

**REPORT OF THE
NORTH-WESTERN WORKING GROUP**

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Part 1 of 2

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1 INTRODUCTION

1.1 Participants

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1.2 Terms of Reference

The North Western Working Group (Chairman: J. Reinert, Faroe Islands) met at ICES Headquarters from 29 April to 7 May 1997 to:

- a) assess the status of and provide catch options for 1998 for the stocks of oceanic redfish in Sub-areas V, XII and XIV, Greenland halibut in Sub-areas V and XIV, cod in Sub-area XIV, NAFO Sub-area 1 and Divisions Va and Vb, saithe in Divisions Va and Vb and haddock in Division Vb;
- b) for cod, haddock and saithe in Division Vb, where an effort control management system is in effect, estimate the probability profile of fishing mortalities which would be generated under the current effort control scheme and provide effort options which have a high probability (>80%) that the realised fishing mortalities in 1998 would correspond to the fishing mortality identified as within safe biological limits under items d) and e);
- c) update fishery information on the stocks of redfish in Sub-areas V, VI, XII and XIV;
- d) propose a definition of safe biological limits using target reference points based, where appropriate, on biomass, fishing mortality, maturity, growth, age structure, exploitation pattern, geographic distribution and other relevant parameters; based on the above parameters, propose limit reference points to be avoided with a high probability;
- e) prepare medium-term forecasts of yield and SSB, taking into account uncertainties in data and assessments and assuming a stock-recruitment relationship, to indicate the probability of attaining target reference points and avoiding limit reference points;
- f) provide a detailed description of the various fleets (i.e. gears, seasons, main fishing grounds, and main species) and, where possible, provide the landings, selection parameters, annual mortalities and predicted catches by fleet and species;
- g) update information on the stock composition, distribution and migration of the redfish stocks in Sub-areas V and XIV and comment on the possible relationship between pelagic "deep sea" *Sebastes mentella* and the *Sebastes mentella* fished in demersal fisheries on the continental shelf and slope;

- h) provide information on quantities of discards by gear type and OSPAR area for the stocks of fish and fisheries considered by this group [OSPAR 1997/5.3] and report to WGECCO.

Since the above terms of reference were decided, ICES have received the official request for advice from the North-East Atlantic Fisheries Commission. In addition to their standard requests which are addressed in the above terms of reference, the Commission has made additional requests which necessitate adding new items to the terms of reference. ACFM have therefore decided to ask the Working Group to:

- i) provide information on the relationship between pelagic "deep sea" *Sebastes mentella* and the *S. mentella* fished in demersal fisheries on the continental shelf and slope;
- j) provide advice on the medium-term consequences of an adaptive harvesting strategy, based on a constant annual catch within each 5 year period, set at a level required to obtain sustainable yields of "Oceanic" *S. mentella* and "deep sea" *S. mentella*;
- k) describe the depth distribution of the pelagic components of *Sebastes mentella* by season, area and year and provide information on the stock identity of the deep sea type and oceanic type *S. mentella*.

The above terms of reference were set up to provide ACFM with the information required to respond to the requests for advice from NEAFC and OSPAR.

2 DEMERSAL STOCKS IN THE FAROE AREA (DIVISIONS Vb AND IIa)

2.1 General Trends in Demersal Fisheries in the Faroe Area

Tables 2.1.1 to 2.1.3 show the yields of cod, haddock and saithe for Faroese fleet categories. The fishery at the Faroes may be considered a multi-fleet and multi-species fishery. The catches of cod have been very low in recent years but in 1995 and 1996 most fleet categories have increased their catches. The cod catches increase by 10 000 tonnes (gutted weight) in 1995 and 20 000 tonnes (gutted weight) in 1996. The haddock catches more than doubled from 1995 to 1996 reaching more than 8 500 tonnes (gutted weight) but the saithe catches declined to 25 000 tonnes (gutted weight) in 1995 and again in 1996 to 17 000 tonnes (gutted weight). In 1995 and 1996 most fleets increased their effort (Table 2.1.4).

In 1977 an EEZ was introduced in the Faroe area, (Figure 2.1.1). The demersal fishery by foreign nations have since decreased. The fishing mortalities on cod remained at a high level in the first years, increased considerably during the 1980s and decreased then to a very low level in the first half of the 1990s. In 1995 and especially in 1996 the fishing mortalities increased again substantially. For saithe there has been a substantial increase in the fishing mortalities during most of the period but from 1995 it has decreased to a relatively low level. The increase was mainly due to the introduction of pair trawlers whereas the decrease is because of the reduction in the availability of saithe and the increased availability of cod. The haddock catches decreased to a very low level due to poor recruitment but has in 1995 and 1996 increased again as the recruitment has increased in recent years.

During the 1980s the Faroese authorities have attempted to regulate the fishery and the investment in fishing vessels. In 1987 a system of fishing licenses was introduced. The fishery also has been regulated by technical means such as legislation on the mesh size, closed areas, import ban on fishing vessels and a programme of buying back fishing licenses. Mesh size regulations and closed areas are still enforced.

In March 1994 the Faroese Parliament passed a law on the regulation of fisheries within the EEZ. This law introduced quotas for 5 demersal stocks including the Faroe Plateau and the Faroe Bank Cod, Faroe Haddock, Faroe Saithe and redfish. The quotas were allocated to each fleet category by percentage of the total quota and then equally divided between all vessels in each category.

The fishing year starts 1 September and ends 31 August the following year.

2.1.1 Revised management system

The catch quota management system introduced in the Faroese fisheries in 1994 was met with considerable criticism and it resulted in at least some fleets misreporting substantial portions of their catches. As a result of the dissatisfaction with the catch quota management system, the Faroese Parliament has adopted a law stipulating that the quota system would end as of May 31, 1996. In addition, the Faroese government has developed, in close cooperation with the fishing industry, a new system based on within fleet category individual transferable effort quotas in days. The new system entered into force on 1 June 1996.

The within fleet category individual transferable effort quotas apply to 1) the longliners less than 100 GRT, the jiggers and the single trawlers less than 400 HP, 2) the pair trawlers and 3) the longliners greater than 100 GRT. The single trawlers 400-1000 HP and greater than 1000 do not have effort limitations, but they are not allowed to fish within the 12 n. miles limit and the areas closed to them as well to the pairtrawlers have increased in area and time. Their harvest of cod and haddock is limited by maximum by-catch allocation of 5%. The single trawlers < 400 HP are given special licenses to fish inside 12 n. miles with a by-catch allocation of 30% cod and 10% haddock. Holders of individual transferable effort quotas who fish outside an area where cod and haddock are normally found can fish 3 days for each day allocated within the area of normal cod and haddock distribution. One fishing days by longliners less than 100 GRT is considered equivalent to two fishing days for jiggers in the same gear category. Therefore longliners less than 100 GRT (and single trawlers < 400 HP) could double their allocation by converting to jigging.

The effort quotas are transferable within gear categories. The allocation of number of days by gear categories was originally made such that the fixed allocation of catches in tonnes under the previous catch quota management regime were expected to be reduced about 20%. However, the actual number of allocated days was set somewhat higher than that.

The number of days fished by gear category since 1985, the average for 1990-1995 and the number of days by category as stated in the law, are presented in Table 2.1.5.

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, respectively, each fleet category are allowed to fish. These percentages are as follows:

Fleet category	Cod	Haddock	Saithe	Redfish
Longliners < 100GRT, jiggers, single trawl. < 400HP	51%	58%	17.5%	1%
Longliners > 100GRT	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%

Table 2.1.1. Catches of COD in Vb by various faroese fleet categories. Tonnes gutted weight.

Year	Open boats	Longliners < 100 GRT	Singletrawl < 400 HP	Gill nett	Jiggers	Singletrawl 400-1000HP	Singletrawl > 1000 HP	Pairtrawl < 1000 HP	Pairtrawl > 1000 HP	Longliners > 100 GRT	Industrial trawlers	Others	Total
1985	5650	9667	2506	291	1522	3049	4354	5393	2223	3133	54	202	38044
1986	2946	4708	1643	443	921	2049	2840	10132	4793	1700	141	391	32706
1987	2151	3232	1393	283	639	1543	1794	6361	3273	2586	112	30	23408
1988	579	3055	1114	568	1657	1652	1510	6065	3455	3201	137	35	23025
1989	923	6019	1213	692	1932	1203	1157	2278	1729	3840	148	12	21147
1990	471	4252	582	201	1000	442	568	863	1259	2440	79	27	12184
1991	335	2478	574	160	629	277	371	663	1038	1394	45	8	7971
1992	136	1360	361	1	382	123	193	634	1119	708	258	21	5296
1993	109	815	803	0	455	219	178	717	1141	696	40	23	5194
1994	240	1086	956	58	1500	235	447	651	1942	1128	45	7	8295
1995	733	3112	1137	55	4407	714	865	1164	2204	3341	11	1	17744
1996	1345	6845	1562	95	7384	1319	666	3454	7254	7339	66	30	37359

Table 2.1.2. Catches of HADDOCK in Vb by various faroese fleet categories. Tonnes gutted weight.

Year	Open boats	Longliners < 100 GRT	Singletrawl < 400 HP	Gill nett	Jiggers	Singletrawl 400-1000HP	Singletrawl > 1000 HP	Pairtrawl < 1000 HP	Pairtrawl > 1000 HP	Longliners > 100 GRT	Industrial trawlers	Others	Total
1985	903	5299	196	18	86	780	1055	2546	832	1816	15	28	13575
1986	951	5039	250	4	62	354	664	2654	1313	1535	87	56	12967
1987	1520	5418	313	3	47	625	288	2340	1251	1796	204	29	13834
1988	197	5227	167	2	50	430	259	1205	914	2076	161	13	10700
1989	450	7433	138	2	176	409	213	862	749	2257	180	5	12876
1990	248	6141	76	1	132	294	192	534	800	1815	68	18	10319
1991	210	4213	116	0	40	95	126	495	799	1321	52	5	7473
1992	79	1892	64	0	13	30	45	439	576	917	41	8	4104
1993	27	787	261	0	6	101	37	424	713	818	98	4	3275
1994	34	630	290	0	4	85	121	363	1045	913	93	3	3582
1995	46	1009	295	0	16	207	91	371	695	1654	11	0	4397
1996	122	2349	486	0	59	572	162	564	1142	3066	5	2	8529

Table 2.1.3. Catches of SAITHE in Vb by various faroese fleet categories. Tonnes gutted weight.

Year	Open boats	Longliners < 100 GRT	Singletrawl < 400 HP	Gill nett	Jiggers	Singletrawl 400-1000HP	Singletrawl > 1000 HP	Pairtrawl < 1000 HP	Pairtrawl > 1000 HP	Longliners > 100 GRT	Industrial trawlers	Others	Total
1985	89	38	23	13	982	2509	12930	10822	10805	28	60	79	38377
1986	107	67	31	54	1296	1004	9872	9921	13173	21	254	330	36132
1987	244	52	116	157	1985	1458	7289	8134	15790	37	408	1	35700
1988	173	101	40	113	2576	2660	8257	7748	17266	31	501	21	39587
1989	352	55	133	90	3723	2144	7118	9440	16513	60	504	5	40136
1990	315	132	110	122	4032	2096	10742	13127	23442	101	495	8	54721
1991	298	55	78	281	4784	585	6791	12978	22584	64	404	7	48910
1992	123	121	18	0	3300	135	2253	7677	17486	37	320	1	31472
1993	168	56	57	0	2697	146	1879	6234	17639	29	203	3	29111
1994	139	112	44	2	3655	315	1995	5408	17240	63	202	0	29175
1995	50	19	90	5	2579	216	2406	4289	14776	73	19	0	24519
1996	6	6	24	5	1590	213	1178	4119	10174	38	3	0	17356

Table 2.1.4. Fishing effort (days) by various faroese fleet categories in Vb.

Year	Open boats	Longliners < 100 GRT	Singletrawl < 400 HP	Gill nett	Jiggers	Singletrawl 400-1000HP	Singletrawl > 1000 HP	Pairtrawl < 1000 HP	Pairtrawl > 1000 HP	Longliners > 100 GRT
1985		7558	2171	108	3348	2077	5565	5389	3193	2973
1986		6692	1509	123	2745	1221	5402	6573	4433	2176
1987		6728	1297	201	2973	1531	4389	6314	5546	2915
1988		8753	1261	234	8072	2204	4964	6026	6034	3203
1989		12804	1445	208	10670	1993	4939	5175	5127	3369
1990		14543	1159	157	9611	1853	4020	5444	7491	3521
1991		14801	1141	183	10332	1038	4005	5828	7875	3573
1992		10599	1150	181	10128	495	4174	3985	7243	2892
1993		7497	2045	561	8056	1008	3577	2851	6335	2046
1994		7625	2029	1833	13410	677	3825	2120	6227	2925
1995		9742	1985	2052	18744	1342	4317	2594	6752	3959
1996		12636	1475	2407	23663	1311	3780	3396	7285	4285

Table 2.1.5. Effort (days) used by various fleet categories at Faroes 1985-1995. At the right the average of 1990-1995 and the number of fishing days allocated in the law.

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	Avg90-95	Allocated days
Longliners < 100 GRT and jiggers	10906	9437	9701	16825	23474	24154	25133	20727	15553	21035	28486	22187	31320
Single trawlers < 400 HP	2171	1509	1297	1261	1445	1159	1141	1150	2045	2029	1985	1670 ¹⁾	²⁾
Pairtrawlers	8582	11006	11860	12060	10302	12935	13703	11228	9186	8347	9346	10362	8225
Longliners > 100 GRT	2973	2176	2915	3203	3369	3521	3573	2892	2046	2925	3959	3079	3040
Single trawl 400-1000 HP	No effort limitations. Cod and haddock catches management by bycatch percentages												
Single trawl > 1000 HP	No effort limitations. Cod and haddock catches management by bycatch percentages												

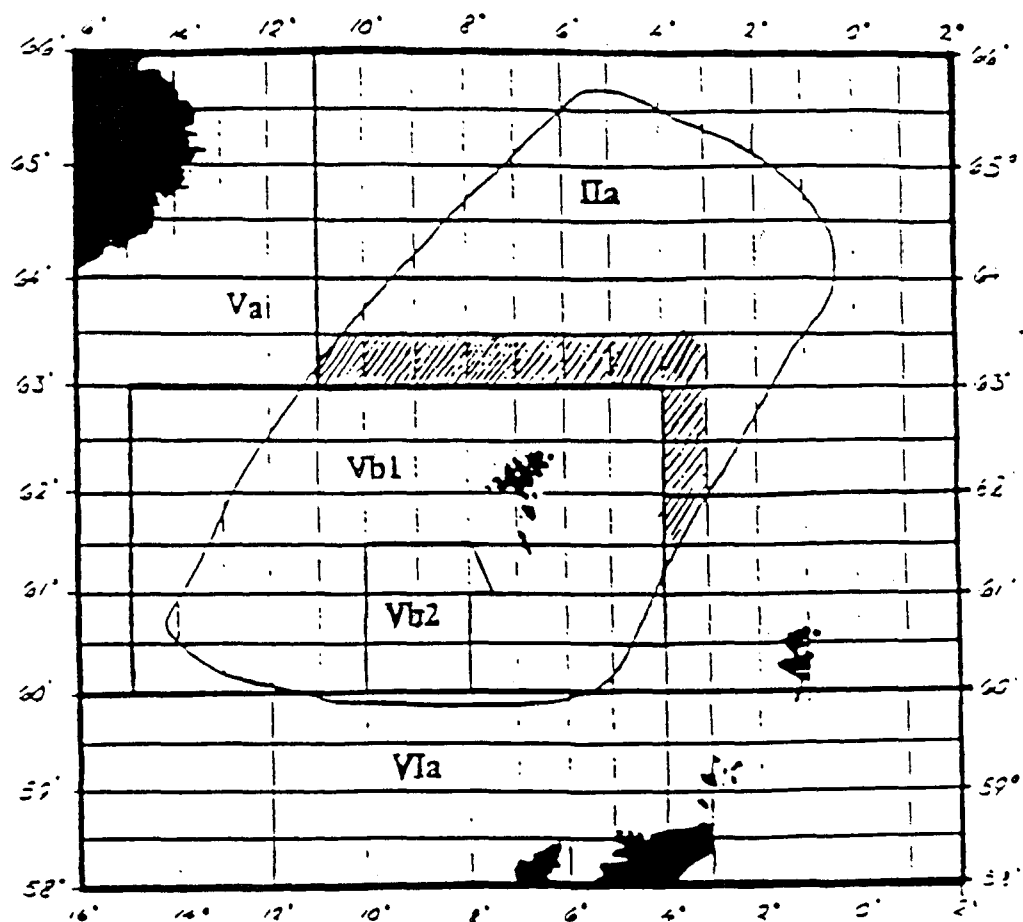
¹⁾ Includes effort used inside 12 nautical miles zone.

²⁾ Included in the longliners and jiggers category.

Obs! 1,000 days are kept outside the above mentioned allocation of days for use in special cases

Obs! The Faroe Bank has its own effort contom scheme.

Figure 2.1.1 The Faroe area and adjacent areas divided into ICES Divisions. The Faroese 200 Miles economic zone is indicated.



2.2 Faroe Plateau Cod

2.2.1 Trends in landings

The nominal landings of cod (1985-1996) from the Faroe Plateau by nations as officially reported to ICES, are given in Table 2.2.1.1. The relatively high recruitment in 1980-1983 maintained the good fishery for cod from 1983 to 1986 when the catches reached almost 40 000 t. The catches have steadily decreased afterwards to only 6 000 t in 1993, the lowest catch on record. In 1995 the officially reported catches increased to slightly above 19 000 t. Landings increased in 1996, to above 40 000 t, the highest value during the 1961 to 1996 time period. This increase is believed to be due to a combination of increased stock size, increased availability, and increased effective fishing effort as a result of the new management system introduced June 1, 1996.

In recent years, statistics for the Faroese fishery in that part of Sub-division IIa (Figure 2.1.1) which is within the Faroese EEZ, have become available. It is expected that these catches are taken from the Faroe Plateau area so they are included in the total catches used in the assessment. This is depicted in Table 2.2.1.2 under the row labelled "Total used in the assessment". No information on the Faroese catches in IIa were available for 1993-1996, however. The French catches of Faroe Plateau cod in 1989 and 1990 as reported to the Faroese authorities are also included.

The fishery for Faroe Plateau cod has been considerably better than in previous years in both 1995 and 1996, and preliminary information for 1997 continues to indicate good fishing success, although the jigger fishery is not as good as in 1996. Informal information from the fishing industry indicate misreported 1995 nominal catches in the order of 3 330 t (3 000 t gutted weight) which were added to the officially reported catches in Table 2.2.1.2. Misreporting is not suspected to have been a problem in 1996.

During the last 15 years, the Faroe Plateau Cod has almost entirely been exploited by the Faroese fishing fleet. Tables 2.2.1.3 and 2.2.1.4 show the landings for the most important fleet categories. In recent years, the long liners and the pair trawlers have taken most of the catches. The long liners, at least those lesser than 100 GRT, have a directed fishery for cod during the entire year. Up to 1995 the pair trawlers took cod mainly as by-catch in the saithe fishery, but in 1996 they directed more towards for cod.

Figure 2.2.1 shows the catch rates per day from 1985 to 1996 for the long liners, trawlers and jiggers. The catch rates have steadily decreased until 1992 while they increased markedly from 1992/1993 to 1996, except for the single trawlers greater than 1000 HP whose cod catches are relatively small. As indicated above, preliminary information from the fishery during the first months of 1997, indicates sustained high catch rates except for the jiggers.

2.2.2 Catch-at-age

Catch in numbers-at-age were updated to account for a change in the nominal catches in 1995. Catch at age for 1996 is provided for the Faroese fishery in Table 2.2.2.1. Faroese landings from most of the fleet categories were sampled (Table 2.2.2.2). The catch-in-numbers for the fleets covered by the sampling scheme were calculated from the age composition in each fleet category and raised by their respective catches. The age composition of the combined Faroese catch was used to raise the foreign catches. Catch in numbers at age from 1961 to 1996 is shown in Table 2.2.2.3.

2.2.3 Mean weight-at-age

Mean weight-at-age data for 1961-1996 are provided for the Faroese fishery in Table 2.2.3.1. 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 1996 showed a discrepancy of 0.6 %.

Figure 2.2.2 shows the mean weight-at-age for 1978 to 1996. From 1991 to 1995 weights at age appeared to have increased, they remained stable in 1996 and appear to have decreased in the first quarter of 1997 (Figure 2.2.3).

2.2.4 Maturity-at-age

The proportion of mature cod by age are given in Table 2.2.4.1 and shown in Figure 2.2.4 for 1983 to 1997. The data were obtained during the Faroese groundfish surveys carried out during the spawning period (March). The average maturity at age for 1983 to 1996 were used in years prior to 1983.

Considerable changes have been observed in the proportion mature at age between years. In 1994 the proportion increase for most of the ages, particularly for age groups 2, 3 and 4. The observed values were used in the assessment as in previous years, since calculations during the 1995 assessment showed that smoothed values gave nearly the same spawning stock biomass.

2.2.5 Groundfish surveys

The groundfish surveys in Faroese waters with the research vessel *Magnus Heinason* were initiated in 1983. Up to 1991 three cruises each year, with approximately 50 trawl stations in each cruise, have been conducted between February and the end of March. In 1992 the period was shortened by dropping the first cruise. Random stratified sampling based on depth stratification and on general knowledge of the distribution of fish in the area has been used to select the trawl stations. In 1992 one third of the 1991-stations were used as fixed stations. Since 1993 all stations were fixed stations. The standard abundance estimates is the stratified mean catch per hour calculated using smoothed age/length keys.

The overall mean catch (kg) of cod per unit effort (trawl hour) 1982-1997 is given in Figure 2.2.5. The CPUE have increased substantially in 1995 and 1996 and have remained high in 1997. The stratified mean catch per trawl hour by age groups 2 to 7 increased for all age-groups in the 1995 and 1996, possibly because of increased availability.

2.2.6 Stock assessment

2.2.6.1 Tuning and estimates of fishing mortality

Eight catch and effort series were available for tuning of the VPA. One series is derived from the annual Faroese groundfish survey (Table 2.2.6.1.1). The estimates of stratified catches in number by age groups per unit time are used as the surveys represented one fleet with constant effort for all the years in the tuning process. To use the survey in 1997 in the assessment, the results were shifted back in time by approximately three months for each year, and the fish were considered to be one year younger.

The other catch and effort series available are obtained from long liners and trawlers (Table 2.2.6.1.2 - Table 2.2.6.1.8). The series consist of catch-at-age in numbers and the corresponding effort estimated as number of days at sea. Catches are broken down using the age composition from the sampling of the corresponding fleet categories. No attempt has been made to select those trips where the cod catches exceeded a certain percentage of the total catches. The same series were also available to the North Western Working Group in 1995 and 1996.

In 1995 the North-Western Working Group scrutinized the tuning data series and decided not to use pairtrawlers series nor the single trawlers > 1000 HP in the assessment, to remove age group 2 from all of the commercial series and age group 3 for the single trawlers 400-1000 HP. The decision not to use these series was based on trends in the catchabilities. This year, examination of the residuals from ADAPT calibrations showed trends similar to those which had led to the rejection of those series and these series were not used.

Up to the 1996 assessment, the CPUE for longliners < 100 GRT have sometimes been used because they caught 25 percent of the total cod catches (Table 2.2.1.4) on average. But in recent years their share has dropped and this category may have changed its activity in recent years due to the low CPUE and partly due to the influence of changed management rules. This series was not used in the 1994 assessment as done by ACFM in the autumn of 1995 and is not used in the current assessment either.

In addition the series by the single trawlers < 400 HP is questionable because their fishing possibilities have been influenced by special management rules for this category only. These have been given special licenses for trawl fishery inside the 12 nautical miles zone during part of the year and different closed areas outside 12 n. mile, mainly to reduce their catches of cod. Also in the quota management system for 1994-95 this fleet has been given conditions that may affect the usefulness of the series in the Faroe Plateau cod assessment.

The remaining fleets, the longliners > 100 GRT and the single trawlers 400-1000 HP, are not expected to have been affected by misreporting of catches to any degree and the tuning data are not adjusted for misreporting in 1995.

A multiplicative analysis of the survey results by ACFM in the autumn of 1995 and again in May 1996 indicated that the 1995 and 1996 survey results should be considered as outliers. In 1996, the NWWG further evaluated the usefulness of the survey series as a consistent index of stock size by doing ADAPT calibrations by 5 year periods and calculating the catchability coefficient of the survey for each period. This showed a marked increase in catchability during the last period, 1991 to 1995 and therefore the survey results were not used in the assessment. The analysis was extended to include 1992 to 1996 and the results are presented in the table below suggesting that the availability to the survey may be returning to more average values, but does remain above typical values observed during 1983 to 1993. It is therefore likely that using the survey in the current assessment would result in an overestimation of stock size. Therefore consistent, with the two most recent assessments, the survey results have not been used. The Working Group concluded however, that the survey may become again a useful index of stock size if the availability returns to normal values.

Table 2.2.6.1.9 Faroe Plateau cod: Results of ADAPT calibrations with the research vessel survey index of stock size alone by 5 year periods to investigate changes in the availability of cod to the survey. The 5 year periods correspond to the catch at age used while the survey index for the year following the last year of catch at age data in each period was included in the calibration. The period 1991 to 1995 is strikingly different from the other periods suggesting that the series cannot be treated as a consistent continuous time series of stock size. The period 1992 to 1996 shows lower availability, but still higher than during 1983 to 1993.

	83 to 87	84 to 88	85 to 89	86 to 90	87 to 91	88 to 92	89 to 93	90 to 94	91 to 95	92 to 96
k2	7966	5919	6118	4256	3324	2154	2722	5378	171099	5453
k3	831	711	858	734	1006	874	979	1846	35596	1577
k4	501	378	370	240	351	360	386	503	9957	690
k5	563	368	309	193	237	260	238	324	5802	725
k6	692	472	414	237	304	303	291	297	5519	846
k7	745	417	362	201	324	267	242	275	6708	1174
k8	755	367	335	205	333	380	378	368	10415	3084
k9	1578	375	514	366	520	447	491	362	9779	

Therefore, only the longliners greater than 100 GRT and the single trawlers 400 to 999 HP were used in the XSA calibrations reported below as the other indices previously used, the small longliners and the large trawlers appeared to suffer from trends in catchabilities over time.

Fishing for cod on Faroe Plateau in 1995, 1996 and in the first part of 1997 has been very successful and it is possible that the commercial indices of stock size used in the calibrations have also been affected by increased availability. The increase in CPUE for these fleets is less than that for the surveys, possibly because the increased availability would be particularly high during spawning time, when the survey is conducted. In addition, the change in management regime is likely to have increased the efficiency of the fleets by allowing them to fish when the conditions were most favourable. If the commercial indices were also rejected, there would be no basis to conduct a calibrated VPA assessment. The Working Group therefore went ahead with the calibrations using the two commercial indices, bearing in mind that their efficiency has probably increased in 1996.

An XSA run was made with the same parameters and assumptions as last year with updated data: the catchability of age groups < 3 years being dependent of year class strength, the catchability being independent of age for age groups 6 and older, using shrinkage of s.e.= 0.5 and survivors estimates shrunk towards the mean F of the final 5 years or the 5 oldest ages. The results showed that the stock size indices consistently suggested higher fishing mortality than the shrinkage did. A second calibration was made with lighter shrinkage of 2.0, consistent with the observation that the introduction of the new management system invalidates the implicit assumption of shrinkage that things have not changed. In Figures 2.2.6 and 2.2.7 the estimates of F at age and spawning biomass in the two runs are compared. A run with no shrinkage was also made, with very similar results as that with light shrinkage, but it had some anomalous fishing mortalities at older ages in the early years of the fishing mortality matrix.

The residuals of log catchabilities are shown in Figure 2.2.8. There are clear trends in residuals: those for the longliners have a sinusoidal form, with all the 1996 values being positive; the 1996 values for the trawlers are more balanced, but the overall slope of the trend is negative from 1986 to 1995. Table 2.2.6.1.10 shows that the standard error of the mean log catchability coefficients are relatively high. This is not surprising considering that the number of days fished is used as a measure of fishing effort to calculate cpue for all fleets. Days fished is not a very precise, and perhaps not very reliable measure of the actual effective fishing effort, especially with changes in management approaches as implemented in the Faroes in 1996.

The Working Group considered that the assessment was a useful reconstruction of the history of the stocks, but it concluded that the results were not sufficiently precise to be used for short term predictions of the effects of various fishing mortalities in 1998. The Working Group noted that the results suggest that the 1996 spawning stock biomass is about equal to the 1985 spawning stock biomass, consistent with the available cpue series (Table 2.2.6.1.11).

The results from the retrospective analysis of the XSA (Figure 2.2.9) show that a light shrinkage does not result in poorer performance of XSA. The retrospective analysis shows that the tendency has been to consistently underestimate stock size and therefore overestimate fishing mortality. From a conservation point of view, such a retrospective pattern is less worrying than when the tendency is to underestimate F and overestimate stock size.

The estimated fishing mortalities are shown in Table 2.2.6.1.12 and in Figure 2.2.10A. The average F for age groups 3 to 7 in 1996 ($F_{(3-7)}$) is estimated at 0.79, more than double the 1995 value of $F_{(3-7)} = 0.34$ and substantially above $F_{max} = 0.31$.

2.2.6.2 Stock estimates and recruitment

The stock size in numbers is given in Table 2.2.6.2.1. A summary of the VPA, with recruitment set at 2 years old, and biomass estimates are given in Table 2.2.6.2.2 and in Figure 2.2.10B. The stock-recruitment relationship is presented in Figure 2.2.11.

The assessment confirms the poor recruitment observed in the Faroe Plateau cod stock for the 1984 to 1991 year classes, but the 1992 and 1993 year classes to be above the long term average. Due to the continuous poor recruitment from 1984 to 1991 and the high fishing mortalities, the spawning stock biomass declined steadily from 1983 to 1992 when it was lowest on record at 20 600 t. It has increased sharply since, with the increase in 1994 being partly due to a very high proportion of mature for ages 2 and 3 (Table 2.2.6.2.2) to almost 87 000 t in 1996. The spawning stock biomass is expected to decrease in the medium term as the strong 1992 and 1993 year classes pass through the fishery.

2.2.7 Predictions of catch and biomass

2.2.7.1 Short-term prediction

As indicated above, the results of the assessment are not considered sufficiently precise to be used in short term predictions.

2.2.7.2 Medium-term prediction model and input data

A Ricker stock recruitment relationship ($R = a S \text{ EXP}[-bS]$) was fitted to the spawning stock biomass and recruitment for the 1961 to 1994 year classes by minimizing the sum of squares of the ln observed recruitment minus the ln predicted recruitment. The parameters estimated were $a = 0.874$ and $b = 0.00001874$.

There was insufficient time to run medium term projections.

2.2.7.3 Biological reference points

The stock-recruitment scatter plot (Figures 2.2.11 and 2.2.12) was examined to identify biomass thresholds below which the recruitment appears to decline. Similar to last year's analysis, there are no clear breaking point where the probability of average or above average year-class is decreased. Last year, the Working Group observed that no strong year class have been produced at SSB's lower than 70 000t, but this has changed now with the 1993 year class being produced by a spawning stock biomass of about 33 000t.

The Ricker stock recruitment relationship was used (the curve shown in Figure 2.2.12), in combination with yield per recruit predictions to make equilibrium yield calculations. For the Ricker curve, an equilibrium spawning stock biomass is calculated for each fishing mortality from the S/R ratio from the Y/R calculations using:

$$SSB = LN (a * S/R) / b,$$

and the equilibrium recruits are simply:

$$SSB/(S/R).$$

The yield per recruit calculations used recent values for weights at age (1991-1996), maturity (1991-1996) and exploitation pattern (1991-1995, 1996 excluded because less precisely estimated). The various equilibrium curves and biological reference points derived from this analysis are presented in Figure 2.2.13. The Working Group considered this approach promising, but concluded that further work and reflection on the input data were necessary before these reference points could be used to formulate advice. It would be particularly important to refine the estimates of maturity, and better quantify the relationship between the quantity and the quality of spawners and the recruitment success.

Although it was not possible to identify F_{MSY} and B_{MSY} , the Working Group suggests that F_{MED} be used as a preliminary estimate of a fishing mortality not to be exceeded. F_{MED} was calculated (see below) to be equal to 0.37.

2.2.7.4 Long-term prediction

The input data for the yield-per-recruit calculations (long-term predictions) are given in Table 2.2.7.4.1. The long term (1961-1996) exploitation pattern, the mean weight-at-age the average for 1978 to 1996 and the average maturity at age for the years 1983 to 1996 were used as input.

The output from the yield-per-recruit calculations is shown in Table 2.2.7.4.2. and in Figure 2.2.14. $F_{0.1}$ was calculated as 0.14 and F_{max} as 0.31. The present average fishing mortality in 1996 of 0.79 is substantially higher than these reference points and also higher than $F_{med} = 0.37$ (Figure 2.2.11).

2.2.8 Management considerations

In 1996, the Working Group estimated that the new management system proposed by the Faroese government could reduce the fishing mortality on cod in 1996 by a maximum of about 23% if all the factors relating nominal fishing effort to fishing mortality were the same in 1996 as in 1995 except for the number of days fished. The Working Group expected that it was highly unlikely, however, that all factors would remain the same, and it speculated that the decrease in fishing mortality would probably be less than 23%, or that perhaps fishing mortality would not decrease at all. The current assessment suggests that the fishing mortality more than doubled from 1995 to 1996, as did the catch.

There are many possible reasons to explain the discrepancy between the expected result of limiting the number of fishing days, and the estimated one. The fishing mortality is generally considered as being the product of the nominal fishing effort exerted multiplied by a factor, the catchability coefficient. As indicated earlier, fishing day is an imprecise measure of the actual nominal fishing effort applied, and it leaves considerable scope for changes, for example in the number of hours fished, or the amount of gear fished. The success of fishing is also related to atmospheric and hydrological conditions and to season. Therefore, by having the possibility to choose when to fish, one might predominantly fish during those days when the success is expected to be the greatest, and thus increase the efficiency of the fishing effort used. Thirdly, it is expected that the availability of fish varies from year to year, and therefore, a given amount of fishing effort will capture more fish when the availability is higher than normal. Evidence from the surveys suggests that cod may have been more available from 1995 to 1997, and this may have affected the commercial fishery as well. The reported poor success of the jiggers in 1997 may be the result of an opposite phenomenon where the catchability may have decreased. Alternatively, it may be the result of the low abundance of those age classes predominantly fished by that gear category.

In order to evaluate the fishing mortality that could be generated in the 1997/1998 fishing year from the present number of fishing days allocated to each fishing fleets, the partial fishing mortalities by age and year were

calculated for each fleet from the catch at age ratios for 1985 to 1995. The values for 1996 were not included in the analysis because of the lesser reliability of the fishing mortality estimate for that year. The partial F's were divided by each fleet's yearly fishing effort to obtain estimates of the catchability coefficient by age, year and fleet. These catchability coefficients represent the variability observed in the period covered and it is assumed that the same variability will be observed in the future. Therefore, knowing the number of fishing days allocated, it is possible to estimate the fishing mortality in a given year by multiplying the number of days allocated by each catchability, adding up the results across fleets and then calculating the frequency distribution of the resulting F.

Figure 2.2.15 shows the average age-specific catchabilities for all fleets covered, Figure 2.2.16 shows the average catchability and standard deviations for each fleet, while Figure 2.2.17 shows the trends in each fleet's catchability over time. Figure 2.2.18 shows the relationships at age between partial fishing mortalities and fishing effort. Few of the relationships are good, suggesting that the amount of fishing effort in days fished is an imprecise measure of the fishing mortality exerted. Figure 2.2.19 shows the partial fishing mortalities at age for each year by fleet for 1985 to 1990 and 1991 to 1996, while Figure 2.2.20 shows the average partial F at age by fleets for 1991 to 1995.

The longliners less than 100 feet, the jiggers and the single trawlers less than 400HP have collectively been allocated 9320 fishing days, because they have the flexibility to change from one type of fishing to the other. The longliners are considered twice as efficient as the jiggers (this is supported by the catchability analysis (Table 2.2.8.1)), and if they decide to fish as jiggers rather than longliners, they could double their number of days fished. In principle, the ST < 400 could also double their number of days allocated by electing to fish as jiggers.

The number allocated to each fleet category are given in the table below:

Gear	Trial allocation	Optional change
LL<100	9320	There are 9320 days to be shared/chosen to be fished either by longlining (<100), jigging or trawling (<400hp)
ST<400	0	There are 9320 days to be shared/chosen to be fished either by longlining (<100), jigging or trawling (<400hp)
ST400-1000	0	No effort limitation, assumed to catch less than 4% cod.
ST>1000	0	No effort limitation, assumed to catch less than 4% cod.
PT400-1000	3055	
PT>1000	5170	
LL>100	3040	
OPEN	22000	
JIGGERS		There are 9320 days to be shared/chosen to be fished either by longlining (<100), jigging or trawling (<400hp)

The probability density function of the potential fishing mortalities in 1998 given the allocated number of days to each fleet is given in Figure 2.2.21. A few combination of unusually high catchabilities resulted in potential F estimates well in excess of $F=2.0$. Although, not impossible, such high values are unlikely, and the upper limit of the fishing mortality was constrained to be less than about $F=1.8$. The fishing mortality referred to so far do not include the partial F exerted by the ST 400-1000 and ST > 1000 that have not been allocated cod fishing days. These two fleets should be expected to exert at least a fishing mortality of 0.04. Therefore, in examining table 2.2.8.1 a fishing mortality of 0.04 should be added to the fishing mortality columns to reflect the activities of these two fleets. The results show that there is an approximately 80% probability that the fishing mortality in 1998 will be equal to or less than about $F=0.64$ (Table 2.2.8.1). If the allocations to all fleets are cut by half, there is an approximate 80 % probability that the fishing mortality will be equal to or less than 0.30.

In addition to the effort control, the fleets are supposed to be constrained to a pre-agreed species composition in the catch as indicated in the table below.

Table 2.2.8.2. Proportion of cod, haddock, saithe and redfish in the catches by fleets as stated in the law for fishing days.

Groups of fleets	Fleet	Cod	Haddock	Saithe	Redfish
Group 1	Single trawlers	4.0	1.75	13.0	90.5
Group 2	Pair trawlers	21.0	10.25	69.0	8.5
Group 3	Longliners > 100 GRT	23.0	28.0		
Group 4	Longliners and jiggers > 15 GRT	31.0	34.5	11.5	0.5
Group 5	Longliners and jiggers < 15 GRT	20.0	23.5	6.0	
Group 6	Others	1.0	2.0	0.5	0.5
		100	100	100	100

These restrictions do not take into account that several of these fleets are in fact involved in a multispecies fishery and that the actual species composition in the water is unlikely to be exactly the same as in the regulation. Therefore, if the regulation is implemented somewhere else than at sea, it could result in discarding and misreporting, thus jeopardizing one of the eventual potential benefits of an effort management system, an improvement in the quality of the information collected from the fisheries.

Management systems based on effort controls are expected to lead to overcapitalisation in the fishing fleets because fishing captains will want to maximise the catch they can harvest with the fishing effort allocation they have received. In the medium to long term, this process will lead to increased fishing efficiency of the fleets and it will be necessary to decrease the total number of fishing days available to be allocated in order not to exert excessive fishing mortality. In extreme cases, effort controls can lead to the fishery being open only for a few days per year.

In order to constrain fishing mortality within reasonable limits, it will therefore be necessary to adjust the number of day periodically. For this purpose, there is a need for a mechanism to monitor changes in efficiency, and detailed information on the activities of the fleets, on the physical characteristics of the boats and their equipment should therefore be collected.

2.2.9 Comments on the assessment

The fishing mortality estimated for 1996 in the current assessment is relatively high. This could be the result of the 1995 catches being in reality higher than estimated in the assessment, in other words the magnitude of misreporting in 1995 may have been greater than estimated in the assessment.

ACFM, in October 1995 considered the increase in the 1995 survey index of the stock size to be an outlier. The analyses reported here support this conclusion and suggest that the 1996 survey index should also be considered an outlier. The assessment is based on two indices of stock size derived from the commercial fishery which may have been affected by management measures and technological changes.

The assessment of the Faroe Plateau cod presented in this report indicate that the stock size has increased substantially from its previous very low level. Some of this increase can be attributed to the average 1992 year-class and the above average 1993 year-class, but the current assessment also shows several other year-classes as being more abundant than in the previous assessment. It is therefore possible that the increase is only apparent, perhaps as a result of increased availability. If this were the case, the existing fishing effort could exert very high fishing mortality.

Table 2.2.1.1

Faroe Plateau (Sub-division Vb1) COD. Nominal catches (tonnes) by countries, 1986-1996,
as officially reported to ICES.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996 ¹⁾
Denmark	8	30	10	-	-	-	-	-	-	-	-
Faroe Islands	34,492	21,303	22,272	20,535	12,232	8,203	5,938	5,744	8,724 ¹⁾	19,079 ⁶⁾	39,403
France ¹⁾	4	17	17	-	-	-	318 ³⁾	1 ³⁾	-	-	3 ⁴⁾
Germany	8	12	5	7	24	16	12	+	2 ³⁾	2	+
Norway	83	21	163	285	124	89	39	61 ¹⁾	36 ¹⁾	38 ¹⁾	570
UK (Engl. and Wales)	-	8	-	-	-	1	79	186	56	43	-
UK (Scotland) ²⁾	-	-	-	-	-	-	-	-	-	-	-
United Kingdom	-	-	-	-	-	-	-	-	-	551 ⁵⁾	508
Total	34,595	21,391	22,467	20,827	12,380	8,309	6,386	5,992	8,818	19,713 ⁶⁾	40,484

¹⁾ Preliminary

¹⁾ Quantity unknown 1989-1991 and 1994.

²⁾ Catches included in Sub-division Vb2

³⁾ Reported as Vb.

⁴⁾ Reported to Faroese Coastal Guard Service

⁵⁾ Reported as Vb2

⁶⁾ Updated in 1997

Table 2.2.1.2

Nominal catch (tonnes) of COD in sub-division Vb1 (Faroe Plateau) 1986-1996, as used in the assessment.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995 ¹⁾	1996 ¹⁾
Officially reported	34,595	21,391	22,467	20,827	12,380	8,309	6,386	5,992	8,818	19,713 ¹⁾	40,484
Faroe 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						
Total used in the assessment	34,595	21,391	23,182	22,068	13,487	8,660	6,540	5,992	8,818	23,043 ¹⁾	40,484

¹⁾ Preliminary

¹⁾ Updated in 1997. The 1995 assessment was based on 19,807 (off. rep.) and 23,137 (total).

Table 2.2.1.3. Catch, tonnes landed weight.

Year	Open boats	Longliners < 100 GRT	Singletrawl < 400 HP	Gill nett	Jiggers 400-1000HP	Singletrawl > 1000 HP	Pairtrawl < 1000 HP	Pairtrawl > 1000 HP	Longliners > 100 GRT	Industrial trawlers	Others	Total
1985	5650	9650	2372	202	1515	2787	3979	4367	1999	2643	54	35420
1986	2945	4697	1594	409	907	1930	2629	9203	4618	1590	137	31051
1987	2148	3209	1355	116	631	1445	1726	5631	3139	2146	112	21689
1988	584	3029	1072	564	1636	1612	1494	5542	3426	2788	135	21915
1989	932	6006	1174	654	1911	1179	1142	2185	1728	3674	148	20739
1990	472	4228	577	171	978	442	512	845	1247	2328	78	11903
1991	335	2477	554	160	623	262	366	652	1016	1349	44	7846
1992	136	1352	360	1	366	116	186	623	1079	697	257	5195
1993	109	792	763	0	444	204	179	704	1077	624	40	4956
1994	243	1032	764	41	1462	309	409	633	1811	1045	39	7791
1995	728	3093	1118	53	4289	713	817	1108	2122	3180	10	17232
1996	1302	6823	1503	93	6934	1226	636	2871	6577	7311	66	35373

Table 2.2.1.4 The Faroese catches (nominal weight) of Faroe Plateau cod 1985-1996 in Vb1 by percent for different fleet categories.

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Open boats	16	9	10	3	4	4	4	3	2	3	4	4
Longliners < 10	27	15	15	14	29	36	32	26	16	13	18	19
Singletrawl < 40	7	5	6	5	6	5	7	7	15	10	6	4
Tangle nett	1	1	1	3	3	1	2	0	0	1	0	0
Jiggers	4	3	3	8	9	8	8	7	9	19	25	20
Singletrawl 400	8	6	7	7	6	4	3	2	4	3	4	3
Singletrawl > 10	11	8	8	7	6	4	5	4	4	5	5	2
Pairtrawl < 100	12	30	26	25	11	7	8	12	14	8	6	8
Pairtrawl > 100	6	15	14	16	8	10	13	21	22	24	12	19
Longliners > 10	7	5	10	13	18	20	17	13	13	14	18	21
Industrial trawl	0	0	1	1	1	1	1	5	1	1	0	0
Others	1	1	0	0	0	0	0	0	0	0	0	0
Total Faroese t	39,422	34,492	21,303	22,987	21,764	13,322	8,554	6,092	5,744	8,724	22,409	39,403

Table 2.2.2.1 Catch in numbers at age for Faroe Plateau cod for each fleet in 1996.

Numbers are in thousands and the catch is in tonnes, round weight.

Fleet Age	Open boats	LL <100 GRT	S. trawl. <400 HP	Jiggers	S. trawl. 400-999 HP	S. trawl. >1000 HP	P. trawl. <1000 HP	P. trawl. >1000 HP	LL >100 GRT	Others	Total Far. fleets	Foreign fleets	Total
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	0	0	0	0	0	0	0	0	2	0	2
2	26	192	30	19	4	2	9	26	23	3	332	19	352
3	211	1,138	266	1,143	125	76	324	836	746	26	4,891	281	5,172
4	128	767	154	1,171	147	79	354	819	728	18	4,365	251	4,615
5	41	216	45	334	66	34	146	282	292	5	1,460	84	1,544
6	76	363	78	228	32	17	69	175	400	6	1,446	83	1,529
7	31	149	29	100	10	5	21	42	175	2	564	32	597
8	9	41	9	23	1	0	1	1	53	1	139	8	147
9	20	96	21	36	4	2	10	17	121	1	329	19	347
10	2	7	2	1	0	0	1	3	14	0	30	2	32
11	1	2	1	0	0	0	0	0	6	0	9	1	10
12	0	1	0	0	0	0	0	0	2	0	4	0	4
13	0	0	0	0	0	0	0	0	1	0	1	0	1
14	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	1	0	1
Tot.num.	546	2,973	636	3,053	389	217	935	2,200	2,560	62	13,573	780	14,353
Catch, t	1,446	7,574	1,669	7,698	1,361	706	3,188	7,300	8,062	209	39,210	1,274	40,484

Others include gillnetters, pelagic trawl and longlining for Atlantic salmon and Atlantic halibut

Table 2.2.2.2. Samples of length, otoliths and individual weight of Faroe Plateau cod.

Fleet	Size	Samples	Length	Otoliths	Weight
Longliners	<100 GRT	189	21,403	2,750	1,560
Longliners	>100 GRT	88	15,870	2,347	1,058
Jiggers		85	11,695	1,386	1,172
Sing. trawlers	<400 HP	8	1,624	240	240
Sing. trawlers	400-1000 HP	3	534	160	60
Sing. trawlers	>1000 HP	2	327	0	0
Pair trawlers	<1000 HP	33	6,295	1,351	759
Pair trawlers	>1000 HP	41	7,038	1,294	906
Total		449	64,786	9,528	5,755

Table 2.2.2.3

Run title : Cod FaroePlateau Vb1 (run: XSAPET03/X03)

At 3-May-97 17:22:20

Table 1	Catch numbers at age			Numbers*10**-3		
YEAR,	1961,	1962,	1963,	1964,	1965,	1966,
AGE						
2,	3093,	4424,	4110,	2033,	852,	1337,
3,	2686,	2500,	3958,	3021,	3230,	970,
4,	1331,	1255,	1280,	2300,	2564,	2080,
5,	1066,	855,	662,	630,	1416,	1339,
6,	232,	481,	284,	350,	363,	606,
7,	372,	93,	204,	158,	155,	197,
8,	78,	94,	48,	79,	48,	104,
9,	29,	22,	30,	41,	63,	33,
+gp,	0,	0,	0,	0,	0,	0,
TOTALNUM,	8887,	9724,	10576,	8612,	8691,	6666,
TONSLAND,	21598,	20967,	22215,	21078,	24212,	20418,
SOPCOF %,	102,	101,	102,	100,	100,	100,

Table 1	Catch numbers at age			Numbers*10**-3						
YEAR,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE										
2,	1609,	1529,	878,	402,	328,	875,	723,	2161,	2584,	1497,
3,	2690,	3322,	3106,	1163,	757,	1176,	3124,	1266,	5689,	4158,
4,	860,	2663,	3300,	2172,	821,	810,	1590,	1811,	2157,	3799,
5,	1706,	945,	1538,	1685,	1287,	596,	707,	934,	2211,	1380,
6,	847,	1226,	477,	752,	1451,	1021,	384,	563,	813,	1427,
7,	309,	452,	713,	244,	510,	596,	312,	452,	295,	617,
8,	64,	105,	203,	300,	114,	154,	227,	149,	190,	273,
9,	27,	11,	92,	44,	179,	25,	120,	141,	118,	120,
+gp,	0,	0,	0,	0,	0,	0,	97,	91,	150,	186,
TOTALNUM,	8112,	10253,	10307,	6762,	5447,	5253,	7284,	7568,	14207,	13457,
TONSLAND,	23562,	29930,	32371,	24183,	23010,	18727,	22228,	24581,	36775,	39799,
SOPCOF %,	100,	100,	100,	100,	100,	100,	100,	106,	94,	93,

Table 2.2.2.3 (Continued)

Run title : Cod FaroePlateau Vb1 (run: XSAPET03/X03)

At 3-May-97 17:22:20

Table 1	Catch numbers at age				Numbers*10**-3					
YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
2,	425,	555,	575,	1129,	646,	1139,	2149,	4396,	998,	210,
3,	3282,	1219,	1732,	2263,	4137,	1965,	5771,	5234,	9484,	3586,
4,	6844,	2643,	1673,	1461,	1981,	3073,	2760,	3487,	3795,	8462,
5,	3718,	3216,	1601,	895,	947,	1286,	2746,	1461,	1669,	2373,
6,	788,	1041,	1906,	807,	582,	471,	1204,	912,	770,	907,
7,	1160,	268,	493,	832,	487,	314,	510,	314,	872,	236,
8,	239,	201,	134,	339,	527,	169,	157,	82,	309,	147,
9,	134,	66,	87,	42,	123,	254,	104,	34,	65,	47,
+gp,	9,	56,	38,	18,	55,	122,	102,	66,	80,	38,
TOTALNUM,	16599,	9265,	8239,	7786,	9485,	8793,	15503,	15986,	18042,	16006,
TONSLAND,	34927,	26585,	23112,	20513,	22963,	21489,	38133,	36979,	39484,	34595,
SOPCOF %,	93,	100,	98,	106,	104,	100,	97,	97,	95,	96,

Table 1	Catch numbers at age				Numbers*10**-3					
YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
2,	257,	509,	2237,	243,	190,	209,	118,	559,	2614,	352,
3,	1362,	2122,	2151,	2849,	446,	465,	787,	768,	2716,	5172,
4,	2611,	1945,	2187,	1481,	2130,	476,	591,	1035,	2008,	4615,
5,	3083,	1484,	1121,	852,	616,	932,	218,	519,	1012,	1544,
6,	812,	2178,	1026,	404,	300,	300,	323,	122,	465,	1529,
7,	224,	492,	997,	294,	141,	135,	94,	172,	118,	597,
8,	68,	168,	220,	291,	92,	55,	32,	38,	175,	147,
9,	69,	33,	61,	50,	52,	30,	22,	22,	44,	347,
+gp,	26,	25,	9,	26,	24,	35,	25,	16,	49,	47,
TOTALNUM,	8512,	8956,	10009,	6490,	3991,	2637,	2210,	3251,	9201,	14350,
TONSLAND,	21391,	23182,	22068,	13487,	8660,	6540,	5992,	8818,	23043,	40484,
SOPCOF %,	96,	101,	98,	99,	106,	102,	102,	101,	101,	99,

Table 2.2.3.1. Mean weight at age (kg) for Faroe Plateau cod from 1961 to 1996.

Year\Age	2	3	4	5	6	7	8	9	10
1961	1.06	1.89	2.92	4.07	5.30	6.58	7.85	9.08	10.27
1962	1.06	1.89	2.92	4.07	5.30	6.58	7.85	9.08	10.27
1963	1.06	1.89	2.92	4.07	5.30	6.58	7.85	9.08	10.27
1964	1.06	1.89	2.92	4.07	5.30	6.58	7.85	9.08	10.27
1965	1.06	1.89	2.92	4.07	5.30	6.58	7.85	9.08	10.27
1966	1.06	1.89	2.92	4.07	5.30	6.58	7.85	9.08	10.27
1967	1.06	1.89	2.92	4.07	5.30	6.58	7.85	9.08	10.27
1968	1.06	1.89	2.92	4.07	5.30	6.58	7.85	9.08	10.27
1969	1.06	1.89	2.92	4.07	5.30	6.58	7.85	9.08	10.27
1970	1.06	1.89	2.92	4.07	5.30	6.58	7.85	9.08	10.27
1971	1.06	1.89	2.92	4.07	5.30	6.58	7.85	9.08	10.27
1972	1.06	1.89	2.92	4.07	5.30	6.58	7.85	9.08	10.27
1973	1.06	1.89	2.92	4.07	5.30	6.58	7.85	9.08	10.27
1974	1.06	1.89	2.92	4.07	5.30	6.58	7.85	9.08	10.27
1975	1.06	1.89	2.92	4.07	5.30	6.58	7.85	9.08	10.27
1976	1.06	1.89	2.92	4.07	5.30	6.58	7.85	9.08	10.27
1977	0.68	1.17	1.87	2.67	3.59	4.77	5.92	5.45	6.00
1978	1.11	1.39	2.14	3.13	4.36	5.93	6.35	8.72	12.23
1979	0.90	1.68	2.21	3.05	3.64	4.72	7.27	8.37	13.04
1980	0.93	1.43	2.22	3.11	3.54	4.39	6.10	7.60	9.67
1981	1.08	1.47	2.18	3.21	3.70	4.24	4.43	6.69	10.00
1982	1.28	1.41	2.14	3.11	4.01	5.44	5.56	5.22	6.71
1983	1.34	1.95	2.40	3.11	4.11	5.02	5.60	8.01	8.03
1984	1.20	1.89	2.98	3.68	4.47	5.49	6.47	6.63	10.98
1985	0.91	1.66	2.63	3.40	3.75	4.22	4.74	6.51	10.98
1986	1.10	1.46	2.05	2.94	3.79	4.90	5.89	9.67	8.82
1987	1.09	1.52	2.16	2.77	3.91	5.46	6.34	8.51	9.81
1988	1.06	1.75	2.30	2.91	3.11	3.98	4.90	7.09	8.29
1989	1.01	1.60	2.18	2.93	3.47	3.75	4.68	6.14	9.16
1990	0.95	1.30	1.96	2.53	3.27	4.65	4.76	6.70	8.69
1991	0.78	1.27	1.57	2.52	3.19	4.09	5.66	5.97	8.15
1992	0.99	1.36	1.78	2.31	3.48	4.55	6.28	7.62	9.73
1993	1.16	1.70	2.42	3.13	3.72	4.97	6.16	7.61	9.59
1994	1.19	1.84	2.61	3.65	4.58	4.98	7.15	8.56	8.80
1995	1.22	1.99	2.62	3.93	5.18	6.08	6.24	7.78	8.63
1996	1.02	1.74	2.75	3.80	4.46	4.98	5.27	5.59	7.48

Table 2.2.4.1. Proportion mature of Faroe Plateau cod 1961-1996.

Year\Age	2	3	4	5	6	7	8	9	10
1961	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1962	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1963	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1964	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1965	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1966	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1967	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1968	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1969	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1970	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1971	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1972	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1973	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1974	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1975	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1976	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1977	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1978	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1979	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1980	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1981	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1982	0.17	0.64	0.87	0.95	1.00	1.00	1.00	1.00	1.00
1983	0.63	0.71	0.93	0.94	1.00	1.00	1.00	1.00	1.00
1984	0.40	0.96	0.98	0.97	1.00	1.00	1.00	1.00	1.00
1985	0.00	0.50	0.96	0.96	1.00	1.00	1.00	1.00	1.00
1986	0.00	0.38	0.93	1.00	1.00	0.96	0.94	1.00	1.00
1987	0.00	0.67	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1988	0.06	0.72	0.90	0.97	1.00	1.00	1.00	1.00	1.00
1989	0.05	0.54	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1990	0.00	0.68	0.90	0.99	0.96	0.98	1.00	1.00	1.00
1991	0.00	0.72	0.86	1.00	1.00	1.00	1.00	1.00	1.00
1992	0.06	0.50	0.82	0.98	1.00	1.00	1.00	1.00	1.00
1993	0.25	0.73	0.78	0.91	0.99	1.00	1.00	1.00	1.00
1994	0.72	0.89	0.98	0.99	1.00	0.98	1.00	1.00	1.00
1995	0.21	0.53	0.55	0.74	0.97	1.00	1.00	1.00	1.00
1996	0.04	0.44	0.75	0.87	0.94	1.00	1.00	1.00	1.00

Table 2.2.6.1.1. CPUE for ages 2 to 8 from the research vessel (shifted back by 3 months).

Year	Effort\Age	2	3	4	5	6	7	8
1982	100	25.92	17.84	14.41	5.28	1.46	0.51	0.08
1983	100	21.84	16.19	5.08	3.29	1.31	0.13	0.01
1984	100	42.96	15.46	6.21	1.31	1.57	0.6	0.01
1985	100	26.69	94.23	26.49	11.13	5.45	3.52	1.07
1986	100	15.39	34.48	45.95	7.22	0.91	1.15	0.1
1987	100	12.65	16.62	12.84	14.27	2.75	0.72	0.18
1988	100	6.02	10.06	8.24	4.05	6.61	0.66	0.09
1989	100	6.38	15.22	13.78	4.36	5.45	3.7	0.62
1990	100	3.52	12.22	3.15	1.5	0.51	0.12	0.23
1991	100	2.1	4.72	18.1	3.94	1.26	0.65	0.13
1992	100	4.48	2.32	1.63	3.29	1.18	0.44	0.12
1993	100	3.74	13.74	7.83	2.11	3.05	0.32	0.01
1994	100	9.77	20.89	29.13	27.54	7.55	9.04	1.27
1995	100	52.93	68.85	37.41	28.04	8.14	1.54	3.16
1996	100	13.98	84.47	35.21	4.76	3.23	0.8	0.22

Table 2.2.6.1.2. CPUE for ages 2 to 9 for longliners < 100 GRT.

Year	Effort\Age	2	3	4	5	6	7	8	9
1985	7530	550	3110	799	375	181	282	73	17
1986	6622	47	646	1239	352	148	43	26	6
1987	6669	166	223	427	528	130	29	11	11
1988	8680	315	532	236	173	273	67	23	5
1989	12774	1466	931	672	303	270	216	34	4
1990	14440	181	1302	481	317	119	86	85	14
1991	14780	152	255	984	185	79	28	15	10
1992	10523	109	198	164	230	50	22	9	6
1993	7326	46	178	85	28	53	11	5	3
1994	7443	190	166	140	47	12	16	3	2
1995	9582	759	475	169	110	58	16	24	5
1996	12546	159	1118	798	231	364	151	44	104

Table 2.2.6.1.3. CPUE for ages 2 to 9 single trawlers < 400 HP.

Year	Effort\Age	2	3	4	5	6	7	8	9
1985	1987	96	1120	257	82	33	27	11	1
1986	1477	37	398	466	68	16	4	3	1
1987	1259	28	266	295	214	28	4	1	1
1988	1196	36	188	144	71	91	14	4	0
1989	1376	105	221	175	66	49	57	11	4
1990	1144	1	274	141	29	10	6	4	0
1991	1106	3	41	197	54	22	8	4	2
1992	1148	18	33	27	59	22	9	4	1
1993	1977	29	169	90	31	42	10	4	3
1994	1600	48	73	101	54	10	15	3	1
1995	1924	28	153	175	89	33	6	9	3
1996	1424	33	262	178	50	78	31	9	22

Table 2.2.6.1.4. CPUE for ages 2 to 9 single trawlers 400-1000 HP.

Year	Effort\Age	2	3	4	5	6	7	8	9
1985	1969	29	665	339	118	57	41	13	2
1986	1133	5	239	658	141	38	9	6	2
1987	1463	12	91	257	245	36	10	3	3
1988	2175	23	169	142	113	165	38	11	2
1989	1952	122	171	156	58	51	59	11	4
1990	1853	2	112	55	19	15	10	10	2
1991	1013	0	1	52	27	15	8	3	3
1992	465	4	9	10	18	6	3	1	1
1993	963	4	44	39	11	11	3	1	1
1994	636	6	20	18	15	4	5	1	1
1995	1302	17	40	70	47	22	5	5	1
1996	1253	3	105	154	81	40	12	1	5

Table 2.2.6.1.5. CPUE for ages 2 to 9 single trawlers 400-1000 HP.

Year	Effort\Age	2	3	4	5	6	7	8	9
1985	5296	26	706	520	230	91	62	25	9
1986	5232	2	258	813	206	62	17	10	5
1987	4181	9	41	154	275	92	27	6	7
1988	4481	16	105	92	98	152	47	13	4
1989	4572	8	44	90	82	75	75	18	5
1990	3601	10	120	63	36	17	12	12	2
1991	3644	0	8	51	28	16	9	6	2
1992	3580	7	15	15	29	10	4	2	1
1993	3547	1	9	16	7	10	4	1	1
1994	3500	9	20	28	34	9	12	3	1
1995	3789	16	44	74	54	27	6	7	2
1996	3526	2	55	80	42	21	6	1	2

Table 2.2.6.1.6. CPUE for ages 2 to 9 for pair trawlers 400-1000 HP.

Year	Effort\Age	2	3	4	5	6	7	8	9
1985	4906	61	802	424	201	94	120	43	12
1986	5953	20	848	2667	747	265	54	37	15
1987	5575	46	383	755	927	221	54	16	21
1988	5736	52	558	698	467	663	108	31	4
1989	4987	49	139	265	148	122	114	30	8
1990	5273	1	77	92	68	35	28	24	4
1991	5626	0	13	92	53	29	15	11	6
1992	3832	2	16	33	97	38	17	6	3
1993	2771	4	52	60	26	38	15	4	3
1994	1962	17	42	44	50	15	19	4	3
1995	2388	26	62	109	72	34	8	8	2
1996	3207	5	217	360	199	96	29	3	11

Table 2.2.6.1.7. CPUE for ages 2 to 9 for pair trawlers > 1000 HP.

Year	Effort\Age	2	3	4	5	6	7	8	9
1985	3064	14	370	218	98	39	47	17	6
1986	4336	17	267	1001	388	166	44	27	8
1987	5420	7	117	319	484	173	46	10	8
1988	5973	9	217	263	247	377	91	34	6
1989	5111	10	73	152	119	104	99	25	7
1990	7424	2	139	149	92	47	29	29	5
1991	7673	1	21	134	82	45	25	17	8
1992	6853	2	29	55	158	64	29	12	5
1993	5953	4	79	106	48	64	24	7	5
1994	5302	28	91	123	151	43	53	12	8
1995	6069	42	115	191	142	71	16	19	6
1996	6551	21	692	843	358	196	49	4	21

Table 2.2.6.1.8. CPUE for ages 2 to 9 for longliners > 100 GRT.

Year	Effort\Age	2	3	4	5	6	7	8	9
1985	2740	33	468	231	124	69	103	39	9
1986	2085	2	95	300	128	67	20	14	4
1987	2444	5	25	132	232	117	56	21	18
1988	2831	27	191	183	173	229	69	35	10
1989	3220	314	306	290	163	192	189	54	16
1990	3367	33	344	179	133	88	77	77	14
1991	3442	14	47	289	98	52	30	23	13
1992	2829	19	47	47	89	33	16	8	5
1993	1754	3	78	76	26	47	12	6	3
1994	2334	105	134	67	42	13	24	9	5
1995	3648	151	384	221	152	90	28	59	15
1996	4126	17	683	719	310	413	190	60	134

Table 2.2.6.1.10

Lowestoft VPA Version 3.1

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Extended Survivors Analysis

Cod FaroePlateau Vb1 (run: XSAPET03/X03)

CPUE data from file /users/fish/ifad/ifapwork/nwwg/cod_farp/FLEET.X03

Catch data for 36 years. 1961 to 1996. Ages 2 to 10.

Fleet,	First, Last, First, Last, Alpha, Beta
	year, year, age, age
LLGT: LONGLINERS > 1,	1985, 1996, 3, 9, .000, 1.000
ST4AD: TRAWLERS 400-,	1985, 1996, 4, 9, .000, 1.000

Time series weights :

Tapered time weighting applied
Power = 3 over 20 years

Catchability analysis :

Catchability dependent on stock size for ages < 3

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

Catchability independent of age for ages >= 6

Terminal population estimation :

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

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

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

Prior weighting not applied

Tuning had not converged after 30 iterations

Total absolute residual between iterations
29 and 30 = .00052

Final year F values

Age	2,	3,	4,	5,	6,	7,	8,	9
Iteration 29,	.0302,	.1960,	.4431,	.4856,	1.3674,	1.4605,	1.7878,	2.3033
Iteration 30,	.0302,	.1960,	.4431,	.4856,	1.3675,	1.4606,	1.7880,	2.3035

Regression weights

,	.751,	.820,	.877,	.921,	.954,	.976,	.990,	.997,	1.000,	1.000
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Fishing mortalities

Age,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996
2,	.029,	.067,	.175,	.082,	.034,	.023,	.010,	.024,	.071,	.030
3,	.222,	.345,	.446,	.353,	.214,	.108,	.114,	.087,	.159,	.196
4,	.466,	.569,	.730,	.640,	.490,	.372,	.195,	.216,	.343,	.443
5,	.474,	.532,	.775,	.717,	.608,	.412,	.290,	.263,	.339,	.486
6,	.553,	.742,	.898,	.724,	.599,	.688,	.243,	.262,	.399,	1.367
7,	.432,	.791,	.954,	.711,	.603,	.600,	.476,	.197,	.436,	1.461
8,	.570,	.682,	1.073,	.842,	.504,	.501,	.272,	.358,	.316,	1.788
9,	.595,	.608,	.569,	.763,	.340,	.303,	.383,	.304,	.937,	2.303

Table 2.2.6.1.10 (Cont'd)

XSA population numbers (Thousands)

YEAR ,	2,	AGE 3,	4,	5,	6,	7,	8,	9,
1987 ,	1.01E+04,	7.56E+03,	7.74E+03,	9.02E+03,	2.11E+03,	7.06E+02,	1.73E+02,	1.70E+02,
1988 ,	8.63E+03,	8.04E+03,	4.96E+03,	3.98E+03,	4.60E+03,	9.95E+02,	3.75E+02,	8.00E+01,
1989 ,	1.54E+04,	6.61E+03,	4.66E+03,	2.30E+03,	1.91E+03,	1.79E+03,	3.70E+02,	1.55E+02,
1990 ,	3.40E+03,	1.06E+04,	3.46E+03,	1.84E+03,	8.67E+02,	6.38E+02,	5.65E+02,	1.04E+02,
1991 ,	6.34E+03,	2.56E+03,	6.08E+03,	1.50E+03,	7.36E+02,	3.44E+02,	2.57E+02,	1.99E+02,
1992 ,	1.01E+04,	5.02E+03,	1.69E+03,	3.05E+03,	6.67E+02,	3.31E+02,	1.54E+02,	1.27E+02,
1993 ,	1.26E+04,	8.07E+03,	3.69E+03,	9.56E+02,	1.65E+03,	2.74E+02,	1.49E+02,	7.64E+01,
1994 ,	2.55E+04,	1.02E+04,	5.89E+03,	2.48E+03,	5.85E+02,	1.06E+03,	1.40E+02,	9.28E+01,
1995 ,	4.21E+04,	2.04E+04,	7.64E+03,	3.89E+03,	1.56E+03,	3.69E+02,	7.14E+02,	7.99E+01,
1996 ,	1.31E+04,	3.21E+04,	1.42E+04,	4.44E+03,	2.27E+03,	8.59E+02,	1.95E+02,	4.26E+02,

Estimated population abundance at 1st Jan 1997

, .00E+00, 1.04E+04, 2.16E+04, 7.49E+03, 2.23E+03, 4.73E+02, 1.63E+02, 2.67E+01,

Taper weighted geometric mean of the VPA populations:

, 1.34E+04, 1.05E+04, 6.15E+03, 3.02E+03, 1.47E+03, 6.62E+02, 2.88E+02, 1.36E+02,

Standard error of the weighted Log(VPA populations) :

, .7040, .7197, .6313, .5891, .6055, .6087, .6000, .5804,

Log catchability residuals.

Fleet : LLGT: LONGLINERS > 1

Age ,	1985,	1986
3 ,	-.04,	-.39
4 ,	-.22,	-.30
5 ,	-.18,	-.06
6 ,	-.03,	-.11
7 ,	.47,	.07
8 ,	.57,	-.14
9 ,	.63,	-.32

Age ,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996
3 ,	-1.37,	.51,	1.09,	.65,	-.01,	-.53,	-.02,	-.01,	-.06,	-.05
4 ,	-.38,	.29,	.75,	.49,	.32,	-.08,	.02,	-.85,	-.30,	.17
5 ,	-.27,	.13,	.59,	.54,	.38,	-.32,	.03,	-.74,	-.32,	.21
6 ,	.07,	-.10,	.54,	.43,	-.01,	-.13,	-.40,	-.93,	-.36,	1.07
7 ,	.38,	.25,	.61,	.60,	.20,	-.19,	.13,	-.94,	-.07,	1.30
8 ,	.86,	.50,	.98,	.77,	.19,	-.16,	-.04,	.18,	-.03,	1.74
9 ,	.74,	.76,	.42,	.73,	-.20,	-.53,	-.02,	-.02,	1.05,	1.93

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

Age ,	3,	4,	5,	6,	7,	8,	9
Mean Log q,	-11.9370,	-11.1805,	-10.8691,	-10.4131,	-10.4131,	-10.4131,	-10.4131,
S.E(Log q),	.6019,	.4501,	.4104,	.5369,	.6149,	.7596,	.8568,

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
3,	1.00,	-.004,	11.94,	.61,	12,	.64,	-11.94,
4,	1.19,	-.704,	11.65,	.62,	12,	.55,	-11.18,
5,	1.29,	-1.026,	11.71,	.60,	12,	.53,	-10.87,
6,	.75,	1.174,	9.63,	.73,	12,	.40,	-10.41,
7,	.83,	.673,	9.55,	.65,	12,	.49,	-10.19,
8,	.98,	.073,	9.86,	.50,	12,	.61,	-9.96,
9,	.63,	1.353,	8.08,	.61,	12,	.44,	-9.97,

Table 2.2.6.1.10 (Cont'd)

Fleet : ST4AD: TRAWLERS 400-

Age	,	1985,	1986
3	,	No data	for this fleet at this age
4	,	.41,	1.02
5	,	.19,	.73
6	,	.53,	.35
7	,	.30,	.30
8	,	.22,	.04
9	,	-.12,	.02

Age	,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996
3	,	No data	for this fleet at this age								
4	,	.72,	.22,	.56,	-.18,	-.26,	.10,	-.13,	-.94,	-.50,	-.26
5	,	.38,	.05,	.15,	-.72,	.40,	-.03,	-.14,	-.39,	-.37,	.14
6	,	-.18,	.25,	.13,	-.32,	.39,	.39,	-.84,	-.39,	-.32,	.34
7	,	-.41,	.34,	.36,	-.43,	.52,	.36,	-.24,	-.79,	-.34,	.15
8	,	-.15,	.03,	.31,	-.25,	-.21,	-.02,	-.81,	-.30,	-1.05,	-.74
9	,	-.12,	-.17,	-.04,	-.20,	-.03,	.09,	-.10,	.09,	-.21,	.26

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

Age	,	4,	5,	6,	7,	8,	9
Mean Log q,		-11.1014,	-10.9567,	-10.8318,	-10.8318,	-10.8318,	-10.8318,
S.E(Log q),		.5435,	.3920,	.4335,	.4370,	.5254,	.1495,

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	
4,	.87,		.558,		10.78,		.67,	12,	.49,	-11.10,
5,	.81,		1.178,		10.38,		.81,	12,	.31,	-10.96,
6,	.93,		.291,		10.60,		.70,	12,	.43,	-10.83,
7,	1.00,		-.020,		10.86,		.67,	12,	.46,	-10.84,
8,	.99,		.051,		11.05,		.65,	12,	.45,	-11.12,
9,	.84,		2.848,		9.89,		.97,	12,	.09,	-10.87,

Table 2.2.6.1.10 (Cont'd)

Terminal year survivor and F summaries :

Age 2 Catchability dependent on age and year class strength

Year class = 1994

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
LLGT: LONGLINERS > 1,	1.,	.000,	.000,	.00,	0,	.000,	.000
ST4AD: TRAWLERS 400-,	1.,	.000,	.000,	.00,	0,	.000,	.000
P shrinkage mean ,	10504.,	.72,,,,				.885,	.030
F shrinkage mean ,	9598.,	2.00,,,,				.115,	.033

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
10396.,	.68,	9.25,	2,	13.659,	.030

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

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
LLGT: LONGLINERS > 1,	20618.,	.630,	.000,	.00,	1,	.892,	.205
ST4AD: TRAWLERS 400-,	1.,	.000,	.000,	.00,	0,	.000,	.000
F shrinkage mean ,	31890.,	2.00,,,,				.108,	.137

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
21609.,	.60,	.14,	2,	.238,	.196

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

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
LLGT: LONGLINERS > 1,	8251.,	.378,	.111,	.29,	2,	.657,	.410
ST4AD: TRAWLERS 400-,	5804.,	.569,	.000,	.00,	1,	.305,	.542
F shrinkage mean ,	10868.,	2.00,,,,				.038,	.325

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
7491.,	.31,	.11,	4,	.368,	.443

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

Year class = 1991

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
LLGT: LONGLINERS > 1,	2264.,	.289,	.160,	.56,	3,	.546,	.481
ST4AD: TRAWLERS 400-,	2167.,	.337,	.287,	.85,	2,	.433,	.498
F shrinkage mean ,	2975.,	2.00,,,,				.022,	.385

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
2235.,	.22,	.11,	6,	.525,	.486

Table 2.2.6.1.10 (Cont'd)

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

Year class = 1990

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Weights,	Scaled, Weights,	Estimated F
LLGT: LONGLINERS > 1,	470.,	.261,	.424,	1.63,	4,	.479,	1.372
ST4AD: TRAWLERS 400-,	409.,	.275,	.340,	1.24,	3,	.478,	1.478
F shrinkage mean ,	2494.,	2.00, , , ,				.043,	.441

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
473.,	.20,	.27,	8,	1.338,	1.367

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

Year class = 1989

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Weights,	Scaled, Weights,	Estimated F
LLGT: LONGLINERS > 1,	161.,	.250,	.389,	1.56,	5,	.430,	1.473
ST4AD: TRAWLERS 400-,	142.,	.243,	.135,	.55,	4,	.524,	1.567
F shrinkage mean ,	910.,	2.00, , , ,				.046,	.466

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
163.,	.19,	.22,	10,	1.163,	1.461

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

Year class = 1988

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Weights,	Scaled, Weights,	Estimated F
LLGT: LONGLINERS > 1,	31.,	.255,	.380,	1.49,	6,	.386,	1.673
ST4AD: TRAWLERS 400-,	18.,	.233,	.125,	.54,	5,	.545,	2.128
F shrinkage mean ,	276.,	2.00, , , ,				.069,	.393

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
27.,	.21,	.27,	12,	1.283,	1.788

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

Year class = 1987

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Weights,	Scaled, Weights,	Estimated F
LLGT: LONGLINERS > 1,	36.,	.258,	.367,	1.42,	7,	.256,	2.265
ST4AD: TRAWLERS 400-,	29.,	.192,	.240,	1.25,	6,	.665,	2.478
F shrinkage mean ,	152.,	2.00, , , ,				.079,	1.122

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
35.,	.21,	.22,	14,	1.013,	2.303

Table 2.2.6.1.11. CPUEs for various faroese fleets standardized to their own mean from 1985-1996. The indices in 1996 are divided by the 1985 indices and the average of the proportion shown.

Year	Open boats	Longliners < 100 GRT	Singletrawl < 400 HP	Singletrawl 400-1000HP	Singletrawl > 1000 HP	Pairtrawl < 1000 HP	Pairtrawl > 1000 HP	Longliners > 100 GRT
1985	6.73	3.08	1.61	2.02	2.90	1.48	1.41	1.22
1986	2.88	1.70	1.45	2.43	1.94	2.57	2.31	0.96
1987	1.71	1.16	1.45	1.41	1.59	1.68	1.25	1.11
1988	0.10	0.84	1.21	1.06	1.29	1.60	1.24	1.24
1989	0.11	1.13	1.15	0.86	0.96	0.73	0.73	1.44
1990	0.07	0.71	0.68	0.34	0.55	0.27	0.36	0.87
1991	0.05	0.40	0.67	0.37	0.39	0.19	0.29	0.49
1992	0.03	0.31	0.42	0.36	0.20	0.27	0.34	0.31
1993	0.03	0.26	0.52	0.30	0.19	0.42	0.39	0.45
1994	0.05	0.33	0.64	0.69	0.45	0.54	0.74	0.57
1995	0.10	0.78	0.78	0.78	0.83	0.77	0.76	1.10
1996	0.15	1.31	1.42	1.39	0.70	1.49	2.17	2.24
Ind96/Ind85	0.022	0.424	0.884	0.691	0.240	1.006	1.539	1.837
Average		proportion:		0.830				

Table 2.2.6.1.12

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Terminal Fs derived using XSA (With F shrinkage)

Table 8	Fishing mortality (F) at age												
YEAR	2	3	4	5	6	7	8	9	+gp	0 FBAR	3- 7	FBAR 4- 7	FBAR 5- 7
1961	0.3346	0.5141	0.4986	0.5737	0.4863	0.9566	0.8116	0.6715	0.6715		0.6059	0.6288	0.6722
1962	0.2701	0.4982	0.4838	0.7076	0.5569	0.3662	0.6826	0.5641	0.5641		0.5226	0.5287	0.5436
1963	0.2534	0.4138	0.5172	0.5124	0.5405	0.4879	0.3269	0.4806	0.4806		0.4944	0.5145	0.5136
1964	0.1086	0.2997	0.4523	0.5229	0.5659	0.6677	0.3531	0.5164	0.5164		0.5017	0.5522	0.5855
1965	0.1209	0.2518	0.4498	0.5622	0.6604	0.5305	0.4345	0.5318	0.5318		0.4909	0.5507	0.5844
1966	0.0829	0.1969	0.2552	0.4499	0.5016	0.968	0.852	0.6106	0.6106		0.4743	0.5437	0.6398
1967	0.0789	0.2389	0.2687	0.3442	0.5779	0.5203	1.0438	0.5556	0.5556		0.39	0.4278	0.4808
1968	0.101	0.2318	0.3949	0.5339	0.4472	0.7132	0.3331	0.4882	0.4882		0.4642	0.5223	0.5648
1969	0.1099	0.3063	0.3806	0.418	0.5709	0.5118	0.8457	0.5499	0.5499		0.4375	0.4703	0.5002
1970	0.053	0.2081	0.3654	0.3409	0.3709	0.6559	0.4208	0.4339	0.4339		0.3882	0.4333	0.4559
1971	0.0309	0.1337	0.2225	0.3845	0.5572	0.4651	0.7528	0.4801	0.4801		0.3526	0.4073	0.4689
1972	0.0464	0.1476	0.207	0.2497	0.6058	0.4687	0.2464	0.3578	0.3578		0.3358	0.3828	0.4414
1973	0.0657	0.2322	0.3048	0.2813	0.2526	0.3722	0.3259	0.3092	0.3092		0.2886	0.3027	0.302
1974	0.0816	0.1568	0.2046	0.2953	0.3797	0.533	0.3052	0.3457	0.3457		0.3139	0.3532	0.4027
1975	0.0775	0.3194	0.436	0.4134	0.4545	0.3504	0.4486	0.4235	0.4235		0.3947	0.4136	0.4061
1976	0.0933	0.1723	0.3666	0.5569	0.5168	0.762	0.643	0.5739	0.5739		0.4749	0.5506	0.6119
1977	0.0481	0.3037	0.475	0.7535	0.7336	1.1141	0.7778	0.7785	0.7785		0.676	0.769	0.867
1978	0.0591	0.1897	0.4293	0.4292	0.4853	0.5973	0.5677	0.5057	0.5057		0.4262	0.4853	0.5039
1979	0.043	0.2641	0.431	0.5054	0.4911	0.4484	0.6913	0.5175	0.5175		0.428	0.469	0.4816
1980	0.0545	0.2374	0.3731	0.434	0.5189	0.4126	0.6447	0.4803	0.4803		0.3952	0.4346	0.4552
1981	0.0522	0.2887	0.3376	0.4432	0.5649	0.6959	0.5027	0.5129	0.5129		0.4661	0.5104	0.568
1982	0.0581	0.222	0.3618	0.3834	0.4137	0.6938	0.5555	0.4853	0.4853		0.4149	0.4632	0.497
1983	0.0991	0.4621	0.556	0.6459	0.7641	1.1321	0.9455	0.817	0.817		0.7121	0.7745	0.8474
1984	0.1066	0.3708	0.5684	0.6555	0.4592	0.4548	0.5325	0.5384	0.5384		0.5017	0.5345	0.5232
1985	0.0651	0.3516	0.5068	0.5932	0.9067	1.1415	1.178	1.1418	1.1418		0.7	0.7871	0.8805
1986	0.0248	0.35	0.6145	0.7012	0.7712	0.8042	0.5778	0.5406	0.5406		0.6482	0.7228	0.7589
1987	0.0285	0.2221	0.4662	0.4744	0.5529	0.4317	0.5703	0.595	0.595		0.4295	0.4813	0.4863
1988	0.0674	0.3447	0.5687	0.5316	0.7418	0.7905	0.6824	0.6082	0.6082		0.5955	0.6582	0.688
1989	0.1751	0.446	0.7302	0.7748	0.8978	0.9543	1.0726	0.5692	0.5692		0.7606	0.8393	0.8756
1990	0.0824	0.3535	0.6399	0.7169	0.7239	0.7112	0.8423	0.7631	0.7631		0.629	0.6979	0.7173
1991	0.0337	0.2138	0.4897	0.6076	0.5991	0.6031	0.5044	0.3403	0.3403		0.5026	0.5749	0.6033
1992	0.0232	0.1081	0.372	0.412	0.6877	0.5996	0.5015	0.3028	0.3028		0.4359	0.5178	0.5664
1993	0.0104	0.1141	0.195	0.2905	0.2431	0.4757	0.2716	0.3829	0.3829		0.2637	0.3011	0.3364
1994	0.0245	0.0871	0.2158	0.2627	0.2619	0.1972	0.3577	0.3038	0.3038		0.2049	0.2344	0.2406
1995	0.0711	0.1591	0.3433	0.3392	0.3986	0.4365	0.316	0.9371	0.9371		0.3353	0.3794	0.3914
1996	0.0302	0.196	0.4431	0.4856	1.3675	1.4606	1.788	2.3035	2.3035		0.7906	0.9392	1.1046
FBAR	0.0419	0.1474	0.3341	0.3625	0.676	0.6981	0.8206	1.1815					

Table 2.2.6.2.1

At 3-May-97 17:22:20

Terminal Fs derived using XSA (With F shrinkage)

Table 10	Stock number at age (start of year)				Numbers*10**-3						
YEAR	2	3	4	5	6	7	8	9	+gp	0	TOTAL
1961	12019	7385	3747	2699	666	668	155	66	0		27403
1962	20654	7042	3616	1863	1245	335	210	56	0		35021
1963	20290	12907	3503	1825	752	584	190	87	0		40138
1964	21834	12893	6986	1710	895	358	294	112	0		45083
1965	8269	16037	7823	3639	830	416	151	169	0		37332
1966	18566	5999	10207	4085	1698	351	200	80	0		41186
1967	23451	13990	4034	6475	2133	842	109	70	0		51103
1968	17582	17744	9020	2525	3757	980	410	31	0		52049
1969	9325	13012	11522	4976	1212	1967	393	240	0		42646
1970	8608	6840	7843	6447	2682	561	965	138	0		34084
1971	11928	6684	4548	4456	3754	1515	238	519	0		33642
1972	21320	9469	4788	2981	2483	1760	779	92	0		43672
1973	12572	16663	6688	3187	1901	1109	902	499	400		43922
1974	30478	9639	10816	4037	1969	1209	626	533	342		59649
1975	38310	22998	6746	7217	2460	1103	581	378	476		80268
1976	18569	29028	13681	3571	3908	1279	636	304	466		71441
1977	9993	13849	20004	7764	1675	1908	489	274	18		55973
1978	10687	7797	8369	10185	2992	659	513	184	154		41539
1979	15089	8247	5280	4460	5429	1508	297	238	103		40651
1980	23520	11833	5185	2809	2203	2720	788	122	52		49233
1981	14036	18235	7641	2923	1490	1073	1474	339	150		47362
1982	22309	10907	11186	4463	1536	694	438	730	347		52611
1983	25178	17234	7152	6378	2491	832	284	206	199		59953
1984	48048	18670	8889	3358	2737	950	220	90	173		83134
1985	17496	35361	10549	4122	1428	1416	493	106	127		71098
1986	9464	13421	20370	5203	1865	472	370	124	100		51389
1987	10107	7558	7744	9020	2113	706	173	170	63		37655
1988	8632	8042	4956	3977	4596	995	375	80	60		31714
1989	15388	6607	4665	2298	1914	1792	370	155	23		33210
1990	3397	10574	3463	1840	867	638	565	104	53		21501
1991	6336	2561	6080	1495	736	344	257	199	91		18099
1992	10084	5016	1693	3050	667	331	154	127	147		21269
1993	12560	8067	3686	956	1654	274	149	76	86		27508
1994	25542	10177	5892	2483	585	1062	140	93	67		46041
1995	42107	20406	7637	3888	1563	369	714	80	88		76851
1996	13087	32109	14250	4436	2267	859	195	426	56		67684
1997	0	10396	21609	7491	2235	473	163	27	39		42432

Average 17690 13194 7785 4078 2032 962 425 203

Table 2.2.6.2.2

At 3-May-97 17:22:20

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 3-7
	Age 2 TotB 2.0	SSB 2.0				
1961	12019	58355	40784	21598	0.5296	0.6059
1962	20654	64307	39592	20967	0.5296	0.5226
1963	20290	73668	45333	22215	0.49	0.4944
1964	21834	85299	54316	21078	0.3881	0.5017
1965	8269	86578	64681	24212	0.3743	0.4909
1966	18566	91054	65933	20418	0.3097	0.4743
1967	23451	107766	74766	23562	0.3151	0.39
1968	17582	118650	87170	29930	0.3434	0.4642
1969	9325	113005	90561	32371	0.3574	0.4375
1970	8608	97929	81412	24183	0.297	0.3882
1971	11928	93139	75464	23010	0.3049	0.3526
1972	21320	98303	70680	18727	0.265	0.3358
1973	12572	110417	84831	22228	0.262	0.2886
1974	30478	130194	91894	24581	0.2675	0.3139
1975	38310	166320	112937	36775	0.3256	0.3947
1976	18569	170688	128680	39799	0.3093	0.4749
1977	9993	154719	127331	34927	0.2743	0.676
1978	10687	96122	78452	26585	0.3389	0.4262
1979	15089	85072	66646	23112	0.3468	0.428
1980	23520	84960	58831	20513	0.3487	0.3952
1981	14036	88367	63501	22963	0.3616	0.4661
1982	22309	100265	67213	21489	0.3197	0.4149
1983	25178	123546	98944	38133	0.3854	0.7121
1984	48048	152877	116116	36979	0.3185	0.5017
1985	17496	131934	85117	39484	0.4639	0.7
1986	9464	100569	74887	34595	0.462	0.6482
1987	10107	79468	63132	21391	0.3388	0.4295
1988	8632	67360	53325	23182	0.4347	0.5955
1989	15388	59255	39434	22068	0.5596	0.7606
1990	3397	38048	29541	13487	0.4565	0.629
1991	6336	28645	21461	8660	0.4035	0.5026
1992	10084	34066	20587	6540	0.3177	0.4359
1993	12560	50016	33130	5992	0.1809	0.2637
1994	25542	84071	72965	8818	0.1209	0.2049
1995	42107	143268	70483	23043	0.3269	0.3353
1996	13087	143246	86673	40484	0.4671	0.7906
Mean	17690	97543	70467	24392	0.3582	0.4791

Table 2.2.7.4.1

The SAS System

15:18 Tuesday, May 6, 1997

Cod in the Faroe Plateau (Fishing Area Vb1)

Yield per recruit: Input data

Age	Recruit- ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
2	1.000	0.2000	0.1730	0.0000	0.0000	1.068	0.0850	1.068
3	.	0.2000	0.6410	0.0000	0.0000	1.600	0.2670	1.600
4	.	0.2000	0.8740	0.0000	0.0000	2.279	0.4150	2.279
5	.	0.2000	0.9510	0.0000	0.0000	3.116	0.4890	3.116
6	.	0.2000	0.9900	0.0000	0.0000	3.881	0.5730	3.881
7	.	0.2000	0.9940	0.0000	0.0000	4.833	0.6520	4.833
8	.	0.2000	0.9960	0.0000	0.0000	5.781	0.6310	5.781
9	.	0.2000	1.0000	0.0000	0.0000	7.316	0.6310	7.316
10+	.	0.2000	1.0000	0.0000	0.0000	9.409	0.6310	9.408
Unit	Numbers	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : YLDJMM05
Date and time: 06MAY97:15:19

Table 2.2.7.4.2

The SAS System

15:18 Tuesday, May 6, 1997 -

Cod in the Faroe Plateau (Fishing Area Vb1)

Yield per recruit: Summary table

F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January		Spawning time	
						Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
0.0000	0.0000	0.000	0.000	5.517	23162.523	4.276	21497.658	4.276	21497.658
0.0500	0.0240	0.094	474.357	5.047	19483.503	3.811	17829.948	3.811	17829.948
0.1000	0.0479	0.167	786.689	4.686	16772.328	3.454	15129.659	3.454	15129.659
0.1500	0.0719	0.225	996.906	4.399	14707.432	3.171	13075.249	3.171	13075.249
0.2000	0.0958	0.272	1140.417	4.164	13093.023	2.940	11470.952	2.940	11470.952
0.2500	0.1198	0.311	1239.163	3.968	11803.446	2.749	10191.137	2.749	10191.137
0.3000	0.1438	0.345	1307.236	3.802	10754.618	2.586	9151.742	2.586	9151.742
0.3500	0.1677	0.374	1353.954	3.658	9888.338	2.446	8294.585	2.446	8294.585
0.4000	0.1917	0.399	1385.615	3.533	9163.168	2.325	7578.247	2.325	7578.247
0.4500	0.2156	0.422	1406.559	3.423	8548.903	2.218	6972.539	2.218	6972.539
0.5000	0.2396	0.442	1419.821	3.324	8023.073	2.123	6455.005	2.123	6455.005
0.5500	0.2636	0.459	1427.548	3.236	7568.667	2.038	6008.651	2.038	6008.651
0.6000	0.2875	0.476	1431.279	3.156	7172.612	1.961	5620.414	1.961	5620.414
0.6500	0.3115	0.490	1432.122	3.083	6824.718	1.892	5280.118	1.892	5280.118
0.7000	0.3354	0.504	1430.884	3.017	6516.949	1.829	4979.738	1.829	4979.738
0.7500	0.3594	0.516	1428.152	2.956	6242.898	1.771	4712.876	1.771	4712.876
0.8000	0.3834	0.528	1424.360	2.899	5997.404	1.717	4474.383	1.717	4474.383
0.8500	0.4073	0.539	1419.825	2.847	5776.275	1.668	4260.074	1.668	4260.074
0.9000	0.4313	0.549	1414.783	2.798	5576.073	1.622	4066.521	1.622	4066.521
0.9500	0.4552	0.558	1409.407	2.753	5393.963	1.579	3890.895	1.579	3890.895
1.0000	0.4792	0.567	1403.825	2.710	5227.583	1.539	3730.843	1.539	3730.843
1.0500	0.5032	0.575	1398.132	2.670	5074.958	1.502	3584.395	1.502	3584.395
1.1000	0.5271	0.583	1392.398	2.632	4934.423	1.467	3449.894	1.467	3449.894
1.1500	0.5511	0.590	1386.672	2.596	4804.566	1.434	3325.934	1.434	3325.934
1.2000	0.5750	0.597	1380.993	2.563	4684.186	1.403	3211.319	1.403	3211.319
1.2500	0.5990	0.604	1375.386	2.531	4572.251	1.374	3105.022	1.374	3105.022
1.3000	0.6230	0.610	1369.870	2.500	4467.874	1.346	3006.163	1.346	3006.163
1.3500	0.6469	0.616	1364.458	2.471	4370.288	1.319	2913.977	1.319	2913.977
1.4000	0.6709	0.621	1359.158	2.444	4278.825	1.294	2827.802	1.294	2827.802
1.4500	0.6948	0.627	1353.976	2.418	4192.903	1.270	2747.059	1.270	2747.059
1.5000	0.7188	0.632	1348.913	2.392	4112.012	1.247	2671.243	1.247	2671.243
1.5500	0.7428	0.637	1343.971	2.368	4035.701	1.226	2599.907	1.226	2599.907
1.6000	0.7667	0.642	1339.150	2.345	3963.575	1.205	2532.659	1.205	2532.659
1.6500	0.7907	0.647	1334.448	2.323	3895.281	1.185	2469.150	1.185	2469.150
1.7000	0.8146	0.651	1329.862	2.302	3830.508	1.166	2409.071	1.166	2409.071
1.7500	0.8386	0.655	1325.392	2.281	3768.975	1.148	2352.145	1.148	2352.145
1.8000	0.8626	0.659	1321.033	2.262	3710.433	1.130	2298.126	1.130	2298.126
1.8500	0.8865	0.663	1316.783	2.242	3654.658	1.113	2246.791	1.113	2246.791
1.9000	0.9105	0.667	1312.638	2.224	3601.447	1.097	2197.942	1.097	2197.942
1.9500	0.9344	0.671	1308.596	2.206	3550.618	1.081	2151.399	1.081	2151.399
2.0000	0.9584	0.674	1304.653	2.189	3502.006	1.066	2106.998	1.066	2106.998
2.0500	0.9824	0.678	1300.807	2.173	3455.461	1.052	2064.592	1.052	2064.592
2.1000	1.0063	0.681	1297.053	2.157	3410.846	1.038	2024.047	1.038	2024.047
2.1500	1.0303	0.684	1293.390	2.141	3368.038	1.024	1985.241	1.024	1985.241
2.2000	1.0542	0.688	1289.814	2.126	3326.923	1.011	1948.062	1.011	1948.062
2.2500	1.0782	0.691	1286.322	2.112	3287.396	0.998	1912.408	0.998	1912.408
2.3000	1.1022	0.694	1282.911	2.097	3249.362	0.986	1878.185	0.986	1878.185
2.3500	1.1261	0.697	1279.580	2.084	3212.734	0.974	1845.307	0.974	1845.307
2.4000	1.1501	0.699	1276.324	2.070	3177.429	0.963	1813.695	0.963	1813.695
2.4500	1.1740	0.702	1273.142	2.057	3143.375	0.952	1783.276	0.952	1783.276
2.5000	1.1980	0.705	1270.032	2.045	3110.501	0.941	1753.982	0.941	1753.982
2.5500	1.2220	0.707	1266.991	2.032	3078.743	0.930	1725.750	0.930	1725.750
2.6000	1.2459	0.710	1264.017	2.020	3048.044	0.920	1698.524	0.920	1698.524
2.6500	1.2699	0.712	1261.108	2.009	3018.346	0.910	1672.249	0.910	1672.249
2.7000	1.2938	0.715	1258.261	1.997	2989.600	0.901	1646.876	0.901	1646.876
2.7500	1.3178	0.717	1255.475	1.986	2961.757	0.891	1622.357	0.891	1622.357
2.8000	1.3418	0.719	1252.748	1.975	2934.773	0.882	1598.651	0.882	1598.651
2.8500	1.3657	0.722	1250.079	1.965	2908.606	0.873	1575.715	0.873	1575.715
2.9000	1.3897	0.724	1247.464	1.955	2883.218	0.864	1553.514	0.864	1553.514
2.9500	1.4136	0.726	1244.903	1.945	2858.572	0.856	1532.010	0.856	1532.010
3.0000	1.4376	0.728	1242.395	1.935	2834.634	0.848	1511.172	0.848	1511.172
3.0500	1.4616	0.730	1239.937	1.925	2811.372	0.840	1490.969	0.840	1490.969
3.1000	1.4855	0.732	1237.527	1.916	2788.756	0.832	1471.370	0.832	1471.370
3.1500	1.5095	0.734	1235.166	1.906	2766.758	0.824	1452.350	0.824	1452.350
3.2000	1.5334	0.736	1232.851	1.897	2745.350	0.817	1433.881	0.817	1433.881
3.2500	1.5574	0.738	1230.580	1.889	2724.509	0.809	1415.941	0.809	1415.941
3.3000	1.5814	0.740	1228.353	1.880	2704.211	0.802	1398.507	0.802	1398.507
3.3500	1.6053	0.742	1226.169	1.872	2684.432	0.795	1381.556	0.795	1381.556
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

(cont.)

Table 2.2.7.4.2 (Cont'd)

The SAS System

15:18 Tuesday, May 6, 1997

Cod in the Faroe Plateau (Fishing Area Vb1)

Yield per recruit: Summary table

(cont.)						1 January		Spawning time	
F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
3.4000	1.6293	0.743	1224.025	1.863	2665.152	0.789	1365.068	0.789	1365.068
3.4500	1.6532	0.745	1221.922	1.855	2646.351	0.782	1349.025	0.782	1349.025
3.5000	1.6772	0.747	1219.857	1.847	2628.011	0.775	1333.409	0.775	1333.409
3.5500	1.7012	0.748	1217.830	1.839	2610.113	0.769	1318.201	0.769	1318.201
3.6000	1.7251	0.750	1215.840	1.832	2592.640	0.763	1303.387	0.763	1303.387
3.6500	1.7491	0.752	1213.886	1.824	2575.576	0.757	1288.950	0.757	1288.950
3.7000	1.7730	0.753	1211.966	1.817	2558.907	0.751	1274.876	0.751	1274.876
3.7500	1.7970	0.755	1210.081	1.810	2542.617	0.745	1261.151	0.745	1261.151
3.8000	1.8210	0.756	1208.228	1.803	2526.693	0.739	1247.762	0.739	1247.762
3.8500	1.8449	0.758	1206.408	1.796	2511.121	0.734	1234.697	0.734	1234.697
3.9000	1.8689	0.759	1204.618	1.789	2495.890	0.728	1221.944	0.728	1221.944
3.9500	1.8928	0.761	1202.859	1.782	2480.987	0.723	1209.491	0.723	1209.491
4.0000	1.9168	0.762	1201.130	1.775	2466.402	0.717	1197.327	0.717	1197.327
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDJMM05
 Date and time : 06MAY97:15:19
 Computation of ref. F: Simple mean, age 3 - 7
 F-0.1 factor : 0.2944
 F-max factor : 0.6426
 F-0.1 reference F : 0.1411
 F-max reference F : 0.3080
 Recruitment : Single recruit

Table 2.2.8.1 Faroe Plateau Cod. Probability density functions of the 1997/1998 fishing mortality under various assumptions of effort distribution.

IF 9320 Days Fished by LL<100		IF 9320 Days fished by ST<400		IF 9320 Days(X 2) fished by JIGGERS		Number of days halved	
Fishing Mort.	Cumul. Freq.	Fishing Mortality	Cumul. Freq.	Fishing Mort.	Cumul. Freq.	Fishing Mort.	Cumul. Freq.
0.07	0.02	0.10	0.03	0.05	0.03	0.02	0.02
0.09	0.05	0.12	0.05	0.08	0.05	0.04	0.05
0.11	0.07	0.19	0.08	0.09	0.08	0.05	0.07
0.12	0.10	0.23	0.10	0.11	0.10	0.05	0.10
0.16	0.12	0.28	0.13	0.12	0.13	0.06	0.12
0.18	0.15	0.31	0.15	0.15	0.15	0.07	0.14
0.20	0.20	0.32	0.20	0.17	0.20	0.08	0.19
0.22	0.22	0.32	0.23	0.19	0.23	0.10	0.21
0.22	0.24	0.32	0.25	0.20	0.25	0.10	0.24
0.23	0.27	0.33	0.28	0.21	0.28	0.10	0.26
0.25	0.29	0.36	0.30	0.24	0.30	0.12	0.29
0.26	0.32	0.39	0.33	0.25	0.33	0.13	0.31
0.27	0.34	0.42	0.35	0.27	0.35	0.14	0.33
0.29	0.37	0.45	0.38	0.30	0.38	0.15	0.36
0.31	0.39	0.45	0.40	0.31	0.40	0.15	0.38
0.32	0.41	0.47	0.43	0.31	0.43	0.15	0.40
0.33	0.44	0.48	0.45	0.31	0.45	0.15	0.43
0.34	0.46	0.49	0.48	0.32	0.48	0.16	0.45
0.36	0.49	0.52	0.50	0.35	0.50	0.17	0.48
0.42	0.54	0.54	0.55	0.37	0.55	0.19	0.52
0.43	0.56	0.55	0.58	0.41	0.58	0.21	0.55
0.43	0.59	0.58	0.60	0.42	0.60	0.21	0.57
0.44	0.61	0.61	0.63	0.43	0.63	0.22	0.60
0.45	0.63	0.67	0.65	0.45	0.65	0.22	0.62
0.46	0.66	0.69	0.68	0.45	0.68	0.23	0.64
0.46	0.68	0.73	0.70	0.46	0.70	0.23	0.67
0.48	0.71	0.75	0.73	0.47	0.73	0.24	0.69
0.50	0.73	0.77	0.75	0.50	0.75	0.25	0.71
0.52	0.76	0.78	0.78	0.54	0.78	0.27	0.74
0.55	0.78	0.78	0.80	0.55	0.80	0.27	0.76
0.59	0.80	0.86	0.83	0.55	0.83	0.28	0.79
0.61	0.85	0.86	0.88	0.62	0.88	0.31	0.83
0.62	0.88	0.89	0.90	0.63	0.90	0.31	0.86
0.66	0.90	0.91	0.93	0.64	0.93	0.32	0.88
0.71	0.93	0.92	0.95	0.69	0.95	0.34	0.90
0.80	0.95	0.97	0.98	0.79	0.98	0.39	0.93
1.23	0.98	1.36	1.00	1.23	1.00	0.61	0.95
1.81	1.00					0.91	0.98
						1.20	1.00

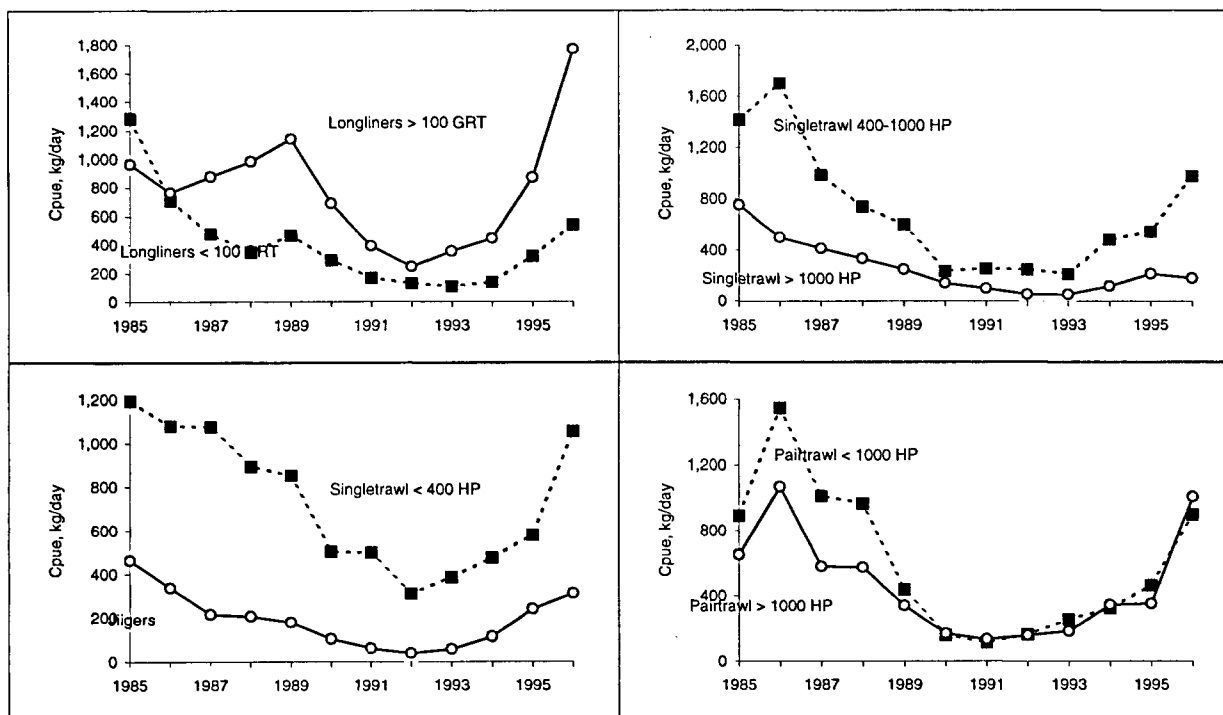


Figure 2.2.1 Catch per unit effort of Faroe Plateau Cod January-December. (kg/day)

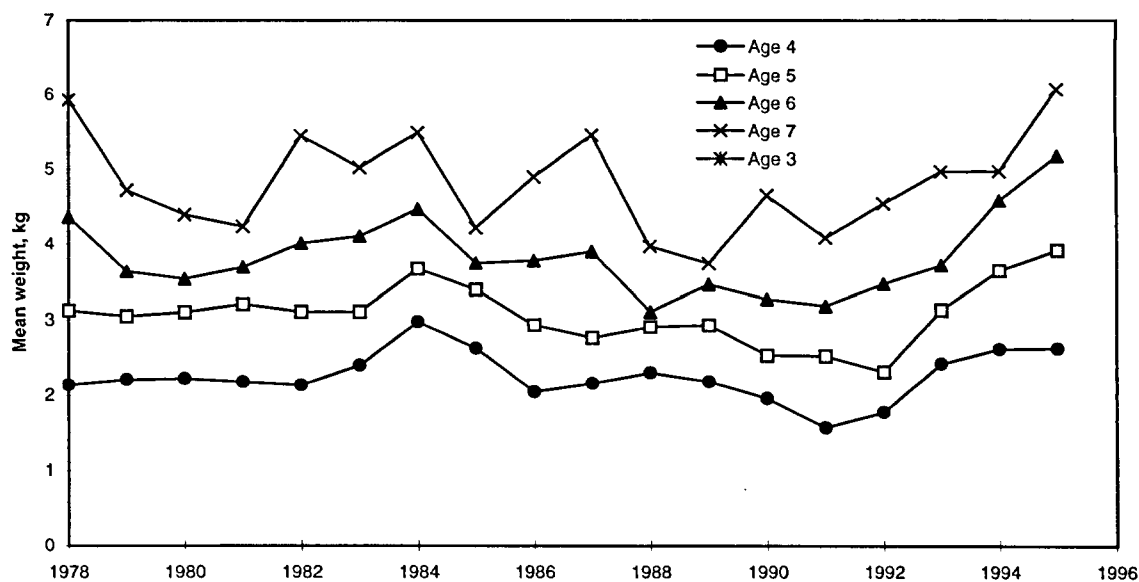


Figure 2.2.2. Mean weight at age for Faroe Plateau cod 1978-1995.

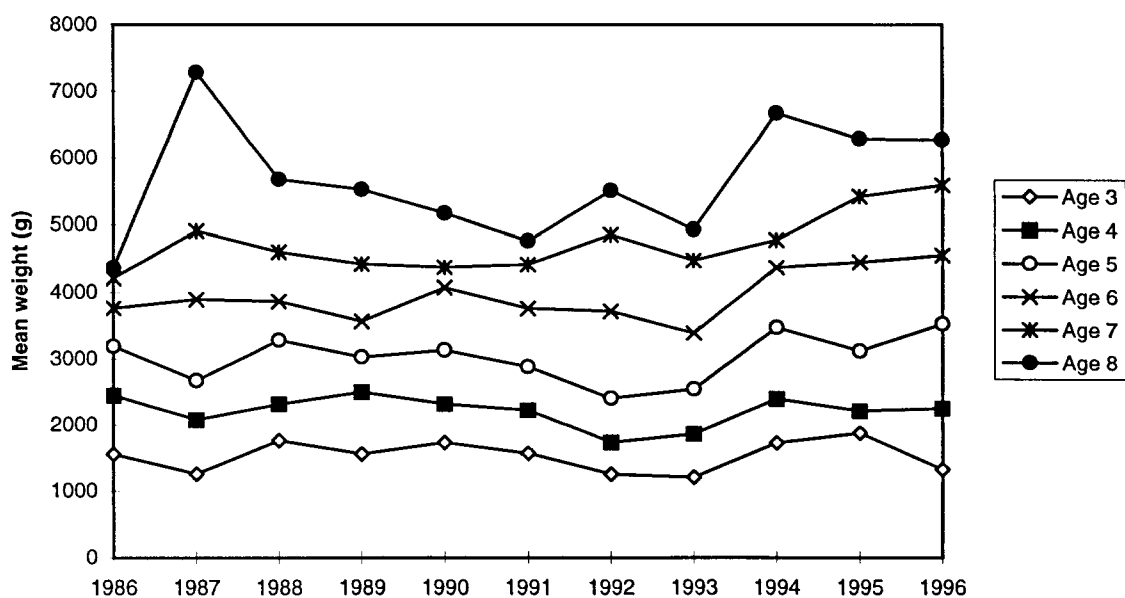


Figure 2.2.3 Faroe Plateau cod mean weight at age 1st quarter 1986-1996. Commercial data.

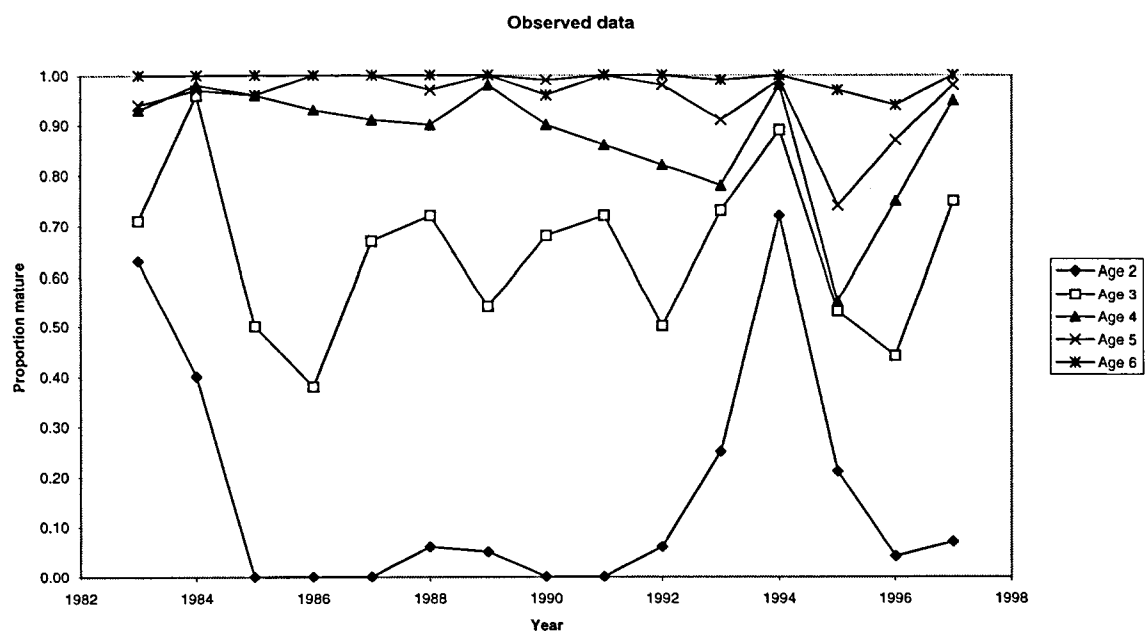


Figure 2.2.4 Faroe Plateau cod. Proportion mature at age as observed in the groundfish survey.

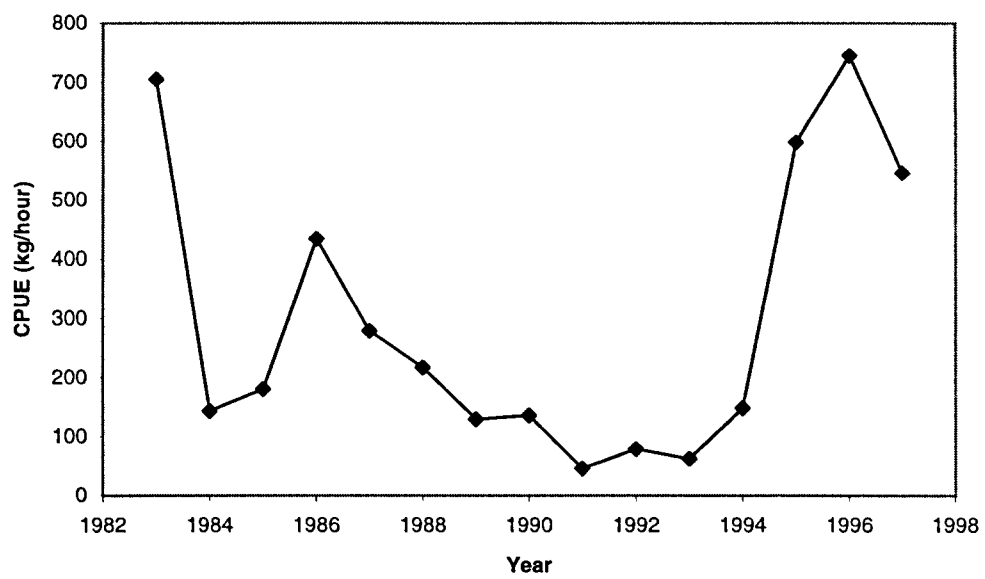


Figure 2.2.5. Catch per unit effort of Faroe Plateau cod in the groundfish survey.

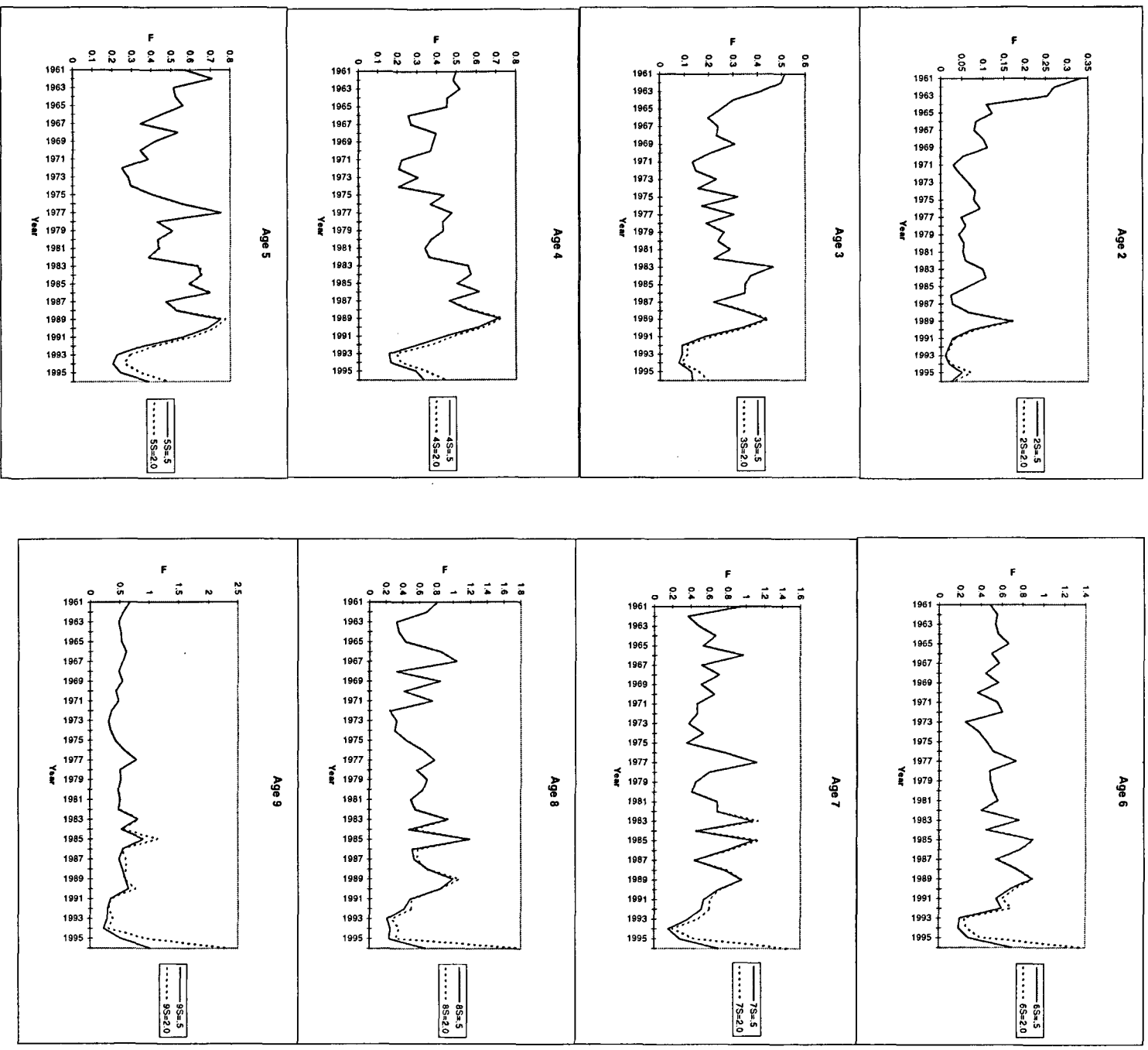


Figure 2.2.6 Faroe Plateau cod, F at age with and without shrinkage

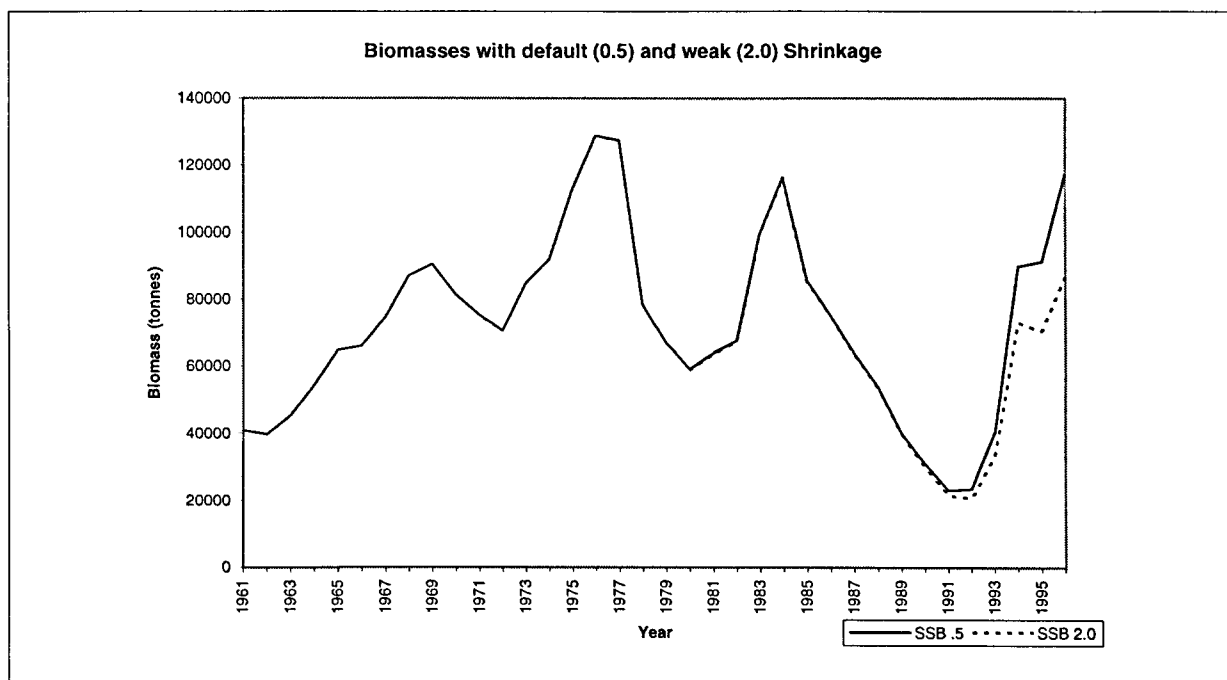


Figure 2.2.7 Spawning biomass of Faroe Plateau cod estimated from XSA with shrinkage of 0.5 and shrinkage of 2.0

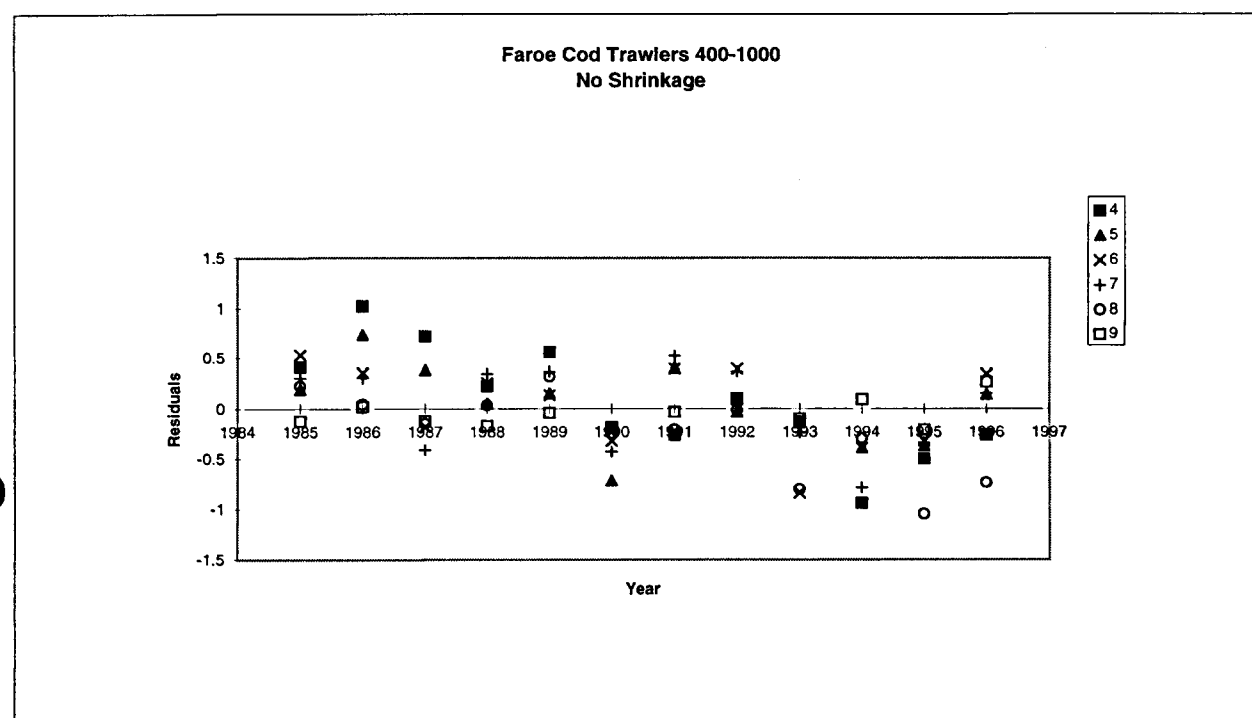
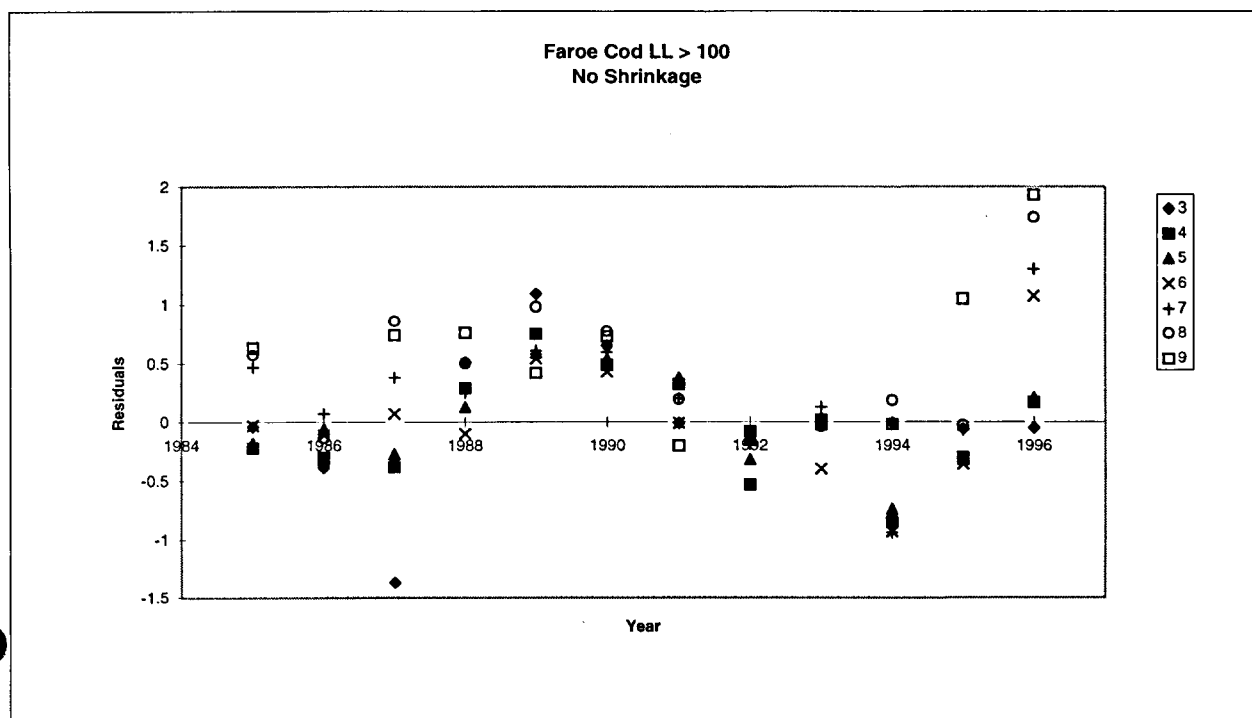


Figure 2.2.8 Faroe Plateau cod. Residuals from XSA using LL > 100 and OTB 400-1000 without shrinkage.

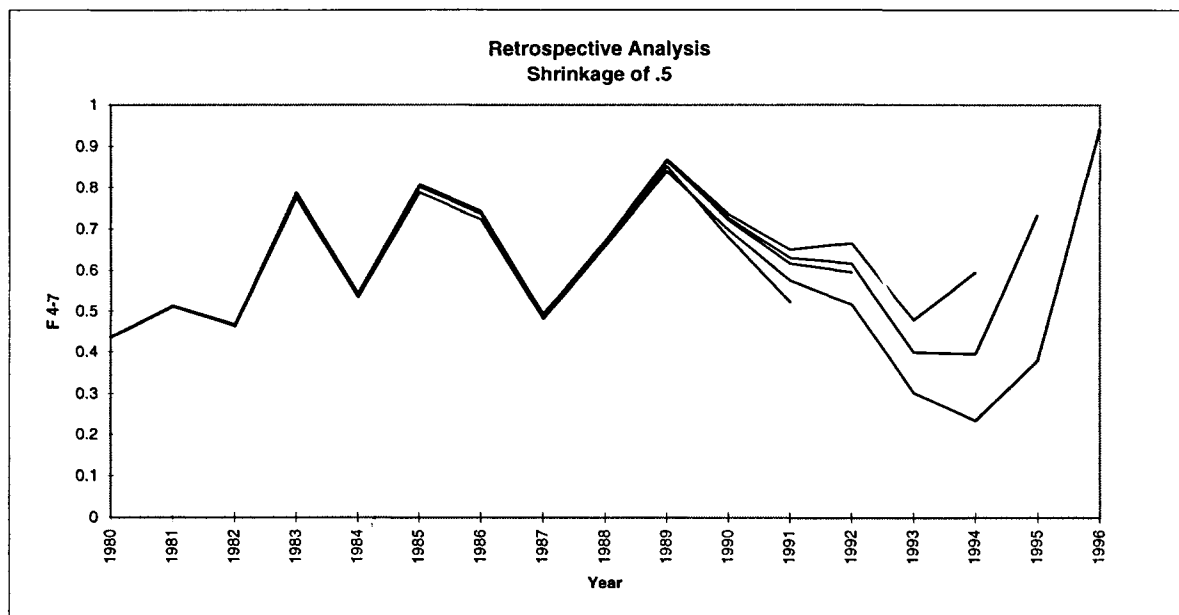
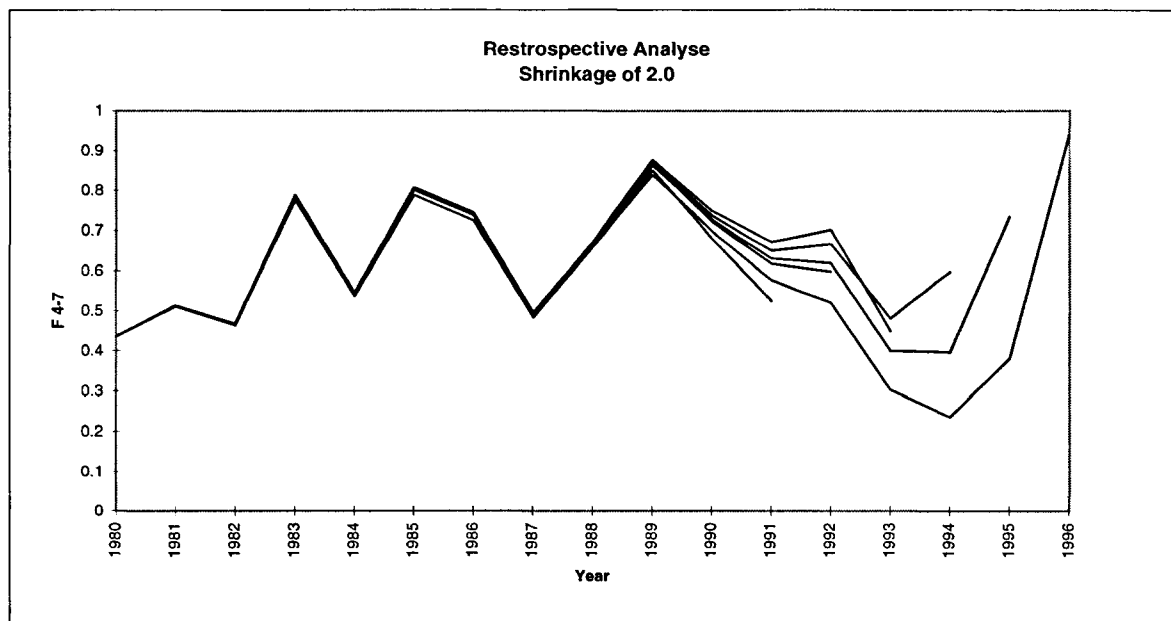
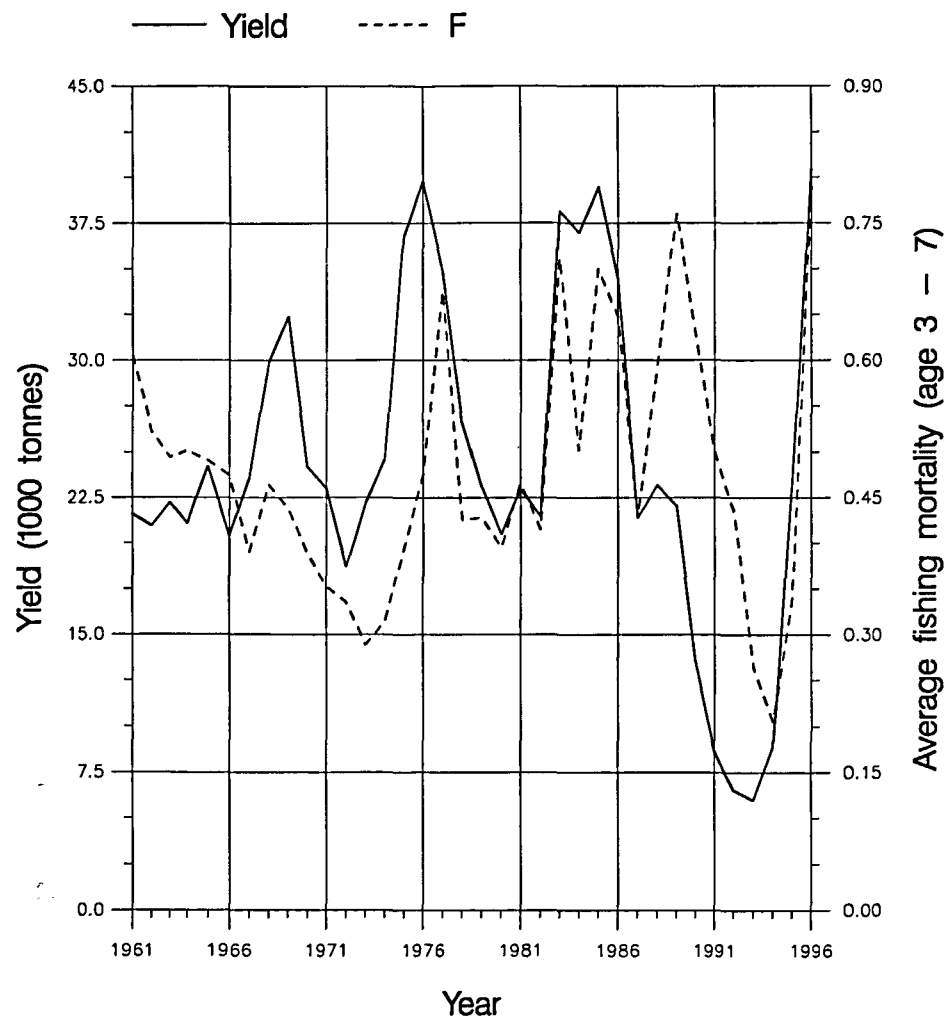


Figure 2.2.9 Faroe Plateau cod. Retrospective analyses with and without shrinkage.

Figure 2.2.10

Fish Stock Summary Cod in the Faroe Plateau (Fishing Area Vb1) 3 – 5 – 1997

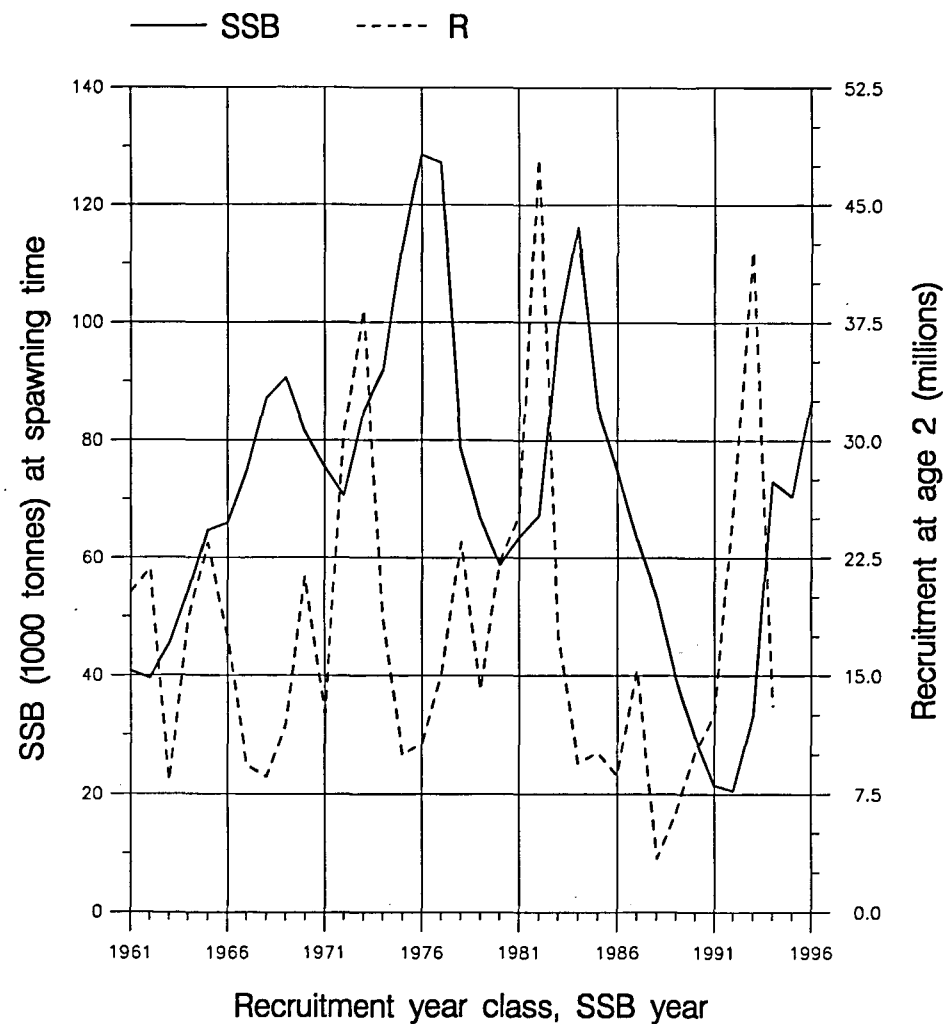
Yield and fishing mortality



(run: XSAPET03)

A

Spawning stock and recruitment



(run: XSAPET03)

B

Cod in the Faroe Plateau (Fishing Area Vb1)
3 – 5 – 1997

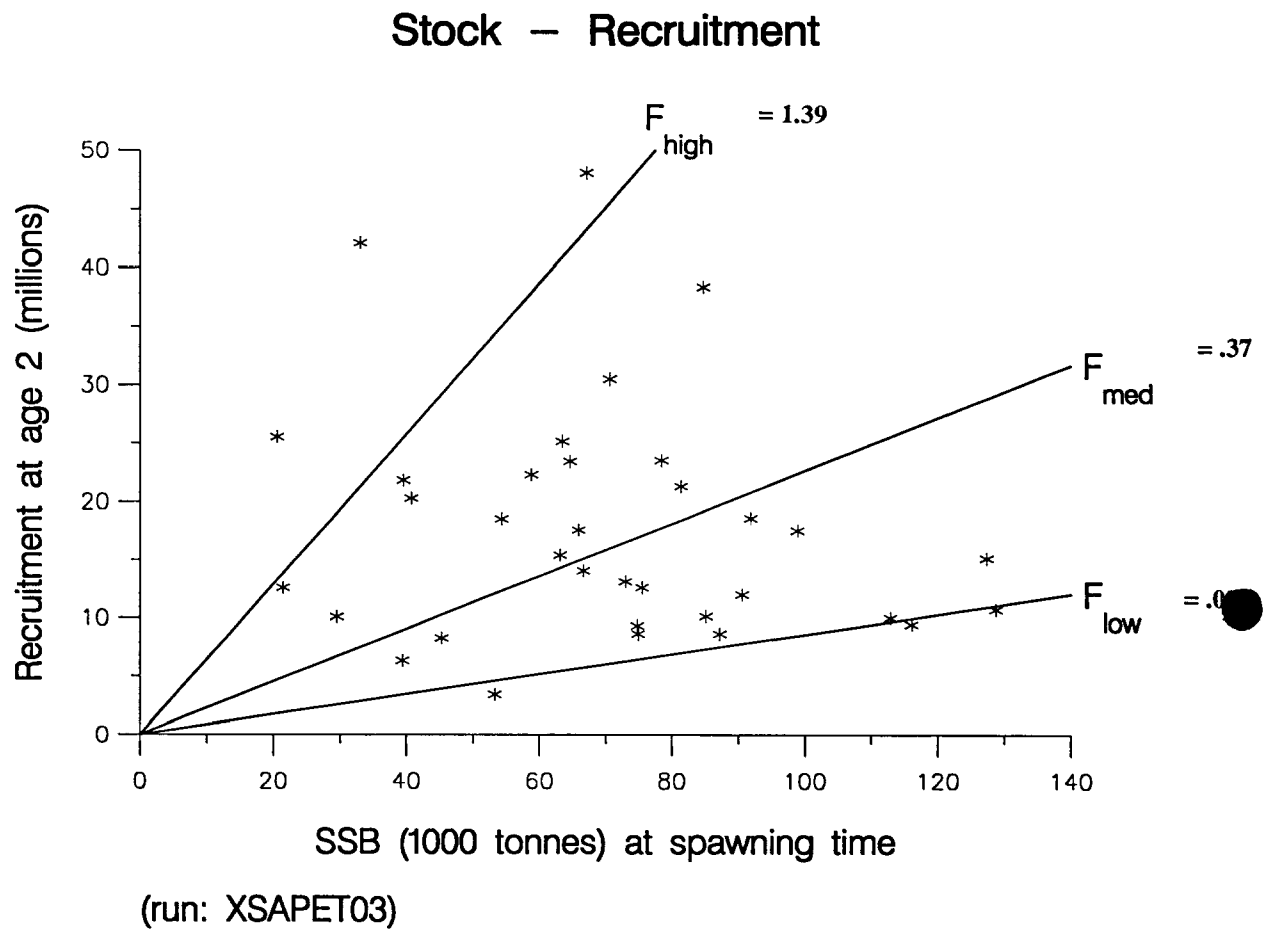


Figure 2.2.11

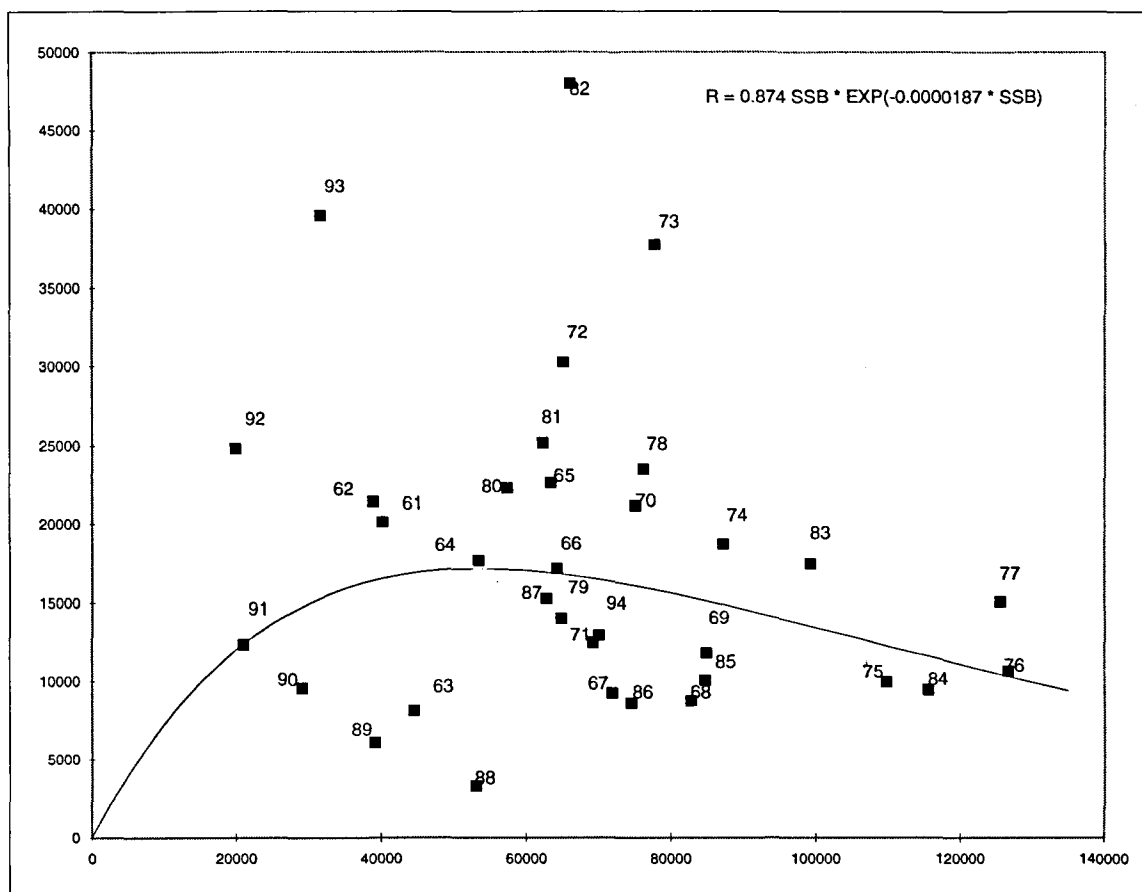


Figure 2.2.12 Faroe Plateau cod. Ricker stock recruitment relationship fitted to 1961 to 1994 ssb and year-classes.

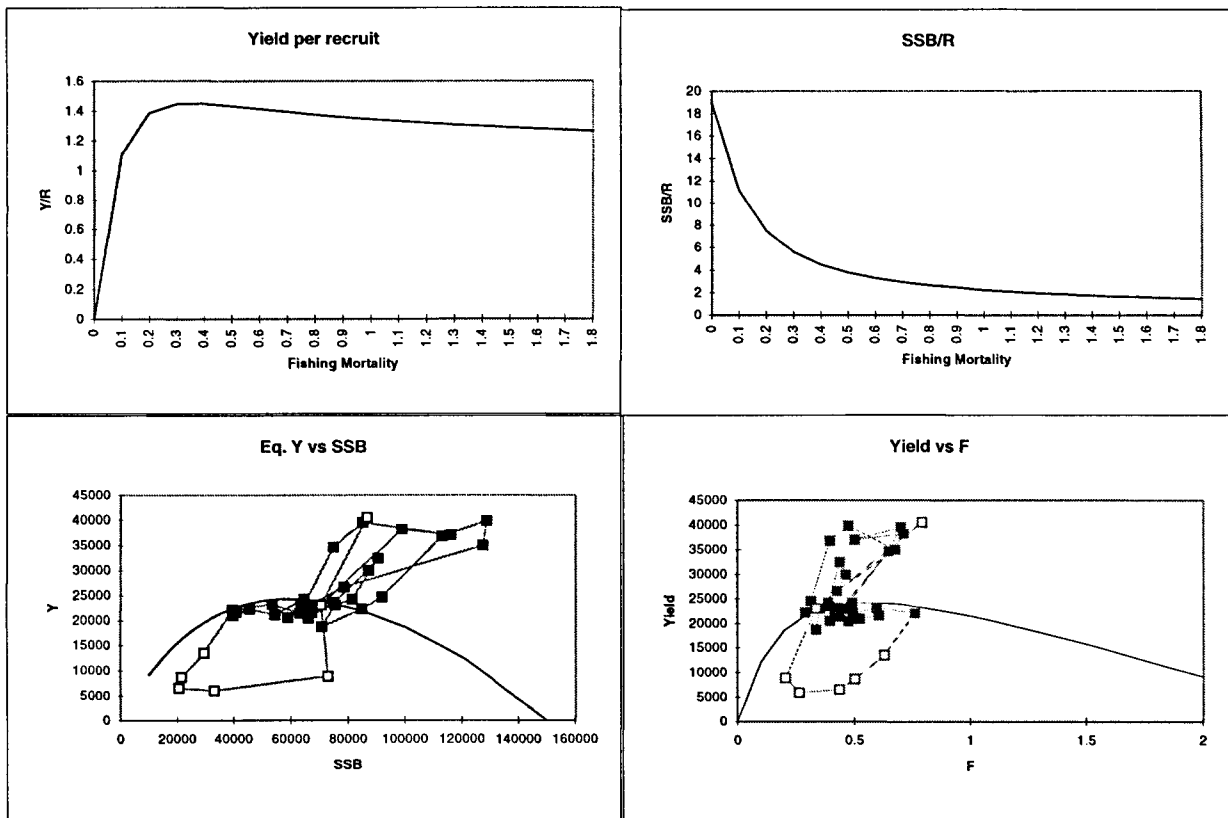


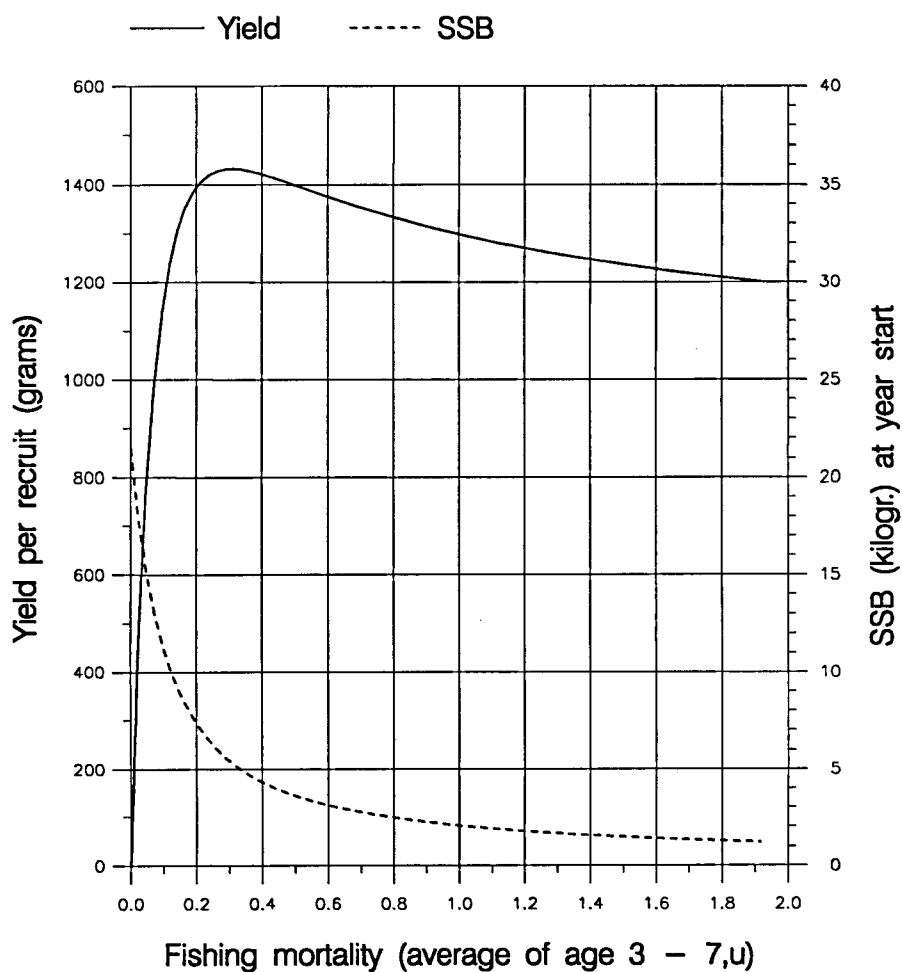
Figure 2.2.13 Faroe Plateau cod. Results of age-structured production modelling with a Ricker stock recruitment relationship.

	F	S/R	Y/R	%MaxS/f	eq S	eq R	eq Y
F0.1	0.17	8.42	1.33	44%	#####	12651	16864
Fmax	0.35	5.00	1.45	26%	78737	15734	22825
Fmed	0.41	4.42	1.45	23%	72114	16315	23602
Fhigh	1.43	1.74	1.29	9%	22377	12859	16622
Fmsy	0.56	3.48	1.42	18%	59291	17058	24241
Fcrash	2.64	1.14	1.21	6%	0	0	0
Flow	0.10	10.95	1.12	58%	#####	11006	12369

Figure 2.2.14

Fish Stock Summary
Cod in the Faroe Plateau (Fishing Area Vb1)
6 – 5 – 1997

Long term yield and spawning stock biomass



(run: YLDJJM05)

C

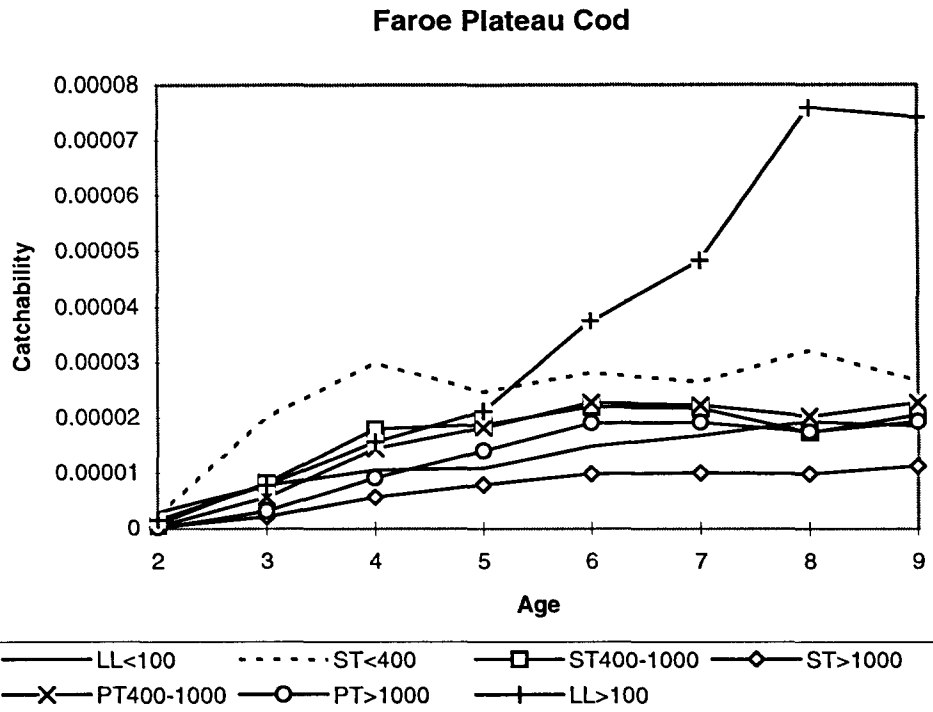


Figure 2.2.15 Average age-specific catchabilities for different faroese fleets.

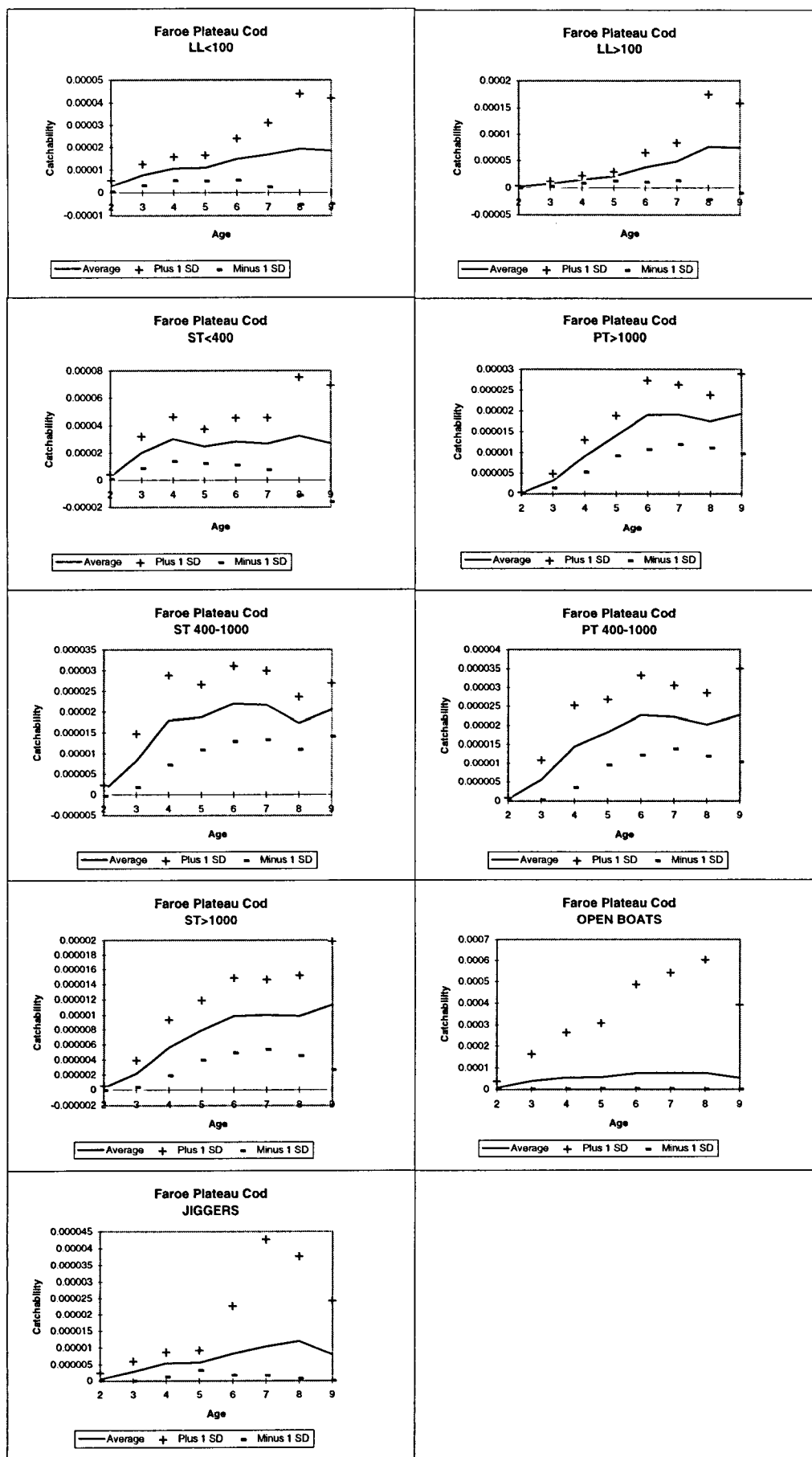
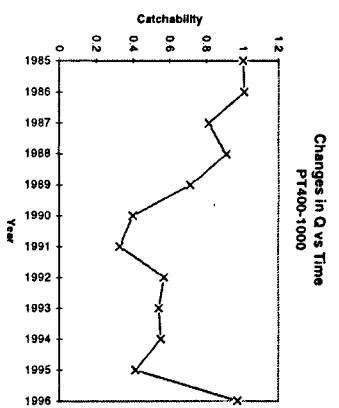
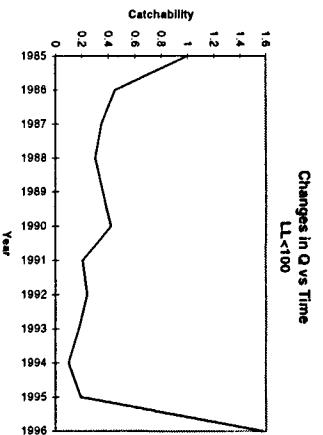
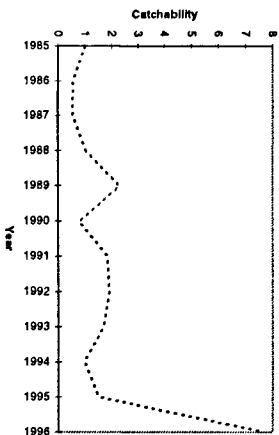


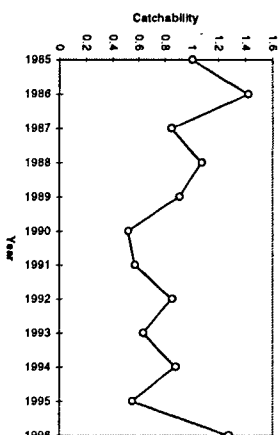
Figure 2.216 Catchability at age (average,plus/minus 1 SD) for different faroese fleets from 1985 to 1996.



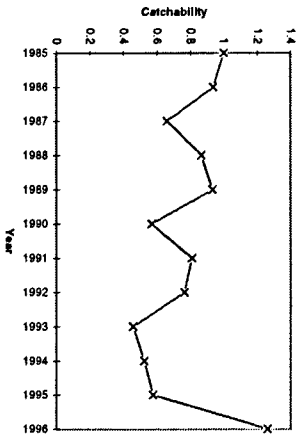
Changes in Q vs Time
ST<400



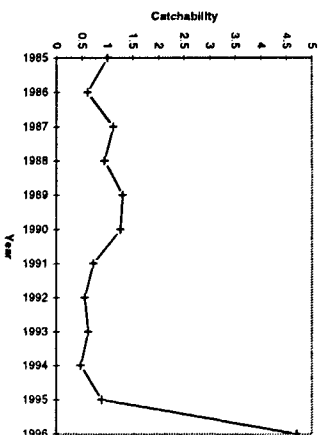
Changes in Q vs Time
PT>1000



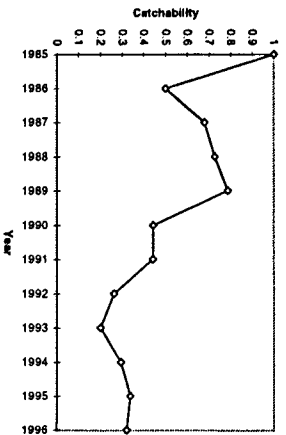
Changes in Q vs Time
ST400-1000



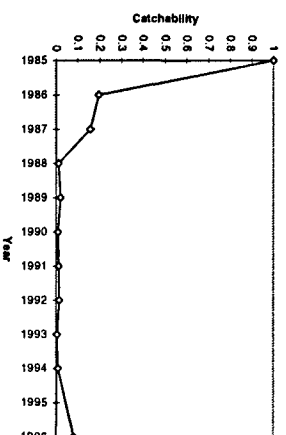
Changes in Q vs Time
LL>100



Changes in Q vs Time
ST>1000



Changes in Q vs Time
OPEN BOATS



Changes in Q vs Time
JIGGERS

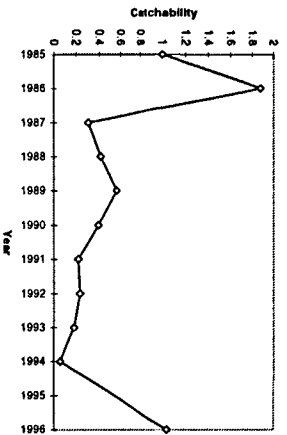


Figure 2.2.17 Catchability of different faroesse fleets versus time (1985 to 1996).

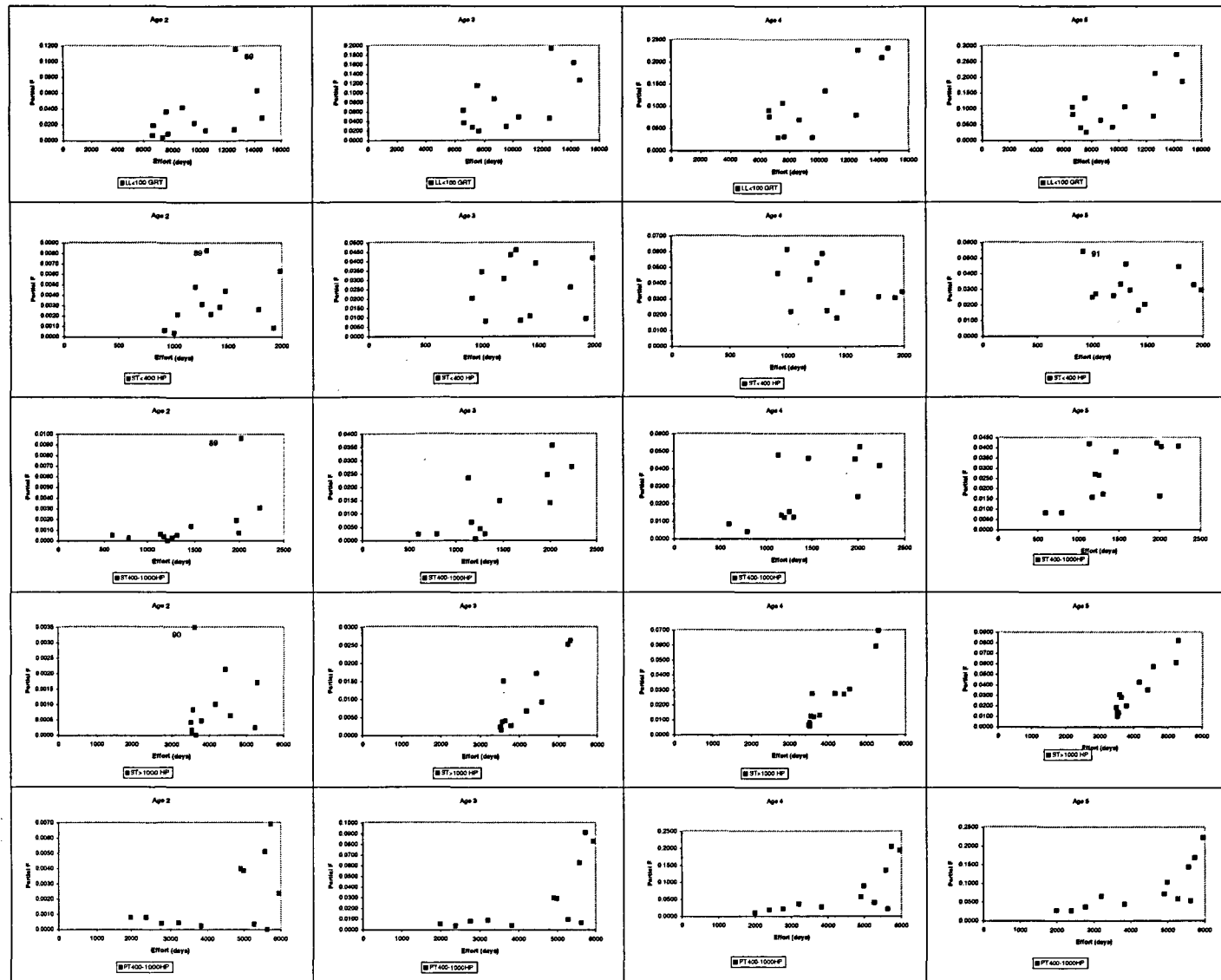


Figure 2.2.18 Partial F at age versus effort (days) for different faroese fleets

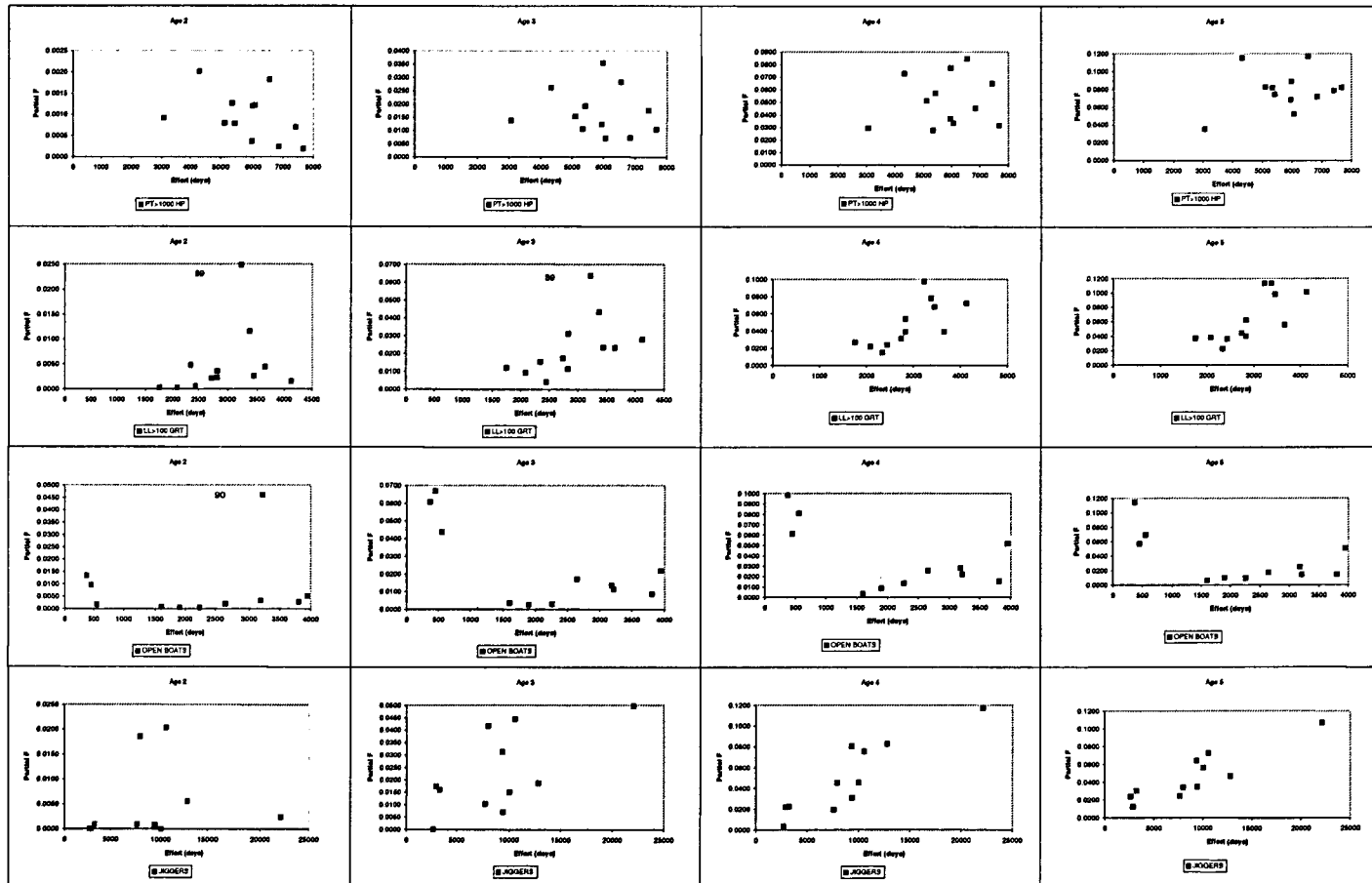


Figure 2.2.18 (Cont'd)

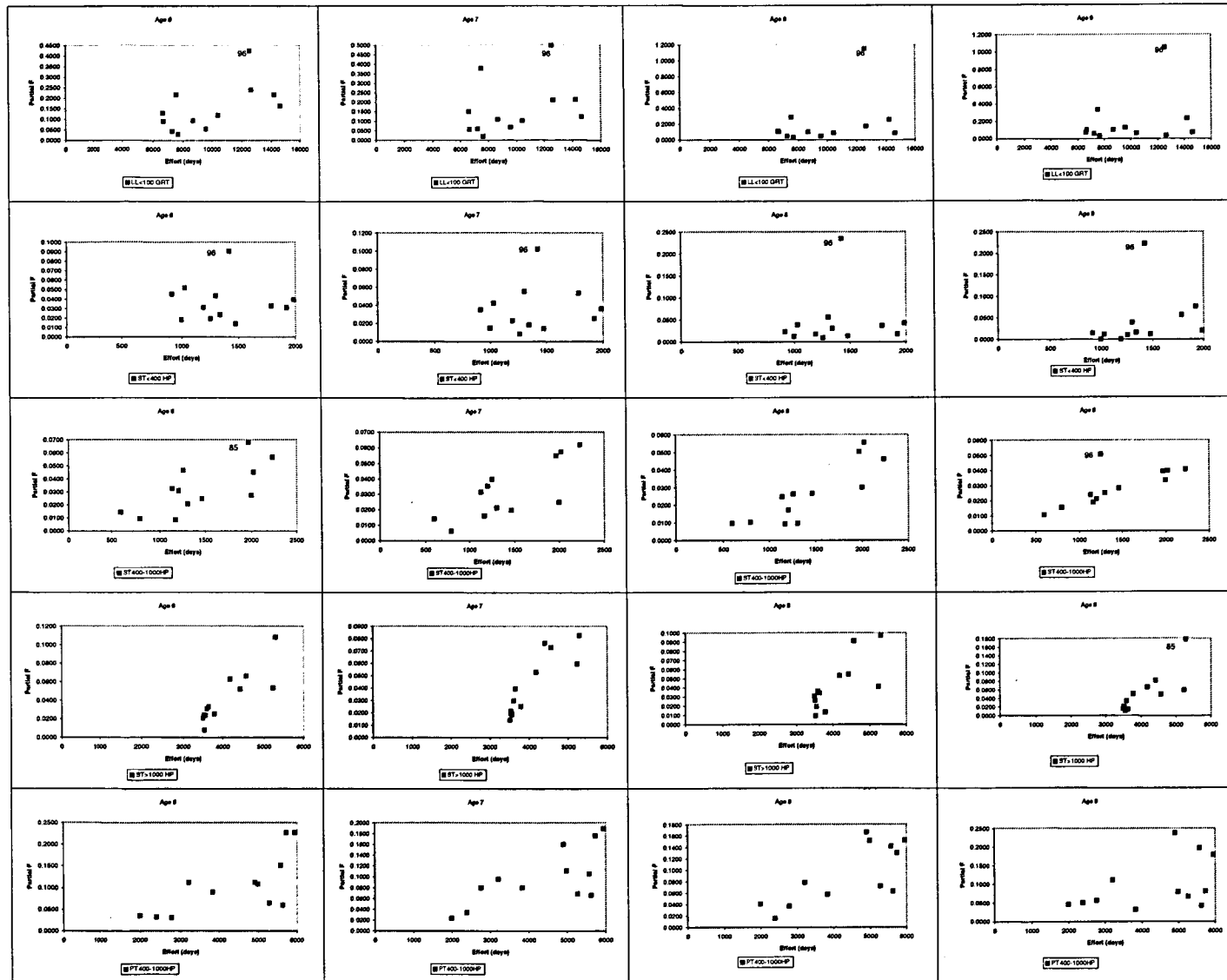


Figure 2.2.18 (Cont'd)

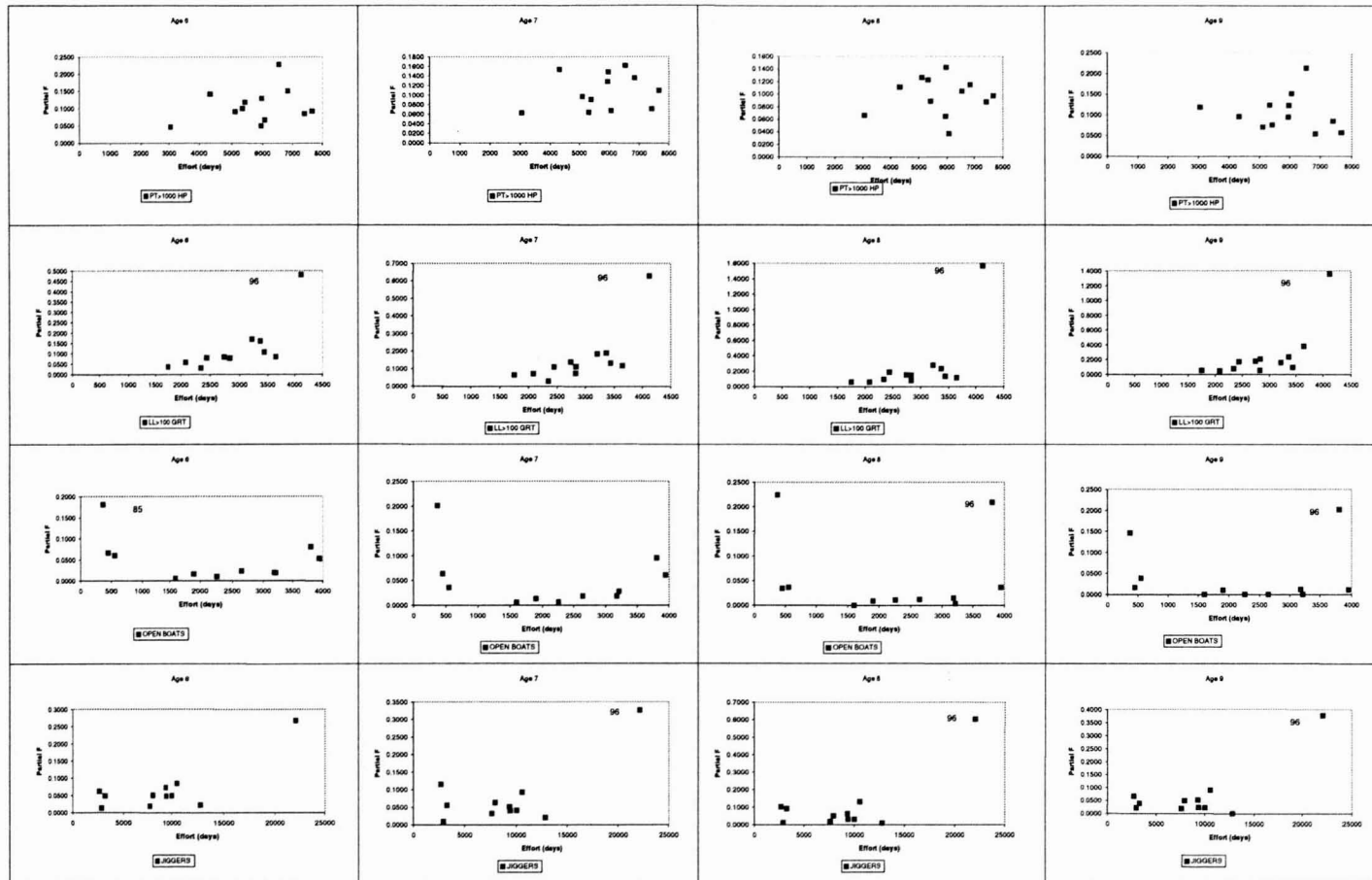


Figure 2.2.18 (Cont'd)

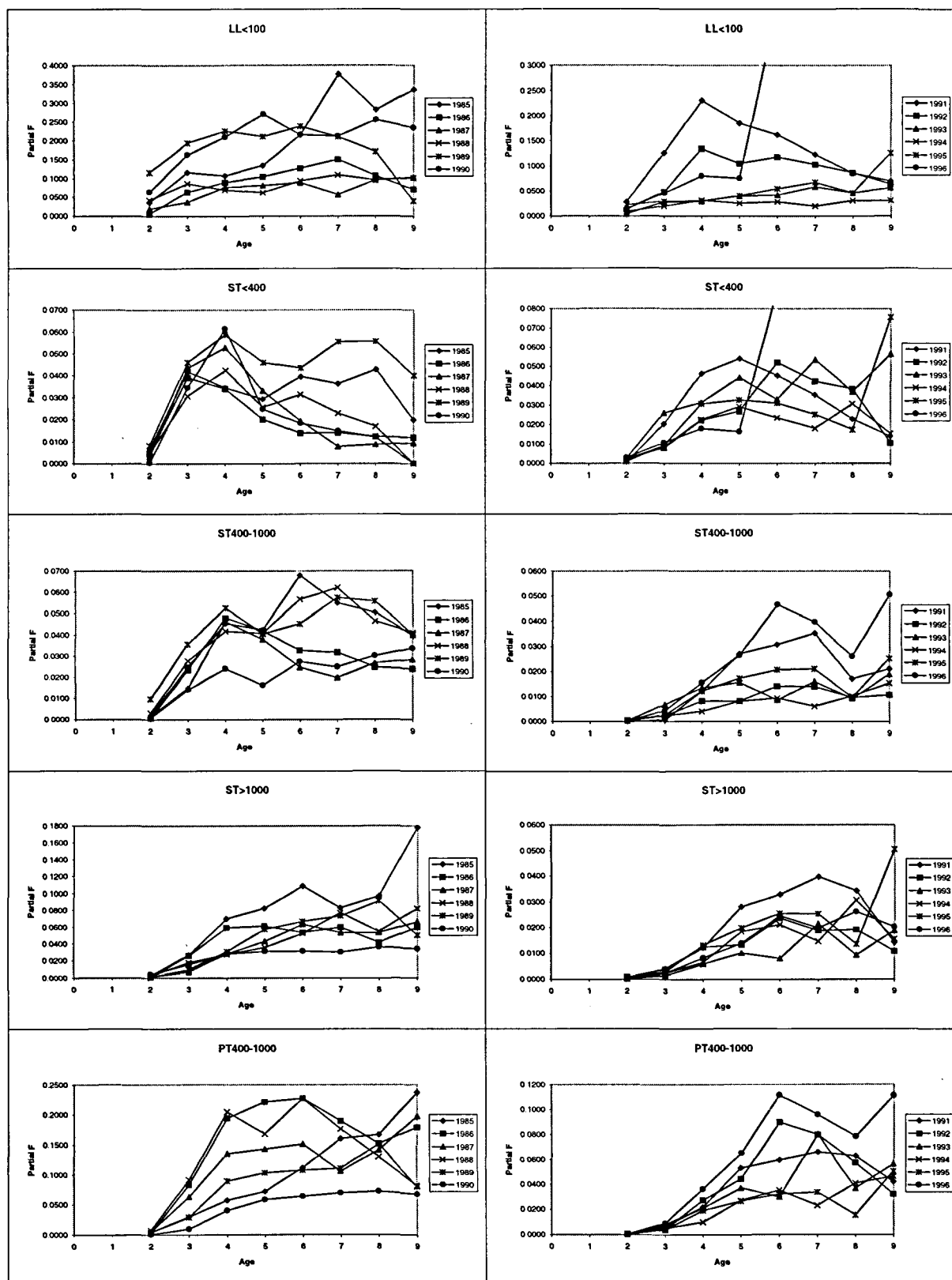


Figure 2.2.19 Partial F at age for different faroese fleets 1985-1996.

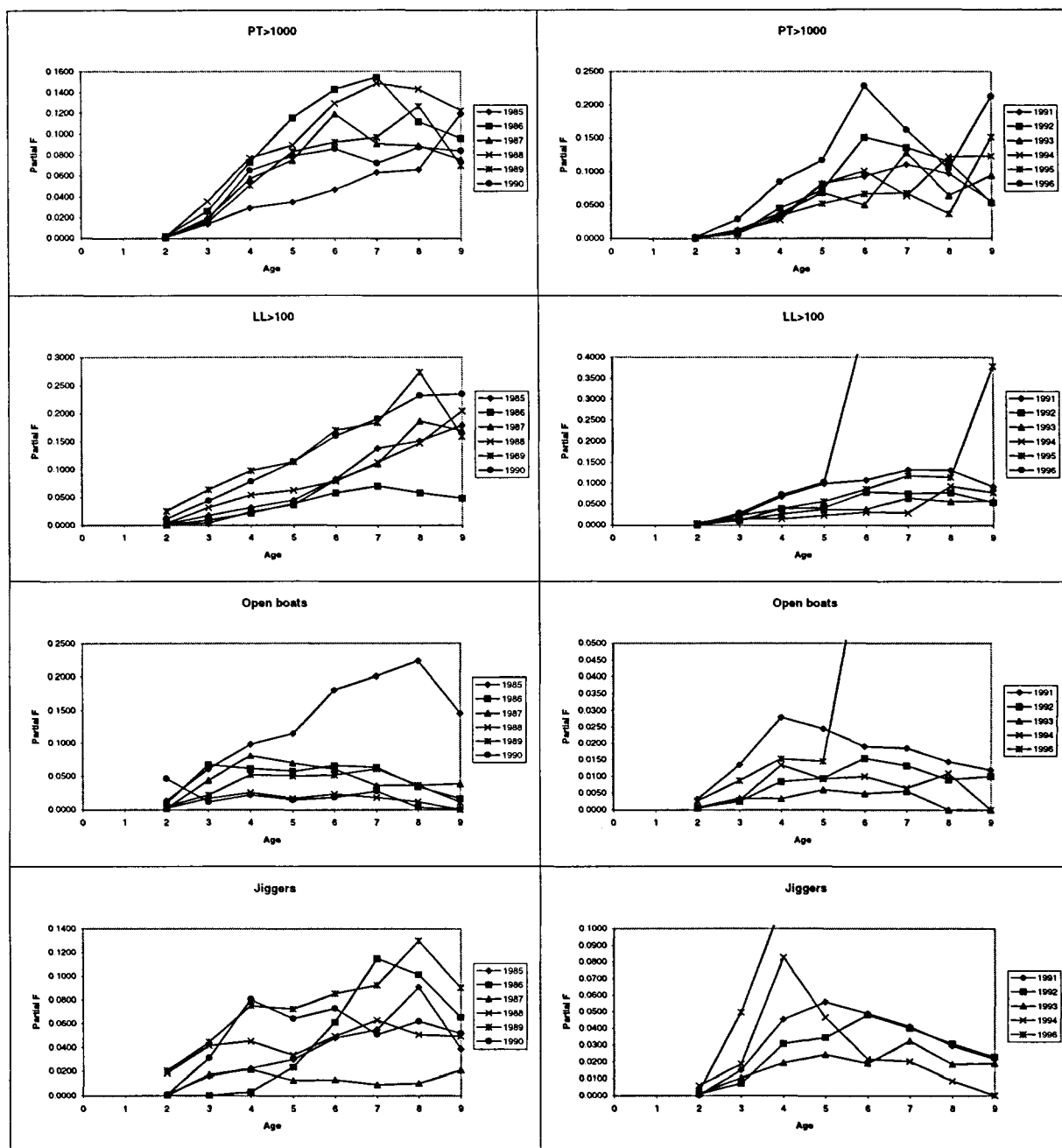


Figure 2.2.19 (continued) Partial F at age for different faroese fleets 1985-1996.

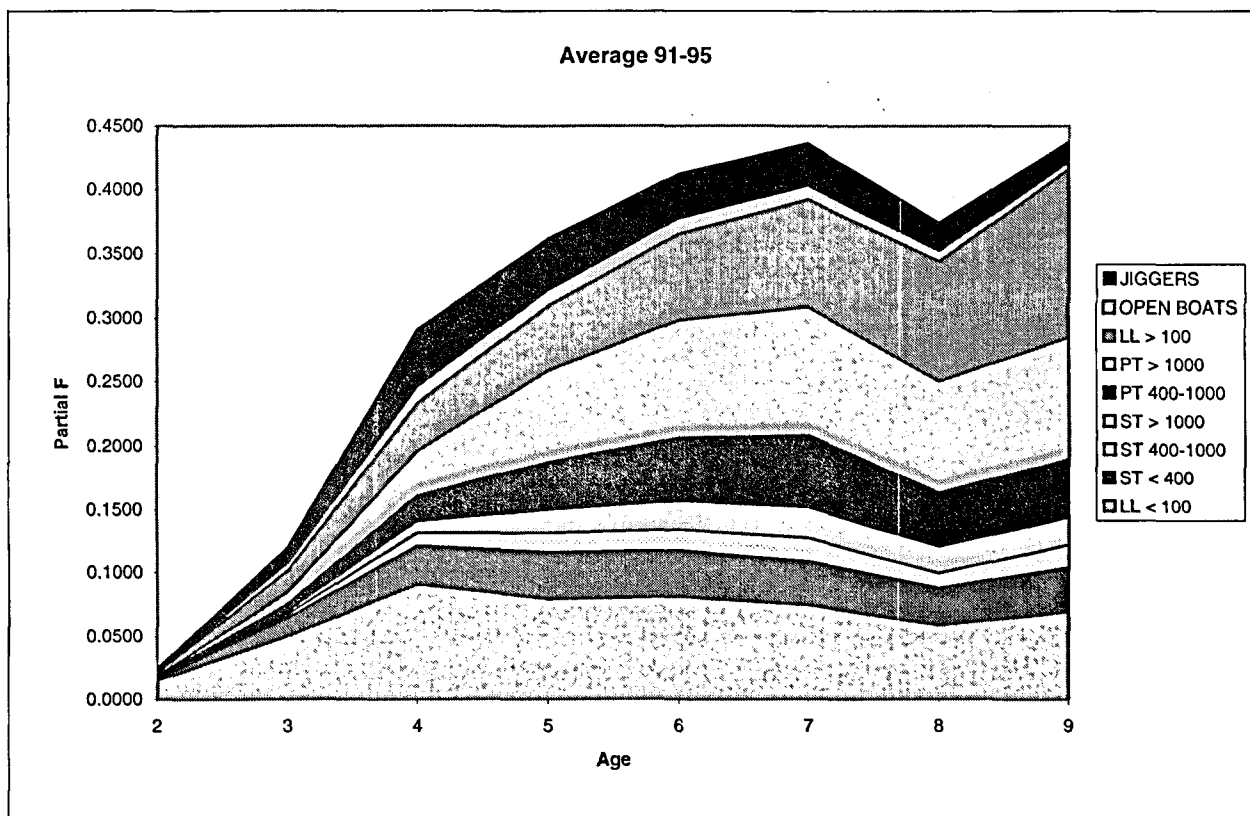


Figure 2.2.20 Partial F at age (average 1991-1995) for different faroese fleets.

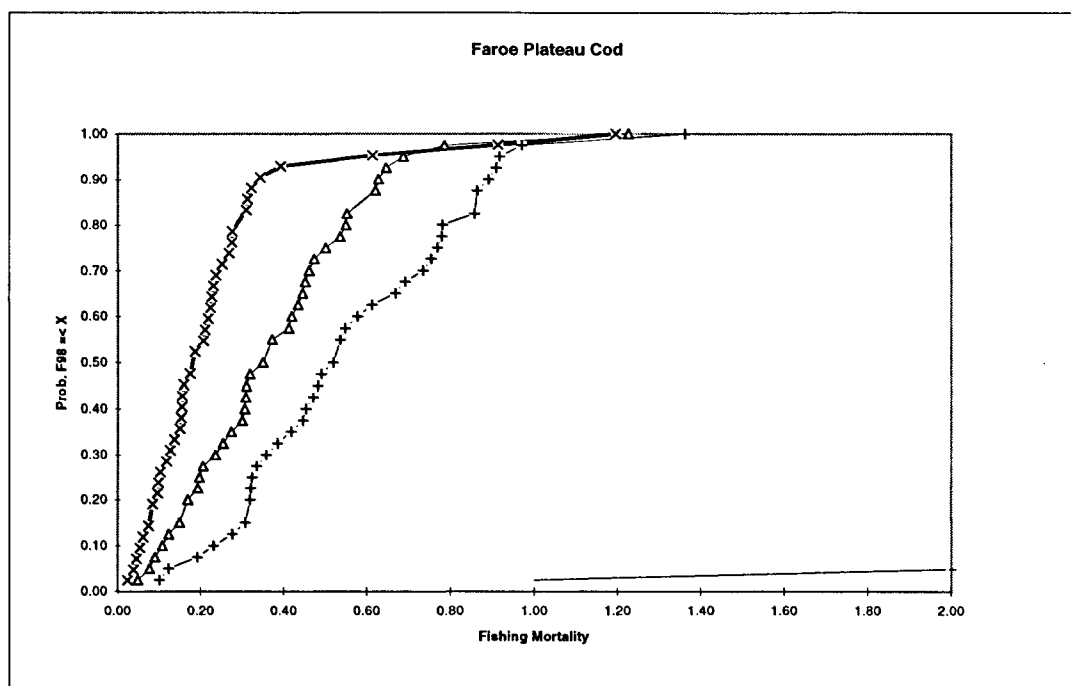


Figure 2.2.21 Faroe Plateau Cod. Cumulative probability distribution of the 1998 fishing mortalities under the current number of fishing days allocated for the LL<100, ST<400, PT400-1000, PT>1000, LL>100, OPEN, and JIGGERS. Three options are presented where the 9320 days allocated to the LL < 100, Jiggers and ST < 400 is either used entirely by the LL (solid line), the ST < 400 (line with +) or by the Jiggers (line with triangles, with 18640 days). The probability does not reach 1.0 on the graph because of a few very high catchabilities in 1985 for some of the fleets. The line with X shows a reduction by half of the days for every fleet.

2.3 Faroe Bank Cod

2.3.1 Trends in landings and effort

Total nominal landings of the Faroe Bank cod from 1985 to 1996 as officially reported to ICES are given in Table 2.3.1.1. The catches reached a maximum of 5 000 t in 1973. In recent years the catches have declined from about 3 500 t in 1987 to only 330 t in 1992. The catches in 1994 increased to 953 t, decreased to 666 t in 1995, and increased in 1996 to 2 108 t.

Due to the decreasing trend in the cod catches at Faroe Bank, ACFM in 1990 advised the Faroese authorities to close the Bank to all fishing. This advice was followed for depths shallower than 200 meters. In 1992 and 1993 long liners and jiggers were allowed to participate in an experimental fishery inside the 200 meter depth contour. The catches reported for 1992-1994, therefore, partly originate from the shallower parts of the Bank. For the quota year 1 September 1995 to 31 August 1996 a fixed quota of 1 050 t was set. The new management regime which is based on fishing days was, however, introduced on 1 June 1996 allowing longliners and jiggers to fish inside the 200 m contour. The trawlers are only allowed to fish outside the 200 m depth contour.

2.3.2 Stock assessment

Biological sampling has been taken in the most recent years from commercial landings (the 1996 sampling level is shown in Table 2.3.2.1) and from the groundfish survey. The available data for the Faroe Bank cod are not adequate to allow for a detailed analytical assessment of the stock, but the results of a tentative general production model are presented.

Faroese groundfish surveys cover waters on the Faroe Bank. Cod is mainly taken within the 200 m depth contour. The catches of cod per trawl hour in water shallower than 200 meter are shown in Figure 2.3.2.1. The CPUE declined from 202 kg/hour in 1984 to only 22 kg/hour in 1990. The index of stock size has increased in recent years, reaching its highest value in 1997.

The length distributions in the survey 1983-1997 are shown in Figure 2.3.2.2 and seem to reflect the development in the catches by having a wider range when catches are on a high level.

A Schaefer general production model was fit to the Faroe Bank cod landings data using the research vessel survey CPUE for 1983 to 1996 in kg/hour as an index of stock biomass. The Schaefer model is defined by three parameters, the intrinsic rate of growth of the stock (r), the virgin biomass or carrying capacity (k) and the initial biomass at the start of the time series. The catchability coefficient (q) is derived analytically as the average (exponential of the average $\ln(\text{cpue}/B)$) q estimated in the period covered.

The model was fitted using Excel Solver to minimize the sum of squared residuals between the \ln observed CPUE and the \ln predicted CPUE where the predicted CPUE is:

$$\text{CPUE}_{\text{pred}_t} = B_t \cdot q$$

the biomass is:

$$B_{t+1} = B_t + (r \cdot B_t \cdot (1 - B_t/k)) - C_t$$

and C is catch.

Parameter values obtained last year were used as starting values.

Year of Assess.	Virgin Biomass	Rate of increase	q	Init. Biomass
1996	11654 t.	.558	.027	9294 t.
1997	11706 t.	.560	.0149	11194 t.

The model parameters are not very stable and needed to be constrained ($r \leq 0.99$, $k \leq 14\,000$ t. and $B_i \leq k$). The minimization was done for 1984 to 1996 with the initial biomass estimated for 1983. Once reasonably stable parameters had been obtained, the Excel Function Goal Seek was used to find the k that made MSY equal to the average landings of 1633 t. This changed the k slightly from 11194t. to the value in the table above. This implies

an FMSY of about 0.28. Landings, CPUE, predicted CPUE, the residuals, and predicted biomass are presented in Table 2.3.2.2 while the equilibrium production curves with the transient points is shown in Figure 2.3.2.3. The parameter estimates are given in the text table above.

2.3.3 Target reference points and limit reference points

The results presented above should be used with caution as they are based on very limited data, several assumptions and that different minimizations gave different results. Thus, no specific values can be put forward as reference points.

2.3.4 Management considerations

The data presented indicate that the stock appears to be increasing from its previous low level. However, similar to Faroe Plateau cod, it is not known if the increase in the survey is due to increased abundance or increased availability. Therefore, caution should continue to be exercised in order to rebuild the biomass to values which will produce good recruitment on a sustained basis.

Table 2.3.1.1. Faroe Bank (Sub-division Vb2) COD. Nominal catches (tonnes) by countries, 1986-1996, as officially reported to ICES.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996 ^{*)}
Faroe Islands	1,836	3,409	2,960	1,270	289	297	122	264	717	561	2,051
Norway	6	23	94	128	72	38	32	2 *	8 *	105 *	57
UK (Engl. and Wales)	-	-	-	-	-	-	+	1	1	- ²	-
UK (Scotland) ²⁾	63	47	37	14	205 ³⁾	90	176 ³⁾	118	227	- ²	- ²
United Kingdom	-	-	-	-	-	-	-	-	-	-	- ²
Total	1,905	3,479	3,091	1,412	566	425	330	385	953	666	2,108

*) Provisional data

1) Includes Vb1

2) Included in Vb1 /UK

3) Revised

Table 2.3.2.1. Samples of lengths, otoliths, and individual weights of Faroe Bank cod in 1996.

Fleet	Size	Samples	Length	Otoliths	Weights
Longliners	<100 GRT	0	0	0	0
Longliners	>100 GRT	3	361	60	60
Jiggers		18	1,262	240	240
Sing. trawlers	<400 HP	0	0	0	0
Sing. trawlers	400-1000 HP	0	0	0	0
Sing. trawlers	>1000 HP	0	0	0	0
Pair trawlers	<1000 HP	1	239	0	0
Pair trawlers	>1000 HP	1	56	51	0
Total		23	1,918	351	300

Table 2.3.2.2. Landings, CPUE, predicted CPUE, residuals and predicted biomass of Faroe Bank cod.

Year	Observed Catch	Observed CPUE	Predicted CPUE	ln(CPUE/B)	Predicted Biomass
1983	2,367	88.8	167.1	-4.84	11,194
1984	2,216	201.6	135.8	-3.81	9,100
1985	2,961	149.4	119.6	-3.98	8,015
1986	1,905	266.1	96.5	-3.19	6,464
1987	3,479	151.2	92.1	-3.71	6,174
1988	3,091	82.9	64.5	-3.95	4,323
1989	1,412	36.3	41.1	-4.33	2,754
1990	566	21.5	37.6	-4.76	2,517
1991	425	54.6	45.6	-4.02	3,053
1992	330	28.4	58.0	-4.92	3,887
1993	385	25.8	74.7	-5.27	5,006
1994	953	52.3	92.8	-4.78	6,220
1995	666	95.3	102.9	-4.28	6,893
1996	2,108	380.3	116.5	-3.02	7,809
1997	1,995 *				7,151
1998					6,709

*) Predicted

Index

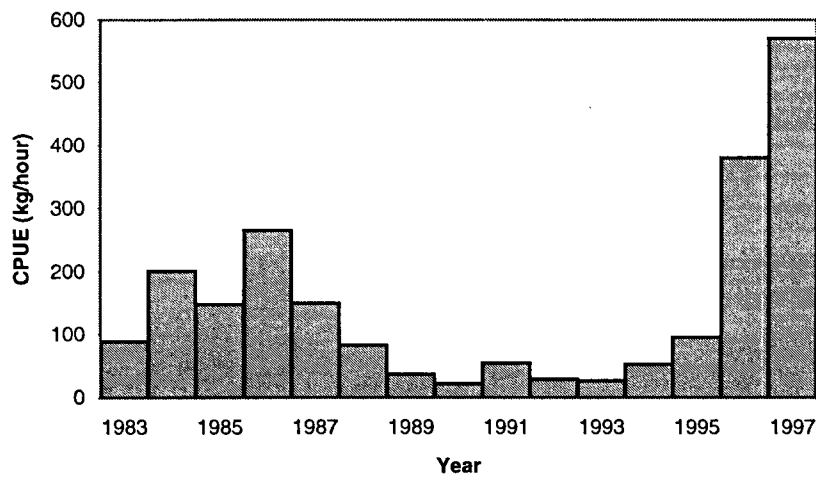


Figure 2.3.2.1. Catch per unit effort of Faroe Bank cod in the groundfish survey.

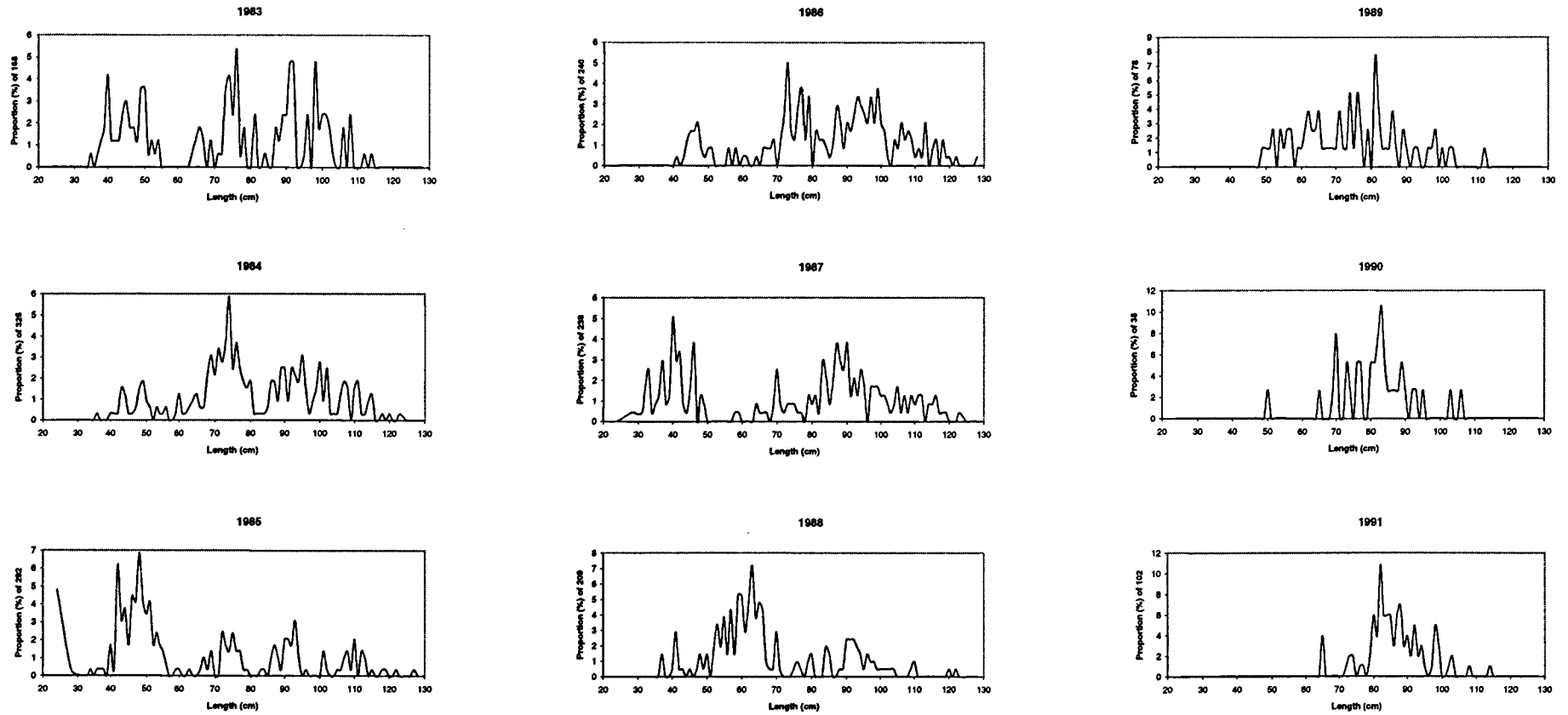


Fig. 2.3.2.2 Length distributions of Faroe Bank cod in the groundfish surveys 1983-1997.

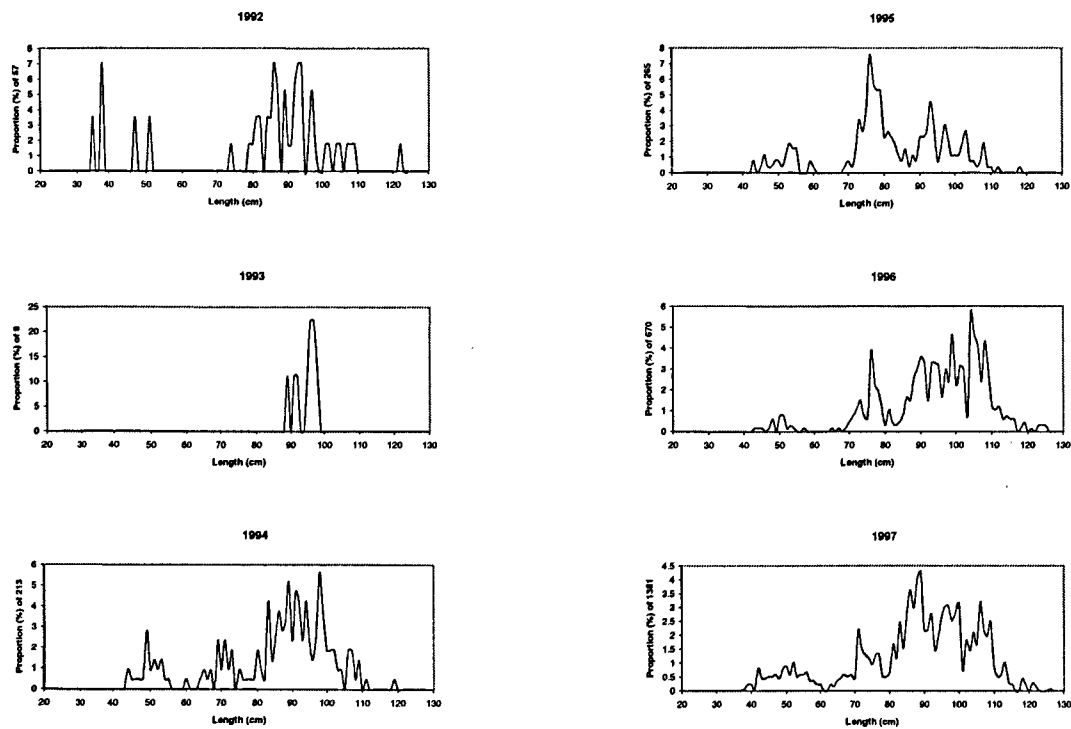


Fig. 2.3.2.2 (continued) Length distributions of Faroe Bank cod in the groundfish surveys 1993-1997.

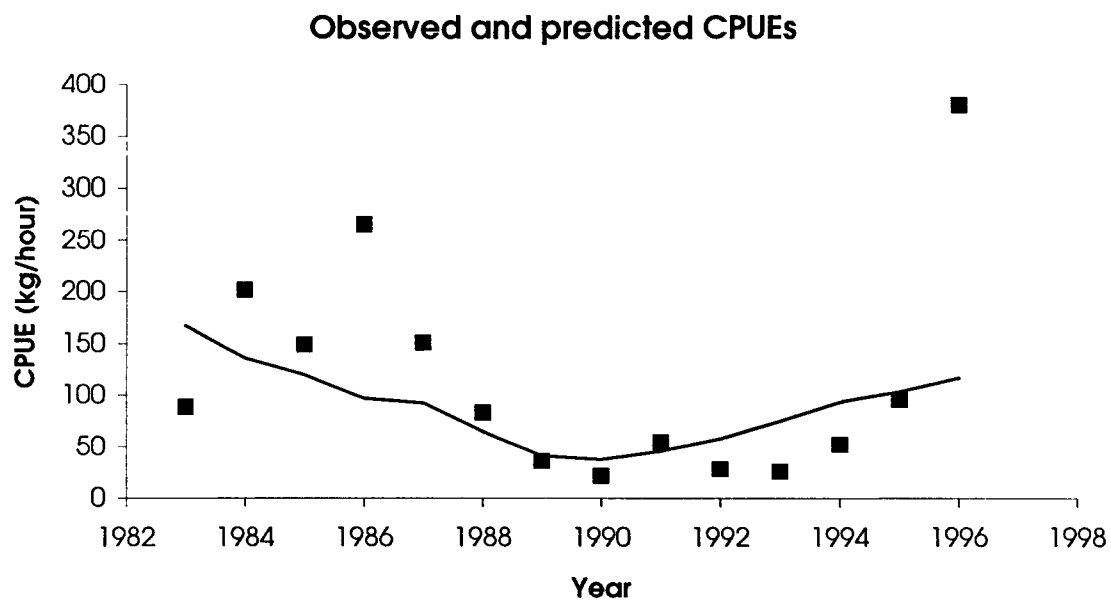


Fig. 2.3.2.3. Observed (points) and predicted (line) CPUEs of Faroe Bank cod.

2.4 Faroe Haddock

2.4.1 Landings and trends in the fishery

Officially reported catches of haddock from the Faroe Plateau increased from a low level of 10 000 t in 1982 to 14 000 t in 1987, but later decreased to a very low level in 1993 and 1994 below 4 000 t; a slight increase to about 4 600 t was noted for 1995 but in 1996 catches rose to almost 9 400 t (Table 2.4.1). Officially reported catches for 1981-1992 from the Faroe Bank have varied between 500 and 1 600 t (on average 1 000 t), but dropped in 1993-1996 to 300-375 t. The closure of the fishery on the shallower parts of the Bank in 1990 and the introduction of a controlled fishery there since 1993, as described in Section 2.1, reduced the Faroese catches (Table 2.4.2) whereas Scottish catches remained relatively high in 1990-92. However, in the assessment only the fraction of the Scottish catches which have been reported to the Faroese authorities are included. In addition, some minor French catches in Division Vb, reported to the Faroese authorities, and minor Faroese catches of haddock in ICES Sub-Division IIa close to the boundary with Sub-Division Vb1 (see Figure 2.1.1), are used in the assessment (Table 2.4.1).

Faroese vessels have taken almost the entire catch in recent years. Table 2.4.3 shows the Faroese landings since 1985 and the proportion taken by each fleet category. Pair trawlers and longliners took most of the catches in these years and within these two groups the relative importance of the larger vessels has increased. Due to poor catches and poor economic conditions, the effort of most fleets decreased in the early 1990s but from 1995 it has increased again (Tables 2.1.4 and 2.4.8). In addition, the fishing ban on the cod spawning grounds before and during the spawning period of cod since 1992 (Section 2.1) has had an impact on the haddock fishery as well. The catch per unit effort for most fleets has declined drastically since the late 1980s. However, from 1995 the cpue for most fleets has increased considerably (Figure 2.4.1).

The 1996 monthly Faroese landings of haddock by fleet category from Sub-Divisions Vb1 and Vb2, are shown on Figure 2.4.2. On the Plateau the catches are fairly evenly distributed throughout the year with peaks during the spawning season in the spring and in November/December. On the Faroe Bank the monthly catches show a similar pattern with an additional peak in July-August. Although being a bycatch in the pairtrawlers directed fishery for saithe, the pairtrawlers take almost all the catch of haddock on the Faroe Bank. On the Faroe Plateau the longliner catches are substantial except during the summer months when most of the longliners fish in deeper waters and/or outside the Faroese EEZ. The longline fishery mostly targets both cod and haddock, while trawler catches of haddock in the most recent years must be regarded as a by-catch.

2.4.2 Catch at age

For the Faroese landings, catch-at-age data were provided for fish taken from the Faroe Plateau and the Faroe Bank. Data from the two areas are combined as the fish are believed to belong to the same stock. The sampling intensity in 1996 was:

No. of samples:	227
No. of length measurements:	42195
No. of individual weight measurements:	3635
No. of otoliths:	6504

Samples from each fleet category were disaggregated by season and then raised by the catch proportions to give the 1996 catch at age in numbers for each fleet (Table 2.4.4). Catches of some minor fleets have been included under the others heading. No catch-at-age data were available from other nations fishing in Faroese waters. Therefore, catches by UK trawlers were assumed to have the same age composition as Faroese otter board trawlers greater than 1000 HP. The Norwegian longliners were assumed to have the same age distribution as the Faroese longliners greater than 100 GRT. The most recent data were revised according to the final catch figures. The resulting total catch at age in numbers are given in Table 2.4.4 and Table 2.4.5.

2.4.3 Weight at age

Mean weight-at-age data are provided for the Faroese fishery (Table 2.4.6). The sum-of-products check for 1996 was 1.03. Figure 2.4.3 shows that the mean weights-at-age for most age groups, which were declining since the mid-1980s, stabilized at a low level for 2-3 years and increased again in 1993-1995. The weights of the 2-4 years old have since decreased, however. By comparing the mean weights at age for the commercial landings in the first

quarter of the year in 1996 with the recent years, the growth seems to have decreased for most year classes (Table 2.4.7).

2.4.4 Maturity at age

Maturity-at-age data were available from the Faroese Groundfish Surveys 1982-1997. The surveys are carried out in February-March, so the maturity at age is determined just prior to the spawning of haddock in Faroese waters and the determinations of the different maturity stages should be relatively easy. In order to reduce eventual year to year effects due to possible inadequate sampling and at the same time allow for trends in the series, a 3 year running average was used in the assessment at the 1996 meeting of the Working Group.

This year a model described in the 1993 North Western Working Group Report (ICES C.M 1993/Assess:18) was used in order to predict maturity at age. The basic model used was a GLM with a Logit link function describing maturity at age as a function of age, year class strength, mean weight at age and a year effect. Of those factors age, mean weight at age and year were significant and no other variables were needed. However, the predicted maturity at age values from the model were not very different from the observed values so the procedure with the running 3 years average was used in this years assessment as well. A comparison of the three different maturity at age series is shown in Figure 2.4.4.

For the years prior to 1982, average maturity at age from the surveys 1982-1995 was adopted (Table 2.4.8).

2.4.5 Assessment

2.4.5.1 Tuning and estimates of fishing mortality

Following numerous analyses of all available series of catch and effort data, it was decided at the 1995 meeting of the North Western Working Group to reduce the number of fleets to five and omit some years and ages from the series. The same revised fleets were updated and used for tuning of the VPA in the 1996 assessment. This year a preliminary run with the same series updated resulted in very unreliable numbers of survivors and fishing mortalities and the statistic diagnostics looked poor. Therefore, a reanalysis of all available tuning series was made using ADAPT and XSA as tools (Working Document no. 1). However, no additional series could be used for tuning, and based on this analysis one of the 1996 commercial series was omitted. Some years and ages in the remaining series were removed as well.

The four tuning series used in this years assessment are shown in Table 2.4.9. The trawl survey is carried out every year in February-March, so the results are available prior to the annual NWWG meeting; the estimates of catches in numbers at age per trawl hour in the surveys (Figure 2.4.5) are used as if they represented one fleet with the same effort for all the years in the tuning process. In the tuning, the survey estimates 1986-97 were shifted back to the end of the year before. The commercial series consist of effort measured in number of fishing days and the corresponding catch at age in numbers for each fleet.

Several XSA runs were made with different settings. The best retrospective pattern was obtained with no shrinkage of the mean but for some unknown reason the tuning gave strange constant high fishing mortalities for the oldest ages. The retrospective patterns of the resulting fishing mortalities in three runs with different shrinkages are presented in Figure 2.4.7 A-C. Based on this, the working group decided to use the XSA shrunk 2.0 in this assessment.

The diagnostics from the XSA are shown in Table 2.4.10, and a plot of the log catchability residuals for each of the four fleets is shown in Figure 2.4.8. The diagnostics and the residual plots still show high CV's for two of the series, and there are indications of trends in some cases. The longliners below 100 GRT and the trawl survey have poor statistic diagnostics. However, when these fleets were excluded, the XSA resulted in very low fishing mortalities, especially for the younger age groups. Therefore, they were included in the tuning.

The fishing mortalities from the final XSA run are given in Table 2.4.11 and in Figure 2.4.10A. Up to 1991 there was an increase in fishing mortality. This is consistent with the decreasing stock sizes and the information on increased effort (more hooks per set) and decreased hook sizes in the long line fishery. However from 1992, the mean F for ages 3-7 decreased again which may be partly explained by the introduction of a fishing ban on the cod spawning grounds before and during the cod spawning season, and the poor economic situation for most fleets which is reflected in the decline in number of fishing days in 1993 and 1994 as seen in Table 2.1.4. In those two years, the

fishing mortality is estimated to be below the natural mortality of 0.2. A slight increase in mean F is noted in 1995 but in 1996 the fishing mortality increased considerably which also is in agreement with the increased number of fishing days as seen in Table 2.1.4. The mean fishing mortality for ages 3-7 was estimated at 0.31.

2.4.5.2 Stock estimates and recruitment

The stock size in numbers is given in Table 2.4.12 and a summary of the "VPA" with the biomass estimates is given in Table 2.4.13. The spawning stock biomass decreased from over 62 000 t in 1987 to 21 000 t in 1994, increased to 25 000 t in 1995 and to 44 000 t in 1996. The decline in the spawning stock began in the late 1970s due to very poor recruitment in those years. The stabilisation in the spawning stock biomass at a relatively high level in the mid-1980s was due to the relatively good 1982 and 1983 year classes, but the decline since then was partly due to poor year classes since the mid-1980s, as well as the pronounced decline in the mean weights at age in the stock. The mean weights at age increased for most ages from 1993-95 but are now decreasing again (Figure 2.4.3). The 1993 year class is estimated to be the second best in the series and the 1994 year class at about average size.

2.4.6 Prediction of catch and biomass

2.4.6.1 Input data

2.4.6.1.1 Short-term prediction

The input data for the short-term predictions are given in Table 2.4.16

The year classes up to 1994 inclusive are from the final VPA while the 1995-96 year classes at age 2 were predicted using the RCT3 program. As input for RCT3, stratified mean-catch-per-hour of age groups 1-3 in the Faroese groundfish survey 1985-97 were used (Table 2.4.14). The output from the RCT3 is given in Table 2.4.15. The very strong 1993 year class at age 2 is estimated from the RCT3 to be only half of the XSA value in this years assessment while the 1994 year class is estimated at above 62 millions 2 years old fish in 1996. One reason for this high estimate is the relatively high weight which is given to the survey index in 1995 for age 1. It is not believed that the indices for age 1 and 2 in the survey are precisely reflecting the recruitment at age 2 for the 1994 year class because the 1995-1997 survey results for this year class reflect a high mortality for this year class from 1995-96 (Figure 2.4.6). This is confirmed by stomach analysis showing a high predation by cod on 1 and 2 year old haddock in 1995-96. Further, the 1994 year class does not show strongly in 1996 and in January-March 1997 compared to the 1993 year class (Figure 2.4.9). Therefore, the XSA value from the current assessment was used for the 1994 year class in the prediction. The 1997 year class at age 2 was estimated as the average of the 2 year olds in 1986-98, i.e. 1984-94 year classes from the final VPA, the 1995-96 year classes from the RCT3.

The exploitation pattern used in the prediction was derived from averaging the 1994-1996 fishing mortality matrices from the final VPA and then rescaling the averages to the 1996 level.

The mean weight at age for ages 3-9 in 1997 was predicted using a multiple regression analysis. The mean weight at age was predicted by the parameters age, catch in numbers from the final VPA and the mean weights for the preceding year and the preceding age. The regression analysis showed a significant relationship for the above ages. The predicted weights are shown in Figure 2.4.3B. The mean weight at age for the two year olds in 1997 were calculated as the average weight at age for age 2 in 1994-96. The 1997 mean weights at age were also applied for 1998 and 1999.

The maturity ogive for 1997-99 is based on samples from the Faroese Groundfish Surveys and estimated as the average of the observations in 1995-97.

2.4.6.1.2 Medium-term prediction

Because of shortage of time the working group did not make any medium-term predictions.

2.4.6.1.3 Long-term Prediction

The input data for the long-term yield and spawning stock biomass (yield per recruit calculations) are listed in Table 2.4.18. Mean weights-at-age are averages for the 1977-1996 period. The maturity ogives are averages for the years 1983-96. The exploitation pattern was derived from the fishing mortality matrix from the final VPA as average F -

values for the long time period. Before averaging the annual fishing mortalities were scaled to let the $F_{bar}(age3-7)$ equal 1.0. In the input table the values are rescaled again to the $F_{bar}(age3-7)$ long term average.

2.4.6.2 Biological reference points

The yield- and spawning stock biomass per recruit (age 2) based on the long-term data are shown in Table 2.4.19 and Figure 2.4.10C. F_{max} and $F_{0.1}$ are indicated here as 0.42 and 0.17, respectively. From Figure 2.4.11, showing the recruit/spawning stock relationship, and from Table 2.4.19, F_{med} and F_{high} were calculated to be 0.3 and 0.86, respectively.

MBAL for this stock has previously been set at 40 000 t and based on an analysis during the 1996 meeting of this working group, it was concluded that it would be advisable to keep this stock at the 40-60 000t level. However this years assessment confirm that strong and average year classes can be produced from SSB's just above 20 000 t. The reasons for this discrepancy could be related to ecological phenomena because good year classes seem to occur in many areas at the same time. Another possible explanation could be the structure or quality of the SSB. Inspecting the stock in number table (Table 2.4.12) it is seen, that even if the stock is small, the proportion of old fish in the stock is high. This may enhance reproductive success.

In Table 2.4.20 estimates of different reference points are given. These results should at this stage be taken only as illustrative for the progress in getting such values to use for future definitions of safe biological limits.

2.4.6.3 Projections of catch and biomass

2.4.6.3.1 Short-term prediction

In the light of the performance of the new management system (Section 2.4.8), it is not unrealistic to assume the same level of fishing mortalities in 1997 as in 1996. The prediction was therefore run with a status quo reference F in 1997. The catch in 1997 is then predicted to be about 17 000 t and continuing with this fishing mortality will result in a 1998 catch of 16 000 t. The SSB will in this case increase from 55 000 t in 1997 to 61 000 t in 1998, but will then decrease to 54 000 t in 1999. The results of the short-term prediction are shown in Table 2.4.17 and in Figure 2.4.10D.

2.4.6.3.2 Medium-term considerations

Although no medium-term prediction was made the working group concluded that no future increase in SSB is expected in the medium term as there is already seen in the short term prediction a decrease in SSB from the predicted value in 1998, and there are no signs of good recruiting year classes in the survey.

2.4.7 Managements considerations

The stock seems at present to be within safe biological limits.

In order to evaluate the fishing mortality that could be generated in 1997 and 1998 from the present number of fishing days allocated to each fishing fleets, the partial fishing mortalities by age and year were calculated for all fleets except jiggers and open boats from the catch at age ratios for 1985 to 1995. The reason for not including the jiggers and the open boats are, that their share of total catches is relatively small (2 - 3% of the total catch). The same analysis as for the Faroe Plateau Cod (see Section 2.2.2) was performed for the haddock.

The average partial F at age by fleet in this analysis for 1991-95 is shown in Figure 2.4.12.

The average age specific catchabilities for all fleets in this analysis are shown in Figure 2.4.13.

The probability density function of the potential fishing mortality in 1997 and 1998 given the allocated number of fishing days to each fleets is given in Table 2.4.21 and in Figure 2.4.14. Three options are presented where the 9320 days allocated to the Longliners < 100 GRT, Single Trawlers < 400 HP and Jiggers are used entirely by one of the mentioned fleet categories. The longliners < 100 GRT show a reduction by half of the days for every fleet. The fishing mortality referred to so far do not include the partial F exerted by the Single trawlers 400-1000 HP and the Single trawlers >1000 HP because these fleets are not in the fishing day regulation scheme (see Section 2.2.1). These two fleets are expected to exert at least a fishing mortality of 0.02. Therefore, in examining Table

2.4.21, the 0.02 from the ST and the 0.03 from the jiggers and open boats that is, 0.05 should be added to the fishing mortality column to reflect the activities of these three fleets. The results show that there is an approximately 80% probability that the fishing mortality in 1998 will not exceed $F=0.3$ if the present level of fishing days are exerted in 1997 -1998. If the allocation of fishing days to all fleets are cut by half, there is an approximate 80% that the fishing mortality will not exceed $F=0.18$.

(See Sections 2.1 and 2.2 for further explanation).

Table 2.4.1 Faroe Plateau (Sub-division Vb1) HADDOCK. Nominal catches (tonnes) by countries 1982-1996, as officially reported to ICES, and the total Working Group estimate in Vb.

Country	1982	1983	1984	1985	1986	1987	1988	1989
Denmark	-	-	-	-	1	8	4	-
Faroe Islands	10,319	11,898	11,418	13,597	13,359	13,954	10,867	13,506
France ¹	2	2	20	23	8	22	14	-
Germany	1	+	+	+	1	1	-	+
Norway	12	12	10	21	22	13	54	111
UK (Engl. and Wales)	-	-	-	-	-	2	-	-
UK (Scotland) ³	1	-	-	-	-	-	-	-
United Kingdom								
Total	10,335	11,912	11,448	13,641	13,391	14,000	10,939	13,617
Working Group estimate ^{4,5}	11,937	12,894	12,378	15,143	14,477	14,882	12,178	14,325

Country	1990	1991	1992	1993	1994	1995	1996 ²
Denmark	-	-	-	-	-	-	-
Faroe Islands	11,106	8,074	4,629	3,622	3,675	4,566	9,122
France ¹	-	-	164	-	-	-	-
Germany	+	+	-	-	-	5	-
Norway	94	125	71	29 ²	22 ²	28 ²	164
UK (Engl. and Wales)	7	-	71	80	-	-	...
UK (Scotland) ³	-	-	-	-	-	-	...
United Kingdom					200 ⁶	55 ⁶	67 ⁶
Total	11,207	8,199	4,935	3,731	3,897	4,654	9,353
Working Group estimate ^{4,5}	11,726	8,429	5,476	4,026	4,251	4,987	9,761

1) Including catches from Sub-division Vb2. Quantity unknown 1989-1991, 1993 and 1995-96.

2) Provisional data

3) From 1983 catches included in Sub-division Vb2.

4) Includes catches from Sub-division Vb2 and Division IIa in Faroese waters.

5) Includes French catches from Division Vb, as reported to the Faroese coastal guard service

6) Reported as Division Vb.

Table 2.4.2 Faroe Bank (Sub-division Vb2) HADDOCK. Nominal catches (tonnes) by countries, 1982-1996, as officially reported to ICES.

Country	1982	1983	1984	1985	1986	1987	1988	1989
Faroe Islands	1,533	967	925	1,474	1,050	832	1,160	659
France ¹	-	-	-	-	-	-	-	-
Norway	1	2	5	3	10	5	43	16
UK (Engl. and Wales)	-	-	-	-	-	-	-	-
UK (Scotland) ³	48	13	+	25	26	45	15	30
Total	1,582	982	930	1,502	1,086	882	1,218	705

Country	1990	1991	1992	1993	1994	1995	1996 ²
Faroe Islands	325	217	338	185	353	313	338
France ¹	-	-	-	-	-	-	-
Norway	97	4	23	8 ²	1 ²	20 ²	40
UK (Engl. and Wales)	-	-	+	+	... ¹	... ¹	... ¹
UK (Scotland) ³	725	287	852	102	... ¹	... ¹	... ¹
Total	1,147	508	1,213	295	354	333	378

1) Catches included in Sub-division Vb1.

2) Provisional data

3) Since 1983 includes also catches taken in Sub-division Vb1 (see Table 2.4.1)

Table 2.4.3

Total Faroese landings of haddock from Division Vb and the contribution (%) by each fleet category (metier). In the column to the right are the average haddock percentages of the total landings of all species by each fleet category.

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Haddock %
Open boats	7	7	11	2	3	2	3	2	1	1	1	2	23
Longliners < 100GRT	39	39	39	49	58	60	56	46	24	18	23	28	49
Longliners > 100GRT	13	12	13	19	18	18	18	22	25	25	38	36	27
Otterboard trawlers < 400HP	1	2	2	2	1	1	2	2	8	8	7	6	13
Otter board trawlers 400-999	6	3	5	4	3	3	1	1	3	2	5	7	13
Otterboard trawlers > 1000HP	8	5	2	2	2	2	2	1	1	3	2	2	1
Pairtrawlers < 1000HP	19	20	17	11	7	5	7	11	13	10	8	7	9
Pairtrawlers > 1000HP	6	10	9	9	6	8	11	14	22	29	16	13	5
Nets	0	0	0	0	0	0	0	0	0	0	0	0	0
Jigging	1	0	0	0	1	1	1	0	0	0	0	1	2
Industry trawlers	0	1	1	2	1	1	1	1	3	3	0	0	12
Other gears	0	0	0	0	0	0	0	0	0	0	0	0	9
Total catch, tonnes gutted	13575	12967	13834	10700	12876	10319	7473	4104	3275	3582	4395	8525	

Table 2.4.4

Haddock in ICES Division Vb 1996
Catch at age in numbers by fleet category

Age	Vb1 Open Boats	Vb1 LLiners < 100GRT	Vb1 LLiners > 100GRT	Vb1 OB. trawl. < 400HP	Vb1 OB. trawl. 400-999HP	Vb1 OB. trawl. > 1000HP	Vb1 Pair trawl. < 1000HP	Vb1 Pair trawl. > 1000HP	Vb1 Others	Vb2 All Fleets	Vb Foreign Trawlers	Vb Foreign LLiners	Vb Total
1	0	0	0	0	0	0	0	0	0	1	0	0	1
2	10	154	47	12	5	1	3	6	4	85	0	2	330
3	116	2171	1566	357	255	51	200	391	66	31	19	76	5298
4	9	198	388	56	78	24	65	145	11	30	9	19	1032
5	1	24	72	7	18	4	11	21	2	15	2	4	181
6	1	16	66	4	8	3	8	18	1	36	1	3	165
7	1	26	45	9	10	4	8	18	1	36	2	2	163
8	2	36	111	8	15	7	18	33	3	34	3	5	273
9	2	39	97	9	19	6	17	28	3	12	2	5	237
10	1	14	86	5	18	7	16	32	2	14	2	4	203
11	0	3	25	2	7	2	7	12	1	9	1	1	69
12	1	9	17	3	5	3	6	15	0	3	1	1	63
13	0	4	14	1	5	2	4	8	1	0	1	1	40
14	0	1	4	1	2	1	2	4	0	0	0	0	16
15	0	0	3	0	2	0	1	1	0	0	0	0	6
Total no.	145	2697	2542	472	446	113	367	732	95	306	43	123	8080
Catch, t.	130	2344	3046	445	561	160	484	976	100	340	60	148	8794

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 trawlers Pair Trawl. = Pair trawlers

Table 2.4.5

Run title : Haddock Faroes Vb (run: XSAJAK17/X17)

At 6-May-97 15:26:59

Table 1	Catch numbers at age			Numbers*10**-3		
YEAR,	1961,	1962,	1963,	1964,	1965,	1966,
AGE						
2,	7932,	9631,	13552,	2284,	1368,	1081,
3,	7330,	13977,	8907,	7457,	4286,	3304,
4,	5134,	5233,	7403,	3899,	5133,	4804,
5,	1937,	2361,	2242,	2360,	1443,	2710,
6,	1305,	1407,	1539,	1120,	1209,	1112,
7,	838,	868,	860,	728,	673,	740,
8,	236,	270,	257,	198,	1345,	180,
9,	59,	72,	75,	49,	43,	54,
*gp,	0,	0,	0,	0,	0,	0,
TOTALNUM,	24771,	33819,	34835,	18095,	15500,	13985,
TONSLAND,	20831,	27151,	27571,	19490,	18479,	18766,
SOPCOF %,	89,	90,	90,	101,	94,	109,

Table 1	Catch numbers at age			Numbers*10**-3						
YEAR,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE										
2,	1425,	5881,	2384,	1728,	717,	750,	3300,	5633,	7337,	4396,
3,	2405,	4097,	7539,	4855,	4393,	3744,	8388,	2899,	7952,	7858,
4,	2599,	2812,	4567,	6581,	4727,	4179,	1236,	3970,	2097,	6798,
5,	1785,	1524,	1565,	1624,	3267,	2706,	2786,	451,	1371,	1251,
6,	1426,	1526,	1485,	1383,	1292,	1171,	916,	976,	247,	1189,
7,	631,	923,	1224,	1099,	864,	696,	1051,	466,	352,	298,
8,	197,	230,	378,	326,	222,	180,	150,	535,	237,	720,
9,	52,	68,	114,	68,	147,	113,	68,	68,	419,	258,
*gp,	0,	0,	0,	0,	0,	0,	11,	147,	187,	318,
TOTALNUM,	10520,	17061,	19256,	17664,	15629,	13539,	17906,	15145,	20199,	23086,
TONSLAND,	13381,	17852,	23272,	21361,	19393,	16485,	17976,	14773,	20715,	26211,
SOPCOF %,	102,	103,	108,	103,	99,	98,	98,	97,	117,	107,

Table 2.4.5 (Cont'd)

Run title : Haddock Faroes Vb (run: XSAJAK17/X17)

At 6-May-97 15:26:59

Table 1	Catch numbers at age				Numbers*10**-3					
YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
2,	255,	32,	1,	143,	74,	539,	441,	1195,	985,	230,
3,	4039,	1022,	1161,	58,	455,	934,	1969,	1561,	4553,	2549,
4,	5168,	4248,	1754,	3724,	202,	784,	383,	2462,	2196,	4452,
5,	4918,	4054,	3341,	2583,	2586,	298,	422,	147,	1242,	1522,
6,	2128,	1841,	1850,	2496,	1354,	2182,	93,	234,	169,	738,
7,	946,	717,	772,	1568,	1559,	973,	1444,	42,	91,	39,
8,	443,	635,	212,	660,	608,	1166,	740,	861,	61,	130,
9,	731,	243,	155,	99,	177,	1283,	947,	388,	503,	71,
+gp,	855,	312,	74,	86,	36,	214,	795,	968,	973,	712,
TOTALNUM,	19483,	13104,	9320,	11417,	7051,	8373,	7234,	7858,	10773,	10443,
TONSLAND,	25555,	19200,	12418,	15016,	12233,	11937,	12894,	12378,	15143,	14477,
SOPCOF %,	98,	99,	104,	100,	109,	92,	106,	106,	106,	101,

Table 1	Catch numbers at age				Numbers*10**-3					
YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
2,	283,	655,	63,	105,	77,	40,	113,	277,	810,	330,
3,	1718,	444,	1518,	1275,	1044,	154,	298,	191,	456,	5298,
4,	3565,	2463,	658,	1921,	1774,	776,	274,	307,	237,	1032,
5,	2972,	3036,	2787,	768,	1248,	1120,	554,	153,	227,	181,
6,	1114,	2140,	2554,	1737,	651,	959,	538,	423,	133,	165,
7,	529,	475,	1976,	1909,	1101,	335,	474,	427,	298,	163,
8,	83,	151,	541,	885,	698,	373,	131,	383,	293,	273,
9,	48,	18,	133,	270,	317,	401,	201,	125,	264,	237,
+gp,	334,	128,	81,	108,	32,	162,	185,	301,	298,	399,
TOTALNUM,	10646,	9510,	10311,	8978,	6942,	4320,	2768,	2587,	3016,	8078,
TONSLAND,	14882,	12178,	14325,	11726,	8429,	5476,	4026,	4251,	4987,	9761,
SOPCOF %,	102,	97,	100,	102,	106,	106,	104,	100,	103,	100,

Table 2.4.6

Run title : Haddock Faroes Vb (run: XSAJAK17/X17)

At 6-May-97 15:26:59

Table 2	Catch weights at age (kg)					
YEAR,	1961,	1962,	1963,	1964,	1965,	1966,
AGE						
2,	.4700,	.4700,	.4700,	.4700,	.4700,	.4700,
3,	.7300,	.7300,	.7300,	.7300,	.7300,	.7300,
4,	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,
6,	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,
8,	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,
+gp,	3.5500,	3.5500,	3.5500,	3.5500,	3.5500,	3.5500,
SOPCOFAC,	.8938,	.9011,	.8964,	1.0131,	.9401,	1.0920,

Table 2	Catch weights at age (kg)									
YEAR,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE										
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,	1.0166,	1.0278,	1.0835,	1.0274,	.9874,	.9795,	.9776,	.9718,	1.1712,	1.0746,

Table 2.4.6 (Cont'd)

Run title : Haddock Faroes Vb (run: XSAJAK17/X17)

At 6-May-97 15:26:59

Table 2 YEAR,	Catch weights at age (kg)			1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
2,	.3110,	.3570,	.3570,	.6430,	.4520,	.7000,	.4700,	.6810,	.5280,	.6080,
3,	.6330,	.7900,	.6720,	.7130,	.7250,	.8960,	.7400,	1.0110,	.8590,	.8870,
4,	1.0440,	1.0350,	.8940,	.9410,	.9570,	1.1500,	1.0100,	1.2550,	1.3910,	1.1750,
5,	1.4260,	1.3980,	1.1560,	1.1570,	1.2370,	1.4440,	1.3200,	1.8120,	1.7770,	1.6310,
6,	1.8250,	1.8700,	1.5900,	1.4930,	1.6510,	1.4980,	1.6600,	2.0610,	2.3260,	1.9840,
7,	2.2410,	2.3500,	2.0700,	1.7390,	2.0530,	1.8290,	2.0500,	2.0590,	2.4400,	2.5190,
8,	2.2050,	2.5970,	2.5250,	2.0950,	2.4060,	1.8870,	2.2600,	2.1370,	2.4010,	2.5830,
9,	2.5700,	3.0140,	2.6960,	2.4650,	2.7250,	1.9610,	2.5400,	2.3680,	2.5320,	2.5700,
+gp,	2.5910,	2.9200,	3.5190,	3.3100,	3.2500,	2.8560,	3.0400,	2.6860,	2.6860,	2.9220,
SOPCOFAC,	.9784,	.9947,	1.0380,	1.0017,	1.0870,	.9238,	1.0554,	1.0602,	1.0559,	1.0141,

Table 2 YEAR,	Catch weights at age (kg)			1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
2,	.6050,	.5010,	.5800,	.4380,	.5470,	.5250,	.7550,	.7540,	.6660,	.5340,
3,	.8310,	.7810,	.7790,	.6990,	.6930,	.7240,	.9820,	1.1030,	1.0540,	.8580,
4,	1.1260,	.9740,	.9230,	.9390,	.8840,	.8170,	1.0270,	1.2540,	1.4890,	1.4590,
5,	1.4620,	1.3630,	1.2070,	1.2040,	1.0860,	1.0380,	1.1920,	1.4650,	1.7790,	1.9930,
6,	1.9410,	1.6800,	1.5640,	1.3840,	1.2760,	1.2490,	1.3780,	1.5930,	1.9400,	2.3300,
7,	2.1730,	1.9750,	1.7460,	1.5640,	1.4770,	1.4300,	1.6430,	1.8040,	2.1820,	2.3510,
8,	2.3470,	2.3440,	2.0860,	1.8180,	1.5740,	1.5640,	1.7960,	2.0490,	2.3570,	2.4690,
9,	3.1180,	2.2480,	2.4240,	2.1680,	1.9300,	1.6330,	1.9710,	2.2250,	2.4900,	2.7770,
+gp,	2.9330,	3.2950,	2.5140,	2.3350,	2.1530,	2.1260,	2.2400,	2.4230,	2.6780,	2.5820,
SOPCOFAC,	1.0197,	.9695,	1.0025,	1.0195,	1.0635,	1.0554,	1.0361,	.9967,	1.0323,	1.0044,

Table 2.4.7 Mean weight at age in the commercial catches, the 1st quarter 1993-97.

Haddock in BIOHAG the 1. quarter 1993-1997, mean weight at age					
Age	1993	1994	1995	1996	1997
2	547	424	308	285	
3	645	909	890	647	628
4	906	1162	1466	1429	970
5	1067	1395	1679	1780	1714
6	1304	1579	1864	2167	1988
7	1500	1734	2119	2378	2353
8	1696	1942	2268	2414	2527
9	1830	2128	2376	2476	2447
10+	2301	2497	2627	2778	2680

Table 2.4.8

Run title : Haddock Faroes Vb (run: XSAJAK17/X17)

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Table 5	Proportion mature at age					
YEAR,	1961,	1962,	1963,	1964,	1965,	1966,
AGE						
2,	.0600,	.0600,	.0600,	.0600,	.0600,	.0600,
3,	.4800,	.4800,	.4800,	.4800,	.4800,	.4800,
4,	.9100,	.9100,	.9100,	.9100,	.9100,	.9100,
5,	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,
7,	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,
9,	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,

Table 5	Proportion mature at age									
YEAR,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE										
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 2.4.8 (Cont'd)

Run title : Haddock Faroes Vb (run: XSAJAK17/X17)

At 6-May-97 15:26:59

Table 5	Proportion mature at age									
YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
2,	.0600,	.0600,	.0600,	.0600,	.0600,	.0700,	.0800,	.0800,	.0300,	.0300,
3,	.4800,	.4800,	.4800,	.4800,	.4800,	.5200,	.6200,	.7600,	.6200,	.4300,
4,	.9100,	.9100,	.9100,	.9100,	.9100,	.8800,	.8900,	.9800,	.9600,	.9500,
5,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	.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,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
2,	.0500,	.0500,	.0200,	.0800,	.1600,	.1800,	.1500,	.1200,	.1000,	.0600,
3,	.3200,	.2400,	.2200,	.3700,	.5800,	.6500,	.5300,	.5000,	.5500,	.5700,
4,	.9100,	.8900,	.8700,	.9000,	.9300,	.9100,	.9000,	.9200,	.9700,	.9500,
5,	.9800,	.9800,	.9900,	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 2.4.9

Haddock in the Faroe Grounds (Fishing Area Vb) (run name: XSAJAK17)

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FLT35: LL94A: lline<100GRT (Catch: Thousands) (Effort: 1) (Catch: Unknown) (Effort: Unknown)

1985 1996

1 1 0.00 1.00

2 4

7558	613	2542	787
6692	167	1435	1747
6728	200	1027	1819
8753	599	311	1557
12804	48	1042	433
14543	94	993	1141
14801	53	733	1165
10599	35	103	419
7497	31	92	80
7625	127	47	50
9582	470	133	45
12546	154	2169	198

FLT36: MH93: Magnus Heinason revised95A shifted back (Catch: Number) (Eff (Catch: Unknown) (Effort: Unknown)

1985 1996

1 1 0.90 1.00

2 4

100	46.5	21.7	4.2
100	26.4	16.7	8.7
100	11.8	21.2	10.7
100	113.0	8.5	23.2
100	64.0	23.9	2.5
100	13.4	9.8	3.9
100	8.5	15.5	6.8
100	9.9	6.2	6.3
100	3.1	4.0	2.0
100	10.1	2.9	2.5
100	137.1	6.1	0.9
100	161.7	244.7	5.3

FLT37: LL97: Longliners > 100 GRT (Catch: Thousands) (Effort: 1) (Catch: Unknown) (Effort: Unknown)

1988 1996

1 1 0.00 1.00

5 6

3203	470	504
3369	421	492
3521	146	312
3573	223	127
2892	216	188
2046	124	134
2925	43	98
3648	82	55
4126	72	67

FLT38: PT97: Pair trawlers > 1000 HP (Catch: Thousands) (Effort: 1) (Catch: Unknown) (Effort: Unknown)

1988 1996

1 1 0.00 1.00

5 6

6034	251	194
5127	162	156
7491	57	156
7875	181	104
7243	107	150
6335	82	111
6227	32	133
6069	33	18
6551	21	18

Table 2.4.10

Lowestoft VPA Version 3.1

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Extended Survivors Analysis

Haddock Faroes Vb (run: XSAJAK17/X17)

CPUE data from file /users/fish/ifad/ifapwork/nwng/had_faro/FLEET.X17

Catch data for 36 years. 1961 to 1996. Ages 2 to 10.

Fleet,	First,	Last,	First,	Last,	Alpha,	Beta
	year,	year,	age,	age		
FLT35: LL94A: lline<,	1985,	1996,	2,	4,	.000,	1.000
FLT36: MH93: Magnus ,	1985,	1996,	2,	4,	.900,	1.000
FLT37: LL97: Longlin,	1988,	1996,	5,	6,	.000,	1.000
FLT38: PT97: Pair tr,	1988,	1996,	5,	6,	.000,	1.000

Time series weights :

Tapered time weighting applied
Power = 3 over 20 years

Catchability analysis :

Catchability dependent on stock size for ages < 3

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

Catchability independent of age for ages >= 6

Terminal population estimation :

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

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

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

Prior weighting not applied

Tuning had not converged after 50 iterations

Total absolute residual between iterations
49 and 50 = .00681

Final year F values

Age	2,	3,	4,	5,	6,	7,	8,	9
Iteration 49,	.0143,	.1285,	.4898,	.2612,	.2442,	.4078,	.2581,	.3079
Iteration 50,	.0143,	.1283,	.4887,	.2606,	.2435,	.4064,	.2571,	.3062

Table 2.4.10 (Cont'd)

Regression weights

, .751, .820, .877, .921, .954, .976, .990, .997, 1.000, 1.000

Fishing mortalities

Age,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996
2,	.038,	.042,	.005,	.011,	.030,	.014,	.054,	.059,	.015,	.014
3,	.099,	.078,	.129,	.125,	.149,	.078,	.132,	.122,	.131,	.128
4,	.214,	.201,	.159,	.240,	.257,	.158,	.195,	.196,	.220,	.489
5,	.269,	.285,	.367,	.282,	.243,	.257,	.162,	.159,	.218,	.261
6,	.344,	.317,	.414,	.412,	.412,	.298,	.188,	.179,	.201,	.244
7,	.512,	.240,	.546,	.632,	.503,	.386,	.235,	.224,	.184,	.406
8,	.628,	.265,	.475,	.506,	.501,	.315,	.255,	.304,	.237,	.257
9,	.397,	.264,	.396,	.462,	.340,	.609,	.279,	.413,	.355,	.306

XSA population numbers (Thousands)

YEAR ,	2,	AGE 3,	4,	5,	6,	7,	8,	9,
1987 ,	8.29E+03,	2.02E+04,	2.05E+04,	1.39E+04,	4.23E+03,	1.46E+03,	1.97E+02,	1.62E+02,
1988 ,	1.76E+04,	6.53E+03,	1.50E+04,	1.35E+04,	8.71E+03,	2.46E+03,	7.16E+02,	8.59E+01,
1989 ,	1.47E+04,	1.38E+04,	4.94E+03,	1.00E+04,	8.32E+03,	5.19E+03,	1.58E+03,	4.50E+02,
1990 ,	1.03E+04,	1.20E+04,	9.94E+03,	3.45E+03,	5.68E+03,	4.50E+03,	2.46E+03,	8.06E+02,
1991 ,	2.85E+03,	8.32E+03,	8.64E+03,	6.40E+03,	2.13E+03,	3.08E+03,	1.96E+03,	1.22E+03,
1992 ,	3.29E+03,	2.26E+03,	5.87E+03,	5.47E+03,	4.11E+03,	1.16E+03,	1.53E+03,	9.72E+02,
1993 ,	2.36E+03,	2.66E+03,	1.71E+03,	4.10E+03,	3.46E+03,	2.50E+03,	6.44E+02,	9.12E+02,
1994 ,	5.32E+03,	1.83E+03,	1.90E+03,	1.15E+03,	2.86E+03,	2.35E+03,	1.62E+03,	4.08E+02,
1995 ,	6.03E+04,	4.11E+03,	1.33E+03,	1.28E+03,	8.06E+02,	1.96E+03,	1.54E+03,	9.76E+02,
1996 ,	2.57E+04,	4.86E+04,	2.95E+03,	8.72E+02,	8.44E+02,	5.39E+02,	1.33E+03,	9.93E+02,

Estimated population abundance at 1st Jan 1997

, .00E+00, 2.07E+04, 3.51E+04, 1.49E+03, 5.51E+02, 5.43E+02, 2.95E+02, 8.46E+02,

Taper weighted geometric mean of the VPA populations:

, 1.10E+04, 8.24E+03, 5.21E+03, 3.67E+03, 2.69E+03, 1.83E+03, 1.22E+03, 7.02E+02,

Standard error of the weighted Log(VPA populations) :

, 1.0674, 1.0769, .9767, 1.0126, .9452, .9313, .8590, .9804,

Table 2.4.10 (Cont'd)

Log catchability residuals.

Fleet : FLT35: LL94A: lline<

Age	,	1985,	1986
2	,	1.17,	.00
3	,	.76,	.41
4	,	.33,	.54
5	,	No data for this fleet at this age	
6	,	No data for this fleet at this age	

Age	,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996
2	,	1.34,	1.65,	-1.89,	-.83,	-.29,	-.55,	.09,	1.06,	-.02,	-.93
3	,	.39,	.05,	.15,	.12,	.17,	-.19,	-.09,	-.41,	-.40,	-.35
4	,	.63,	.51,	-.06,	.12,	.27,	-.07,	-.13,	-.73,	-.69,	-.15
5	,	No data for this fleet at this age									
6	,	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	,	3,	4
Mean Log q,		-12.0326,	-11.6605,
S.E(Log q),		.3427,	.4472,

Regression statistics :

Ages with q dependent on year class strength

Age	,	Slope	,	t-value	,	Intercept	,	RSquare	,	No Pts	,	Reg s.e.	,	Mean Log q
2	,	1.27,		-.822,		14.69,		.51,		12,		1.11,		-13.52,

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

Age	,	Slope	,	t-value	,	Intercept	,	RSquare	,	No Pts	,	Reg s.e.	,	Mean Q
3	,	.86,		1.780,		11.62,		.95,		12,		.27,		-12.03,
4	,	.70,		7.209,		10.75,		.99,		12,		.12,		-11.66,

Table 2.4.10 (Cont'd)

Fleet : FLT36: MH93: Magnus

Age	,	1985,	1986
2	,	-.64,	-.84
3	,	-.75,	-.94
4	,	-.71,	-.69
5	,	No data for this fleet at this age	
6	,	No data for this fleet at this age	

Age	,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996
2	,	-.45,	.87,	.50,	-.57,	.31,	.29,	-.41,	-.13,	-.21,	.80
3	,	-.39,	-.20,	.13,	-.62,	.23,	.55,	.00,	.04,	-.02,	1.20
4	,	-.45,	.62,	-.54,	-.72,	.00,	.21,	.33,	.45,	-.19,	1.04
5	,	No data for this fleet at this age									
6	,	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	,	3,	4
Mean Log q,		-10.7869,	-11.3146,
S.E(Log q),		.5819,	.5870,

Regression statistics :

Ages with q dependent on year class strength

Age,	Slope	,	t-value	,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Log q	
2,	.92,		.466,		10.32,		.79,	12,	.60,	-10.42,

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

Age,	Slope	,	t-value	,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Q	
3,	1.03,		-.161,		10.84,		.78,	12,	.63,	-10.79,
4,	1.36,		-1.448,		12.31,		.65,	12,	.76,	-11.31,

Table 2.4.10 (Cont'd)

Fleet : FLT37: LL97: Longlin

Age ,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996
2 ,	No data for this fleet at this age									
3 ,	No data for this fleet at this age									
4 ,	No data for this fleet at this age									
5 ,	99.99,	-.20,	-.03,	-.10,	-.33,	.01,	.05,	-.10,	.25,	.40
6 ,	99.99,	.09,	.10,	-.02,	.05,	-.05,	.07,	-.41,	.07,	.12

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

Age ,	5,	6
Mean Log q,	-10.9946,	-10.7623,
S.E(Log q),	.2243,	.1673,

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
5,	1.18,	-2.328,	11.52,	.96,	9,	.21,	-10.99,
6,	1.01,	-.192,	10.80,	.96,	9,	.18,	-10.76,

Fleet : FLT38: PT97: Pair tr

Age ,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996
2 ,	No data for this fleet at this age									
3 ,	No data for this fleet at this age									
4 ,	No data for this fleet at this age									
5 ,	99.99,	-.06,	.01,	-.39,	.08,	-.20,	-.09,	.26,	.24,	.11
6 ,	99.99,	-.18,	-.15,	-.15,	.38,	.12,	.07,	.46,	-.24,	-.34

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

Age ,	5,	6
Mean Log q,	-12.4036,	-12.0779,
S.E(Log q),	.2086,	.2837,

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
5,	1.12,	-1.503,	12.92,	.96,	9,	.22,	-12.40,
6,	.96,	.374,	11.89,	.91,	9,	.29,	-12.08,

Table 2.4.10 (Cont'd)

Terminal year survivor and F summaries :

Age 2 Catchability dependent on age and year class strength

Year class = 1994

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT35: LL94A: lline<,	8165.,	1.161,	.000,	.00,	1,	.184,	.036
FLT36: MH93: Magnus ,	46042.,	.680,	.000,	.00,	1,	.536,	.006
FLT37: LL97: Longlin,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT38: PT97: Pair tr,	1.,	.000,	.000,	.00,	0,	.000,	.000
P shrinkage mean ,	8244.,	1.08,,,				.217,	.036
F shrinkage mean ,	8493.,	2.00,,,				.063,	.035

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
20745.,	.50,	.54,	4,	1.075,	.014

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

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT35: LL94A: lline<,	25199.,	.344,	.089,	.26,	2,	.620,	.174
FLT36: MH93: Magnus ,	61990.,	.451,	.700,	1.55,	2,	.359,	.074
FLT37: LL97: Longlin,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT38: PT97: Pair tr,	1.,	.000,	.000,	.00,	0,	.000,	.000
F shrinkage mean ,	36595.,	2.00,,,				.021,	.123

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
35099.,	.27,	.30,	5,	1.115,	.128

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

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT35: LL94A: lline<,	1172.,	.277,	.228,	.82,	3,	.617,	.586
FLT36: MH93: Magnus ,	2099.,	.359,	.382,	1.06,	3,	.362,	.368
FLT37: LL97: Longlin,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT38: PT97: Pair tr,	1.,	.000,	.000,	.00,	0,	.000,	.000
F shrinkage mean ,	4078.,	2.00,,,				.021,	.206

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
1486.,	.22,	.21,	7,	.968,	.489

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

Year class = 1991

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT35: LL94A: lline<,	336.,	.278,	.131,	.47,	3,	.256,	.397
FLT36: MH93: Magnus ,	467.,	.368,	.122,	.33,	3,	.144,	.301
FLT37: LL97: Longlin,	818.,	.300,	.000,	.00,	1,	.296,	.182
FLT38: PT97: Pair tr,	615.,	.300,	.000,	.00,	1,	.296,	.236
F shrinkage mean ,	707.,	2.00,,,				.009,	.208

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
551.,	.15,	.13,	9,	.825,	.261

Table 2.4.10 (Cont'd)

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

Year class = 1990

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLT35: LL94A: lline<,	379.,	.279,	.218,	.78,	3, .148,	.332
FLT36: MH93: Magnus ,	698.,	.361,	.135,	.37,	3, .088,	.194
FLT37: LL97: Longlin,	645.,	.213,	.063,	.30,	2, .379,	.208
FLT38: PT97: Pair tr,	497.,	.213,	.288,	1.35,	2, .379,	.263
F shrinkage mean ,	509.,	2.00, , , ,			.006,	.257

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
543.,	.13,	.09,	11,	.747,	.244

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

Year class = 1989

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLT35: LL94A: lline<,	247.,	.280,	.026,	.09,	3, .154,	.468
FLT36: MH93: Magnus ,	439.,	.364,	.075,	.21,	3, .091,	.290
FLT37: LL97: Longlin,	292.,	.213,	.085,	.40,	2, .373,	.409
FLT38: PT97: Pair tr,	291.,	.213,	.248,	1.16,	2, .373,	.410
F shrinkage mean ,	408.,	2.00, , , ,			.008,	.308

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
295.,	.13,	.07,	11,	.544,	.406

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

Year class = 1988

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLT35: LL94A: lline<,	865.,	.283,	.162,	.57,	3, .152,	.251
FLT36: MH93: Magnus ,	834.,	.367,	.254,	.69,	3, .090,	.259
FLT37: LL97: Longlin,	691.,	.214,	.227,	1.06,	2, .375,	.306
FLT38: PT97: Pair tr,	1038.,	.214,	.271,	1.27,	2, .375,	.213
F shrinkage mean ,	645.,	2.00, , , ,			.009,	.324

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
846.,	.13,	.10,	11,	.783,	.257

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

Year class = 1987

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLT35: LL94A: lline<,	652.,	.288,	.312,	1.08,	3, .134,	.284
FLT36: MH93: Magnus ,	562.,	.374,	.311,	.83,	3, .079,	.323
FLT37: LL97: Longlin,	628.,	.216,	.030,	.14,	2, .387,	.294
FLT38: PT97: Pair tr,	572.,	.216,	.134,	.62,	2, .387,	.318
F shrinkage mean ,	542.,	2.00, , , ,			.013,	.333

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
602.,	.13,	.07,	11,	.552,	.306

Table 2.4.11

Run title : Haddock Faroes Vb (run: XSAJAK17/X17)

At 6-May-97 15:26:59

Terminal Fs derived using XSA (With F shrinkage)

Table 8	Fishing mortality (F) at age					
YEAR,	1961,	1962,	1963,	1964,	1965,	1966,
AGE						
2,	.1875,	.3232,	.3801,	.0876,	.0691,	.0610,
3,	.4162,	.5866,	.5640,	.3723,	.2354,	.2371,
4,	.4209,	.5980,	.7261,	.5193,	.4767,	.4515,
5,	.4387,	.3480,	.5591,	.5369,	.3678,	.5006,
6,	.5879,	.6706,	.4026,	.6107,	.5882,	.5421,
7,	.9483,	1.0499,	1.2493,	.3375,	.9618,	.9128,
8,	.8742,	.9736,	1.1139,	1.2027,	2.3618,	.7509,
9,	.6600,	.7351,	.8185,	.6472,	.9619,	.6373,
+gp,	.6600,	.7351,	.8185,	.6472,	.9619,	.6373,
FBAR 3- 7,	.5624,	.6506,	.7002,	.4753,	.5260,	.5288,

Table 8	Fishing mortality (F) at age									
YEAR,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE										
2,	.0641,	.1262,	.0860,	.0552,	.0527,	.0253,	.1673,	.1268,	.1237,	.0914,
3,	.1873,	.2647,	.2365,	.2530,	.1939,	.4235,	.4313,	.2174,	.2655,	.1890,
4,	.2971,	.3483,	.5321,	.3347,	.4190,	.2858,	.2390,	.3736,	.2416,	.3819,
5,	.2997,	.2847,	.3330,	.3640,	.2758,	.4524,	.3139,	.1282,	.2120,	.2220,
6,	.5406,	.4540,	.4976,	.5561,	.5563,	.1497,	.2699,	.1717,	.0960,	.2879,
7,	.6906,	.8367,	.8278,	.8743,	.8383,	.6727,	.1949,	.2138,	.0861,	.1607,
8,	.6635,	.5852,	1.0633,	.5432,	.4227,	.4064,	.2911,	.1436,	.1603,	.2546,
9,	.5022,	.5057,	.6567,	.5388,	.5064,	.3961,	.2632,	.2072,	.1598,	.2628,
+gp,	.5022,	.5057,	.6567,	.5388,	.5064,	.3961,	.2632,	.2072,	.1598,	.2628,
FBAR 3- 7,	.4031,	.4377,	.4854,	.4764,	.4567,	.3968,	.2898,	.2210,	.1802,	.2483,

Table 2.4.11 (Cont'd)

Run title : Haddock Faroes Vb (run: XSAJAK17/X17)

At 6-May-97 15:26:59

Terminal Fs derived using XSA (With F shrinkage)

Table 8	Fishing mortality (F) at age									
YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
2,	.0109,	.0010,	.0004,	.0328,	.0240,	.0389,	.0264,	.0334,	.0316,	.0103,
3,	.1136,	.0551,	.0462,	.0291,	.1388,	.4679,	.1950,	.1230,	.1722,	.1069,
4,	.1829,	.1678,	.1264,	.2047,	.1342,	.3759,	.3550,	.3988,	.2546,	.2542,
5,	.5293,	.2135,	.1930,	.2776,	.2140,	.2993,	.3567,	.2229,	.3595,	.2817,
6,	.7267,	.3842,	.1424,	.2160,	.2292,	.2823,	.1427,	.3428,	.4317,	.3768,
7,	.3919,	.5791,	.2743,	.1724,	.2032,	.2564,	.3061,	.0884,	.2160,	.1651,
8,	.3805,	.4999,	.3331,	.3998,	.0933,	.2305,	.3167,	.3022,	.1791,	.5458,
9,	.4455,	.3713,	.2149,	.2555,	.1756,	.2906,	.2972,	.2726,	.2900,	.3270,
+gp,	.4455,	.3713,	.2149,	.2555,	.1756,	.2906,	.2972,	.2726,	.2900,	.3270,
FBAR 3- 7,	.3889,	.2799,	.1564,	.1800,	.1839,	.3364,	.2711,	.2352,	.2868,	.2369,

Table 8	Fishing mortality (F) at age									
YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
2,	.0385,	.0420,	.0048,	.0114,	.0304,	.0135,	.0543,	.0592,	.0150,	.0143,
3,	.0989,	.0781,	.1294,	.1253,	.1493,	.0783,	.1324,	.1224,	.1309,	.1283,
4,	.2140,	.2008,	.1591,	.2403,	.2574,	.1581,	.1947,	.1962,	.2199,	.4887,
5,	.2691,	.2853,	.3673,	.2822,	.2428,	.2567,	.1617,	.1585,	.2179,	.2606,
6,	.3437,	.3169,	.4143,	.4123,	.4118,	.2983,	.1884,	.1788,	.2014,	.2435,
7,	.5119,	.2403,	.5457,	.6323,	.5025,	.3860,	.2355,	.2243,	.1845,	.4064,
8,	.6285,	.2653,	.4746,	.5058,	.5007,	.3150,	.2549,	.3038,	.2367,	.2571,
9,	.3966,	.2636,	.3958,	.4624,	.3397,	.6088,	.2793,	.4130,	.3551,	.3062,
+gp,	.3966,	.2636,	.3958,	.4624,	.3397,	.6088,	.2793,	.4130,	.3551,	.3062,
FBAR 3- 7,	.2875,	.2243,	.3232,	.3385,	.3128,	.2355,	.1825,	.1761,	.1909,	.3055,

Table 2.4.12

Run title : Haddock Faroes Vb (run: XSAJAK17/X17)

At 6-May-97 15:26:59

Terminal Fs derived using XSA (With F shrinkage)

Table 10	Stock number at age (start of year)					Numbers*10**-3
YEAR,	1961,	1962,	1963,	1964,	1965,	1966,
AGE						
2,	51279,	38537,	47362,	30109,	22643,	20204,
3,	23796,	34806,	22837,	26514,	22585,	17301,
4,	16517,	12850,	15850,	10638,	14961,	14613,
5,	6028,	8877,	5786,	6278,	5182,	7604,
6,	3245,	3182,	5132,	2708,	3005,	2937,
7,	1512,	1476,	1332,	2809,	1204,	1366,
8,	448,	480,	423,	313,	1641,	377,
9,	135,	153,	148,	114,	77,	127,
+9p,	0,	0,	0,	0,	0,	0,
TOTAL,	102958,	100361,	98870,	79484,	71297,	64528,

Table 10	Stock number at age (start of year)					Numbers*10**-3				
YEAR,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE										
2,	25353,	54818,	31957,	35553,	15431,	33147,	23671,	52267,	69694,	55650,
3,	15563,	19468,	39560,	24007,	27545,	11985,	26460,	16394,	37695,	50422,
4,	11175,	10566,	12232,	25568,	15262,	18577,	6425,	14074,	10799,	23667,
5,	7617,	6798,	6106,	5882,	14978,	8218,	11428,	4142,	7930,	6944,
6,	3774,	4621,	4186,	3583,	3347,	9307,	4280,	6836,	2983,	5252,
7,	1398,	1799,	2403,	2084,	1682,	1571,	6560,	2675,	4713,	2219,
8,	449,	574,	638,	860,	712,	596,	656,	4420,	1769,	3541,
9,	146,	189,	262,	180,	409,	382,	325,	402,	3135,	1234,
+9p,	0,	0,	0,	0,	0,	0,	52,	864,	1393,	1512,
TOTAL,	65475,	98834,	97344,	97717,	79366,	83783,	79858,	102073,	140112,	150439,

Table 2.4.12 (Cont'd)

Run title : Haddock Faroes Vb (run: XSAJAK17/X17)

At 6-May-97 15:26:59

Terminal Fs derived using XSA (With F shrinkage)

Table 10	Stock number at age (start of year)					Numbers*10**-3				
YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
2,	26011,	34770,	2732,	4898,	3456,	15596,	18700,	40171,	35040,	24892,
3,	41584,	21065,	28438,	2236,	3880,	2762,	12281,	14912,	31808,	27797,
4,	34172,	30392,	16322,	22233,	1778,	2765,	1416,	8273,	10796,	21922,
5,	13226,	23301,	21039,	11776,	14833,	1273,	1555,	813,	4546,	6852,
6,	4553,	6378,	15409,	14202,	7304,	9804,	773,	891,	533,	2598,
7,	3224,	1803,	3556,	10942,	9369,	4755,	6053,	548,	518,	283,
8,	1547,	1784,	827,	2213,	7540,	6260,	3013,	3649,	411,	342,
9,	2247,	866,	886,	485,	1215,	5623,	4070,	1797,	2208,	281,
+gp,	2605,	1103,	421,	419,	246,	932,	3395,	4456,	4244,	2802,
TOTAL,	129170,	121461,	89631,	69404,	49621,	49771,	51256,	75510,	90104,	87769,

Table 10	Stock number at age (start of year)					Numbers*10**-3					
YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,
AGE											
2,	8288,	17600,	14679,	10275,	2846,	3287,	2362,	5323,	60300,	25664,	0,
3,	20172,	6529,	13817,	11961,	8318,	2261,	2655,	1832,	4107,	48637,	20745,
4,	20452,	14961,	4944,	9939,	8639,	5865,	1712,	1904,	1327,	2950,	35099,
5,	13920,	13519,	10020,	3452,	6399,	5468,	4100,	1153,	1281,	872,	1486,
6,	4233,	8708,	8321,	5682,	2132,	4110,	3463,	2855,	806,	844,	551,
7,	1459,	2458,	5193,	4502,	3080,	1156,	2497,	2349,	1955,	539,	543,
8,	197,	716,	1582,	2464,	1958,	1526,	644,	1616,	1537,	1331,	295,
9,	162,	86,	450,	806,	1216,	972,	912,	408,	976,	993,	846,
+gp,	1118,	607,	272,	319,	122,	388,	834,	975,	1094,	1660,	1603,
TOTAL,	70000,	65183,	59277,	49400,	34710,	25033,	19178,	18415,	73383,	83491,	61169,

Table 2.4.13

Run title : Haddock Faroes Vb (run: XSAJAK17/X17)

At 6-May-97 15:26:59

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS, Age 2	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 3- 7,
1961,	51278,	81164,	47797,	20831,	.4358,	.5624,
1962,	38537,	83420,	51875,	27151,	.5234,	.6506,
1963,	47362,	80753,	49547,	27571,	.5565,	.7002,
1964,	30109,	68577,	44127,	19490,	.4417,	.4753,
1965,	22643,	65653,	45555,	18479,	.4056,	.5260,
1966,	20204,	60931,	43951,	18766,	.4270,	.5288,
1967,	25353,	60202,	41956,	13381,	.3189,	.4031,
1968,	54818,	78058,	45374,	17852,	.3934,	.4377,
1969,	31957,	83788,	53408,	23272,	.4357,	.4854,
1970,	35553,	87252,	59831,	21361,	.3570,	.4764,
1971,	15431,	81690,	62864,	19393,	.3085,	.4567,
1972,	33147,	82996,	61912,	16485,	.2663,	.3968,
1973,	23671,	82651,	61496,	17976,	.2923,	.2898,
1974,	52267,	95270,	64524,	14773,	.2290,	.2210,
1975,	69694,	121456,	75258,	20715,	.2753,	.1802,
1976,	55650,	135090,	88957,	26211,	.2946,	.2483,
1977,	26011,	120542,	96039,	25555,	.2661,	.3889,
1978,	34770,	119711,	96559,	19200,	.1988,	.2799,
1979,	2732,	96818,	84651,	12418,	.1467,	.1564,
1980,	4898,	86742,	81069,	15016,	.1852,	.1800,
1981,	3456,	77970,	74886,	12233,	.1634,	.1839,
1982,	15596,	67295,	55573,	11937,	.2148,	.3364,
1983,	18700,	62518,	50821,	12894,	.2537,	.2711,
1984,	40171,	81276,	52282,	12378,	.2368,	.2352,
1985,	35040,	89401,	60471,	15143,	.2504,	.2868,
1986,	24892,	92384,	62250,	14477,	.2326,	.2369,
1987,	8288,	80790,	62149,	14882,	.2395,	.2875,
1988,	17600,	70269,	56045,	12178,	.2173,	.2243,
1989,	14679,	63089,	45636,	14325,	.3139,	.3232,
1990,	10275,	48227,	37886,	11726,	.3095,	.3385,
1991,	2846,	34869,	30606,	8429,	.2754,	.3128,
1992,	3287,	25415,	22996,	5476,	.2381,	.2355,
1993,	2362,	24731,	21814,	4026,	.1846,	.1825,
1994,	5323,	25478,	20745,	4251,	.2049,	.1761,
1995,	60300,	63555,	25403,	4987,	.1963,	.1909,
1996,	25664,	75042,	44000,	9761,	.2218,	.3055,
Arith.						
Mean	26793,	76530,	55009,	15694,	.2920,	.3381,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		

Table 2.4.14 Input data for RCT3

Faroe Haddock: VPA and groundfish survey data

3 12 2

'Yearclass'	'VPAage2'	'Survage1'	'Survage2'	'Survage3'
1985	8288	23.6	11.8	11.8
1986	17600	40.6	88.1	113.0
1987	14679	40.5	146.6	64.0
1988	10275	43.8	43.1	13.4
1989	2846	6.1	16.5	8.5
1990	3287	4.0	26.9	9.9
1991	2362	6.2	9.2	3.1
1992	5323	28.1	21.3	10.1
1993	60300	186.3	252.6	137.1
1994	25664	486.9	244.2	161.7
1995	-11	65.6	84.7	-11
1996	-11	3.2	-11	-11

Table 2.4.15

Analysis by RCT3 ver3.1 of data from file :

rct3c97.dat

Faroe Haddock: VPA and groundfish survey data

Data for 3 surveys over 12 years : 1985 - 1996

Regression type = C

Tapered time weighting applied

power = 3 over 20 years

Survey weighting not applied

Final estimates shrunk towards mean

Minimum S.E. for any survey taken as .20

Minimum of 3 points used for regression

Forecast/Hindcast variance correction used.

Yearclass = 1990

	I-----Regression-----I					I-----Prediction-----I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Survag	.96	5.95	.27	.906	5	1.61	7.50	.531	.460
Survag	.91	5.69	.72	.567	5	3.33	8.74	1.043	.120
Survag	.79	6.52	.58	.667	5	2.39	8.41	.884	.166
VPA Mean =						9.12		.716	.254

Yearclass = 1991

	I-----Regression-----I					I-----Prediction-----I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Survag	.82	6.48	.28	.905	6	1.97	8.10	.402	.639
Survag	1.13	4.80	.83	.519	6	2.32	7.42	1.278	.063
Survag	.87	6.21	.57	.690	6	1.41	7.44	.922	.122
VPA Mean =						8.94		.765	.176

Yearclass = 1992

	I-----Regression-----I					I-----Prediction-----I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Survag	.89	6.23	.30	.902	7	3.37	9.24	.390	.554
Survag	1.04	5.16	.69	.639	7	3.10	8.38	.881	.109
Survag	.81	6.44	.49	.778	7	2.41	8.39	.627	.215
VPA Mean =						8.77		.830	.122

Yearclass = 1993

	I-----Regression-----I					I-----Prediction-----I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Survag	.92	6.08	.38	.825	8	5.23	10.87	.643	.331
Survag	1.03	5.21	.62	.645	97 8	5.54	10.91	.990	.140

Table 2.4.15 (Cont'd)

Survag	.81	6.47	.45	.778	8	4.93	10.45	.677	.299
VPA Mean =							8.73	.771	.230

Yearclass = 1994

I-----Regression-----I					I-----Prediction-----I				
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Survag	.95	5.99	.37	.904	9	6.19	11.85	.599	.382
Survag	1.06	5.12	.58	.794	9	5.50	10.93	.803	.212
Survag	.93	6.16	.50	.839	9	5.09	10.90	.694	.284
VPA Mean =							8.99	1.062	.121

Yearclass = 1995

I-----Regression-----I					I-----Prediction-----I				
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Survag	.80	6.32	.55	.811	10	4.20	9.68	.666	.414
Survag	.97	5.35	.54	.817	10	4.45	9.68	.655	.428
Survag									
VPA Mean =							9.11	1.077	.158

Yearclass = 1996

I-----Regression-----I					I-----Prediction-----I				
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Survag	.80	6.32	.56	.812	10	1.44	7.47	.739	.686
Survag									
Survag									
VPA Mean =							9.11	1.091	.314

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1990	3682	8.21	.36	.40	1.23	3288	8.10
1991	3384	8.13	.32	.26	.66	2363	7.77
1992	7363	8.90	.29	.22	.59	5323	8.58
1993	28455	10.26	.37	.49	1.77	60300	11.01
1994	62174	11.04	.37	.51	1.87	25665	10.15
1995	14632	9.59	.43	.15	.12		
1996	2931	7.98	.61	.76	1.56		

Table 2.4.16

The SAS System

23:55 Wednesday, May 7, 1997

Haddock in the Faroe Grounds (Fishing Area Vb)

Prediction with management option table: Input data

Year: 1997								
Age	Stock size	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
2	14632.000	0.2000	0.0633	0.0000	0.0000	0.652	0.0402	0.652
3	20745.000	0.2000	0.5467	0.0000	0.0000	0.771	0.1734	0.771
4	35099.000	0.2000	0.9500	0.0000	0.0000	0.969	0.4111	0.969
5	1486.000	0.2000	1.0000	0.0000	0.0000	1.810	0.2894	1.810
6	551.000	0.2000	1.0000	0.0000	0.0000	2.288	0.2833	2.288
7	543.000	0.2000	1.0000	0.0000	0.0000	2.559	0.3703	2.559
8	295.000	0.2000	1.0000	0.0000	0.0000	2.508	0.3624	2.508
9	846.000	0.2000	1.0000	0.0000	0.0000	2.666	0.4881	2.666
10+	1603.000	0.2000	1.0000	0.0000	0.0000	3.050	0.4881	3.050
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1998								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
2	2931.000	0.2000	0.0633	0.0000	0.0000	0.652	0.0402	0.652
3	.	0.2000	0.5467	0.0000	0.0000	0.771	0.1734	0.771
4	.	0.2000	0.9500	0.0000	0.0000	0.969	0.4111	0.969
5	.	0.2000	1.0000	0.0000	0.0000	1.810	0.2894	1.810
6	.	0.2000	1.0000	0.0000	0.0000	2.288	0.2833	2.288
7	.	0.2000	1.0000	0.0000	0.0000	2.559	0.3703	2.559
8	.	0.2000	1.0000	0.0000	0.0000	2.508	0.3624	2.508
9	.	0.2000	1.0000	0.0000	0.0000	2.666	0.4881	2.666
10+	.	0.2000	1.0000	0.0000	0.0000	3.050	0.4881	3.050
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1999								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
2	14852.000	0.2000	0.0633	0.0000	0.0000	0.652	0.0402	0.652
3	.	0.2000	0.5467	0.0000	0.0000	0.771	0.1734	0.771
4	.	0.2000	0.9500	0.0000	0.0000	0.969	0.4111	0.969
5	.	0.2000	1.0000	0.0000	0.0000	1.810	0.2894	1.810
6	.	0.2000	1.0000	0.0000	0.0000	2.288	0.2833	2.288
7	.	0.2000	1.0000	0.0000	0.0000	2.559	0.3703	2.559
8	.	0.2000	1.0000	0.0000	0.0000	2.508	0.3624	2.508
9	.	0.2000	1.0000	0.0000	0.0000	2.666	0.4881	2.666
10+	.	0.2000	1.0000	0.0000	0.0000	3.050	0.4881	3.050
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANJAK01
Date and time: 07MAY97:23:57

Table 2.4.17

The SAS System

23:55 Wednesday, May 7, 1997

Haddock in the Faroe Grounds (Fishing Area Vb)

Prediction with management option table

Year: 1997					Year: 1998					Year: 1999	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.0000	0.3055	72770	54883	17134	0.0000	0.0000	67028	60523	0	84281	73915
.	0.1000	0.0306	.	60523	1830	81977	71623
.	0.2000	0.0611	.	60523	3603	79751	69408
.	0.3000	0.0917	.	60523	5319	77599	67267
.	0.4000	0.1222	.	60523	6980	75519	65198
.	0.5000	0.1528	.	60523	8590	73509	63198
.	0.6000	0.1833	.	60523	10148	71565	61265
.	0.7000	0.2139	.	60523	11658	69686	59396
.	0.8000	0.2444	.	60523	13120	67869	57590
.	0.9000	0.2750	.	60523	14537	66113	55843
.	1.0000	0.3055	.	60523	15909	64414	54154
.	1.1000	0.3361	.	60523	17239	62772	52522
.	1.2000	0.3666	.	60523	18528	61183	50943
.	1.3000	0.3972	.	60523	19777	59646	49416
.	1.4000	0.4277	.	60523	20988	58160	47939
.	1.5000	0.4583	.	60523	22161	56722	46511
.	1.6000	0.4888	.	60523	23299	55332	45129
.	1.7000	0.5194	.	60523	24401	53986	43793
.	1.8000	0.5499	.	60523	25470	52684	42500
.	1.9000	0.5805	.	60523	26507	51425	41249
.	2.0000	0.6110	.	60523	27512	50206	40039
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANJAK01
Date and time : 07MAY97:23:57
Computation of ref. F: Simple mean, age 3 - 7
Basis for 1997 : F factors

Table 2.4.18

The SAS System

14:51 Tuesday, May 6, 1997

Haddock in the Faroe Grounds (Fishing Area Vb)

Yield per recruit: Input data

Age	Recruit- ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
2	1.000	0.2000	0.0700	0.0000	0.0000	0.515	0.0600	0.515
3	.	0.2000	0.4878	0.0000	0.0000	0.781	0.1918	0.781
4	.	0.2000	0.9144	0.0000	0.0000	1.106	0.2972	1.106
5	.	0.2000	0.9983	0.0000	0.0000	1.471	0.2944	1.471
6	.	0.2000	1.0000	0.0000	0.0000	1.829	0.3374	1.828
7	.	0.2000	1.0000	0.0000	0.0000	2.174	0.4068	2.174
8	.	0.2000	1.0000	0.0000	0.0000	2.435	0.4504	2.435
9	.	0.2000	1.0000	0.0000	0.0000	2.710	0.3898	2.710
10+	.	0.2000	1.0000	0.0000	0.0000	3.107	0.3898	3.107
Unit	Numbers	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : YLDJAK04
Date and time: 06MAY97:15:46

Table 2.4.19

The SAS System

14:51 Tuesday, May 6, 1997

Haddock in the Faroe Grounds (Fishing Area Vb)

Yield per recruit: Summary table

F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January		Spawning time	
						Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
0.0000	0.0000	0.000	0.000	5.517	9186.564	4.109	8315.575	4.109	8315.575
0.0500	0.0153	0.064	126.386	5.198	8311.545	3.792	7442.466	3.792	7442.466
0.1000	0.0306	0.118	225.603	4.930	7589.062	3.526	6721.680	3.526	6721.680
0.1500	0.0458	0.164	304.436	4.701	6983.491	3.300	6117.893	3.300	6117.893
0.2000	0.0611	0.204	367.698	4.503	6469.594	3.104	5605.766	3.104	5605.766
0.2500	0.0764	0.238	418.888	4.330	6028.739	2.933	5166.668	2.933	5166.668
0.3000	0.0917	0.269	460.594	4.178	5646.937	2.782	4786.609	2.782	4786.609
0.3500	0.1069	0.296	494.769	4.042	5313.485	2.648	4454.888	2.648	4454.888
0.4000	0.1222	0.321	522.905	3.920	5020.068	2.528	4163.188	2.528	4163.188
0.4500	0.1375	0.343	546.157	3.810	4760.132	2.420	3904.956	2.420	3904.956
0.5000	0.1528	0.363	565.430	3.710	4528.444	2.322	3674.960	2.322	3674.960
0.5500	0.1680	0.382	581.439	3.619	4320.785	2.233	3468.981	2.233	3468.981
0.6000	0.1833	0.399	594.754	3.535	4133.715	2.151	3283.577	2.151	3283.577
0.6500	0.1986	0.414	605.837	3.458	3964.402	2.076	3115.920	2.076	3115.920
0.7000	0.2139	0.429	615.057	3.387	3810.501	2.006	2963.662	2.006	2963.662
0.7500	0.2291	0.442	622.719	3.321	3670.051	1.942	2824.842	1.942	2824.842
0.8000	0.2444	0.455	629.070	3.259	3541.401	1.882	2697.811	1.882	2697.811
0.8500	0.2597	0.466	634.318	3.202	3423.154	1.826	2581.171	1.826	2581.171
0.9000	0.2750	0.477	638.630	3.148	3314.119	1.774	2473.732	1.774	2473.732
0.9500	0.2902	0.488	642.149	3.097	3213.278	1.725	2374.475	1.725	2374.475
1.0000	0.3055	0.497	644.993	3.049	3119.752	1.679	2282.523	1.679	2282.523
1.0500	0.3208	0.507	647.261	3.004	3032.783	1.636	2197.115	1.636	2197.115
1.1000	0.3361	0.515	649.038	2.961	2951.710	1.595	2117.593	1.595	2117.593
1.1500	0.3513	0.523	650.394	2.921	2875.958	1.556	2043.381	1.556	2043.381
1.2000	0.3666	0.531	651.388	2.883	2805.023	1.519	1973.975	1.519	1973.975
1.2500	0.3819	0.539	652.072	2.846	2738.460	1.485	1908.930	1.485	1908.930
1.3000	0.3972	0.546	652.490	2.811	2675.878	1.452	1847.856	1.452	1847.856
1.3500	0.4125	0.553	652.679	2.778	2616.931	1.420	1790.406	1.420	1790.406
1.4000	0.4277	0.559	652.670	2.746	2561.309	1.390	1736.272	1.390	1736.272
1.4500	0.4430	0.565	652.492	2.716	2508.740	1.362	1685.179	1.362	1685.179
1.5000	0.4583	0.571	652.167	2.687	2458.976	1.334	1636.882	1.334	1636.882
1.5500	0.4736	0.577	651.717	2.659	2411.799	1.308	1591.161	1.308	1591.161
1.6000	0.4888	0.582	651.159	2.633	2367.009	1.283	1547.818	1.283	1547.818
1.6500	0.5041	0.588	650.508	2.607	2324.430	1.259	1506.676	1.259	1506.676
1.7000	0.5194	0.593	649.778	2.582	2283.900	1.236	1467.573	1.236	1467.573
1.7500	0.5347	0.598	648.980	2.558	2245.273	1.214	1430.363	1.214	1430.363
1.8000	0.5499	0.602	648.124	2.535	2208.417	1.192	1394.915	1.192	1394.915
1.8500	0.5652	0.607	647.219	2.513	2173.212	1.172	1361.109	1.172	1361.109
1.9000	0.5805	0.611	646.273	2.492	2139.548	1.152	1328.834	1.152	1328.834
1.9500	0.5958	0.616	645.293	2.471	2107.325	1.133	1297.991	1.133	1297.991
2.0000	0.6110	0.620	644.283	2.451	2076.451	1.115	1268.487	1.115	1268.487
2.0500	0.6263	0.624	643.250	2.432	2046.842	1.097	1240.240	1.097	1240.240
2.1000	0.6416	0.628	642.198	2.413	2018.421	1.080	1213.172	1.080	1213.172
2.1500	0.6569	0.631	641.131	2.395	1991.117	1.063	1187.212	1.063	1187.212
2.2000	0.6721	0.635	640.052	2.378	1964.865	1.047	1162.295	1.047	1162.295
2.2500	0.6874	0.639	638.964	2.361	1939.603	1.032	1138.360	1.032	1138.360
2.3000	0.7027	0.642	637.870	2.344	1915.277	1.017	1115.352	1.017	1115.352
2.3500	0.7180	0.645	636.772	2.328	1891.834	1.002	1093.218	1.002	1093.218
2.4000	0.7332	0.649	635.673	2.313	1869.226	0.988	1071.912	0.988	1071.912
2.4500	0.7485	0.652	634.573	2.297	1847.409	0.974	1051.388	0.974	1051.388
2.5000	0.7638	0.655	633.476	2.283	1826.342	0.961	1031.606	0.961	1031.606
2.5500	0.7791	0.658	632.381	2.268	1805.986	0.948	1012.526	0.948	1012.526
2.6000	0.7944	0.661	631.290	2.254	1786.305	0.935	994.113	0.935	994.113
2.6500	0.8096	0.664	630.205	2.241	1767.264	0.923	976.333	0.923	976.333
2.7000	0.8249	0.666	629.126	2.227	1748.834	0.911	959.155	0.911	959.155
2.7500	0.8402	0.669	628.054	2.214	1730.985	0.900	942.550	0.900	942.550
2.8000	0.8555	0.672	626.989	2.202	1713.688	0.889	926.491	0.889	926.491
2.8500	0.8707	0.674	625.933	2.189	1696.919	0.878	910.951	0.878	910.951
2.9000	0.8860	0.677	624.885	2.177	1680.653	0.867	895.906	0.867	895.906
2.9500	0.9013	0.679	623.846	2.166	1664.867	0.857	881.334	0.857	881.334
3.0000	0.9166	0.682	622.817	2.154	1649.540	0.847	867.214	0.847	867.214
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDJAK04
Date and time : 06MAY97:15:46
Computation of ref. F: Simple mean, age 3 - 7
F-0.1 factor : 0.5554
F-max factor : 1.3723
F-0.1 reference F : 0.1697
F-max reference F : 0.4193
Recruitment : Single recruit

Table 2.4.20

Ref. Pts.

Faroe Haddock. Calculations of various reference points using a spreadsheet modified from one developed by Alan Sinclair during the 1996 Comite meeting.

	2	3	4	5	6	7	8	9	10	11	12	13	14	15
WtStock	0.515	0.781	1.106	1.471	1.829	2.174	2.435	2.71	3.107	same as w/cat				
WtCatch	0.515	0.781	1.106	1.471	1.829	2.174	2.435	2.71	3.107	avg for 94 to 96				
F at age	0.06	0.1918	0.2972	0.2944	0.3374	0.4068	0.4504	0.3898	0.3898	0.3898	0.3898	0.3898	0.3898	avg of xsa 94 to 96
M	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2					
N	1	0.594	0.175	0.029	0.005	0.001	0.000	0.000	0.000					
	1	0.594	0.175	0.029	0.005	0.001	0.000	0.000	0.000					
Mal	0.0847	0.5053	0.9213	0.996	1	1	1	1	1					
Bio	0.515	0.46429	0.193504	0.043168	0.009138	0.00147	0.000154	1.27E-05	1.49E-06					
	0.515	0.464281	0.193488	0.04316	0.009136	0.00147	0.000154	1.27E-05	1.49E-06					
C	0.24957	0.350926	0.129301	0.021599	0.003888	0.000561	5.4E-05	3.83E-06	3.92E-07					
	0.249583	0.350932	0.129293	0.021596	0.003887	0.000561	5.4E-05	3.83E-06	3.92E-07					

Stock Recruitment Parameters			S	R	R/S
a	1.959735		1	1.959687	1.959687
b	2.47E-05		100	195.4895	1.954895
cc			1000	1911.863	1.911863
eqs	700		2000	3730.322	1.865161
eqrs	0.979868		3000	5458.798	1.819599
			4000	7100.603	1.775151
			5000	8658.939	1.731788
			7500	12209.69	1.627958
			10000	15303.54	1.530354
			12500	17982.52	1.438602
			15000	20285.25	1.35235
			17500	22247.22	1.27127
			20000	23901.02	1.195051
			25000	26401.2	1.056048
			30000	27996.4	0.933213
			35000	28863.31	0.824666
			40000	29149.78	0.728745
			45000	28979.11	0.64398
			55000	27658.57	0.502883
			65000	25525.54	0.392701
			75000	22999.44	0.306659
			85000	20354.92	0.23947
			95000	17765.14	0.187001
			105000	15333.06	0.146029
			115000	13113.9	0.114034
			125000	11131.11	0.089049
			135000	9387.645	0.069538

F	F Mult	Y/R	S/R	Slope Y/R	eq S	eq R	eq Y
0	0.000	0.585855	0.510273	-0.01193	5.42E-08	1.06E-07	6.23E-08
0.1	0.327	0.400596	3.890755	0.75161	82140.22	21111.64	8457.247
0.2	0.655	0.561306	2.900635	0.296121	70265.53	24224.19	13597.18
0.3	0.982	0.622906	2.262959	0.107393	60227.27	26614.39	16578.26
0.4	1.309	0.643396	1.832476	0.029099	51695.27	28210.61	18150.61
0.5	1.637	0.646883	1.528931	-0.00305	44372.5	29021.92	18773.8
0.6	1.964	0.643483	1.306447	-0.01572	38013.8	29097.09	18723.48
0.7	2.291	0.637479	1.137838	-0.02011	32426.44	28498.29	18167.07
0.8	2.618	0.630695	1.006383	-0.02098	27462.35	27288.16	17210.51
0.9	2.946	0.623899	0.901416	-0.02039	23008.39	25524.71	15924.85
1	3.273	0.617406	0.815892	-0.01923	18977.63	23259.97	14360.84
1.1	3.600	0.611325	0.745006	-0.01791	15302.5	20540.1	12556.68
1.2	3.928	0.605683	0.685385	-0.01658	11929.72	17405.87	10542.43
1.3	4.255	0.600463	0.634597	-0.01533	8816.643	13893.29	8342.405
1.4	4.582	0.595637	0.590854	-0.01418	5928.689	10034.11	5976.685
1.5	4.910	0.591171	0.552808	-0.01313	3237.445	5856.361	3462.108
1.6	5.237	0.58703	0.518432	-0.01219	719.3202	1384.822	812.9312
1.7	5.564	0.583182	0.489925	-0.01134	-1645.46	-3358.59	-1958.67
1.8	5.892	0.579598	0.463658	-0.01057	-3873.59	-8354.41	-4842.2
1.9	6.219	0.576252	0.44013	-0.00988	-5979.32	-13585.3	-7828.57
2	6.546	0.57312	0.418937	-0.00926	-7974.83	-19035.9	-10909.8

F	Y/R	S/R	%MaxS/R	eq S	eq R	eq Y	Goal seek
F0.1	0.247645	0.598293	2.56381	11%	65274.42	25459.93	15232.51
Fmax	0.482447	0.646953	1.57535	12%	45581.87	28934.44	18719.22
Fmed	0.279908	0.615013	2.370987	11%	62112.88	26197.06	16111.54
Fhigh	0.880879	0.625181	0.919805	11%	23824.95	25902.18	16193.56
Fmsy	0.540131	0.646025	1.43174	12%	41716.82	29137.14	18823.32
Fcrash	1.629774	0.585855	0.510273	11%	5.42E-08	1.06E-07	6.23E-08

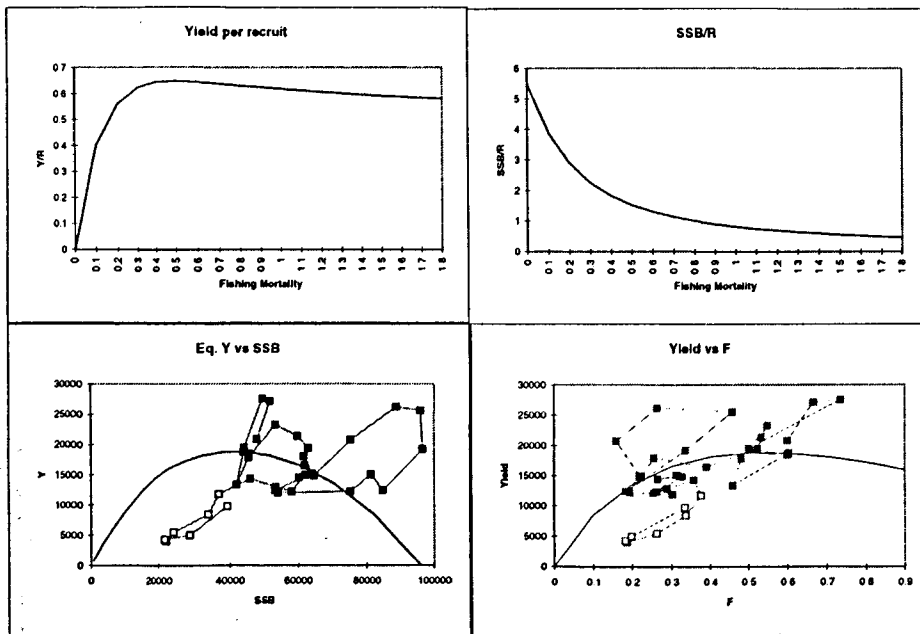


Table 2.4.21

If the 9320 days are allocated to the LL<100.		If the 9320 days are allocated to the ST<400.		If the 9320 X 2 days are allocated to the Jiggers.		If days are cut by half 4660 used by LL<100	
F	Cumul Freq	F	Cumul Freq	F	Cumul Freq	F	Cumul Freq
0.068787	0.018182	0.018465	0.018182	0.008947	0.018182	0.034394	0.018182
0.072703	0.036364	0.020879	0.036364	0.010003	0.036364	0.036352	0.036364
0.076448	0.054545	0.02333	0.054545	0.012271	0.054545	0.038224	0.054545
0.082789	0.072727	0.033047	0.072727	0.016649	0.072727	0.041395	0.072727
0.089986	0.090909	0.037649	0.090909	0.021186	0.090909	0.044993	0.090909
0.094299	0.109091	0.044731	0.109091	0.021841	0.109091	0.047149	0.109091
0.106568	0.145455	0.046942	0.145455	0.034488	0.145455	0.053284	0.145455
0.108025	0.163636	0.058355	0.163636	0.035581	0.163636	0.054012	0.163636
0.113385	0.181818	0.062411	0.181818	0.045348	0.181818	0.056693	0.181818
0.122773	0.2	0.071405	0.2	0.046692	0.2	0.061387	0.2
0.1282	0.218182	0.078563	0.218182	0.048462	0.218182	0.0641	0.218182
0.135536	0.236364	0.091441	0.236364	0.051169	0.236364	0.067768	0.236364
0.143369	0.254545	0.097688	0.254545	0.055438	0.254545	0.071684	0.254545
0.14593	0.272727	0.103066	0.272727	0.058377	0.272727	0.072965	0.272727
0.148249	0.290909	0.104317	0.290909	0.066917	0.290909	0.074124	0.290909
0.149288	0.309091	0.105511	0.309091	0.071384	0.309091	0.074644	0.309091
0.149362	0.327273	0.10685	0.327273	0.073109	0.327273	0.074681	0.327273
0.149553	0.345455	0.111393	0.345455	0.077388	0.345455	0.074777	0.345455
0.149649	0.363636	0.113966	0.363636	0.081546	0.363636	0.074824	0.363636
0.153537	0.4	0.125092	0.4	0.085585	0.4	0.076768	0.4
0.154012	0.418182	0.129283	0.418182	0.087966	0.418182	0.077006	0.418182
0.156672	0.436364	0.131745	0.436364	0.095594	0.436364	0.078336	0.436364
0.165811	0.454545	0.135354	0.454545	0.096376	0.454545	0.082906	0.454545
0.171222	0.472727	0.140743	0.472727	0.097733	0.472727	0.085611	0.472727
0.172399	0.490909	0.147309	0.490909	0.0984	0.490909	0.086199	0.490909
0.173747	0.509091	0.150211	0.509091	0.099201	0.509091	0.086874	0.509091
0.176359	0.527273	0.151727	0.527273	0.099811	0.527273	0.08818	0.527273
0.187176	0.545455	0.153331	0.545455	0.103721	0.545455	0.093588	0.545455
0.193501	0.563636	0.154025	0.563636	0.106368	0.563636	0.09675	0.563636
0.198078	0.581818	0.155986	0.581818	0.10792	0.581818	0.099039	0.581818
0.205648	0.6	0.156923	0.6	0.108721	0.6	0.102824	0.6
0.209143	0.636364	0.16217	0.636364	0.112257	0.636364	0.104572	0.636364
0.219095	0.654545	0.163318	0.654545	0.114278	0.654545	0.109548	0.654545
0.228934	0.672727	0.16457	0.672727	0.119515	0.672727	0.114467	0.672727
0.237787	0.690909	0.171812	0.690909	0.121022	0.690909	0.118894	0.690909
0.240192	0.709091	0.189739	0.709091	0.124146	0.709091	0.120096	0.709091
0.242365	0.727273	0.190991	0.727273	0.130266	0.727273	0.121182	0.727273
0.246981	0.745455	0.192293	0.745455	0.136964	0.745455	0.12349	0.745455
0.249309	0.763636	0.196664	0.763636	0.138785	0.763636	0.124654	0.763636
0.25127	0.781818	0.201485	0.781818	0.140283	0.781818	0.125635	0.781818
0.254451	0.8	0.202856	0.8	0.14763	0.8	0.127225	0.8
0.262916	0.818182	0.209042	0.818182	0.151421	0.818182	0.131458	0.818182
0.26963	0.836364	0.211552	0.836364	0.157732	0.836364	0.134815	0.836364
0.281791	0.854545	0.213669	0.854545	0.160519	0.854545	0.140896	0.854545
0.301919	0.890909	0.217993	0.890909	0.172926	0.890909	0.150959	0.890909
0.322658	0.909091	0.222245	0.909091	0.179741	0.909091	0.161329	0.909091
0.358169	0.927273	0.227319	0.927273	0.180446	0.927273	0.179084	0.927273
0.374111	0.945455	0.242338	0.945455	0.187235	0.945455	0.187055	0.945455
0.401576	0.963636	0.26801	0.963636	0.200297	0.963636	0.200788	0.963636
0.444345	0.981818	0.286352	0.981818	0.236949	0.981818	0.222173	0.981818
0.487431	1	0.306473	1	0.277819	1	0.243716	1

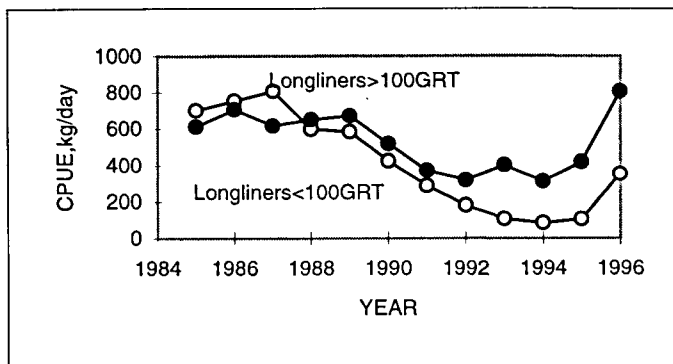


Figure A: Haddock in Division Vb 1985-1996.
Catch per day for longliners.

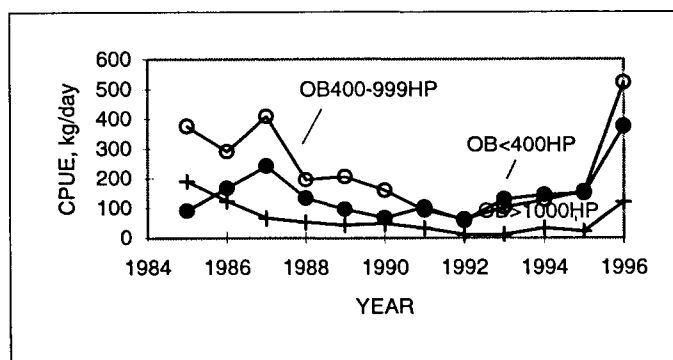


Figure B: Haddock in Division Vb 1985-1996.
Catch per day for otter board trawlers.

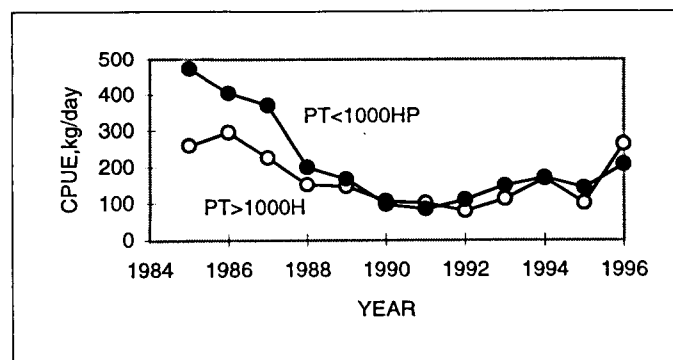


Figure C: Haddock in Division Vb 1985-1996.
Catch per day for pair trawlers.

Figure 2.4.1

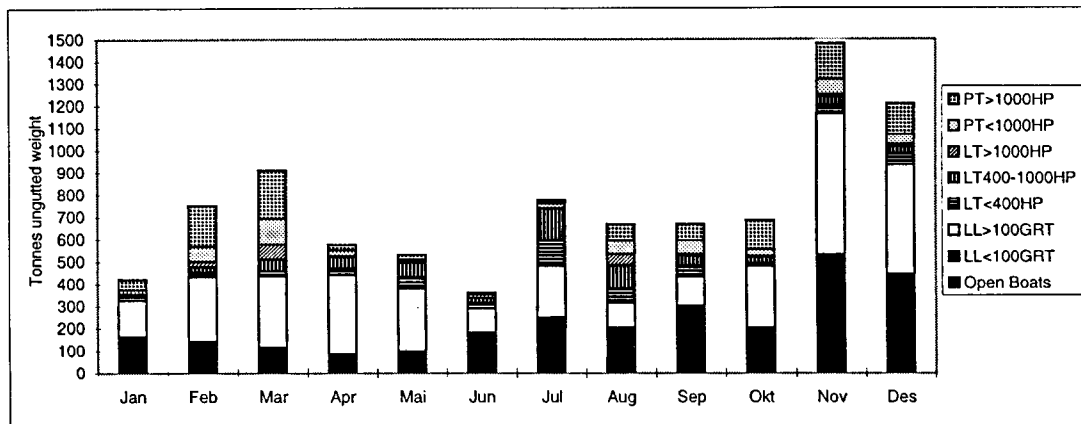


Figure A Faroese landings of haddock from Vb1 in 1996 per fleet category. Tonnes ungutted weight.

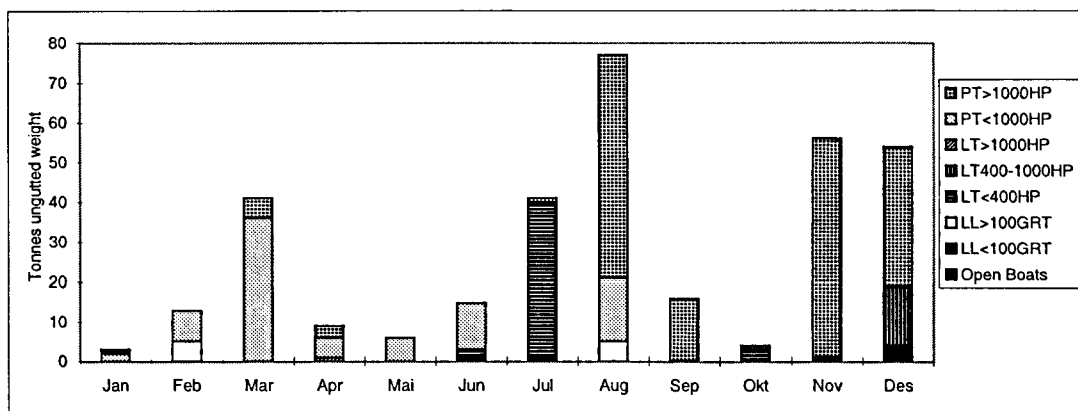


Figure B Faroese landings of haddock from Vb2 in 1996 per fleet category. Tonnes ungutted weight.

Figure 2.4.2 Faroe Haddock.

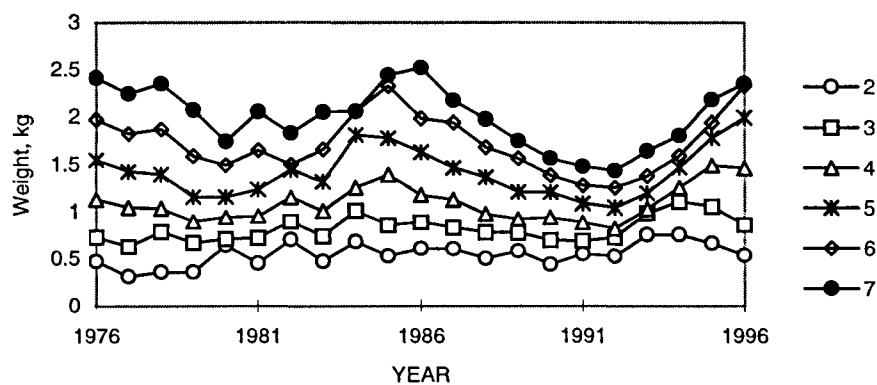


Figure A: Mean weight at age of Faroe haddock 1976-1996, as estimated from sampling of the commercial catches.

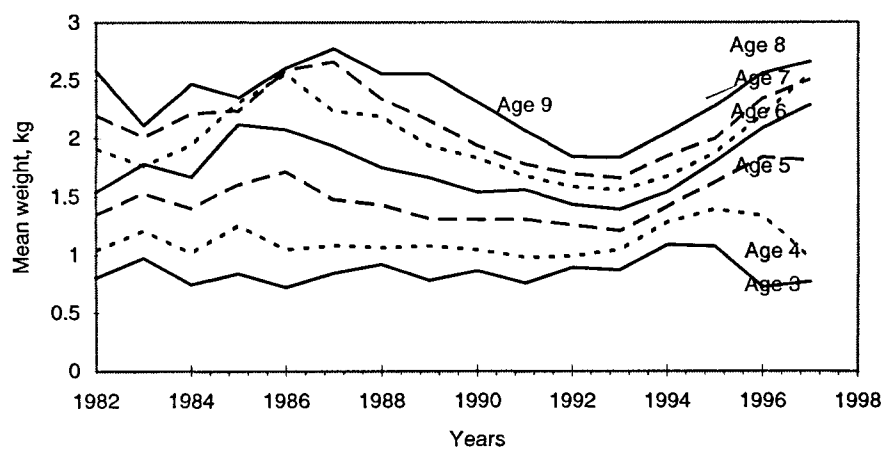
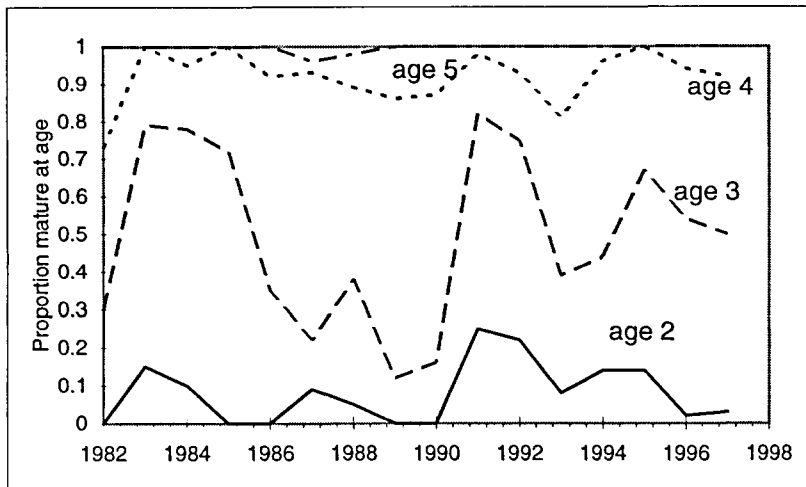
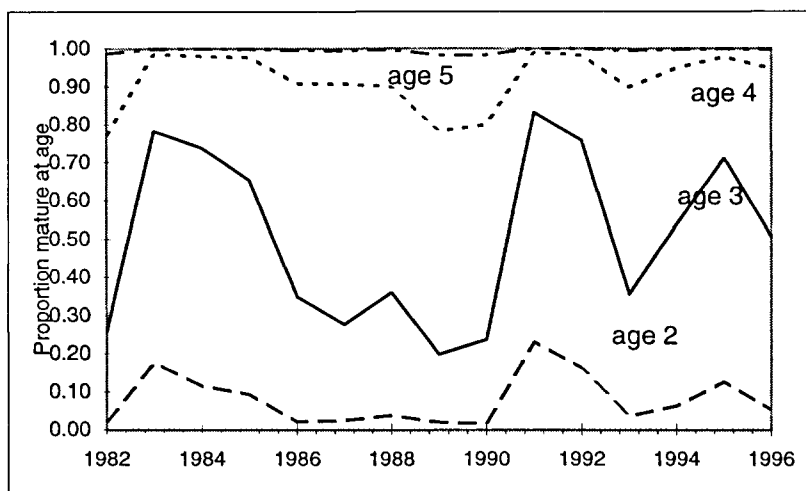


Figure B: Mean weight at age of Faroe haddock 1982-1997, as predicted from the model. Ages 3-9.

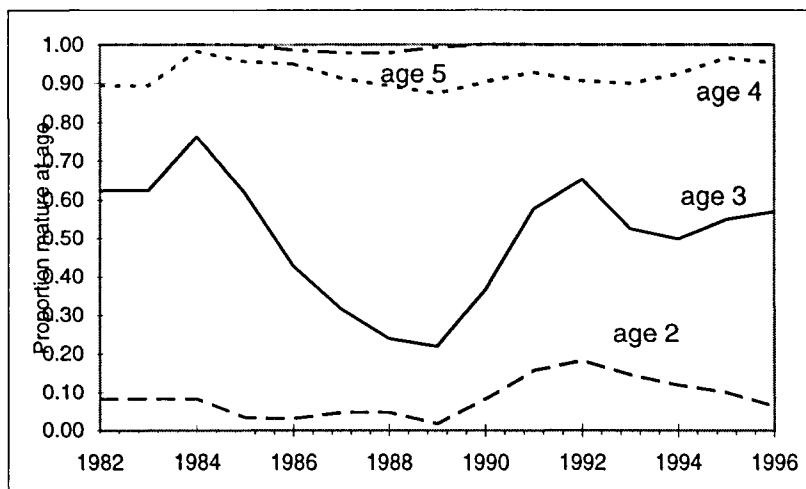
Figure 2.4.3 Faroe Haddock.



A 'Faroe haddock. Maturity ogives. Observed values from the surveys in spring.



B 'Faroe haddock - runi. Maturity ogives. Fitted values from the model: $pM = a + YC\text{-strength} + \text{age} + \text{year}$.



C 'Faroe haddock. Maturity ogives. Running 3 years average

Figure 2.4.4

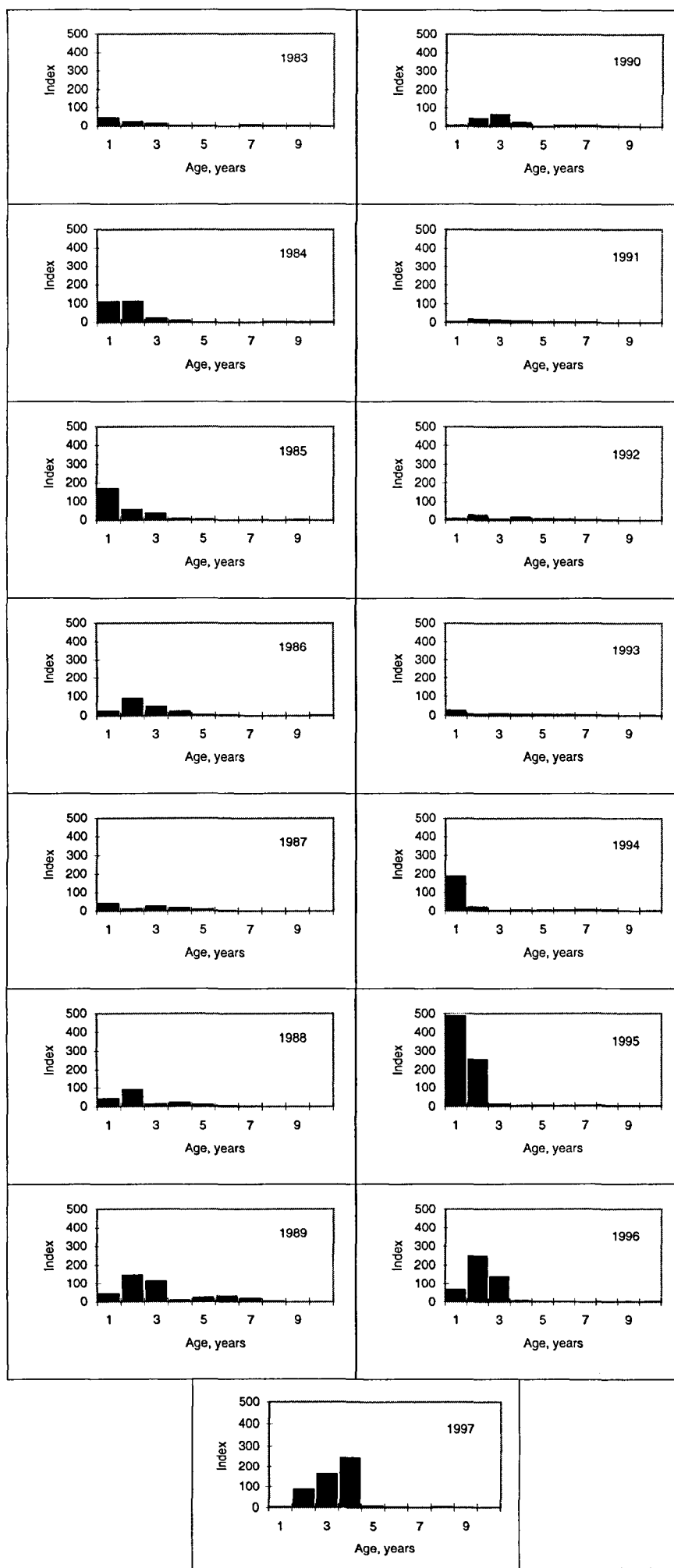


Figure 2.4.5: Faroe Plateau Haddock. Stratified mean catch in number at age per trawl hour from the Faroese Groundfish Surveys 1983-97

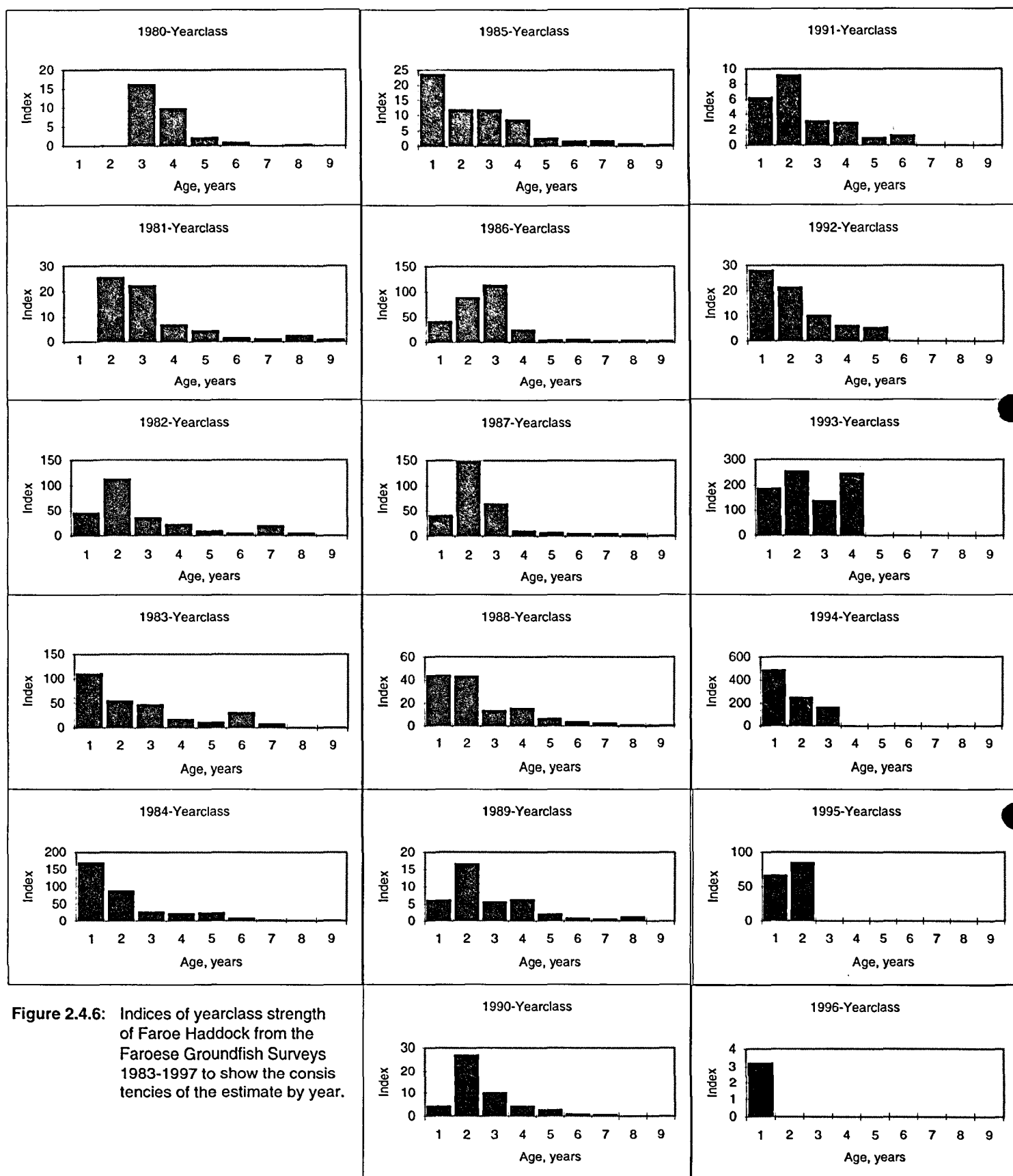


Figure 2.4.6: Indices of yearclass strength of Faroe Haddock from the Faroese Groundfish Surveys 1983-1997 to show the consistencies of the estimate by year.

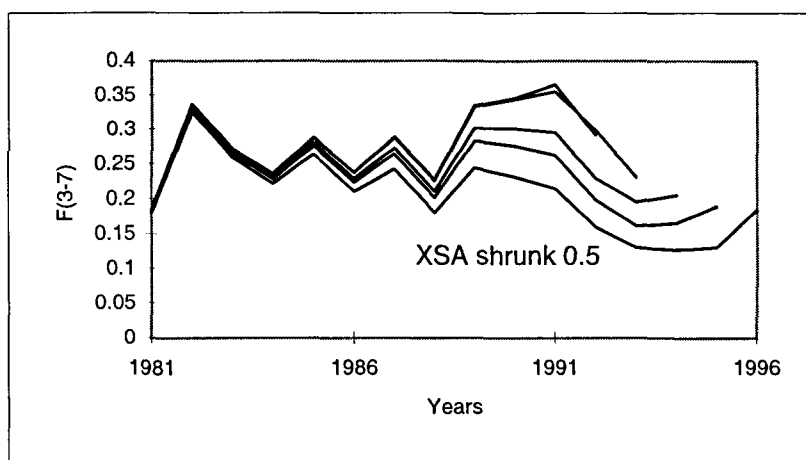


Figure A: Retrospective analysis of XSA (run x16 shrunk 0.5) of Faroe haddock

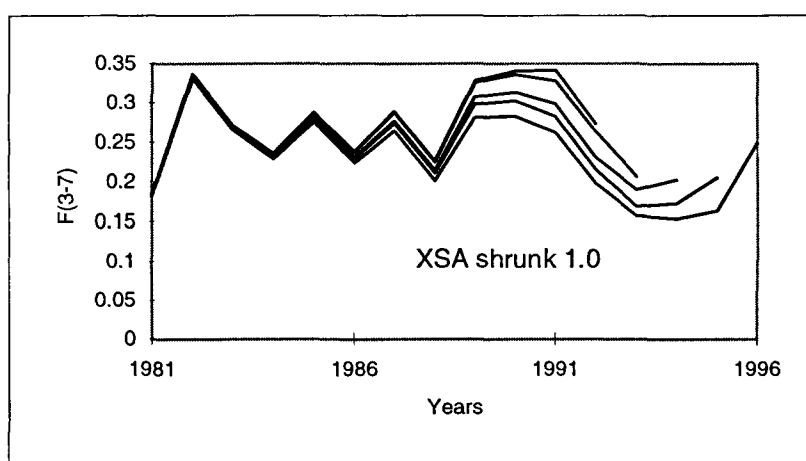


Figure B: Retrospective analysis of XSA (run x16 shrunk 1.0) of Faroe haddock

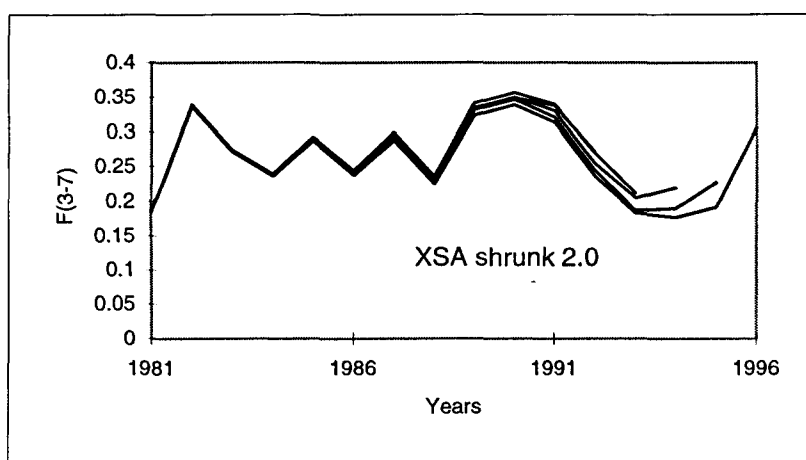


Figure C: Retrospective analysis of XSA (run x16 shrunk 2.0) of Faroe haddock

Figure 2.4.7

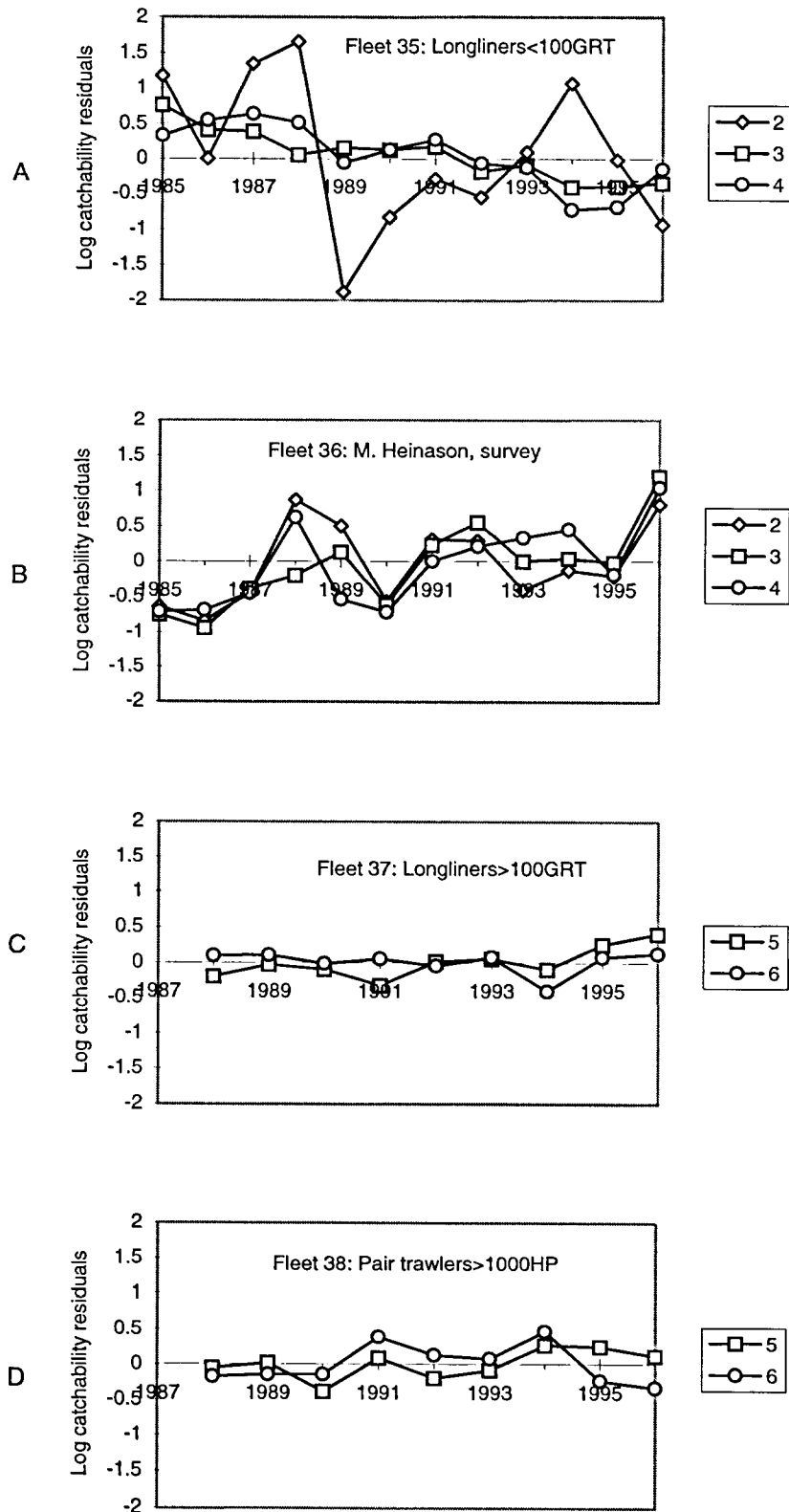


Figure 2.4.8. Tuning fleets for Faroe haddock Vb. Log Catchability Residuals Plots.

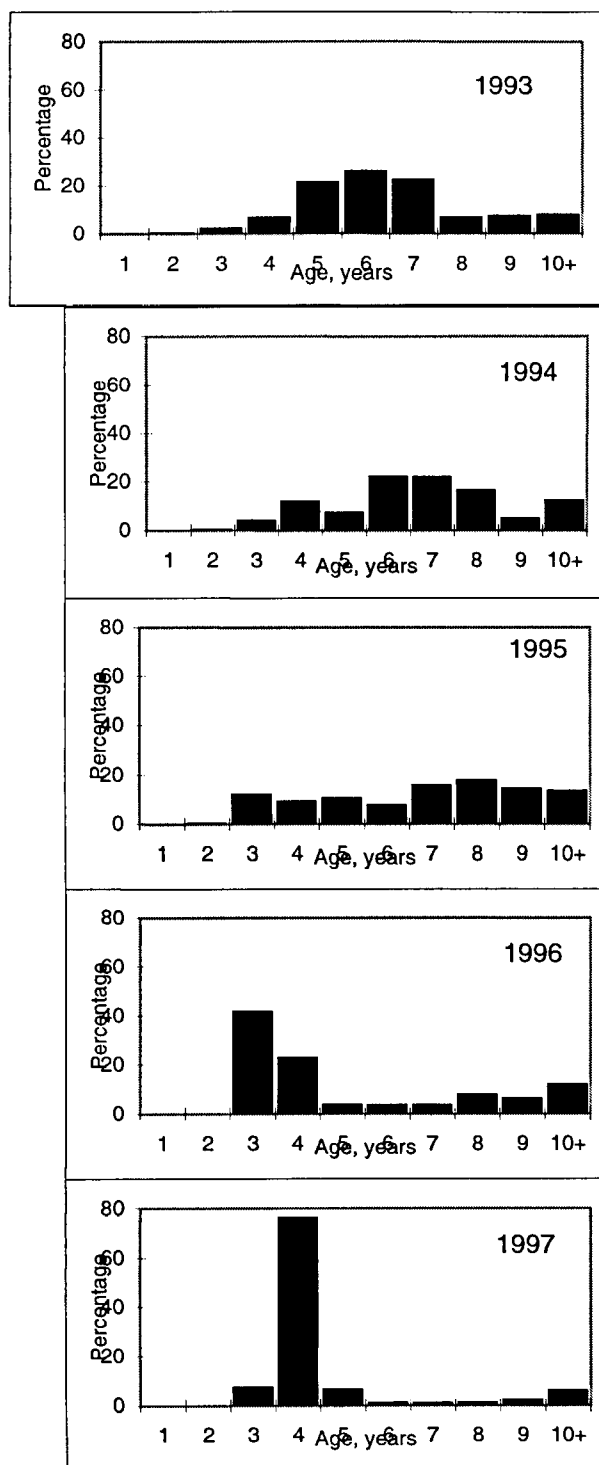
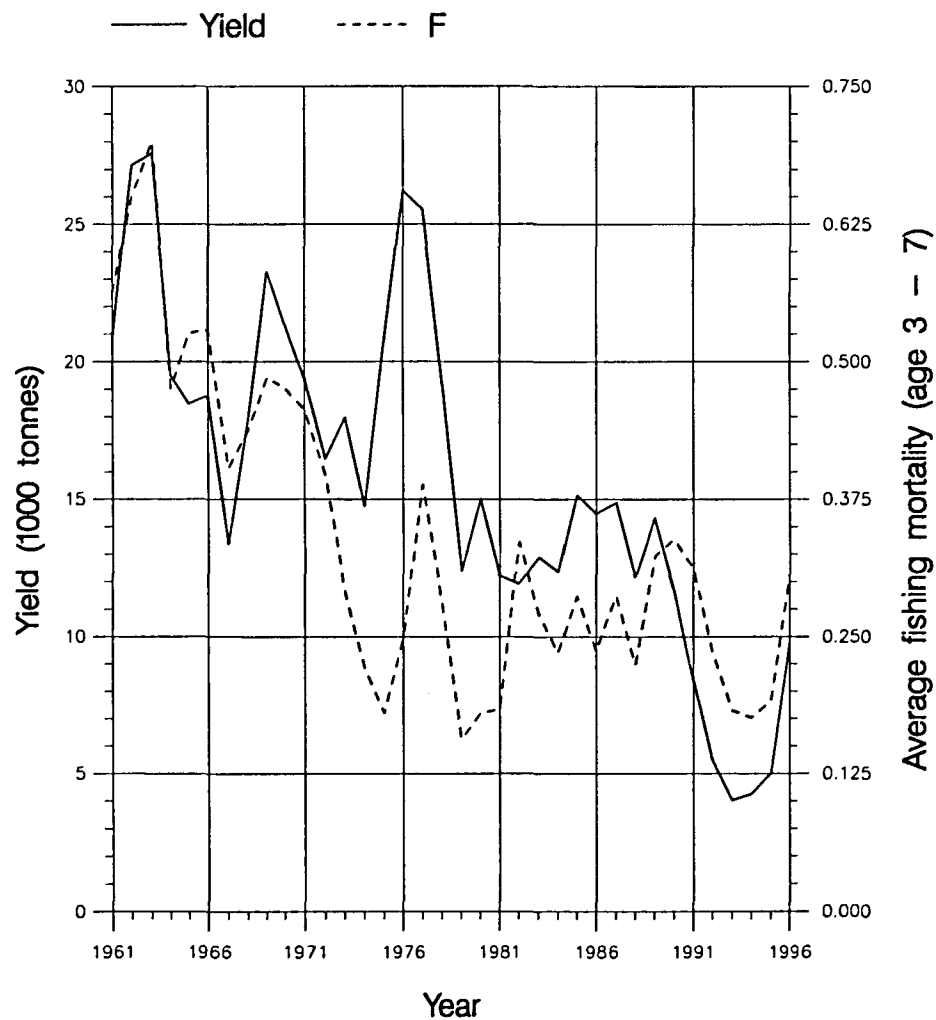


Figure 2.4.9.: Age distribution of Faroe haddock in the Faroese commercial catches the 1. quarter of the years 1993-1997.

Figure 2.4.10

Fish Stock Summary Haddock in the Faroe Grounds (Fishing Area Vb) 6 – 5 – 1997

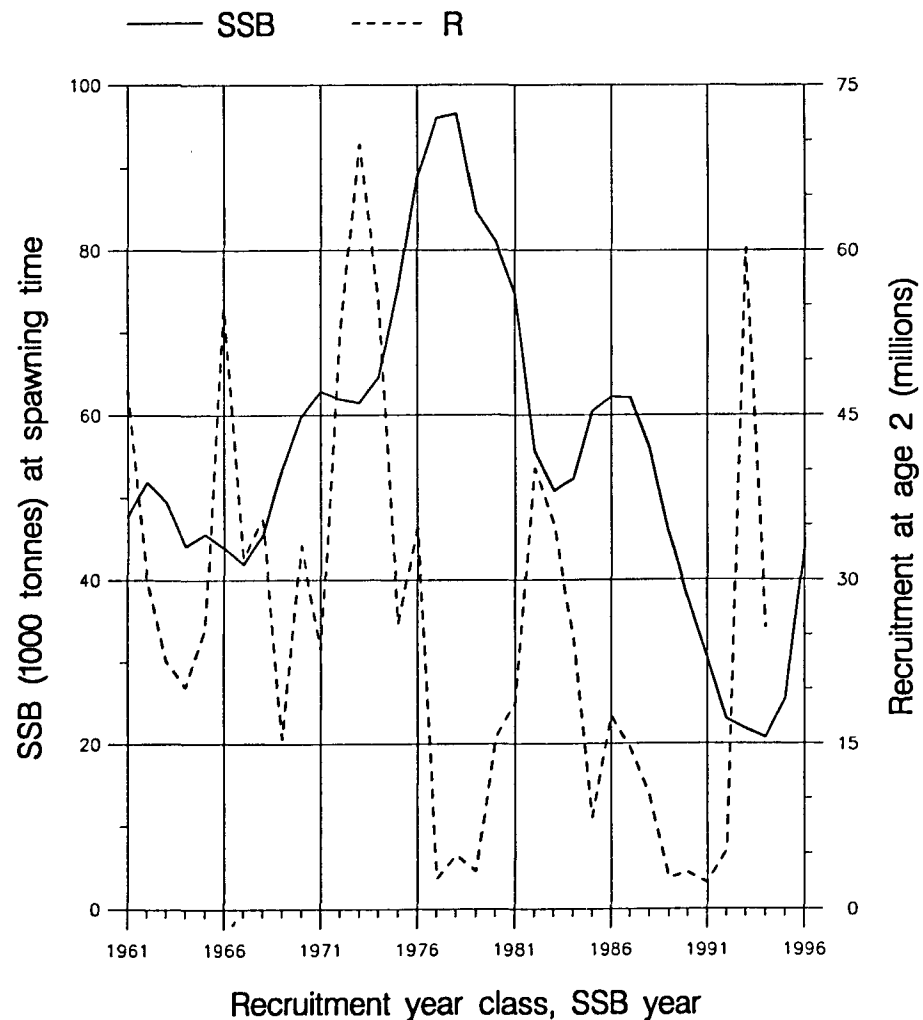
Yield and fishing mortality



(run: XSAJAK17)

A

Spawning stock and recruitment

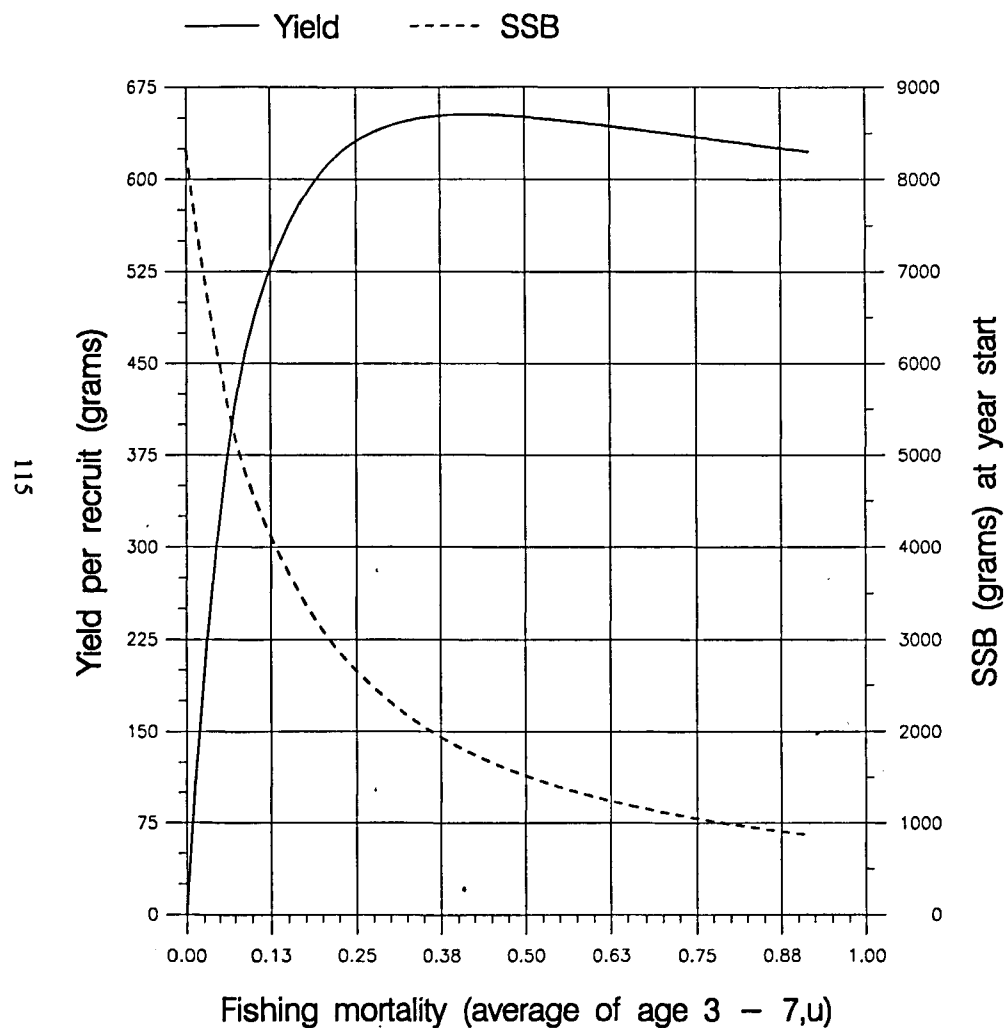


(run: XSAJAK17)

B

Fish Stock Summary Haddock in the Faroe Grounds (Fishing Area Vb) 6 – 5 – 1997

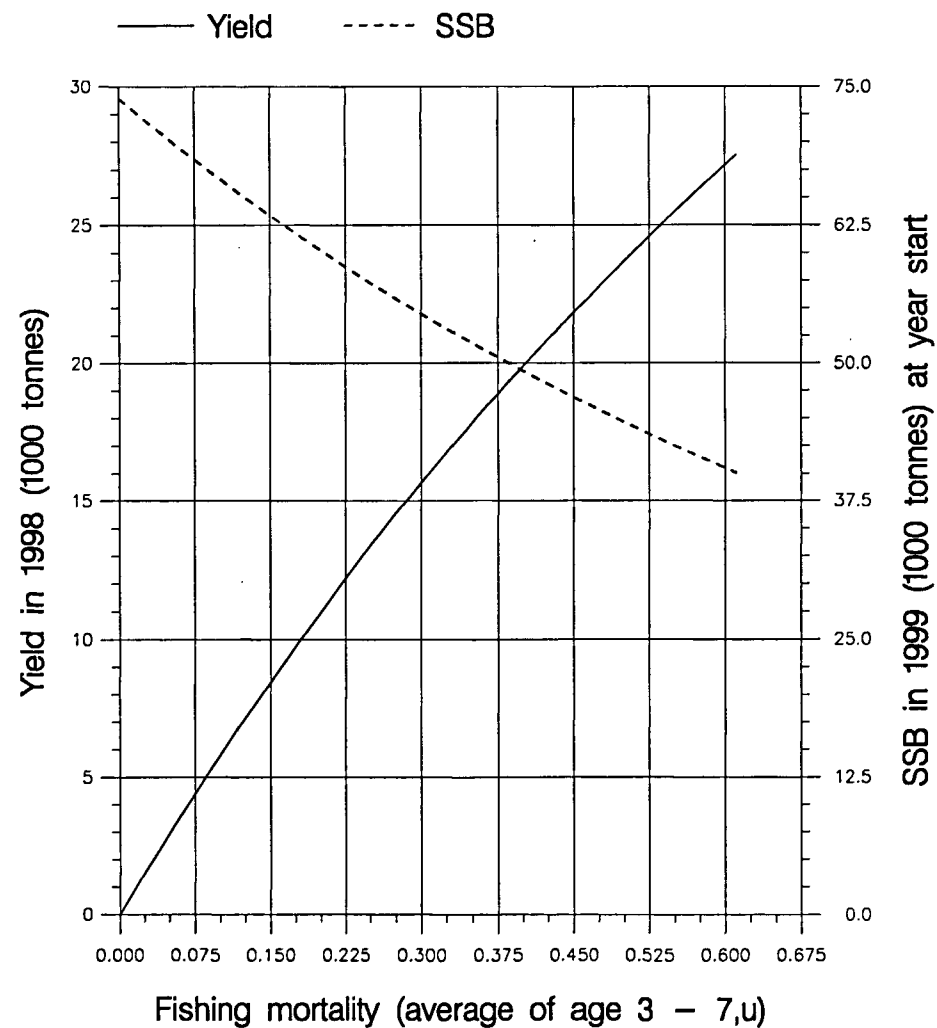
Long term yield and spawning stock biomass



(run: YLDJAK04)

C

Short term yield and spawning stock biomass

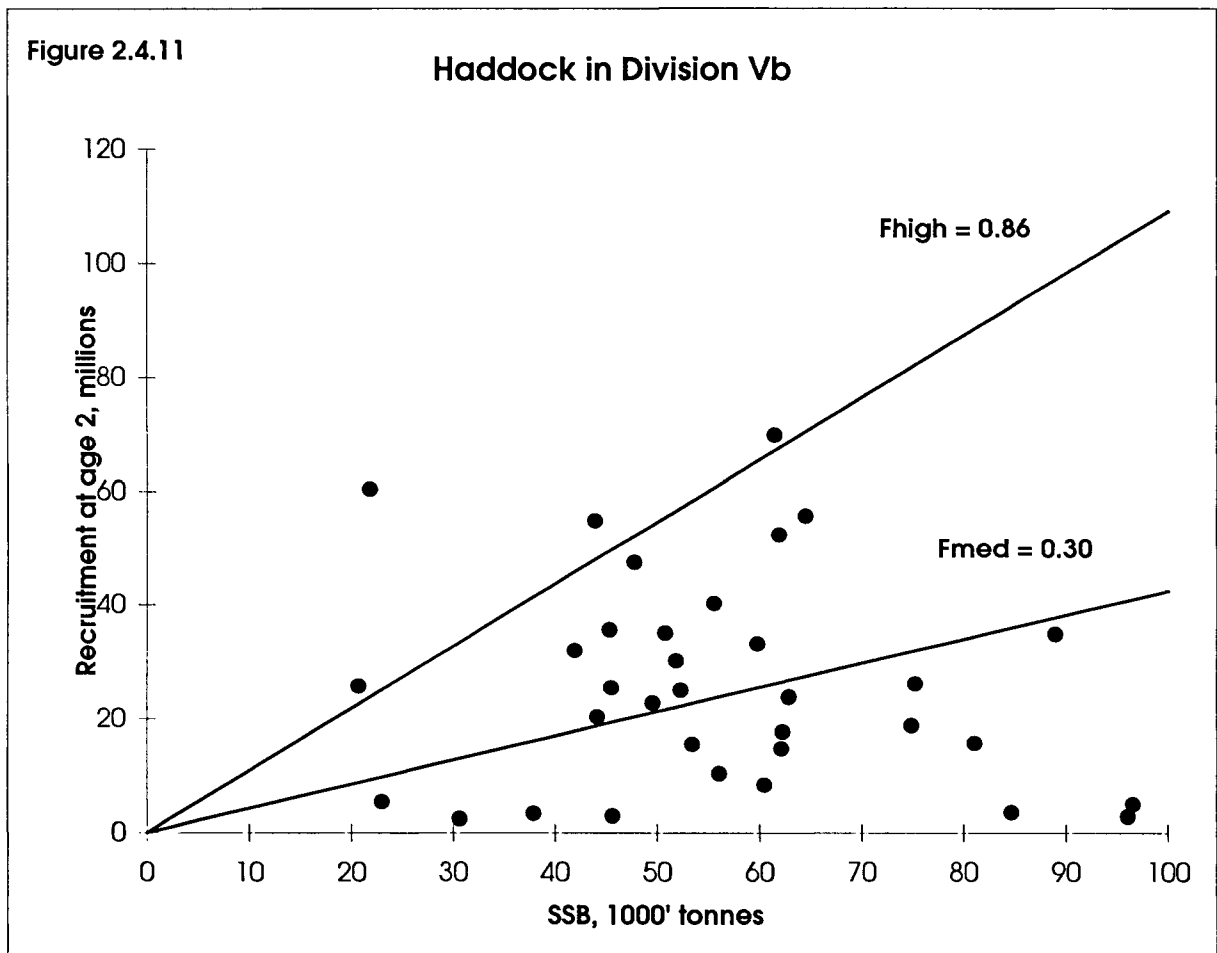


(run: MANJAK01)

D

Figure 2.4.11

Haddock in Division Vb



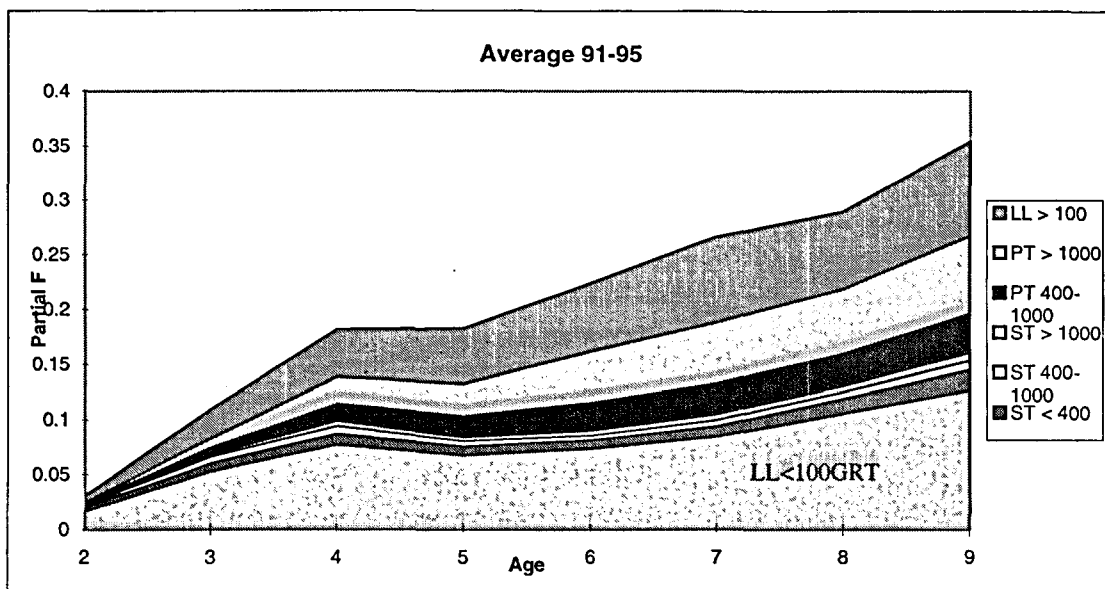


Figure 2.4.12. Partial F at age for different fleet categories.

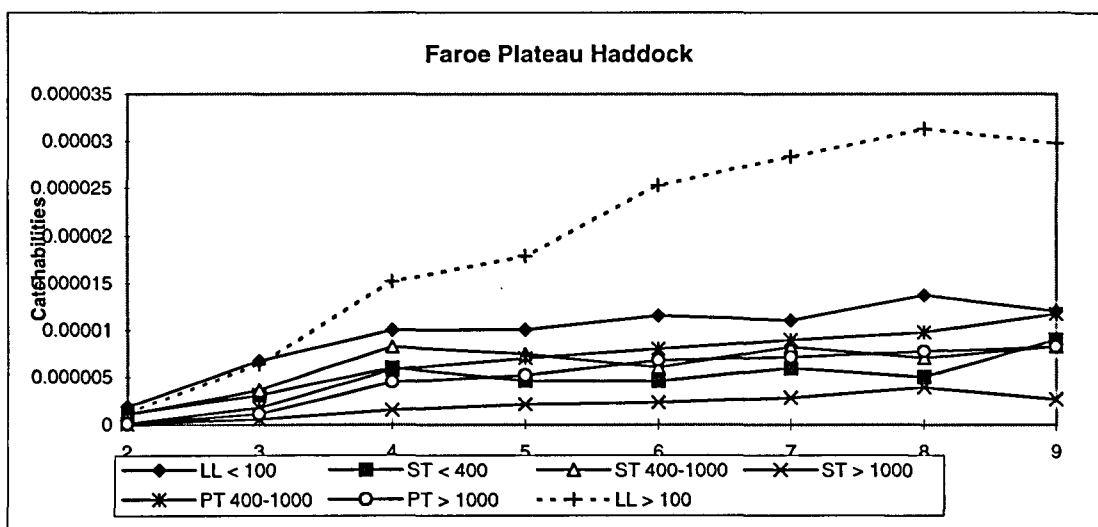


Figure 2.4.13. Catchabilities at age for different fleet categories.

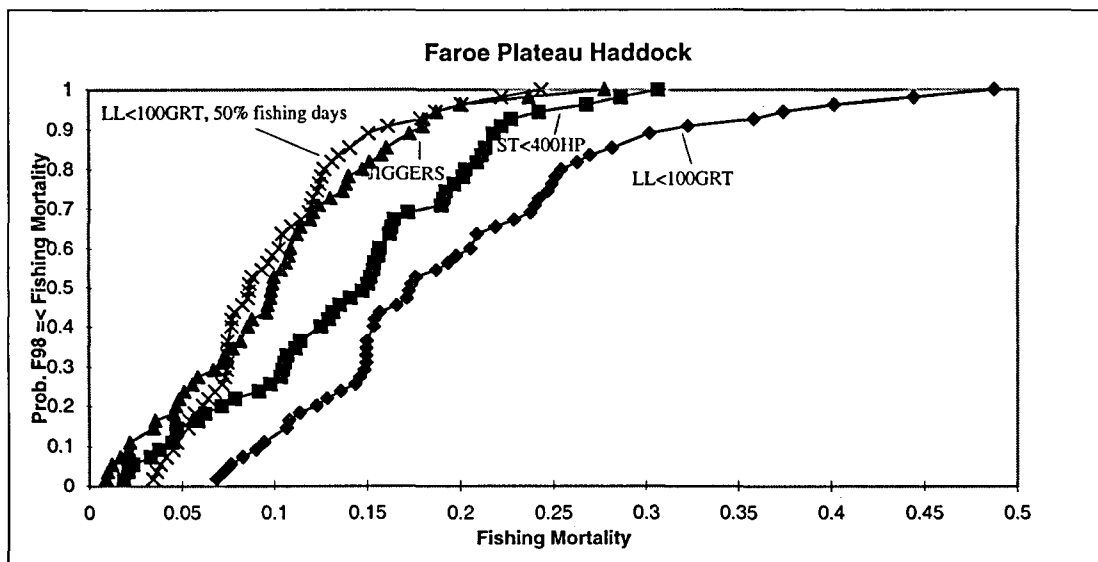


Figure 2.4.14. Probability profiles for fishing mortalities in 1998.

2.5 Faroe Saithe

2.5.1 Landings and trends in the fishery

Landings of saithe from the Faroese grounds (Division Vb) varied between around 40 000 - 45 000 t in the period 1985-1989 (Table 2.5.1). In 1990 record high catches were reached at about 60 000 t and since then catches have steadily decreased to about 33 000 t in 1993 and 1994 and dropped further to 27 200 t and 20 000 t in 1995 and 1996 respectively. According to preliminary statistics for the first quarter of 1997 total landings were about 3 100 t compared to about 6 600 t in the same period in 1996.

With the introduction of the 200 miles EEZ in 1977 saithe has, for all practical purposes, only been fished by Faroese vessels. The principal fleet consists of large pair trawlers, with engines larger than 1000 HP, accounting for about 60% of the catches in 1993-96. In the same period the smaller pair trawlers (<1000 HP) caught about 20%, jiggers 10% and larger single trawlers about 8%. All other vessels only have small catches of saithe as by-catch.

Generally speaking effort has increased in the period 1994-96, Table 2.1.4. For the period 1985-91 the effort of the larger pair trawlers increased from around 3 200 days at sea to 7 900 days. There after the effort decreased to 6 200 days in 1994 but increased again to 7 300 days in 1996. In the smaller pair trawler fleet the effort fluctuated between 5 200-6 500 days in the period 1985-1991 then dropped to 2 100 days in 1994 but then increased to 3 400 days in 1996. Since 1985 the effort of the large single trawlers have declined from 5 600 days to 4 000 days in 1991 and fluctuated between 3 600-4 300 days in the period 1992-96. The effort of jiggers has increased in the period 1985-96 from 3 300 days to 8 000-10 600 days in 1988-93 and increased further to 23 700 days in 1996.

In terms of CPUE there has been a general downwards trend in the last 2-3 years, Table 2.5.2 and Figure 2.5.1. Looking at the whole period 1985-96 the range of CPUE for larger pair trawlers has decreased from 3.4 t/day to 1.4 t/day. CPUE for smaller pair trawlers has varied between about 1.2 t/day to 2.5 t/day and has halved in the last three years. The jiggers have had a decline in CPUE from 0.5 t/day to 0.1 t/day in the period 1991-96. For larger single trawlers there has been a decline from 2.3 t/day to 0.3 t/day in the period 1985-96.

In the last ten years many single trawlers have switched to pair trawling and an increasing proportion of the catches are caught by larger vessels. Jiggers, on the other hand, have increased their effort substantially from about 3 300 days to some 23 700 days in the last 12 years.

Catches and effort are shown by fleet categories for the period 1985-1996 in Tables 2.1.3 and 2.1.4.

Catches used in the assessment are presented in Table 2.5.1. These include foreign catches that have been reported to the Faroese Authorities but not officially reported to ICES. Also catches in that part of Sub-division IIa which lies immediately north of the Islands have been included.

2.5.2 Catch at age

Catch at age are based on length and otolith samples from Faroese landings mostly in the fleet categories small and large pair trawlers and jiggers and landing statistic by fleet provided by the Faroese Statistical Department for Faroese landings and the Faroese Coast Guard for catches by foreign vessels. Catch at age was calculated by each fleet and by each third of the year before the numbers were combined. Finally the numbers were raised by the foreign catches.

Catch at age data in previous years were revised according to the final catch statistics. Catch in numbers at age in 1996 reflects the age composition in the Faroese catches (Table 2.5.3). In 1996 167 samples were taken from landings of saithe with 28 662 length measurements, 4 467 otoliths, and 3 116 individual weights.

2.5.3 Weight at age

Through the recorded period 1961-1996 mean weight at age has varied considerably, *e.g.* with mean weights for age 5 between about 1.6 kg to 3.3 kg and for age 7 between 2.6 kg and 5.3 kg, Table 2.5.4 and Figure 2.5.2. In the period 1984-1986 mean weight at age values were generally high and dropped to a low level in the years 1990-1991. Since then mean weights have been increasing.

The SOP for 1996 shows a discrepancy of 3% which was not corrected for by the working Group (Table 2.5.3).

2.5.4 Maturity at age

Maturity at age data are available for the period 1983-1997. Due to poor sampling in 1988 the proportion mature for this year was calculated as the average of the two adjacent years. In 1994 the values for proportion mature were unrealistically high probably caused by biased sampling and it was decided to use the 1993 values for 1994. A GLM model, described in the 1993 Working Group report (Anon. C.M.1993/Assess:18), was used to explain proportion mature at age as a function of age and year class strength, Figure 2.5.3. These fitted values were used in the assessment (Table 2.5.5). In the period 1961-1982, the values are average for the period 1983-1992.

2.5.5 Stock assessment

2.5.5.1 Tuning and estimation of fishing mortality

Only one tuning data series was used in the assessment. The series extends back to 1982 and consists of data from 8 pair trawlers greater than 1000 HP (Cuba trawlers) which specialise in fishing on saithe and account for 5 000-8 000 t of saithe each year, Table 2.5.6. In the 1993 Working Group report (ICES C.M.1993/Assess:18) a description is provided as to how and why this particular series was chosen.

An XSA run was made with the tuning data with the same run parameters as last year. The diagnostics from this run are shown in Table 2.5.7. The log catchability residuals from the XSA tuning for age groups 4-8 is presented in Figure 2.5.4. The overall impression is that the graphs indicate different trends through the period. The fishing mortalities for 1960-1996 in Table 2.5.8. The average fishing mortality for age groups 4-8 was 0.41 in 1996.

2.5.5.2 Stock estimates and recruitment

In historical terms the spawning stock biomass has in 1992-1996 been in its lowest range ever recorded even if recruitment up till year class 1990 has been close to the geometric mean of the long term recruitment level (20 millions), Table 2.5.10 and Figure 2.5.6B.

Stock in numbers at age as estimated by the VPA is presented in Table 2.5.9. The high numbers in the stock in 1986-1990 are due to very good recruitment. Mean number of recruits as 3 year olds in the period 1980-1989 is about 33 million. The recruits in 1993 are about 20 million, near the long term mean, whereas the recruits in 1994 are one half the mean level. First indications from the SA are that the recruitment level of year classes 1991-93 is very low.

Spawning stock biomass is given in Table 2.5.10 and Figure 2.5.6B. The spawning stock biomass is continuing the decline from 70 000 t in 1993 and to 50 000 t in 1996.

2.5.6 Prediction of catch and biomass

2.5.6.1 Input data

Input data for prediction with management options are presented in Table 2.5.12 and input data for the yield per recruit calculations are given in Table 2.5.14.

In the short term prediction stock in numbers up to year class 1993 are from the final VPA run whereas values for the 1994-1996 year classes are the arithmetic mean of the three most recent years. An attempt was made to estimate the 1994 year class with RCT3 with survey index and VPA stock in numbers at age 3 but the results showed that the survey did not contribute much to the predicted result (Table 2.5.11).

In the short term prediction, the input for mean weight for 1997 in age groups 3-5 are mean weight for 1994-96 and for the older age groups, mean weight were predicted using a multiple regression analysis. The mean weight for 1998-99 are calculated by using the mean weight in 1997 and adding the mean weight increase for the period 1994-96 in each age group. Values for age group 3 in 1998-99 are equal to the 1997-value. Weights in the stock were set equal to the mean weights in the catches. In the long term prediction (yield per recruit) mean weight for 1961-1996 was used.

In the short term prediction the fitted proportion mature values for 1997 were used for that year and for 1998 and 1999 the average of fitted values for 1983-1996 were used. This long term mean was also used in the long term prediction.

For all three years in the short term prediction the average exploitation pattern in the final VPA for 1994-96 rescaled to F_{bar} (age 4-8) in 1996 was used. In the long term prediction the exploitation pattern was the average of exploitation patterns for 1961-1996 which were rescaled to F_{bar} (ages 4-8) in 1996.

2.5.6.2 Biological reference points

The yield per recruit and spawning stock biomass per recruit curves are presented in Figure 2.5.7C. Compared to the fishing mortality level in age groups 4-8 in 1996 of 0.41, the reference values for F_{max} is 0.42 and $F_{0.1}$ is 0.17. F_{med} and F_{high} were estimated at 0.28 and 0.56, respectively, (Table 2.5.15, Figure 2.5.7C and Figure 2.5.8). The average fishing mortality for age 4-8 in 1996 thus coincides with F_{max} .

The stock-recruitment scatter plot suggests that the probability of above average recruitment is substantially diminished when the spawning stock biomass is below 85 000 t which suggests that this is the level of the minimum biologically acceptable level (MBAL). The spawning stock has been below this level since 1991 and in 1996 reached a record low of 50 000 t.

2.5.6.3 Projection of catch and biomass

Results from predictions with management option are presented in Table 2.5.13 and Figure 2.5.7D. With unchanged fishing mortality in 1997 and 1998 catches will be at 17 500 t and 15 000 t respectively and the spawning stock biomass will decrease from 40 000 to 30 000 t for the period 1997-1999.

Results from the yield per recruit estimates are shown in Table 2.5.15 and Figure 2.5.7C.

2.5.7 Management considerations

The spawning stock biomass is continuing its downward trend and is at a record low level which is far below MBAL. If the present fishing mortality level is maintained the spawning stock will drop even further. Even with a drastic reduction in fishing mortality, say to half of the 1996 level, the spawning stock is only going to recover slowly in the short term.

2.5.8 Comments on the assessment

There still is no independent recruitment index to predict recruits in the first year in the short term prediction. An attempt should be done to analyse the correlation between survey index and stock in number from VPA. A programme for echo sounding age group 2-3 might eventually give a series that could serve this purpose.

The commercial pair trawler series (Cuba trawlers) is still the only useable tuning series and shows reasonable low variation even if the unit of effort (day) is rather crude. It would be desirable to have a more precise unit of effort (trawl hours) and maybe take into account targeting of species, technical and manpower development, etc.

Table 2.5.1 Saithe in the Faroese Grounds. Nominal catches (t) by countries as officially reported to ICES and the total Working Group estimate, 1983-96.

Country	1983	1984	1985	1986	1987	1988	1989
Denmark	-	-	-	21	255	94	-
Faroe Islands	38,963	54,344	42,874	40,139	39,301	44,402	43,624
France	180	243	839	87	153	313	-
German Dem.Rep.	-	-	31	-	-	-	9
German Fed. Rep.	28	73	227	105	49	74	20
Netherlands	-	-	-	-	-	-	22
Norway	5	5	-	24	14	52	51
UK (Eng. & W.)	-	-	4	-	108	-	-
UK (Scotland)	-	-	630	1,340	140	92	9
United Kingdom	-	-	-	-	-	-	-
USSR	-	-	-	-	-	-	-
Total	39,176	54,665	44,605	41,716	40,020	45,027	43,735
<i>Working Group estimate</i> ^{4,5}	39,176	54,665	44,605	41,716	40,020	45,285	44,477

Country	1990	1991	1992	1993	1994	1995	1996 ¹
Denmark	2	-	-	-	-	-	-
Faroe Islands	59,821	53,321	35,979	32,719	32,406	26,918	19,267
France ³	-	-	1,999	75	-	-	-
German Dem.Rep.	-	-	-	-	-	-	-
German Fed. Rep.	15	32	5	2	1	41	3
Netherlands	67	65	-	-	-	-	-
Norway	46	103	85	34	156	14	96
UK (Eng. & W.)	-	5	74	279	151	21	-
UK (Scotland)	33	79	98	425	438	200	-
United Kingdom	-	-	-	-	-	-	631
USSR/Russia ²	30	-	12	-	-	-	-
Total	60,014	53,605	38,252	33,534	33,152	27,194	19,997
<i>Working Group estimate</i> ^{4,5}	61,628	54,858	38,366	33,596	33,173	27,502	20,056

¹ Preliminary.

² As from 1991.

³ Quantity unknown 1989-91 and 1994.

⁴ Includes catches from Sub-division Vb2 and Division IIa in Faroese waters.

⁵ Includes French catches from Division Vb, as reported to the Faroese coastal guard service.

Table 2.5.2 Saithe in the Faroes (Div Vb) Faroese CPUE (t/day), gutted weight, by fleet categories.

Year	Open boats	Long- liners < 100GRT	Single trawlers < 400HP	Gill- netters	Jiggers	Single trawlers 400-1000 HP	Single trawlers >1000 HP	Pair trawlers <1000 HP	Pair trawlers >1000 HP	Long- liners > 100 GRT	Indust. trawlers	Other vessels
1985		0.005	0.011	0.120	0.293	1.208	2.323	2.008	3.384	0.009		
1986		0.010	0.021	0.439	0.472	0.822	1.827	1.509	2.972	0.010		
1987		0.008	0.089	0.781	0.668	0.952	1.661	1.288	2.847	0.013		
1988		0.012	0.032	0.483	0.319	1.207	1.663	1.286	2.861	0.010		
1989		0.004	0.092	0.433	0.349	1.076	1.441	1.824	3.221	0.018		
1990		0.009	0.095	0.777	0.420	1.131	2.672	2.411	3.129	0.029		
1991		0.004	0.068	1.536	0.463	0.564	1.696	2.227	2.868	0.018		
1992		0.011	0.016	0.000	0.326	0.273	0.540	1.926	2.414	0.013		
1993		0.007	0.028	0.000	0.335	0.145	0.525	2.187	2.784	0.014		
1994		0.015	0.022	0.001	0.273	0.465	0.522	2.551	2.769	0.022		
1995		0.002	0.045	0.002	0.138	0.161	0.557	1.653	2.188	0.018		
1996		0.000	0.016	0.002	0.067	0.163	0.312	1.213	1.397	0.009		

Table 2.5.3 Saithe in Faroes Grounds. Catch numbers (thousands) at age.

Table 1	Catch numbers at age Numbers*10**-3					
YEAR,	1961,	1962,	1963,	1964,	1965,	1966,
AGE						
3,	183,	562,	614,	684,	996,	488,
4,	379,	542,	340,	1908,	850,	1540,
5,	483,	617,	340,	1506,	1708,	1201,
6,	403,	495,	415,	617,	965,	1686,
7,	216,	286,	406,	572,	510,	806,
8,	129,	131,	202,	424,	407,	377,
9,	116,	129,	174,	179,	306,	294,
10,	82,	113,	158,	150,	201,	205,
11,	45,	71,	94,	100,	156,	156,
+gp,	82,	105,	274,	174,	285,	225,
0 TOTALNUM,	2118,	3051,	3017,	6314,	6384,	6978,
TONSLAND,	9592,	10454,	12693,	21893,	22181,	25563,
SOPCOF %,	108,	93,	96,	99,	92,	98,

Table 1	Catch numbers at age Numbers*10**-3									
YEAR,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE										
3,	595,	614,	1191,	1445,	2857,	2714,	2515,	3504,	2062,	3178,
4,	796,	1689,	2086,	6577,	3316,	1774,	6253,	4126,	3361,	3217,
5,	1364,	1116,	2294,	1558,	5585,	2588,	7075,	4011,	3801,	1720,
6,	792,	1095,	1414,	1478,	1005,	2742,	3478,	2784,	1939,	1250,
7,	1192,	548,	1118,	899,	828,	1529,	1634,	1401,	1045,	877,
8,	473,	655,	589,	730,	469,	1305,	693,	640,	714,	641,
9,	217,	254,	580,	316,	326,	1017,	550,	368,	302,	468,
10,	190,	128,	239,	241,	164,	743,	403,	340,	192,	223,
11,	97,	89,	115,	86,	100,	330,	215,	197,	193,	141,
+gp,	140,	187,	190,	132,	100,	210,	186,	265,	298,	287,
0 TOTALNUM,	5856,	6375,	9816,	13462,	14750,	14952,	23002,	17636,	13907,	12002,
TONSLAND,	21319,	20387,	27437,	29110,	32706,	42663,	57431,	47188,	41576,	33065,
SOPCOF %,	104,	102,	97,	96,	109,	100,	120,	113,	116,	107,

Table 1	Catch numbers at age Numbers*10**-3									
YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
3,	1609,	611,	287,	996,	411,	387,	2483,	368,	1224,	1167,
4,	2937,	1743,	933,	877,	1804,	4076,	1103,	11067,	3990,	1997,
5,	2034,	1736,	1341,	720,	769,	994,	5052,	2359,	5583,	4473,
6,	1288,	548,	1033,	673,	932,	1114,	1343,	4093,	1182,	3730,
7,	767,	373,	584,	726,	908,	380,	575,	875,	1898,	953,
8,	708,	479,	414,	284,	734,	417,	339,	273,	273,	1077,
9,	498,	466,	247,	212,	343,	296,	273,	161,	103,	245,
10,	338,	473,	473,	171,	192,	105,	98,	52,	38,	104,
11,	272,	407,	368,	196,	92,	88,	98,	65,	26,	67,
+gp,	330,	535,	691,	786,	1021,	902,	540,	253,	275,	158,
0 TOTALNUM,	10781,	7371,	6371,	5641,	7206,	8759,	11904,	19566,	14592,	13971,
TONSLAND,	34835,	28138,	27246,	25230,	30103,	30964,	39176,	54665,	44605,	41716,
SOPCOF %,	104,	100,	102,	99,	96,	96,	100,	100,	94,	94,

Table 1	Catch numbers at age Numbers*10**-3									
YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
3,	1581,	866,	451,	294,	1030,	548,	1319,	690,	402,	298,
4,	5793,	2950,	5981,	3837,	5125,	4281,	2615,	3960,	1030,	1088,
5,	3827,	9555,	5300,	10131,	7452,	3860,	4696,	2662,	3506,	1147,
6,	2785,	2784,	7136,	9229,	5544,	2820,	1668,	2367,	1855,	1451,
7,	990,	1300,	793,	5076,	3487,	1445,	859,	746,	1190,	1157,
8,	532,	621,	546,	478,	1630,	941,	493,	500,	348,	522,
9,	333,	363,	185,	123,	405,	645,	449,	307,	243,	132,
10,	81,	159,	83,	61,	238,	129,	246,	303,	194,	77,
11,	43,	27,	55,	60,	128,	66,	54,	150,	105,	64,
+gp,	97,	60,	39,	79,	118,	114,	52,	49,	118,	82,
0 TOTALNUM,	16062,	18685,	20569,	29368,	25157,	14849,	12451,	11734,	8991,	6018,
TONSLAND,	40020,	45285,	44477,	61628,	54863,	38366,	33596,	33173,	27502,	20056,
SOPCOF %,	96,	99,	97,	98,	99,	105,	102,	102,	102,	103,

Table 2.5.4 Saithe in Faroes Grounds. Catch weight (kg) at age.

Table 2	Catch weights at age (kg)									
YEAR,	1961,	1962,	1963,	1964,	1965,	1966,				
AGE										
3,	1.4300,	1.2730,	1.2800,	1.1750,	1.1810,	1.3610,				
4,	2.3020,	2.0450,	2.1970,	2.0550,	2.1250,	2.0260,				
5,	3.3480,	3.2930,	3.2120,	3.2660,	2.9410,	3.0550,				
6,	4.2870,	4.1910,	4.5680,	4.2550,	4.0960,	3.6580,				
7,	5.1280,	5.1460,	5.0560,	5.0380,	4.8780,	4.5850,				
8,	6.1550,	5.6550,	5.9320,	5.6940,	5.9320,	5.5200,				
9,	7.0600,	6.4690,	6.2590,	6.6620,	6.3210,	6.8370,				
10,	7.2650,	6.7060,	8.0000,	6.8370,	7.2880,	7.2650,				
11,	7.4970,	7.1500,	7.2650,	7.6860,	8.0740,	7.6620,				
+gp,	9.3400,	9.0240,	8.8590,	8.5590,	8.9040,	9.2230,				
0 SOPCOFAC,	1.0779,	.9342,	.9590,	.9933,	.9220,	.9769,				

Table 2	Catch weights at age (kg)									
YEAR,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE										
3,	1.2730,	1.3020,	1.1880,	1.2440,	1.1010,	1.0430,	1.0880,	1.4300,	1.1140,	1.0880,
4,	1.7800,	1.7370,	1.6670,	1.4450,	1.3160,	1.4850,	1.4610,	1.5250,	1.6580,	1.6760,
5,	2.5340,	2.0360,	2.3020,	2.2490,	1.8180,	2.0550,	1.5820,	2.2070,	2.2600,	2.8780,
6,	3.5720,	3.1200,	2.8530,	2.8530,	2.9780,	2.8290,	2.2490,	2.5000,	3.1200,	3.0810,
7,	4.3680,	4.0490,	3.6730,	3.5150,	3.7020,	3.7910,	3.6870,	3.1200,	3.5570,	4.2870,
8,	5.3130,	5.1830,	5.0020,	4.4180,	4.2710,	4.1750,	4.3850,	4.6010,	4.0960,	4.3520,
9,	5.8120,	6.2380,	5.7140,	5.4440,	5.3880,	4.8080,	5.1280,	5.5590,	5.1280,	4.7900,
10,	6.5540,	7.5200,	6.4050,	5.7330,	5.9720,	5.2940,	5.2760,	5.7140,	6.0940,	5.9120,
11,	7.8060,	8.0490,	6.5540,	6.6620,	6.4900,	6.9480,	6.7270,	6.2590,	7.1960,	6.6190,
+gp,	8.1490,	9.0920,	8.0870,	8.5840,	8.0050,	7.5150,	8.0310,	8.0100,	8.5980,	7.8940,
0 SOPCOFAC,	1.0357,	1.0194,	.9663,	.9634,	1.0935,	1.0043,	1.2006,	1.1296,	1.1607,	1.0680,

Table 2	Catch weights at age (kg)									
YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
3,	1.2230,	1.4930,	1.2200,	1.2300,	1.3100,	1.3370,	1.2080,	1.4310,	1.4010,	1.7180,
4,	1.6410,	2.3240,	1.8800,	2.1200,	2.1300,	1.8510,	2.0290,	1.9530,	2.0320,	1.9860,
5,	2.6600,	3.0680,	2.6200,	3.3200,	3.0000,	2.9510,	2.9650,	2.4700,	2.9650,	2.6180,
6,	3.7900,	3.7460,	3.4000,	4.2800,	3.8100,	3.5770,	4.1430,	3.8500,	3.5960,	3.2770,
7,	4.2390,	4.9130,	4.1800,	5.1600,	4.7500,	4.9270,	4.7240,	5.1770,	5.3360,	4.1860,
8,	5.5970,	4.3680,	4.9500,	6.4200,	5.2500,	6.2430,	5.9010,	6.3470,	7.2020,	5.5890,
9,	5.3500,	5.2760,	5.6900,	6.8700,	5.9500,	7.2320,	6.8110,	7.8250,	6.9660,	6.0500,
10,	5.9120,	5.8320,	6.3800,	7.0900,	6.4300,	7.2390,	7.0510,	6.7460,	9.8620,	6.1500,
11,	6.8370,	6.0530,	7.0200,	7.9300,	7.0000,	8.3460,	7.2480,	8.6360,	10.6700,	9.5360,
+gp,	7.7080,	7.5760,	8.6260,	9.2150,	8.9620,	10.0410,	10.0550,	10.0980,	11.9500,	10.2180,
0 SOPCOFAC,	1.0442,	1.0049,	1.0248,	.9937,	.9564,	.9632,	.9997,	.9991,	.9415,	.9419,

Table 2	Catch weights at age (kg)									
YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
3,	1.6090,	1.5000,	1.3090,	1.2230,	1.2400,	1.2640,	1.4080,	1.5030,	1.4560,	1.4320,
4,	1.8350,	1.9750,	1.7350,	1.6330,	1.5680,	1.6020,	1.8600,	1.9510,	2.1770,	1.8750,
5,	2.3950,	1.9780,	1.9070,	1.8300,	1.8640,	2.0690,	2.3230,	2.2670,	2.4200,	2.4960,
6,	3.1820,	2.9370,	2.3730,	2.0520,	2.2110,	2.5540,	3.1310,	2.9360,	2.8950,	3.2290,
7,	4.0670,	3.7980,	3.8100,	2.8660,	2.6480,	3.0570,	3.7300,	4.2140,	3.6510,	3.7440,
8,	5.1490,	4.4190,	4.6670,	4.4740,	3.3800,	4.0780,	4.3940,	4.9710,	5.0640,	4.9640,
9,	5.5010,	5.1150,	5.5090,	5.4240,	4.8160,	5.0120,	5.2090,	5.6570,	5.4400,	6.3750,
10,	6.6260,	6.7120,	5.9720,	6.4690,	5.5160,	6.7680,	6.5400,	5.9500,	6.1670,	6.7450,
11,	6.3430,	9.0400,	6.9390,	6.3430,	6.4070,	7.7540,	8.4030,	6.8910,	7.0800,	7.4660,
+gp,	10.2440,	9.3370,	9.9360,	8.2870,	7.7290,	8.2270,	8.0500,	9.1090,	7.5410,	7.9810,
0 SOPCOFAC,	.9620,	.9928,	.9698,	.9800,	.9939,	1.0497,	1.0167,	1.0240,	1.0208,	1.0322,

Table 2.5.5 Saithe in Faroes Grounds. Proportion mature at age.

Table 5	Proportion mature at age					
YEAR,	1961,	1962,	1963,	1964,	1965,	1966,
AGE						
3,	.0400,	.0400,	.0400,	.0400,	.0400,	.0400,
4,	.2600,	.2600,	.2600,	.2600,	.2600,	.2600,
5,	.5700,	.5700,	.5700,	.5700,	.5700,	.5700,
6,	.8200,	.8200,	.8200,	.8200,	.8200,	.8200,
7,	.9100,	.9100,	.9100,	.9100,	.9100,	.9100,
8,	.9800,	.9800,	.9800,	.9800,	.9800,	.9800,
9,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
10,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
11,	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,

Table 5	Proportion mature at age									
YEAR,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE										
3,	.0400,	.0400,	.0400,	.0400,	.0400,	.0400,	.0400,	.0400,	.0400,	.0400,
4,	.2600,	.2600,	.2600,	.2600,	.2600,	.2600,	.2600,	.2600,	.2600,	.2600,
5,	.5700,	.5700,	.5700,	.5700,	.5700,	.5700,	.5700,	.5700,	.5700,	.5700,
6,	.8200,	.8200,	.8200,	.8200,	.8200,	.8200,	.8200,	.8200,	.8200,	.8200,
7,	.9100,	.9100,	.9100,	.9100,	.9100,	.9100,	.9100,	.9100,	.9100,	.9100,
8,	.9800,	.9800,	.9800,	.9800,	.9800,	.9800,	.9800,	.9800,	.9800,	.9800,
9,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
10,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
11,	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,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
3,	.0400,	.0400,	.0400,	.0400,	.0400,	.0400,	.0900,	.1200,	.1200,	.1200,
4,	.2600,	.2600,	.2600,	.2600,	.2600,	.2600,	.3300,	.2800,	.3100,	.3100,
5,	.5700,	.5700,	.5700,	.5700,	.5700,	.5700,	.6600,	.5900,	.6600,	.6100,
6,	.8200,	.8200,	.8200,	.8200,	.8200,	.8200,	.9300,	.9000,	.8900,	.8400,
7,	.9100,	.9100,	.9100,	.9100,	.9100,	.9100,	.9800,	.9800,	.9800,	.9600,
8,	.9800,	.9800,	.9800,	.9800,	.9800,	.9800,	1.0000,	1.0000,	1.0000,	.9900,
9,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
10,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
11,	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,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
3,	.1200,	.1100,	.1100,	.1000,	.1000,	.1100,	.1200,	.1300,	.1300,	.1200,
4,	.2400,	.2800,	.2400,	.2400,	.2400,	.2400,	.2900,	.3000,	.3600,	.3000,
5,	.5700,	.4200,	.4300,	.4200,	.4400,	.5000,	.5500,	.5500,	.5700,	.6000,
6,	.8400,	.8100,	.6800,	.6300,	.6700,	.7500,	.8300,	.8100,	.8100,	.8400,
7,	.9500,	.9500,	.9500,	.8700,	.8600,	.9000,	.9400,	.9600,	.9400,	.9500,
8,	.9900,	.9800,	.9900,	.9900,	.9500,	.9800,	.9800,	.9900,	.9900,	.9900,
9,	1.0000,	1.0000,	1.0000,	1.0000,	.9900,	.9900,	1.0000,	1.0000,	1.0000,	1.0000,
10,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,
11,	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 2.5.6 Saithe in Faroes Grounds. Effort (fishing days) and catch at age (thousands) for commercial Cuba pair trawlers.

<i>Year</i>	<i>Effort days</i>	<i>Age 3</i>	4	5	6	7	8	9	10	11	12	13	14
1982	1805	0	984	275	516	107	47	37	34	14	12	9	17
1983	1792	225	231	1052	312	116	85	73	15	31	32	2	36
1984	1714	77	1780	328	762	182	49	19	3	8	17	2	5
1985	1224	93	518	1196	249	313	41	16	3	6	12	4	1
1986	1341	170	324	891	638	177	188	45	17	9	6	16	1
1987	1762	239	943	798	633	237	125	65	15	10	1	3	4
1988	1705	129	539	1706	599	244	102	67	16	2	2	3	4
1989	1473	96	1096	931	1178	133	79	26	15	10	2	0	2
1990	1820	44	477	1442	1395	768	71	19	8	8	3	2	1
1991	1985	72	594	1035	837	528	258	31	29	21	11	0	0
1992	1932	19	464	488	413	207	120	104	20	10	4	6	1
1993	1649	144	559	906	326	174	103	77	46	10	7	0	0
1994	1638	122	906	558	524	167	117	76	70	34	4	5	0
1995	1872	79	299	957	392	242	82	41	30	23	13	2	3
1996	1492	44	66	236	244	298	228	109	28	15	14	10	2

Table 2.5.7 Saithe in Faroes Grounds. Diagnostic output from XSA run.

Catch data for 36 years. 1961 to 1996. Ages 3 to 12.

Fleet,	First,	Last,	First,	Last,	Alpha,	Beta
	year,	year,	age,	age		
FLT01: COMMERCIAL CU,	1982,	1996,	3,	11,	.000,	1.000

Time series weights :

Tapered time weighting applied
Power = 3 over 20 years

Catchability analysis :

Catchability dependent on stock size for ages < 4

Regression type = C
Minimum of 5 points used for regression
Survivor estimates shrunk to the population mean for ages < 4

Catchability independent of age for ages >= 9

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 = .500

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

Prior weighting not applied

Lowestoft VPA Version 3.1

2-May-97 11:43:39

Retrospective XSA run

Saithe Faroes Vb (run: XSAFRS05/X05)

CPUE data from file /users/fish/ifad/ifapwork/nwwg/sai_faro/FLEET.X05

Terminal year for this assessment : 1996

Tuning converged after 27 iterations

1

Regression weights

, .751, .820, .877, .921, .954, .976, .990, .997, 1.000, 1.000

Fishing mortalities

Age,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996
3,	.036,	.021,	.017,	.015,	.042,	.031,	.075,	.099,	.084,	.042
4,	.137,	.088,	.202,	.200,	.396,	.248,	.206,	.334,	.211,	.342
5,	.428,	.352,	.226,	.624,	.747,	.592,	.474,	.335,	.559,	.384
6,	.581,	.644,	.486,	.778,	.865,	.719,	.556,	.467,	.413,	.476
7,	.465,	.596,	.378,	.784,	.783,	.575,	.497,	.521,	.455,	.494
8,	.487,	.605,	.542,	.412,	.629,	.497,	.392,	.613,	.494,	.370
9,	.576,	.740,	.360,	.221,	.751,	.550,	.471,	.454,	.697,	.351
10,	.875,	.606,	.365,	.192,	.875,	.571,	.418,	.685,	.586,	.494
11,	.528,	.844,	.434,	.493,	.779,	.643,	.500,	.489,	.538,	.387

Table 2.5.7 Saithe in Faroes Grounds. Diagnostic output from XSA run.(continued)

XSA population numbers (Thousands)

	AGE									
YEAR ,	3,	4,	5,	6,	7,	8,	9,	10,	11,	
1987 ,	4.88E+04,	4.99E+04,	1.21E+04,	6.98E+03,	2.94E+03,	1.53E+03,	8.40E+02,	1.53E+02,	1.16E+02,	
1988 ,	4.50E+04,	3.86E+04,	3.56E+04,	6.48E+03,	3.20E+03,	1.51E+03,	7.68E+02,	3.86E+02,	5.24E+01,	
1989 ,	2.90E+04,	3.61E+04,	2.89E+04,	2.05E+04,	2.79E+03,	1.44E+03,	6.77E+02,	3.00E+02,	1.73E+02,	
1990 ,	2.15E+04,	2.34E+04,	2.41E+04,	1.89E+04,	1.03E+04,	1.56E+03,	6.87E+02,	3.87E+02,	1.70E+02,	
1991 ,	2.74E+04,	1.73E+04,	1.57E+04,	1.06E+04,	7.09E+03,	3.86E+03,	8.48E+02,	4.51E+02,	2.61E+02,	
1992 ,	1.96E+04,	2.15E+04,	9.54E+03,	6.08E+03,	3.65E+03,	2.65E+03,	1.68E+03,	3.28E+02,	1.54E+02,	
1993 ,	2.03E+04,	1.55E+04,	1.37E+04,	4.32E+03,	2.42E+03,	1.68E+03,	1.32E+03,	7.95E+02,	1.52E+02,	
1994 ,	8.09E+03,	1.54E+04,	1.03E+04,	7.01E+03,	2.03E+03,	1.21E+03,	9.30E+02,	6.75E+02,	4.28E+02,	
1995 ,	5.52E+03,	6.00E+03,	9.04E+03,	6.06E+03,	3.59E+03,	9.86E+02,	5.35E+02,	4.84E+02,	2.79E+02,	
1996 ,	7.95E+03,	4.15E+03,	3.98E+03,	4.23E+03,	3.28E+03,	1.87E+03,	4.92E+02,	2.18E+02,	2.20E+02,	

Estimated population abundance at 1st Jan 1997

, .00E+00, 6.24E+03, 2.42E+03, 2.22E+03, 2.15E+03, 1.64E+03, 1.06E+03, 2.84E+02, 1.09E+02,

Taper weighted geometric mean of the VPA populations:

, 2.00E+04, 1.72E+04, 1.26E+04, 7.14E+03, 3.36E+03, 1.57E+03, 7.43E+02, 3.61E+02, 1.83E+02,

Standard error of the weighted Log(VPA populations) :

1 , .7326, .7175, .6123, .5439, .4965, .4257, .4145, .4908, .5567,

Log catchability residuals.

Fleet : FLT01: COMMERCIAL CU

Age ,	1982,	1983,	1984,	1985,	1986
3 ,	99.99,	1.73,	-.61,	1.00,	1.28
4 ,	.19,	-.46,	.82,	.21,	-.20
5 ,	-.42,	-.13,	-.49,	.60,	.34
6 ,	.66,	-.04,	-.02,	-.16,	.43
7 ,	-.20,	-.09,	.26,	.24,	.02
8 ,	-.53,	.24,	-.19,	-.08,	.55
9 ,	-.26,	.83,	-.45,	-.34,	.79
10 ,	-.05,	-.42,	-1.47,	-1.38,	.27
11 ,	-.19,	.44,	-.32,	.11,	.26

Age ,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996
3 ,	1.72,	.23,	.26,	-2.07,	-1.20,	-4.35,	1.47,	2.00,	.86,	-.52
4 ,	-.47,	-.77,	.21,	-.40,	.12,	-.38,	.27,	.82,	.47,	-.39
5 ,	.05,	-.27,	-.58,	.01,	.08,	-.22,	.14,	-.12,	.52,	.09
6 ,	.17,	.25,	-.15,	.01,	.03,	-.15,	.04,	.00,	-.31,	-.17
7 ,	.04,	.08,	-.34,	.07,	-.02,	-.35,	.01,	.16,	-.20,	.34
8 ,	.12,	.01,	-.08,	-.54,	-.14,	-.56,	-.15,	.42,	.08,	.63
9 ,	.14,	.36,	-.48,	-1.08,	-.65,	-.19,	-.12,	.21,	.12,	1.26
10 ,	.50,	-.44,	-.21,	-1.39,	-.04,	-.19,	-.15,	.55,	-.14,	.77
11 ,	.23,	-.42,	-.03,	-.43,	.15,	-.10,	.01,	.20,	.13,	.09

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

Age ,	4,	5,	6,	7,	8,	9,	10,	11
Mean Log q,	-10.8038,	-9.9496,	-9.6757,	-9.7211,	-9.7717,	-9.8099,	-9.8099,	-9.8099,
S.E(Log q),	.4911,	.3326,	.2161,	.2164,	.3792,	.6386,	.7117,	.2437,

Table 2.5.7 Saithe in Faroes Grounds. Diagnostic output from XSA run.(continued)

Regression statistics :

Ages with q dependent on year class strength

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

3, 2.66, -2.029, 17.51, .14, 14, 1.96, -12.77,

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

4, 1.14, -.553, 10.94, .63, 15, .58, -10.80,
5, 1.17, -.855, 10.03, .71, 15, .40, -9.95,
6, 1.03, -.208, 9.70, .85, 15, .23, -9.68,
7, .99, .063, 9.71, .85, 15, .23, -9.72,
8, 1.13, -.415, 10.09, .51, 15, .45, -9.77,
9, 1.77, -.926, 12.29, .13, 15, 1.14, -9.81,
10, .92, .189, 9.66, .37, 15, .66, -9.99,
11, .81, 1.812, 8.92, .90, 15, .18, -9.80,

1

Fleet disaggregated estimates of survivors :

Age 3 Catchability dependent on age and year class strength

Year class = 1993

FLT01: COMMERCIAL CU

Age, 3,
Survivors, 3727.,
Raw Weights, .219,

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLT01: COMMERCIAL CU,	3727.,	2.094,	.000,	.00,	1, .035,	.070
P shrinkage mean ,	17210.,	.72,,,			.315,	.016
F shrinkage mean ,	3924.,	.50,,,			.649,	.066

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
6243.,	.40,	.61,	3,	1.511,	.042

1

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

Year class = 1992

FLT01: COMMERCIAL CU

Age, 4, 3,
Survivors, 1640., 5683.,
Raw Weights, 2.714, .155,

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLT01: COMMERCIAL CU,	1754.,	.497,	.281,	.57,	2, .418,	.445
F shrinkage mean ,	3041.,	.50,,,			.582,	.280

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
2417.,	.36,	.32,	3,	.905,	.342

Table 2.5.7 Saithe in Faroes Grounds. Diagnostic output from XSA run.(continued)

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

Year class = 1991

FLT01: COMMERCIAL CU

Age,	5,	4,	3,
Survivors,	2440.,	3546.,	16420.,
Raw Weights,	5.674,	2.107,	.116,

Fleet,	Estimated,	Int,	Ext,	Var,	N, Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	, Weights,	F
FLT01: COMMERCIAL CU,	2772.,	.286,	.193,	.68,	3, .664,	.318
F shrinkage mean ,	1429.,	.50,,,,			.336,	.546

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
2219.,	.25,	.26,	4,	1.011,	.384

1

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

Year class = 1990

FLT01: COMMERCIAL CU

Age,	6,	5,	4,	3,
Survivors,	1822.,	3637.,	4902.,	9391.,
Raw Weights,	6.901,	2.955,	.968,	.053,

Fleet,	Estimated,	Int,	Ext,	Var,	N, Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	, Weights,	F
FLT01: COMMERCIAL CU,	2421.,	.217,	.223,	1.03,	4, .731,	.433
F shrinkage mean ,	1564.,	.50,,,,			.269,	.609

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
2152.,	.21,	.20,	5,	.962,	.476

1

Age 7 Catchability constant w.r.t. time and dependent on age

Year class = 1989

FLT01: COMMERCIAL CU

Age,	7,	6,	5,	4,	3,
Survivors,	2306.,	1207.,	1460.,	2143.,	21.,
Raw Weights,	6.779,	4.482,	2.397,	.888,	.037,

Fleet,	Estimated,	Int,	Ext,	Var,	N, Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	, Weights,	F
FLT01: COMMERCIAL CU,	1724.,	.180,	.184,	1.02,	5, .785,	.474
F shrinkage mean ,	1358.,	.50,,,,			.215,	.571

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
1638.,	.18,	.15,	6,	.868,	.494

Table 2.5.7 Saithe in Faroes Grounds. Diagnostic output from XSA run.(continued)

Age 8 Catchability constant w.r.t. time and dependent on age

Year class = 1988

FLT01: COMMERCIAL CU

Age,	8,	7,	6,	5,	4,	3,
Survivors,	1988.,	863.,	1052.,	1215.,	719.,	317.,
Raw Weights,	4.426,	4.867,	3.042,	1.409,	.497,	.029,

Fleet,	Estimated,	Int,	Ext,	Var,	N, Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	, Weights,	F
FLT01: COMMERCIAL CU,	1196.,	.176,	.163,	.92,	6, .781,	.333
F shrinkage mean ,	677.,	.50,,,,			.219,	.529

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	, Ratio,		
1056.,	.18,	.17,	7,	.969,	.370

1

Age 9 Catchability constant w.r.t. time and dependent on age

Year class = 1987

FLT01: COMMERCIAL CU

Age,	9,	8,	7,	6,	5,	4,	3,
Survivors,	997.,	306.,	334.,	295.,	228.,	320.,	36.,
Raw Weights,	1.589,	2.749,	2.823,	1.607,	.657,	.198,	.011,

Fleet,	Estimated,	Int,	Ext,	Var,	N, Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	, Weights,	F
FLT01: COMMERCIAL CU,	371.,	.189,	.186,	.98,	7, .707,	.279
F shrinkage mean ,	149.,	.50,,,,			.293,	.589

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	, Ratio,		
284.,	.20,	.24,	8,	1.192,	.351

1

Age 10 Catchability constant w.r.t. time and age (fixed at the value for age) 9

Year class = 1986

FLT01: COMMERCIAL CU

Age,	10,	9,	8,	7,	6,	5,	4,	3,
Survivors,	237.,	123.,	165.,	110.,	94.,	118.,	73.,	142.,
Raw Weights,	1.110,	.687,	1.053,	1.103,	.530,	.184,	.067,	.004,

Fleet,	Estimated,	Int,	Ext,	Var,	N, Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	, Weights,	F
FLT01: COMMERCIAL CU,	143.,	.231,	.126,	.55,	8, .542,	.396
F shrinkage mean ,	79.,	.50,,,,			.458,	.633

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	, Ratio,		
109.,	.26,	.17,	9,	.641,	.494

Table 2.5.7 Saithe in Faroes Grounds. Diagnostic output from XSA run.(continued)

Age 11 Catchability constant w.r.t. time and age (fixed at the value for age) 9

Year class = 1985

FLT01: COMMERCIAL CU

Age, 11,
Survivors, 135.,
Raw Weights, 7.546,

Age,	10,	9,	8,	7,	6,	5,	4,	3,
Survivors,	107.,	152.,	106.,	86.,	126.,	124.,	151.,	154.,
Raw Weights,	.687,	.541,	1.029,	.990,	.407,	.158,	.056,	.003,

Fleet,	Estimated,	Int,	Ext,	Var,	N, Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	, Weights,	F
FLT01: COMMERCIAL CU,	125.,	.211,	.052,	.25,	9, .741,	.380
F shrinkage mean ,	115.,	.50,,,,			.259,	.408

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	, Ratio,		
123.,	.20,	.04,	10,	.220,	.387

Table 2.5.8 Saithe in Faroes Grounds. Fishing mortality at age.

Terminal Fs derived using XSA (With F shrinkage)

Table 8		Fishing mortality (F) at age					
YEAR,		1961,	1962,	1963,	1964,	1965,	1966,
AGE							
3,		.0226,	.0465,	.0307,	.0478,	.0495,	.0250,
4,		.0556,	.0863,	.0358,	.1260,	.0773,	.1007,
5,		.0994,	.1208,	.0716,	.2198,	.1588,	.1492,
6,		.1219,	.1402,	.1115,	.1798,	.2137,	.2326,
7,		.0933,	.1192,	.1634,	.2213,	.2217,	.2785,
8,		.0852,	.0752,	.1157,	.2567,	.2424,	.2537,
9,		.0972,	.1150,	.1355,	.1424,	.2983,	.2771,
10,		.0915,	.1295,	.2012,	.1658,	.2356,	.3347,
11,		.0916,	.1069,	.1514,	.1891,	.2601,	.2901,
+gp,		.0916,	.1069,	.1514,	.1891,	.2601,	.2901,
FBAR 4- 8,		.0911,	.1083,	.0996,	.2007,	.1828,	.2029,

Table 8		Fishing mortality (F) at age									
YEAR,		1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE											
3,		.0248,	.0321,	.0328,	.0479,	.0886,	.0935,	.1272,	.2303,	.1488,	.2073,
4,		.0518,	.0910,	.1453,	.2548,	.1481,	.0728,	.3226,	.3171,	.3616,	.3648,
5,		.1217,	.0955,	.1720,	.1539,	.3581,	.1650,	.4588,	.3542,	.5444,	.3179,
6,		.1388,	.1358,	.1684,	.1598,	.1405,	.2987,	.3489,	.3283,	.2890,	.3434,
7,		.2564,	.1345,	.2001,	.1537,	.1262,	.3289,	.2922,	.2299,	.1962,	.2047,
8,		.2616,	.2184,	.2095,	.1944,	.1119,	.2998,	.2428,	.1771,	.1754,	.1772,
9,		.2269,	.2183,	.3064,	.1657,	.1245,	.3762,	.1984,	.1963,	.1184,	.1666,
10,		.2904,	.2027,	.3290,	.2009,	.1213,	.4604,	.2498,	.1811,	.1488,	.1204,
11,		.2610,	.2141,	.2832,	.1878,	.1196,	.3813,	.2315,	.1857,	.1481,	.1554,
+gp,		.2610,	.2141,	.2832,	.1878,	.1196,	.3813,	.2315,	.1857,	.1481,	.1554,
0 FBAR 4- 8,		.1661,	.1350,	.1791,	.1833,	.1769,	.2330,	.3331,	.2813,	.3133,	.2816,

Table 8		Fishing mortality (F) at age									
YEAR,		1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE											
3,		.1480,	.0835,	.0373,	.0932,	.0138,	.0296,	.0694,	.0158,	.0630,	.0210,
4,		.3011,	.2370,	.1773,	.1529,	.2434,	.1838,	.1104,	.4960,	.2374,	.1387,
5,		.4154,	.2925,	.2895,	.2020,	.1948,	.2051,	.3646,	.3636,	.5036,	.4571,
6,		.4190,	.1857,	.2836,	.2304,	.4368,	.4789,	.4712,	.5714,	.3124,	.7642,
7,		.3669,	.2035,	.3087,	.3306,	.5568,	.3185,	.4898,	.6519,	.5737,	.4481,
8,		.2536,	.4126,	.3651,	.2418,	.6613,	.5412,	.5254,	.4564,	.4312,	.7701,
9,		.2033,	.2640,	.3881,	.3224,	.5168,	.6192,	.8537,	.5123,	.3100,	.8939,
10,		.1743,	.3032,	.4694,	.5125,	.5462,	.2917,	.4258,	.3764,	.2143,	.5946,
11,		.2114,	.3286,	.4104,	.3612,	.5796,	.5223,	.4878,	.5621,	.3273,	.7230,
+gp,		.2114,	.3286,	.4104,	.3612,	.5796,	.5223,	.4878,	.5621,	.3273,	.7230,
0 FBAR 4- 8,		.3512,	.2663,	.2848,	.2315,	.4186,	.3455,	.3922,	.5079,	.4117,	.5156,

Table 8		Fishing mortality (F) at age										
YEAR,		1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	FBAR 94-96
AGE												
3,		.0364,	.0215,	.0173,	.0152,	.0424,	.0315,	.0745,	.0990,	.0839,	.0423,	.0751,
4,		.1374,	.0883,	.2024,	.2003,	.3960,	.2482,	.2061,	.3337,	.2105,	.3417,	.2953,
5,		.4281,	.3520,	.2265,	.6238,	.7466,	.5923,	.4740,	.3349,	.5593,	.3838,	.4260,
6,		.5811,	.6440,	.4858,	.7779,	.8648,	.7194,	.5561,	.4674,	.4133,	.4762,	.4523,
7,		.4651,	.5964,	.3776,	.7841,	.7834,	.5754,	.4973,	.5215,	.4554,	.4942,	.4904,
8,		.4868,	.6045,	.5420,	.4122,	.6290,	.4974,	.3918,	.6126,	.4943,	.3697,	.4922,
9,		.5764,	.7395,	.3597,	.2206,	.7505,	.5504,	.4709,	.4539,	.6965,	.3513,	.5006,
10,		.8754,	.6064,	.3650,	.1916,	.8755,	.5709,	.4184,	.6847,	.5858,	.4937,	.5881,
11,		.5280,	.8439,	.4343,	.4925,	.7793,	.6428,	.5003,	.4892,	.5381,	.3870,	.4714,
+gp,		.5280,	.8439,	.4343,	.4925,	.7793,	.6428,	.5003,	.4892,	.5381,	.3870,	.4714,
0 FBAR 4- 8,		.4197,	.4570,	.3669,	.5597,	.6840,	.5266,	.4251,	.4540,	.4266,	.4131,	

Table 2.5.9 Saithe in Faroese Grounds. Stock in numbers (thousands) at age.

Table 10	Stock number at age (start of year)						Numbers*10**-3			
YEAR,	1961,	1962,	1963,	1964,	1965,	1966,				
AGE										
3,	9046,	13662,	22428,	16188,	22798,	21823,				
4,	7739,	7241,	10677,	17807,	12635,	17764,				
5,	5643,	5993,	5438,	8434,	12853,	9575,				
6,	3880,	4183,	4348,	4144,	5543,	8977,				
7,	2680,	2812,	2977,	3185,	2835,	3665,				
8,	1746,	1999,	2044,	2070,	2090,	1860,				
9,	1384,	1313,	1518,	1491,	1311,	1343,				
10,	1036,	1028,	958,	1085,	1058,	797,				
11,	568,	774,	740,	641,	753,	685,				
+gp,	1032,	1141,	2147,	1111,	1367,	981,				
TOTAL,	34754,	40145,	53274,	56156,	63242,	67470,				

Table 10	Stock number at age (start of year)						Numbers*10**-3			
YEAR,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE										
3,	26869,	21505,	40787,	34122,	37251,	33610,	23276,	18822,	16487,	18763,
4,	17426,	21460,	17051,	32316,	26629,	27913,	25062,	16781,	12240,	11632,
5,	13151,	13547,	16042,	12073,	20507,	18801,	21248,	14861,	10006,	6980,
6,	6753,	9533,	10081,	11058,	8474,	11736,	13052,	10995,	8538,	4753,
7,	5825,	4812,	6814,	6975,	7716,	6029,	7128,	7539,	6483,	5236,
8,	2271,	3690,	3444,	4567,	4897,	5568,	3553,	4357,	4905,	4362,
9,	1181,	1431,	2429,	2287,	3079,	3585,	3378,	2282,	2988,	3369,
10,	833,	771,	942,	1464,	1586,	2226,	2015,	2268,	1535,	2173,
11,	467,	510,	515,	555,	980,	1150,	1150,	1285,	1549,	1083,
+gp,	670,	1067,	846,	848,	977,	726,	989,	1720,	2383,	2195,
TOTAL,	75445,	78326,	98952,	106264,	112097,	111346,	100851,	80911,	67113,	60547,

Table 10	Stock number at age (start of year)						Numbers*10**-3			
YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
3,	12928,	8425,	8664,	12373,	33221,	14677,	40946,	25893,	22166,	62206,
4,	12486,	9129,	6345,	6834,	9229,	26827,	11666,	31277,	20867,	17040,
5,	6613,	7565,	5897,	4351,	4802,	5924,	18276,	8553,	15594,	13474,
6,	4158,	3574,	4623,	3614,	2911,	3236,	3950,	10392,	4868,	7715,
7,	2760,	2239,	2430,	2850,	2350,	1540,	1641,	2019,	4805,	2916,
8,	3493,	1566,	1496,	1461,	1677,	1103,	917,	823,	861,	2216,
9,	2991,	2219,	849,	850,	939,	709,	525,	444,	427,	458,
10,	2335,	1999,	1395,	471,	504,	459,	312,	183,	218,	256,
11,	1578,	1606,	1208,	714,	231,	239,	281,	167,	103,	144,
+gp,	1904,	2096,	2250,	2843,	2536,	2425,	1531,	643,	1081,	335,
TOTAL,	51247,	40418,	35157,	36363,	58400,	57137,	80046,	80396,	70990,	106762,

Table 10	Stock number at age (start of year)						Numbers*10**-3						
YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	GMST 61-94	AMST 61-94
AGE													
3,	48843,	45021,	29035,	21481,	27427,	19558,	20296,	8086,	5518,	7954,	0,	21768,	24667,
4,	49874,	38558,	36076,	23364,	17321,	21523,	15517,	15423,	5996,	4154,	6243,	16847,	19169,
5,	12145,	35592,	28900,	24125,	15657,	9544,	13748,	10338,	9044,	3977,	2417,	11170,	12831,
6,	6984,	6480,	20494,	18865,	10585,	6076,	4321,	7007,	6055,	4232,	2219,	6603,	7527,
7,	2942,	3198,	2787,	10323,	7095,	3650,	2423,	2029,	3595,	3279,	2152,	3700,	4197,
8,	1525,	1513,	1442,	1564,	3858,	2654,	1681,	1206,	986,	1867,	1638,	2160,	2485,
9,	840,	768,	677,	687,	848,	1684,	1321,	930,	535,	492,	1056,	1280,	1545,
10,	153,	386,	300,	387,	451,	328,	795,	675,	484,	218,	284,	749,	982,
11,	116,	52,	173,	170,	261,	154,	152,	428,	279,	220,	109,	441,	623,
+gp,	259,	115,	121,	222,	237,	262,	145,	139,	310,	280,	278,		
TOTAL,	123681,	131683,	120005,	101188,	83741,	65433,	60398,	46262,	32803,	26676,	16396,		

Table 2.5.10 Saithe in Faroes Grounds. Summary of population statistics in the period 1961-1996.

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS, Age 3	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR	4- 8,
1961,	9046,	121964,	83793,	9592,	.1145,		.0911,
1962,	13662,	126453,	85629,	10454,	.1221,		.1083,
1963,	22428,	158224,	100623,	12693,	.1261,		.0996,
1964,	16188,	160411,	98373,	21893,	.2226,		.2007,
1965,	22798,	174750,	107202,	22181,	.2069,		.1828,
1966,	21823,	184113,	108759,	25563,	.2350,		.2029,
1967,	26869,	181602,	104610,	21319,	.2038,		.1661,
1968,	21505,	189740,	115927,	20387,	.1759,		.1350,
1969,	40787,	214955,	123751,	27437,	.2217,		.1791,
1970,	34122,	224355,	129086,	29110,	.2255,		.1833,
1971,	37251,	228298,	139429,	32706,	.2346,		.1769,
1972,	33610,	236920,	147480,	42663,	.2893,		.2330,
1973,	23276,	210401,	136580,	57431,	.4205,		.3331,
1974,	18822,	203827,	137481,	47188,	.3432,		.2813,
1975,	16487,	187374,	137729,	41576,	.3019,		.3133,
1976,	18763,	169557,	121859,	33065,	.2713,		.2816,
1977,	12928,	156177,	113991,	34835,	.3056,		.3512,
1978,	8425,	137199,	95908,	28138,	.2934,		.2663,
1979,	8664,	113090,	83580,	27246,	.3260,		.2848,
1980,	12373,	125374,	89081,	25230,	.2832,		.2315,
1981,	33221,	141818,	76122,	30103,	.3955,		.4186,
1982,	14677,	147595,	81591,	30964,	.3795,		.3455,
1983,	40946,	180059,	99464,	39176,	.3939,		.3922,
1984,	25893,	187598,	98138,	54665,	.5570,		.5079,
1985,	22166,	188179,	113436,	44605,	.3932,		.4117,
1986,	62206,	234342,	98537,	41716,	.4234,		.5156,
1987,	48843,	250258,	94807,	40020,	.4221,		.4197,
1988,	45021,	259921,	99798,	45285,	.4538,		.4570,
1989,	29035,	229469,	100500,	44477,	.4426,		.3669,
1990,	21481,	193016,	96530,	61628,	.6384,		.5597,
1991,	27427,	155978,	77102,	54863,	.7116,		.6840,
1992,	19558,	130457,	67080,	38366,	.5719,		.5266,
1993,	20296,	133849,	70848,	33596,	.4742,		.4251,
1994,	8086,	114295,	67801,	33173,	.4893,		.4540,
1995,	5518,	88832,	59908,	27502,	.4591,		.4266,
1996,	7954,	72811,	50471,	20056,	.3974,		.4131,
Arith.							
Mean	23671,	172591,	100361,	33636,	.3479,		.3229,
0 Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),			

Table 2.5.11 Saithe in the Faroes Grounds. Input data to and results from RCT3.

Input data file to RCT3 with yearclass stock in numbers from VPA and survey index age group 3.

Faroe Saithe: VPA and groundfish survey data

```
1 9 2
'Yearclass'  'VPAage3'    'SurveyAge3'
1986         29035        8.618
1987         21481        8.831
1988         27427        2.332
1989         19558        0.017
1990         20296        4.616
1991         8086         1.067
1992         5518         1.494
1993         7954         0.223
1994         -11          0.826
```

Output from RCT3.

Analysis by RCT3 ver3.1 of data from file :

p.dat

Faroe Saithe: VPA and groundfish survey data

Data for 1 surveys over 9 years : 1986 - 1994

Regression type = C
Tapered time weighting applied
power = 3 over 20 years
Survey weighting not applied

Final estimates shrunk towards mean
Minimum S.E. for any survey taken as .20
Minimum of 3 points used for regression

Forecast/Hindcast variance correction used.

Yearclass = 1989

I-----Regression-----I					I-----Prediction-----I				
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Survey	-.73	11.55	.60	.126	3	.02	11.54	2.545	.004
VPA Mean =						10.16		.160	.996

Yearclass = 1990

I-----Regression-----I					I-----Prediction-----I				
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Survey	.34	9.60	.38	.277	4	1.73	10.18	.603	.090
VPA Mean =						10.09		.190	.910

Table 2.5.11 Saithe in the Faroes Grounds. Input data to and results from RCT3, (*continued*).

Yearclass = 1991

I-----Regression-----I						I-----Prediction-----I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Survey	.46	9.36	.46	.173	5	.73	9.70	.694	.064
VPA Mean =							10.05	.181	.936

Yearclass = 1992

I-----Regression-----I						I-----Prediction-----I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Survey	1.11	8.36	.99	.214	6	.91	9.38	1.347	.106
VPA Mean =							9.87	.463	.894

Yearclass = 1993

I-----Regression-----I						I-----Prediction-----I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Survey	1.70	7.49	1.39	.202	7	.20	7.84	1.988	.094
VPA Mean =							9.69	.640	.906

Yearclass = 1994

I-----Regression-----I						I-----Prediction-----I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Survey	1.37	8.02	1.08	.296	8	.60	8.85	1.365	.182
VPA Mean =							9.59	.644	.818

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1989	25905	10.16	.16	.09	.29	19559	9.88
1990	24250	10.10	.18	.03	.02	20296	9.92
1991	22705	10.03	.18	.09	.25	8087	9.00
1992	18426	9.82	.44	.15	.12	5518	8.62
1993	13539	9.51	.61	.54	.79	7954	8.98
1994	12763	9.45	.58	.29	.24		

Table 2.5.12

The SAS System

23:52 Wednesday, May 7, 1997

Saithe in the Faroes Grounds (Fishing Area Vb)

Prediction with management option table: Input data

Year: 1997								
Age	Stock size	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
3	7200.000	0.2000	0.0900	0.0000	0.0000	1.464	0.0720	1.464
4	6243.000	0.2000	0.2400	0.0000	0.0000	2.019	0.2830	2.019
5	2417.000	0.2000	0.5500	0.0000	0.0000	2.538	0.4080	2.538
6	2219.000	0.2000	0.8100	0.0000	0.0000	3.331	0.4330	3.331
7	2152.000	0.2000	0.9400	0.0000	0.0000	4.046	0.4700	4.046
8	1638.000	0.2000	0.9800	0.0000	0.0000	4.979	0.4720	4.979
9	1056.000	0.2000	1.0000	0.0000	0.0000	5.766	0.4800	5.766
10	284.000	0.2000	1.0000	0.0000	0.0000	7.004	0.5630	7.004
11	109.000	0.2000	1.0000	0.0000	0.0000	7.716	0.4520	7.716
12+	278.000	0.2000	1.0000	0.0000	0.0000	8.154	0.4520	8.154
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1998								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
3	7200.000	0.2000	0.1100	0.0000	0.0000	1.464	0.0720	1.464
4	.	0.2000	0.2800	0.0000	0.0000	2.062	0.2830	2.062
5	.	0.2000	0.5400	0.0000	0.0000	2.550	0.4080	2.550
6	.	0.2000	0.8000	0.0000	0.0000	3.176	0.4330	3.176
7	.	0.2000	0.9400	0.0000	0.0000	4.221	0.4700	4.221
8	.	0.2000	0.9900	0.0000	0.0000	5.073	0.4720	5.073
9	.	0.2000	1.0000	0.0000	0.0000	5.835	0.4800	5.835
10	.	0.2000	1.0000	0.0000	0.0000	6.724	0.5630	6.724
11	.	0.2000	1.0000	0.0000	0.0000	8.085	0.4520	8.085
12+	.	0.2000	1.0000	0.0000	0.0000	8.462	0.4520	8.462
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1999								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
3	7200.000	0.2000	0.1100	0.0000	0.0000	1.464	0.0720	1.464
4	.	0.2000	0.2800	0.0000	0.0000	2.062	0.2830	2.062
5	.	0.2000	0.5400	0.0000	0.0000	2.592	0.4080	2.592
6	.	0.2000	0.8000	0.0000	0.0000	3.187	0.4330	3.187
7	.	0.2000	0.9400	0.0000	0.0000	4.066	0.4700	4.066
8	.	0.2000	0.9900	0.0000	0.0000	5.248	0.4720	5.248
9	.	0.2000	1.0000	0.0000	0.0000	5.929	0.4800	5.929
10	.	0.2000	1.0000	0.0000	0.0000	6.793	0.5630	6.793
11	.	0.2000	1.0000	0.0000	0.0000	7.805	0.4520	7.805
12+	.	0.2000	1.0000	0.0000	0.0000	8.831	0.4520	8.831
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANFRS01
Date and time: 07MAY97:23:53

Table 2.5.13

The SAS System

23:52 Wednesday, May 7, 1997

Saithe in the Faroes Grounds (Fishing Area Vb)

Prediction with management option table

Year: 1997					Year: 1998					Year: 1999	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.0000	0.4132	64720	40698	17462	0.0000	0.0000	57667	34434	0	69661	43850
.	0.1000	0.0413	.	34434	1810	67671	42166
.	0.2000	0.0826	.	34434	3548	65762	40554
.	0.3000	0.1240	.	34434	5217	63930	39012
.	0.4000	0.1653	.	34434	6820	62172	37535
.	0.5000	0.2066	.	34434	8361	60484	36122
.	0.6000	0.2479	.	34434	9841	58865	34769
.	0.7000	0.2892	.	34434	11264	57310	33474
.	0.8000	0.3306	.	34434	12631	55818	32234
.	0.9000	0.3719	.	34434	13945	54384	31046
.	1.0000	0.4132	.	34434	15209	53008	29910
.	1.1000	0.4545	.	34434	16424	51686	28821
.	1.2000	0.4958	.	34434	17592	50417	27778
.	1.3000	0.5372	.	34434	18716	49197	26779
.	1.4000	0.5785	.	34434	19797	48025	25823
.	1.5000	0.6198	.	34434	20837	46898	24906
.	1.6000	0.6611	.	34434	21839	45816	24028
.	1.7000	0.7024	.	34434	22802	44775	23187
.	1.8000	0.7438	.	34434	23729	43775	22381
.	1.9000	0.7851	.	34434	24622	42813	21609
.	2.0000	0.8264	.	34434	25482	41887	20869
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANFRS01
Date and time : 07MAY97:23:53
Computation of ref. F: Simple mean, age 4 - 8
Basis for 1997 : F factors

Table 2.5.14

The SAS System

12:11 Monday, May 5, 1997

Saithe in the Faroes Grounds (Fishing Area Vb)

Yield per recruit: Input data

Age	Recruit- ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
3	1.000	0.2000	0.1100	0.0000	0.0000	1.308	0.0820	1.308
4	.	0.2000	0.2800	0.0000	0.0000	1.852	0.2580	1.852
5	.	0.2000	0.5400	0.0000	0.0000	2.534	0.4110	2.534
6	.	0.2000	0.8000	0.0000	0.0000	3.311	0.4790	3.311
7	.	0.2000	0.9400	0.0000	0.0000	4.188	0.4630	4.188
8	.	0.2000	0.9900	0.0000	0.0000	5.114	0.4550	5.114
9	.	0.2000	1.0000	0.0000	0.0000	5.880	0.4700	5.880
10	.	0.2000	1.0000	0.0000	0.0000	6.555	0.4630	6.555
11	.	0.2000	1.0000	0.0000	0.0000	7.405	0.4760	7.405
12+	.	0.2000	1.0000	0.0000	0.0000	8.799	0.4760	8.799
Unit	Numbers	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : YLDFRS03
Date and time: 05MAY97:12:40

Table 2.5.15

The SAS System

12:11 Monday, May 5, 1997

Saithe in the Faroes Grounds (Fishing Area Vb)

Yield per recruit: Summary table

F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January		Spawning time	
						Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
0.0000	0.0000	0.000	0.000	5.517	23009.412	3.588	19477.068	3.588	19477.068
0.1000	0.0413	0.147	661.057	4.786	17809.673	2.885	14354.655	2.885	14354.655
0.2000	0.0826	0.247	1022.252	4.286	14473.553	2.410	11091.044	2.410	11091.044
0.3000	0.1240	0.321	1229.378	3.921	12189.111	2.069	8874.708	2.069	8874.708
0.4000	0.1653	0.377	1351.678	3.642	10547.784	1.812	7297.454	1.812	7297.454
0.5000	0.2066	0.422	1424.927	3.421	9323.564	1.613	6133.609	1.613	6133.609
0.6000	0.2479	0.458	1468.761	3.241	8382.433	1.454	5249.455	1.454	5249.455
0.7000	0.2892	0.489	1494.459	3.091	7640.551	1.324	4561.423	1.324	4561.423
0.8000	0.3306	0.515	1508.736	2.965	7043.187	1.216	4015.028	1.216	4015.028
0.9000	0.3719	0.537	1515.712	2.856	6553.340	1.126	3573.490	1.126	3573.490
1.0000	0.4132	0.556	1517.969	2.761	6145.249	1.048	3211.247	1.048	3211.247
1.1000	0.4545	0.573	1517.164	2.678	5800.517	0.982	2910.086	0.982	2910.086
1.2000	0.4958	0.588	1514.376	2.604	5505.722	0.924	2656.750	0.924	2656.750
1.3000	0.5372	0.602	1510.319	2.538	5250.875	0.873	2441.400	0.873	2441.400
1.4000	0.5785	0.614	1505.469	2.479	5028.416	0.828	2256.613	0.828	2256.613
1.5000	0.6198	0.625	1500.148	2.425	4832.534	0.788	2096.704	0.788	2096.704
1.6000	0.6611	0.636	1494.573	2.375	4658.699	0.752	1957.257	0.752	1957.257
1.7000	0.7024	0.645	1488.893	2.330	4503.337	0.720	1834.802	0.720	1834.802
1.8000	0.7438	0.654	1483.208	2.288	4363.592	0.691	1726.581	0.691	1726.581
1.9000	0.7851	0.662	1477.585	2.250	4237.162	0.664	1630.377	0.664	1630.377
2.0000	0.8264	0.669	1472.070	2.214	4122.169	0.640	1544.396	0.640	1544.396
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDFRS03
Date and time : 05MAY97:12:40
Computation of ref. F: Simple mean, age 4 - 8
F-0.1 factor : 0.4080
F-max factor : 1.0175
F-0.1 reference F : 0.1686
F-max reference F : 0.4204
Recruitment : Single recruit

Figure 2.5.1 Saithe in the Faroese Grounds, CPUE (tonnes/day) by fleet categories.

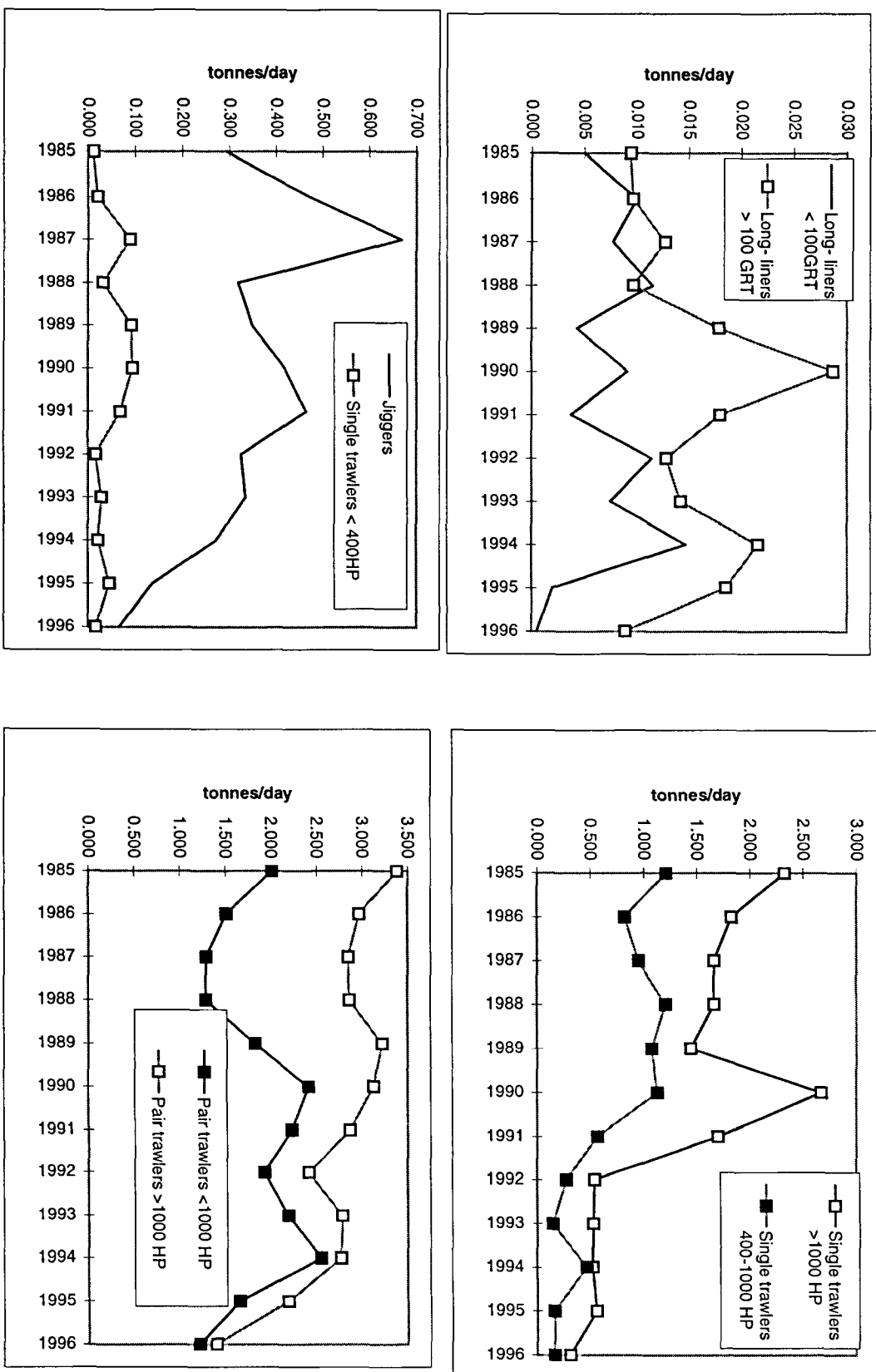


Figure 2.5.2 Saithe in the Faroese Grounds. Mean weight (kg) at age in the catches in the period 1961-1997.

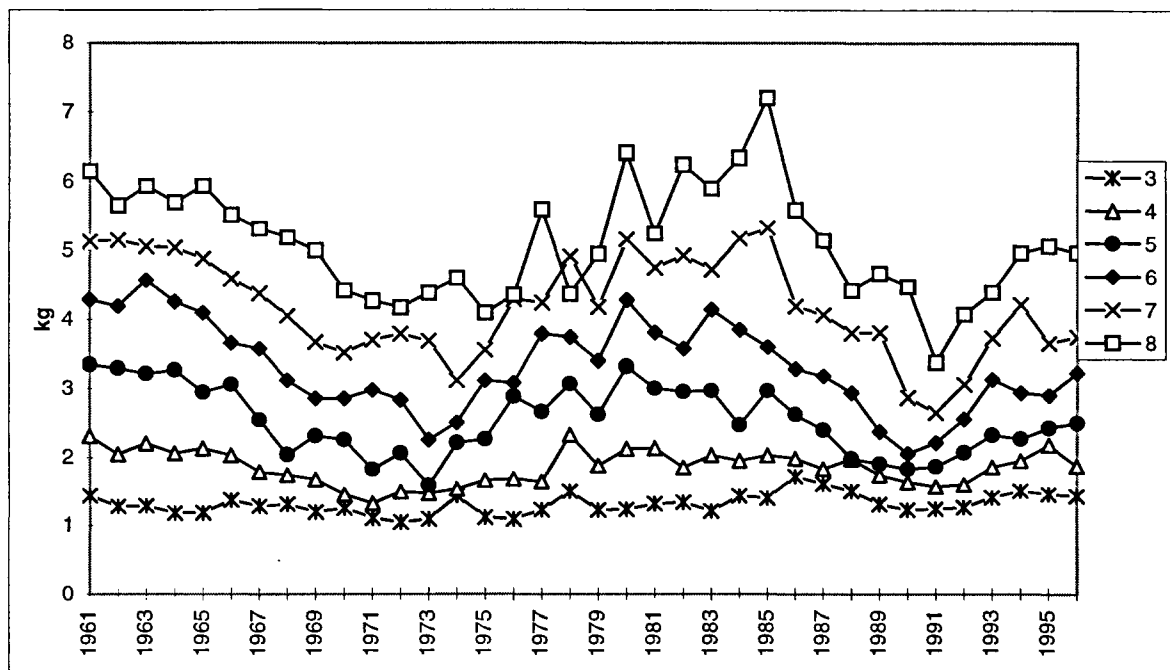


Figure 2.5.3 Saithe in the Faroese Grounds. Observed and fitted values for the period 1983-1997.

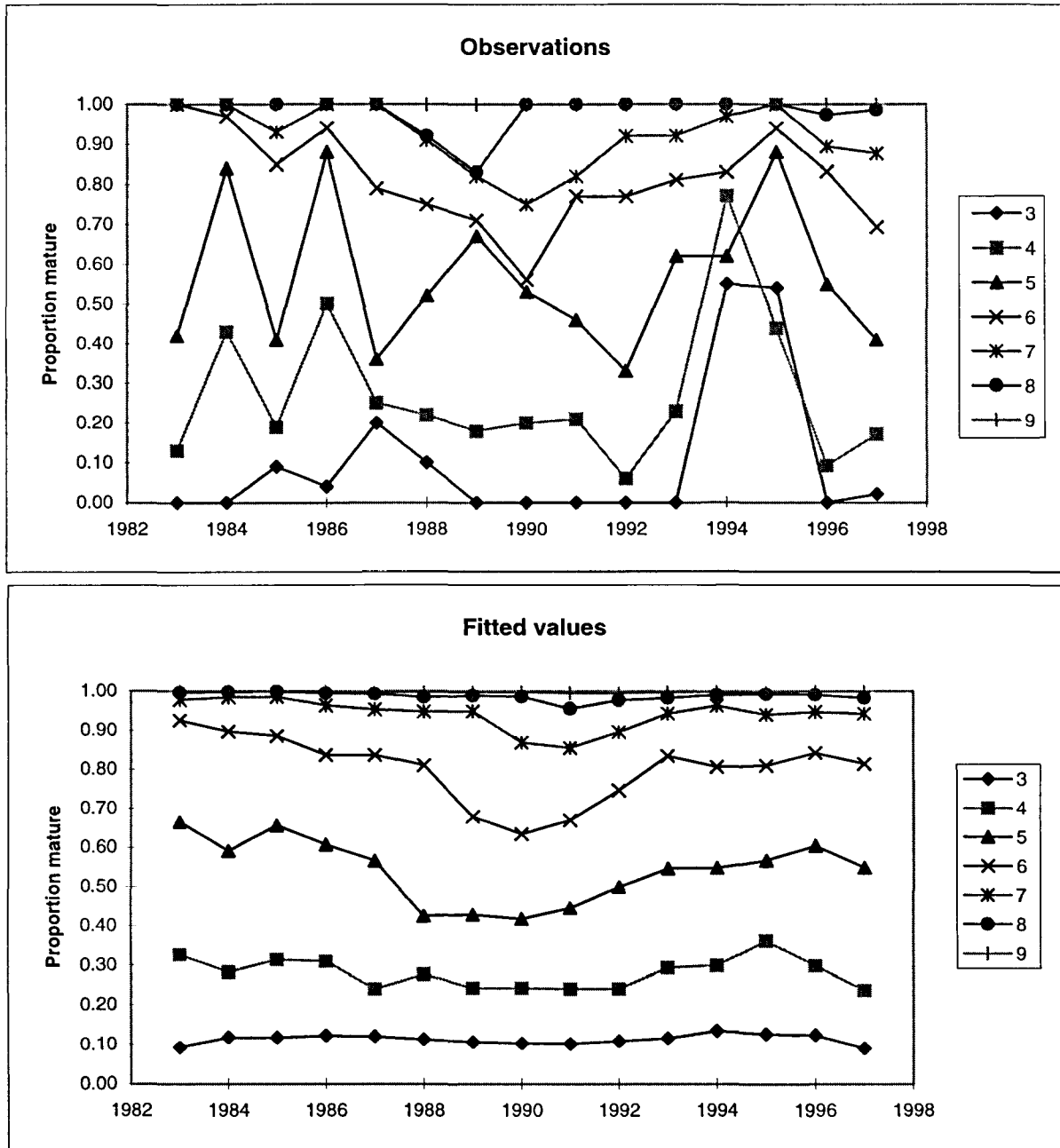


Figure 2.5.4 Saithe in the Faroese Ground. Log catchability residuals for age groups 4-11 yrs from XSA tuning run. Data from the commercial Cuba pair trawlers.

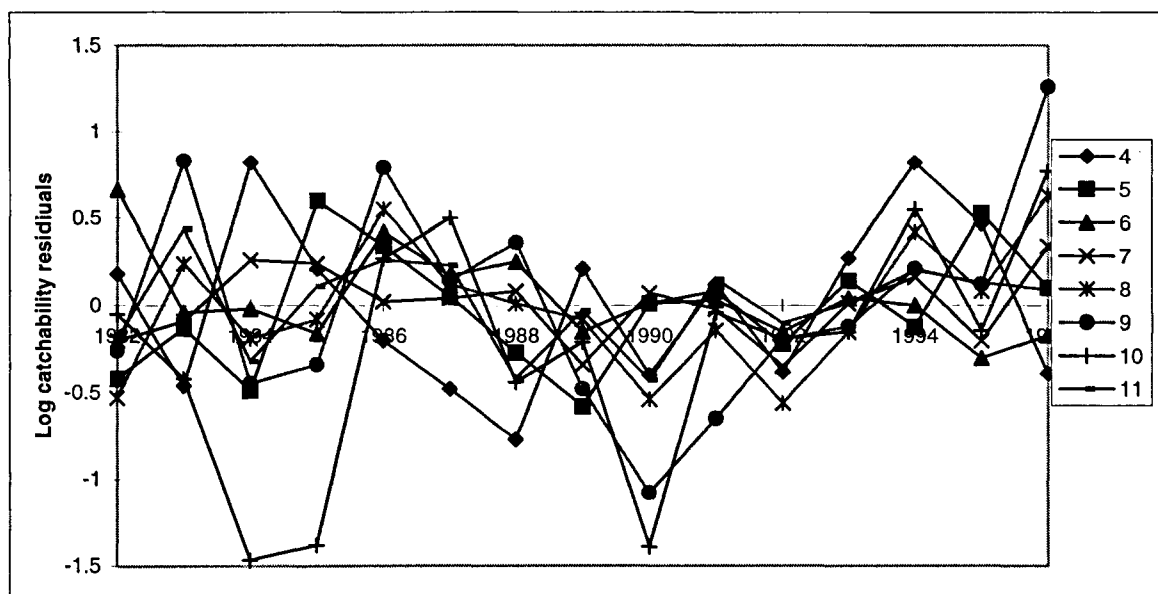


Figure 2.5.5 Saithe in the Faroese Grounds. Retrospective analysis of fishing mortality from XSA run for 1992-1997.

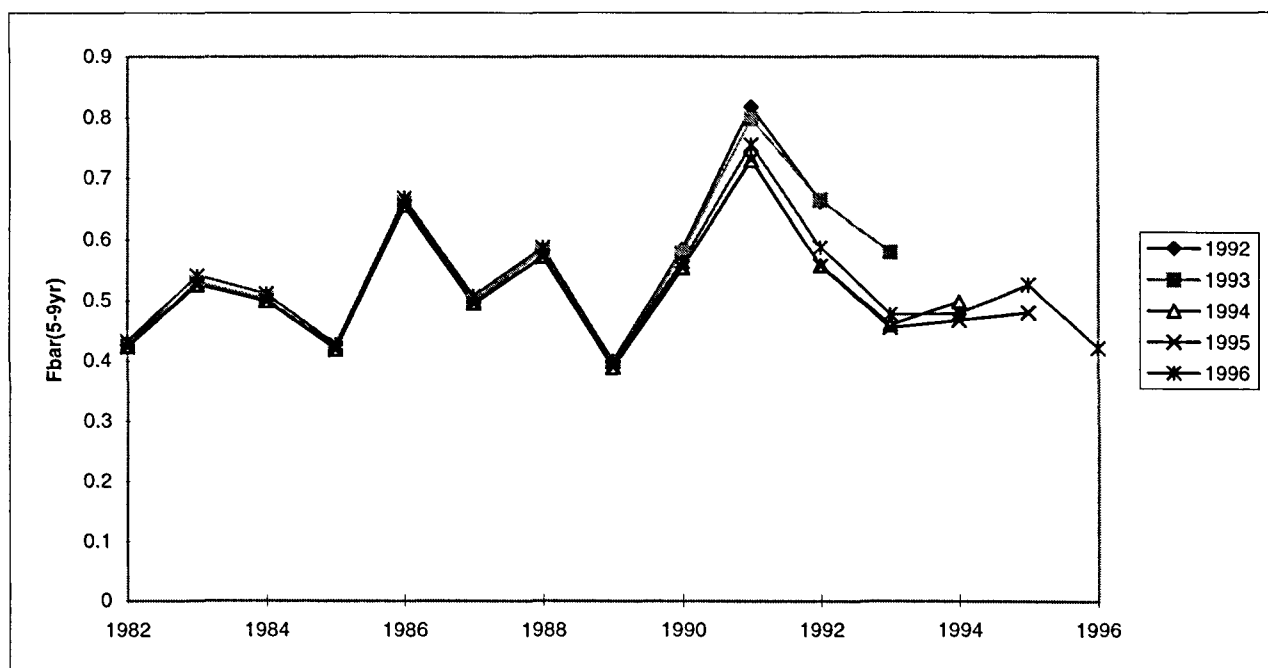
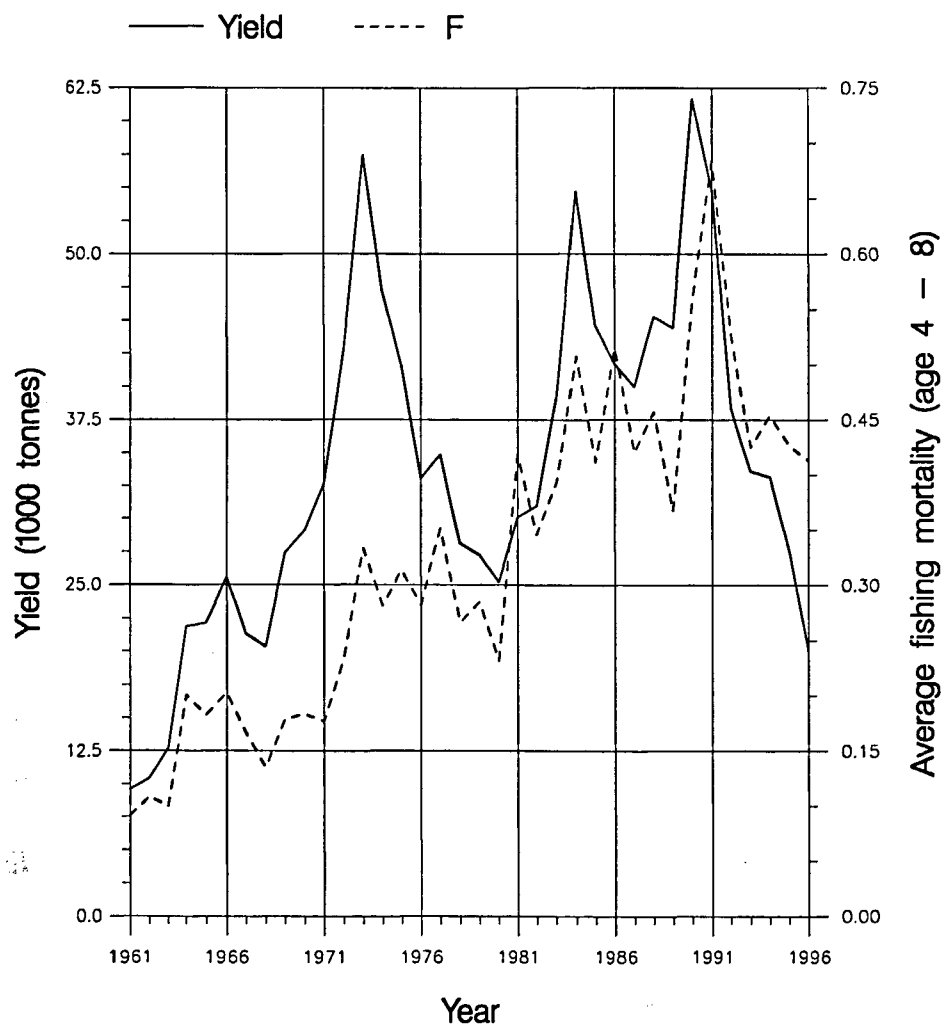


Figure 2.5.6

Fish Stock Summary Saithe in the Faroes Grounds (Fishing Area Vb) 2 – 5 – 1997

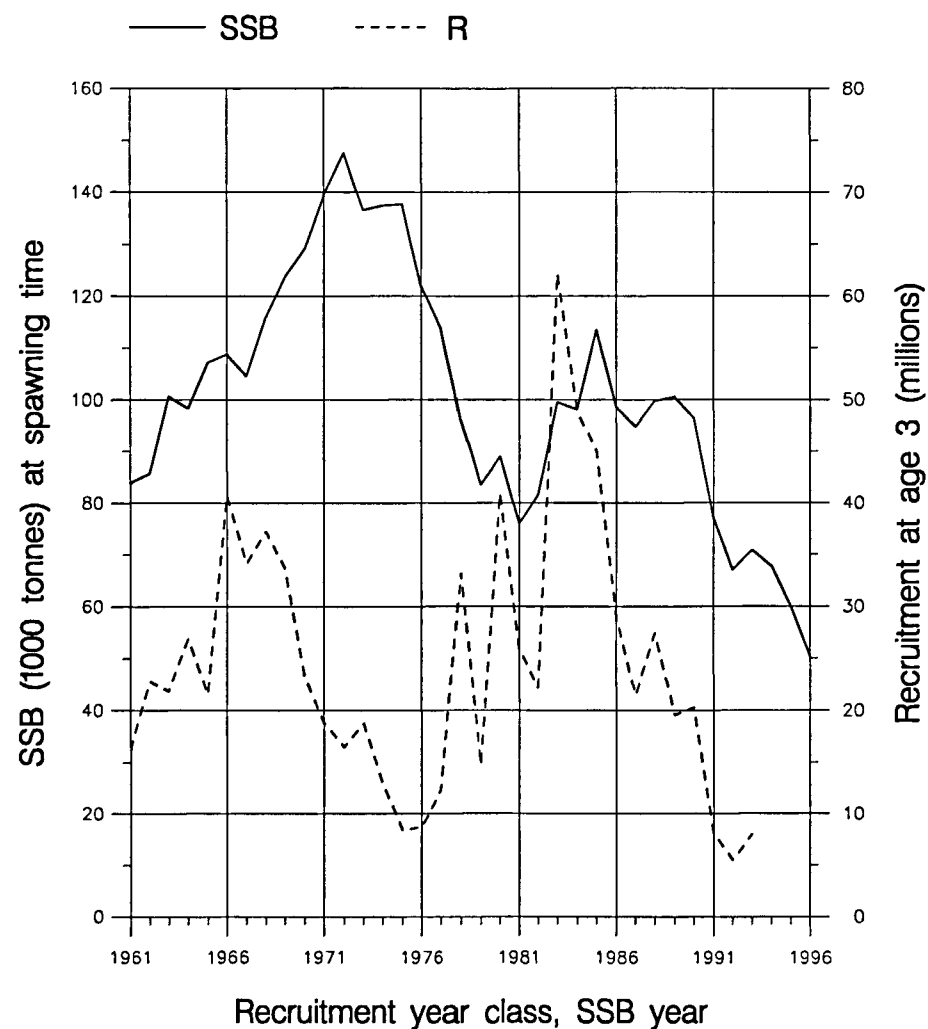
Yield and fishing mortality



(run: XSAFRS05)

A

Spawning stock and recruitment



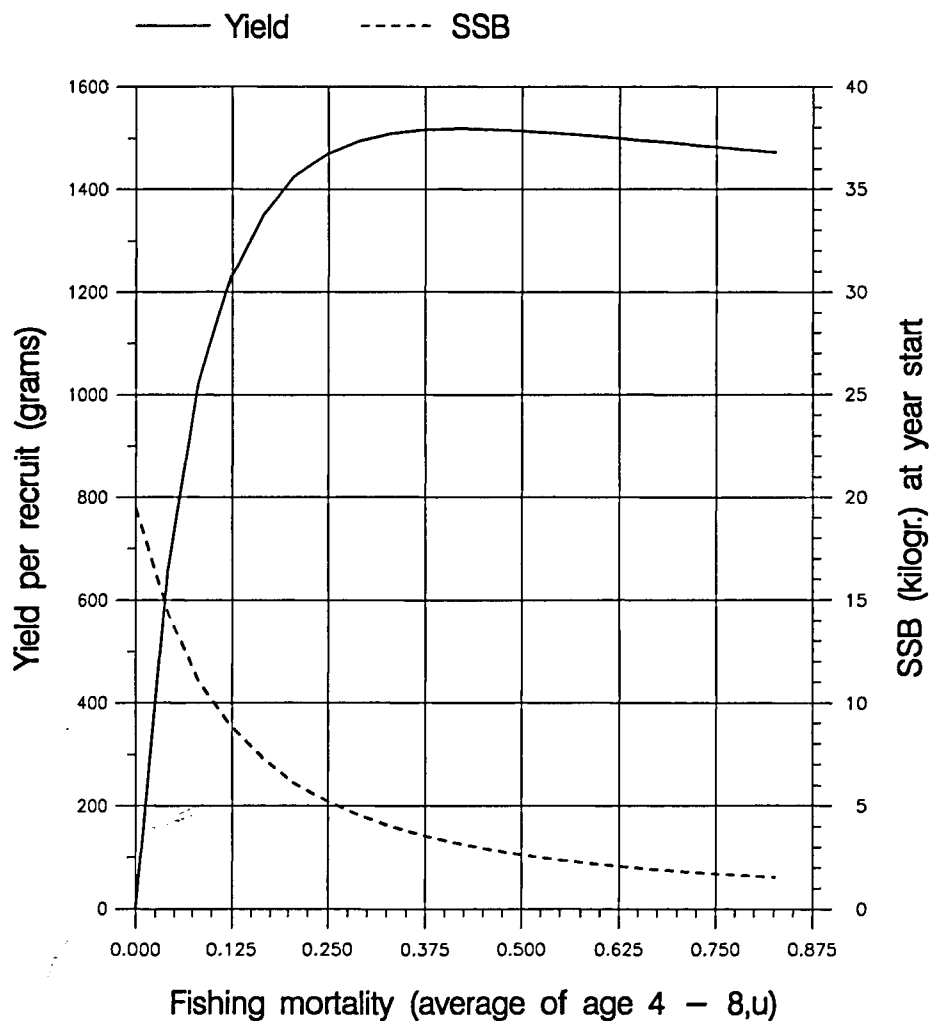
(run: XSAFRS05)

B

Figure 2.5.7

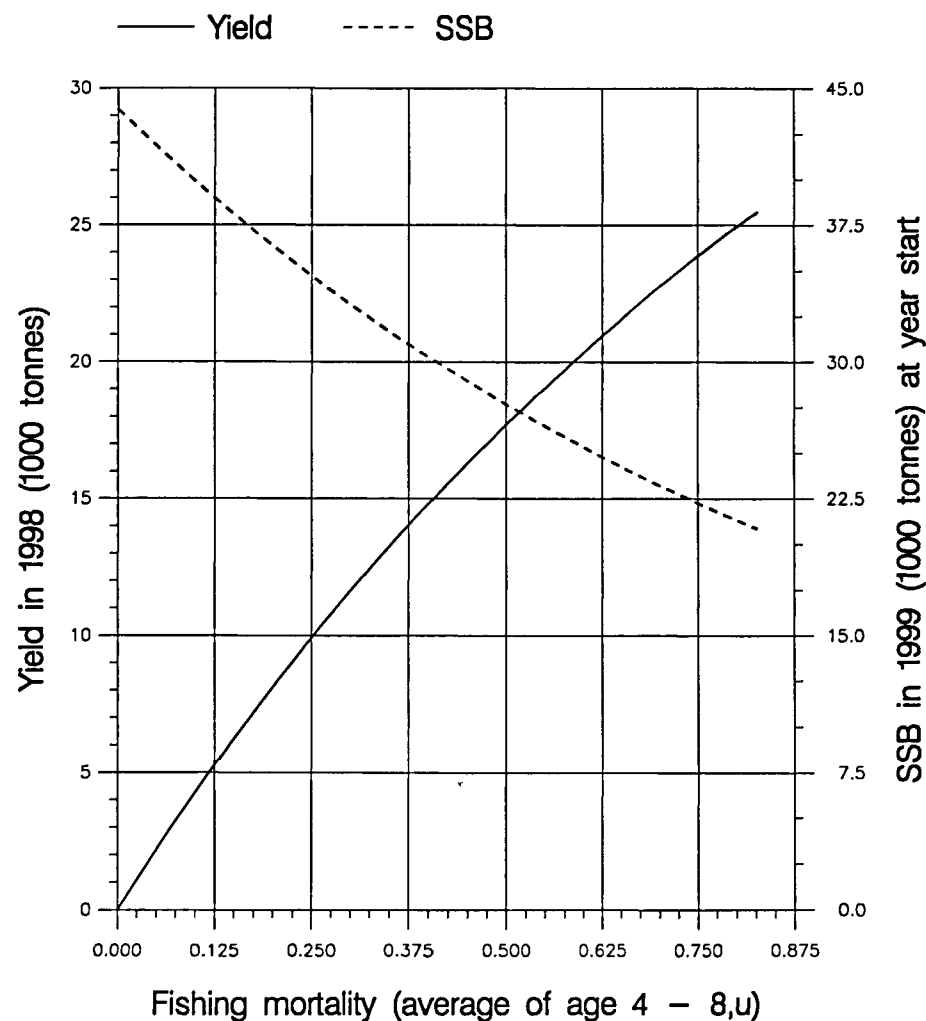
Fish Stock Summary Saithe in the Faroes Grounds (Fishing Area Vb) 5 – 5 – 1997

Long term yield and spawning stock biomass



(run: YLDFRS03) C

Short term yield and spawning stock biomass



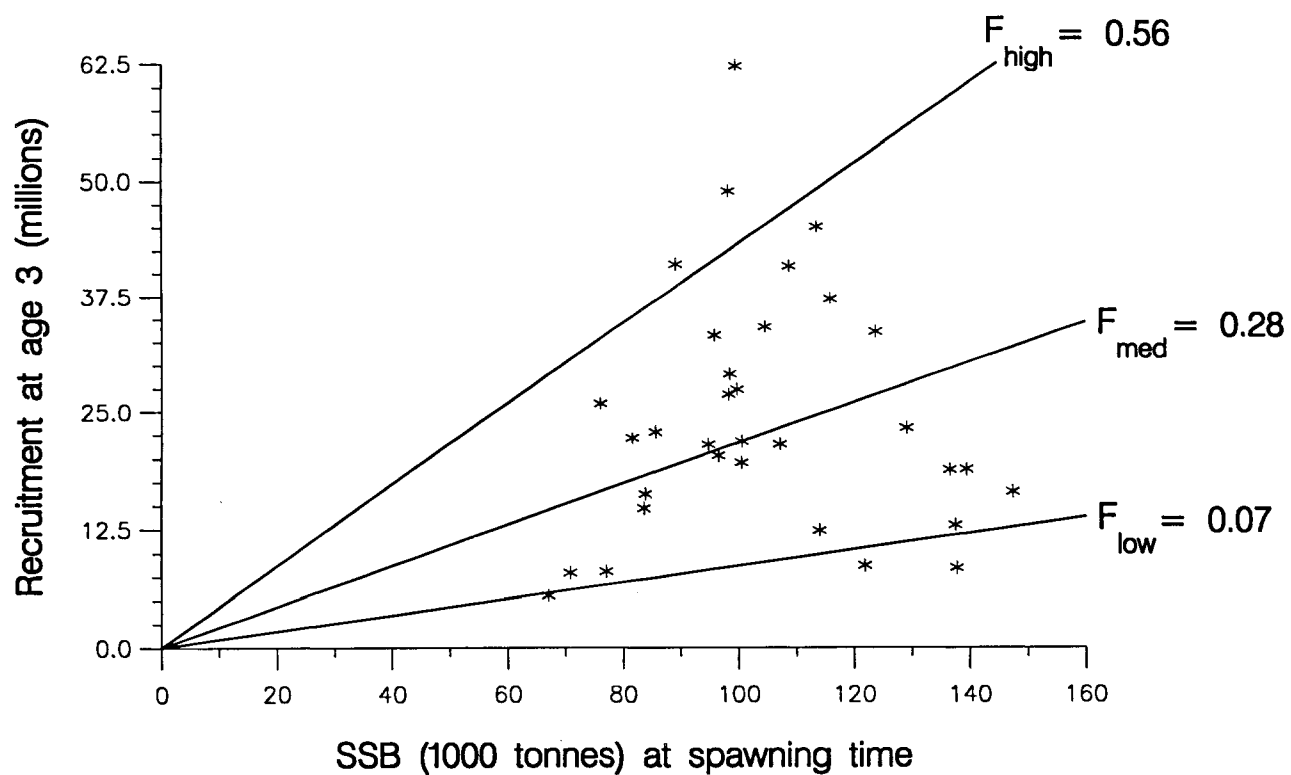
(run: MANFRS01) D

Saithe in the Faroes Grounds (Fishing Area Vb)

2 – 5 – 1997

Figure 2.5.8

Stock – Recruitment



(run: XSAFRS05)

3 DEMERSAL STOCKS AT ICELAND (DIVISION VA)

3.1 Regulation of Demersal Fisheries

With the extension of fisheries jurisdiction to 200 miles in 1975, Iceland introduced new measures to protect young juvenile fish. In the cod, saithe, and haddock fisheries, the mesh size in trawls was increased from 120 mm to 135 mm in 1976 and to 155 mm the following year. Only in the fisheries for redfish was 135 mm allowed in certain areas. Also the mesh size in Danish seines was increased to 170 mm to aim for flatfish, but that fishery turned out not to be profitable. It was, therefore, found necessary to change to a smaller mesh size of 135 mm.

In certain areas outside the 12-mile limit, a temporary protection for trawling was introduced. In addition a system was implemented whereby fishing can be forbidden immediately in areas where the number of small fish in the catches exceeds a certain percentage (25% < 55 cm for cod and saithe and 25% < 48 cm for haddock). These areas have usually been closed for a week. If small fish are still found to be present at the end of that time, the same process is either repeated or regulations are drawn up and the area closed for a longer period of time.

The frequency with which such closures have had to be implemented varies widely from year to year and depends on the year class strength and the age structure of the stock. When strong year classes are entering the fishery, immediate closures are often necessary. On the other hand, when there are few small fish, such closures are much more infrequent.

Increases in trawl mesh size and closure of nursery areas have reduced mortality directly due to fishing effort among small cod and haddock aged three and, to some extent, four years, from the levels which they had reached before these measures were implemented. However, this proved in no way sufficient to protect the stocks. Since 1975, the Marine Research Institute in Iceland has recommended TACs for cod and a few years later also for other important demersal species. A quota system was not introduced, however, until 1984.

Attempts were made to limit cod catches from 1977-1983 by means of the so-called *scratch-days* system, by which cod fishing was limited to a certain number of days each year. This system failed to limit fishing effort sufficiently and the quota system was adopted instead. The quotas are transferable boat quotas. The agreed quotas were based on the Marine Research Institute's TAC recommendations, also taking socio-economic effects into account.

Until 1990, the quota year corresponded to the calendar year but at present the quota, or so-called fishing year, starts on 1 September and ends on 31 August of the following year. This was done to meet the need of the fishing industry.

In order to manage the cod fisheries, a catch rule was introduced by the Icelandic government in spring 1995 and was enforced from the beginning of 1995/1996 fishing year i.e. 1st of September 1995. According to this management scheme, catch will be limited to 25% of the fishable (4+) stock biomass calculated from the average stock at 1st of January of the previous fishing year and the coming fishing year. However, with a minimum catch level of 155 000 t.

3.2 Icelandic Saithe

3.2.1 Trends in landings

Saithe landings from Icelandic grounds (Division Va) fluctuated between 57 000 t and 70 000 t during the period 1981-1986 (Table 3.2.1). From 1987 to 1989, annual landings were about 80 000 t. In 1990, landings increased by more than 20% to 98 000 t and in 1991 the catches reached 103 000 t. Since 1991, landings have decreased to a historically low level in 1996. In 1996 preliminary reported landings for saithe in Division Va are 40 099 t (Table 3.2.1) as compared to 46 000 t expected by the working group last year.

The Icelandic landings in the quota year September-August 1995/1996 amounted to about 41 000 t whereas the national TAC for the same period was 70 000 t. This is in part explained by lower effort because of a limiting quota in the cod fishery and also by decreases in both saithe recruitment and stock size.

3.2.2 Fleets and fishing grounds

About 70 % of the 1996 catches were taken by bottom trawl, 23% by gillnets and the remainder mainly by hooks. The proportion caught by bottom trawl has increased slightly compared to three previous years and decreased correspondingly by gillnets (Figure 3.2.1).

Landings were reported from 162 vessels using bottom trawl in 1996. If only vessels with more than 50 tonnes annual landings are considered, 86 vessels account for 97% of the total saithe bottom trawl landings. The size composition of these selected 86 vessels, along with landings by size class, are shown in Figure 3.2.2.

For vessels operating with gillnets, landings were reported by 263 vessels in 1996. If only vessels with more than 10 tonnes annual landings are considered, 84 vessels account for 97 % of the total saithe gillnet landings. The size composition of these selected 84 vessels, along with landings by size class, are shown in Figure 3.2.3.

The highest landings in the bottom trawl fishery occurred in the months of March and April in 1996 but in February and March in the gillnet fishery (Figure 3.2.4).

The main fishing grounds of the bottom trawl fishery are southwest of Reykjanes and off the south east coast (Figure 3.2.5) but the gillnet fishery is concentrated on the spawning grounds southwest of Iceland (Figure 3.2.6).

3.2.3 Catch in numbers

Minor adjustments were made to the catch in numbers at age in 1995 to account for revised total landings.

Data from bottom trawls, gillnets, handlines and danish seines (see text table below), which represented 96% of the Icelandic landings in 1996, were used to calculate the catch at age for the total landings and used as input for the assessment (Table 3.2.2).

Gear	Number of otoliths	Length measurements
Bottom trawl	2408	7907
Gillnets	1086	3276
Danish seine	100	705
Handlines	97	325
Total	3691	12213

Compared to last year's prognosis, a higher proportion of age groups 3 and 4 and a lower proportion for other age groups were observed in the 1996 landings (Figure 3.2.7).

3.2.4 Mean weight at age in the landings

Mean weight at age in the landings are computed on the basis of samples of otoliths and lengths as well as length distributions and length-weight relationships. The mean weights at age are computed for the same categories as the catch in numbers at age and are then weighted across the fleets. Decreased mean weight at age was observed in 1996 for age groups 3 to 5, but an increase for age groups 6 and 7 was seen (Table 3.2.3). These weights at age were also used as stock weights.

3.2.5 Maturity at age in the landings

In 1996 a sharp decrease in the proportion mature at age was observed for age groups 5 and 7 (Table 3.2.4). As has been pointed out in earlier reports of this working group, the raw maturity at age data for saithe can be misleading due to the nature of the fishery and of the species. A GLM model, described in the 1993 Working Group report (ICES. C.M.1993/Assess:18), was used to explain maturity at age as a function of age and year class strength. The raw data given in Table 3.2.4 was then used to predict the entire maturity at age table for 1980-1996 (Table 3.2.4 and Figure 3.2.8). The maturity at age prior to 1980 (Table 3.2.5) is derived from ICES, (C.M. 1979/G:6).

3.2.6 Stock Assessment

3.2.6.1 Tuning input

CPUE data, based on Icelandic trawler logbooks from 1970-1996 and from the gillnet fleet from 1988 are available. The basic method for computing an aggregate CPUE index from bottom trawl, consists of first selecting individual tows where the catch contains more than 70 % saithe (lower proportions show similar pattern in CPUE). The catches and towing times are then added and the ratio computed. As the CPUE series from bottom trawls, derived from the first part of the year, showed markedly different behaviour in recent years from the series based on the latter part of the year, the two series were age-disaggregated separately (Table 3.2.6) and both used in the tuning module. The age-disaggregation was based on otolith samples taken from commercial trawlers in the respective time periods. The second bottom trawl data set was based on trawler effort (Table 3.2.6), calculated by dividing trawler landings to the annual CPUE. A tuning data set was then constructed from the effort measure along with catch-in-numbers from the same fleet. For the gillnet fleet, individual settings, where the catch contained more than 70% saithe were selected. The catches and number of nets were then added and the ratio computed. The age-disaggregation was based on otolith samples taken from gillnet landings (Table 3.2.6).

3.2.6.2 Estimates of fishing mortality

Two different runs were tried with XSA based on the two different fleet categories. Tuning diagnostics were relatively poor in both cases (Tables 3.2.7 and 3.2.8). The resulting mean F in 1996 for age groups 4-9 from these runs was 0.23, using the trawler effort data and 0.22, using the trawler and gillnet CPUE data.

The time series analysis was carried out as described in "Time series analysis of catch-at-age observations" by Gudmundsson (Applied Statistics (1994) 43 No.1 pp 117-126).

The fishing mortality rates are represented by a time series model where the properties of the model are given by a few parameters. The values of $F(a,y)$ and $N(a,y)$ are estimated from the data by means of a linear approximation to the Kalman filter and the parameters are estimated by the likelihood function of the catch prediction errors of the Kalman filter. The estimation can be carried out with catch-at-age data only or by a joint analysis of catch-at-age and a set of CPUE data. The present analysis was based on annual values from 1981-1996 and ages 4-11 years.

The model for $F(a,y)$ is given by

$$\log F(a,y) = V(t) + U(a,y) + \varepsilon(a,y).$$

The joint variations of all $\log F(a,y)$ in the same year, denoted by $V(t)$, are described by three parameters, representing irregular permanent variations (random walk), linear trend and transitory variations. Variations of catchability with age, denoted by $U(a,y)$, can change gradually according to a multivariate random walk model.

The magnitude of the random variations, $\varepsilon(a,y)$, is estimated assuming that the variances of $\varepsilon(a,y)$ and the measurement errors of $\log C(a,y)$ are equal in ages 5-9. In principle the two kinds of variations can be estimated separately but in practice the estimated ratio between them is very inaccurate. By fixing it as 1 we ensure that neither measurement errors nor irregular variations of $F(a,y)$ are ignored. In VPA the measurement errors are implicitly assumed to be zero, and in non linear least squares estimation, e.g. CAGEAN, where $F(a,y)$ are fully specified by a parametric model, $\varepsilon(a,y)$ are assumed to be zero. The estimated variances of $\varepsilon(a,t)$ and $\log C(a,t)$ are 0.17^2 for ages 5-9. For 4, 10 and 11 years ages the variability was higher. This was ascribed to higher variance of $\varepsilon(a,t)$ for the 4 years old where catchability could be higher than for older ages, e.g. because of variations in growth. For 10 and 11 years old fish, larger variability was assigned to the measurement errors.

CPUE is modelled as

$$CPUE(a,y) = \phi(a)q(y)N(a,y)e^{-Z(a,y)} + \delta(a,y)$$

where variations of catchability with age $\phi(a)$ are estimated by a parametric function. The variations of $q(y)$ follow a time series model and account for joint permanent or transitory variations of catchability at all ages. The

average time of the year when the CPUE is observed is given by τ ; $\delta(a,t)$ are random variations, produced by measurement errors and transitory irregularities in catchability.

Three sets of CPUE data were used: Trawlers January-May, trawlers June-December and gillnets. With our present programmes only one set of CPUE can be analysed jointly with catch-at-age data at the same time. According to the estimated standard deviations of the final results, improvement in accuracy of estimated stocks and fishing mortality rates in the last year by including CPUE data is negligible. The main reason for this is probably that the random variations of the catchability of CPUE, represented by $q(y)$, are considerably larger than random variations of $V(y)$ in the model of $\log F(a,y)$. The time series parameters indicate that the CPUE data set for 5-7 years old fish from the trawlers in June-December is somewhat better than the other two. This is supported by the retrospective analyses. We present results of a joint analysis with this set together with estimation based only on catch-at-age data. The estimated variance of $\delta(a,t)$ was 0.27^2 on a log-scale. The variance of joint transitory variations in $q(y)$ was 0.16^2 and permanent variations negligible.

Estimated stocks and fishing mortality rates are presented in Table 3.2.9 together with associated standard deviations. These standard deviations only refer to uncertainty caused by the random elements but not uncertainty in parameters representing fixed effects (expected recruitment, trend, initial values of $U(a,y)$, $\phi(a)$). The joint effect of random elements and errors in estimation of these parameters cannot be estimated in the same way as in regression analysis. The estimated standard deviations are rather large and the actual uncertainty is bigger. There is considerable positive correlation between the errors in all stock values in the same year and also between F -values, but of course there is a negative correlation between errors in corresponding values of $N(a,y)$ and $F(a,y)$.

Deterministic trend are an unsatisfactory elements in time series models unless there is auxiliary evidence that they should be there. There is little such evidence here, but the retrospective analyses indicate that we have been underestimating F 's in recent years. If trend is present, estimating permanent changes only by random walk is apt to underestimate the trend. In interpreting and using results from models including trends it is important to keep in mind that the parameter of a linear trend is likely to be significant if any non-negligible positive trend is present, regardless of its shape. With series as short as the present ones the residual diagnostics carried out may not detect misspecifications.

In the present data set estimation with catch-at-age alone and no trend (Table 3.2.9) produces a significant random walk element in $V(y)$ with a standard deviation about 0.06, but when linear trend is included in the model (Table 3.2.9) the random walk is negligible but the estimated annual linear increase in $\log F(a,y)$ is 0.035 with a standard deviation of 0.011. The results are analogous when the CPUE data are included (Table 3.2.9) with an estimated annual linear increase of 0.026 and a standard deviation of 0.013.

The estimated random walk element in $U(a,y)$ was always negligible, indicating that there were little systematic changes in catchability by age during the period from 1981-1996. When no trend is included the variance of the random walk residual in $V(y)$ was about 0.06^2 , and transitory variations negligible, but when trend is included the random walk disappears but transitory variations with similar variability are included.

The resulting reference F 's from the TSA runs vary from 0.28 (CPUE data, no trend) to 0.41 (catch at age data with trend estimated). According to the estimated standard deviations and other diagnostics from the TSA-runs there is no significant difference between the four results.

A retrospective analysis was performed for the different methods and fleets (Figure 3.2.9). As in previous years assessments the TSA-runs seem to be more consistent than the XSA-runs. From the TSA-runs the analysis of cpue data from trawlers June-December with trend estimated, appears to be the most consistent one and was adopted by the working group.

Both XSA and TSA seem to consistently underestimate the present fishing mortalities. This has lead to an overestimation of the stock size in recent years reflected in the fact that the national TAC has not been reached in the last three quota years. In order to correct for this effect the estimated F 's were raised by factor of 1.32 which corresponds to the average underestimation in the last three years according to the retrospective analysis.

The raised terminal fishing mortalities from the TSA were used to run a traditional VPA and the F 's for the oldest age groups were taken as the mean of the four younger ages. Natural mortality was set to a value of 0.2. The results of this run are given in Tables 3.2.10 - 3.2.12 and Figures 3.2.10.A and 3.2.10.B.

3.2.6.3 Spawning stock and recruitment

The spawning stock biomass is shown in Figure 3.2.10.B and Table 3.2.12. After a decline from 1970-1977, the spawning stock biomass averaged between 160-180 000 t in 1978-1989 and increased to about 190 000 t in 1990. Since 1992 the spawning stock biomass has declined to a minimum in 1996 of about 85 000 t, which is the lowest recorded level. The estimated spawning stock biomass in the beginning of 1997 is only 70 000 t.

Estimates of recruitment at age 3 are plotted in Figure 3.2.10.B. The 1983-1985 year classes are all well above the 1967-1987 long-term average (about 40 million). The 1984 year class is the highest on record at about 110 million. All year classes after 1985 are well below average. The average size of the 1985-1991 year classes is estimated at only 26 million recruits.

Since no information is available for the more recent year classes, the 1992-1995 year classes were set at the rounded average for the 1985-1991 year classes, i.e. at 25 million recruits.

3.2.7 Prediction of catch and biomass

3.2.7.1 Input data

The input data for the catch projections is shown in Table 3.2.13.

For catch predictions and stock biomass calculations, the mean weight at ages 4-9 were predicted using a multiple regression analysis where the mean weight at age was predicted by the mean weight of the year class in the previous year and the year class strength. Since the regression analysis showed significant relationships only for the above age groups, the mean weights at age for other age groups were averaged over the 1994-1996 period.

For the short-term predictions, maturity at age was predicted as described in Section 3.2.5. For long term predictions of maturity at age, averages over the period 1980-1996 were used.

For a short term prediction the rounded average of the 1985-1991 year classes was used as recruitment.

For long-term yield and spawning stock biomass per recruit, the exploitation pattern was taken as the average of the fishing mortalities during 1980-1996 from the standard VPA run. Averages over 1980-1996 for maturity and mean weight at age for all age groups were used, along with a natural mortality of 0.2 (Table 3.2.15).

3.2.7.2 Biological reference points

The yield and spawning stock biomass-per-recruit (age 3) curves are shown in Figure 3.2.11.C.

Compared to the estimated 1996 fishing mortality level of $F_{4.9} = 0.47$, the reference values for F_{max} and $F_{0.1}$ are 0.43 and 0.18, respectively (Table 3.2.16). From Figure 3.2.12, showing the recruit/spawning stock relationship, and Figure 3.2.11.C, showing the spawning stock biomass-per-recruit relationship, $F_{med} = 0.23$ and $F_{high} = 0.8$ were estimated.

The stock-recruitment scatter plot (Figure 3.2.12) does not provide a basis to define MBAL since the recruitment seems to be higher at the lower end of the SSB range.

3.2.7.3 Projections of catch and biomass

Based on the input data given in Table 3.2.13, options for 1997 were calculated and are given in Table 3.2.14 and Figure 3.2.11.D.

As can be seen from the prediction (Table 3.2.14), an assumption of the same fishing mortalities in 1997 as estimated for 1996, will lead to a catch of about 37 000 t in 1997. The resulting stock size in the beginning of 1998 will be about 175 000 t which is a little higher than in the beginning of 1997 (165 000 t). The spawning stock biomass in the beginning of 1998 will also show a slight increase as compared to 1997, i.e. about 75 000 t. The same reference F in 1998, as compared to 1997, will result in a yield of about 40 000 t, and both total and spawning stock biomass in 1999 will increase from the 1997 level. Total and spawning stock biomass are below

historical low levels and will continue to be at a low level in the coming years, even at very low fishing mortalities, unless an increase in recruitment occurs.

3.2.8 Management considerations

The stock has been overestimated in recent years and seems to be at a historically low level at present. The reference F values have been substantially above F_{med} , and a little higher than F_{max} in recent years. Recruitment in recent years (i.e. after the 1986 year class) has been below the long term average.

3.2.9 Comments on the assessment

As mentioned in last year's report, catch at age data for saithe in Division Va seem to be relatively consistent. This is reflected in the low standard deviations of the log F 's from the TSA. Present fishing mortalities have been consistently underestimated in recent years.

Table 3.2.1. Nominal catch (tonnes) of SAITHE in Division Va, by countries, 1981-1996, as officially reported to ICES

Country	1981	1982	1983	1984	1985	1986	1987	1988
Belgium	532	201	224	269	158	218	217	268
Faroe Islands	3,545	3,582	2,138	2,044	1,778	783	2,139	2,596
France	-	23	-	-	-	-	-	-
Iceland	54,921	65,124	55,904	60,406	55,135	63,867	78,175	74,383
Norway	3	1	+	-	1	-	-	-
UK (Engl. and Wales)	-	-	-	-	29	-	-	-
Total	59,001	68,931	58,266	62,719	57,101	64,868	80,531	77,247
Working Group estimate	-	-	-	-	-	66,376 ²⁾	-	-

Country	1989	1990	1991	1992	1993	1994	1995	1996 ¹⁾
Belgium	369	190	236	195	104	30	-	-
Faroe Islands	2,246	2,905	2,690	1,570	1,562	975	1,184	803
France	-	-	-	-	-	-	-	-
Iceland	79,796	95,032	99,390	77,832	69,982	63,333	47,466	39,296
Norway	-	-	-	-	-	-	-	-
UK (Engl. and Wales)	-	-	-	-	-	-	-	-
Total	82,411	98,127	102,316	79,597	71,648	64,338	48,650	40,099
Working Group estimate	-	-	102,737 ³⁾	-	-	-	-	-

1) Provisional.

2) Additional catch by Faroe Islands of 1,508 t included.

3) Additional catch by Iceland of 451 t included.

Table 3.2.2

Run title : Saithe Iceland Va (run: XSABSI03/X03)

At 2-May-97 15:37:34

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

Age/year	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
3	59	548	480	275	203	508	107	53	376	3108
4	2099	1145	3764	2540	1325	1092	1750	657	4014	1400
5	2858	2435	1991	5214	3503	2804	1065	800	3366	4170
6	1801	1556	3616	2596	5404	4845	2455	1825	1958	2665
7	1036	1275	1566	2169	1457	4293	4454	2184	1536	1550
8	1068	961	718	1341	1415	1215	2311	3610	1172	1116
9	1528	537	292	387	578	975	501	844	747	628
10	958	575	669	262	242	306	251	376	479	1549
11	538	476	589	155	61	59	38	291	74	216
12	166	279	489	112	154	35	12	135	23	51
13	71	139	150	64	135	48	2	185	72	30
14	12	91	72	33	128	46	4	226	71	14
+gp	49	55	0	58	141	99	174	190	291	95
0 TOTALNUM	12243	10072	14396	15206	14746	16325	13124	11376	14179	16592
TONSLAND	62026	49672	63504	58347	58986	68615	58266	62719	57101	66376
SOPCOF %	98	97	98	100	99	99	99	100	99	100

Age/year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
3	956	1318	315	143	198	242	657	702	1573	2123
4	5135	5067	4313	1692	874	2928	1083	2955	1853	3485
5	4428	6619	8471	5471	3613	3844	2841	1770	2661	2343
6	5409	3678	7309	10112	6844	4355	2252	2603	1807	1853
7	2915	2859	1794	6174	10772	3884	2247	1377	2370	820
8	1348	1775	1928	1816	3223	4046	2314	1243	905	1138
9	661	845	848	1087	858	1290	3671	1263	574	323
10	496	226	270	380	838	350	830	2009	482	210
11	498	270	191	151	228	196	223	454	521	144
12	58	107	135	55	40	56	188	158	106	168
13	27	24	76	76	6	54	81	188	35	84
14	48	1	10	37	5	15	12	82	13	33
+gp	22	1	8	42	42	1	1	51	17	29
0 TOTALNUM	22001	22790	25668	27236	27541	21261	16400	14855	12917	12753
TONSLAND	80559	77247	82425	98130	102737	79597	71648	64338	48650	40099
SOPCOF %	100	100	100	100	100	100	100	100	100	99

Table 3.2.3

Run title : Saithe Iceland Va (run: XSABSI03/X03)

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Table 2 Catch weights at age (kg)

Age/year	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
3	1.120	1.120	1.120	1.428	1.585	1.547	1.530	1.653	1.609	1.450
4	1.760	1.760	1.760	1.983	2.037	2.194	2.221	2.432	2.172	2.190
5	2.730	2.730	2.730	2.667	2.696	3.015	3.171	3.330	3.169	2.959
6	4.290	4.290	4.290	3.689	3.525	3.183	4.270	4.681	3.922	4.402
7	5.540	5.540	5.540	5.409	4.541	5.114	4.107	5.466	4.697	5.488
8	7.270	7.270	7.270	6.321	6.247	6.202	5.984	4.973	6.411	6.406
9	8.420	8.420	8.420	7.213	6.991	7.256	7.565	7.407	6.492	7.570
10	9.410	9.410	9.410	8.565	8.202	7.922	8.673	8.179	8.346	6.487
11	10.000	10.000	10.000	9.147	9.537	8.924	8.801	8.770	9.401	9.616
12	10.560	10.560	10.560	9.617	9.089	10.134	9.039	8.831	10.335	10.462
13	11.870	11.870	11.870	10.066	9.351	9.447	11.138	11.010	11.027	11.747
14	13.120	13.120	13.120	11.041	10.225	10.535	9.818	11.127	10.644	11.902
+gp	14.000	14.000	13.120	13.000	13.000	13.000	13.000	13.000	13.000	13.000
0 SOPCOFAC	0.9769	0.9691	0.984	0.9989	0.9933	0.9922	0.9915	0.9975	0.9929	0.9987

Age/year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
3	1.516	1.261	1.403	1.647	1.224	1.269	1.381	1.444	1.370	1.210
4	1.715	2.017	2.021	1.983	1.939	1.909	2.143	1.836	1.977	1.745
5	2.670	2.513	2.194	2.566	2.432	2.578	2.742	2.649	2.769	2.684
6	3.839	3.476	3.047	3.021	3.160	3.288	3.636	3.512	3.722	3.741
7	5.081	4.719	4.505	4.077	3.634	4.150	4.398	4.906	4.621	4.850
8	6.185	5.932	5.889	5.744	4.967	4.865	5.421	5.539	5.854	5.620
9	7.330	7.523	7.172	7.038	6.629	6.168	5.319	6.818	6.416	6.966
10	8.025	8.439	8.852	7.564	7.704	7.926	7.006	6.374	7.356	7.430
11	7.974	8.748	10.170	8.854	9.061	8.349	8.070	8.341	6.815	8.884
12	9.615	9.559	10.392	10.645	9.117	9.029	10.048	9.770	8.312	8.025
13	12.246	10.824	12.522	11.674	10.922	11.574	9.106	10.528	9.119	10.246
14	11.656	14.099	11.923	11.431	11.342	9.466	11.591	11.257	11.910	12.177
+gp	13.000	13.000	13.000	13.000	13.000	13.000	13.000	13.000	13.000	13.000
0 SOPCOFAC	1.0005	0.9999	0.9998	1.0005	0.9999	1.0002	1.0013	1.0018	1.0027	0.9945

Table 3.2.4 Saithe in Division Va. Maturity at age, data and fitted values.

Fitted:

Year/age	3	4	5	6	7	8	9
1980	0.10	0.15	0.31	0.62	0.77	0.90	0.95
1981	0.11	0.21	0.29	0.52	0.79	0.89	0.95
1982	0.11	0.23	0.38	0.50	0.72	0.90	0.95
1983	0.09	0.22	0.42	0.60	0.70	0.86	0.96
1984	0.08	0.20	0.41	0.63	0.78	0.85	0.93
1985	0.09	0.16	0.37	0.62	0.80	0.89	0.93
1986	0.05	0.19	0.32	0.58	0.79	0.90	0.95
1987	0.03	0.12	0.36	0.52	0.76	0.90	0.96
1988	0.07	0.07	0.24	0.57	0.72	0.88	0.96
1989	0.10	0.15	0.16	0.43	0.76	0.86	0.95
1990	0.11	0.20	0.29	0.31	0.64	0.88	0.94
1991	0.10	0.23	0.38	0.50	0.51	0.81	0.95
1992	0.12	0.21	0.41	0.59	0.70	0.71	0.91
1993	0.11	0.25	0.39	0.62	0.77	0.85	0.85
1994	0.11	0.23	0.44	0.60	0.80	0.89	0.93
1995	0.10	0.23	0.41	0.65	0.78	0.90	0.95
1996	0.1	0.22	0.41	0.63	0.81	0.89	0.96

Data:

Year/age	3	4	5	6	7	8	9
1980	0.00	0.05	0.21	0.53	0.90	0.98	0.99
1981	0.04	0.06	0.32	0.60	0.76	0.97	1.00
1982	0.00	0.00	0.31	0.53	0.77	0.84	1.00
1983	0.33	0.50	0.45	0.86	0.54	0.97	0.97
1984	0.39	0.14	0.40	0.77	0.91	0.79	0.99
1985	0.00	0.76	0.62	0.65	0.67	0.82	0.84
1986	0.00	0.01	0.10	0.71	0.90	0.79	0.82
1987	0.00	0.00	0.13	0.52	0.73	0.97	0.98
1988	0.00	0.01	0.09	0.20	0.79	0.79	1.00
1989	0.00	0.04	0.13	0.38	0.79	0.97	0.99
1990	0.00	0.10	0.36	0.45	0.75	0.90	1.00
1991	0.00	0.06	0.24	0.42	0.40	0.58	0.79
1992	0.00	0.16	0.44	0.60	0.73	0.78	0.95
1993	0.14	0.54	0.82	0.94	0.96	0.99	0.95
1994	0.00	0.68	0.92	0.97	0.99	0.99	1.00
1995	0.24	0.49	0.46	0.41	0.41	0.55	0.70
1996	0.00	0.00	0.08	0.50	0.18	0.96	1.00

Table 3.2.5

Run title : Saithe Iceland Va (run: XSABSI03/X03)

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Table 5 Proportion mature at age

Age/year	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
3	0	0	0	0.1	0.11	0.11	0.09	0.08	0.09	0.05
4	0.06	0.06	0.06	0.15	0.21	0.23	0.22	0.2	0.16	0.19
5	0.27	0.27	0.27	0.31	0.29	0.38	0.42	0.41	0.37	0.32
6	0.63	0.63	0.63	0.62	0.52	0.5	0.6	0.63	0.62	0.58
7	0.81	0.81	0.81	0.77	0.79	0.72	0.7	0.78	0.8	0.79
8	0.97	0.97	0.97	0.9	0.89	0.9	0.86	0.85	0.89	0.9
9	1	1	1	0.95	0.95	0.95	0.96	0.93	0.93	0.95
10	1	1	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1	1	1
12	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	1	1
14	1	1	1	1	1	1	1	1	1	1
+gp	1	1	1	1	1	1	1	1	1	1

Age/year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
3	0.03	0.07	0.1	0.11	0.1	0.12	0.11	0.11	0.1	0.1
4	0.12	0.07	0.15	0.2	0.23	0.21	0.25	0.23	0.23	0.22
5	0.36	0.24	0.16	0.29	0.38	0.41	0.39	0.44	0.41	0.41
6	0.52	0.57	0.43	0.31	0.5	0.59	0.62	0.6	0.65	0.63
7	0.76	0.72	0.76	0.64	0.51	0.7	0.77	0.8	0.78	0.81
8	0.9	0.88	0.86	0.88	0.81	0.71	0.85	0.89	0.9	0.89
9	0.96	0.96	0.95	0.94	0.95	0.91	0.85	0.93	0.95	0.96
10	1	1	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1	1	1
12	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	1	1
14	1	1	1	1	1	1	1	1	1	1
+gp	1	1	1	1	1	1	1	1	1	1

Table 3.2.6 Tuning data series
Trawlers Effort in division Va:

Year	Effort	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10	Catch, age 11	Catch, age 12	Catch, age 13
1980	26	275	2534	5153	2320	1525	704	176	154	101	67	132
1981	23	203	1325	3499	5232	1117	384	127	98	6	13	37
1982	26	508	1092	2483	4404	1857	400	181	92	26	29	176
1983	29	103	1589	996	1991	3563	1106	196	61	1	1	307
1984	35	53	657	680	1463	981	2705	331	361	279	135	616
1985	34	376	3934	3145	1765	1204	672	488	266	21	1	361
1986	32	3104	1370	4021	1965	1121	552	343	536	145	42	118
1987	43	956	5116	4289	4805	2008	842	337	239	141	27	85
1988	46	1318	5066	6596	3526	2368	959	447	90	127	35	19
1989	50	315	4302	8328	6944	1279	774	434	171	137	112	103
1990	62	143	1681	5378	9655	5381	1099	571	217	127	41	146
1991	59	191	848	3542	6664	10126	2484	496	575	152	20	5
1992	47	242	2928	3712	4167	3480	3184	895	231	96	24	49
1993	36	631	963	2509	1911	1649	1251	2206	458	105	132	67
1994	35	678	2830	1623	1944	715	602	616	1216	274	91	199
1995	28	1571	1819	2452	1489	1635	462	251	200	236	54	30
1996	27	1135	2484	1801	1513	578	776	169	109	62	88	86

Trawlers age disaggregated CPUE in Jan.-May and June-Des. in Division Va.

Jan.-May: Year	Fishing effort	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10	Catch, age 11
80	100	0.0534	0.1119	0.0512	0.0280	0.0191	0.0040	0.0066	0.0052
81	100	0.0279	0.1012	0.2176	0.0473	0.0140	0.0035	0.0013	0.0003
82	100	0.0211	0.1364	0.0552	0.0633	0.0260	0.0162	0.0032	0.0016
83	100	0.0095	0.0278	0.0723	0.1359	0.0380	0.0037	0.0007	0.0000
84	100	0.0394	0.0516	0.0446	0.0298	0.0840	0.0053	0.0026	0.0000
85	100	0.0094	0.0584	0.0361	0.0519	0.0346	0.0180	0.0043	0.0007
86	100	0.0277	0.2478	0.0703	0.0203	0.0018	0.0000	0.0018	0.0000
87	100	0.1257	0.0864	0.1132	0.0440	0.0149	0.0039	0.0031	0.0016
88	100	0.0189	0.1013	0.0774	0.0700	0.0280	0.0206	0.0049	0.0074
89	100	0.0097	0.0434	0.1263	0.0531	0.0381	0.0179	0.0060	0.0022
90	100	0.0208	0.0477	0.1024	0.0887	0.0189	0.0122	0.0061	0.0051
91	100	0.0059	0.0387	0.0783	0.1292	0.0412	0.0135	0.0126	0.0042
92	100	0.0235	0.0483	0.0713	0.0736	0.0734	0.0185	0.0037	0.0016
93	100	0.0048	0.0242	0.0546	0.0710	0.0520	0.0480	0.0112	0.0026
94	100	0.0369	0.0316	0.0632	0.0298	0.0265	0.0222	0.0392	0.0056
95	100	0.0278	0.0421	0.0421	0.0603	0.0194	0.0090	0.0081	0.0096
96	100	0.0621	0.0422	0.0464	0.0232	0.0333	0.0070	0.0046	0.0023

June-Des.: Year	Fishing effort	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10	Catch, age 11	Catch, age 12
80	100	0.0007	0.0203	0.0721	0.0413	0.0518	0.0243	0.0105	0.0098	0.0058	0.0040
81	100	0.0114	0.0517	0.1159	0.1249	0.0270	0.0098	0.0031	0.0023	0.0000	0.0008
82	100	0.0098	0.0242	0.0600	0.1590	0.0585	0.0103	0.0025	0.0015	0.0003	0.0008
83	100	0.0045	0.1249	0.0382	0.0376	0.0924	0.0185	0.0013	0.0006	0.0000	0.0000
84	100	0.0019	0.0137	0.0056	0.0361	0.0149	0.0766	0.0062	0.0081	0.0075	0.0037
85	100	0.0105	0.1504	0.0900	0.0561	0.0197	0.0055	0.0105	0.0055	0.0000	0.0000
86	100	0.0716	0.0284	0.0734	0.0400	0.0248	0.0144	0.0122	0.0160	0.0077	0.0025
87	100	0.0236	0.0721	0.0676	0.0575	0.0409	0.0216	0.0112	0.0070	0.0039	0.0008
88	100	0.0173	0.1087	0.1042	0.0592	0.0343	0.0159	0.0048	0.0007	0.0007	0.0003
89	100	0.0022	0.0557	0.1058	0.0947	0.0156	0.0118	0.0088	0.0037	0.0033	0.0028
90	100	0.0047	0.0307	0.0936	0.1436	0.0439	0.0064	0.0022	0.0006	0.0006	0.0000
91	100	0.0026	0.0118	0.0440	0.0875	0.1380	0.0353	0.0041	0.0041	0.0002	0.0000
92	100	0.0027	0.0501	0.0698	0.0682	0.0546	0.0526	0.0141	0.0023	0.0011	0.0002
93	100	0.0142	0.0232	0.0628	0.0383	0.0261	0.0211	0.0540	0.0105	0.0023	0.0008
94	100	0.0200	0.0432	0.0324	0.0381	0.0162	0.0140	0.0127	0.0386	0.0057	0.0014
95	100	0.0841	0.0310	0.0515	0.0310	0.0335	0.0111	0.0085	0.0060	0.0063	0.0028
96	100	0.0927	0.111	0.0848	0.0538	0.0096	0.0109	0.0026	0.0013	0.0004	0.0009

Table 3.2.6 (continued)

Disaggregated gillnet cpue:

Year	Fishing effort	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10	Catch, age 11	Catch, age 12
88	100	0.0174	0.1046	0.2267	0.3027	0.1271	0.0361	0.0399	0.0187
89	100	0.0675	0.1665	0.2268	0.587	0.2584	0.0646	0.0373	0.0129
90	100	0.0213	0.125	0.235	0.2329	0.1789	0.0646	0.0107	0.0064
91	100	0.0263	0.0572	0.2318	0.3213	0.1866	0.1452	0.0436	0.0128
92	100	0.0134	0.0433	0.1671	0.4298	0.2209	0.0701	0.0612	0.0164
93	100	0.0661	0.1014	0.1861	0.3825	0.3657	0.1135	0.04	0.0223
94	100	0.0343	0.1487	0.1655	0.1617	0.1846	0.1625	0.0481	0.0168
95	100	0.0812	0.1212	0.2798	0.1749	0.135	0.1324	0.1291	0.0275
96	100	0.1364	0.176	0.1428	0.2211	0.0921	0.0562	0.0359	0.0405

Table 3.2.7

Lowestoft VPA Version 3.1

1-May-97 19:26:19

Extended Survivors Analysis

Saithe Iceland Va (run: XSABSI02/X02)

CPUE data from file /users/fish/ifad/ifapwork/nwwg/sai_icel/FLEET.X02

Catch data for 20 years. 1977 to 1996. Ages 3 to 15.

Fleet,	First,	Last,	First,	Last,	Alpha,	Beta
	year,	year,	age,	age,		
FLT04: TRW EFFORT (C,	1985,	1996,	3,	13,	.000,	1.000

Time series weights :

Tapered time weighting applied
Power = 3 over 20 years

Catchability analysis :

Catchability dependent on stock size for ages < 4

Regression type = C
Minimum of 5 points used for regression
Survivor estimates shrunk to the population mean for ages < 4

Catchability independent of age for ages >= 11

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 28 iterations

Table 3.2.7 (continued)

Regression weights

, .751, .820, .877, .921, .954, .976, .990, .997, 1.000, 1.000

Fishing mortalities

Age,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996
3,	.010,	.026,	.011,	.007,	.007,	.016,	.024,	.026,	.028,	.033
4,	.103,	.065,	.114,	.076,	.055,	.134,	.090,	.144,	.087,	.079
5,	.253,	.188,	.147,	.206,	.232,	.365,	.186,	.209,	.187,	.152
6,	.365,	.345,	.327,	.263,	.430,	.485,	.379,	.260,	.341,	.192
7,	.422,	.334,	.281,	.510,	.496,	.466,	.499,	.421,	.401,	.256
8,	.507,	.494,	.396,	.514,	.553,	.349,	.566,	.575,	.545,	.341
9,	.611,	.703,	.467,	.407,	.490,	.447,	.622,	.709,	.578,	.380
10,	.533,	.434,	.508,	.394,	.640,	.379,	.586,	.858,	.656,	.430
11,	.849,	.632,	.823,	.601,	.437,	.296,	.444,	.760,	.563,	.413
12,	.664,	.432,	.774,	.597,	.310,	.180,	.517,	.661,	.393,	.353
13,	2.362,	.647,	.632,	1.624,	.115,	.917,	.428,	1.757,	.292,	.626
14,	1.053,	.570,	.622,	.743,	.396,	.466,	.523,	1.078,	.519,	.495

XSA population numbers (Thousands)

YEAR ,	3,	4,	AGE	5,	6,	7,	8,	9,	10	
1987 ,	1.10E+05,	5.78E+04,	2.19E+04,	1.96E+04,	9.36E+03,	3.75E+03,	1.60E+03,	1.33E+03,	9.62E+02,	1.32E+02,
1988 ,	5.57E+04,	8.92E+04,	4.26E+04,	1.39E+04,	1.11E+04,	5.03E+03,	1.85E+03,	7.09E+02,	6.37E+02,	3.37E+02,
1989 ,	3.14E+04,	4.44E+04,	6.84E+04,	2.89E+04,	8.08E+03,	6.52E+03,	2.51E+03,	7.49E+02,	3.76E+02,	2.77E+02,
1990 ,	2.21E+04,	2.54E+04,	3.25E+04,	4.84E+04,	1.71E+04,	5.00E+03,	3.59E+03,	1.29E+03,	3.69E+02,	1.35E+02,
1991 ,	3.17E+04,	1.79E+04,	1.93E+04,	2.16E+04,	3.04E+04,	8.39E+03,	2.45E+03,	1.96E+03,	7.11E+02,	1.66E+02,
1992 ,	1.72E+04,	2.58E+04,	1.39E+04,	1.25E+04,	1.15E+04,	1.52E+04,	3.95E+03,	1.23E+03,	8.45E+02,	3.76E+02,
1993 ,	3.05E+04,	1.39E+04,	1.85E+04,	7.90E+03,	6.32E+03,	5.91E+03,	8.76E+03,	2.07E+03,	6.88E+02,	5.14E+02,
1994 ,	3.07E+04,	2.44E+04,	1.04E+04,	1.26E+04,	4.43E+03,	3.14E+03,	2.75E+03,	3.85E+03,	9.42E+02,	3.61E+02,
1995 ,	6.39E+04,	2.45E+04,	1.73E+04,	6.90E+03,	7.93E+03,	2.38E+03,	1.45E+03,	1.11E+03,	1.34E+03,	3.61E+02,
1996 ,	7.15E+04,	5.09E+04,	1.84E+04,	1.17E+04,	4.02E+03,	4.35E+03,	1.13E+03,	6.64E+02,	4.70E+02,	6.24E+02,

Estimated population abundance at 1st Jan 1997

, .00E+00, 5.67E+04, 3.85E+04, 1.29E+04, 7.93E+03, 2.55E+03, 2.53E+03, 6.33E+02, 3.54E+02, 2.55E+02,

Taper weighted geometric mean of the VPA populations:

, 3.92E+04, 2.99E+04, 2.14E+04, 1.46E+04, 8.73E+03, 5.03E+03, 2.50E+03, 1.29E+03, 6.14E+02, 2.89E+02,

Standard error of the weighted Log(VPA populations) :

, .5367, .5204, .5141, .5485, .5732, .5074, .5568, .5532, .4878, .5917,

Table 3.2.7 (continued)

YEAR ,	13,	AGE 14,
1987 ,	3.29E+01,	8.15E+01,
1988 ,	5.57E+01,	2.54E+00,
1989 ,	1.79E+02,	2.39E+01,
1990 ,	1.05E+02,	7.80E+01,
1991 ,	6.10E+01,	1.69E+01,
1992 ,	9.94E+01,	4.45E+01,
1993 ,	2.57E+02,	3.26E+01,
1994 ,	2.51E+02,	1.37E+02,
1995 ,	1.53E+02,	3.55E+01,
1996 ,	1.99E+02,	9.34E+01,

Estimated population abundance at 1st Jan 1997

, 3.59E+02, 8.73E+01,

Taper weighted geometric mean of the VPA populations:

, 1.38E+02, 4.82E+01,

Standard error of the weighted Log(VPA populations) :

1 , .7280, 1.2031,

Log catchability residuals.

Fleet : FLT04: TRW EFFORT (C

Age ,	1985,	1986
3 ,	-.03,	.56
4 ,	.49,	-.20
5 ,	.12,	.12
6 ,	-.04,	-.26
7 ,	.14,	-.01
8 ,	-.06,	.12
9 ,	-.48,	-.08
10 ,	.49,	.28
11 ,	-.49,	.97
12 ,	-3.64,	1.14
13 ,	3.12,	1.60

Age ,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996
3 ,	-.75,	.09,	-.26,	-.53,	-.68,	.22,	.39,	.45,	.37,	.08
4 ,	.13,	-.40,	.07,	-.54,	-.84,	.30,	.05,	.62,	.37,	-.02
5 ,	.19,	-.14,	-.48,	-.36,	-.20,	.47,	-.03,	.15,	.27,	-.08
6 ,	.09,	.05,	-.10,	-.53,	.03,	.36,	.26,	-.21,	.38,	-.16
7 ,	-.07,	-.19,	-.59,	-.02,	.08,	.20,	.33,	-.15,	.31,	-.08
8 ,	.09,	-.15,	-.75,	-.30,	.07,	-.14,	.23,	.16,	.39,	.25
9 ,	.09,	.20,	-.32,	-.65,	-.32,	.00,	.45,	.40,	.31,	.11
10 ,	-.21,	-.67,	-.13,	-.70,	.01,	-.32,	.20,	.70,	.28,	.12
11 ,	-.26,	-.11,	.49,	.13,	-.37,	-.84,	-.21,	.60,	.24,	-.08
12 ,	.00,	-.85,	.58,	.00,	-1.00,	-1.47,	.34,	.41,	.00,	-.04
13 ,	3.15,	.44,	.87,	1.93,	-1.48,	.90,	.32,	1.98,	.22,	1.19

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

Age ,	4,	5,	6,	7,	8,	9,	10,	11,	12,	13
Mean Log q,	-6.1648,	-5.3665,	-4.9904,	-4.9317,	-5.0079,	-5.0320,	-4.9251,	-4.9470,	-4.9470,	-4.9470
S.E(Log q),	.4442,	.2785,	.2771,	.2576,	.3115,	.3581,	.4312,	.4955,	1.1586,	1.6960

Table 3.2.7 (continued)

Regression statistics :

Ages with q dependent on year class strength

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

3, .61, 1.403, 8.90, .60, 12, .48, -7.82,

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

4,	1.00,	.011,	6.18,	.59,	12,	.47,	-6.16,
5,	1.65,	-3.146,	2.36,	.74,	12,	.33,	-5.37,
6,	1.51,	-2.758,	2.66,	.78,	12,	.32,	-4.99,
7,	.96,	.278,	5.09,	.85,	12,	.26,	-4.93,
8,	1.38,	-1.500,	3.68,	.65,	12,	.40,	-5.01,
9,	1.03,	-.153,	4.94,	.71,	12,	.39,	-5.03,
10,	.71,	1.812,	5.58,	.82,	12,	.28,	-4.93,
11,	1.09,	-.238,	4.82,	.47,	12,	.57,	-4.95,
12,	.96,	.071,	5.27,	.23,	12,	1.12,	-5.25,
13,	1.04,	-.055,	3.84,	.19,	12,	1.39,	-3.87,

1

Terminal year survivor and F summaries :

Age 3 Catchability dependent on age and year class strength

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, , Weights,	Estimated F
FLT04: TRW EFFORT (C,	61281.,	.518,	.000,	.00,	1, .319,	.031
P shrinkage mean ,	29944.,	.52,,,,			.327,	.062
F shrinkage mean ,	95073.,	.50,,,,			.354,	.020

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
56650.,	.30,	.34,	3,	1.161,	.033

1

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

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, , Weights,	Estimated F
FLT04: TRW EFFORT (C,	44679.,	.349,	.189,	.54,	2, .652,	.068
F shrinkage mean ,	29231.,	.50,,,,			.348,	.102

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
38544.,	.29,	.21,	3,	.723,	.079

Table 3.2.7 (continued)

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

Year class = 1991

Fleet,	Estimated,	Int,	Ext,	Var,	N, Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	, Weights,	F
FLT04: TRW EFFORT (C,	14582.,	.225,	.171,	.76,	3, .802,	.136
F shrinkage mean ,	7935.,	.50,,,			.198,	.237

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
12931.,	.21,	.20,	4,	.971,	.152

1

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

Year class = 1990

Fleet,	Estimated,	Int,	Ext,	Var,	N, Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	, Weights,	F
FLT04: TRW EFFORT (C,	9166.,	.182,	.164,	.90,	4, .845,	.168
F shrinkage mean ,	3610.,	.50,,,			.155,	.382

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
7934.,	.17,	.23,	5,	1.309,	.192

Age 7 Catchability constant w.r.t. time and dependent on age

Year class = 1989

Fleet,	Estimated,	Int,	Ext,	Var,	N, Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	, Weights,	F
FLT04: TRW EFFORT (C,	2876.,	.160,	.094,	.58,	5, .852,	.230
F shrinkage mean ,	1270.,	.50,,,			.148,	.460

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
2548.,	.16,	.16,	6,	1.033,	.256

Table 3.2.7 (continued)

Age 8 Catchability constant w.r.t. time and dependent on age

Year class = 1988

Fleet,	Estimated,	Int,	Ext,	Var,	N, Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	, Weights,	F
FLT04: TRW EFFORT (C,	2790.,	.150,	.114,	.76,	6, .843,	.314
F shrinkage mean ,	1503.,	.50,,,,			.157,	.522

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
2532.,	.15,	.14,	7,	.931,	.341

Age 9 Catchability constant w.r.t. time and dependent on age

Year class = 1987

Fleet,	Estimated,	Int,	Ext,	Var,	N, Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	, Weights,	F
FLT04: TRW EFFORT (C,	722.,	.159,	.118,	.74,	7, .796,	.340
F shrinkage mean ,	377.,	.50,,,,			.204,	.574

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
633.,	.16,	.15,	8,	.908,	.380

1

Age 10 Catchability constant w.r.t. time and dependent on age

Year class = 1986

Fleet,	Estimated,	Int,	Ext,	Var,	N, Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	, Weights,	F
FLT04: TRW EFFORT (C,	423.,	.175,	.070,	.40,	8, .733,	.371
F shrinkage mean ,	217.,	.50,,,,			.267,	.629

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
354.,	.19,	.13,	9,	.725,	.430

Table 3.2.7 (continued)

Age 11 Catchability constant w.r.t. time and dependent on age

Year class = 1985

Fleet,	Estimated,	Int,	Ext,	Var,	N,	Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	,	Weights,	F
FLT04: TRW EFFORT (C,	289.,	.204,	.073,	.36,	9,	.662,	.372
F shrinkage mean ,	199.,	.50,,,,				.338,	.504

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
255.,	.22,	.09,	10,	.424,	.413

Age 12 Catchability constant w.r.t. time and age (fixed at the value for age) 11

Year class = 1984

Fleet,	Estimated,	Int,	Ext,	Var,	N,	Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	,	Weights,	F
FLT04: TRW EFFORT (C,	417.,	.212,	.124,	.59,	10,	.564,	.311
F shrinkage mean ,	295.,	.50,,,,				.436,	.415

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
359.,	.25,	.11,	11,	.459,	.353

Age 13 Catchability constant w.r.t. time and age (fixed at the value for age) 11

Year class = 1983

Fleet,	Estimated,	Int,	Ext,	Var,	N,	Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	,	Weights,	F
FLT04: TRW EFFORT (C,	111.,	.221,	.110,	.50,	11,	.408,	.520
F shrinkage mean ,	74.,	.50,,,,				.592,	.708

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
87.,	.31,	.12,	12,	.378,	.626

1

Age 14 Catchability constant w.r.t. time and age (fixed at the value for age) 11

Year class = 1982

Fleet,	Estimated,	Int,	Ext,	Var,	N,	Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	,	Weights,	F
PLT04: TRW EFFORT (C,	38.,	.194,	.080,	.41,	11,	.410,	.577
F shrinkage mean ,	53.,	.50,,,,				.590,	.444

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
47.,	.31,	.09,	12,	.301,	.495

Table 3.2.8

Lowestoft VPA Version 3.1

2-May-97 15:36:38

Extended Survivors Analysis

Saithe Iceland Va (run: XSABSI03/X03)

CPUE data from file /users/fish/ifad/ifapwork/nwwg/sai_icel/FLEET.X03

Catch data for 20 years. 1977 to 1996. Ages 3 to 15.

Fleet,	First, Last,	First, Last,	Alpha,	Beta
	year, year,	age, age		
FLT06: TRW CPU JAN.-,	1985, 1996,	4, 11,	.000,	.420
FLT08: TRW CPU JUNE ,	1985, 1996,	3, 12,	.420,	1.000
GN1: GILLNET JAN-DES,	1988, 1996,	5, 12,	.000,	1.000

Time series weights :

Tapered time weighting applied
Power = 3 over 20 years

Catchability analysis :

Catchability dependent on stock size for ages < 4

Regression type = C
Minimum of 5 points used for regression
Survivor estimates shrunk to the population mean for ages < 4

Catchability independent of age for ages >= 11

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 41 iterations

Regression weights

, .751, .820, .877, .921, .954, .976, .990, .997, 1.000, 1.000

Fishing mortalities

Age,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996
3,	.010,	.026,	.011,	.007,	.007,	.016,	.024,	.021,	.020,	.026
4,	.103,	.065,	.112,	.075,	.054,	.135,	.092,	.141,	.072,	.057
5,	.253,	.188,	.147,	.204,	.226,	.352,	.188,	.213,	.183,	.122
6,	.365,	.345,	.328,	.264,	.423,	.469,	.359,	.263,	.352,	.187
7,	.423,	.334,	.282,	.511,	.498,	.454,	.473,	.390,	.406,	.266
8,	.506,	.496,	.396,	.515,	.554,	.351,	.542,	.525,	.482,	.348
9,	.614,	.701,	.470,	.407,	.491,	.449,	.629,	.652,	.494,	.315
10,	.534,	.437,	.505,	.398,	.640,	.380,	.590,	.879,	.560,	.336
11,	.858,	.633,	.833,	.596,	.444,	.296,	.446,	.769,	.591,	.320
12,	.670,	.440,	.776,	.612,	.306,	.184,	.517,	.667,	.401,	.382
13,	2.370,	.658,	.654,	1.642,	.119,	.894,	.440,	1.751,	.296,	.649
14,	1.021,	.578,	.642,	.796,	.408,	.489,	.498,	1.152,	.514,	.506

Table 3.2.8 (Continued)

1

XSA population numbers (Thousands)

YEAR ,	3,	AGE	5,	6,	7,	8,	9,	10,		
11,	12,	4,								
1987 ,	1.10E+05,	5.77E+04,	2.19E+04,	1.96E+04,	9.34E+03,	3.75E+03,	1.59E+03,	1.32E+03,	9.56E+02,	1.31E+02,
1988 ,	5.63E+04,	8.90E+04,	4.26E+04,	1.39E+04,	1.11E+04,	5.01E+03,	1.85E+03,	7.06E+02,	6.36E+02,	3.32E+02,
1989 ,	3.20E+04,	4.49E+04,	6.83E+04,	2.89E+04,	8.08E+03,	6.52E+03,	2.50E+03,	7.52E+02,	3.73E+02,	2.76E+02,
1990 ,	2.27E+04,	2.59E+04,	3.28E+04,	4.82E+04,	1.71E+04,	4.99E+03,	3.59E+03,	1.28E+03,	3.72E+02,	1.33E+02,
1991 ,	3.16E+04,	1.85E+04,	1.97E+04,	2.19E+04,	3.03E+04,	8.38E+03,	2.44E+03,	1.96E+03,	7.03E+02,	1.68E+02,
1992 ,	1.69E+04,	2.57E+04,	1.43E+04,	1.29E+04,	1.18E+04,	1.51E+04,	3.94E+03,	1.22E+03,	8.45E+02,	3.69E+02,
1993 ,	3.10E+04,	1.36E+04,	1.84E+04,	8.25E+03,	6.59E+03,	6.12E+03,	8.69E+03,	2.06E+03,	6.85E+02,	5.15E+02,
1994 ,	3.70E+04,	2.48E+04,	1.02E+04,	1.25E+04,	4.72E+03,	3.36E+03,	2.91E+03,	3.80E+03,	9.35E+02,	3.59E+02,
1995 ,	8.61E+04,	2.97E+04,	1.76E+04,	6.73E+03,	7.84E+03,	2.62E+03,	1.63E+03,	1.24E+03,	1.29E+03,	3.55E+02,
1996 ,	9.03E+04,	6.91E+04,	2.26E+04,	1.20E+04,	3.88E+03,	4.28E+03,	1.32E+03,	8.13E+02,	5.81E+02,	5.85E+02,

Estimated population abundance at 1st Jan 1997

, .00E+00, 7.23E+04, 5.33E+04, 1.56E+04, 7.95E+03, 2.40E+03, 2.49E+03, 7.88E+02, 4.77E+02, 3.46E+02,

Taper weighted geometric mean of the VPA populations:

, 4.18E+04, 3.13E+04, 2.19E+04, 1.46E+04, 8.78E+03, 5.10E+03, 2.56E+03, 1.32E+03, 6.21E+02, 2.86E+02,

Standard error of the weighted Log(VPA populations) :

, .5849, .5496, .5118, .5466, .5696, .4901, .5271, .5287, .4750, .5838,

YEAR ,	13,	AGE	14,
1987 ,	3.29E+01,	8.29E+01,	
1988 ,	5.50E+01,	2.52E+00,	
1989 ,	1.75E+02,	2.33E+01,	
1990 ,	1.04E+02,	7.45E+01,	
1991 ,	5.90E+01,	1.65E+01,	
1992 ,	1.01E+02,	4.29E+01,	
1993 ,	2.51E+02,	3.38E+01,	
1994 ,	2.51E+02,	1.32E+02,	
1995 ,	1.51E+02,	3.58E+01,	
1996 ,	1.94E+02,	9.18E+01,	

Estimated population abundance at 1st Jan 1997

, 3.28E+02, 8.32E+01,

Taper weighted geometric mean of the VPA populations:

, 1.36E+02, 4.77E+01,

Standard error of the weighted Log(VPA populations) :

, .7284, 1.2023,

Table 3.2.8 (Continued)

Log catchability residuals.

Fleet : FLT06: TRW CPU JAN.-

Age		1985,	1986
3		No data for this fleet at this age	
4		-.93,	.45
5		.21,	1.35
6		-.24,	.04
7		.42,	-.66
8		.47,	-2.21
9		-.30,	99.99
10		-.07,	-1.97
11		-.37,	99.99
12		No data for this fleet at this age	

Age		1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996	
3		No data for this fleet at this age										
4		1.26,	-1.08,	-1.05,	.27,	-.67,	.40,	-.57,	.89,	.41,	.37	
5		.58,	.06,	-1.27,	-.42,	-.12,	.44,	-.53,	.33,	.06,	-.20	
6		.24,	.19,	-.05,	-.77,	-.24,	.21,	.37,	.08,	.31,	-.20	
7		-.26,	.01,	.04,	-.13,	-.35,	.03,	.58,	.03,	.23,	-.05	
8		-.26,	.08,	.10,	-.29,	-.04,	-.09,	.50,	.43,	.36,	.38	
9		-.76,	.77,	.28,	-.47,	.03,	-.14,	.05,	.38,	.03,	-.05	
10		-.72,	.35,	.50,	-.02,	.31,	-.50,	.13,	.83,	.31,	.12	
11		-1.04,	.85,	.21,	1.03,	.15,	-1.03,	-.30,	.22,	.40,	-.29	
12		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		4,	5,	6,	7,	8,	9,	10,	11
Mean Log q,		-18.8385,	-17.5331,	-16.7842,	-16.4824,	-16.6334,	-16.5977,	-16.6982,	-16.6499,
S.E(Log q),		.7798,	.6240,	.3295,	.3175,	.6691,	.4000,	.6836,	.6671,

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
4,	1.03,	-.062,	19.10,	.33,	12,	.85,	-18.84,
5,	2.47,	-1.644,	28.52,	.13,	12,	1.42,	-17.53,
6,	1.77,	-3.286,	22.34,	.68,	12,	.41,	-16.78,
7,	1.23,	-1.073,	18.16,	.72,	12,	.39,	-16.48,
8,	.91,	.207,	15.93,	.40,	12,	.64,	-16.63,
9,	1.04,	-.147,	16.93,	.65,	11,	.44,	-16.60,
10,	1.19,	-.368,	18.50,	.30,	12,	.85,	-16.70,
11,	1.37,	-.574,	20.42,	.23,	11,	.95,	-16.65,

Table 3.2.8 (Continued)

Fleet : FLT08: TRW CPU JUNE

Age	1985	1986
3	-.05	1.15
4	1.05	-.33
5	.35	-.16
6	.33	-.40
7	.00	.08
8	-.89	.41
9	-.44	.44
10	.73	.87
11	99.99	2.30
12	99.99	2.57

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
3	-.39	-.02	-1.53	-.43	-1.35	-.68	.38	.54	1.14	1.19
4	-.08	-.13	-.08	-.16	-.78	.40	.22	.28	-.28	.14
5	.07	-.21	-.69	-.05	-.27	.60	.13	.07	-.03	.17
6	-.25	.10	-.17	-.32	.09	.42	.20	-.29	.19	.04
7	.26	-.15	-.66	-.22	.35	.35	.19	-.01	.22	-.42
8	.66	.05	-.58	-.84	.38	.05	.17	.35	.33	-.27
9	.91	-.03	.12	-1.68	-.61	.13	.79	.46	.53	-.57
10	.57	-1.17	.48	-1.95	-.29	-.57	.57	1.46	.49	-.77
11	.71	-.75	1.47	-.39	-2.24	-.82	.23	1.05	.71	-1.44
12	.98	-1.08	1.56	99.99	99.99	-1.77	-.49	1.30	1.06	-.59

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

Age	4	5	6	7	8	9	10	11	12
Mean Log q	-17.9042	-17.0466	-16.6919	-16.7659	-16.8320	-16.8101	-16.8089	-16.9902	-16.9902
S.E(Log q)	.4260	.3281	.2671	.3228	.4923	.7435	1.0006	1.3187	1.4415

Regression statistics :

Ages with q dependent on year class strength

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

3	.52	2.191	15.19	.71	12	.41	-19.42
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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

4	.93	.272	17.41	.67	12	.42	-17.90
5	1.83	-2.956	22.86	.60	12	.45	-17.05
6	1.37	-2.032	19.32	.78	12	.32	-16.69
7	.84	1.127	15.51	.85	12	.27	-16.77
8	1.16	-.417	18.18	.44	12	.60	-16.83
9	.92	.177	16.13	.39	12	.72	-16.81
10	.49	1.957	11.92	.63	12	.43	-16.81
11	1.33	-.221	20.50	.05	11	1.86	-16.99
12	-1.72	-1.994	-13.07	.08	9	2.03	-16.68

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Table 3.2.8 (Continued)

Fleet : GN1: GILLNET JAN-DES

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
3	No data for this fleet at this age									
4	No data for this fleet at this age									
5	99.99	-1.47	-.61	-1.00	-.27	-.57	.70	.65	.95	1.19
6	99.99	.07	-.21	-1.03	-.96	-.68	.57	.49	.94	.66
7	99.99	-.11	.19	-.42	-1.01	-.41	.28	.46	.49	.45
8	99.99	.17	.52	-.08	-.26	-.65	.22	-.05	.26	-.06
9	99.99	.13	.44	-.32	.15	-.18	-.39	.03	.23	-.03
10	99.99	-.25	.29	-.28	.21	-.17	-.11	-.24	.53	.00
11	99.99	.04	.59	-.75	-.05	.03	-.11	-.10	.49	-.11
12	99.99	-.15	-.19	-.23	.09	-.51	-.38	-.24	.15	.03

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

Age	5	6	7	8	9	10	11	12
Mean Log q	-17.6552	-16.2107	-15.0441	-14.1572	-13.9045	-13.9295	-13.9342	-13.9342
S.E(Log q)	.9386	.7499	.5258	.3393	.2666	.2884	.3837	.2783

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
5	13.74	-1.764	114.87	.00	9	11.40	-17.66
6	41.71	-3.461	284.66	.00	9	19.95	-16.21
7	4.25	-6.945	34.26	.41	9	.83	-15.04
8	1.64	-1.925	17.69	.58	9	.48	-14.16
9	1.46	-2.378	16.69	.80	9	.31	-13.90
10	1.12	-.554	14.77	.75	9	.34	-13.93
11	.75	.957	12.08	.69	9	.29	-13.93
12	1.07	-.344	14.64	.81	9	.25	-14.09

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Table 3.2.8 (Continued)

Terminal year survivor and F summaries :

Age 3 Catchability dependent on age and year class strength

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, , Weights,	Estimated F
FLT06: TRW CPU JAN.-,	1.,	.000,	.000,	.00,	0, .000,	.000
FLT08: TRW CPU JUNE ,	236488.,	.989,	.000,	.00,	1, .120,	.008
GNI: GILLNET JAN-DES,	1.,	.000,	.000,	.00,	0, .000,	.000
P shrinkage mean ,	31310.,	.55, , , ,			.399,	.060
F shrinkage mean ,	107732.,	.50, , , ,			.482,	.018

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
72333.,	.35,	.98,	3,	2.834,	.026

¹

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

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, , Weights,	Estimated F
FLT06: TRW CPU JAN.-,	76915.,	.816,	.000,	.00,	1, .128,	.040
FLT08: TRW CPU JUNE ,	72422.,	.406,	.370,	.91,	2, .513,	.043
GNI: GILLNET JAN-DES,	1.,	.000,	.000,	.00,	0, .000,	.000
F shrinkage mean ,	30307.,	.50, , , ,			.360,	.099

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
53341.,	.29,	.34,	4,	1.163,	.057

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

Year class = 1991

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, , Weights,	Estimated F
FLT06: TRW CPU JAN.-,	16884.,	.510,	.293,	.57,	2, .160,	.118
FLT08: TRW CPU JUNE ,	17193.,	.262,	.176,	.67,	3, .603,	.116
GNI: GILLNET JAN-DES,	53787.,	.992,	.000,	.00,	1, .043,	.039
F shrinkage mean ,	8059.,	.50, , , ,			.193,	.234

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
15560.,	.21,	.20,	7,	.952,	.122

Table 3.2.8 (Continued)

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

Year class = 1990

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, , Weights,	Estimated F
FLT06: TRW CPU JAN.-,	7714.,	.287,	.227,	.79,	3, .278,	.197
FLT08: TRW CPU JUNE ,	8737.,	.199,	.068,	.34,	4, .546,	.176
GN1: GILLNET JAN-DES,	17464.,	.622,	.136,	.22,	2, .059,	.092

F shrinkage mean ,	3679.,	.50,,,,			.117,	.376
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Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
7947.,	.15,	.13,	10,	.876,	.187

Age 7 Catchability constant w.r.t. time and dependent on age

Year class = 1989

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, , Weights,	Estimated F
FLT06: TRW CPU JAN.-,	2634.,	.222,	.131,	.59,	4, .330,	.248
FLT08: TRW CPU JUNE ,	2274.,	.176,	.146,	.83,	5, .473,	.282
GN1: GILLNET JAN-DES,	4378.,	.423,	.143,	.34,	3, .095,	.157

F shrinkage mean ,	1315.,	.50,,,,			.101,	.447
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Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
2404.,	.13,	.11,	13,	.844,	.266

Age 8 Catchability constant w.r.t. time and dependent on age

Year class = 1988

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, , Weights,	Estimated F
FLT06: TRW CPU JAN.-,	2894.,	.214,	.108,	.50,	5, .269,	.304
FLT08: TRW CPU JUNE ,	2399.,	.171,	.138,	.81,	6, .406,	.357
GN1: GILLNET JAN-DES,	2779.,	.280,	.153,	.55,	4, .216,	.315

F shrinkage mean ,	1609.,	.50,,,,			.109,	.495
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Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
2493.,	.12,	.08,	16,	.670,	.348

Table 3.2.8 (Continued)

Age 9 Catchability constant w.r.t. time and dependent on age

Year class = 1987

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT06: TRW CPU JAN.-,	861.,	.215,	.095,	.44,	6,	.273,	.292
FLT08: TRW CPU JUNE ,	830.,	.181,	.161,	.89,	7,	.268,	.302
GN1: GILLNET JAN-DES,	870.,	.215,	.097,	.45,	5,	.352,	.289
F shrinkage mean ,	401.,	.50,,,,				.107,	.547

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
788.,	.12,	.08,	19,	.707,	.315

1

Age 10 Catchability constant w.r.t. time and dependent on age

Year class = 1986

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT06: TRW CPU JAN.-,	589.,	.230,	.089,	.39,	7,	.216,	.280
FLT08: TRW CPU JUNE ,	528.,	.204,	.162,	.79,	8,	.183,	.308
GN1: GILLNET JAN-DES,	509.,	.188,	.063,	.34,	6,	.476,	.317
F shrinkage mean ,	224.,	.50,,,,				.125,	.615

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
477.,	.13,	.08,	22,	.675,	.336

Age 11 Catchability constant w.r.t. time and dependent on age

Year class = 1985

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT06: TRW CPU JAN.-,	363.,	.266,	.122,	.46,	8,	.201,	.307
FLT08: TRW CPU JUNE ,	360.,	.245,	.198,	.81,	9,	.134,	.309
GN1: GILLNET JAN-DES,	403.,	.190,	.128,	.67,	7,	.504,	.280
F shrinkage mean ,	194.,	.50,,,,				.160,	.513

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
346.,	.14,	.09,	25,	.637,	.320

Table 3.2.8 (Continued)

Age 12 Catchability constant w.r.t. time and age (fixed at the value for age) 11

Year class = 1984

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Weights,	Scaled, Weights,	Estimated F
FLT06: TRW CPU JAN.-,	359.,	.281,	.193,	.69,	8,	.107,	.353
FLT08: TRW CPU JUNE ,	358.,	.318,	.209,	.66,	10,	.087,	.354
GN1: GILLNET JAN-DES,	330.,	.193,	.112,	.58,	8,	.618,	.379
F shrinkage mean ,	293.,	.50,,,,				.188,	.418

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
328.,	.16,	.07,	27,	.433,	.382

Age 13 Catchability constant w.r.t. time and age (fixed at the value for age) 11

Year class = 1983

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Weights,	Scaled, Weights,	Estimated F
FLT06: TRW CPU JAN.-,	86.,	.258,	.074,	.29,	8,	.092,	.635
FLT08: TRW CPU JUNE ,	111.,	.313,	.170,	.54,	10,	.074,	.520
GN1: GILLNET JAN-DES,	85.,	.189,	.061,	.32,	8,	.525,	.638
F shrinkage mean ,	74.,	.50,,,,				.309,	.707

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
83.,	.19,	.04,	27,	.235,	.649

1

Age 14 Catchability constant w.r.t. time and age (fixed at the value for age) 11

Year class = 1982

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Weights,	Scaled, Weights,	Estimated F
FLT06: TRW CPU JAN.-,	41.,	.240,	.096,	.40,	8,	.109,	.550
FLT08: TRW CPU JUNE ,	37.,	.247,	.203,	.82,	10,	.088,	.589
GN1: GILLNET JAN-DES,	39.,	.170,	.052,	.31,	7,	.466,	.566
F shrinkage mean ,	60.,	.50,,,,				.338,	.403

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
45.,	.19,	.07,	26,	.349,	.506

1

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Table 3.2.9 Saithe in Division Va. Results from TSA-runs.

TSA-Catch at age, no trend.

STOCK IN NUMBERS:

Age/year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
4	23271	16591	18496	27050	38247	28578	57557	87603	44635	25129	18628	22903	11411	19031	19186	39925
5	31679	17822	12470	13810	21084	27751	21922	42312	66159	32735	18960	14189	15906	8356	12929	14110
6	20793	22308	12127	8851	9972	14190	19035	13788	28568	44941	21923	12255	7825	10392	5392	8318
7	5661	12479	13914	7679	5658	6273	8999	10688	8056	17259	27290	11799	6258	4196	6102	2924
8	4806	3235	6353	7912	4312	3296	3707	4763	5901	4674	8937	13978	6122	3029	2119	3024
9	1362	2568	1574	3188	3947	2397	1765	1854	2300	3063	2231	4193	7376	2732	1337	939
10	512	635	1252	828	1636	2274	1307	853	830	1144	1514	1021	2150	3240	1111	597
11	166	235	288	677	401	900	1175	641	435	412	569	637	504	978	1313	488

STANDARD DEVIATION OF STOCK ESTIMATES:

Age/year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
4	1604	1181	1283	1682	2743	1841	4339	6515	3004	1747	1435	2672	2039	4771	5931	12769
5	2496	1248	937	982	1326	1991	1439	3222	4922	2168	1366	1133	2115	1630	3863	4747
6	1347	1874	918	680	742	933	1486	1022	2331	3417	1590	1025	872	1629	1241	2955
7	584	909	1261	609	455	481	652	991	699	1519	2191	1055	699	663	1181	920
8	456	320	615	745	410	281	312	427	664	460	940	1341	686	504	484	837
9	194	283	200	379	490	257	180	199	281	412	281	600	826	469	353	339
10	133	131	187	123	286	325	180	130	142	191	271	196	393	599	335	246
11	70	84	87	107	87	188	206	123	88	93	123	179	123	261	411	223

FISHING MORTALITY RATES:

Age/year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
4	0.067	0.074	0.084	0.049	0.115	0.065	0.111	0.08	0.109	0.081	0.072	0.143	0.09	0.144	0.099	0.098
5	0.146	0.182	0.138	0.126	0.193	0.17	0.241	0.192	0.183	0.199	0.228	0.337	0.208	0.22	0.217	0.198
6	0.305	0.272	0.257	0.248	0.262	0.253	0.349	0.311	0.303	0.293	0.401	0.443	0.351	0.321	0.381	0.302
7	0.359	0.443	0.353	0.375	0.335	0.324	0.426	0.377	0.342	0.454	0.469	0.446	0.471	0.42	0.482	0.394
8	0.428	0.512	0.487	0.495	0.382	0.423	0.493	0.514	0.455	0.537	0.548	0.432	0.572	0.551	0.557	0.504
9	0.529	0.517	0.429	0.457	0.342	0.405	0.524	0.591	0.495	0.505	0.57	0.468	0.619	0.629	0.56	0.498
10	0.525	0.554	0.369	0.516	0.398	0.46	0.512	0.472	0.499	0.498	0.64	0.506	0.578	0.668	0.567	0.51
11	0.481	0.436	0.357	0.48	0.378	0.428	0.529	0.523	0.543	0.516	0.584	0.519	0.59	0.616	0.554	0.507
F(4-9)	0.306	0.333	0.291	0.292	0.272	0.273	0.357	0.344	0.315	0.345	0.381	0.378	0.385	0.381	0.383	0.332

STANDARD DEVIATIONS OF LOG(F):

Age/year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
4	0.22	0.15	0.18	0.19	0.25	0.21	0.29	0.33	0.25	0.17	0.13	0.19	0.12	0.21	0.22	0.33
5	0.13	0.13	0.1	0.09	0.13	0.11	0.12	0.13	0.16	0.11	0.11	0.11	0.11	0.12	0.14	0.21
6	0.11	0.15	0.12	0.14	0.13	0.11	0.11	0.1	0.12	0.14	0.1	0.1	0.09	0.13	0.16	0.21
7	0.16	0.1	0.14	0.12	0.12	0.12	0.1	0.11	0.1	0.12	0.13	0.1	0.11	0.11	0.16	0.21
8	0.13	0.12	0.1	0.14	0.12	0.13	0.12	0.1	0.12	0.12	0.12	0.14	0.12	0.13	0.15	0.21
9	0.14	0.14	0.13	0.14	0.16	0.16	0.14	0.13	0.13	0.15	0.14	0.15	0.16	0.15	0.17	0.23
10	0.17	0.15	0.17	0.18	0.17	0.19	0.17	0.16	0.16	0.17	0.18	0.17	0.19	0.18	0.19	0.23
11	0.2	0.19	0.19	0.2	0.18	0.19	0.19	0.18	0.19	0.19	0.19	0.19	0.2	0.2	0.21	0.24

Table 3.2.9 (continued)

TSA-Catch at age, trend estimated.

STOCK IN NUMBERS:

Age/year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
4	23043	16419	18534	27040	38338	28518	56867	84422	44514	25106	18606	22073	11033	17297	16509	34004
5	32982	17661	12417	13853	20996	27971	21811	41850	63439	32897	18883	14082	15329	8063	11650	11898
6	20553	23446	12014	8801	9945	14199	19191	13907	28238	42908	21992	12215	7813	9917	5069	7177
7	5534	12291	14725	7656	5602	6224	8998	10857	8144	17020	25820	11913	6187	4213	5614	2596
8	4930	3224	6216	8447	4302	3240	3656	4785	5977	4670	8805	13091	6115	3009	2085	2589
9	1347	2692	1585	3175	4201	2368	1734	1836	2315	3071	2219	4106	6749	2742	1297	865
10	491	631	1355	858	1641	2424	1289	845	833	1147	1516	1016	2067	2932	1101	544
11	178	226	293	761	419	905	1252	635	429	412	569	647	493	930	1157	456

STANDARD DEVIATION OF STOCK ESTIMATES:

Age/year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
4	1534	1143	1234	1583	2541	1719	4005	6053	2711	1505	1096	1953	1302	3035	4000	11015
5	2505	1202	899	933	1238	1856	1333	2952	4509	1989	1164	851	1518	1021	2417	3152
6	1324	1905	887	647	693	858	1364	937	2110	3102	1438	843	615	1117	746	1778
7	563	901	1289	586	417	437	582	881	621	1351	1934	904	536	433	742	516
8	467	326	605	759	377	248	269	365	565	398	802	1113	553	346	289	470
9	216	300	206	375	479	225	148	162	227	341	233	471	639	331	215	183
10	154	152	202	128	271	312	148	102	111	155	219	154	295	414	216	138
11	84	103	104	119	88	173	185	97	67	72	98	137	93	176	255	128

FISHING MORTALITY RATES:

Age/year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
4	0.064	0.07	0.084	0.049	0.112	0.067	0.107	0.076	0.103	0.085	0.078	0.149	0.103	0.161	0.121	0.117
5	0.141	0.176	0.136	0.13	0.191	0.176	0.244	0.193	0.18	0.203	0.235	0.356	0.231	0.26	0.271	0.25
6	0.29	0.267	0.251	0.25	0.261	0.256	0.362	0.329	0.306	0.292	0.41	0.47	0.389	0.369	0.459	0.38
7	0.336	0.417	0.347	0.377	0.334	0.317	0.432	0.396	0.356	0.46	0.472	0.467	0.509	0.487	0.571	0.489
8	0.402	0.485	0.463	0.499	0.381	0.411	0.48	0.526	0.465	0.544	0.563	0.438	0.601	0.629	0.665	0.623
9	0.477	0.477	0.408	0.451	0.332	0.394	0.517	0.591	0.503	0.503	0.581	0.48	0.63	0.7	0.66	0.602
10	0.464	0.493	0.345	0.508	0.394	0.452	0.505	0.475	0.504	0.499	0.649	0.521	0.598	0.727	0.67	0.615
11	0.421	0.392	0.332	0.464	0.369	0.42	0.52	0.525	0.543	0.516	0.591	0.536	0.615	0.679	0.656	0.612
F(4-9)	0.285	0.315	0.282	0.293	0.269	0.270	0.357	0.352	0.319	0.348	0.390	0.393	0.411	0.434	0.458	0.410

STANDARD DEVIATIONS OF LOG(F):

Age/year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
4	0.21	0.18	0.19	0.19	0.23	0.19	0.27	0.31	0.22	0.15	0.11	0.16	0.1	0.16	0.17	0.31
5	0.12	0.11	0.1	0.09	0.13	0.1	0.12	0.12	0.15	0.1	0.11	0.1	0.09	0.1	0.12	0.17
6	0.1	0.14	0.11	0.14	0.13	0.1	0.11	0.1	0.12	0.14	0.1	0.1	0.08	0.12	0.13	0.17
7	0.15	0.09	0.13	0.11	0.12	0.12	0.1	0.11	0.1	0.11	0.13	0.1	0.1	0.1	0.14	0.17
8	0.12	0.11	0.09	0.13	0.12	0.12	0.12	0.1	0.12	0.11	0.12	0.13	0.11	0.12	0.13	0.17
9	0.13	0.13	0.12	0.13	0.15	0.15	0.14	0.13	0.13	0.14	0.14	0.15	0.15	0.14	0.16	0.18
10	0.16	0.14	0.15	0.17	0.16	0.18	0.16	0.16	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.19
11	0.19	0.18	0.18	0.19	0.18	0.19	0.18	0.18	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19

Table 3.2.9 (Continued)

TSA - Catch at age and CPUE from trawlers, June-Dec., no trend estimated.

STOCK IN NUMBERS:

Age/year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
4	22059	16589	18869	27339	37000	28717	56663	84814	45379	25614	19867	24514	14615	19091	21444	41768
5	33121	16874	12507	14089	21304	26837	22039	41498	63814	33494	19307	15111	17304	10906	13065	15917
6	20920	23403	11455	8866	10123	14410	18464	13967	28000	43161	22517	12619	8622	11461	7312	8534
7	5690	12611	14666	7157	5657	6430	9151	10425	8206	16887	26328	12314	6552	4813	6914	4340
8	4846	3254	6536	8431	4032	3310	3805	4878	5793	4705	8790	13827	6430	3316	2580	3680
9	1376	2589	1585	3282	4197	2263	1769	1899	2378	2977	2253	4166	7335	2981	1559	1249
10	505	643	1268	838	1726	2464	1231	859	866	1187	1470	1045	2137	3312	1304	755
11	163	231	295	690	414	963	1277	604	439	432	593	642	518	1002	1427	623

STANDARD DEVIATION OF STOCK ESTIMATES:

Age/year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
4	1419	1048	1093	1551	2558	1774	3999	5765	2834	1626	1316	2242	1693	3445	4821	12593
5	2324	1100	824	823	1215	1877	1381	2875	4296	2029	1265	1031	1768	1352	2778	3861
6	1339	1742	795	597	604	870	1383	948	2039	2908	1473	921	800	1361	1034	2109
7	589	900	1168	509	390	395	605	876	629	1287	1825	964	621	603	984	775
8	459	320	595	724	322	254	270	391	560	392	774	1168	632	442	439	724
9	197	285	197	369	480	215	171	181	253	329	235	498	748	436	312	321
10	138	134	187	121	274	337	155	121	127	165	212	166	334	550	314	226
11	73	88	89	107	84	190	222	106	80	80	103	140	107	224	376	215

FISHING MORTALITY RATES:

Age/year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
4	0.068	0.073	0.083	0.047	0.114	0.065	0.114	0.079	0.104	0.083	0.074	0.136	0.084	0.14	0.094	0.09
5	0.141	0.186	0.139	0.125	0.188	0.169	0.246	0.194	0.178	0.197	0.225	0.328	0.201	0.197	0.212	0.18
6	0.302	0.267	0.266	0.249	0.254	0.252	0.362	0.323	0.304	0.278	0.4	0.447	0.347	0.303	0.319	0.279
7	0.357	0.441	0.348	0.372	0.334	0.324	0.422	0.386	0.352	0.451	0.442	0.448	0.462	0.403	0.424	0.3
8	0.427	0.515	0.489	0.497	0.372	0.426	0.494	0.515	0.458	0.532	0.547	0.423	0.557	0.533	0.506	0.417
9	0.523	0.513	0.422	0.441	0.327	0.408	0.522	0.582	0.493	0.497	0.568	0.464	0.595	0.601	0.511	0.408
10	0.52	0.547	0.362	0.502	0.384	0.458	0.512	0.47	0.494	0.488	0.626	0.502	0.556	0.632	0.519	0.428
11	0.478	0.433	0.349	0.467	0.365	0.411	0.522	0.534	0.535	0.5	0.571	0.52	0.569	0.586	0.507	0.43
F(4-9)	0.303	0.333	0.291	0.289	0.265	0.274	0.36	0.347	0.315	0.34	0.376	0.374	0.374	0.363	0.344	0.279

STANDARD DEVIATIONS OF LOG(F):

Age/year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
4	0.22	0.16	0.19	0.2	0.25	0.22	0.3	0.33	0.24	0.15	0.12	0.18	0.11	0.2	0.21	0.33
5	0.13	0.12	0.1	0.09	0.14	0.12	0.12	0.13	0.16	0.11	0.11	0.11	0.1	0.11	0.12	0.18
6	0.11	0.15	0.12	0.14	0.14	0.11	0.12	0.1	0.13	0.14	0.11	0.11	0.09	0.13	0.15	0.18
7	0.16	0.1	0.13	0.13	0.12	0.11	0.1	0.12	0.11	0.12	0.13	0.11	0.12	0.11	0.16	0.19
8	0.13	0.13	0.11	0.14	0.14	0.13	0.11	0.1	0.13	0.13	0.13	0.14	0.13	0.14	0.16	0.2
9	0.14	0.14	0.14	0.15	0.16	0.16	0.14	0.13	0.13	0.16	0.15	0.16	0.17	0.15	0.18	0.22
10	0.17	0.15	0.17	0.18	0.17	0.19	0.17	0.16	0.16	0.17	0.18	0.18	0.19	0.19	0.2	0.23
11	0.2	0.19	0.19	0.2	0.19	0.19	0.19	0.19	0.19	0.2	0.2	0.2	0.21	0.21	0.22	0.24

Table 3.2.9 (Continued)

TSA-Catch at age and CPUE from trawlers, June-Dec.. Trend estimated.

STOCK IN NUMBERS:

Age/year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
4	21876	16454	18838	27348	37318	28697	56229	84027	44669	25089	19218	23192	13089	17155	18419	36897
5	33787	16735	12434	14074	21253	27187	21983	41314	63204	33011	18901	14606	16224	9694	11539	13434
6	20619	24008	11341	8827	10036	14402	18661	14017	27868	42902	22124	12287	8162	10612	6312	7223
7	5546	12355	15041	7120	5600	6361	9116	10522	8205	16824	26135	12004	6274	4465	6171	3517
8	4874	3217	6338	8657	3983	3255	3767	4861	5815	4705	8735	13575	6193	3108	2274	3042
9	1349	2634	1568	3193	4258	2207	1735	1883	2359	2999	2247	4103	7129	2817	1380	999
10	493	628	1302	833	1653	2471	1190	839	855	1175	1483	1035	2086	3146	1166	607
11	172	226	288	716	404	909	1267	580	424	425	588	640	509	957	1280	507

STANDARD DEVIATION OF STOCK ESTIMATES:

Age/year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
4	1418	1021	1078	1486	2432	1655	3768	5562	2663	1499	1094	1859	1285	2724	3823	11266
5	2321	1106	800	809	1160	1786	1284	2732	4137	1937	1163	851	1441	1016	2170	3031
6	1311	1754	805	579	588	821	1300	893	1941	2839	1402	831	622	1078	757	1600
7	565	884	1177	515	373	374	559	820	590	1249	1783	885	528	444	737	538
8	459	318	579	720	313	233	247	359	522	378	750	1091	553	346	303	498
9	203	290	196	356	461	195	148	162	230	320	228	459	666	343	223	203
10	145	140	191	120	255	311	133	103	114	158	209	155	297	445	229	149
11	78	94	94	110	81	168	191	88	68	75	101	133	96	182	280	141

FISHING MORTALITY RATES:

Age/year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
4	0.066	0.071	0.083	0.049	0.112	0.066	0.109	0.076	0.103	0.083	0.074	0.142	0.092	0.154	0.11	0.106
5	0.14	0.184	0.138	0.13	0.188	0.176	0.245	0.194	0.177	0.2	0.231	0.344	0.215	0.226	0.253	0.223
6	0.296	0.269	0.262	0.254	0.255	0.257	0.37	0.33	0.305	0.282	0.408	0.462	0.37	0.341	0.382	0.348
7	0.344	0.431	0.349	0.378	0.336	0.323	0.428	0.393	0.356	0.455	0.453	0.46	0.488	0.457	0.502	0.381
8	0.416	0.505	0.482	0.509	0.377	0.421	0.492	0.522	0.46	0.538	0.556	0.432	0.583	0.598	0.606	0.53
9	0.5	0.501	0.422	0.456	0.332	0.406	0.525	0.589	0.497	0.501	0.575	0.473	0.617	0.668	0.61	0.525
10	0.49	0.524	0.359	0.521	0.398	0.463	0.516	0.479	0.498	0.491	0.637	0.51	0.578	0.695	0.62	0.547
11	0.445	0.416	0.346	0.481	0.378	0.424	0.53	0.542	0.541	0.504	0.579	0.527	0.592	0.645	0.605	0.547
F(4-9)	0.294	0.327	0.289	0.296	0.267	0.275	0.362	0.351	0.316	0.343	0.383	0.386	0.394	0.407	0.411	0.352

STANDARD DEVIATIONS OF LOG(F):

Age/year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
4	0.22	0.17	0.19	0.19	0.23	0.2	0.27	0.31	0.22	0.15	0.12	0.17	0.1	0.17	0.17	0.31
5	0.12	0.12	0.1	0.09	0.13	0.11	0.12	0.13	0.15	0.1	0.11	0.1	0.09	0.09	0.11	0.16
6	0.1	0.14	0.12	0.13	0.14	0.1	0.11	0.1	0.12	0.14	0.1	0.1	0.08	0.11	0.12	0.16
7	0.15	0.09	0.12	0.12	0.11	0.11	0.1	0.11	0.11	0.12	0.13	0.1	0.1	0.1	0.14	0.16
8	0.13	0.12	0.1	0.13	0.13	0.12	0.11	0.1	0.12	0.12	0.12	0.13	0.11	0.12	0.13	0.17
9	0.13	0.13	0.13	0.13	0.15	0.15	0.14	0.13	0.13	0.15	0.14	0.15	0.15	0.14	0.15	0.18
10	0.17	0.14	0.16	0.17	0.16	0.18	0.17	0.16	0.16	0.16	0.17	0.17	0.17	0.17	0.17	0.19
11	0.19	0.18	0.18	0.19	0.18	0.19	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.2

Table 3.2.10

Run title : Saithe Iceland Va (run: SVPBSI06/V06)

At 3-May-97 15:47:02

Traditional vpa using screen input for terminal F

Table 8 Fishing mortality (F) at age

Age/year	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
3	0.003	0.0123	0.0096	0.0109	0.0116	0.0258	0.0036	0.0012	0.0121	0.0479
4	0.0959	0.074	0.1095	0.0645	0.0665	0.0796	0.1162	0.0277	0.1206	0.0568
5	0.2524	0.1538	0.1777	0.2174	0.119	0.1953	0.1039	0.0713	0.1929	0.1773
6	0.281	0.212	0.3574	0.3693	0.3662	0.2396	0.2618	0.2596	0.249	0.2302
7	0.2336	0.3289	0.342	0.3778	0.3656	0.5582	0.3616	0.3923	0.3627	0.3189
8	0.354	0.3531	0.312	0.5534	0.4546	0.5941	0.6745	0.5619	0.3783	0.4897
9	0.4772	0.3025	0.1715	0.276	0.4935	0.6592	0.5262	0.5627	0.2128	0.3581
10	0.3587	0.331	0.7625	0.2293	0.278	0.5315	0.3494	0.9941	0.7385	0.9009
11	0.4977	0.3039	0.6698	0.3939	0.0763	0.1006	0.1133	0.8847	0.5315	0.9168
12	0.3534	0.5249	0.5861	0.2524	0.8706	0.0572	0.0267	0.7246	0.1496	0.8846
13	0.2025	0.5657	0.6027	0.1374	0.5457	0.7539	0.0041	0.7003	1.1654	0.2963
14	0.353	0.431	0.655	0.253	0.443	0.361	0.123	0.826	0.646	0.75
+gp	0.353	0.431	0.655	0.253	0.443	0.361	0.123	0.826	0.646	0.75
0 FBAR 4- 9	0.2823	0.2374	0.245	0.3097	0.3109	0.3877	0.3407	0.3126	0.2527	0.2718

Age/year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	F94-96
3	0.0099	0.0271	0.0115	0.0077	0.0083	0.0203	0.0387	0.0431	0.0472	0.029	0.0398
4	0.1041	0.0663	0.1159	0.0791	0.0597	0.1628	0.1188	0.2433	0.153	0.14	0.1788
5	0.255	0.1894	0.1505	0.2109	0.2409	0.3987	0.2347	0.289	0.3601	0.294	0.3144
6	0.3659	0.3485	0.3294	0.2695	0.4423	0.5097	0.4313	0.3503	0.5381	0.459	0.4491
7	0.4226	0.336	0.2859	0.5129	0.5124	0.4866	0.5425	0.5145	0.6244	0.503	0.5473
8	0.5071	0.4954	0.3983	0.5236	0.5569	0.3678	0.6073	0.6649	0.7719	0.709	0.7152
9	0.6091	0.7014	0.4688	0.4108	0.5062	0.454	0.6737	0.8101	0.7588	0.709	0.7593
10	0.5347	0.4328	0.5075	0.3971	0.6473	0.3989	0.5988	1.0193	0.8705	0.709	0.8663
11	0.8543	0.6336	0.8111	0.5994	0.4417	0.3032	0.4796	0.7899	0.8273	0.709	0.7754
12	0.6816	0.4409	0.774	0.5823	0.3105	0.1831	0.5333	0.7553	0.4234	0.709	0.6292
13	2.31	0.6808	0.6522	1.5778	0.1122	0.903	0.4361	1.8534	0.3671	0.709	0.9765
14	1.095	0.547	0.686	0.789	0.378	0.447	0.512	1.105	0.622	0.709	0.812
+gp	1.095	0.547	0.686	0.789	0.378	0.447	0.512	1.105	0.622	0.709	
0 FBAR 4- 9	0.3773	0.3562	0.2915	0.3345	0.3864	0.3966	0.4347	0.4787	0.5344	0.469	

Table 3.2.11

Run title : Saithe Iceland Va (run: SVPBSI06/V06)

At 3-May-97 15:47:02

Traditional vpa using screen input for terminal F

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

Age/year	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
3	21672	49434	55231	28020	19421	22014	32487	47574	34539	73270
4	25276	17690	39978	44786	22693	15717	17565	26501	38903	27938
5	14078	18801	13451	29338	34376	17384	11883	12803	21104	28232
6	8074	8955	13199	9219	19327	24986	11708	8768	9761	14248
7	5466	4991	5931	7559	5217	10971	16098	7378	5537	6230
8	3930	3543	2941	3450	4242	2963	5140	9180	4080	3155
9	4407	2258	2038	1763	1624	2204	1339	2144	4285	2288
10	3486	2239	1366	1405	1095	812	934	648	1000	2836
11	1501	1994	1317	522	915	679	391	539	196	391
12	612	747	1205	552	288	694	503	286	182	94
13	426	352	362	549	351	99	537	401	113	128
14	44	285	164	162	392	166	38	438	163	29
+gp	181	172	0	285	432	358	1655	368	668	196
TOTAL	89154	111463	137183	127610	110372	99049	100277	117027	120531	159037

Age/year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997 GMS -94
3	107441	54442	30290	20450	26417	13275	19088	18331	37599	81909	0
4	57183	87102	43383	24515	16614	21449	10650	15035	14375	29364	65144
5	21611	42187	66741	31630	18545	12814	14923	7743	9651	10099	20900
6	19359	13710	28580	47010	20972	11933	7042	9662	4748	5512	6162
7	9267	10993	7922	16833	29395	11033	5869	3745	5573	2270	2852
8	3708	4972	6432	4873	8251	14418	5553	2793	1833	2444	1124
9	1583	1828	2481	3536	2363	3871	8172	2477	1176	694	985
10	1310	705	742	1271	1920	1166	2013	3411	902	451	279
11	943	628	374	366	699	823	641	905	1008	309	182
12	128	329	273	136	164	368	497	325	336	361	125
13	32	53	173	103	62	99	251	239	125	180	145
14	78	3	22	74	17	46	33	133	31	71	73
+gp	36	3	18	84	146	3	3	83	40	62	54
TOTAL	222678	216954	187431	150881	125567	91297	74734	64882	77397	133726	98025

Table 3.2.12

Run title : Saithe Iceland Va (run: SVPBSI06/V06)

At 3-May-97 15:47:03

Table 16 Summary (without SOP correction)

Traditional vpa using screen input for terminal F

	RECRUITS	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 4-9
Age 3						
1962	30999	277003	142184	50514	0.3553	0.2867
1963	84106	336274	144613	48011	0.332	0.304
1964	55195	380521	141947	60257	0.4245	0.25
1965	94062	465836	165999	60177	0.3625	0.2313
1966	70223	550397	214136	52003	0.2429	0.1783
1967	68332	648019	279292	75712	0.2711	0.2375
1968	59672	697092	345778	77549	0.2243	0.2102
1969	88751	762546	395280	115853	0.2931	0.2947
1970	66328	755885	399454	116601	0.2919	0.3225
1971	50638	717074	381384	136764	0.3586	0.4429
1972	26456	603752	334676	111301	0.3326	0.3609
1973	26103	516600	313690	110888	0.3535	0.3446
1974	25125	434163	288072	97568	0.3387	0.2875
1975	25927	387979	264698	87954	0.3323	0.2779
1976	31235	347146	227234	82003	0.3609	0.3256
1977	21672	300238	186664	62026	0.3323	0.2823
1978	49434	307893	165549	49672	0.3	0.2374
1979	55231	342153	159512	63504	0.3981	0.245
1980	28020	349624	158991	58347	0.367	0.3097
1981	19421	332579	161706	58986	0.3648	0.3109
1982	22014	317833	170362	68615	0.4028	0.3877
1983	32487	327344	185286	58266	0.3145	0.3407
1984	47574	355241	174159	62719	0.3601	0.3126
1985	34539	348952	160696	57101	0.3553	0.2527
1986	73270	412957	169252	66376	0.3922	0.2718
1987	107441	495619	164665	80559	0.4892	0.3773
1988	54442	508362	161450	77247	0.4785	0.3562
1989	30290	470914	170746	82425	0.4827	0.2915
1990	20450	444416	190373	98130	0.5155	0.3345
1991	26417	364799	188882	102737	0.5439	0.3864
1992	13275	290918	171943	79597	0.4629	0.3966
1993	19088	242055	149815	71648	0.4782	0.4347
1994	18331	196803	120371	64338	0.5345	0.4787
1995	37599	186681	89370	48650	0.5444	0.5344
1996	81909	240164	83580	40099	0.4798	0.469
Arith.						
Mean	45602	420452	206337	75263	0.3849	0.3247
Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)		

Table 3.2.13

The SAS System

12:06 Saturday, May 3, 1997 1

Saithe in the Iceland Grounds (Fishing Area Va)

Prediction with management option table: Input data

Year: 1997								
Age	Stock size	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
3	25.000	0.2000	0.1000	0.0000	0.0000	1.341	0.0380	1.341
4	19.877	0.2000	0.2200	0.0000	0.0000	1.917	0.1700	1.917
5	13.897	0.2000	0.3900	0.0000	0.0000	2.613	0.2980	2.613
6	6.162	0.2000	0.6200	0.0000	0.0000	3.709	0.4260	3.709
7	2.852	0.2000	0.8000	0.0000	0.0000	4.825	0.5200	4.825
8	1.124	0.2000	0.9100	0.0000	0.0000	6.041	0.6790	6.041
9	0.985	0.2000	0.9500	0.0000	0.0000	7.268	0.7210	7.268
10	0.279	0.2000	1.0000	0.0000	0.0000	6.937	0.8220	6.934
11	0.182	0.2000	1.0000	0.0000	0.0000	7.742	0.7360	7.742
12	0.125	0.2000	1.0000	0.0000	0.0000	8.702	0.5970	8.702
13	0.145	0.2000	1.0000	0.0000	0.0000	9.964	0.9270	9.964
14+	0.073	0.2000	1.0000	0.0000	0.0000	11.781	0.7710	11.781
Unit	Millions	-	-	-	-	Kilograms	-	Kilograms

Year: 1998								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
3	25.000	0.2000	0.1000	0.0000	0.0000	1.341	0.0380	1.341
4	.	0.2000	0.2200	0.0000	0.0000	2.011	0.1700	2.011
5	.	0.2000	0.3900	0.0000	0.0000	2.736	0.2980	2.736
6	.	0.2000	0.6100	0.0000	0.0000	3.629	0.4260	3.629
7	.	0.2000	0.8000	0.0000	0.0000	4.801	0.5200	4.801
8	.	0.2000	0.9000	0.0000	0.0000	5.984	0.6790	5.984
9	.	0.2000	0.9600	0.0000	0.0000	7.648	0.7210	7.648
10	.	0.2000	1.0000	0.0000	0.0000	6.937	0.8220	6.937
11	.	0.2000	1.0000	0.0000	0.0000	7.472	0.7360	7.742
12	.	0.2000	1.0000	0.0000	0.0000	8.702	0.5970	8.702
13	.	0.2000	1.0000	0.0000	0.0000	9.964	0.9270	9.964
14+	.	0.2000	1.0000	0.0000	0.0000	11.781	0.7710	11.781
Unit	Millions	-	-	-	-	Kilograms	-	Kilograms

Year: 1999								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
3	25.000	0.2000	0.1000	0.0000	0.0000	1.341	0.0380	1.341
4	.	0.2000	0.2200	0.0000	0.0000	2.011	0.1700	2.011
5	.	0.2000	0.3900	0.0000	0.0000	2.804	0.2980	2.804
6	.	0.2000	0.6100	0.0000	0.0000	3.718	0.4260	3.718
7	.	0.2000	0.7800	0.0000	0.0000	4.716	0.5200	4.716
8	.	0.2000	0.9000	0.0000	0.0000	5.967	0.6790	5.967
9	.	0.2000	0.9600	0.0000	0.0000	6.817	0.7210	6.817
10	.	0.2000	1.0000	0.0000	0.0000	6.937	0.8220	6.937
11	.	0.2000	1.0000	0.0000	0.0000	7.742	0.7360	7.742
12	.	0.2000	1.0000	0.0000	0.0000	8.702	0.5970	8.702
13	.	0.2000	1.0000	0.0000	0.0000	9.964	0.9270	9.964
14+	.	0.2000	1.0000	0.0000	0.0000	11.781	0.7710	11.781
Unit	Millions	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : PRED94
Date and time: 03MAY97:14:06

Table 3.2.14

The SAS System

12:06 Saturday, May 3, 1997 2

Saithe in the Iceland Grounds (Fishing Area Va)

Prediction with management option table

Year: 1997					Year: 1998					Year: 1999	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.0000	0.4690	165244	70793	37194	0.6000	0.2814	174594	74507	25509	196623	89578
.	0.7000	0.3283	.	74507	29181	192410	86609
.	0.8000	0.3752	.	74507	32708	188363	83773
.	0.9000	0.4221	.	74507	36098	184472	81062
.	1.0000	0.4690	.	74507	39358	180731	78470
.	1.1000	0.5159	.	74507	42493	177133	75991
.	1.2000	0.5628	.	74507	45509	173671	73619
.	1.3000	0.6097	.	74507	48413	170339	71349
.	1.4000	0.6566	.	74507	51209	167130	69176
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : PRED94
 Date and time : 03MAY97:14:06
 Computation of ref. F: Simple mean, age 4 - 9
 Basis for 1997 : F factors

Table 3.2.15

The SAS System

12:06 Saturday, May 3, 1997 3

Saithe in the Iceland Grounds (Fishing Area Va)

Yield per recruit: Input data

Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
3	1.000	0.2000	0.0929	0.0000	0.0000	1.443	0.0600	1.443
4	.	0.2000	0.1924	0.0000	0.0000	2.030	0.2700	2.030
5	.	0.2000	0.3524	0.0000	0.0000	2.753	0.5700	2.753
6	.	0.2000	0.5582	0.0000	0.0000	3.654	0.9300	3.654
7	.	0.2000	0.7412	0.0000	0.0000	4.692	1.1500	4.692
8	.	0.2000	0.8682	0.0000	0.0000	5.798	1.5400	5.798
9	.	0.2000	0.9400	0.0000	0.0000	6.934	1.5400	6.934
10	.	0.2000	1.0000	0.0000	0.0000	7.826	1.5400	7.826
11	.	0.2000	1.0000	0.0000	0.0000	8.792	1.5400	8.792
12	.	0.2000	1.0000	0.0000	0.0000	9.531	1.5400	9.531
13	.	0.2000	1.0000	0.0000	0.0000	10.738	1.5400	10.738
14	.	0.2000	1.0000	0.0000	0.0000	12.236	1.5400	12.236
Unit	Numbers	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : YIELD3
 Date and time: 03MAY97:14:21

Table 3.2.16

The SAS System

12:06 Saturday, May 3, 1997 5

Saithe in the Iceland Grounds (Fishing Area Va)

Yield per recruit: Summary table

(cont.)

						1 January		Spawning time	
F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1.3600	1.3600	0.635	1669.875	2.388	4959.633	0.513	1339.711	0.513	1339.711
1.3800	1.3800	0.637	1668.032	2.380	4930.640	0.509	1323.802	0.509	1323.802
1.4000	1.4000	0.638	1666.215	2.372	4902.280	0.505	1308.330	0.505	1308.330
1.4200	1.4200	0.640	1664.425	2.364	4874.529	0.501	1293.278	0.501	1293.278
1.4400	1.4400	0.642	1662.661	2.356	4847.365	0.497	1278.629	0.497	1278.629
1.4600	1.4600	0.643	1660.921	2.348	4820.769	0.493	1264.367	0.493	1264.367
1.4800	1.4800	0.645	1659.207	2.340	4794.720	0.489	1250.476	0.489	1250.476
1.5000	1.5000	0.646	1657.517	2.333	4769.200	0.486	1236.943	0.486	1236.943
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YIELD3
 Date and time : 03MAY97:14:21
 Computation of ref. F: Simple mean, age 4 - 9
 F-0.1 factor : 0.1844
 F-max factor : 0.4314
 F-0.1 reference F : 0.1844
 F-max reference F : 0.4314
 Recruitment : Single recruit

Figure 3.2.1 Isaithe in Division Va. Proportional catches in different gears 1980-1996

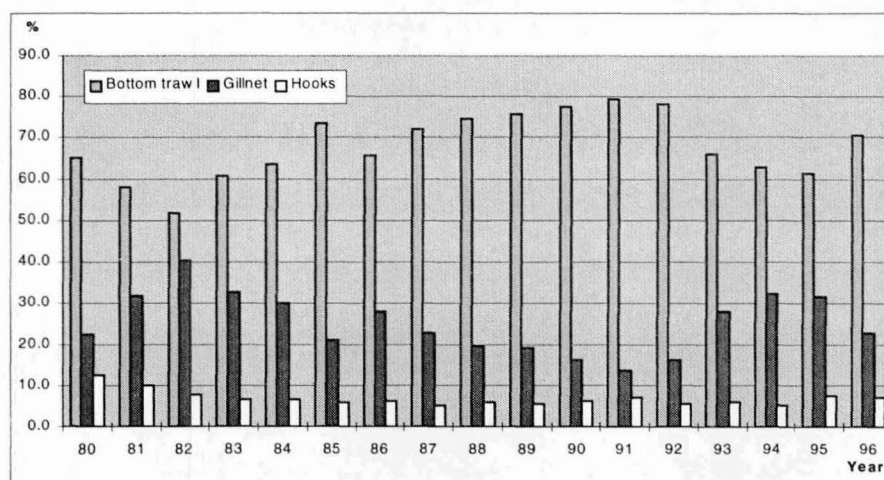


Figure 3.2.2. Bottom trawl landings categorised by different size classes of vessels and number of vessels in each size class (only vessels with more than 50 tonnes annual landings).

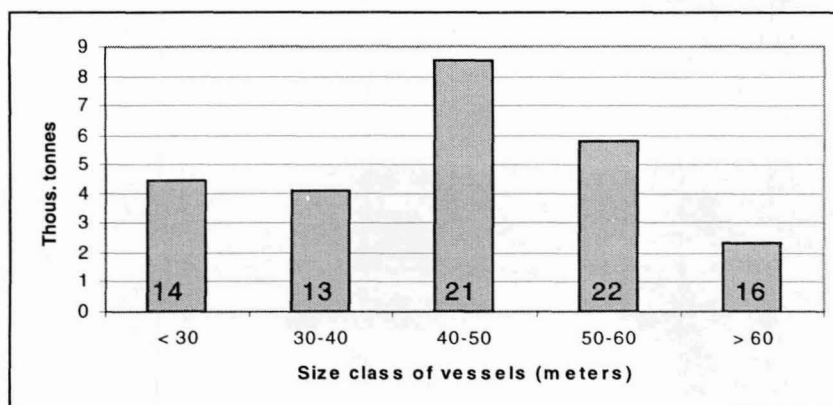


Figure 3.2.3. Gillnet landings categorised by different size classes of vessels and number of vessels in each size class (only vessels with more than 10 tonnes annual landings).

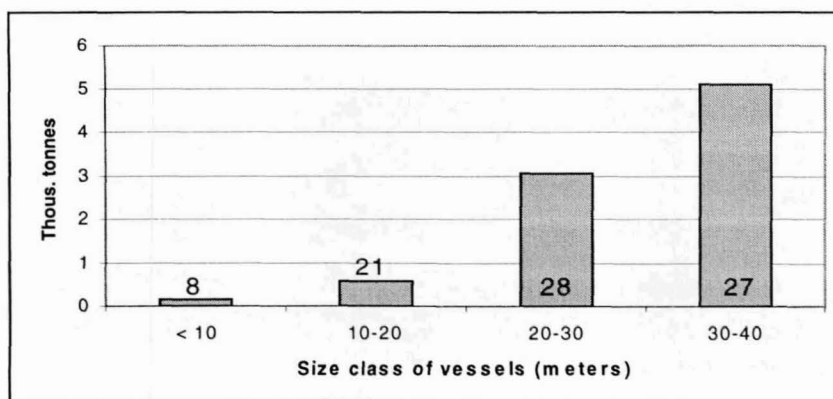


Figure 3.2.4. Proportional landings by gear and months in 1996.

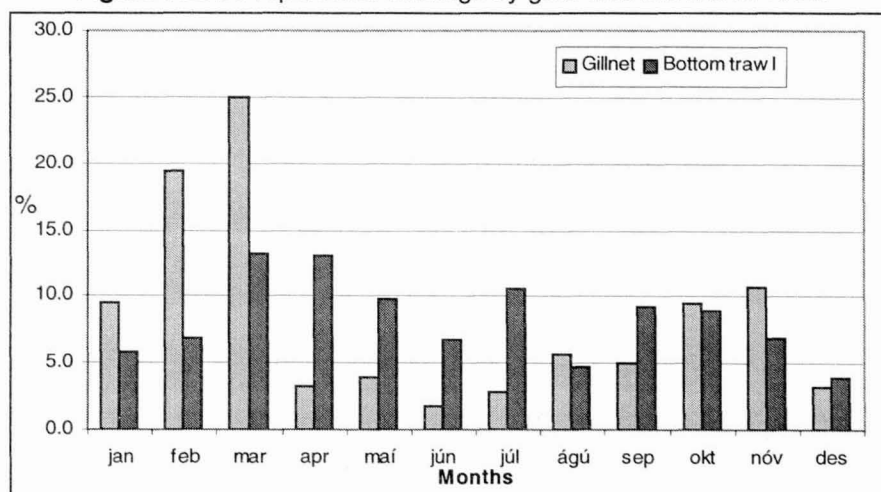


Figure 3.2.5. Bottom trawl catches in 1996 (tonnes/square nm).

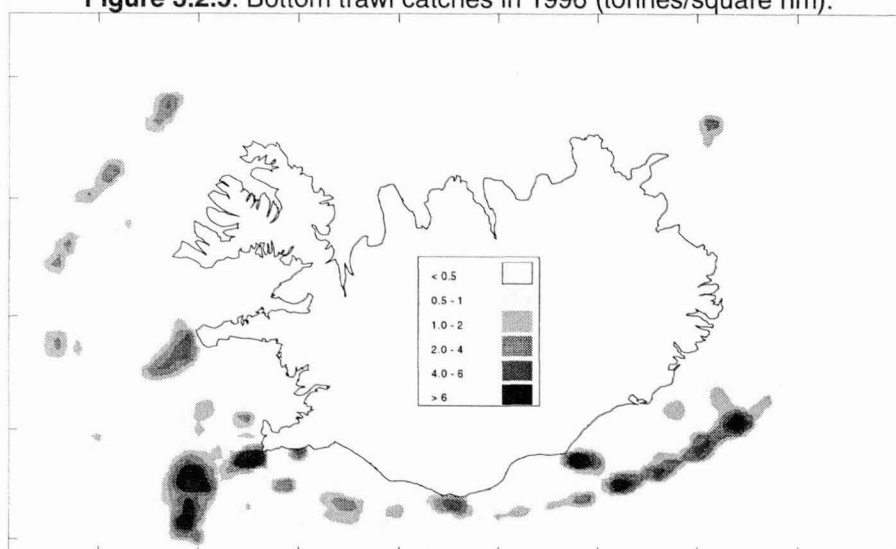


Figure 3.2.6 Gillnet catches in 1996 (tonnes/square nm).

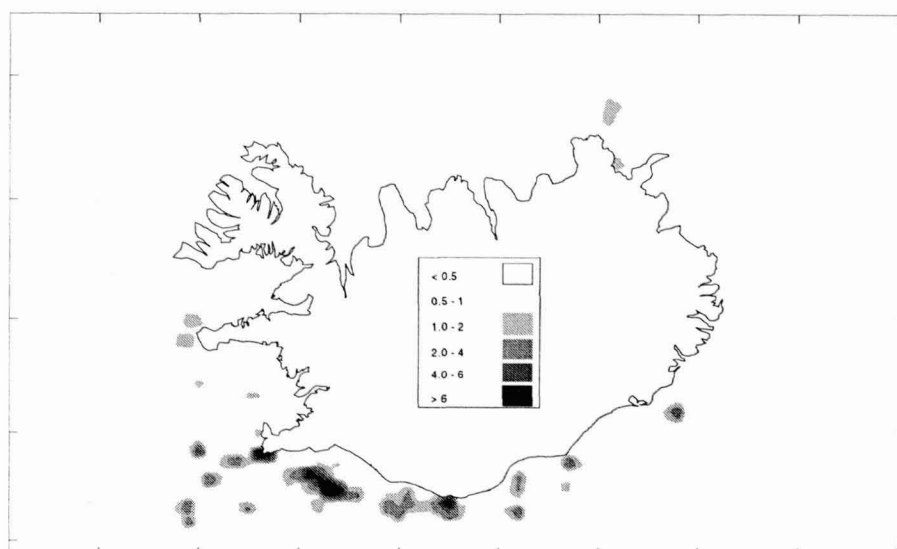


Figure 3.2.7 Icelandic Saithe. Prognosis in May 1996 and estimate in April 1996 for percent (by number) age distribution in the 1996 landings.

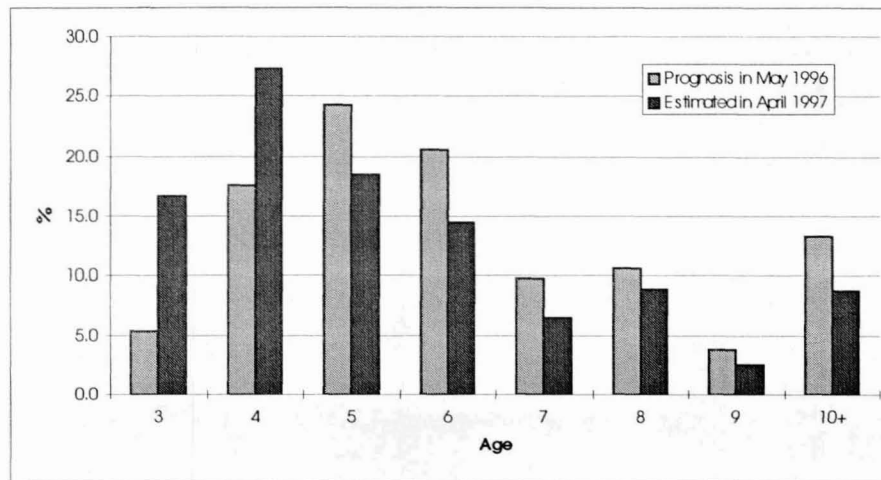


Figure 3.2.8 Saithe in Division Va. Maturity at age, data and fitted values.

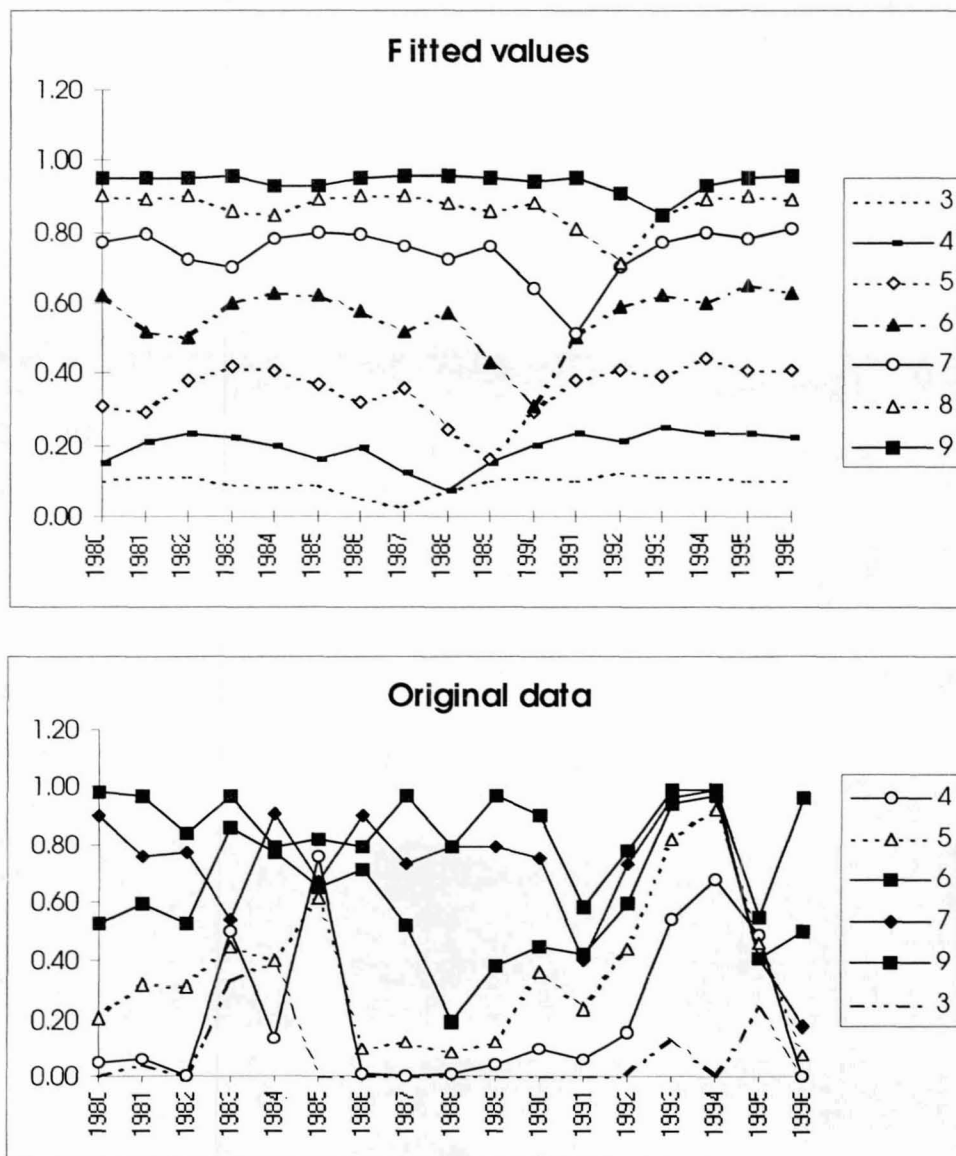


Figure 3.2.9 Retrospective analysis

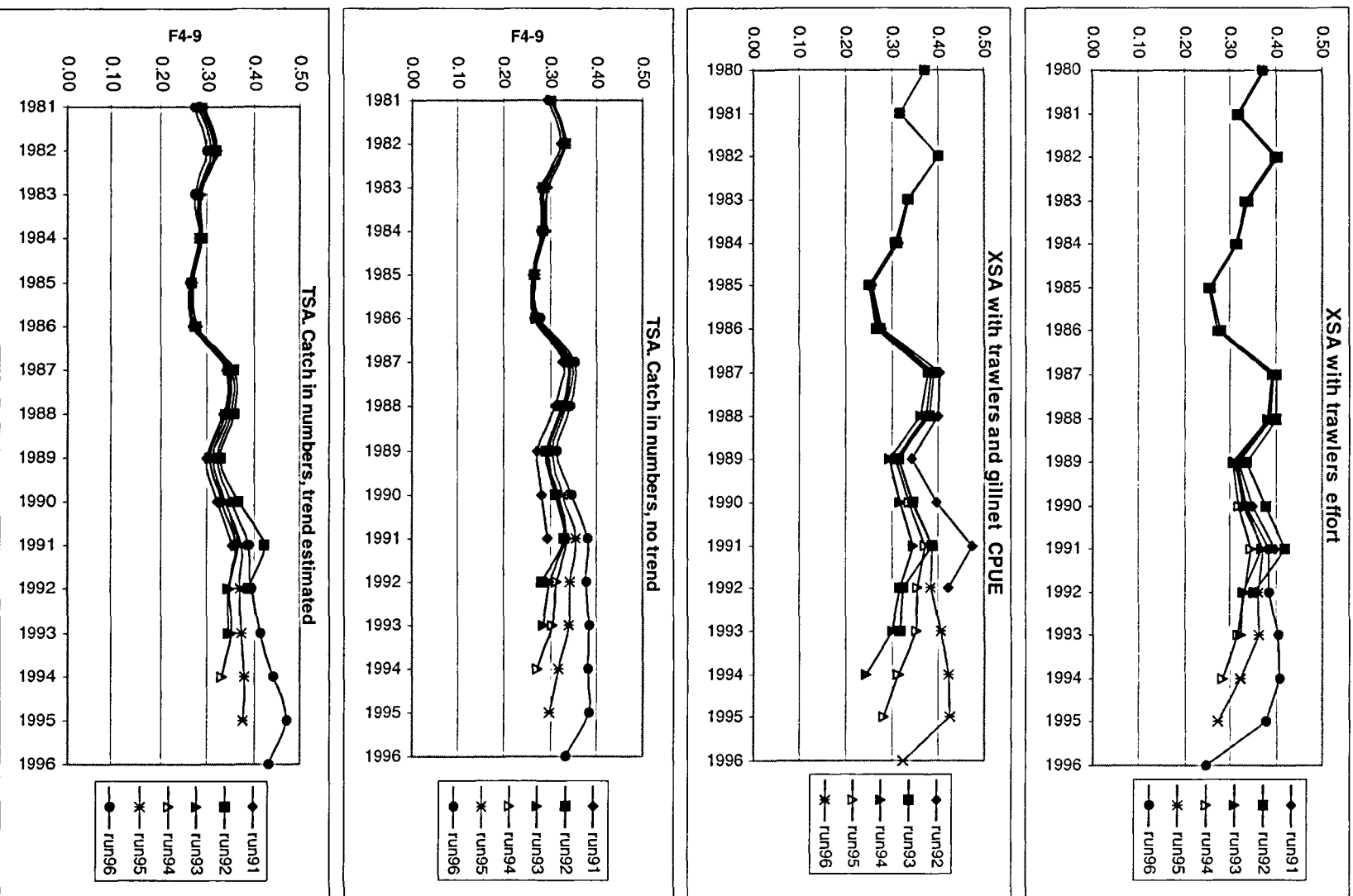


Figure 3.2.9 (continued)

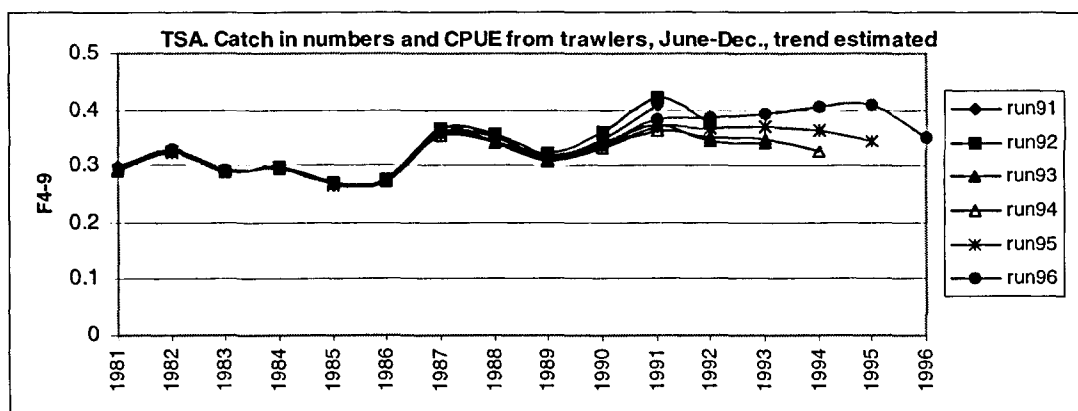
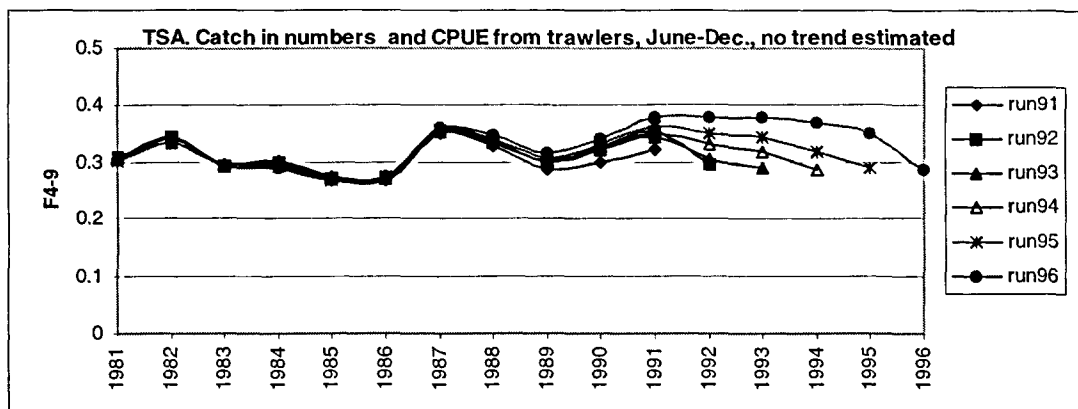
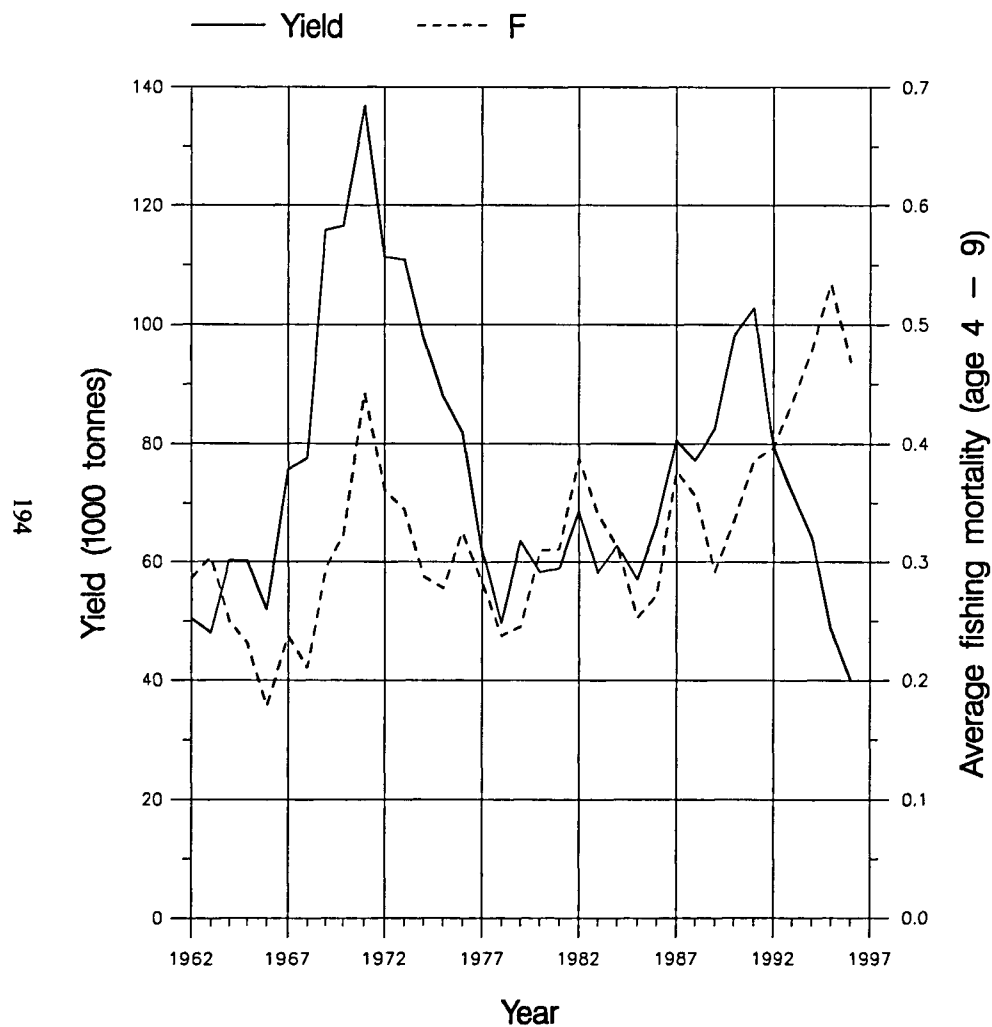


Figure 3.2.10

Fish Stock Summary Saithe in the Iceland Grounds (Fishing Area Va) 3 – 5 – 1997

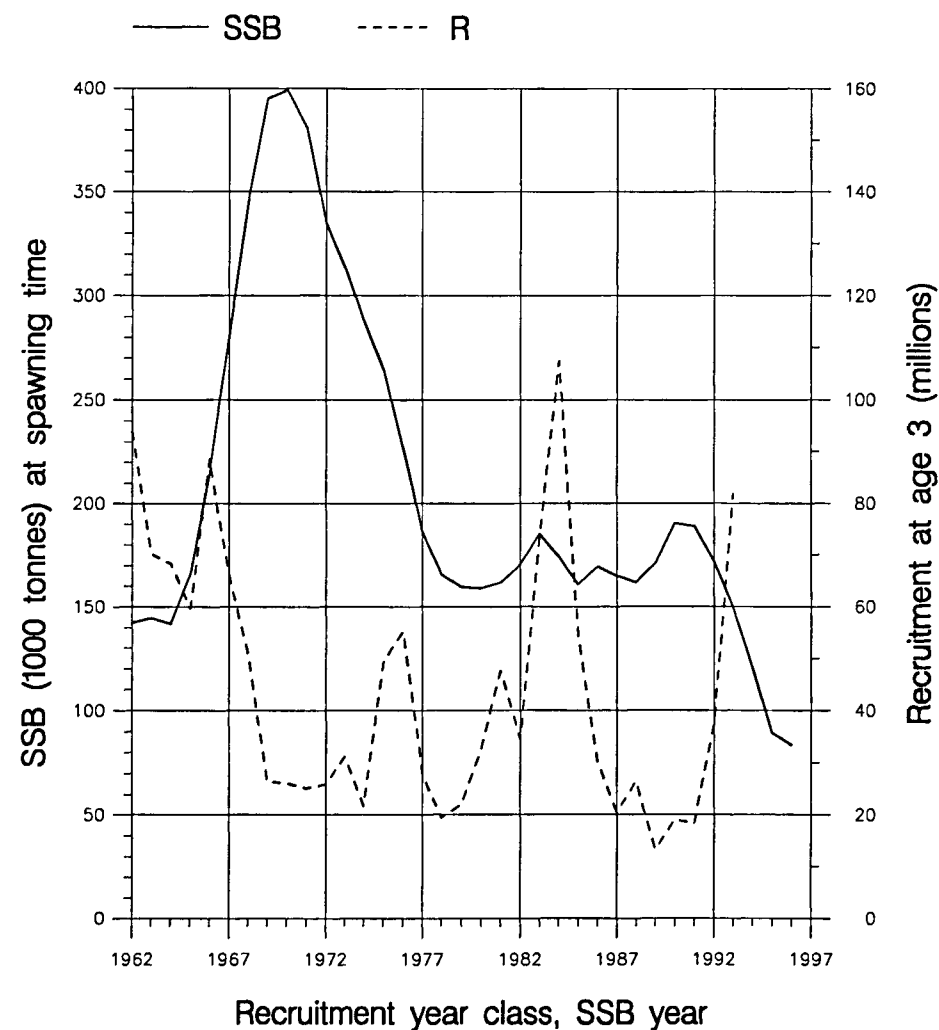
Yield and fishing mortality



(run: SVPBSI06)

A

Spawning stock and recruitment



(run: SVPBSI06)

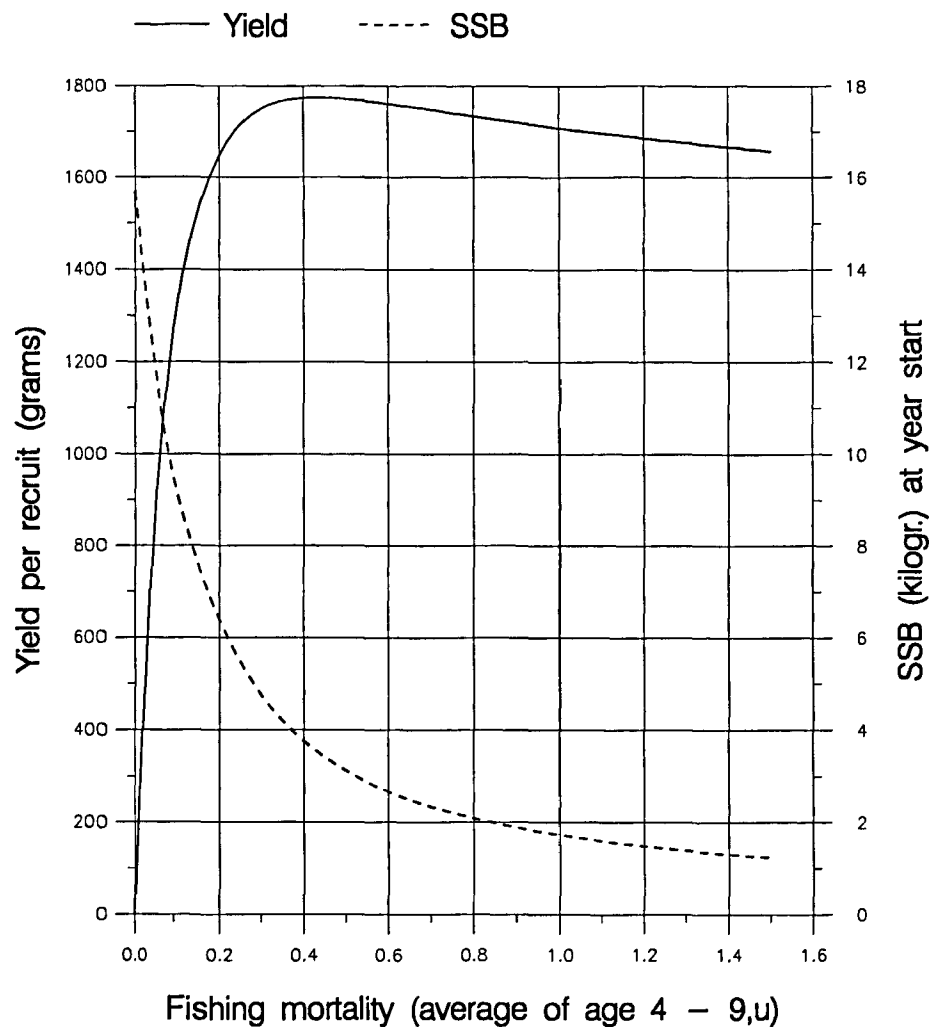
B

Figure 3.2.11

Fish Stock Summary Saithe in the Iceland Grounds (Fishing Area Va) 3 – 5 – 1997

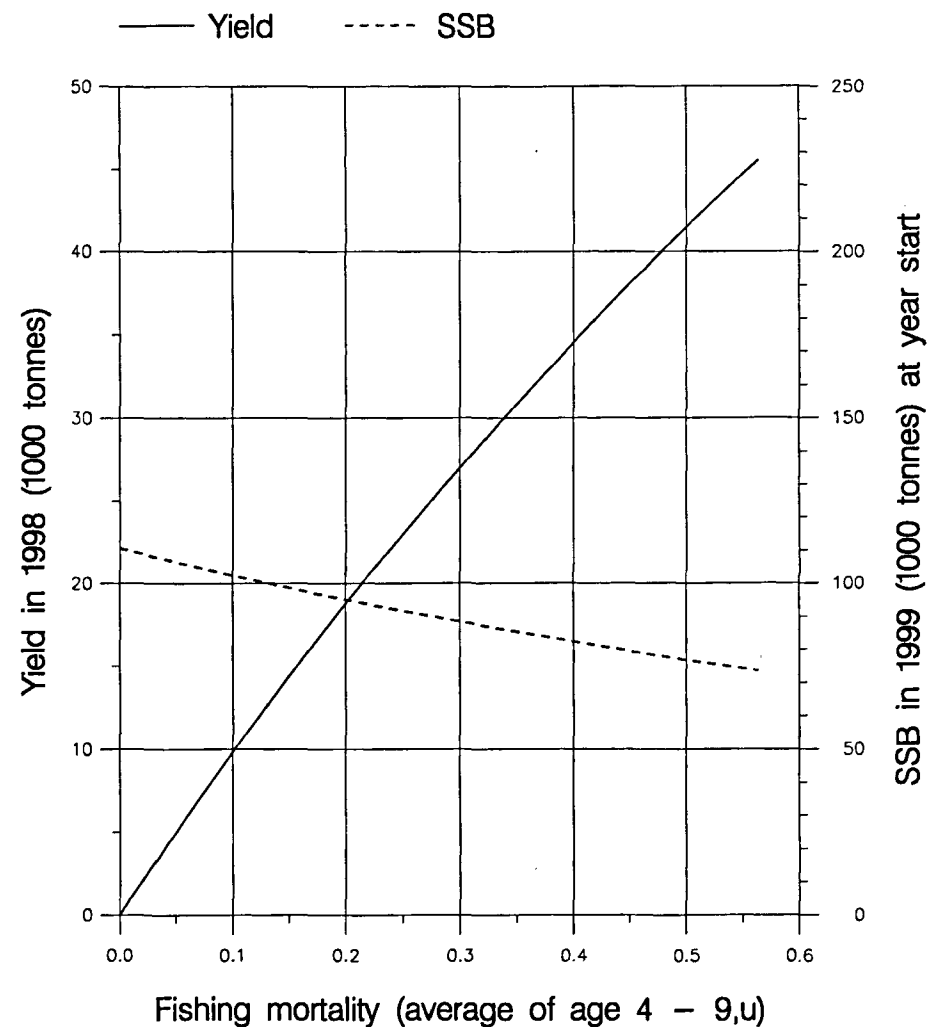
Long term yield and spawning stock biomass

Short term yield and spawning stock biomass



(run: YIELD3)

C



(run: PRED94)

D

Figure 3.2.12

