1 THE FAROE PLATEAU ECOSYSTEM

1.4.1 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	Harvested unsustainably	Overexploited	Above agreed target	

Based on the most recent estimates of SSB, ICES classifies the stock as being at risk of reduced reproductive capacity. SSB in 2005 is on 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 harvested unsustainably. The estimate of fishing mortality has been above the proposed $\mathbf{F}_{pa}$ since 1996. The spawning stock biomass was well above $\mathbf{B}_{pa}$ for several years, 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 1998 assessment

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 3-7	Yield/R	SSB/R
Average 1999–2004	0.56	1.37	3.01
$\mathbf{F}_{max}$	0.46	1.38	3.60
$\mathbf{F}_{0.1}$	0.25	1.27	5.40
$\mathbf{F}_{med}$	0.38	1.36	4.20

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. Assuming proportionality between effort and F and adherence to the management plan would imply a reduction in effort of more than 40% compared to the average F of the last 3 years.

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 0.75 is above rates that would support optimal long-term yield and low risk of stock depletion ($\mathbf{F}_{0.1}$=0.25 and $\mathbf{F}_{max}$=0.46).

Exploitation boundaries in relation to precautionary limits

Rebuilding SSB to above $\mathbf{B}_{pa}$ in one year will require closing all directed cod fisheries in 2006. Rebuilding SSB over a longer period will require a rebuilding plan.

Such a rebuilding plan should at least result in a fishing mortality below $\mathbf{F}_{pa.}$ This would amount to an effort reduction of about 50% compared to the recent level.

Short-term implications

Outlook for 2006

Basis: F(2005) =0.75; SSB(2006) = 26; catch (2005) = 17.
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 (2006)	Basis	SSB (2006)	Landings (2006)	SSB (2007)	% change SSB [1]
Zero catch	0	F=0	26	0	43	63
Target ref. point	0.45	F(management plan)	26	10.6	31	19
Status quo	0.75	$\mathbf{F}_{sq}$	26	15.7	26	-1
Management plan	0.05	F(management plan) * 0.1	26	1.3	41	58
	0.11	F(management plan) * 0.25	26	3.1	39	51
	0.23	F(management plan) * 0.50	26	5.9	36	39
	0.34	F(management plan) * 0.75	26	8.4	34	29
	0.41	F(management plan) * 0.90	26	9.8	32	23
	0.45	F(management plan)	26	10.6	31	19
	0.50	F(management plan) * 1.1	26	11.5	30	16
	0.56	F(management plan) * 1.25	26	12.7	29	11
Precautionary limits	0.04	$\mathbf{F}_{pa}$ * 0.1	26	1.0	42	59
	0.09	$\mathbf{F}_{pa}$ * 0.25	26	2.4	40	53
	0.18	$\mathbf{F}_{pa}$ * 0.5	26	4.7	38	44
	0.26	$\mathbf{F}_{pa}$ * 0.75	26	6.7	35	35
	0.32	$\mathbf{F}_{pa}$ * 0.90	26	7.9	34	31
	0.35	$\mathbf{F}_{pa}$	26	8.6	33	28
	0.39	$\mathbf{F}_{pa}$ * 1.1	26	9.4	33	25
	0.44	$\mathbf{F}_{pa}$ * 1.25	26	10.4	32	20

All weights in ´000 tonnes.
Shaded scenarios are not considered consistent with the precautionary approach.
[1)] SSB 2007 relative to SSB 2006.

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 (cod, haddock, or saithe), thus reducing the fishing mortality on stocks being in

a 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 plan evaluations

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

Ecosystem considerations

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. Primary productivity of the Faroe ecosystem in 2005 appears to be about average but may vary by a factor of five and has profound effects on fish stocks. Extended periods of low ecosystem production may require a reconsideration of the effort management system and a shift to catch-based management.

The productivity of the Faroe Shelf ecosystem has been shown to be of ultimate importance to the cod stock (Steingrund and Gaard, 2005). The index of primary production was considerably higher in 2004 than in 1990–1992, which may prevent a collapse in the fishery in the near future. The fishing mortality in 2004 was, however, very high when the low stock size is taken into account. Under the present fishing mortality, normal catches in the near future can only be achieved if the environmental conditions are favourable.

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 reference fishing mortality is based on a simple average of age group 3 to 7. In some years the fishing mortality of a particular age group may be unduly high and may more reflect sampling error rather than fishing mortality rates. Using a different basis for calculating reference F gives a different indication of the exploitation of this stock. However, this would require a re-evaluation of the F reference points.

Comparison with previous assessment and advice

The present assessment confirms the increase in fishing mortality in recent years. In last year's assessment the 2004 SSB and F were estimated at 30 000 t and 0.99, respectively. This year's estimate of the 2004 SSB and F are 34 000 t and 0.79.

Source of information

Report of the North-Western Working Group, 26 April–5 May 2005 (ICES CM 2005/ACFM:21).

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

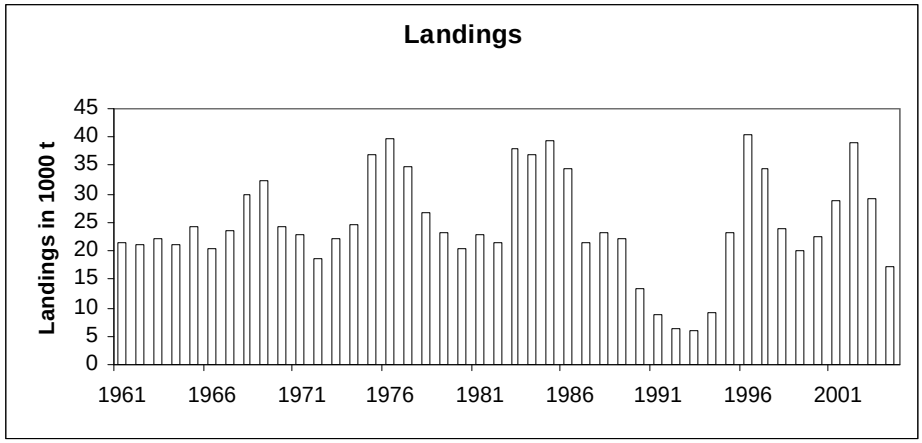
Steingrund, P., and Gaard, E. 2005. Relationship between phytoplankton production and cod production on the Faroe Shelf. *ICES Journal of Marine Science*, Vol. 62: 163-176.

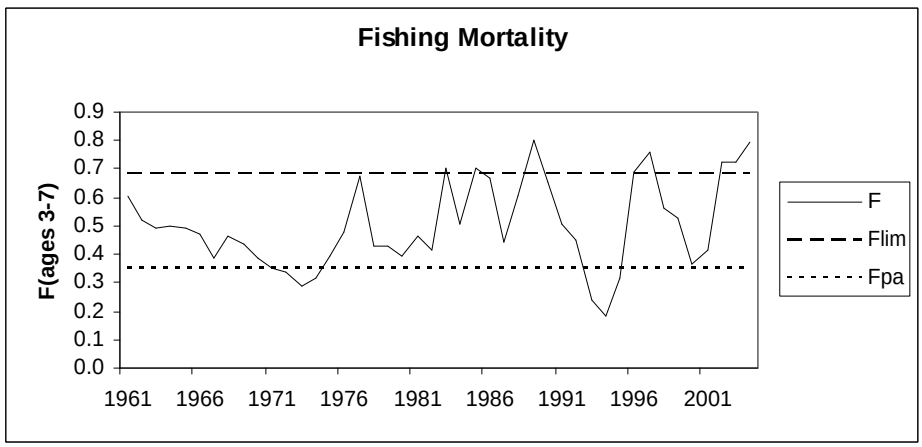
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	No increase in F	<31		21.4
1988	No increase in F (Revised estimate)	<29 (23)		23.2
1989	No increase in F	<19		22.1
1990	No increase in F	<20		13.5
1991	TAC	<16		8.7
1992	No increase in F	<20		6.4
1993	No fishing	0		6.1
1994	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		19.9
2000	F less than proposed $\mathbf{F}_{pa}$ (0.35)	<20		22.4
2001	F less than proposed $\mathbf{F}_{pa}$ (0.35)	<16		28.9
2002	75% of F(2000)	<22		39.0
2003	75% of F(2001)	<32		29.3
2004	25% reduction in effort	-		17.3
2005	Rebuilding plan involving large reduction	-		
2006	Rebuilding plan involving large reduction	-		

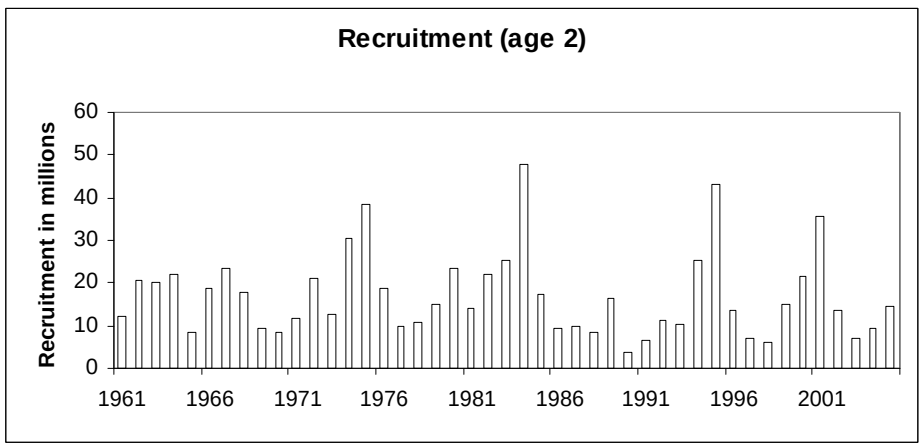
Weights in '000 t.

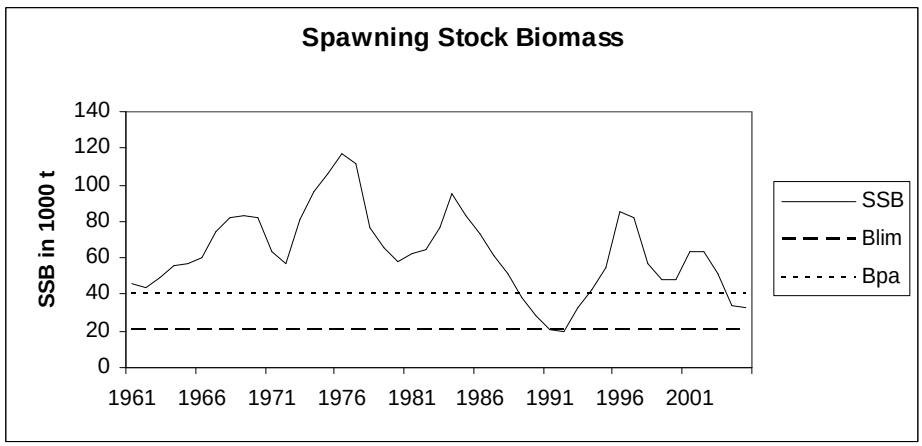
[1] In the quota year 1 September–31 August the following year. [2] The TAC was increased during the quota year.

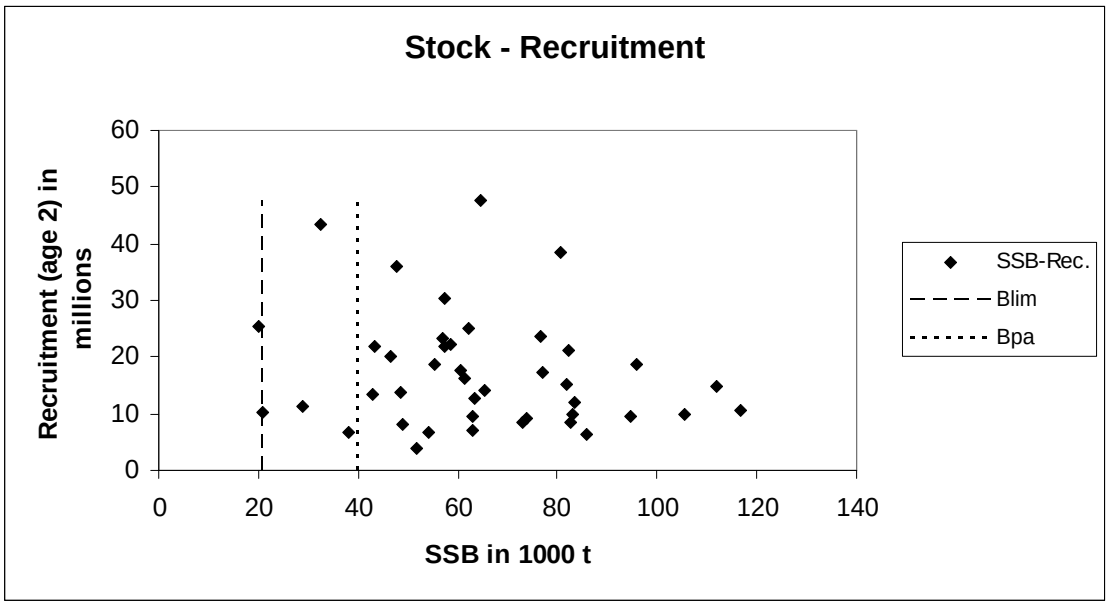
Faroe Plateau cod (Subdivision Vb_1)

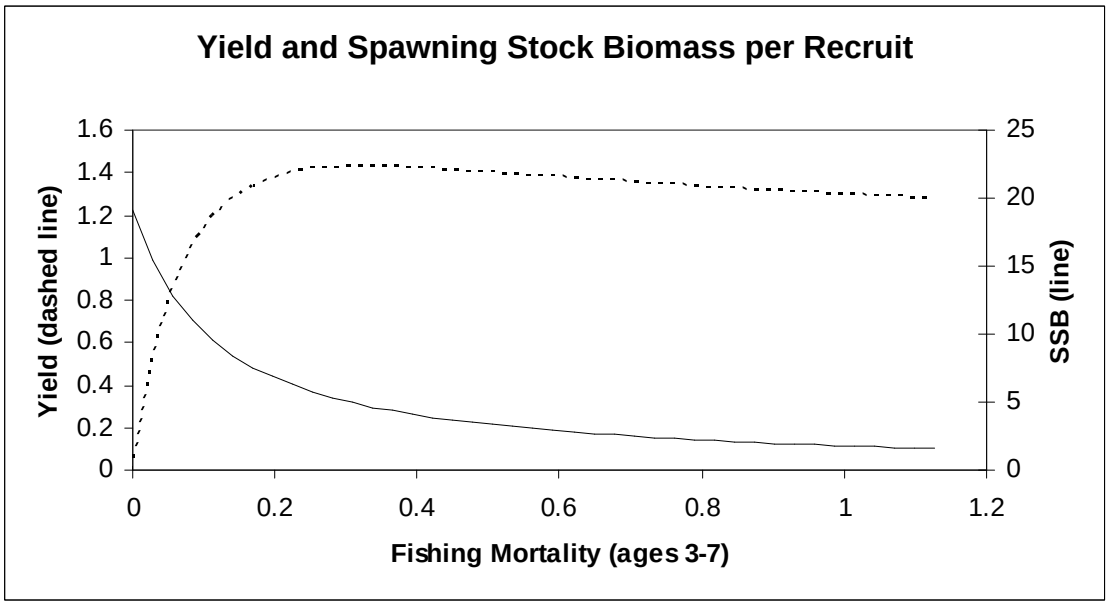









Stock - Recruitment
Recruitment (age 2) in millions
60
50
40
30
20
10
0
0
20
40
60
80
100
120
140
SSB in 1000 t
SSB-Rec.
Blim
Bpa


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

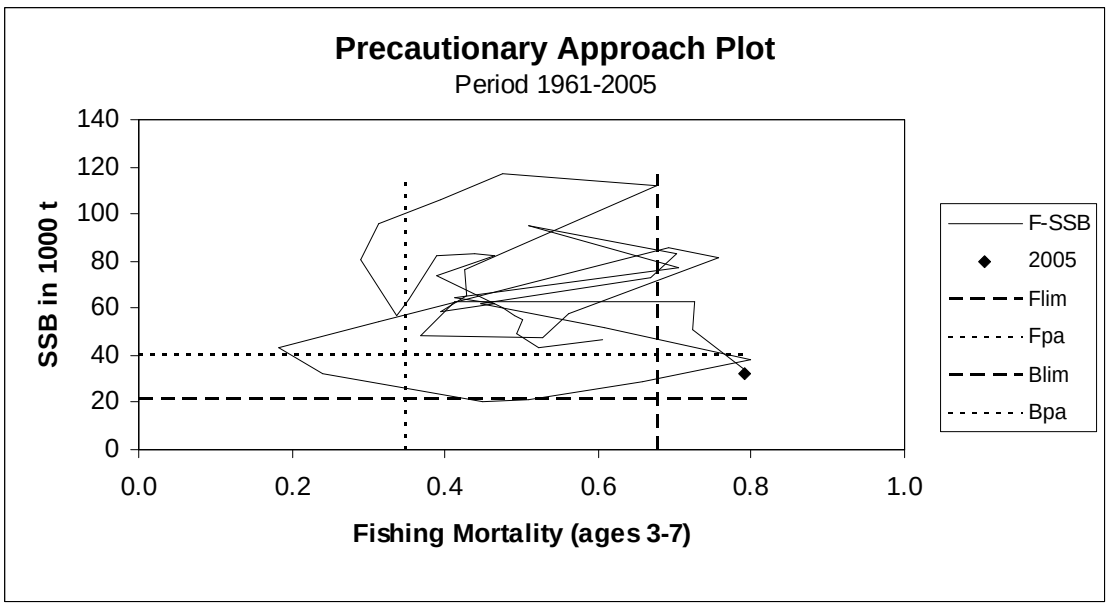

Precautionary Approach Plot
Period 1961-2005
SSB in 1000 t
140
120
100
80
60
40
20
0
0.0
0.2
0.4
0.6
0.8
1.0
Fishing Mortality (ages 3-7)
F-SSB
2005
Flim
Fpa
Blim
Bpa

Table 1.4.1.1 Faroe Plateau (ICES sub-division Vb1) COD. Nominal catches in 2004 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 [*]
Denmark	-					
Faroe Islands	19,156		29,762	40,602	30,259	17,619
France	- [*]	1	9 [2]	20	14	
Germany	39	2	9	6	7	3 [2]
Iceland	-	-	-	5	-	
Norway	450	374	531 [*]	573	527	414
Greenland	-	-	-	29 [2]	-	
Portugal						0
UK (E/W/NI)[2]	51	18	50	42	15	
UK (Scotland)[1]	-	-	-	-	-	-
United Kingdom						[1]
Total	19,696	395	30,361	41,277	30,822	18,036

[*] Preliminary

[1)] Included in Vb2.

[2)] Reported as Vb.

Table1.4.1.2 Faroe Plateau (ICES sub-division Vb1) COD. Catch 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 [*]
Officially reported	19,696	395	30,361	41,277	30,822	18,036
Faroese catches in Vb1		21,793 [*]				
Correction of Faroese catches in Vb1 [1]			-1,766	-2,409	-1,795	-1,045
Greenland[2]						35
France[2]						2
Catches reported as Vb2:						
UK (E/W/NI)	-	-	-	-	-	-
UK (Scotland)	210	245	288	218	254	-
United Kingdom				-	-	259
Used in the assessment	19,906	22,433	28,883	39,086	29,281	17,287

[*)] Preliminary

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

[2)] Reported to Faroese Coastal Guard.

Table1.4.1.3 Faroe Plateau cod (Subdivision Vb_1.

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	76932	38133	0.7057
1984	47756	94847	36979	0.5082
1985	17316	83165	39484	0.7015
1986	9508	72952	34595	0.6694
1987	9917	61527	21391	0.4456
1988	8644	51648	23182	0.6082
1989	16271	38176	22068	0.7988
1990	3738	28781	13487	0.6570
1991	6705	20847	8750	0.5082
1992	11409	20223	6396	0.4493
1993	10114	32657	6107	0.2394
1994	25388	42866	9046	0.1818
1995	43332	54193	23045	0.3137
1996	13379	85826	40422	0.6914
1997	6808	81719	34304	0.7568
1998	6307	57389	24005	0.5622
1999	15224	47648	19906	0.5265
2000	21707	48538	22433	0.3671
2001	35840	63008	28883	0.4121
2002	13650	63133	39086	0.7255
2003	7193	51004	29281	0.7245
2004	9480	33782	17287	0.7922
2005	14488	32412		
Average	17079	63007	24853	0.5082