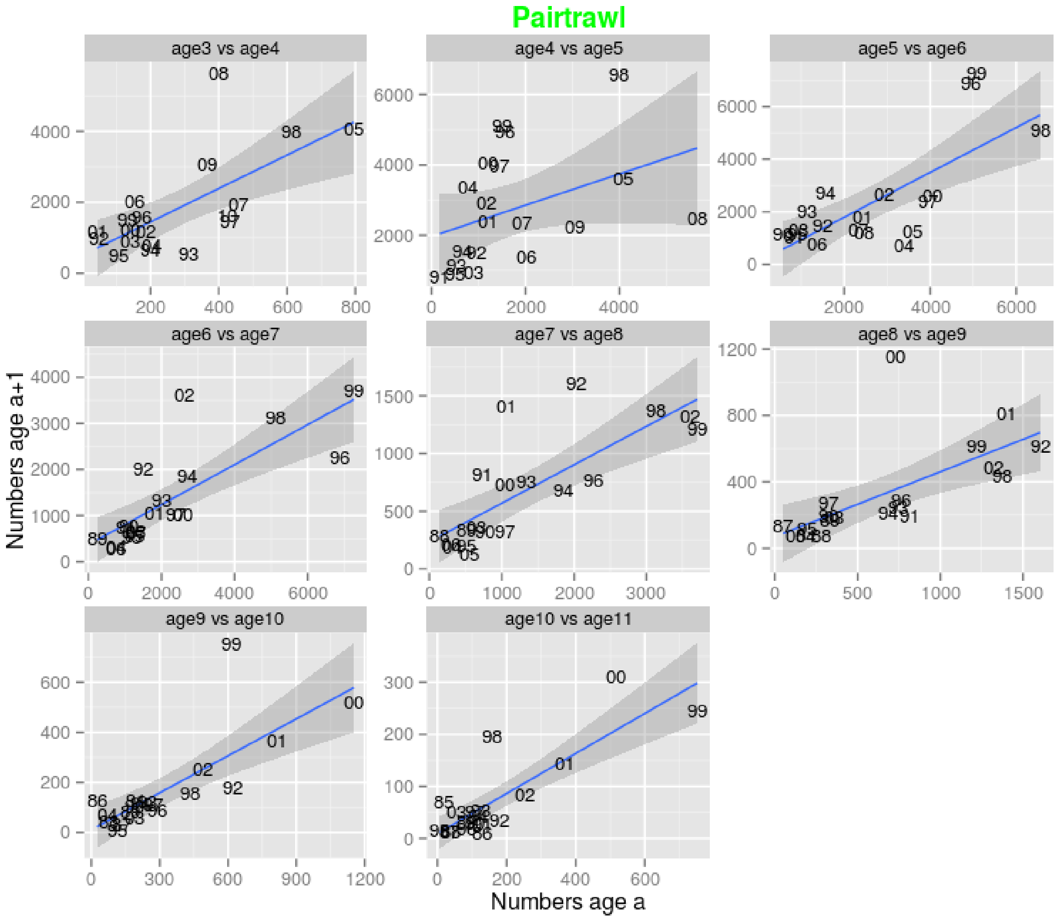


Figure 6.2.5.2.2. Faroe saithe (Division Vb). Indices from in the commercial pair-trawl plotted against indices of the same year class one year later. Letters in the figures represent year classes.

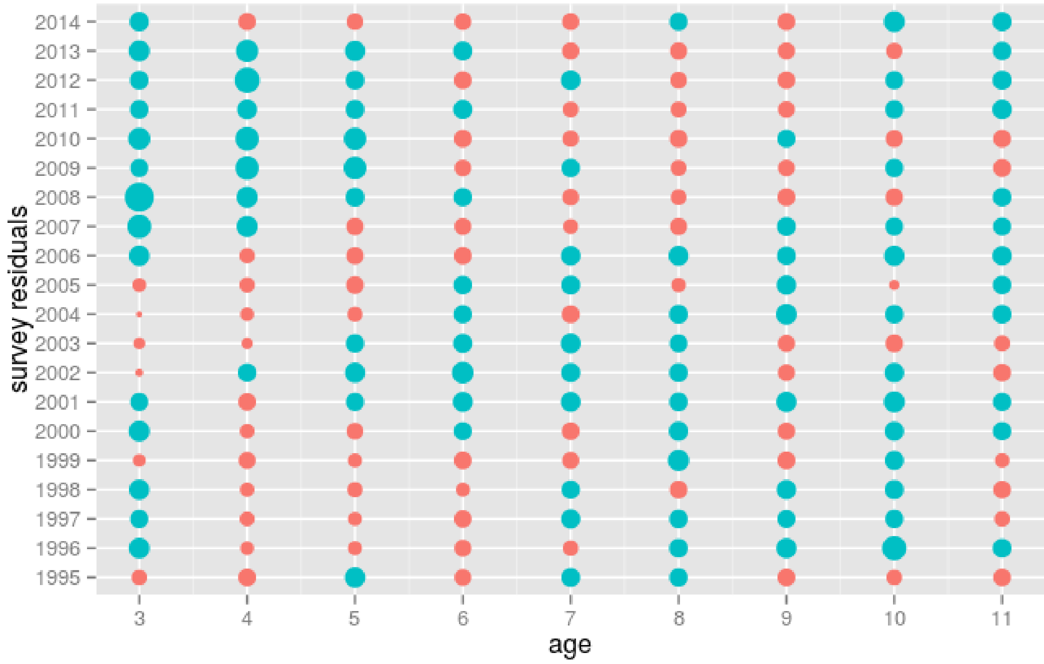


Figure 6.3.1. Faroe saithe (Division Vb). Log-catchability residuals of the spaly assessment calibrated with the commercial series (ages 3-11, years 1995-2014). Blue and red bubbles represent positive and negative residuals respectively.

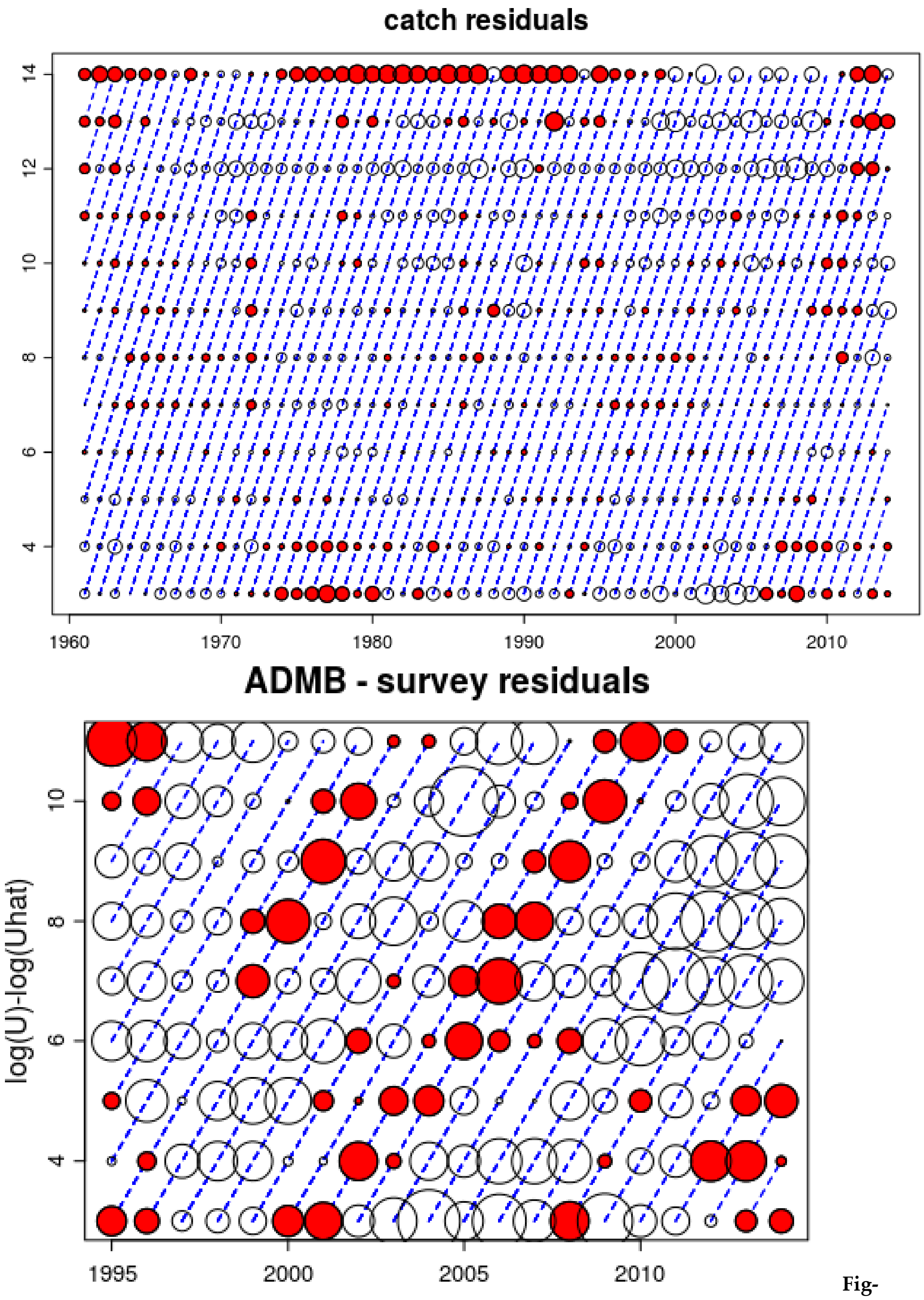


Figure 6.3.3. Faroe saithe (Division Vb). Catch- (ages 3-14+, years 1961-2014)(top plot) and survey-at-age (ages 3-11, years 1995-2014)(bottom plot) residuals from a statistical catch-at-age model. Red and white bubbles represent positive and negative residuals respectively.

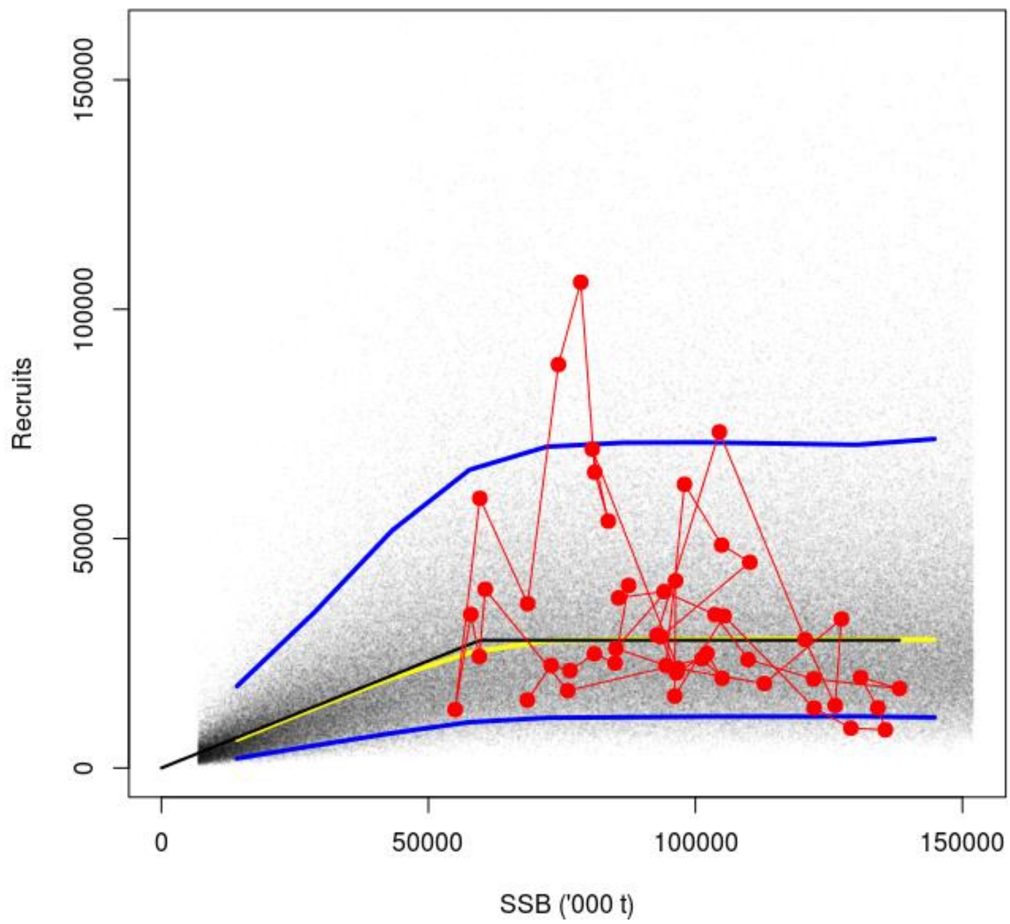


Figure 6.4.1.1. Faroe saithe (Division Vb). EqSim simulation. Stock-recruitment function used in the simulations (Hockey-stick).

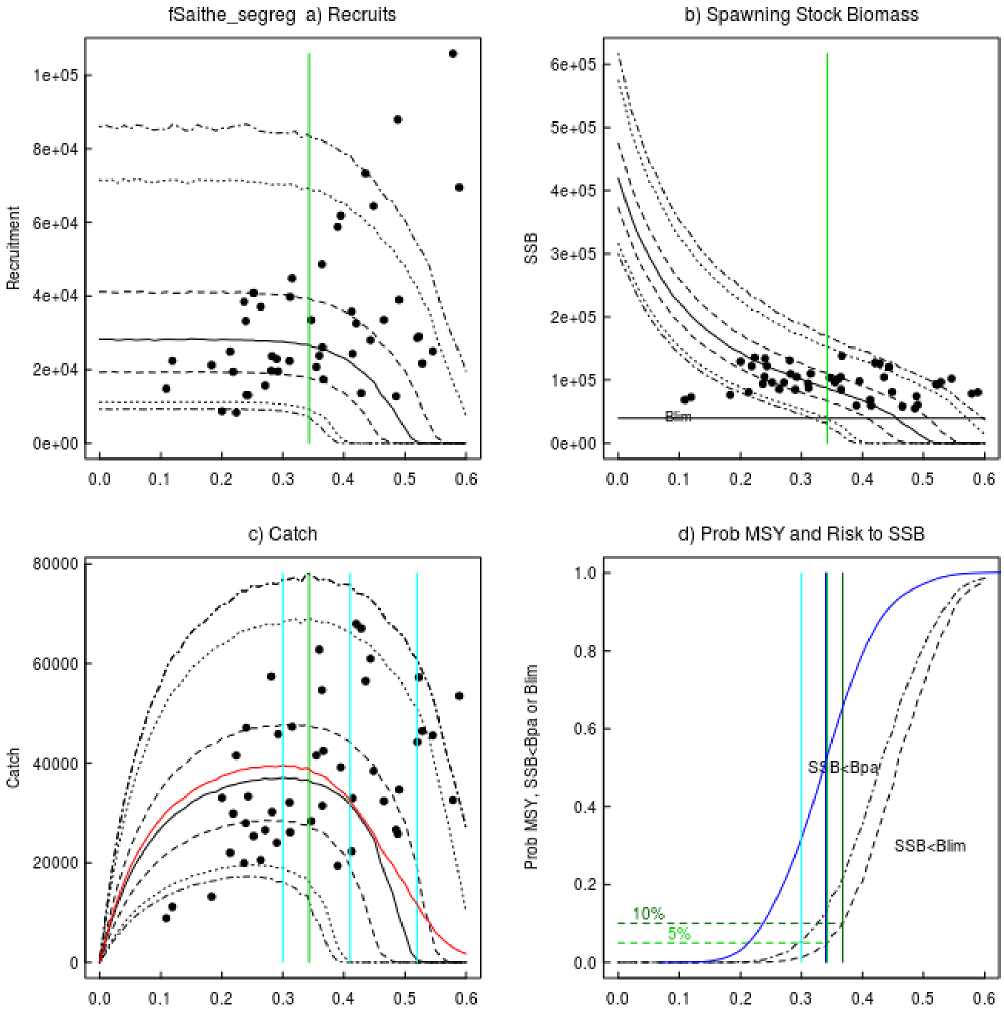


Figure 6.4.1.2. Faroe saithe (Division Vb). EqSim simulation outputs with assessment errors and Hockey-stick function from WKMSYREF2 report. Blim is undefined but was set as Blim=Bpa/1.4.

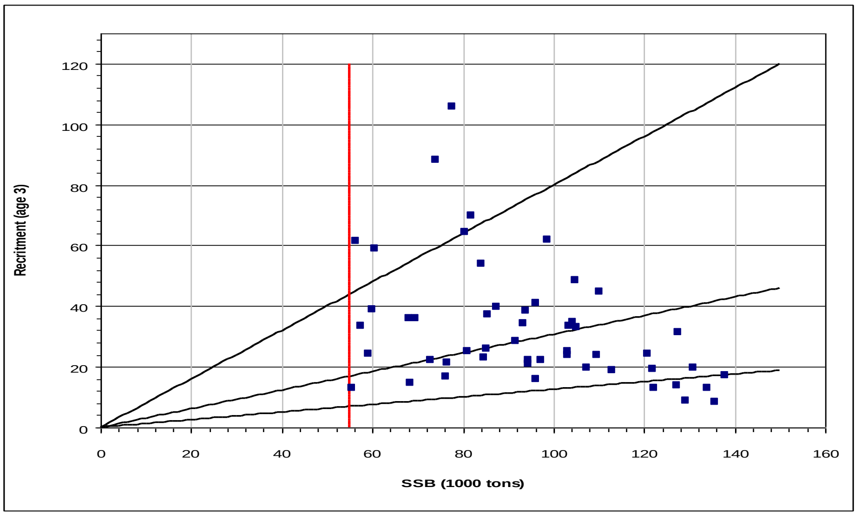


Figure 6.4.1.3. Faroe saithe (Division Vb). Stock-Recruitment plot in relation to Flow=0.13 (lowest regression line), Fmed=0.31 (middle regression line) and Fhigh=0.80 (top regression line). Vertical red line represents Btrigger= 55 000 t.

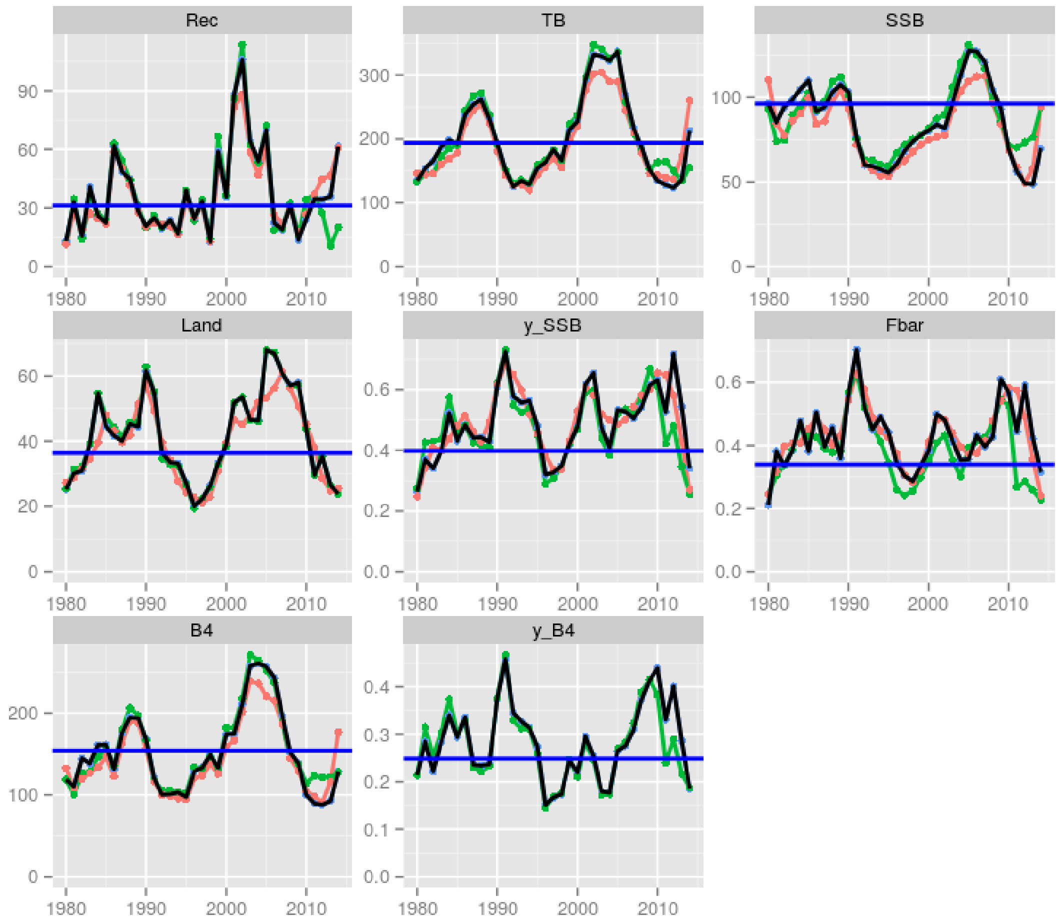


Figure 6.5.1. Faroe saithe (Division Vb). Recruitment (age 3) in millions (top-left), total stock biomass (thousand tonnes)(top-middle), spawning stock biomass (thousand tonnes) (bottom-left), landings (thousand tonnes)(middle-left), landings SSB ratio (middle-middle), Fbar (ages 4 to 8)(middle-right), reference biomass (B4+) (thousand tonnes) (bottom-left) and landings B4+ ratio (bottom-right). Black line represents the spaly run. Green lines show estimates from a catch-at-age statistical model implemented in ADMB. Red lines show a 'a4a' statistical model implemented in R. Horizontal blue lines represent historical averages.

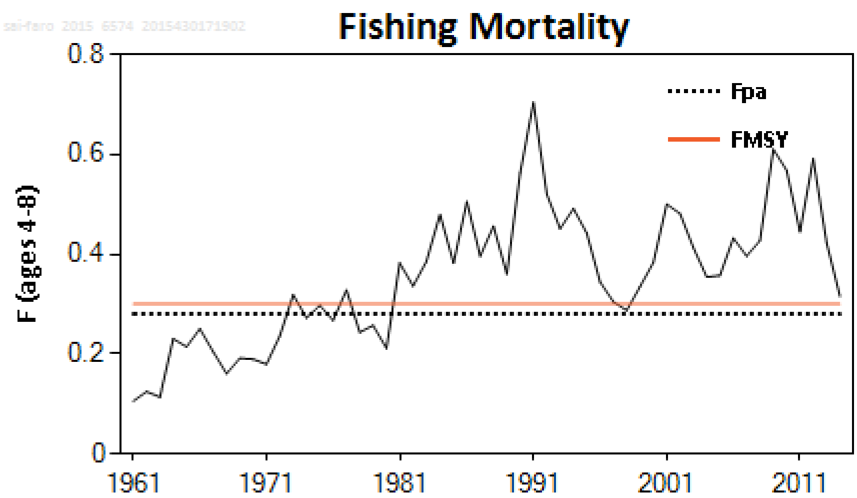


Figure 6.5.2. Faroe saithe (Division Vb). Fishing mortality (average over ages 4-8)(1961-2014)

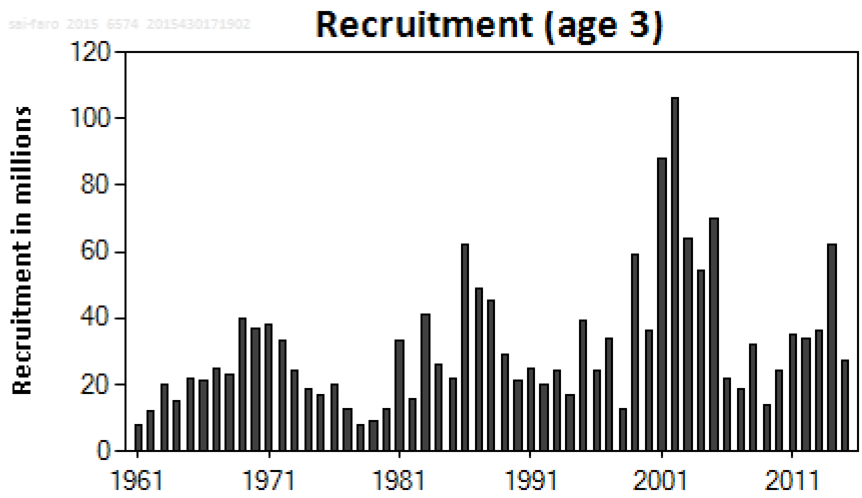


Figure 6.5.3. Faroe saithe (Division Vb). Recruitment at age 3 (millions)(1961-2015). The 2015 recruitment estimate is used in the short-term forecast.

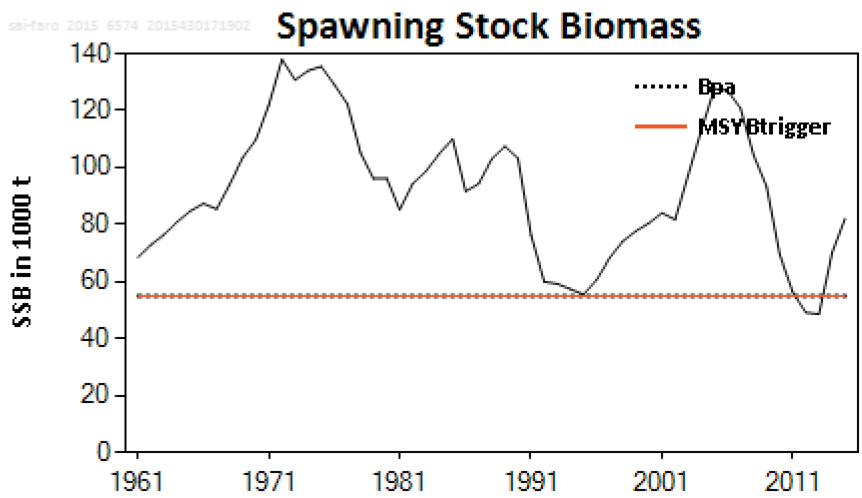


Figure 6.5.4. Faroe saithe (Division Vb). Spawning stock biomass ('000 tonnes)(1961-2015). The 2015 SSB estimate is used in the short-term forecast. Horizontal lines represent Btrigger=Bpa=55 000 t.

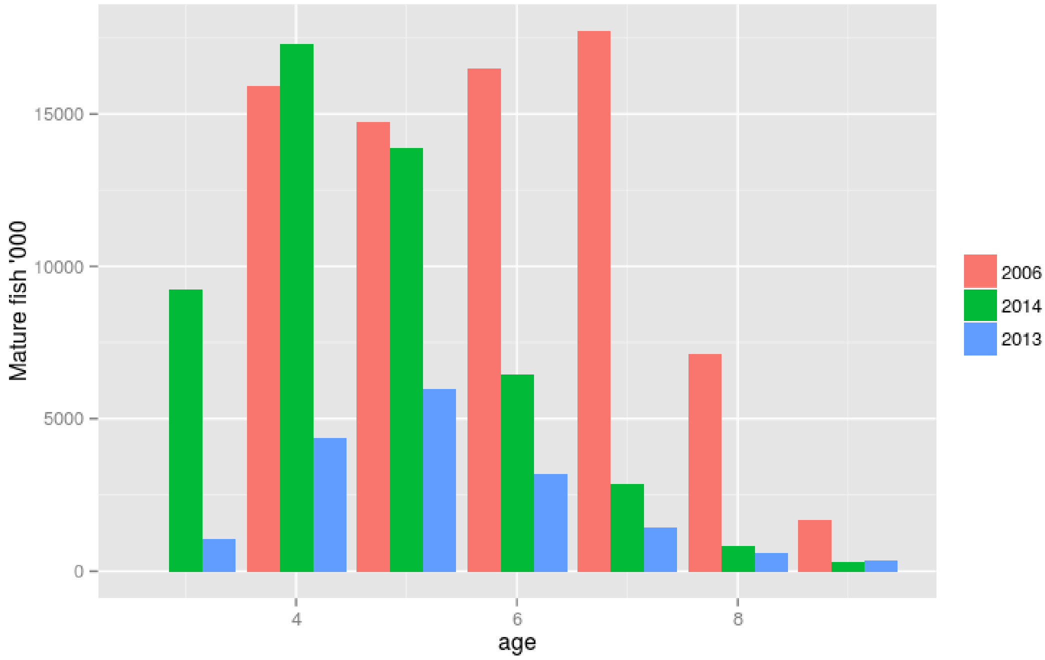


Figure 6.5.6. Faroe saithe (Division Vb). Numbers of mature fish in the stock (ages 3-9) for 2006, 2013 and 2014.

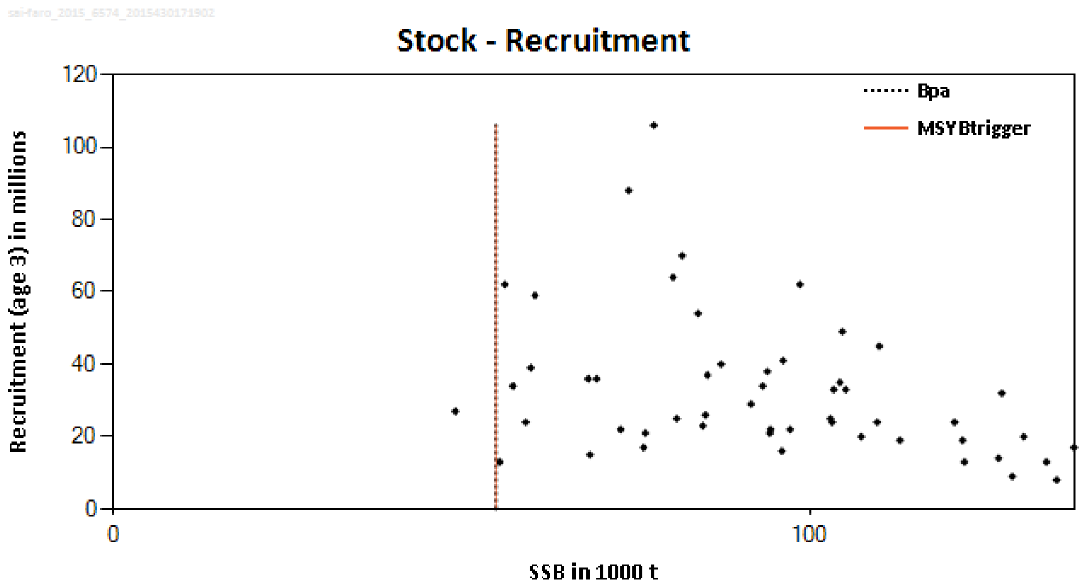


Figure 6.5.7. Faroe saithe (Division Vb). SSB - Recruitment (age 3) plot. Btrigger=Bpa=55 000 t.

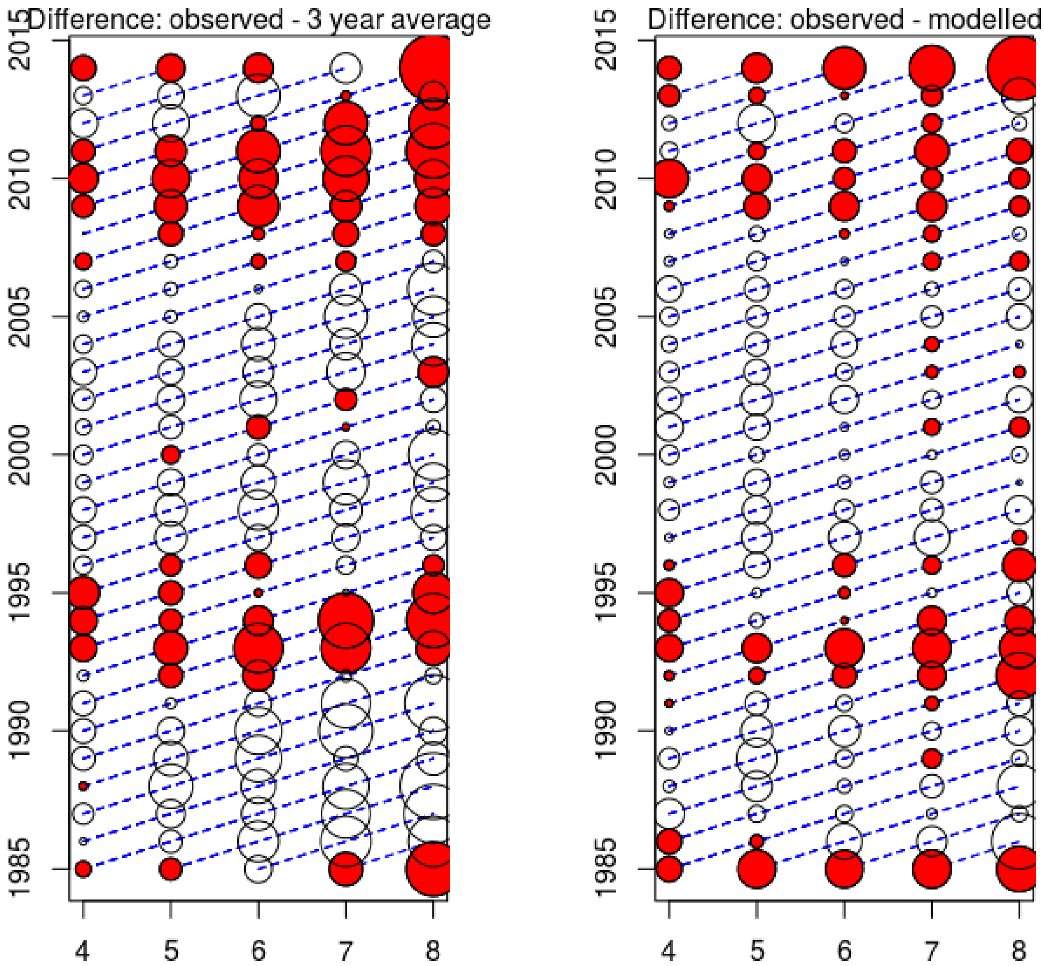


Figure 6.6.1.1. Faroe saithe (Division Vb). Residual plots from a 3-year running average weight model and the model in which weights are predicted from the previous year in the same year class. Red and white bubbles represent positive and negative residuals respectively.

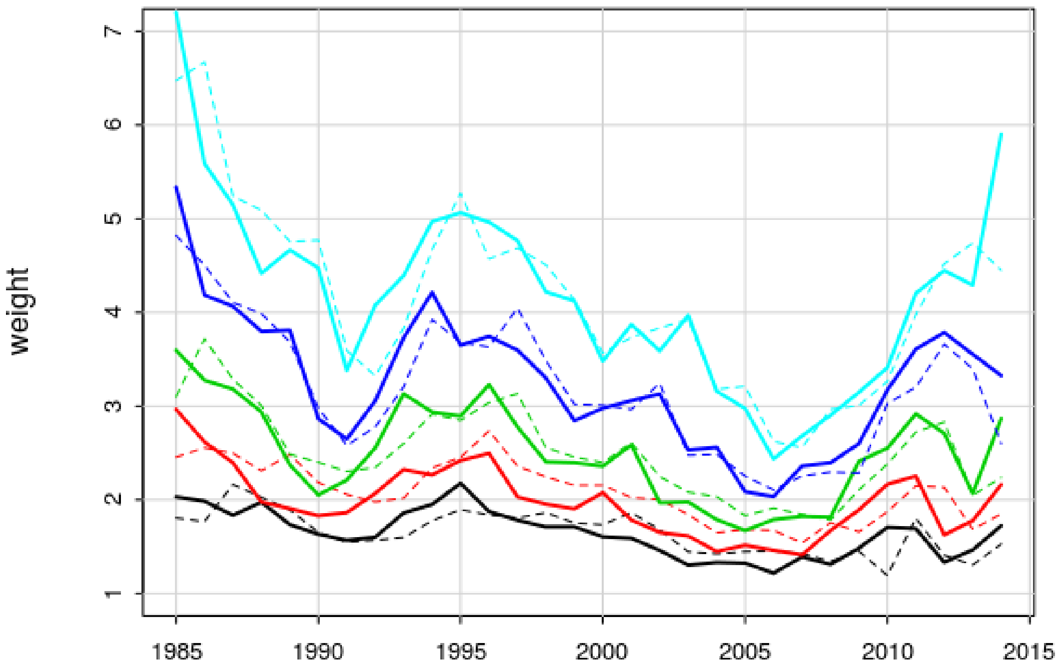


Figure 6.6.1.2. Faroe saithe (Division Vb). Observed (stapled lines) and predicted weights (solid lines)(ages 4-8, years 1985-2014)

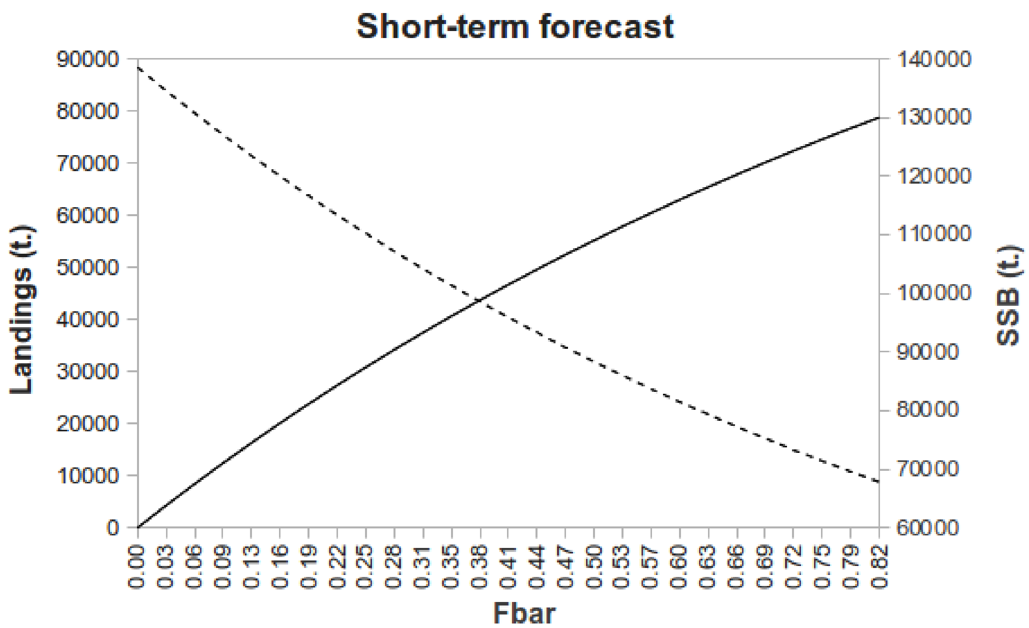
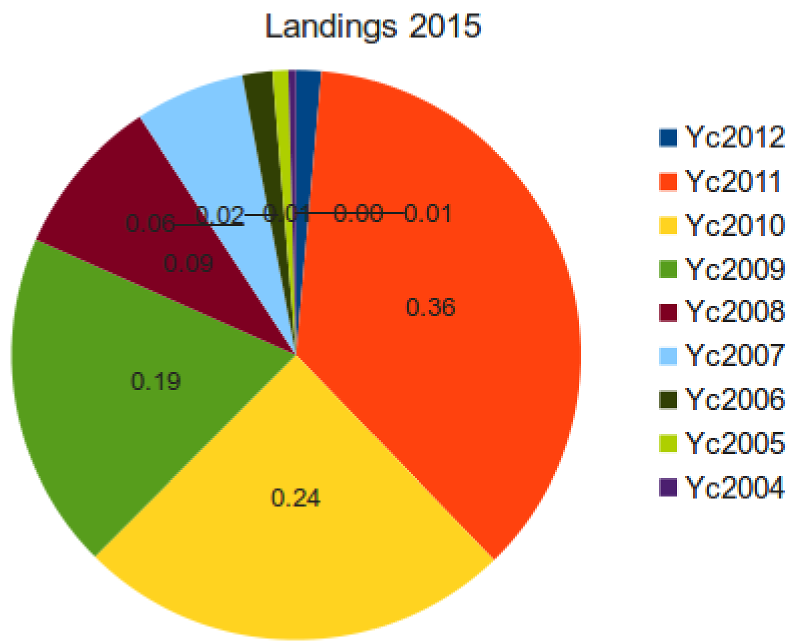


Figure 6.6.2.1. Faroe saithe (Division Vb). Short-term prediction output (spaly assessment). Solid and broken lines represent landings (t) and spawning stock biomass (t) respectively.



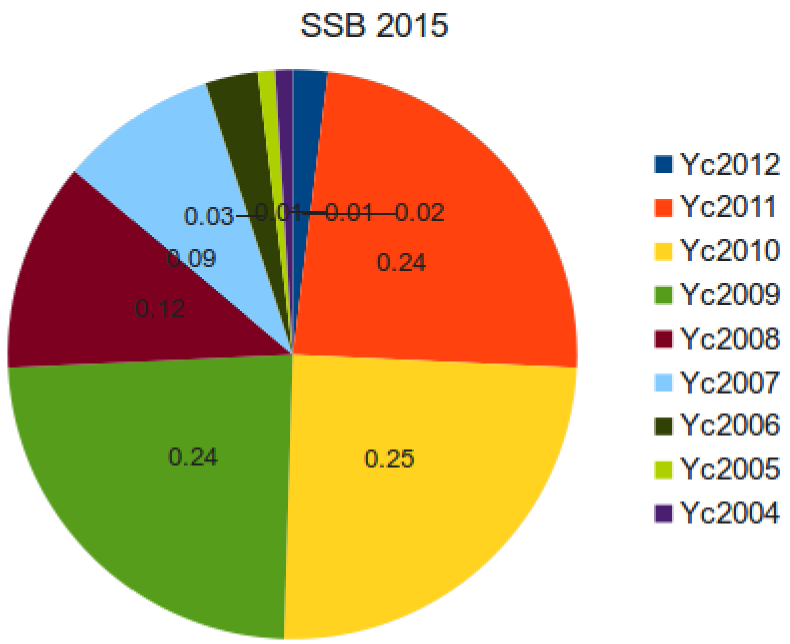


Figure 6.6.2.2 Faroe saithe (Division Vb). Composition of landings (upper figure) and SSB (lower figure) by year classes in 2015.

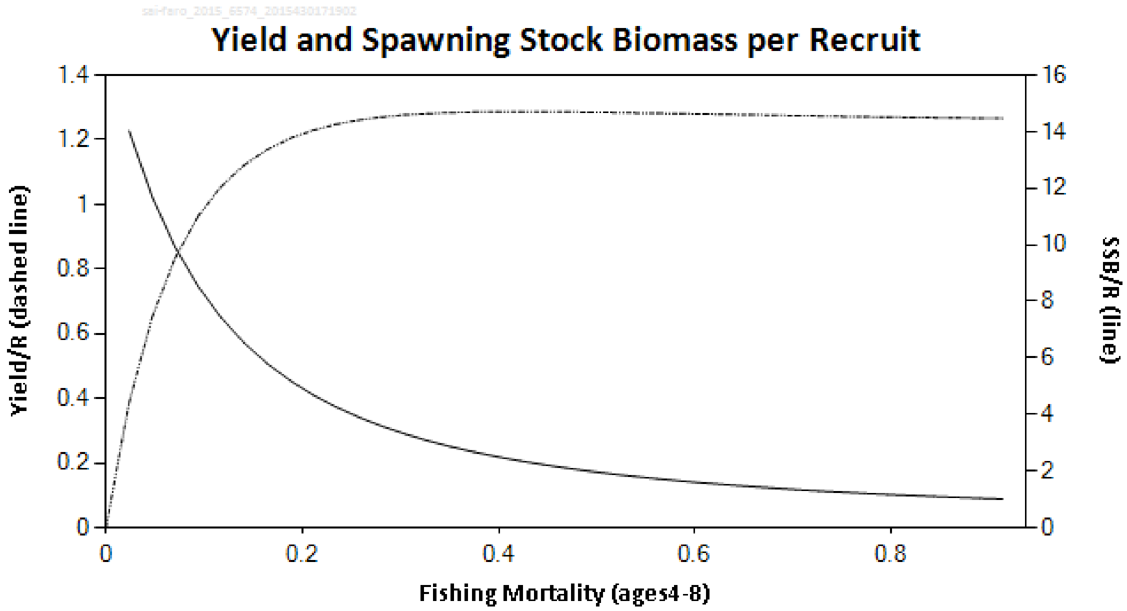


Figure 6.7.1.1. Faroe saithe (Division Vb). Yield and spawning per-recruit calculations. Dashed and solid lines represent Yield/R and SSB/R respectively.

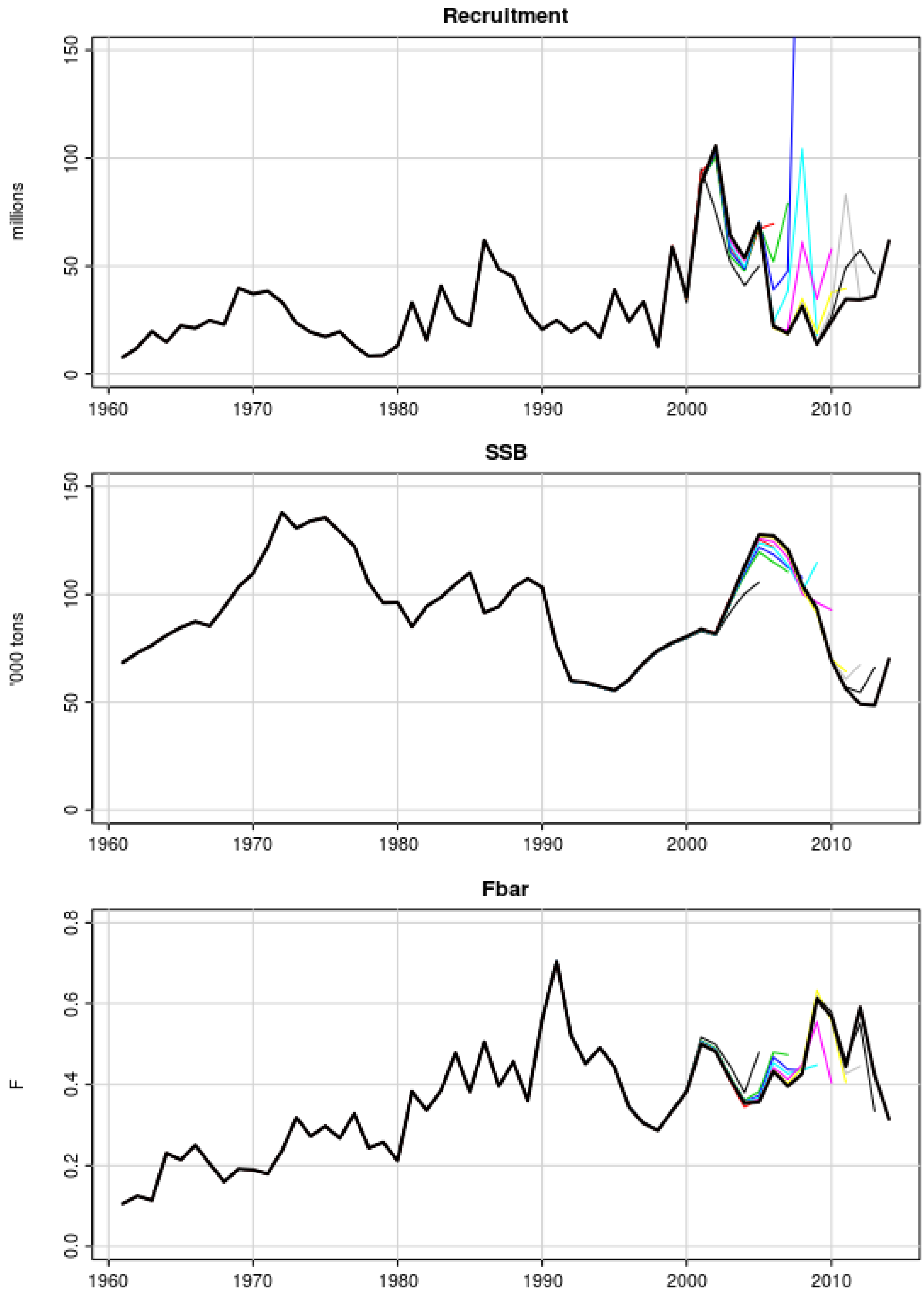


Figure 6.8.1. Faroe saithe (Division Vb). Retrospective analysis of recruitment at age 3 (millions)(top figure), spawning stock biomass ('000 tonnes)(middle figure) and average fishing mortality over age groups 4-8 (bottom figure) from the spaly assessment.

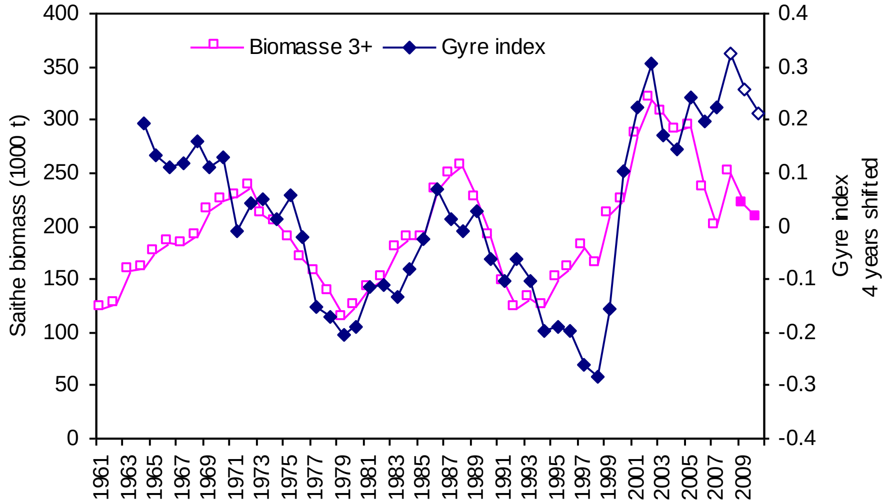


Figure 6.15.1. Faroe saithe (Division Vb). Relationship between the Gyre index (4 years shifted) and saithe biomasse (age 3+) in Faroese waters.