Skjal 1.

Report of the North-Western Working Group (NWWG) 2016. ICES C.M. 2016/ACOM:08

2 Demersal Stocks in the Faroe Area (Division 5b and Subdivision 2a4)

2.1 Overview

2.1.1 Fisheries

The main fisheries in Faroese waters are mixed-species, demersal fisheries and single species pelagic fisheries. The demersal fisheries are mainly conducted by Faroese 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.

2.1.2 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 UK with the result that a large part of the Faroese fishing fleet became specialized 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 multifleet and multispecies 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 portions of the catches. Reorganization 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 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 pairtrawlers (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 pairtrawlers, have increased in area and time. Their catch of cod and haddock was before 2011 limited by maximum bycatch allocation. This fleet started to pair-trawl, and since the fiscal year 2011/12, merged with the pairtrawlers group. The single trawlers less than 400 HP are given special licenses to target flatfish inside 12 nautical miles with a bycatch allocation of 30% cod and 10% haddock. In addition, they are obliged to use sorting devices in their trawls in order to minimize their bycatches. 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 summertime.

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 been almost at 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 was introduced (See the 2013 NWWG report, Figure 2.3) in July 2011, but was terminated in August 2013.

2.1.3 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 Seawater, 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 of 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 2016 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 Subpolar 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. If all three species are combined, the positive correlation becomes stronger (Figure 2.4). However, 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. The catchability of cod with longlines also increased by a factor of 2–3 in the same period.

2.1.4 Summary of the 2016 assessment of Faroe Plateau cod, haddock and saithe

A summary of selected parameters from the 2016 assessment of Faroe Plateau cod, Faroe haddock and Faroe saithe is shown in Figure 2.6. 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 (Figure 2.6). For haddock, the exploitation rate was high in the 1930s and decreasing from the 1950s and 1960s, while it has been fluctuating since the mid-1970s. For saithe, the exploitation rate was low in the 1930s and 1950s and increased until the 1970s, it decreased from the early 1990s–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. Moreover, while the sum of cod, haddock and saithe biomasses has been rather constant over time (varied between 300–500 thousand tonnes most years), the proportion of saithe has increased during the period from 1924 up to today whereas the proportion of cod has decreased (Figure 2.6).

2.1.5 Reference points for Faroese stocks

As explained elsewhere in this report, MSY reference points were estimated for cod and haddock in 2011 and for saithe in 2014 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). For example, 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.

Faroe saithe stock dynamics is puzzling. If the biomass estimates prior to 1961 are approximately correct then there has been an increase in biomass from 1925 up to now as well as in catch and exploitation rate. There might be an interaction with cod, since the cod biomass has decreased over the same period. It might be speculated that trawling activity in the deep areas (> 150 m) from the 1950s has had a negative effect on cod and a positive effect on saithe. Hence, it might not be possible to maximize cod and saithe catches at the same time.

2.1.6 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 and the Faroese University, of 1 representative from the industry (trawlers) and 1 from the Ministry of Fisheries. The results of this work was delivered to the Minister of Fisheries in spring 2012 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.

2.1.7 Oher issues

In order to put the current assessment into a wider context, the biomass of Faroe saithe was estimated back to 1925 by scaling cpue values for English steam trawlers to the biomass obtained from the stock assessment, see Working Document 13. The cpue series was from 1924– 1978 and the stock assessment from 1961–2015. The overlapping years 1961–1971 were used as a basis to scale the saithe biomass back to 1924. Since the biomass estimates were rather noisy, a three-year moving average was taken as the final estimate of biomass back in time (Table 2.1.7.1). The table shows that the saithe biomass prior to 1960, when there was little fishery for saithe, was lower than during the fishery intensive period after 1970.

2.1.8 References:

Gaard. E., Hansen, B., Olsen, B and Reinert, J. 2001. Ecological features and recent trends in physical environment, plankton, fish stocks and seabirds 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.

Allocated number of days:													Available	
Bólkur	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
2015/16	(L108-5/8-15)				1530	4455	2387	1029	1530		1386	9865		22182

Table 2.2. Number of days allocated and the number actually used since the fiscal year 2014/2015

				pr. 10. mars. 2016 (6 1/3 mdr)			Estimation of the whole year		Tillutað
Fleet segment	Allocated days 2014/15	Used days pr. Dato	% used days	Allocated days 2015/16	Used days pr. Dato	% used days	Mett ársnýtsla Faktor Væntandi:	1.895	smb. Vørn (05/10-15)
Reference:	(L89-18/8-14)			(L108-5/8-15)			(L108-5/8-15)	Predicted	Óbroytt (10/3-16)
Group 1 - innaru leiðir									
Group 1 - ytri leiðir									
Group 2 - (innaru leiði	4455	4,307.87	97%	4455	2000.70	45%	3,791.00	82%	4,353.25
Group 2 - ytri leiðir	1530	1,125.41	74%	1530	524.34	34%	993.54	65%	1,522.83
Group 3	2387	1234.57	52%	2387	939.92	39%	1,780.99	69%	2,148.22
Group 4A	1029	253.59	25%	1029	167.07	16%	316.57	31%	595.76
Group 4B	1530	565.34	37%	1530	424.94	28%	805.19	53%	932.62
Group 4T	1386	716.83	52%	1386	371.1	27%	703.17	51%	1,180.84
Group 5A	2640	1297	49%	2310	486	21%	920.89	19%	2310
Group 5B	7225	3709	51%	7555	1697	22%	3,215.54	55%	7555
Total	22182	13,209.61	60%	22182	6611.07	30%	12,526.90	54%	20,598.52

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Table 2.3. Main regulatory measures by fleet in the Faroese fisheries in 5b. 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	Subgroups		Main regulation tools
1	Single trawlers > 400 HP	none		Fishing days, have from 2011/12 been merged with the pairtrawlers, area closures
2	Pairtrawlers > 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

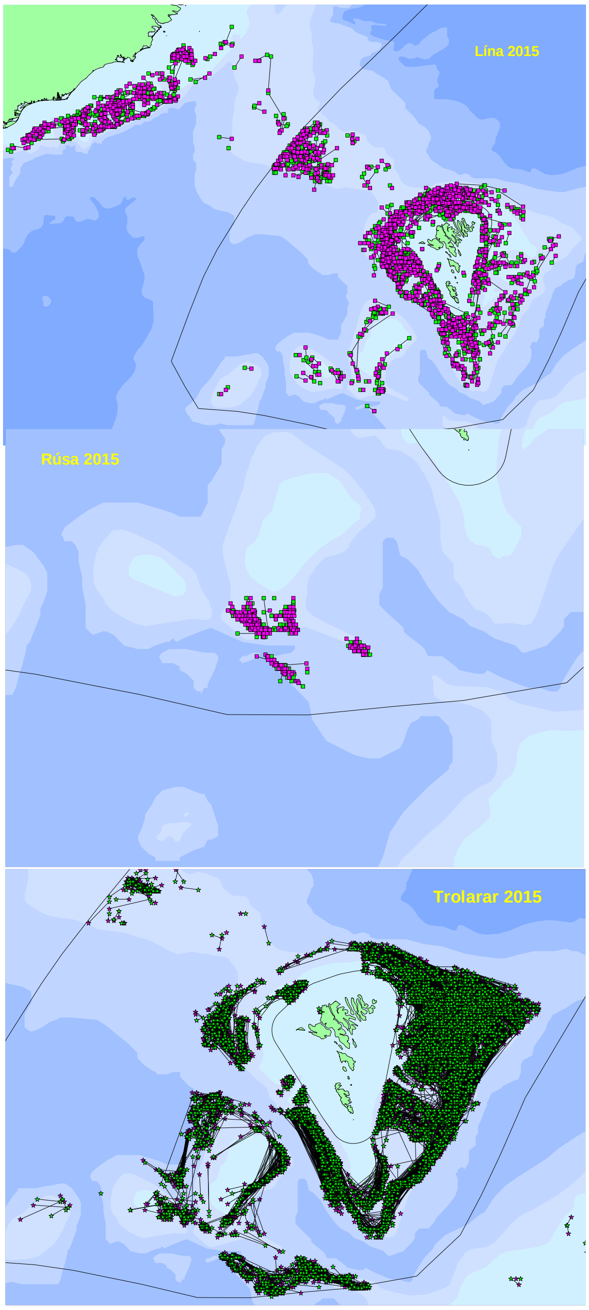


Figure 2.1. The 2015 distribution of fishing activities by some major fleets. From top: Gillnet, long-line>1010HP, trap and trawl. The longline fleet below 110 GRT is not shown here since they are not obliged to keep logbooks.

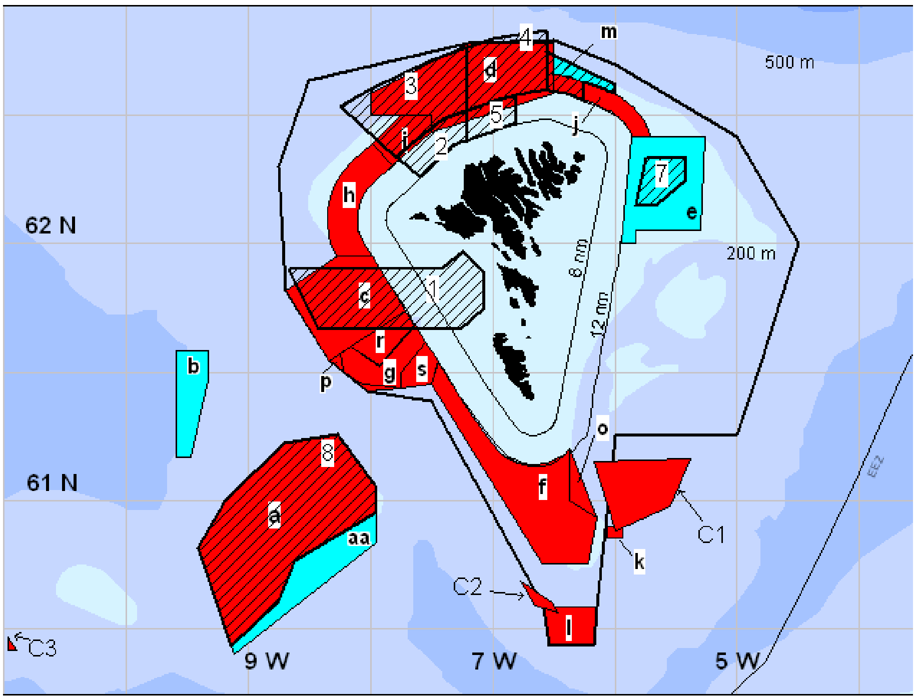
Exclusion zones for trawling

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 5b. 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.



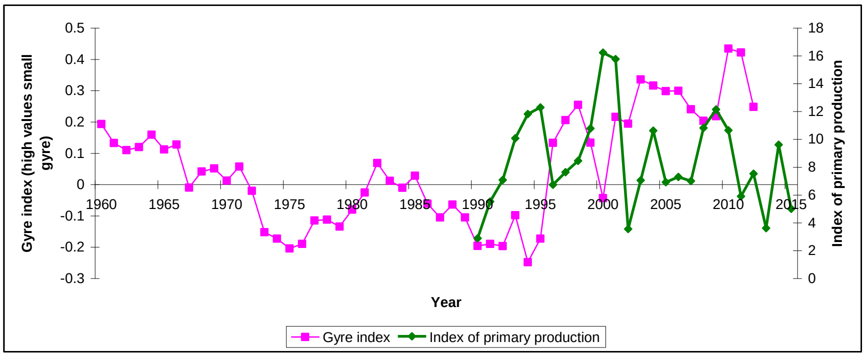


Figure 2.3. Temporal development of the phytoplankton index over the Faroe Shelf area (< 130 m) and the Subpolar Gyre index which indicates productivity in deeper waters.

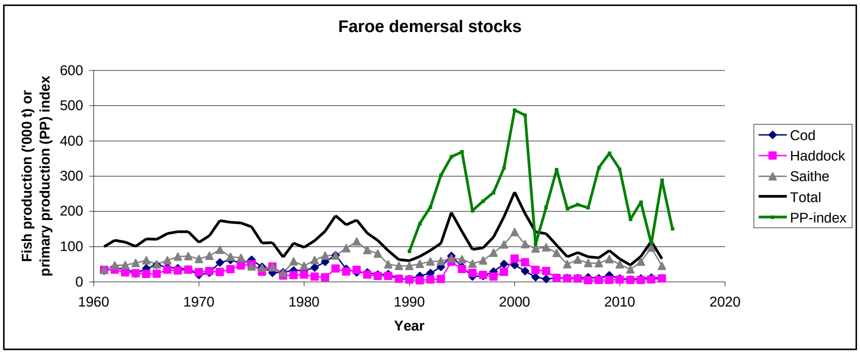


Figure 2.4. Relationship between primary production and production of cod, haddock and saithe.

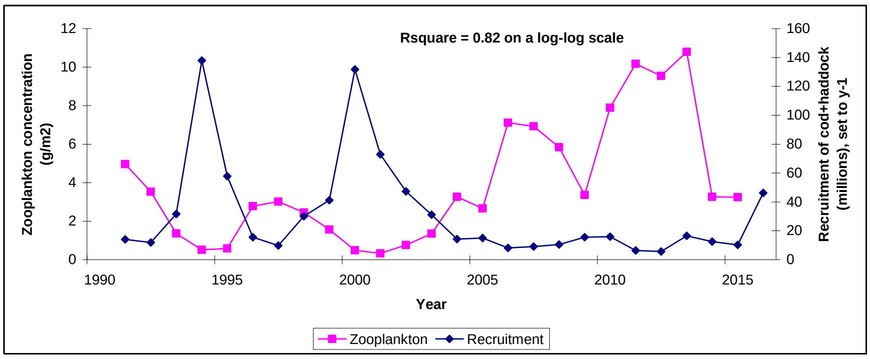


Figure 2.5. Relationship between zooplankton concentration and recruitment of cod and haddock on the Faroe Plateau.

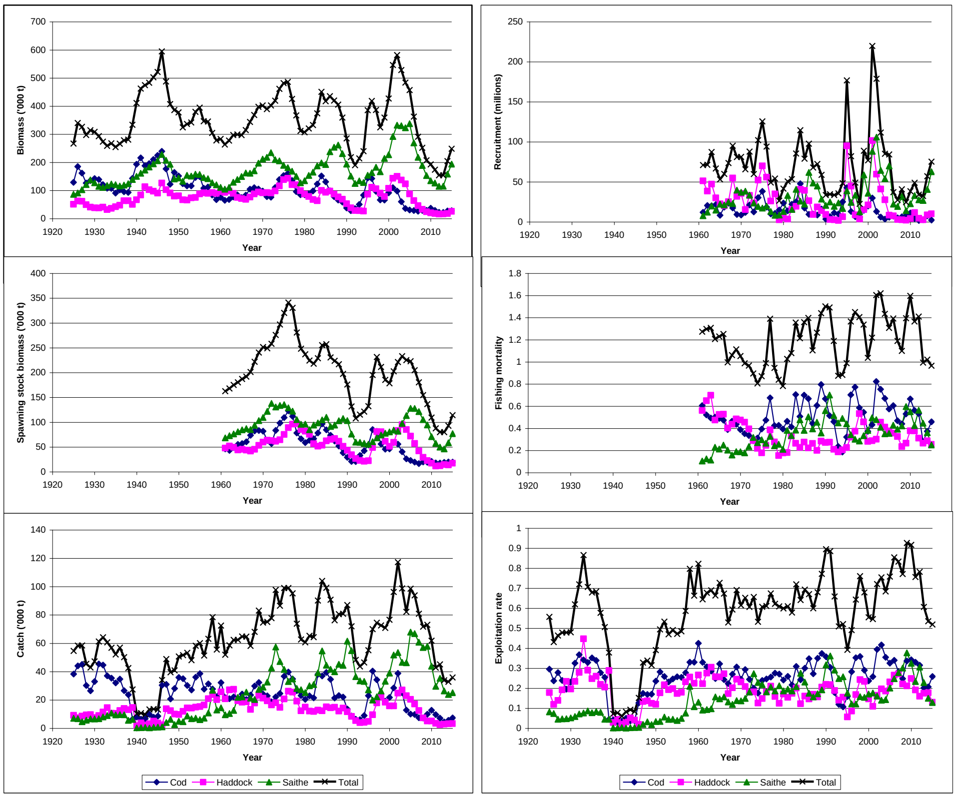


Figure 2.6. Summary of the stock dynamics for Faroe Plateau cod, Faroe haddock and Faroe saithe.

Table 2.1.7.1. Saithe biomass (age 3+) 1925–2015 in tons. Year label is sum of first row and first column.

	1925	1950	1975	2000
0	86621	144660	189794	227759
1	91614	133220	181587	292429
2	102955	154250	168856	332716
3	121390	151612	150481	330728
4	137929	158206	127858	323589
5	127712	157146	134902	338048
6	115346	146198	153827	269512
7	111440	142441	165608	218366
8	118018	127763	187681	189274
9	123435	120344	198291	153457
10	121033	111550	192715	134874
11	116390	105008	238071	126661
12	119400	111502	254322	115439
13	124442	129760	261993	115660
14	139453	139221	231424	158781
15	150543	150302	193901	194118
16	161634	162609	151523	
17	172724	161578	125365	
18	183815	170304	134696	
19	194905	197298	128717	
20	205996	212238	154403	
21	228522	218372	163848	
22	207472	234819	183162	
23	193811	210057	166861	
24	141145	205557	214410	

3 Faroe Bank Cod

3.1 State of the stock

Total nominal catches of the Faroe Bank cod from 1987 to 2015 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 2015 landings were estimated at 17t 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 2005–2007 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.

Spring survey was initiated in 1983 and discontinued in 1996, 2004 and 2005. Summer survey has been carried out since 1996. The cpue of spring survey was low during 1988–1995 varying between 73 and 95 kg per tow. Although noisy, the survey suggests higher, possibly increasing biomass during 1995–2003. Spring index suggests that the stock increased in 2013 and 2014 but it decreased rapidly in 2015 and 2016 well below the average of that of the period 1996–2002. The 2015 summer index is estimated at 25 kg per tow and the 2016 spring survey at 19 kg per tow, which are among the lowest values in both series. There are conflicting signals between both indices from 2012 to 2014. The agreement between 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 indices 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 summer survey from 2000–2002 (lengths 26–45 cm), corresponding to good recruitment of 2 years old in spring surveys from 2001 to 2003 (40–60 cm). Spring index shows poor recruitment from 2006–2016 reflecting the weak year classes observed in 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 spring index, recruitment was estimated as total number of fish below 60 cm (2-year old) and in summer index as number of fish below 45 cm (1-year old). According to 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) Spring recruitment index in 2015 shows no sign of incoming year classes. Correlation between spring and summer survey recruitment indices is fairly good (r=0.86). 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, $B1/B_{MSY}$ 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 1983-2015 including spring survey and 1996–2015 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=0.34 and F_{MSY}=0.17 (using autumn 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 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 autumn 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 spring and summer indices suggest the stock is well below average while there are no indications of incoming recruitment. Spring index suggests an increasing stock biomass from 2012–2014 which it is however not picked up by 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 in 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 2015 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–1 May) has been enforced since 2005. In 2009, fishing was restricted to all fishing gears from 1 January–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 (subdivision Vb2) cod. Nominal catches (tonnes) by countries 1986-2015 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	1350
														1089

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Faroe Islands		1094	1840	5957	3607	1270	1005	471	231	81	111	393	115	40	40	18 *
Norway	49	51	25	72	18	37	10	7	1	4	1		0			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				45	
Total	312	1483	2125	6298	3884	2460	1294	531	264	123	171	393	116	40	85	
Correction of Faroese catches in Vb2		-65	-109	-353	-214	-75	-60	-28	-14	-5	-7	-23	-7	-2	-2	-1
Used in assessment	1194	1080	1756	5676	3411	1232	955	450	218	80	105	370	108	38	38	17

* Preliminary
[2] Included in Vb1.
[3] Reported as Vb.

Table 3.2. Faroe Bank (subdivision Vb2) cod. Surplus production model output using summer index.

```
Faroe Bank Cod RV                                                    Page 1
                                                   28 Apr 2016 at 13:32.23
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:               51          Number of bootstrap trials:              0
Number of dataseries:                    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
------------------------------------------------------------------------------------------------------------------------
                                 Weighted       Weighted     Current   Suggested   R-squared
Loss component number and title                 SSE    N         MSE      weight      weight    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            1.545E+01  33    4.983E-01   1.000E+00   1.000E+00     0.443
TOTAL OBJECTIVE FUNCTION:                    1.54481033E+01

Number of restarts required for convergence:          10
Est. B-ratio coverage index (0 worst, 2 best):      0.7964          < These two measures are defined in Prager
Est. B-ratio nearness index (0 worst, 1 best):      0.8438          <     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	7.438E-01	1.000E+00	1	1
MSY	Maximum sustainable yield	2.568E+03	3.000E+03	1	1
r	Intrinsic rate of increase	3.455E-01	8.000E-01	1	1
....	Catchability coefficients by fishery:				
q(1)	Survey cpue Spring	2.158E-02	1.000E-02	1	1

MANAGEMENT PARAMETER ESTIMATES (NON-BOOTSTRAPPED)

Parameter		Estimate	Formula	Related quantity
MSY	Maximum sustainable yield	2.568E+03	Kr/4	
K	Maximum stock biomass	2.973E+04		
Bmsy	Stock biomass at MSY	1.486E+04	K/2	
Fmsy	Fishing mortality at MSY	1.728E-01	r/2	
F(0.1)	Management benchmark	1.555E-01	0.9*Fmsy	
Y(0.1)	Equilibrium yield at F(0.1)	2.542E+03	0.99*MSY	
B-ratio	Ratio of B(2016) to Bmsy	2.545E-01		
F-ratio	Ratio of F(2015) to Fmsy	3.011E-02		
F01-mult	Ratio of F(0.1) to F(2015)	2.989E+01		
Y-ratio	Proportion of MSY avail in 2016	4.443E-01	2*Br-Br^2	Ye(2016) = 1.141E+03
....	Fishing effort at MSY in units of each fishery:			
fmsy(1)	Survey cpue Spring	8.004E+00	r/2q(1)	f(0.1) = 7.203E+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	0.211	1.106E+04	1.109E+04	2.341E+03	2.341E+03	2.402E+03	1.222E+00	7.438E-01
2	1966	0.168	1.112E+04	1.138E+04	1.909E+03	1.909E+03	2.426E+03	9.711E-01	7.479E-01
3	1967	0.130	1.163E+04	1.209E+04	1.569E+03	1.569E+03	2.478E+03	7.510E-01	7.827E-01
4	1968	0.328	1.254E+04	1.181E+04	3.871E+03	3.871E+03	2.457E+03	1.898E+00	8.438E-01
5	1969	0.221	1.113E+04	1.110E+04	2.457E+03	2.457E+03	2.403E+03	1.281E+00	7.487E-01
6	1970	0.279	1.107E+04	1.075E+04	3.002E+03	3.002E+03	2.371E+03	1.617E+00	7.451E-01
7	1971	0.196	1.044E+04	1.058E+04	2.079E+03	2.079E+03	2.355E+03	1.137E+00	7.026E-01
8	1972	0.200	1.072E+04	1.083E+04	2.168E+03	2.168E+03	2.378E+03	1.159E+00	7.212E-01
9	1973	0.544	1.093E+04	9.385E+03	5.101E+03	5.101E+03	2.211E+03	3.146E+00	7.353E-01
10	1974	0.258	8.040E+03	8.017E+03	2.068E+03	2.068E+03	2.023E+03	1.493E+00	5.409E-01
11	1975	0.255	7.995E+03	7.985E+03	2.036E+03	2.036E+03	2.018E+03	1.476E+00	5.379E-01
12	1976	0.288	7.977E+03	7.842E+03	2.258E+03	2.258E+03	1.995E+03	1.667E+00	5.366E-01
13	1977	0.116	7.713E+03	8.260E+03	9.590E+02	9.590E+02	2.060E+03	6.720E-01	5.189E-01
14	1978	0.583	8.814E+03	7.507E+03	4.379E+03	4.379E+03	1.933E+03	3.376E+00	5.930E-01
15	1979	0.198	6.368E+03	6.603E+03	1.306E+03	1.306E+03	1.774E+03	1.145E+00	4.284E-01
16	1980	0.168	6.837E+03	7.174E+03	1.203E+03	1.203E+03	1.880E+03	9.706E-01	4.599E-01
17	1981	0.156	7.514E+03	7.901E+03	1.229E+03	1.229E+03	2.004E+03	9.005E-01	5.055E-01
18	1982	0.266	8.288E+03	8.223E+03	2.184E+03	2.184E+03	2.055E+03	1.537E+00	5.576E-01
19	1983	0.285	8.160E+03	8.027E+03	2.284E+03	2.284E+03	2.024E+03	1.647E+00	5.490E-01
20	1984	0.281	7.900E+03	7.797E+03	2.189E+03	2.189E+03	1.987E+03	1.625E+00	5.315E-01
21	1985	0.407	7.698E+03	7.161E+03	2.913E+03	2.913E+03	1.877E+03	2.355E+00	5.179E-01
22	1986	0.277	6.663E+03	6.635E+03	1.836E+03	1.836E+03	1.781E+03	1.602E+00	4.482E-01
23	1987	0.605	6.607E+03	5.630E+03	3.409E+03	3.409E+03	1.574E+03	3.505E+00	4.445E-01
24	1988	0.785	4.772E+03	3.777E+03	2.966E+03	2.966E+03	1.136E+03	4.546E+00	3.210E-01
25	1989	0.465	2.942E+03	2.728E+03	1.270E+03	1.270E+03	8.560E+02	2.694E+00	1.979E-01
26	1990	0.103	2.528E+03	2.815E+03	2.890E+02	2.890E+02	8.801E+02	5.944E-01	1.701E-01
27	1991	0.085	3.119E+03	3.491E+03	2.970E+02	2.970E+02	1.064E+03	4.925E-01	2.098E-01
28	1992	0.035	3.886E+03	4.441E+03	1.540E+02	1.540E+02	1.304E+03	2.007E-01	2.614E-01
29	1993	0.047	5.036E+03	5.677E+03	2.660E+02	2.660E+02	1.585E+03	2.712E-01	3.388E-01
30	1994	0.105	6.355E+03	6.900E+03	7.250E+02	7.250E+02	1.829E+03	6.082E-01	4.275E-01
31	1995	0.074	7.459E+03	8.172E+03	6.010E+02	6.010E+02	2.045E+03	4.257E-01	5.018E-01
32	1996	0.236	8.904E+03	8.931E+03	2.106E+03	2.106E+03	2.159E+03	1.365E+00	5.990E-01
33	1997	0.441	8.956E+03	8.143E+03	3.594E+03	3.594E+03	2.040E+03	2.555E+00	6.026E-01
34	1998	0.488	7.403E+03	6.637E+03	3.239E+03	3.239E+03	1.779E+03	2.825E+00	4.980E-01
35	1999	0.159	5.943E+03	6.297E+03	1.001E+03	1.001E+03	1.714E+03	9.201E-01	3.998E-01
36	2000	0.171	6.656E+03	6.981E+03	1.194E+03	1.194E+03	1.845E+03	9.900E-01	4.478E-01
37	2001	0.139	7.308E+03	7.755E+03	1.080E+03	1.080E+03	1.980E+03	8.061E-01	4.916E-01
38	2002	0.210	8.207E+03	8.370E+03	1.756E+03	1.756E+03	2.078E+03	1.214E+00	5.522E-01
39	2003	0.899	8.529E+03	6.312E+03	5.676E+03	5.676E+03	1.703E+03	5.205E+00	5.738E-01
40	2004	1.074	4.556E+03	3.176E+03	3.411E+03	3.411E+03	9.746E+02	6.217E+00	3.065E-01
41	2005	0.696	2.119E+03	1.769E+03	1.232E+03	1.232E+03	5.744E+02	4.031E+00	1.426E-01
42	2006	0.830	1.462E+03	1.151E+03	9.550E+02	9.550E+02	3.819E+02	4.804E+00	9.833E-02
43	2007	0.567	8.885E+02	7.932E+02	4.500E+02	4.500E+02	2.667E+02	3.284E+00	5.977E-02
44	2008	0.304	7.052E+02	7.170E+02	2.180E+02	2.180E+02	2.418E+02	1.760E+00	4.744E-02
45	2009	0.097	7.290E+02	8.235E+02	8.000E+01	8.000E+01	2.766E+02	5.623E-01	4.904E-02
46	2010	0.101	9.256E+02	1.042E+03	1.050E+02	1.050E+02	3.475E+02	5.831E-01	6.227E-02
47	2011	0.314	1.168E+03	1.179E+03	3.700E+02	3.700E+02	3.911E+02	1.817E+00	7.858E-02
48	2012	0.080	1.189E+03	1.351E+03	1.080E+02	1.080E+02	4.455E+02	4.626E-01	8.000E-02
49	2013	0.021	1.527E+03	1.785E+03	3.800E+01	3.800E+01	5.793E+02	1.233E-01	1.027E-01
50	2014	0.016	2.068E+03	2.415E+03	3.800E+01	3.800E+01	7.662E+02	9.107E-02	1.391E-01
51	2015	0.005	2.796E+03	3.268E+03	1.700E+01	1.700E+01	1.004E+03	3.011E-02	1.881E-01
52	2016		3.783E+03						2.545E-01

Faroe Bank Cod RV Page 3

RESULTS FOR DATASERIES # 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	*	2.393E+02	0.2112	2.341E+03	2.341E+03	0.00000	0.000E+00
2	1966	*	2.456E+02	0.1678	1.909E+03	1.909E+03	0.00000	0.000E+00
3	1967	*	2.610E+02	0.1297	1.569E+03	1.569E+03	0.00000	0.000E+00
4	1968	*	2.548E+02	0.3279	3.871E+03	3.871E+03	0.00000	0.000E+00
5	1969	*	2.396E+02	0.2213	2.457E+03	2.457E+03	0.00000	0.000E+00
6	1970	*	2.320E+02	0.2793	3.002E+03	3.002E+03	0.00000	0.000E+00
7	1971	*	2.284E+02	0.1964	2.079E+03	2.079E+03	0.00000	0.000E+00
8	1972	*	2.337E+02	0.2003	2.168E+03	2.168E+03	0.00000	0.000E+00
9	1973	*	2.026E+02	0.5435	5.101E+03	5.101E+03	0.00000	0.000E+00
10	1974	*	1.730E+02	0.2580	2.068E+03	2.068E+03	0.00000	0.000E+00
11	1975	*	1.724E+02	0.2550	2.036E+03	2.036E+03	0.00000	0.000E+00
12	1976	*	1.693E+02	0.2879	2.258E+03	2.258E+03	0.00000	0.000E+00
13	1977	*	1.783E+02	0.1161	9.590E+02	9.590E+02	0.00000	0.000E+00
14	1978	*	1.620E+02	0.5833	4.379E+03	4.379E+03	0.00000	0.000E+00
15	1979	*	1.425E+02	0.1978	1.306E+03	1.306E+03	0.00000	0.000E+00
16	1980	*	1.549E+02	0.1677	1.203E+03	1.203E+03	0.00000	0.000E+00
17	1981	*	1.705E+02	0.1556	1.229E+03	1.229E+03	0.00000	0.000E+00
18	1982	*	1.775E+02	0.2656	2.184E+03	2.184E+03	0.00000	0.000E+00
19	1983	7.899E+01	1.733E+02	0.2845	2.284E+03	2.284E+03	0.78546	0.000E+00
20	1984	1.752E+02	1.683E+02	0.2807	2.189E+03	2.189E+03	-0.04023	0.000E+00
21	1985	1.735E+02	1.546E+02	0.4068	2.913E+03	2.913E+03	-0.11540	0.000E+00
22	1986	2.661E+02	1.432E+02	0.2767	1.836E+03	1.836E+03	-0.61957	0.000E+00
23	1987	1.640E+02	1.215E+02	0.6055	3.409E+03	3.409E+03	-0.30001	0.000E+00
24	1988	7.311E+01	8.152E+01	0.7853	2.966E+03	2.966E+03	0.10885	0.000E+00
25	1989	3.655E+01	5.889E+01	0.4655	1.270E+03	1.270E+03	0.47703	0.000E+00
26	1990	2.324E+01	6.075E+01	0.1027	2.890E+02	2.890E+02	0.96093	0.000E+00
27	1991	5.097E+01	7.535E+01	0.0851	2.970E+02	2.970E+02	0.39090	0.000E+00
28	1992	2.843E+01	9.585E+01	0.0347	1.540E+02	1.540E+02	1.21539	0.000E+00
29	1993	2.576E+01	1.225E+02	0.0469	2.660E+02	2.660E+02	1.55957	0.000E+00
30	1994	8.674E+01	1.489E+02	0.1051	7.250E+02	7.250E+02	0.54054	0.000E+00
31	1995	9.017E+01	1.764E+02	0.0735	6.010E+02	6.010E+02	0.67094	0.000E+00
32	1996	3.105E+02	1.928E+02	0.2358	2.106E+03	2.106E+03	-0.47675	0.000E+00
33	1997	4.491E+02	1.758E+02	0.4414	3.594E+03	3.594E+03	-0.93826	0.000E+00
34	1998	3.871E+02	1.433E+02	0.4880	3.239E+03	3.239E+03	-0.99397	0.000E+00
35	1999	1.495E+02	1.359E+02	0.1590	1.001E+03	1.001E+03	-0.09548	0.000E+00
36	2000	1.199E+02	1.507E+02	0.1710	1.194E+03	1.194E+03	0.22854	0.000E+00
37	2001	2.626E+02	1.674E+02	0.1393	1.080E+03	1.080E+03	-0.45023	0.000E+00
38	2002	3.471E+02	1.807E+02	0.2098	1.756E+03	1.756E+03	-0.65318	0.000E+00
39	2003	1.618E+02	1.362E+02	0.8992	5.676E+03	5.676E+03	-0.17170	0.000E+00
40	2004	7.303E+01	6.856E+01	1.0739	3.411E+03	3.411E+03	-0.06323	0.000E+00
41	2005	6.187E+01	3.818E+01	0.6964	1.232E+03	1.232E+03	-0.48266	0.000E+00
42	2006	2.927E+01	2.484E+01	0.8299	9.550E+02	9.550E+02	-0.16419	0.000E+00
43	2007	3.331E+01	1.712E+01	0.5673	4.500E+02	4.500E+02	-0.66560	0.000E+00
44	2008	3.117E+01	1.548E+01	0.3040	2.180E+02	2.180E+02	-0.70013	0.000E+00
45	2009	4.926E+01	1.778E+01	0.0971	8.000E+01	8.000E+01	-1.01932	0.000E+00
46	2010	4.164E+01	2.250E+01	0.1007	1.050E+02	1.050E+02	-0.61562	0.000E+00
47	2011	5.854E+01	2.544E+01	0.3139	3.700E+02	3.700E+02	-0.83345	0.000E+00
48	2012	3.425E+01	2.917E+01	0.0799	1.080E+02	1.080E+02	-0.16067	0.000E+00
49	2013	1.737E+01	3.852E+01	0.0213	3.800E+01	3.800E+01	0.79638	0.000E+00
50	2014	2.575E+01	5.214E+01	0.0157	3.800E+01	3.800E+01	0.70542	0.000E+00
51	2015	2.481E+01	7.054E+01	0.0052	1.700E+01	1.700E+01	1.04488	0.000E+00

* Asterisk indicates missing value(s).

Faroe Bank Cod RV Page 4

UNWEIGHTED LOG RESIDUAL PLOT FOR DATASERIES # 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   0.7855                       |================
1984  -0.0402                      =|
1985  -0.1154                     ==|
1986  -0.6196           ============|
1987  -0.3000                 ======|
1988   0.1088                       |==
1989   0.4770                       |==========
1990   0.9609                       |===================
1991   0.3909                       |========
1992   1.2154                       |========================
1993   1.5596                       |===============================
1994   0.5405                       |===========
1995   0.6709                       |=============
1996  -0.4767             ==========|
1997  -0.9383      ===================|
1998  -0.9940     ====================|
1999  -0.0955                     ==|
2000   0.2285                       |=====
2001  -0.4502              =========|
2002  -0.6532          =============|
2003  -0.1717                    ===|
2004  -0.0632                      =|
2005  -0.4827             ==========|
2006  -0.1642                    ===|
2007  -0.6656          =============|
2008  -0.7001         ==============|
2009  -1.0193     ====================|
2010  -0.6156           ============|
2011  -0.8335       =================|
2012  -0.1607                    ===|
2013   0.7964                       |================
2014   0.7054                       |==============
2015   1.0449                       |=====================
                 ------------------------------------------------------------------
```

```
Faroe Bank Cod RV                                                   Page  5

         Observed (O) and Estimated (*) cpue for Dataseries # 1 -- Survey cpue Spring
    :
480. -:
    :
    :                                 O
    :
    :
400. -:
    :                                  O
    :
    :                                     O
    :
320. -:
    :                                 O
    :
    :                        O
    :      * *                            O
240. -:    * *   **  *
    :          *
    :           *
    :                                 *
    :           * ** *    ** * 2O         *  *     *
160. -:              * *      *  O              * O
    :               *      *       *    * O*   *
    :                      *     *     *
    :                                     O
    :                          *  O
 80. -:                  O     2  *  O          O
    :                        * *              * O    O   *
    :                          O                  O O    *
    :                        O   O O            *2 O O  *2 * OO
    :                          O               * ** *  O
  0. -:
    :..................................................................................
    :     :     :     :     :     :     :     :     :     :     :
  1959.  1965.  1971.  1977.  1983.  1989.  1995.  2001.  2007.  2013.  2019.
                  Time Plot of Estimated F-Ratio and B-Ratio
    :
7.2 -:
    :
    :
    :
    :                                       F
6.0 -:
    :
    :
    :                                      F
    :
4.8 -:                                       F
    :                          F
    :
    :                                       F
    :
3.6 -:                          F
    :                F                          F
    :            F
    :                                   F
    :                          F        F
2.4 -:                        F
    :
    :     F                                         F
    :       F       F      F F  F                   F
    :             F F      F           F
1.2 -:    F     F  F F      F                      F
    :  -- - -- - 2- 2 -- - -- - -- - -- 2 2- - -- - -- - -- - -- - --- - 22 - -- - -- - -- - -- - -- - -- - -
    :     B B2  BB B BB    F                F   B     F
    :              B BB B BB B BB B BB B B    FF   B 2 B  B BB B BB       F F  F
    :                         B B BB 2 2            B B        F BB B
0.0 -:                                          B B BB B BB B FF
    :..................................................................................
    :     :     :     :     :     :     :     :     :     :     :
  1959.  1965.  1971.  1977.  1983.  1989.  1995.  2001.  2007.  2013.  2019.
```

Table 3.3. Faroe Bank (subdivision Vb2) cod. Surplus production model output using spring index.

Faroe Bank Cod RV Page 1

28 Apr 2016 at 13:24.32

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:	51	Number of bootstrap trials:	0
Number of dataseries:	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	2.279E+01	30	8.140E-01	1.000E+00	1.000E+00	0.102
TOTAL OBJECTIVE FUNCTION:	2.27906013E+01					

Number of restarts required for convergence: 33

Est. B-ratio coverage index (0 worst, 2 best): 0.3202 < These two measures are defined in Prager

Est. B-ratio nearness index (0 worst, 1 best): 0.3595 < *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	2.964E-01	1.000E+00	1	1
MSY	Maximum sustainable yield	4.789E+03	3.000E+03	1	1
r	Intrinsic rate of increase	3.328E-01	8.000E-01	1	1
....	Catchability coefficients by fishery:				
q(1)	Survey cpue Spring	2.786E-02	1.000E-02	1	1

MANAGEMENT PARAMETER ESTIMATES (NON-BOOTSTRAPPED)

Parameter		Estimate	Formula	Related quantity
MSY	Maximum sustainable yield	4.789E+03	Kr/4	
K	Maximum stock biomass	5.756E+04		
Bmsy	Stock biomass at MSY	2.878E+04	K/2	
Fmsy	Fishing mortality at MSY	1.664E-01	r/2	
F(0.1)	Management benchmark	1.498E-01	0.9*Fmsy	
Y(0.1)	Equilibrium yield at F(0.1)	4.741E+03	0.99*MSY	
B-ratio	Ratio of B(2016) to Bmsy	2.953E-01		
F-ratio	Ratio of F(2015) to Fmsy	1.382E-02		
F01-mult	Ratio of F(0.1) to F(2015)	6.513E+01		
Y-ratio	Proportion of MSY avail in 2016	5.034E-01	2*Br-Br^2	Ye(2016) = 2.411E+03
....	Fishing effort at MSY in units of each fishery:			
fmsy(1)	Survey cpue Spring	5.973E+00	r/2q(1)	f(0.1) = 5.376E+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	0.273	8.530E+03	8.574E+03	2.341E+03	2.341E+03	2.428E+03	1.641E+00	2.964E-01
2	1966	0.214	8.618E+03	8.916E+03	1.909E+03	1.909E+03	2.507E+03	1.287E+00	2.994E-01
3	1967	0.160	9.216E+03	9.776E+03	1.569E+03	1.569E+03	2.700E+03	9.646E-01	3.202E-01
4	1968	0.397	1.035E+04	9.741E+03	3.871E+03	3.871E+03	2.692E+03	2.388E+00	3.595E-01
5	1969	0.266	9.169E+03	9.230E+03	2.457E+03	2.457E+03	2.579E+03	1.600E+00	3.186E-01
6	1970	0.332	9.291E+03	9.055E+03	3.002E+03	3.002E+03	2.539E+03	1.992E+00	3.228E-01
7	1971	0.230	8.828E+03	9.058E+03	2.079E+03	2.079E+03	2.540E+03	1.379E+00	3.067E-01
8	1972	0.228	9.289E+03	9.528E+03	2.168E+03	2.168E+03	2.646E+03	1.368E+00	3.227E-01
9	1973	0.614	9.767E+03	8.312E+03	5.101E+03	5.101E+03	2.363E+03	3.688E+00	3.393E-01
10	1974	0.295	7.029E+03	7.020E+03	2.068E+03	2.068E+03	2.051E+03	1.770E+00	2.442E-01
11	1975	0.290	7.012E+03	7.019E+03	2.036E+03	2.036E+03	2.051E+03	1.743E+00	2.436E-01
12	1976	0.327	7.027E+03	6.908E+03	2.258E+03	2.258E+03	2.023E+03	1.964E+00	2.442E-01
13	1977	0.130	6.792E+03	7.370E+03	9.590E+02	9.590E+02	2.138E+03	7.821E-01	2.360E-01
14	1978	0.655	7.971E+03	6.683E+03	4.379E+03	4.379E+03	1.963E+03	3.938E+00	2.769E-01
15	1979	0.227	5.555E+03	5.763E+03	1.306E+03	1.306E+03	1.726E+03	1.362E+00	1.930E-01
16	1980	0.191	5.975E+03	6.303E+03	1.203E+03	1.203E+03	1.868E+03	1.147E+00	2.076E-01
17	1981	0.174	6.639E+03	7.048E+03	1.229E+03	1.229E+03	2.058E+03	1.048E+00	2.307E-01
18	1982	0.293	7.468E+03	7.456E+03	2.184E+03	2.184E+03	2.160E+03	1.760E+00	2.595E-01
19	1983	0.310	7.444E+03	7.370E+03	2.284E+03	2.284E+03	2.139E+03	1.862E+00	2.586E-01
20	1984	0.302	7.299E+03	7.259E+03	2.189E+03	2.189E+03	2.111E+03	1.812E+00	2.536E-01
21	1985	0.432	7.221E+03	6.740E+03	2.913E+03	2.913E+03	1.980E+03	2.597E+00	2.509E-01
22	1986	0.291	6.288E+03	6.304E+03	1.836E+03	1.836E+03	1.868E+03	1.750E+00	2.185E-01
23	1987	0.635	6.320E+03	5.370E+03	3.409E+03	3.409E+03	1.619E+03	3.815E+00	2.196E-01
24	1988	0.846	4.529E+03	3.508E+03	2.966E+03	2.966E+03	1.094E+03	5.082E+00	1.574E-01
25	1989	0.530	2.658E+03	2.395E+03	1.270E+03	1.270E+03	7.638E+02	3.186E+00	9.235E-02
26	1990	0.121	2.152E+03	2.380E+03	2.890E+02	2.890E+02	7.590E+02	7.299E-01	7.476E-02
27	1991	0.102	2.622E+03	2.925E+03	2.970E+02	2.970E+02	9.237E+02	6.103E-01	9.110E-02
28	1992	0.041	3.249E+03	3.731E+03	1.540E+02	1.540E+02	1.161E+03	2.481E-01	1.129E-01
29	1993	0.055	4.255E+03	4.837E+03	2.660E+02	2.660E+02	1.474E+03	3.305E-01	1.478E-01
30	1994	0.121	5.463E+03	5.979E+03	7.250E+02	7.250E+02	1.782E+03	7.288E-01	1.898E-01
31	1995	0.083	6.520E+03	7.253E+03	6.010E+02	6.010E+02	2.108E+03	4.980E-01	2.265E-01
32	1996	0.259	8.028E+03	8.138E+03	2.106E+03	2.106E+03	2.325E+03	1.555E+00	2.789E-01
33	1997	0.479	8.247E+03	7.508E+03	3.594E+03	3.594E+03	2.172E+03	2.877E+00	2.865E-01
34	1998	0.533	6.825E+03	6.077E+03	3.239E+03	3.239E+03	1.808E+03	3.203E+00	2.371E-01
35	1999	0.174	5.393E+03	5.748E+03	1.001E+03	1.001E+03	1.722E+03	1.047E+00	1.874E-01
36	2000	0.185	6.114E+03	6.468E+03	1.194E+03	1.194E+03	1.910E+03	1.110E+00	2.124E-01

37	2001	0.147	6.830E+03	7.347E+03	1.080E+03	1.080E+03	2.132E+03	8.834E-01	2.373E-01
38	2002	0.215	7.882E+03	8.170E+03	1.756E+03	1.756E+03	2.333E+03	1.292E+00	2.739E-01
39	2003	0.892	8.459E+03	6.360E+03	5.676E+03	5.676E+03	1.876E+03	5.364E+00	2.939E-01
40	2004	1.024	4.659E+03	3.331E+03	3.411E+03	3.411E+03	1.042E+03	6.153E+00	1.619E-01
41	2005	0.624	2.290E+03	1.975E+03	1.232E+03	1.232E+03	6.347E+02	3.748E+00	7.956E-02
42	2006	0.666	1.692E+03	1.433E+03	9.550E+02	9.550E+02	4.649E+02	4.005E+00	5.880E-02
43	2007	0.386	1.202E+03	1.167E+03	4.500E+02	4.500E+02	3.805E+02	2.317E+00	4.177E-02
44	2008	0.179	1.133E+03	1.221E+03	2.180E+02	2.180E+02	3.975E+02	1.073E+00	3.936E-02
45	2009	0.053	1.312E+03	1.508E+03	8.000E+01	8.000E+01	4.885E+02	3.189E-01	4.560E-02
46	2010	0.053	1.721E+03	1.974E+03	1.050E+02	1.050E+02	6.343E+02	3.196E-01	5.979E-02
47	2011	0.151	2.250E+03	2.450E+03	3.700E+02	3.700E+02	7.806E+02	9.075E-01	7.818E-02
48	2012	0.035	2.661E+03	3.072E+03	1.080E+02	1.080E+02	9.673E+02	2.113E-01	9.245E-02
49	2013	0.009	3.520E+03	4.107E+03	3.800E+01	3.800E+01	1.269E+03	5.561E-02	1.223E-01
50	2014	0.007	4.751E+03	5.527E+03	3.800E+01	3.800E+01	1.661E+03	4.132E-02	1.651E-01
51	2015	0.002	6.374E+03	7.393E+03	1.700E+01	1.700E+01	2.142E+03	1.382E-02	2.215E-01
52	2016		8.499E+03				2.953E-01		

Faroe Bank Cod RV Page 3

RESULTS FOR DATASERIES # 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	*	2.389E+02	0.2730	2.341E+03	2.341E+03	0.00000	0.000E+00
2	1966	*	2.484E+02	0.2141	1.909E+03	1.909E+03	0.00000	0.000E+00
3	1967	*	2.723E+02	0.1605	1.569E+03	1.569E+03	0.00000	0.000E+00
4	1968	*	2.713E+02	0.3974	3.871E+03	3.871E+03	0.00000	0.000E+00
5	1969	*	2.571E+02	0.2662	2.457E+03	2.457E+03	0.00000	0.000E+00
6	1970	*	2.523E+02	0.3315	3.002E+03	3.002E+03	0.00000	0.000E+00
7	1971	*	2.523E+02	0.2295	2.079E+03	2.079E+03	0.00000	0.000E+00
8	1972	*	2.654E+02	0.2275	2.168E+03	2.168E+03	0.00000	0.000E+00
9	1973	*	2.315E+02	0.6137	5.101E+03	5.101E+03	0.00000	0.000E+00
10	1974	*	1.956E+02	0.2946	2.068E+03	2.068E+03	0.00000	0.000E+00
11	1975	*	1.955E+02	0.2900	2.036E+03	2.036E+03	0.00000	0.000E+00
12	1976	*	1.924E+02	0.3269	2.258E+03	2.258E+03	0.00000	0.000E+00
13	1977	*	2.053E+02	0.1301	9.590E+02	9.590E+02	0.00000	0.000E+00
14	1978	*	1.862E+02	0.6553	4.379E+03	4.379E+03	0.00000	0.000E+00
15	1979	*	1.605E+02	0.2266	1.306E+03	1.306E+03	0.00000	0.000E+00
16	1980	*	1.756E+02	0.1909	1.203E+03	1.203E+03	0.00000	0.000E+00
17	1981	*	1.963E+02	0.1744	1.229E+03	1.229E+03	0.00000	0.000E+00
18	1982	*	2.077E+02	0.2929	2.184E+03	2.184E+03	0.00000	0.000E+00
19	1983	7.899E+01	2.053E+02	0.3099	2.284E+03	2.284E+03	0.95525	0.000E+00
20	1984	1.752E+02	2.022E+02	0.3015	2.189E+03	2.189E+03	0.14337	0.000E+00
21	1985	1.735E+02	1.878E+02	0.4322	2.913E+03	2.913E+03	0.07919	0.000E+00
22	1986	2.661E+02	1.756E+02	0.2913	1.836E+03	1.836E+03	-0.41561	0.000E+00
23	1987	1.640E+02	1.496E+02	0.6348	3.409E+03	3.409E+03	-0.09212	0.000E+00
24	1988	7.311E+01	9.772E+01	0.8455	2.966E+03	2.966E+03	0.29011	0.000E+00
25	1989	3.655E+01	6.673E+01	0.5302	1.270E+03	1.270E+03	0.60194	0.000E+00
26	1990	2.324E+01	6.629E+01	0.1214	2.890E+02	2.890E+02	1.04815	0.000E+00
27	1991	5.097E+01	8.148E+01	0.1015	2.970E+02	2.970E+02	0.46909	0.000E+00
28	1992	2.843E+01	1.039E+02	0.0413	1.540E+02	1.540E+02	1.29632	0.000E+00
29	1993	2.576E+01	1.347E+02	0.0550	2.660E+02	2.660E+02	1.65448	0.000E+00
30	1994	8.674E+01	1.666E+02	0.1213	7.250E+02	7.250E+02	0.65241	0.000E+00
31	1995	9.017E+01	2.020E+02	0.0829	6.010E+02	6.010E+02	0.80681	0.000E+00
32	1996	*	2.267E+02	0.2588	2.106E+03	2.106E+03	0.00000	0.000E+00
33	1997	5.934E+02	2.092E+02	0.4787	3.594E+03	3.594E+03	-1.04282	0.000E+00
34	1998	6.074E+02	1.693E+02	0.5330	3.239E+03	3.239E+03	-1.27765	0.000E+00
35	1999	4.210E+02	1.601E+02	0.1741	1.001E+03	1.001E+03	-0.96669	0.000E+00
36	2000	3.645E+02	1.802E+02	0.1846	1.194E+03	1.194E+03	-0.70467	0.000E+00

37	2001	1.022E+03	2.047E+02	0.1470	1.080E+03	1.080E+03	-1.60839	0.000E+00
38	2002	4.439E+02	2.276E+02	0.2149	1.756E+03	1.756E+03	-0.66803	0.000E+00
39	2003	8.671E+02	1.772E+02	0.8925	5.676E+03	5.676E+03	-1.58807	0.000E+00
40	2004	*	9.281E+01	1.0239	3.411E+03	3.411E+03	0.00000	0.000E+00
41	2005	*	5.503E+01	0.6236	1.232E+03	1.232E+03	0.00000	0.000E+00
42	2006	6.051E+01	3.992E+01	0.6664	9.550E+02	9.550E+02	-0.41589	0.000E+00
43	2007	5.206E+01	3.251E+01	0.3855	4.500E+02	4.500E+02	-0.47070	0.000E+00
44	2008	6.402E+01	3.400E+01	0.1786	2.180E+02	2.180E+02	-0.63283	0.000E+00
45	2009	5.550E+01	4.200E+01	0.0531	8.000E+01	8.000E+01	-0.27870	0.000E+00
46	2010	5.808E+01	5.500E+01	0.0532	1.050E+02	1.050E+02	-0.05455	0.000E+00
47	2011	1.224E+02	6.826E+01	0.1510	3.700E+02	3.700E+02	-0.58401	0.000E+00
48	2012	4.454E+01	8.557E+01	0.0352	1.080E+02	1.080E+02	0.65294	0.000E+00
49	2013	1.390E+02	1.144E+02	0.0093	3.800E+01	3.800E+01	-0.19452	0.000E+00
50	2014	2.092E+02	1.540E+02	0.0069	3.800E+01	3.800E+01	-0.30657	0.000E+00
51	2015	3.719E+01	2.060E+02	0.0023	1.700E+01	1.700E+01	1.71162	0.000E+00

* Asterisk indicates missing value(s).

Faroe Bank Cod RV Page 4

UNWEIGHTED LOG RESIDUAL PLOT FOR DATASERIES # 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   0.9552                                   |===================
1984   0.1434                                   |===
1985   0.0792                                   |==
1986  -0.4156                           ========|
1987  -0.0921                                 ==|
1988   0.2901                                   |======
1989   0.6019                                   |============
1990   1.0481                                   |=====================
1991   0.4691                                   |=========
1992   1.2963                                   |==========================
1993   1.6545                                   |=================================
1994   0.6524                                   |=============
1995   0.8068                                   |================
1996   0.0000                                   |
1997  -1.0428               =====================|
1998  -1.2777          ==========================|
1999  -0.9667                 ===================|
2000  -0.7047                      ==============|
2001  -1.6084    ================================|
2002  -0.6680                       =============|
2003  -1.5881    ================================|
2004   0.0000                                   |
```

```
2005   0.0000                 |
2006  -0.4159         ========|
2007  -0.4707        =========|
2008  -0.6328    =============|
2009  -0.2787           ======|
2010  -0.0545                =|
2011  -0.5840     ============|
2012   0.6529                 |=============
2013  -0.1945             ====|
2014  -0.3066           ======|
2015   1.7116                 |==================================
         ------------------------------------------------------------------------------------
```

Faroe Bank Cod RV Page 5

```
          Observed (O) and Estimated (*) cpue for Dataseries # 1 -- Survey cpue Spring
       :
 1200. -:
       :
       :
       :
       :                                   O
 1000. -:
       :
       :
       :                                    O
       :
  800. -:
       :
       :
       :
       :
  600. -:                                 O O
       :
       :
       :
       :                                  O   O
  400. -:
       :                                   O
       :
       :     * *   *            O
       :   * *   ** *  *                  *     *
  200. -:             * ** * *   ** * **        *  *   * *          O*
       :               * *   OO * 2     *   * *   *         *
       :                          * *               O  2
       :                   O    2 * **   O O      *  O   O   **
       :                         O OO O O         ** 2 *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
   :
7.2 -:
   :
   :
   :
   :                                              F
6.0 -:
   :
   :
   :                                            F
   :                             F
4.8 -:
   :
   :
   :                                                F
   :                    F        F                  F
3.6 -:                F
   :                               F        F
   :                                      F
   :                          F
2.4 -:          F                                    F
   :           F      F      F F
   :      F    F    F F      F    F
   :            F F     F                 F
1.2 -:        F            F                  F  F
   :  -- - -- - -2 - -- - -- - -- - --- - 2- - -- - -- - -- - -- - -- - 2- 2 -- - -- - 2- - 2- - -- - -- - -
   :                  F            FF   F
   :                                     F
   :      B BB B BB B BB B BB B BB B BB B BB B BB      F 2B B BB B BB B BB B      F F  F B BB B
0.0 -:                             B BB B            BB B BB B BB F FF
   :........................................................................................................
    :     :     :     :     :     :     :     :     :     :     :
  1959.   1965.   1971.   1977.   1983.   1989.   1995.   2001.   2007.   2013.   2019.
```

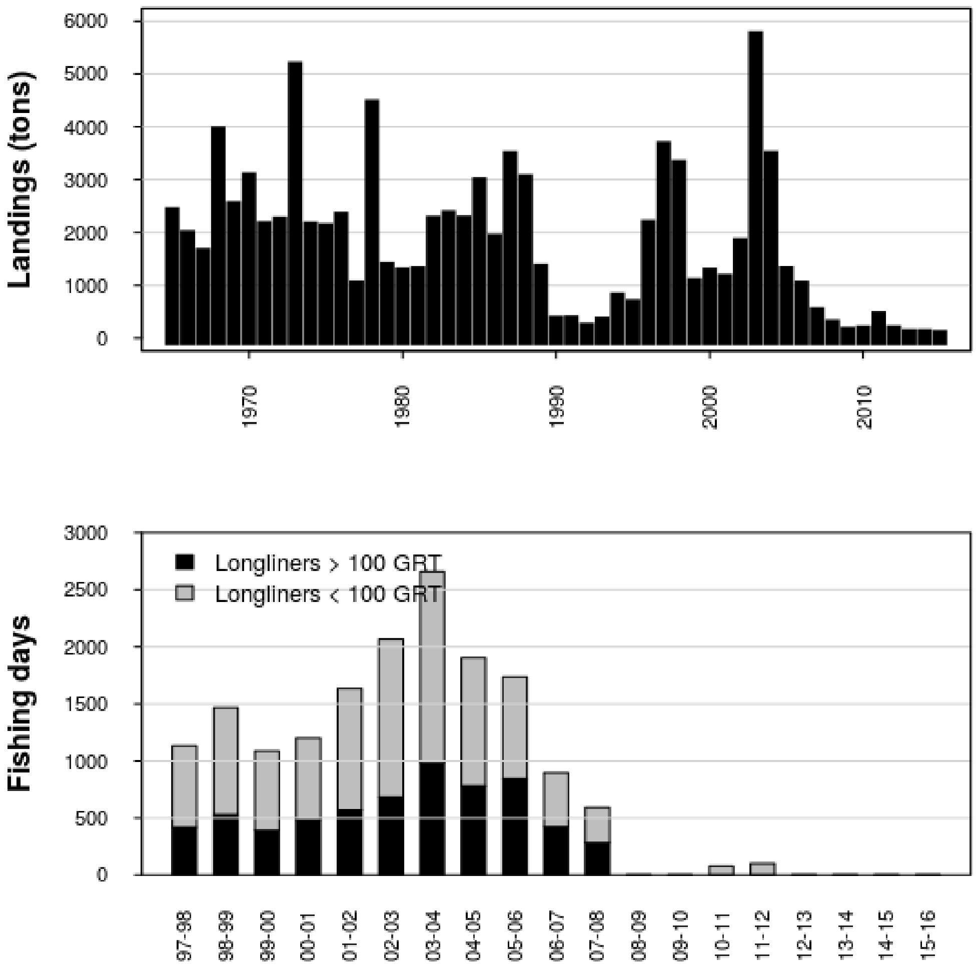

Figure 3.1. Faroe Bank (subdivision Vb2) cod. Reported landings 1965–2015. Since 1992 only catches from Faroese and Norwegian vessels are considered to be taken on Faroe Bank. Lower plot: fishing days (fishing year) 1997–2016 for longline gear type in the Faroe Bank.

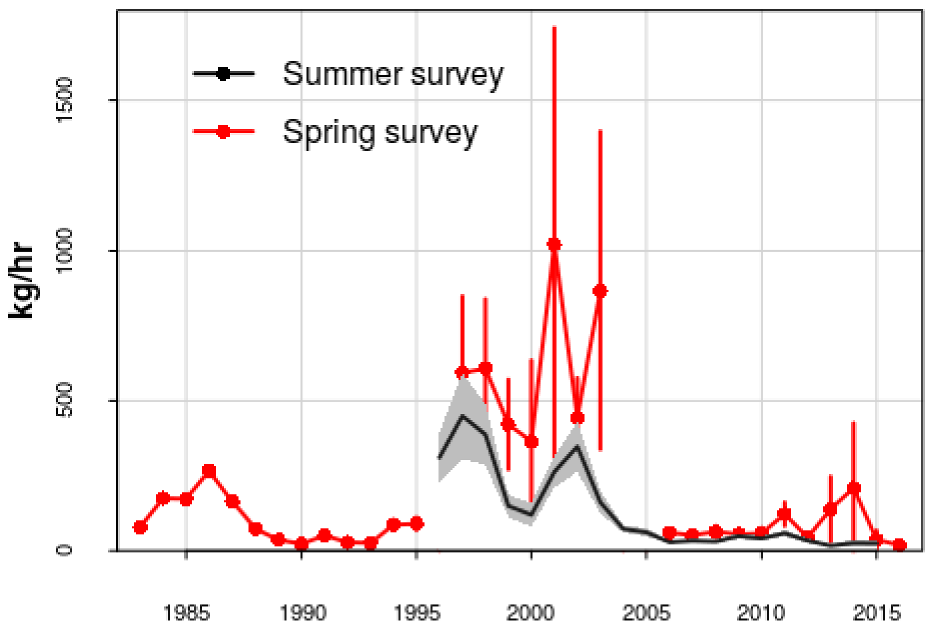

Figure 3.2. Faroe Bank (subdivision Vb2) cod. Catch per unit of effort in spring groundfish survey (1983–2016)(red line) and summer survey (1996–2015)(black line). Vertical bars and shaded areas show the standard error in the estimation of indices.

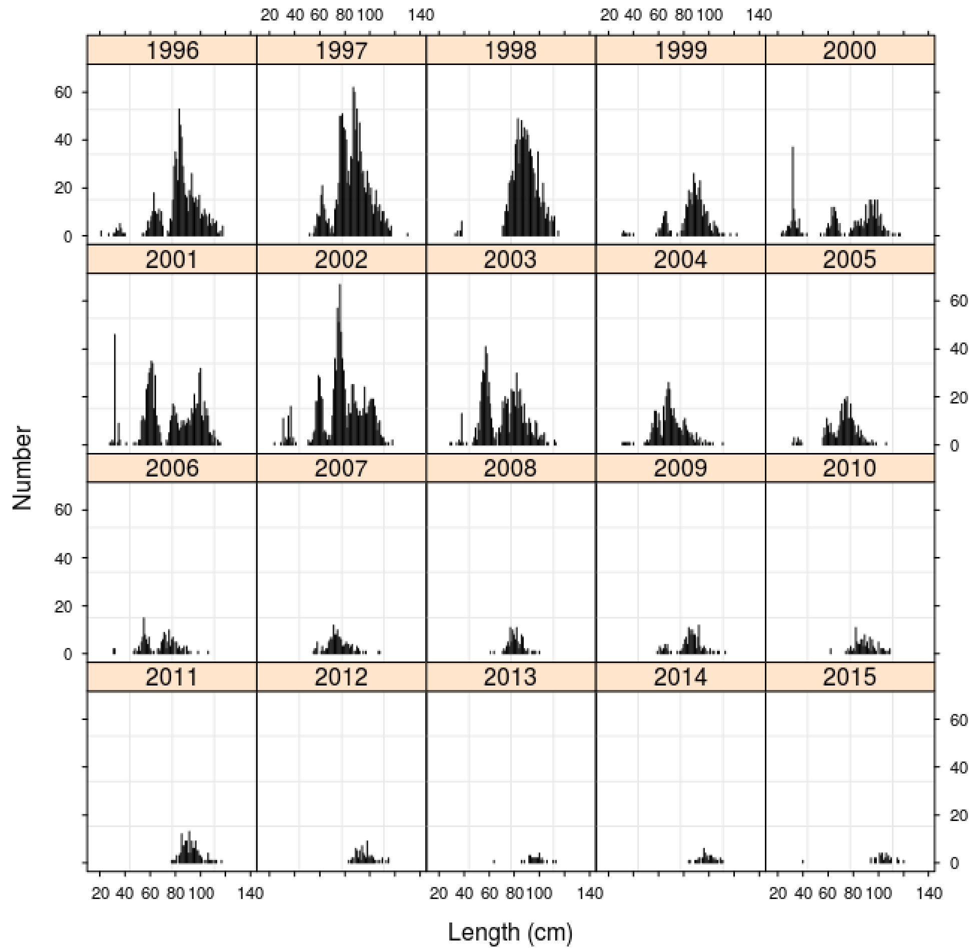

Figure 3.3. Faroe Bank (subdivision Vb2) cod. Length distributions in summer survey (1996–2015)

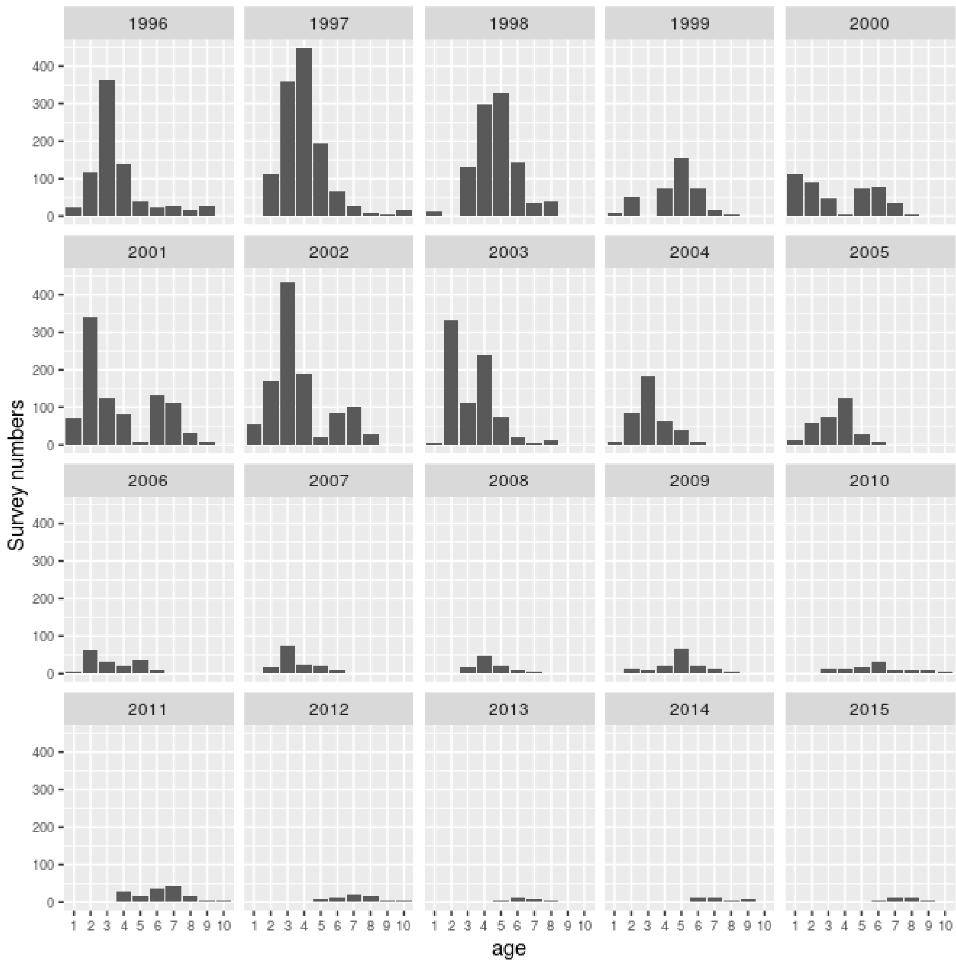

Figure 3.4. Faroe Bank (subdivision Vb2) cod. Age-disaggregated indices in summer survey (ages 1–10)(1996–2015)

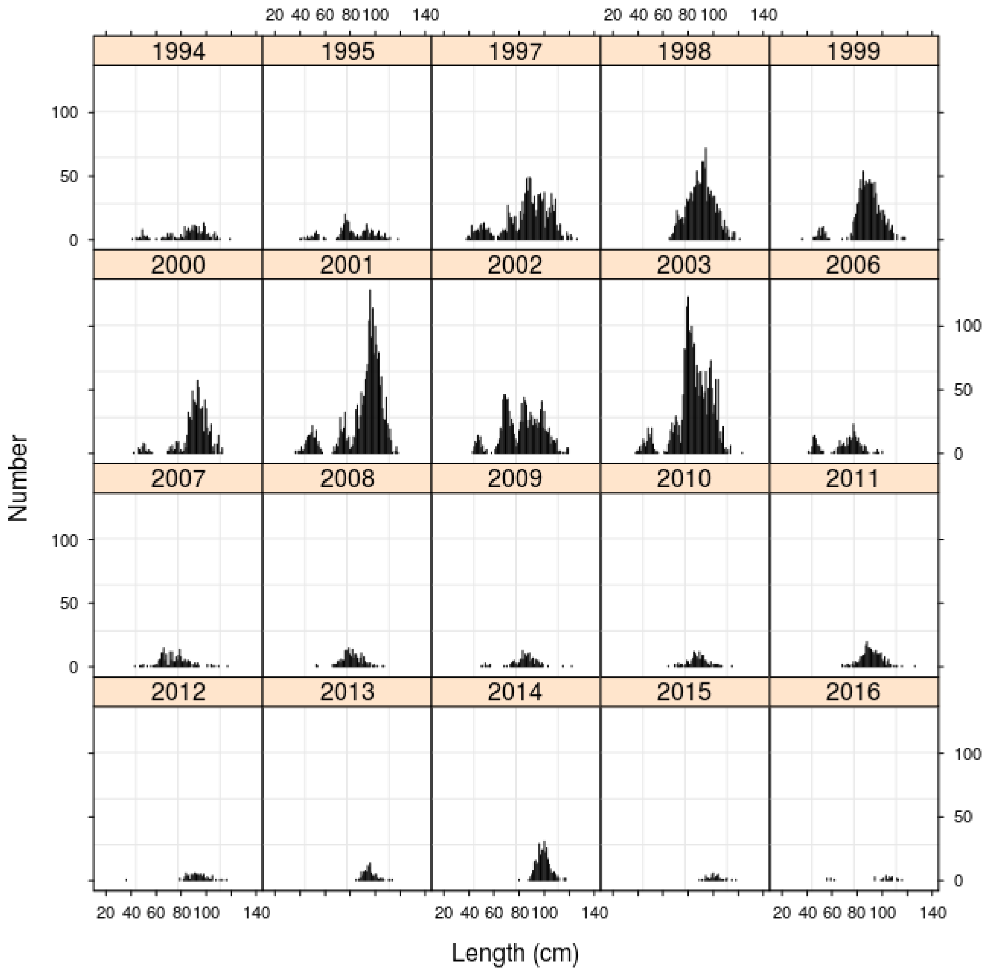

Figure 3.5. Faroe Bank (subdivision Vb2) cod. Length distributions in spring survey (1994–2016). No surveys were conducted in 1996, 2004 and 2005.

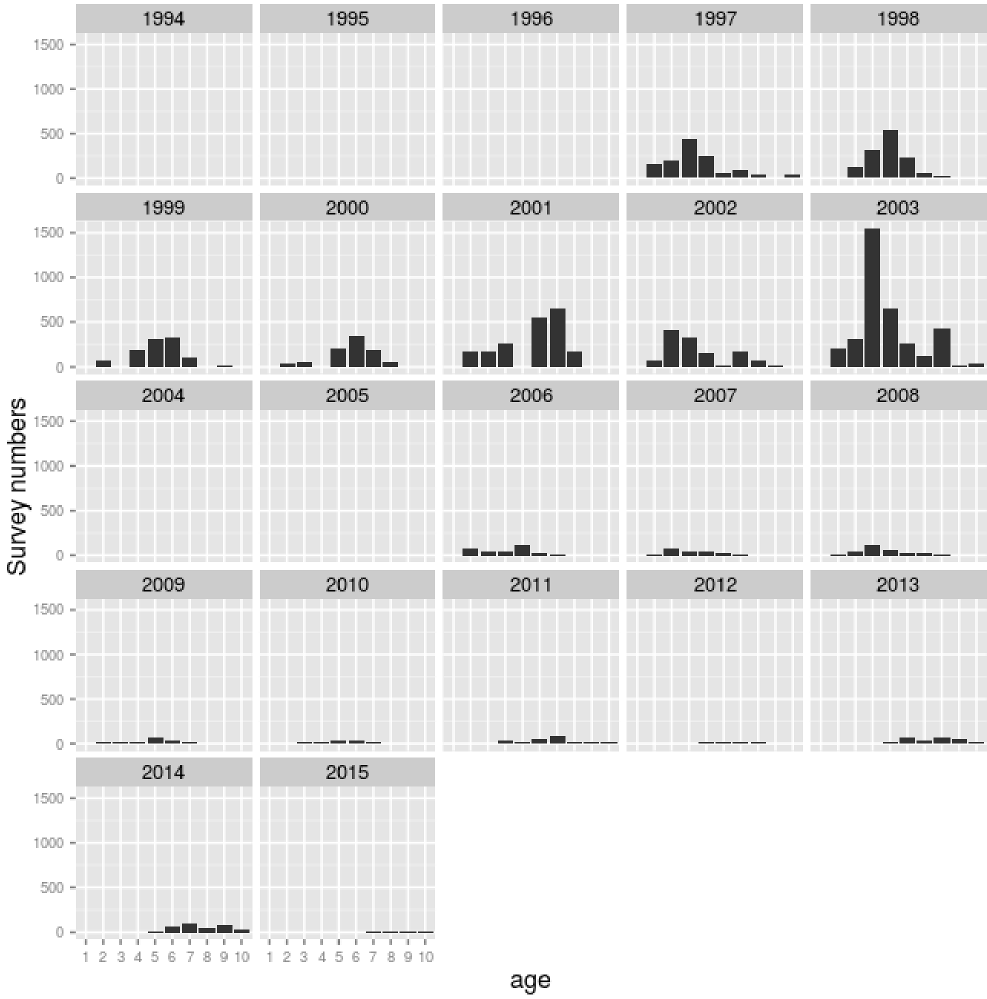

Figure 3.6. Faroe Bank (subdivision Vb2) cod. Age-disaggregated indices in spring survey (ages 1–10) (1994–2015). No surveys were conducted in 1996, 2004 and 2005. Data for 2016 were not available due to lack of age readings.

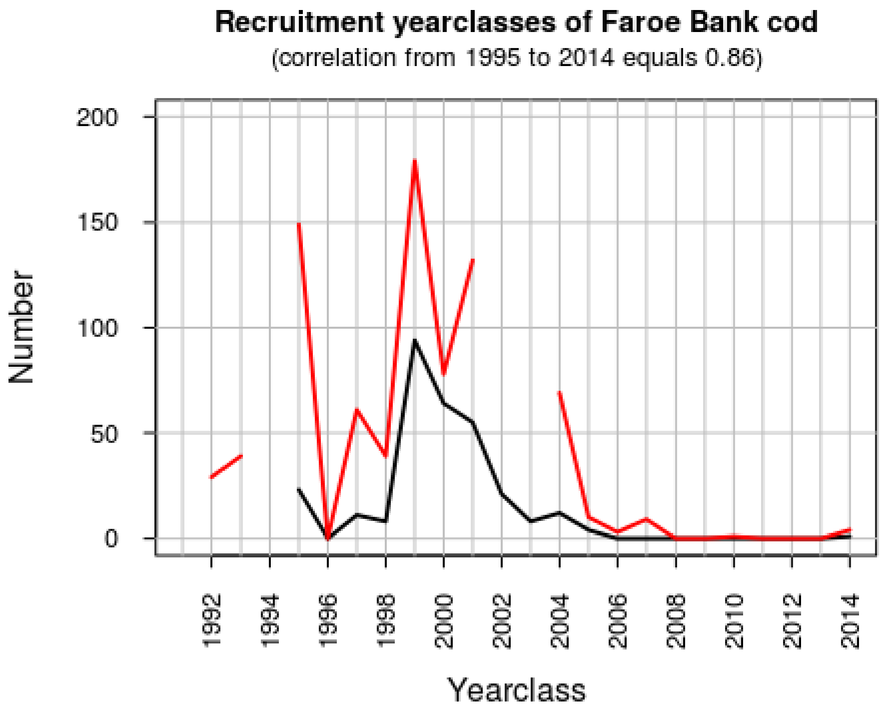

Figure 3.7. Faroe Bank (subdivision Vb2) cod. Correlation between recruitment year classes in both survey indices.

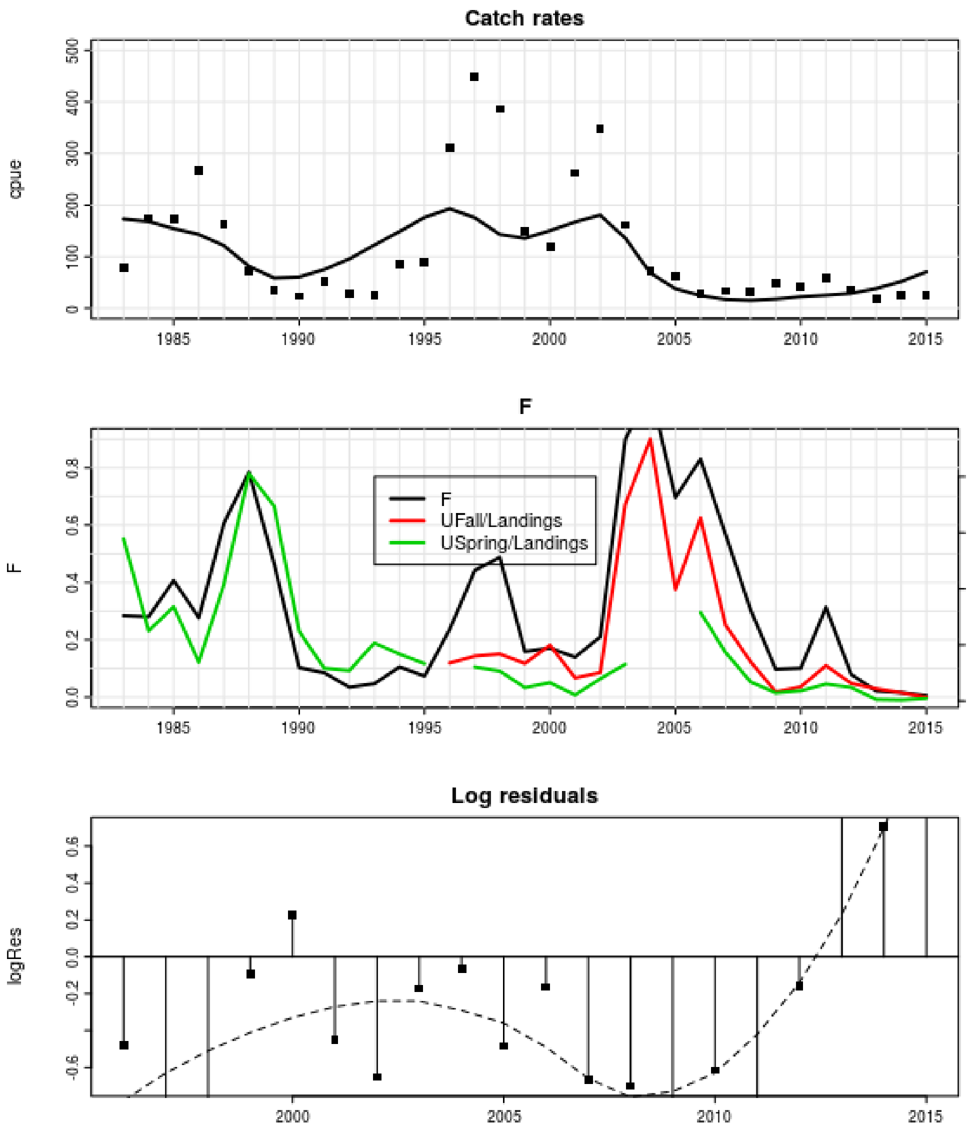

Figure 3.8. Results from the surplus production model using summer index. Observed (points) and expected catch rates (kg/hour) (top panel). Estimated fishing mortality (black line) and exploitation ratios (ratio of spring index to landings)(green line) (ratio of summer index to landings)(red line)(middle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

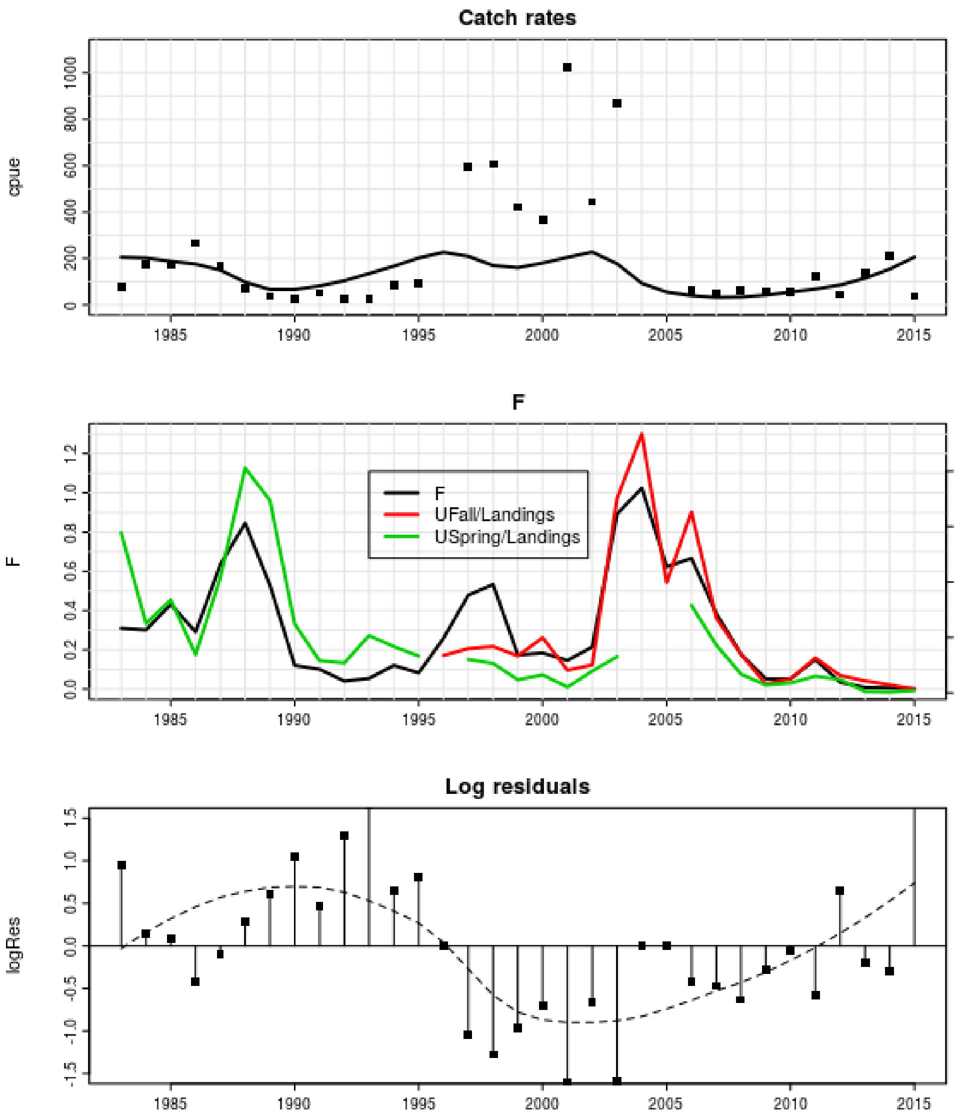

Figure 3.9. Results from the surplus production model using spring index. Observed (points) and expected catch rates (kg/hour) (top panel). Estimated fishing mortality (black line) and exploitation ratios (ratio of spring index to landings)(green line) (ratio of summer index to landings)(red line)(middle 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 1959–2015 and two age-disaggregated abundance indices obtained from the two Faroese groundfish surveys: spring survey 1994-2016 (shifted back to the previous year) and summer survey 1996-2015. The maturities were obtained from spring survey 1983-2016.

The assessment settings were the same as in the 2015 assessment. An XSA was run and tuned with the two survey indices. The fishing mortality in 2015 (average of ages 3-7 years) was estimated at 0.46, which was higher than the F_{MSY} of 0.32. The total stock size (age 2+) at the beginning of 2015 was estimated at 28 500 tonnes and the spawning-stock biomass at 19 700 tonnes, which was slightly below the limit biomass of 21 000 tonnes.

The short-term prediction until year 2018 showed a slightly decreasing total-stock biomass to 25 000 tonnes and a spawning-stock biomass to 19 000 tonnes.

It is advised 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 5.b.2), on the Faroe Plateau (Division 5.b.1) 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. This year the catch figures back to 1999 on the Faroe-Iceland Ridge were revised. They were extracted from the database on the Faroese Coastal Guard directly using their definition of the relevant area. 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 2015 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 Figure 4.2.1.

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 2015 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

Fisheries independent cpue series

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 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. The YC2009 was present in nearly constant numbers in summer groundfish survey. Both tuning series are presented in Table 4.2.9 and they show that there are few small cod in the stock.

Commercial cpue series

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: B_{pa} = 40 kt, Blim = 21 kt, F_{pa} = 0.35 and F_{lim} = 0.68.

The reference points based on the yield-per-recruit curve are the following: F_{max} = 0.25, $F_{0.1}$ = 0.12, F35%SPR = 0.18, F_{med} = 0.37, F_{low} = 0.10, F_{high} = 0.91.

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 - historical and compared to what is now

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 increased in recent years (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 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 below B_{lim} and the fishing mortality above F_{MSY} and F_{pa} (Figure 4.6.5).

To put the recent low biomass of Faroe Plateau cod into a wider context, and also to provide a basis to evaluate ecosystem properties and biomass reference points, the stock size (age 2+) of Faroe Plateau cod has been estimated back to 1710 (Table 4.6.5, Table 4.6.6, Figure 4.6.6). The first step, estimating the 1906–1958 period, was done in NWWG 2015 whereas the rest was done this year. Scaling Shetland and Faroese cpue series 1859–1914 gave biomass estimates from 1860–1905 (Working Document 24). In the same period there was information about occasional 'good' and 'bad' cod years. It happened that 'bad' years corresponded to approximately 80 thousand tons of cod and 'good' years to approximately 220 thousand tons of cod. Information about occasional 'good' and 'bad' years were available back to the seventeenth century, i.e. the biomass was roughly known for these years. From 1709 to 1856 the Royal Monopoly Trade (Den Kongelige Monopolhandel) recorded export of dried cod from the Faroes almost every year. Based on this export and an effect of year (taking into account an increasing tendency to export dried cod over the years) gave estimates of cod for the 1710–1859 period (Working Document 25, Model 1). An attempt (Model 2, and a factor between dried cod export and biomass 1841–1856) was also made to take account of a possible increased access to landing places during the 1841–1856 period, i.e. that the relationship between dried cod export and biomass had changed compared with the 1710–1840 period. The biomass estimates were quite different for the 1841–1859 period and more work could therefore be done to evaluate the importance of the potential increased access to landing sites and other technological improvements in the fishery. The results prior to 1906 should be interpreted with care, especially prior to 1860. The results indicate that the poor state of the stock in recent years is unprecedented the last three centuries.

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 YC2013 and YC2014, 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 2013–2015 and scaled to the 2015 value. The weights at age in the catches in 2016 were estimated from spring survey (ages 2 and 6–8 years) whereas the other ages were estimated from the catch weights in January-February 2016. The weights in the catches in 2017 were set to the values in 2016 and the average of 2014–2016 was expected for 2018. The proportion mature in 2016 was set to the 2016 values from spring groundfish survey, and for 2017–2018 to the average values for 2014–2016.

4.7.2 Results

The landings in 2016 are expected to be 7500 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 5.b.1 area). The spawning-stock biomass is expected to be 22400 tonnes in 2016, 20200 tonnes in 2017 and eventually 18900 tonnes in 2017. Many year classes contribute to the SSB in 2017–18 (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 F_{MSY} values lower than F_{pa}. An FLR procedure (MSE, Management strategy evaluations using FLR standard packages; a simulation of management and stock response over a 20 yr period) for Faroe Plateau cod indicates that F_{MSY} is 0.32. This value (0.32) was adopted by the NWWG 2011 as a preliminary F_{MSY}.

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.

The retrospective pattern indicates less uncertainty in the assessment than seen some years ago (Figure 4.9.1).

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 2016 assessment was much in line with the 2015 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 subarea 5.b. This was before ICES introduced PA and MSY reference values and at the time it was believed that the purpose was achieved, if the total allowable number of fishing days was set such that on average 33% of the cod exploitable stock in numbers would be harvested annually. This translates into an average F of 0.45, above the F_{pa} of 0.35. ICES considers this to be inconsistent with the PA and MSY approaches. Some work has been done in the Faroes to move away from the F_{targe}t of 0.45 to be more consistent with the ICES advice. A committee set by Faroese authorities to evaluate the management system will deliver its recommendations in summer 2016. The recommendations along with political modifications are expected to be set in force in 2018.

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 future. Hence, a reduction in fishing mortality is urgently needed.

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 compared with 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 at the beginning of the 1990s. They also have fished in other areas, e.g. in Greenland and on the Flemish Cap. 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 2008–2010, but it is not believed that this has any relationship with a change in the environment. The temperature has been high in recent years (although it has been a little bit cooler in 2014–2015), 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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4.18 Tables

Table 4.2.1. Faroe Plateau cod (subdivision 5.b.1). 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	34492	4	8		83	-		0	0	-	34595
1987	30	21303	17	12		21	-		8	0	-	21391
1988	10	22272	17	5		163	-		0	0	-	22467
1989	-	20535	-	7		285	-		0	0	-	20827
1990	-	12232	-	24		124	-		0	0	-	12380
1991	-	8203	- **	16		89	-		1	0	-	8309
1992	-	5938	3 ***	12		39	-		74	0	-	6066
1993	-	5744	1 ***	+		57	-		186	0	-	5988
1994	-	8724	-	2 ***		36	-		56	0	-	8818
1995	-	19079	2 ***	2		38	-		43	0	-	19164
1996	-	39406	1 ***	+		507	-		126	0	-	40040
1997	-	33556	-	+		410	-		61 ***	0	-	34027
1998	-	23308	- *	-		405	-		27 ***	0	-	23740
1999	-	19156	- *	39	-	450	-		51	0		19696
2000		0	1	2	-	374	-		18	0		395
2001		29762	9 ***	9	-	531 *	-		50	0		30361
2002		40602	20	6	5	573			42	0		41248
2003		30259	14	7	-	447	-		15	0		30742
2004		17540	2	3 ***		414		1	15	0		17975
2005		13556	-			201			24	0		13781
2006		11629	7	1 ***		49	5		0	0		11691
2007		9905	1 ***			71	7		0	360		10344
2008		9394	1			40			0	383		9818
2009		10736	1			14	7		0	300		11058
2010		13878	1			10.338			0	312		14201
2011		11348	-			0			0	0		11348
2012		8437	0		28	0			0	0		8465
2013		5331	0		20	0	2		0	0		5333
2014		6655				6.414			0	226		6887
2015 *		7812				33	14		0	382		8241

* Preliminary, ** Included in 5.b.2, *** Reported as 5.b.

Table 4.2.2. Faroe Plateau cod (subdivision 5.b.1). Nominal catch (t) used in the assessment.

		Faroese catches:				Catches reported as 5.b.2:		Foreign catches:					
	Officially reported	in 5.b.1	Corrections in 5.b.1	On Faroe-Iceland ridge	in IIA within Faroe area jurisdiction	UK (E/W/NI)	UK (Scotland)	UK	French***	Greenland ***	Russia ***	UK ***	Used in the 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 ****				-	551						23045
1996	40040					-	382						40422
1997	34027					-	277						34304
1998	23740					-	265						24005
1999	19696			-661		-	210						19245
2000	395	21793 *		-600		-	245						21833
2001	30361		-1766	-306		-	288						28577
2002	41248		-2409	-223		-	218	-				-	38834
2003	30742		-1795	-4034		-	254	-				-	25167
2004	17975		-1041	-4338		-	244	-				-	12840
2005	13781		-804	-3987			1129	-				-	10119
2006	11691		-690	-1435			278						9844
2007	10344		-588	-2304			53			6			7511
2008	9818		-557	-1978			32						7315
2009	11058		-637	-510			38			26	4		9979
2010	14201		-823	-680			54			5			12757
2011	11348		-673	-986						3			9692
2012	8465		-500	-766						5			7204
2013	5333		-316	-544							0		4473
2014	6887		-395	-777									5715
2015	8241 *		-463	-384									7394

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

Table 4.2.3. Faroe Plateau cod (subdivision 5.b.1). The landings of Faroese fleets (in percent) of total catch (t). Note that the catches on the Faroe-Iceland ridge (mainly belonging to single trawl-ers > 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
2015	9.0	26.0	9.6	0.1	9.1	2.1	4.2	2.2	10.9	26.9	0.0	0.0	5,890
Average	5.0	26.1	5.8	0.8	9.0	3.9	7.5	7.4	12.4	21.6	0.3	0.1	

Table 4.2.4. Faroe Plateau cod (subdivision 5.b.1). 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	119	18	0	5	1	0	2	21	0	-10	156
3	0	491	106	0	90	26	3	60	330	0	-71	1035
4	0	171	40	0	48	38	3	73	183	0	-34	522
5	0	69	17	0	22	18	2	35	61	0	-14	210
6	0	96	26	0	36	23	2	48	71	0	-20	282
7	0	68	21	0	26	19	2	43	56	0	-14	221
8	0	15	5	0	3	4	0	9	13	0	-2	47
9	0	11	3	0	1	2	0	3	5	0	-2	23
10+	0	1	1	0	1	1	0	1	3	0	-1	7
Sum	0	1041	237	0	232	132	12	274	743	0	-168	2503
G.weight	0	2313	585	0	627	509	48	1049	1986	0	-456	6661

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 (subdivision 5.b.1). Number of samples, lengths, otoliths, and individual weights in terminal year.

Fleet	Size	Samples	Lengths	Otoliths	Weights
Open boats		4	794	80	794
Longliners	<100 GRT	8	1,561	160	1,561
Longliners	>100 GRT	17	3,529	358	3,529
Jiggers		0	0	0	0
Gillnetters		0	0	0	0
Sing. trawlers	<400 HP	0	0	0	0
Sing. trawlers	400-1000 HP	11	1,981	200	1,981
Sing. trawlers	>1000 HP	0	0	0	0
Pair trawlers	<1000 HP	0	0	0	0
Pair trawlers	>1000 HP	29	5,575	439	4,412
Total		69	13,440	1,237	12,277

Table 4.2.6. Faroe Plateau cod (subdivision 5.b.1). Catch in numbers-at-age used in the XSA model.

Year\age	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	247	2892	1504	865	410	298	295	51	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	1246	1044	840	1164	2339	461	62	18	8

Year\age	1	2	3	4	5	6	7	8	9	10+
2000	0	2170	2737	811	443	700	840	108	8	1
2001	0	3967	3812	2130	373	372	728	443	36	6
2002	0	2099	7354	3405	1688	474	538	417	293	7
2003	0	697	2186	4696	1979	657	182	94	118	21
2004	0	98	673	1230	2051	717	234	63	41	36
2005	0	504	604	896	1146	841	208	41	19	31
2006	0	1110	1097	469	663	801	333	76	10	3
2007	0	506	1226	723	315	289	255	85	20	3
2008	0	287	761	783	430	187	157	156	57	19
2009	0	873	2262	861	618	296	85	55	43	17
2010	0	2113	2034	861	468	481	178	58	33	38
2011	0	328	2343	1234	365	188	126	50	19	2
2012	0	49	517	1346	555	200	99	69	25	22
2013	0	55	173	333	587	175	39	25	15	5
2014	0	387	518	286	499	350	86	14	9	1
2015	0	156	1035	522	210	282	221	47	23	7

Table 4.2.7. Faroe Plateau cod (subdivision 5.b.1). Mean weight at age (kg) in the catches.

Year\age	2	3	4	5	6	7	8	9	10+
1959	0.850	1.730	3.230	4.400	5.800	6.370	7.340	7.880	10.270
1960	1.000	2.030	3.370	4.420	6.020	6.650	8.120	11.000	10.270
1961	1.080	2.220	3.450	4.690	5.520	7.090	9.910	8.030	10.270
1962	1.000	2.270	3.350	4.580	4.930	9.080	6.590	6.660	10.270
1963	1.040	1.940	3.510	4.600	5.500	6.780	8.710	11.720	10.820
1964	0.970	1.830	3.150	4.330	6.080	7.000	6.250	6.190	14.390
1965	0.920	1.450	2.570	3.780	5.690	7.310	7.930	8.090	11.110
1966	0.980	1.770	2.750	3.510	4.800	6.320	7.510	10.340	11.650
1967	0.960	1.930	3.130	4.040	4.780	6.250	7.000	11.010	10.690
1968	0.880	1.720	3.070	4.120	4.650	5.500	7.670	10.950	9.280
1969	1.090	1.800	2.850	3.670	4.890	5.050	7.410	8.660	14.390
1970	0.960	2.230	2.690	3.940	5.140	6.460	10.310	7.390	9.340
1971	0.810	1.800	2.980	3.580	3.940	4.870	6.480	6.370	10.220
1972	0.660	1.610	2.580	3.260	4.290	4.950	6.480	6.900	11.550
1973	1.110	2.000	3.410	3.890	5.100	5.100	6.120	8.660	7.570
1974	1.080	2.220	3.440	4.800	5.180	5.880	6.140	8.630	7.620
1975	0.790	1.790	2.980	4.260	5.460	6.250	7.510	7.390	8.170
1976	0.940	1.720	2.840	3.700	5.260	6.430	6.390	8.550	13.620
1977	0.870	1.790	2.530	3.680	4.650	5.340	6.230	8.380	10.720
1978	1.112	1.385	2.140	3.125	4.363	5.927	6.348	8.715	12.229
1979	0.897	1.682	2.211	3.052	3.642	4.719	7.272	8.368	13.042
1980	0.927	1.432	2.220	3.105	3.539	4.392	6.100	7.603	9.668
1981	1.080	1.470	2.180	3.210	3.700	4.240	4.430	6.690	10.000

Year\age	2	3	4	5	6	7	8	9	10+
1982	1.230	1.413	2.138	3.107	4.012	5.442	5.563	5.216	6.707
1983	1.338	1.950	2.403	3.107	4.110	5.020	5.601	8.013	8.031
1984	1.195	1.888	2.980	3.679	4.470	5.488	6.466	6.628	10.981
1985	0.905	1.658	2.626	3.400	3.752	4.220	4.739	6.511	10.981
1986	1.099	1.459	2.046	2.936	3.786	4.699	5.893	9.700	8.815
1987	1.093	1.517	2.160	2.766	3.908	5.461	6.341	8.509	9.811
1988	1.061	1.749	2.300	2.914	3.109	3.976	4.896	7.087	8.287
1989	1.010	1.597	2.200	2.934	3.468	3.750	4.682	6.140	9.156
1990	0.945	1.300	1.959	2.531	3.273	4.652	4.758	6.704	8.689
1991	0.779	1.271	1.570	2.524	3.185	4.086	5.656	5.973	8.147
1992	0.989	1.364	1.779	2.312	3.477	4.545	6.275	7.619	9.725
1993	1.155	1.704	2.421	3.132	3.723	4.971	6.159	7.614	9.587
1994	1.194	1.843	2.613	3.654	4.584	4.976	7.146	8.564	8.796
1995	1.218	1.986	2.622	3.925	5.180	6.079	6.241	7.782	8.627
1996	1.016	1.737	2.745	3.800	4.455	4.978	5.270	5.593	7.482
1997	0.901	1.341	1.958	3.012	4.158	4.491	5.312	6.172	7.056
1998	1.004	1.417	1.802	2.280	3.478	5.433	5.851	7.970	8.802
1999	1.050	1.586	2.350	2.774	3.214	5.496	8.276	9.129	10.652
2000	1.416	2.170	3.187	3.795	4.048	4.577	8.182	11.895	13.009
2001	1.164	2.076	3.053	3.976	4.394	4.871	5.563	7.277	12.394
2002	1.017	1.768	2.805	3.529	4.095	4.475	4.650	6.244	7.457
2003	0.820	1.362	2.127	3.329	4.092	4.670	6.000	6.727	6.810
2004	1.037	1.154	1.693	2.363	3.830	5.191	6.326	7.656	9.573
2005	0.986	1.373	1.760	2.293	3.138	5.287	8.285	8.703	9.517
2006	0.839	1.304	1.988	2.386	3.330	4.691	7.635	9.524	11.990
2007	0.937	1.324	1.970	3.076	3.529	4.710	6.464	9.461	9.509
2008	1.209	1.478	2.104	2.714	3.804	4.669	5.915	7.233	9.559
2009	0.805	1.431	2.287	2.723	3.435	5.081	6.281	8.312	9.959
2010	1.049	1.642	2.400	3.212	3.678	4.774	5.973	7.094	9.800
2011	0.815	1.367	2.413	3.493	4.525	5.076	6.631	6.863	10.089
2012	1.007	1.315	1.893	3.102	4.279	5.573	5.871	7.482	9.206
2013	1.011	1.527	2.528	3.180	4.672	6.776	6.966	9.028	10.324
2014	1.099	1.653	2.466	3.000	4.148	6.489	9.394	9.236	12.120
2015	1.198	1.733	2.769	3.650	4.403	5.768	8.035	10.334	11.127
2016	1.057	1.857	2.706	3.686	4.237	5.057	6.472	9.644	9.644

Table 4.2.8. Faroe Plateau cod (subdivision 5.b.1). 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.

Year/Age	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

Year/Age	1	2	3	4	5	6	7	8	9	10+
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
2015	0.00	0.28	0.48	0.70	0.95	0.97	1.00	1.00	1.00	1.00

Table 4.2.9. Faroe Plateau cod (subdivision 5.b.1). 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 5.B.1)        Surveys_re-
vised.TXT
102
SUMMER SURVEY
1996 2015
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
 200  235.3   2230.4   1696.1    414.7   363.4  242.3   67.2
```

```
SPRING SURVEY (shifted back to december)
1993 2015
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
100   81.7    280.1      697.3      151.8      73.4      77.3
27.2       7.7
```

Table 4.2.10. Faroe Plateau cod (subdivision 5.b.1). Pairtrawler abundance index (number of individuals per 1000 fishing hours). This series was not used in the tuning of the XSA. The season is June–December. The otoliths are selected from deep (> 150 m) locations.

Year\age	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
2015	43	967	1943	1019	1190	1086	320	96

Table 4.2.11. Faroe Plateau cod (subdivision 5.b.1). 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.

YEAR\AGE	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
2015	0	1260	10417	8202	3167	3342	2428	414

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.

Year\Age	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
2015	0.9	25.4	148.6	65.3	23.0	17.9	10.7	0.7

Table 4.6.1. Faroe Plateau cod (subdivision 5.b.1). The XSA-run.

Lowestoft VPA Version 3.1

12/04/2016 8:57

Extended Survivors Analysis

COD FAROE PLATEAU (ICES SUBDIVISION 5.b.1) COD_ind_Surveys_revised

cpue data from file Surveys_revised_1replacedvalue.TXT

Catch data for 57 years. 1959 to 2015. Ages 1 to 10.

Fleet,	First, year,	Last, year,	First, age ,	Last, age	Alpha,	Beta
SUMMER SURVEY ,	1996,	2015,	2,	8,	.600,	.700
SPRING SURVEY (shift,	1993,	2015,	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,	2006,	2007,	2008,	2009,	2010,	2011,	2012,	2013,	2014,	2015
1,	.000,	.000,	.000,	.000,	.000,	.000,	.000,	.000,	.000,	.000
2,	.181,	.118,	.050,	.125,	.231,	.088,	.029,	.021,	.057,	.075
3,	.326,	.313,	.261,	.687,	.474,	.435,	.195,	.137,	.284,	.215
4,	.352,	.371,	.337,	.531,	.614,	.597,	.482,	.186,	.350,	.518
5,	.601,	.426,	.396,	.489,	.627,	.578,	.595,	.400,	.469,	.472
6,	.808,	.577,	.486,	.524,	.914,	.558,	.741,	.376,	.443,	.533
7,	.946,	.661,	.730,	.426,	.706,	.650,	.655,	.303,	.320,	.562
8,	1.004,	.675,	1.204,	.616,	.585,	.434,	.946,	.336,	.169,	.290
9,	.292,	.811,	1.562,	1.542,	.978,	.383,	.403,	.542,	.193,	.461

XSA population numbers (Thousands)

	AGE								
YEAR ,	1,	2,	3,	4,	5,	6,	7,	8,	9,
2006 ,	6.14E+03,	7.39E+03,	4.36E+03,	1.75E+03,	1.62E+03,	1.60E+03,	6.02E+02,	1.33E+02,	4.36E+01,
2007 ,	7.90E+03,	5.03E+03,	5.05E+03,	2.58E+03,	1.00E+03,	7.28E+02,	5.83E+02,	1.91E+02,	3.98E+01,

```
 2008 ,    1.01E+04, 6.46E+03, 3.66E+03, 3.02E+03, 1.45E+03, 5.37E+02,
3.35E+02, 2.46E+02, 7.97E+01,
 2009 ,    1.38E+04, 8.24E+03, 5.03E+03, 2.31E+03, 1.77E+03, 8.02E+02,
2.71E+02, 1.32E+02, 6.05E+01,
 2010 ,    5.24E+03, 1.13E+04, 5.95E+03, 2.07E+03, 1.11E+03, 8.88E+02,
3.89E+02, 1.45E+02, 5.84E+01,
 2011 ,    2.30E+03, 4.29E+03, 7.34E+03, 3.03E+03, 9.19E+02, 4.86E+02,
2.91E+02, 1.57E+02, 6.60E+01,
 2012 ,    3.53E+03, 1.88E+03, 3.22E+03, 3.89E+03, 1.37E+03, 4.22E+02,
2.28E+02, 1.25E+02, 8.34E+01,
 2013 ,    9.35E+03, 2.89E+03, 1.50E+03, 2.17E+03, 1.97E+03, 6.17E+02,
1.65E+02, 9.68E+01, 3.96E+01,
 2014 ,    2.92E+03, 7.65E+03, 2.32E+03, 1.07E+03, 1.47E+03, 1.08E+03,
3.47E+02, 9.95E+01, 5.66E+01,
 2015 ,    4.12E+03, 2.39E+03, 5.92E+03, 1.43E+03, 6.17E+02, 7.55E+02,
5.68E+02, 2.06E+02, 6.88E+01,

 Estimated population abundance at 1st Jan 2016

    ,     0.00E+00, 3.37E+03, 1.81E+03, 3.91E+03, 6.97E+02, 3.15E+02, 3.63E+02,
2.65E+02, 1.26E+02,

 Taper weighted geometric mean of the VPA populations:

    ,     1.39E+04, 1.16E+04, 8.91E+03, 5.41E+03, 2.99E+03, 1.48E+03, 6.66E+02,
2.70E+02, 1.08E+02,

 Standard error of the weighted Log(VPA populations) :

    ,        .7233,    .7048,    .6634,    .6680,    .6456,    .6312,    .6644,
.7107,    .8305,


 Log catchability residuals.


 Fleet : SUMMER SURVEY

  Age  ,  1996,  1997,  1998,  1999,  2000,  2001,  2002,  2003,  2004,  2005
     1 , No data for this fleet at this age
     2 ,  -.19,   .17,   .32,  -.90,   .11,   .64,  1.10,  -.05,   .64,   .52
     3 ,   .06,  -.30,  -.68,   .44,  -.49,   .00,   .54,  -.40,   .01,   .38
     4 ,   .09,   .20,  -.72,  -.24,  -.04,   .00,  -.01,   .02,  -.27,   .16
     5 ,   .59,  -.15,   .14,  -.79,  -.87,  -.19,   .04,  -.40,   .38,   .23
     6 ,   .08,  -.26,   .49,   .03,  -.73,  -.67,  -.42,  -.77,   .21,   .62
     7 ,   .21,  -.11,  -.44,   .46,  -.03,  -.40,  -.49, -1.44,   .07,   .44
     8 ,  -.20,  -.34,   .08,   .43,  -.26,  -.10,  -.55, -1.13,   .16,   .49



  Age  ,  2006,  2007,  2008,  2009,  2010,  2011,  2012,  2013,  2014,  2015
     1 , No data for this fleet at this age
     2 ,   .80,  -.28, -1.80,  -.17,   .65,   .11, -1.72,  -.63,   .27,   .44
     3 ,  -.10,  -.68,  -.58,  1.05,   .50,   .15,  -.97,  -.36,   .73,   .70
     4 ,  -.25,  -.74,  -.88,   .43,   .81,   .48,   .16, -1.09,   .26,  1.63
     5 ,  -.34,  -.53,  -.11,   .07,   .21,   .41,   .32,   .38,  -.19,   .82
     6 ,  -.42,  -.43,  -.01,   .51,   .18,   .14,  -.20,  1.00,   .18,   .50
     7 ,  -.09,  -.73,  -.50,   .44,   .38,   .28,  -.54,   .62,   .06,   .39
     8 ,  -.02,  -.50,  -.53,   .26,   .01,  -.27,  -.36,   .31,  -.01,  -.05



 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,   -7.8746,   -6.7078,   -6.2936,   -6.0845,   -6.0486,   -6.0486,
-6.0486,
 S.E(Log q),     .7723,     .5560,     .6124,     .4451,     .4861,     .5222,
.4091,



 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,	.74,	1.413,	8.13,	.63,	20,	.56,	-7.87,
3,	.95,	.273,	6.80,	.66,	20,	.54,	-6.71,
4,	1.15,	-.719,	6.00,	.56,	20,	.71,	-6.29,
5,	1.13,	-.847,	5.87,	.69,	20,	.51,	-6.08,
6,	1.11,	-.587,	5.94,	.60,	20,	.55,	-6.05,
7,	1.06,	-.327,	6.11,	.59,	20,	.56,	-6.12,
8,	1.37,	-1.958,	6.54,	.61,	20,	.49,	-6.18,

Fleet : SPRING SURVEY (shift

Age	1993	1994	1995
1	.00,	-.51,	-.39
2	-.92,	-.90,	.18
3	-.62,	.02,	.12
4	-.56,	-.01,	.59
5	-.56,	.76,	.39
6	-.60,	.89,	.52
7	-.36,	.39,	.19
8	-4.60,	.71,	.09

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1	-.79,	-.75,	.69,	-.43,	.26,	.18,	-.50,	1.97,	.99,	-.07
2	-.25,	-.24,	.36,	.24,	.47,	.74,	-.25,	.24,	.42,	-1.06
3	-.04,	-.17,	.09,	.05,	.20,	.31,	.38,	-.47,	.43,	-.92
4	-.06,	.18,	-.24,	-.52,	-.14,	.33,	-.02,	-.23,	.28,	-.43
5	-.12,	.25,	.17,	-.58,	-.34,	.08,	.27,	-.39,	.41,	-.60
6	-.09,	-.03,	.22,	.39,	.33,	.11,	-.26,	-.43,	.29,	-.52
7	-.14,	-.21,	-.19,	.17,	-.71,	.04,	.13,	-.24,	-.64,	-.82
8	-1.44,	.92,	.13,	-1.18,	-1.51,	.18,	-.06,	-.15,	-.74,	-1.05

Age	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	-1.09,	.12,	.43,	.94,	.36,	-.10,	-.03,	-.35,	-.95,	.00
2	-.66,	.22,	-.09,	.76,	.54,	-.20,	.89,	-.75,	-.14,	.40
3	-.83,	.10,	.51,	.33,	.47,	.27,	1.13,	-.53,	-.48,	-.35
4	-.79,	-.03,	.66,	.35,	.58,	-.36,	1.12,	-.17,	-.08,	-.45
5	-.36,	-.16,	.47,	.25,	.61,	-.65,	.36,	-.07,	.19,	-.36
6	-.39,	-.05,	.04,	-.03,	1.12,	-.79,	-.29,	-.19,	-.06,	-.20
7	-.30,	-.50,	-.10,	.09,	.72,	-.33,	-.13,	-.16,	-.49,	-.94
8	.30,	-.46,	.42,	.11,	.24,	-1.25,	.51,	-.08,	-.79,	-1.45

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,	-8.3359,	-6.8864,	-5.9989,	-5.7133,	-5.7378,	-5.9828,	-5.9828,	-5.9828,
S.E(Log q),	.7023,	.5683,	.4869,	.4573,	.4211,	.4557,	.4400,	1.2634,

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,	1.00,	-.024,	8.33,	.57,	23,	.72,	-8.34,
2,	1.04,	-.221,	6.81,	.65,	23,	.60,	-6.89,
3,	.89,	.833,	6.29,	.75,	23,	.44,	-6.00,
4,	.91,	.756,	5.95,	.77,	23,	.42,	-5.71,
5,	.90,	.858,	5.93,	.79,	23,	.38,	-5.74,
6,	.89,	.776,	6.10,	.71,	23,	.41,	-5.98,

```
  7,     .97,     .199,      6.18,     .75,     23,     .39,   -6.18,
  8,     .64,    1.579,      6.03,     .48,     23,     .72,   -6.47,


 Terminal year survivor and F summaries :

 Age  1   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 (shift,      3374.,   .717,       .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,
     3374.,       .72,      .00,    1,    .000,   .000

 Age  2   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       ,      2810.,   .791,       .000,    .00,   1,  .236,
.049
 SPRING SURVEY (shift,      1586.,   .451,       .659,   1.46,   2,  .725,
.085

   F shrinkage mean  ,      1576.,   2.00,,,,                        .040,
.086

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
     1815.,       .38,      .35,    4,    .917,   .075


 Age  3   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       ,      6838.,   .463,       .206,    .44,   2,  .338,
.128
 SPRING SURVEY (shift,      2949.,   .334,       .070,    .21,   3,  .639,
.276

   F shrinkage mean  ,      2609.,   2.00,,,,                        .023,
.307

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
     3908.,       .27,      .19,    6,    .708,   .215
```

```
 Age  4   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       ,      1625.,   .376,       .587,   1.56,   3,  .341,
.255
 SPRING SURVEY (shift,       439.,   .275,       .115,    .42,   4,  .635,
.730

   F shrinkage mean  ,       833.,   2.00,,,,                        .024,
.449

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       697.,       .22,      .30,    8,   1.365,   .518


 Age  5   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       ,       394.,   .296,       .459,   1.55,   4,  .395,
.393
 SPRING SURVEY (shift,       273.,   .236,       .212,    .90,   5,  .588,
.529

   F shrinkage mean  ,       267.,   2.00,,,,                        .017,
.538

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       315.,       .18,      .21,   10,   1.127,   .472

 Age  6   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       ,       322.,   .264,       .302,   1.14,   5,  .416,
.584
 SPRING SURVEY (shift,       398.,   .219,       .193,    .88,   6,  .567,
.495

   F shrinkage mean  ,       302.,   2.00,,,,                        .017,
.612

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       363.,       .17,      .16,   12,    .924,   .533


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

 Year class = 2008
```

```
 Fleet,                Estimated,    Int,       Ext,    Var,    N, Scaled,
Estimated
     ,                 Survivors,    s.e,       s.e,   Ratio,    , Weights,
F
 SUMMER SURVEY       ,       361.,   .263,       .053,    .20,   6,  .419,
.441
 SPRING SURVEY (shift,       210.,   .226,       .270,   1.19,   7,  .562,
.669

   F shrinkage mean  ,       285.,   2.00,,,,                        .019,
.531

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       265.,       .17,      .16,   14,    .912,   .562


 Age  8   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       ,       156.,   .243,       .155,    .64,   7,  .558,
.241
 SPRING SURVEY (shift,        99.,   .235,       .180,    .77,   8,  .427,
.359

   F shrinkage mean  ,        66.,   2.00,,,,                        .015,
.498

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       126.,       .17,      .13,   16,    .731,   .290


 Age  9   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       ,        42.,   .259,       .150,    .58,   7,  .571,
.402
 SPRING SURVEY (shift,        28.,   .258,       .121,    .47,   8,  .405,
.555

   F shrinkage mean  ,        34.,   2.00,,,,                        .024,
.478

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
        36.,       .19,      .10,   16,    .548,   .461
```

Table 4.6.2. Faroe Plateau cod (subdivision 5.b.1). Fishing mortality-at-age from the XSA model.

YEAR\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	0.9417	0.8087	0.8087	0.7056
1984	0.1073	0.3712	0.5790	0.6609	0.4533	0.4761	0.4792	0.5340	0.5340	0.5081
1985	0.0658	0.3543	0.5075	0.6134	0.9235	1.1081	1.3203	0.9042	0.9042	0.7014
1986	0.0247	0.3545	0.6225	0.7030	0.8256	0.8400	0.5408	0.7131	0.7131	0.6691
1987	0.0291	0.2208	0.4754	0.4850	0.5555	0.4896	0.6222	0.5298	0.5298	0.4453
1988	0.0666	0.3531	0.5639	0.5490	0.7735	0.7980	0.8641	0.7165	0.7165	0.6075
1989	0.1659	0.4394	0.7614	0.7620	0.9617	1.0574	1.0994	0.9386	0.9386	0.7964
1990	0.0780	0.3355	0.6371	0.8016	0.7141	0.8518	1.1365	0.8369	0.8369	0.6680
1991	0.0324	0.1997	0.4499	0.5980	0.7462	0.5816	0.7180	0.6242	0.6242	0.5151
1992	0.0201	0.1001	0.3270	0.3478	0.6366	0.8918	0.4457	0.5342	0.5342	0.4607
1993	0.0132	0.1021	0.1869	0.2550	0.2027	0.4403	0.5790	0.3350	0.3350	0.2374
1994	0.0254	0.1130	0.1910	0.2503	0.2228	0.1588	0.3209	1.1015	1.1015	0.1872
1995	0.0698	0.1615	0.4658	0.2809	0.3620	0.3394	0.2344	0.7368	0.7368	0.3219
1996	0.0301	0.1916	0.4512	0.8130	0.9099	1.1481	0.9542	1.0211	1.0211	0.7028
1997	0.0341	0.1459	0.4082	0.8299	1.0584	1.4231	1.3855	1.1287	1.1287	0.7731
1998	0.0866	0.1719	0.2665	0.6381	1.0420	0.8124	1.2396	0.9235	0.9235	0.5862
1999	0.0989	0.2922	0.2987	0.3267	0.6857	1.1262	0.9085	0.6112	0.6112	0.5459

Year\age	2	3	4	5	6	7	8	9	10+	FBAR 3-7
2000	0.1279	0.3268	0.3887	0.2539	0.3338	0.5659	0.9070	0.2657	0.2657	0.3738
2001	0.1586	0.3465	0.4580	0.3104	0.3517	0.7000	0.6738	0.9194	0.9194	0.4333
2002	0.1939	0.4930	0.6010	0.8261	0.8322	1.3642	1.2352	1.4999	1.4999	0.8233
2003	0.1347	0.3177	0.6873	0.8792	0.9433	0.9388	0.9717	1.8512	1.8512	0.7532
2004	0.0312	0.1864	0.2971	0.7491	0.9767	1.1465	1.0737	2.0794	2.0794	0.6712
2005	0.0995	0.2725	0.4053	0.5004	0.8175	0.8836	0.6153	1.2362	1.2362	0.5758
2006	0.1815	0.3260	0.3524	0.6008	0.8083	0.9459	1.0038	0.2921	0.2921	0.6067
2007	0.1179	0.3125	0.3714	0.4256	0.5770	0.6611	0.6755	0.8110	0.8110	0.4695
2008	0.0503	0.2611	0.3371	0.3956	0.4856	0.7299	1.2043	1.5623	1.5623	0.4419
2009	0.1246	0.6865	0.5315	0.4886	0.5243	0.4263	0.6160	1.5416	1.5416	0.5314
2010	0.2314	0.4741	0.6140	0.6268	0.9135	0.7058	0.5852	0.9782	0.9782	0.6668
2011	0.0882	0.4349	0.5969	0.5779	0.5580	0.6496	0.4336	0.3831	0.3831	0.5635
2012	0.0292	0.1954	0.4817	0.5952	0.7415	0.6551	0.9463	0.4027	0.4027	0.5338
2013	0.0213	0.1365	0.1861	0.3999	0.3758	0.3035	0.3360	0.5422	0.5422	0.2804
2014	0.0575	0.2839	0.3501	0.4690	0.4433	0.3199	0.1690	0.1931	0.1931	0.3732
2015	0.0749	0.2148	0.5177	0.4715	0.5328	0.5624	0.2899	0.4610	0.4610	0.4599

Table 4.6.3. Faroe Plateau cod (subdivision 5.b.1). Stock number-at-age from the XSA model.

YEAR\AGE	1	2	3	4	5	6	7	8	9	10+	TOTAL
1959	17399	13238	12185	2634	4092	683	503	213	29	0	50976
1960	14680	14245	9027	6141	1380	1784	378	225	129	0	47989
1961	25227	12019	7385	3747	2699	666	668	155	66	0	52630
1962	24782	20654	7042	3616	1863	1245	335	210	56	0	59804
1963	26668	20290	12907	3503	1825	752	584	190	87	0	66807
1964	10100	21834	12893	6986	1710	895	358	294	112	0	55183
1965	22676	8269	16037	7823	3639	830	416	151	169	0	60009
1966	28643	18566	5999	10207	4085	1698	351	200	80	0	69829
1967	21475	23451	13990	4034	6475	2133	842	109	70	0	72579
1968	11390	17582	17744	9020	2525	3757	980	410	31	0	63439
1969	10514	9325	13012	11522	4976	1212	1967	393	240	0	53161
1970	14569	8608	6840	7843	6447	2682	561	965	138	0	48654
1971	26041	11928	6684	4548	4456	3754	1516	238	519	0	59683
1972	15356	21320	9469	4788	2981	2483	1760	779	92	0	59029
1973	37229	12573	16664	6689	3187	1901	1109	902	499	400	81153
1974	46803	30480	9639	10816	4037	1969	1209	626	533	342	106456
1975	22687	38319	23000	6747	7217	2460	1103	581	378	476	102968
1976	12208	18575	29035	13683	3572	3908	1279	636	304	466	83665
1977	13128	9995	13853	20010	7765	1676	1909	489	274	18	69116
1978	18318	10748	7799	8372	10190	2993	659	513	184	154	59931
1979	28804	14998	8298	5282	4463	5433	1509	297	238	103	69424
1980	17100	23582	11759	5226	2811	2206	2723	789	122	52	66370
1981	27027	14000	18286	7580	2957	1491	1076	1477	339	150	74384
1982	30732	22128	10878	11228	4413	1564	694	440	732	348	83159
1983	58342	25161	17086	7128	6412	2450	854	284	207	200	118126
1984	21157	47766	18656	8767	3339	2765	916	238	91	174	103870
1985	11616	17322	35130	10538	4023	1412	1439	466	121	146	82212
1986	12108	9511	13279	20181	5194	1784	459	389	102	81	63087
1987	10661	9913	7597	7627	8866	2105	640	162	185	69	47826
1988	19749	8729	7884	4987	3882	4469	989	321	71	53	51135
1989	4441	16169	6686	4535	2323	1835	1688	365	111	16	38170
1990	8132	3636	11214	3528	1734	888	574	480	99	50	30336
1991	13900	6658	2754	6565	1527	637	356	201	126	56	32780
1992	12320	11380	5277	1846	3428	688	247	163	80	90	35520
1993	30804	10087	9132	3909	1090	1982	298	83	85	96	57567
1994	52357	25220	8150	6751	2655	692	1325	157	38	26	97371
1995	15991	42867	20130	5960	4566	1692	453	926	93	102	92780
1996	8049	13092	32730	14024	3062	2823	965	264	599	80	75688
1997	7407	6590	10401	22125	7312	1112	930	251	83	192	56403
1998	17868	6064	5214	7359	12043	2611	316	184	51	45	51755
1999	24393	14629	4553	3595	4616	5209	754	115	44	19	57926

Year\Age	1	2	3	4	5	6	7	8	9	10+	TOTAL
2000	36505	19972	10850	2783	2183	2726	2148	200	38	5	77409
2001	16074	29888	14388	6406	1545	1387	1598	999	66	11	72361
2002	7466	13160	20880	8331	3318	927	799	650	417	10	55957
2003	4308	6112	8875	10441	3739	1189	330	167	155	27	35344
2004	7182	3527	4374	5288	4300	1271	379	106	52	44	26522
2005	9029	5880	2799	2972	3217	1664	392	99	30	47	26129
2006	6143	7393	4358	1745	1623	1597	602	133	44	13	23649
2007	7896	5030	5048	2576	1004	728	583	191	40	6	23102
2008	10060	6465	3660	3024	1454	537	335	246	80	26	25887
2009	13806	8237	5033	2308	1767	802	271	132	60	23	32439
2010	5244	11303	5954	2074	1111	888	389	145	58	66	27231
2011	2301	4294	7343	3034	919	486	291	157	66	7	18898
2012	3530	1884	3218	3892	1368	422	228	125	83	73	14822
2013	9349	2890	1498	2167	1968	617	165	97	40	13	18804
2014	2918	7654	2316	1070	1473	1080	347	100	57	6	17022
2015	4121	2389	5917	1428	617	755	568	206	69	21	16090
2016	0	3374	1815	3908	697	315	363	265	126	46	10908

Table 4.6.4. Faroe Plateau cod (subdivision 5.b.1). Summary table from the XSA model. The re-sults from the short-term prediction are shown in bold.

Year	Recruitment	Biomass	Biomass	Biomass	Landings	Mean F
	Age 2	Age 2+	Age 3+	SSB		Ages 3-7
	thousands	tonnes	tonnes	tonnes	tonnes	
1959	13238	67803	56550	48869	22415	0.5117
1960	14245	75862	61619	54447	32255	0.661
1961	12019	65428	52459	46439	21598	0.6059
1962	20654	68225	47568	43326	20967	0.5226
1963	20290	77602	56500	49054	22215	0.4944
1964	21834	84666	63483	55362	21078	0.5017
1965	8269	75043	67442	57057	24212	0.4909
1966	18566	83919	65724	60629	20418	0.4743
1967	23451	105289	82778	73934	23562	0.39
1968	17582	110433	94958	82484	29930	0.4642
1969	9325	105537	95372	83487	32371	0.4375
1970	8608	98398	90131	82035	24183	0.3882
1971	11928	78218	68559	63308	23010	0.3526
1972	21320	76439	62363	57180	18727	0.3358
1973	12573	110713	96756	83547	22228	0.2886
1974	30480	139266	106341	98434	24581	0.3139
1975	38319	153664	123391	109566	36775	0.3947
1976	18575	161260	143807	123077	39799	0.4749
1977	9995	136211	127520	112057	34927	0.6757
1978	10748	96227	84269	78497	26585	0.4259
1979	14998	85112	71659	66723	23112	0.4273
1980	23582	85038	63178	58887	20513	0.3945
1981	14000	88411	73287	63562	22963	0.4648
1982	22128	98963	71739	67033	21489	0.4138
1983	25161	123255	89581	78542	38133	0.7056
1984	47766	152158	95072	96773	36979	0.5081
1985	17322	131240	115566	84786	39484	0.7014
1986	9511	99271	88821	73693	34595	0.6691
1987	9913	78362	67522	62241	21391	0.4453
1988	8729	66177	56912	52125	23182	0.6075
1989	16169	59031	42701	38406	22068	0.7964
1990	3636	38276	34837	29270	13692	0.668
1991	6658	28679	23491	21069	8750	0.5151
1992	11380	35684	24430	20755	6396	0.4607
1993	10087	51034	39378	33068	6107	0.2374
1994	25220	83914	53804	42475	9046	0.1872
1995	42867	144645	92428	54320	23045	0.3219
1996	13092	143005	129704	85321	40422	0.7028
1997	6590	97233	91293	81714	34304	0.7731
1998	6064	66872	60784	56284	24005	0.5862
1999	14629	66269	50916	45830	19245	0.5459

YEAR	RECRUITMENT	BIOMASS	BIOMASS	BIOMASS	LANDINGS	MEAN F
	AGE 2	AGE 2+	AGE 3+	SSB		AGES 3–7
	THOUSANDS	TONNES	TONNES	TONNES	TONNES	
2000	19972	91995	63718	46396	21833	0.3738
2001	29888	110410	75622	59118	28577	0.4333
2002	13160	98445	85066	56006	38834	0.8233
2003	6112	60392	55378	40542	25167	0.7532
2004	3527	36140	32490	26435	12840	0.6712
2005	5880	31066	25273	22942	10119	0.5758
2006	7393	28949	22757	19879	9844	0.6067
2007	5030	26543	21832	16786	7511	0.4695
2008	6465	29423	21607	20129	7315	0.4419
2009	8237	29617	22981	19359	9979	0.5314
2010	11303	37225	25370	21047	12757	0.6668
2011	4294	29310	25810	18135	9692	0.5635
2012	1884	22838	20946	17848	7204	0.5338
2013	2890	22114	19196	19083	4473	0.2804
2014	7654	27567	19156	20087	5715	0.3732
2015	2389	28520	25663	19729	7394	0.4599
2016	3374	26625	25663	22408	7514	0.4599
2017	4311	25745		20162	7170	0.4599
2018	4311	25020		18911		
Average	14736	79908	64677	55347	21832	0.5102

Table 4.6.5. Faroe Plateau cod (subdivision 5.b.1). Biomass (age 2+, tons) from 1710–1859 based on two approaches. The left part of the table is modelled by scaled dried cod export (taking account of increasing tendency to export more fish over time) 1710-1859. The right part of the table is modelled by the same model, but fitted for the 1710–1840 period, and a separate model, a factor, is used for the 1841–1859 period. This was an attempt to take account of a possible increased dried cod export caused by better possibilities of fishers to sell their landings. The value in 1860 (taken from next table) is also shown. Missing years are modelled by linear interpolation. Year label = first row + first column.

	1700	1750	1800	1850	1700	1750	1800	1850
0		203118	145689	163103		209334	153202	69133
1		150800	150618	168040		154170	158624	75653
2		100949	109427	175508		100590	113557	86379
3		74141	81679	181495		72481	83220	95999
4		98616	70210	205909		97678	70898	142806
5		62191	89050	236862		60147	91333	215365
6		131926	100897	210540		134388	104274	193343
7		141252	115479	184218		144056	120134	171320
8		180782	113116	157896		186010	117581	149298
9		159904	93431	131574		163392	96800	127275
10	142041	133776	73745	105252	139327	135636	76018	105252
11	168323	107648	54060		166755	107881	55236	
12	193811	120502	34374		193421	121629	34455	
13	193026	120502	14689		192735	121629	13673	
14	154233	128892	67502		152771	130692	69965	
15	109779	145077	90579		107070	148357	94857	
16	58303	139000	111302		54676	141834	116549	
17	70962	129309	113210		67616	131610	118767	
18	98712	111100	130165		96031	112061	138050	
19	127083	95355	173807		124525	95335	187049	
20	114273	103794	183183		111543	104507	197681	
21	98139	117533	151025		94963	119275	161727	
22	77036	117533	128521		73459	119275	136272	
23	65720	131271	121350		62238	134044	128310	
24	54404	94983	119010		51018	95739	125814	
25	54404	58694	113337		51018	57434	119552	
26	55649	71518	102938		52294	70870	108042	
27	86296	79834	116320		83531	79659	122965	
28	101645	90404	124944		99323	90772	132793	
29	120159	96467	136327		118226	97236	145626	
30	122389	104086	150109		120593	105556	161352	
31	112436	111704	161142		110278	113876	174088	
32	86199	92367	169340		83857	93305	183519	
33	59963	92367	171628		57435	93305	186276	
34	33726	85472	157524		31014	86016	170288	
35	49250	102178	153222		46434	103919	165504	
36	81195	100998	154433		79333	102688	167039	
37	86494	120264	159721		84577	123750	173188	

	1700	1750	1800	1850	1700	1750	1800	1850
38	79128	146668	141223		77256	152842	152440	
39	61034	172556	135717		58429	181282	146245	
40	50622	164087	156283		48317	172091	135996	
41	54594	138988	219704		52530	144576	199136	
42	18387	122896	238434		16411	126933	187345	
43	103720	117417	243695		102334	121048	199009	
44	83076	124089	223875		81115	128422	154909	
45	83076	130899	210972		81115	136024	136441	
46	88182	113963	188260		86580	117918	101729	
47	186414	96159	184208		191549	98703	95822	
48	193149	77125	177024		198624	77981	88167	
49	237895	117737	175956		247009	122529	87678	

Table 4.6.6. Faroe Plateau cod (subdivision 5.b.1). Biomass (age 2+, tons) from 1860–2015. The biomass from 1860–1905 is based on scaled cpue from Faroese and Shetland vessels. The biomass from 1906–1958 is based on scaled cpue from British steam trawlers. The results from the age-based assessment from 1959–2015 are shown for completeness. Year label = first row + first column.

	1850	1875	1900	1925	1950	1975	2000
0		236420	143952	129353	152207	153664	91995
1		224948	156472	185574	124325	161260	110410
2		208758	151509	162034	116783	136211	98445
3		213729	163172	126611	116783	96227	60392
4		199256	145938	135524	146493	85112	36140
5		241850	130638	142608	149464	85038	31066
6		254217	125162	139409	108327	88411	28949
7		257567	148793	121354	112898	98963	26543
8		221818	108532	108327	84102	123255	29423
9		173547	175051	107870	67803	152158	29617
10	105252	102923	149669	91187	75862	131240	37225
11	88276	86780	175051	102385	65428	99271	29310
12	95349	72702	161922	95758	68225	78362	22838
13	127038	71090	137415	93244	77602	66177	22114
14	152220	84268	112908	143439	84666	59031	27567
15	118946	166257	122391	193635	75043	38276	28520
16	107629	253036	143731	216611	83919	28679	
17	94463	258572	171332	188465	105289	35684	
18	149274	187962	213691	196270	110433	51034	
19	198563	137071	205685	210683	105537	83914	
20	181645	195446	98904	225096	98398	144645	
21	139371	184553	117284	239509	78218	143005	
22	108056	155015	160172	177346	76439	97233	
23	178060	104436	133039	122497	110713	66872	
24	232567	133637	136895	164777	139266	66269	

Table 4.7.1. Faroe Plateau cod (subdivision 5.b.1). Input to management option table.

Year	Yearclass	Recr.	Source
2013	YC2011	2890	
2014	YC2012	7654	
2015	YC2013	2389	XSA-output
2016	YC2014	3374	XSA-output
2017	YC2015	4311	Avg13-15
2018	YC2016	4311	Avg13-15

	Stock size	
Age	2016	Source
2	3374	XSA-output
3	1815	XSA-output
4	3908	XSA-output
5	697	XSA-output
6	315	XSA-output
7	363	XSA-output
8	265	XSA-output
9	126	XSA-output
10+	46	XSA-output

	Maturity			Exploitation pattern (rescaled to final year)			Weights		
	Observed	Avg14-16	Avg14-16	Avg13-15	Avg13-15	Avg13-15		= 2016	Avg14-16
Age	2016	2017	2018	2016	2017	2018	2016	2017	2018
2	0.21	0.24	0.24	0.0635	0.0635	0.0635	1.057	1.057	1.118
3	0.89	0.70	0.70	0.2624	0.2624	0.2624	1.857	1.857	1.748
4	0.91	0.86	0.86	0.4353	0.4353	0.4353	2.706	2.706	2.647
5	0.97	0.97	0.97	0.5536	0.5536	0.5536	3.686	3.686	3.445
6	1.00	0.99	0.99	0.5584	0.5584	0.5584	4.237	4.237	4.263
7	1.00	1.00	1.00	0.4898	0.4898	0.4898	5.057	5.057	5.771
8	1.00	1.00	1.00	0.3283	0.3283	0.3283	6.472	6.472	7.967
9	1.00	1.00	1.00	0.4941	0.4941	0.4941	9.644	9.644	9.738
10+	1.00	1.00	1.00	0.4941	0.4941	0.4941	9.644	9.644	10.964
			Fbar:	0.4599	0.4599	0.4599			

Table 4.7.2. Faroe Plateau cod (subdivision 5.b.1). Management option table.

MFDP VERSION 1						
Run: Cod_farp						
Index file 29/4-2016						
Time and date: 15:12 29/04/2016						
Fbar age range: 3-7						
2016						
Biomass	SSB	FMult	FBar	Landings		
26625	22408	1.0000	0.4599	7514		
2017					2018	
Biomass	SSB	FMult	FBar	Landings	Biomass	SSB
25745	20162	0.0000	0.0000	0	33196	26726
.	20162	0.1000	0.0460	869	32203	25774
.	20162	0.2000	0.0920	1700	31254	24864
.	20162	0.3000	0.1380	2494	30347	23995
.	20162	0.4000	0.1840	3254	29481	23166
.	20162	0.5000	0.2300	3980	28652	22374
.	20162	0.6000	0.2759	4676	27860	21617
.	20162	0.7000	0.3219	5341	27102	20894
.	20162	0.8000	0.3679	5978	26377	20203
.	20162	0.9000	0.4139	6587	25684	19542
.	20162	1.0000	0.4599	7170	25020	18911
.	20162	1.1000	0.5059	7729	24385	18307
.	20162	1.2000	0.5519	8265	23777	17730
.	20162	1.3000	0.5979	8777	23194	17178
.	20162	1.4000	0.6439	9269	22637	16650
.	20162	1.5000	0.6899	9740	22102	16144
.	20162	1.6000	0.7358	10192	21591	15661
.	20162	1.7000	0.7818	10625	21100	15198
.	20162	1.8000	0.8278	11040	20630	14755
.	20162	1.9000	0.8738	11439	20179	14330
.	20162	2.0000	0.9198	11821	19747	13924
Input units are thousands and kg–output in tonnes						

Table 4.8.1. Faroe Plateau cod (subdivision 5.b.1). Input to yield-per-recruit calculations (long-term prediction).

	Expl.	Weight	Prop
	pattern	at age	mature
	Average	Average	Average
Age	2002–2015	1978–2015	1983–2016
	Not rescaled		
2	0.103	1.044	0.06
3	0.328	1.571	0.58
4	0.452	2.296	0.84
5	0.572	3.097	0.94
6	0.681	3.903	0.98
7	0.735	4.999	0.99
8	0.725	6.254	1.00
9	0.988	7.820	1.00
10+	0.988	9.676	1.00

Table 4.8.2. Faroe Plateau cod (subdivision 5.b.1). Output from yield-per-recruit calculations (long-term prediction).

Reference point	F multiplier	Absolute F
F_{bar}(3–7)	1.0000	0.5536
F_{Max}	0.4576	0.2533
$F_{0.1}$	0.2112	0.1169
$F_{35\%}$SPR	0.3175	0.1758
F_{low}	0.1862	0.1031
F_{med}	0.6715	0.3717
F_{high}	1.6421	0.9091
Weights in kilograms		

4.19 Figures

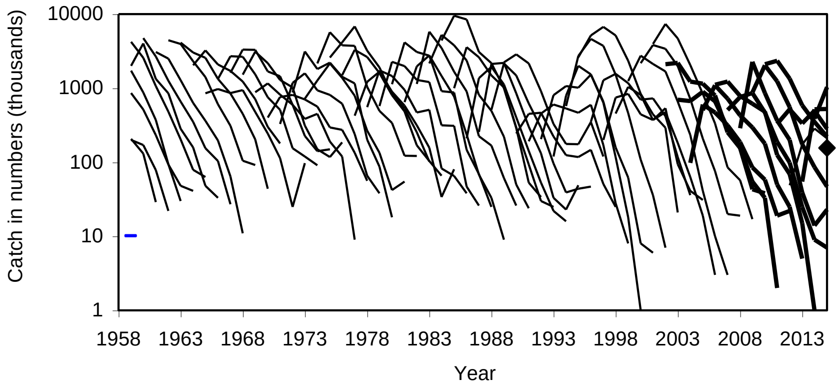


Figure 4.2.1. Faroe Plateau cod (subdivision 5.b.1). Catch in numbers-at-age shown as catch curves.

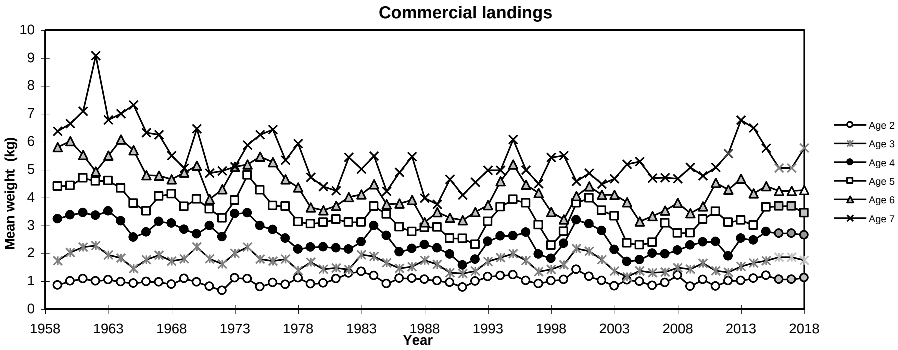


Figure 4.2.2. Faroe Plateau cod (subdivision 5.b.1). Mean weight at age. The predicted weights are also shown.

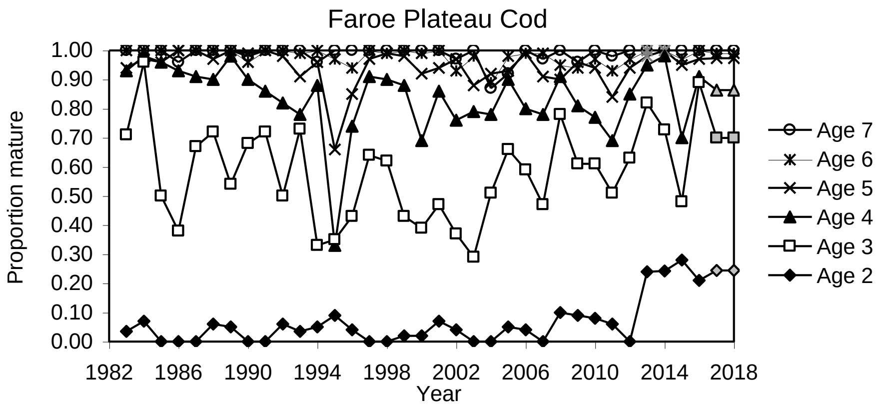


Figure 4.2.3. Faroe Plateau cod (subdivision 5.b.1). Proportion mature at age as observed in spring groundfish survey. The predicted values are shown in grey.

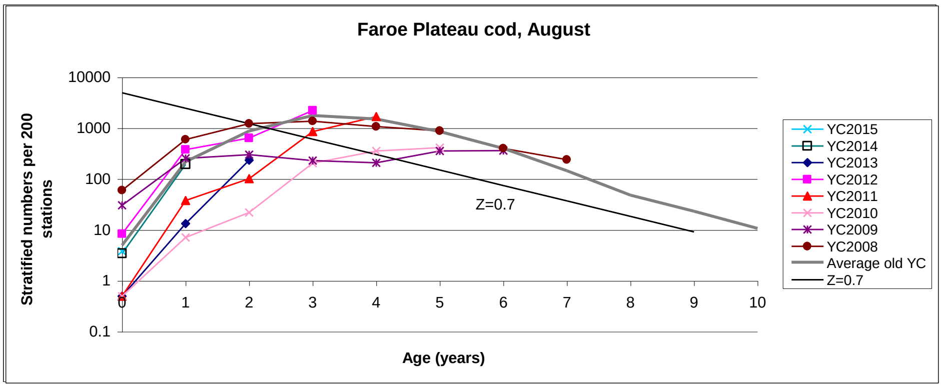


Figure 4.2.4. Faroe Plateau cod (subdivision 5.b.1). Catch curves from spring groundfish survey.

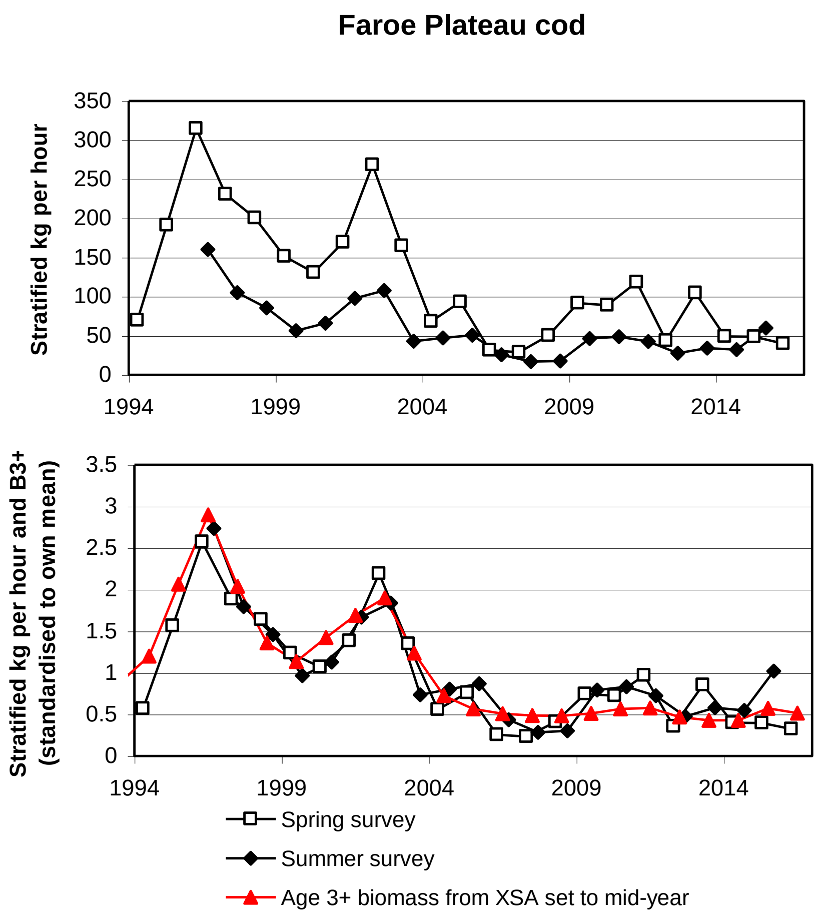


Figure 4.2.5. Faroe Plateau cod (subdivision 5.b.1). Stratified kg/hour in spring and summer surveys (upper figure). The age 3+ biomass obtained from the assessment is also included as an index.

Figure 4.2.6. Faroe Plateau cod (subdivision 5.b.1). Catch curves from summer groundfish survey.

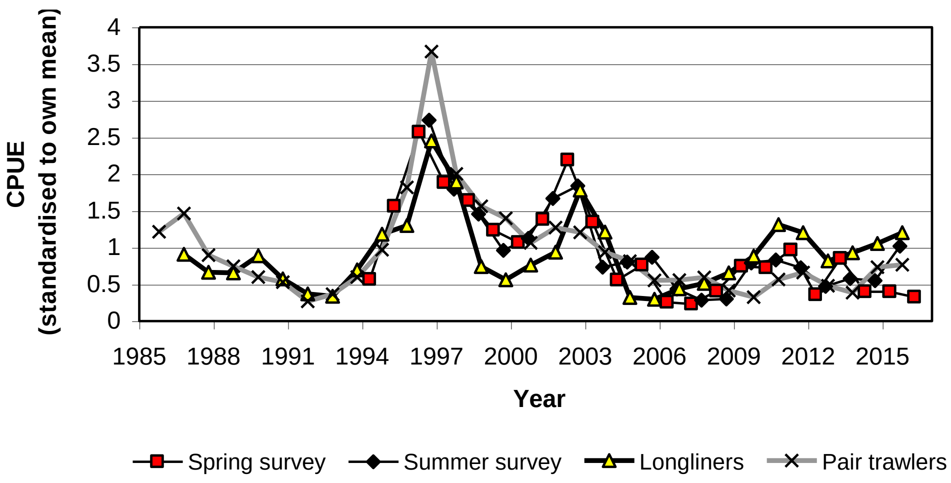


Figure 4.2.7. Faroe Plateau cod (subdivision 5.b.1). Standardized catch per unit of effort for pairtrawlers and longliners. The two surveys are shown as well.

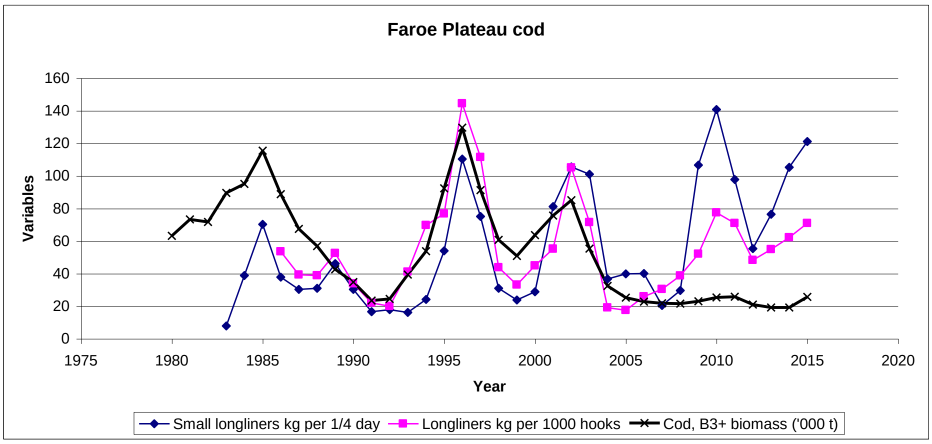


Figure 4.2.8. Faroe Plateau cod (subdivision 5.b.1). Catch per unit of effort for small and large longliners compared with the fishable (age 3+) biomass.

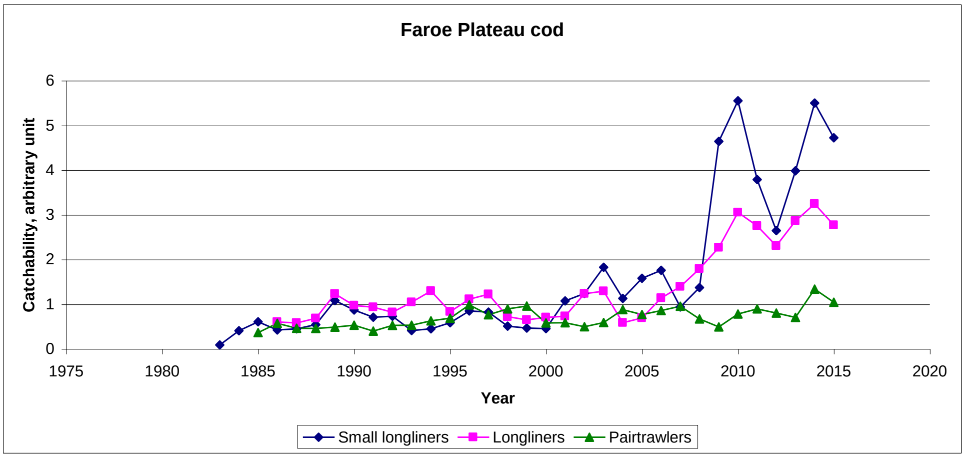


Figure 4.2.9. Faroe Plateau cod (subdivision 5.b.1). Catchability (cpue divided by age 3+ biomass) for small and large longliners and pairtrawlers.

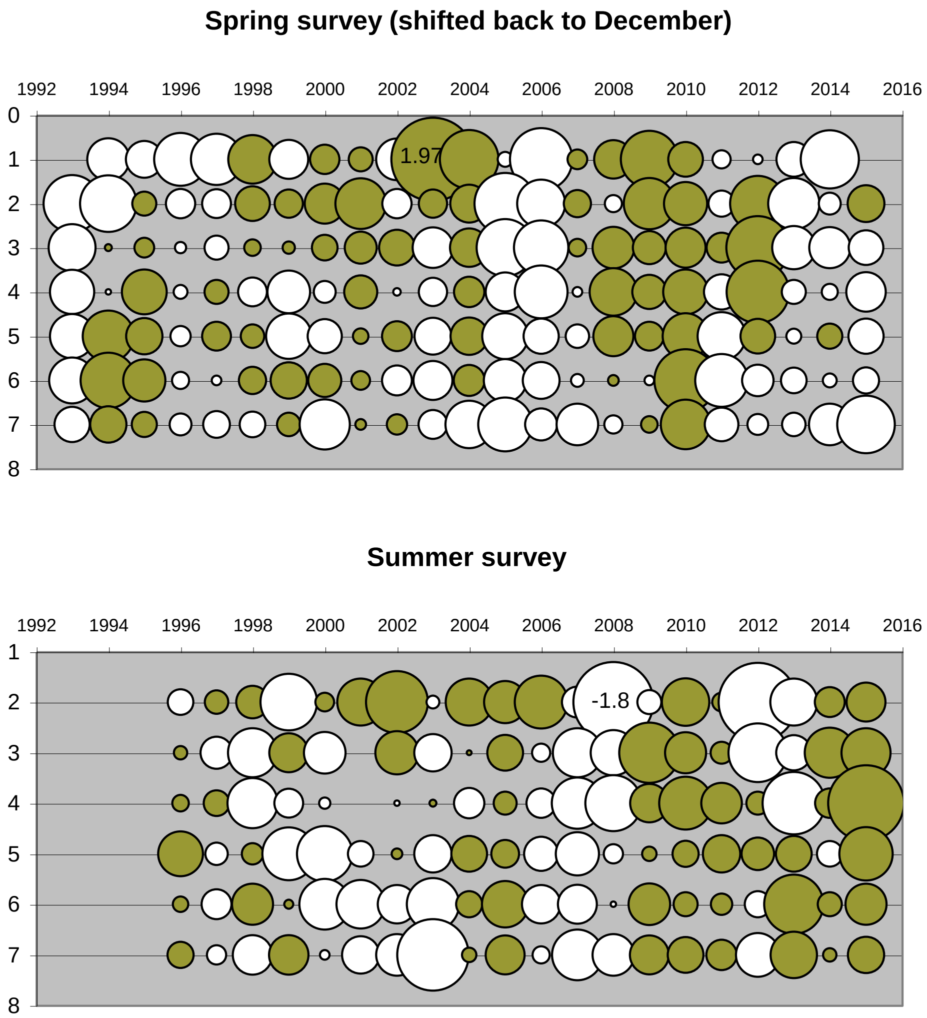


Figure 4.6.1. Faroe Plateau cod (subdivision 5.b.1). Log catchability residuals for age 2–7 for spring (upper figure) and summer survey. The residuals for age 8 are not presented because some values were off scale. White bubbles indicate negative residuals.

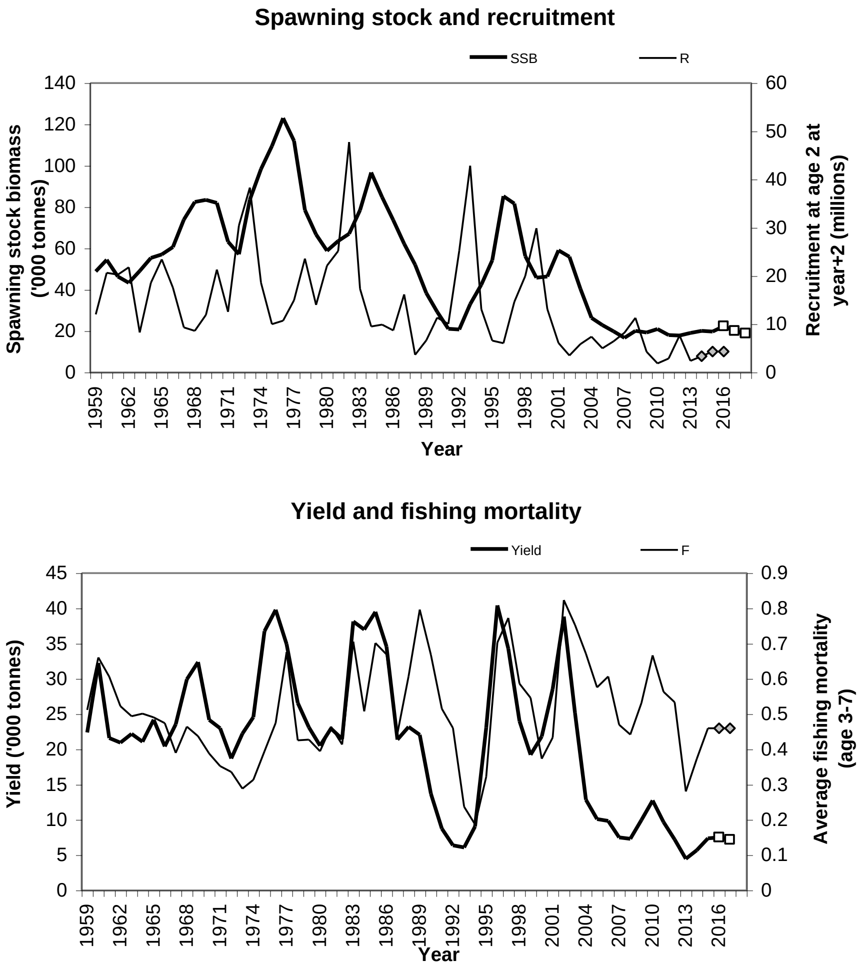


Figure 4.6.2. Faroe Plateau cod (subdivision 5.b.1). Spawning-stock biomass (SSB) and recruitment (year class) vs. year (upper figure) and yield and fishing mortality vs. year. Points (white and grey) are taken from the short-term projections.

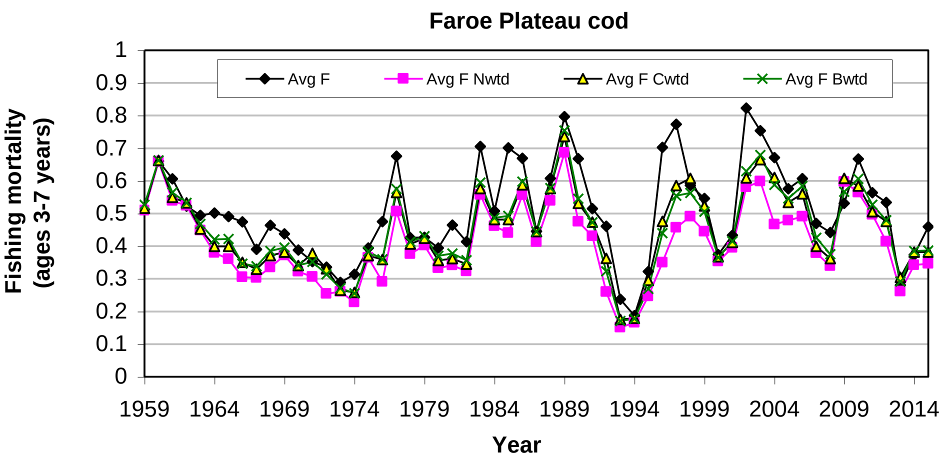


Figure 4.6.3. Faroe Plateau cod (subdivision 5.b.1). Different measures of fishing mortality: straight arithmetic average (Avg F), weighted by stock numbers (Nwtd), weighted by stock biomass (Bwtd) or weighted by catch (Cwtd).

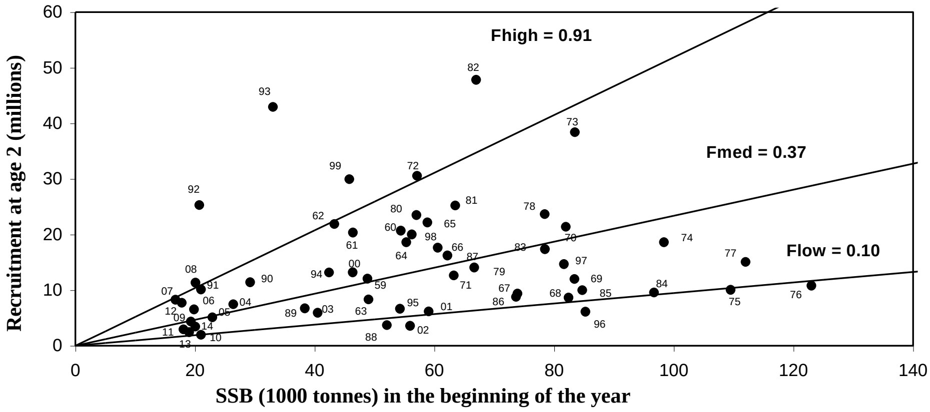


Figure 4.6.4. Faroe Plateau cod (subdivision 5.b.1). Spawning stock – recruitment relationship. Years are shown at each data point.

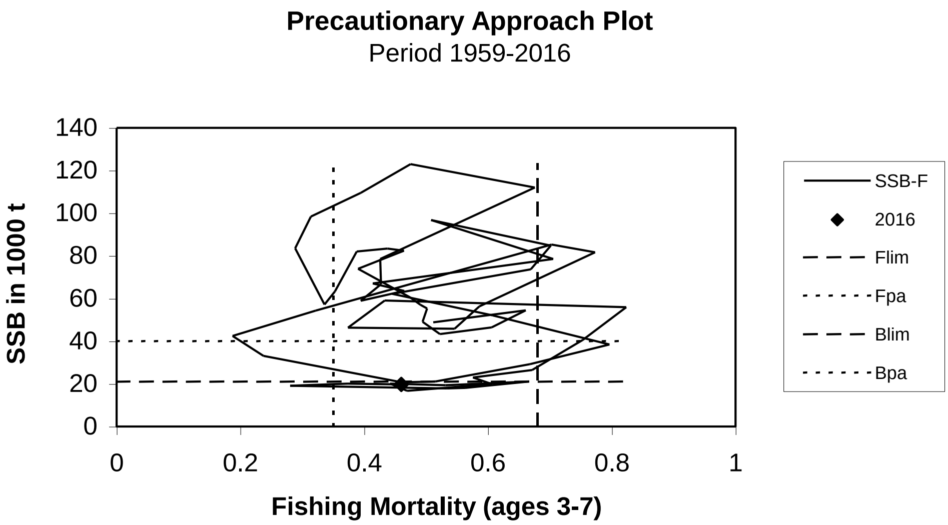


Figure 4.6.5. Faroe Plateau cod (subdivision 5.b.1). Spawning-stock biomass vs. fishing mortality.

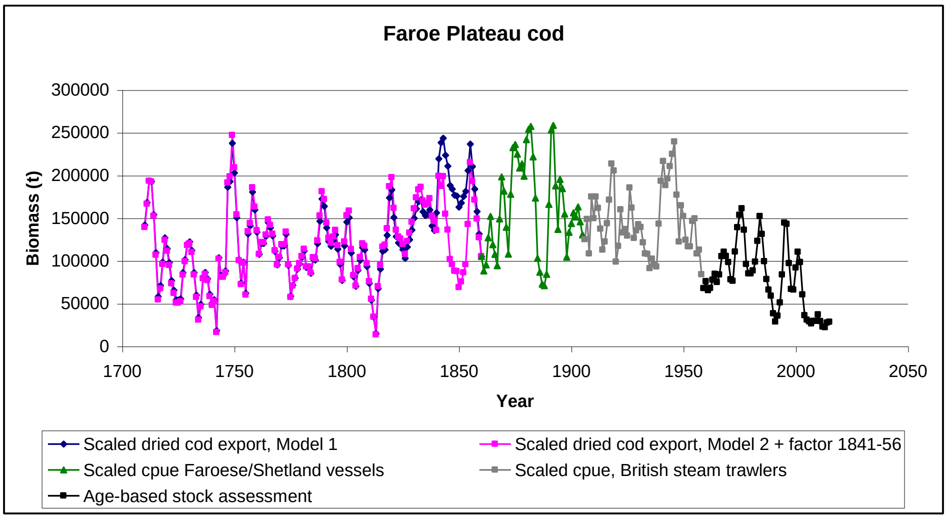


Figure 4.6.6. Faroe Plateau cod (subdivision 5.b.1). Biomass (age 2+) obtained from the age-based assessment as well as from cpue of British trawlers and Faroe/Shetland vessels that were scaled to biomass. Prior to 1860 the export of dried cod was used as a basis to estimate the biomass also accounting for increased tendency to export dried cod during the period. The high estimates around 1850 are based on the assumption that the high values of dried cod export were due to an increased biomass alone. The lower estimates are based on the assumption that dried cod export increased, not only due to increased biomass, but also due to better possibilities to land fish during this period.

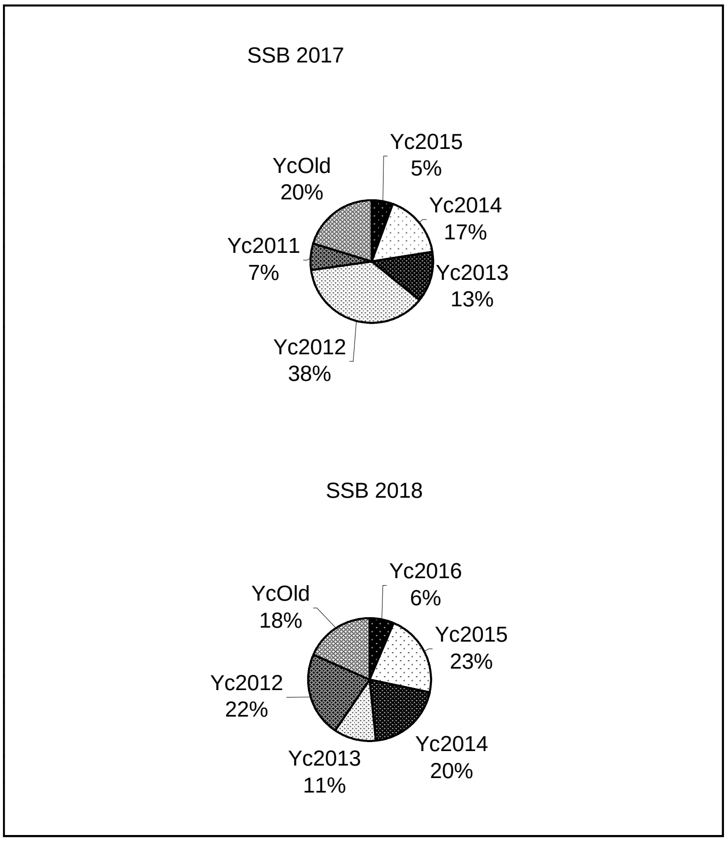


Figure 4.7.1. Faroe Plateau cod (subdivision 5.b.1). Predictions of the contribution of various year classes to the spawning-stock biomass in terminal year +1 (upper figure) and terminal year +2 (lower figure).

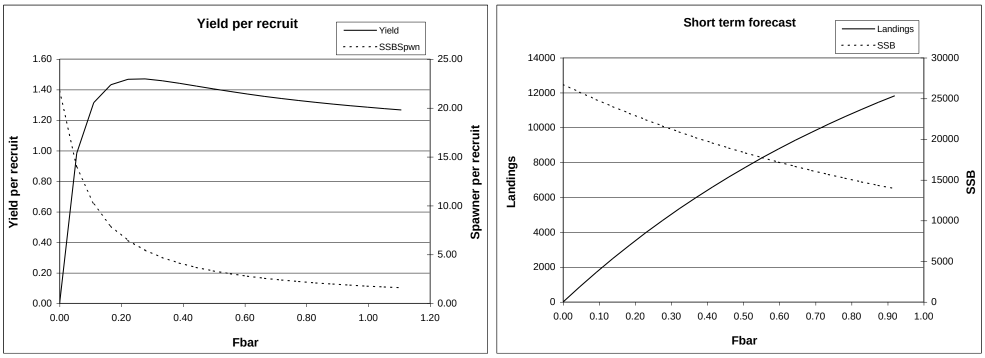


Figure 4.8.1. Faroe Plateau cod (subdivision 5.b.1). Yield-per-recruit and spawning-stock biomass (SSB) per recruit vs. fishing mortality (left figure). Landings and SSB versus F_{bar} (3-7) (right figure).

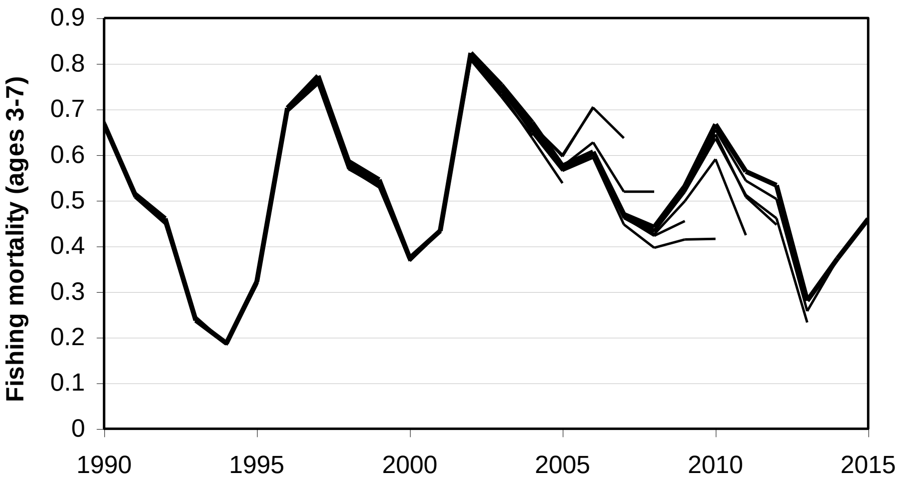
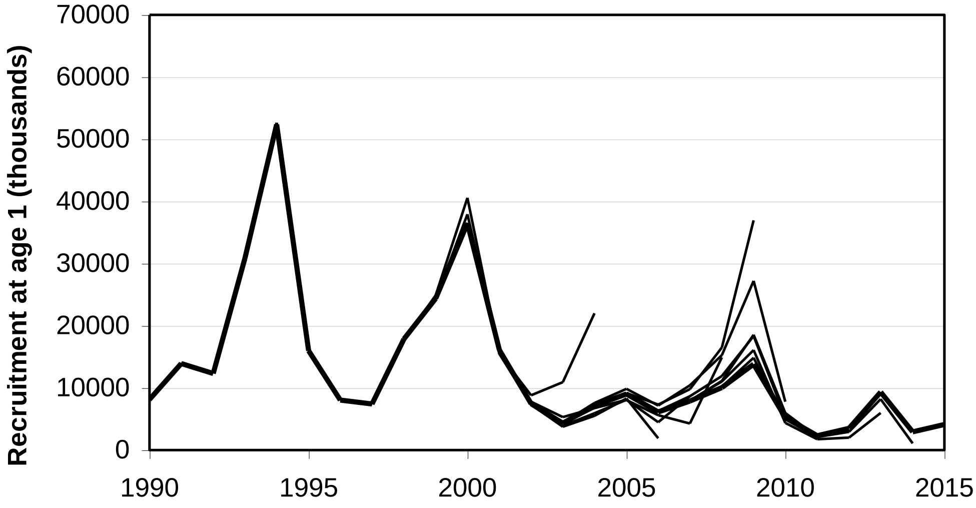


Figure 4.9.1. Faroe Plateau cod (subdivision 5.b.1). Results from the XSA retrospective analysis of fishing mortality (ages 3-7).



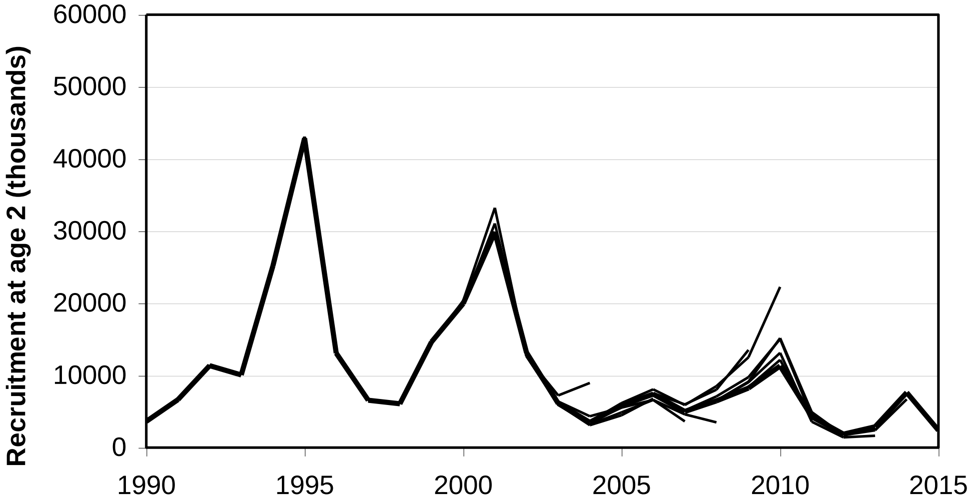


Figure 4.9.1. Faroe Plateau cod (subdivision 5.b.1). Results from the XSA retrospective analysis (continued). Recruitment-at-age 1 (upper figure) and at age 2.

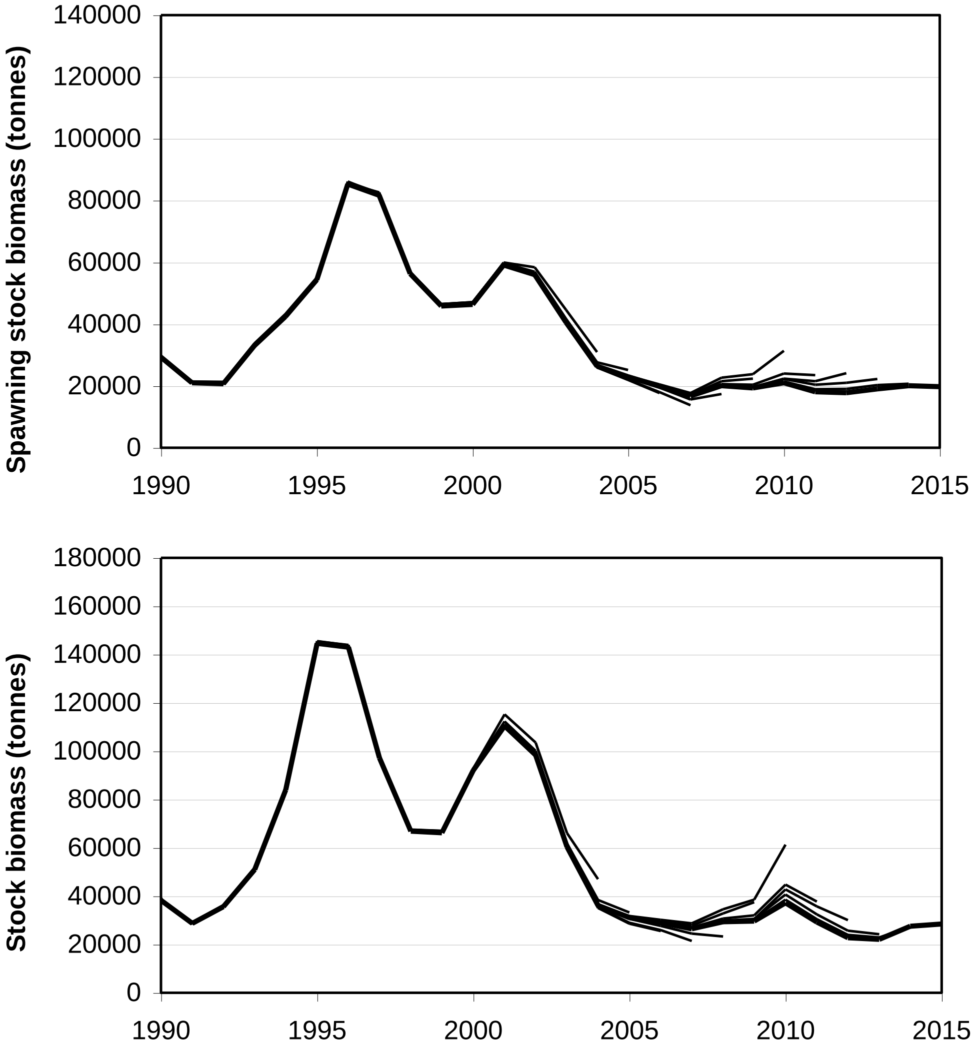


Figure 4.9.1. Faroe Plateau cod (subdivision 5.b.1). Results from the XSA retrospective analysis (continued). Spawning-stock biomass (upper figure) and total-stock biomass.

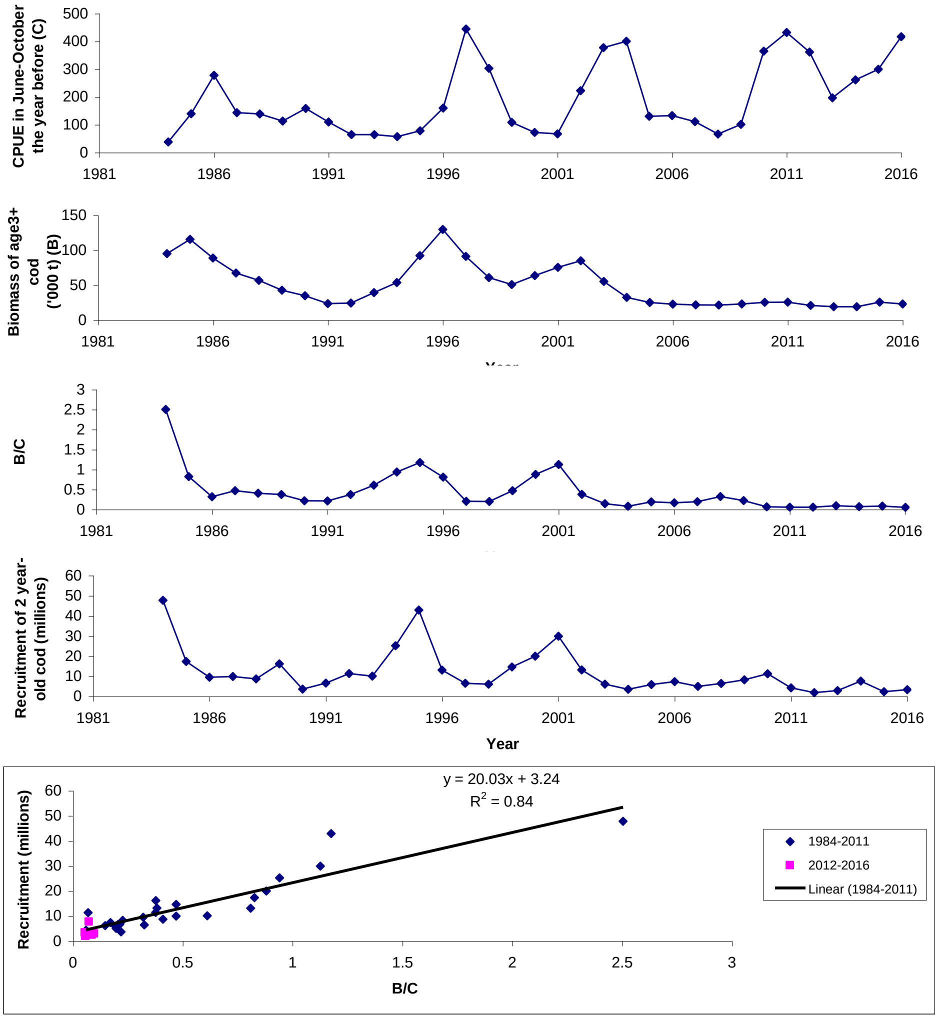


Figure 4.9.2. Faroe Plateau cod (subdivision 5.b.1). Modelling cod recruitment in three steps. First, the catch-per-unit –effort of cod (C) for small boats operating close to land, as being indicative of the amount of cannibalistic cod. Second, the amount of cod (older than the recruiting cod) (B), as 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.

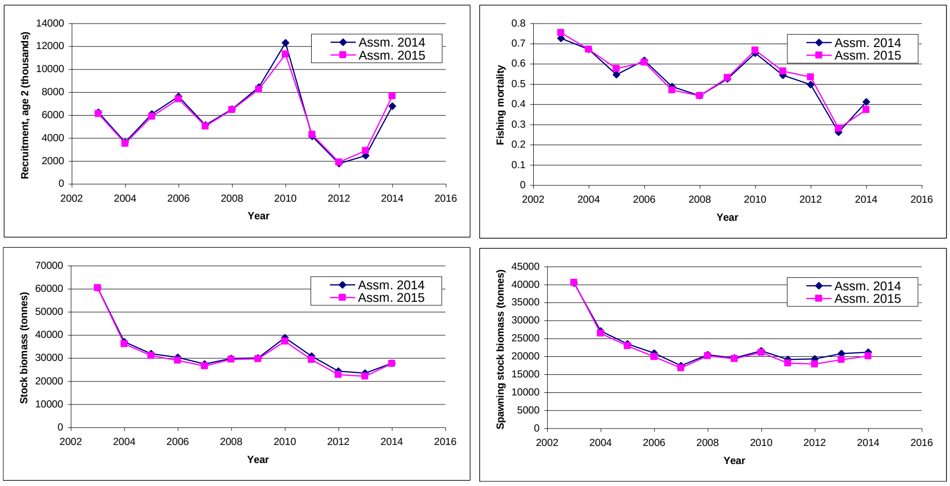


Figure 4.10.1. Faroe Plateau cod (subdivision 5.b.1). Comparison between the results from the current assessment (Assm. 2016) and the assessment last year (Assm. 2015) for recruitment (upper left), fishing mortality (upper right), stock biomass (lower left) and spawning-stock biomass (lower right).

5 Faroe haddock

5.1 Stock description and management units

Haddock in Faroese Waters, i.e. ICES Subdivisions 5.b.1 and 5.b.2 and in the southern part of ICES Division 2.a, close to the border of Subdivision 5.b.1, 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 Faroes waters is given in the stock annex. The spatial distribution of the haddock in the summer survey and in 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

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 2012 to only about 2 600 t; they have increased a bit to 3 400 t in 2015. Most of the landings are taken from the Faroe Plateau; the 2015 landings from the Faroe Bank (Subdivision 5.b.2), 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 31 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 was 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 5.b 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 longlines have taken most of the catches in recent years followed by the trawlers. This was also the case in 2015, where the share by longlines was 81% and that by trawlers 19% (Figure 5.3).

Catch-at-age

Catch-at-age data were provided for fish taken by the Faroese fleets from 5.b.1 and 5.b.2. The sampling intensity in 2015 is shown in Table 5.3 showing some decrease in intensity as compared to 2014. 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 is 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 some 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 F_{BAR} 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 fish 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). Next year there will be a benchmark assessment of this stock, and all issues will be carefully investigated. 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 highgrade 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.

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.

Maturity-at-age

Maturity-at-age data are available from the Faroese Spring Groundfish Surveys 1982–2016. 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, mostly in April, 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 2016 assessment but catch per unit of 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 2015 assessment, with exactly the same settings of the XSA. The only changes are minor revisions of recent landings according to revised data and corresponding revisions of the c@age input. All other input files (VPA) are the same except for the addition of the 2015data.

5.4.1 Tuning and estimates of fishing mortality

Commercial cpue series. Several commercial catch per unit of 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 pairtrawlers 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. 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".

In order to illustrate stock biomass further back in time, historical cpue series from British trawlers have been used together with the 2015 assessment. The method is described in WD12, "Faroe haddock biomass 1914-56". The results are given in Table 5.17, and in section 02 of this report. The biomass of Faroe haddock was estimated back to 1914 by scaling cpue values to the biomass obtained from the stock assessment. There was an overlap between cpue values from Aberdeen trawlers 1914-1959 and the age based assessment 1957–2015 by three years (1957-1959). Cpue values for English steam trawlers from 1922 to 1976 (with gaps) confirmed that the former overlap of three years was sufficient to provide a scaling of Aberdeen trawler cpue back to 1914 (Table 5.17). The table shows that the low biomass since 2006 has been unprecedented the last century.

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). 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; both surveys indicate a slow increase in recent years. 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.

A SPALY (same procedure as last year) run, with the same settings of the XSA as in 2015 (tuned with the two surveys combined) (Table 5.8), with 2016 data included and some minor revisions of recent catch figures, gave in general similar results as last year (Table 5.9), although this year's assessment indicates that the 2015 assessment underestimated the 2014 recruitment by 42% (2.6 million vs. 4.4.5 million, which still is among the lowest on record), underestimated the fishing mortality in 2014 by 10% (0.26 vs. 0.29) and overestimated the 2014 total and spawning-stock biomasses by 7% and 27%, respectively (20 and 18 thous. t vs. 18 and 14 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 F_{BAR} 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 are being carefully inspected.

It has been questioned if a rather heavy shrinkage of 0.5 is the most appropriate to 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. From Table 5.16, $\mathbf{F}_{med}$, and $\mathbf{F}_{high}$ were calculated at 0.22 and 0.82, respectively. The F_{max} of 0.6 should not be used since it is very poorly determined due to the flat YPR curve. $F_{0.1}$ is estimated at 0.2. The F35%SPR was estimated at 0.23.

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 F_{MSY} 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 - historical and compared to what is now.

The stock size in numbers is given in Table 5.11 and a summary of the VPA with the biomass estimates is given in Table 5.12 and in Figure 5.14. 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 2010 and 2014 YC's, which are estimated somewhat higher than the other small year classes. Fishing mortality has been relatively high since 2003, highest when the stock was large leading to large variability of catches. Currently fishing mortality is estimated close to F_{MSY} (0.25).

5.7 Short-term forecast

Input data

The input data for the short-term predictions are estimated in accordance with the procedures last year and explained in Tables 5.12-13. The YC 2016 at age 2 in 2018 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 2018 has little effect on the short-term prediction.

Results

Although the allocated number of fishing days for the fishing year 2015-2016was reduced for some fleets as compared to the year before (see section 2), it should not be unrealistic to assume fishing mortalities in 2016 as the average of some recent years, here the average of F(2013–2015), 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 2016 are then predicted to be about 4000 t, and continuing with this fishing mortality will result in 2017 landings of about 5300 t (Table 5.15). The SSB will increase to 20 000 t in 2016, and increase further in 2017 and 2018 to 24 000 t and 41 000 t, respectively. This prediction should however be treated with great care since most of the increase is based on number of 1 year old in the 2016 spring survey. 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 2015/16, will contribute by a large proportion of the SSB in 2017/18.

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 1977–2015 period. The maturity o-gives are averages for the years 1982-2015. 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 year's assessment indicates that the 2015 assessment underestimated the 2014 recruitment by 42% (2.6 million vs. 4.5 million, which still is among the lowest on record), underestimated the fishing mortality in 2014 by 10% (0.29 vs. 0.26) and overestimated the 2014 total- and spawning-stock biomasses by 7% and 27%, respectively (20 and 18 thous. t vs. 19 and 14 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 2015. 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 2015 assessment. The only changes are minor revisions of recent landings according to revised data and corresponding revisions of the c@age input. All other input files (VPA and tuning fleets) are the same except for the addition of the 2015 data.

Following differences in the 2014 estimates were observed as compared to last year (see text above):

Comparisons between 2015 and 2016 assessment of 2014 data
The year of comparison is 2014

	R at age 2 (thousands)	Total B (tonnes)	SSB (tonnes)	Landings (tonnes)	F (3-7)
2015 spaly	2596	19643	17931	2950	0.2595
2016 spaly	4513	18411	14083	3276	0.2876
%-change	42	-7	-27	10	10

5.11 Management plans and evaluations

There is no explicit management plan for this stock. A management system based on number of fishing days, closed areas and other technical measures was introduced in 1996 with the purpose to ensuring sustainable fisheries. There has been some work with establishing a management plan with a harvest control role for cod, haddock and saithe including a recovery plan, but the proposal has not yet been officially accepted. There is ongoing work with a revision on most aspect of the fisheries legislation. See overview in section 2 for details.

5.12 Management considerations

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

5.13 Ecosystem considerations

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

5.14 Regulations and their effects

As explained in the overview (section 2), the fishery for haddock in 5.b 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 longline fisheries. Since the minimum mesh size in the trawls (codend) is 145 mm, the trawl catches consist of fewer small fish than the longline fisheries. Other nations fishing in Faroese waters are regulated by TACs 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 and 2015, 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.

5.17 Tables

Table 5.1 Faroe Plateau (Sub-division 5.b.1) HADDOCK. Nominal catches (tonnes) by countries 2000-2015 and Working Group estimates in 5.b .

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015 [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	2,756	2,910
France1	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	5
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]				350	449
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	3,364
Used in the assessment in 5.b.	15,821	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	3,276	3,395

1) Including catches from Sub-division 5.b.2. Quantity unknown 1989-1991, 1993 and 1995-2001.
2) Preliminary data
3)From 1983 to 1996 catches included in Sub-division 5.b.2.
4) Reported as Division 5.b, to the Faroese coastal guard service.
5) Reported as Division 5.b.
6) Includes Faroese landings reported to the NWWG by the Faroe Marine Research Institute

Table 5.2 Faroe Bank (Sub-division 5.b.2) HADDOCK. Nominal catches (tonnes) by countries, 2000-2015.

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015 [2]
Faroe Island	1,565 [5]	1,948	3,698	4,934	3,594	2,444	1,375	810	556	192	178	194	141	47	71	30
France1						+										
Norway	48	66	28	54	17	45	1	8		3	1				1	1
UK (Engl. and Wales)	[1]	[1]	[1]	[1]	[1]	[1]	[4]									
UK (Scotlar	185	148	177	[4]	[1]	[1]	[4]	15	5	27	33				74	
Total	1,798	2,162	3,903	4,988	3,611	1,944	1,376	833	561	222	212	194	141	47	146	31

1) Catches included in Sub-division 5.b.1.
2) Provisional data
3)From 1983 to 1996 includes also catches taken in Sub-division 5.b.1. (see Table 2.4.1)
4) Reported as Division 5.b.
5) Provided by the NWWG

Table 5.3

Catch at age 2015

Age	5.b LLiners < 100GRT	5.b LLiners > 100GRT	5.b Trawl < 1000HP	5.b Trawl > 1000HP	5.b Regulator	5.b All Faroese fleets	5.b Foreign Trawlers	5.b Foreign Lliners	5.b Total All fleets
1	0	0	0	1	0	0	1	0	1
2	260	81	4	16	2	362	24	0	384
3	633	211	71	92	0	1007	137	1	1144
4	87	59	43	52	2	242	77	0	318
5	212	193	42	47	3	493	70	1	560
6	114	116	23	28	2	281	42	1	322
7	12	17	4	6	0	40	10	0	50
8	4	11	2	4	0	21	5	0	27
9	3	14	1	2	0	20	3	0	23
10	4	3	1	1	0	10	2	0	11
11	1	3	0	1	0	4	1	0	5
12	0	0	0	1	0	1	1	0	2
13	1	1	0	0	0	2	0	0	2
14	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0
Total no.	1333	709	192	251	16	2485	373	4	2847
Catch, t.	1296	896	201	273	17	2665	405	5	3058

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 tra\ Pair Trawl. = Pair trawlers

Comm. Sampling 2015	5.b LLiners < 100GRT	5.b LLiners > 100GRT	5.b Trawl <1000HP	5.b Trawl <1000HP	5.b Regulator	5.b All Faroese Fleets	5.b Foreign Trawlers	5.b Foreign Lliners	5.b Total
No. samples	7	14	9	34	0	64	0	0	73
No. lengths	1525	2947	1599	7476	0	13547	0	0	16942
No. weights	1525	2947	1599	7476	0	13547	0	0	16942
No. ages	140	300	159	589	0	1188	0	0	1379

As compared to 2014, the sampling in 2015 was:
no samples - 7%, no of lengths - 8%, no of weights 5%, no of otoliths - 4%.

Table 5.4 Faroe haddock. Catch number-at-age

Run title : FAROE HADDOCK (ICES DIVISION 5.b) HAD_IND

At 29/04/2016 11:08

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

YEAR	1957	1958	1959	1960	1961	1962	1963	1964	1965
AGE									
0	0	0	0	0	0	0	0	0	0
1	45	116	525	854	941	784	356	46	39
2	4133	6255	3971	6061	7932	9631	13552	2284	1368
3	7130	8021	7663	10659	7330	13977	8907	7457	4286
4	8442	5679	4544	6655	5134	5233	7403	3899	5133
5	1615	3378	2056	2482	1937	2361	2242	2360	1443
6	894	1299	1844	1559	1305	1407	1539	1120	1209
7	585	817	721	1169	838	868	860	728	673
8	227	294	236	243	236	270	257	198	1345
9	94	125	98	85	59	72	75	49	43
+gp	58	105	47	28	13	22	23	7	8
TOTALNUM	23223	26089	21705	29795	25725	34625	35214	18148	15547
TONSLAND	20995	23871	20239	25727	20831	27151	27571	19490	18479
SOPCOF %	89	90	90	88	88	89	89	101	94

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

YEAR	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
AGE										
0	0	0	0	0	0	0	0	0	0	0
1	90	70	49	95	57	55	43	665	253	94
2	1081	1425	5881	2384	1728	717	750	3311	5633	7337
3	3304	2405	4097	7539	4855	4393	3744	8416	2899	7952
4	4804	2599	2812	4567	6581	4727	4179	1240	3970	2097
5	2710	1785	1524	1565	1624	3267	2706	2795	451	1371
6	1112	1426	1526	1485	1383	1292	1171	919	976	247
7	740	631	923	1224	1099	864	696	1054	466	352
8	180	197	230	378	326	222	180	150	535	237
9	54	52	68	114	68	147	113	68	68	419
+gp	9	13	12	20	10	102	95	11	147	187
TOTALNUM	14084	10603	17122	19371	17731	15786	13677	18629	15398	20293
TONSLAND	18766	13381	17852	23272	21361	19393	16485	18035	14773	20715
SOPCOF %	109	101	102	108	102	97	96	97	97	117

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

YEAR	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
AGE										
0,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
1,	40,	0,	0,	1,	0,	0,	0,	0,	25,	0,
2,	4396,	255,	32,	1,	143,	74,	539,	441,	1195,	985,
3,	7858,	4039,	1022,	1162,	58,	455,	934,	1969,	1561,	4553,
4,	6798,	5168,	4248,	1755,	3724,	202,	784,	383,	2462,	2196,
5,	1251,	4918,	4054,	3343,	2583,	2586,	298,	422,	147,	1242,
6,	1189,	2128,	1841,	1851,	2496,	1354,	2182,	93,	234,	169,
7,	298,	946,	717,	772,	1568,	1559,	973,	1444,	42,	91,
8,	720,	443,	635,	212,	660,	608,	1166,	740,	861,	61,
9,	258,	731,	243,	155,	99,	177,	1283,	947,	388,	503,
+gp,	318,	855,	312,	74,	86,	36,	214,	795,	968,	973,
TOTALNUM,	23126,	19483,	13104,	9326,	11417,	7051,	8373,	7234,	7883,	10773,
TONSLAND,	26211,	25555,	19200,	12424,	15016,	12233,	11937,	12894,	12378,	15143,
SOPCOF %,	107,	98,	99,	104,	100,	109,	92,	106,	106,	106,

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

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

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
AGE										
0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	43	1	0
2	230	283	655	63	105	77	40	113	277	804
3	2549	1718	444	1518	1275	1044	154	298	191	452
4	4452	3565	2463	658	1921	1774	776	274	307	235
5	1522	2972	3036	2787	768	1248	1120	554	153	226
6	738	1114	2140	2554	1737	651	959	538	423	132
7	39	529	475	1976	1909	1101	335	474	427	295
8	130	83	151	541	885	698	373	131	383	290
9	71	48	18	133	270	317	401	201	125	262
+gp	712	334	128	81	108	32	162	185	301	295
TOTALNUM	10443	10646	9510	10311	8978	6942	4320	2811	2588	2991
TONSLAND	14477	14882	12178	14325	11726	8429	5476	4026	4252	4948
SOPCOF %	101	102	97	100	102	106	106	103	100	103

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

YEAR	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
AGE										
0	0	0	0	0	0	0	0	0	0	0
1	1	0	0	9	73	19	0	0	3	0
2	326	77	106	174	1461	4380	1515	133	243	85
3	5234	2913	1055	1142	3061	3128	14039	3436	2007	1671
4	1019	10517	5269	942	210	2423	2879	13551	4802	3852
5	179	710	9856	4677	682	173	1200	2224	10426	6753
6	163	116	446	6619	2685	451	133	949	1163	6127
7	161	123	99	226	2846	1151	239	163	409	542
8	270	93	87	26	79	1375	843	334	89	147
9	234	220	95	20	1	17	1095	858	166	28
+gp	394	516	502	192	71	18	33	924	811	154
TOTALNUM	7981	15285	17515	14027	11169	13135	21976	22572	20119	19359
TONSLAND	9642	17924	22210	18482	15821	15890	24933	27072	23101	20455
SOPCOF %	100	103	101	100	103	100	100	100	99	100

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

YEAR	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
AGE										

0,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
1,	0,	0,	6,	0,	0,	0,	0,	0,	0,	0,
2,	247,	76,	66,	27,	389,	170,	8,	83,	238,	384,
3,	446,	982,	204,	329,	445,	773,	960,	510,	395,	1144,
4,	2566,	547,	918,	402,	426,	324,	513,	1118,	642,	318,
5,	3949,	2732,	424,	555,	279,	198,	156,	219,	1141,	560,
6,	5423,	3309,	1471,	514,	484,	186,	114,	95,	102,	322,
7,	3278,	2758,	1706,	1133,	553,	280,	123,	78,	61,	49,
8,	136,	1117,	1254,	739,	718,	353,	94,	88,	32,	27,
9,	63,	89,	320,	285,	444,	367,	171,	71,	15,	23,
+gp,	70,	9,	39,	48,	159,	187,	114,	119,	48,	20,
TOTALNUM,	16178,	11619,	6408,	4032,	3897,	2838,	2253,	2381,	2674,	2847,
TONSLAND,	17154,	12631,	7388,	5197,	5202,	3540,	2634,	2950,	3276,	3395,
SOPCOF %,	100,	100,	101,	100,	101,	101,	102,	101,	101,	100,

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

Run title : FAROE HADDOCK (ICES DIVISION 5.b) HAD_IND

At 29/04/2016 11:08

Table 2 Catch weights at age (kg)

YEAR,	1957,	1958,	1959,	1960,	1961,	1962,	1963,	1964,	1965,
AGE									
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.2500,	.2500,	.2500,	.2500,	.2500,	.2500,	.2500,	.2500,	.2500,
2,	.4700,	.4700,	.4700,	.4700,	.4700,	.4700,	.4700,	.4700,	.4700,
3,	.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,
5,	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,
7,	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,
9,	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,
SOPCOFAC,	.8937,	.8983,	.9034,	.8832,	.8832,	.8929,	.8915,	1.0111,	.9383,

Table 2 Catch weights at age (kg)

YEAR,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,
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,	1.0885,	1.0117,	1.0246,	1.0787,	1.0249,	.9688,	.9597,	.9690,	.9678,	1.1696,

Table 2 Catch weights at age (kg)

YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.2500,	.0000,	.0000,	.3000,	.0000,	.0000,	.0000,	.0000,	.3590,	.0000,

```
          2,       .4700,   .3110,   .3570,   .3570,   .6430,   .4520,   .7000,   .4700,
 .6810,   .5280,
          3,       .7300,   .6330,   .7900,   .6720,   .7130,   .7250,   .8960,   .7400,
1.0110,   .8590,
          4,      1.1300,  1.0440,  1.0350,   .8940,   .9410,   .9570,  1.1500,  1.0100,
1.2550,  1.3910,
          5,      1.5500,  1.4260,  1.3980,  1.1560,  1.1570,  1.2370,  1.4440,  1.3200,
1.8120,  1.7770,
          6,      1.9700,  1.8250,  1.8700,  1.5900,  1.4930,  1.6510,  1.4980,  1.6600,
2.0610,  2.3260,
          7,      2.4100,  2.2410,  2.3500,  2.0700,  1.7390,  2.0530,  1.8290,  2.0500,
2.0590,  2.4400,
          8,      2.7600,  2.2050,  2.5970,  2.5250,  2.0950,  2.4060,  1.8870,  2.2600,
2.1370,  2.4010,
          9,      3.0700,  2.5700,  3.0140,  2.6960,  2.4650,  2.7250,  1.9610,  2.5400,
2.3680,  2.5320,
        +gp,      3.5500,  2.5910,  2.9200,  3.5190,  3.3100,  3.2500,  2.8560,  3.0400,
2.6860,  2.6860,
     SOPCOFAC,    1.0741,   .9784,   .9947,  1.0380,  1.0017,  1.0870,   .9238,  1.0554,
1.0593,  1.0559,
```

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

Table 2 Catch weights at age (kg)

YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.3600,	.0000,	.0000,
2,	.6080,	.6050,	.5010,	.5800,	.4380,	.5470,	.5250,	.7550,	.7540,	.6660,
3,	.8870,	.8310,	.7810,	.7790,	.6990,	.6930,	.7240,	.9820,	1.1030,	1.0540,
4,	1.1750,	1.1260,	.9740,	.9230,	.9390,	.8840,	.8170,	1.0270,	1.2540,	1.4890,
5,	1.6310,	1.4620,	1.3630,	1.2070,	1.2040,	1.0860,	1.0380,	1.1920,	1.4650,	1.7790,
6,	1.9840,	1.9410,	1.6800,	1.5640,	1.3840,	1.2760,	1.2490,	1.3780,	1.5930,	1.9400,
7,	2.5190,	2.1730,	1.9750,	1.7460,	1.5640,	1.4770,	1.4300,	1.6430,	1.8040,	2.1820,
8,	2.5830,	2.3470,	2.3440,	2.0860,	1.8180,	1.5740,	1.5640,	1.7960,	2.0490,	2.3570,
9,	2.5700,	3.1180,	2.2480,	2.4240,	2.1680,	1.9300,	1.6330,	1.9710,	2.2250,	2.4900,
+gp,	2.9220,	2.9330,	3.2950,	2.5140,	2.3350,	2.1530,	2.1260,	2.2400,	2.4230,	2.6780,
SOPCOFAC,	1.0141,	1.0197,	.9695,	1.0025,	1.0195,	1.0635,	1.0554,	1.0320,	.9969,	1.0331,

Table 2 Catch weights at age (kg)

YEAR,	1996,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.3600,	.0000,	.0000,	.2780,	.2800,	.2800,	.0000,	.0000,	.3670,	.0000,
2,	.5340,	.5190,	.6220,	.5040,	.6610,	.6080,	.5840,	.5710,	.5740,	.5380,
3,	.8580,	.7710,	.8460,	.6240,	.9360,	.9400,	.8570,	.7150,	.7700,	.6490,
4,	1.4590,	1.0660,	1.0160,	.9740,	1.1660,	1.3740,	1.4050,	1.0080,	.8870,	.7970,
5,	1.9930,	1.7990,	1.2830,	1.2200,	1.4830,	1.7790,	1.7990,	1.5370,	1.1590,	1.0200,
6,	2.3300,	2.2700,	2.0800,	1.4900,	1.6160,	1.9710,	1.9740,	1.9110,	1.6380,	1.2450,

7,	2.3510,	2.3400,	2.5560,	2.4560,	1.8930,	2.1190,	2.3010,	2.0910,	1.8700,	1.8430,
8,	2.4690,	2.4750,	2.5720,	2.6580,	2.8210,	2.3730,	2.3700,	2.3010,	2.4380,	2.0610,
9,	2.7770,	2.5010,	2.4520,	2.5980,	3.7490,	2.7500,	2.6260,	2.4060,	2.3570,	2.2630,
+gp,	2.5820,	2.6760,	2.7530,	2.9530,	3.1960,	3.9660,	3.1300,	2.5350,	2.4170,	2.5790,
SOPCOFAC,	1.0043,	1.0250,	1.0106,	.9973,	1.0349,	.9960,	1.0010,	1.0049,	.9929,	.9988,

Table 2 Catch weights at age (kg)

YEAR,	2006,	2007,	2008,	2009,	2010,	2011,	2012,	2013,	2014,	2015,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0000,	.0000,	.4910,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.4240,
2,	.4750,	.6280,	.6360,	.4820,	.6920,	.5530,	.6190,	.5760,	.5470,	.5330,
3,	.6010,	.6690,	.7540,	.7340,	.8700,	.8150,	.7860,	.8300,	.9020,	.8890,
4,	.7680,	.8590,	.8600,	.9850,	1.1490,	1.0860,	1.0690,	1.1490,	1.1650,	1.3530,
5,	.9110,	.9690,	.9910,	1.1300,	1.3080,	1.3030,	1.4050,	1.4650,	1.3540,	1.6400,
6,	1.1260,	1.0600,	1.0820,	1.2640,	1.3860,	1.3870,	1.6160,	1.7100,	1.6930,	1.7290,
7,	1.3740,	1.2450,	1.1510,	1.3570,	1.4290,	1.4690,	1.6560,	1.8270,	1.8410,	2.4240,
8,	2.1580,	1.4750,	1.3790,	1.5450,	1.5680,	1.5380,	1.6750,	1.8860,	1.8720,	2.0030,
9,	2.2110,	2.2660,	1.7270,	1.7920,	1.7400,	1.7020,	1.7270,	1.8560,	1.8560,	2.2180,
+gp,	2.5690,	2.2560,	2.4350,	2.1540,	1.8410,	1.8620,	1.9050,	2.0850,	1.8230,	2.3020,
SOPCOFAC,	.9987,	.9999,	1.0065,	.9955,	1.0076,	1.0060,	1.0190,	1.0077,	1.0112,	.9994,

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

Run title : FAROE HADDOCK (ICES DIVISION 5.b)   HAD_IND

At 29/04/2016 11:08

Table 5 Proportion mature at age

YEAR	1957	1958	1959	1960	1961	1962	1963	1964	1965
AGE									
0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
2	.0600	.0600	.0600	.0600	.0600	.0600	.0600	.0600	.0600
3	.4800	.4800	.4800	.4800	.4800	.4800	.4800	.4800	.4800
4	.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
6	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
8	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
+gp	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	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
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	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
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,   .0800,   .0800,
 .0800,   .0300,
         3,        .4800,   .4800,   .4800,   .4800,   .4800,   .4800,   .6200,   .6200,
 .7600,   .6200,
         4,        .9100,   .9100,   .9100,   .9100,   .9100,   .9100,   .8900,   .8900,
 .9800,   .9600,
         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,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,
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,	.0500,	.0500,	.0200,	.0800,	.1600,	.1800,	.1100,	.0500,	.0300,
3,	.4300,	.3200,	.2400,	.2200,	.3700,	.5800,	.6500,	.5000,	.4200,	.4700,
4,	.9500,	.9100,	.8900,	.8700,	.9000,	.9300,	.9100,	.8500,	.8600,	.9100,
5,	.9900,	.9800,	.9800,	.9900,	1.0000,	1.0000,	1.0000,	.9700,	.9600,	.9600,
6,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	.9900,	.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,	1996,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,
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,	.0100,	.0100,	.0100,	.0200,	.0900,	.0800,	.0700,	.0000,	.0100,
3,	.4700,	.4700,	.3600,	.3500,	.3600,	.5400,	.4900,	.4500,	.3500,	.3400,
4,	.9300,	.9100,	.8700,	.8600,	.8700,	.9300,	.9700,	.9700,	.9400,	.9100,
5,	.9800,	1.0000,	.9900,	.9900,	.9900,	1.0000,	1.0000,	.9900,	.9900,	.9900,
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,	2006,	2007,	2008,	2009,	2010,	2011,	2012,	2013,	2014,	2015,
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,	.0200,	.0100,	.0100,	.0300,	.0900,	.1300,	.1700,	.1700,	.1900,
3,	.4200,	.5200,	.6400,	.6100,	.6500,	.7400,	.7900,	.8300,	.8300,	.9000,
4,	.9100,	.9100,	.9500,	.9300,	.9600,	.9700,	.9900,	.9900,	1.0000,	1.0000,
5,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
6,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
7,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
8,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
9,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
+gp,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,

Table 5.7. Faroe haddock. 2016 tuning file.

```
FAROE Haddock (ICES DIVISION 5.b)       COMB-SURVEY-SPALY-16-jr.txt
102
SUMMER SURVEY
1996 2015
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
200    7730.19  9372.86  4026.61    841.18  1374.75  1016.83  117.22
65.82
SPRING SURVEY SHIFTED
1993 2015
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	1545.00	3327.70	4123.00	1086.10	2026.30	1296.40	184.10
100	12458.90	4441.90	2487.80	1332.90	263.00	428.50	107.00

Table 5.8 Faroe haddock 2016 xsa.

```
Lowestoft VPA Version 3.1

   29/04/2016  11:07

 Extended Survivors Analysis

 FAROE HADDOCK (ICES DIVISION 5.b)                 HAD_IND

 cpue data from file D:\Vpa\vpa2016\input-files\comb-survey-spaly-16-jr.txt

 Catch data for  59 years. 1957 to 2015. Ages  0 to  10.

      Fleet,            First, Last, First, Last, Alpha,  Beta
                  ,    year, year,  age ,  age
 SUMMER SURVEY      ,   1996, 2015,   1,     8,   .600,   .700
 SPRING SURVEY SHIFTE,   1993, 2015,   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,  2006,  2007,  2008,  2009,  2010,  2011,  2012,  2013,  2014,  2015

      0,  .000,  .000,  .000,  .000,  .000,  .000,  .000,  .000,  .000,  .000
      1,  .000,  .000,  .002,  .000,  .000,  .000,  .000,  .000,  .000,  .000
      2,  .037,  .028,  .028,  .013,  .107,  .016,  .002,  .034,  .030,  .043
      3,  .075,  .200,  .096,  .188,  .308,  .322,  .120,  .166,  .224,  .200
      4,  .184,  .124,  .291,  .279,  .397,  .387,  .367,  .200,  .325,  .284
      5,  .287,  .306,  .133,  .287,  .318,  .324,  .326,  .263,  .323,  .526
      6,  .541,  .415,  .268,  .237,  .438,  .363,  .314,  .337,  .188,  .141
      7,  .699,  .591,  .391,  .341,  .433,  .492,  .437,  .369,  .378,  .129
      8,  .366,  .547,  .593,  .292,  .378,  .550,  .302,  .652,  .253,  .285
      9,  .621,  .435,  .294,  .255,  .287,  .338,  .569,  .393,  .212,  .291
```

Table 5.8 Faroe haddock 2016 xsa (cont.)

XSA population numbers (Thousands)

YEAR	AGE 0	1	2	3	4	5	6	7	8	9
2006	3.97E+03	3.77E+03	7.59E+03	6.83E+03	1.68E+04	1.75E+04	1.43E+04	7.20E+03	4.91E+02	1.51E+02
2007	3.43E+03	3.25E+03	3.09E+03	5.99E+03	5.19E+03	1.15E+04	1.08E+04	6.83E+03	2.93E+03	2.79E+02
2008	6.30E+03	2.81E+03	2.66E+03	2.46E+03	4.01E+03	3.75E+03	6.91E+03	5.82E+03	3.10E+03	1.39E+03
2009	1.74E+04	5.16E+03	2.29E+03	2.12E+03	1.83E+03	2.45E+03	2.69E+03	4.33E+03	3.22E+03	1.40E+03
2010	6.73E+03	1.42E+04	4.22E+03	1.85E+03	1.44E+03	1.13E+03	1.51E+03	1.74E+03	2.52E+03	1.97E+03
2011	4.10E+03	5.51E+03	1.17E+04	3.11E+03	1.12E+03	7.90E+02	6.75E+02	7.97E+02	9.22E+02	1.41E+03
2012	1.31E+04	3.35E+03	4.51E+03	9.39E+03	1.84E+03	6.20E+02	4.68E+02	3.84E+02	3.99E+02	4.36E+02
2013	1.51E+04	1.07E+04	2.75E+03	3.69E+03	6.82E+03	1.05E+03	3.67E+02	2.80E+02	2.03E+02	2.41E+02
2014	1.02E+04	1.24E+04	8.80E+03	2.17E+03	2.56E+03	4.57E+03	6.58E+02	2.14E+02	1.58E+02	8.67E+01
2015	6.24E+04	8.34E+03	1.01E+04	6.99E+03	1.42E+03	1.51E+03	2.71E+03	4.46E+02	1.20E+02	1.01E+02

Estimated population abundance at 1st Jan 2016

0.00E+00	5.11E+04	6.83E+03	7.94E+03	4.69E+03	8.77E+02	7.32E+02	1.93E+03	3.21E+02	7.40E+01

Taper weighted geometric mean of the VPA populations:

2.37E+04	1.94E+04	1.63E+04	1.27E+04	8.58E+03	5.26E+03	3.16E+03	1.74E+03	8.64E+02	4.18E+02

Standard error of the weighted Log(VPA populations) :

1.0889	1.0879	1.0855	1.0622	1.0649	1.0380	1.0191	1.0355	1.1488	1.3676

Log catchability residuals.

Fleet : SUMMER SURVEY

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
0	No data for this fleet at this age									
1	1.22	.27	-.14	-.20	.13	.17	.44	.21	-.26	.32
2	.16	.65	.05	-.16	.25	.30	.20	.19	.52	.23
3	.34	.18	-.40	1.52	.20	.40	.36	-.15	-.22	.04
4	-.45	.42	.03	-.53	-.71	.26	.11	.33	-.18	.17
5	-.21	-.06	.02	.07	-.20	-1.01	.09	.51	.23	.00
6	.19	.41	-.29	.06	.09	-.35	-.53	-.15	-.10	.74
7	-.04	-.37	.95	.28	.05	.00	-.36	-.30	-.45	.24
8	-.09	.14	.61	.43	.29	-.08	-.26	.40	-.75	-1.21

Age	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
0	No data for this fleet at this age									
1	-.21	.05	.38	.57	.41	-2.28	-.49	-.32	-.06	-.21
2	.57	1.16	.03	-.17	.27	.22	-2.09	-2.20	-.44	.27
3	-.65	-.61	-.16	-.99	.39	.12	.10	-.35	-.22	.11
4	-.02	-.66	.22	.36	.47	-.27	.19	.32	-.20	.15
5	.05	-.27	-.71	.06	.06	-.05	-.36	.70	.28	.78
6	.26	.15	.00	-.28	.29	-.31	-.41	.25	.24	-.26
7	.32	.00	.28	.19	.09	-.32	-.05	-.14	-.10	-.62
8	-.50	-.68	.20	-.15	.19	-.17	-.60	.79	.07	.21

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,	-5.0345,	-5.4842,	-5.6978,	-5.6563,	-5.7041,	-5.7964,	-5.7964,	-5.7964,
S.E(Log q),	.6641,	.8064,	.5220,	.3637,	.4181,	.3231,	.3521,	.5034,

Table 5.8 Faroe haddock 2016 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	.90	.806	5.48	.77	20	.60	-5.03
2	.83	1.314	6.14	.76	20	.65	-5.48
3	.94	.662	5.91	.87	20	.50	-5.70
4	.94	1.084	5.86	.94	20	.34	-5.66
5	.96	.616	5.81	.92	20	.41	-5.70
6	.94	1.229	5.91	.96	20	.30	-5.80
7	.96	.621	5.86	.94	20	.34	-5.82
8	1.09	-1.034	5.81	.88	20	.54	-5.85

Fleet : SPRING SURVEY SHIFTE

Age	1993	1994	1995
0	-.57	.98	.91
1	-.46	-.86	.43
2	-.64	-.74	-.16
3	-.23	-.24	-.45
4	-.52	-.40	-.34
5	-.48	-1.28	-.44
6	.15	-.62	-.53
7	No data for this fleet at this age		
8	No data for this fleet at this age		

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
0	-1.09	-.28	-.35	-.15	.35	.55	.13	-.32	.94	-.26
1	.63	-.16	-.11	-.21	-.31	-.49	.11	.18	.39	.54
2	.38	.45	-2.05	.28	-.33	.10	-.05	.04	.16	-.25
3	.43	.28	.07	-.70	-.70	-.41	-.16	-.31	-.17	-.07
4	.23	.33	.06	-.55	-2.13	-.31	-.58	.43	-.26	-.25
5	.83	.43	-.37	-.20	-1.34	-1.13	-.63	-.14	.44	.12
6	-.33	-.91	-.46	-.03	-.78	-.68	-1.18	-.59	.20	.30
7	No data for this fleet at this age									
8	No data for this fleet at this age									

Age	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
0	.41	-.02	1.19	.69	-2.59	-.67	.27	.16	-.27	.00
1	.22	.53	.63	.82	.11	-1.78	-.08	-.04	-.39	.29
2	.87	.12	.59	.16	.71	.58	-1.28	.31	.69	.06
3	-.38	.39	-.24	.03	.34	.55	.73	.25	.99	.00
4	.25	-.40	.45	-.32	.32	.43	.91	.72	1.72	.23
5	.53	.17	-.38	-.09	.44	.41	.48	.71	.86	1.06
6	.95	.44	.28	-.05	.64	1.55	.83	.96	.94	-1.07
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	-6.0219	-5.3341	-5.8327	-5.8721	-6.0498	-6.2134	-6.4387
S.E(Log q)	.8089	.5742	.6749	.4384	.7231	.6814	.7497

Table 5.8 Faroe haddock 2016 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,     .89,     .804,      6.42,     .73,     23,     .73,   -6.02,
  1,    1.15,   -1.247,      4.71,     .77,     23,     .65,   -5.33,
  2,     .93,     .637,      6.08,     .79,     23,     .64,   -5.83,
  3,    1.03,    -.373,      5.78,     .89,     23,     .46,   -5.87,
  4,     .95,     .451,      6.18,     .79,     23,     .70,   -6.05,
  5,    1.02,    -.181,      6.17,     .78,     23,     .71,   -6.21,
  6,     .99,     .071,      6.45,     .75,     23,     .76,   -6.44,
1


 Terminal year survivor and F summaries :

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

 Year class = 2015

 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,     51118.,   .826,       .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,
     51118.,       .83,      .00,    1,    .000,   .000


 Age  1   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       ,      5536.,   .680,       .000,     .00,   1,  .331,     .000
 SPRING SURVEY SHIFTE,      7573.,   .478,       .268,     .56,   2,  .669,     .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,
      6828.,       .39,      .19,    3,    .478,   .000
```

Table 5.8 Faroe haddock 2016 xsa (cont.)

```
Age  2   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       ,      8543.,   .525,       .159,    .30,   2,  .254,     .040
 SPRING SURVEY SHIFTE,      7056.,   .393,       .175,    .44,   3,  .454,     .048

   F shrinkage mean  ,      8957.,    .50,,,,                         .292,     .038

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      7942.,       .27,      .10,    6,    .370,   .043
 Age  3   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       ,      4106.,   .375,       .172,    .46,   3,  .303,     .225
 SPRING SURVEY SHIFTE,      5441.,   .295,       .157,    .53,   4,  .486,     .174

   F shrinkage mean  ,      4021.,    .50,,,,                         .211,     .229

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      4688.,       .21,      .10,    8,    .496,   .200
Age  4   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       ,       701.,   .266,       .380,   1.43,   4,  .442,     .344
 SPRING SURVEY SHIFTE,      1259.,   .275,       .273,    .99,   5,  .374,     .206

   F shrinkage mean  ,       717.,    .50,,,,                         .184,     .337

 Weighted prediction :
```

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
877.,	.18,	.21,	10,	1.138,	.284

Table 5.8 Faroe haddock 2016 xsa (cont.)

```
Age  5   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       ,       624.,   .230,       .487,   2.12,   5,  .466,     .595
 SPRING SURVEY SHIFTE,       609.,   .260,       .617,   2.37,   6,  .323,     .606

   F shrinkage mean  ,      1381.,    .50,,,,                          .210,     .313

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       732.,       .17,      .33,   12,   1.914,   .526


Age  6   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       ,      2011.,   .193,       .122,    .63,   6,  .586,     .135
 SPRING SURVEY SHIFTE,      2710.,   .249,       .272,   1.09,   7,  .286,     .102

   F shrinkage mean  ,       745.,    .50,,,,                          .128,     .330

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      1928.,       .15,      .16,   14,   1.093,   .141


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

 Year class = 2008

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 SUMMER SURVEY       ,       330.,   .177,       .195,   1.10,   7,  .676,     .126
 SPRING SURVEY SHIFTE,       702.,   .264,       .072,    .27,   7,  .196,     .061

   F shrinkage mean  ,        84.,    .50,,,,                          .128,     .425

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       321.,       .15,      .20,   15,   1.363,   .129
```

Table 5.8 Faroe haddock 2016 xsa (cont.)

```
Age  8   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       ,        76.,   .179,       .089,    .49,   8,  .663,     .278
 SPRING SURVEY SHIFTE,       122.,   .264,       .115,    .44,   7,  .145,     .182

   F shrinkage mean  ,        45.,    .50,,,,                         .192,     .430

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
        74.,       .16,      .10,   16,    .621,   .285


 Age  9   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       ,        55.,   .177,       .113,    .64,   8,  .626,     .323
 SPRING SURVEY SHIFTE,        94.,   .260,       .112,    .43,   7,  .145,     .199

   F shrinkage mean  ,        66.,    .50,,,,                         .229,     .275

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
        62.,       .16,      .08,   16,    .509,   .291
```

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

Run title : FAROE HADDOCK (ICES DIVISION 5.b) HAD_IND

At 29/04/2016 11:08

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR,	1957,	1958,	1959,	1960,	1961,	1962,	1963,	1964,	1965,
AGE									
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0010,	.0024,	.0132,	.0150,	.0219,	.0149,	.0106,	.0018,	.0017,
2,	.1394,	.1939,	.1066,	.2074,	.1875,	.3232,	.3801,	.0876,	.0691,
3,	.3707,	.4378,	.3860,	.4599,	.4162,	.5866,	.5639,	.3723,	.2354,
4,	.6163,	.5737,	.4782,	.6926,	.4209,	.5980,	.7261,	.5193,	.4767,
5,	.3909,	.5386,	.4195,	.5260,	.4387,	.3480,	.5591,	.5369,	.3678,
6,	.4380,	.6346,	.6458,	.6591,	.5879,	.6706,	.4026,	.6107,	.5882,
7,	.6340,	.9504,	.9184,	1.2130,	.9483,	1.0499,	1.2493,	.3375,	.9618,
8,	.5599,	.7839,	.8206,	.9667,	.8742,	.9736,	1.1139,	1.2027,	2.3618,
9,	.5321,	.7028,	.6625,	.8198,	.6600,	.7351,	.8185,	.6472,	.9619,
+gp,	.5321,	.7028,	.6625,	.8198,	.6600,	.7351,	.8185,	.6472,	.9619,
FBAR 3- 7,	.4900,	.6270,	.5696,	.7101,	.5624,	.6506,	.7002,	.4753,	.5260,

Table 8 Fishing mortality (F) at age

YEAR,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0032,	.0012,	.0014,	.0024,	.0033,	.0015,	.0016,	.0114,	.0033,	.0015,
2,	.0610,	.0641,	.1261,	.0860,	.0551,	.0526,	.0253,	.1677,	.1266,	.1230,
3,	.2370,	.1873,	.2647,	.2363,	.2528,	.1936,	.4226,	.4320,	.2172,	.2650,
4,	.4515,	.2971,	.3483,	.5320,	.3344,	.4186,	.2853,	.2392,	.3730,	.2412,
5,	.5006,	.2997,	.2847,	.3330,	.3639,	.2754,	.4517,	.3143,	.1279,	.2116,
6,	.5421,	.5406,	.4540,	.4975,	.5561,	.5560,	.1495,	.2703,	.1714,	.0957,
7,	.9128,	.6906,	.8367,	.8277,	.8740,	.8385,	.6721,	.1951,	.2134,	.0859,
8,	.7509,	.6634,	.5851,	1.0631,	.5430,	.4224,	.4066,	.2907,	.1433,	.1599,
9,	.6373,	.5022,	.5057,	.6566,	.5386,	.5061,	.3957,	.2633,	.2068,	.1595,
+gp,	.6373,	.5022,	.5057,	.6566,	.5386,	.5061,	.3957,	.2633,	.2068,	.1595,
FBAR 3- 7,	.5288,	.4031,	.4377,	.4853,	.4762,	.4564,	.3962,	.2902,	.2206,	.1799,

Table 8 Fishing mortality (F) at age

YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,
AGE										

0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0014,	.0000,	.0000,	.0002,	.0000,	.0000,	.0000,	.0000,	.0006,	.0000,
2,	.0908,	.0108,	.0010,	.0004,	.0325,	.0237,	.0383,	.0252,	.0329,	.0280,
3,	.1878,	.1128,	.0547,	.0458,	.0285,	.1374,	.4618,	.1917,	.1167,	.1695,
4,	.3810,	.1815,	.1665,	.1255,	.2025,	.1314,	.3709,	.3481,	.3896,	.2392,
5,	.2216,	.5273,	.2116,	.1913,	.2750,	.2112,	.2918,	.3498,	.2171,	.3475,
6,	.2871,	.7246,	.3820,	.1409,	.2136,	.2264,	.2775,	.1383,	.3336,	.4163,
7,	.1601,	.3904,	.5760,	.2721,	.1702,	.2004,	.2524,	.2991,	.0853,	.2084,
8,	.2539,	.3788,	.4969,	.3303,	.3954,	.0920,	.2266,	.3102,	.2929,	.1720,
9,	.2621,	.4437,	.3690,	.2130,	.2526,	.1730,	.2854,	.2907,	.2651,	.2782,
+gp,	.2621,	.4437,	.3690,	.2130,	.2526,	.1730,	.2854,	.2907,	.2651,	.2782,
FBAR 3- 7,	.2476,	.3873,	.2782,	.1551,	.1780,	.1814,	.3309,	.2654,	.2285,	.2762,

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

Table 8 Fishing mortality (F) at age

YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0061,	.0000,	.0000,
2,	.0097,	.0337,	.0394,	.0050,	.0125,	.0290,	.0167,	.0709,	.0489,	.0094,
3,	.0941,	.0927,	.0680,	.1207,	.1313,	.1654,	.0745,	.1662,	.1645,	.1053,
4,	.2491,	.1846,	.1863,	.1363,	.2211,	.2724,	.1782,	.1842,	.2582,	.3128,
5,	.2598,	.2623,	.2368,	.3328,	.2335,	.2185,	.2763,	.1865,	.1484,	.3077,
6,	.3589,	.3082,	.3062,	.3210,	.3575,	.3178,	.2604,	.2067,	.2122,	.1846,
7,	.1573,	.4748,	.2083,	.5175,	.4240,	.4045,	.2681,	.1979,	.2518,	.2248,
8,	.5179,	.5848,	.2381,	.3887,	.4633,	.2690,	.2310,	.1588,	.2433,	.2712,
9,	.3104,	.3653,	.2363,	.3414,	.3420,	.2981,	.2440,	.1876,	.2239,	.2616,
+gp,	.3104,	.3653,	.2363,	.3414,	.3420,	.2981,	.2440,	.1876,	.2239,	.2616,
FBAR 3- 7,	.2239,	.2645,	.2011,	.2857,	.2735,	.2757,	.2115,	.1883,	.2070,	.2271,

Table 8 Fishing mortality (F) at age

YEAR,	1996,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0001,	.0000,	.0000,	.0004,	.0006,	.0003,	.0000,	.0000,	.0003,	.0000,
2,	.0081,	.0096,	.0319,	.0125,	.0793,	.0487,	.0284,	.0036,	.0098,	.0112,
3,	.0781,	.0929,	.1756,	.5561,	.3159,	.2431,	.2175,	.0833,	.0684,	.0860,
4,	.3651,	.2222,	.2423,	.2349,	.1828,	.4449,	.3701,	.3376,	.1604,	.1815,
5,	.4181,	.4700,	.3352,	.3528,	.2667,	.2255,	.4139,	.5493,	.4738,	.3550,
6,	.3819,	.5291,	.6169,	.3954,	.3519,	.2836,	.2711,	.6838,	.6303,	.5710,
7,	.3596,	.5598,	1.2984,	.7509,	.2940,	.2495,	.2385,	.6277,	.7269,	.6928,
8,	.3310,	.3643,	1.0446,	1.9269,	.6496,	.2253,	.2923,	.6158,	.8732,	.6332,
9,	.3668,	.4951,	.7948,	.7283,	.3225,	.2750,	.2820,	.5484,	.7272,	.7676,
+gp,	.3668,	.4951,	.7948,	.7283,	.3225,	.2750,	.2820,	.5484,	.7272,	.7676,
FBAR 3- 7,	.3206,	.3748,	.5337,	.4580,	.2823,	.2893,	.3023,	.4563,	.4119,	.3773,

Table 8 Fishing mortality (F) at age

YEAR,	2006,	2007,	2008,	2009,	2010,	2011,	2012,	2013,	2014,	2015,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0000,	.0000,	.0024,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.0367,	.0276,	.0278,	.0131,	.1073,	.0162,	.0020,	.0340,	.0303,	.0428,
3,	.0749,	.2000,	.0962,	.1884,	.3082,	.3216,	.1199,	.1659,	.2242,	.1995,

4,	.1844,	.1238,	.2914,	.2786,	.3974,	.3871,	.3674,	.1999,	.3250,	.2839,
5,	.2866,	.3057,	.1333,	.2875,	.3179,	.3244,	.3257,	.2633,	.3227,	.5263,
6,	.5413,	.4150,	.2681,	.2372,	.4381,	.3634,	.3140,	.3374,	.1880,	.1408,
7,	.6995,	.5909,	.3915,	.3415,	.4334,	.4919,	.4369,	.3686,	.3779,	.1294,
8,	.3657,	.5473,	.5931,	.2924,	.3784,	.5499,	.3018,	.6516,	.2527,	.2853,
9,	.6209,	.4352,	.2943,	.2545,	.2867,	.3385,	.5687,	.3931,	.2123,	.2909,
+gp,	.6209,	.4352,	.2943,	.2545,	.2867,	.3385,	.5687,	.3931,	.2123,	.2909,
FBAR 3- 7,	.3573,	.3271,	.2361,	.2666,	.3790,	.3777,	.3128,	.2670,	.2876,	.2560,

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

Run title : FAROE HADDOCK (ICES DIVISION 5.b) HAD_IND

At 29/04/2016 11:08

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,	1965,
AGE									
0,	64927,	54061,	77651,	58761,	71715,	45399,	33843,	30192,	37948,
1,	47944,	53158,	44261,	63576,	48109,	58715,	37170,	27709,	24719,
2,	35106,	39212,	43417,	35763,	51279,	38537,	47362,	30110,	22644,
3,	25440,	25003,	26445,	31954,	23796,	34806,	22837,	26515,	22585,
4,	20280,	14377,	13213,	14717,	16517,	12850,	15850,	10638,	14961,
5,	5517,	8965,	6632,	6706,	6028,	8877,	5786,	6278,	5182,
6,	2786,	3055,	4284,	3570,	3245,	3182,	5132,	2708,	3005,
7,	1377,	1472,	1326,	1839,	1512,	1476,	1332,	2809,	1204,
8,	585,	598,	466,	433,	448,	480,	423,	313,	1641,
9,	252,	274,	224,	168,	135,	153,	148,	114,	77,
+gp,	154,	227,	106,	54,	29,	46,	45,	16,	14,
TOTAL,	204367,	200401,	218024,	217540,	222811,	204522,	169929,	137402,	133981,

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

YEAR,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,
AGE										
0,	81923,	47768,	53237,	23136,	49621,	35418,	78970,	104847,	83625,	39127,
1,	31069,	67073,	39109,	43587,	18942,	40627,	28998,	64655,	85842,	68466,
2,	20203,	25356,	54851,	31975,	35600,	15457,	33213,	23702,	52333,	70052,
3,	17302,	15563,	19470,	39587,	24022,	27583,	12006,	26513,	16410,	37750,
4,	14613,	11176,	10566,	12234,	25590,	15275,	18608,	6442,	14092,	10812,
5,	7604,	7617,	6798,	6106,	5884,	14996,	8229,	11454,	4152,	7946,
6,	2937,	3774,	4622,	4187,	3583,	3348,	9322,	4288,	6849,	2992,
7,	1366,	1398,	1800,	2403,	2084,	1682,	1572,	6572,	2680,	4724,
8,	377,	449,	574,	638,	860,	712,	595,	657,	4427,	1772,
9,	127,	146,	189,	262,	180,	409,	382,	325,	402,	3141,
+gp,	21,	36,	33,	45,	26,	281,	319,	52,	865,	1396,
TOTAL,	177542,	180355,	191249,	164160,	166393,	155787,	192213,	249509,	271678,	248178,

Terminal Fs derived using XSA (With F shrinkage)

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

YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,
AGE										

0	52360	4153	7376	5208	23620	29255	60791	58809	39475	14060
1	32035	42868	3400	6039	4264	19339	23952	49772	48148	32319
2	55970	26192	35098	2784	4944	3491	15833	19610	40750	39398
3	50715	41847	21213	28707	2278	3918	2791	12475	15656	32282
4	23712	34412	30607	16443	22452	1813	2796	1440	8432	11406
5	6955	13262	23498	21215	11874	15012	1301	1580	832	4676
6	5265	4562	6408	15570	14345	7385	9951	796	912	548
7	2226	3235	1810	3581	11073	9486	4821	6173	567	535
8	3549	1553	1792	833	2233	7647	6356	3067	3747	427
9	1237	2254	870	893	490	1231	5711	4149	1841	2289
+gp	1515	2613	1109	424	423	249	946	3460	4566	4400
TOTAL	235538	176951	133181	101696	97996	98825	135250	161330	164927	142340

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

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

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
AGE										
0	27960	20970	13967	4444	3984	2723	9619	141703	66628	13321
1	11512	22892	17169	11436	3638	3262	2229	7875	116016	54551
2	26461	9425	18742	14057	9363	2979	2671	1825	6409	94985
3	31365	21456	7460	14752	11452	7570	2369	2150	1392	4996
4	22310	23373	16012	5706	10705	8222	5254	1800	1491	967
5	7351	14238	15911	10881	4077	7026	5127	3599	1226	943
6	2705	4642	8968	10279	6387	2643	4623	3184	2445	865
7	296	1547	2792	5406	6105	3657	1575	2917	2120	1619
8	355	207	788	1856	2638	3271	1998	986	1960	1349
9	294	173	95	508	1030	1359	2047	1298	689	1258
+gp	2929	1197	668	307	409	136	822	1189	1650	1408
TOTAL	133538	120120	102572	79633	59787	42848	38332	168528	202026	176262

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

YEAR	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
AGE										
0	5566	23046	31610	151922	89144	61342	41236	12594	11316	4603
1	10906	4557	18869	25880	124383	72985	50223	33761	10311	9265
2	44662	8928	3731	15448	21180	101770	59738	41119	27641	8439
3	77040	36271	7240	2959	12491	16019	79359	47538	33545	22411
4	3682	58339	27061	4973	1389	7457	10285	52271	35812	25648
5	579	2092	38248	17388	3219	947	3913	5816	30534	24975
6	567	312	1071	22396	10004	2019	619	2118	2749	15566

7,	589,	317,	150,	473,	12348,	5761,	1245,	386,	875,	1198,
8,	1059,	337,	148,	34,	183,	7534,	3675,	803,	169,	346,
9,	842,	623,	191,	43,	4,	78,	4924,	2246,	355,	58,
+gp,	1407,	1446,	997,	405,	283,	82,	147,	2393,	1711,	313,
TOTAL,	146900,	136268,	129316,	241920,	274627,	275995,	255364,	201045,	155018,	112822,

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

YEAR,	2006,	2007,	2008,	2009,	2010,	2011,	2012,	2013,	2014,	2015,	2016,
AGE											
0,	3966,	3432,	6301,	17390,	6731,	4097,	13129,	15105,	10186,	62435,	0,
1,	3769,	3247,	2810,	5159,	14238,	5511,	3354,	10749,	12367,	8340,	51118,
2,	7585,	3085,	2659,	2295,	4224,	11657,	4512,	2746,	8801,	10125,	6828,
3,	6833,	5987,	2457,	2117,	1854,	3106,	9390,	3687,	2173,	6990,	7942,
4,	16836,	5191,	4013,	1827,	1436,	1116,	1844,	6819,	2557,	1422,	4688,
5,	17514,	11463,	3755,	2455,	1132,	790,	620,	1045,	4572,	1512,	877,
6,	14338,	10766,	6913,	2690,	1508,	675,	468,	367,	658,	2710,	732,
7,	7200,	6832,	5820,	4329,	1738,	797,	384,	280,	214,	446,	1928,
8,	491,	2929,	3098,	3221,	2519,	922,	399,	203,	158,	120,	321,
9,	151,	279,	1387,	1402,	1969,	1413,	436,	241,	87,	101,	74,
+gp,	165,	28,	168,	235,	701,	715,	287,	401,	276,	87,	115,
TOTAL,	78847,	53237,	39381,	43120,	38048,	30797,	34822,	41644,	42048,	94289,	74622,

Table 5.11. Faroe haddock. Stock summary of the 2016 VPA.

Run title : FAROE HADDOCK (ICES DIVISION 5.b)			HAD_IND				
14/04/2016	16:59						
Table 16	Summary	(without SOP correction)					
	Terminal Fs derived using XSA (With F shrinkage)						
	RECRUIT	RECRU	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 3- 7
	Age 0	Age 2					
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	49621	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	104847	23702	98976	61620	18035	0.2927	0.2902
1974	83625	52333	116873	64629	14773	0.2286	0.2206
1975	39127	70052	138898	75403	20715	0.2747	0.1799
1976	52360	55970	143617	89217	26211	0.2938	0.2476
1977	4153	26192	121035	96371	25555	0.2652	0.3873
1978	7376	35098	120568	97225	19200	0.1975	0.2782
1979	5208	2784	99492	85392	12424	0.1455	0.1551
1980	23620	4944	87629	81895	15016	0.1834	0.178
1981	29255	3491	78954	75838	12233	0.1613	0.1814
1982	60791	15833	68298	56797	11937	0.2102	0.3309
1983	58809	19610	63951	51803	12894	0.2489	0.2654
1984	39475	40750	100634	53808	12378	0.23	0.2285
1985	14060	39398	93926	62576	15143	0.242	0.2762
1986	27960	26461	98457	65563	14477	0.2208	0.2239
1987	20970	9425	87574	67247	14882	0.2213	0.2645
1988	13967	18742	77340	61842	12178	0.1969	0.2011
1989	4444	14057	69437	51668	14325	0.2773	0.2857
1990	3984	9363	53438	43617	11726	0.2688	0.2735
1991	2723	2979	38613	34532	8429	0.2441	0.2757
1992	9619	2671	28972	26835	5476	0.2041	0.2115
1993	141703	1825	28639	23072	4026	0.1745	0.1883
1994	66628	6409	27298	21444	4252	0.1983	0.207
1995	13321	94985	86938	22571	4948	0.2192	0.2271
1996	5566	44662	111696	49203	9642	0.196	0.3206
1997	23046	8928	106263	81257	17924	0.2206	0.3748
1998	31610	3731	91219	80936	22210	0.2744	0.5337
1999	151922	15448	78812	61819	18482	0.299	0.458
2000	89144	21180	107887	51599	15821	0.3066	0.2823
2001	61342	101770	143907	59520	15890	0.267	0.2893
2002	41236	59738	150576	83361	24933	0.2991	0.3023
2003	12594	41119	137270	95070	27072	0.2848	0.4563
2004	11316	27641	124158	85459	23101	0.2703	0.4119
2005	4603	8439	88241	72052	20455	0.2839	0.3773
2006	3966	7585	64448	57336	17154	0.2992	0.3573
2007	3432	3085	46441	42218	12631	0.2992	0.3271
2008	6301	2659	33351	29458	7388	0.2508	0.2361
2009	17390	2295	24503	22676	5197	0.2292	0.2666
2010	6731	4224	20905	17439	5202	0.2983	0.379
2011	4097	11657	18478	11917	3540	0.2971	0.3777
2012	13129	4512	16375	12376	2634	0.2128	0.3128
2013	15105	2746	16814	14903	2950	0.1979	0.267
2014	10186	8801	18411	14082	3276	0.2326	0.2876
2015	62435	10125	25984	17455	3395	0.1945	0.256
Arith.							
Mean	40914	25890	99094	68560	15339	0.2501	0.2915
Units	(Thousands)	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)		

Table 5.12. Management options table INPUT DATA descriptions.

Stock size

The stock in numbers 2016 is taken directly from the 2016 XSA. The yearclass 2015 at age 2 (in 2017) is estimated from the 2016 XSA age 1 applying a natural mortality of 0.2in forward calculation of the number using the standard VPA equation. The yearclass 2016 at age 2 (in 2018) is estimated as the geomean of the numbers-at-age 2 since 2005.

Age	2016	2017	2018
2	6828	41852	5930
3	7942		
4	4688		
5	877		
6	732		
7	1928		
8	321		
9	74		
10+	115		

Numbers in thousands (predicted values rounded).

Proportion mature at age

The proportion mature at age in 2016 is estimated as the average of the observed data in 2015 and 2016. For 2017 and 2018, the average of 2014–2016 is used.

Age	2016	2017	2018
2	0.18	0.18	0.18
3	0.89	0.87	0.87
4	1.00	1.00	1.00
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 2016–2018 are simply the average of the estimated point-values for 2013–2015 not re-scaled to 2015 since most weights have been fluctuating without any trend during the last 3 years (no model was available to predict future mean weights at age).

AGE	2016	2017	2018
2	0.552	0.552	0.552
3	0.874	0.874	0.874
4	1.122	1.122	1.122
5	1.486	1.486	1.486
6	1.711	1.711	1.711
7	2.031	2.031	2.031
8	1.920	1.920	1.920
9	1.977	1.977	1.977
10+	2.070	2.070	2.070

Exploitation pattern

The exploitation pattern 2016 is estimated like last year as the average fishing mortality matrix in the 3 preceding years (2013-2015) from the final VPA in 2016, without re-scaling to the terminal year (2015) 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	2016	2017	2018
2	0.0357	0.0357	0.0357
3	0.1965	0.1965	0.1965
4	0.2696	0.2696	0.2696
5	0.3708	0.3708	0.3708
6	0.2221	0.2221	0.2221
7	0.2920	0.2920	0.2920
8	0.3965	0.3965	0.3965
9	0.2988	0.2988	0.2988
10+	0.2988	0.2988	0.2988

Table 5.13 Faroe haddock. Management option table - Input data

MFDP version 1
Run: jr1
Time and date: 15:31 20/04/2016
Fbar age range: 3-7

2016

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
2	6828	0.2	0.18	0	0	0.552	0.036	0.552
3	7942	0.2	0.89	0	0	0.874	0.197	0.874
4	4688	0.2	1	0	0	1.222	0.270	1.222
5	877	0.2	1	0	0	1.486	0.371	1.486
6	732	0.2	1	0	0	1.711	0.222	1.711
7	1928	0.2	1	0	0	2.031	0.292	2.031
8	321	0.2	1	0	0	1.920	0.397	1.920
9	74	0.2	1	0	0	1.977	0.299	1.977
10	115	0.2	1	0	0	2.070	0.299	2.070

2017

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
2	41852	0.2	0.18	0	0	0.552	0.036	0.552
3	.	0.2	0.87	0	0	0.874	0.197	0.874
4	.	0.2	1	0	0	1.222	0.270	1.222
5	.	0.2	1	0	0	1.486	0.371	1.486
6	.	0.2	1	0	0	1.711	0.222	1.711
7	.	0.2	1	0	0	2.031	0.292	2.031
8	.	0.2	1	0	0	1.920	0.397	1.920
9	.	0.2	1	0	0	1.977	0.299	1.977
10	.	0.2	1	0	0	2.070	0.299	2.070

2018

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
2	5930	0.2	0.18	0	0	0.552	0.036	0.552
3	.	0.2	0.87	0	0	0.874	0.197	0.874
4	.	0.2	1	0	0	1.222	0.270	1.222
5	.	0.2	1	0	0	1.486	0.371	1.486
6	.	0.2	1	0	0	1.711	0.222	1.711
7	.	0.2	1	0	0	2.031	0.292	2.031
8	.	0.2	1	0	0	1.920	0.397	1.920
9	.	0.2	1	0	0	1.977	0.299	1.977
10	.	0.2	1	0	0	2.070	0.299	2.070

Input units are thousands and kg - output in tonnes

Table 5.14 Faroe haddock. Management option table - Results

MFDP version 1
Run: jr1
Index file 20/04/2016
Time and date: 15:31 20/04/2016
Fbar age range: 3-7

2016				
Biomass	SSB	FMult	FBar	Landings
23910	20056	1	0.2702	4251

2017					2018	
Biomass	SSB	FMult	FBar	Landings	Biomass	SSB
43375	23818	0	0	0	53195	46619
.	23818	0.1	0.027	597	52532	45970
.	23818	0.2	0.054	1178	51887	45338
.	23818	0.3	0.0811	1745	51257	44723
.	23818	0.4	0.1081	2297	50643	44123
.	23818	0.5	0.1351	2835	50045	43538
.	23818	0.6	0.1621	3359	49461	42968
.	23818	0.7	0.1891	3870	48892	42412
.	23818	0.8	0.2161	4368	48337	41871
.	23818	0.9	0.2432	4854	47795	41342
.	23818	1	0.2702	5328	47267	40827
.	23818	1.1	0.2972	5790	46751	40325
.	23818	1.2	0.3242	6240	46247	39835
.	23818	1.3	0.3512	6680	45756	39356
.	23818	1.4	0.3783	7109	45276	38890
.	23818	1.5	0.4053	7527	44807	38434
.	23818	1.6	0.4323	7936	44350	37990
.	23818	1.7	0.4593	8335	43903	37556
.	23818	1.8	0.4863	8724	43466	37132
.	23818	1.9	0.5134	9104	43039	36719
.	23818	2	0.5404	9476	42622	36315

Input units are thousands and kg - output in tonnes

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

MFYPR version 1
Run: jr2
Index file 20/04/2016
Time and date: 16:20 20/04/2016
Fbar age range: 3-7

Age	M	Mat	PF	PM	SWt	Sel	CWt
2	0.2	0.064	0	0	0.569	0.036	0.569
3	0.2	0.527	0	0	0.809	0.197	0.809
4	0.2	0.926	0	0	1.075	0.270	1.075
5	0.2	0.993	0	0	1.376	0.371	1.376
6	0.2	0.999	0	0	1.650	0.222	1.650
7	0.2	1.000	0	0	1.913	0.292	1.913
8	0.2	1.000	0	0	2.117	0.397	2.117
9	0.2	1.000	0	0	2.333	0.299	2.333
10	0.2	1.000	0	0	2.629	0.299	2.629

Weights in kilograms

Table 5.16 Faroe haddock. Long-term Prediction - Results

MFYPR version 1
Run: jr2
Time and date: 16:20 20/04/2016
Yield per results

FMult	Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0	0	0	0	5.5167	8.2937	4.1398	7.3883	4.1398	7.3883
0.1	0.027	0.1035	0.1726	5.0011	7.0969	3.6269	6.1942	3.6269	6.1942
0.2	0.054	0.1831	0.2925	4.605	6.2018	3.2336	5.3018	3.2336	5.3018
0.3	0.0811	0.2463	0.378	4.2911	5.5115	2.9224	4.614	2.9224	4.614
0.4	0.1081	0.2976	0.4402	4.0362	4.9658	2.6701	4.0708	2.6701	4.0708
0.5	0.1351	0.3403	0.4863	3.8248	4.5256	2.4613	3.6331	2.4613	3.6331
0.6	0.1621	0.3763	0.5208	3.6467	4.1643	2.2857	3.2743	2.2857	3.2743
0.7	0.1891	0.4071	0.547	3.4943	3.8634	2.1359	2.9758	2.1359	2.9758
0.8	0.2161	0.4338	0.567	3.3625	3.6096	2.0065	2.7243	2.0065	2.7243
0.9	0.2432	0.4572	0.5824	3.2472	3.3931	1.8936	2.5101	1.8936	2.5101
1	0.2702	0.4779	0.5943	3.1454	3.2066	1.7942	2.3259	1.7942	2.3259
1.1	0.2972	0.4963	0.6035	3.0548	3.0445	1.7061	2.166	1.7061	2.166
1.2	0.3242	0.5129	0.6107	2.9737	2.9024	1.6272	2.0261	1.6272	2.0261
1.3	0.3512	0.5278	0.6162	2.9005	2.777	1.5564	1.9029	1.5564	1.9029
1.4	0.3783	0.5414	0.6205	2.8341	2.6656	1.4922	1.7937	1.4922	1.7937
1.5	0.4053	0.5538	0.6238	2.7736	2.5661	1.434	1.6962	1.434	1.6962
1.6	0.4323	0.5652	0.6263	2.7181	2.4767	1.3808	1.6089	1.3808	1.6089
1.7	0.4593	0.5757	0.6282	2.6672	2.3959	1.332	1.5302	1.332	1.5302
1.8	0.4863	0.5854	0.6296	2.6201	2.3227	1.287	1.4589	1.287	1.4589
1.9	0.5134	0.5944	0.6306	2.5765	2.2559	1.2456	1.3941	1.2456	1.3941
2	0.5404	0.6028	0.6312	2.5359	2.1949	1.2071	1.335	1.2071	1.335

Reference point	F multiplier	Absolute F
Fbar(3-7)	1	0.2702
FMax	2.2356	0.604
F0.1	0.7341	0.1984
F35%SPR	0.8628	0.2331
Flow	-99	
Fmed	0.812	0.2194
Fhigh	3.0515	0.8245

Weights in kilograms

Table 5.17 Haddock biomass (age 2+) 1914-2015 in tons. Year label is sum of first row and first column.

	1900	1925	1950	1975	2000
0		51433	81427	138898	107887
1		62983	67514	143617	143907
2		61870	66118	121035	150576
3		49631	73973	120568	137270
4		41313	75493	99492	124158
5		38518	88337	87629	88241
6		38412	91960	78954	64448
7		41379	90264	68298	46441
8		32637	92975	63951	33351
9		36717	89969	100634	24503
10		42386	96422	93926	20905
11		48161	93296	98457	18478
12		63897	98262	87574	16375
13		63738	90204	77340	16814
14	68122	50969	75561	69437	18411
15	60228	67182	71884	53438	25984
16	59115	84454	68774	38613	
17	58850	113753	77101	28972	
18	145265	103316	87971	28639	
19	195704	97594	94878	27298	
20	92229	90918	92142	86938	
21	101713	126946	92929	111696	
22	63831	103104	91506	106263	
23	61076	91342	98976	91219	
24	44757	80374	116873	78812	

5.18 Figures

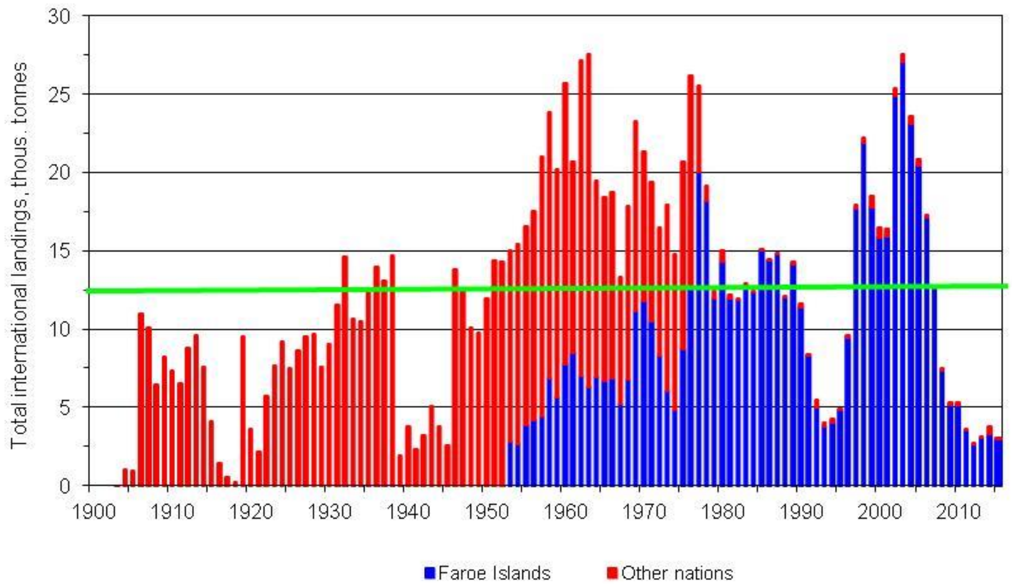


Figure 5.1. Haddock in ICES Division 5.b. Landings by all nations 1904–2015. Horisontal line average for the whole period.

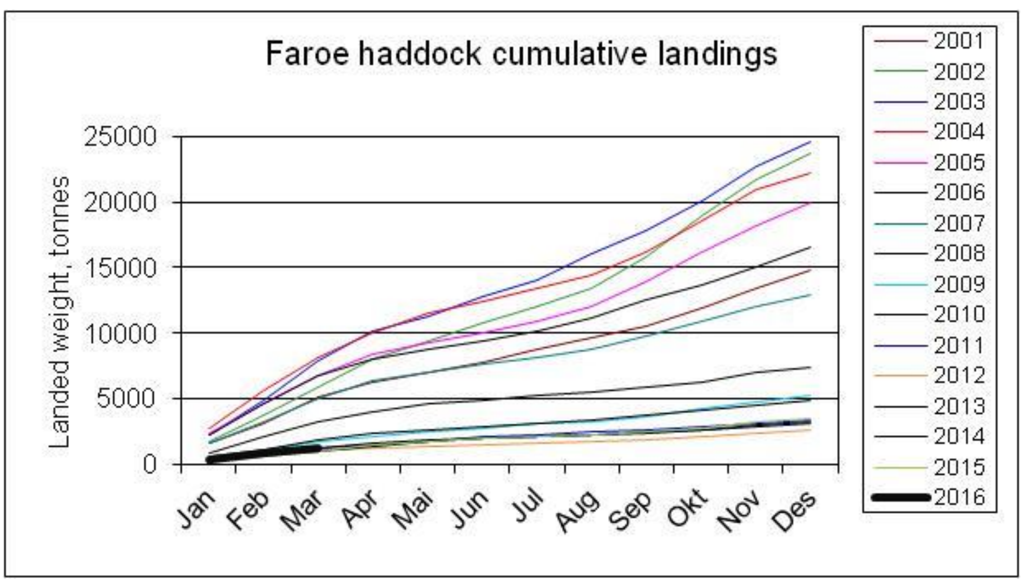


Figure 5.2. Faroe haddock. Cumulative Faroese landings from 5.b.

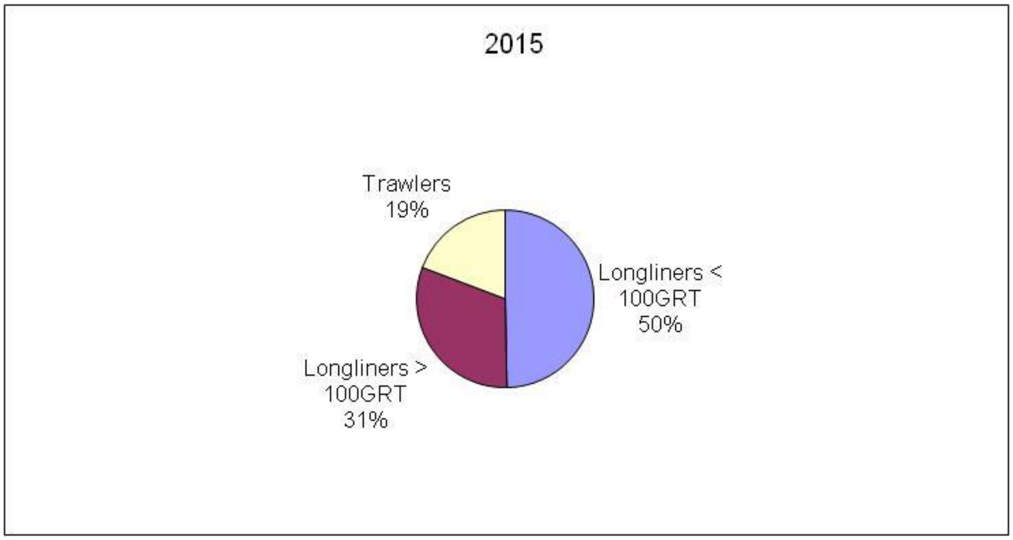


Figure 5.3. Faroe haddock. Contribution (%) by fleet to the total Faroese landings 2015.

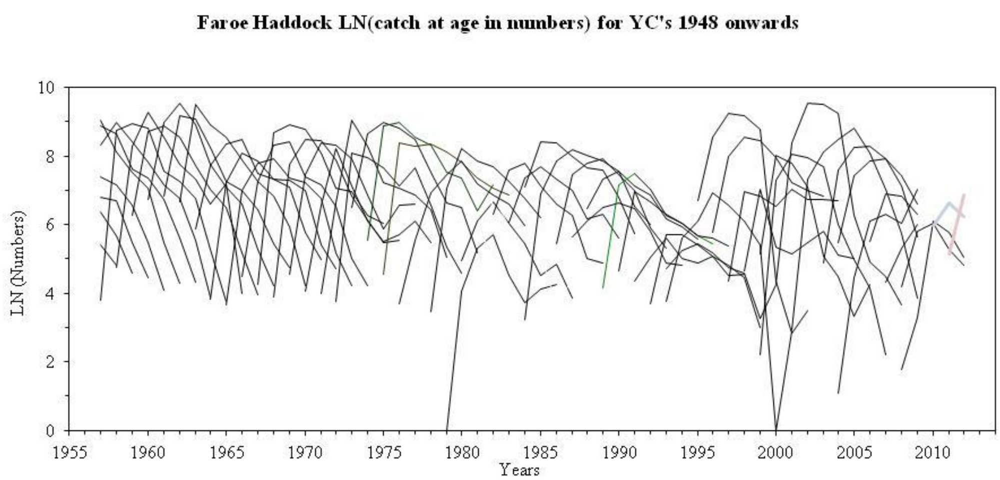


Figure 5.4.

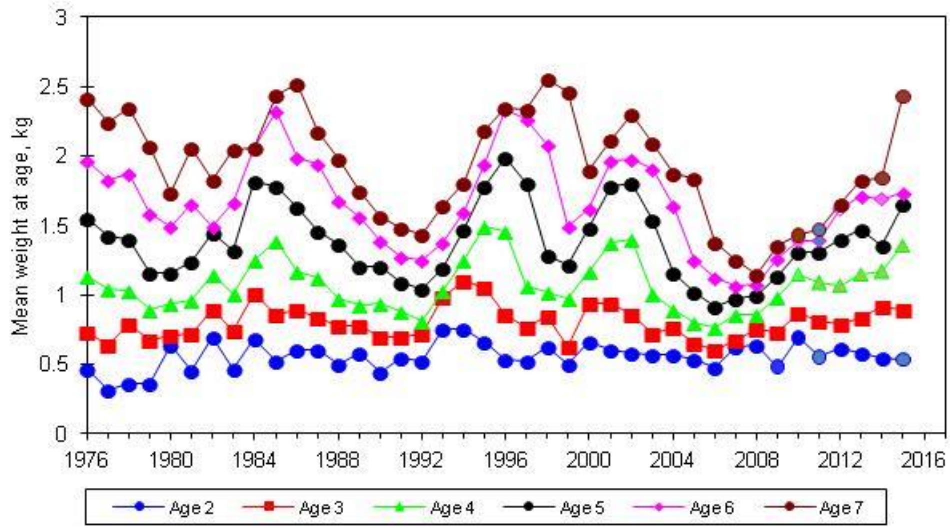


Figure 5.5. Faroe haddock. Mean weight at age (2-7).

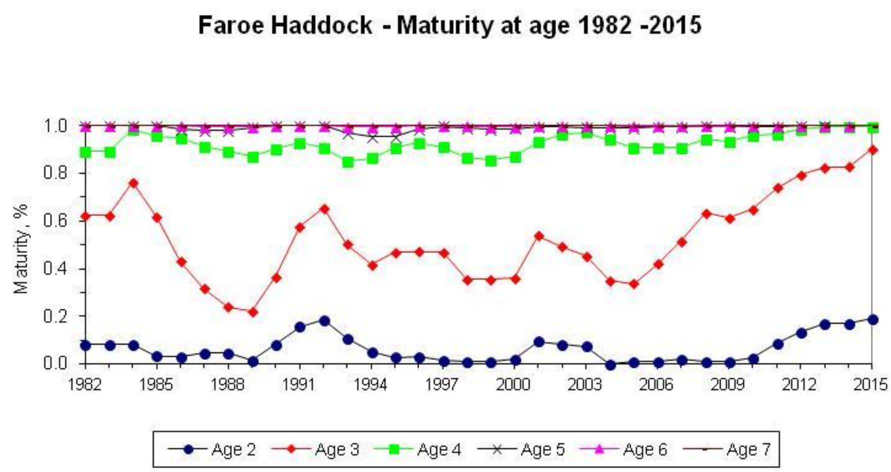


Figure 5.6. Faroe haddock. Maturity-at-age since 1982. Running 3–years average of survey observations.

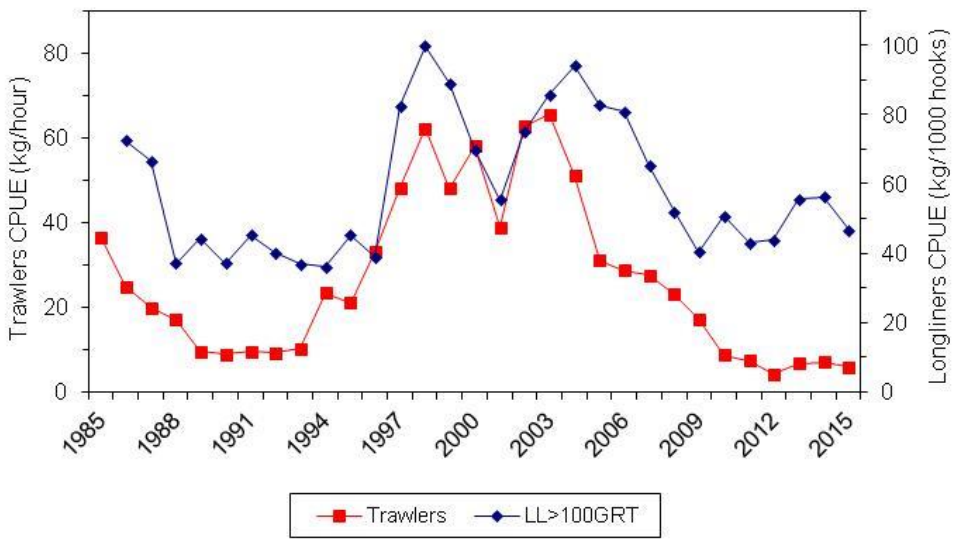


Figure 5.7. Commercial cpue's for Pairtrawlers > 1000 HP and longliners > 100 HP.

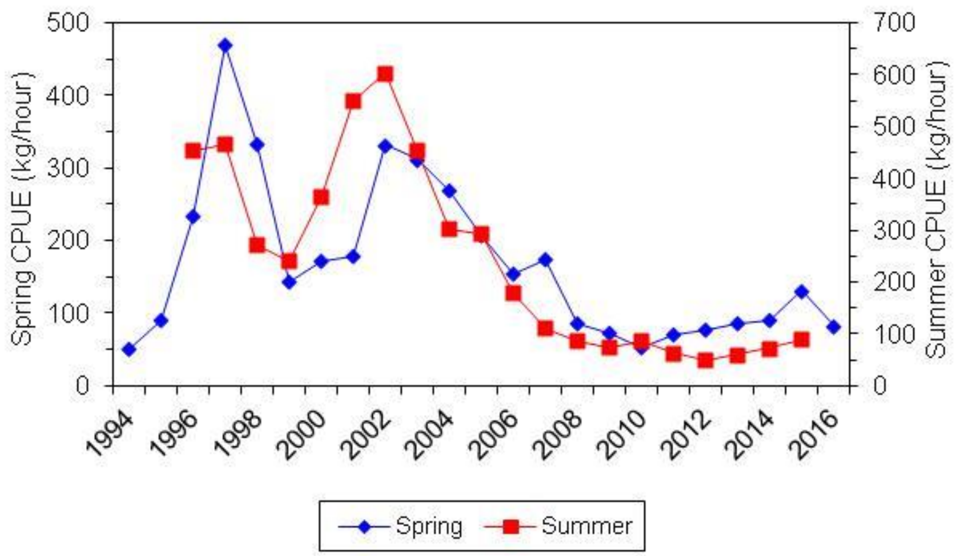
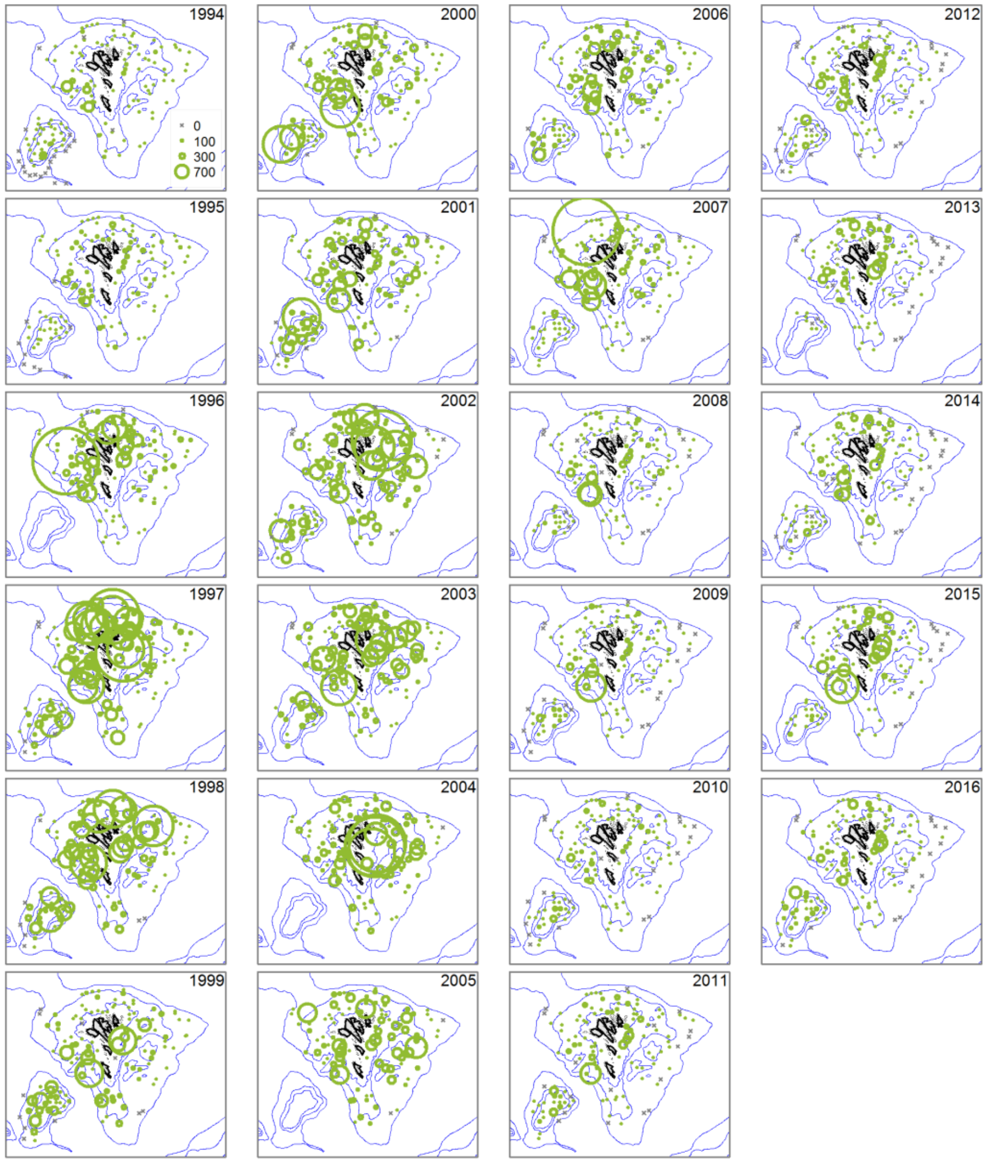


Figure 5.8. Faroe haddock. cpue (kg/trawlhour) in the spring and summer surveys.


1994
0
100
300
700
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016

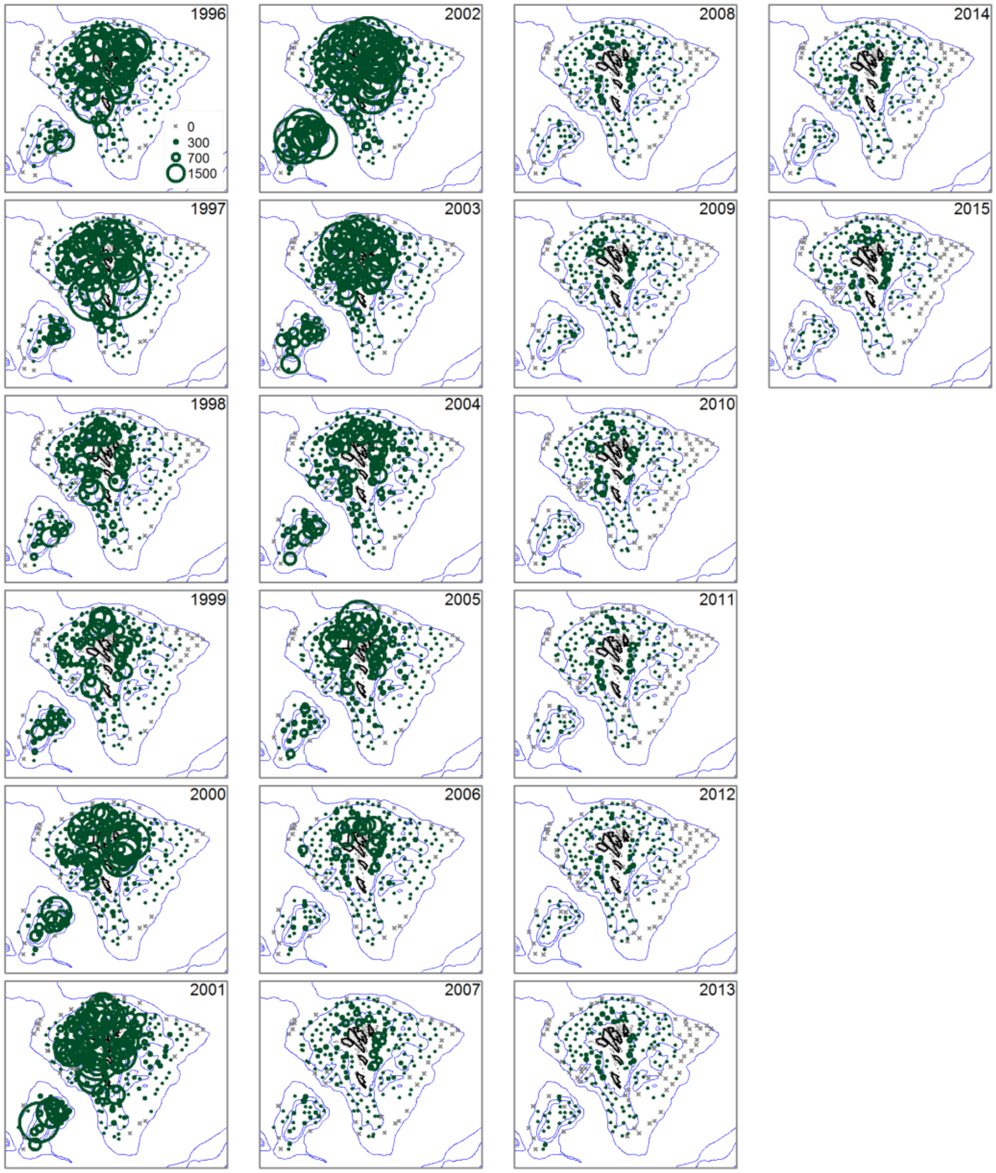


Figure 5.9. Distribution of Faroe haddock catches in the spring survey (page above) and in the summer survey (this page).

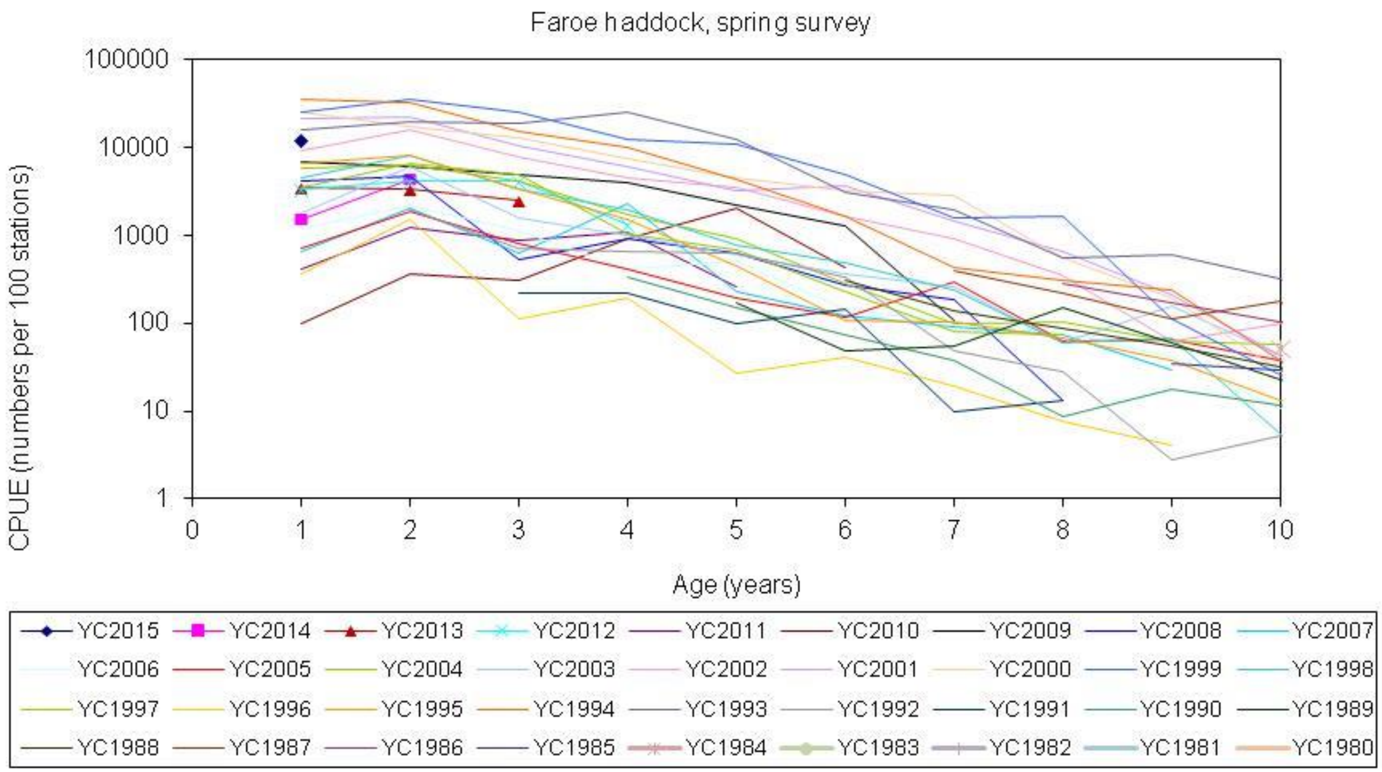


Figure 5.10. Faroe haddock. LN (c@age in numbers) in the spring survey.

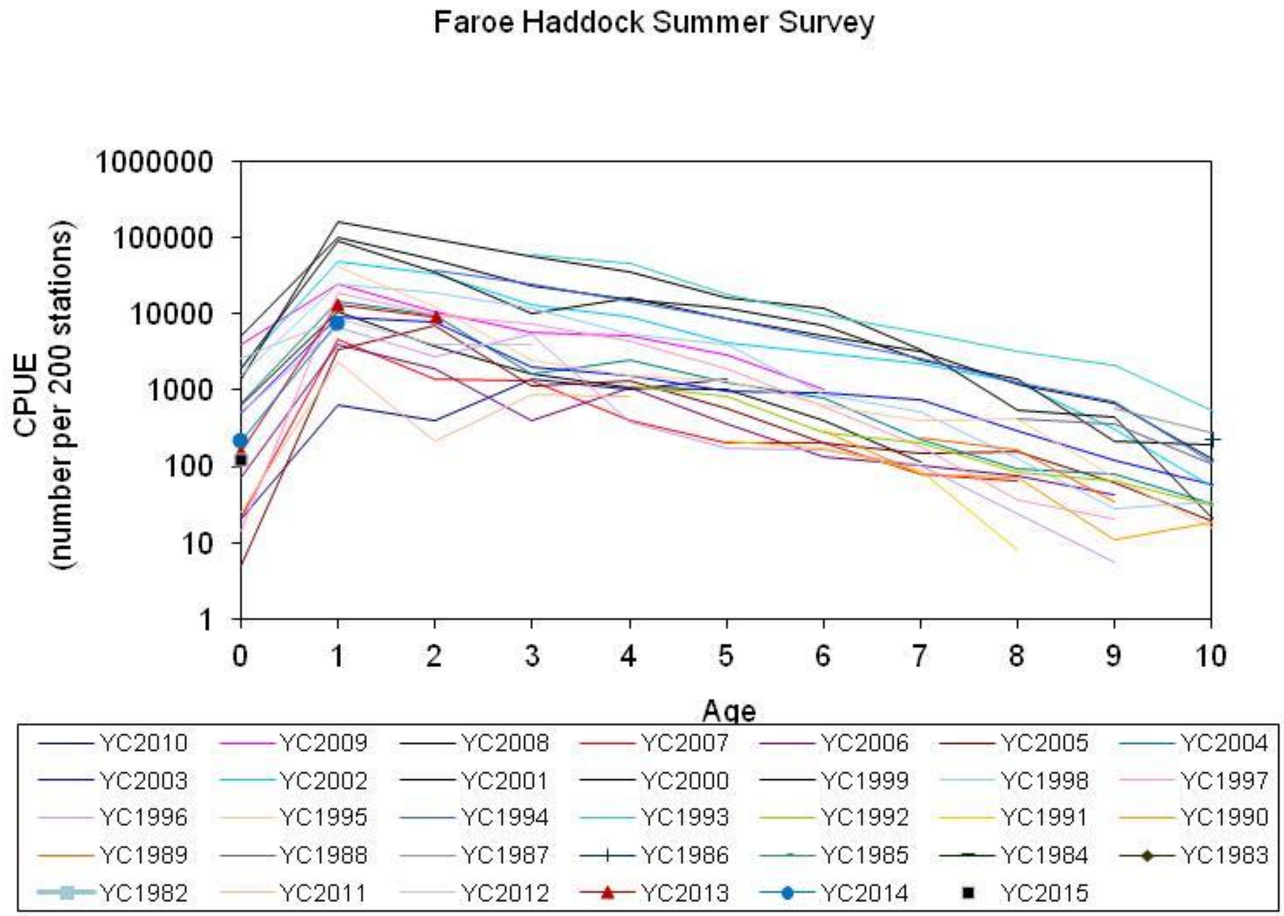


Figure 5.11. Faroe haddock. LN (c@age in numbers) in the summer survey.

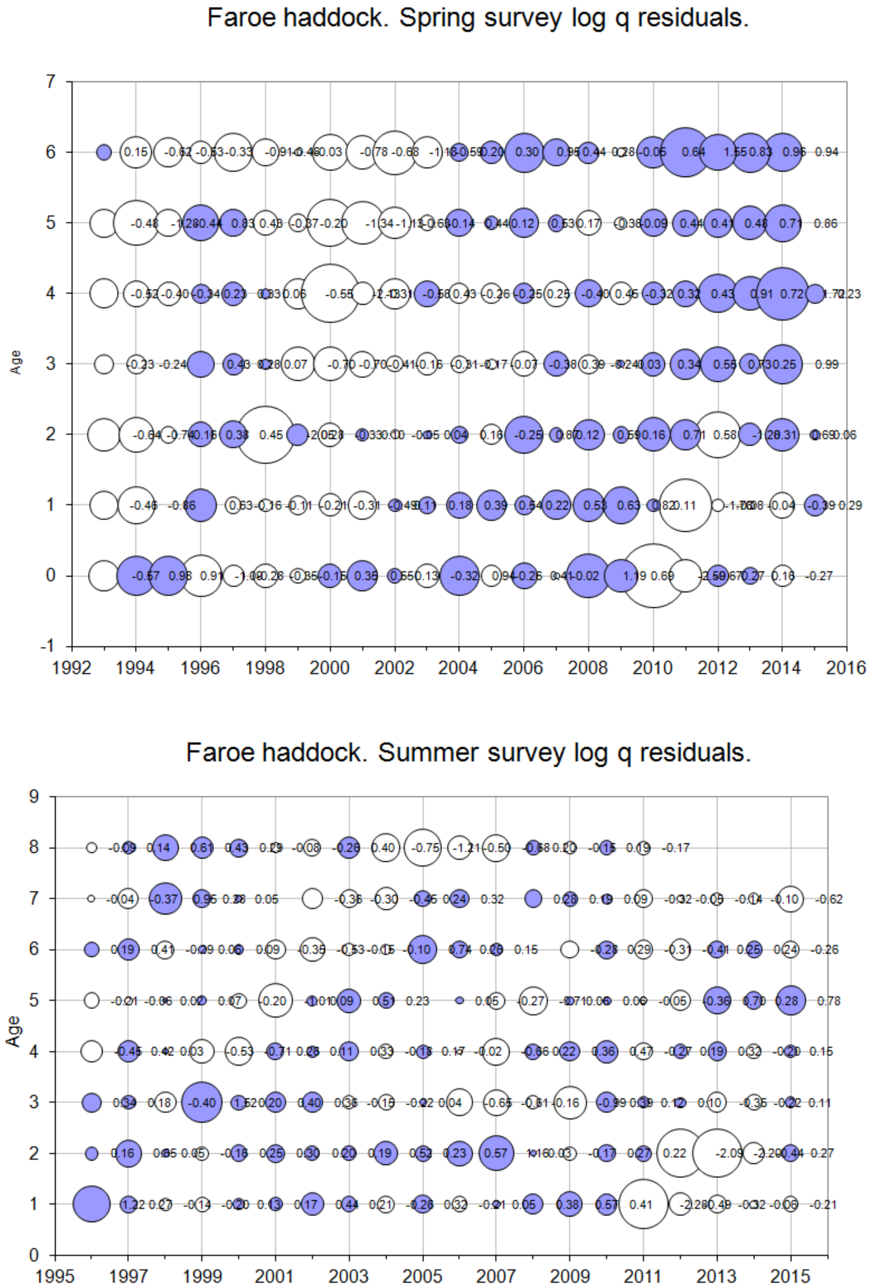


Figure 5.12. Faroe haddock survey log q residuals.

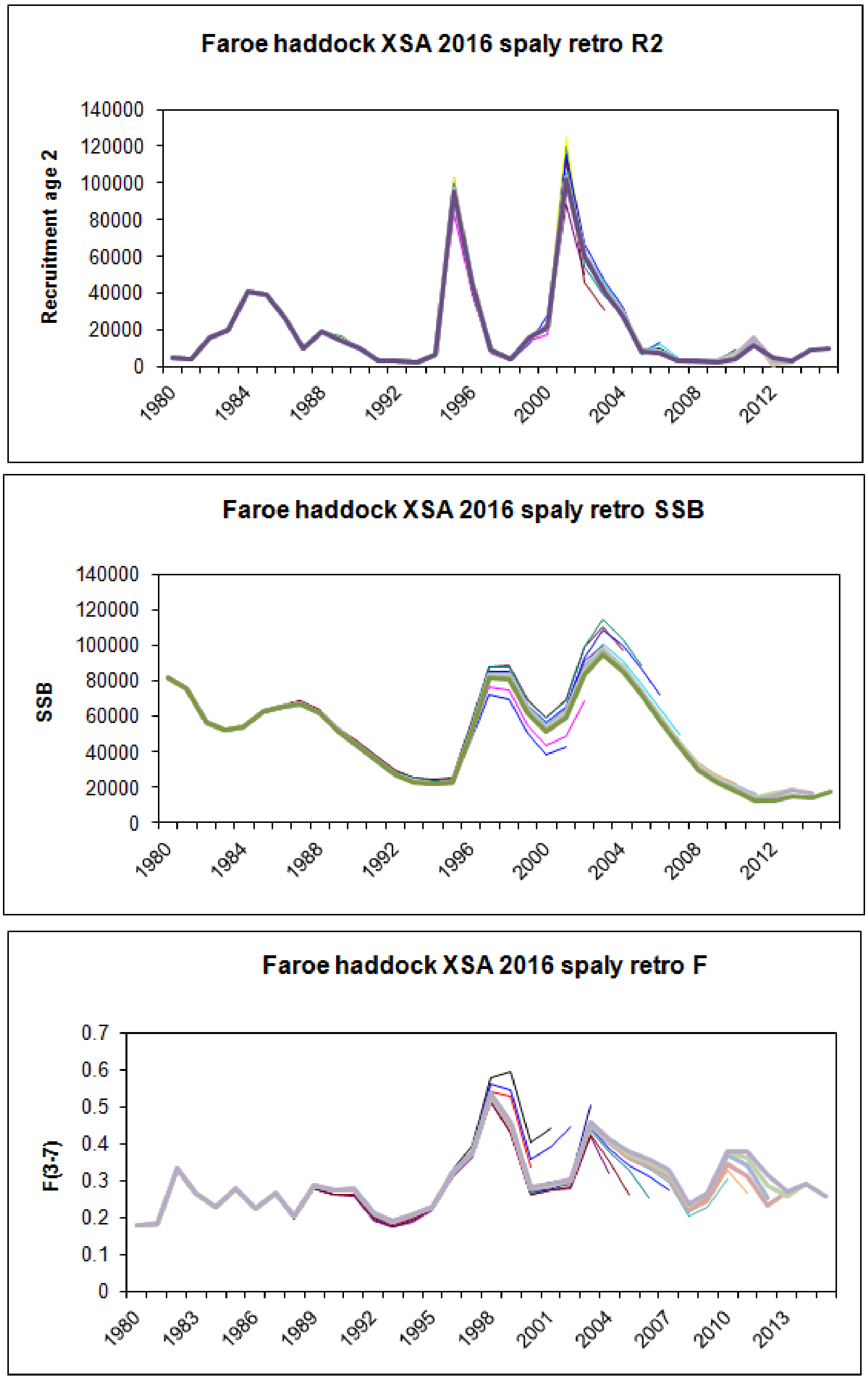


Figure 5.13. Faroe haddock. Retrospective analysis on the 2015 XSA.

6 Faroe Saithe

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 5.b) 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. Since 2011 landings have remained below historical average (37 000 t.) The total tonnage in 2015 is 25 000t.

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 pairtrawlers (>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 pairtrawlers (<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 pairtrawler fleet has accounted for about 75% of the total tonnage for saithe but since 2007 it has increased gradually up to 93% in 2015 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 2014. 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 2013/2014 fishing year only 58% and 41% of fishing days were utilized in the inner and outer areas respectively while in the 2014/2015 fishing year these ratios went up to 97% and 74%, i.e. 29% of fishing days were not used in the last finished year season.

Cumulative landings of saithe for the domestic fleets since 2000 are shown in Figure 6.2.1.2. The period from 2011 to 2015 are among the poorest in the time-series. The progression of landings in the first three months of 2016 is below monthly averages and suggests 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 pairtrawlers, 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 2014 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 3 and 6-years old were higher in 2015 than in 2014. While catches of 4 and 5-years old saithe decreased from 2323 and 3143 thous. to 2269 and 2577 thous. respectively in 2015. Numbers of age 3 (recruiting age) in 2015 (2135 thous.) is the largest since 2010 (2324 thous.)

The sampling program and sampling intensity in 2015 as well as the approach used in compiling catch numbers is the same as in preceding years. Sampling levels of catches in 2014 was 8.9% and it went up to 9.9% in 2015 (Table 6.2.2.3.) The average amount sampled per tonnes landed since 2000 is 6.2%.

6.2.3 Weight at age

Mean weights at age have varied by a factor of about 2 during since 1961. 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. In 2011 age classes 4 to 6 were close or at long-term average. From 2012 to 2014 weight was below average for age groups 3 to 7. Age classes 7 and older are in 2015 above mean values whereas younger age groups (3–5) are lower than average. Mean weight of the 2012 year class (age 3 in 2015) is estimated at 0.932 kg. which is the lowest ever observed in the time-series. On the other hand weight for 9-years old saithe (6.715 kg.) is the largest since 1985. 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 1962–1982 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 randomized 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 interannual 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 2007 the indices 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. The most recent estimate of the spring survey suggest a slightly decrease in stock biomass in 2016 but given the uncertainty associated with the index the point estimate ought to be taken with cautioagreement between survey indices and the commercial series used in the model tuning is good. Both survey at age numbers agreed in the lack of year classes present in the stock since 2007. The spring index suggests that the 2002 year class (age 3 in 2015) is quite strong, which is confirmed by very abundant individuals of the same year class in 2016. Year-class strength in the summer index also suggests that the 2012 year class is strong.

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 pairtrawler series. A GLM model and a survey spatial scaling factor is used to standardized 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 suggest that stock abundance was low in the 1990s and increased subsequently in the 2000's and a sharp downward trend from 2006 to 2011. Since 2012 the predicted cpue has remained remarkably stable at approximately 384 kg/hour (Figure 6.2.5.1.1)

The correlation between predicted cpue and the spring and summer surveys is R^2=0.55 and R^2=0.70 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 (Section C) and in the benchmark report (WKROUND 2010.) The 2010 XSA was calibrated with the standardized pairtrawlers 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 catchability, selectivity over 4 distinct periods and including a stock–recruitment relationship 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 F_{MSY}. The work was presented at the NWWG meeting in 2014 and the results agree with the previous simulations (see above) in that estimates of F_{MSY} are in the range of F_{MSY}=0.30 and F_{MSY} y=0.34 and not as the present level of F_{MSY} =0.28. In the 2014 meeting ACOM adopted the EqSim framework and agreed to set F_{MSY} =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) 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 B_{lim} is defined for faroe saithe but for the purposes of the analysis a value of $B_{lim}=B_{pa}/1.4$ 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
F_{lim}	0.34	87327.43	36479.8	ass. Error
F_{lim}	0.37	79116.87	35447.45	ass. Error
F_{lim}	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
$F_{Crash}5$	0.41	63312	31637.31	ass. Error
$F_{Crash}50$	0.52	855.73	550.19	ass. Error
F_{lim}	0.40	78435.72	38526.07	No ass. Error
F_{lim}	0.42	73052.08	37660.27	No ass. Error
F_{lim}	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
$F_{Crash}5$	0.43	69750.99	37114.99	No ass. Error
$F_{Crash}50$	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	NWWG2015
$B_{trigger}$	55 000 t.	55 000 t.
B_{lim}	not defined.	
B_{pa}	60 000 t.	
F_{lim}	not defined	
F_{pa}	0.28	0.30
F_{MSY}	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	0.35	1.28	2.84
F_{max}	0.42	1.29	2.36
$F_{0.1}$	0.15	1.15	6.10
F_{med}	0.31	1.28	3.29

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 million (Figures 6.5.1–6.5.4. 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 compared with the exceptionally high recruitment pulses observed from 2001–2005. However the 2012 year class (numbers of age-3 saithe in 2015) is estimated at 63 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 separable statistical model, which predicts recruitment at $N_3(2015)$=36 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 2015 spaly assessment indicates that the point estimator of SSB (2014) is approximately 77 000 t. From 2005 to 2013 SSB has been declining sharply but it has increased again since 2013 above $B_{trigger}$=55 000 t. due to improving maturity ogives and growth. 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(2015)=68 000 t.

In 2015 average fishing mortality over age groups 4 to 8 (F_{bar}) is estimated at F(2015)=0.25, which is the lowest since 1980 (F=0.21) and therefore below F_{MSY}=0.30. On the other hand the statistical model framework suggests that F(2015)=0.32 is higher than that of the spaly assessment. The assessment model suggests a drop in fishing mortality since 2013 reflecting the abrupt decline in landings since 2011. 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 2010–2014. 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 4–8 is estimated by weight-at-age the previous year from the same year class (Eq. 2) Weight for ages 9–14+ 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.

$W_{3,y} = \alpha N_{3,y-3} + \beta$ for a = 3(Eq. 1)

$W_{a+1,y+1} = \alpha W_{a,y} + \beta$ for $4 \le a \le 8$ (Eq. 2)

$$W_{a,y} = (W_{a-3,y}\ W_{a-2,y}\ W_{a-1,y})/3 \qquad \text{for } 9 \le a \le 14+ \qquad \text{(Eq. 3)}$$

Proportion mature for 2016-2018 is taken as the average of predicted maturity ogives from 2014 and 2016. 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=0.25 landings would increase to 32 kt. in 2016 and 40 kt. in 2017 while spawning-stock biomass is expected to around 97 kt. in 2016 and increase to 126 kt. tonnes in 2017. Landings in 2016 are predicted to rely on the 2010, 2011 and 2012 year classes (69%) while in the SSB these year classes will contribute to around 62% of the spawning biomass in 2016 (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 (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 2015 the amount of catch sampled was 9.9%, 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 highly schooling and widely migrating behaviour of the species. 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. The retrospective plots show very small revisions in SSB and F in 2014 and 2015.

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 of maturities.

6.9 Comparison with previous assessment and forecast

The 2015 assessment predicted recruitment for 205 to around 27 million while the observed year class strength was 63 million (Table 6.9.1). Fishing mortality was overestimated from F=0.31 to F=0.25. The spawning-stock biomass was overestimated by around 5%. Landings for 2015 were predicted at Land(2015)=35 kt. while actual observed catches in that year reached Land(2015)=25 kt an overestimation of 40%. Landings and recruitment estimates from the statistical model were however closer to the actual measurements Land(2015)=26 kt. and recruitment Rec(2015)=36 mill.than the spaly run.

6.10 Management plans and evaluations

No management plan exists for saithe in Division 5.b

6.11 Management considerations

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

In 2014 ACOM adopted F_{MSY}=0.30 (F_{pa}=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 PhD. 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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6.17 Tables

Table 6.2.1.1. Faroe saithe (Division 5.b). Nominal catches (tonnes round weight) by countries 1988–2015 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	2015
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	25 474	26796
France	607	370	147	123	315	108	97	68	46	135	40	31	0	122
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	40
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	204
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	25 979	27262
Working Group estimate	53 546	46 555	46 355	67 967	66 902	60 785	57 044	57 949	43 885	29 658	35 314	26 463	23 885	25128

Table 6.2.1.2. Faroe saithe (Division 5.b). Total Faroese landings (rightmost column) and the contribution (%) by each fleet category (1985-2015). Averages for 1985-2015 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
2015	0.2	0.4	1.1	0.0	2.3	0.0	0.2	18.0	75.5	0.3	0.0	0.0	20956
Avg.	0.3	0.2	0.8	0.1	5.2	1.5	13.9	19.3	58.0	0.3	0.4	0.0	38535

Table 6.2.2.1. Faroe saithe (Division 5.b). Catch number-at-age by fleet categories in 2015 (calculated from gutted weights).

Age	Jiggers	Single trawlers >1000 HP	Pairtrawlers <1000 HP	Pairtrawlers >1000HP	Others	Total Division 5.b
0	0	0	0	0	0	0
1	0	0	0	0	0	0
2	0	0	4	22	0	27
3	27	28	447	1233	45	1781
4	48	40	349	1414	41	1892
5	58	39	358	1645	49	2149
6	37	40	296	1206	30	1608
7	17	15	118	556	14	719
8	5	5	37	185	4	236
9	5	3	25	111	4	149
10	3	1	10	55	2	72
11	1	1	7	48	1	58
12	0	1	6	20	0	27
13	0	1	5	20	0	26
14	0	0	1	6	0	7
15	0	0	1	3	0	5
Total No.	202	174	1665	6525	192	8757
Catch, t.	498	428	3764	15818	449	20957

Table 6.2.2.2. Faroe saithe (Division 5.b). 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	879	2323	3143	1681	865	330	99	92	70	55	16	1
2015	2135	2269	2577	1928	863	283	179	86	69	33	31	15

Table 6.2.2.3. Faroe saithe (Division 5.b). Sampling intensity in 2001–2015.

Year		Jiggers	Single trawlers >1000 HP	Pairtrawlers <1000 HP	Pairtrawlers >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	

Year		Jiggers	Single trawlers >1000 HP	Pairtrawlers <1000 HP	Pairtrawlers >1000 HP	Others	Total	Amount sampled pr tons landed (%)
2014	Lengths	0	201	0	22131	920	23252	8.9
	Otoliths	0	0	0	2542	120	2662	
	Weights	0	0	0	15448	920	16368	
2015	Lengths	0	0	173	22455	753	23381	9.9
	Otoliths	0	0	20	2169	90	2279	
	Weights	0	0	173	17199	753	18125	

Table 6.2.3.1. Faroe saithe (Division 5.b). Catch weights at age (kg)(equal to stock-weights) from the commercial fleet (1961-2015). The value for 2016 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

CW	3	4	5	6	7	8	9	10	11	12	13	14+
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
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	0.932	1.555	2.091	3.17	4.208	5.032	6.715	7.858	7.428	7.565	7.629	9.367
2016	1.295	1.120	1.997	2.719	4.076	5.373	5.935	6.826	6.710	7.150	7.564	9.272

Table 6.2.4.1. Faroe saithe (Division 5.b). Proportion mature at age (1982-2015). Maturities-at-age from 1961 to 1981 are fixed and equal to those in 1982.

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	0.05	0.26	0.51	0.74	0.9	0.98	0.98	1.00	1.00	1.00	1.00	1.00

Table 6.3.1. Faroe saithe (Division 5.b). Effort (hours) and catch in number-at-age for the commercial pairtrawlers (1995-2015)

YEAR	EFFORT	3	4	5	6	7	8	9	10	11
1995	10883	47	180	577	236	146	49	24	19	14
1996	47531	310	958	821	1119	503	282	133	127	70
1997	34606	199	533	1488	1013	768	333	73	33	10
1998	34144	107	656	1148	1486	730	325	170	40	13
1999	43218	174	487	1554	2016	2024	817	190	83	12
2000	43920	434	1566	913	2700	1333	1604	192	106	31
2001	41534	611	1438	4946	1165	1855	748	618	127	29
2002	41575	133	3976	3964	6888	520	682	246	177	25
2003	38076	141	1494	6560	2373	2263	197	212	124	35
2004	35237	43	1200	5089	5116	1035	762	113	116	53
2005	32493	188	1189	4039	7266	3130	320	291	7	43
2006	25068	140	1176	2410	2584	3700	1376	268	85	14
2007	24885	204	879	2913	1815	1034	1215	435	110	19
2008	25014	796	762	947	2641	1063	726	611	156	51
2009	67648	154	4082	3377	1283	3612	1402	1153	751	195
2010	61407	459	2019	3586	737	657	1325	814	518	245
2011	58209	397	1936	1367	1257	323	356	488	366	310
2012	58244	366	5652	2332	756	554	187	189	252	143
2013	43770	424	3047	2462	1295	293	122	71	56	83
2014	48449	625	1624	2226	1200	613	216	72	70	50
2015	37639	437	1414	1645	1206	556	185	111	55	48

Table 6.3.2. Faroe saithe (Division 5.b). Diagnostics from XSA with commercial pairtrawler tuning series (spaly)

FLR XSA Diagnostics 2016-04-12 10:28:36

cpue data from indices

Catch data for 55 years 1961 to 2015. Ages 3 to 14.

	fleet	first age	last age	first year	last year	alpha	beta
1	PairTrawlers_GLM_SD	3	11	1995	2015	<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

year

age	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
all	1	1	1	1	1	1	1	1	1	1

Fishing mortalities

year

age	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
3	0.076	0.049	0.182	0.037	0.119	0.066	0.035	0.030	0.024	0.038
4	0.103	0.245	0.258	0.476	0.343	0.202	0.560	0.301	0.129	0.080
5	0.296	0.353	0.458	0.860	0.760	0.404	0.532	0.500	0.302	0.206
6	0.414	0.432	0.558	0.451	0.472	0.641	0.498	0.624	0.380	0.307

7	0.619	0.367	0.456	0.701	0.480	0.374	0.795	0.388	0.524	0.342
8	0.715	0.574	0.384	0.501	0.700	0.503	0.436	0.422	0.469	0.322
9	0.488	0.737	0.600	0.572	0.681	0.537	0.620	0.312	0.362	0.505
10	0.908	0.667	0.485	0.743	0.621	0.688	0.678	0.398	0.411	0.621
11	0.518	0.731	0.605	0.696	0.641	0.808	0.758	0.569	0.571	0.626
12	0.120	0.335	0.217	0.303	0.241	0.515	0.637	0.721	0.434	0.586
13	0.224	0.124	0.308	0.077	0.264	0.251	0.783	0.374	0.278	0.469
14	0.224	0.124	0.308	0.077	0.264	0.251	0.783	0.374	0.278	0.469

XSA population number (Thousand)

	age											
year	3	4	5	6	7	8	9	10	11	12	13	14
2006	22264	56937	33524	25132	24659	8136	1833	522	87	117	66	27
2007	19345	16894	42051	20407	13598	10873	3259	922	173	43	85	28
2008	31701	15086	10828	24200	10851	7712	5017	1277	387	68	25	0
2009	14068	21626	9539	5609	11335	5632	4303	2254	644	173	45	15
2010	22830	11102	10999	3306	2926	4605	2793	1988	878	263	105	0
2011	33045	16589	6451	4211	1689	1482	1872	1158	875	379	169	20
2012	27788	25338	11099	3526	1816	951	734	895	476	319	185	42
2013	26799	21974	11848	5339	1754	671	503	323	372	183	138	127
2014	40622	21289	13311	5883	2343	974	360	302	178	173	73	5
2015	62836	32463	15328	8054	3295	1135	499	206	164	82	91	44

Estimated population abundance at 1st Jan 2016

	age											
year	3	4	5	6	7	8	9	10	11	12	13	14
2016	47	49515	24526	10218	4850	1917	673	246	90	72	37	47

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 2015

3 -0.441 0.440 -0.006 0.355 -0.926 0.475 -0.031 -1.746 -1.102 -2.037 -0.737 0.407 0.918 1.844 -0.050
0.694 0.207 0.284 0.750 0.618 0.083

4 -0.057 -0.755 -0.550 -0.638 -0.202 -0.588 -0.090 0.036 -1.101 -0.738 -0.478 -0.470 0.528 0.499 0.921
0.921 0.466 1.275 0.969 0.190 -0.141

5 0.437 -0.670 -0.690 -0.441 -0.656 -0.208 0.023 0.381 0.062 -0.479 -0.050 -0.100 -0.104 0.171 0.747
0.720 0.187 0.235 0.496 0.088 -0.148

6 -0.196 -0.175 -0.078 -0.665 -0.053 0.009 0.344 0.650 0.206 0.050 0.096 -0.049 -0.179 0.077 -0.225 -
0.145 0.274 -0.120 0.344 -0.038 -0.128

7 0.164 -0.398 0.231 0.066 -0.164 -0.031 0.331 0.214 0.375 -0.006 0.179 0.295 -0.489 -0.201 0.091 -
0.259 -0.413 0.237 -0.257 0.151 -0.117

8 0.138 0.198 0.145 0.029 0.608 0.315 0.153 0.182 0.043 0.208 -0.545 0.391 -0.076 -0.337 -0.307 0.021
-0.192 -0.422 -0.222 -0.103 -0.225

9 0.005 0.435 0.041 0.286 0.021 -0.078 0.453 -0.158 -0.123 0.523 0.315 0.147 0.171 0.016 -0.202 0.025
-0.095 -0.072 -0.525 -0.256 0.169

10 -0.344 1.103 0.101 0.231 0.218 0.287 0.564 0.336 -0.002 0.124 -1.292 0.433 0.030 -0.031 0.089 -
0.113 0.163 0.042 -0.281 -0.085 0.404

11 -0.041 0.147 -0.363 -0.043 -0.526 0.052 0.081 -0.007 -0.293 0.137 0.068 0.251 -0.024 0.096 -0.026 -
0.036 0.328 0.140 0.048 0.179 0.496

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	-15.4706	-13.3917	-12.4239	-12.0639	-11.9395	-11.8752	-11.8752	-11.8752	-11.8752
S.E_Logq	0.4616	0.4616	0.4616	0.4616	0.4616	0.4616	0.4616	0.4616	0.4616

Terminal year survivor and F summaries:

,Age 3 Year class =2012

source

	scaledWts	survivors	yrcls
PairTrawlers_GLM_SD	0.816	53809	2012
fshk	0.184	34201	2012

,Age 4 Year class =2011

source

scaledWts survivors yrcls

PairTrawlers_GLM_SD 0.887 21303 2011

fshk 0.113 5676 2011

,Age 5 Year class =2010

source

scaledWts survivors yrcls

PairTrawlers_GLM_SD 0.944 8813 2010

fshk 0.056 3562 2010

,Age 6 Year class =2009

source

scaledWts survivors yrcls

PairTrawlers_GLM_SD 0.97 4268 2009

fshk 0.03 2513 2009

,Age 7 Year class =2008

source

scaledWts survivors yrcls

PairTrawlers_GLM_SD 0.969 1705 2008

fshk 0.031 1155 2008

,Age 8 Year class =2007

source

scaledWts survivors yrcls

PairTrawlers_GLM_SD 0.97 538 2007

fshk 0.03 385 2007

,Age 9 Year class =2006

source

scaledWts survivors yrcls

PairTrawlers_GLM_SD 0.964 292 2006

fshk 0.036 246 2006

,Age 10 Year class =2005

source

scaledWts survivors yrcls

PairTrawlers_GLM_SD 0.909 135 2005

fshk 0.091 103 2005

,Age 11 Year class =2004

source

scaledWts survivors yrcls

PairTrawlers_GLM_SD 0.96 118 2004

fshk 0.04 65 2004

,Age 12 Year class =2003

source

scaledWts survivors yrcls

fshk 1 44 2003

,Age 13 Year class =2002

source

scaledWts survivors yrcls

fshk 1 33 2002

Table 6.5.1. Faroe saithe (Division 5.b). Fishing mortality-at-age (1961-2015). The value for 2016 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	0.235	0.507	0.276	0.579	0.314	0.304	0.243	0.232	0.415	0.298	0.298
1986	0.021	0.137	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	0.47	0.649	0.167	1.598	0.813	0.813
1989	0.018	0.203	0.228	0.492	0.365	0.51	0.383	0.183	0.488	0.086	0.254	0.254
1990	0.016	0.203	0.626	0.783	0.8	0.391	0.202	0.208	0.196	0.29	0.232	0.232
1991	0.047	0.414	0.767	0.872	0.797	0.657	0.686	0.754	0.901	0.414	0.696	0.696
1992	0.03	0.262	0.595	0.707	0.547	0.48	0.556	0.455	0.452	0.726	0.549	0.549
1993	0.063	0.205	0.547	0.6	0.514	0.383	0.474	0.452	0.37	0.473	0.435	0.435
1994	0.046	0.274	0.333	0.596	0.598	0.651	0.44	0.695	0.557	0.333	0.533	0.533
1995	0.011	0.089	0.41	0.404	0.683	0.62	0.776	0.549	0.546	0.585	0.565	0.565
1996	0.014	0.039	0.137	0.3	0.484	0.755	0.513	0.612	0.353	0.484	0.487	0.487
1997	0.011	0.048	0.115	0.324	0.5	0.528	0.574	0.58	0.491	0.491	0.674	0.674
1998	0.014	0.071	0.15	0.238	0.454	0.52	0.694	0.583	0.567	1.376	0.49	0.49
1999	0.006	0.073	0.18	0.301	0.492	0.626	0.622	0.671	0.358	1.541	1.037	1.037
2000	0.025	0.068	0.234	0.417	0.469	0.721	0.518	0.724	0.588	0.502	0.403	0.403
2001	0.014	0.099	0.294	0.632	0.759	0.703	0.999	1.197	0.99	0.543	1.838	1.838
2002	0.003	0.14	0.371	0.66	0.563	0.659	0.472	0.841	0.382	1.753	0.348	0.348
2003	0.006	0.032	0.279	0.458	0.694	0.593	0.467	0.656	0.519	1.17	0.665	0.665
2004	0.002	0.043	0.148	0.369	0.474	0.726	0.988	0.711	0.786	2.449	1.134	1.134
2005	0.007	0.077	0.294	0.476	0.582	0.348	0.877	0.286	0.581	0.315	0.49	0.49

F	3	4	5	6	7	8	9	10	11	12	13	14+
2006	0.076	0.103	0.296	0.414	0.619	0.715	0.488	0.908	0.518	0.12	0.224	0.224
2007	0.049	0.245	0.353	0.432	0.367	0.574	0.737	0.667	0.731	0.335	0.124	0.124
2008	0.182	0.258	0.458	0.558	0.456	0.384	0.6	0.485	0.605	0.217	0.308	0.308
2009	0.037	0.476	0.86	0.451	0.701	0.501	0.572	0.743	0.696	0.303	0.077	0.077
2010	0.119	0.343	0.76	0.472	0.48	0.7	0.681	0.621	0.641	0.241	0.264	0.264
2011	0.066	0.202	0.404	0.641	0.374	0.503	0.537	0.688	0.808	0.515	0.251	0.251
2012	0.035	0.56	0.532	0.498	0.795	0.436	0.62	0.678	0.758	0.637	0.783	0.783
2013	0.03	0.301	0.5	0.624	0.388	0.422	0.312	0.398	0.569	0.721	0.374	0.374
2014	0.024	0.129	0.302	0.38	0.524	0.469	0.362	0.411	0.571	0.434	0.278	0.278
2015	0.038	0.08	0.206	0.307	0.342	0.322	0.505	0.621	0.626	0.586	0.469	0.469
2016	0.022	0.121	0.239	0.311	0.298	0.288	0.280	0.340	0.419	1.00	1.00	1.00

Table 6.3.2. Faroe saithe (Division 5.b). Stock number-at-age (start of year) (Thousands)(1961-2015). The value for 2016 is used for short-term prognosis.

YEAR	3	4	5	6	7	8	9	10	11	12	13	14+
1961	7827.26	7421.86	5158.38	3351.65	2113.91	1494.26	1232.82	904.51	468.22	179.78	53.02	431.33
1962	12256.26	6242.83	5733.57	3786.29	2379.45	1535.28	1106.68	904.39	666.35	342.63	122.76	592.7
1963	19837.08	9526.05	4620.77	4135.96	2652.05	1689.34	1138.44	789.35	638.21	481.32	254.28	182.18
1964	14811.8	15685.65	7491.63	3475.53	3010.73	1803.95	1200.34	774.64	503.3	437.46	241.15	224.48
1965	22362.95	11507.97	11115.9	4770.94	2287.23	1947.41	1093.3	820.79	498.49	321.58	283.06	239.61
1966	21229.3	17408.01	8652.81	7555.46	3032.95	1411.16	1226.14	618.24	490.13	266.98	154.71	232.85
1967	24897.69	16939.52	12859.03	5997.62	4660.34	1753.87	814.24	737.85	320.68	260.13	133.53	94.13
1968	22879.44	19846.12	13148.65	9293.88	4193.8	2736.99	1007.96	470.29	432.19	174.78	145.12	316.81
1969	39798.62	18176.53	14720.36	9755.41	6618.39	2937.74	1648.19	595.42	269.22	273.31	89.71	133.05
1970	37092.28	31506.69	12994.19	9976.32	6707.61	4407.07	1872.27	824.62	271.23	116.37	133.29	109.05
1971	38446.77	29061.1	19844.38	9229.01	6830.57	4678.28	2947.67	1246.96	457.08	144.25	51.84	130.67
1972	33424.52	28892.43	20792.77	11193.69	6646.71	4843.19	3405.88	2118.37	872.53	283.74	69.24	119.79
1973	23621.9	24909.95	22049.94	14681.96	6683.55	4058.37	2784.46	1868.28	1062.08	415.77	111.96	258.1
1974	19420.68	17064.31	14736.6	11651.24	8873.55	3993.53	2695.66	1782.06	1164.97	675.02	247.21	524.53
1975	17327.33	12729.76	10237.71	8436	7020.16	5997.37	2690.53	1874.04	1151.38	775.54	440.46	739.88
1976	19709.34	12320.65	7381.08	4942.64	5152.33	4802.07	4264.18	1929.56	1360.61	768.04	520.95	1132.95
1977	13106.22	13261.07	7176.43	4486.8	2915.65	3424.83	3351.6	3067.75	1378.01	986.39	541.95	815.92
1978	8333.03	9274.58	8199.74	4035.12	2508.05	1693.12	2163.39	2293.45	2205.83	882.1	690.86	837.17
1979	8686.42	6269.65	6016.26	5142.58	2807.83	1715.91	952.79	1349.58	1449.73	1437.71	531.28	1353.61
1980	13076.4	6852.15	4288.94	3712.31	3275.69	1770.43	1030.27	556.59	676.95	853.96	990.7	1390.35
1981	33145.83	9804.84	4816.52	2860	2430.42	2025	1192.53	651.69	300.97	376.9	558.01	2253.4
1982	15680.48	26765.62	6395.19	3247.62	1498.27	1168.27	993.78	666	359.83	163.17	192.76	3112.94
1983	40831.64	12487.92	18225.72	4336.53	1650.93	882.84	579.18	545.8	450.27	214.98	82.92	1368.23
1984	26079.33	31183.41	9226.21	10350.72	2335.26	831.39	416.07	227.17	358.19	279.98	86.43	840.01
1985	22341.19	21018.97	15516.98	5419.27	4770.95	1120.21	433.66	194.97	138.94	234.45	175.84	690.2
1986	61871.03	17183.9	13598.58	7652.52	3367.41	2188.74	670.13	261.85	125.24	90.23	126.8	154.27
1987	48649.53	49599.77	12262.02	7086.23	2890.31	1894.69	817.48	326.97	120.29	41.92	44.01	321.84
1988	44899.26	38400.32	35367.13	6576.48	3281.75	1470.6	1069.87	367.99	194.41	59.57	29.79	3.91
1989	28604.58	35976.81	28770.25	20310.44	2865.3	1510.58	642.12	547.48	157.41	134.74	9.87	132.42

YEAR	3	4	5	6	7	8	9	10	11	12	13	14+
1990	20720.44	23011.37	24043.49	18759.45	10171.86	1628.37	742.71	358.33	373.13	79.11	101.27	222.62
1991	24974.51	16698.44	15371.87	10528.19	7017.24	3740.49	901.59	496.79	238.18	251.21	48.48	41.33
1992	19604.36	19515.42	9034.23	5842.58	3603.33	2590.06	1587.57	371.7	191.38	79.19	136	49.16
1993	23784.03	15579.27	12297.9	4078.56	2359.44	1707.82	1311.64	745.13	193.03	99.69	31.35	24.86
1994	16884.95	18281.95	10392.7	5825.89	1832.69	1155.39	953.06	668.51	388.37	109.18	50.85	5.3
1995	38977.69	13199.89	11383.93	6099.24	2627.18	825.47	493.54	502.52	273.17	182.25	64.05	48.15
1996	24412.3	31552.11	9885.13	6182.4	3332.35	1085.96	363.67	186.01	237.7	129.55	83.16	22.72
1997	33577.13	19718.36	24849.12	7056.31	3750.61	1682.31	417.69	178.31	82.62	136.7	65.35	51.17
1998	12772.68	27179.37	15391.2	18136.94	4178.37	1862.78	812.74	192.67	81.74	41.4	68.49	59.35
1999	58856.59	10309.89	20724.31	10851.3	11704.96	2173.19	907.11	332.43	88.08	37.97	8.56	62.19
2000	35923.96	47896.34	7848.36	14166.25	6576.05	5861.61	951.33	398.84	139.16	50.39	6.66	16.51
2001	88189.56	28678.22	36653.52	5082.91	7645.11	3369.85	2333.4	464	158.25	63.27	24.97	16.57
2002	106023.28	71185.56	21261.08	22375.25	2211.61	2929.49	1366.45	703.37	114.78	48.13	30.08	3.73
2003	64513.04	86531.26	50682.08	12012.46	9464.56	1030.75	1240.27	698.01	248.32	64.11	6.83	0
2004	54075.99	52520.21	68645.24	31404.23	6221.05	3869.89	466.59	636.32	296.41	120.97	16.3	3.19
2005	70045.1	44204.91	41180.29	48471.04	17783.42	3170.59	1533.36	142.23	255.86	110.57	8.56	0
2006	22264.39	56937.28	33524.46	25132.28	24659	8136.39	1833.08	522.49	87.49	117.19	66.1	27.39
2007	19344.73	16893.91	42051.4	20406.97	13598.46	10872.87	3259.33	921.7	172.61	42.68	85.08	28.26
2008	31700.64	15086.21	10827.5	24199.58	10850.8	7712.29	5016.58	1276.87	387.26	68.03	24.99	0
2009	14067.61	21625.54	9539.31	5609.2	11334.62	5631.9	4302.84	2254.12	643.67	173.19	44.84	14.9
2010	22829.91	11102.26	10998.84	3305.84	2925.72	4604.7	2793.19	1988.26	878.25	262.78	104.7	0
2011	33044.78	16588.71	6451.26	4211.26	1688.65	1482.39	1871.66	1157.63	875.02	378.83	169	19.77
2012	27787.98	25338.3	11098.81	3526.46	1815.56	950.95	734.12	895.38	476.37	319.19	185.29	42.14
2013	26799.38	21973.62	11847.98	5339.1	1754.36	671.2	503.5	323.26	372.05	182.81	138.27	126.63
2014	40621.85	21289.09	13310.66	5882.8	2342.64	973.98	360.42	301.84	177.8	172.5	72.76	4.52
2015	62836.26	32463.01	15328.09	8053.94	3295.4	1135.31	498.83	205.51	163.88	82.23	91.47	43.84
2016	29626	49527.71	24535.02	10213.26	4850.89	1916..55	673.62	246.48	90.42	71.75	37.47	69.31

Table 6.3.3. Faroe saithe (Division 5.b). Summary table (1961-2015). Values for 2016-2018 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	121970	32706	0.245	0.179
1972	33424	137957	42663	0.308	0.236
1973	23621	130735	57431	0.439	0.318
1974	19420	134010	47188	0.352	0.272
1975	17327	135485	41576	0.307	0.297
1976	19709	129100	33065	0.256	0.267
1977	13106	122228	34835	0.273	0.328
1978	8333	105218	28138	0.266	0.243
1979	8686	96038	27246	0.277	0.257
1980	13076	96219	25230	0.264	0.211
1981	33145	85058	30103	0.37	0.382
1982	15680	94394	30964	0.341	0.336
1983	40831	98647	39176	0.397	0.385
1984	26079	104718	54665	0.522	0.478
1985	22341	110024	44605	0.431	0.382
1986	61871	91607	41716	0.483	0.505
1987	48649	94334	40020	0.441	0.396
1988	44899	103062	45285	0.443	0.456
1989	28604	107481	44477	0.427	0.359
1990	20720	103321	61628	0.608	0.561
1991	24974	76297	54858	0.723	0.702
1992	19604	60153	36487	0.577	0.518
1993	23784	59452	33543	0.555	0.45
1994	16884	57615	33182	0.562	0.49
1995	38977	55735	27209	0.478	0.441
1996	24412	60797	20029	0.319	0.343
1997	33577	68468	22306	0.326	0.303
1998	12772	74278	26421	0.348	0.286
1999	58856	77828	33207	0.419	0.334
2000	35923	80608	39020	0.477	0.382
2001	88189	84237	51786	0.614	0.497
2002	106023	81993	53546	0.653	0.479
2003	64513	97592	46555	0.476	0.411
2004	54075	113454	46355	0.407	0.352

YEAR	RECRUITS (AGE 3)	SSB (TONNES)	YIELD (TONNES)	YIELD/SSB	FBAR(4–8)
2005	70045	128179	67967	0.53	0.355
2006	22264	127839	66902	0.525	0.429
2007	19344	121636	60785	0.501	0.394
2008	31700	105278	57044	0.537	0.423
2009	14067	94514	57949	0.606	0.598
2010	22829	70921	43885	0.618	0.551
2011	33044	57701	29658	0.514	0.425
2012	27787	49796	35314	0.709	0.564
2013	26799	46255	26463	0.572	0.447
2014	40621	58803	23885	0.406	0.361
2015	62836	77216	25128	0.325	0.251
2016	**29626**	**96770**	**32085**		**0.251**
2017	**29626**	**126058**	**40403**		**0.251**
2018	**29626**	**144712**			
Avg.	**31543**	**91844**	**36779**	**0.41**	**0.35**

Table 6.6.1.1. Faroe saithe (Division 5.b). Input data for prediction with management options for the SPALY assessment.

2016

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
3	29626	0.2	0.04	0	0	1.295	0.022	1.295
4	49528	0.2	0.26	0	0	1.120	0.121	1.120
5	24535	0.2	0.51	0	0	1.997	0.239	1.997
6	10213	0.2	0.74	0	0	2.719	0.311	2.719
7	4851	0.2	0.90	0	0	4.076	0.298	4.076
8	1917	0.2	0.98	0	0	5.373	0.288	5.373
9	674	0.2	0.98	0	0	5.935	0.280	5.935
10	246	0.2	1.00	0	0	6.826	0.339	6.826
11	90	0.2	1.00	0	0	6.710	0.419	6.710
12	72	0.2	1.00	0	0	7.150	1.000	7.150
13	37	0.2	1.00	0	0	7.564	1.000	7.564
14	69	0.2	1.00	0	0	9.272	1.000	9.272

2017

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
3	29626	0.2	0.04	0	0	1.295	0.022	1.295
4	-	0.2	0.26	0	0	1.120	0.121	1.120
5	-	0.2	0.51	0	0	1.997	0.239	1.997
6	-	0.2	0.74	0	0	2.719	0.311	2.719
7	-	0.2	0.90	0	0	4.076	0.298	4.076
8	-	0.2	0.98	0	0	5.373	0.288	5.373
9	-	0.2	0.98	0	0	5.935	0.280	5.935
10	-	0.2	1.00	0	0	6.826	0.339	6.826
11	-	0.2	1.00	0	0	6.710	0.419	6.710
12	-	0.2	1.00	0	0	7.150	1.000	7.150
13	-	0.2	1.00	0	0	7.564	1.000	7.564
14	-	0.2	1.00	0	0	9.272	1.000	9.272

2018

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
3	29626	0.2	0.04	0	0	1.295	0.022	1.295
4	-	0.2	0.26	0	0	1.120	0.121	1.120
5	-	0.2	0.51	0	0	1.997	0.239	1.997
6	-	0.2	0.74	0	0	2.719	0.311	2.719
7	-	0.2	0.90	0	0	4.076	0.298	4.076
8	-	0.2	0.98	0	0	5.373	0.288	5.373
9	-	0.2	0.98	0	0	5.935	0.280	5.935
10	-	0.2	1.00	0	0	6.826	0.339	6.826
11	-	0.2	1.00	0	0	6.710	0.419	6.710
12	-	0.2	1.00	0	0	7.150	1.000	7.150

Input units are thousands and kg - output in tonnes

Table 6.6.2.1. Faroe saithe (Division 5.b). Prediction with management option for SPALY assessment.

2016				
Biomass	SSB	FMult	FBar	Landings
208397	96770	1.000	0.251	32086

2017					2018	
Biomass	SSB	FMult	FBar	Landings	Biomass	SSB
232095	126058	0.0000	0.0000	0	288608	185585
	126058	0.1000	0.0251	4520	283032	180964
	126058	0.2000	0.0503	8922	277606	176471
	126058	0.3000	0.0754	13209	272324	172103
	126058	0.4000	0.1006	17386	267181	167856
	126058	0.5000	0.1257	21455	262175	163726
	126058	0.6000	0.1508	25419	257301	159709
	126058	0.7000	0.1760	29282	252554	155803
	126058	0.8000	0.2011	33047	247933	152003
	126058	0.9000	0.2263	36715	243431	148308
	126058	1.0000	0.2514	40291	239048	144712
	126058	1.1000	0.2765	43776	234778	141215
	126058	1.2000	0.3017	47174	230619	137813
	126058	1.3000	0.3268	50486	226568	134503
	126058	1.4000	0.3520	53715	222622	131282
	126058	1.5000	0.3771	56864	218777	128148
	126058	1.6000	0.4022	59934	215031	125099
	126058	1.7000	0.4274	62928	211381	122131
	126058	1.8000	0.4525	65848	207825	119243

Input units are thousands and kg - output in tonnes

Table 6.7.1.1. Faroe saithe (Division 5.b). 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 5.b). Comparison between the current assessment (NWWG2016 SPALY) statistical assessment (NWWG2016 ADMB) and predictions from last year in the terminal year (2015).

	NWWG2015 PREDICTION	NWWG2016 (SPALY)	NWWG2016 (ADMB)
Recruitment	27 mill.	62 mill.	36 mill.
SSB	82 089 t.	77 000 t.	68 278 t.
Fbar(4-8)	0.310	0.25	0.32
Landings	35 360 t.	25 128 t.	26 482 t.

6.18 Figures

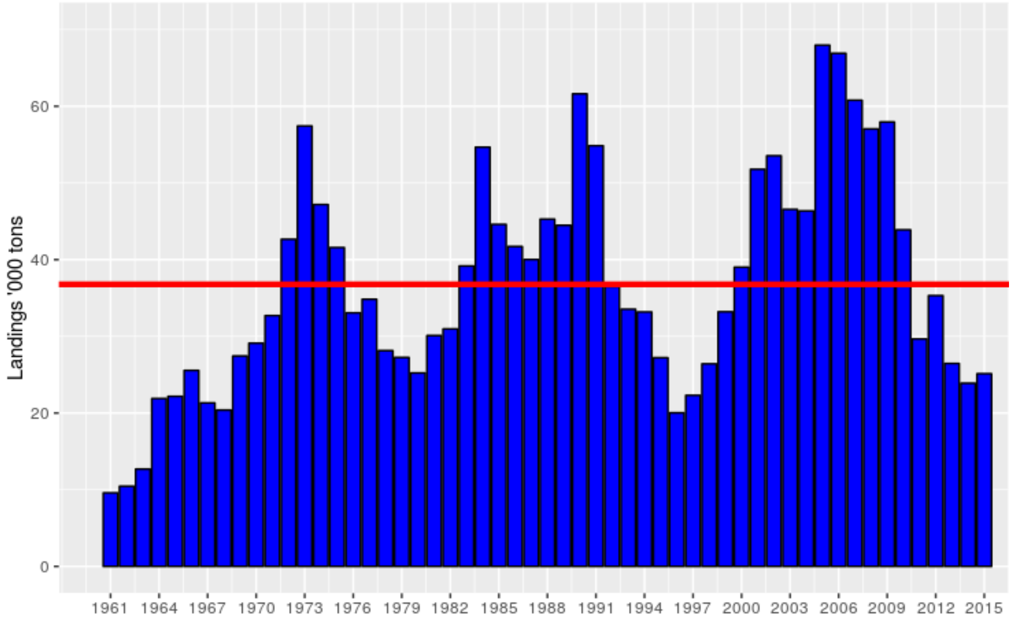


Figure 6.2.1.1. Faroe saithe (Division 5.b). Landings in 1000 tonnes (1961–2015). Horizontal red line represents historical average landings.

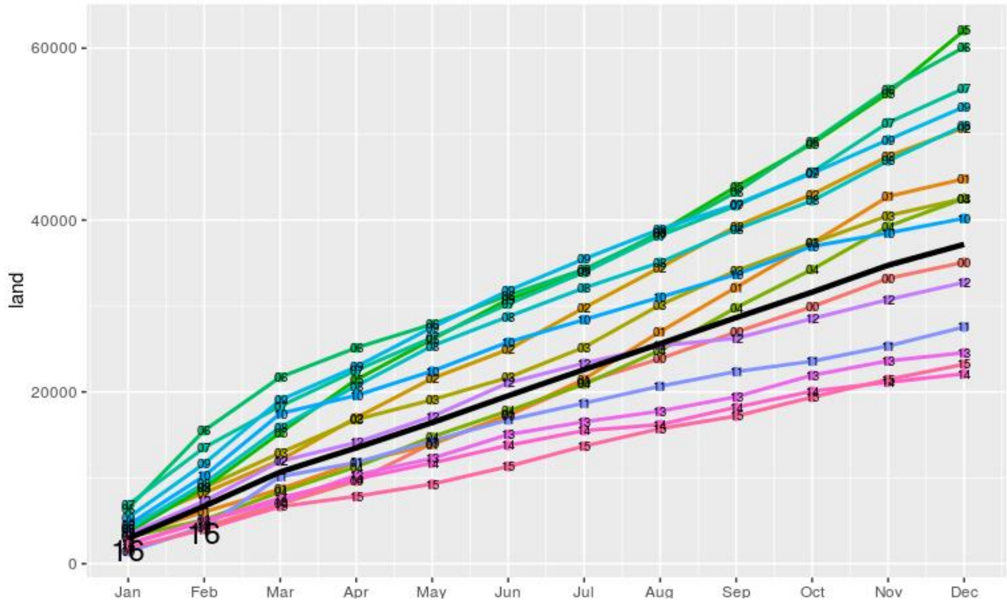


Figure 6.2.1.2. Saithe in the Faroes (Division 5.b). Cumulative domestic landings (2000–2016).

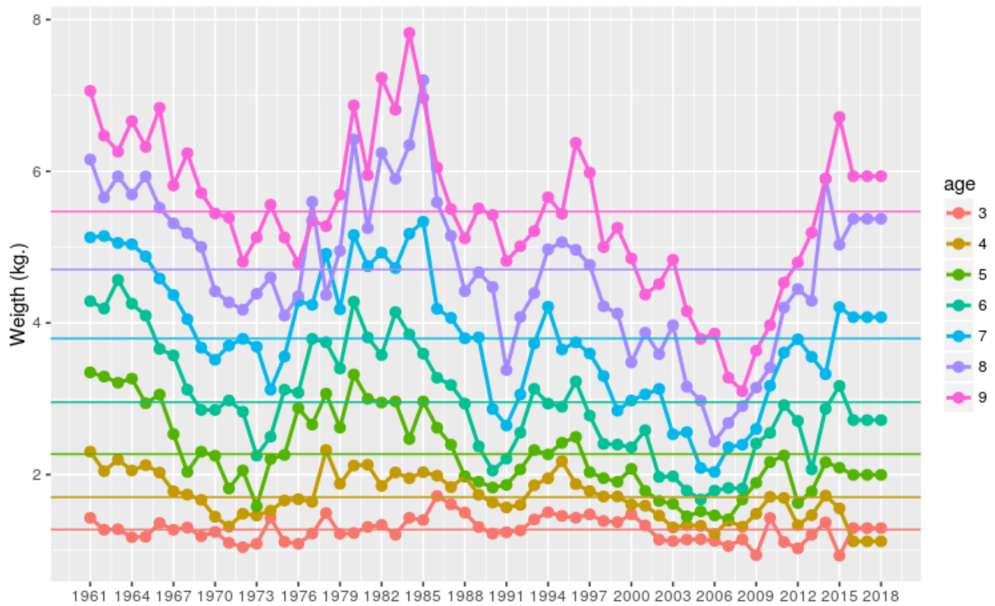


Figure 6.2.3.1. Faroe saithe (Division 5.b). Mean weight at age (kg) in commercial catches (ages 3–9) (1961–2018). Weights from 2016 to 2018 are estimates. Horizontal lines show historical average.

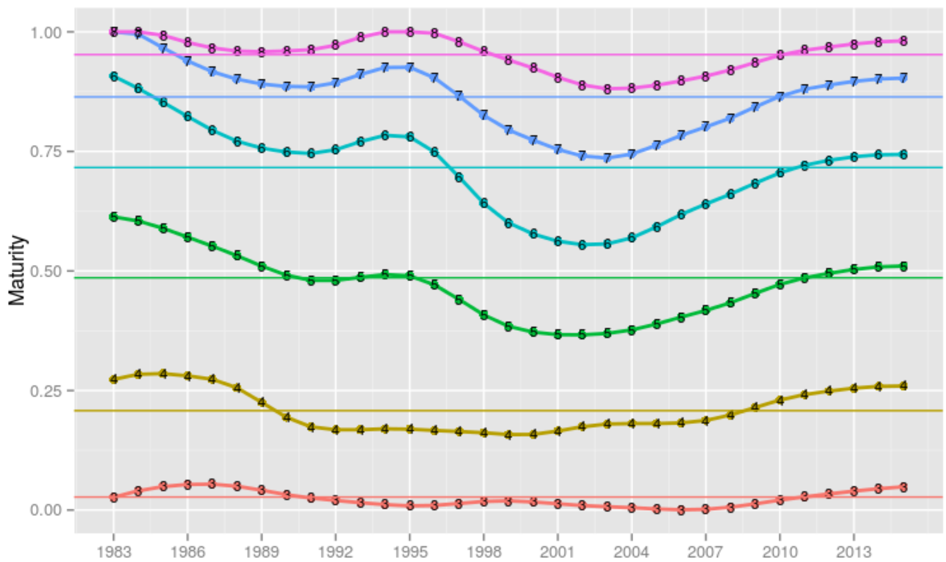


Figure 6.2.4.1. Faroe saithe (Division 5.b). Smoothed maturity ogives (ages 3-8)(1983–2015) from FGFS1 (spring survey). Horizontal lines show historical average.

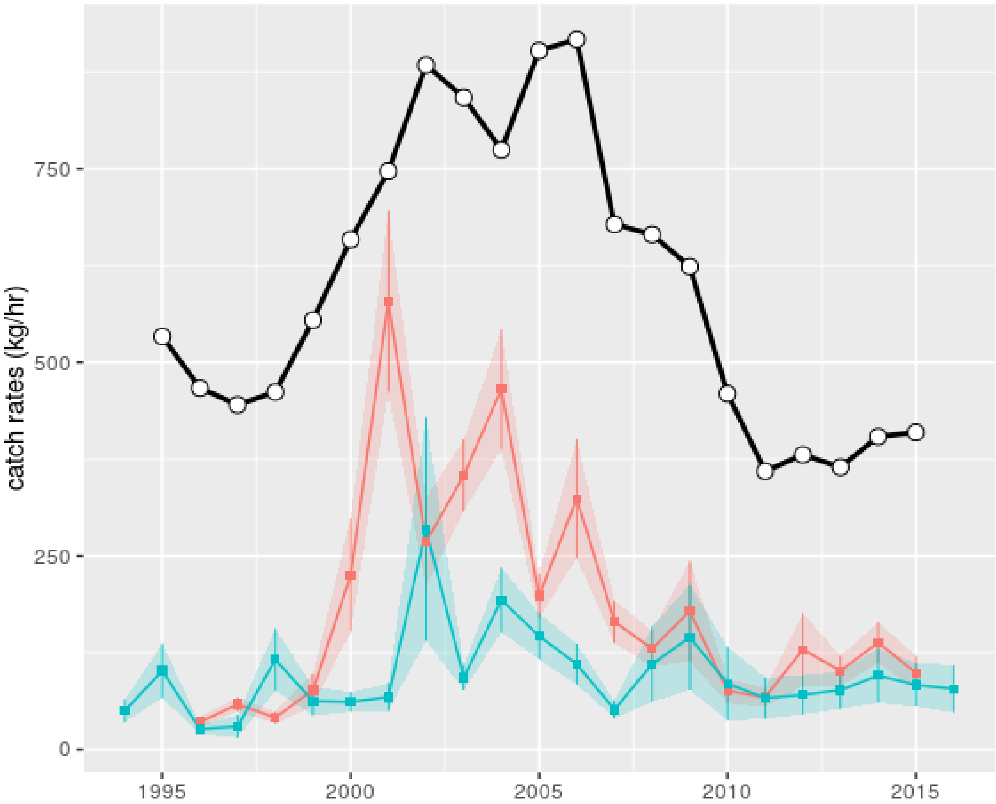


Figure 6.2.5.1.1. Faroe saithe (Division 5.b). Predicted catch rates from the commercial fleet (pairtrawlers) used for tuning the assessment (black line). Catch rates (kg/hour) from the Faroese bottom-trawl fall FGFS2 (1996–2015)(red line) and spring survey FGFS1 (1994–2016)(blue line). Shade areas show standard errors in the estimation of indices.

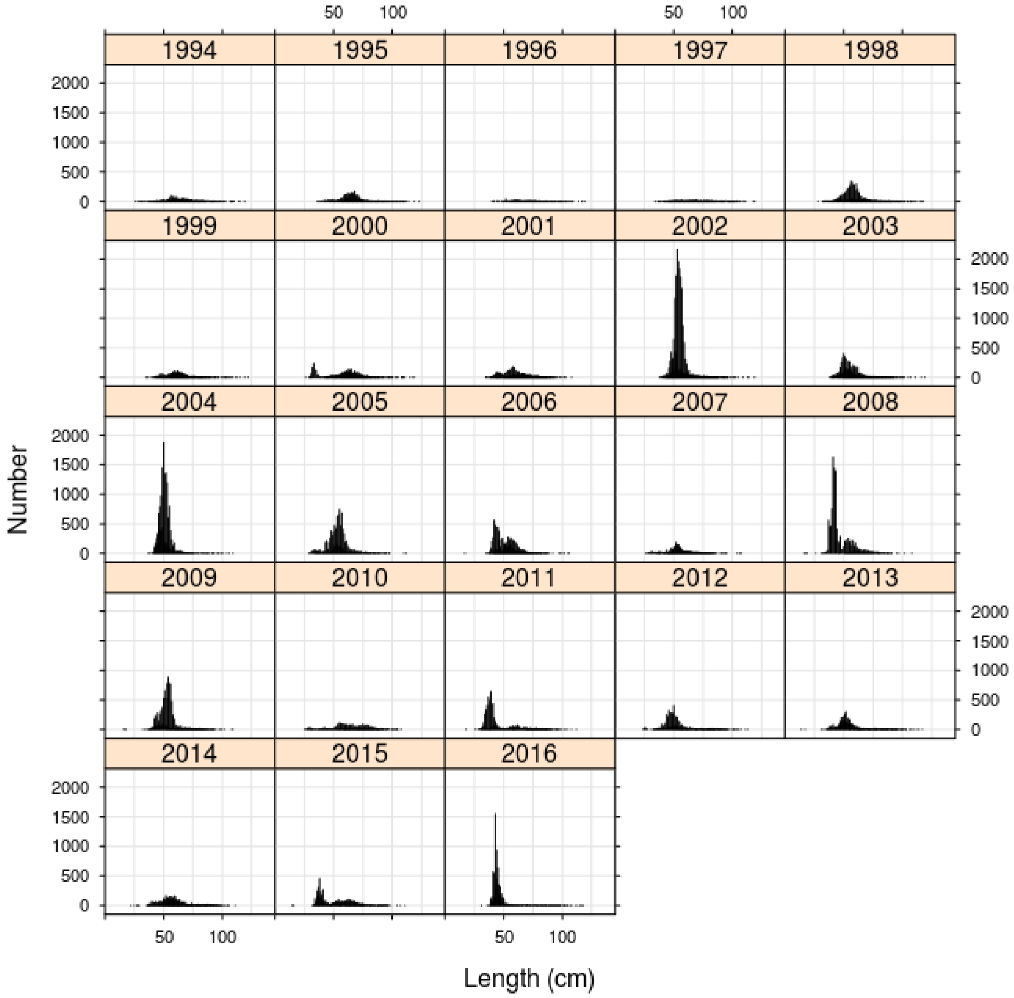


Figure 6.2.5.1.2. Faroe saithe (Division 5.b). Length composition from the Faroese bottom-trawl spring survey FGFS1 (1994–2016)

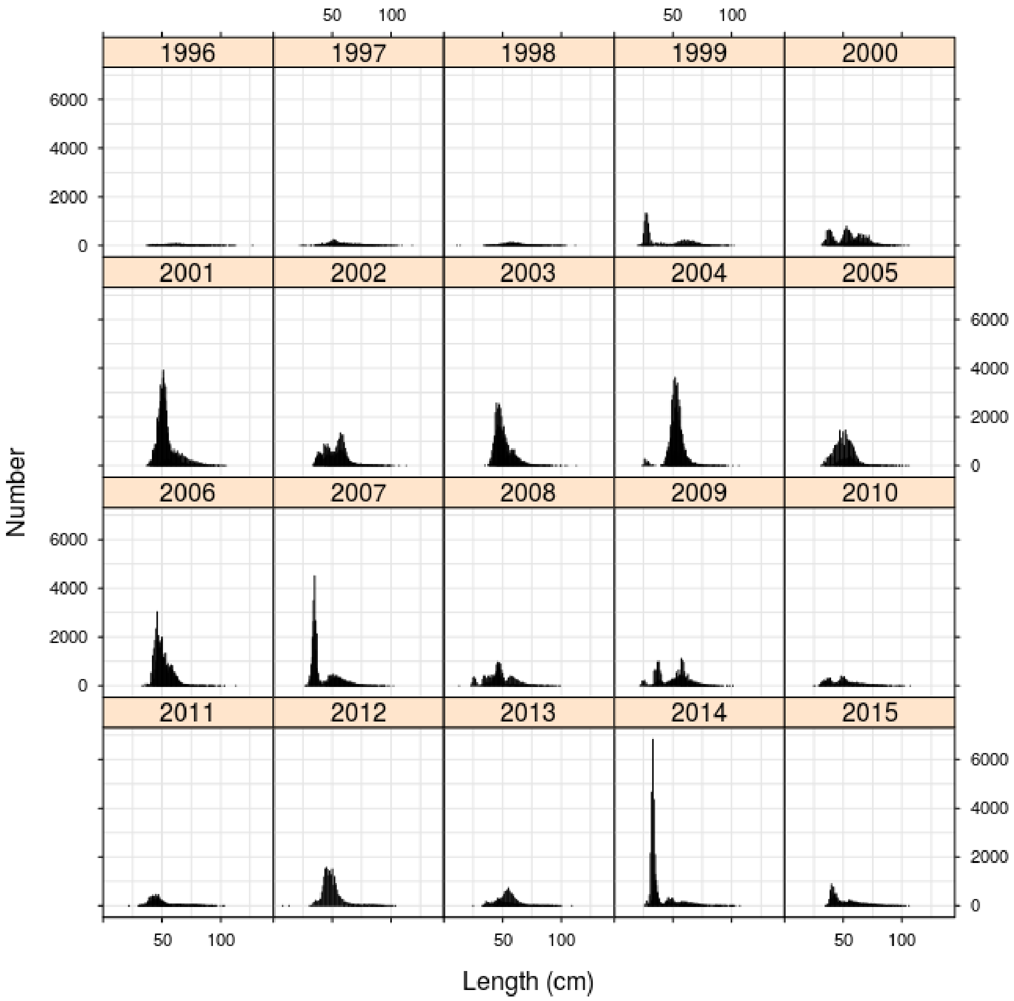


Figure 6.2.5.1.3. Faroe saithe (Division 5.b). Length composition from the Faroese bottom-trawl summer survey FGFS2 (1996–2015)

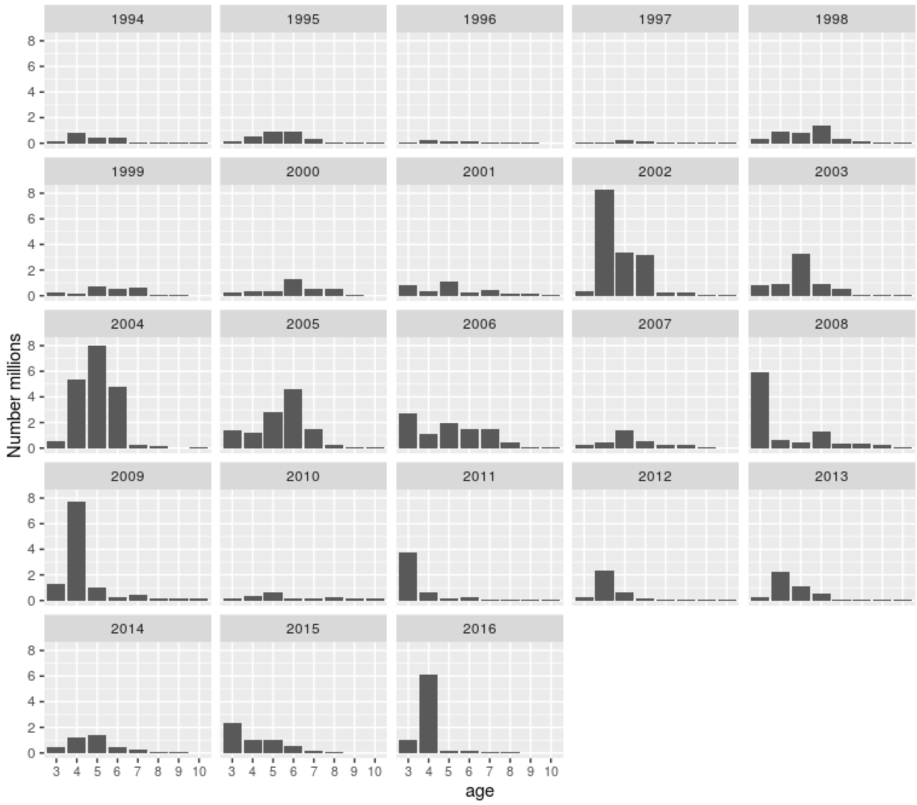


Figure 6.2.5.1.4. Faroe saithe (Division 5.b). Age-disaggregated indices in the Faroese bottom-trawl spring survey FGFS1 (ages 3–10, years 1994–2016)

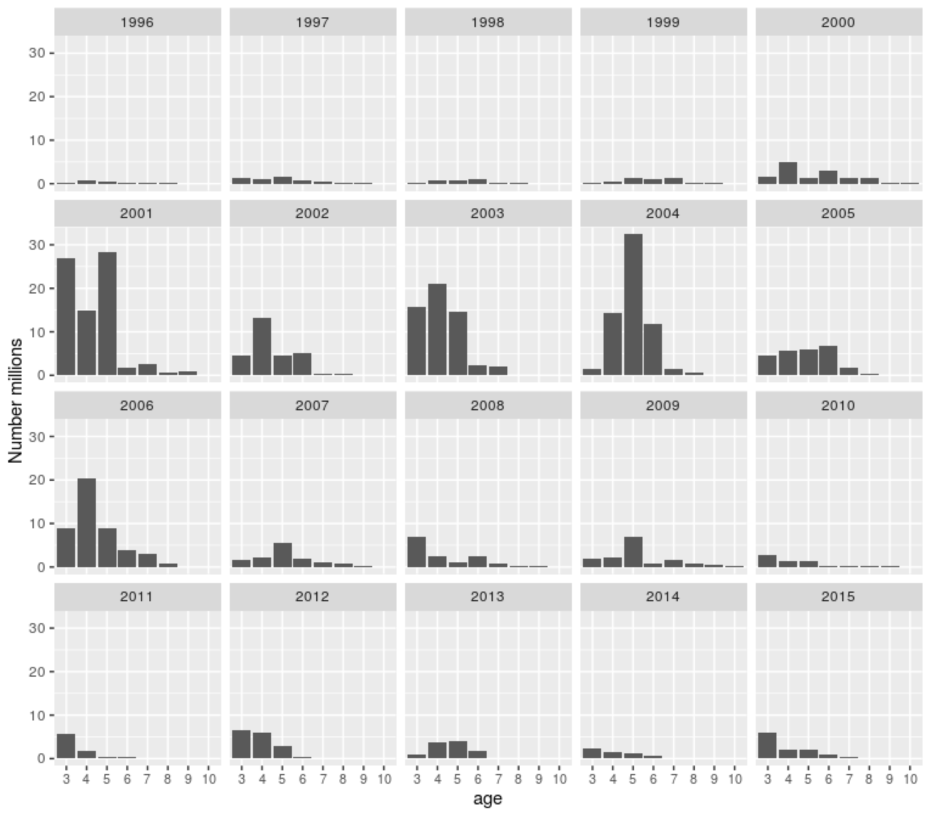


Figure 6.2.5.1.5. Faroe saithe (Division 5.b). Age-disaggregated indices in the Faroese bottom-trawl fall survey FGFS2 (ages 3–10, years 1996–2015)

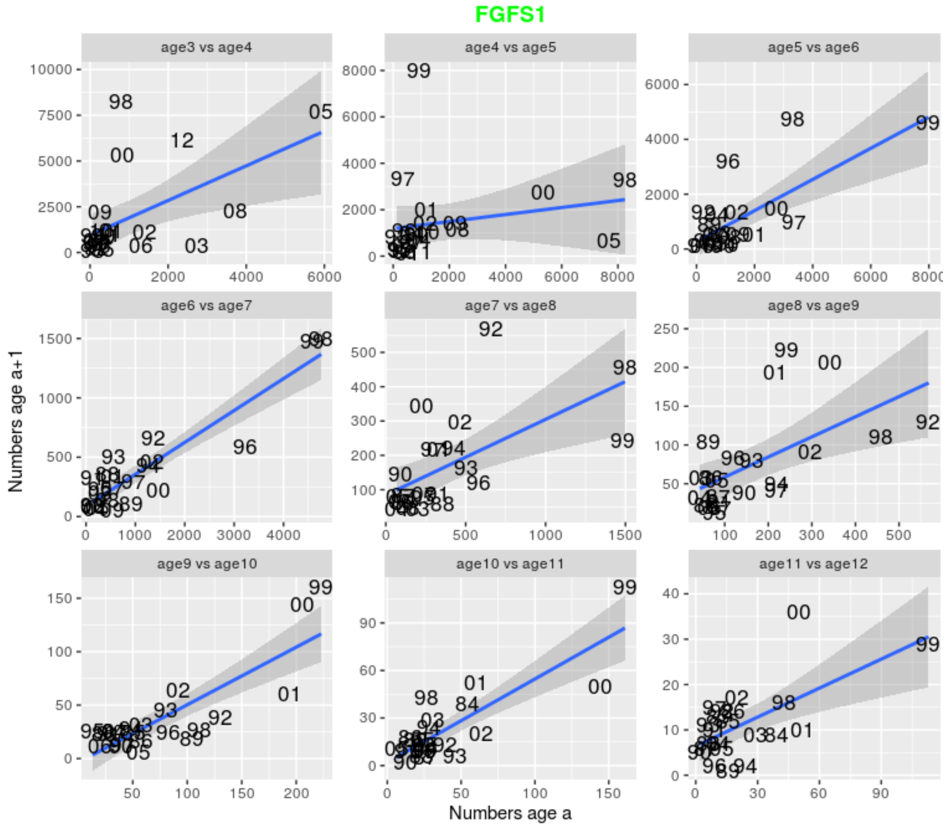


Figure 6.2.5.1.6. Faroe saithe (Division 5.b). Numbers from spring survey (FGFS1) plotted against numbers of the same year class one year later. Letters in the figures represent year classes.

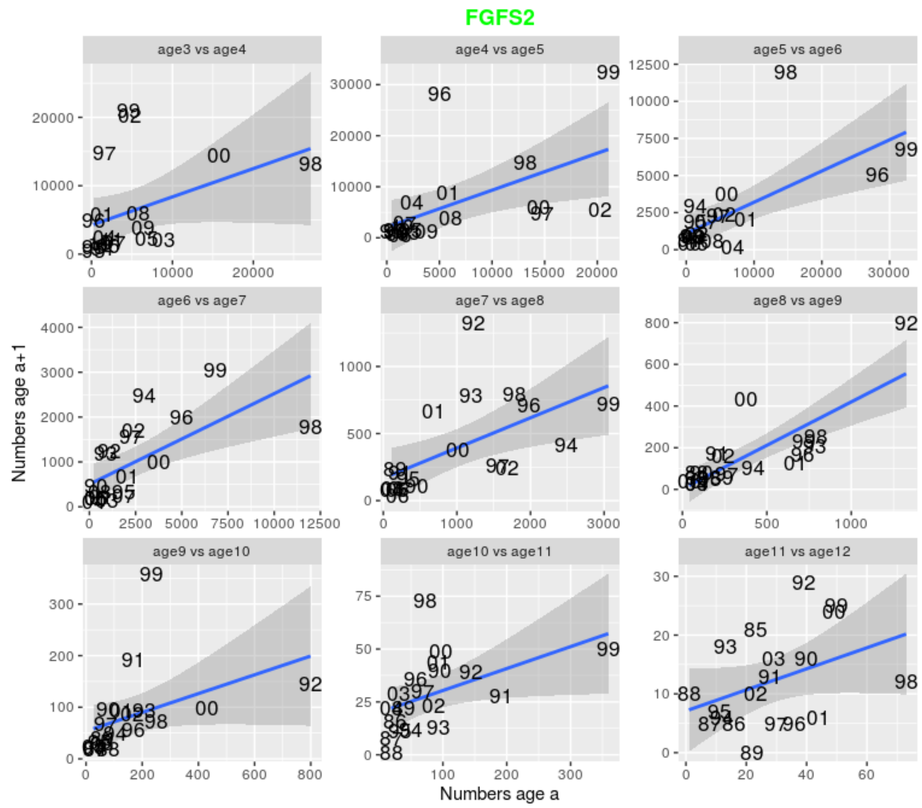


Figure 6.2.5.1.7. Faroe saithe (Division 5.b). Numbers from summer survey (FGFS2) plotted against numbers of the same year class one year later. Letters in the figures represent year classes.

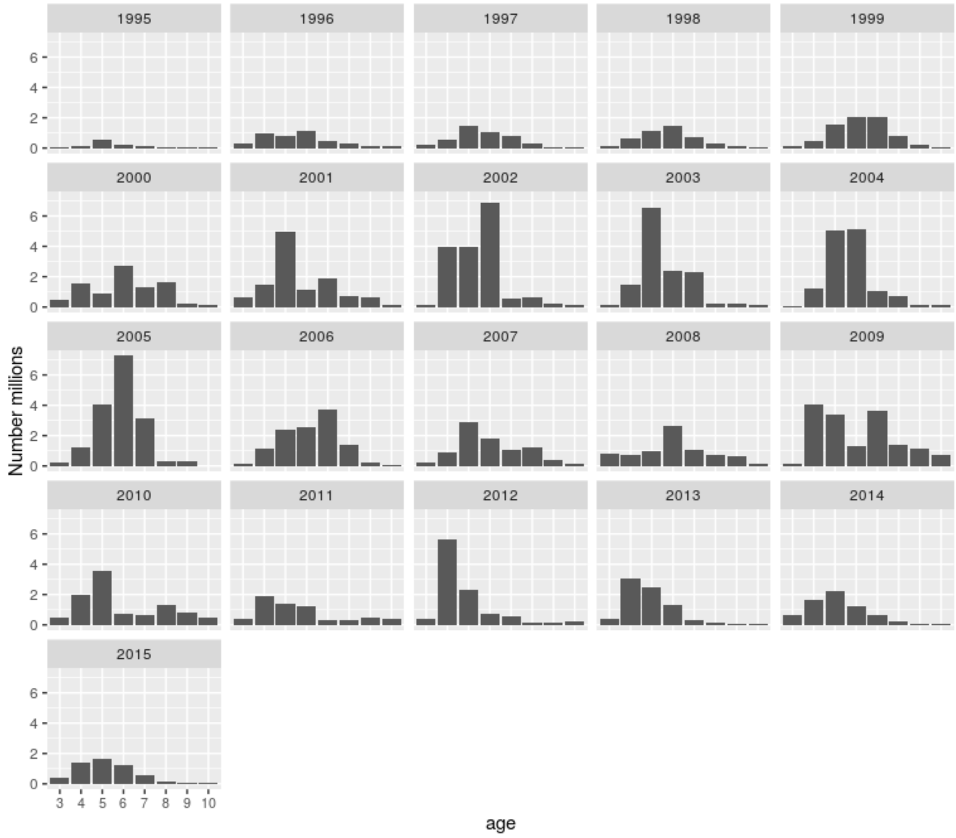


Figure 6.2.5.2.1. Faroe saithe (Division 5.b). Age-disaggregated indices in the commercial pair-trawl fleet (ages 3-10, years 1995-2015)

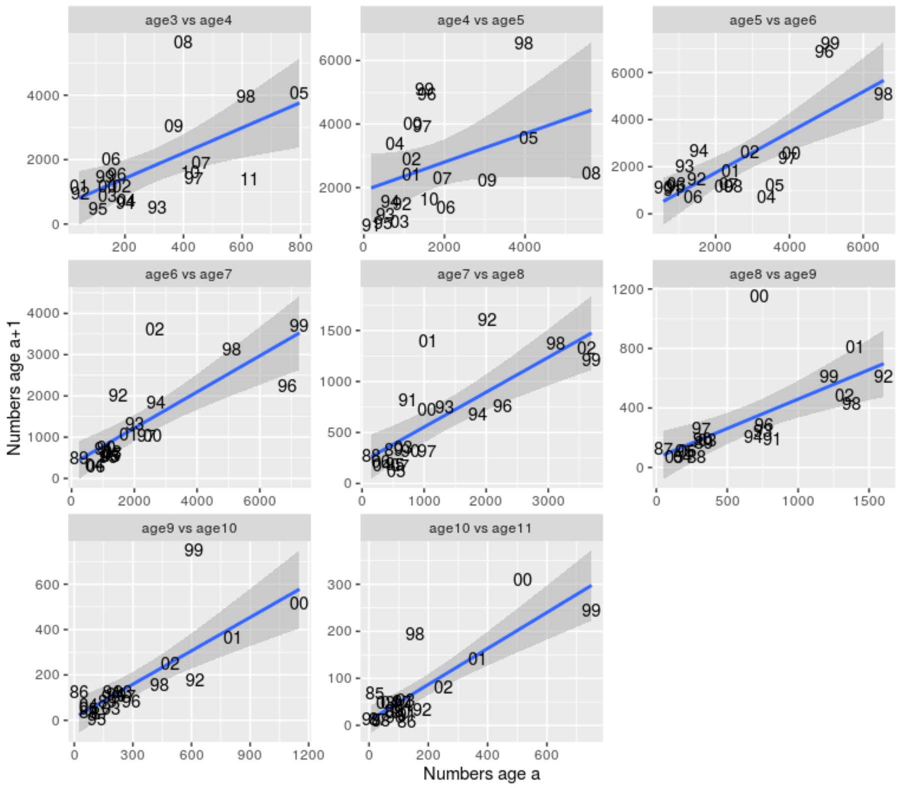


Figure 6.2.5.2.2. Faroe saithe (Division 5.b). Indices from in the commercial pair-trawl plotted against indices of the same year class one year later. Letters in the figures represent year classes.

Figure 6.3.1. Faroe saithe (Division 5.b). Log-catchability residuals of the spaly assessment calibrated with the commercial series (ages 3–11, years 1995–2015). Blue and red bubbles represent positive and negative residuals respectively.

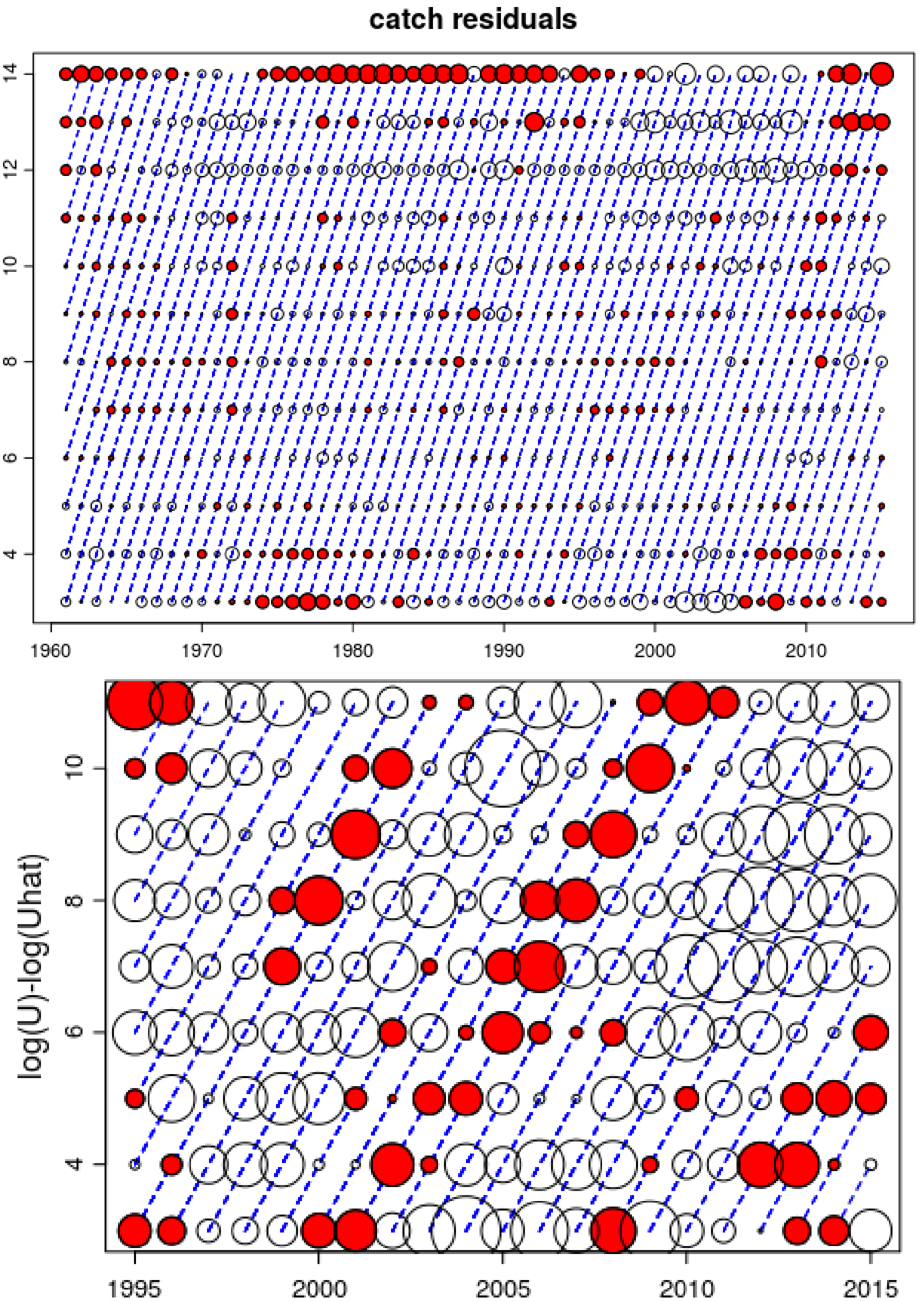


Figure 6.3.3. Faroe saithe (Division 5.b). Catch-(ages 3-14+, years 1961–2015)(top plot) and survey-at-age (ages 3–11, years 1995–2015)(bottom plot) residuals from a statistical catch-at-age model. Red and white bubbles represent positive and negative residuals respectively.

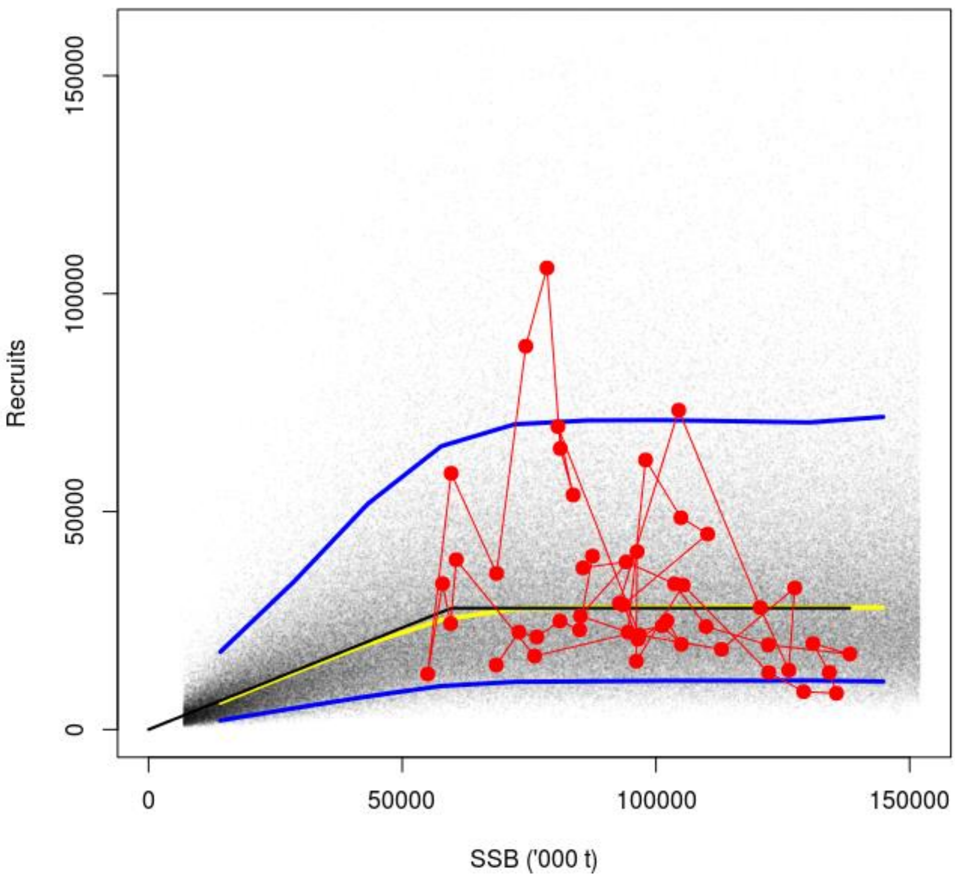


Figure 6.4.1.1. Faroe saithe (Division 5.b). EqSim simulation. Stock–recruitment function used in the simulations (Hockey-stick).

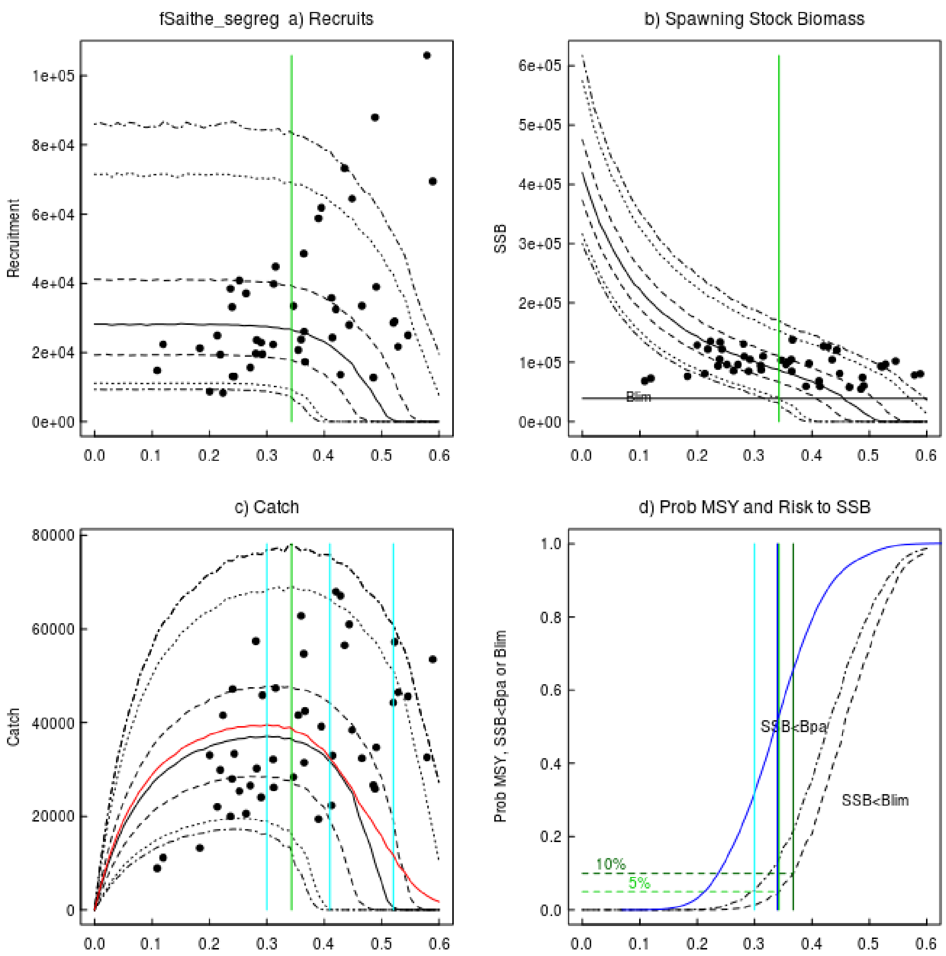


Figure 6.4.1.2. Faroe saithe (Division 5.b). EqSim simulation outputs with assessment errors and Hockey-stick function from WKMSYREF2 report. B_{lim} is undefined but was set as $B_{lim}=B_{pa}/1.4$.

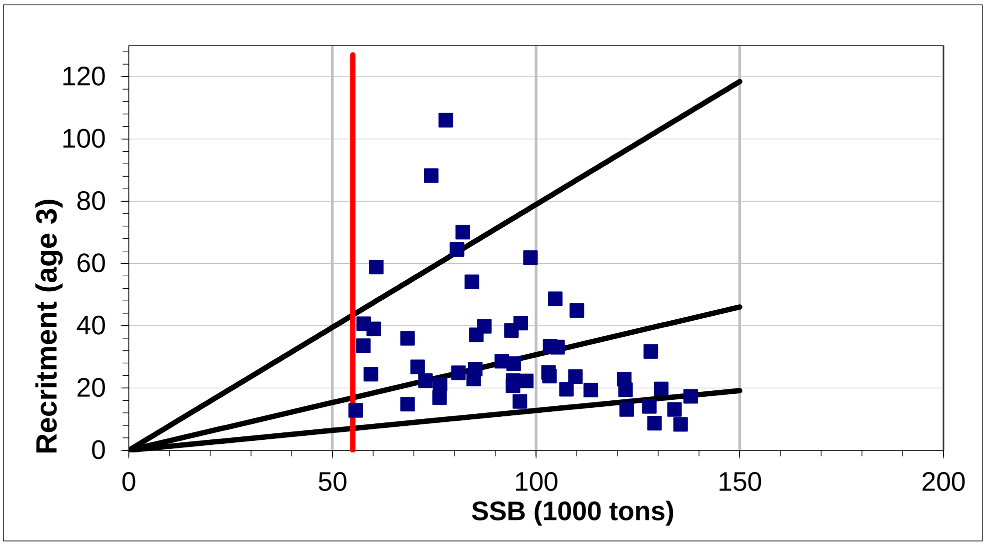


Figure 6.4.1.3. Faroe saithe (Division 5.b). Stock–recruitment plot in relation to F_{low}=0.13 (lowest regression line), F_{med}=0.31 (middle regression line) and Fhigh=0.79 (top regression line). Vertical red line represents $B_{trigger}$= 55 000 t.

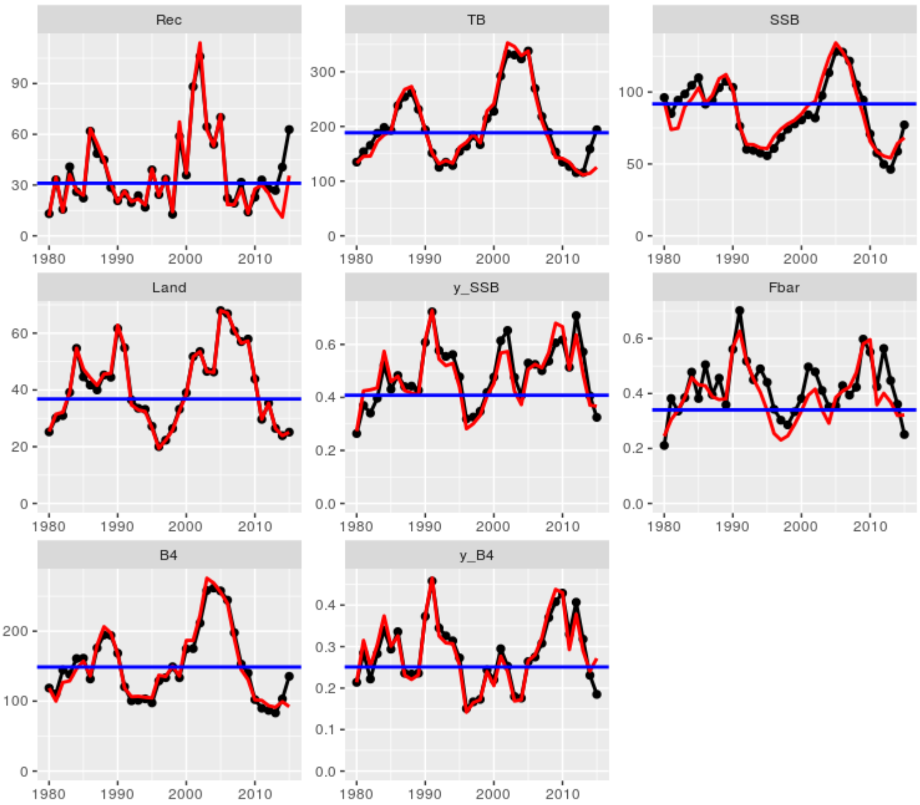


Figure 6.5.1. Faroe saithe (Division 5.b). Recruitment (age 3) in millions (top-left), total-stock biomass (thousand tonnes)(top-middle), spawning-stock biomass (thousand tonnes) (bottom-left), landings (thousand tonnes)(middle-left), landings SSB ratio (middle-middle), F_{bar} (ages 4 to 8)(middle-right), reference biomass (B4+) (thousand tonnes) (bottom-left) and landings B4+ ratio (bottom-right). Black line represents the spaly run. Red lines show estimates from a catch-at-age statistical model implemented in ADMB. Horizontal blue lines represent historical averages.

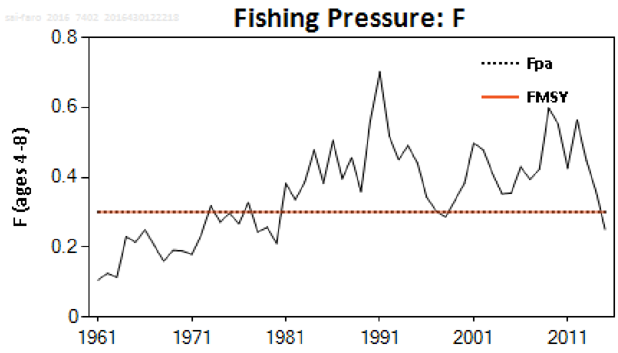


Figure 6.5.2. Faroe saithe (Division 5.b). Fishing mortality (average over ages 4–8)(1961–2015)

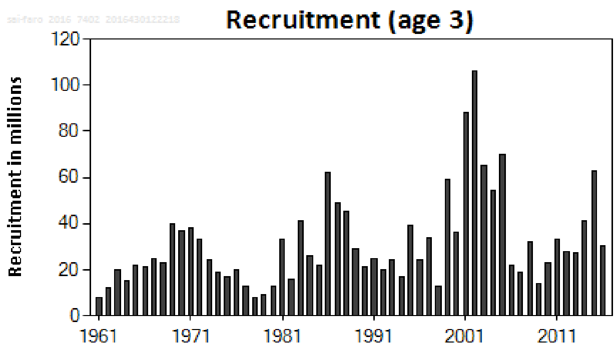


Figure 6.5.3. Faroe saithe (Division 5.b). Recruitment-at-age 3 (millions)(1961–2016). The 2016 recruitment estimate is used in the short-term forecast.

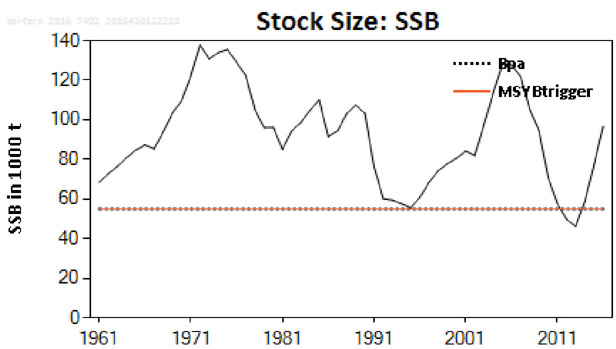


Figure 6.5.4. Faroe saithe (Division 5.b). Spawning-stock biomass ('000 tonnes)(1961–2016). The 2016 SSB estimate is used in the short-term forecast. Horizontal lines represent $B_{trigger}$=B_{pa}=55 000 t.

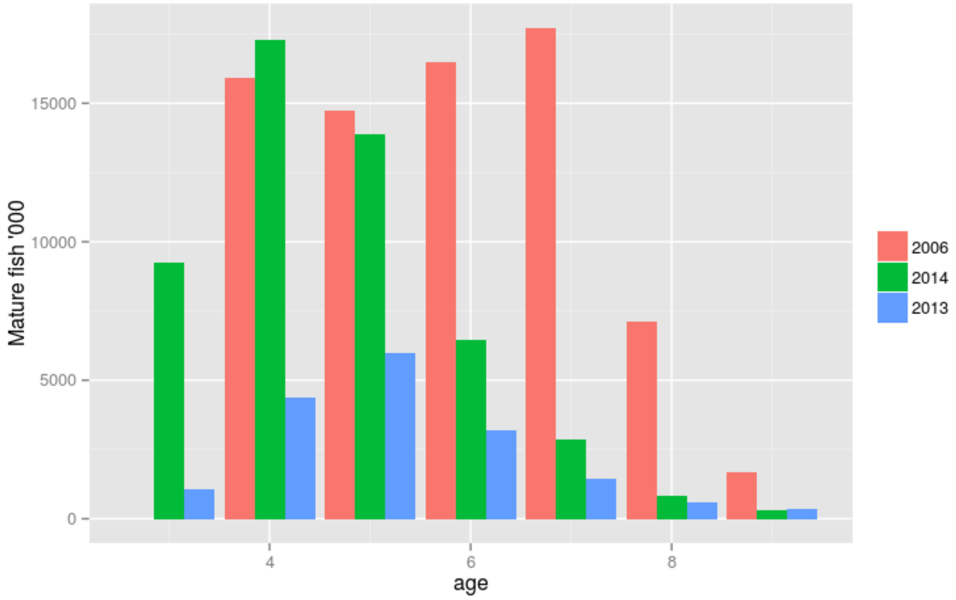


Figure 6.5.6. Faroe saithe (Division 5.b). Numbers of mature fish in the stock (ages 3–9) for 2006, 2013 and 2014.

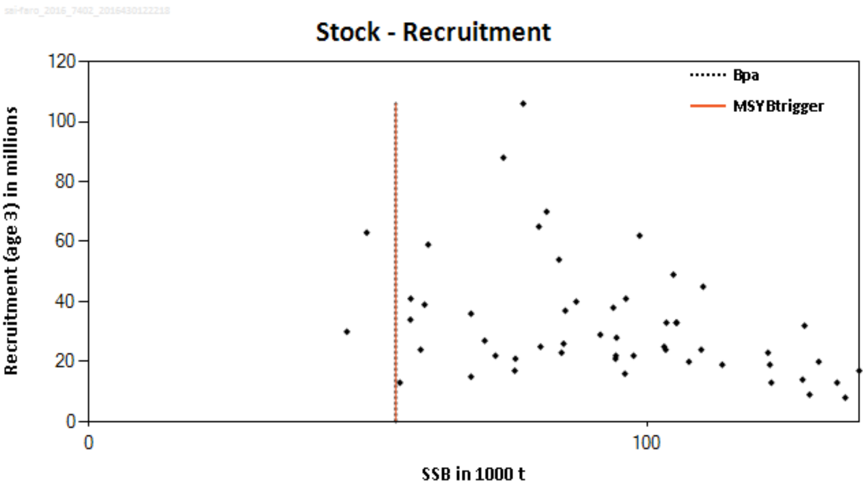


Figure 6.5.7. Faroe saithe (Division 5.b). SSB Recruitment (age 3) plot. $B_{trigger}$=B_{pa}=55 000 t.

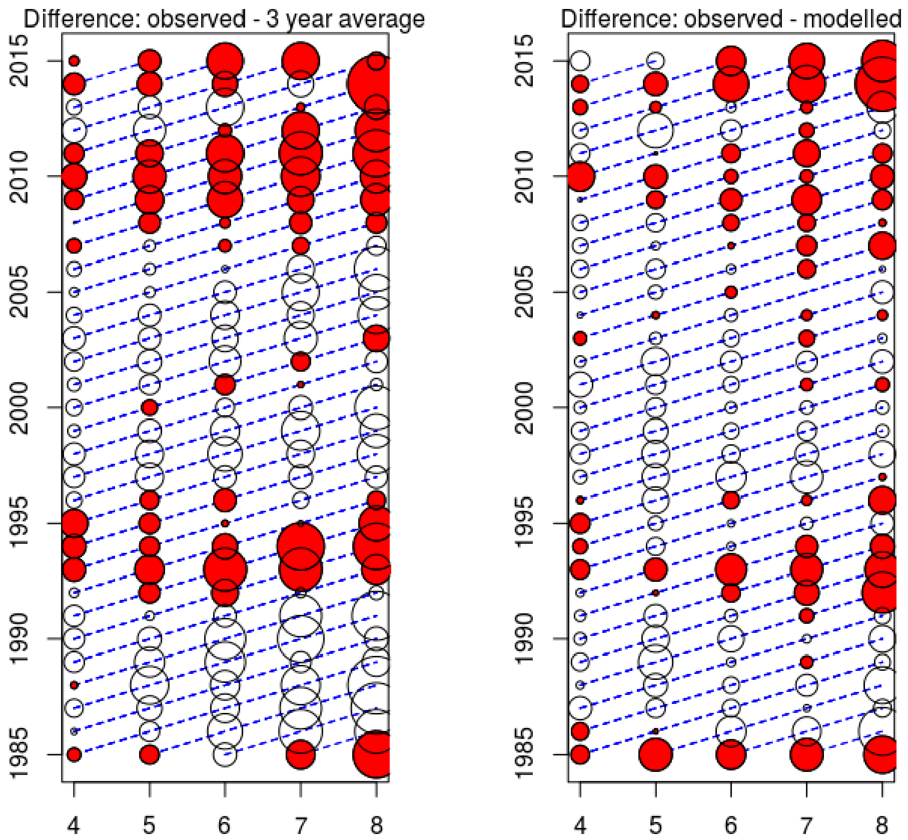


Figure 6.6.1.1. Faroe saithe (Division 5.b). Residual plots from a 3-year running average weight model and the model in which weights are predicted from the previous year in the same year class. Red and white bubbles represent positive and negative residuals respectively.

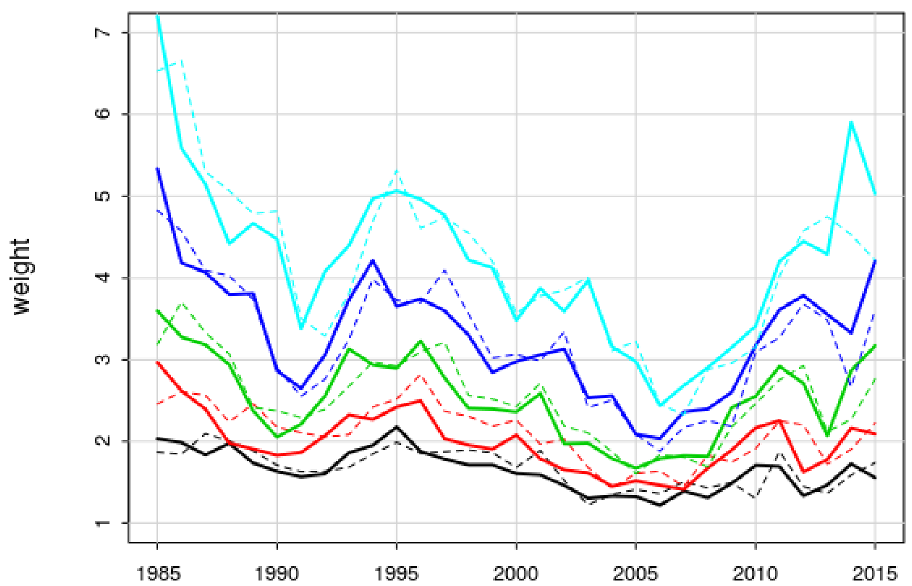


Figure 6.6.1.2. Faroe saithe (Division 5.b). Observed (stapled lines) and predicted weights (solid lines)(ages 4–8, years 1985–2015)

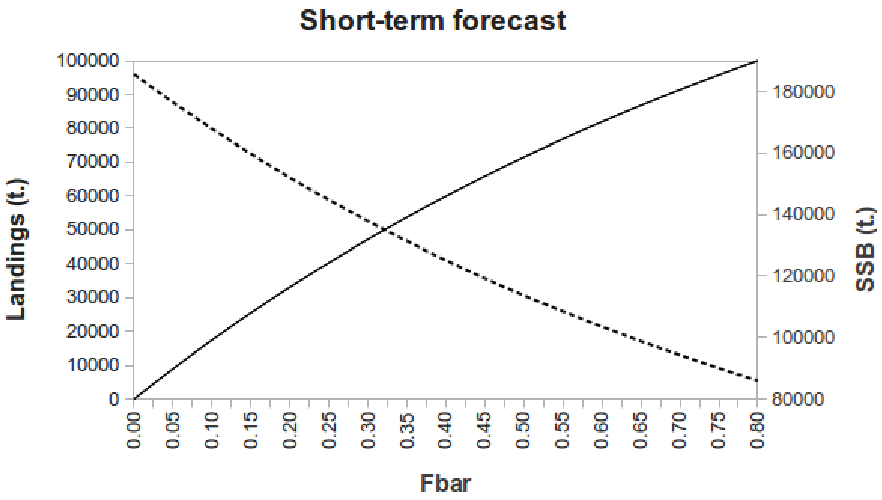
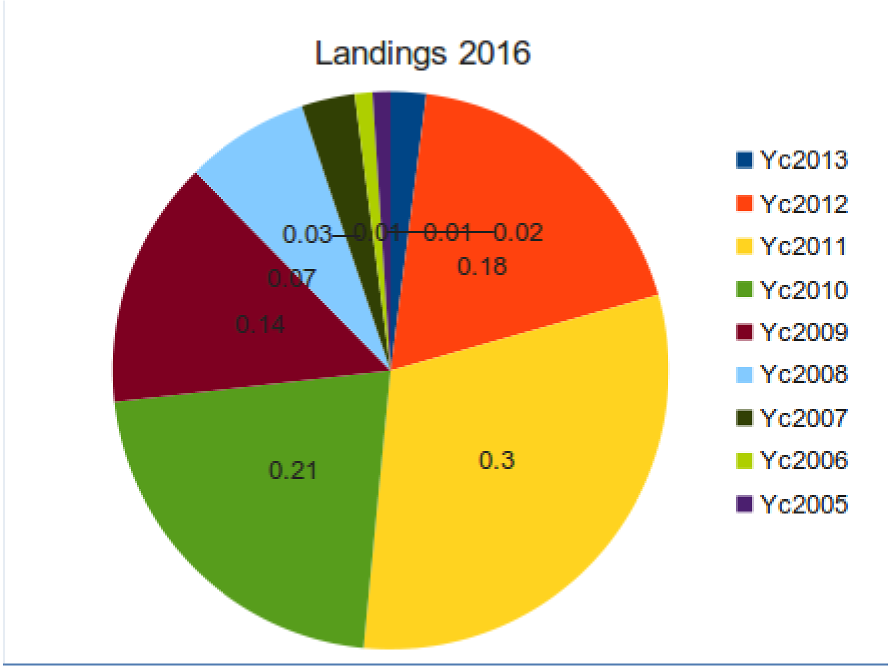


Figure 6.6.2.1. Faroe saithe (Division 5.b). Short-term prediction output (spaly assessment). Solid and broken lines represent landings (t) and spawning-stock biomass (t) respectively.



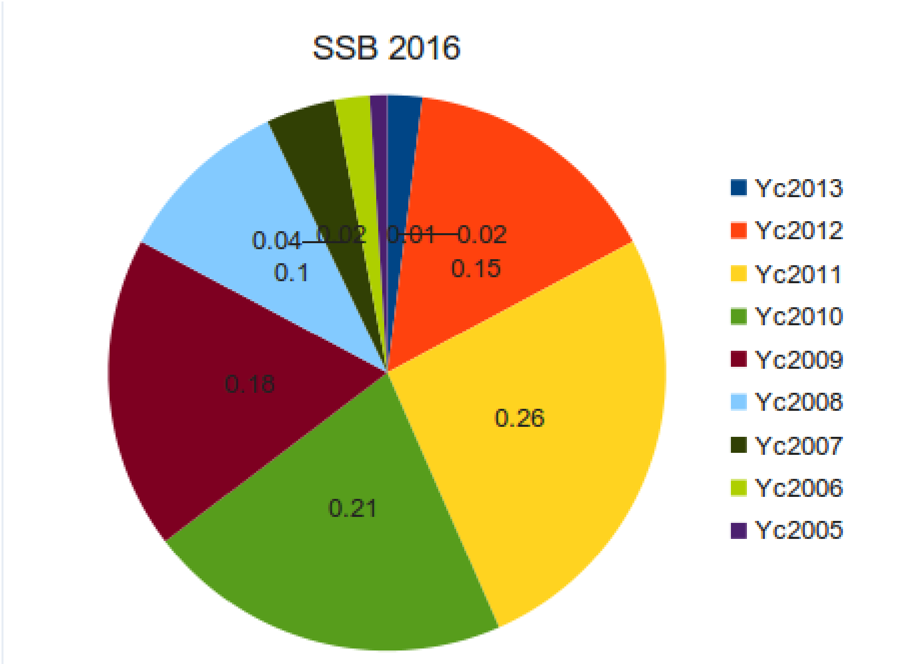


Figure 6.6.2.2 Faroe saithe (Division 5.b). Composition of landings (upper figure) and SSB (lower figure) by year classes in 2016.

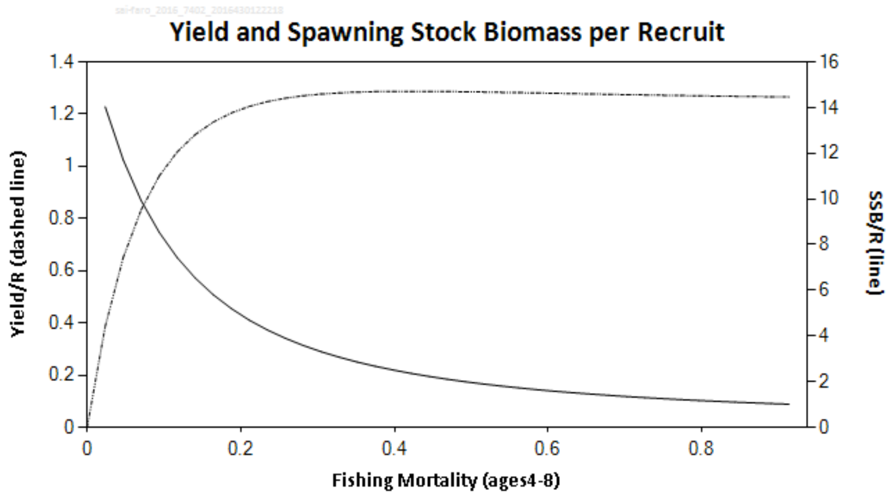


Figure 6.7.1.1. Faroe saithe (Division 5.b). Yield and spawning per-recruit calculations. Dashed and solid lines represent Yield/R and SSB/R respectively.

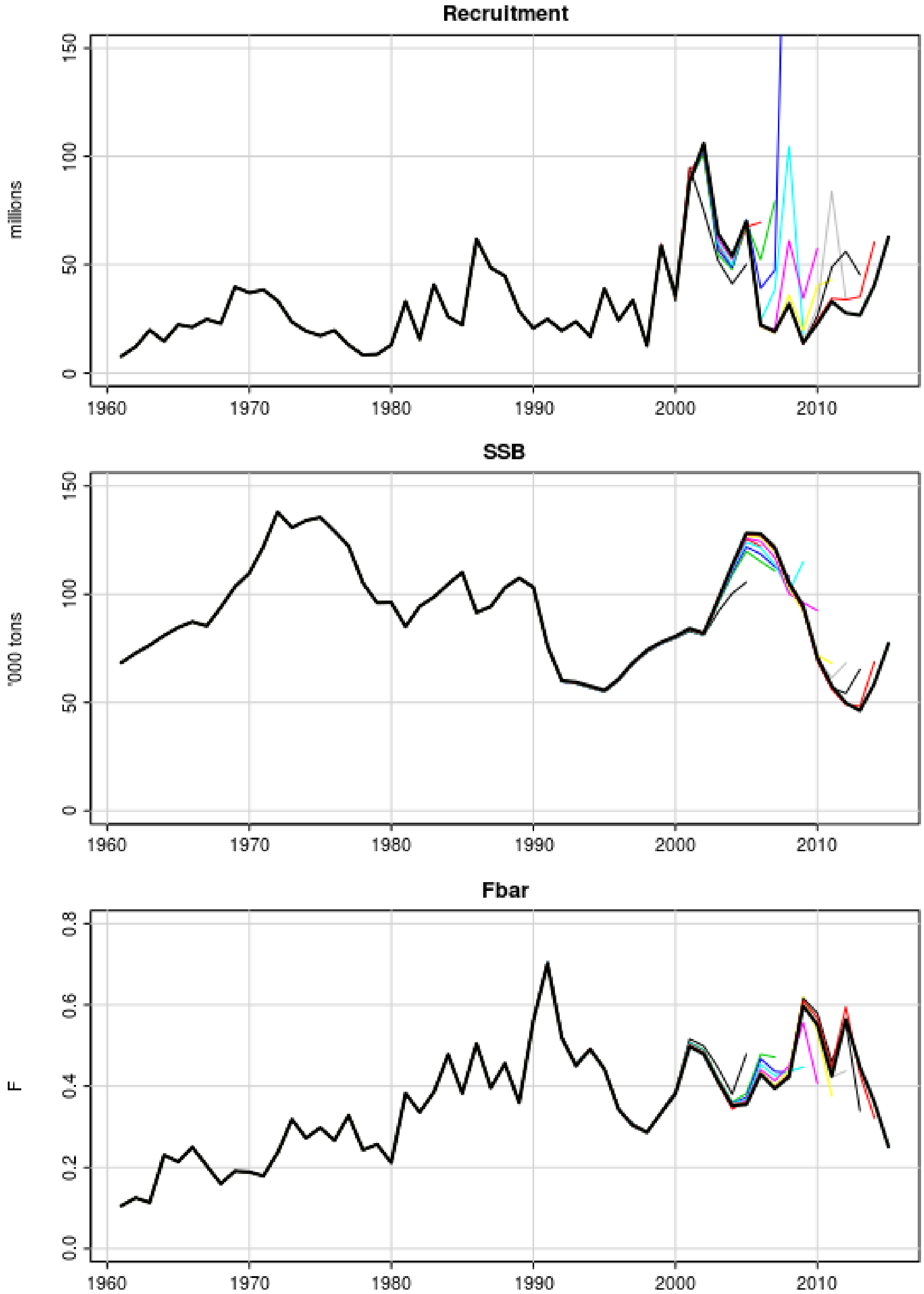


Figure 6.8.1. Faroe saithe (Division 5.b). Retrospective analysis of recruitment-at-age 3 (millions)(top figure), spawning-stock biomass ('000 tonnes)(middle figure) and average fishing mortality over age groups 4–8 (bottom figure) from the spaly assessment.