4.4 THE FAROE PLATEAU ECOSYSTEM

4.4.1 Faroe Plateau cod (Subdivision Vb_1)

State of the stock

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

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

Management objectives

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

Reference points

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

Technical basis

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

Yield and spawning biomass per Recruit
F-reference points:

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

Single-stock exploitation boundaries

Exploitation boundaries in relation to existing management plans

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

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

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

Exploitation boundaries in relation to precautionary limits

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

Short-term implications

Outlook for 2007

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

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

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

Management considerations

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

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

Management plan evaluations

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

Ecosystem considerations

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

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

Factors affecting the fisheries and the stock

Regulations and their effects

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

Changes in fishing technology and fishing patterns

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

Scientific basis

Data and methods

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

Comparison with previous assessment and advice

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

Source of information

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

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

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

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

Weights in '000 t.

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

Faroe Plateau cod (Subdivision Vb1)

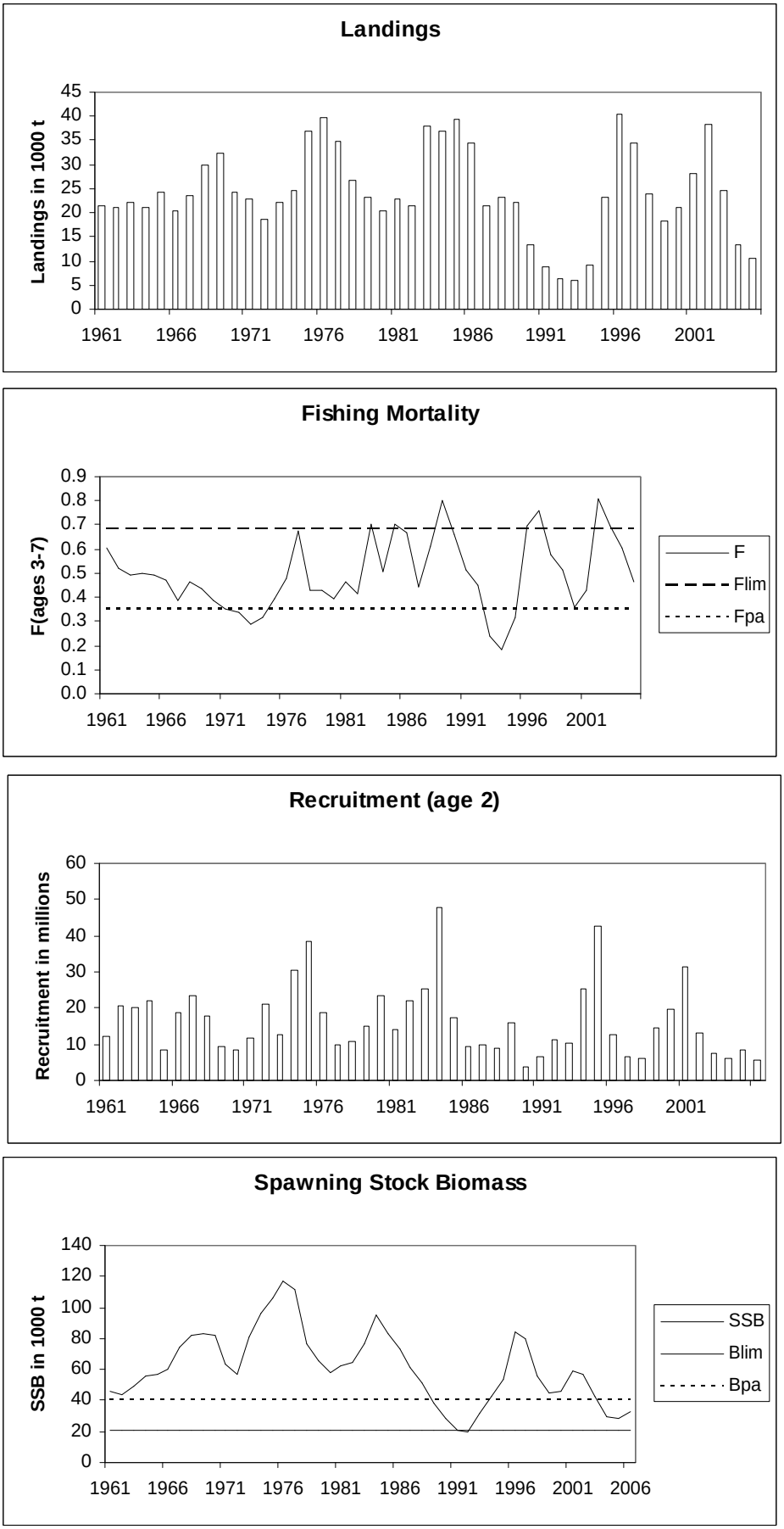
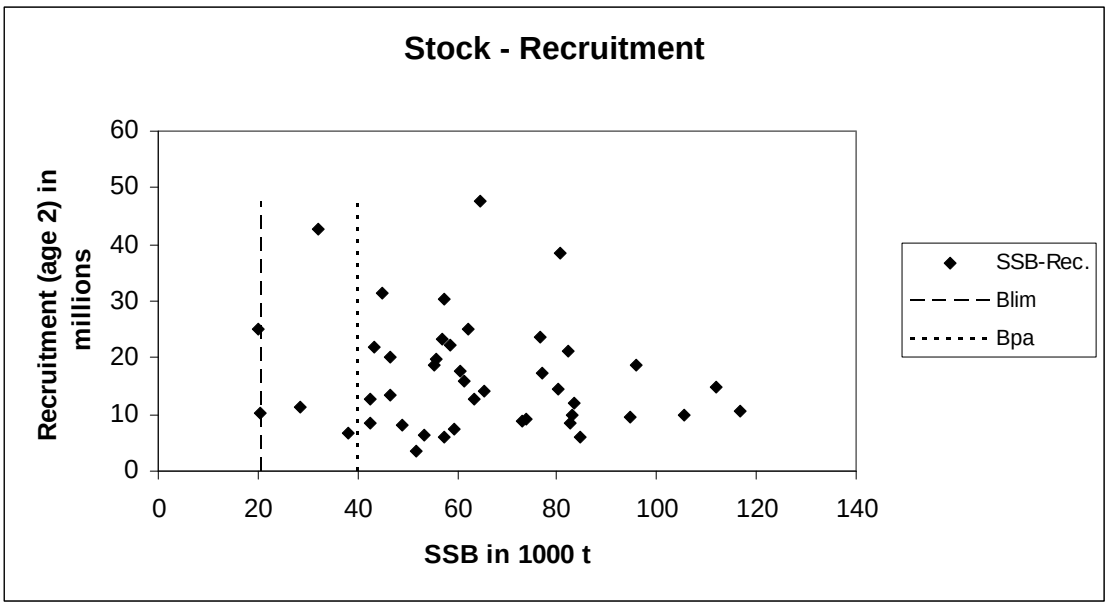
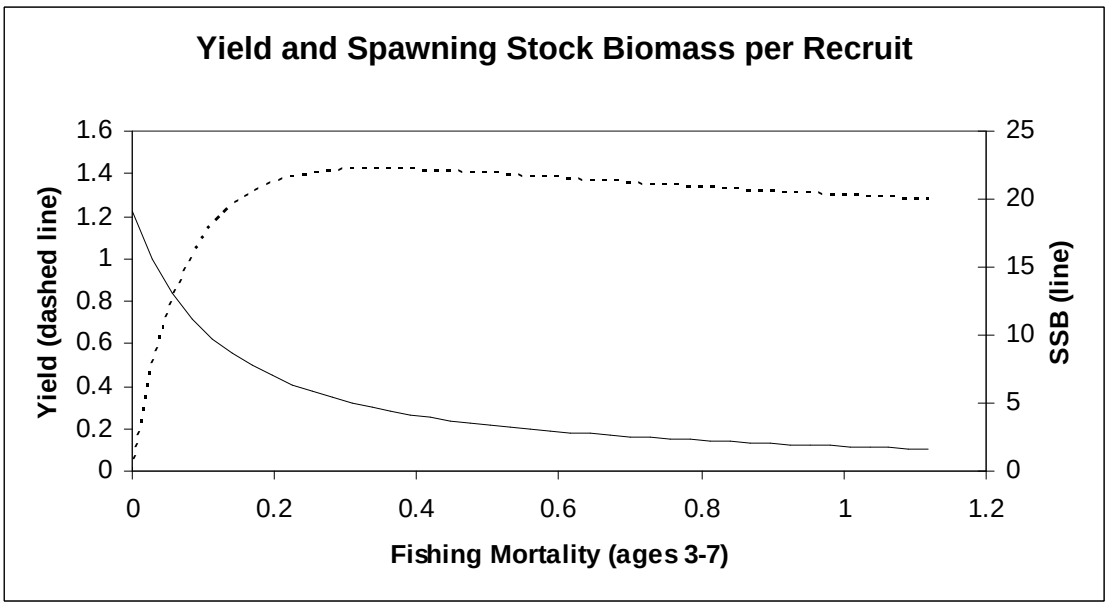


Figure 4.4.1.1


Stock - Recruitment
Recruitment (age 2) in millions
SSB in 1000 t
0
10
20
30
40
50
60
0
20
40
60
80
100
120
140
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-7)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
0
5
10
15
20
25
0
0.2
0.4
0.6
0.8
1
1.2

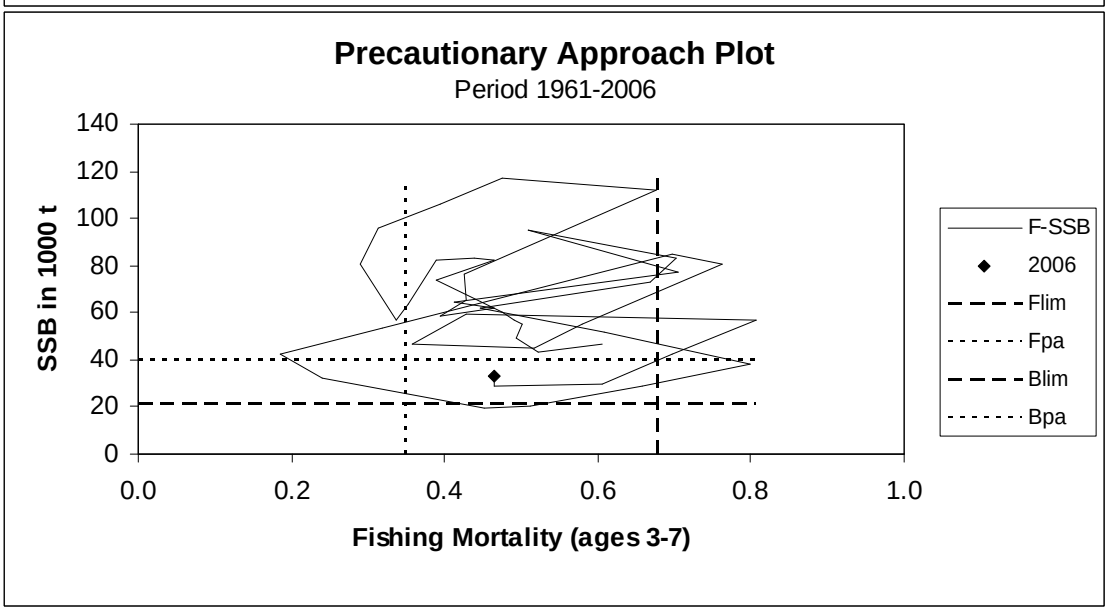

Precautionary Approach Plot
Period 1961-2006
SSB in 1000 t
Fishing Mortality (ages 3-7)
0
20
40
60
80
100
120
140
0.0
0.2
0.4
0.6
0.8
1.0
F-SSB
2006
Flim
Fpa
Blim
Bpa

Figure 4.4.1.2

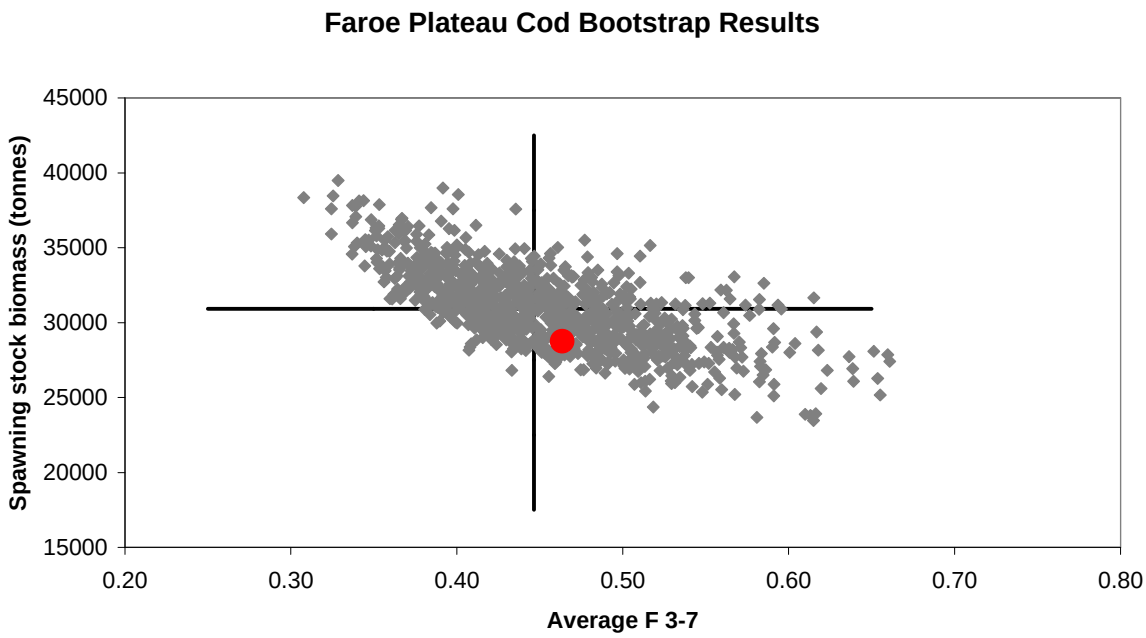


Figure 4.4.1.3 Faroe Plateau cod (Subdivision Vb1).

Table 4.4.1.1 Faroe Plateau cod (Subdivision Vb1).

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

Table 4.4.1.2 Faroe Plateau (Subdivision Vb1) COD. Nominal catches (tonnes) by countries, 1986–2005, as officially reported to ICES.

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

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

[*] Preliminary

[1)] Included in Vb2.

[2)] Reported as Vb.

Table 4.4.1.3 Nominal catch (tonnes) of COD in Subdivision Vb1 (Faroe Plateau) 1986–2005, as used in the assessment.

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

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

[*)] Preliminary

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

[2)] Reported to Faroese Coastal Guard.