REPORT OF THE

NORTH-WESTERN WORKING GROUP

ICES Headquarters
28 April - 6 May 1998

PART 1 OF 2

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International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

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1.2 Terms of Reference

The North Western Working Group (Chairman: J. Reinert, Faroe Islands) met at ICES Headquarters from 28 April to 6 May 1998 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 survey and fishery information on the stocks of redfish in Sub-areas V, VI, XII and XIV;

d) consider the reference points proposed by the SGPAFM, adopting those reference points or presenting alternatives with reasons for the alternative selection;

e) consider the harvest control rules proposed by the SGPAFM, taking into account uncertainties in the data, in the assessments and in the biological processes, and assuming a stock-recruitment relationship, to estimate the probability of avoiding limit reference points;

f) update information on quantities of discards by gear type for the stocks and fisheries considered by this group using the format proposed by the WGECO with a view to establishing a time series;

g) 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;

h) 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 *S. mentella* fished in demersal fisheries on the continental shelf and slope.

Since the above terms of reference were decided, ICES has received the official request for advice from the North-East Atlantic Fisheries Commission. The Commission formally asked ICES to provide information and advice on the management of all the fish stocks in the NEAFC Convention area for which sufficient data are available to provide such

advice, taking into account the precautionary approach. The above Terms of Reference are supposed to cover this general request.

In addition, ICES was particularly requested to provide information and advice on some specific items of which the following are relevant to the North Western Working Group:

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 *S. mentella* by season, area and year and provide information on the stock identity of the deep sea type and oceanic type *S. mentella*;

l) advice NEAFC on an appropriate scientific monitoring scheme for the pelagic fishery for *S. mentella* in the Irminger Sea considering the current knowledge of the stock complexity and respond not later than 1 May 1998.

1.3 General comments

This year the terms of reference for the working group had been changed compared to former years, especially by adding two new items regarding reference points and harvest control rules. This implied a lot of extra work to the working group and in addition several factors hampered the work. Due to a strike, the ordinary work could not begin at the scheduled time and only after 1 1/2 day all participants had arrived. The photocopying facilities were also hampered due to the strike so it was difficult to distribute material for discussion in the plenary. And, the ICES computers are very slow.

The different items are dealt with on a stock by stock basis in the relevant chapters.

By consultations with the chairman of ACFM it was decided not to use time for item e) on the terms of reference and item f) was only occasionally included.

The working group discussed the precautionary approach and evaluated the different biological reference points as suggested by the SGPAFM. The results of this are presented in the different chapters of the report. As the WG did not have a preliminary draft of the SGPAFM report before on the second day of the meeting it was difficult to go into details with this item. Also the group felt that the instructions how to find/define the different reference points were not precise enough and sometimes even not very consistent. It was concluded that at present it is somewhat premature to come up with accurate values and it was especially difficult in cases where analytical assessments are poor or even lacking.

1.4 Recommendations

- Studies on stock identification of *S. mentella* and *S. marinus* should be continued. It is important to work further on genetic methods and morphological methods should also be applied. The Working Group recommends that all available genetic results related to the stock structure of *S.mentella* in the Irminger Sea should be dealt with as a Term of reference by the ICES Working Group on the Application of Genetics in Fisheries and Mariculture in 1999. A suggested Term of reference might be: Review all available genetic results to make conclusions about how the *S.mentella* types in the Irminger Sea and adjacent waters should be structured into stocks or populations in order to make an optimal biological management.

- An operational manual for the identification of different *S. mentella* types is urgently required.

- Reproductive biology – both spawning and larval drift—of *S. marinus* in the area between Iceland and the Faroe Islands needs to be studied in order to determine whether these fish might constitute a separate stock element.

- Age readings. In order to assess the redfish stocks successfully, it is important to investigate further the possibility of developing a reliable age reading technique. Iceland has just started to investigate the otoliths of *S. marinus* collected

in recent years and Norway, Russia and Spain has worked further on the matter since the last age reading workshop held in Germany in 1995 (ICES C.M.1996/G:1).

- An Acoustic survey on Irminger Sea should be conducted in June/July 1999. Due to the decreasing catch rates in the fishery on oceanic redfish (ICES C.M. 1997/Assess 13) as well as low biomass estimate in most recent acoustic surveys (ICES C.M. 1996/G:8; WD7) the Study Group on Redfish Stocks (ICES C.M. 1998/G:3) recommended a more frequent monitoring of oceanic redfish abundance in the Irminger sea in the future. The frequency of joint international surveys should be increased and conducted at least every second year. In the light of the recent shift in fishing effort towards deeper water on the Reykjanes Ridge (ICES, C.M. 1997/Assess:13) the Study Group finds the need for further deep-sea hauls (>500) in future surveys. Furthermore, it is important prior to the survey to investigate the possibilities of applying narrow beam transducers, and new development in technology, in order to give an estimate of fish deeper than 500 meters.

- In order to have the catch statistics for the international fishery of *S. mentella* in the Irminger Sea as complete and updated as possible (also by depth) in advance of the North Western Working Group meeting every year, the Working Group recommends ICES to put forward a formal request both to NEAFC and FAO to send their statistics as a routine to ICES since not all countries report directly to ICES. Otherwise the quality of the advice from ICES may be of reduced quality.

- Countries participating should analyse and present effort and CPUE data together with catch statistics and biological data from this international fishery to ICES.

- The Working Group reiterates its recommendation that each country should investigate and conduct scientific work to find the best factors for a particular product and fishery, and that the results are published/documented and made available for the assessment work.

- In order to gain important knowledge on the location of the nursery areas for the Oceanic redfish stock and of the recruitment to the Irminger Sea, a joint international synoptic trawl survey for 0-group and/or juvenile redfish covering the entire distribution area would be necessary.

- A different approach to this would be to follow the extruded larvae from the spawning grounds in the Irminger Sea on their way to the nursery grounds by conducting e.g., monthly surveys covering the larvae/0-group as they drift/swim.

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 1995–1997 most fleet categories have increased theirs catches. The cod catches increased by 10 000 t (gutted weight) in 1995 and 20 000 t (gutted weight) in 1996 but dropped again by 4 000 t (gutted weight) in 1997. The haddock catches doubled from 1995 to 1996 and from 1996 to 1997 reaching more than 8 500 t and 15 900 t(gutted weight), respectively. The saithe catches declined to 24 000 t (gutted weight) in 1995 and again to 17 000 t (gutted weight) in 1996 but increased slightly again in 1997 to 19 500 t (gutted weight). In 1995–1997 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, declined again in 1997, but is still on a high level. 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 –1997 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.

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 t 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 averages for 1985–1997 and 1990–1997 and the number of days by category as stated in the law, are presented in Table 2.1.5. For the fishing year 1997/1998 the number of days allocated has been reduced by 12.5 % compared to the year before.

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 %

Technical measures such as area closures during the spawning periods, to protect juveniles and young fish and mesh size regulations are also in effect.

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

Year	Open boats	Longliners < 100 GRT	Singletraw < 400 HP	Gill net	Jiggers	Singletraw 400-1000h	Singletraw >1000 HP	Pairtrawl <1000 HP	Pairtrawl >1000HP	Longliners > 100 GRT	Industrial trawlers	Others	Total
1985	5650	9659	2506	291	1522	3051	4352	5393	2223	3133	54	202	38037
1986	2946	4707	1643	443	919	2049	2840	10132	4793	1700	141	391	32704
1987	2151	3231	1393	283	638	1546	1791	6361	3273	2586	112	30	23407
1988	591	3049	1114	568	1647	1660	1501	6065	3455	3201	137	35	23022
1989	964	5986	1102	692	1913	1314	1157	2278	1729	3840	148	12	21135
1990	511	4225	507	201	988	517	568	863	1259	2440	79	27	12184
1991	342	2474	439	160	624	413	371	663	1038	1394	45	8	7969
1992	142	1359	325	1	376	161	192	634	1119	708	258	21	5295
1993	113	809	699	0	452	323	178	717	1141	701	40	23	5194
1994	244	1090	914	58	1507	332	448	651	1950	1259	50	7	8508
1995	732	3108	1135	55	4348	713	865	1164	2203	3328	8	1	17662
1996	1345	6849	1562	95	7388	1317	666	3313	7253	7340	67	30	37225
1997	956	8569	1326	191	3287	1659	983	1966	4585	9571	20	23	33135

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

Year	Open boats	Longliners < 100 GRT	Singletraw < 400 HP	Gill net	Jiggers	Singletraw 400-1000h	Singletraw >1000 HP	Pairtrawl <1000 HP	Pairtrawl >1000HP	Longliners > 100 GRT	Industrial trawlers	Others	Total
1985	903	5294	196	18	86	780	1055	2546	832	1816	15	28	13570
1986	951	5038	250	4	62	354	664	2654	1313	1535	87	56	12967
1987	1520	5414	313	3	47	639	274	2340	1251	1796	204	29	13829
1988	201	5219	167	2	50	436	253	1205	914	2076	161	13	10697
1989	476	7399	122	2	173	425	213	862	749	2257	180	5	12866
1990	278	6109	63	1	132	308	192	534	800	1815	68	18	10316
1991	213	4206	86	0	41	125	126	495	799	1321	52	5	7469
1992	76	1893	57	0	13	38	44	439	576	917	41	8	4103
1993	27	783	217	0	6	145	37	424	713	821	98	4	3275
1994	34	631	247	0	4	136	121	363	1046	952	93	3	3629
1995	46	1010	296	0	15	207	91	370	695	1630	11	0	4371
1996	124	2351	487	0	60	572	163	562	1141	3068	6	2	8535
1997	231	4860	447	0	72	966	405	973	1850	6059	27	0	15890

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 net	Jiggers	Singletrawl 400-1000HP	Singletrawl >1000 HP	Pairtrawl <1000 HP	Pairtrawl >1000HP	Longliners > 100 GRT	Industrial trawlers	Others	Total
1985	89	38	23	13	982	2515	12923	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	1468	7279	8134	15790	37	408	1	35700
1988	173	101	40	113	2575	2693	8224	7748	17266	31	501	21	39586
1989	356	52	129	90	3717	2148	7118	9440	16513	60	504	5	40132
1990	309	131	84	122	4038	2123	10742	13127	23442	101	495	8	54721
1991	287	55	40	281	4795	625	6791	12978	22584	64	404	7	48910
1992	124	121	8	0	3300	151	2248	7677	17486	37	320	1	31472
1993	168	56	39	0	2696	164	1879	6234	17639	29	203	3	29111
1994	131	112	37	2	3666	335	1995	5408	17243	63	202	0	29194
1995	49	15	91	5	2320	215	2406	4288	14776	75	6	0	24248
1996	5	6	24	5	1590	213	1178	4118	10173	37	4	0	17353
1997	9	14	27	3	1746	495	2098	3491	11529	72	76	1	19561

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	372	7558	2171	108	3348	2077	5565	5389	3193	2973
1986	453	6692	1509	123	2745	1221	5402	6573	4433	2176
1987	556	6728	1297	201	2973	1531	4389	6314	5546	2915
1988	2650	8753	1261	234	8072	2204	4964	6026	6034	3203
1989	3831	12804	1445	208	10670	1993	4939	5175	5127	3369
1990	3060	14543	1159	157	9611	1853	4020	5444	7491	3521
1991	3146	14801	1141	183	10332	1038	4005	5828	7875	3573
1992	1885	10599	1150	181	10128	495	4174	3985	7243	2892
1993	1572	7497	2045	561	8056	1008	3577	2851	6335	2046
1994	2227	7625	2029	1833	13410	677	3825	2120	6227	2925
1995	3289	9742	1985	2052	18744	1342	4317	2594	6752	3959
1996	3733	12636	1475	2407	23663	1311	3780	3396	7285	4285
1997	3278	13968	1704	2315	13379	1307	3704	3236	7718	5851

Table 2.1.5. Effort (days) used by various fleet categories in Vb1 1985-97. Also shown are the averages for 2 periods and the number of fishing days allocated in the law. Other 1000 fishing days are kept outside the system for use in special cases. For other fleets there are no effort limitations. Catches of cod,haddock, saithe and redfish are regulated by the bycatch percentages given in section 2.1.1.

Year	*Longliners 0-100GRT, jiggers trawlers<400HP*	*Longliners > 100 GRT*	*Pairtrawlers*
1985	13449	2973	8582
1986	11399	2176	11006
1987	11554	2915	11860
1988	20736	3203	12060
1989	28750	3369	10302
1990	28373	3521	12935
1991	29420	3573	13703
1992	23762	2892	11228
1993	19170	2046	9186
1994	25291	2925	8347
1995	33760	3659	9346
1996	22333	3050	10778
1997	26281	3660	10362
Average (85-97)	22637	3074	10746
Average (91-97)	25717	3115	10421
Allocated days	27405	2660	7197

2.2 Faroe Plateau Cod

2.2.1 Trends in landings

The nominal landings of cod (1986–1997) from the Faroe Plateau by nations as officially reported to ICES, are given in Table 2.2.1.1. The relatively high recruitment in 1980-83 maintained the good fishery for cod from 1983 to 1986 when the catches have steadily decreased from 1986 to only 6,000 t in 1993, the lowest catch on record (Figure 2.2.6.1.5). In 1995 the officially reported catches increased to slightly above 19,000 t. Landings increased spectacularly 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. The catches decreased slightly in 1997 to 34,000 t.

In recent years, statistics for the Faroese fishery in that part of Sub-division IIa (i.e. IIa4) (see Figure 2.2.1 in last year's report) 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 in 1995–1997 has been considerably better than in previous years, and preliminary information for 1998 continues to indicate good fishing success, especially for the longliners. Informal reports from the fishing industry indicate misreported 1995 nominal catches in the order of 3,330 t. (3,000t. 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 or 1997.

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 and have increased their part of the catch substantially from 1993-97. 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. In 1997, however, their part of the catch decreased. The jiggers increased their part of the catch from less than 10 % in 1993 to 25 % in 1995, but have not been successful in 1997 (Table 2.2.1.4).

Figure 2.2.1.1 shows the catch rates per day from 1985 to 1997 for the long liners, trawlers and jiggers. The catch rates have generally decreased until 1992 while they increased markedly from 1992/1993 to 1997, except for the single trawlers greater than 1000 HP whose cod catches are relatively small. The catch rates in 1997 seemed to level off for some fleets (single trawlers < 400 HP, jiggers and longliners > 100 GRT) but increased for others (pair trawlers, longliners < 100 GRT, and single trawlers 400–1000 HP).

2.2.2 Catch-at-age

Catch in numbers-at-age were updated to account for a change in the nominal catches for 1992, 93, 95, and 1996. Catch at age for 1997 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 1997 is shown in Table 2.2.2.3.

2.2.3 Mean weight-at-age

Mean weights-at-age data for 1961–1997 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 values from 1961 to 1976, which were calculated, are replaced by actual values taken from Jákupsstovu and Reinert (1994). The sum-of-products-check for 1997 showed a discrepancy of 1 %.

Figure 2.2.3.1 shows the mean weight-at-age for 1978 to 1997. From 1991 to 1995 the mean weights at age have increased, but from 1995 to 1997 they have decreased again. The decrease seems to continue (at least for the ages most frequent in the catches) in the first quarter of 1998. (Figure 2.2.3.2).

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 2.2.4.1 for 1983 to 1998. 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 increased 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 Ground fish 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) 1983–1998 is given in Figure 2.2.5.1. The CPUE have increased substantially in 1995 and have remained high up to 1998. Following a year class, the stratified mean catch per trawl hour normally increases the first 3-4 years of life, and decreases afterwards (Table 2.2.6.1). From 1994 to 1995, however, there was an increase for all year classes (age groups 3-8 in 1994 compared to age groups 4-9 in 1995), possibly because of increased availability. A more normal picture is observed from 1996-98 (ages > 4 decrease from one year to another).

2.2.6 Stock assessment

2.2.6.1 Tuning and estimates of fishing mortality

Eight catch and effort series have been investigated for tuning of the VPA in the 1995-97 reports of the NWWG. One series is derived from the annual Faroese groundfish survey (Table 2.2.6.1.1) showing the mean stratified number caught of each age group per trawl hour. The effort is set at a constant value (100). In order to use the most recent survey values in XSA runs, the results were shifted back in time by approximately three months for each year, and the fish were considered to be one year younger to correspond to the end of the last year for which catch at age is available.

The other catch and effort series available are obtained from long liners and trawlers (Table 2.2.6.1.1). 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 1995-97.

In 1995 the North-Western Working Group scrutinised 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 400–999 HP. The decision not to use these series was based on trends in the catchabilities. In 1997, 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. 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. Thus 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 400–999 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. In 1997, the analysis was extended to include 1992 to 1996 and the results suggested that the availability to the survey may be returning to more average values, but was still above typical values observed during 1983 to 1993. No attempt to use the survey result in calibrations this year as it is expected that the higher catchabilities/availabilities in 91 to 95 (years of the last catch at age available) would still influence the results.

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 1995-97 and in the first part of 1998 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 and 1997.

An XSA run (Table 2.2.6.1.2) was made with the same parameters and assumptions as in 1997 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, and survivors estimates shrunk towards the mean F of the final 5 years or the 5 oldest ages. As last year, runs with shrinkage of 0.5 and 2.0 were compared (Table 2.2.6.1.5 and Figure 2.2.6.1.2). Lighter shrinkage (2.0) gave higher F's and lower spawning biomass, and is considered to be more realistic than 0.5, consistent with the observation that the introduction of the new management system is changing the conditions for the fleets. This light shrinkage, however, results in very high fishing mortalities on age-groups 7 to 9 in 1996 and 1997.

In addition to the tuning series used last year, a new tuning series was introduced this year, for comparison. It is based on logbooks for five longliners > 100 GRT during the period 1986-97, giving yield of the fish species caught and the corresponding number of hooks used. In order to get a series giving directed fishery towards cod, the catches of tusk and ling together had to be less than 20 % of the cod catches. All these cod catches and the corresponding hooks were then pooled for all five ships, and the CPUE is shown in Figure 2.2.6.1.1 as kg/1000 hooks. The cod catches were broken into numbers at age, using the same age composition as for all longliners > 100 GRT. Just for comparison this series was used instead of the longliners > 100 GRT in XSA calibration and it generally gave slightly higher biomasses and lower F's (Table 2.2.6.1.5). Further analyses of this new series arre necessary, particularly in attempting to standardise for month and area effects, before it should be used in the assessment.

The residuals of log catchabilities are shown in Figure 2.2.6.1.3. There are clear trends in residuals: those for the longliners have a sinusoidal form, with nearly all the 1996 and 1997 values being positive; the 1997 values for the trawlers are more balanced, but the overall slope of the trend is negative from 1986 to 1995. The XSA run 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. The Working Group noted that the results suggest that the 1996 and 1997 spawning stock biomasses are about equal to the 1985 spawning stock biomass, consistent with the available CPUE series (Table 2.2.6.1.3).

The results from the retrospective analysis of the XSA (Figure 2.2.6.1.4) 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 2.2.6.1.4 and in Figure 2.2.6.1.6. The average F for age groups 3 to 7 in 1997 ($F_{(3-7)}$) is estimated at 0.43, above F_{max}= 0.34.

2.2.6.2 Stock estimates and recruitment

The stock size in numbers is given in Table 2.2.6.1.5. A summary of the VPA, with recruitment set at 2 years old, and biomass estimates are given in Table 2.2.6.1.6 and in Figure 2.2.6.1.5. The stock-recruitment relationship is presented in Figure 2.2.7.3.1.

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 are estimated to be well 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 21,800 t. It has increased sharply since, with the increase in 1994 being partly due to a very high proportion mature for ages 2 and 3 (Table 2.2.4.1) to 109,000 t in 1996. The spawning stock biomass was on the same level in 1997, but is expected to decrease in the medium term as the strong 1992 and 1993 year classes pass through the fishery, unless new strong year classes show up.

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

No medium term projection was carried out.

2.2.7.3 Biological reference points

The stock-recruitment scatterplot (Figure 2.2.7.3.1) 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. In 1996, the WG observed that no strong year-class have been produced at SSB's lower than 70,000t, but this has changed now with the 1992 and 1993 year class being produced by a spawning stock biomass of about 22,000t and 36,000t, respectively.

For Faroe Plateau cod, the SGPAFM suggested B_{lim} of 21,000t, the lowest observed biomass, and B_{pa} of 40,000t based on $B_{pa}=B_{lim}e^{1.645\sigma}$ assuming a σ of about 0.40 to account for the relatively large uncertainties in the assessment. In previous years, MBAL was considered to be 52,000t. The WG supports the proposals of the SGPAFM for biomass reference points.

The SGPAFM did not make suggestions for fishing mortality reference points for Faroe Plateau cod. From the current assessment, $F_{0.1}$ is estimated to be equal to 0.15, F_{MAX} to be equal to 0.34, F_{med} to be equal to 0.40, and F_{MSY} has been estimated to range from 0.33 (Stefansson and Bell, WD prepared for the SGPAFM) to 0.56 (NWWG, 1997). The Working Group suggests that F_{pa} be set at 0.35, that is, close to F_{MAX}, F_{med} and possibly F_{MSY}. Over the period covered by the assessment, fishing mortality has been equal to or less than this F_{pa} in 6 years.

Following the logic used to set Bpa, F_{lim} could be set at $F_{lim}=F_{pa}e^{1.645\sigma}$, that is, F_{lim}=0.68, but F has been estimated to exceed this value in 3 years since 1961. Therefore, following a logic similar to that leading to the choice of B_{lim}, the WG suggests that F_{lim} be selected as the highest fishing mortality observed in the time series, in this case F_{lim}= 0.74.

The above defined reference points should be regarded as preliminary due to the uncertainties in the assessment.

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 average values for the period 1961-97 were used as estimates of exploitation pattern and mean weight-at-age and for the maturity ogive the period 1983-97.

The output from the yield-per-recruit calculations is shown in Table 2.2.7.4.2. and in Figure 2.2.7.4.1. $F_{0.1}$ was calculated at 0.15 and F_{max} at 0.33. The present average fishing mortality in 1997 of 0.43 is somewhat higher than these reference points and also higher than Fmed = 0.40 (Figure 2.2.7.3.1).

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 doubled from F =.27 in 1995 to F =.52 in 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, especially for longliners.

In order to evaluate the fishing mortality that could be generated in the 1998/1999 fishing year from the present number of fishing days allocated to each fishing fleets, the partial fishing mortalities by age (3 to 7) and year were calculated for each fleet from the catch at age ratios for 1985 to 1997. The days are used as shown in Figure 2.2.8.1. 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 thus calculated 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 the each catchability, adding up the results across fleets and then calculating the frequency distribution of the resulting F.

The longliners less than 100 feet, the jiggers and the single trawlers less than 400HP have been allocated collectively 8155 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 changing to fish as jiggers. Figure 2.2.8.2 shows the average partial F at age by fleets for 1993 to 1997 and shows that the Fs depend on, which fleet is using the days.

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

Gear	Trial allocation	Optional change
LL<100	8155	There are 8155 days to be shared/chosen to be fished either by longlining (<100), jigging or trawling (<400hp)
ST<400	0	There are 8155 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	2673	
PT>1000	4524	
LL>100	2660	
OPEN	19250	
JIGGERS		There are 8155 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 fleets is given in Figure 2.2.8.3. 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 0.03 should be added to the fishing mortality columns to reflect the activities of these two fleets. It is not presently known by what gear(s) the 8155 days allocated collectively to the LL<100, the ST<400, and the jiggers will be used. The greatest fishing mortality would occur if all the days were fished by the ST<400. If that was the case, there would be an approximately 80 % probability that the 1998 F would be equal to or less than 0.80. If the 12 % reduction is achieved, and the days are fished either by the jiggers (16310 days) or by the LL<100, there is an approximately 80 % probability that the F in 1998 would be equal to or less than 0.64 and 0.69, respectively, that is lower than Flim suggested earlier, but almost double the suggested Fpa. (Table 2.2.8.1). Therefore a substantial reduction in the number of days would be required to achieve Fpa in 1998 or 1999. Current biomass is estimated to be above Bpa.

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:

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 catches under the regulation. Therefore, the regulation 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 days 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 (0.52) is considerably lower than that estimated for that year in the previous assessment (0.79), and F is estimated to have decreased in 1997 compared to 1996. The number of days utilized in 1997 is presented in the table below:

Gear	1997 utilisation
LL<100	13706
ST<400	1685
ST400–1000	1063
ST>1000	3412
PT400–1000	2602
PT>1000	5397
LL>100	3087
OPEN	3207
JIGGERS	12260

When these days are used with the method described they result in a median F of about 0.48, slightly higher than the average obtained from the XSA, but not inconsistent with it.

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 a part of the observed increase is a result of increased availability.

Table 2.2.1.1. Faroe Plateau (Sub-division Vb1) cod. Nominal catches (t) by countries, 1986–1997 as officially reported to ICES.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997 *)
Denmark	8	30	10	-	-	-	-	-	-	-	-	-
Faroe Islands	34,492	21,303	22,272	20,535	12,232	8,203	5,938	5,744	8,724	19,079	39,406	33,556
France [1]	4	17	17	-	-	- [2]	318 [3]	1 [3]	-	2 [3]	-	
Germany	8	12	5	7	24	16	12	+	2 [3]	2	+	+ [A]
Norway	83	21	163	285	124	89	39	57	36	38	574	410
UK (Engl. and Wales)	-	8	-	-	-	1	74	186	56	43	126	
UK (Scotland) [2]	-	-	-	-	-	-	-	-	-	-	-	
United Kingdom	-	-	-	-	-	-	-	-	-	-		324 [3]
Total	34,595	21,391	22,467	20,827	12,380	8,309	6,381	5,988	8,818	19,164	40,106	34,290

*) Preliminary

[1] included in Vb2.

[2] Quantity unknown 1991.

[3] Reported as Vb.

[A] Reported to the Faroese Coastal Guard.

Table 2.2.1.2. Nominal catch (tonnes) of COD in sub-division Vb1 (Faroe Plateau) 1986–1997, as used in the assessment.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997 *)
Officially reported	34,595	21,391	22,467	20,827	12,380	8,309	6,381	5,988	8,818	19,164	40,106	34,290
Faroese catches in IIA within Faroe area jurisdiction			715	1,229	1,090	351	154					
Expected misreporting/discard										3330		
French catches as reported to Faroese authorities				12	17							
Total used in the assessmer	34,595	21,391	23,182	22,068	13,487	8,660	6,535	5,988	8,818	22,494	40,106	34,290

*) Preliminary

Table 2.2.1.3. Catches of COD in Vb by various faroese fleet categories. Tonnes gutted weight.

Year	*Open boats*	*Longliner < 100 GRT*	*Singletraw < 400 HP*	*Gill net*	*Jiggers*	*Singletraw 400-1000h*	*Singletraw >1000 HP*	*Pairtrawl <1000 HP*	*Pairtrawl >1000HP*	*Longliner > 100 GRT*	*Industrial trawlers*	*Others*	*Total*
1985	5650	9659	2506	291	1522	3051	4352	5393	2223	3133	54	202	38037
1986	2946	4707	1643	443	919	2049	2840	10132	4793	1700	141	391	32704
1987	2151	3231	1393	283	638	1546	1791	6361	3273	2586	112	30	23407
1988	591	3049	1114	568	1647	1660	1501	6065	3455	3201	137	35	23022
1989	964	5986	1102	692	1913	1314	1157	2278	1729	3840	148	12	21135
1990	511	4225	507	201	988	517	568	863	1259	2440	79	27	12184
1991	342	2474	439	160	624	413	371	663	1038	1394	45	8	7969
1992	142	1359	325	1	376	161	192	634	1119	708	258	21	5295
1993	113	809	699	0	452	323	178	717	1141	701	40	23	5194
1994	244	1090	914	58	1507	332	448	651	1950	1259	50	7	8508
1995	732	3108	1135	55	4348	713	865	1164	2203	3328	8	1	17662
1996	1345	6849	1562	95	7388	1317	666	3313	7253	7340	67	30	37225
1997	956	8569	1326	191	3287	1659	983	1966	4585	9571	20	23	33135

Table 2.2.1.4. The Faroese catches (landed weight) of Faroe Plateau cod 1985–1997 in Vb1 by percent different fleet categories.

Year	Open boats	Longliners < 100 GRT	Singletraw < 400 HP	Gill net	Jiggers	Singletraw 400-1000h	Singletraw >1000 HP	Pairtrawl <1000 HP	Pairtrawl >1000HP	Longliners > 100 GRT	Industrial trawlers	Others	Total Gutt.weig
1985	16.0	27.2	6.7	0.6	4.3	7.9	11.2	12.3	5.6	7.5	0.2	0.6	35413
1986	9.5	15.1	5.1	1.3	2.9	6.2	8.5	29.6	14.9	5.1	0.4	1.3	31050
1987	9.9	14.8	6.2	0.5	2.9	6.7	7.9	26.0	14.5	9.9	0.5	0.1	21697
1988	2.7	13.8	4.9	2.6	7.5	7.4	6.8	25.3	15.6	12.7	0.6	0.2	21911
1989	4.7	28.8	5.3	3.2	9.2	6.1	5.5	10.5	8.3	17.7	0.7	0.0	20730
1990	4.3	35.3	4.2	1.4	8.1	4.3	4.3	7.1	10.5	19.6	0.6	0.2	11900
1991	4.3	31.5	5.4	2.0	7.9	5.0	4.7	8.3	13.0	17.2	0.6	0.1	7844
1992	2.7	26.0	6.3	0.0	6.9	3.0	3.6	12.0	20.8	13.4	5.0	0.4	5195
1993	2.3	15.9	13.3	0.0	8.9	6.2	3.6	14.2	21.7	12.7	0.8	0.4	4957
1994	3.1	13.1	9.1	0.5	18.7	3.6	5.2	8.1	23.2	15.0	0.5	0.1	7863
1995	4.2	18.0	6.5	0.3	24.7	4.1	4.8	6.5	12.4	18.5	0.0	0.0	17157
1996	3.7	19.3	4.2	0.3	19.6	3.5	1.8	8.1	18.6	20.7	0.2	0.1	35379
1997	3.1	28.3	4.4	0.5	9.8	5.1	2.9	4.8	11.3	29.7	0.0	0.1	30019

Table 2.2.2.1. Catch in numbers at age for Faroe Plateau cod for each fleet in 1997. 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 HI	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	2	0	0	0	0	0	0	0	0	2	0	2
2	16	126	7	19	0	0	0	2	21	2	193	6	200
3	74	553	55	206	16	10	15	59	239	8	1237	40	1277
4	261	2295	341	814	231	140	215	512	1651	37	6498	210	6707
5	126	1043	140	311	200	116	177	429	1053	19	3613	117	3730
6	13	125	29	56	41	23	34	77	236	3	637	21	657
7	22	231	16	35	16	10	15	39	231	2	619	20	639
8	5	57	4	13	4	2	3	8	69	1	165	5	171
9	1	15	1	1	1	0	1	0	29	0	50	2	52
10	3	31	3	4	1	1	1	5	43	0	93	3	96
11	0	5	0	0	0	0	0	0	11	0	17	1	17
12	0	1	0	0	1	0	0	0	2	0	5	0	5
13	0	0	0	0	0	0	0	0	0	0	1	0	1
14	0	0	0	0	0	0	0	0	1	0	1	0	1
15	0	0	0	0	0	0	0	0	0	0	0	0	0
Tot.num.	522	4483	598	1459	512	302	461	1132	3588	73	13131	424	13555
Catch, t	1048	9430	1457	3228	1688	981	1665	3766	9893	184	33280	1010	34290

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

Table 2.2.2.2. Samples of lengths, otoliths, and individual weights of Faroe Plateau cod in 1997.

Fleet	Size	Samples	Length	Otoliths	Weights
Longliners	<100 GRT	148	23,626	3,851	2,149
Longliners	>100 GRT	54	10,285	2,144	839
Jiggers		33	5,122	1,320	1,319
Sing. trawlers	<400 HP	14	2,226	832	832
Sing. trawlers	400-1000 HP	5	823	300	300
Sing. trawlers	>1000 HP	6	1,090	300	120
Pair trawlers	<1000 HP	26	4,600	879	777
Pair trawlers	>1000 HP	25	4,558	846	599
Total		311	52,330	10,472	6,935

Table 2.2.2.3. Catch in numbers at age 1961-97.

Run title : Cod FaroePlateau Vb1 (run: XSAPET02/X02)

At 1-May-98 10:10:19

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

	YEAR,	1961,	1962,	1963,	1964,	1965,	1966,	1967,
	AGE							
	2,	3093,	4424,	4110,	2033,	852,	1337,	1609,
	3,	2686,	2500,	3958,	3021,	3230,	970,	2690,
	4,	1331,	1255,	1280,	2300,	2564,	2080,	860,
	5,	1066,	855,	662,	630,	1416,	1339,	1706,
	6,	232,	481,	284,	350,	363,	606,	847,
	7,	372,	93,	204,	158,	155,	197,	309,
	8,	78,	94,	48,	79,	48,	104,	64,
	9,	29,	22,	30,	41,	63,	33,	27,
	+gp,	0,	0,	0,	0,	0,	0,	0,
0	TOTALNUM,	8887,	9724,	10576,	8612,	8691,	6666,	8112,
	TONSLAND,	21598,	20967,	22215,	21078,	24212,	20418,	23562,
	SOPCOF %,	91,	94,	96,	98,	113,	109,	102,

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

	YEAR,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
	AGE										
	2,	1529,	878,	402,	328,	875,	723,	2161,	2584,	1497,	425,
	3,	3322,	3106,	1163,	757,	1176,	3124,	1266,	5689,	4158,	3282,
	4,	2663,	3300,	2172,	821,	810,	1590,	1811,	2157,	3799,	6844,
	5,	945,	1538,	1685,	1287,	596,	707,	934,	2211,	1380,	3718,
	6,	1226,	477,	752,	1451,	1021,	384,	563,	813,	1427,	788,
	7,	452,	713,	244,	510,	596,	312,	452,	295,	617,	1160,
	8,	105,	203,	300,	114,	154,	227,	149,	190,	273,	239,
	9,	11,	92,	44,	179,	25,	120,	141,	118,	120,	134,
	+gp,	0,	0,	0,	0,	0,	97,	91,	150,	186,	9,
0	TOTALNUM,	10252,	10307,	6762,	5447,	5253,	7284,	7568,	14207,	13457,	16599,
	TONSLAND,	29930,	32371,	24183,	23010,	18727,	22228,	24581,	36775,	39799,	34927,
	SOPCOF %,	106,	109,	99,	123,	125,	101,	101,	97,	97,	70,
1											

Run title : Cod FaroePlateau Vb1 (run: XSAPET02/X02)

At 1-May-98 10:10:19

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

	YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
	AGE										
	2,	555,	575,	1129,	646,	1139,	2149,	4396,	998,	210,	257,
	3,	1219,	1732,	2263,	4137,	1965,	5771,	5234,	9484,	3586,	1362,
	4,	2643,	1673,	1461,	1981,	3073,	2760,	3487,	3795,	8462,	2611,
	5,	3216,	1601,	895,	947,	1286,	2746,	1461,	1669,	2373,	3083,
	6,	1041,	1906,	807,	582,	471,	1204,	912,	770,	907,	812,
	7,	268,	493,	832,	487,	314,	510,	314,	872,	236,	224,
	8,	201,	134,	339,	527,	169,	157,	82,	309,	147,	68,
	9,	66,	87,	42,	123,	254,	104,	34,	65,	47,	69,
	+gp,	56,	38,	18,	55,	122,	102,	66,	80,	38,	26,
0	TOTALNUM,	9265,	8239,	7786,	9485,	8793,	15503,	15986,	18042,	16006,	8512,
	TONSLAND,	26585,	23112,	20513,	22963,	21489,	38133,	36979,	39484,	34595,	21391,
	SOPCOF %,	100,	98,	106,	104,	100,	97,	97,	95,	96,	96,

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

	YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,
	AGE										
	2,	509,	2237,	243,	190,	209,	118,	559,	2552,	348,	200,
	3,	2122,	2151,	2849,	446,	465,	786,	768,	2651,	5124,	1277,
	4,	1945,	2187,	1481,	2130,	476,	591,	1035,	1960,	4572,	6707,
	5,	1484,	1121,	852,	616,	931,	218,	519,	988,	1530,	3730,
	6,	2178,	1026,	404,	300,	300,	323,	122,	454,	1514,	657,
	7,	492,	997,	294,	141,	135,	94,	172,	115,	591,	639,
	8,	168,	220,	291,	92,	55,	32,	38,	171,	146,	171,
	9,	33,	61,	50,	52,	30,	22,	22,	43,	344,	52,
	+gp,	25,	9,	26,	24,	35,	25,	16,	48,	47,	120,
0	TOTALNUM,	8956,	10009,	6490,	3991,	2636,	2209,	3251,	8982,	14216,	13553,
	TONSLAND,	23182,	22068,	13487,	8660,	6535,	5988,	8818,	22494,	40106,	34290,
	SOPCOF %,	101,	98,	99,	106,	102,	102,	101,	101,	99,	101,
1											

Table 2.2.3.1. Catch weight at age 1961-97.

Run title : Cod FaroePlateau Vbl (run: XSAPET02/X02)

At 1-May-98 10:10:19

Table 2 Catch weights at age (kg)

YEAR,	1961,	1962,	1963,	1964,	1965,	1966,	1967,
AGE							
2,	1.0800,	1.0000,	1.0400,	.9700,	.9200,	.9800,	.9600,
3,	2.2200,	2.2700,	1.9400,	1.8300,	1.4500,	1.7700,	1.9300,
4,	3.4500,	3.3500,	3.5100,	3.1500,	2.5700,	2.7500,	3.1300,
5,	4.6900,	4.5800,	4.6000,	4.3300,	3.7800,	3.5100,	4.0400,
6,	5.5200,	4.9300,	5.5000,	6.0800,	5.6900,	4.8000,	4.7800,
7,	7.0900,	9.0800,	6.7800,	7.0000,	7.3100,	6.3200,	6.2500,
8,	9.9100,	6.5900,	8.7100,	6.2500,	7.9300,	7.5100,	7.0000,
9,	8.0300,	6.6600,	11.7200,	6.1900,	8.0900,	10.3400,	11.0100,
+gp,	10.2700,	10.2700,	10.8200,	14.3900,	11.1100,	11.6500,	10.6900,
0 SOPCOFAC,	.9068,	.9444,	.9573,	.9824,	1.1262,	1.0905,	1.0224,

Table 2 Catch weights at age (kg)

YEAR,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
AGE										
2,	.8800,	1.0900,	.9600,	.8100,	.6600,	1.1100,	1.0800,	.7900,	.9400,	.8700,
3,	1.7200,	1.8000,	2.2300,	1.8000,	1.6100,	2.0000,	2.2200,	1.7900,	1.7200,	1.7900,
4,	3.0700,	2.8500,	2.6900,	2.9800,	2.5800,	3.4100,	3.4400,	2.9800,	2.8400,	2.5300,
5,	4.1200,	3.6700,	3.9400,	3.5800,	3.2600,	3.8900,	4.8000,	4.2600,	3.7000,	3.6800,
6,	4.6500,	4.8900,	5.1400,	3.9400,	4.2900,	5.1000,	5.1800,	5.4600,	5.2600,	4.6500,
7,	5.5000,	5.0500,	6.4600,	4.8700,	4.9500,	5.1000,	5.8800,	6.2500,	6.4300,	5.3400,
8,	7.6700,	7.4100,	10.3100,	6.4800,	6.4800,	6.1200,	6.1400,	7.5100,	6.3900,	6.2300,
9,	10.9500,	8.6600,	7.3900,	6.3700,	6.9000,	8.6600,	8.6300,	7.3900,	8.5500,	8.3800,
+gp,	9.2800,	14.3900,	9.3400,	10.2200,	11.5500,	7.5700,	7.6200,	8.1700,	13.6200,	10.7200,
0 SOPCOFAC,	1.0598,	1.0851,	.9943,	1.2264,	1.2481,	1.0134,	1.0134,	.9709,	.9653,	.7012,
1										

Run title : Cod FaroePlateau Vbl (run: XSAPET02/X02)

At 1-May-98 10:10:19

Table 2 Catch weights at age (kg)

YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
2,	1.1120,	.8970,	.9270,	1.0800,	1.2300,	1.3380,	1.1950,	.9050,	1.0990,	1.0930,
3,	1.3850,	1.6820,	1.4320,	1.4700,	1.4130,	1.9500,	1.8880,	1.6580,	1.4590,	1.5170,
4,	2.1400,	2.2110,	2.2200,	2.1800,	2.1380,	2.4030,	2.9800,	2.6260,	2.0460,	2.1600,
5,	3.1250,	3.0520,	3.1050,	3.2100,	3.1070,	3.1070,	3.6790,	3.4000,	2.9360,	2.7660,
6,	4.3630,	3.6420,	3.5390,	3.7000,	4.0120,	4.1100,	4.4700,	3.7520,	3.7860,	3.9080,
7,	5.9270,	4.7190,	4.3920,	4.2400,	5.4420,	5.0200,	5.4880,	4.2200,	4.6990,	5.4610,
8,	6.3480,	7.2720,	6.1000,	4.4300,	5.5630,	5.6010,	6.4660,	4.7390,	5.8930,	6.3410,
9,	8.7150,	8.3680,	7.6030,	6.6900,	5.2160,	8.0130,	6.6280,	6.5110,	9.7000,	8.5090,
+gp,	12.3000,	13.0420,	9.6680,	10.0000,	6.7070,	8.0310,	10.9810,	10.9810,	8.8150,	9.8110,
0 SOPCOFAC,	.9964,	.9843,	1.0584,	1.0408,	1.0030,	.9695,	.9685,	.9491,	.9625,	.9642,

Table 2 Catch weights at age (kg)

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,
AGE										
2,	1.0610,	1.0100,	.9450,	.7790,	.9890,	1.1550,	1.1940,	1.2180,	1.0160,	.9010,
3,	1.7490,	1.5970,	1.3000,	1.2710,	1.3640,	1.7040,	1.8430,	1.9860,	1.7370,	1.3410,
4,	2.3000,	2.2000,	1.9590,	1.5700,	1.7790,	2.4210,	2.6130,	2.6220,	2.7450,	1.9580,
5,	2.9140,	2.9340,	2.5310,	2.5240,	2.3120,	3.1320,	3.6540,	3.9250,	3.8000,	3.0120,
6,	3.1090,	3.4680,	3.2730,	3.1850,	3.4770,	3.7230,	4.5840,	5.1800,	4.4550,	4.1580,
7,	3.9760,	3.7500,	4.6520,	4.0860,	4.5450,	4.9710,	4.9760,	6.0790,	4.9780,	4.4910,
8,	4.8960,	4.6820,	4.7580,	5.6560,	6.2750,	6.1590,	7.1460,	6.2410,	5.2700,	5.3120,
9,	7.0870,	6.1400,	6.7040,	5.9730,	7.6190,	7.6140,	8.5640,	7.7820,	5.5930,	6.1720,
+gp,	8.2870,	9.1560,	8.6890,	8.1470,	9.7250,	9.5870,	8.7960,	8.6270,	7.4820,	7.0560,
0 SOPCOFAC,	1.0061,	.9774,	.9897,	1.0597,	1.0193,	1.0213,	1.0136,	1.0106,	.9940,	1.0104,
1										

Table 2.2.4.1. Proportion mature of Faroe Plateau cod 1961-97.

Run title : Cod FaroePlateau Vb1 (run: XSAPET02/X02)

At 1-May-98 10:10:19

Table 5 Proportion mature at age

YEAR,	1961,	1962,	1963,	1964,	1965,	1966,	1967,
AGE							
2,	.1700,	.1700,	.1700,	.1700,	.1700,	.1700,	.1700,
3,	.6400,	.6400,	.6400,	.6400,	.6400,	.6400,	.6400,
4,	.8700,	.8700,	.8700,	.8700,	.8700,	.8700,	.8700,
5,	.9500,	.9500,	.9500,	.9500,	.9500,	.9500,	.9500,
6,	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,
8,	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,
+gp,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,

Table 5 Proportion mature at age

YEAR,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
AGE										
2,	.1700,	.1700,	.1700,	.1700,	.1700,	.1700,	.1700,	.1700,	.1700,	.1700,
3,	.6400,	.6400,	.6400,	.6400,	.6400,	.6400,	.6400,	.6400,	.6400,	.6400,
4,	.8700,	.8700,	.8700,	.8700,	.8700,	.8700,	.8700,	.8700,	.8700,	.8700,
5,	.9500,	.9500,	.9500,	.9500,	.9500,	.9500,	.9500,	.9500,	.9500,	.9500,
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,

1

Run title : Cod FaroePlateau Vb1 (run: XSAPET02/X02)

At 1-May-98 10:10:19

Table 5 Proportion mature at age

YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
2,	.1700,	.1700,	.1700,	.1700,	.1700,	.6300,	.4000,	.0000,	.0000,	.0000,
3,	.6400,	.6400,	.6400,	.6400,	.6400,	.7100,	.9600,	.5000,	.3800,	.6700,
4,	.8700,	.8700,	.8700,	.8700,	.8700,	.9300,	.9800,	.9600,	.9300,	.9100,
5,	.9500,	.9500,	.9500,	.9500,	.9500,	.9400,	.9700,	.9600,	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,	.9600,	1.0000,
8,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	1.0000,	.9400,	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,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,
AGE										
2,	.0600,	.0500,	.0000,	.0000,	.0600,	.2500,	.7200,	.2100,	.0400,	.0000,
3,	.7200,	.5400,	.6800,	.7200,	.5000,	.7300,	.8900,	.5300,	.4400,	.7400,
4,	.9000,	.9600,	.9000,	.8600,	.8200,	.7800,	.9800,	.5500,	.7500,	.9300,
5,	.9700,	1.0000,	.9900,	1.0000,	.9800,	.9100,	.9900,	.7400,	.8700,	.9900,
6,	1.0000,	1.0000,	.9600,	1.0000,	1.0000,	.9900,	1.0000,	.9700,	.9400,	1.0000,
7,	1.0000,	1.0000,	.9800,	1.0000,	1.0000,	1.0000,	.9800,	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,

1

Table 2.2.6.1.1 Tuning series for Faroe Plateau Cod: a) Groundfish survey and b-h) commercial fleets. The groundfish survey is shifted back by 3 months, meaning that the ages 2-8 in the years 1982-97 actually are ages 3-9 in the years 1983-98. The first column from left shows the fishing effort (relative unit for the groundfish survey and number of days for the others). The other columns show number of fish catched of each age group (ages 2-8 for the groundfish survey and ages 2-9 for the commercial fleets). The rows represent years (see below the name of each tuning series).

a)

```
FAROE PLATEAU COD  (ICES SUBDIVISION VB1)
108
R/V  Magnus Heinason   (Groundfish surveys) shifted back by 3 months
1982 1997
1 1  .9 1.0
2 8
100   25.92   17.84   14.41    5.28    1.46    0.51    0.08
100   21.84   16.19    5.08    3.29    1.31    0.13    0.01
100   42.96   15.46    6.21    1.31    1.57    0.60    0.01
100   26.69   94.23   26.49   11.13    5.45    3.52    1.07
100   15.39   34.48   45.95    7.22    0.91    1.15    0.10
100   12.65   16.62   12.84   14.27    2.75    0.72    0.18
100    6.02   10.06    8.24    4.05    6.61    0.66    0.09
100    6.38   15.22   13.78    4.36    5.45    3.70    0.62
100    3.52   12.22    3.15    1.50    0.51    0.12    0.23
100    2.10    4.72   18.10    3.94    1.26    0.65    0.13
100    4.48    2.32    1.63    3.29    1.18    0.44    0.12
100    3.74   13.74    7.83    2.11    3.05    0.32    0.01
100    9.77   20.89   29.13   27.54    7.55    9.04    1.27
100   52.93   68.85   37.41   28.04    8.14    1.54    3.16
100   13.98   84.47   35.21    4.76    3.23    0.80    0.22
100    9.99   34.38   96.62   19.70    1.31    0.63    0.56
```

b)

```
LONGLINERS < 100 GRT
1985 1997
1 1 0 1
2 9
 7530   550  3110   799   375   181   282    73    17
 6622    47   646  1239   352   148    43    26     6
 6669   166   223   427   528   130    29    11    11
 8680   315   532   236   173   273    67    23     5
12774  1466   931   672   303   270   216    34     4
14440   181  1302   481   317   119    86    85    14
14780   152   255   984   185    79    28    15    10
10523   109   198   164   230    50    22     9     6
 7326    46   178    85    28    53    11     5     3
 7443   190   166   140    47    12    16     3     2
 9582   759   475   169   110    58    16    24     5
12546   194  1152   776   219   367   151    42    97
13706   126   553  2296  1043   125   231    57    15
```

c)

TRAWLERS < 400 HP
1985 1997
1 1 0 1
2 9

1987	96	1120	257	82	33	27	11	1
1477	37	398	466	68	16	4	3	1
1259	28	266	295	214	28	4	1	1
1196	36	188	144	71	91	14	4	0
1376	105	221	175	66	49	57	11	4
1144	1	274	141	29	10	6	4	0
1106	3	41	197	54	22	8	4	2
1148	18	33	27	59	22	9	4	1
1977	29	169	90	31	42	10	4	3
1600	48	73	101	54	10	15	3	1
1924	28	153	175	89	33	6	9	3
1424	32	281	162	48	83	31	9	22
1685	7	55	342	141	29	16	4	1

d)

SINGLE TRAWLERS 400-1000 HP
1985 1997
1 1 0 1
2 9

1969	29	665	339	118	57	41	13	2
1133	5	239	658	141	38	9	6	2
1463	12	91	257	245	36	10	3	3
2175	23	169	142	113	165	38	11	2
1952	122	171	156	58	51	59	11	4
1853	2	112	55	19	15	10	10	2
1013	0	1	52	27	15	8	3	3
465	4	9	10	18	6	3	1	1
963	4	44	39	11	11	3	1	1
636	6	20	18	15	4	5	1	1
1302	17	40	70	47	22	5	5	1
1253	4	137	162	72	36	11	1	4
1063	0	18	232	200	41	16	4	1

e)

SINGLE TRAWLERS > 1000 HP
1985 1997
1 1 0 1
2 9

5296	26	706	520	230	91	62	25	9
5232	2	258	813	206	62	17	10	5
4181	9	41	154	275	92	27	6	7
4481	16	105	92	98	152	47	13	4
4572	8	44	90	82	75	75	18	5
3601	10	120	63	36	17	12	12	2
3644	0	8	51	28	16	9	6	2
3580	7	15	15	29	10	4	2	1
3547	1	9	16	7	10	4	1	1
3500	9	20	28	34	9	12	3	1
3789	16	44	74	54	27	6	7	2
3526	2	76	79	34	17	5	0	2
3412	0	10	139	116	23	10	2	0

f)

PAIR TRAWLERS 400-1000 HP
1985 1997
1 1 0 1
2 9

4906	61	802	424	201	94	120	43	12
5953	20	848	2667	747	265	54	37	15
5575	46	383	755	927	221	54	16	21
5736	52	558	698	467	663	108	31	4
4987	49	139	265	148	122	114	30	8
5273	1	77	92	68	35	28	24	4
5626	0	13	92	53	29	15	11	6
3832	2	16	33	97	38	17	6	3
2771	4	52	60	26	38	15	4	3
1962	17	42	44	50	15	19	4	3
2388	26	62	109	72	34	8	8	2
3207	9	341	373	154	73	22	1	10
2608	0	16	225	185	35	16	3	1

g)

PAIR TRAWLERS > 1000 HP
1985 1997
1 1 0 1
2 9

3064	14	370	218	98	39	47	17	6
4336	17	267	1001	388	166	44	27	8
5420	7	117	319	484	173	46	10	8
5973	9	217	263	247	377	91	34	6
5111	10	73	152	119	104	99	25	7
7424	2	139	149	92	47	29	29	5
7673	1	21	134	82	45	25	17	8
6853	2	29	55	158	64	29	12	5
5953	4	79	106	48	64	24	7	5
5302	28	91	123	151	43	53	12	8
6069	42	115	191	142	71	16	19	6
6551	27	862	845	290	180	43	2	17
6406	2	59	513	430	77	39	8	0

h)

LONGLINERS > 100 GRT
1985 1997
1 1 0 1
2 9

2740	33	468	231	124	69	103	39	9
2085	2	95	300	128	67	20	14	4
2444	5	25	132	232	117	56	21	18
2831	27	191	183	173	229	69	35	10
3220	314	306	290	163	192	189	54	16
3367	33	344	179	133	88	77	77	14
3442	14	47	289	98	52	30	23	13
2829	19	47	47	89	33	16	8	5
1754	3	78	76	26	47	12	6	3
2334	105	134	67	42	13	24	9	5
3648	151	384	221	152	90	28	59	15
4126	24	757	739	296	407	178	54	123
5302	21	239	1651	1053	236	231	69	29

Table 2.2.6.1.2. XSA run for Faroe Plateau cod.

```
Lowestoft VPA Version 3.1

 1-May-98 10:08:58

 Extended Survivors Analysis

 Cod FaroePlateau Vb1 (run: XSAPET02/X02)

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

 Catch data for 37 years. 1961 to 1997. Ages 2 to 10.

 Fleet, First, Last, First, Last, Alpha, Beta
, year, year, age, age
 FLT17: SINGLE TRAWLE, 1985, 1997, 4, 9,.000, 1.000
 FLT18: LONGLINERS >, 1985, 1997, 3, 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 converged after 25 iterations

1


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



 Fishing mortalities
 Age, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997

 2,.067,.175,.077,.031,.020,.010,.018,.059,.033,.017
 3,.342,.444,.353,.197,.099,.095,.085,.112,.161,.164
 4,.565,.721,.635,.489,.335,.176,.175,.324,.288,.329
 5,.524,.764,.699,.599,.411,.251,.232,.252,.455,.404
 6,.730,.873,.702,.571,.669,.242,.217,.326,.767,.359
 7,.774,.918,.669,.570,.550,.453,.197,.328,.950,.904
 8,.632, 1.015,.769,.452,.455,.239,.333,.306,.921,.822
 9,.529,.495,.671,.291,.258,.331,.256,.788, 2.125, 1.071

1
 XSA population numbers (Thousands)

 AGE
 YEAR, 2, 3, 4, 5, 6, 7, 8, 9,

 1988, 8.66E+03, 8.09E+03, 4.98E+03, 4.02E+03, 4.65E+03, 1.01E+03, 3.97E+02, 8.87E+01,
 1989, 1.54E+04, 6.63E+03, 4.70E+03, 2.32E+03, 1.95E+03, 1.83E+03, 3.81E+02, 1.73E+02,
 1990, 3.63E+03, 1.06E+04, 3.48E+03, 1.87E+03, 8.85E+02, 6.66E+02, 5.99E+02, 1.13E+02,
 1991, 6.87E+03, 2.75E+03, 6.08E+03, 1.51E+03, 7.62E+02, 3.59E+02, 2.80E+02, 2.27E+02,
 1992, 1.19E+04, 5.45E+03, 1.85E+03, 3.05E+03, 6.80E+02, 3.53E+02, 1.66E+02, 1.46E+02,
 1993, 1.28E+04, 9.59E+03, 4.04E+03, 1.08E+03, 1.66E+03, 2.85E+02, 1.67E+02, 8.63E+01,
 1994, 3.43E+04, 1.04E+04, 7.14E+03, 2.78E+03, 6.90E+02, 1.07E+03, 1.48E+02, 1.07E+02,
 1995, 4.92E+04, 2.76E+04, 7.82E+03, 4.91E+03, 1.80E+03, 4.55E+02, 7.16E+02, 8.72E+01,
 1996, 1.18E+04, 3.80E+04, 2.02E+04, 4.63E+03, 3.12E+03, 1.07E+03, 2.68E+02, 4.32E+02,
 1997, 1.28E+04, 9.31E+03, 2.65E+04, 1.24E+04, 2.41E+03, 1.19E+03, 3.37E+02, 8.74E+01,

 Estimated population abundance at 1st Jan 1998

,.00E+00, 1.03E+04, 6.47E+03, 1.56E+04, 6.79E+03, 1.38E+03, 3.94E+02, 1.21E+02,

 Taper weighted geometric mean of the VPA populations:

, 1.39E+04, 1.10E+04, 7.27E+03, 3.49E+03, 1.59E+03, 7.17E+02, 3.06E+02, 1.40E+02,

 Standard error of the weighted Log(VPA populations):

,.7117,.7315,.7580,.6851,.6020,.5886,.5384,.5443,
1
```

Log catchability residuals.

Fleet : FLT17: SINGLE TRAWLE

Age ,	1985,	1986,	1987
3 ,	No data for this fleet at this age		
4 ,	.54,	1.14,	.84
5 ,	.24,	.79,	.44
6 ,	.62,	.44,	-.08
7 ,	.38,	.37,	-.35
8 ,	.28,	.09,	-.12
9 ,	-.10,	.01,	-.12

Age ,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997
3 ,	No data for this fleet at this age									
4 ,	.34,	.67,	-.06,	-.13,	.12,	-.10,	-1.03,	-.41,	-.50,	-.22
5 ,	.11,	.20,	-.68,	.45,	.04,	-.22,	-.44,	-.58,	.04,	.21
6 ,	.35,	.21,	-.24,	.45,	.47,	-.73,	-.46,	-.38,	-.21,	.17
7 ,	.43,	.44,	-.38,	.58,	.38,	-.17,	-.68,	-.49,	-.24,	.17
8 ,	.06,	.37,	-.23,	-.21,	.00,	-.83,	-.26,	-.95,	-1.27,	.01
9 ,	-.19,	-.07,	-.21,	-.07,	.04,	-.13,	.03,	-.24,	.07,	.07

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,	-11.2292,	-11.0241,	-10.9422,	-10.9422,	-10.9422,	-10.9422,
S.E(Log q),	.5802,	.4212,	.4279,	.4371,	.5926,	.1344,

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,	1.06,	-.244,	11.38,	.62,	13,	.65,	-11.23,
5,	.85,	.925,	10.60,	.81,	13,	.36,	-11.02,
6,	1.00,	-.020,	10.96,	.67,	13,	.45,	-10.94,
7,	1.01,	-.023,	10.97,	.65,	13,	.46,	-10.94,
8,	.97,	.086,	11.09,	.54,	13,	.52,	-11.24,
9,	.91,	1.424,	10.47,	.97,	13,	.10,	-11.01,

1

Fleet : FLT18: LONGLINERS >

Age ,	1985,	1986,	1987
3 ,	.04,	-.32,	-1.30
4 ,	-.16,	-.23,	-.31
5 ,	-.14,	-.01,	-.23
6 ,	.07,	-.01,	.18
7 ,	.57,	.15,	.45
8 ,	.64,	-.08,	.91
9 ,	.66,	-.32,	.75

Age ,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997
3 ,	.58,	1.17,	.73,	-.01,	-.54,	-.12,	.05,	-.31,	-.05,	-.05
4 ,	.36,	.81,	.55,	.39,	-.11,	-.01,	-.99,	-.27,	-.15,	.15
5 ,	.17,	.64,	.57,	.42,	-.27,	-.06,	-.81,	-.53,	.16,	.17
6 ,	.00,	.63,	.52,	.07,	-.04,	-.29,	-.99,	-.41,	.62,	-.10
7 ,	.35,	.69,	.66,	.27,	-.16,	.20,	-.82,	-.20,	.94,	.82
8 ,	.55,	1.05,	.81,	.20,	-.14,	-.05,	.23,	.08,	1.12,	.84
9 ,	.75,	.41,	.73,	-.24,	-.57,	-.04,	-.07,	1.03,	1.90,	1.42

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,	-12.0158,	-11.2522,	-10.9256,	-10.5342,	-10.5342,	-10.5342,	-10.5342,
S.E(Log q),	.5847,	.4740,	.4370,	.4692,	.5971,	.6710,	.9325,

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,	1.05,	-.200,	12.16,	.60,	13,	.65,	-12.02,
4,	1.14,	-.647,	11.59,	.69,	13,	.56,	-11.25,
5,	1.14,	-.619,	11.32,	.68,	13,	.52,	-10.93,
6,	.79,	1.091,	9.87,	.76,	13,	.37,	-10.53,
7,	.76,	1.163,	9.38,	.73,	13,	.39,	-10.25,
8,	.82,	.766,	9.30,	.67,	13,	.39,	-10.07,
9,	.75,	.666,	8.76,	.45,	13,	.59,	-10.02,

1

Fleet disaggregated estimates of survivors:

Age 2 Catchability dependent on age and year class strength

Year class = 1995

FLT17: SINGLE TRAWLE
Age, 2,
Survivors, 0.,
Raw Weights,.000,

FLT18: LONGLINERS >
Age, 2,
Survivors, 0.,
Raw Weights,.000,

Fleet, Estimated, Int, Ext, Var, N, Scaled, Estimated
, Survivors, s.e, s.e, Ratio,, Weights, F
FLT17: SINGLE TRAWLE, 1.,.000,.000,.00, 0,.000,.000
FLT18: LONGLINERS >, 1.,.000,.000,.00, 0,.000,.000

P shrinkage mean, 10995.,.73,,,,.882,.016

F shrinkage mean, 6352., 2.00,,,,.118,.028

Weighted prediction:

Survivors, Int, Ext, N, Var, F
at end of year, s.e, s.e,, Ratio,
10306.,.69, 9.24, 2, 13.453,.017

1
Age 3 Catchability constant w.r.t. time and dependent on age

Year class = 1994

FLT17: SINGLE TRAWLE
Age, 3, 2,
Survivors, 0., 0.,
Raw Weights,.000,.000,

FLT18: LONGLINERS >
Age, 3, 2,
Survivors, 6178., 0.,
Raw Weights, 2.275,.000,

Fleet, Estimated, Int, Ext, Var, N, Scaled, Estimated
, Survivors, s.e, s.e, Ratio,, Weights, F
FLT17: SINGLE TRAWLE, 1.,.000,.000,.00, 0,.000,.000
FLT18: LONGLINERS >, 6178.,.611,.000,.00, 1,.901,.171

F shrinkage mean, 9851., 2.00,,,,.099,.111

Weighted prediction:

Survivors, Int, Ext, N, Var, F
at end of year, s.e, s.e,, Ratio,
6470.,.58,.15, 2,.251,.164

1
Age 4 Catchability constant w.r.t. time and dependent on age

Year class = 1993

FLT17: SINGLE TRAWLE
Age, 4, 3, 2,
Survivors, 12471., 0., 0.,
Raw Weights, 1.961,.000,.000,

FLT18: LONGLINERS >
Age, 4, 3, 2,
Survivors, 18208., 14844., 0.,
Raw Weights, 2.937, 1.642,.000,

Fleet, Estimated, Int, Ext, Var, N, Scaled, Estimated
, Survivors, s.e, s.e, Ratio,, Weights, F
FLT17: SINGLE TRAWLE, 12471.,.606,.000,.00, 1,.289,.397
FLT18: LONGLINERS >, 16921.,.386,.098,.25, 2,.674,.306

F shrinkage mean, 20361., 2.00,,,,.037,.261

Weighted prediction:

Survivors, Int, Ext, N, Var, F
at end of year, s.e, s.e,, Ratio,
15600.,.32,.10, 4,.301,.329

1
Age 5 Catchability constant w.r.t. time and dependent on age

Year class = 1992

FLT17: SINGLE TRAWLE
Age, 5, 4, 3, 2,
Survivors, 8405., 4130., 0., 0.,
Raw Weights, 3.451, 1.364,.000,.000,

FLT18: LONGLINERS >
Age, 5, 4, 3, 2,
Survivors, 8040., 5855., 4979., 0.,
Raw Weights, 3.206, 2.043, 1.197,.000,

Fleet, Estimated, Int, Ext, Var, N, Scaled, Estimated
, Survivors, s.e, s.e, Ratio,, Weights, F
FLT17: SINGLE TRAWLE, 6873.,.359,.320,.89, 2,.418,.400
FLT18: LONGLINERS >, 6652.,.298,.139,.47, 3,.560,.410

F shrinkage mean, 8887., 2.00,,,,.022,.322

Weighted prediction:

Survivors, Int, Ext, N, Var, F
at end of year, s.e, s.e,, Ratio,
6786.,.23,.12, 6,.504,.404

1
Age 6 Catchability constant w.r.t. time and dependent on age

Year class = 1991

FLT17: SINGLE TRAWLE
Age, 6, 5, 4, 3, 2,
Survivors, 1627., 1427., 915., 0., 0.,
Raw Weights, 3.496, 2.289,.870,.000,.000,

FLT18: LONGLINERS >
Age, 6, 5, 4, 3, 2,
Survivors, 1248., 1614., 1055., 1443., 0.,
Raw Weights, 2.907, 2.127, 1.303,.781,.000,

Fleet, Estimated, Int, Ext, Var, N, Scaled, Estimated
, Survivors, s.e, s.e, Ratio,, Weights, F
FLT17: SINGLE TRAWLE, 1442.,.290,.132,.45, 3,.475,.345
FLT18: LONGLINERS >, 1328.,.267,.088,.33, 4,.508,.370

F shrinkage mean, 1053., 2.00,,,,.018,.448

Weighted prediction:

Survivors, Int, Ext, N, Var, F
at end of year, s.e, s.e,, Ratio,
1375.,.20,.07, 8,.340,.359

1
Age 7 Catchability constant w.r.t. time and age (fixed at the value for age) 6

Year class = 1990

FLT17: SINGLE TRAWLE
Age, 7, 6, 5, 4, 3, 2,
Survivors, 466., 319., 221., 141., 0., 0.,
Raw Weights, 1.944,.941,.753,.331,.000,.000,

FLT18: LONGLINERS >
Age, 7, 6, 5, 4, 3, 2,
Survivors, 897., 729., 231., 146., 349., 0.,
Raw Weights, 1.041,.783,.700,.496,.292,.000,

Fleet, Estimated, Int, Ext, Var, N, Scaled, Estimated
, Survivors, s.e, s.e, Ratio,, Weights, F
FLT17: SINGLE TRAWLE, 335.,.266,.223,.84, 4,.527, 1.004
FLT18: LONGLINERS >, 450.,.264,.351, 1.33, 5,.440,.827

F shrinkage mean, 893., 2.00,,,,.033,.499

```
Weighted prediction:

Survivors, Int, Ext, N, Var, F
at end of year, s.e, s.e,, Ratio,
394.,.19,.19, 10, 1.004,.904


1
Age 8 Catchability constant w.r.t. time and age (fixed at the value for age) 6

Year class = 1989

FLT17: SINGLE TRAWLE
Age, 8, 7, 6, 5, 4, 3, 2,
Survivors, 122., 95., 83., 78., 110., 0., 0.,
Raw Weights, 1.148,.816,.613,.498,.217,.000,.000,




FLT18: LONGLINERS >
Age, 8, 7, 6, 5, 4, 3, 2,
Survivors, 281., 311., 80., 54., 120., 71., 0.,
Raw Weights,.895,.437,.510,.463,.325,.189,.000,



Fleet, Estimated, Int, Ext, Var, N, Scaled, Estimated
, Survivors, s.e, s.e, Ratio,, Weights, F
FLT17: SINGLE TRAWLE, 99.,.269,.088,.33, 5,.517,.941
FLT18: LONGLINERS >, 144.,.278,.314, 1.13, 6,.443,.731

F shrinkage mean, 269., 2.00,,,,.039,.454

Weighted prediction:

Survivors, Int, Ext, N, Var, F
at end of year, s.e, s.e,, Ratio,
121.,.20,.16, 12,.809,.822


1
Age 9 Catchability constant w.r.t. time and age (fixed at the value for age) 6

Year class = 1988

FLT17: SINGLE TRAWLE
Age, 9, 8, 7, 6, 5, 4, 3, 2,
Survivors, 26., 7., 15., 15., 20., 28., 0., 0.,
Raw Weights, 3.806,.356,.470,.392,.310,.114,.000,.000,



FLT18: LONGLINERS >
Age, 9, 8, 7, 6, 5, 4, 3, 2,
Survivors, 102., 75., 20., 9., 23., 22., 24., 0.,
Raw Weights,.361,.278,.252,.326,.288,.171,.089,.000,



Fleet, Estimated, Int, Ext, Var, N, Scaled, Estimated
, Survivors, s.e, s.e, Ratio,, Weights, F
FLT17: SINGLE TRAWLE, 22.,.221,.164,.74, 6,.730, 1.151
FLT18: LONGLINERS >, 31.,.278,.352, 1.27, 7,.237,.924

F shrinkage mean, 62., 2.00,,,,.033,.568

Weighted prediction:

Survivors, Int, Ext, N, Var, F
at end of year, s.e, s.e,, Ratio,
25.,.19,.16, 14,.849, 1.071
```

Table 2.2.6.1.3. CPUEs for various faroese fleets standardized to their own mean from 1985-97. The indices in 1996 and 1997 are divided by the 1985 and 1986 indices respectively, and also the average for 1996-97 divided by the average for 1985-86 are divided. The averages of these proportions are shown to the right. The open boats are not used in the calculations of the averages due to anomal values in 1985-86.

Year	Open boats	Longliners < 100 GRT	Singletrawl < 400 HP	Singletrawl 400-1000H	Singletrawl > 1000 HP	Pairtrawl < 1000 HP	Pairtrawl > 1000 HP	Longliners > 100 GRT	Average
1985	7.21	2.97	1.60	1.86	2.90	1.49	1.40	1.12	
1986	3.09	1.64	1.45	2.24	1.94	2.58	2.28	0.88	
1987	1.83	1.11	1.45	1.30	1.59	1.69	1.24	1.02	
1988	0.11	0.81	1.20	0.96	1.30	1.62	1.23	1.14	
1989	0.12	1.09	1.12	0.82	0.97	0.73	0.72	1.32	
1990	0.08	0.68	0.67	0.34	0.55	0.27	0.36	0.80	
1991	0.05	0.39	0.62	0.43	0.39	0.19	0.28	0.45	
1992	0.04	0.30	0.42	0.34	0.20	0.27	0.34	0.28	
1993	0.03	0.25	0.50	0.35	0.19	0.42	0.39	0.41	
1994	0.05	0.31	0.71	0.46	0.45	0.53	0.73	0.58	
1995	0.10	0.75	0.78	0.72	0.83	0.78	0.75	1.00	
1996	0.16	1.26	1.42	1.29	0.70	1.50	2.15	2.05	
1997	0.14	1.44	1.05	1.88	0.99	0.93	1.14	1.94	
Ind96/Ind85		0.42	0.88	0.69	0.24	1.01	1.54	1.84	0.95
Ind97/Ind85		0.48	0.65	1.01	0.34	0.62	0.81	1.74	0.81
Aver96-97/aver85-86		0.59	0.81	0.77	0.35	0.60	0.89	2.00	0.86

Table 2.2.6.1.4. Results from XSA run.

Run title : Cod FaroePlateau Vb1 (run: XSAPET05/X05)

At 3-May-98 15:28:23

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR,	1961,	1962,	1963,	1964,	1965,	1966,	1967,
AGE							
2,	.3346,	.2701,	.2534,	.1086,	.1209,	.0829,	.0789,
3,	.5141,	.4982,	.4138,	.2997,	.2518,	.1969,	.2389,
4,	.4986,	.4838,	.5172,	.4523,	.4498,	.2552,	.2687,
5,	.5737,	.7076,	.5124,	.5229,	.5622,	.4499,	.3442,
6,	.4863,	.5569,	.5405,	.5659,	.6604,	.5016,	.5779,
7,	.9566,	.3662,	.4879,	.6677,	.5305,	.9680,	.5203,
8,	.8116,	.6826,	.3269,	.3531,	.4345,	.8520,	1.0438,
9,	.6715,	.5641,	.4806,	.5164,	.5318,	.6106,	.5556,
+gp,	.6715,	.5641,	.4806,	.5164,	.5318,	.6106,	.5556,
0 FBAR 3- 7,	.6059,	.5226,	.4944,	.5017,	.4909,	.4743,	.3900,

Table 8 Fishing mortality (F) at age

YEAR,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
AGE										
2,	.1010,	.1099,	.0530,	.0309,	.0464,	.0657,	.0816,	.0774,	.0933,	.0481,
3,	.2318,	.3063,	.2081,	.1337,	.1476,	.2322,	.1568,	.3193,	.1723,	.3036,
4,	.3949,	.3806,	.3654,	.2225,	.2070,	.3048,	.2046,	.4359,	.3665,	.4747,
5,	.5339,	.4180,	.3409,	.3845,	.2497,	.2813,	.2953,	.4134,	.5569,	.7532,
6,	.4472,	.5709,	.3709,	.5572,	.6058,	.2526,	.3797,	.4544,	.5167,	.7334,
7,	.7132,	.5118,	.6559,	.4651,	.4686,	.3722,	.5330,	.3504,	.7619,	1.1137,
8,	.3331,	.8457,	.4208,	.7528,	.2484,	.3259,	.3052,	.4485,	.6429,	.7776,
9,	.4882,	.5499,	.4339,	.4800,	.3578,	.3091,	.3457,	.4235,	.5738,	.7782,
+gp,	.4882,	.5499,	.4339,	.4800,	.3578,	.3091,	.3457,	.4235,	.5738,	.7782,
0 FBAR 3- 7,	.4642,	.4375,	.3882,	.3526,	.3358,	.2886,	.3139,	.3947,	.4748,	.6757,
1										

Run title : Cod FaroePlateau Vb1 (run: XSAPET05/X05)

At 3-May-98 15:28:23

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
2,	.0590,	.0429,	.0544,	.0521,	.0579,	.0989,	.1063,	.0648,	.0247,	.0283,
3,	.1896,	.2634,	.2365,	.2878,	.2214,	.4602,	.3701,	.3505,	.3480,	.2210,
4,	.4290,	.4307,	.3718,	.3359,	.3603,	.5535,	.5644,	.5052,	.6114,	.4623,
5,	.4288,	.5049,	.4335,	.4409,	.3806,	.6413,	.6502,	.5858,	.6971,	.4702,
6,	.4850,	.4904,	.5181,	.5638,	.4103,	.7543,	.4537,	.8906,	.7520,	.5469,
7,	.5969,	.4479,	.4117,	.6938,	.6912,	1.1115,	.4443,	1.1098,	.7717,	.4129,
8,	.5673,	.6905,	.6434,	.5010,	.5523,	.9373,	.5115,	1.1159,	.5426,	.5267,
9,	.5054,	.5169,	.4793,	.5111,	.4826,	.8078,	.5290,	1.0399,	.4801,	.5329,
+gp,	.5054,	.5169,	.4793,	.5111,	.4826,	.8078,	.5290,	1.0399,	.4801,	.5329,
0 FBAR 3- 7,	.4259,	.4274,	.3943,	.4644,	.4128,	.7042,	.4965,	.6884,	.6360,	.4227,

Table 8 Fishing mortality (F) at age

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	FBAR 95-97
AGE											
2,	.0672,	.1751,	.0769,	.0310,	.0195,	.0102,	.0181,	.0590,	.0333,	.0174,	.0366,
3,	.3423,	.4440,	.3533,	.1973,	.0990,	.0950,	.0851,	.1122,	.1614,	.1643,	.1460,
4,	.5646,	.7211,	.6348,	.4893,	.3346,	.1762,	.1747,	.3243,	.2877,	.3286,	.3135,
5,	.5243,	.7638,	.6987,	.5987,	.4109,	.2514,	.2315,	.2517,	.4545,	.4037,	.3700,
6,	.7297,	.8725,	.7025,	.5707,	.6687,	.2425,	.2174,	.3262,	.7674,	.3593,	.4843,
7,	.7736,	.9183,	.6685,	.5697,	.5498,	.4529,	.1966,	.3279,	.9498,	.9038,	.7272,
8,	.6315,	1.0153,	.7690,	.4519,	.4553,	.2385,	.3325,	.3063,	.9208,	.8215,	.6829,
9,	.5292,	.4951,	.6707,	.2912,	.2582,	.3309,	.2564,	.7879,	2.1249,	1.0713,	1.3281,
+gp,	.5292,	.4951,	.6707,	.2912,	.2582,	.3309,	.2564,	.7879,	2.1249,	1.0713,	
0 FBAR 3- 7,	.5869,	.7439,	.6116,	.4851,	.4126,	.2436,	.1811,	.2685,	.5242,	.4319,	
1											

Table 2.2.6.1.5. Terminal Fs from XSA.

Run title : Cod FaroePlateau Vbl (run: XSAPET02/X02)

At 1-May-98 10:10:19

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,	1967,
AGE							
2,	12019,	20654,	20290,	21834,	8269,	18566,	23451,
3,	7385,	7042,	12907,	12893,	16037,	5999,	13990,
4,	3747,	3616,	3503,	6986,	7823,	10207,	4034,
5,	2699,	1863,	1825,	1710,	3639,	4085,	6475,
6,	666,	1245,	752,	895,	830,	1698,	2133,
7,	668,	335,	584,	358,	416,	351,	842,
8,	155,	210,	190,	294,	151,	200,	109,
9,	66,	56,	87,	112,	169,	80,	70,
+gp,	0,	0,	0,	0,	0,	0,	0,
0 TOTAL,	27403,	35021,	40138,	45083,	37332,	41186,	51104,

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

YEAR,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
AGE										
2,	17582,	9325,	8609,	11928,	21320,	12573,	30481,	38323,	18575,	9998,
3,	17744,	13012,	6840,	6684,	9469,	16664,	9639,	23001,	29038,	13854,
4,	9020,	11522,	7843,	4548,	4788,	6689,	10817,	6746,	13684,	20012,
5,	2525,	4976,	6447,	4456,	2981,	3187,	4037,	7217,	3572,	7766,
6,	3757,	1212,	2682,	3754,	2483,	1901,	1970,	2460,	3908,	1676,
7,	980,	1967,	561,	1516,	1760,	1109,	1209,	1103,	1279,	1909,
8,	410,	393,	965,	238,	779,	902,	626,	581,	636,	489,
9,	31,	240,	138,	519,	92,	499,	533,	378,	304,	274,
+gp,	0,	0,	0,	0,	0,	400,	342,	476,	466,	18,
0 TOTAL,	52050,	42647,	34085,	33643,	43673,	43924,	59654,	80286,	71462,	55994,
1										

Run title : Cod FaroePlateau Vbl (run: XSAPET02/X02)

At 1-May-98 10:10:19

Terminal Fs derived using XSA (With F shrinkage)

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

YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
2,	10709,	15137,	23579,	14071,	22379,	25217,	48163,	17572,	9504,	10167,
3,	7801,	8266,	11873,	18283,	10936,	17292,	18701,	35455,	13484,	7591,
4,	8373,	5284,	5200,	7673,	11226,	7176,	8936,	10575,	20446,	7795,
5,	10192,	4464,	2812,	2936,	4490,	6410,	3378,	4161,	5225,	9083,
6,	2994,	5434,	2206,	1493,	1547,	2512,	2764,	1443,	1896,	2130,
7,	659,	1509,	2725,	1076,	695,	840,	967,	1438,	485,	732,
8,	513,	297,	790,	1478,	440,	285,	226,	508,	388,	184,
9,	184,	238,	122,	340,	733,	207,	91,	111,	136,	185,
+gp,	154,	103,	52,	150,	349,	200,	176,	134,	109,	69,
0 TOTAL,	41579,	40732,	49358,	47500,	52795,	60140,	83402,	71397,	51673,	37935,

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

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	1998,	GMST 61-95	AMST 61-95
AGE													
2,	8661,	15394,	3630,	6869,	11938,	12834,	34348,	49220,	11760,	12809,	0,	15764,	18377,
3,	8091,	6631,	10570,	2752,	5452,	9585,	10401,	27616,	37989,	9314,	10306,	11304,	12943,
4,	4983,	4704,	3483,	6084,	1850,	4043,	7137,	7821,	20211,	26466,	6470,	6761,	7668,
5,	4019,	2320,	1873,	1511,	3054,	1084,	2775,	4906,	4629,	12411,	15600,	3620,	4119,
6,	4647,	1949,	865,	762,	680,	1658,	690,	1803,	3123,	2406,	6786,	1751,	2043,
7,	1009,	1834,	666,	359,	353,	285,	1065,	455,	1065,	1187,	1375,	823,	974,
8,	397,	381,	589,	280,	166,	167,	148,	716,	268,	337,	334,	358,	437,
9,	89,	173,	113,	227,	146,	86,	107,	87,	432,	87,	121,	155,	201,
+gp,	67,	25,	58,	104,	169,	97,	78,	96,	57,	198,	83,		
0 TOTAL,	31963,	33419,	21887,	18949,	23808,	29839,	56749,	92720,	79535,	65215,	41132,		
1													

Table 2.2.6.1.6. Summary table from XSA.

Run title : Cod FaroePlateau Vb1 (run: XSAPET05/X05)

At 3-May-98 15:28:23

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,	12019,	65428,	46439,	21598,	.4651,	.6059,
1962,	20654,	68225,	43326,	20967,	.4839,	.5226,
1963,	20290,	77602,	49054,	22215,	.4529,	.4944,
1964,	21834,	84666,	55362,	21078,	.3807,	.5017,
1965,	8269,	75043,	57057,	24212,	.4244,	.4909,
1966,	18566,	83919,	60629,	20418,	.3368,	.4743,
1967,	23451,	105289,	73934,	23562,	.3187,	.3900,
1968,	17582,	110433,	82484,	29930,	.3629,	.4642,
1969,	9325,	105537,	83487,	32371,	.3877,	.4375,
1970,	8609,	98398,	82035,	24183,	.2948,	.3882,
1971,	11928,	78218,	63308,	23010,	.3635,	.3526,
1972,	21320,	76439,	57180,	18727,	.3275,	.3358,
1973,	12573,	110714,	83548,	22228,	.2661,	.2886,
1974,	30481,	139267,	98434,	24581,	.2497,	.3139,
1975,	38323,	153668,	109567,	36775,	.3356,	.3947,
1976,	18575,	161268,	123082,	39799,	.3234,	.4748,
1977,	9998,	136223,	112066,	34927,	.3117,	.6757,
1978,	10709,	96207,	78512,	26585,	.3386,	.4259,
1979,	15137,	85197,	66722,	23112,	.3464,	.4274,
1980,	23579,	85153,	58953,	20513,	.3480,	.3943,
1981,	14071,	88632,	63697,	22963,	.3605,	.4644,
1982,	22379,	99531,	67304,	21489,	.3193,	.4128,
1983,	25217,	124031,	99367,	38133,	.3838,	.7042,
1984,	48163,	153579,	116728,	36979,	.3168,	.4965,
1985,	17572,	132690,	85719,	39484,	.4606,	.6884,
1986,	9504,	101318,	75519,	34595,	.4581,	.6360,
1987,	10167,	80321,	63893,	21391,	.3348,	.4227,
1988,	8661,	68097,	53999,	23182,	.4293,	.5869,
1989,	15394,	60002,	40153,	22068,	.5496,	.7439,
1990,	3630,	38857,	30118,	13487,	.4478,	.6116,
1991,	6869,	29900,	22232,	8660,	.3895,	.4851,
1992,	11938,	37358,	21808,	6535,	.2997,	.4126,
1993,	12834,	54546,	36498,	5988,	.1641,	.2436,
1994,	34348,	100097,	85925,	8818,	.1026,	.1811,
1995,	49220,	172636,	84984,	22494,	.2647,	.2685,
1996,	11760,	174477,	109062,	40106,	.3677,	.5242,
1997,	12809,	132294,	113505,	34290,	.3021,	.4319,
Arith. Mean ,	18048,	98521,	71775,	24634,	.3532,	.4640,
0 Units, 1	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		

Table 2.2.6.1.7. Comparison between different XSA runs with tuning series: ST (single trawlers 400-1000 HP), LL (longliners > 100 GRT with days as effort), and LL5 (five longliners > 100 GRT with hooks as effort).

TuningFl	Shrinkage	Year	RECRUITS,	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 4- 7,
ST LL	2.0	1997,	12809,	132294,	113505,	34290,	.3021,	.4988,
ST LL	0.5	1997,	10519,	149627,	131223,	34290,	.2613,	.4002,
ST LL5	2.0	1997,	13346,	145545,	125162,	34290,	.2740,	.4251,
ST LL5	0.5	1997,	11110,	162717,	142919,	34290,	.2399,	.3511,

Table 2.2.7.4.1. Input data to yield per recruit calculations.

The SAS System 11:23 Tuesday, May 5, 1998
Cod in the Faroe Plateau (Fishing Area Vbl)

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	0.1613	0.0000	0.0000	1.008	0.1400	1.027
3	.	0.2000	0.6473	0.0000	0.0000	1.725	0.4300	1.589
4	.	0.2000	0.8773	0.0000	0.0000	2.609	0.6600	2.217
5	.	0.2000	0.9540	0.0000	0.0000	3.531	0.7900	3.074
6	.	0.2000	0.9907	0.0000	0.0000	4.426	0.8900	3.861
7	.	0.2000	0.9947	0.0000	0.0000	5.453	1.0000	4.650
8	.	0.2000	0.9960	0.0000	0.0000	6.481	1.0000	5.639
9	.	0.2000	1.0000	0.0000	0.0000	7.814	1.0000	6.925
10+	.	0.2000	1.0000	0.0000	0.0000	9.934	1.0000	8.555
Unit	Numbers	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : YLDPET04
Date and time: 05MAY98:11:24

Table 2.2.7.4.2. Output data from yield per recruit calculations.

The SAS System 11:23 Tuesday, May 5, 1998
Cod in the Faroe Plateau (Fishing Area Vb1)

Yield per recruit: Summary table

						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
0.0000	0.0000	0.000	0.000	5.517	25045.803	4.274	23361.757	4.274	23361.757
0.0200	0.0154	0.063	304.666	5.204	22415.116	3.964	20738.988	3.964	20738.988
0.0400	0.0307	0.116	538.551	4.941	20260.660	3.704	18592.259	3.704	18592.259
0.0600	0.0461	0.161	720.127	4.717	18469.375	3.483	16808.517	3.483	16808.517
0.0800	0.0614	0.200	862.351	4.523	16960.775	3.292	15307.285	3.292	15307.285
0.1000	0.0768	0.234	974.533	4.354	15676.069	3.125	14029.776	3.125	14029.776
0.1200	0.0921	0.264	1063.493	4.205	14571.356	2.978	12932.100	2.978	12932.100
0.1400	0.1075	0.290	1134.313	4.072	13613.233	2.848	11980.858	2.848	11980.858
0.1600	0.1228	0.315	1190.835	3.952	12775.862	2.731	11150.218	2.731	11150.218
0.1800	0.1382	0.336	1236.003	3.845	12038.967	2.625	10419.911	2.625	10419.911
0.2000	0.1536	0.356	1272.091	3.747	11386.432	2.530	9773.825	2.530	9773.825
0.2200	0.1689	0.374	1300.879	3.658	10805.303	2.443	9199.011	2.443	9199.011
0.2400	0.1843	0.391	1323.766	3.576	10285.057	2.363	8684.953	2.363	8684.953
0.2600	0.1996	0.406	1341.863	3.500	9817.072	2.290	8223.032	2.290	8223.032
0.2800	0.2150	0.420	1356.060	3.430	9394.221	2.222	7806.125	2.222	7806.125
0.3000	0.2303	0.433	1367.067	3.365	9010.570	2.159	7428.304	2.159	7428.304
0.3200	0.2457	0.446	1375.463	3.305	8661.141	2.101	7084.594	2.101	7084.594
0.3400	0.2610	0.457	1381.712	3.248	8341.735	2.047	6770.799	2.047	6770.799
0.3600	0.2764	0.468	1386.197	3.195	8048.786	1.996	6483.358	1.996	6483.358
0.3800	0.2918	0.478	1389.228	3.145	7779.250	1.948	6219.229	1.948	6219.229
0.4000	0.3071	0.487	1391.061	3.098	7530.515	1.903	5975.806	1.903	5975.806
0.4200	0.3225	0.496	1391.906	3.054	7300.331	1.861	5750.839	1.861	5750.839
0.4400	0.3378	0.505	1391.937	3.012	7086.749	1.821	5542.383	1.821	5542.383
0.4600	0.3532	0.513	1391.296	2.972	6888.073	1.783	5348.745	1.783	5348.745
0.4800	0.3685	0.521	1390.104	2.934	6702.823	1.747	5168.449	1.747	5168.449
0.5000	0.3839	0.528	1388.459	2.898	6529.704	1.713	5000.201	1.713	5000.201
0.5200	0.3992	0.535	1386.444	2.864	6367.574	1.680	4842.862	1.680	4842.862
0.5400	0.4146	0.542	1384.127	2.831	6215.429	1.650	4695.430	1.650	4695.430
0.5600	0.4300	0.548	1381.565	2.800	6072.377	1.620	4557.016	1.620	4557.016
0.5800	0.4453	0.554	1378.807	2.770	5937.629	1.592	4426.833	1.592	4426.833
0.6000	0.4607	0.560	1375.892	2.742	5810.481	1.565	4304.179	1.565	4304.179
0.6200	0.4760	0.566	1372.855	2.714	5690.305	1.540	4188.427	1.540	4188.427
0.6400	0.4914	0.571	1369.723	2.688	5576.539	1.515	4079.018	1.515	4079.018
0.6600	0.5067	0.576	1366.519	2.662	5468.677	1.491	3975.448	1.491	3975.448
0.6800	0.5221	0.581	1363.264	2.638	5366.266	1.468	3877.266	1.468	3877.266
0.7000	0.5374	0.586	1359.974	2.614	5268.897	1.447	3784.063	1.447	3784.063
0.7200	0.5528	0.591	1356.663	2.591	5176.199	1.425	3695.471	1.425	3695.471
0.7400	0.5682	0.596	1353.342	2.570	5087.838	1.405	3611.157	1.405	3611.157
0.7600	0.5835	0.600	1350.021	2.548	5003.508	1.386	3530.819	1.386	3530.819
0.7800	0.5989	0.604	1346.708	2.528	4922.935	1.367	3454.180	1.367	3454.180
0.8000	0.6142	0.608	1343.410	2.508	4845.865	1.349	3380.990	1.349	3380.990
0.8200	0.6296	0.612	1340.131	2.489	4772.068	1.331	3311.021	1.331	3311.021
0.8400	0.6449	0.616	1336.877	2.470	4701.335	1.314	3244.063	1.314	3244.063
0.8600	0.6603	0.620	1333.652	2.452	4633.471	1.297	3179.925	1.297	3179.925
0.8800	0.6756	0.623	1330.458	2.435	4568.301	1.281	3118.431	1.281	3118.431
0.9000	0.6910	0.627	1327.298	2.418	4505.661	1.266	3059.419	1.266	3059.419
0.9200	0.7064	0.630	1324.173	2.401	4445.402	1.251	3002.740	1.251	3002.740
0.9400	0.7217	0.634	1321.086	2.385	4387.384	1.236	2948.258	1.236	2948.258
0.9600	0.7371	0.637	1318.037	2.370	4331.482	1.222	2895.846	1.222	2895.846
0.9800	0.7524	0.640	1315.027	2.354	4277.576	1.209	2845.386	1.209	2845.386
1.0000	0.7678	0.643	1312.058	2.340	4225.557	1.195	2796.771	1.195	2796.771
1.0200	0.7831	0.646	1309.128	2.325	4175.324	1.182	2749.900	1.182	2749.900
1.0400	0.7985	0.649	1306.240	2.311	4126.782	1.170	2704.679	1.170	2704.679
1.0600	0.8138	0.652	1303.391	2.297	4079.844	1.157	2661.021	1.157	2661.021
1.0800	0.8292	0.655	1300.584	2.284	4034.428	1.146	2618.847	1.146	2618.847
1.1000	0.8446	0.657	1297.816	2.271	3990.456	1.134	2578.080	1.134	2578.080
1.1200	0.8599	0.660	1295.089	2.258	3947.863	1.123	2538.650	1.123	2538.650
1.1400	0.8753	0.662	1292.402	2.246	3906.576	1.112	2500.493	1.112	2500.493
1.1600	0.8906	0.665	1289.754	2.234	3866.536	1.101	2463.545	1.101	2463.545
1.1800	0.9060	0.667	1287.145	2.222	3827.684	1.090	2427.750	1.090	2427.750
1.2000	0.9213	0.670	1284.574	2.210	3789.965	1.080	2393.054	1.080	2393.054
1.2200	0.9367	0.672	1282.042	2.199	3753.329	1.070	2359.406	1.070	2359.406
1.2400	0.9520	0.675	1279.547	2.188	3717.726	1.060	2326.759	1.060	2326.759
1.2600	0.9674	0.677	1277.088	2.177	3683.113	1.051	2295.069	1.051	2295.069
1.2800	0.9828	0.679	1274.667	2.167	3649.446	1.041	2264.292	1.041	2264.292
1.3000	0.9981	0.681	1272.280	2.156	3616.684	1.032	2234.391	1.032	2234.391
1.3200	1.0135	0.683	1269.929	2.146	3584.791	1.023	2205.326	1.023	2205.326
1.3400	1.0288	0.685	1267.613	2.136	3553.731	1.015	2177.064	1.015	2177.064
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

(cont.)

Table 2.2.7.4.2 continued.

Tuesday, May 5, 1998
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
1.3600	1.0442	0.688	1265.330	2.126	3523.469	1.006	2149.571	1.006	2149.571
1.3800	1.0595	0.690	1263.081	2.117	3493.973	0.998	2122.816	0.998	2122.816
1.4000	1.0749	0.691	1260.865	2.107	3465.214	0.989	2096.768	0.989	2096.768
1.4200	1.0902	0.693	1258.681	2.098	3437.163	0.981	2071.400	0.981	2071.400
1.4400	1.1056	0.695	1256.528	2.089	3409.793	0.974	2046.686	0.974	2046.686
1.4600	1.1210	0.697	1254.406	2.080	3383.077	0.966	2022.599	0.966	2022.599
1.4800	1.1363	0.699	1252.315	2.071	3356.992	0.958	1999.116	0.958	1999.116
1.5000	1.1517	0.701	1250.254	2.063	3331.514	0.951	1976.214	0.951	1976.214
1.5200	1.1670	0.703	1248.222	2.054	3306.621	0.944	1953.872	0.944	1953.872
1.5400	1.1824	0.704	1246.218	2.046	3282.292	0.937	1932.069	0.937	1932.069
1.5600	1.1977	0.706	1244.243	2.038	3258.508	0.930	1910.785	0.930	1910.785
1.5800	1.2131	0.708	1242.296	2.030	3235.249	0.923	1890.002	0.923	1890.002
1.6000	1.2284	0.709	1240.375	2.022	3212.497	0.916	1869.703	0.916	1869.703
1.6200	1.2438	0.711	1238.481	2.015	3190.234	0.910	1849.869	0.910	1849.869
1.6400	1.2592	0.713	1236.614	2.007	3168.445	0.903	1830.486	0.903	1830.486
1.6600	1.2745	0.714	1234.772	2.000	3147.114	0.897	1811.538	0.897	1811.538
1.6800	1.2899	0.716	1232.955	1.992	3126.225	0.890	1793.010	0.890	1793.010
1.7000	1.3052	0.717	1231.163	1.985	3105.764	0.884	1774.888	0.884	1774.888
1.7200	1.3206	0.719	1229.394	1.978	3085.717	0.878	1757.158	0.878	1757.158
1.7400	1.3359	0.720	1227.650	1.971	3066.071	0.872	1739.809	0.872	1739.809
1.7600	1.3513	0.722	1225.929	1.964	3046.815	0.867	1722.827	0.867	1722.827
1.7800	1.3666	0.723	1224.231	1.957	3027.934	0.861	1706.201	0.861	1706.201
1.8000	1.3820	0.725	1222.555	1.951	3009.419	0.855	1689.920	0.855	1689.920
1.8200	1.3974	0.726	1220.901	1.944	2991.258	0.850	1673.973	0.850	1673.973
1.8400	1.4127	0.727	1219.268	1.938	2973.440	0.844	1658.349	0.844	1658.349
1.8600	1.4281	0.729	1217.657	1.931	2955.955	0.839	1643.039	0.839	1643.039
1.8800	1.4434	0.730	1216.066	1.925	2938.793	0.834	1628.034	0.834	1628.034
1.9000	1.4588	0.731	1214.496	1.919	2921.945	0.828	1613.323	0.828	1613.323
1.9200	1.4741	0.733	1212.946	1.913	2905.402	0.823	1598.899	0.823	1598.899
1.9400	1.4895	0.734	1211.415	1.907	2889.155	0.818	1584.753	0.818	1584.753
1.9600	1.5048	0.735	1209.904	1.901	2873.196	0.813	1570.877	0.813	1570.877
1.9800	1.5202	0.736	1208.411	1.895	2857.517	0.809	1557.263	0.809	1557.263
2.0000	1.5356	0.738	1206.937	1.889	2842.110	0.804	1543.904	0.804	1543.904
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDPET04
Date and time : 05MAY98:11:24
Computation of ref. F: Simple mean, age 2 - 10
F-0.1 factor : 0.1930
F-max factor : 0.4307
F-0.1 reference F : 0.1482
F-max reference F : 0.3307
Recruitment : Single recruit

Table 2.2.8.1. Faroe Plateau cod. Probability density functions of the 1998/1999 fishing mortality under various assumptions of effort distribution.

IF 8155 Days Fished by LL<100		IF 8155 Days fished by ST<400		IF 8155 Days(X 2) fished by JIGGERS	
Fishing Mort.	Cumul. Freq.	Fishing Mortality	Cumul. Freq.	Fishing Mort.	Cumul. Freq.
0.07	0.02	0.09	0.02	0.07	0.02
0.08	0.05	0.11	0.05	0.08	0.05
0.11	0.08	0.14	0.08	0.11	0.08
0.13	0.11	0.20	0.11	0.13	0.11
0.14	0.14	0.23	0.14	0.16	0.14
0.16	0.17	0.23	0.17	0.18	0.17
0.18	0.20	0.24	0.20	0.19	0.20
0.20	0.23	0.26	0.23	0.20	0.23
0.21	0.26	0.27	0.26	0.20	0.26
0.21	0.28	0.29	0.28	0.21	0.28
0.22	0.31	0.30	0.31	0.21	0.31
0.23	0.34	0.32	0.34	0.22	0.34
0.26	0.37	0.38	0.37	0.25	0.37
0.29	0.40	0.42	0.40	0.28	0.40
0.33	0.43	0.44	0.43	0.31	0.43
0.36	0.46	0.47	0.46	0.34	0.46
0.37	0.49	0.50	0.49	0.35	0.49
0.37	0.52	0.53	0.52	0.37	0.52
0.38	0.55	0.57	0.55	0.39	0.55
0.40	0.58	0.60	0.58	0.43	0.58
0.45	0.62	0.62	0.62	0.44	0.62
0.47	0.63	0.64	0.63	0.48	0.63
0.52	0.66	0.67	0.66	0.50	0.66
0.54	0.69	0.72	0.69	0.51	0.69
0.57	0.72	0.74	0.72	0.53	0.72
0.59	0.75	0.75	0.75	0.54	0.75
0.64	0.78	0.76	0.78	0.59	0.78
0.68	0.82	0.77	0.82	0.64	0.82
0.71	0.85	0.78	0.85	0.69	0.85
0.75	0.88	0.80	0.88	0.74	0.88
0.79	0.91	0.85	0.91	0.80	0.91
0.88	0.94	0.91	0.94	1.03	0.94
1.06	0.97	1.04	0.97	1.37	0.97
1.96	1.00	1.71	1.00	1.83	1.00

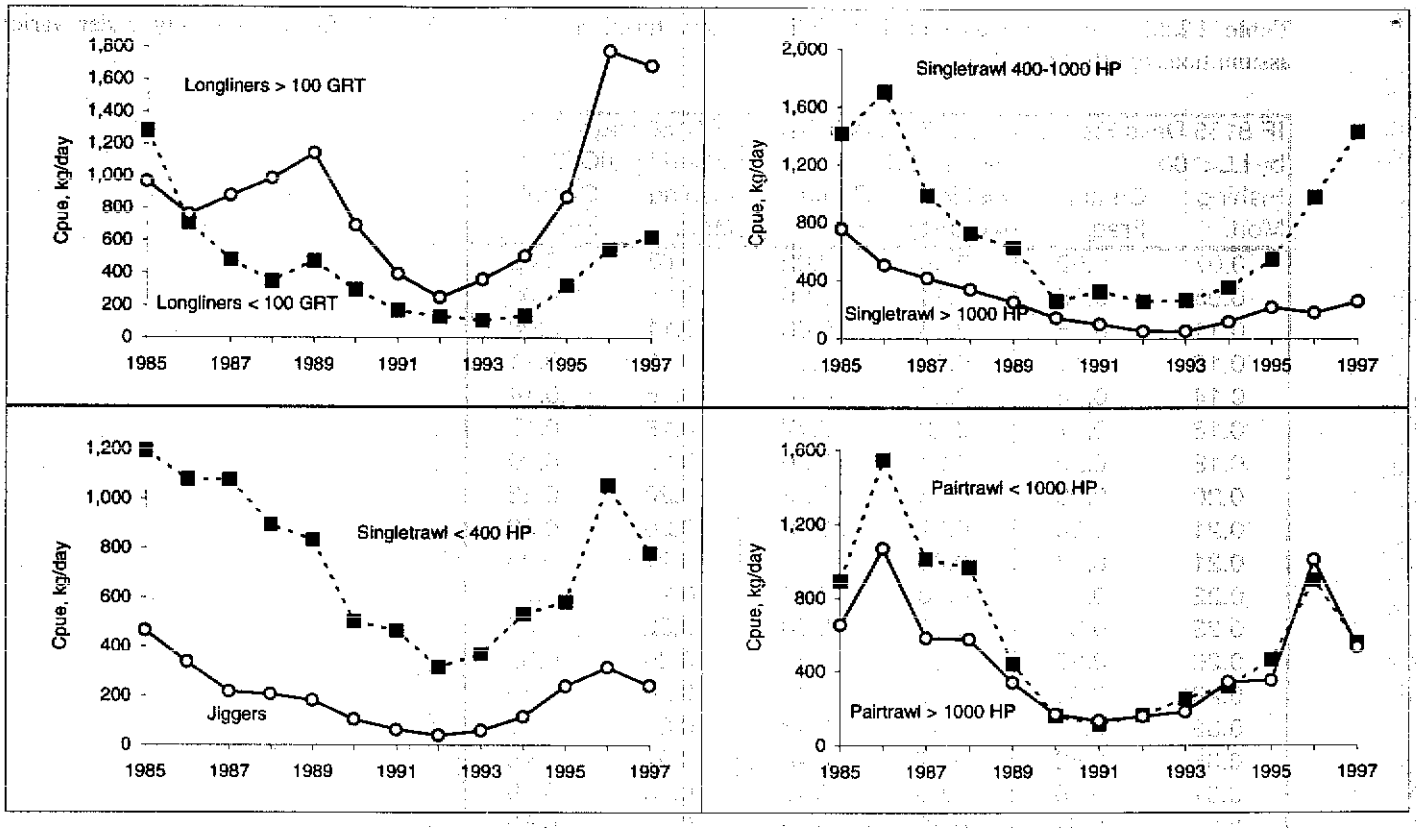


Figure 2.2.1.1. Catch per unit effort (kg/day) of Faroe Plateau Cod Januar-December.

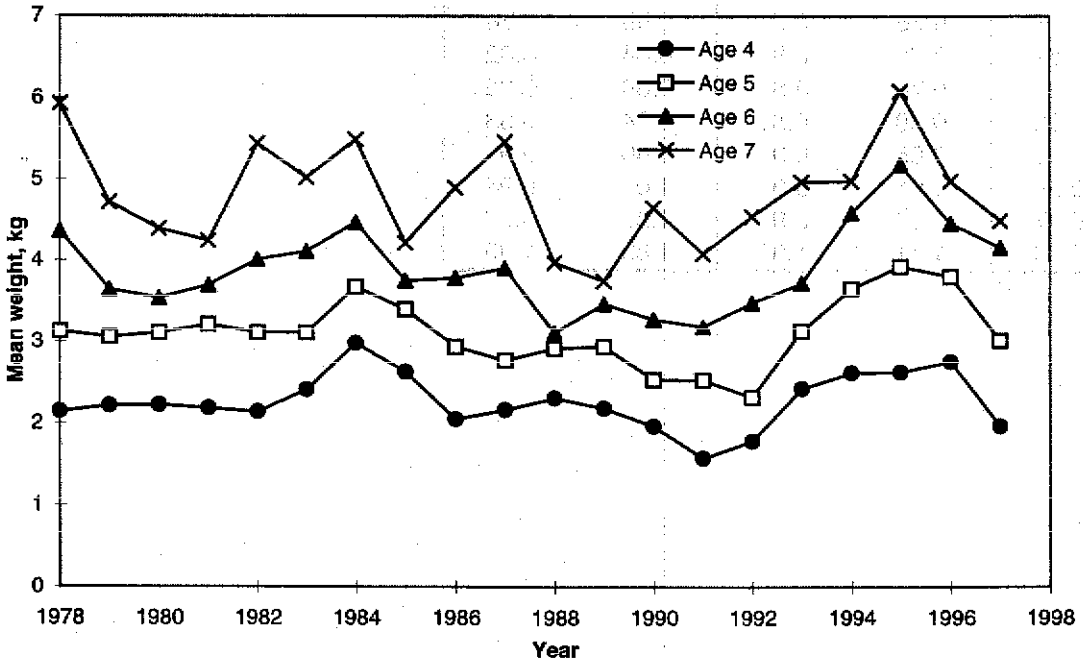


Figure 2.2.3.1. Mean weight at age for Faroe Plateau cod 1978–1997.

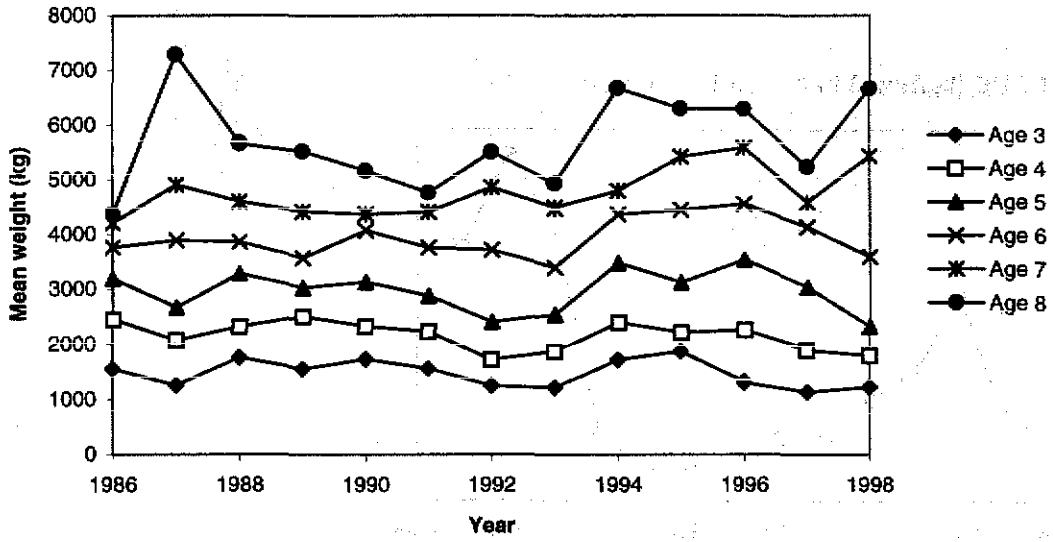


Figure 2.2.3.2. Faroe Plateau cod mean weight at age 1st quarter 1986-98. Commercial data.

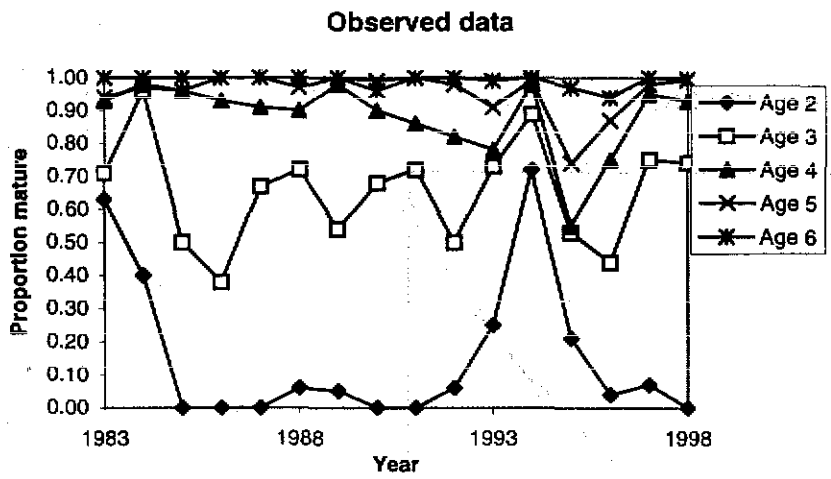


Figure 2.2.4.1. Faroe Plateau cod. Proportion mature at age as observed in the spring groundfish survey.

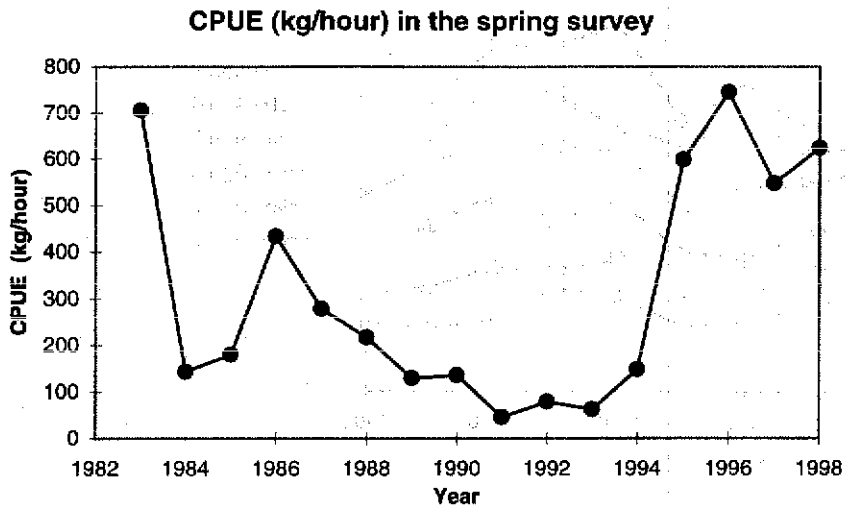


Figure 2.2.5.1. Catch per unit effort of Faroe Plateau cod in the groundfish survey.

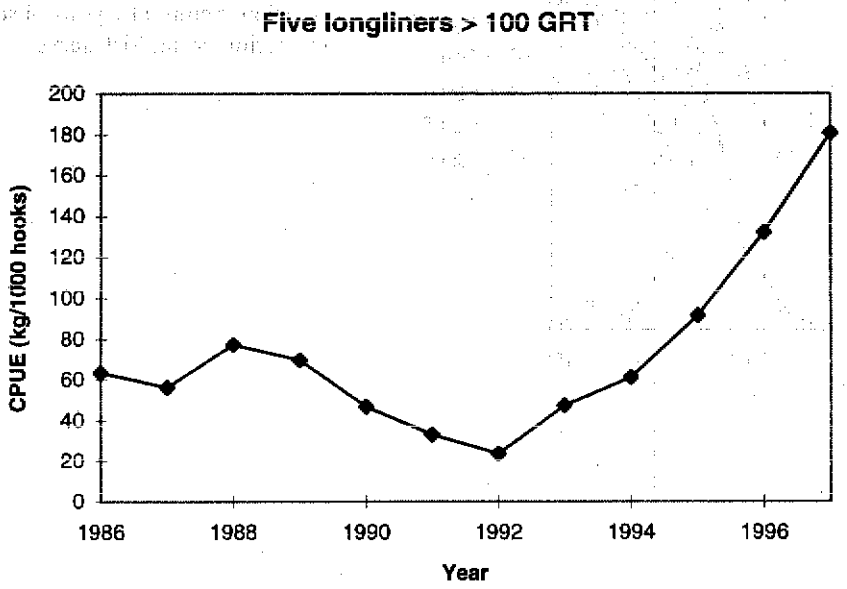


Figure 2.2.6.1.1. Catch per unit effort of Faroe Plateau cod for five longliners > 100 GRT.

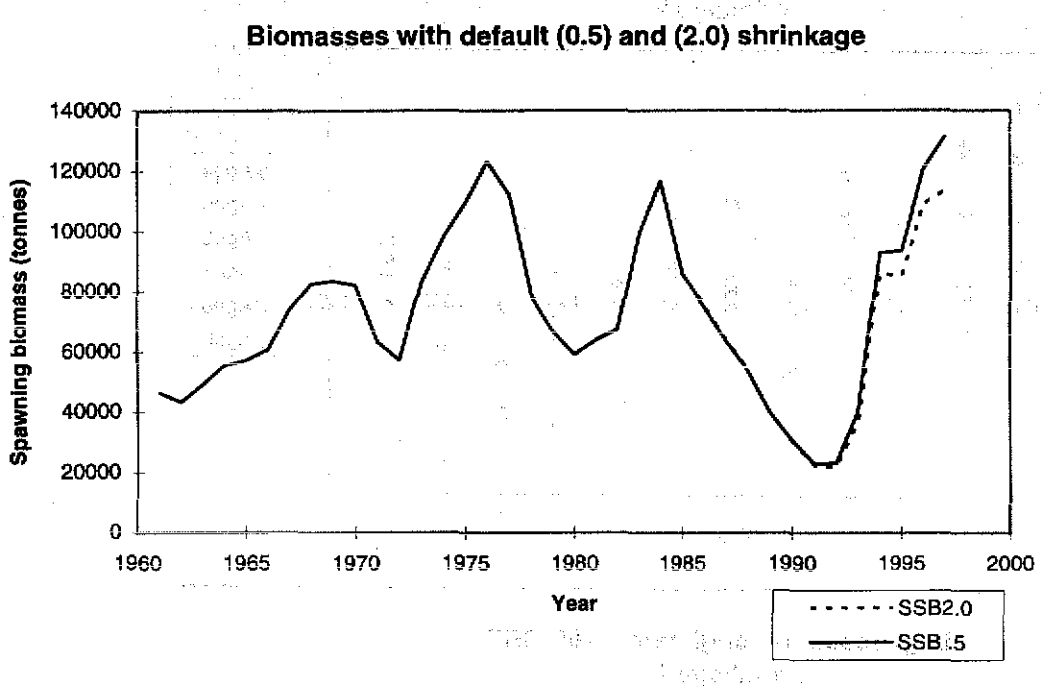
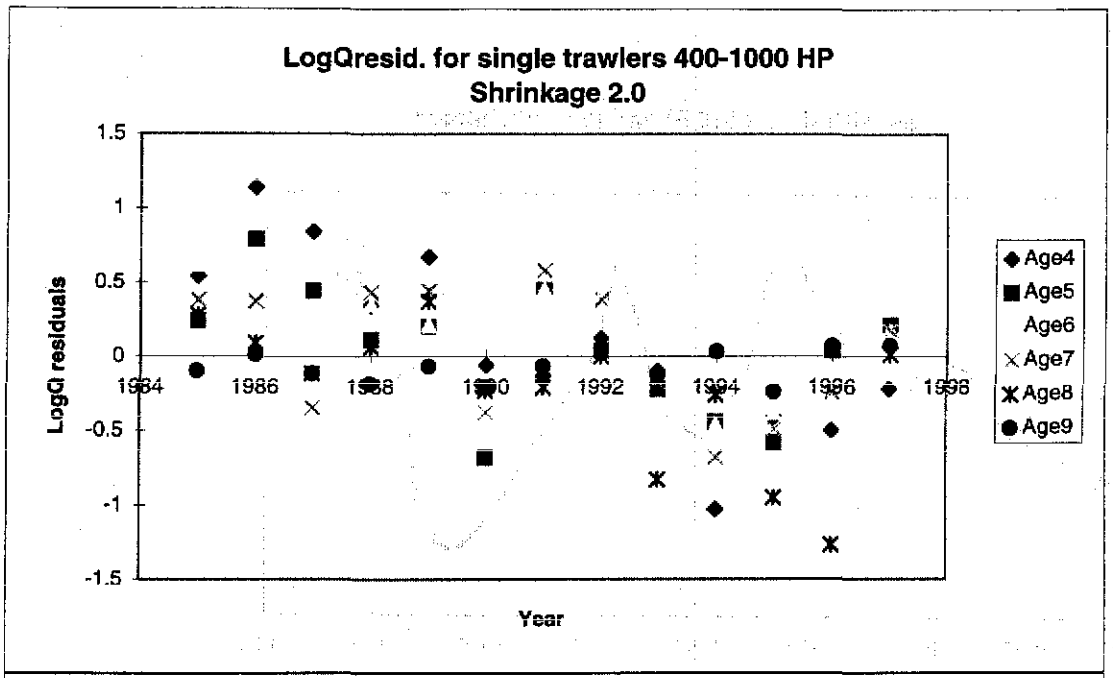


Figure 2.2.6.1.2. Spawning biomass of Faroe Plateau cod estimated from XSA with shrinkage of 0.5 and shrinkage of 2.0.



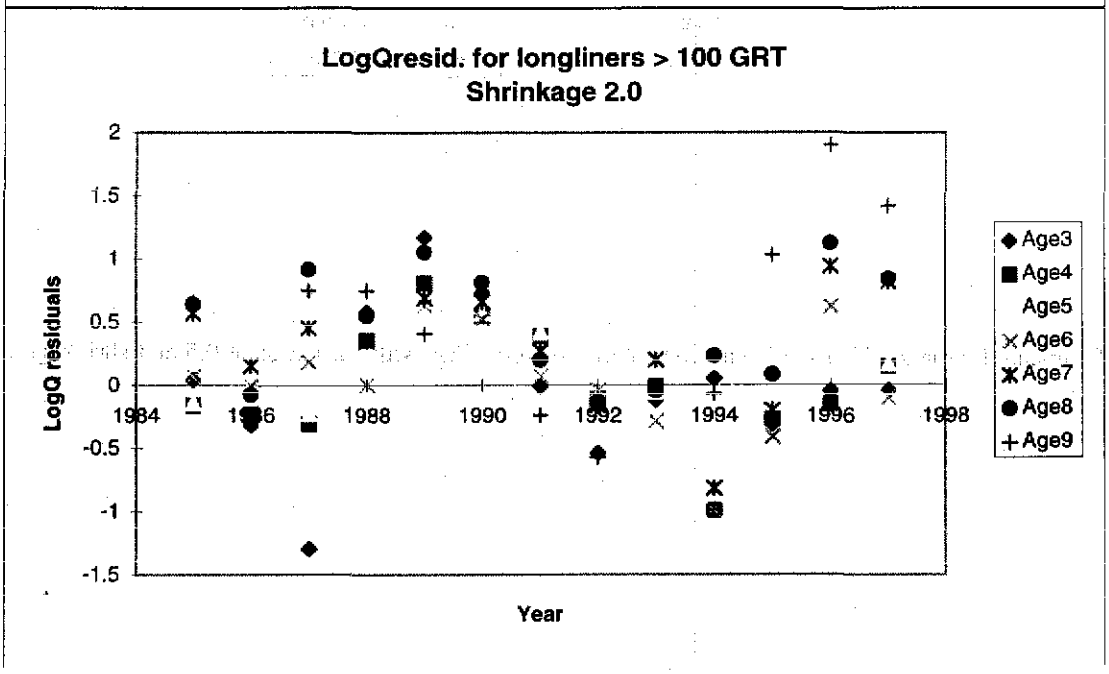


Figure 2.2.6.1.3. Faroe Plateau cod. Residuals from XSA using LL>100 and OTB 400–1000 with shrinkage 2.0.

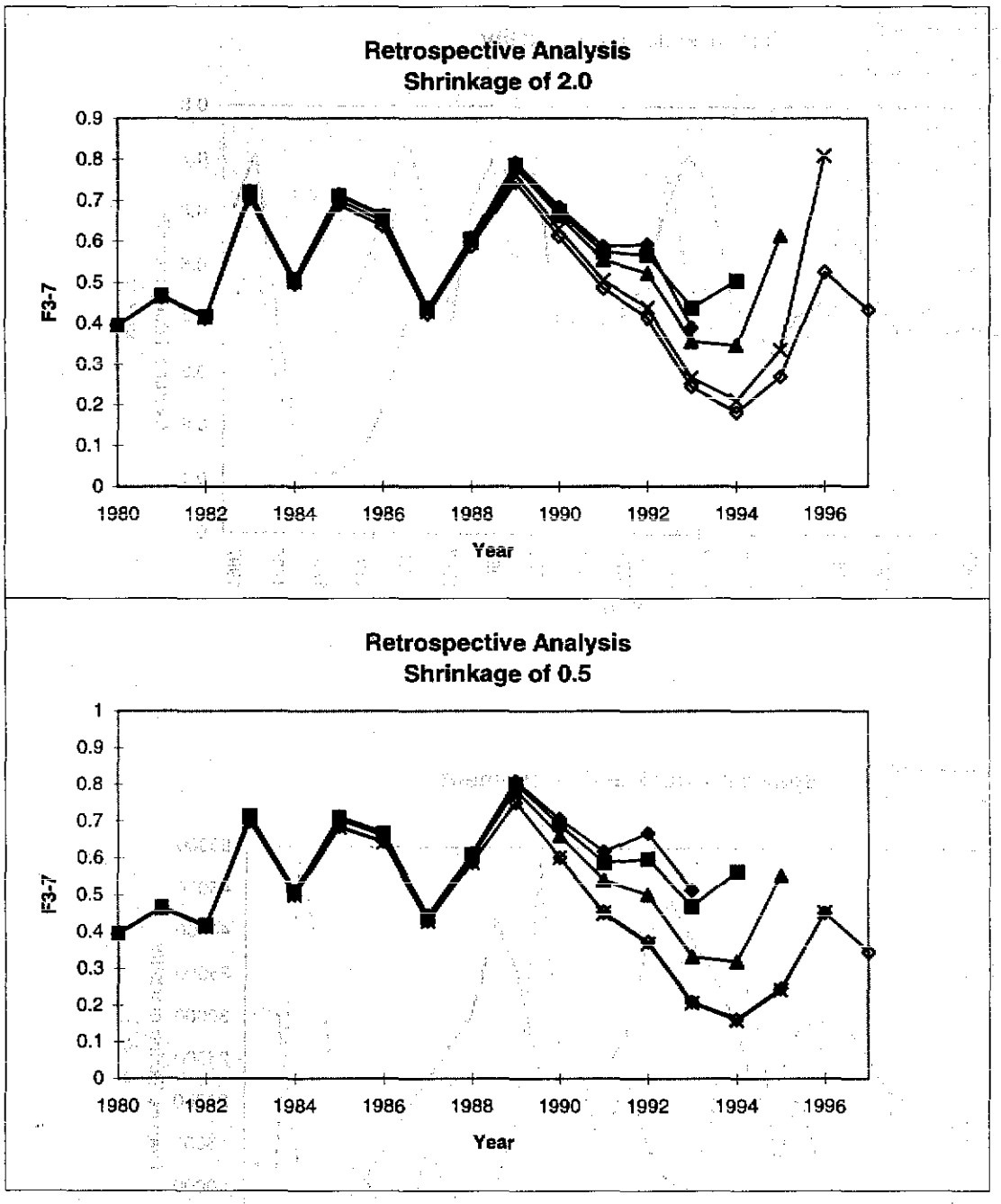


Figure 2.2.6.1.4. Faroe Plateau cod. Retrospective analyses with shrinkage of 0.5 or 2.0.

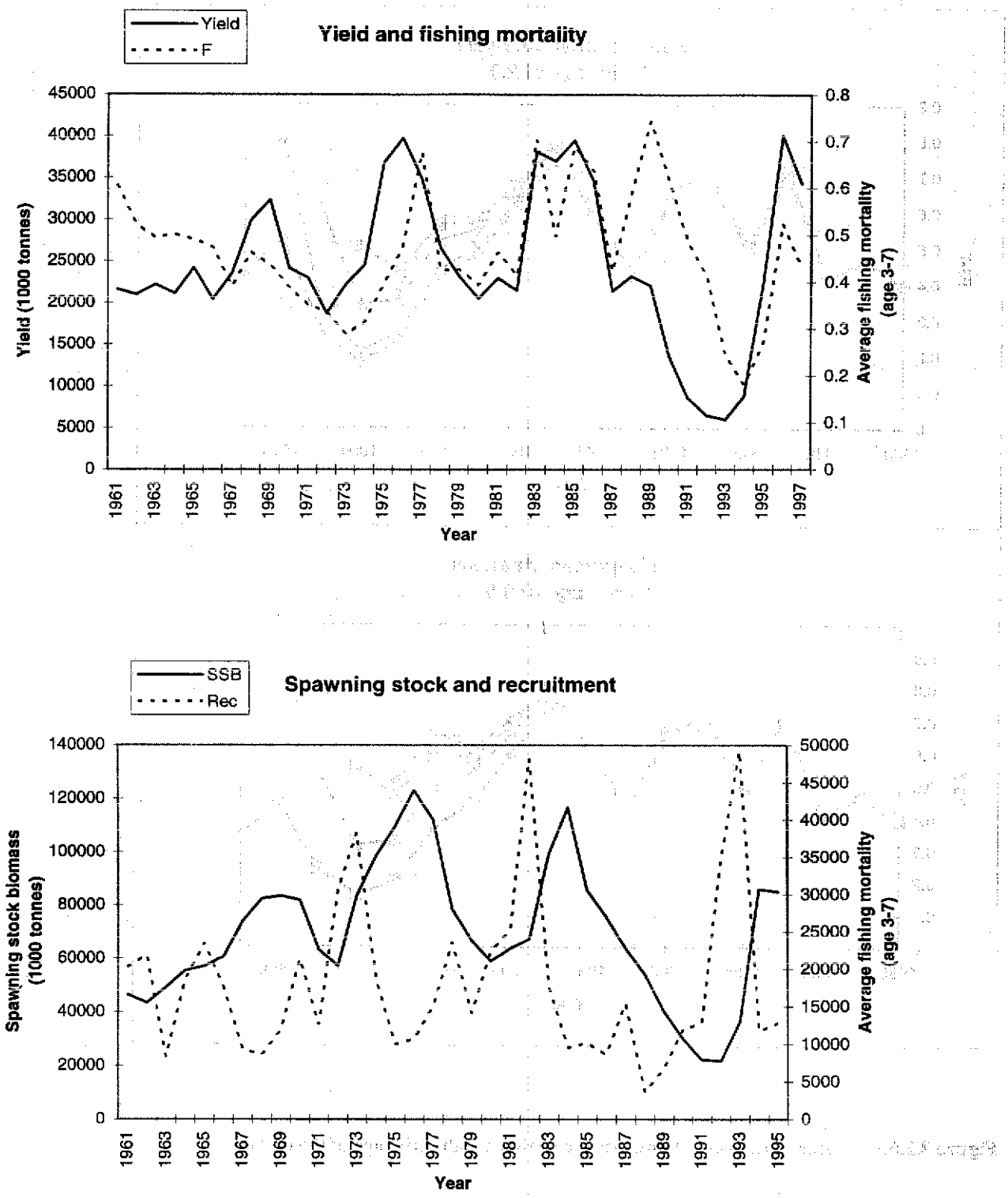


Figure 2.2.6.1.5. Yield and average fishing mortality (age 3 - 7) versus years. Spawning stock biomass (SSB) and fishing mortality (F) versus years.

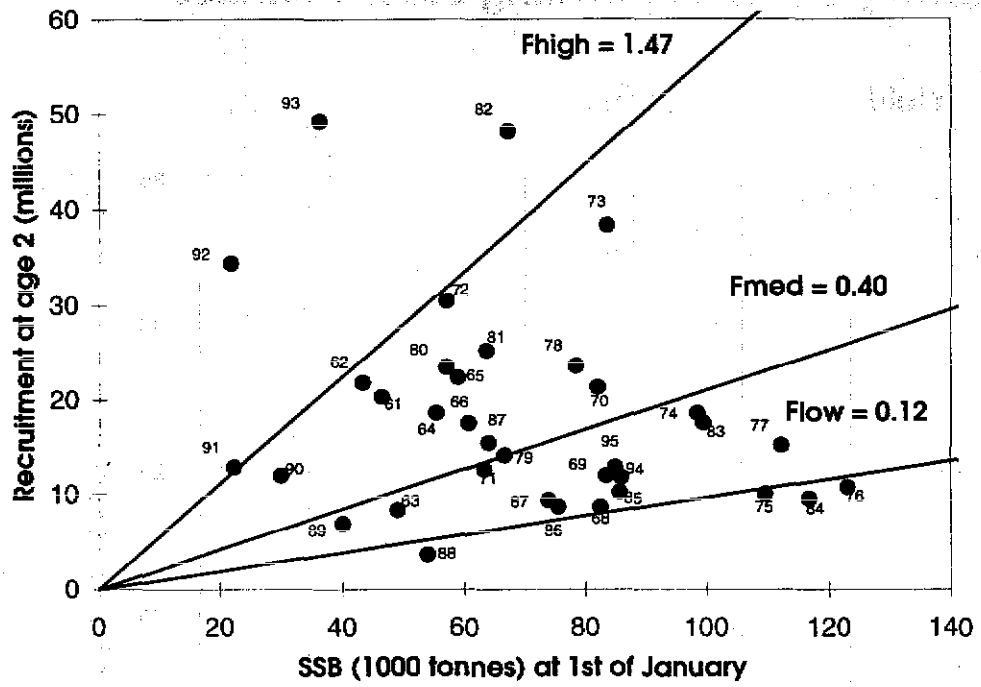


Figure 2.2.7.3.1. Spawning stock - recruitment relationship for Faroe Plateau cod 1961-95. Years are shown at each data point.

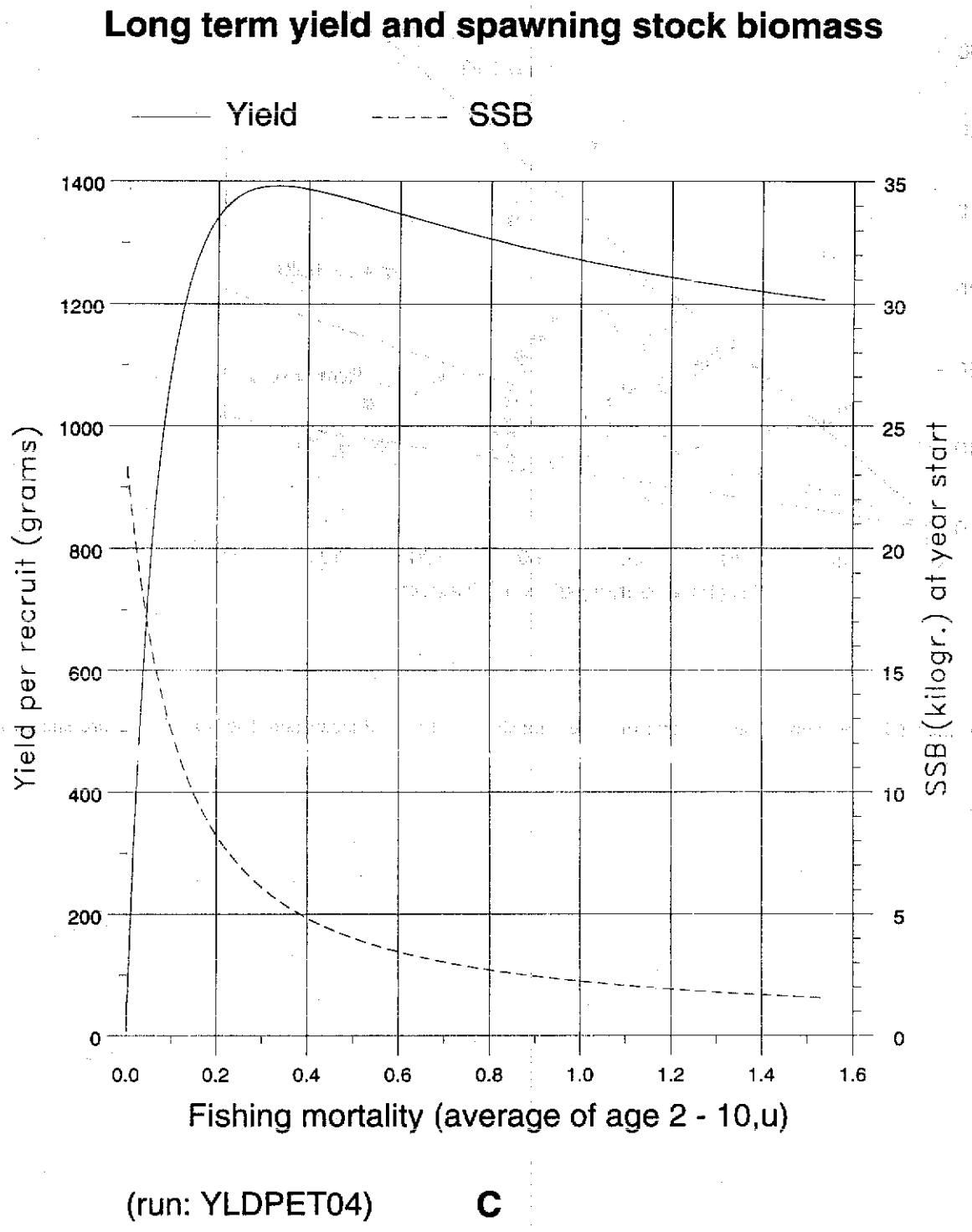


Figure 2.2.7.4.1 Yield per recruit and spawning stock biomass as a function of fishing mortality.

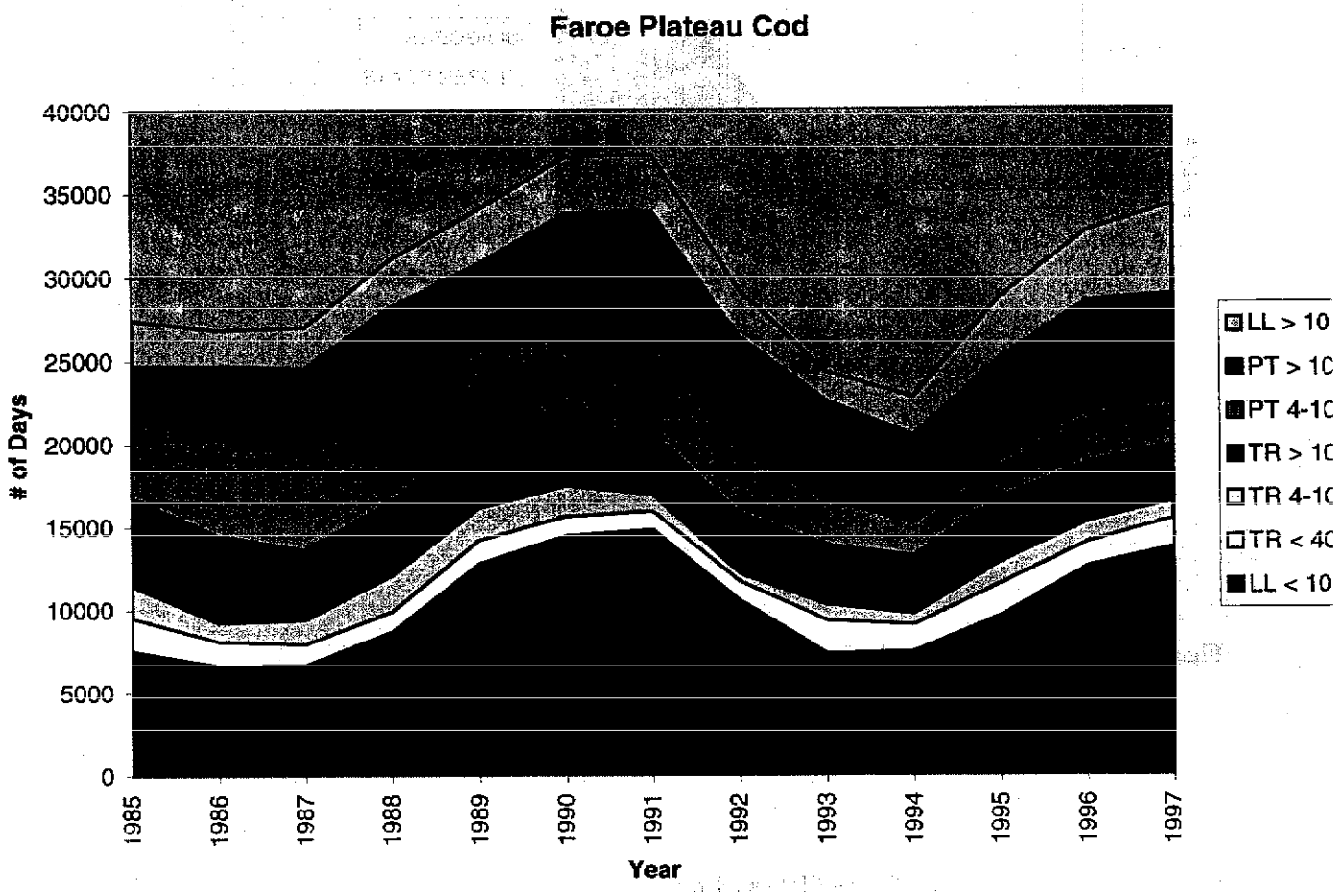


Figure 2.2.8.1. Number of days used by the different faroese fleets 1985-97.

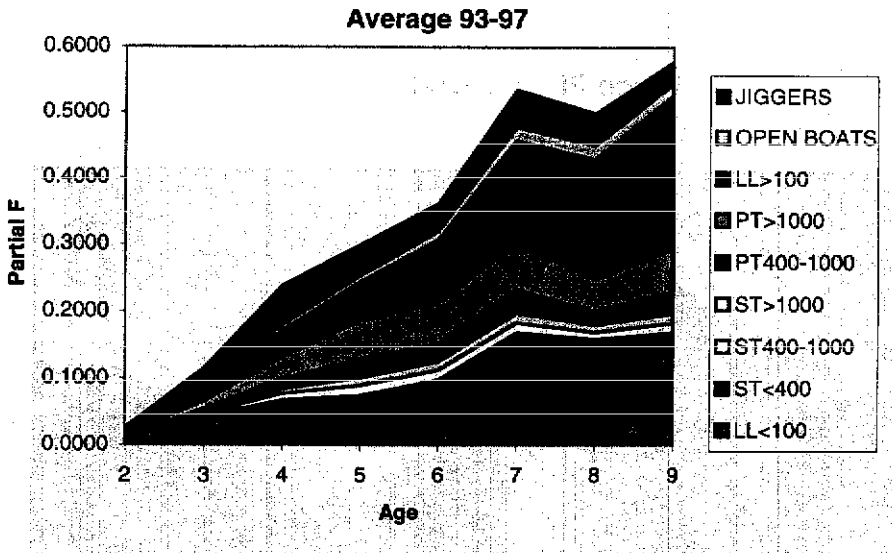


Figure 2.2.8.2. Partial F at age for faroese fleets as an average for the years 1993-97.

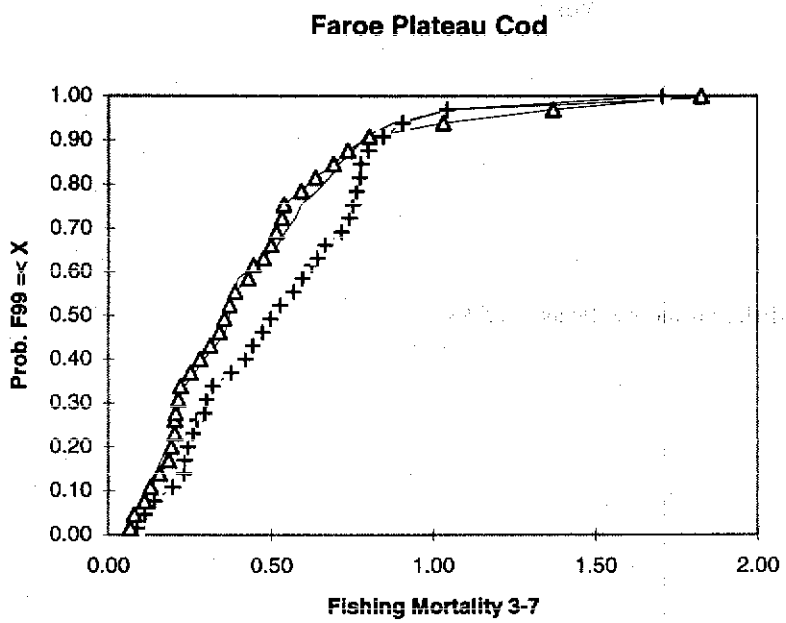


Figure 2.2.8.3. Faroe Plateau Cod. Cumulative probability distribution of the 1998 fishing mortalities under the current number of fishing days allocated for the LL<100, ST<400, PT>1000, LL>100, OPEN, and JIGGERS. Three options are presented where the 8155 days allocated to the LL<100, jiggers and ST<400 is either used intirely 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.

2.3 Faroe Bank Cod

2.3.1 Trends in landings and effort

Total nominal landings of the Faroe Bank cod from 1986 to 1997 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 and increased to 3,600 t in 1997.

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 with fishing days was, however, introduced at 1 June 1996 allowing longliners and jiggers to fish inside the 200 m contour. The trawlers are allowed to fish outside the 200 m contour.

2.3.2 Stock assessment

Biological sampling has been taken in the most recent years from commercial landings (the 1997 sampling level is shown in Table 2.3.1.2) 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.

The 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 m 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 1998.

The length distributions in the survey 1983–1998 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 1997 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 (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:

$$CPUEpred_t = B_t . q$$

the biomass is:

$$Bt+1 = Bt + (r. Bt. (1-Bt/k)) - Ct$$

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 ($r \leq 0.55$, $k \leq 25{,}000$ t. and $Bi \leq k$). The minimization was done for 1984 to 1997 with the initial biomass estimated for 1983. It was not possible to get a reasonable solution, because the growth rate tended to be unreasonable high (over 0.76) if it was not constrained, giving to low biomass (same size order as the catch). The result with r=0.55 is shown in Table 2.3.2.2.

2.3.3 Target reference points and limit reference points

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.

It shall be stressed here, that the catches may not be correct because the vessels are now allowed to fish on both the plateau and Faroe Bank during the same trip. This can intermingle the catches, making the catch from both areas uncertain. The working group considers this to be very unfortunate, because this is destroying the catch series from the Faroe Bank which began in 1965. The fish managers should thus change the rules in order to keep both catch series separate.

Table 2.3.1.1. Faroe Bank (Sub-division Vb2) COD. Nominal catches (tonnes) by countries, 1986-97. As officially reported to ICES.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997 *)
Faroe Islands	1,836	3,409	2,960	1,270	289	297	122	264	717	561	2,051	3,459
Norway	6	23	94	128	72	38	32	2	8 *	105 *	57 *	138
UK (E/W/NI)	-	-	-	-	-	-	+	1	1	-	- [2]	- [3]
UK (Scotland) [1]	63	47	37	14	205	90	176	118	227	551	382	- [3]
Total	1,905	3,479	3,091	1,412	566	425	330	385	953	1,217	2,490	3,597

*) Preliminary.

1) Includes Vb1

2) Included in Vb1

3) See cod Vb1

Table 2.3.1.2. Samples of lengths, otoliths, and individual weights of Faroe Bank cod in 1997.

Fleet	Size	Samples	Length	Otoliths	Weights
Longliners	<100 GRT	0	0	0	0
Longliners	>100 GRT	14	1,814	778	600
Jiggers		15	1,956	890	840
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	47	50	0
Pair trawlers	>1000 HP	2	348	60	60
Total		32	4,165	1,778	1,500

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

Year	Observed Catch	Observed CPUE	Predicted CPUE	ln(CPUE/B)	Predicted Biomass
1983	2,367	79.0	157.3	-4.60	7,842
1984	2,216	175.2	145.2	-3.72	7,242
1985	2,961	173.5	137.1	-3.67	6,837
1986	1,905	266.1	114.3	-3.06	5,700
1987	3,479	164.0	112.0	-3.53	5,584
1988	3,091	73.1	77.9	-3.97	3,885
1989	1,412	36.6	46.2	-4.14	2,306
1990	566	23.2	38.9	-4.43	1,942
1991	425	51.0	45.9	-3.80	2,288
1992	330	28.4	58.2	-4.63	2,904
1993	385	25.8	76.7	-5.00	3,822
1994	953	44.7	99.0	-4.70	4,935
1995	1,217	95.3	114.1	-4.09	5,687
1996	2,490	362.1	125.5	-2.85	6,258
1997	3,597	488.6	112.1	-2.44	5,588
1998	1,037 *				3,772
1999					4,220

*) Predicted

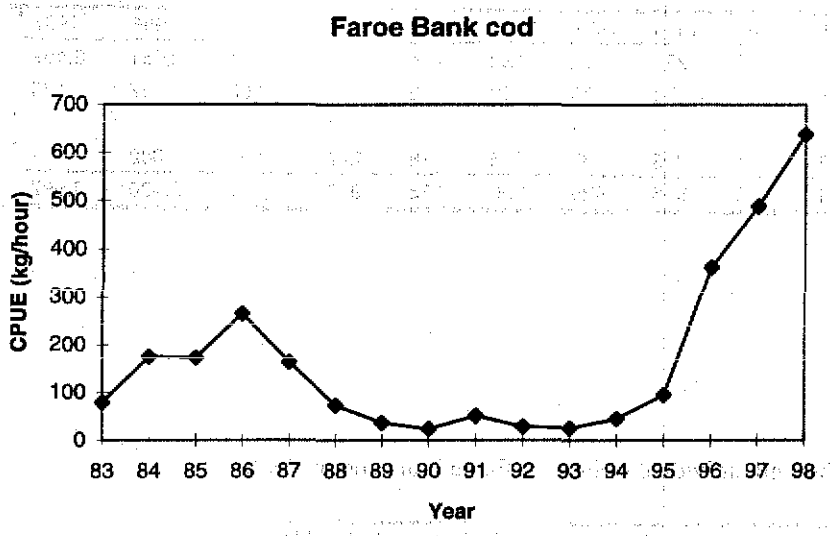


Figure 2.3.2.1. Catch per unit effort of Faroe Bank cod in the spring groundfish survey.

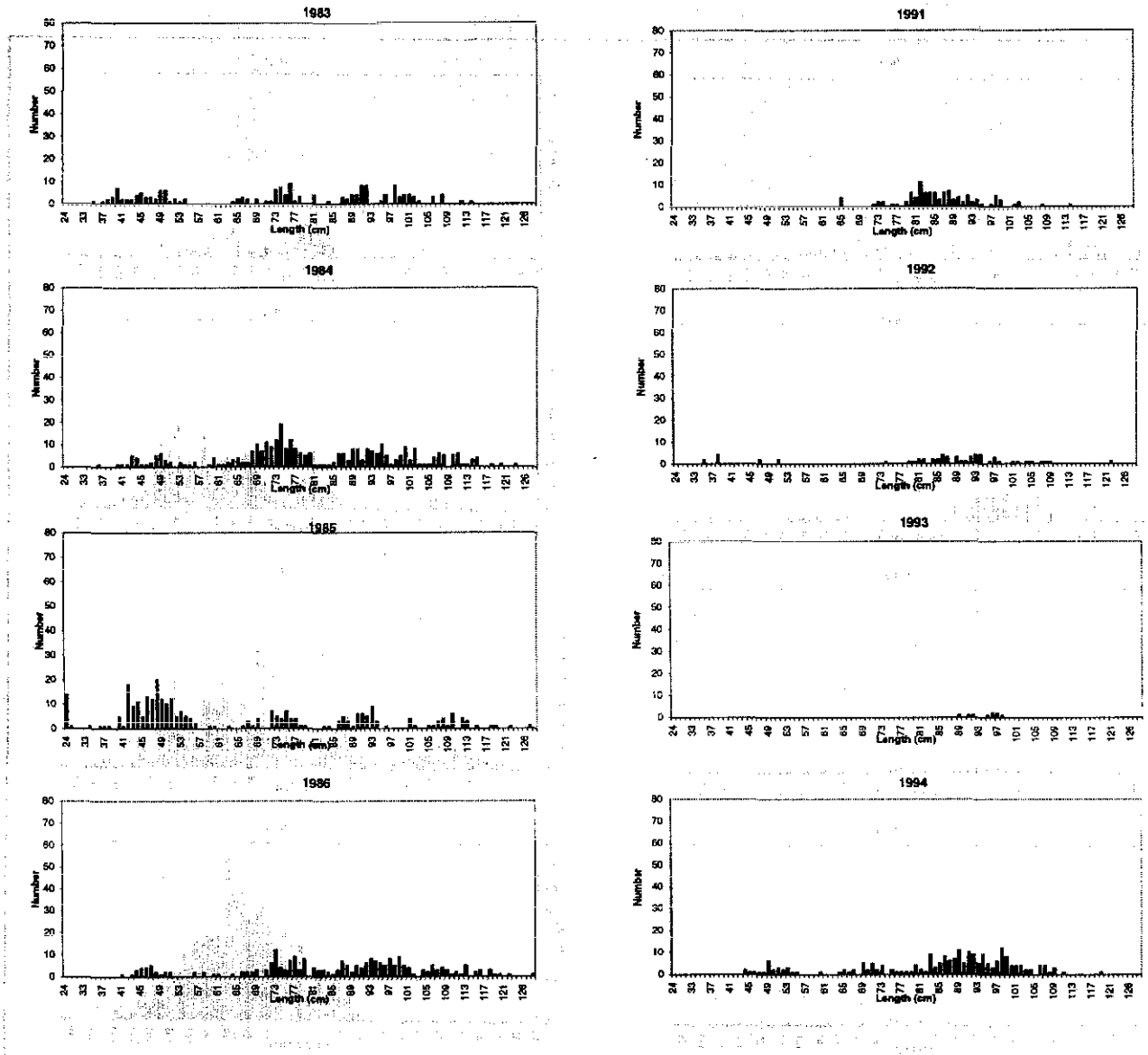


Figure 2.3.2.2. Length distributions of Faroe Bank cod in the spring survey 1983-98.

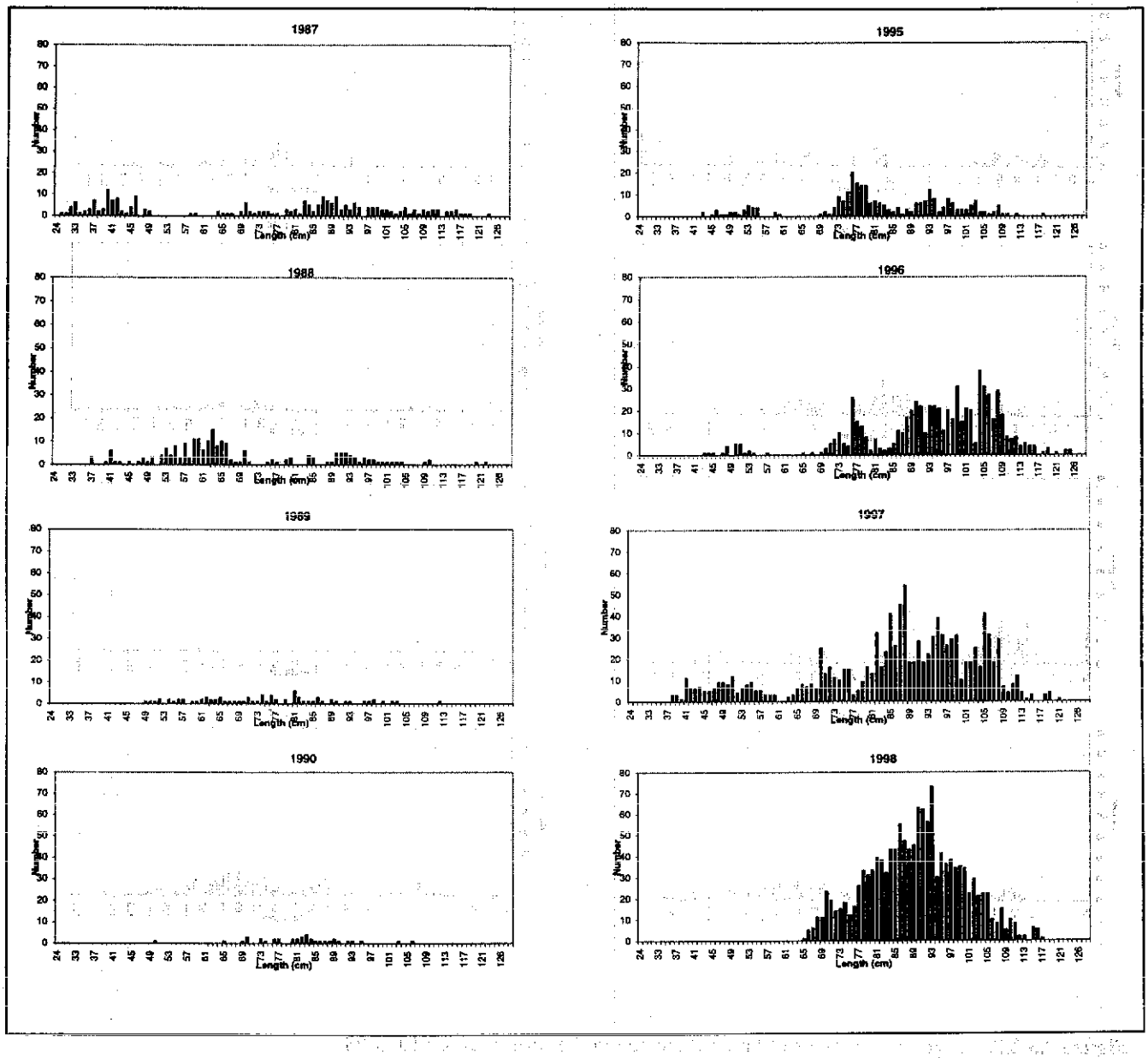


Figure 2.3.2.2 (Cont'd). Length distributions of Faroe Bank cod in the spring survey 1983-98.

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 and 1997 catches almost doubled each year to about 9,300 t and 16,800 t, respectively (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 300-500 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 IIa4 close to the boundary with Sub-Division (see Figure 2.1.15 in last years report), are used in the assessment (Table 2.4.1). In 1997, catches increased again to 1,100 t.

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 rates 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 1997 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 April and in the winter. On the Faroe Bank the monthly catches show a similar pattern. Although haddock is a bycatch in the pairtrawlers directed fishery for saithe, the pairtrawlers take a very large proportion of the haddock catches on the Faroe Bank; the longliners larger than 100 GRT come in second place. 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 1997 was:

No. of samples:	252
No. of length measurements:	49397
No. of individual weight measurements:	5219
No. of otoliths:	8603

Samples from each fleet category were disaggregated by season and then raised by the catch proportions to give the 1997 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 1997 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, stabilised at a low level for 2-3 years, increased again in 1993–1995 but have since decreased. By comparing the mean weights at age

for the commercial landings in the first quarter of the year in 1998 with the recent years the growth seems to have decreased further for the ages 6 and younger (Figure 2.4.4).

2.4.4 Maturity at age

Maturity-at-age data were available from the Faroese Groundfish Surveys 1982–1998. 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.

In 1996, 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 running 3 years average was used in the assessment and repeated this year. A comparison of the observed maturity at age series and the running 3 years average series is shown in Figure 2.4.5.

For the years prior to 1982, average maturity at age from the surveys 1982–1995 was adopted (Table 2.4.7).

2.4.5 Assessment

2.4.5.1 Tuning and estimates of fishing mortality

Several catch per unit effort series are available for tuning. They consist of two trawl groundfish surveys in February-March (from 1983) and in July-August (from 1992) and 8 commercial series. In the surveys, the estimates of catches in numbers at age per trawl hour in the surveys are used as if they represented one fleet with the same effort for all the years in the tuning process. In order to have the most recent data available for tuning, the spring survey is shifted back from February-March to the end of December the year before. 7 of the commercial series consist of effort measured in number of fishing days and the corresponding catch at age in numbers for each fleet; in addition this year a new commercial tuning series was available based on logbook data 1986–1997 for 5 longliners larger than 100 GRT and this series consists of effort measured in hooks and the corresponding catch at age in numbers. The catch per unit effort is first calculated for each statistical rectangle and weighted by the proportional catch before the total catch per unit effort is derived.

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. Last year only 4 reduced series were used for tuning of the assessment but when the same updated series was used for tuning of this years assessment they resulted in very unlikely low fishing mortalities and very high year class strengths of the most recent year classes (Working Document No.1).

The new summer survey gave poor diagnostics when used for tuning of the XSA presumably due to a poor coverage of the survey area prior to 1996. From 1996 onwards the number of stations has been considerably increased and it is expected that this series will be of great value as a tuning series for this stock in a few years. This year it could not be used, however.

The diagnostics from the new commercial longliner series based on number of hooks and the corresponding catch at age in numbers looked more promising except for some years and ages which consequently were removed from the series.

The working group then decided to use two of the commercial series from last years assessment, i.e., the longliners less than 100 GRT and the pairtrawlers larger than 1,000 HP, and the new longliner series consisting of the logbook data from 5 selected longliners larger than 100 GRT, in this years tuning of the VPA (Table 2.4.8).

Several XSA runs were made with different settings. The retrospective patterns of the resulting fishing mortalities in five runs with different shrinkages are presented in Figure 2.4.7 A-E. Based on this, the working group decided to use the XSA shrunk 0.7 in the assessment. The difference between the pattern of shrinkages 0.7 and 0.8 was negligible but the tuning shrunk 0.7 gave slightly better diagnostics and converged after fewer iterations than the one shrunk 0.8.

The diagnostics from the XSA are shown in Table 2.4.9.

The fishing mortalities from the final XSA run are given in Table 2.4.10 and in Figure 2.4.10A. Up to 1989-91 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 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 and 1997 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 in these two years is estimated at 0.28 and 0.32, respectively.

2.4.5.2 Stock estimates and recruitment

The stock size in numbers is given in Table 2.4.11 and a summary of the "VPA" with the biomass estimates is given in Table 2.4.12. The spawning stock biomass decreased from over 68 000 t in 1987 to 26 000 t in 1994, increased to 25 000 t in 1995 but have since increased considerably to almost 60 000t in 1997. 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 just below the long term average.

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 2.4.15.

The year classes up to 1995 inclusive are from the final VPA while the 1996-97 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 1986-98 were used (Table 2.4.13). In order to have the most recent information in the prediction, the survey estimates from the spring were shifted back to the end of the year before. The output from the RCT3 is given in Table 2.4.14. The large discrepancies between the XSA and the RCT3 values for the year classes, especially the 1993 and the 1994 year classes, was discussed in last years report and will not be repeated here. The 1998 year class at age 2 was estimated as the average of the 2 year olds in 1986-99, i.e., 1984-95 year classes from the final VPA, the 1996-97 year classes from the RCT3.

The exploitation pattern used in the prediction was derived from averaging the 1995–1997 fishing mortality matrices from the final VPA and then rescaling the averages to the 1997 level.

The mean weight at age for ages 3-9 in 1998 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 mean weight at age for the two year olds in 1998 was calculated as the average weight at age for age 2 in 1995-97. The 1998 mean weights at age were also applied for 1999 and 2000.

The maturity ogive for 1998 and 1999 is based on samples from the Faroese Groundfish Surveys and estimated as the average of the observations in 1996-98 and 1997–1998, respectively. The maturity ogive for 2000 is estimated as the average 1996–1998.

2.4.6.1.2 Medium-term prediction

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 2.4.17. Mean weights-at-age are averages for the 1977–1997 period. The maturity ogives are averages for the years 1983-97. 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 Fbar(age3-7) equal 1.0. In the input table the values are rescaled again to the Fbar(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 2.4.18 and Figure 2.4.10C. F_{max} and $F_{0.1}$ are indicated here as 0.53 and 0.19, respectively. From Figure 2.4.11, showing the recruit/spawning stock relationship, and from Table 2.4.18, F_{med} and F_{high} were calculated to be 0.25 and 0.83, respectively.

In previous assessments of this stock the Minimum Biological Acceptable Limit (MBAL) was set at 40,000 t because the probability of a good recruitment is considerably larger when the spawning stock biomass is above this value (Figs. 2.4.11 and 2.4.12A). Therefore, this is an appropriate value for a limit reference point and thus, B_{lim} is set at 40,000 t. The B_{pa} was calculated as the value lying 2 standard deviations above B_{lim} and is set to 65,000 t. The G_{loss} programme (written by Dr R. Cook) was used to produce four plots (Fig 2.4.12) to determine the F reference points, using data from this years XSA. The reference point F_{pa} was chosen as the F_{med} value 0.25, which again corresponds to a SSB of 75,000 t. This implies a buffer on 10,000 t to the B_{pa} value. (Figure 2.4.12B). If fishing at present level (Figure 2.4.12A), there is 13 % probability that the replacement line G(F) will be above the replacement line for the lowest observed spawning stock biomass G_{loss}. From the cumulative F_{loss} distribution plot (Fig 2.4.12C) it can be seen that the probability that F_{pa} >=F_{loss} is approximately 25 %. This means that once out of every 4 years the F_{pa} will be above the F_{loss} for which the stock would be expected to decline to an equilibrium spawning stock biomass below the lowest observed. An equilibrium yield at F = F_{pa} = 0.25 is approximately 17,000 t (Figure 2.4.12D).

The F_{lim} is defined to be two standard deviations above F_{pa} and is calculated to 0.40.

The history of the haddock fishery in relation to the four reference points can be seen in Figure 2.4.13. In the period 1961-71 the fishing mortality was above F_{lim} and the spawning stock biomass was below B_{pa}. Except for 1977–1978 the stock/fishery was in a precautionary zone in the period 1974–1981. In 1987 the biomass went below Bpa and continued to decrease and went below B_{lim} in 1991. This decrease in SSB continued until the B_{loss} was reached in 1994. The biomass has since increased, mainly due to the very good 1993 year class.

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 2.4.7), it is not unrealistic to assume the same level of fishing mortalities in 1998 as in 1997. The prediction was therefore run with a status quo reference F in 1998. The catch in 1998 is then predicted to be about 14 000 t and continuing with this fishing mortality will result in a 1999 catch of 11 000 t. The SSB will in this case decrease from 50 000 t in 1997 to 42 000 t in 1999, and 36 000 t in 2000. The results of the short-term prediction are shown in Table 2.4.16 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. A decrease in SSB is already seen in the short term prediction from the predicted value in 1998. There are no signs of good recruiting year classes in the survey.

2.4.7 Managements considerations

In order to evaluate the fishing mortality that could be generated in 1998 and 1999 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 from the catch at age ratios for 1985 to 1997. The same analysis as for the Faroe Plateau Cod was performed on the Faroe Plateau Haddock. Figure 2.4.14 shows the average partial F at age by fleet for 1993 to 1997. This figure shows that the long liners > 100 GRT are exerting the highest fishing mortality on the stock. Furthermore, the longliners < 100 GRT are

exerting more than three times the fishing mortality on the stock than the ST < 400 HP and fifty times the fishing mortality that the jiggers are exerting on the stock.

The probability density function of the potential fishing mortality in 1998 and 1999 given the allocated number of fishing days to each fleets is given in Figure 2.4.15. Three options are presented where the 8202 days allocated to the LL < 100 (longliners below 100 GRT), ST < 400 (otterboard trawlers less than 400 HP) and Jiggers is either used entirely by the LL < 100, the ST < 400 or by the Jiggers (16404 days). The fishing mortality referred to so far do not include the partial F exerted by the ST 400–1000 HP (otterboard trawlers 400–1 000 HP) and ST > 1000 HP (otterboard trawlers larger than 1 000 HP) that have not been allocated haddock fishing days. However, these two fleets accounted for 9 % of the total haddock catch in 1997. So these two fleets should be expected to exert at least a fishing mortality of 0.034. Therefore, in examining Table 2.4.19, the 0.034 from the ST should be added to the fishing mortality column to reflect the activities of these two fleets. The results show that there is an approximately 80 % probability, when the longliners < 100 GRT are using the 8202 fishing days, that the fishing mortality in 1999 will not exceed F = (.034+0.254) = 0.29, if the present level of fishing days is used in 1998–1999.

Table 2.4.1 Faroe Plateau (Sub-division Vb1) HADDOCK. Nominal catches (tonnes) by countries 1982-1997, 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	1997 [2]
Denmark	-	-	-	-	-	-	-	-
Faroe Islands	11,106	8,074	4,655	3,622	3,675	4,549	9,152	16,585
France[1]	-	-	164	-				
Germany	+	+	-	-		5	-	-
Norway	94	125	71	28 [2]	22 [2]	28 [2]	164	45
UK (Engl. and Wales)	7	-	54	81	31	23	5	...
UK (Scotland)[3]	-	-	-	-	-	-	...	...
United Kingdom								156 [6]
Total	11,207	8,199	4,944	3,731	3,728	4,605	9,321	16,786
Working Group estimate[4,5]	11,726	8,429	5,476	4,026	4,252	4,967	9,761	17,923

1) Including catches from Sub-division Vb2. Quantity unknown 1989-1991, 1993 and 1995-97.

2) Provisional data

3)From 1983 to 1996 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, 1982-1997, 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	1997 [2]
Faroe Islands	325	217	338	185	353	303	338	1133
France[1]	-	-	-	-	-	-	-	-
Norway	97	4	23	8 [2]	1 [2]	20 [2]	40	4
UK (Engl. and Wales)	-	-	+	+	... [1]	... [1]	... [1]	... [1]
UK (Scotland)[3]	725	287	869	102	170	39	62	... [1]
Total	1,147	508	1,230	295	524	362	440	1,137

1) Catches included in Sub-division Vb1.

2) Provisional data

3)From 1983 to 1996 includes also catches taken in Sub-division Vb1 (see Table 2.4.1)

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	1997	Haddock %
Open boats	7	7	11	2	3	2	3	2	1	1	1	2	2	16
Longliners < 100GRT	39	39	39	49	58	60	56	46	24	18	23	28	31	38
Longliners > 100GRT	13	12	13	19	18	18	18	22	25	25	38	36	38	21
Otterboard trawlers < 400HP	1	2	2	2	1	1	2	2	8	8	7	6	3	11
Otter board trawlers 400-999HP	6	3	5	4	3	3	1	1	3	2	5	7	6	12
Otterboard trawlers > 1000HP	8	5	2	2	2	2	2	1	1	3	2	2	3	1
Pairtrawlers < 1000HP	19	20	17	11	7	5	7	11	13	10	8	7	6	7
Pairtrawlers > 1000HP	6	10	9	9	6	8	11	14	22	29	16	13	12	4
Nets	0	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	1	1
Industry trawlers	0	1	1	2	1	1	1	1	3	3	0	0	0	5
Other gears	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total catch, tonnes gutted	13570	12967	13829	10697	12866	10319	7469	4103	3275	3629	4371	8535	15890	

Table 2.4.4

Haddock in ICES Division Vb 1997
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	Vb1 All Faroese Fleets	Vb2 All LLiners	Vb2 All OB. Trawl.	Vb2 All Pair trawl.	Vb2 All Others
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	1	26	26	1	9	0	0	0	1	63	13	0	0	1
3	60	1139	919	48	287	38	69	114	25	2701	82	14	92	4
4	160	3499	3552	271	593	257	597	952	108	9987	134	34	232	6
5	6	126	304	12	19	22	56	84	7	635	12	8	43	1
6	1	11	56	4	6	2	6	5	1	94	4	2	14	0
7	1	14	65	3	5	2	6	11	1	108	3	1	9	0
8	1	17	41	7	6	2	4	11	1	91	1	0	1	0
9	2	37	109	12	12	4	8	22	2	210	2	1	4	0
10	3	46	85	9	13	5	5	25	2	193	5	1	8	0
11	1	14	78	6	5	2	7	8	1	123	4	1	8	0
12	1	10	24	1	4	1	1	4	1	47	2	0	4	0
13	0	14	18	1	4	1	3	4	1	46	0	0	2	0
14	1	11	28	4	3	0	1	2	1	51	0	0	0	0
15	0	5	5	0	1	0	0	4	0	15	0	0	0	0
Total no.	238	4969	5310	378	966	337	765	1247	152	14363	263	62	417	13
Catch, t.	230	4834	5737	443	910	378	826	1424	158	14940	345	86	574	17

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: XSAJAK10/X10) At 1-May-98 16:38:20

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

YEAR		1961	1962	1963	1964	1965	1966	1967
AGE	2	7932	9631	13552	2284	1368	1081	1425
	3	7330	13977	8907	7457	4286	3304	2405
	4	5134	5233	7403	3899	5133	4804	2599
	5	1937	2361	2242	2360	1443	2710	1785
	6	1305	1407	1539	1120	1209	1112	1426
	7	838	868	860	728	673	740	631
	8	236	270	257	198	1345	180	197
	9	59	72	75	49	43	54	52
	+gp	0	0	0	0	0	0	0
0	TOTALNUM	24771	33819	34835	18095	15500	13985	10520
	TONSLAND	20831	27151	27571	19490	18479	18766	13381
	SOPCOF %	89	90	90	101	94	109	102

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

YEAR		1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
AGE	2	5881	2384	1728	717	750	3300	5633	7337	4396	255
	3	4097	7539	4855	4393	3744	8388	2899	7952	7858	4039
	4	2812	4567	6581	4727	4179	1236	3970	2097	6798	5168
	5	1524	1565	1624	3267	2706	2786	451	1371	1251	4918
	6	1526	1485	1383	1292	1171	916	976	247	1189	2128
	7	923	1224	1099	864	696	1051	466	352	298	946
	8	230	378	326	222	180	150	535	237	720	443
	9	68	114	68	147	113	68	68	419	258	731
	+gp	0	0	0	0	0	11	147	187	318	855
0	TOTALNUM	17061	19256	17664	15629	13539	17906	15145	20199	23086	19483
	TONSLAND	17852	23272	21361	19393	16485	17976	14773	20715	26211	25555
	SOPCOF %	103	108	103	99	98	98	97	117	107	98

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

YEAR		1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE	2	32	1	143	74	539	441	1195	985	230	283
	3	1022	1161	58	455	934	1969	1561	4553	2549	1718
	4	4248	1754	3724	202	784	383	2462	2196	4452	3565
	5	4054	3341	2583	2586	298	422	147	1242	1522	2972
	6	1841	1850	2496	1354	2182	93	234	169	738	1114
	7	717	772	1568	1559	973	1444	42	91	39	529
	8	635	212	660	608	1166	740	861	61	130	83
	9	243	155	99	177	1283	947	388	503	71	48
	+gp	312	74	86	36	214	795	968	973	712	334
0	TOTALNUM	13104	9320	11417	7051	8373	7234	7858	10773	10443	10646
	TONSLAND	19200	12418	15016	12233	11937	12894	12378	15143	14477	14882
	SOPCOF %	99	104	100	109	92	106	106	106	101	102

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

YEAR		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
AGE	2	655	63	105	77	40	113	277	810	330	77
	3	444	1516	1275	1044	154	298	191	456	5298	2913
	4	2463	658	1921	1774	776	274	307	237	1032	10517
	5	3036	2787	768	1248	1120	554	153	227	181	710
	6	2140	2554	1737	651	959	538	423	133	165	116
	7	475	1976	1909	1101	335	474	427	298	163	123
	8	151	541	885	698	373	131	383	293	273	93
	9	18	133	270	317	401	201	125	264	237	220
	+gp	128	81	108	32	162	185	301	298	399	517
0	TOTALNUM	9510	10311	8978	6942	4320	2768	2587	3016	8078	15286
	TONSLAND	12178	14325	11726	8429	5476	4026	4252	4967	9761	17923
	SOPCOF %	97	100	102	106	106	104	100	103	100	103

Table 2.4.6

Run title : Haddock Faroes Vb (run: XSAJAK10/X10) At 1-May-98 16:38:20

Table 2 Catch weights at age (kg)

	YEAR	1961	1962	1963	1964	1965	1966	1967
	AGE 2	0.47	0.47	0.47	0.47	0.47	0.47	0.47
	3	0.73	0.73	0.73	0.73	0.73	0.73	0.73
	4	1.13	1.13	1.13	1.13	1.13	1.13	1.13
	5	1.55	1.55	1.55	1.55	1.55	1.55	1.55
	6	1.97	1.97	1.97	1.97	1.97	1.97	1.97
	7	2.41	2.41	2.41	2.41	2.41	2.41	2.41
	8	2.76	2.76	2.76	2.76	2.76	2.76	2.76
	9	3.07	3.07	3.07	3.07	3.07	3.07	3.07
	+gp	3.55	3.55	3.55	3.55	3.55	3.55	3.55
0	SOPCOFAC	0.8938	0.9011	0.8964	1.0131	0.9401	1.092	1.0166

Table 2 Catch weights at age (kg)

	YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
	AGE 2	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.311
	3	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.633
	4	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.044
	5	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.426
	6	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.825
	7	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.241
	8	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.205
	9	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	2.57
	+gp	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	2.591
0	SOPCOFAC	1.0278	1.0835	1.0274	0.9874	0.9795	0.9776	0.9718	1.1712	1.0746	0.9784

Table 2.4.6 (Continued)

Table 2 Catch weights at age (kg)

YEAR		1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE	2	0.357	0.357	0.643	0.452	0.7	0.47	0.681	0.528	0.608	0.605
	3	0.79	0.672	0.713	0.725	0.896	0.74	1.011	0.859	0.887	0.831
	4	1.035	0.894	0.941	0.957	1.15	1.01	1.255	1.391	1.175	1.126
	5	1.398	1.156	1.157	1.237	1.444	1.32	1.812	1.777	1.631	1.462
	6	1.87	1.59	1.493	1.651	1.498	1.66	2.061	2.326	1.984	1.941
	7	2.35	2.07	1.739	2.053	1.829	2.05	2.059	2.44	2.519	2.173
	8	2.597	2.525	2.095	2.406	1.887	2.26	2.137	2.401	2.583	2.347
	9	3.014	2.696	2.465	2.725	1.961	2.54	2.368	2.532	2.57	3.118
	+gp	2.92	3.519	3.31	3.25	2.856	3.04	2.686	2.686	2.922	2.933
0 SOPCOFAC		0.9947	1.038	1.0017	1.087	0.9238	1.0554	1.0602	1.0559	1.0141	1.0197

Table 2 Catch weights at age (kg)

YEAR		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
AGE	2	0.501	0.58	0.438	0.547	0.525	0.755	0.754	0.666	0.534	0.519
	3	0.781	0.779	0.699	0.693	0.724	0.982	1.103	1.054	0.858	0.771
	4	0.974	0.923	0.939	0.884	0.817	1.027	1.254	1.489	1.459	1.066
	5	1.363	1.207	1.204	1.086	1.038	1.192	1.465	1.779	1.993	1.799
	6	1.68	1.564	1.384	1.276	1.249	1.378	1.593	1.94	2.33	2.27
	7	1.975	1.746	1.564	1.477	1.43	1.643	1.604	2.162	2.351	2.34
	8	2.344	2.086	1.818	1.574	1.564	1.796	2.049	2.357	2.469	2.475
	9	2.248	2.424	2.168	1.93	1.633	1.971	2.225	2.49	2.777	2.501
	+gp	3.295	2.514	2.335	2.153	2.126	2.24	2.423	2.678	2.582	2.669
0 SOPCOFAC		0.9695	1.0025	1.0195	1.0635	1.0554	1.0361	0.9969	1.0281	1.0044	1.025

Table 2.4.7

Run title : Haddock Faroes Vb (run: XSAJAK10/X10) At 1-May-98 16:38:21

Table 5 Proportion mature at age

YEAR	1961	1962	1963	1964	1965	1966	1967
AGE 2	0.06	0.06	0.06	0.06	0.06	0.06	0.06
3	0.48	0.48	0.48	0.48	0.48	0.48	0.48
4	0.91	0.91	0.91	0.91	0.91	0.91	0.91
5	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1
9	1	1	1	1	1	1	1
+gp	1	1	1	1	1	1	1

Table 5 Proportion mature at age

YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
AGE 2	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
3	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48
4	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
5	1	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1
9	1	1	1	1	1	1	1	1	1	1
+gp	1	1	1	1	1	1	1	1	1	1

Table 5 Proportion mature at age

YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE 2	0.06	0.06	0.06	0.06	0.07	0.08	0.08	0.03	0.03	0.05
3	0.48	0.48	0.48	0.48	0.52	0.62	0.76	0.62	0.43	0.32
4	0.91	0.91	0.91	0.91	0.88	0.89	0.98	0.96	0.95	0.91
5	1	1	1	1	1	1	1	1	0.99	0.98
6	1	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1
9	1	1	1	1	1	1	1	1	1	1
+gp	1	1	1	1	1	1	1	1	1	1

Table 5 Proportion mature at age

YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
AGE 2	0.05	0.02	0.08	0.16	0.18	0.15	0.12	0.1	0.06	0.02
3	0.24	0.22	0.37	0.58	0.65	0.53	0.5	0.55	0.57	0.55
4	0.89	0.87	0.9	0.93	0.91	0.9	0.92	0.97	0.95	0.93
5	0.98	0.99	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1
9	1	1	1	1	1	1	1	1	1	1
+gp	1	1	1	1	1	1	1	1	1	1

Table 2.4.8

Haddock in the Faroe Grounds (Fishing Area Vb) (run name : XSAJAK10)

103							
FLT35:	LL94A:	lline<100GRT	(Catch:	Thousands)	(Effort:	1)	
1985	1997						
1	1	0	1				
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			
	13706	26	1140	3501			
FLT38:	PT97:	Pair trawlers > 1000 HP	(Catch:	Thousands)	(Effort:	1)	
1988	1997						
1	1	0	1				
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				
	6406	84	5				
FLT41:	5	longliners	reduced	(Catch:	Thousands)	(Effort:	Unknown)
1990	1997						
1	1	0	1				
4	9						
	4066	34.229	15.815	33.796	41.161	20.256	4.983
	3516	38.99	33.442	19.045	33.442	19.945	10.647
	3308	13.634	32.011	27.862	14.079	10.522	9.04
	3684	10.355	23.345	25.227	23.533	3.765	8.095
	1601	7.729	3.612	8.233	8.569	7.309	2.604
	1297	3.035	3.771	2.529	4.737	4.967	3.633
	3915	28.012	5.198	4.765	3.249	8.014	7.003
	3240	125.759	10.763	1.983	2.301	1.452	3.859

Table 2.4.9

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Lowestoft VPA Version 3.1          1-May-98  16:37:30

 Extended Survivors Analysis

 Haddock Faroes Vb (run: XSAJAK10/X10)

 CPUE data from file /users/fish/ifad/ifapwork/nwwg/had_faro/FLEET.X10

 Catch data for  37 years. 1961 to 1997. Ages  2 to  10.

      Fleet,              First, Last, First, Last, Alpha,  Beta
                          year, year,  age ,  age
FLT35: LL94A: lline<,     1985, 1997,   2,     4,    .000,  1.000
FLT38: PT97: Pair tr,     1988, 1997,   5,     6,    .000,  1.000
FLT41: 5 longliners ,     1990, 1997,   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 =     .700

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

     Prior weighting not applied


Tuning converged after   58 iterations


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


Fishing mortalities
   Age,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996,  1997

     2,  .037,  .004,  .011,  .028,  .014,  .062,  .042,  .014,  .015,  .026
     3,  .067,  .112,  .116,  .149,  .073,  .133,  .142,  .091,  .123,  .179
     4,  .182,  .134,  .201,  .235,  .157,  .180,  .197,  .263,  .307,  .381
     5,  .240,  .324,  .228,  .195,  .228,  .161,  .144,  .219,  .330,  .359
     6,  .278,  .327,  .344,  .308,  .226,  .163,  .177,  .180,  .245,  .365
     7,  .227,  .448,  .435,  .382,  .258,  .166,  .188,  .183,  .351,  .291
     8,  .235,  .438,  .370,  .279,  .214,  .151,  .196,  .191,  .254,  .347
     9,  .234,  .336,  .408,  .218,  .256,  .171,  .211,  .201,  .233,  .335
```

Table 2.4.9 (Cont'd)

XSA population numbers (Thousands)

AGE / YEAR	2,	3,	4,	5,	6,	7,	8,	9,
1988 ,	2.01E+04,	7.59E+03,	1.63E+04,	1.57E+04,	9.75E+03,	2.58E+03,	7.96E+02,	9.55E+01,
1989 ,	1.58E+04,	1.59E+04,	5.81E+03,	1.11E+04,	1.01E+04,	6.05E+03,	1.69E+03,	5.15E+02,
1990 ,	1.03E+04,	1.29E+04,	1.16E+04,	4.16E+03,	6.60E+03,	5.98E+03,	3.17E+03,	8.91E+02,
1991 ,	3.03E+03,	8.36E+03,	9.37E+03,	7.79E+03,	2.71E+03,	3.83E+03,	3.17E+03,	1.79E+03,
1992 ,	3.28E+03,	2.42E+03,	5.90E+03,	6.07E+03,	5.25E+03,	1.63E+03,	2.14E+03,	1.96E+03,
1993 ,	2.07E+03,	2.65E+03,	1.84E+03,	4.13E+03,	3.95E+03,	3.43E+03,	1.03E+03,	1.42E+03,
1994 ,	7.36E+03,	1.59E+03,	1.90E+03,	1.26E+03,	2.88E+03,	2.75E+03,	2.38E+03,	7.26E+02,
1995 ,	6.27E+04,	5.78E+03,	1.13E+03,	1.28E+03,	8.91E+02,	1.97E+03,	1.87E+03,	1.60E+03,
1996 ,	2.44E+04,	5.06E+04,	4.32E+03,	7.12E+02,	8.39E+02,	6.09E+02,	1.35E+03,	1.26E+03,
1997 ,	3.36E+03,	1.97E+04,	3.67E+04,	2.60E+03,	4.19E+02,	5.38E+02,	3.51E+02,	8.55E+02,

Estimated population abundance at 1st Jan 1998

,	.00E+00,	2.68E+03,	1.35E+04,	2.05E+04,	1.49E+03,	2.38E+02,	3.29E+02,	2.03E+02,

Taper weighted geometric mean of the VPA populations:

,	1.03E+04,	9.27E+03,	6.39E+03,	3.68E+03,	2.50E+03,	1.87E+03,	1.31E+03,	9.06E+02,

Standard error of the weighted Log(VPA populations) :

,	1.1043,	1.0893,	1.1090,	1.0281,	1.0772,	.9765,	.9254,	.9620,

Log catchability residuals.

Fleet : FLT35: LL94A: lline<100GRT

Age ,	1985,	1986,	1987 ,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997
2 ,	.96,	-.01,	1.23 ,	1.44,	-1.63,	-.59,	-.02,	-.20,	.54,	.84,	-.09,	-.72,	-.85
3 ,	.79,	.39,	.40 ,	-.01,	.10,	.14,	.26,	-.16,	.01,	-.16,	-.66,	-.30,	-.06
4 ,	.40,	.56,	.59 ,	.52,	-.13,	.04,	.28,	.02,	-.12,	-.63,	-.41,	-.52,	.16
5 ,	No data for this fleet at this age												
6 ,	No data for this fleet at this age												
7 ,	No data for this fleet at this age												
8 ,	No data for this fleet at this age												
9 ,	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,	-12.1319,	-11.7575,
S.E(Log q),	.3423,	.4051,

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,	1.14,	-.513,	14.26,	.61,	13,	.93,	-13.66,

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,	.91,	1.080,	11.85,	.94,	13,	.31,	-12.13,
4,	.78,	3.968,	11.10,	.97,	13,	.20,	-11.76,

Table 2.4.9 (Cont'd)

Fleet : FLT38: PT97: Pair trawler > 1000 HP

Age ,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997
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 ,	-.22,	-.11,	-.59,	-.13,	-.31,	-.08,	.17,	.25,	.36,	.48
6 ,	-.09,	-.16,	-.11,	.31,	.06,	.15,	.67,	-.13,	-.11,	-.62
7 ,	No data for this fleet at this age									
8 ,	No data for this fleet at this age									
9 ,	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 ,	5,	6
Mean Log q,	-12.4141,	-12.3010,
S.E(Log q),	.3323,	.3509,

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,	1.28,	-2.407,	13.62,	.91,	10,	.34,	-12.41,
6,	.89,	1.123,	11.82,	.94,	10,	.31,	-12.30,

Fleet : FLT41: 5 longliners

Age ,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997
2 ,	No data for this fleet at this age									
3 ,	No data for this fleet at this age									
4 ,	99.99,	99.99,	-.62,	-.11,	-.68,	.12,	.63,	.46,	.26,	-.16
5 ,	99.99,	99.99,	-.49,	-.24,	.04,	-.03,	.12,	.39,	.25,	-.12
6 ,	99.99,	99.99,	-.24,	.21,	-.05,	.00,	.04,	.24,	-.14,	-.08
7 ,	99.99,	99.99,	.10,	.46,	.45,	.07,	.13,	.08,	-.15,	-.21
8 ,	99.99,	99.99,	.00,	.09,	-.13,	-.57,	.12,	.18,	-.09,	-.22
9 ,	99.99,	99.99,	-.12,	.00,	-.18,	-.11,	.28,	.03,	-.17,	-.14

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,	-13.3237,	-13.1845,	-13.0896,	-13.0896,	-13.0896,	-13.0896,
S.E(Log q),	.4724,	.2762,	.1623,	.2716,	.2554,	.1629,

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,	1.35,	-2.020,	15.03,	.85,	8,	.53,	-13.32,
5,	1.29,	-2.342,	14.74,	.92,	8,	.28,	-13.18,
6,	1.03,	-.380,	13.23,	.97,	8,	.18,	-13.09,
7,	.85,	1.818,	12.19,	.96,	8,	.18,	-12.98,
8,	.84,	1.661,	12.25,	.95,	8,	.18,	-13.17,
9,	1.19,	-1.006,	14.29,	.83,	8,	.18,	-13.14,

Table 2.4.9 (Cont'd)

Terminal year survivor and F summaries :

Age 2 Catchability dependent on age and year class strength

Year class = 1995

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT35: LL94A: lline<,	1147.,	1.048,	.000,	.00,	1,	.235,	.059
FLT38: PT97: Pair tr,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT41: 5 longliners ,	1.,	.000,	.000,	.00,	0,	.000,	.000
P shrinkage mean ,	9266.,	1.09,,,,				.223,	.007
F shrinkage mean ,	2319.,	.70,,,,				.541,	.030

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
2678.,	.51,	.79,	3,	1.536,	.026

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

Year class = 1994

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT35: LL94A: lline<,	11756.,	.335,	.212,	.63,	2,	.784,	.202
FLT38: PT97: Pair tr,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT41: 5 longliners ,	1.,	.000,	.000,	.00,	0,	.000,	.000
F shrinkage mean ,	22068.,	.70,,,,				.216,	.113

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
13467.,	.30,	.25,	3,	.810,	.179

Age 4 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<,	18670.,	.265,	.156,	.59,	3,	.657,	.412
FLT38: PT97: Pair tr,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT41: 5 longliners ,	17501.,	.502,	.000,	.00,	1,	.196,	.434
F shrinkage mean ,	38303.,	.70,,,,				.147,	.222

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
20496.,	.22,	.17,	5,	.744,	.381

Table 2.4.9 (Cont'd)

Age 5 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: 11ine<,	898.,	.264,	.259,	.98,	3,	.285,	.540
FLT38: PT97: Pair tr,	2410.,	.350,	.000,	.00,	1,	.233,	.236
FLT41: 5 longliners ,	1426.,	.260,	.153,	.59,	2,	.399,	.372
F shrinkage mean ,	2645.,	.70,,,,				.083,	.217

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1487.,	.16,	.19,	7,	1.139,	.359

Age 6 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: 11ine<,	190.,	.265,	.163,	.61,	3,	.162,	.440
FLT38: PT97: Pair tr,	198.,	.257,	.487,	1.89,	2,	.296,	.426
FLT41: 5 longliners ,	263.,	.200,	.137,	.69,	3,	.476,	.336
F shrinkage mean ,	476.,	.70,,,,				.066,	.199

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
238.,	.14,	.14,	9,	1.011,	.365

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

Year class = 1990

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT35: LL94A: 11ine<,	251.,	.267,	.218,	.82,	3,	.137,	.368
FLT38: PT97: Pair tr,	349.,	.256,	.182,	.71,	2,	.221,	.277
FLT41: 5 longliners ,	334.,	.168,	.172,	1.03,	4,	.586,	.287
F shrinkage mean ,	430.,	.70,,,,				.056,	.230

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
329.,	.13,	.10,	10,	.788,	.291

Table 2.4.9 (Cont'd)

Age 8 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<,	178.,	.269,	.024,	.09,	3,	.113,	.387
FLT38: PT97: Pair tr,	207.,	.255,	.151,	.59,	2,	.170,	.341
FLT41: 5 longliners ,	196.,	.150,	.094,	.63,	5,	.659,	.357
F shrinkage mean ,	376.,	.70,,,,				.058,	.202

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
203.,	.12,	.07,	11,	.616,	.347

Age 9 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<,	555.,	.273,	.153,	.56,	3,	.089,	.306
FLT38: PT97: Pair tr,	681.,	.257,	.378,	1.47,	2,	.139,	.257
FLT41: 5 longliners ,	468.,	.136,	.065,	.48,	6,	.720,	.355
F shrinkage mean ,	474.,	.70,,,,				.052,	.351

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
501.,	.11,	.07,	12,	.637,	.335

Table 2.4.10

Run title : Haddock Faroes Vb (run: XSAJAK10/X10) At 1-May-98 16:38:21

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR	1961	1962	1963	1964	1965	1966	1967
AGE 2	0.1875	0.3232	0.3801	0.0876	0.0691	0.0609	0.0641
3	0.4162	0.5866	0.5639	0.3723	0.2354	0.2370	0.1873
4	0.4209	0.5980	0.7261	0.5193	0.4767	0.4515	0.2971
5	0.4387	0.3480	0.5591	0.5369	0.3678	0.5006	0.2997
6	0.5879	0.6706	0.4026	0.6107	0.5882	0.5421	0.5406
7	0.9483	1.0499	1.2493	0.3375	0.9618	0.9128	0.6906
8	0.8742	0.9736	1.1139	1.2027	2.3618	0.7509	0.6634
9	0.6600	0.7351	0.8185	0.6472	0.9619	0.6373	0.5022
+gp	0.6600	0.7351	0.8185	0.6472	0.9619	0.6373	0.5022
0 FBAR 3- 7	0.5624	0.6506	0.7002	0.4753	0.5260	0.5288	0.4030

Table 8 Fishing mortality (F) at age

YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
AGE 2	0.1261	0.0860	0.0552	0.0526	0.0253	0.1672	0.1266	0.1230	0.0908	0.0108
3	0.2647	0.2364	0.2529	0.1937	0.4228	0.4308	0.2172	0.2650	0.1878	0.1128
4	0.3483	0.5320	0.3345	0.4187	0.2855	0.2385	0.3730	0.2412	0.3810	0.1815
5	0.2847	0.3330	0.3639	0.2755	0.4520	0.3134	0.1279	0.2116	0.2216	0.5273
6	0.4540	0.4975	0.5559	0.5560	0.1495	0.2695	0.1714	0.0957	0.2871	0.7246
7	0.8367	0.8276	0.8740	0.8378	0.6720	0.1946	0.2134	0.0859	0.1601	0.3904
8	0.5851	1.0631	0.5429	0.4224	0.4059	0.2907	0.1433	0.1599	0.2539	0.3788
9	0.5057	0.6566	0.5386	0.5060	0.3957	0.2627	0.2068	0.1595	0.2621	0.4437
+gp	0.5057	0.6566	0.5386	0.5060	0.3957	0.2627	0.2068	0.1595	0.2621	0.4437
0 FBAR 3- 7	0.4377	0.4853	0.4762	0.4564	0.3964	0.2894	0.2206	0.1799	0.2475	0.3873

Table 8 Fishing mortality (F) at age

YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE 2	0.0010	0.0004	0.0325	0.0237	0.0383	0.0259	0.0316	0.0283	0.0095	0.0332
3	0.0547	0.0458	0.0285	0.1373	0.4611	0.1913	0.1205	0.1616	0.0950	0.0909
4	0.1665	0.1254	0.2027	0.1313	0.3707	0.3473	0.3886	0.2486	0.2351	0.1866
5	0.2115	0.1912	0.2749	0.2115	0.2914	0.3496	0.2165	0.3461	0.2730	0.2435
6	0.3820	0.1408	0.2135	0.2263	0.2780	0.1380	0.3333	0.4147	0.3569	0.3293
7	0.5760	0.2721	0.1702	0.2004	0.2523	0.2998	0.0852	0.2082	0.1565	0.4708
8	0.4968	0.3303	0.3954	0.0920	0.2265	0.3100	0.2938	0.1716	0.5171	0.5803
9	0.3689	0.2130	0.2526	0.1730	0.2854	0.2906	0.2649	0.2794	0.3095	0.3644
+gp	0.3689	0.2130	0.2526	0.1730	0.2854	0.2906	0.2649	0.2794	0.3095	0.3644
0 FBAR 3- 7	0.2781	0.1551	0.1780	0.1814	0.3307	0.2652	0.2288	0.2758	0.2233	0.2642

Table 8 Fishing mortality (F) at age

YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
AGE										
2	0.0366	0.0044	0.0113	0.0264	0.0136	0.0622	0.0425	0.0144	0.0151	0.0257
3	0.0669	0.1116	0.1161	0.1486	0.0731	0.1329	0.1421	0.0913	0.1229	0.1787
4	0.1823	0.1338	0.2014	0.2347	0.1571	0.1800	0.1970	0.2632	0.3068	0.3814
5	0.2400	0.3236	0.2282	0.1948	0.2282	0.1606	0.1445	0.2190	0.3297	0.3592
6	0.2777	0.3267	0.3436	0.3084	0.2255	0.1630	0.1773	0.1804	0.2450	0.3649
7	0.2271	0.4478	0.4349	0.3820	0.2575	0.1657	0.1882	0.1827	0.3508	0.2914
8	0.2353	0.4379	0.3696	0.2788	0.2138	0.1512	0.1959	0.1907	0.2539	0.3465
9	0.2336	0.3360	0.4078	0.2177	0.2557	0.1707	0.2109	0.2011	0.2326	0.3348
+gp	0.2336	0.3360	0.4078	0.2177	0.2557	0.1707	0.2109	0.2011	0.2326	0.3348
0 FBAR 3- 7	0.1988	0.2687	0.2649	0.2537	0.1883	0.1604	0.1698	0.1873	0.2711	0.3151

Table 2.4.11

Run title : Haddock Faroes Vb (run: XSAJAK10/X10) At 1-May-98 16:38:21

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	1967
AGE	2	51279	38537	47362	30110	22644	20206	25356
	3	23796	34806	22837	26515	22586	17302	15565
	4	16517	12850	15850	10638	14961	14613	11176
	5	6028	8877	5786	6278	5182	7605	7618
	6	3245	3182	5132	2708	3005	2937	3774
	7	1512	1476	1332	2809	1204	1366	1398
	8	448	480	423	313	1641	377	449
	9	135	153	148	114	77	127	146
	+gp	0	0	0	0	0	0	0
0 TOTAL		102958	100361	98871	79485	71299	64532	65481

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

YEAR		1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
AGE	2	54843	31968	35582	15450	33176	23690	52333	70054	55974	26196
	3	19470	39580	24016	27568	12001	26483	16410	37750	50717	41850
	4	10567	12234	25584	15270	18596	6438	14093	10812	23712	34413
	5	6798	6107	5884	14992	8225	11444	4152	7946	6955	13263
	6	4622	4187	3584	3348	9318	4285	6849	2992	5265	4562
	7	1800	2403	2084	1683	1572	6569	2680	4724	2226	3235
	8	574	638	860	712	596	657	4428	1772	3549	1553
	9	189	262	180	409	382	325	402	3141	1237	2254
	+gp	0	0	0	0	0	52	865	1396	1515	2613
0 TOTAL		98863	97379	97775	79432	83866	79945	102212	140587	151149	129938

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

YEAR		1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE	2	35063	2787	4945	3495	15861	19045	42501	39063	26937	9578
	3	21217	28678	2281	3919	2794	12498	15194	33715	31091	21846
	4	30609	16446	22429	1815	2797	1443	8451	11027	23484	23149
	5	23499	21217	11878	14994	1303	1581	835	4691	7041	15199
	6	6408	15571	14348	7387	9936	797	912	550	2717	4388
	7	1810	3581	11074	9488	4823	6161	568	535	298	1557
	8	1793	833	2233	7648	6358	3068	3737	427	356	208
	9	870	893	490	1231	5712	4150	1843	2281	295	174
	+gp	1109	424	423	249	947	3462	4569	4384	2936	1199
0 TOTAL		122377	90430	70101	50227	50531	52205	78610	96675	95154	77297

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

YEAR		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
AGE	2	20137	15770	10323	3035	3277	2071	7362	62731	24388	3356
	3	7585	15894	12855	8357	2415	2647	1593	5777	50627	19668
	4	16331	5809	11639	9371	5898	1838	1897	1132	4317	36656
	5	15727	11142	4160	7791	6067	4126	1257	1276	712	2601
	6	9755	10129	6601	2711	5250	3954	2877	891	839	419
	7	2584	6050	5982	3833	1631	3430	2750	1973	609	538
	8	796	1686	3165	3170	2142	1032	2380	1865	1346	351
	9	95	515	891	1791	1964	1416	726	1602	1262	855
	+gp	675	311	353	180	789	1297	1740	1799	2113	1994
0 TOTAL		73686	67307	55970	40239	29431	21812	22583	79045	86213	66437

Table 2.4.12

Run title : Haddock Faroes Vb (run: XSAJAK10/X10) At 1-May-98 16:38:21

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

Year	Recruits Age 2	Total Biomass	Total SSB	Landings	Yield/SSB	FBAR (3-7)
1961	51279	81164	47797	20831	0.4358	0.5624
1962	38537	83420	51875	27151	0.5234	0.6506
1963	47362	80753	49547	27571	0.5565	0.7002
1964	30110	68577	44128	19490	0.4417	0.4753
1965	22644	65655	45555	18479	0.4056	0.526
1966	20206	60934	43953	18766	0.427	0.5288
1967	25356	60206	41959	13381	0.3189	0.403
1968	54843	78075	45379	17852	0.3934	0.4377
1969	31968	83814	53422	23272	0.4356	0.4853
1970	35582	87297	59858	21361	0.3569	0.4762
1971	15450	81751	62907	19393	0.3083	0.4564
1972	33176	83079	61975	16485	0.266	0.3964
1973	23690	82752	61578	17976	0.2919	0.2894
1974	52333	95414	64631	14773	0.2286	0.2206
1975	70054	121784	75405	20715	0.2747	0.1799
1976	55974	135612	89219	26211	0.2938	0.2475
1977	26196	121164	96497	25555	0.2648	0.3873
1978	35063	120564	97230	19200	0.1975	0.2781
1979	2787	97670	85390	12418	0.1454	0.1551
1980	4945	87622	81888	15016	0.1834	0.178
1981	3495	78949	75830	12233	0.1613	0.1814
1982	15861	68312	56398	11937	0.2117	0.3307
1983	19045	63696	51786	12894	0.249	0.2652
1984	42501	84096	53570	12378	0.2311	0.2288
1985	39063	94425	62800	15143	0.2411	0.2758
1986	26937	99429	66329	14477	0.2183	0.2233
1987	9578	88682	68043	14882	0.2187	0.2642
1988	20137	79152	62887	12178	0.1936	0.1988
1989	15770	72292	52839	14325	0.2711	0.2687
1990	10323	56448	45534	11726	0.2575	0.2649
1991	3035	42150	37743	8429	0.2233	0.2537
1992	3277	31707	29251	5476	0.1872	0.1883
1993	2071	29604	26864	4026	0.1499	0.1604
1994	7362	31782	25828	4252	0.1646	0.1698
1995	62731	71057	30666	4967	0.162	0.1873
1996	24388	79848	48613	9761	0.2008	0.2711
1997	3356	71198	59932	17923	0.2991	0.3151
Arith. Mean	26662	78923	57165	15754	0.2808	0.3265
0 Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)		

Table 2.4.13 Input data for RCT3

Faroe Haddock: VPA and groundfish survey data

3 13 2

'Yearclass'	'VPAage2'	'Survage1'	'Survage2'	'Survage3'
1985	9578	23.6	11.8	11.8
1986	20137	40.6	88.1	113
1987	15770	40.5	146.6	64
1988	10323	43.8	43.1	13.4
1989	3035	6.1	16.5	8.5
1990	3277	4	26.9	9.9
1991	2071	6.2	9.2	3.1
1992	7362	28.1	21.3	10.1
1993	62731	186.3	252.6	137.1
1994	24388	486.9	244.2	161.7
1995	-11	65.6	84.7	43.6
1996	-11	3.2	3.1	-11
1997	-11	32.5	-11	-11

Table 2.4.14

Analysis by RCT3 ver3.1 of data from file :

rct3c97.dat

Faroe Haddock: VPA and groundfish survey data

Data for 3 surveys over 13 years : 1985 - 1997

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

Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I----------Regression----------I					I----------Prediction---------I			
Survage1	1.00	5.90	.33	.868	5	1.61	7.52	.656	.370
Survage2	.97	5.58	.80	.528	5	3.33	8.80	1.151	.120
Survage3	.80	6.59	.57	.686	5	2.39	8.49	.865	.213
			VPA Mean =				9.20	.731	.298

Yearclass = 1991

Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I----------Regression----------I					I----------Prediction---------I			
Survage1	.86	6.44	.31	.894	6	1.97	8.13	.446	.612
Survage2	1.22	4.53	.93	.478	6	2.32	7.36	1.441	.059
Survage3	.90	6.19	.59	.699	6	1.41	7.46	.941	.137
			VPA Mean =				9.01	.796	.192

Yearclass = 1992

Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I----------Regression----------I					I----------Prediction---------I			
Survage1	.98	6.03	.37	.877	7	3.37	9.32	.479	.486
Survage2	1.14	4.84	.78	.615	7	3.10	8.38	1.001	.111
Survage3	.87	6.31	.50	.792	7	2.41	8.40	.650	.264
			VPA Mean =				8.80	.896	.139

Table 2.4.14 (Cont'd)

Yearclass = 1993

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I----------Regression---------I					I----------Prediction---------I			
Survage1	.97	6.00	.37	.855	8	5.23	11.06	.620	.402
Survage2	1.15	4.86	.74	.597	8	5.54	11.24	1.183	.110
Survage3	.88	6.35	.50	.761	8	4.93	10.68	.764	.264
			VPA Mean =				8.81	.830	.224

Yearclass = 1994

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I----------Regression---------I					I----------Prediction---------I			
Survage1	.96	6.01	.34	.921	9	6.19	11.97	.552	.450
Survage2	1.11	5.01	.65	.765	9	5.50	11.09	.901	.169
Survage3	.96	6.15	.52	.838	9	5.09	11.03	.717	.266
			VPA Mean =				9.06	1.092	.115

Yearclass = 1995

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I----------Regression---------I					I----------Prediction---------I			
Survage1	.82	6.31	.59	.794	10	4.20	9.75	.713	.276
Survage2	1.01	5.26	.62	.777	10	4.45	9.76	.750	.250
Survage3	.88	6.29	.52	.831	10	3.80	9.65	.629	.356
			VPA Mean =				9.17	1.090	.118

Yearclass = 1996

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I----------Regression---------I					I----------Prediction---------I			
Survage1	.82	6.31	.60	.794	10	1.44	7.48	.790	.435
Survage2	1.01	5.25	.62	.785	10	1.41	6.68	.890	.343
Survage3									
			VPA Mean =				9.17	1.104	.223

Table 2.4.14 (Cont'd)

Yearclass = 1997

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I----------Regression----------I					I----------Prediction---------I			
Survage1	.81	6.31	.61	.795	10	3.51	9.17	.737	.698
Survage2									
Survage3									
			VPA Mean =				9.17	1.120	.302

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1990	4359	8.38	.40	.41	1.04	3278	8.09
1991	3509	8.16	.35	.28	.67	2071	7.64
1992	7346	8.90	.33	.25	.54	7362	8.90
1993	35469	10.48	.39	.53	1.81	62732	11.05
1994	75984	11.24	.37	.52	1.96	24389	10.10
1995	15490	9.65	.37	.11	.08		
1996	1965	7.58	.52	.65	1.55		
1997	9578	9.17	.62	.00	.00		

Table 2.4.15

The SAS System 14:43 Tuesday, May 5, 1998

Haddock in the Faroe Grounds (Fishing Area Vb)

Prediction with management option table: Input data

Year: 1998								
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	1965.000	0.2000	0.0300	0.0000	0.0000	0.573	0.0225	0.573
3	2678.000	0.2000	0.5600	0.0000	0.0000	0.877	0.1602	0.877
4	13467.000	0.2000	0.9300	0.0000	0.0000	1.063	0.3876	1.063
5	20496.000	0.2000	1.0000	0.0000	0.0000	1.240	0.3699	1.240
6	1487.000	0.2000	1.0000	0.0000	0.0000	2.047	0.3220	2.047
7	238.000	0.2000	1.0000	0.0000	0.0000	2.493	0.3360	2.493
8	329.000	0.2000	1.0000	0.0000	0.0000	2.573	0.3223	2.573
9	203.000	0.2000	1.0000	0.0000	0.0000	2.714	0.3131	2.714
10+	1669.000	0.2000	1.0000	0.0000	0.0000	2.643	0.3131	2.643
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	9578.000	0.2000	0.0300	0.0000	0.0000	0.573	0.0225	0.573
3	.	0.2000	0.5600	0.0000	0.0000	0.877	0.1602	0.877
4	.	0.2000	0.9300	0.0000	0.0000	1.063	0.3876	1.063
5	.	0.2000	1.0000	0.0000	0.0000	1.240	0.3699	1.240
6	.	0.2000	1.0000	0.0000	0.0000	2.047	0.3220	2.047
7	.	0.2000	1.0000	0.0000	0.0000	2.493	0.3360	2.493
8	.	0.2000	1.0000	0.0000	0.0000	2.573	0.3223	2.573
9	.	0.2000	1.0000	0.0000	0.0000	2.714	0.3131	2.714
10+	.	0.2000	1.0000	0.0000	0.0000	2.643	0.3131	2.643
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 2000								
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	14322.000	0.2000	0.0300	0.0000	0.0000	0.573	0.0225	0.573
3	.	0.2000	0.5600	0.0000	0.0000	0.877	0.1602	0.877
4	.	0.2000	0.9300	0.0000	0.0000	1.063	0.3876	1.063
5	.	0.2000	1.0000	0.0000	0.0000	1.240	0.3699	1.240
6	.	0.2000	1.0000	0.0000	0.0000	2.047	0.3220	2.047
7	.	0.2000	1.0000	0.0000	0.0000	2.493	0.3360	2.493
8	.	0.2000	1.0000	0.0000	0.0000	2.573	0.3223	2.573
9	.	0.2000	1.0000	0.0000	0.0000	2.714	0.3131	2.714
10+	.	0.2000	1.0000	0.0000	0.0000	2.643	0.3131	2.643
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANJAK03
Date and time: 03MAY98:10:00

Table 2.4.16

The SAS System 14:43 Tuesday, May 5, 1998

Haddock in the Faroe Grounds (Fishing Area Vb)

Prediction with management option table

Year: 1998					Year: 1999					Year: 2000	
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	0.3151	52651	49523	14046	0.0000	0.0000	47911	41841	0	59566	48484
.	.	.	.	.	0.1000	0.0315	.	41841	1261	58093	47019
.	.	.	.	.	0.2000	0.0630	.	41841	2482	56668	45602
.	.	.	.	.	0.3000	0.0945	.	41841	3664	55290	44232
.	.	.	.	.	0.4000	0.1261	.	41841	4810	53957	42908
.	.	.	.	.	0.5000	0.1576	.	41841	5919	52668	41627
.	.	.	.	.	0.6000	0.1891	.	41841	6993	51421	40388
.	.	.	.	.	0.7000	0.2206	.	41841	8034	50215	39190
.	.	.	.	.	0.8000	0.2521	.	41841	9042	49048	38032
.	.	.	.	.	0.9000	0.2836	.	41841	10018	47920	36912
.	.	.	.	.	1.0000	0.3151	.	41841	10964	46829	35828
.	.	.	.	.	1.1000	0.3467	.	41841	11881	45773	34780
.	.	.	.	.	1.2000	0.3782	.	41841	12769	44752	33767
.	.	.	.	.	1.3000	0.4097	.	41841	13629	43764	32787
.	.	.	.	.	1.4000	0.4412	.	41841	14462	42808	31839
.	.	.	.	.	1.5000	0.4727	.	41841	15270	41884	30923
.	.	.	.	.	1.6000	0.5042	.	41841	16053	40989	30036
.	.	.	.	.	1.7000	0.5357	.	41841	16811	40124	29178
.	.	.	.	.	1.8000	0.5673	.	41841	17546	39287	28349
.	.	.	.	.	1.9000	0.5988	.	41841	18258	38477	27547
.	.	.	.	.	2.0000	0.6303	.	41841	18948	37693	26771
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANJAK03
Date and time : 03MAY98:10:00
Computation of ref. F: Simple mean, age 3 - 7
Basis for 1998 : F factors

Table 2.4.17

The SAS System 14:43 Tuesday, May 5, 1998

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	0.0800	0.0000	0.0000	0.549	0.0630	0.549
3	.	0.2000	0.5000	0.0000	0.0000	0.819	0.2070	0.819
4	.	0.2000	0.9200	0.0000	0.0000	1.086	0.3210	1.086
5	.	0.2000	1.0000	0.0000	0.0000	1.426	0.3220	1.426
6	.	0.2000	1.0000	0.0000	0.0000	1.741	0.3600	1.741
7	.	0.2000	1.0000	0.0000	0.0000	2.002	0.4220	2.002
8	.	0.2000	1.0000	0.0000	0.0000	2.189	0.4620	2.189
9	.	0.2000	1.0000	0.0000	0.0000	2.425	0.3820	2.425
10+	.	0.2000	1.0000	0.0000	0.0000	2.749	0.3820	2.749
Unit	Numbers	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : YLDJAK02
Date and time: 03MAY98:11:02

Table 2.4.18

The SAS System 18:57 Thursday, May 21, 1998

Haddock in the Faroe Grounds (Fishing Area Vb)

Yield per recruit: Summary table

						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
0.0000	0.0000	0.000	0.000	5.517	8568.020	4.134	7669.432	4.134	7669.432
0.0500	0.0163	0.066	118.707	5.187	7760.989	3.806	6864.237	3.806	6864.237
0.1000	0.0326	0.122	212.421	4.909	7093.960	3.530	6199.029	3.530	6199.029
0.1500	0.0490	0.169	287.308	4.673	6534.767	3.296	5641.644	3.296	5641.644
0.2000	0.0653	0.211	347.765	4.469	6060.231	3.094	5168.902	3.094	5168.902
0.2500	0.0816	0.246	396.997	4.290	5653.242	2.917	4763.695	2.917	4763.695
0.3000	0.0979	0.278	437.386	4.133	5300.916	2.762	4413.137	2.762	4413.137
0.3500	0.1142	0.306	470.731	3.994	4993.372	2.625	4107.347	2.625	4107.347
0.4000	0.1306	0.331	498.413	3.869	4722.917	2.502	3838.634	2.502	3838.634
0.4500	0.1469	0.354	521.502	3.757	4483.480	2.391	3600.927	2.391	3600.927
0.5000	0.1632	0.375	540.836	3.655	4270.211	2.291	3389.374	2.291	3389.374
0.5500	0.1795	0.393	557.082	3.562	4079.191	2.201	3200.059	2.201	3200.059
0.6000	0.1958	0.410	570.771	3.477	3907.228	2.117	3029.787	2.117	3029.787
0.6500	0.2122	0.426	582.332	3.399	3751.692	2.041	2875.930	2.041	2875.930
0.7000	0.2285	0.441	592.112	3.327	3610.403	1.971	2736.309	1.971	2736.309
0.7500	0.2448	0.454	600.395	3.260	3481.540	1.906	2609.101	1.906	2609.101
0.8000	0.2611	0.467	607.415	3.198	3363.571	1.846	2492.776	1.846	2492.776
0.8500	0.2774	0.479	613.364	3.140	3255.198	1.790	2386.035	1.790	2386.035
0.9000	0.2938	0.490	618.402	3.086	3155.318	1.737	2287.775	1.737	2287.775
0.9500	0.3101	0.500	622.663	3.035	3062.984	1.688	2197.050	1.688	2197.050
1.0000	0.3264	0.510	626.258	2.988	2977.383	1.642	2113.046	1.642	2113.046
1.0500	0.3427	0.519	629.282	2.943	2897.812	1.599	2035.061	1.599	2035.061
1.1000	0.3590	0.528	631.815	2.900	2823.660	1.558	1962.484	1.558	1962.484
1.1500	0.3754	0.536	633.923	2.860	2754.395	1.520	1894.783	1.520	1894.783
1.2000	0.3917	0.544	635.665	2.822	2689.549	1.484	1831.490	1.484	1831.490
1.2500	0.4080	0.551	637.089	2.786	2628.713	1.449	1772.197	1.449	1772.197
1.3000	0.4243	0.558	638.236	2.751	2571.527	1.416	1716.543	1.416	1716.543
1.3500	0.4406	0.565	639.145	2.718	2517.669	1.385	1664.206	1.385	1664.206
1.4000	0.4570	0.571	639.844	2.687	2466.856	1.356	1614.904	1.356	1614.904
1.4500	0.4733	0.577	640.361	2.657	2418.835	1.327	1568.384	1.327	1568.384
1.5000	0.4896	0.583	640.720	2.629	2373.380	1.300	1524.419	1.300	1524.419
1.5500	0.5059	0.589	640.940	2.601	2330.289	1.275	1482.808	1.275	1482.808
1.6000	0.5222	0.594	641.038	2.575	2289.379	1.250	1443.369	1.250	1443.369
1.6500	0.5386	0.600	641.031	2.550	2250.488	1.226	1405.937	1.226	1405.937
1.7000	0.5549	0.605	640.930	2.525	2213.467	1.204	1370.367	1.204	1370.367
1.7500	0.5712	0.609	640.749	2.502	2178.182	1.182	1336.523	1.182	1336.523
1.8000	0.5875	0.614	640.497	2.480	2144.513	1.161	1304.285	1.161	1304.285
1.8500	0.6038	0.618	640.183	2.458	2112.348	1.141	1273.542	1.141	1273.542
1.9000	0.6202	0.623	639.815	2.437	2081.589	1.122	1244.195	1.122	1244.195
1.9500	0.6365	0.627	639.399	2.417	2052.142	1.103	1216.151	1.103	1216.151
2.0000	0.6528	0.631	638.943	2.397	2023.924	1.085	1189.327	1.085	1189.327
2.0500	0.6691	0.635	638.451	2.379	1996.858	1.068	1163.646	1.068	1163.646
2.1000	0.6854	0.639	637.929	2.360	1970.873	1.051	1139.037	1.051	1139.037
2.1500	0.7018	0.642	637.380	2.343	1945.906	1.035	1115.436	1.035	1115.436
2.2000	0.7181	0.646	636.808	2.326	1921.895	1.020	1092.783	1.020	1092.783
2.2500	0.7344	0.649	636.216	2.309	1898.785	1.005	1071.022	1.005	1071.022
2.3000	0.7507	0.653	635.608	2.293	1876.526	0.990	1050.104	0.990	1050.104
2.3500	0.7670	0.656	634.986	2.277	1855.071	0.976	1029.980	0.976	1029.980
2.4000	0.7834	0.659	634.352	2.262	1834.375	0.962	1010.608	0.962	1010.608
2.4500	0.7997	0.662	633.709	2.247	1814.398	0.949	991.946	0.949	991.946
2.5000	0.8160	0.665	633.058	2.233	1795.102	0.936	973.957	0.936	973.957
2.5500	0.8323	0.668	632.401	2.219	1776.453	0.924	956.606	0.924	956.606
2.6000	0.8486	0.671	631.739	2.206	1758.416	0.911	939.860	0.911	939.860
2.6500	0.8650	0.674	631.074	2.192	1740.963	0.900	923.688	0.900	923.688
2.7000	0.8813	0.676	630.406	2.179	1724.063	0.888	908.062	0.888	908.062
2.7500	0.8976	0.679	629.738	2.167	1707.691	0.877	892.956	0.877	892.956
2.8000	0.9139	0.682	629.069	2.155	1691.821	0.866	878.345	0.866	878.345
2.8500	0.9302	0.684	628.401	2.143	1676.429	0.856	864.204	0.856	864.204
2.9000	0.9466	0.687	627.734	2.131	1661.495	0.846	850.512	0.846	850.512
2.9500	0.9629	0.689	627.069	2.120	1646.996	0.836	837.249	0.836	837.249
3.0000	0.9792	0.691	626.407	2.109	1632.915	0.826	824.395	0.826	824.395
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDJAK02
Date and time : 21MAY98:19:01
Computation of ref. F: Simple mean, age 3 - 7
F-0.1 factor : 0.5812
F-max factor : 1.6209
F-0.1 reference F : 0.1897
F-max reference F : 0.5291
Recruitment : Single recruit

Table 2.4.19

If the 8202 days are allocated to the LL<100.		If the 8202 days are allocated to the ST<400.		If the 8202 X 2 days are allocated to the Jiggers.	
F	LL<100	F	ST<400	F	Jiggers
0.067712	0.018182	0.034642	0.018182	0.030177	0.018182
0.074859	0.036364	0.044443	0.036364	0.034221	0.036364
0.076249	0.054545	0.049177	0.054545	0.039194	0.054545
0.084846	0.072727	0.061584	0.072727	0.043477	0.072727
0.095447	0.090909	0.066582	0.090909	0.048241	0.090909
0.100599	0.109091	0.069011	0.109091	0.050672	0.109091
0.10849	0.145455	0.073995	0.145455	0.055796	0.145455
0.109224	0.163636	0.083155	0.163636	0.063052	0.163636
0.109764	0.181818	0.087927	0.181818	0.064719	0.181818
0.11248	0.2	0.089864	0.2	0.067289	0.2
0.116755	0.218182	0.09527	0.218182	0.06985	0.218182
0.120686	0.236364	0.101582	0.236364	0.072964	0.236364
0.127634	0.254545	0.103372	0.254545	0.078075	0.254545
0.129219	0.272727	0.114317	0.272727	0.08049	0.272727
0.130051	0.290909	0.115689	0.290909	0.083852	0.290909
0.131935	0.309091	0.117386	0.309091	0.084681	0.309091
0.134241	0.327273	0.119055	0.327273	0.085024	0.327273
0.137362	0.345455	0.1261	0.345455	0.085854	0.345455
0.141018	0.363636	0.128495	0.363636	0.089455	0.363636
0.143024	0.4	0.130927	0.4	0.09484	0.4
0.143464	0.418182	0.132791	0.418182	0.097682	0.418182
0.144761	0.436364	0.133218	0.436364	0.105091	0.436364
0.145936	0.454545	0.134122	0.454545	0.108696	0.454545
0.151093	0.472727	0.143808	0.472727	0.109349	0.472727
0.151621	0.490909	0.144956	0.490909	0.109745	0.490909
0.154474	0.509091	0.146522	0.509091	0.110457	0.509091
0.157068	0.527273	0.149605	0.527273	0.111202	0.527273
0.157303	0.545455	0.151212	0.545455	0.113353	0.545455
0.160746	0.563636	0.152339	0.563636	0.115844	0.563636
0.164179	0.581818	0.155048	0.581818	0.11763	0.581818
0.166457	0.6	0.156603	0.6	0.118822	0.6
0.172014	0.636364	0.160812	0.636364	0.11955	0.636364
0.173472	0.654545	0.162227	0.654545	0.122394	0.654545
0.182726	0.672727	0.162547	0.672727	0.123997	0.672727
0.18927	0.690909	0.164945	0.690909	0.126533	0.690909
0.1988	0.709091	0.172784	0.709091	0.127611	0.709091
0.203137	0.727273	0.173754	0.727273	0.128888	0.727273
0.214466	0.745455	0.18193	0.745455	0.130708	0.745455
0.233883	0.763636	0.18258	0.763636	0.137101	0.763636
0.243765	0.781818	0.18548	0.781818	0.138626	0.781818
0.254601	0.8	0.192331	0.8	0.148864	0.8
0.261542	0.818182	0.198447	0.818182	0.155622	0.818182
0.288067	0.836364	0.206582	0.836364	0.16889	0.836364
0.299015	0.854545	0.217838	0.854545	0.175934	0.854545
0.303814	0.890909	0.223718	0.890909	0.191974	0.890909
0.312343	0.909091	0.227645	0.909091	0.213886	0.909091
0.322638	0.927273	0.2456	0.927273	0.217418	0.927273
0.373294	0.945455	0.277443	0.945455	0.260587	0.945455
0.417855	0.963636	0.288923	0.963636	0.273505	0.963636
0.467075	0.981818	0.333839	0.981818	0.3072	0.981818
0.513074	1	0.367393	1	0.354844	1

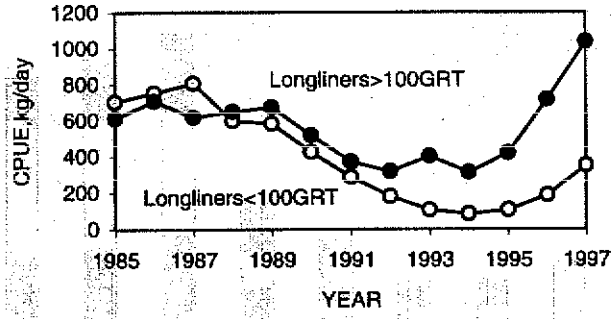


Fig.: A. Haddock in Division Vb 1985-1997.
Catch per day for longliners.

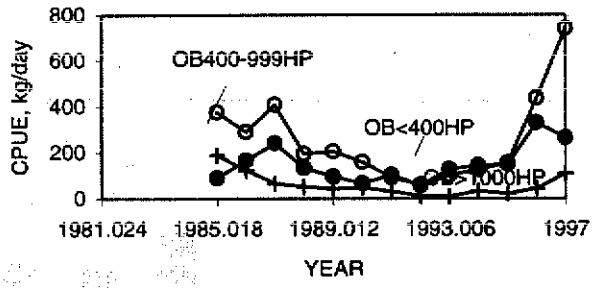


Fig.: B. Haddock in Division Vb 1985-1997.
Catch per day for otter board trawlers.

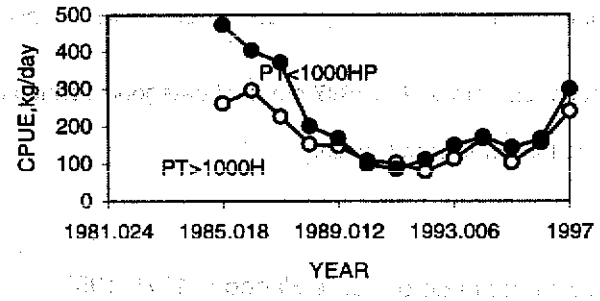


Fig.: C. Haddock in Division Vb 1985-1997.
Catch per day for pair trawlers.

Figure 2.4.1. Faroe haddock. CPUE for selected fleets.

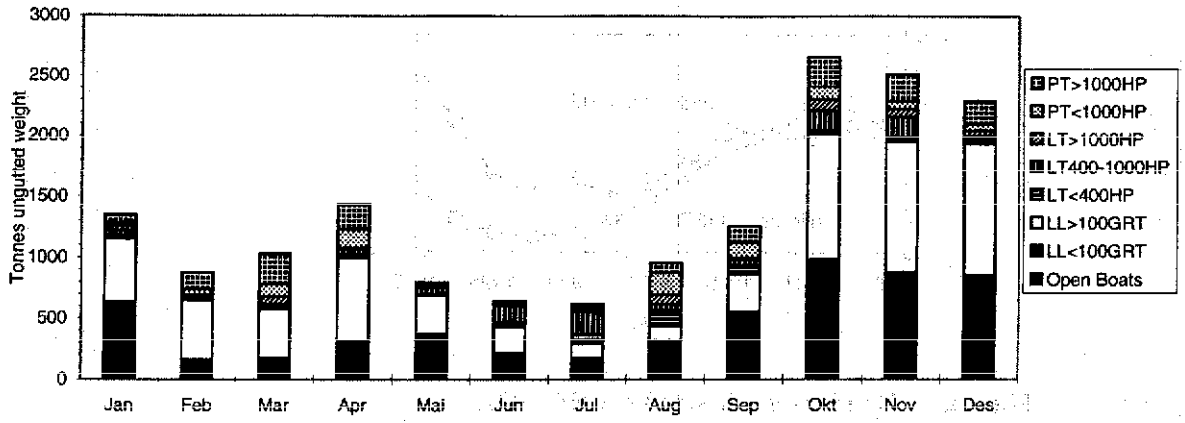


Figure A. Faroese landings of haddock from Vb1 in 1997 per fleet category. Tonnes ungutted weight.

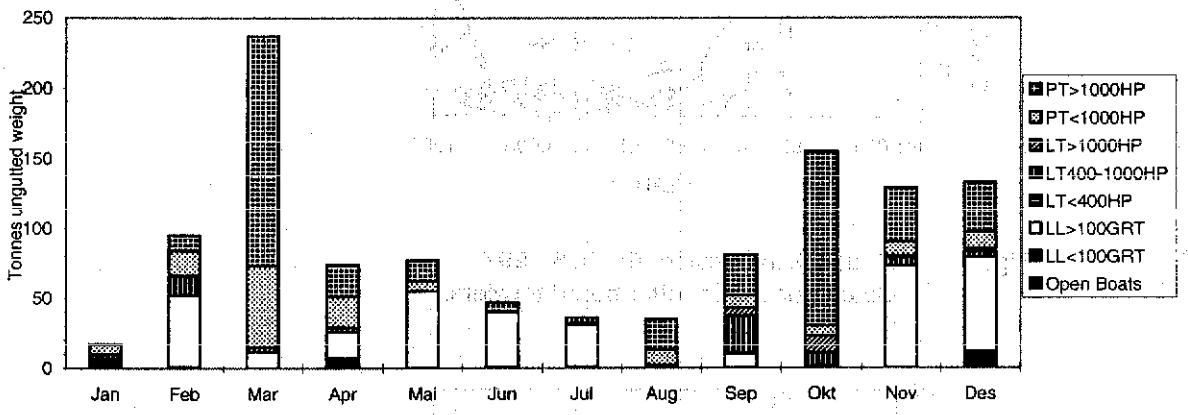


Figure B. Faroese landings of haddock from Vb2 in 1997 per fleet category. Tonnes ungutted weight.

Figure 2.4.2. Faroe haddock. Landings in 1997 by fleet and month.

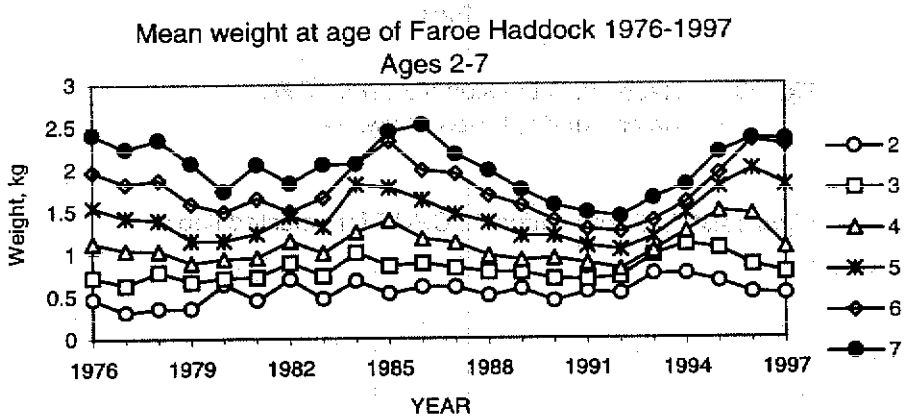


Figure 2.4.3. Faroe haddock. Mean weight at age for ages 2-7in the years 1976-1997.

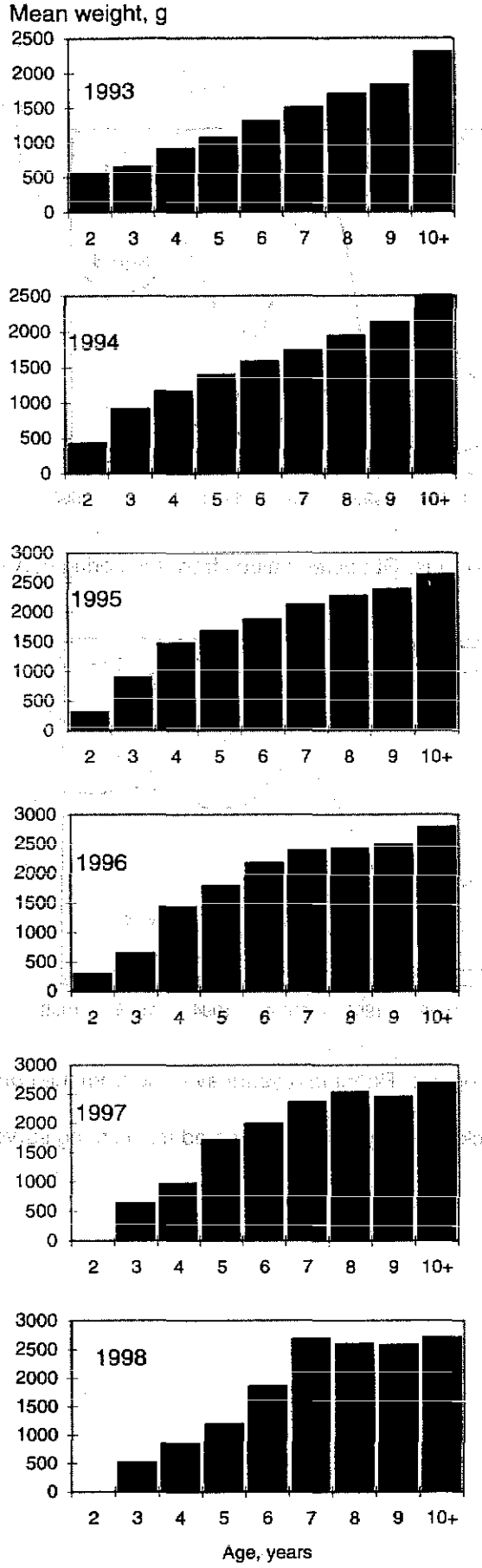
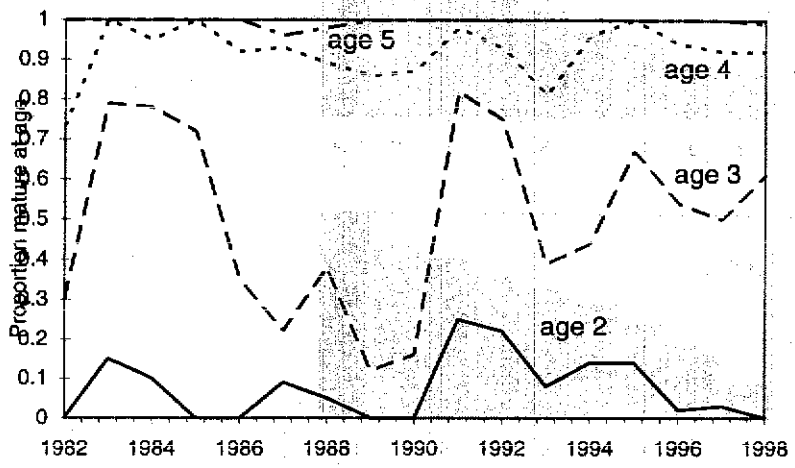
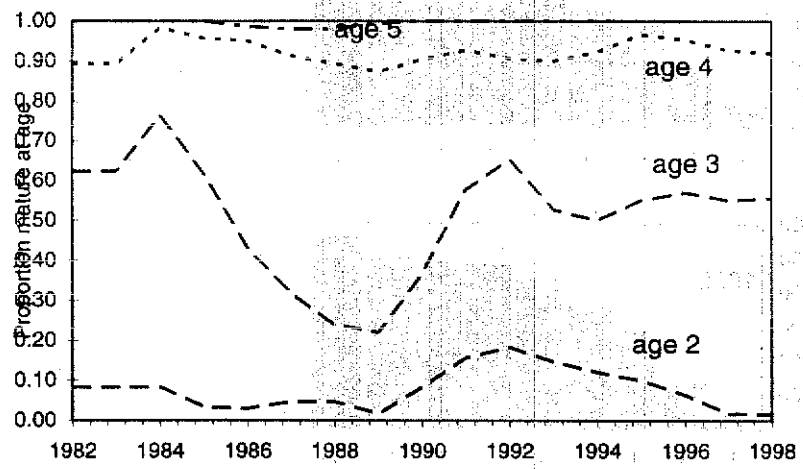


Fig.: 2.4.4. Weight at age of Faroe haddock in the Faroese commercial catches the 1. quarter of the years 1993-1998.

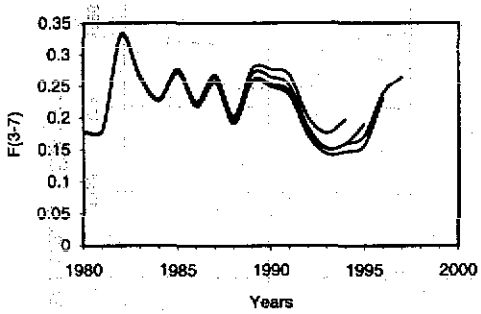


A: Faroe haddock. Maturity ogives. Observed values from the spring survey.

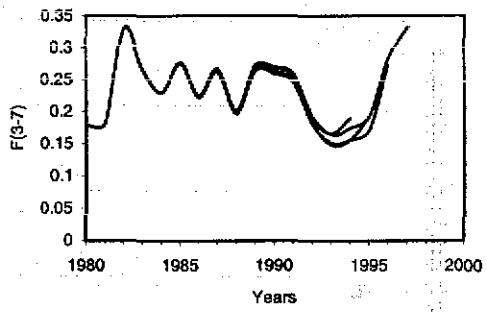


B: Faroe haddock. Maturity ogives. Running 3 years average from the spring survey.

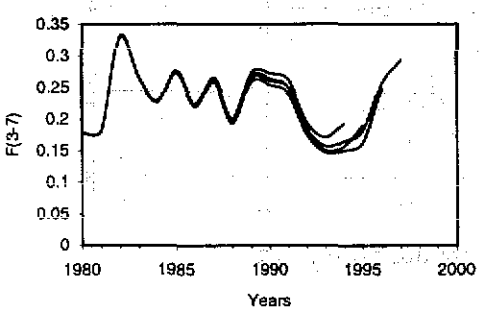
Figure 2.4.5. Faroe haddock. Maturity ogives estimated from spring surveys.



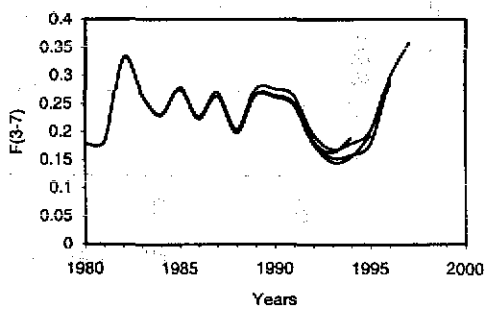
A: Retrospective analysis of XSA (X08) shrunk 0.5



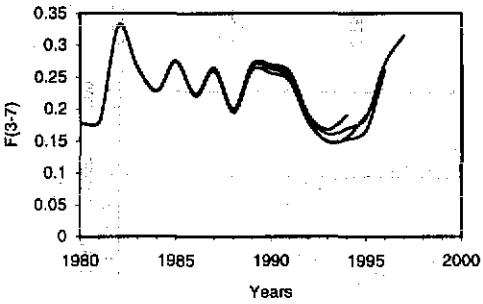
D: Retrospective analysis of XSA (X08) shrunk 0.8



B: Retrospective analysis of XSA (X08) shrunk 0.6



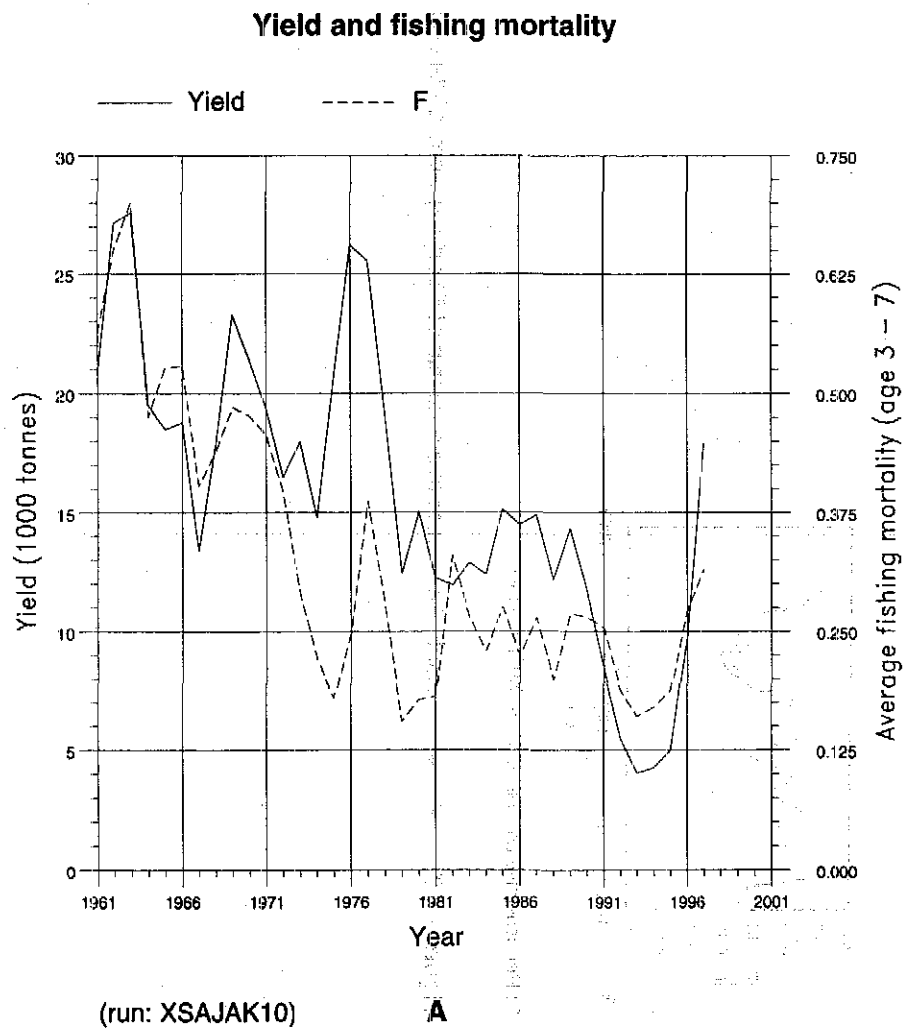
E: Retrospective analysis of XSA (X08) shrunk 1.0

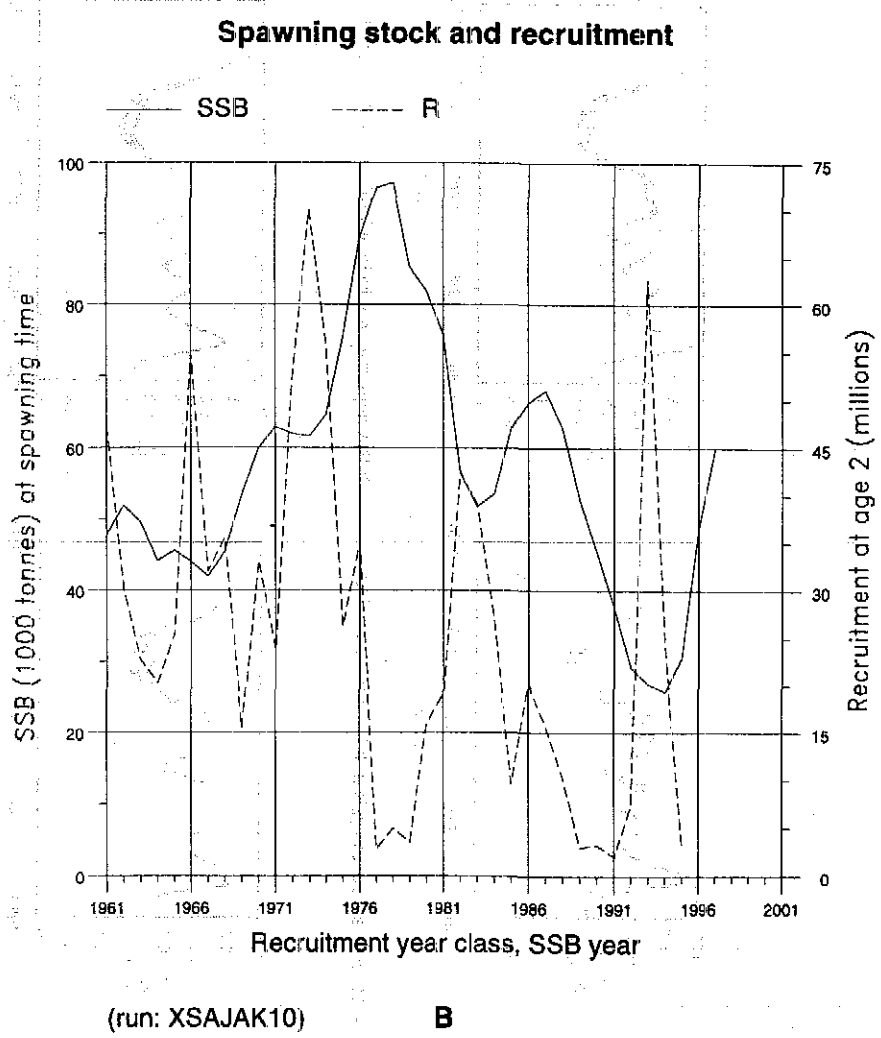


C: Retrospective analysis of XSA (X08) shrunk 0.7

Figure 2.4.7. Faroe Haddock. Retrospective analysis of Fbar(3-7) from XSA-runs

Figure 2.4.10 Fish Stock Summary. Haddock in the Faroe Grounds (ICES Division Vb).





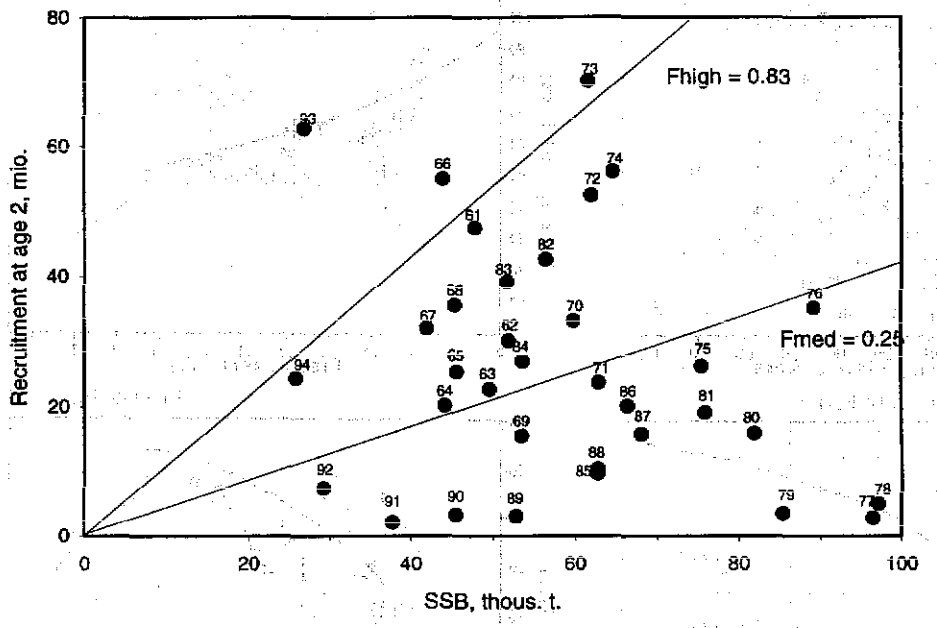


Figure 2.4.11. Haddock in Division Vb. SSB-R plot with reference points.

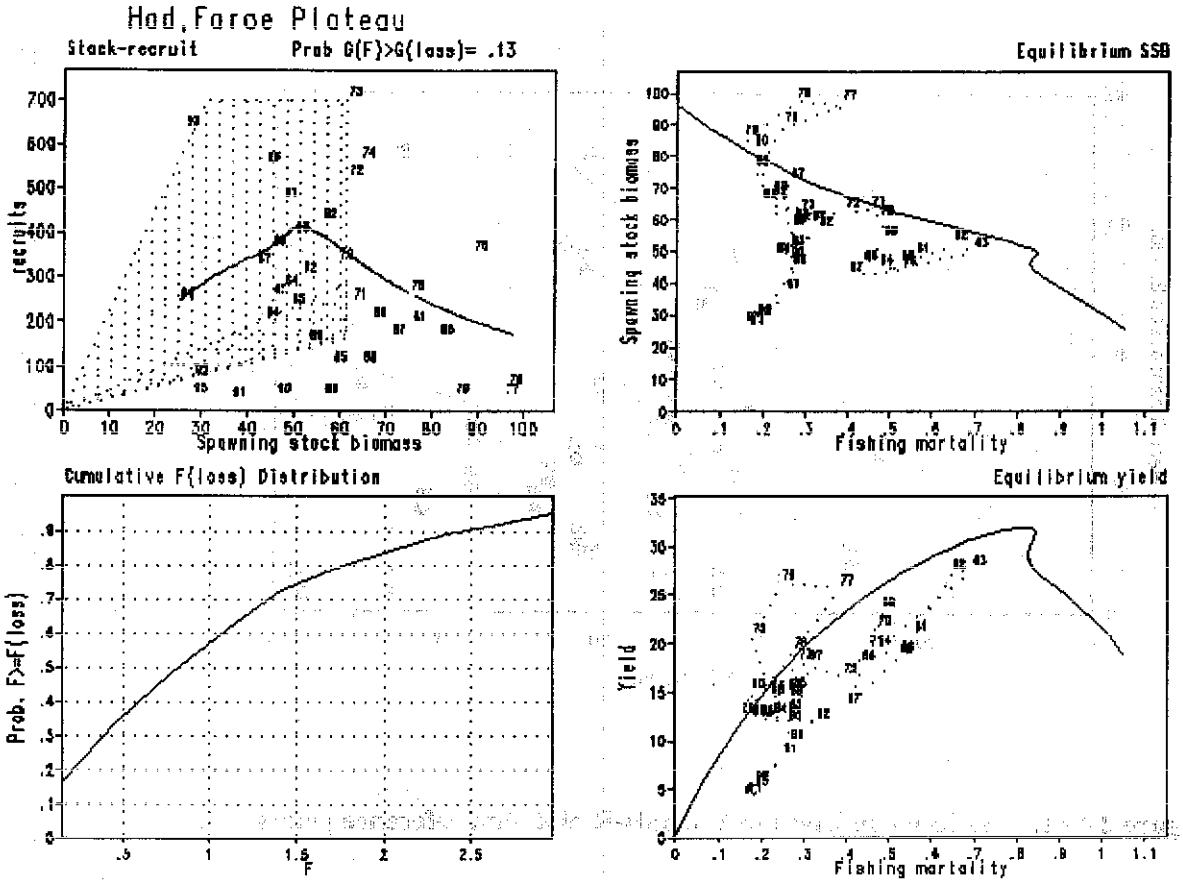


Figure 2.4.12. Faroe haddock. Output from the Gloss programme. **A**: Stock - recruitment data with expected recruitment line and Gloss (vertical shading) and GF (horizontal shading) distributions. **B**: Plot of observed fishing mortality - spawning stock biomass with expected equilibrium SSB curve (solid line). **C**: The Cumulative distribution of Floss. **D**: Observed fishing mortality - yield with expected equilibrium yield curve (solid line).

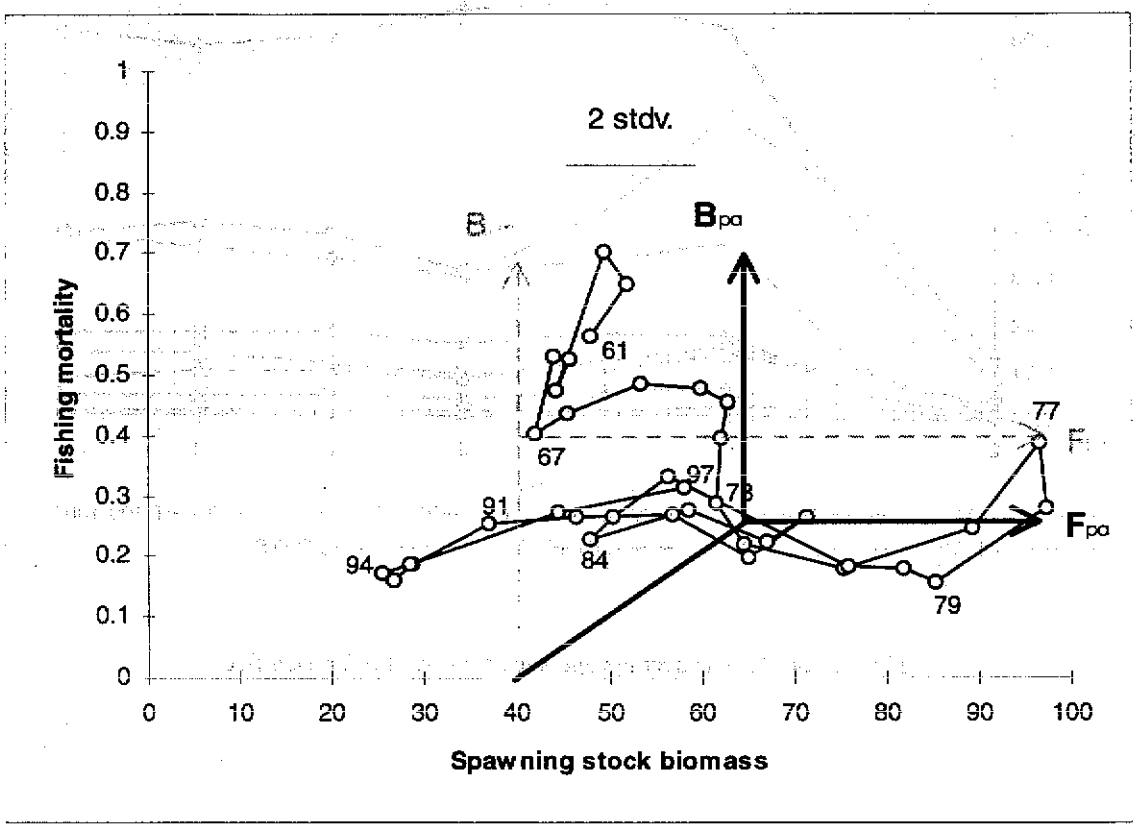


Figure 2.4.13. Faroe haddock.

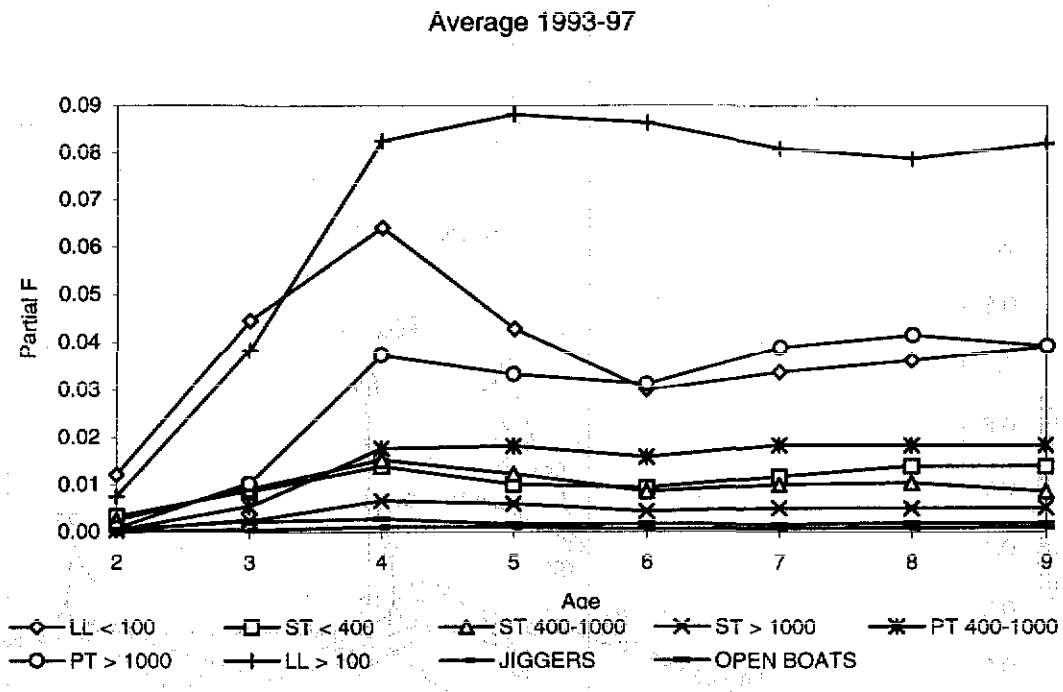


Figure 2.4.14. The average age-specific Partial F for each fleet.

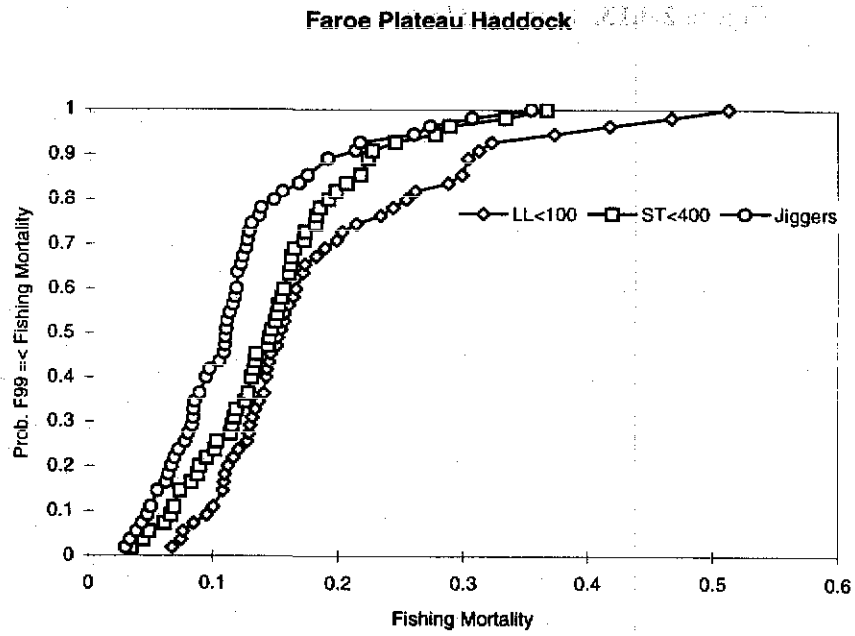


Figure 2.4.15. Faroe Haddock. Cumulative probability distribution of the 1998-1999 fishing mortalities under the current number of fishing days allocated for the LL<100, ST<400, PT400-1000, PT>1000 and LL>100.

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 20 000 t in 1996 and maintained this level in 1997.

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 1993-97. In the same period the smaller pair trawlers (<1000 HP) caught about 20%, jiggers 10% and larger single trawlers about 8% (Tables 2.5.3 and 2.5.4). All other vessels only have small catches of saithe as by-catch.

Generally speaking effort has increased in the period 1994-96 (Table 2.5.5). For the period 1985-91 the effort of the larger pair trawlers increased from around 3 200 days at sea to 7 900 days. Thereafter the effort decreased to 6 200 days in 1994 but increased again to 7 700 days in 1997. 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 and dropped to 3200 days in 1977. 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 1992-97. 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 but dropped again to 13 000 days in 1997.

In terms of CPUE there has been a general downwards trend in the period 1994-96 but a slight increase in 1997 (Table 2.5.6 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 but went up slightly to 1.5 t/day in 1997. CPUE for smaller pair trawlers has varied between about 1.2 t/day to 2.5 t/day and has more than halved in the last four years. The jiggers have had a decline in CPUE from 0.5 t/day to 0.1 t/day in the period 1991-97. For larger single trawlers there has been a decline from 2.3 t/day to 0.6 t/day in the period 1985-97.

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 period 1985-96 but have decreased their effort to 13 000 days in 1997.

Catches and effort are shown by fleet categories for the period 1985–1997 in Tables 2.5.2 - 2.5.5.

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 where 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 1997 reflects the age composition in the Faroese catches (Table 2.5.7). In 1997 109 samples were taken from landings of saithe with 19 176 length measurements, 3 936 otoliths, and 3 130 individual weights. The SOP for 1997 shows no discrepancy (Table 2.5.7).

2.5.3 Weight at age

Through the recorded period 1961–1997 mean weight at age has varied by a factor of about 2, 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 2.5.8 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. The mean weights have been increasing in the period 1992-96 and have since decreased.

2.5.4 Maturity at age

Maturity at age data are available for the period 1983–1998. Due to poor sampling in 1988 the proportion mature for this year was calculated as the average of the two adjacent years. A model was used, described in the 1993 Working Group report (ICES C.M.1993/Assess:18), for predicting maturity at age in order to alleviate some of the problems involved with the sampling data. 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 and mean weight at age where significant and no other independent variables were needed. This model was then applied, using the raw data given in Table 2.5.9 to predict the entire maturity at age for 1982–1998, given in Table 2.5.10 and Figure 2.5.3.

2.5.5 Stock assessment

2.5.5.1 Tuning and estimation of fishing mortality

Two tuning series representing the same vessels were tried in the XSA runs. The first one was the commercial Cuba series consisting of total saithe catch at age and total effort in days, hereafter referred to as the Cuba Beta series. 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 2.5.11). 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. The second series is new and consists of saithe catch at age and effort in hours, hereafter referred to as the Cuba Logbook series. In the Cuba Logbook series information for each haul was supplied and only those hauls where saithe consisted of more than 50% of the total catches of cod, haddock and saithe were used (Table 2.5.16). Indices of CPUE and effort of the two series is presented in Figs. 2.5.7a and b and the show major differences for some years. In Fig. 2.5.7a the higher values in the Cuba Beta series in 1995-96 might be explained by the fact that more effort was directed towards cod in these years. As the hauls targeting cod were excluded in the Cuba logbook series CPUE values for these years were higher in this series. The difference in the effort indices in 1993-94 could not be explained. Both XSA runs were made with the same parameters as last year. The output from the first XSA run using the Cuba Beta series is presented in Tables 2.5.12–15 and the output from the second using the Cuba Logbooks is shown in Tables 2.5.17–20. The diagnostics from these runs are shown in Tables 2.5.12 and 2.5.17, respectively. The values of the S.E. log q are reasonably low for the principal year classes in both runs so there was no reason for choosing the Cuba Beta tuning series in stead of Cuba Logbook series. The average fishing mortality for age groups 4-8 years for these two series are shown in Figs. 2.5.6a and b. Both series give results that converge reasonably well and there is little difference between the results of the two. Still it was agreed the new series should be analysed statistically by fitting a multivariate model to it taken in to account factor like year, season and area. In the following only the XSA run using Cuba Beta will be discussed.

The log catchability residuals from the XSA tuning for age groups 4-8 is presented in Figs. 2.5.4 and 2.5.5. The overall impression is that there is a trend in the data and it is similar for both series. The fishing mortalities for 1961–1997 are presented in Table 2.5.13. The average fishing mortality for age groups 4-8 was 0.44 in 1997.

2.5.5.2 Stock estimates and recruitment

In historical terms the spawning stock biomass has in 1992–1997 been in its lowest range ever recorded even though recruitment up till year class 1980-90 has been close to or above the arithmetic mean of the long term recruitment level (23 millions) (Table 2.5.15 and Figure 2.5.8B).

Stock in numbers at age as estimated by the VPA is presented in Table 2.5.14. 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 23 million, equal to the long term mean, whereas the recruits in 1994 are half long term the mean level.

Spawning stock biomass is given in Table 2.5.15 and Figure 2.5.8B. The spawning stock biomass is continuing the decline from 69 000 t in 1993 to 52 000 t in 1997.

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 2.5.21 and input data for the yield per recruit calculations are given in Table 2.5.23.

In the short term prediction stock in numbers up to year class 1994 are from the final VPA run whereas values for the 1995–1997 year classes are the arithmetic mean of the three most recent years.

In the short term prediction, the input for mean weight for 1998 in age groups 3-5 are mean weight for 1995-97 and for the older age groups, mean weight were predicted using a multiple regression analysis. The mean weight for 1999-2000 are calculated by using the mean weight in 1998 and adding the mean weight increase for the period 1995-97 in each age group. Values for age group 3 in 1999-2000 are equal to the 1998-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 1961–1997 was used.

In the short term prediction the fitted proportion mature values for 1998 were used for that year and for 1999 and 2000 the average of fitted values for 1983–1997 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 1995-97 rescaled to Fbar (age 4-8) in 1997 was used. In the long term prediction the exploitation pattern was the average of exploitation patterns for 1961–1997 which were rescaled to Fbar (ages 4-8) in 1997.

2.5.6.2 Biological reference points

The yield per recruit and spawning stock biomass per recruit curves are presented in Figure 2.5.9C. Compared to the fishing mortality level in age groups 4-8 in 1997 of 0.44, 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 2.5.24, Figure 2.5.9C and Figure 2.5.10). The average fishing mortality for age 4-8 in 1997 thus is a little higher than F_{max}.

The stock-recruitment scatter plot shows 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) (Figure 2.5.10). The spawning stock has been below this level since 1991 and in 1997 reached a record low of 52 000 t.

In previous assessments of this stock the Minimum Biological Acceptable Limit (MBAL) was set to 85,000 t because the probability of a good recruitment is considerably larger when the spawning stock is above this value (Figure 2.5.10). Therefore, this is an appropriate value for a limit reference point and thus, B_{lim} is set to 85,000 t. The Gloss programme (written by Dr. R. Cook) was used to produce four plots (Fig 2.5.12) to determine the F and B reference points, using data from this years XSA run. From the expected equilibrium spawning stock biomass curve in plot B, the F_{lim} corresponding to B_{lim} is estimated to 0.40. The reference point F_{pa} was calculated as the value lying 2 standard deviations below F_{lim} which implies that the F_{pa} value is 0.28, which again corresponds to a B_{pa} at 110,000 t (Fig. 2.5.12B). As it can be seen on Fig. 2.5.12A, if fishing at present level there is 68% probability that the replacement line G(F) will be above the replacement line for the lowest observed spawning stock biomass G_{loss}. From the cumulative F_{loss} distribution plot (Fig. 2.5.12C) it can be seen that the probability that $F_{pa} >= F_{loss}$ is about 40%. This means that once out of every 2½ years the F_{pa} will be above the F_{loss} for which the stock would be expected to decline to an equilibrium spawning stock biomass below the lowest observed. An equilibrium yield at $F = F_{pa} = 0.28$ is approximately 35,000 t, (Fig 2.5.12D).

The history of the stock/fishery in relation to the four reference points can be seen in Figure 2.5.13. In 1961-62 the stock level was below Blim and the stock/fishery was in the risk of stock collapse zone. Except for 1964 the stock/fishery was in the precautionary zone in the period 1963-72 and went into the danger zone in the period 1973-78 and went on into the risk of stock collapse zone in the period 1979-83. The stock/fishery went back into the danger zone in the period 1984-90 and in 1991 the stock/fishery again went into the risk of stock collapse zone and the decreasing stock has since moved further away from Blim and F has been above Flim in this period except for 1996.

2.5.6.3 Projection of catch and biomass

Results from predictions with management option are presented in Table 2.5.22 and Figure 2.5.9D. With unchanged fishing mortality in 1998 and 1999 catches will be at 21 000 t and 19 000 t respectively and the spawning stock biomass will decrease from 50 000 to 40 000 t for the period 1998-2000.

Results from the yield per recruit estimates are shown in Table 2.5.24 and Figure 2.5.9C.

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 Blim. 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 1997 level, the spawning stock will still not recover in the short term.

The effort in the effort quota system has been reduced by 12.5% in the fishing year 1 September 1997 to 31 August 1998 compared to the previous fishing year. The quota for 1997/98 is 7 199 days for the pair trawlers with 4 525 and 2 674 for large and small pair trawlers respectively. The jiggers are expected to fish for 16 403 day in 1997/98. The same effort allocation is assumed for 1999. The cumulative probability distribution of F for these three fleet categories is presented in Fig. 2.5.11. These three fleets have accounted for 85.7% of the total catches in 1997. The single trawlers > 400 HP caught 13% of the total catch so the F exerted by this fleet on 0.06 should be added to the fishing mortality column to reflect the activity of this fleet. The result shows that there is an approximately 80% probability that the fishing mortality in 1998-99 will not exceed F = (0.06 + 0.39) = 0.45 if the present level of fishing days are exerted in 1998-99.

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. A new Cuba series based on logbooks with the unit of effort in days was presented but needs to be analysed further with respect to the influence of season, area, etc.

The question of migration has been brought up previously but still no tangible attempt has been made to measure the rate of migration of saithe between management areas.

Table 2.5.1 Saithe in the Faroes. Nominal catches (t) by countries, 1984-97 as officially reported to ICES

Country	1984	1985	1986	1987	1988	1989	1990
Denmark	-	-	21	255	94	-	2
Faroe Islands	54,344	42,874	40,139	39,301	44,402	43,624	59,821
France	243	839	87	153	313	-	-
German Dem.Rep.	-	31	-	-	-	9	
German Fed. Rep.	73	227	105	49	74	20	15
Netherlands	-	-	-	-	-	22	67
Norway	5	-	24	14	52	51	46
UK (Eng. & W.)	-	4	-	108	-	-	-
UK (Scotland)	-	630	1,340	140	92	9	33
United Kingdom	-	-	-	-	-	-	-
USSR	-	-	-	-	-	-	30
Total	54,665	44,605	41,716	40,020	45,027	43,735	60,014
Working Group estimate [4,5]	54,665	44,605	41,716	40,020	45,285	44,477	61,628

Country	1991	1992	1993	1994	1995	1996	1997 [1]
Denmark	-	-	-	-	-	-	-
Faroe Islands	53,321	35,979	32,719	32,406	26,918	19,267	21,721
France [3]	-	1,999	75	19	10	8	-
German Dem.Rep.	-	-	-	-	-	-	-
German Fed. Rep.	32	5	2	1	41	3	5
Netherlands	65	-	-	-	-	-	-
Norway	103	85	32	156	14	96	67
UK (Eng. & W.)	5	74	279	151	21	53	-
UK (Scotland)	79	98	425	438	200	580	-
United Kingdom	-	-	-	-	-	-	394
USSR/Russia [2]	-	12	-	-	-	18	28
Total	53,605	38,252	33,532	33,171	27,204	20,025	22,215
Working Group estimate [4,5]	54,858	38,366	33,543	33,182	27,213	20,025	22,229

[1] Preliminary.
[2] As from 1991.
[3] Quantity unknown 1989-91.
[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. Catches of saithe in the Faroe grounds by various faroese fleet categories. Tonnes gutted weight.

Year	Open boats	Long-liners < 100 GRT	Single trawl < 400 HP	Gill	Jiggers	Single trawl 400-1000HP	Single trawl >1000 HP	Pair trawl <1000 HP	Pair trawl >1000HP	Long-liners > 100 GRT	Indust- rial trawlers	Others	Total gutted weight
1985	89	38	23	13	982	2515	12923	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	1468	7279	8134	15790	37	408	1	35700
1988	173	101	40	113	2575	2693	8224	7748	17266	31	501	21	39586
1989	356	52	129	90	3717	2148	7118	9440	16513	60	504	5	40132
1990	309	131	84	122	4038	2123	10742	13127	23442	101	495	8	54721
1991	287	55	40	281	4795	625	6791	12978	22584	64	404	7	48910
1992	124	121	8	0	3300	151	2248	7677	17486	37	320	1	31472
1993	168	56	39	0	2696	164	1879	6234	17639	29	203	3	29111
1994	131	112	37	2	3666	335	1995	5408	17243	63	202	0	29194
1995	49	15	91	5	2320	215	2406	4288	14776	75	6	0	24248
1996	5	6	24	5	1590	213	1178	4118	10173	37	4	0	17353
1997	9	14	27	3	1746	495	2098	3491	11529	72	76	1	19561

Table 2.5.3. Total Faroese landings of saithe in the Faroe grounds (rightmost column) and the contribution (%) by each fleet category.

Year	Open boats	Long-liners < 100 GRT	Single trawl < 400 HP	Gill	Jiggers	Single trawl 400-1000 HP	Single trawl >1000 HP	Pair trawl <1000 HP	Pair trawl >1000HP	Long-liners > 100 GRT	Indust- rial trawlers	Others	Total gutted weight
1985	0.2	0.1	0.1	0.0	2.6	6.6	33.7	28.2	28.2	0.1	0.2	0.2	38377
1986	0.3	0.2	0.1	0.1	3.6	2.8	27.3	27.5	36.5	0.1	0.7	0.9	36132
1987	0.7	0.1	0.3	0.4	5.6	4.1	20.4	22.8	44.2	0.1	1.1	0.0	35700
1988	0.4	0.3	0.1	0.3	6.5	6.8	20.8	19.6	43.6	0.1	1.3	0.1	39586
1989	0.9	0.1	0.3	0.2	9.3	5.4	17.7	23.5	41.1	0.1	1.3	0.0	40132
1990	0.6	0.2	0.2	0.2	7.4	3.9	19.6	24.0	42.8	0.2	0.9	0.0	54721
1991	0.6	0.1	0.1	0.6	9.8	1.3	13.9	26.5	46.2	0.1	0.8	0.0	48910
1992	0.4	0.4	0.0	0.0	10.5	0.5	7.1	24.4	55.6	0.1	1.0	0.0	31472
1993	0.6	0.2	0.1	0.0	9.3	0.6	6.5	21.4	60.6	0.1	0.7	0.0	29111
1994	0.4	0.4	0.1	0.0	12.6	1.1	6.8	18.5	59.1	0.2	0.7	0.0	29194
1995	0.2	0.1	0.4	0.0	9.6	0.9	9.9	17.7	60.9	0.3	0.0	0.0	24248
1996	0.0	0.0	0.1	0.0	9.2	1.2	6.8	23.7	58.6	0.2	0.0	0.0	17353
1997	0.0	0.1	0.1	0.0	8.9	2.5	10.7	17.8	58.9	0.4	0.4	0.0	19561

Table 2.5.4. Catches of saithe in the Faroe grounds in percent of total catch of each fleet 1985-97. Average percents weighted by the total catch are shown at the bottom, as well as average total catch.

Year	Open boats	Long-liners < 100 GRT	Single trawl < 400 HP	Gill	Jiggers	Single trawl 400-1000 HP	Single trawl >1000 HP	Pair trawl <1000 HP	Pair trawl >1000HP	Long-liners > 100 GRT	Indust- rial trawlers	Others	All fleets	Total gutted weight all species
1985	1.3	0.2	0.7	3.3	36.6	35.0	36.4	54.3	71.2	0.3	22.9	2.7	31.5	121995
1986	2.6	0.6	1.2	10.0	55.2	26.2	29.0	41.5	64.4	0.3	35.1	8.5	31.5	114526
1987	5.6	0.5	4.9	24.6	71.5	35.6	26.8	45.3	73.1	0.4	39.2	0.0	33.0	108094
1988	17.1	1.0	2.1	15.5	58.5	49.5	27.1	48.9	75.2	0.4	41.9	0.5	37.0	106858
1989	18.4	0.3	6.9	10.9	62.6	47.2	26.9	70.8	82.9	0.6	35.8	10.2	39.7	101111
1990	26.6	1.1	6.7	35.2	76.1	27.8	39.4	86.8	88.4	1.3	2.0	0.1	38.0	144013
1991	30.4	0.7	4.0	59.5	85.7	36.3	27.7	87.3	87.7	0.8	2.0	0.1	39.6	123638
1992	31.2	2.6	1.0	0.0	86.5	21.8	10.4	82.0	74.4	0.7	1.4	0.0	21.4	147343
1993	50.5	1.9	2.6	0.0	84.4	18.7	12.1	77.9	76.1	0.8	0.7	0.0	28.0	104119
1994	30.3	4.0	1.9	0.1	69.9	29.7	14.0	78.2	74.9	1.1	1.3	0.0	31.2	93588
1995	5.8	0.3	4.0	0.3	34.1	12.4	12.4	65.2	63.3	0.8	4.1	0.0	17.9	135670
1996	0.3	0.1	0.8	0.2	17.3	7.6	9.4	46.7	38.7	0.3	0.3	0.0	13.4	129240
1997	0.7	0.1	1.0	0.1	33.8	12.9	16.5	47.5	43.8	0.4	0.6	0.0	11.8	165893
Weight Mean	16.3	1.0	2.8	12.2	58.4	26.6	22.0	64.0	69.4	0.6	13.0	1.5	27.8	122776

Table 2.5.5. Effort (days) by various Faroese fleet categories in the Faroe grounds.

Year	Open boats	Long-liners < 100 GRT	Single trawl < 400 HP	Gill	Jiggers	Single trawl 400-1000HP	Single trawl >1000 HP	Pair trawl <1000 HP	Pair trawl >1000 HP	Long-liners > 100 GRT	Indust- rial trawlers	Others	Total
1985	2941	7558	2171	108	3348	2077	5565	5389	3193	2973			35323
1986	2941	6692	1509	123	2745	1221	5402	6573	4433	2176			33815
1987	2941	6728	1297	201	2973	1531	4389	6314	5546	2915			34835
1988	2660	8760	1261	234	8104	2261	4907	6026	6034	3203			43450
1989	3948	12677	1345	208	10663	2093	4939	5175	5127	3369			49544
1990	3228	14321	1013	157	9510	1999	4020	5444	7491	3521			50704
1991	3204	14656	940	183	10215	1239	4005	5828	7875	3573			51718
1992	1913	10508	1032	181	10030	628	4159	3985	7243	2892			42571
1993	1611	7424	1853	561	7940	1211	3566	2851	6335	2046			35398
1994	2283	7979	1722	1883	13484	885	3828	2148	6262	2841			43315
1995	3321	9742	1985	2052	18721	1342	4317	2594	6752	3959			54785
1996	3959	12636	1475	2407	23663	1309	3780	3396	7285	4285			64195
1997	3278	13968	1704	2315	13379	1311	3704	3222	7707	5851			56439

Table 2.5.6. CPUE (t/day) by various Faroese fleet categories in the Faroe grounds.

Year	Open boats	Long-liners < 100 GRT	Single trawl < 400 HP	Gill	Jiggers	Single trawl 400-1000HP	Single trawl >1000 HP	Pair trawl <1000 HP	Pair trawl >1000 HP	Long-liners > 100 GRT	Indust- rial trawlers	Others
1985		0.005	0.011	0.120	0.293	1.211	2.322	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	0.959	1.658	1.288	2.847	0.013		
1988		0.012	0.032	0.483	0.318	1.191	1.676	1.286	2.861	0.010		
1989		0.004	0.096	0.433	0.349	1.026	1.441	1.824	3.221	0.018		
1990		0.009	0.083	0.777	0.425	1.062	2.672	2.411	3.129	0.029		
1991		0.004	0.043	1.536	0.469	0.504	1.696	2.227	2.868	0.018		
1992		0.012	0.008	0.000	0.329	0.240	0.541	1.926	2.414	0.013		
1993		0.008	0.021	0.000	0.340	0.135	0.527	2.187	2.784	0.014		
1994		0.014	0.021	0.001	0.272	0.379	0.521	2.518	2.754	0.022		
1995		0.002	0.046	0.002	0.124	0.160	0.557	1.653	2.188	0.019		
1996		0.000	0.016	0.002	0.067	0.163	0.312	1.213	1.396	0.009		
1997		0.001	0.016	0.001	0.131	0.378	0.566	1.083	1.496	0.012		

Table 2.5.7. Saithe in the Faroes Grounds. Catch in numbers (thousands).

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

YEAR,	1961,	1962,	1963,	1964,	1965,	1966,	1967,
AGE							
3,	183,	562,	614,	684,	996,	488,	595,
4,	379,	542,	340,	1908,	850,	1540,	796,
5,	483,	617,	340,	1506,	1708,	1201,	1364,
6,	403,	495,	415,	617,	965,	1686,	792,
7,	216,	286,	406,	572,	510,	806,	1192,
8,	129,	131,	202,	424,	407,	377,	473,
9,	116,	129,	174,	179,	306,	294,	217,
10,	82,	113,	158,	150,	201,	205,	190,
11,	45,	71,	94,	100,	156,	156,	97,
+gp,	82,	105,	274,	174,	285,	225,	140,
TOTALNUM,	2118,	3051,	3017,	6314,	6384,	6978,	5856,
TONSLAND,	9592,	10454,	12693,	21893,	22181,	25563,	21319,
SOPCOF %,	108,	93,	96,	99,	92,	98,	104,

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

YEAR,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
AGE										
3,	614,	1191,	1445,	2857,	2714,	2515,	3504,	2062,	3178,	1609,
4,	1689,	2086,	6577,	3316,	1774,	6253,	4126,	3361,	3217,	2937,
5,	1116,	2294,	1558,	5585,	2588,	7075,	4011,	3801,	1720,	2034,
6,	1095,	1414,	1478,	1005,	2742,	3478,	2784,	1939,	1250,	1288,
7,	548,	1118,	899,	828,	1529,	1634,	1401,	1045,	877,	767,
8,	655,	589,	730,	469,	1305,	693,	640,	714,	641,	708,
9,	254,	580,	316,	326,	1017,	550,	368,	302,	468,	498,
10,	128,	239,	241,	164,	743,	403,	340,	192,	223,	338,
11,	89,	115,	86,	100,	330,	215,	197,	193,	141,	272,
+gp,	187,	190,	132,	100,	210,	186,	265,	298,	287,	330,
TOTALNUM,	6375,	9816,	13462,	14750,	14952,	23002,	17636,	13907,	12002,	10781,
TONSLAND,	20387,	27437,	29110,	32706,	42663,	57431,	47188,	41576,	33065,	34835,
SOPCOF %,	102,	97,	96,	109,	100,	120,	113,	116,	107,	104,

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

YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
3,	611,	287,	996,	411,	387,	2483,	368,	1224,	1167,	1581,
4,	1743,	933,	877,	1804,	4076,	1103,	11067,	3990,	1997,	5793,
5,	1736,	1341,	720,	769,	994,	5052,	2359,	5583,	4473,	3827,
6,	548,	1033,	673,	932,	1114,	1343,	4093,	1182,	3730,	2785,
7,	373,	584,	726,	908,	380,	575,	875,	1898,	953,	990,
8,	479,	414,	284,	734,	417,	339,	273,	273,	1077,	532,
9,	466,	247,	212,	343,	296,	273,	161,	103,	245,	333,
10,	473,	473,	171,	192,	105,	98,	52,	38,	104,	81,
11,	407,	368,	196,	92,	88,	98,	65,	26,	67,	43,
+gp,	535,	691,	786,	1021,	902,	540,	253,	275,	158,	97,
TOTALNUM,	7371,	6371,	5641,	7206,	8759,	11904,	19566,	14592,	13971,	16062,
TONSLAND,	28138,	27246,	25230,	30103,	30964,	39176,	54665,	44605,	41716,	40020,
SOPCOF %,	100,	102,	99,	96,	96,	100,	100,	94,	94,	96,

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

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,
AGE										
3,	866,	451,	294,	1030,	548,	1316,	690,	398,	297,	343,
4,	2950,	5981,	3833,	5125,	4281,	2611,	3961,	1019,	1087,	829,
5,	9555,	5300,	10120,	7452,	3860,	4689,	2663,	3469,	1146,	2432,
6,	2784,	7136,	9219,	5544,	2820,	1665,	2368,	1836,	1449,	1761,
7,	1300,	793,	5070,	3487,	1445,	858,	746,	1177,	1156,	1330,
8,	621,	546,	477,	1630,	941,	492,	500,	345,	521,	622,
9,	363,	185,	123,	405,	645,	448,	307,	241,	132,	164,
10,	159,	83,	61,	238,	129,	245,	303,	192,	77,	71,
11,	27,	55,	60,	128,	66,	54,	150,	104,	64,	29,
+gp,	60,	39,	79,	118,	114,	52,	49,	117,	82,	100,
TOTALNUM,	18685,	20569,	29336,	25157,	14849,	12430,	11737,	8898,	6011,	7681,
TONSLAND,	45285,	44477,	61561,	54863,	38366,	33543,	33182,	27213,	20025,	22229,
SOPCOF %,	99,	97,	98,	99,	105,	102,	102,	102,	103,	100,

Table 2.5.8. Saithe in the Faroes Grounds. Catch weights at age (kg).

Table 2 Catch weights at age (kg)

YEAR,	1961,	1962,	1963,	1964,	1965,	1966,	1967,
AGE							
3,	1.4300,	1.2730,	1.2800,	1.1750,	1.1810,	1.3610,	1.2730,
4,	2.3020,	2.0450,	2.1970,	2.0550,	2.1250,	2.0260,	1.7800,
5,	3.3480,	3.2930,	3.2120,	3.2660,	2.9410,	3.0550,	2.5340,
6,	4.2870,	4.1910,	4.5680,	4.2550,	4.0960,	3.6580,	3.5720,
7,	5.1280,	5.1460,	5.0560,	5.0380,	4.8780,	4.5850,	4.3680,
8,	6.1550,	5.6550,	5.9320,	5.6940,	5.9320,	5.5200,	5.3130,
9,	7.0600,	6.4690,	6.2590,	6.6620,	6.3210,	6.8370,	5.8120,
10,	7.2650,	6.7060,	8.0000,	6.8370,	7.2880,	7.2650,	6.5540,
11,	7.4970,	7.1500,	7.2650,	7.6860,	8.0740,	7.6620,	7.8060,
+gp,	9.3400,	9.0240,	8.8590,	8.5590,	8.9040,	9.2230,	8.1490,
SOPCOFAC,	1.0779,	.9342,	.9590,	.9933,	.9220,	.9769,	1.0357,

Table 2 Catch weights at age (kg)

YEAR,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
AGE										
3,	1.3020,	1.1880,	1.2440,	1.1010,	1.0430,	1.0880,	1.4300,	1.1140,	1.0880,	1.2230,
4,	1.7370,	1.6670,	1.4450,	1.3160,	1.4850,	1.4610,	1.5250,	1.6580,	1.6760,	1.6410,
5,	2.0360,	2.3020,	2.2490,	1.8180,	2.0550,	1.5820,	2.2070,	2.2600,	2.8780,	2.6600,
6,	3.1200,	2.8530,	2.8530,	2.9780,	2.8290,	2.2490,	2.5000,	3.1200,	3.0810,	3.7900,
7,	4.0490,	3.6730,	3.5150,	3.7020,	3.7910,	3.6870,	3.1200,	3.5570,	4.2870,	4.2390,
8,	5.1830,	5.0020,	4.4180,	4.2710,	4.1750,	4.3850,	4.6010,	4.0960,	4.3520,	5.5970,
9,	6.2380,	5.7140,	5.4440,	5.3880,	4.8080,	5.1280,	5.5590,	5.1280,	4.7900,	5.3500,
10,	7.5200,	6.4050,	5.7330,	5.9720,	5.2940,	5.2760,	5.7140,	6.0940,	5.9120,	5.9120,
11,	8.0490,	6.5540,	6.6620,	6.4900,	6.9480,	6.7270,	6.2590,	7.1960,	6.6190,	6.8370,
+gp,	9.0920,	8.0870,	8.5840,	8.0050,	7.5150,	8.0310,	8.0100,	8.5980,	7.8940,	7.7080,
SOPCOFAC,	1.0194,	.9663,	.9634,	1.0935,	1.0043,	1.2006,	1.1296,	1.1607,	1.0680,	1.0442,

Table 2 Catch weights at age (kg)

YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
3,	1.4930,	1.2200,	1.2300,	1.3100,	1.3370,	1.2080,	1.4310,	1.4010,	1.7180,	1.6090,
4,	2.3240,	1.8800,	2.1200,	2.1300,	1.8510,	2.0290,	1.9530,	2.0320,	1.9860,	1.8350,
5,	3.0680,	2.6200,	3.3200,	3.0000,	2.9510,	2.9650,	2.4700,	2.9650,	2.6180,	2.3950,
6,	3.7460,	3.4000,	4.2800,	3.8100,	3.5770,	4.1430,	3.8500,	3.5960,	3.2770,	3.1820,
7,	4.9130,	4.1800,	5.1600,	4.7500,	4.9270,	4.7240,	5.1770,	5.3360,	4.1860,	4.0670,
8,	4.3680,	4.9500,	6.4200,	5.2500,	6.2430,	5.9010,	6.3470,	7.2020,	5.5890,	5.1490,
9,	5.2760,	5.6900,	6.8700,	5.9500,	7.2320,	6.8110,	7.8250,	6.9660,	6.0500,	5.5010,
10,	5.8320,	6.3800,	7.0900,	6.4300,	7.2390,	7.0510,	6.7460,	9.8620,	6.1500,	6.6260,
11,	6.0530,	7.0200,	7.9300,	7.0000,	8.3460,	7.2480,	8.6360,	10.6700,	9.5360,	6.3430,
+gp,	7.5760,	8.6260,	9.2150,	8.9620,	10.0410,	10.0550,	10.0980,	11.9500,	10.2180,	10.2440,
SOPCOFAC,	1.0049,	1.0248,	.9937,	.9564,	.9632,	.9997,	.9991,	.9415,	.9419,	.9620,

Table 2 Catch weights at age (kg)

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,
AGE										
3,	1.5000,	1.3090,	1.2230,	1.2400,	1.2640,	1.4080,	1.5030,	1.4560,	1.4320,	1.4760,
4,	1.9750,	1.7350,	1.6330,	1.5680,	1.6020,	1.8600,	1.9510,	2.1770,	1.8750,	1.7830,
5,	1.9780,	1.9070,	1.8300,	1.8640,	2.0690,	2.3230,	2.2670,	2.4200,	2.4960,	2.0320,
6,	2.9370,	2.3730,	2.0520,	2.2110,	2.5540,	3.1310,	2.9360,	2.8950,	3.2290,	2.7780,
7,	3.7980,	3.8100,	2.8660,	2.6480,	3.0570,	3.7300,	4.2140,	3.6510,	3.7440,	3.5980,
8,	4.4190,	4.6670,	4.4740,	3.3800,	4.0780,	4.3940,	4.9710,	5.0640,	4.9640,	4.7660,
9,	5.1150,	5.5090,	5.4240,	4.8160,	5.0120,	5.2090,	5.6570,	5.4400,	6.3750,	5.9820,
10,	6.7120,	5.9720,	6.4690,	5.5160,	6.7680,	6.5400,	5.9500,	6.1670,	6.7450,	7.6580,
11,	9.0400,	6.9390,	6.3430,	6.4070,	7.7540,	8.4030,	6.8910,	7.0800,	7.4660,	7.8820,
+gp,	9.3370,	9.9360,	8.2870,	7.7290,	8.2270,	8.0500,	9.1090,	7.5390,	7.9810,	9.2450,
SOPCOFAC,	.9928,	.9698,	.9800,	.9939,	1.0497,	1.0169,	1.0240,	1.0205,	1.0317,	.9992,

Table 2.5.9. Saithe in the Faroes Grounds. Observed proportion mature in the period 1983-98.

	3	4	5	6	7	8	9	10	11	12	13	14	15
1983	0.00	0.13	0.42	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1984	0.00	0.43	0.84	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1985	0.09	0.19	0.41	0.85	0.93	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1986	0.04	0.50	0.88	0.94	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1987	0.20	0.25	0.36	0.79	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1988	0.10	0.22	0.52	0.75	0.91	0.92	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1989	0.00	0.18	0.67	0.71	0.82	0.83	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1990	0.00	0.20	0.53	0.56	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1991	0.00	0.21	0.46	0.77	0.82	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1992	0.00	0.06	0.33	0.77	0.92	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1993	0.00	0.23	0.62	0.81	0.92	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1994	0.55	0.77	0.62	0.83	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1995	0.54	0.44	0.88	0.94	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1996	0.00	0.09	0.55	0.83	0.89	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1997	0.02	0.17	0.41	0.69	0.88	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1998	0.13	0.25	0.43	0.53	0.83	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table 2.5.10. Saithe in the Faroes Grounds. Proportion mature at age.

Table 5 Proportion mature at age

YEAR,	1961,	1962,	1963,	1964,	1965,	1966,	1967,
AGE							
3,	.0400,	.0400,	.0400,	.0400,	.0400,	.0400,	.0400,
4,	.2600,	.2600,	.2600,	.2600,	.2600,	.2600,	.2600,
5,	.5700,	.5700,	.5700,	.5700,	.5700,	.5700,	.5700,
6,	.8200,	.8200,	.8200,	.8200,	.8200,	.8200,	.8200,
7,	.9100,	.9100,	.9100,	.9100,	.9100,	.9100,	.9100,
8,	.9800,	.9800,	.9800,	.9800,	.9800,	.9800,	.9800,
9,	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,
11,	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,

Table 5 Proportion mature at age

YEAR,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
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,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
3,	.0400,	.0400,	.0400,	.0400,	.0400,	.1000,	.1200,	.1100,	.1500,	.1300,
4,	.2600,	.2600,	.2600,	.2600,	.2600,	.3100,	.3000,	.3100,	.3000,	.2700,
5,	.5700,	.5700,	.5700,	.5700,	.5700,	.6800,	.5700,	.6800,	.6000,	.5500,
6,	.8200,	.8200,	.8200,	.8200,	.8200,	.9200,	.9000,	.8800,	.8500,	.8400,
7,	.9100,	.9100,	.9100,	.9100,	.9100,	.9800,	.9800,	.9900,	.9600,	.9600,
8,	.9800,	.9800,	.9800,	.9800,	.9800,	1.0000,	1.0000,	1.0000,	.9900,	.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,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,
AGE										
3,	.1200,	.1100,	.1000,	.1000,	.1000,	.1100,	.1200,	.1200,	.1200,	.1200,
4,	.3000,	.2600,	.2400,	.2300,	.2300,	.2800,	.3000,	.3400,	.2800,	.2600,
5,	.4600,	.4400,	.4300,	.4400,	.4800,	.5400,	.5300,	.5600,	.5800,	.4700,
6,	.8000,	.7100,	.6400,	.6800,	.7400,	.8300,	.8000,	.8000,	.8400,	.7800,
7,	.9500,	.9500,	.8800,	.8600,	.9000,	.9400,	.9600,	.9400,	.9400,	.9400,
8,	.9800,	.9900,	.9800,	.9600,	.9800,	.9800,	.9900,	.9900,	.9900,	.9900,
9,	1.0000,	1.0000,	1.0000,	.9900,	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 2.5.11. Saithe in the Faroes Grounds. Effort (fishing days) and catch at age (thousands) for commercial Cuba Beta trawlers.

		Age											
Year	**Effort, days**	**3**	**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
1997	1514	101	197	515	379	291	131	31	15	6	12	7	3

Table 2.5.12. Saithe in the Faroes Grounds. Diagnostic output from the XSA run with the Cuba Beta tuning series.

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Lowestoft VPA Version 3.1

    6-May-98  15:06:15

 Extended Survivors Analysis

 Saithe Faroes Vb (run: XSAARN03/X03)

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

 Catch data for  37 years. 1961 to 1997. Ages  3 to  12.

      Fleet,            First, Last, First, Last, Alpha,  Beta
                  ,      year, year,  age ,  age
 FLT11: Cuba Beta ser,   1982, 1997,   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


 Tuning converged after   29 iterations

1


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


 Fishing mortalities
    Age,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996,  1997

      3,  .022,  .017,  .015,  .045,  .031,  .065,  .063,  .035,  .044,  .029
      4,  .088,  .203,  .201,  .401,  .266,  .203,  .282,  .125,  .125,  .166
      5,  .352,  .227,  .625,  .749,  .604,  .525,  .329,  .428,  .202,  .453
      6,  .644,  .487,  .778,  .871,  .725,  .574,  .554,  .398,  .319,  .544
      7,  .597,  .378,  .785,  .785,  .584,  .503,  .553,  .597,  .471,  .546
      8,  .608,  .542,  .412,  .631,  .500,  .400,  .626,  .539,  .583,  .503
      9,  .739,  .363,  .221,  .751,  .554,  .473,  .471,  .719,  .406,  .363
     10,  .612,  .364,  .194,  .877,  .571,  .421,  .693,  .614,  .529,  .399
     11,  .838,  .441,  .491,  .793,  .646,  .501,  .496,  .543,  .424,  .386
```

Table 2.5.12. Saithe in the Faroes Grounds. Diagnostic output from the XSA run with the Cuba Beta tuning series. *Continued.*

XSA population numbers (Thousands)

YEAR ,	AGE 3,	4,	5,	6,	7,	8,	9,	10,	11,
1988 ,	4.49E+04,	3.85E+04,	3.56E+04,	6.48E+03,	3.20E+03,	1.51E+03,	7.68E+02,	3.84E+02,	5.26E+01,
1989 ,	2.90E+04,	3.60E+04,	2.89E+04,	2.05E+04,	2.78E+03,	1.44E+03,	6.72E+02,	3.00E+02,	1.71E+02,
1990 ,	2.13E+04,	2.33E+04,	2.41E+04,	1.88E+04,	1.03E+04,	1.56E+03,	6.86E+02,	3.83E+02,	1.71E+02,
1991 ,	2.59E+04,	1.72E+04,	1.56E+04,	1.05E+04,	7.08E+03,	3.85E+03,	8.48E+02,	4.50E+02,	2.58E+02,
1992 ,	1.98E+04,	2.02E+04,	9.41E+03,	6.05E+03,	3.61E+03,	2.64E+03,	1.68E+03,	3.28E+02,	1.53E+02,
1993 ,	2.32E+04,	1.57E+04,	1.27E+04,	4.21E+03,	2.40E+03,	1.65E+03,	1.31E+03,	7.89E+02,	1.52E+02,
1994 ,	1.25E+04,	1.78E+04,	1.05E+04,	6.15E+03,	1.94E+03,	1.19E+03,	9.04E+02,	6.70E+02,	4.24E+02,
1995 ,	1.29E+04,	9.60E+03,	1.10E+04,	6.18E+03,	2.89E+03,	9.15E+02,	5.20E+02,	4.62E+02,	2.74E+02,
1996 ,	7.66E+03,	1.02E+04,	6.94E+03,	5.87E+03,	3.40E+03,	1.30E+03,	4.37E+02,	2.07E+02,	2.05E+02,
1997 ,	1.32E+04,	6.00E+03,	7.38E+03,	4.64E+03,	3.49E+03,	1.74E+03,	5.96E+02,	2.38E+02,	1.00E+02,

Estimated population abundance at 1st Jan 1998

,	.00E+00,	1.05E+04,	4.17E+03,	3.84E+03,	2.21E+03,	1.66E+03,	8.61E+02,	3.39E+02,	1.31E+02,

Taper weighted geometric mean of the VPA populations:

,	2.11E+04,	1.76E+04,	1.29E+04,	7.09E+03,	3.35E+03,	1.54E+03,	7.23E+02,	3.47E+02,	1.71E+02,

Standard error of the weighted Log(VPA populations) :

,	.5774,	.5913,	.5179,	.5136,	.4798,	.4175,	.4153,	.4773,	.5325,	1

Log catchability residuals.

Fleet : FLT11: Cuba Beta ser

Age ,	1982,	1983,	1984,	1985,	1986,	1987
3 ,	99.99,	1.02,	-.45,	.71,	.58,	.96
4 ,	.30,	-.35,	.93,	.32,	-.08,	-.36
5 ,	-.38,	-.09,	-.45,	.64,	.38,	.09
6 ,	.67,	-.03,	-.01,	-.15,	.44,	.18
7 ,	-.24,	-.14,	.22,	.19,	-.02,	.00
8 ,	-.60,	.18,	-.25,	-.16,	.48,	.05
9 ,	-.27,	.82,	-.45,	-.34,	.78,	.14
10 ,	-.03,	-.44,	-1.48,	-1.38,	.27,	.49
11 ,	-.21,	.48,	-.35,	.11,	.27,	.24

Age ,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997
3 ,	-.04,	.12,	-1.39,	-.81,	-2.95,	.92,	1.25,	.15,	.02,	.96
4 ,	-.65,	.32,	-.29,	.24,	-.20,	.37,	.77,	.07,	-1.28,	.35
5 ,	-.23,	-.54,	.05,	.12,	-.16,	.28,	-.09,	.31,	-.51,	.31
6 ,	.26,	-.14,	.02,	.05,	-.14,	.08,	.17,	-.32,	-.56,	.21
7 ,	.03,	-.39,	.02,	-.06,	-.39,	-.03,	.17,	.03,	.25,	.21
8 ,	-.06,	-.15,	-.61,	-.21,	-.63,	-.19,	.37,	.10,	1.02,	.12
9 ,	.36,	-.47,	-1.09,	-.66,	-.19,	-.12,	.24,	.16,	1.40,	-.20
10 ,	-.44,	-.22,	-1.38,	-.04,	-.20,	-.15,	.56,	-.09,	.84,	.00
11 ,	-.43,	-.02,	-.44,	.16,	-.10,	.01,	.21,	.14,	.18,	-.05

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,	-10.9157,	-9.9878,	-9.6848,	-9.6725,	-9.7010,	-9.8048,	-9.8048,	-9.8048,
S.E(Log q),	.5727,	.3385,	.2725,	.2060,	.4537,	.6461,	.6739,	.2433,

Table 2.5.12. Saithe in the Faroes Grounds. Diagnostic output from the XSA run with the Cuba Beta tuning series. *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,	1.83,	-1.256,	15.21,	.19,	15,	1.26,	-12.82,

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,	-.012,	10.92,	.51,	16,	.60,	-10.92,
5,	1.05,	-.235,	10.01,	.67,	16,	.37,	-9.99,
6,	1.05,	-.288,	9.73,	.76,	16,	.30,	-9.68,
7,	1.00,	-.023,	9.68,	.84,	16,	.22,	-9.67,
8,	1.45,	-.938,	10.75,	.31,	16,	.66,	-9.70,
9,	2.06,	-1.111,	13.24,	.10,	16,	1.32,	-9.80,
10,	.99,	.017,	9.91,	.35,	16,	.69,	-9.94,
11,	.81,	1.857,	8.89,	.90,	16,	.18,	-9.79,

1

Terminal year survivor and F summaries :

Age 3 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
FLT11: Cuba Beta ser,	27461.,	1.320,	.000,	.00,	1,	.075,	.011
P shrinkage mean ,	17601.,	.59,,,,				.386,	.017
F shrinkage mean ,	6371.,	.50,,,,				.539,	.048

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
10520.,	.37,	.78,	3,	2.136,	.029

1

Age 4 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
FLT11: Cuba Beta ser,	5628.,	.545,	.121,	.22,	2,	.414,	.125
F shrinkage mean ,	3366.,	.50,,,,				.586,	.201

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
4166.,	.37,	.28,	3,	.767,	.166

Age 5 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
FLT11: Cuba Beta ser,	3643.,	.296,	.467,	1.58,	3,	.637,	.472
F shrinkage mean ,	4210.,	.50,,,,				.363,	.420

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
3840.,	.26,	.31,	4,	1.177,	.453

1

Table 2.5.12. Saithe in the Faroes Grounds. Diagnostic output from the XSA run with the Cuba Beta tuning series. *Continued.*

```
Age  6   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
FLT11: Cuba Beta ser,       2160.,   .212,     .214,   1.01,   4,  .745,     .553

  F shrinkage mean  ,       2348.,   .50,,,,                          .255,     .518

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,   Ratio,
     2206.,       .20,      .16,    5,    .793,   .544


Age  7   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
FLT11: Cuba Beta ser,       1657.,   .181,     .206,   1.14,   5,  .778,     .546

  F shrinkage mean  ,       1656.,   .50,,,,                          .222,     .546

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,   Ratio,
     1657.,       .18,      .16,    6,    .905,   .546


1
Age  8   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
FLT11: Cuba Beta ser,        884.,   .178,     .140,    .79,   6,  .744,     .493

  F shrinkage mean  ,        797.,   .50,,,,                          .256,     .534

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,   Ratio,
      861.,       .18,      .11,    7,    .609,   .503


Age  9   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
FLT11: Cuba Beta ser,        432.,   .203,     .181,    .89,   7,  .659,     .296

  F shrinkage mean  ,        213.,   .50,,,,                          .341,     .529

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,   Ratio,
      339.,       .22,      .21,    8,    .955,   .363


1
Age 10   Catchability constant w.r.t. time and age (fixed at the value for age)  9

Year class = 1987

Fleet,                  Estimated,   Int,      Ext,    Var,    N, Scaled,  Estimated
    ,                   Survivors,   s.e,      s.e,    Ratio,    , Weights,    F
FLT11: Cuba Beta ser,        172.,   .217,     .183,    .85,   8,  .620,     .317

  F shrinkage mean  ,         84.,   .50,,,,                          .380,     .570

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,   Ratio,
      131.,       .23,      .21,    9,    .892,   .399
```

Table 2.5.12. Saithe in the Faroes Grounds. Diagnostic output from the XSA run with the Cuba Beta tuning series. *Continued.*

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

Year class = 1986

Fleet,                  Estimated,   Int,      Ext,    Var,    N, Scaled,  Estimated
    ,                   Survivors,   s.e,      s.e,   Ratio,    , Weights,     F
FLT11: Cuba Beta ser,        58.,   .228,      .089,    .39,   9,  .722,     .372

  F shrinkage mean  ,        50.,    .50,,,,                        .278,     .425

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,   Ratio,
      56.,        .22,      .08,   10,    .354,   .386
```

Table 2.5.13 Saithe in the Faroes Grounds. Fishing mortality (F) at age.

Table 8 Fishing mortality (F) at age

YEAR,	1961,	1962,	1963,	1964,	1965,	1966,	1967,
AGE							
3,	.0226,	.0465,	.0307,	.0478,	.0495,	.0250,	.0248,
4,	.0556,	.0864,	.0358,	.1260,	.0773,	.1007,	.0518,
5,	.0994,	.1208,	.0716,	.2198,	.1588,	.1492,	.1218,
6,	.1219,	.1402,	.1115,	.1798,	.2137,	.2326,	.1388,
7,	.0933,	.1192,	.1634,	.2213,	.2217,	.2785,	.2564,
8,	.0852,	.0752,	.1157,	.2567,	.2424,	.2537,	.2616,
9,	.0972,	.1150,	.1355,	.1424,	.2983,	.2771,	.2269,
10,	.0915,	.1295,	.2012,	.1658,	.2356,	.3347,	.2904,
11,	.0916,	.1069,	.1514,	.1891,	.2601,	.2901,	.2610,
+gp,	.0916,	.1069,	.1514,	.1891,	.2601,	.2901,	.2610,
FBAR 4- 8,	.0911,	.1083,	.0996,	.2007,	.1828,	.2029,	.1661,

Table 8 Fishing mortality (F) at age

YEAR,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
AGE										
3,	.0321,	.0328,	.0479,	.0886,	.0935,	.1272,	.2302,	.1492,	.2071,	.1480,
4,	.0910,	.1453,	.2548,	.1481,	.0728,	.3227,	.3171,	.3613,	.3662,	.3007,
5,	.0955,	.1720,	.1539,	.3581,	.1650,	.4588,	.3543,	.5445,	.3175,	.4178,
6,	.1358,	.1684,	.1598,	.1405,	.2987,	.3489,	.3282,	.2891,	.3435,	.4181,
7,	.1345,	.2001,	.1537,	.1262,	.3289,	.2922,	.2299,	.1962,	.2048,	.3670,
8,	.2184,	.2095,	.1944,	.1119,	.2998,	.2428,	.1772,	.1754,	.1772,	.2538,
9,	.2183,	.3065,	.1657,	.1245,	.3762,	.1984,	.1963,	.1185,	.1667,	.2033,
10,	.2027,	.3290,	.2009,	.1213,	.4604,	.2498,	.1811,	.1488,	.1204,	.1744,
11,	.2141,	.2832,	.1878,	.1196,	.3813,	.2315,	.1857,	.1481,	.1554,	.2114,
+gp,	.2141,	.2832,	.1878,	.1196,	.3813,	.2315,	.1857,	.1481,	.1554,	.2114,
FBAR 4- 8,	.1350,	.1791,	.1833,	.1770,	.2331,	.3331,	.2814,	.3133,	.2818,	.3515,

Table 8 Fishing mortality (F) at age

YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
3,	.0836,	.0373,	.0932,	.0138,	.0296,	.0694,	.0158,	.0630,	.0210,	.0365,
4,	.2371,	.1775,	.1531,	.2434,	.1839,	.1103,	.4963,	.2374,	.1387,	.1375,
5,	.2921,	.2895,	.2022,	.1950,	.2051,	.3647,	.3635,	.5041,	.4572,	.4282,
6,	.1872,	.2831,	.2305,	.4375,	.4796,	.4711,	.5718,	.3123,	.7654,	.5812,
7,	.2029,	.3118,	.3297,	.5571,	.3193,	.4910,	.6516,	.5745,	.4479,	.4664,
8,	.4128,	.3637,	.2451,	.6583,	.5416,	.5274,	.4582,	.4309,	.7721,	.4866,
9,	.2643,	.3884,	.3207,	.5271,	.6139,	.8551,	.5157,	.3118,	.8927,	.5792,
10,	.3031,	.4700,	.5130,	.5418,	.3004,	.4198,	.3775,	.2163,	.6001,	.8728,
11,	.3287,	.4102,	.3619,	.5806,	.5151,	.5099,	.5492,	.3286,	.7342,	.5366,
+gp,	.3287,	.4102,	.3619,	.5806,	.5151,	.5099,	.5492,	.3286,	.7342,	.5366,
FBAR 4- 8,	.2664,	.2851,	.2321,	.4182,	.3459,	.3929,	.5083,	.4118,	.5163,	.4200,

Table 8 Fishing mortality (F) at age

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	FBAR 95-97
AGE											
3,	.0215,	.0174,	.0154,	.0450,	.0311,	.0647,	.0630,	.0347,	.0438,	.0291,	.0358,
4,	.0884,	.2029,	.2005,	.4006,	.2663,	.2030,	.2820,	.1248,	.1251,	.1656,	.1385,
5,	.3523,	.2268,	.6255,	.7492,	.6039,	.5247,	.3291,	.4284,	.2017,	.4530,	.3610,
6,	.6442,	.4865,	.7783,	.8712,	.7246,	.5742,	.5543,	.3977,	.3186,	.5436,	.4200,
7,	.5967,	.3779,	.7848,	.7855,	.5841,	.5032,	.5526,	.5973,	.4710,	.5459,	.5381,
8,	.6076,	.5425,	.4115,	.6313,	.4998,	.4004,	.6264,	.5391,	.5831,	.5031,	.5418,
9,	.7388,	.3627,	.2209,	.7507,	.5540,	.4733,	.4705,	.7189,	.4063,	.3629,	.4960,
10,	.6117,	.3644,	.1937,	.8774,	.5712,	.4207,	.6932,	.6143,	.5286,	.3994,	.5141,
11,	.8378,	.4407,	.4912,	.7934,	.6458,	.5007,	.4961,	.5434,	.4237,	.3863,	.4511,
+gp,	.8378,	.4407,	.4912,	.7934,	.6458,	.5007,	.4961,	.5434,	.4237,	.3863,	
0 FBAR 4- 8,	.4579,	.3673,	.5601,	.6876,	.5358,	.4411,	.4689,	.4175,	.3399,	.4422,	

Table 2.5.14 Saithe in the Faroes Grounds. Stock number at age (thousands) (start of year).

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

YEAR,	1961,	1962,	1963,	1964,	1965,	1966,	1967,
AGE							
3,	9046,	13662,	22428,	16188,	22798,	21823,	26868,
4,	7738,	7241,	10677,	17807,	12635,	17764,	17425,
5,	5643,	5993,	5438,	8434,	12853,	9575,	13150,
6,	3880,	4183,	4348,	4144,	5543,	8977,	6753,
7,	2680,	2812,	2977,	3184,	2835,	3665,	5824,
8,	1746,	1998,	2044,	2070,	2090,	1860,	2271,
9,	1384,	1313,	1518,	1491,	1311,	1343,	1181,
10,	1036,	1028,	958,	1085,	1058,	797,	833,
11,	568,	774,	740,	641,	753,	685,	467,
+gp,	1032,	1141,	2147,	1111,	1367,	981,	670,
TOTAL,	34754,	40145,	53274,	56155,	63241,	67468,	75443,

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

YEAR,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
AGE										
3,	21504,	40786,	34120,	37253,	33605,	23275,	18835,	16440,	18777,	12926,
4,	21460,	17051,	32315,	26627,	27915,	25058,	16780,	12250,	11594,	12498,
5,	13546,	16041,	12072,	20506,	18800,	21250,	14857,	10005,	6989,	6582,
6,	9532,	10081,	11058,	8474,	11735,	13050,	10996,	8535,	4752,	4165,
7,	4812,	6814,	6974,	7716,	6029,	7127,	7538,	6484,	5233,	2760,
8,	3690,	3444,	4567,	4897,	5568,	3552,	4357,	4904,	4363,	3491,
9,	1431,	2429,	2287,	3079,	3585,	3378,	2281,	2988,	3369,	2992,
10,	771,	942,	1463,	1586,	2226,	2015,	2268,	1535,	2173,	2335,
11,	510,	515,	555,	980,	1150,	1150,	1285,	1549,	1083,	1577,
+gp,	1067,	846,	848,	977,	726,	989,	1720,	2382,	2195,	1904,
TOTAL,	78324,	98948,	106259,	112095,	111339,	100844,	80917,	67072,	60528,	51230,

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

YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
3,	8418,	8657,	12374,	33211,	14679,	40931,	25891,	22162,	62164,	48796,
4,	9127,	6339,	6828,	9230,	26819,	11668,	31265,	20865,	17038,	49840,
5,	7575,	5896,	4346,	4797,	5924,	18269,	8555,	15584,	13472,	12142,
6,	3548,	4631,	3613,	2907,	3232,	3951,	10386,	4869,	7707,	6983,
7,	2245,	2409,	2857,	2350,	1536,	1638,	2020,	4800,	2917,	2935,
8,	1565,	1501,	1444,	1682,	1102,	914,	821,	862,	2213,	1526,
9,	2218,	848,	854,	925,	713,	525,	442,	425,	459,	837,
10,	1999,	1394,	471,	507,	447,	316,	183,	216,	255,	154,
11,	1606,	1209,	713,	231,	242,	271,	170,	103,	142,	114,
+gp,	2096,	2251,	2839,	2533,	2451,	1479,	655,	1077,	331,	255,
TOTAL,	40397,	35134,	36340,	58373,	57145,	79962,	80386,	70963,	106698,	123582,

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

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	1998,	GMST 61-95	AMST 61-95
AGE													
3,	44913,	28975,	21282,	25854,	19788,	23214,	12484,	12914,	7661,	13228,	0,	21755,	24487,
4,	38520,	35988,	23314,	17156,	20235,	15705,	17815,	9597,	10213,	6004,	10520,	16614,	18920,
5,	35564,	28868,	24053,	15620,	9411,	12694,	10496,	11002,	6935,	7378,	4166,	11135,	12743,
6,	6478,	20471,	18840,	10536,	6046,	4212,	6150,	6183,	5869,	4641,	3840,	6557,	7456,
7,	3197,	2785,	10304,	7083,	3610,	2398,	1942,	2893,	3401,	3494,	2206,	3665,	4154,
8,	1507,	1441,	1563,	3848,	2644,	1648,	1187,	915,	1303,	1739,	1657,	2104,	2437,
9,	768,	672,	686,	848,	1676,	1313,	904,	520,	437,	596,	861,	1245,	1514,
10,	384,	300,	383,	450,	328,	789,	670,	462,	207,	238,	339,	738,	966,
11,	53,	171,	171,	258,	153,	152,	424,	274,	205,	100,	131,	434,	613,
+gp,	115,	120,	223,	235,	262,	144,	137,	305,	260,	342,	246,		
TOTAL,	131500,	119792,	100818,	81890,	64151,	62269,	52209,	45065,	36492,	37760,	23966,		

Table 2.5.15. Saithe in the Faroes Grounds. Summary (without SOP correction).

Table 16 Summary (without SOP correction)

	RECRUITS, Age 3	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 4- 8,
1961,	9046,	121963,	83792,	9592,	.1145,	.0911,
1962,	13662,	126452,	85629,	10454,	.1221,	.1083,
1963,	22428,	158223,	100622,	12693,	.1261,	.0996,
1964,	16188,	160409,	98372,	21893,	.2226,	.2007,
1965,	22798,	174748,	107201,	22181,	.2069,	.1828,
1966,	21823,	184110,	108758,	25563,	.2350,	.2029,
1967,	26868,	181598,	104608,	21319,	.2038,	.1661,
1968,	21504,	189736,	115924,	20387,	.1759,	.1350,
1969,	40786,	214948,	123747,	27437,	.2217,	.1791,
1970,	34120,	224346,	129081,	29110,	.2255,	.1833,
1971,	37253,	228291,	139423,	32706,	.2346,	.1770,
1972,	33605,	236907,	147473,	42663,	.2893,	.2331,
1973,	23275,	210386,	136571,	57431,	.4205,	.3331,
1974,	18835,	203828,	137470,	47188,	.3433,	.2814,
1975,	16440,	187321,	137715,	41576,	.3019,	.3133,
1976,	18777,	169517,	121842,	33065,	.2714,	.2818,
1977,	12926,	156118,	113951,	34835,	.3057,	.3515,
1978,	8418,	137133,	95856,	28138,	.2935,	.2664,
1979,	8657,	112788,	83298,	27246,	.3271,	.2851,
1980,	12374,	124625,	88801,	25230,	.2841,	.2321,
1981,	33211,	141709,	76032,	30103,	.3959,	.4182,
1982,	14679,	147784,	81792,	30964,	.3786,	.3459,
1983,	40931,	179429,	99795,	39176,	.3926,	.3929,
1984,	25891,	187660,	99020,	54665,	.5521,	.5083,
1985,	22162,	188041,	114010,	44605,	.3912,	.4118,
1986,	62164,	234822,	101849,	41716,	.4096,	.5163,
1987,	48796,	250029,	97763,	40020,	.4094,	.4200,
1988,	44913,	259678,	104607,	45285,	.4329,	.4579,
1989,	28975,	229206,	103730,	44477,	.4288,	.3673,
1990,	21282,	192424,	97374,	61561,	.6322,	.5601,
1991,	25854,	153172,	76656,	54863,	.7157,	.6876,
1992,	19788,	128114,	65184,	38366,	.5886,	.5358,
1993,	23214,	135191,	68581,	33543,	.4891,	.4411,
1994,	12484,	122725,	66702,	33182,	.4975,	.4689,
1995,	12914,	109333,	63023,	27213,	.4318,	.4175,
1996,	7661,	93373,	58800,	20025,	.3406,	.3399,
1997,	13228,	88312,	51589,	22229,	.4309,	.4422,
Arith. Mean ,	23728,	171472,	99639,	33316,	.3471,	.3253,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		

Table 2.5.16. Saithe in the Faroes Grounds. Effort (trawl hours) and catch at age (thousands) from commercial Cuba trawler logbooks.

		Age											
Year	**Effort, hours**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1985	3412	30	168	387	81	101	13	5	1	2	4	1	0
1986	3749	63	120	331	237	66	70	17	6	3	2	6	0
1987	6736	118	466	394	313	117	62	32	7	5	0	1	2
1988	7029	65	271	859	302	123	51	34	8	1	1	2	2
1989	6803	51	583	495	626	71	42	14	8	5	1	0	1
1990	8041	23	244	738	714	393	36	10	4	4	2	1	1
1991	7827	34	280	489	395	249	122	15	14	10	5	0	0
1992	8321	11	259	272	230	115	67	58	11	6	2	3	1
1993	8232	82	320	519	187	100	59	44	26	6	4	0	0
1994	8129	80	594	366	344	110	77	50	46	22	3	3	0
1995	8388	62	235	752	308	190	64	32	24	18	10	2	2
1996	6901	35	52	185	191	234	179	86	22	12	11	8	2
1997	6980	56	109	286	210	161	73	17	8	3	7	4	2

Table 2.5.17. Saithe in the Faroes Grounds. Diagnostic output from the XSA run with the Cuba Logbook tuning series.

```
Lowestoft VPA Version 3.1

  29-Apr-98  13:12:23

Extended Survivors Analysis

Saithe Faroes Vb (run: XSAARN07/X07)

CPUE data from file /users/fish/ifad/ifapwork/nwwg/sai_faro/FLEET.X07

Catch data for  37 years. 1961 to 1997. Ages  3 to  12.

     Fleet,                First, Last, First, Last, Alpha,  Beta
                         ,  year, year,  age ,  age
FLT12: Cuba Logbook ,      1985, 1997,   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


Tuning converged after   41 iterations

1


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


Fishing mortalities
   Age,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996,  1997

     3,  .021,  .017,  .015,  .045,  .030,  .062,  .060,  .035,  .042,  .029
     4,  .088,  .202,  .201,  .400,  .264,  .193,  .270,  .118,  .127,  .158
     5,  .352,  .226,  .621,  .750,  .603,  .518,  .309,  .403,  .189,  .464
     6,  .645,  .486,  .771,  .858,  .726,  .573,  .543,  .363,  .292,  .496
     7,  .594,  .378,  .783,  .769,  .567,  .505,  .550,  .575,  .410,  .477
     8,  .610,  .537,  .412,  .628,  .481,  .382,  .631,  .534,  .546,  .406
     9,  .755,  .365,  .218,  .753,  .548,  .445,  .437,  .730,  .401,  .327
    10,  .647,  .378,  .195,  .856,  .575,  .414,  .622,  .543,  .544,  .391
    11,  .870,  .485,  .520,  .805,  .614,  .507,  .484,  .449,  .348,  .404
```

Table 2.5.17. Saithe in the Faroes Grounds. Diagnostic output from the XSA run with the Cuba Logbook tuning series. *Continued.*

1
XSA population numbers (Thousands)

YEAR ,	AGE 3,	4,	5,	6,	7,	8,	9,	10,	11,
1988 ,	4.51E+04,	3.87E+04,	3.56E+04,	6.47E+03,	3.21E+03,	1.50E+03,	7.57E+02,	3.69E+02,	5.14E+01,
1989 ,	2.90E+04,	3.61E+04,	2.90E+04,	2.05E+04,	2.78E+03,	1.45E+03,	6.69E+02,	2.91E+02,	1.58E+02,
1990 ,	2.13E+04,	2.33E+04,	2.42E+04,	1.90E+04,	1.03E+04,	1.56E+03,	6.94E+02,	3.80E+02,	1.63E+02,
1991 ,	2.60E+04,	1.72E+04,	1.56E+04,	1.06E+04,	7.18E+03,	3.86E+03,	8.46E+02,	4.57E+02,	2.56E+02,
1992 ,	2.07E+04,	2.04E+04,	9.42E+03,	6.04E+03,	3.69E+03,	2.72E+03,	1.69E+03,	3.26E+02,	1.59E+02,
1993 ,	2.41E+04,	1.64E+04,	1.28E+04,	4.22E+03,	2.39E+03,	1.71E+03,	1.38E+03,	7.99E+02,	1.50E+02,
1994 ,	1.31E+04,	1.85E+04,	1.11E+04,	6.25E+03,	1.95E+03,	1.18E+03,	9.58E+02,	7.23E+02,	4.32E+02,
1995 ,	1.27E+04,	1.01E+04,	1.16E+04,	6.66E+03,	2.97E+03,	9.21E+02,	5.14E+02,	5.06E+02,	3.18E+02,
1996 ,	8.00E+03,	1.01E+04,	7.34E+03,	6.33E+03,	3.80E+03,	1.37E+03,	4.42E+02,	2.03E+02,	2.41E+02,
1997 ,	1.31E+04,	6.28E+03,	7.24E+03,	4.97E+03,	3.87E+03,	2.06E+03,	6.50E+02,	2.42E+02,	9.64E+01,

Estimated population abundance at 1st Jan 1998

,	.00E+00,	1.14E+04,	4.86E+03,	3.86E+03,	2.54E+03,	1.97E+03,	1.11E+03,	3.82E+02,	1.34E+02,

Taper weighted geometric mean of the VPA populations:

,	2.13E+04,	1.79E+04,	1.30E+04,	7.24E+03,	3.43E+03,	1.58E+03,	7.34E+02,	3.51E+02,	1.75E+02,

Standard error of the weighted Log(VPA populations) :

,	.5700,	.5813,	.5119,	.5063,	.4841,	.4268,	.4219,	.4965,	.5604,

1

Log catchability residuals.

Fleet : FLT12: Cuba Logbook

Age ,	1985,	1986,	1987
3 ,	.26,	-.15,	.14
4 ,	.25,	-.02,	-.32
5 ,	.52,	.39,	.07
6 ,	-.22,	.50,	.21
7 ,	.12,	.04,	.02
8 ,	-.27,	.54,	.08
9 ,	-.47,	.84,	.17
10 ,	-1.44,	.26,	.46
11 ,	.01,	.22,	.26

Age ,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997
3 ,	-.42,	-.19,	-.85,	-.62,	-1.59,	.30,	.89,	.62,	.71,	.67
4 ,	-.68,	.24,	-.36,	.20,	-.17,	.24,	.78,	.36,	-.94,	.27
5 ,	-.30,	-.67,	-.08,	.03,	-.18,	.14,	-.15,	.54,	-.31,	.25
6 ,	.23,	-.23,	-.06,	-.01,	-.10,	-.01,	.21,	-.08,	-.34,	.08
7 ,	-.01,	-.48,	-.07,	-.14,	-.39,	-.11,	.22,	.32,	.41,	.03
8 ,	-.10,	-.26,	-.71,	-.28,	-.65,	-.35,	.41,	.40,	1.23,	-.14
9 ,	.34,	-.56,	-1.17,	-.70,	-.19,	-.30,	.21,	.48,	1.67,	-.38
10 ,	-.44,	-.29,	-1.49,	-.11,	-.19,	-.29,	.48,	.12,	1.15,	-.12
11 ,	-.45,	-.10,	-.50,	.11,	-.06,	-.04,	.20,	.26,	.28,	-.17

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,	-13.0013,	-12.0197,	-11.7630,	-11.7430,	-11.7591,	-11.8599,	-11.8599,	-11.8599,
S.E(Log q),	.4924,	.3441,	.2150,	.2625,	.5639,	.7644,	.7106,	.2625,

Table 2.5.17. Saithe in the Faroes Grounds. Diagnostic output from the XSA run with the Cuba Logbook tuning series. *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,	-1.620,	23.04,	.10,	13,	1.88,	-14.87,

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,	1.17,	-.535,	13.56,	.51,	13,	.60,	-13.00,
5,	1.33,	-1.146,	12.84,	.57,	13,	.45,	-12.02,
6,	1.09,	-.576,	12.02,	.82,	13,	.24,	-11.76,
7,	1.09,	-.429,	12.05,	.73,	13,	.30,	-11.74,
8,	2.19,	-1.310,	16.95,	.12,	13,	1.19,	-11.76,
9,	3.63,	-1.329,	25.65,	.03,	13,	2.68,	-11.86,
10,	1.23,	-.402,	13.35,	.25,	13,	.90,	-11.95,
11,	.77,	2.413,	10.34,	.93,	13,	.17,	-11.86,

1

Terminal year survivor and F summaries :

Age 3 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
FLT12: Cuba Logbook ,	20415.,	.797,	.000,	.00,	1,	.180,	.015
P shrinkage mean ,	17856.,	.58,,,,				.349,	.017
F shrinkage mean ,	6599.,	.50,,,,				.471,	.046

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
11443.,	.34,	.55,	3,	1.610,	.029

1

Age 4 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
FLT12: Cuba Logbook ,	6530.,	.432,	.200,	.46,	2,	.530,	.109
F shrinkage mean ,	3475.,	.50,,,,				.470,	.195

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
4856.,	.33,	.32,	3,	.983,	.158

Age 5 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
FLT12: Cuba Logbook ,	3622.,	.277,	.399,	1.44,	3,	.661,	.475
F shrinkage mean ,	4379.,	.50,,,,				.339,	.407

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
3863.,	.25,	.27,	4,	1.092,	.464

Table 2.5.17. Saithe in the Faroes Grounds. Diagnostic output from the XSA run with the Cuba Logbook tuning series. *Continued.*

```
Age  6   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
FLT12: Cuba Logbook ,       2574.,   .205,     .171,    .84,    4,  .765,     .482

  F shrinkage mean  ,       2437.,   .50,,,,                          .235,     .503

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,    ,    Ratio,
     2541.,       .20,      .13,    5,    .665,   .496


Age  7   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
FLT12: Cuba Logbook ,       2037.,   .177,     .172,    .97,    5,  .797,     .464

  F shrinkage mean  ,       1740.,   .50,,,,                          .203,     .526

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,    ,    Ratio,
     1972.,       .17,      .14,    6,    .812,   .477


1
Age  8   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
FLT12: Cuba Logbook ,       1209.,   .174,     .156,    .89,    6,  .764,     .382

  F shrinkage mean  ,        827.,   .50,,,,                          .236,     .519

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,    ,    Ratio,
     1105.,       .18,      .15,    7,    .817,   .406


Age  9   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
FLT12: Cuba Logbook ,        517.,   .202,     .198,    .98,    7,  .648,     .253

  F shrinkage mean  ,        220.,   .50,,,,                          .352,     .516

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,    ,    Ratio,
      382.,       .22,      .24,    8,   1.104,   .327


1
```

Table 2.5.17. Saithe in the Faroes Grounds. Diagnostic output from the XSA run with the Cuba Logbook tuning series. *Continued.*

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

Year class = 1987

Fleet,                  Estimated,    Int,      Ext,    Var,    N, Scaled,  Estimated
    ,                   Survivors,    s.e,      s.e,    Ratio,    , Weights,    F
FLT12: Cuba Logbook ,       177.,    .225,      .210,    .93,   8,  .593,     .309

  F shrinkage mean  ,        89.,    .50,,,,                          .407,     .544

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,   Ratio,
      134.,       .24,      .22,    9,    .892,   .391


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

Year class = 1986

Fleet,                  Estimated,    Int,      Ext,    Var,    N, Scaled,  Estimated
    ,                   Survivors,    s.e,      s.e,    Ratio,    , Weights,    F
FLT12: Cuba Logbook ,        51.,    .236,      .127,    .54,   9,  .710,     .416

  F shrinkage mean  ,        57.,    .50,,,,                          .290,     .377

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,   Ratio,
       53.,       .22,      .10,   10,    .466,   .404
```

Table 2.5.18. Saithe in the Faroes Grounds. Fishing mortality (F) at age.

Table 8 Fishing mortality (F) at age

YEAR,	1961,	1962,	1963,	1964,	1965,	1966,	1967,
AGE							
3,	.0226,	.0465,	.0307,	.0478,	.0495,	.0250,	.0248,
4,	.0556,	.0863,	.0358,	.1260,	.0772,	.1007,	.0518,
5,	.0994,	.1208,	.0716,	.2198,	.1588,	.1492,	.1217,
6,	.1219,	.1401,	.1115,	.1797,	.2137,	.2326,	.1388,
7,	.0933,	.1192,	.1634,	.2213,	.2216,	.2784,	.2564,
8,	.0852,	.0752,	.1157,	.2566,	.2424,	.2536,	.2615,
9,	.0972,	.1150,	.1355,	.1424,	.2983,	.2770,	.2269,
10,	.0915,	.1295,	.2012,	.1658,	.2355,	.3346,	.2903,
11,	.0916,	.1069,	.1514,	.1891,	.2601,	.2900,	.2609,
+gp,	.0916,	.1069,	.1514,	.1891,	.2601,	.2900,	.2609,
FBAR 4- 8,	.0911,	.1083,	.0996,	.2007,	.1827,	.2029,	.1660,

Table 8 Fishing mortality (F) at age

YEAR,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
AGE										
3,	.0320,	.0328,	.0479,	.0885,	.0935,	.1271,	.2293,	.1505,	.2054,	.1478,
4,	.0910,	.1452,	.2547,	.1480,	.0728,	.3227,	.3170,	.3595,	.3705,	.2976,
5,	.0954,	.1719,	.1538,	.3579,	.1649,	.4582,	.3543,	.5441,	.3153,	.4251,
6,	.1357,	.1684,	.1597,	.1404,	.2985,	.3486,	.3276,	.2891,	.3431,	.4140,
7,	.1345,	.2000,	.1536,	.1262,	.3286,	.2919,	.2297,	.1957,	.2048,	.3664,
8,	.2183,	.2094,	.1943,	.1118,	.2995,	.2425,	.1770,	.1752,	.1767,	.2537,
9,	.2182,	.3063,	.1656,	.1244,	.3759,	.1982,	.1960,	.1183,	.1664,	.2026,
10,	.2027,	.3289,	.2008,	.1213,	.4600,	.2496,	.1809,	.1485,	.1202,	.1740,
11,	.2141,	.2831,	.1877,	.1196,	.3810,	.2312,	.1854,	.1479,	.1550,	.2111,
+gp,	.2141,	.2831,	.1877,	.1196,	.3810,	.2312,	.1854,	.1479,	.1550,	.2111,
FBAR 4- 8,	.1350,	.1790,	.1832,	.1769,	.2329,	.3328,	.2811,	.3127,	.2821,	.3514,

Table 8 Fishing mortality (F) at age

YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
3,	.0837,	.0373,	.0932,	.0138,	.0296,	.0694,	.0158,	.0630,	.0210,	.0363,
4,	.2368,	.1777,	.1531,	.2435,	.1843,	.1106,	.4965,	.2371,	.1388,	.1374,
5,	.2880,	.2891,	.2025,	.1950,	.2052,	.3657,	.3648,	.5044,	.4564,	.4284,
6,	.1915,	.2779,	.2300,	.4382,	.4796,	.4716,	.5743,	.3139,	.7664,	.5795,
7,	.2001,	.3213,	.3216,	.5553,	.3201,	.4910,	.6529,	.5789,	.4511,	.4675,
8,	.4119,	.3572,	.2550,	.6318,	.5387,	.5293,	.4583,	.4323,	.7841,	.4921,
9,	.2642,	.3871,	.3127,	.5594,	.5690,	.8457,	.5188,	.3119,	.8985,	.5970,
10,	.3017,	.4698,	.5104,	.5210,	.3289,	.3710,	.3701,	.2182,	.6002,	.8866,
11,	.3279,	.4075,	.3617,	.5756,	.4825,	.5870,	.4524,	.3195,	.7448,	.5368,
+gp,	.3279,	.4075,	.3617,	.5756,	.4825,	.5870,	.4524,	.3195,	.7448,	.5368,
FBAR 4- 8,	.2657,	.2846,	.2324,	.4128,	.3456,	.3937,	.5094,	.4133,	.5193,	.4210,

Table 8 Fishing mortality (F) at age

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	FBAR 95-97
AGE											
3,	.0215,	.0174,	.0154,	.0447,	.0297,	.0624,	.0600,	.0352,	.0419,	.0293,	.0355,
4,	.0880,	.2020,	.2007,	.4002,	.2641,	.1932,	.2699,	.1183,	.1273,	.1577,	.1344,
5,	.3520,	.2255,	.6212,	.7501,	.6029,	.5182,	.3086,	.4026,	.1894,	.4636,	.3519,
6,	.6447,	.4858,	.7709,	.8584,	.7264,	.5726,	.5427,	.3630,	.2915,	.4964,	.3837,
7,	.5935,	.3784,	.7827,	.7694,	.5670,	.5054,	.5498,	.5754,	.4104,	.4772,	.4877,
8,	.6100,	.5374,	.4123,	.6278,	.4810,	.3817,	.6314,	.5344,	.5457,	.4056,	.4952,
9,	.7548,	.3650,	.2179,	.7534,	.5485,	.4450,	.4373,	.7301,	.4007,	.3272,	.4860,
10,	.6468,	.3780,	.1953,	.8563,	.5751,	.4140,	.6219,	.5431,	.5441,	.3912,	.4928,
11,	.8696,	.4849,	.5202,	.8049,	.6139,	.5065,	.4837,	.4487,	.3477,	.4044,	.4003,
+gp,	.8696,	.4849,	.5202,	.8049,	.6139,	.5065,	.4837,	.4487,	.3477,	.4044,	
FBAR 4- 8,	.4577,	.3658,	.5576,	.6812,	.5283,	.4342,	.4605,	.3987,	.3129,	.4001,	

Table 2.5.19. Saithe in the Faroes Grounds. Stock number at age (thousands) (start of year).

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

YEAR,	1961,	1962,	1963,	1964,	1965,	1966,	1967,
AGE							
3,	9047,	13663,	22431,	16192,	22803,	21830,	26879,
4,	7739,	7241,	10678,	17809,	12638,	17769,	17432,
5,	5643,	5993,	5438,	8435,	12854,	9578,	13154,
6,	3881,	4183,	4349,	4145,	5543,	8979,	6755,
7,	2680,	2813,	2977,	3185,	2835,	3665,	5826,
8,	1746,	1999,	2044,	2070,	2090,	1860,	2272,
9,	1384,	1313,	1518,	1491,	1311,	1343,	1182,
10,	1036,	1028,	958,	1085,	1059,	797,	833,
11,	568,	774,	740,	641,	753,	685,	467,
+gp,	1032,	1141,	2147,	1111,	1367,	981,	670,
TOTAL,	34757,	40149,	53279,	56164,	63254,	67486,	75468,

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

YEAR,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
AGE										
3,	21515,	40798,	34136,	37285,	33607,	23282,	18897,	16305,	18913,	12938,
4,	21468,	17059,	32325,	26640,	27941,	25059,	16786,	12301,	11484,	12609,
5,	13552,	16048,	12079,	20514,	18811,	21271,	14859,	10010,	7030,	6491,
6,	9536,	10085,	11064,	8480,	11742,	13059,	11014,	8536,	4756,	4199,
7,	4814,	6816,	6978,	7721,	6033,	7133,	7545,	6498,	5234,	2763,
8,	3691,	3445,	4569,	4899,	5572,	3556,	4361,	4910,	4375,	3492,
9,	1432,	2429,	2288,	3080,	3587,	3381,	2285,	2991,	3374,	3002,
10,	771,	942,	1464,	1587,	2227,	2016,	2271,	1537,	2176,	2339,
11,	510,	515,	555,	981,	1151,	1151,	1286,	1551,	1085,	1580,
+gp,	1067,	846,	848,	977,	727,	990,	1722,	2386,	2199,	1907,
TOTAL,	78355,	98986,	106306,	112165,	111398,	100899,	81025,	67026,	60626,	51320,

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

YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
3,	8411,	8657,	12368,	33150,	14642,	40919,	25919,	22156,	62206,	49012,
4,	9137,	6334,	6828,	9225,	26769,	11638,	31255,	20888,	17032,	49874,
5,	7666,	5904,	4341,	4797,	5920,	18228,	8530,	15576,	13491,	12138,
6,	3474,	4706,	3620,	2903,	3232,	3948,	10353,	4849,	7701,	6998,
7,	2273,	2349,	2918,	2355,	1533,	1638,	2017,	4773,	2901,	2930,
8,	1568,	1523,	1394,	1732,	1107,	912,	821,	860,	2190,	1513,
9,	2218,	850,	873,	885,	754,	529,	440,	425,	457,	819,
10,	2007,	1395,	473,	523,	414,	349,	186,	214,	255,	152,
11,	1609,	1215,	714,	232,	254,	244,	197,	105,	141,	114,
+gp,	2100,	2263,	2840,	2550,	2579,	1329,	761,	1104,	328,	255,
TOTAL,	40463,	35195,	36369,	58351,	57204,	79733,	80479,	70949,	106701,	123805,

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

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	1998,	GMST 61-95	AMST 61-95
AGE													
3,	45092,	28957,	21298,	26033,	20665,	24059,	13090,	12715,	7998,	13138,	0,	21836,	24568,
4,	38697,	36135,	23300,	17172,	20382,	16423,	18507,	10093,	10050,	6279,	11443,	16687,	18990,
5,	35592,	29013,	24173,	15608,	9422,	12814,	11084,	11568,	7342,	7245,	4856,	11173,	12789,
6,	6475,	20494,	18959,	10634,	6036,	4221,	6248,	6665,	6332,	4974,	3863,	6578,	7481,
7,	3210,	2782,	10322,	7180,	3690,	2390,	1949,	2973,	3795,	3873,	2541,	3673,	4163,
8,	1503,	1452,	1560,	3864,	2724,	1714,	1180,	921,	1369,	2061,	1972,	2108,	2442,
9,	757,	669,	694,	846,	1688,	1378,	958,	514,	442,	650,	1105,	1249,	1518,
10,	369,	291,	380,	457,	326,	799,	723,	506,	203,	242,	382,	742,	970,
11,	51,	158,	163,	256,	159,	150,	432,	318,	241,	96,	134,	436,	615,
+gp,	112,	111,	213,	232,	271,	143,	140,	354,	306,	329,	233,		
0 TOTAL,	131858,	120062,	101063,	82282,	65363,	64091,	54312,	46628,	38078,	38888,	26529,		

Table 2.5.20. Saithe in the Faroes Grounds. Summary (without SOP correction).

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,	9047,	121972,	83798,	9592,	.1145,	.0911,
1962,	13663,	126463,	85636,	10454,	.1221,	.1083,
1963,	22431,	158239,	100632,	12693,	.1261,	.0996,
1964,	16192,	160429,	98383,	21893,	.2225,	.2007,
1965,	22803,	174778,	107216,	22181,	.2069,	.1827,
1966,	21830,	184152,	108779,	25563,	.2350,	.2029,
1967,	26879,	181652,	104635,	21319,	.2037,	.1660,
1968,	21515,	189804,	115962,	20387,	.1758,	.1350,
1969,	40798,	215031,	123796,	27437,	.2216,	.1790,
1970,	34136,	224448,	129143,	29110,	.2254,	.1832,
1971,	37285,	228427,	139502,	32706,	.2344,	.1769,
1972,	33607,	237050,	147570,	42663,	.2891,	.2329,
1973,	23282,	210529,	136683,	57431,	.4202,	.3328,
1974,	18897,	204074,	137612,	47188,	.3429,	.2811,
1975,	16305,	187422,	137888,	41576,	.3015,	.3127,
1976,	18913,	169754,	122019,	33065,	.2710,	.2821,
1977,	12938,	156336,	114099,	34835,	.3053,	.3514,
1978,	8411,	137397,	96030,	28138,	.2930,	.2657,
1979,	8657,	113076,	83560,	27246,	.3261,	.2846,
1980,	12368,	124784,	88947,	25230,	.2837,	.2324,
1981,	33150,	141906,	76310,	30103,	.3945,	.4128,
1982,	14642,	149087,	83216,	30964,	.3721,	.3456,
1983,	40919,	177757,	98218,	39176,	.3989,	.3937,
1984,	25919,	188796,	100173,	54665,	.5457,	.5094,
1985,	22156,	188143,	114105,	44605,	.3909,	.4133,
1986,	62206,	234659,	101620,	41716,	.4105,	.5193,
1987,	49012,	250276,	97659,	40020,	.4098,	.4210,
1988,	45092,	260176,	104593,	45285,	.4330,	.4577,
1989,	28957,	229558,	103745,	44477,	.4287,	.3658,
1990,	21298,	192826,	97557,	61561,	.6310,	.5576,
1991,	26033,	153914,	77088,	54863,	.7117,	.6812,
1992,	20665,	130203,	66057,	38366,	.5808,	.5283,
1993,	24059,	138667,	69900,	33543,	.4799,	.4342,
1994,	13090,	127310,	68855,	33182,	.4819,	.4605,
1995,	12715,	114136,	66468,	27213,	.4094,	.3987,
1996,	7998,	98502,	62968,	20025,	.3180,	.3129,
1997,	13138,	92434,	55308,	22229,	.4019,	.4001,
Arith. Mean ,	23811,	172275,	100155,	33316,	.3438,	.3220,
0 Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		

Table 2.5.21. Saithe in the Faroes Grounds. Prediction with management option table: Input data.

The SAS System 18:26 Saturday, May 2, 1998
Saithe in the Faroes Grounds (Fishing Area Vb)

Prediction with management option table: Input data

Year: 1998								
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	11268.000	0.2000	0.1200	0.0000	0.0000	1.455	0.0400	1.455
4	10520.000	0.2000	0.2800	0.0000	0.0000	1.945	0.1530	1.945
5	4166.000	0.2000	0.5500	0.0000	0.0000	2.316	0.3990	2.316
6	3840.000	0.2000	0.7900	0.0000	0.0000	3.331	0.4640	3.331
7	2206.000	0.2000	0.9400	0.0000	0.0000	4.046	0.5950	4.046
8	1657.000	0.2000	0.9800	0.0000	0.0000	4.979	0.5990	4.979
9	861.000	0.2000	1.0000	0.0000	0.0000	5.766	0.5480	5.766
10	339.000	0.2000	1.0000	0.0000	0.0000	7.004	0.5690	7.004
11	131.000	0.2000	1.0000	0.0000	0.0000	7.716	0.4990	7.716
12+	246.000	0.2000	1.0000	0.0000	0.0000	8.154	0.4990	8.154
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	11268.000	0.2000	0.1200	0.0000	0.0000	1.455	0.0400	1.455
4	.	0.2000	0.2800	0.0000	0.0000	1.847	0.1530	1.847
5	.	0.2000	0.5200	0.0000	0.0000	2.323	0.3990	2.323
6	.	0.2000	0.7900	0.0000	0.0000	2.979	0.4640	2.979
7	.	0.2000	0.9400	0.0000	0.0000	4.061	0.5950	4.061
8	.	0.2000	0.9900	0.0000	0.0000	5.160	0.5990	5.160
9	.	0.2000	1.0000	0.0000	0.0000	6.068	0.5480	6.068
10	.	0.2000	1.0000	0.0000	0.0000	6.912	0.5690	6.912
11	.	0.2000	1.0000	0.0000	0.0000	8.019	0.4990	8.019
12+	.	0.2000	1.0000	0.0000	0.0000	9.378	0.4990	9.378
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 2000								
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	11268.000	0.2000	0.1200	0.0000	0.0000	1.455	0.0400	1.455
4	.	0.2000	0.2800	0.0000	0.0000	1.847	0.1530	1.874
5	.	0.2000	0.5200	0.0000	0.0000	2.225	0.3990	2.225
6	.	0.2000	0.7900	0.0000	0.0000	2.986	0.4640	2.986
7	.	0.2000	0.9400	0.0000	0.0000	3.709	0.5950	3.709
8	.	0.2000	0.9900	0.0000	0.0000	5.175	0.5990	5.175
9	.	0.2000	1.0000	0.0000	0.0000	6.249	0.5480	6.249
10	.	0.2000	1.0000	0.0000	0.0000	7.214	0.5690	7.214
11	.	0.2000	1.0000	0.0000	0.0000	7.927	0.4990	7.927
12+	.	0.2000	1.0000	0.0000	0.0000	9.681	0.4990	9.681
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANARN02
Date and time: 01MAY98:16:41

Table 2.5.22. Saithe in the Faroes Grounds. Prediction with management option table.

The SAS System 18:26 Saturday, May 2, 1998

Saithe in the Faroes Grounds (Fishing Area Vb)

Prediction with management option table

Year: 1998					Year: 1999					Year: 2000	
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	0.4420	86823	49938	21462	0.0000	0.0000	80274	43857	0	97846	59108
.	.	.	.	.	0.1000	0.0442	.	43857	2359	95217	56818
.	.	.	.	.	0.2000	0.0884	.	43857	4616	92706	54636
.	.	.	.	.	0.3000	0.1326	.	43857	6775	90308	52559
.	.	.	.	.	0.4000	0.1768	.	43857	8841	88016	50580
.	.	.	.	.	0.5000	0.2210	.	43857	10818	85825	48695
.	.	.	.	.	0.6000	0.2652	.	43857	12712	83732	46899
.	.	.	.	.	0.7000	0.3094	.	43857	14525	81730	45186
.	.	.	.	.	0.8000	0.3536	.	43857	16262	79816	43554
.	.	.	.	.	0.9000	0.3978	.	43857	17926	77984	41999
.	.	.	.	.	1.0000	0.4420	.	43857	19521	76232	40515
.	.	.	.	.	1.1000	0.4862	.	43857	21050	74555	39100
.	.	.	.	.	1.2000	0.5304	.	43857	22516	72950	37751
.	.	.	.	.	1.3000	0.5746	.	43857	23923	71413	36463
.	.	.	.	.	1.4000	0.6188	.	43857	25272	69940	35235
.	.	.	.	.	1.5000	0.6630	.	43857	26568	68530	34063
.	.	.	.	.	1.6000	0.7072	.	43857	27811	67178	32944
.	.	.	.	.	1.7000	0.7514	.	43857	29005	65882	31875
.	.	.	.	.	1.8000	0.7956	.	43857	30152	64640	30855
.	.	.	.	.	1.9000	0.8398	.	43857	31255	63448	29881
.	.	.	.	.	2.0000	0.8840	.	43857	32314	62305	28950
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANARN02
Date and time : 01MAY98:16:41
Computation of ref. F: Simple mean, age 4 - 8
Basis for 1998 : F factors

Table 2.5.23. Saithe in the Faroes Grounds. Yield per recruit: Input data.

The SAS System 18:26 Saturday, May 2, 1998

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	0.1200	0.0000	0.0000	1.312	0.0820	1.312
4	.	0.2000	0.2800	0.0000	0.0000	1.850	0.2600	1.850
5	.	0.2000	0.5200	0.0000	0.0000	2.520	0.4330	2.520
6	.	0.2000	0.7900	0.0000	0.0000	3.296	0.5140	3.296
7	.	0.2000	0.9400	0.0000	0.0000	4.172	0.5050	4.172
8	.	0.2000	0.9900	0.0000	0.0000	5.105	0.4990	5.105
9	.	0.2000	1.0000	0.0000	0.0000	5.883	0.5030	5.883
10	.	0.2000	1.0000	0.0000	0.0000	6.585	0.4970	6.585
11	.	0.2000	1.0000	0.0000	0.0000	7.418	0.5100	7.418
12+	.	0.2000	1.0000	0.0000	0.0000	8.947	0.5100	8.947
Unit	Numbers	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : YLDARN02
Date and time: 01MAY98:17:10

Table 2.5.24. Saithe in the Faroes Grounds. Yield per recruit: Summary table.

The SAS System 18:26 Satur

May 2, 1998

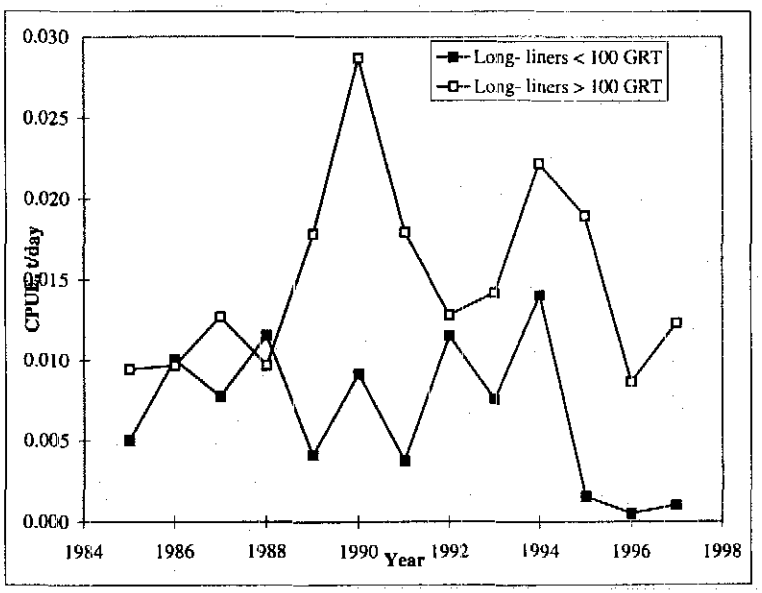
Saithe in the Faroes Grounds (Fishing Area Vb)

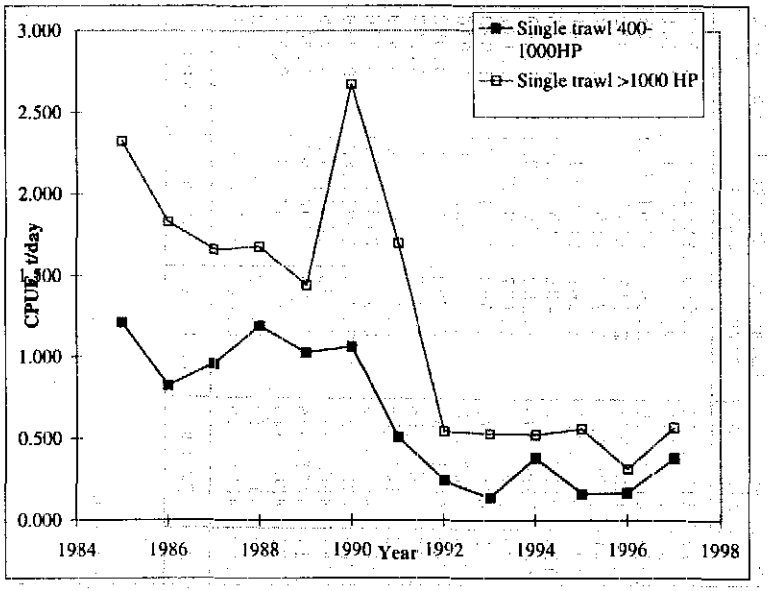
Yield per recruit: Summary table

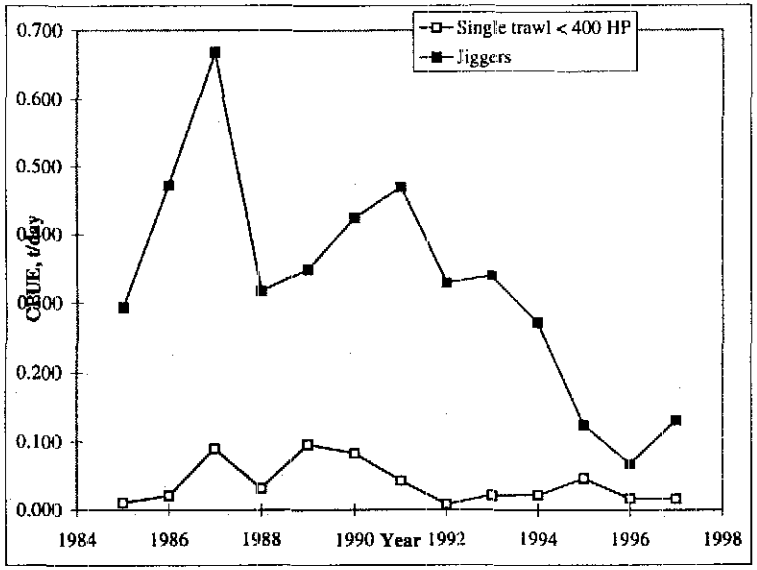
						1 January		Spawning time	
F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
0.0000	0.0000	0.000	0.000	5.517	23129.544	3.580	19562.494	3.580	19562.494
0.1000	0.0442	0.154	697.136	4.750	17607.110	2.841	14121.242	2.841	14121.242
0.2000	0.0884	0.257	1062.253	4.238	14164.555	2.355	10754.615	2.355	10754.615
0.3000	0.1327	0.331	1263.939	3.869	11856.785	2.012	8517.991	2.012	8517.991
0.4000	0.1769	0.387	1378.830	3.591	10225.529	1.757	6953.520	1.757	6953.520
0.5000	0.2211	0.432	1445.116	3.372	9024.260	1.561	5815.049	1.561	5815.049
0.6000	0.2653	0.468	1483.105	3.195	8110.010	1.406	4959.949	1.406	4959.949
0.7000	0.3095	0.497	1504.134	3.049	7394.988	1.280	4300.731	1.280	4300.731
0.8000	0.3538	0.523	1514.775	2.926	6822.783	1.177	3781.255	1.177	3781.255
0.9000	0.3980	0.544	1518.957	2.820	6355.776	1.090	3364.148	1.090	3364.148
1.0000	0.4422	0.563	1519.090	2.728	5968.088	1.016	3023.750	1.016	3023.750
1.1000	0.4864	0.579	1516.681	2.648	5641.434	0.952	2741.979	0.952	2741.979
1.2000	0.5306	0.594	1512.692	2.576	5362.596	0.897	2505.793	0.897	2505.793
1.3000	0.5749	0.607	1507.743	2.513	5121.816	0.849	2305.600	0.849	2305.600
1.4000	0.6191	0.619	1502.240	2.455	4911.763	0.806	2134.218	0.806	2134.218
1.5000	0.6633	0.630	1496.450	2.403	4726.837	0.768	1986.182	0.768	1986.182
1.6000	0.7075	0.640	1490.548	2.355	4562.698	0.735	1857.274	0.735	1857.274
1.7000	0.7517	0.649	1484.651	2.311	4415.936	0.704	1744.197	0.704	1744.197
1.8000	0.7960	0.658	1478.834	2.271	4283.840	0.677	1644.343	0.677	1644.343
1.9000	0.8402	0.665	1473.146	2.233	4164.230	0.652	1555.625	0.652	1555.625
2.0000	0.8844	0.673	1467.617	2.198	4055.335	0.629	1476.360	0.629	1476.360
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDARN02
Date and time : 01MAY98:17:10
Computation of ref. F: Simple mean, age 4 - 8
F-0.1 factor : 0.3789
F-max factor : 0.9523
F-0.1 reference F : 0.1675
F-max reference F : 0.4211
Recruitment : Single recruit

Figure 2.5.1. CPUE (t/day) by various Faroese fleet categories in the Faroe grounds.







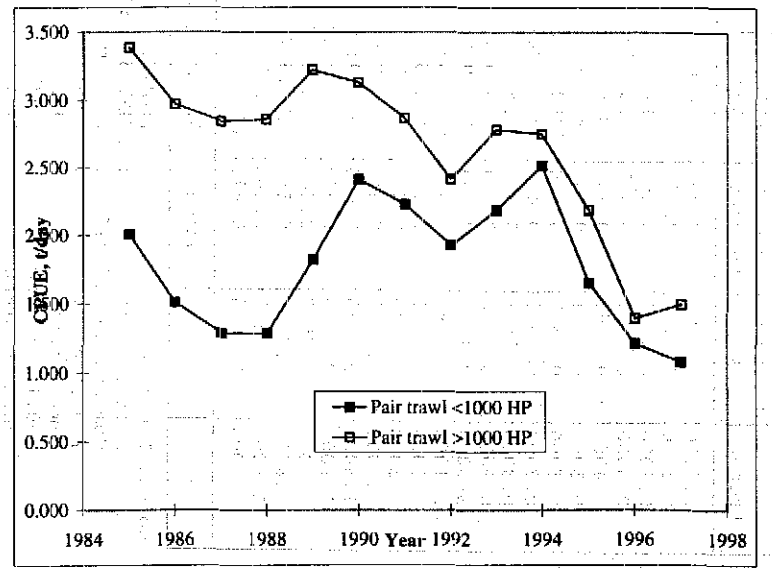


Figure 2.5.2. Saithe in the Faroes Grounds. Mean weight (kg) at age in the catches in the period 1991-1997.

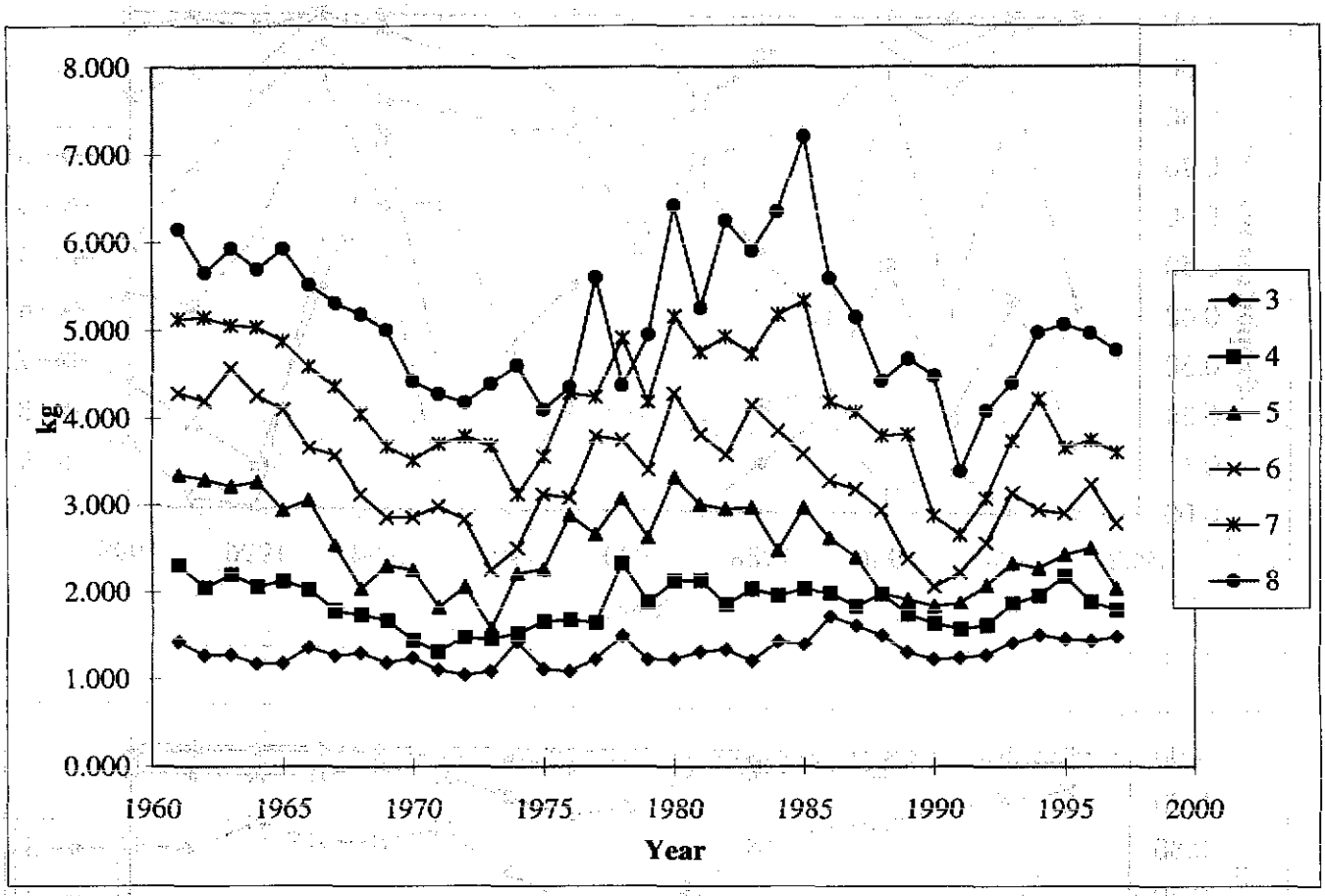
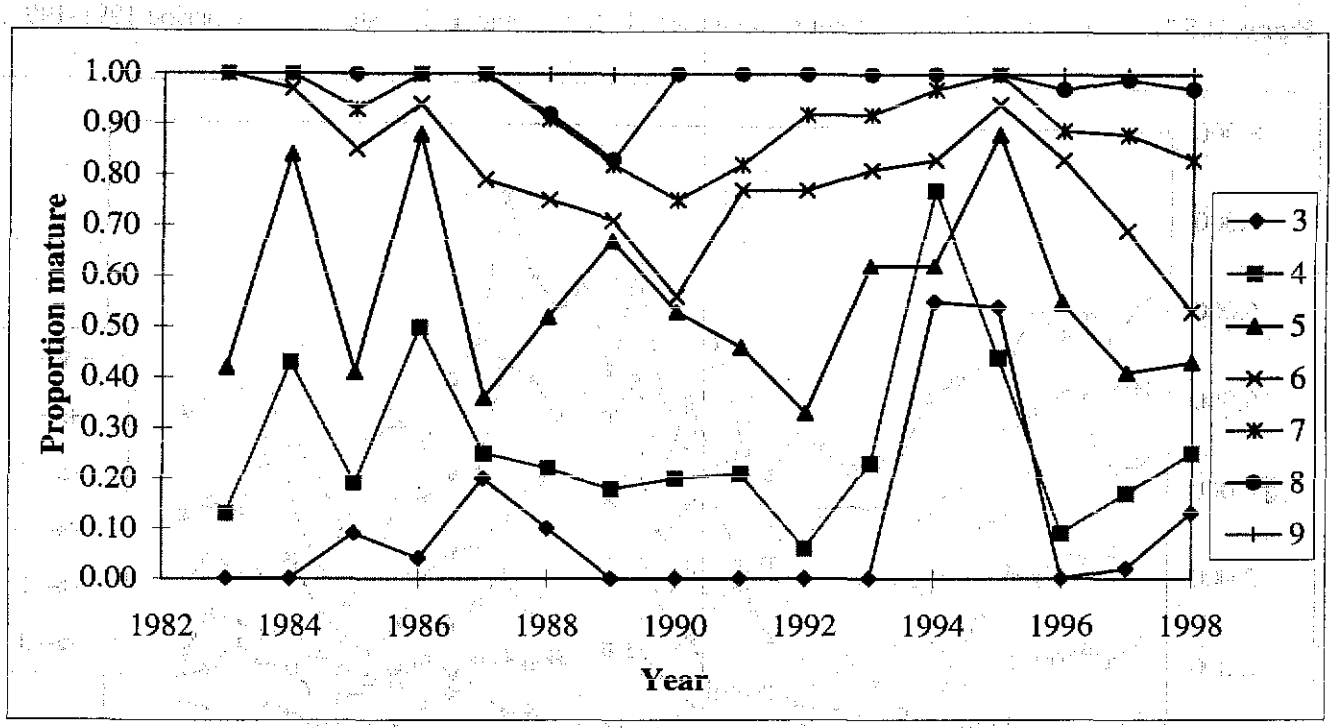


Figure 2.5.3. Saithe in the Faroes Grounds. Observed (upper panel) and fitted values (lower panel) proportion mature for the period 1983-1997.



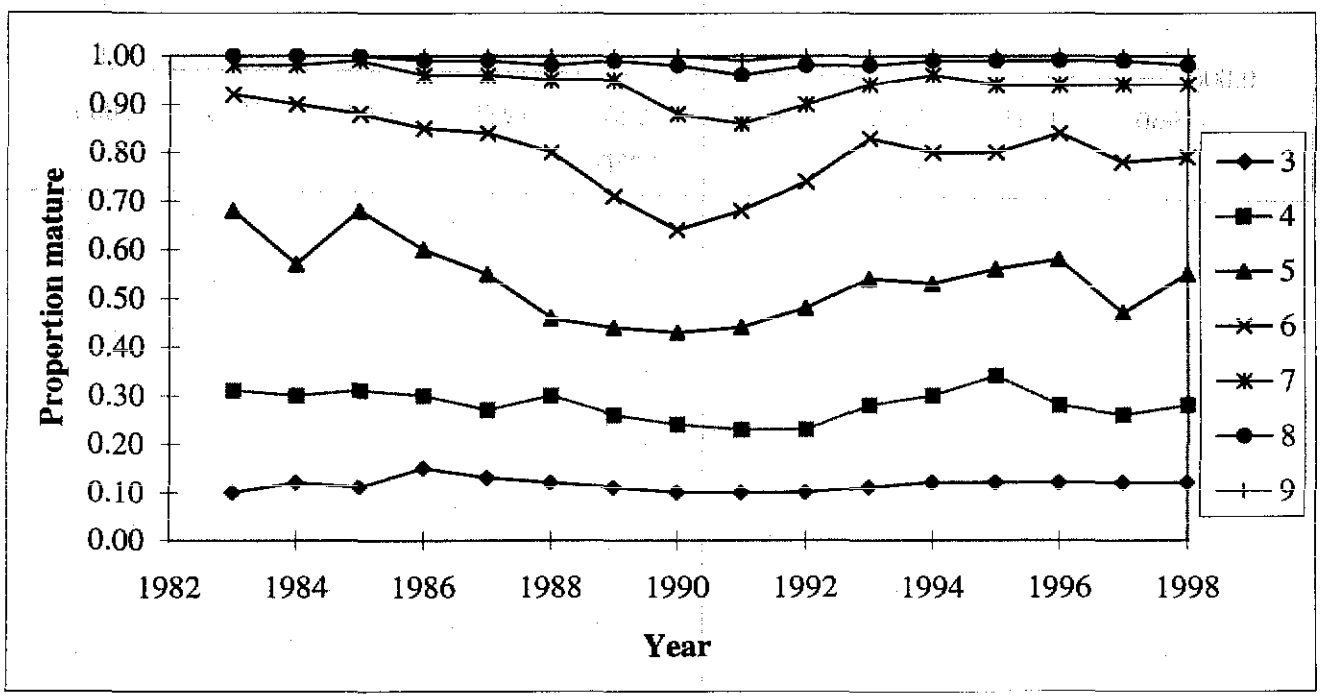


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Figure 2.5.4. Saithe in the Faroe Grounds. Log catchability residuals for age groups 4-11 yrs from XSA run. Tuning data from Cuba Beta series (effort unit: days).

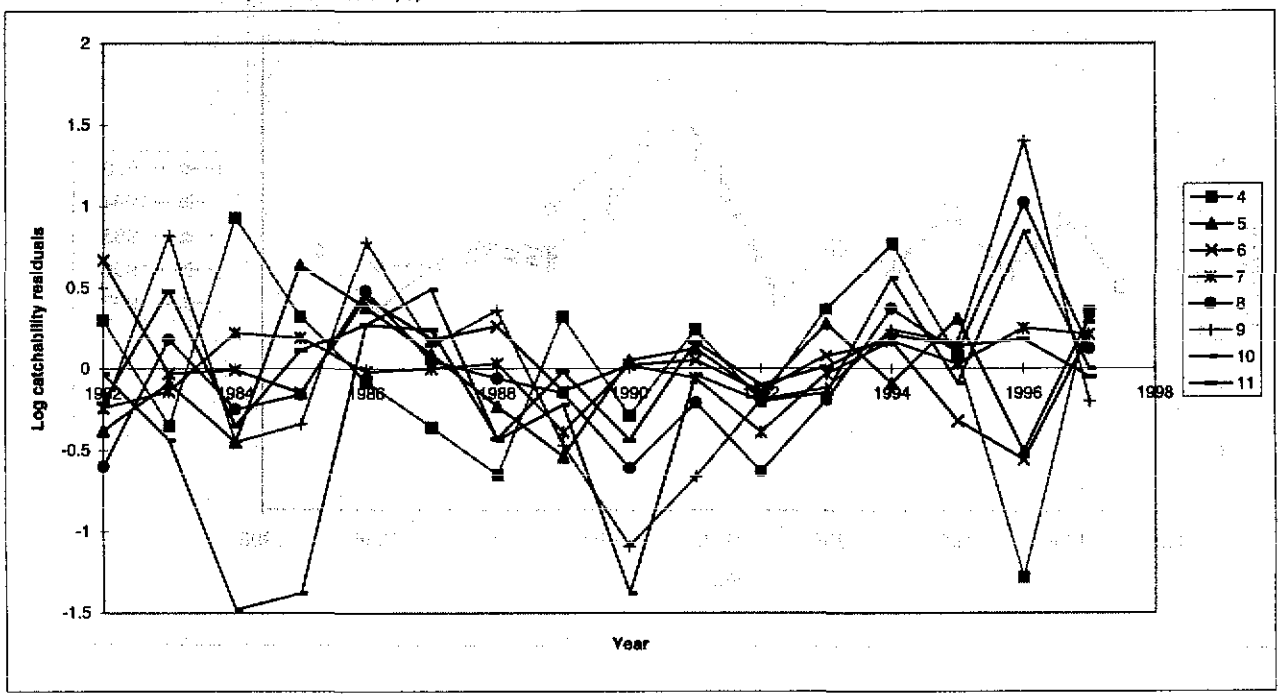

Figure 2.5.5. Saithe in the Faroe Grounds. Log catchability residuals for age groups 4-11 yrs from XSA run. Tuning data from Cuba Logbook series (effort unit: hours).

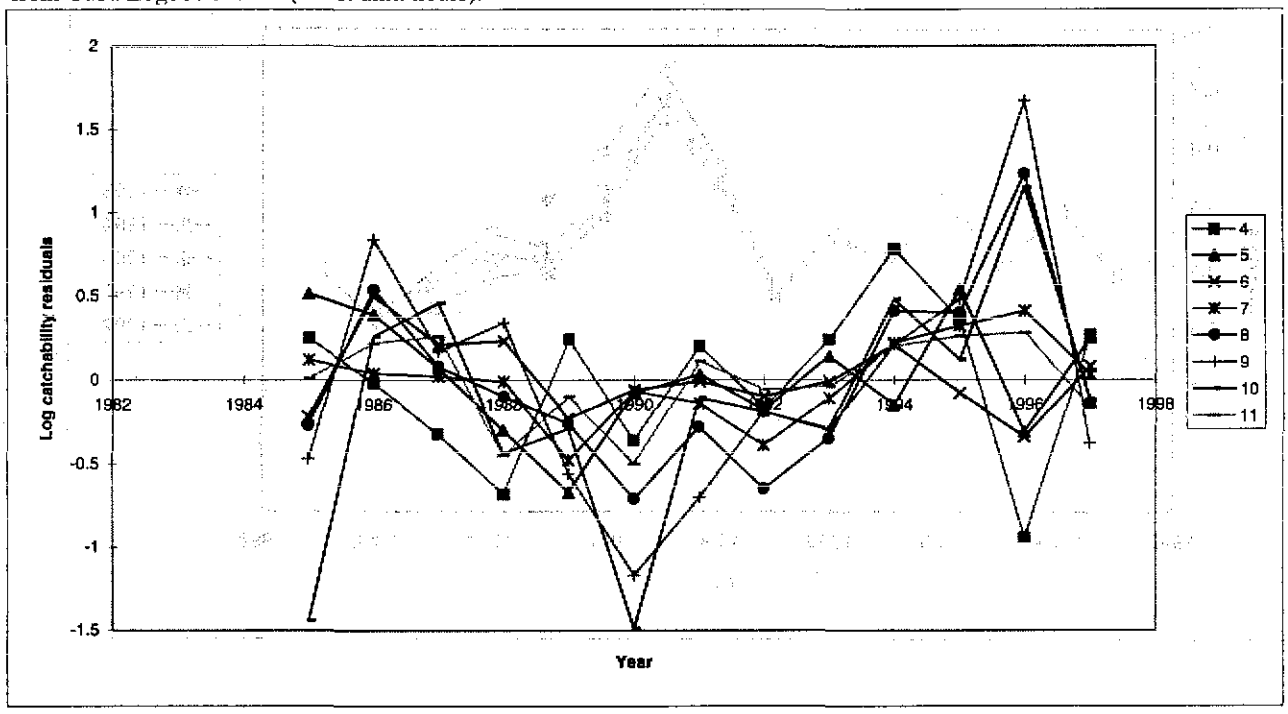

Figure 2.5.6a. Saithe in the Faroes Grounds. Retrospective analysis of average fishing mortality of age groups 4-8 yrs from XSA for 1993-97. Tuning data from the Cuba Beta series.

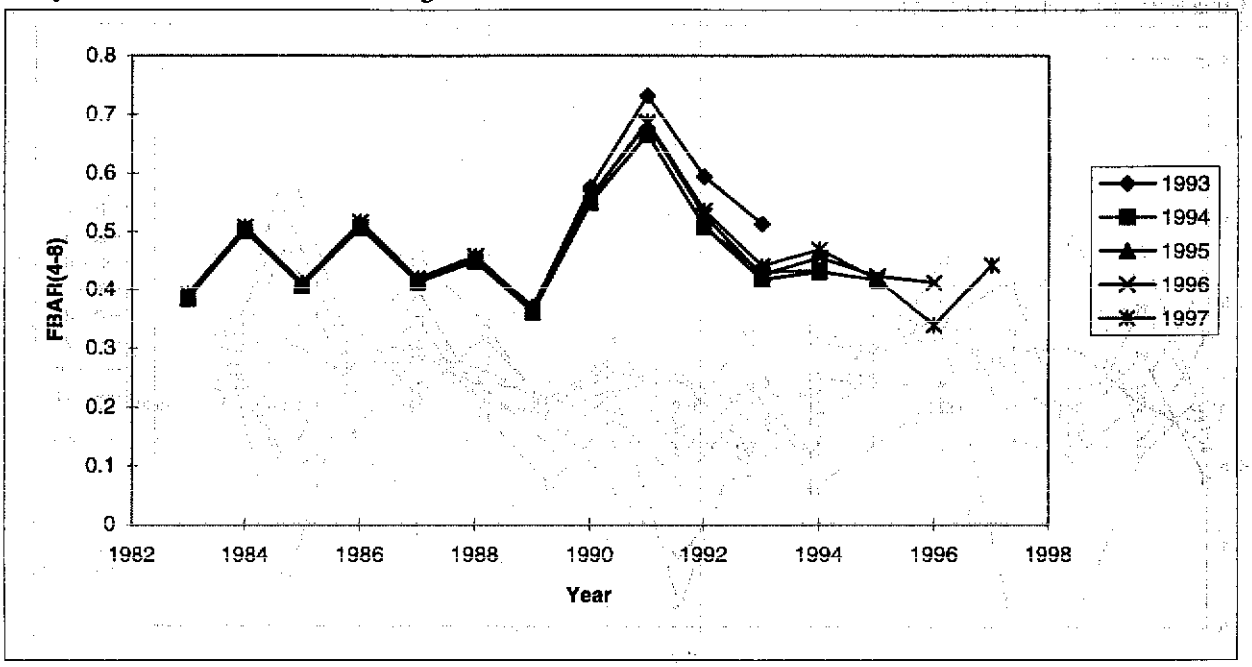

Figure 2.5.6b. Saithe in the Faroes Grounds. Retrospective analysis of average fishing mortality of age groups 4-8 yrs from XSA for 1993-97. Tuning data from the Cuba Logbooks series.

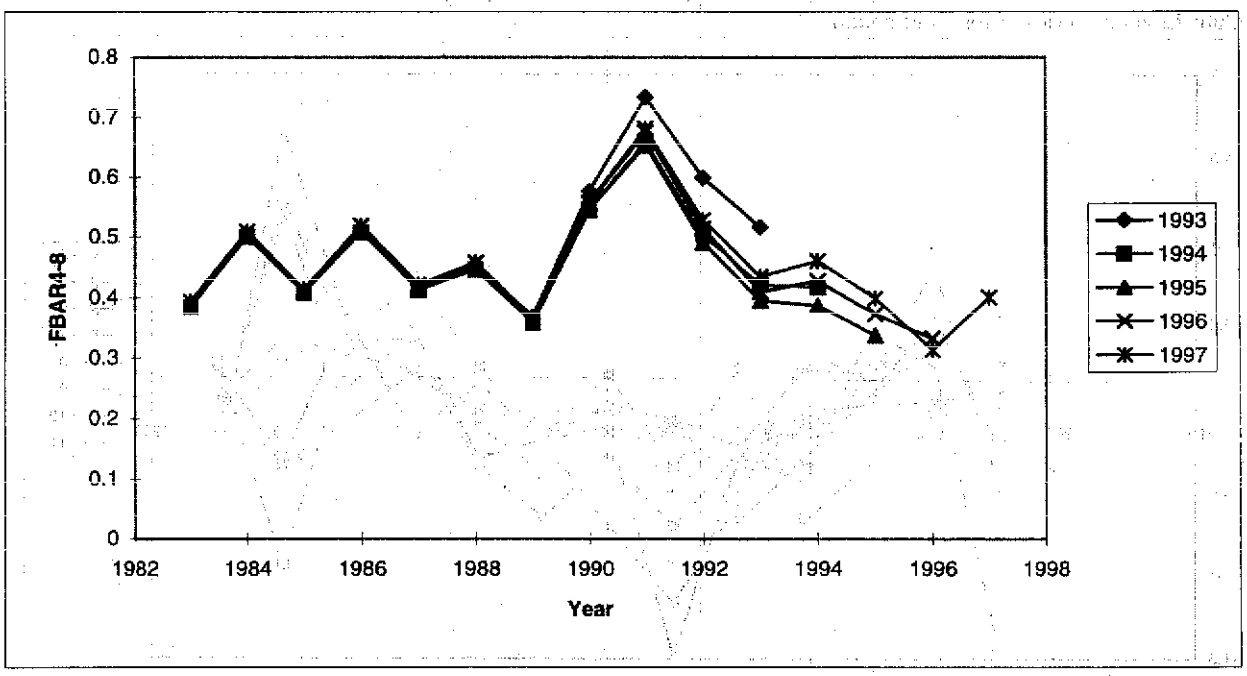

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Figure 2.5.7a. Saithe in the Faroes Grounds. Comparison of the two tuning series CPUE indices: Cuba Beta and Cuba Logbooks.

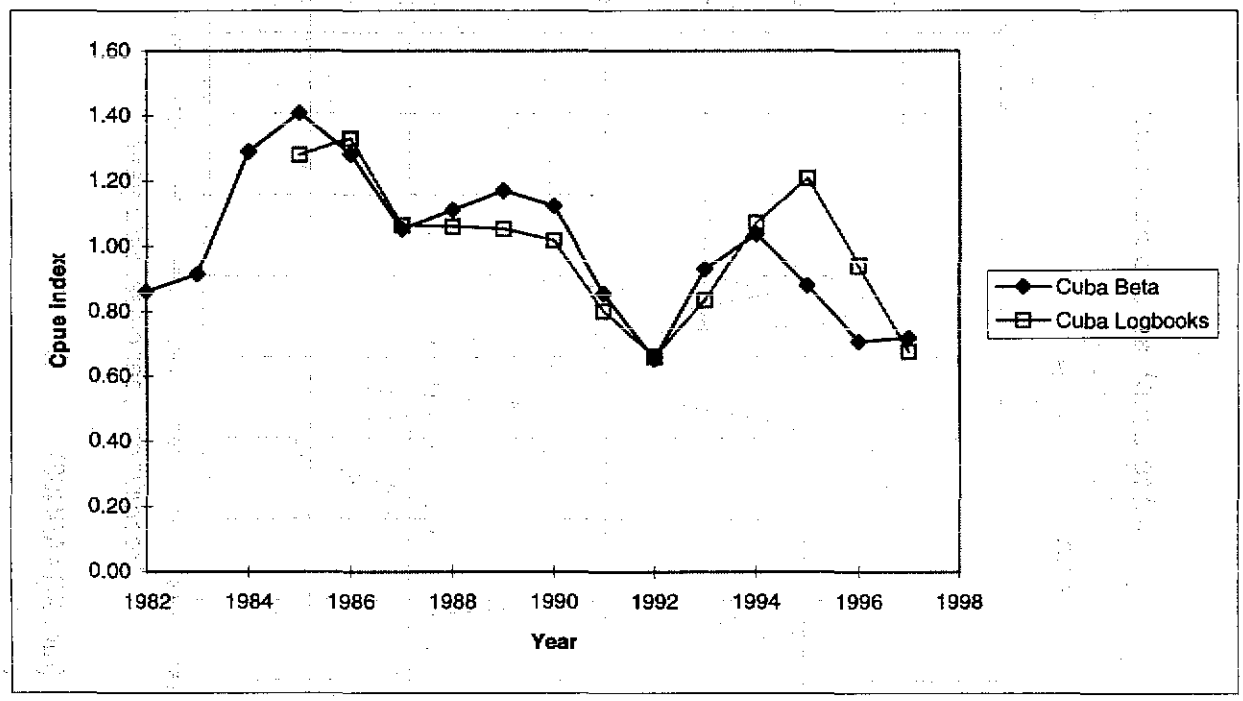


Figure 2.5.7b. Saithe in the Faroes Grounds. Comparison of the two tuning series effort indices: Cuba Beta and Cuba Logbooks.

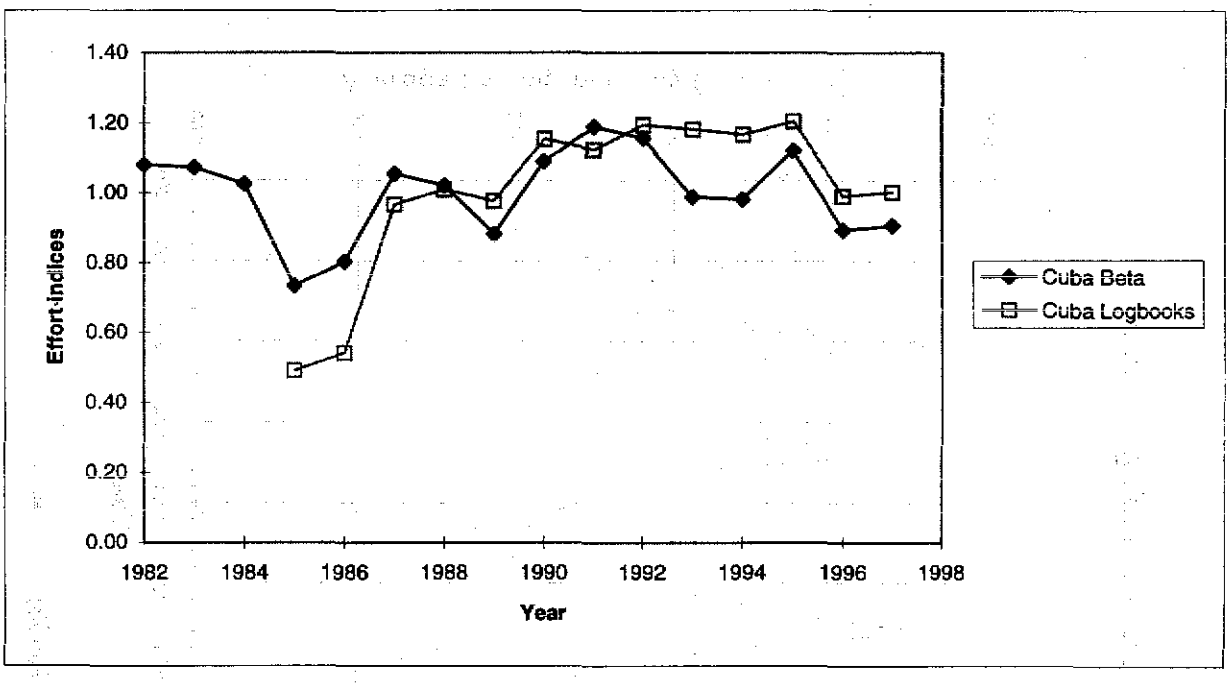
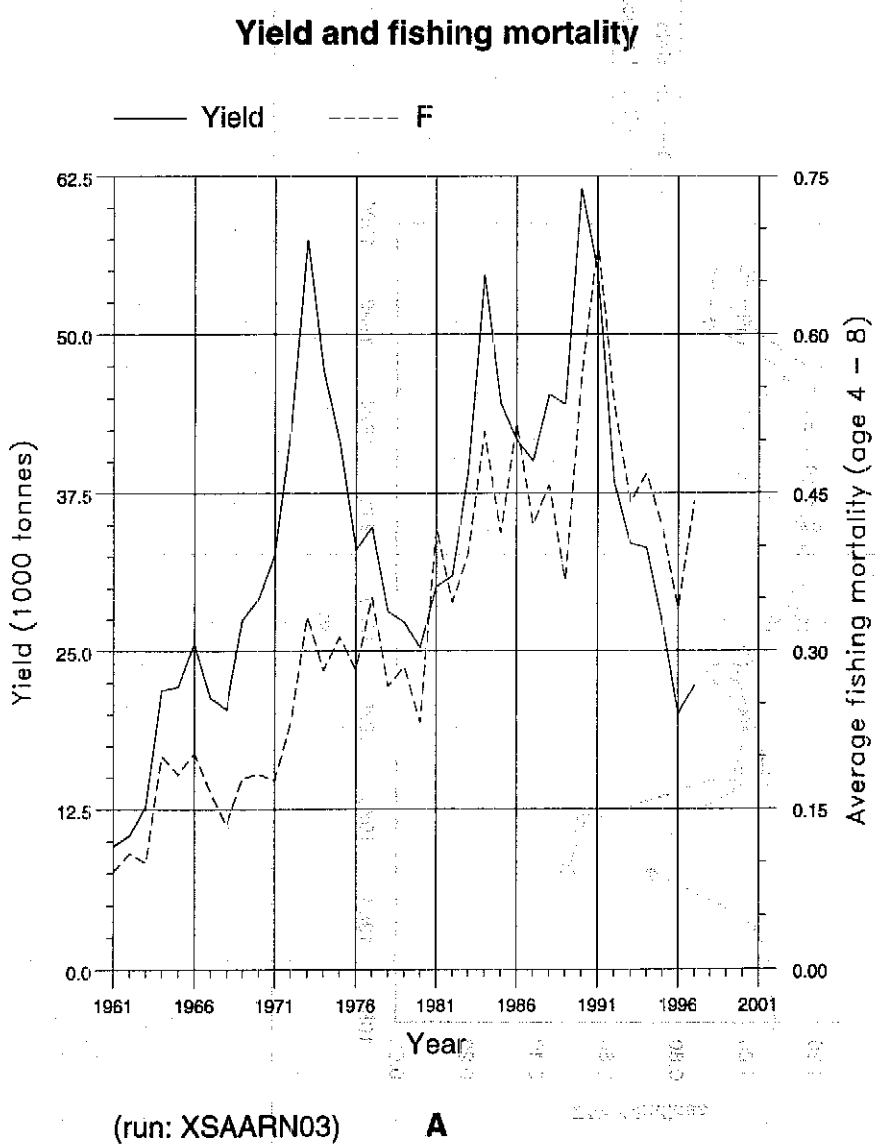


Figure 2.5.8 Saithe in the Faroes Ground. Fish stock summary. A: Yield and fishing mortality. B: Spawning stock and recruitment.



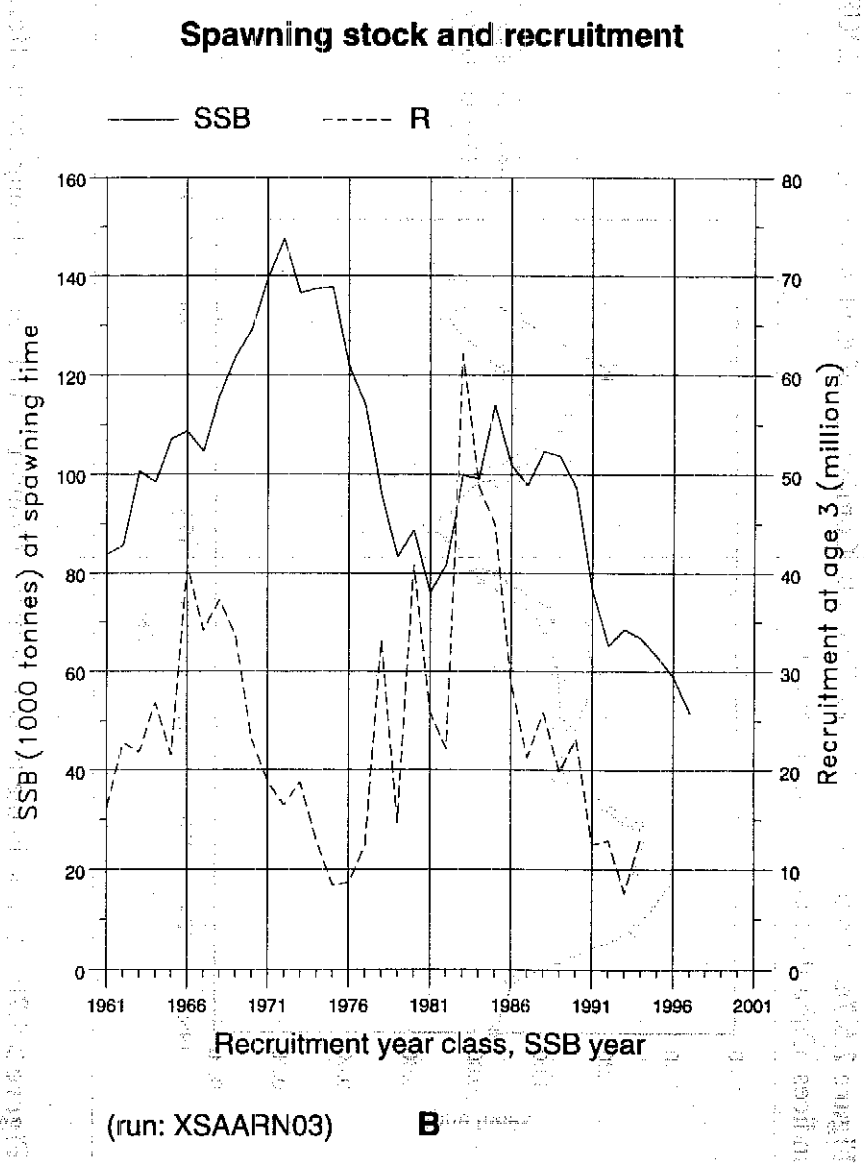
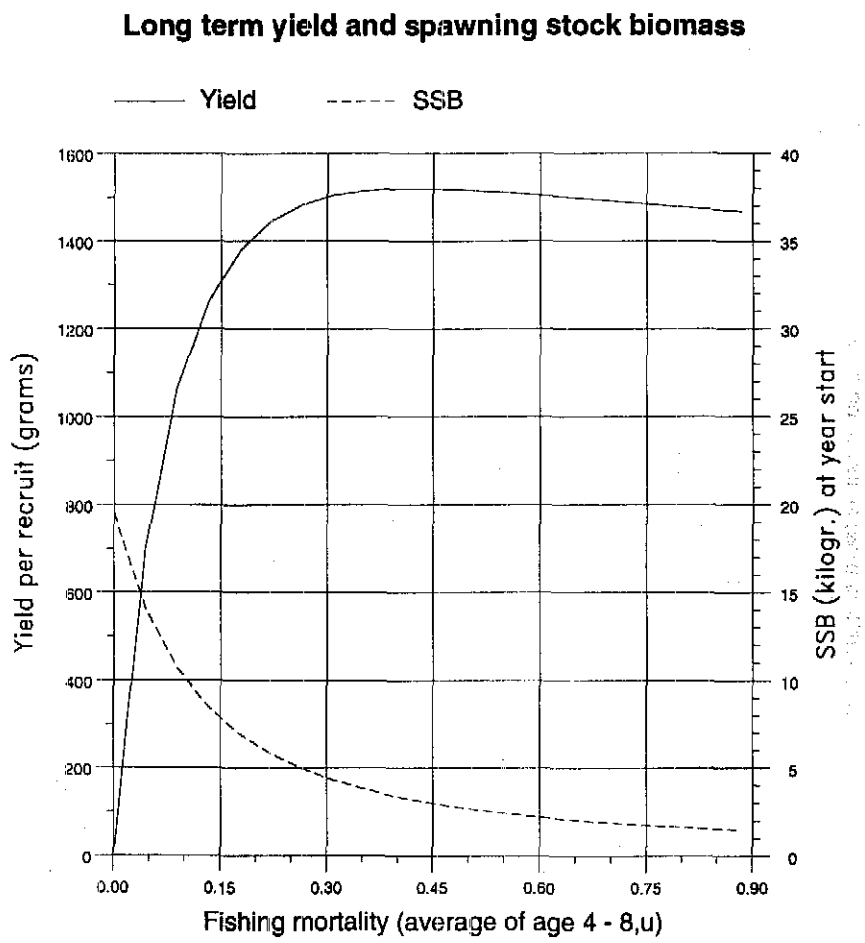
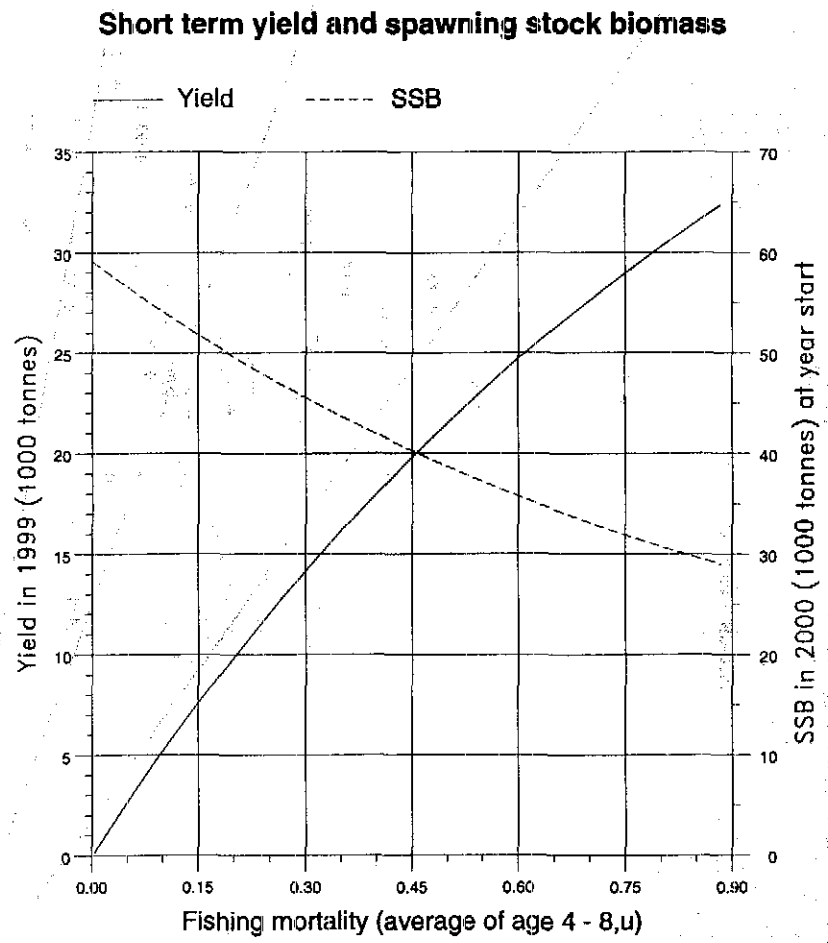


Figure 2.5.9 Saithe in the Faroes Ground. Fish stock summary. C: Short term yield and spawning stock biomass. D: Long term yield and spawning stock biomass.



(run: YLDARN02) **C**



(run: MANARN02) **D**

Figure 2.5.10. Saithe in the Faroes Grounds. Stock-recruitment relationship scatter plot with number for year class year at each point. R/SSB lines for F_{low}, F_{med} and F_{high} are shown with their respective F-values.

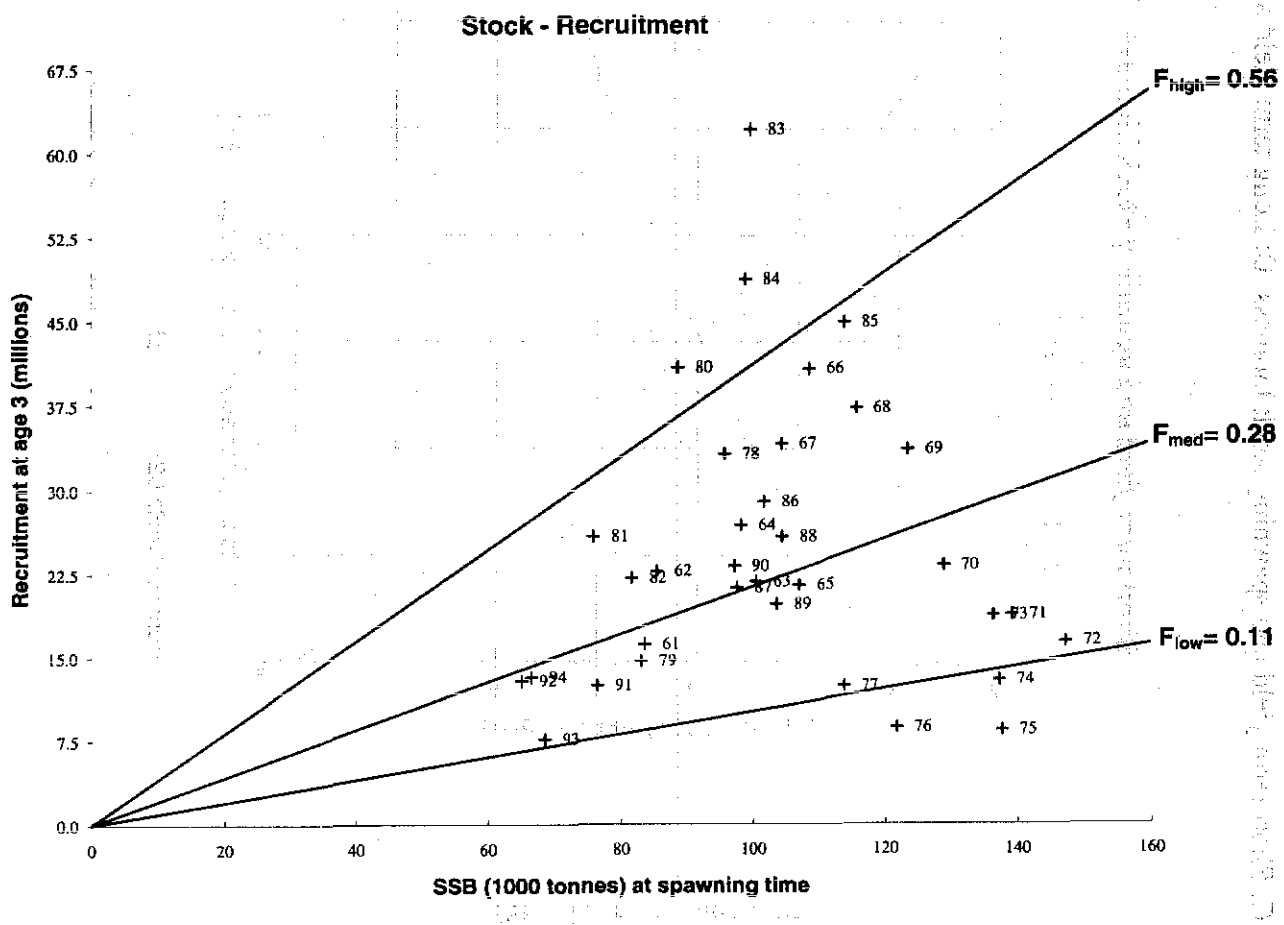


Figure 2.5.11. Saithe in the Faroes Grounds. Probability distribution of fishing mortalities (age 4-8 yrs).

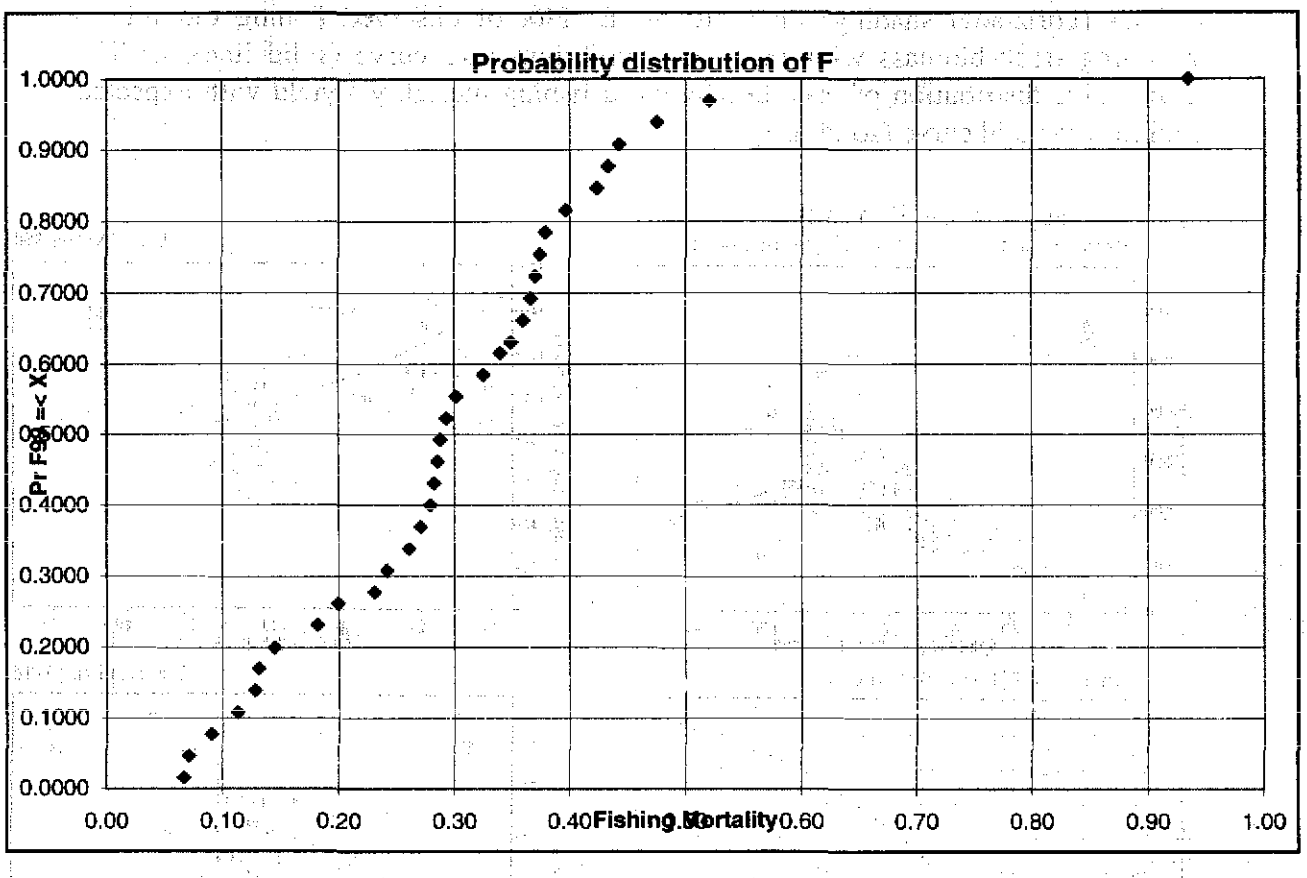


Figure 2.5.12 Saithe in the Faroes Grounds. Output from the Gloss programme. A: Stock - recruitment data with expected recruitment line and G_{loss} (vertical shading) and G_F (horizontal shading) distributions. B: Plot of observed fishing mortality - spawning stock biomass with expected equilibrium SSB curve (solid line). C: The Cumulative distribution of F_{loss}. D: Observed fishing mortality - yield with expected equilibrium yield curve (solid line).

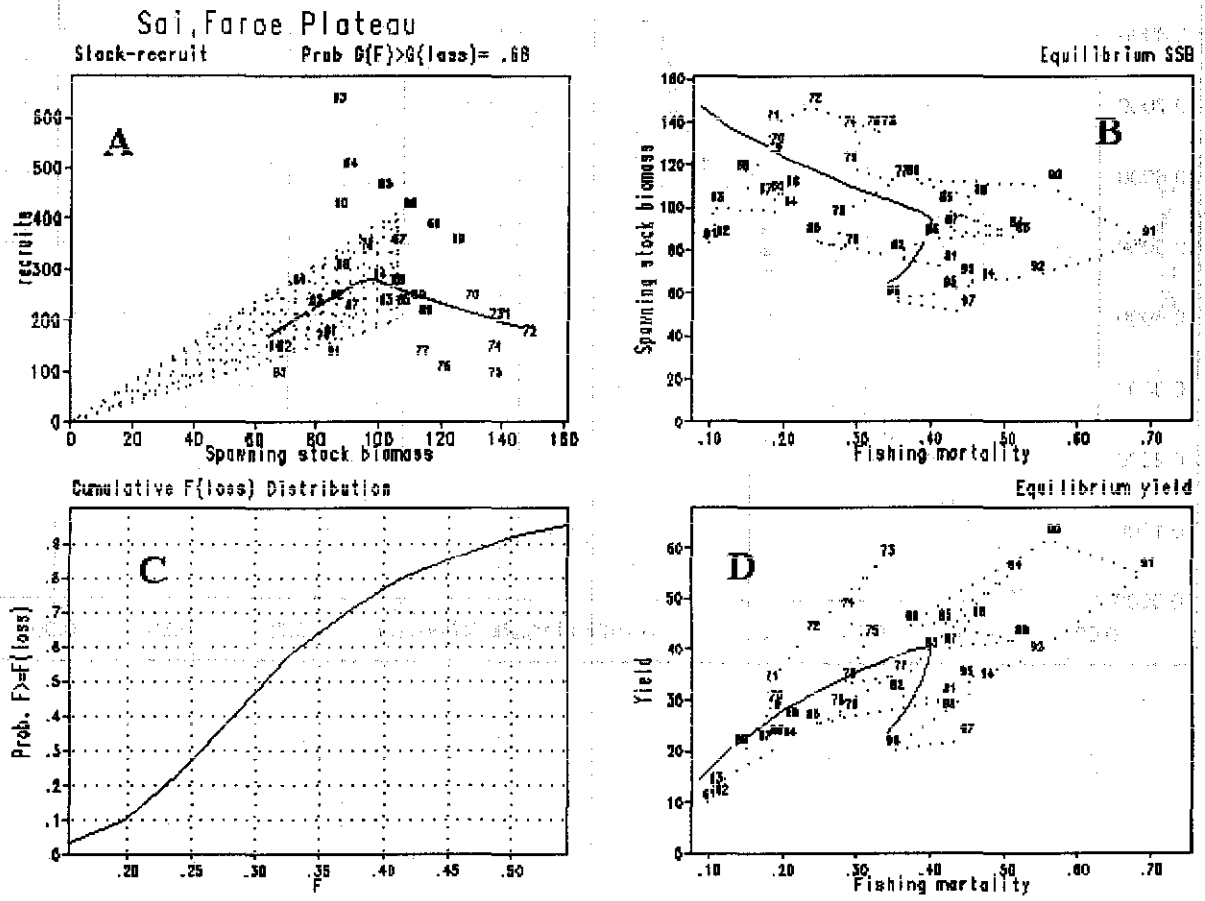
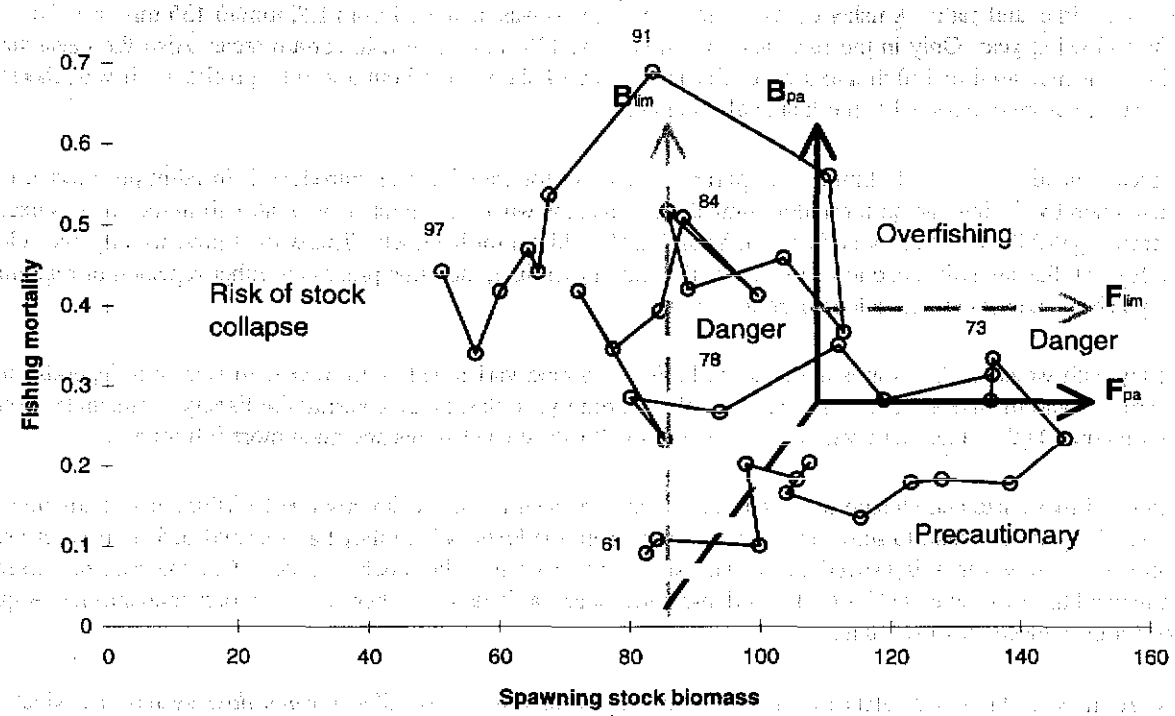


Figure 2.5.13. Saithe in the Faroes Grounds. Observed spawning stock biomas - fishing mortality point in relation to limit and precationary F and B reference points. The line travels through the points from 1961-97.



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 Saithe in Icelandic waters

3.2.1 Trends in landings

Saithe landings from Icelandic grounds (Division Va) fluctuated between 57,000 t and 69,000 t during the period 1982–1986 (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 1997. In 1997 preliminary reported landings for saithe in Division Va are 37,158 t (Table 3.2.1) close to the 37 000 t expected by the working group last year. Landings of 798 t reported by the Faroe Islands to Icelandic authorities were used in the working group estimate.

The Icelandic landings in the quota year September-August 1996/1997 amounted to about 37 000 t whereas the national TAC for the same period was 50 000 t. This can partly be explained by lower effort because of limiting quota in the cod fishery.

3.2.2 Fleets and fishing grounds

Approximately 67 % of the catches were taken by bottom trawl and 20 % in gillnets in 1997. The proportion of the catch taken by the main gear types was close to that observed in 1996, although the proportion caught in gillnets has decreased

while the bottom trawl catch proportion increased slightly. The proportion of catches taken in Danish seine has increased almost continuously since 1988 and constituted close to 5% of the total catch in 1997 (Figure 3.2.1).

Landings were reported from 114 vessels using bottom trawl in 1997. If only vessels with more than 50 t annual landings were considered the number of vessels was 73, constituting 97 % of the reported saithe bottom trawl landings. The size composition of these selected 73 vessels along with landings in each size class are shown in Figure 3.2.2.

Landings were reported from 106 vessels operating with gillnets in 1997. If only vessels with more than 10 t annual landings were considered the number of vessels were 56, constituting 97 % of the total saithe gillnet landings. The size composition of these selected 56 vessels along with landings in each size class are shown in Figure 3.2.3.

Fleet composition of both gillnet vessels and trawlers fishing saithe has been relatively stable since 1991 (Figure 3.2.4), although the proportion of the catch taken by the largest trawlers in 1997 increased slightly from 1995 and 1996. For gillnet vessels an opposite shift has taken place in the last two years, as shown by the increased proportion of landings taken by vessels in the 20-30 m category, at the cost of those 30-40 m long.

Landings from the bottom trawl fishery were highest in April and May in 1997 but in February and March from the gillnet fishery. The trawlers caught saithe fairly evenly over the year, landings each month more than 5% of total trawler catches, while the gillnet fishery has a more seasonal character, with a winter and autumn season (Figure 3.2.5).

The main fishing grounds of the bottom trawl fishery are southwest of Reykjanes and off the south east coast 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 1996 to account for revised total landings.

Data from bottom trawls, gillnets, and Danish seine (see text table below), which represented more than 92% of the Icelandic landings in 1997, 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 read	Length measurements
Bottom trawl	3626	15404
Gillnets	1195	3537
Danish seine	99	698
Total	4920	19639

Compared to last years prognosis higher proportions of age groups 4 and age groups older than 7 were observed in the 1997 landings and lower for other age groups. The difference between last years prognosis and the present estimate was less than 8% for all age groups (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 along with length distributions and length-weight relationships. The mean weights at age are computed for the same categories as the catch numbers at age and are then weighted together across the fleets. A general increase in mean weight at age was observed in 1997. Exceptions of note are age groups 5 and 13, the year classes from 1992 and 1984 (Figure 3.2.8 and Table 3.2.3). These weights at age where also used as weight at age in the stock.

3.2.5 Maturity at age in the landings

In 1997 a sharp increase in the proportion mature at age was observed for age groups 3 through 6, while in 1996 a sharp decrease 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 1980–1997 (Table 3.2.4 and 3.2.5 and Figure 3.2.9). The maturity at age prior to 1980 is derived from ICES C.M. 1979/G:6.

3.2.6 Stock Assessment

3.2.7 Tuning input

CPUE data, based on Icelandic trawler logbooks from 1970–1997 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).

3.2.8 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 1997 for age groups 4-9 from these runs was 0.21 using the trawler effort data, and 0.20 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" (Gudmundsson 1994).

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 filter.

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

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

Joint variations of all logF(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 logC(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 estimation can be based on this model and the basic equations of catch-at-age analysis without including any auxiliary data. But joint analysis with CPUE data can also be performed and is based on the model

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

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.

The present analysis is based on annual values from 1982–1997 and ages 4–11 years.

Results of such estimation are presented in Table 3.2.9A and B. The estimation in Table 3.2.9A was carried out without a trend term, but in Table 3.2.9B an annual trend of 0,030 in logF was estimated. The standard deviation of this value was 0.020 so that it is not significantly different from zero. But the difference between the results presented in the two tables shows that the uncertainty about the trend amounts to a great uncertainty about stock size and fishing mortality rates in the final year.

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 bigger variability was assigned to the measurement errors. The estimated model for joint variations, (V(t) in the model above), was random walk with an annual random element with standard deviation 0.06. This was little affected by the trend estimate. No permanent variation in the pattern of selectivity was detected.

Deterministic trends are unsatisfactory elements in time series models unless there is auxiliary evidence that they should be there. There is no such evidence here. The estimated standard deviations of F's in the last year are high. They only represent the uncertainty due to the random elements in the data but not model uncertainty and thus underestimate the actual uncertainty. The retrospective analyses confirm that the accuracy is low. The discrepancies revealed by the retrospective analyses are larger when the trend is included.

According to the time series analysis the CPUE data do not contain much information about the stocks and fishing mortality beyond what is contained in the catch-at-age data. Results from joint estimation with CPUE indices for 5-7 years age from trawlers in June-December are given in Table 3.2.9C and Table 3.2.9D. Both estimated values and standard deviations are practically the same as were obtained by the catch-at-age data alone.

There is no evidence of permanent variations in catchability in this data set, but joint transitory variations are fairly large with an estimated standard deviation of 0.26 on an ln-scale. The standard deviations of individual CPUE values are estimated at 0.44 on this scale.

The resulting reference F's from the TSA runs vary from 0.34 (both catch at age only and including CPUE data, with trend) to 0.46 (catch at age data and CPUE 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 3.2.10). As in previous years assessments the TSA-runs seem to be more consistent than the XSA-runs. From the TSA–runs, the analysis of catch at age data only, with no 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 1.19 which corresponds to the average underestimation in the last three years according to retrospective analysis. The same approach was used by the WG last year, when a raising factor of 1.32 from the retrospective pattern was used.

The raised terminal fishing mortalities from the TSA were used to run a traditional VPA , where the F's for the age groups 8–14 were taken as the mean of age groups 8–11 in the TSA. 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 3.2.11.A and 3.2.11.B.

3.2.8.1 Spawning stock and recruitment

The spawning stock biomass is shown in Figure 3.2.11.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 of about 90 000 t in 1996, which is the lowest recorded level. The estimated spawning stock biomass in the beginning of 1998 is only 93 000 t.

Estimates of recruitment at age 3 are plotted in Figure 3.2.11.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 108 million recruits. All year classes after 1985 are well below average. Since no information is available for the more recent year classes, the 1993–1996 year classes were set at the rounded average for the 1985–1991 year classes, i.e. at 25 million recruits.

3.2.9 Prediction of catch and biomass

3.2.9.1 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. Regression analysis showed significant relationships for the age groups 4 - 9, mean weights at age for other age groups were averaged over the three most recent years, excluding the strong 1984 year class as it had much lower weight at age than average.

For 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 1980–1997 were used. The rounded average of the 1985–1992 year class strengths was used as recruitment.

For long-term yield and spawning stock biomass per recruit, the exploitation pattern was taken as the average of fishing mortalities during 1980–1997 from the standard VPA run. Averages over 1980–1997 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).

3.2.9.2 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 1997 fishing mortality level of $F_{4-9} = 0.37$, 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 stock recruitment relationship, and Figure 3.2.11.C, showing the spawning stock biomass-per-recruit relationship, $F_{med} = 0.22$ and $F_{high} = 0.79$ were estimated.

The stock-recruitment scatter plot (Figure 3.2.12) does not provide a basis do define MBAL since the recruitment seems to be higher at the lower end of the SSB range. By fitting a Ricker curve to the R vs. SSB scatter for the years 1962–1992 (α 0.59, K 185000) and studying SSB/R and Y/R, the reference Fs, given in the text table below, were found:

Type of F	F-value	SSB/R	Y/R
F_{low}	0.03	13.3	0.6
$F_{0.1}$	0.18	6.8	1.6
F_{med}	0.22	6.0	1.7
$F_{MSY\ (at\ SSB/R=e/\alpha)}$	0.31	4.6	1.8
F_{97}	0.37	4.1	1.8
F_{max}	0.43	3.5	1.8
$F_{lim\ (SGPAFM\ proposal)}$	0.47	3.2	1.8
F_{high}	0.79	2.1	1.7

If F_{pa} is to be interpreted as an upper bound on fishing mortality while at low SSB levels, setting F_{pa} at the F_{med} value of 0.24 (now revised to 0.22) as proposed by the ACFM study group on the precautionary approach to fishery management (SGPAFM) appears too conservative (ICES C. M. 1998/ACFM:10). Reference F values have been at or above F_{med} for the whole time series in the assessment (one exception). The long term average F_{4-9} is 0.32 (close to F_{MSY}). Therefore the WG suggests that the SGPAFM changes the F_{pa} from F_{med} to F_{MSY} ($\approx$0.3), but keep F_{lim} unchanged at 0.47.

B_{pa} of 150 000 t as suggested by GPAFM seems reasonable and was accepted by the working group.

3.2.9.3 Projections of catch and biomass

Based on the input data given in Table 3.2.13, options for 1999 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), total catch in 1998 is assumed 30 000 t which is the most likely result of unchanged TAC of 30 000 t for the 1998/99 quota year. The resulting stock size in the beginning of 1999 will be about 207 000 t which is a little higher than in the beginning of 1999 (190 000 t). The spawning stock biomass in the beginning of 1999 will also show a slight increase as compared to 1998, i.e. about 97 000 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 at the lowest level observed and will remain at a low level in coming years, even at very low fishing mortalities, unless an increase in recruitment occurs.

3.2.10 Management considerations

The stock was overestimated until the 1997 assessment, and is at the lowest observed level at present, but shows signs of a slow recovery. Recruitment in recent years (the 1986 and more recent year classes) has been below the long term average.

3.2.11 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, 1982-1997, as officially reported to ICES.

Country	1982	1983	1984	1985	1986	1987	1988	1989
Belgium	201	224	269	158	218	217	268	369
Faroe Islands	3,582	2,138	2,044	1,778	783	2,139	2,596	2,246
France	23	-	-	-	-	-	-	-
Iceland	65,124	55,904	60,406	55,135	63,867	78,175	74,383	79,810
Norway	1	+	-	1	-	-	-	-
UK (Engl. and Wales)	-	-	-	29	-	-	-	-
Total	68,615	58,266	62,719	57,101	64,869	80,531	77,247	82,425
WG estimate	68,931	-	-	-	66,376[2)]	80,559	-	-

Country	1990	1991	1992	1993	1994	1995	1996	1997[1)]
Belgium	190	236	195	104	30	-	-	-
Faroe Islands	2,905	2,690	1,570	1,562	975	1,161	801	716
France	-	-	-	-	-	-	-	-
Germany	-	-	-	-	-	-	1	-
Iceland	95,032	99,390	77,832	69,982	63,333	47,466	39,297	36,360
Norway	-	-	-	-	-	1	-	-
UK (Engl. and Wales)	-	-	-	-	-	-	-	-
Total	98,127	102,316	79,597	71,648	64,338	48,628	40,099	37,076
WG estimate	98,130	102,737[3)]	-	-	-	48,650	-	37,158[4)]

1) Provisional
2) Additional catch of 1,508 t by Faroe Islands included
3) Additional catch of 451 t by Iceland included
4) Additional catch of 82 t by Faroe Islands included

Table 3.2.2. Saithe in division Va. Catch in numbers 1978-1997.

Run title : Saithe Iceland Va (run: XSASTJ01/X01)

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

YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE										
3	548	480	275	203	508	107	53	376	3108	956
4	1145	3764	2540	1325	1092	1750	657	4014	1400	5135
5	2435	1991	5214	3503	2804	1065	800	3366	4170	4428
6	1556	3616	2596	5404	4845	2455	1825	1958	2665	5409
7	1275	1566	2169	1457	4293	4454	2184	1536	1550	2915
8	961	718	1341	1415	1215	2311	3610	1172	1116	1348
9	537	292	387	578	975	501	844	747	628	661
10	575	669	262	242	306	251	376	479	1549	496
11	476	589	155	61	59	38	291	74	216	498
12	279	489	112	154	35	12	135	23	51	58
+gp	285	222	155	404	193	180	601	434	139	97
0 TOTALNUM	10072	14396	15206	14746	16325	13124	11376	14179	16592	22001
TONSLAND	49672	63504	58347	58986	68615	58266	62719	57101	66376	80559
SOPCOF %	97	98	100	99	99	99	100	99	100	100

YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
AGE										
3	1318	315	143	198	242	657	702	1573	2118	603
4	5067	4313	1692	874	2928	1083	2955	1853	3465	2960
5	6619	8471	5471	3613	3844	2841	1770	2661	2327	2766
6	3678	7309	10112	6844	4355	2252	2603	1807	1838	1651
7	2859	1794	6174	10772	3884	2247	1377	2370	814	1178
8	1775	1928	1816	3223	4046	2314	1243	905	1129	599
9	845	848	1087	858	1290	3671	1263	574	321	454
10	226	270	380	838	350	830	2009	482	209	125
11	270	191	151	228	196	223	454	521	144	95
12	107	135	55	40	56	188	158	106	168	114
+gp	26	94	155	53	70	94	321	65	148	161
0 TOTALNUM	22790	25668	27236	27541	21261	16400	14855	12917	12681	10706
TONSLAND	77247	82425	98130	102737	79597	71648	64338	48650	40099	37158
SOPCOF %	100	100	100	100	100	100	100	100	100	100

Table 3.2.3. Saithe in Division Va. Mean weight (kg) at age in the catches 1978-1997.

Run title : Saithe Iceland Va (run: XSASTJ01/X01)

At 2-May-98 17:49:43

Table 2 Catch weights at age (kg)

YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE										
3	1.12	1.12	1.428	1.585	1.547	1.53	1.653	1.609	1.45	1.516
4	1.76	1.76	1.983	2.037	2.194	2.221	2.432	2.172	2.19	1.715
5	2.73	2.73	2.667	2.696	3.015	3.171	3.33	3.169	2.959	2.67
6	4.29	4.29	3.689	3.525	3.183	4.27	4.681	3.922	4.402	3.839
7	5.54	5.54	5.409	4.541	5.114	4.107	5.466	4.697	5.488	5.081
8	7.27	7.27	6.321	6.247	6.202	5.984	4.973	6.411	6.406	6.185
9	8.42	8.42	7.213	6.991	7.256	7.565	7.407	6.492	7.57	7.33
10	9.41	9.41	8.565	8.202	7.922	8.673	8.179	8.346	6.487	8.025
11	10	10	9.147	9.537	8.924	8.801	8.77	9.401	9.616	7.974
12	10.56	10.56	9.617	9.089	10.134	9.039	8.831	10.335	10.462	9.615
+gp	12.68	12.275	11.371	10.902	11.529	12.909	11.683	12.287	12.619	12.125
0 SOPCOFAC	0.9691	0.984	0.9989	0.9933	0.9922	0.9915	0.9975	0.9929	0.9987	1.0005

YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
AGE										
3	1.261	1.403	1.647	1.224	1.269	1.381	1.444	1.37	1.21	1.325
4	2.017	2.021	1.983	1.939	1.909	2.143	1.836	1.977	1.745	1.936
5	2.513	2.194	2.566	2.432	2.578	2.742	2.649	2.769	2.684	2.409
6	3.476	3.047	3.021	3.16	3.288	3.636	3.512	3.722	3.741	3.906
7	4.719	4.505	4.077	3.634	4.15	4.398	4.906	4.621	4.85	5.032
8	5.932	5.889	5.744	4.967	4.865	5.421	5.539	5.854	5.62	6.171
9	7.523	7.172	7.038	6.629	6.168	5.319	6.818	6.416	6.966	7.202
10	8.439	8.852	7.564	7.704	7.926	7.006	6.374	7.356	7.43	7.883
11	8.748	10.17	8.854	9.061	8.349	8.07	8.341	6.815	8.884	8.856
12	9.559	10.392	10.645	9.117	9.029	10.048	9.77	8.312	8.025	9.649
+gp	11.034	12.499	11.975	12.608	11.143	9.465	11.107	10.692	11.235	10.817
0 SOPCOFAC	0.9999	0.9998	1.0005	0.9999	1.0002	1.0013	1.0018	1.0027	0.9999	0.9988

Table 3.2.4. Saithe in Division Va. Maturity at age, data and fitted values 1980-1997

Fitted:

Year/age	3	4	5	6	7	8	9
1980	0.11	0.16	0.33	0.64	0.78	0.90	0.96
1981	0.13	0.23	0.30	0.53	0.81	0.89	0.96
1982	0.12	0.26	0.41	0.50	0.72	0.91	0.95
1983	0.11	0.25	0.45	0.62	0.70	0.86	0.96
1984	0.08	0.22	0.44	0.66	0.79	0.85	0.93
1985	0.10	0.17	0.39	0.64	0.82	0.90	0.93
1986	0.06	0.21	0.33	0.60	0.81	0.91	0.95
1987	0.03	0.12	0.38	0.54	0.78	0.91	0.96
1988	0.08	0.07	0.24	0.59	0.73	0.89	0.96
1989	0.11	0.16	0.15	0.43	0.77	0.86	0.95
1990	0.13	0.22	0.31	0.29	0.63	0.89	0.94
1991	0.12	0.26	0.40	0.51	0.49	0.80	0.95
1992	0.14	0.24	0.45	0.61	0.71	0.69	0.90
1993	0.13	0.28	0.42	0.65	0.79	0.85	0.84
1994	0.13	0.26	0.48	0.63	0.81	0.90	0.93
1995	0.12	0.26	0.45	0.68	0.80	0.91	0.95
1996	0.12	0.24	0.45	0.66	0.83	0.90	0.96
1997	0.12	0.24	0.42	0.66	0.82	0.92	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	0.83	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
1997	0.32	0.73	0.68	0.95	1.00	0.99	0.98

Table 3.2.5. Saithe in Division Va. Proportion mature at age 1978-1997.

Run title : Saithe Iceland Va (run: XSASTJ01/X01)

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Table 5 Proportion mature at age

YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE										
3	0	0	0.12	0.13	0.13	0.11	0.08	0.1	0.06	0.03
4	0.06	0.06	0.16	0.23	0.26	0.25	0.22	0.18	0.21	0.12
5	0.27	0.27	0.33	0.31	0.41	0.45	0.44	0.39	0.33	0.39
6	0.63	0.63	0.63	0.53	0.51	0.62	0.66	0.65	0.6	0.54
7	0.81	0.81	0.78	0.81	0.73	0.71	0.79	0.82	0.81	0.78
8	0.97	0.97	0.9	0.89	0.91	0.86	0.85	0.9	0.91	0.91
9	1	1	0.96	0.96	0.95	0.96	0.94	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
+gp	1	1	1	1	1	1	1	1	1	1

YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
AGE										
3	0.07	0.11	0.13	0.12	0.14	0.13	0.13	0.11	0.12	0.12
4	0.07	0.16	0.22	0.26	0.24	0.28	0.26	0.27	0.23	0.24
5	0.24	0.15	0.3	0.4	0.44	0.42	0.47	0.45	0.46	0.41
6	0.59	0.43	0.29	0.5	0.61	0.65	0.63	0.67	0.65	0.66
7	0.73	0.77	0.63	0.49	0.7	0.78	0.81	0.8	0.83	0.82
8	0.89	0.86	0.89	0.8	0.69	0.85	0.89	0.91	0.9	0.92
9	0.96	0.95	0.94	0.95	0.9	0.84	0.93	0.95	0.96	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
+gp	1	1	1	1	1	1	1	1	1	1

Table 3.2.6. Saithe in Division Va. 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	66
1997	20	464	2301	2048	956	811	404	275	71	56	74	106

Trawlers age disaggregated CPUE in Jan.-May and June-Dec.

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	0.0628	0.0426	0.0469	0.0235	0.0336	0.0070	0.0047	0.0023
97	100	0.0930	0.0417	0.0401	0.0613	0.0321	0.0208	0.0052	0.0032

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	0.0936	0.1121	0.0856	0.0543	0.0097	0.0110	0.0026	0.0013	0.0004	0.0009
97	100	0.0226	0.0794	0.0400	0.0379	0.0462	0.0245	0.0113	0.0026	0.0009	0.0012

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
97	100	0.2653	0.4976	0.2005	0.1112	0.1198	0.0379	0.0257	0.0208

Table 3.2.7. Saithe in Division Va. XSA tuning results using fleet 04: Trawlers Effort.

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Lowestoft VPA Version 3.1

   2-May-98  17:48:33

Extended Survivors Analysis

Saithe Iceland Va (run: XSASTJ01/X01)

CPUE data from file /users/fish/ifad/ifapwork/nwwg/sai_icel/FLEET.X01

Catch data for  22 years. 1976 to 1997. Ages  3 to  13.

     Fleet,                First, Last, First, Last, Alpha,  Beta
                 ,          year, year,  age ,  age
FLT04: TRW EFFORT (C,       1980, 1997,   3,    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   39 iterations

1


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


Fishing mortalities
   Age,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996,  1997

     3,  .026,  .011,  .007,  .007,  .016,  .027,  .034,  .044,  .047,  .023
     4,  .065,  .111,  .077,  .057,  .141,  .089,  .164,  .117,  .128,  .086
     5,  .189,  .147,  .200,  .232,  .378,  .198,  .206,  .219,  .211,  .143
     6,  .348,  .330,  .262,  .413,  .487,  .398,  .280,  .336,  .230,  .227
     7,  .342,  .285,  .517,  .494,  .437,  .503,  .454,  .446,  .249,  .226
     8,  .564,  .410,  .525,  .565,  .347,  .509,  .582,  .618,  .396,  .292
     9,  .784,  .584,  .429,  .508,  .464,  .616,  .584,  .590,  .463,  .272
    10,  .439,  .625,  .569,  .703,  .400,  .623,  .843,  .461,  .442,  .329
    11,  .552,  .843,  .899,  .824,  .344,  .482,  .860,  .543,  .241,  .369
    12,  .587,  .598,  .626,  .637,  .485,  .657,  .769,  .493,  .334,  .305
```

XSA population numbers (Thousands)

YEAR ,	3,	4,	5,	6,	7,	8,	9,	10,	11,	12,
1988 ,	5.71E+04,	8.93E+04,	4.24E+04,	1.38E+04,	1.09E+04,	4.55E+03,	1.72E+03,	7.03E+02,	7.03E+02,	2.66E+02,
1989 ,	3.13E+04,	4.55E+04,	6.85E+04,	2.87E+04,	7.99E+03,	6.33E+03,	2.12E+03,	6.42E+02,	3.71E+02,	3.32E+02,
1990 ,	2.15E+04,	2.54E+04,	3.34E+04,	4.85E+04,	1.69E+04,	4.92E+03,	3.44E+03,	9.68E+02,	2.81E+02,	1.31E+02,
1991 ,	3.03E+04,	1.75E+04,	1.92E+04,	2.24E+04,	3.05E+04,	8.26E+03,	2.38E+03,	1.83E+03,	4.49E+02,	9.38E+01,
1992 ,	1.74E+04,	2.46E+04,	1.35E+04,	1.25E+04,	1.21E+04,	1.52E+04,	3.84E+03,	1.17E+03,	7.43E+02,	1.61E+02,
1993 ,	2.71E+04,	1.40E+04,	1.75E+04,	7.58E+03,	6.29E+03,	6.41E+03,	8.82E+03,	1.98E+03,	6.44E+02,	4.31E+02,
1994 ,	2.35E+04,	2.16E+04,	1.05E+04,	1.18E+04,	4.17E+03,	3.11E+03,	3.16E+03,	3.90E+03,	8.70E+02,	3.25E+02,
1995 ,	4.07E+04,	1.86E+04,	1.50E+04,	6.99E+03,	7.28E+03,	2.17E+03,	1.42E+03,	1.44E+03,	1.37E+03,	3.01E+02,
1996 ,	5.06E+04,	3.19E+04,	1.35E+04,	9.90E+03,	4.09E+03,	3.82E+03,	9.57E+02,	6.46E+02,	7.44E+02,	6.53E+02,
1997 ,	2.92E+04,	3.95E+04,	2.30E+04,	8.97E+03,	6.44E+03,	2.61E+03,	2.10E+03,	4.93E+02,	3.40E+02,	4.79E+02,

Estimated population abundance at 1st Jan 1998

,	.00E+00,	2.34E+04,	2.97E+04,	1.63E+04,	5.85E+03,	4.21E+03,	1.60E+03,	1.31E+03,	2.91E+02,	1.93E+02,

Taper weighted geometric mean of the VPA populations:

,	3.46E+04,	2.83E+04,	2.05E+04,	1.36E+04,	8.39E+03,	4.67E+03,	2.41E+03,	1.15E+03,	5.41E+02,	2.28E+02,

Standard error of the weighted Log(VPA populations) :

,	.4870,	.5046,	.5204,	.5615,	.5726,	.5469,	.5803,	.6283,	.5510,	.7303,

Log catchability residuals.

Fleet : FLT04: TRW EFFORT (C

Age ,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987
3 ,	-.01,	.23,	.76,	-.98,	-2.07,	-.17,	.82,	-.77
4 ,	.05,	.19,	.26,	.45,	-1.06,	.39,	-.31,	.02
5 ,	.53,	.07,	.30,	-.37,	-1.01,	.13,	.11,	.17
6 ,	.56,	.77,	.17,	.01,	-.18,	-.05,	-.24,	.07
7 ,	.36,	.46,	.20,	.29,	-.43,	.11,	.01,	-.03
8 ,	.43,	-.25,	-.03,	.39,	.50,	-.29,	.02,	.04
9 ,	.46,	-.35,	-.24,	-.05,	-.11,	-.50,	-.18,	.05
10 ,	.92,	.88,	-.19,	-.74,	1.09,	.38,	.25,	-.37
11 ,	.08,	-1.20,	.72,	-4.19,	1.78,	-.79,	.88,	-.15
12 ,	.55,	-1.20,	1.03,	-1.73,	1.17,	-2.41,	.63,	-.14

Age ,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997
3 ,	.10,	-.52,	-.94,	-1.01,	-.09,	.45,	.68,	.98,	.53,	.60
4 ,	-.52,	-.07,	-.66,	-.93,	.24,	-.07,	.64,	.55,	.36,	.35
5 ,	-.16,	-.51,	-.42,	-.22,	.47,	.00,	.11,	.39,	.22,	.09
6 ,	.02,	-.13,	-.57,	-.05,	.33,	.27,	-.17,	.33,	-.01,	-.08
7 ,	-.20,	-.61,	-.04,	.05,	.10,	.31,	-.11,	.38,	-.14,	.04
8 ,	-.12,	-.82,	-.38,	-.01,	-.25,	.02,	.08,	.41,	.30,	.28
9 ,	.26,	-.15,	-.65,	-.33,	-.01,	.39,	.16,	.28,	.26,	.18
10 ,	-.74,	-.01,	-.42,	.02,	-.35,	.18,	.60,	-.15,	.07,	.16
11 ,	-.28,	.47,	.48,	.21,	-.73,	-.17,	.68,	.16,	-.66,	.38
12 ,	-.59,	.28,	.00,	-.33,	-.53,	.54,	.52,	.18,	-.14,	.28

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,	-6.0513,	-5.3376,	-4.9527,	-4.8998,	-4.9087,	-4.9792,	-4.8410,	-4.9049,	-4.9049,
S.E(Log q),	.5229,	.3520,	.2620,	.2617,	.3377,	.3117,	.4332,	.9188,	.7478,

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,	.80,	.393,	8.29,	.27,	18,	.84,	-7.74,

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,	1.08,	-.227,	5.72,	.45,	18,	.59,	-6.05,
5,	1.47,	-1.697,	3.19,	.57,	18,	.48,	-5.34,
6,	1.39,	-2.372,	3.18,	.79,	18,	.31,	-4.95,
7,	.97,	.217,	5.02,	.84,	18,	.27,	-4.90,
8,	1.39,	-1.626,	3.52,	.63,	18,	.44,	-4.91,
9,	1.08,	-.431,	4.76,	.75,	18,	.35,	-4.98,
10,	.85,	.829,	5.17,	.76,	18,	.37,	-4.84,
11,	1.12,	-.200,	4.74,	.22,	18,	1.07,	-4.90,
12,	.65,	1.952,	5.11,	.76,	18,	.43,	-4.95,

1

Terminal year survivor and F summaries :

Age 3 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
FLT04: TRW EFFORT (C,	42477.,	.878,	.000,	.00,	1,	.138,	.013
F shrinkage mean ,	28313.,	.50,,,,				.427,	.019
F shrinkage mean ,	16003.,	.50,,,,				.435,	.034

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
23360.,	.33,	.49,	3,	1.495,	.023

1

Age 4 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
FLT04: TRW EFFORT (C,	44175.,	.466,	.078,	.17,	2,	.510,	.059
F shrinkage mean ,	19588.,	.50,,,,				.490,	.128

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
29661.,	.34,	.40,	3,	1.184,	.086

Age 5 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,	20697.,	.299,	.181,	.63,	3,	.712,	.114
F shrinkage mean ,	9089.,	.50,,,,				.288,	.243

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
16331.,	.25,	.28,	4,	1.129,	.143

1

Age 6 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
FLT04: TRW EFFORT (C,	6595.,	.209,	.141,	.67,	4,	.803,	.204
F shrinkage mean ,	3585.,	.50,,,,				.197,	.348

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
5849.,	.19,	.17,	5,	.893,	.227

Age 7 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
FLT04: TRW EFFORT (C,	4807.,	.175,	.103,	.59,	5,	.844,	.200
F shrinkage mean ,	2039.,	.50,,,,				.156,	.421

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
4206.,	.17,	.17,	6,	1.040,	.226

1

Age 8 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
FLT04: TRW EFFORT (C,	1800.,	.161,	.090,	.56,	6,	.840,	.263
F shrinkage mean ,	848.,	.50,,,,				.160,	.494

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1595.,	.16,	.14,	7,	.915,	.292

Table 3.2.8. Saithe in Division Va. XSA tuning results using fleet Trawlers and gillnet CPUE.

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Lowestoft VPA Version 3.1

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Extended Survivors Analysis

Saithe Iceland Va (run: XSASTJ02/X02)

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

Catch data for  22 years. 1976 to 1997. Ages  3 to  13.

     Fleet,            First, Last, First, Last, Alpha,  Beta
                 ,      year, year,  age ,  age
FLT06: TRW CPU JAN.-,   1980, 1997,   4,    11,   .000,   .420
FLT08: TRW CPU JUNE ,   1980, 1997,   3,    12,   .420,  1.000
GN1: GILLNET JAN-DES,   1988, 1997,   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   39 iterations

1


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


Fishing mortalities
    Age,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996,  1997

      3,  .026,  .011,  .007,  .007,  .016,  .024,  .031,  .042,  .040,  .022
      4,  .065,  .112,  .076,  .056,  .143,  .092,  .144,  .107,  .122,  .072
      5,  .189,  .148,  .203,  .231,  .372,  .202,  .214,  .187,  .191,  .135
      6,  .350,  .329,  .264,  .421,  .481,  .389,  .288,  .353,  .191,  .201
      7,  .346,  .288,  .515,  .499,  .452,  .494,  .439,  .464,  .265,  .180
      8,  .548,  .416,  .531,  .561,  .352,  .537,  .564,  .583,  .421,  .318
      9,  .739,  .555,  .438,  .518,  .458,  .632,  .641,  .558,  .420,  .297
     10,  .445,  .557,  .520,  .729,  .412,  .611,  .888,  .543,  .404,  .286
     11,  .610,  .865,  .712,  .694,  .366,  .506,  .827,  .604,  .306,  .324
     12,  .590,  .721,  .660,  .409,  .357,  .731,  .844,  .457,  .395,  .424


XSA population numbers (Thousands)

                                  AGE
 YEAR ,          3,          4,          5,          6,          7,          8,          9,
10,          11,          12,

 1988 ,    5.64E+04, 8.89E+04, 4.25E+04, 1.38E+04, 1.08E+04, 4.65E+03, 1.79E+03, 6.95E+02, 6.53E+02, 2.65E+02,
 1989 ,    3.15E+04, 4.50E+04, 6.82E+04, 2.88E+04, 7.93E+03, 6.27E+03, 2.20E+03, 6.99E+02, 3.65E+02, 2.91E+02,
 1990 ,    2.17E+04, 2.55E+04, 3.29E+04, 4.82E+04, 1.70E+04, 4.87E+03, 3.39E+03, 1.04E+03, 3.28E+02, 1.26E+02,
 1991 ,    2.98E+04, 1.77E+04, 1.94E+04, 2.20E+04, 3.03E+04, 8.30E+03, 2.35E+03, 1.79E+03, 5.04E+02, 1.32E+02,
 1992 ,    1.69E+04, 2.42E+04, 1.37E+04, 1.26E+04, 1.18E+04, 1.51E+04, 3.88E+03, 1.14E+03, 7.06E+02, 2.06E+02,
 1993 ,    3.04E+04, 1.36E+04, 1.72E+04, 7.72E+03, 6.37E+03, 6.16E+03, 8.66E+03, 2.01E+03, 6.21E+02, 4.01E+02,
 1994 ,    2.54E+04, 2.43E+04, 1.02E+04, 1.15E+04, 4.29E+03, 3.18E+03, 2.95E+03, 3.77E+03, 8.92E+02, 3.06E+02,
 1995 ,    4.25E+04, 2.01E+04, 1.72E+04, 6.72E+03, 7.06E+03, 2.26E+03, 1.48E+03, 1.27E+03, 1.27E+03, 3.19E+02,
 1996 ,    5.98E+04, 3.34E+04, 1.48E+04, 1.17E+04, 3.86E+03, 3.63E+03, 1.03E+03, 6.95E+02, 6.04E+02, 5.69E+02,
 1997 ,    3.13E+04, 4.70E+04, 2.42E+04, 1.00E+04, 7.90E+03, 2.43E+03, 1.95E+03, 5.56E+02, 3.80E+02, 3.65E+02,
```

Estimated population abundance at 1st Jan 1998

, .00E+00, 2.50E+04, 3.58E+04, 1.73E+04, 6.71E+03, 5.40E+03, 1.45E+03, 1.19E+03, 3.42E+02, 2.25E+02,

Taper weighted geometric mean of the VPA populations:

, 3.59E+04, 2.92E+04, 2.09E+04, 1.39E+04, 8.48E+03, 4.63E+03, 2.40E+03, 1.16E+03, 5.39E+02, 2.29E+02,

Standard error of the weighted Log(VPA populations) :

, .4922, .5092, .5110, .5490, .5682, .5447, .5603, .5917, .5046, .6297,

1

Log catchability residuals.

Fleet : FLT06: TRW CPU JAN.-

Age ,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987
3 ,	No data for this fleet at this age							
4 ,	.39,	.41,	.52,	-.39,	.63,	-1.18,	.20,	1.00
5 ,	.46,	.19,	1.19,	-.04,	.50,	.18,	1.31,	.52
6 ,	.16,	.87,	-.76,	.25,	.06,	-.24,	.06,	.24
7 ,	-.52,	.31,	-.08,	.27,	-.48,	.38,	-.69,	-.25
8 ,	-.09,	-.57,	.35,	.20,	.42,	.29,	-2.38,	-.41
9 ,	-.26,	-.98,	.39,	-.79,	-.86,	-.35,	99.99,	-.82
10 ,	1.02,	-.38,	-.23,	-1.77,	-.27,	-.16,	-2.00,	-.82
11 ,	.31,	-1.16,	.96,	99.99,	99.99,	-.69,	99.99,	-1.06
12 ,	No data for this fleet at this age							

Age ,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997
3 ,	No data for this fleet at this age									
4 ,	-1.33,	-1.31,	.03,	-.88,	.20,	-.82,	.65,	.55,	.86,	.90
5 ,	.00,	-1.33,	-.48,	-.17,	.43,	-.53,	.27,	.02,	.19,	-.34
6 ,	.19,	-.07,	-.79,	-.26,	.22,	.42,	.15,	.30,	-.18,	-.18
7 ,	.00,	.02,	-.17,	-.39,	-.02,	.57,	.09,	.30,	-.08,	.15
8 ,	-.01,	-.02,	-.43,	-.20,	-.26,	.33,	.32,	.35,	.40,	.73
9 ,	.74,	.36,	-.47,	.00,	-.20,	-.01,	.30,	.06,	.15,	.57
10 ,	.29,	.51,	.14,	.34,	-.50,	.09,	.76,	.21,	.24,	.54
11 ,	.69,	.11,	1.05,	.40,	-.97,	-.32,	.14,	.29,	-.46,	.34
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,	-18.5814,	-17.4682,	-16.7671,	-16.4388,	-16.4661,	-16.5274,	-16.6230,	-16.5198,
S.E(Log q),	.8539,	.5959,	.3462,	.3195,	.6630,	.4692,	.6984,	.6559,

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,	1.04,	-.078,	18.94,	.25,	18,	.93,	-18.58,
5,	2.49,	-1.896,	28.67,	.14,	18,	1.34,	-17.47,
6,	1.73,	-2.861,	22.05,	.60,	18,	.47,	-16.77,
7,	1.24,	-1.161,	18.21,	.70,	18,	.39,	-16.44,
8,	1.22,	-.481,	18.26,	.31,	18,	.84,	-16.47,
9,	1.10,	-.349,	17.41,	.56,	17,	.54,	-16.53,
10,	1.17,	-.402,	18.29,	.35,	18,	.85,	-16.62,
11,	1.40,	-.691,	20.57,	.26,	15,	.94,	-16.52,

1

Fleet : FLT08: TRW CPU JUNE

Age ,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987
3 ,	-1.57,	.53,	.33,	-.54,	-1.47,	-.09,	.36,	-.74
4 ,	-1.26,	.35,	-.03,	1.54,	-1.11,	.93,	-.46,	-.21
5 ,	-.14,	.12,	.19,	.07,	-1.94,	.44,	-.09,	.14
6 ,	.12,	.49,	.40,	-.27,	.00,	.31,	-.38,	-.26
7 ,	.64,	.27,	.45,	.42,	-.61,	-.07,	.02,	.25
8 ,	.70,	-.42,	-.03,	.09,	.90,	-1.10,	.21,	.49
9 ,	1.33,	-.53,	-.80,	-1.28,	-.10,	-.47,	.36,	.85
10 ,	2.02,	.89,	-.57,	-1.54,	1.49,	.58,	.82,	.43
11 ,	.97,	99.99,	.11,	99.99,	2.50,	99.99,	2.06,	.72
12 ,	1.56,	-.30,	1.30,	99.99,	1.71,	99.99,	1.94,	.67

Age ,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997
3 ,	-.26,	-.97,	-.13,	-.81,	-.22,	.23,	.63,	1.01,	.73,	.49
4 ,	-.26,	-.22,	-.28,	-.87,	.33,	.09,	.17,	.00,	.79,	.06
5 ,	-.15,	-.64,	.00,	-.20,	.72,	.26,	.13,	.05,	.71,	-.58
6 ,	.09,	-.19,	-.35,	.06,	.42,	.26,	-.21,	.16,	.06,	-.14
7 ,	-.20,	-.71,	-.29,	.27,	.26,	.16,	.04,	.29,	-.49,	.30
8 ,	-.03,	-.72,	-1.00,	.19,	-.14,	-.04,	.23,	.35,	-.24,	.89
9 ,	-.04,	.23,	-1.66,	-.62,	.08,	.73,	.37,	.60,	-.32,	.43
10 ,	-1.27,	.47,	-1.77,	-.25,	-.60,	.49,	1.35,	.34,	-.68,	.16
11 ,	-.96,	1.34,	-.36,	-1.90,	-.76,	.20,	.97,	.56,	-1.66,	-.37
12 ,	-.92,	1.31,	99.99,	99.99,	-1.24,	-.26,	1.41,	1.03,	-.72,	.03

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,	-17.7689,	-17.1004,	-16.6650,	-16.6871,	-16.6337,	-16.7413,	-16.6925,	-16.8215,	-16.8215,
S.E(Log q),	.5585,	.5508,	.2570,	.3561,	.5645,	.7069,	.9405,	1.2383,	1.1485,

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,	.62,	.856,	15.96,	.34,	18,	.72,	-19.29,

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,	1.02,	-.046,	17.89,	.45,	18,	.59,	-17.77,
5,	1.63,	-1.223,	21.63,	.27,	18,	.88,	-17.10,
6,	1.28,	-1.671,	18.65,	.78,	18,	.30,	-16.67,
7,	.86,	.866,	15.60,	.79,	18,	.31,	-16.69,
8,	1.42,	-.947,	20.10,	.33,	18,	.81,	-16.63,
9,	.94,	.165,	16.19,	.42,	18,	.69,	-16.74,
10,	.59,	1.504,	12.79,	.58,	18,	.53,	-16.69,
11,	.97,	.041,	16.46,	.13,	15,	1.26,	-16.82,
12,	5.42,	-1.002,	64.43,	.01,	14,	5.92,	-16.48,

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Fleet : GN1: GILLNET JAN-DES

Age ,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997
3 ,	No data for this fleet at this age									
4 ,	No data for this fleet at this age									
5 ,	-1.75,	-.89,	-1.29,	-.53,	-.79,	.50,	.37,	.69,	1.36,	1.51
6 ,	-.16,	-.44,	-1.27,	-1.20,	-.89,	.41,	.35,	.71,	.45,	1.65
7 ,	-.12,	.16,	-.46,	-1.06,	-.46,	.28,	.53,	.57,	.41,	.00
8 ,	.22,	.53,	-.10,	-.29,	-.69,	.17,	-.02,	.41,	.09,	-.23
9 ,	.12,	.55,	-.30,	.14,	-.22,	-.44,	-.04,	.29,	.21,	-.22
10 ,	-.31,	.32,	-.09,	.26,	-.16,	-.15,	-.31,	.43,	.11,	-.11
11 ,	-.09,	.53,	-.68,	.29,	.15,	-.09,	-.13,	.41,	-.26,	-.12
12 ,	.04,	-.37,	-.25,	.28,	.06,	-.14,	-.10,	.18,	-.04,	-.24

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,	-17.3756,	-15.9727,	-14.9985,	-14.1154,	-13.8478,	-13.8546,	-13.8364,	-13.8364,
S.E(Log q),	1.1118,	.9441,	.5271,	.3581,	.3050,	.2629,	.3493,	.2104,

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,	-34.69,	-1.641,	******,	.00,	10,	35.15,	-17.38,
6,	-6.43,	-2.971,	-31.83,	.02,	10,	4.36,	-15.97,
7,	4.66,	-7.067,	36.67,	.34,	10,	.93,	-15.00,
8,	1.46,	-1.643,	16.70,	.64,	10,	.48,	-14.12,
9,	1.57,	-2.788,	17.29,	.77,	10,	.36,	-13.85,
10,	1.10,	-.567,	14.52,	.82,	10,	.30,	-13.85,
11,	.78,	.979,	12.21,	.73,	10,	.27,	-13.84,
12,	1.10,	-.621,	14.76,	.83,	10,	.23,	-13.89,

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Fleet disaggregated estimates of survivors :

Age 3 Catchability dependent on age and year class strength

Year class = 1994

```
FLT06: TRW CPU JAN.-
        Age,          3,
  Survivors,         0.,
Raw Weights,       .000,


FLT08: TRW CPU JUNE
        Age,          3,
  Survivors,     40894.,
Raw Weights,      1.697,


GN1: GILLNET JAN-DES
        Age,          3,
  Survivors,         0.,
Raw Weights,       .000,
```

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 ,	40894.,	.759,	.000,	.00,	1, .178,	.013
GN1: GILLNET JAN-DES,	1.,	.000,	.000,	.00,	0, .000,	.000
P shrinkage mean ,	29207.,	.51,,,,			.404,	.019
F shrinkage mean ,	17534.,	.50,,,,			.419,	.031

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
25043.,	.32,	.42,	3,	1.288,	.022

1

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

Year class = 1993

```
FLT06: TRW CPU JAN.-
        Age,          4,          3,
  Survivors,     88043.,         0.,
Raw Weights,      1.178,       .000,


FLT08: TRW CPU JUNE
        Age,          4,          3,
  Survivors,     38198.,     74536.,
Raw Weights,      2.754,      1.333,


GN1: GILLNET JAN-DES
        Age,          4,          3,
  Survivors,         0.,         0.,
Raw Weights,       .000,       .000,
```

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLT06: TRW CPU JAN.-,	88043.,	.889,	.000,	.00,	1, .127,	.030
FLT08: TRW CPU JUNE ,	47502.,	.474,	.313,	.66,	2, .441,	.055
GN1: GILLNET JAN-DES,	1.,	.000,	.000,	.00,	0, .000,	.000
F shrinkage mean ,	20602.,	.50,,,,			.432,	.122

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
35823.,	.32,	.40,	4,	1.259,	.072

1
Age 5 Catchability constant w.r.t. time and dependent on age

Year class = 1992

FLT06: TRW CPU JAN.-

Age,	5,	4,	3,
Survivors,	12337.,	40887.,	0.,
Raw Weights,	2.272,	.979,	.000,

FLT08: TRW CPU JUNE

Age,	5,	4,	3,
Survivors,	9679.,	38013.,	47429.,
Raw Weights,	2.659,	2.289,	1.121,

GN1: GILLNET JAN-DES

Age,	5,	4,	3,
Survivors,	78541.,	0.,	0.,
Raw Weights,	.638,	.000,	.000,

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT06: TRW CPU JAN.-,	17699.,	.509,	.550,	1.08,	2,	.233,	.132
FLT08: TRW CPU JUNE ,	21746.,	.366,	.508,	1.39,	3,	.435,	.109
GN1: GILLNET JAN-DES,	78541.,	1.170,	.000,	.00,	1,	.046,	.031
F shrinkage mean ,	9479.,	.50,,,,				.287,	.234

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
17327.,	.25,	.31,	7,	1.247,	.135

1
Age 6 Catchability constant w.r.t. time and dependent on age

Year class = 1991

FLT06: TRW CPU JAN.-

Age,	6,	5,	4,	3,
Survivors,	5583.,	8072.,	11593.,	0.,
Raw Weights,	6.302,	1.756,	.766,	.000,

FLT08: TRW CPU JUNE

Age,	6,	5,	4,	3,
Survivors,	5817.,	13638.,	6685.,	12560.,
Raw Weights,	9.087,	2.056,	1.792,	1.016,

GN1: GILLNET JAN-DES

Age,	6,	5,	4,	3,
Survivors,	34973.,	26114.,	0.,	0.,
Raw Weights,	.828,	.493,	.000,	.000,

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT06: TRW CPU JAN.-,	6402.,	.296,	.165,	.56,	3,	.314,	.210
FLT08: TRW CPU JUNE ,	7101.,	.232,	.194,	.83,	4,	.497,	.191
GN1: GILLNET JAN-DES,	31361.,	.761,	.141,	.19,	2,	.047,	.047
F shrinkage mean ,	3657.,	.50,,,,				.142,	.343

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
6706.,	.17,	.17,	10,	.993,	.201

1

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

Year class = 1990

FLT06: TRW CPU JAN.-

Age,	7,	6,	5,	4,	3,
Survivors,	6249.,	4501.,	5524.,	10352.,	0.,
Raw Weights,	7.554,	5.314,	1.483,	.620,	.000,

FLT08: TRW CPU JUNE

Age,	7,	6,	5,	4,	3,
Survivors,	7295.,	5715.,	5672.,	6384.,	6804.,
Raw Weights,	6.080,	7.662,	1.735,	1.451,	.830,

GN1: GILLNET JAN-DES

Age,	7,	6,	5,	4,	3,
Survivors,	5379.,	8464.,	10811.,	0.,	0.,
Raw Weights,	2.714,	.698,	.416,	.000,	.000,

Fleet, ,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT06: TRW CPU JAN.-,	5611.,	.223,	.114,	.51,	4,	.369,	.174
FLT08: TRW CPU JUNE ,	6316.,	.199,	.057,	.28,	5,	.438,	.156
GN1: GILLNET JAN-DES,	6304.,	.451,	.181,	.40,	3,	.094,	.156
F shrinkage mean ,	2010.,	.50,,,,				.099,	.426

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
5399.,	.14,	.11,	13,	.813,	.180

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

Year class = 1989

FLT06: TRW CPU JAN.-

Age,	8,	7,	6,	5,	4,	3,
Survivors,	3013.,	1333.,	1943.,	1890.,	636.,	0.,
Raw Weights,	1.528,	5.045,	3.013,	.815,	.357,	.000,

FLT08: TRW CPU JUNE

Age,	8,	7,	6,	5,	4,	3,
Survivors,	3517.,	889.,	1700.,	1648.,	1579.,	1164.,
Raw Weights,	2.108,	4.061,	4.344,	.954,	.835,	.430,

GN1: GILLNET JAN-DES

Age,	8,	7,	6,	5,	4,	3,
Survivors,	1145.,	2171.,	2936.,	2096.,	0.,	0.,
Raw Weights,	5.119,	1.813,	.396,	.229,	.000,	.000,

Fleet, ,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT06: TRW CPU JAN.-,	1667.,	.217,	.167,	.77,	5,	.307,	.282
FLT08: TRW CPU JUNE ,	1528.,	.195,	.208,	1.06,	6,	.363,	.304
GN1: GILLNET JAN-DES,	1429.,	.295,	.189,	.64,	4,	.216,	.322
F shrinkage mean ,	846.,	.50,,,,				.114,	.495

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
1446.,	.13,	.11,	16,	.847,	.318

1
Age 9 Catchability constant w.r.t. time and dependent on age

Year class = 1988

FLT06: TRW CPU JAN.-

Age,	9,	8,	7,	6,	5,	4,	3,
Survivors,	2111.,	1768.,	1604.,	1383.,	702.,	1454.,	0.,
Raw Weights,	3.105,	1.025,	2.767,	1.755,	.477,	.197,	.000,

FLT08: TRW CPU JUNE

Age,	9,	8,	7,	6,	5,	4,	3,
Survivors,	1818.,	931.,	1587.,	959.,	1540.,	1645.,	528.,
Raw Weights,	1.373,	1.414,	2.228,	2.531,	.559,	.460,	.235,

GN1: GILLNET JAN-DES

Age,	9,	8,	7,	6,	5,	4,	3,
Survivors,	955.,	1304.,	2105.,	1680.,	1952.,	0.,	0.,
Raw Weights,	7.210,	3.433,	.994,	.231,	.134,	.000,	.000,

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT06: TRW CPU JAN.-,	1653.,	.219,	.114,	.52,	6,	.273,	.222
FLT08: TRW CPU JUNE ,	1250.,	.203,	.127,	.63,	7,	.258,	.284
GN1: GILLNET JAN-DES,	1136.,	.227,	.124,	.55,	5,	.352,	.309
F shrinkage mean ,	565.,	.50,,,,				.117,	.546

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1189.,	.13,	.10,	19,	.765,	.297

1
Age 10 Catchability constant w.r.t. time and dependent on age

Year class = 1987

FLT06: TRW CPU JAN.-

Age,	10,	9,	8,	7,	6,	5,	4,	3,
Survivors,	586.,	396.,	487.,	374.,	522.,	524.,	141.,	0.,
Raw Weights,	1.423,	2.061,	.577,	1.591,	.906,	.206,	.092,	.000,

FLT08: TRW CPU JUNE

Age,	10,	9,	8,	7,	6,	5,	4,	3,
Survivors,	400.,	248.,	486.,	357.,	443.,	701.,	143.,	301.,
Raw Weights,	.785,	.912,	.796,	1.280,	1.306,	.241,	.214,	.115,

GN1: GILLNET JAN-DES

Age,	10,	9,	8,	7,	6,	5,	4,	3,
Survivors,	306.,	421.,	515.,	583.,	514.,	155.,	0.,	0.,
Raw Weights,	8.350,	4.788,	1.933,	.571,	.119,	.058,	.000,	.000,

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT06: TRW CPU JAN.-,	445.,	.238,	.091,	.38,	7,	.212,	.226
FLT08: TRW CPU JUNE ,	372.,	.230,	.118,	.51,	8,	.175,	.265
GN1: GILLNET JAN-DES,	368.,	.193,	.098,	.51,	6,	.489,	.268
F shrinkage mean ,	145.,	.50,,,,				.124,	.577

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
342.,	.13,	.09,	22,	.704,	.286

1

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

Year class = 1986

FLT06: TRW CPU JAN.-

Age,	11,							
Survivors,	316.,							
Raw Weights,	1.539,							
Age,	10,	9,	8,	7,	6,	5,	4,	3,
Survivors,	285.,	240.,	310.,	398.,	280.,	189.,	231.,	0.,
Raw Weights,	.914,	1.151,	.327,	.847,	.436,	.113,	.048,	.000,

FLT08: TRW CPU JUNE

Age,	11,							
Survivors,	156.,							
Raw Weights,	.433,							
Age,	10,	9,	8,	7,	6,	5,	4,	3,
Survivors,	114.,	409.,	283.,	264.,	342.,	185.,	170.,	85.,
Raw Weights,	.504,	.509,	.451,	.682,	.628,	.132,	.113,	.055,

GN1: GILLNET JAN-DES

Age,	11,							
Survivors,	200.,							
Raw Weights,	5.352,							
Age,	10,	9,	8,	7,	6,	5,	4,	3,
Survivors,	251.,	302.,	220.,	297.,	92.,	132.,	0.,	0.,
Raw Weights,	5.364,	2.673,	1.095,	.304,	.057,	.032,	.000,	.000,

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT06: TRW CPU JAN.-,	296.,	.266,	.065,	.25,	8,	.194,	.255
FLT08: TRW CPU JUNE ,	236.,	.268,	.156,	.58,	9,	.126,	.311
GN1: GILLNET JAN-DES,	236.,	.183,	.068,	.37,	7,	.536,	.310
F shrinkage mean ,	124.,	.50,,,				.144,	.526

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
225.,	.14,	.07,	25,	.523,	.324

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

Year class = 1985

FLT06: TRW CPU JAN.-

Age,	12,	11,						
Survivors,	0.,	123.,						
Raw Weights,	.000,	1.025,						
Age,	10,	9,	8,	7,	6,	5,	4,	3,
Survivors,	240.,	263.,	272.,	192.,	151.,	120.,	53.,	0.,
Raw Weights,	.528,	.610,	.177,	.474,	.256,	.067,	.027,	.000,

FLT08: TRW CPU JUNE

Age,	12,	11,						
Survivors,	201.,	37.,						
Raw Weights,	.449,	.288,						
Age,	10,	9,	8,	7,	6,	5,	4,	3,
Survivors,	275.,	282.,	188.,	254.,	208.,	195.,	157.,	150.,
Raw Weights,	.291,	.270,	.244,	.381,	.369,	.078,	.064,	.034,

GN1: GILLNET JAN-DES

Age,	12,	11,
Survivors,	153.,	150.,

Raw Weights,	7.271,	3.565,						

Age,	10,	9,	8,	7,	6,	5,	4,	3,
Survivors,	300.,	187.,	231.,	123.,	59.,	54.,	0.,	0.,
Raw Weights,	3.102,	1.416,	.592,	.170,	.034,	.019,	.000,	.000,

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT06: TRW CPU JAN.-,	180.,	.280,	.129,	.46,	8,	.123,	.454
FLT08: TRW CPU JUNE ,	182.,	.318,	.199,	.63,	10,	.096,	.449
GN1: GILLNET JAN-DES,	178.,	.171,	.105,	.61,	8,	.627,	.457
F shrinkage mean ,	316.,	.50,,,,				.155,	.283

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
195.,	.14,	.08,	27,	.538,	.424

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

A. TSA - Catch at age, no trend estimated.

STOCK IN NUMBERS:

Age/year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
4	16503	18668	27062	38249	28451	57344	88993	44379	25017	18169	21961	11259	16579	15203	27822	35798
5	17748	12439	13956	20980	27884	21768	42098	67020	32608	18824	13783	15181	8193	10872	10891	19784
6	22559	12051	8688	10016	14197	19143	13723	28385	45411	21809	12123	7477	9773	5258	6727	7101
7	12162	13977	7610	5571	6314	9029	10755	8027	17173	27584	11700	6137	3896	5656	2791	3984
8	3216	6292	7928	4314	3259	3752	4782	5958	4671	8892	14116	6055	2908	1902	2679	1538
9	2707	1583	3127	3922	2389	1757	1880	2305	3096	2224	4136	7422	2642	1239	777	1287
10	555	1331	836	1629	2263	1322	849	843	1155	1543	1016	2124	3220	1041	527	377
11	167	243	735	412	904	1216	651	437	424	580	646	502	951	1260	437	257

STANDARD DEVIATION OF STOCK ESTIMATES:

Age/year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
4	1136	1168	1555	2512	1706	4033	6084	2786	1365	1012	1745	1207	2578	3243	7169	11623
5	1201	861	899	1222	1831	1330	2987	4577	2003	1058	794	1349	961	2067	2596	5742
6	1537	889	609	675	853	1356	936	2144	3138	1452	771	575	1027	724	1582	1927
7	849	1124	582	404	434	594	899	637	1380	1999	954	492	428	730	528	1093
8	384	546	705	385	248	280	387	601	413	846	1214	612	339	306	501	349
9	275	200	334	474	238	158	180	254	367	248	535	736	416	228	210	315
10	127	191	123	252	318	166	115	129	172	243	175	350	541	297	158	132
11	79	79	113	87	169	200	115	80	85	112	163	111	236	371	198	94

FISHING MORTALITY RATES:

Age/year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
4	0.083	0.087	0.054	0.112	0.068	0.112	0.082	0.108	0.084	0.076	0.145	0.092	0.153	0.109	0.130	0.094
5	0.187	0.144	0.131	0.189	0.171	0.241	0.193	0.183	0.201	0.233	0.350	0.216	0.221	0.228	0.222	0.189
6	0.279	0.258	0.243	0.258	0.251	0.350	0.312	0.302	0.292	0.405	0.452	0.362	0.326	0.388	0.320	0.308
7	0.447	0.363	0.367	0.328	0.318	0.426	0.375	0.341	0.455	0.470	0.450	0.480	0.425	0.502	0.396	0.408
8	0.503	0.499	0.504	0.382	0.413	0.491	0.517	0.455	0.541	0.556	0.434	0.584	0.558	0.576	0.528	0.522
9	0.508	0.424	0.446	0.344	0.389	0.525	0.589	0.489	0.497	0.571	0.466	0.627	0.629	0.563	0.515	0.507
10	0.565	0.366	0.499	0.389	0.422	0.508	0.463	0.487	0.490	0.643	0.504	0.584	0.679	0.567	0.513	0.506
11	0.491	0.363	0.463	0.366	0.404	0.516	0.511	0.532	0.504	0.580	0.516	0.593	0.621	0.554	0.506	0.513
F(4-9)	0.334	0.296	0.291	0.269	0.268	0.358	0.345	0.313	0.345	0.385	0.383	0.394	0.386	0.394	0.352	0.338

STANDARD DEVIATIONS OF LOG(F):

Age/year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
4	0.24	0.14	0.16	0.23	0.19	0.27	0.30	0.23	0.14	0.10	0.16	0.10	0.16	0.16	0.24	0.30
5	0.10	0.12	0.09	0.12	0.11	0.11	0.13	0.15	0.10	0.10	0.09	0.09	0.08	0.09	0.13	0.19
6	0.11	0.12	0.14	0.12	0.10	0.10	0.09	0.11	0.13	0.10	0.09	0.07	0.10	0.11	0.13	0.20
7	0.10	0.13	0.12	0.12	0.12	0.09	0.10	0.09	0.11	0.12	0.10	0.09	0.08	0.12	0.14	0.21
8	0.14	0.10	0.13	0.12	0.12	0.11	0.09	0.11	0.11	0.11	0.12	0.11	0.10	0.10	0.14	0.21
9	0.12	0.13	0.13	0.15	0.15	0.13	0.12	0.11	0.14	0.13	0.13	0.15	0.13	0.12	0.15	0.22
10	0.15	0.15	0.17	0.16	0.18	0.16	0.15	0.15	0.15	0.16	0.15	0.17	0.16	0.16	0.17	0.22
11	0.18	0.18	0.18	0.17	0.18	0.18	0.17	0.17	0.18	0.18	0.17	0.18	0.18	0.18	0.19	0.22

Table 3.2.9 (continued)

B. TSA - Catch at age, trend estimated.

STOCK IN NUMBERS:

Age/year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
4	16551	18550	27014	38330	28374	56767	86835	44239	24942	18076	21546	10850	15208	13017	22081	29273
5	17643	12489	13910	20906	28033	21673	41772	65233	32629	18723	13651	14909	7864	9868	9148	15172
6	23222	11992	8679	9941	14174	19233	13801	28152	43952	21766	12061	7448	9517	4937	5896	5628
7	12075	14485	7584	5558	6241	9012	10879	8081	16972	26501	11730	6074	3886	5370	2496	3226
8	3185	6245	8249	4310	3241	3699	4806	6019	4656	8779	13515	6011	2881	1869	2412	1255
9	2735	1587	3129	4087	2372	1744	1869	2321	3093	2204	4067	6939	2624	1199	726	1032
10	563	1361	841	1631	2353	1306	852	843	1151	1530	1002	2039	2965	1006	481	313
11	179	253	754	416	902	1254	650	437	419	572	643	483	897	1109	397	208

STANDARD DEVIATION OF STOCK ESTIMATES:

Age/year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
4	1116	1152	1501	2397	1624	3834	5820	2618	1303	907	1534	985	1997	2409	5591	10470
5	1178	851	875	1171	1740	1257	2831	4343	1883	1003	705	1172	774	1582	1903	4438
6	1571	875	596	647	805	1273	881	2017	2945	1350	723	494	871	568	1175	1367
7	838	1153	568	384	406	547	830	588	1279	1835	862	445	354	590	393	769
8	375	537	716	365	230	253	348	542	375	759	1079	527	292	241	375	245
9	276	198	326	468	219	140	158	222	324	217	459	617	335	184	154	217
10	129	191	120	241	309	146	101	111	149	210	149	288	432	229	120	92
11	81	81	112	83	158	185	99	68	72	95	137	90	184	281	142	66

FISHING MORTALITY RATES:

Age/year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
4	0.080	0.085	0.053	0.110	0.069	0.108	0.080	0.105	0.087	0.081	0.150	0.104	0.169	0.129	0.160	0.119
5	0.184	0.143	0.133	0.189	0.176	0.241	0.195	0.183	0.205	0.238	0.366	0.237	0.255	0.276	0.282	0.252
6	0.272	0.256	0.243	0.257	0.253	0.356	0.323	0.306	0.291	0.411	0.474	0.396	0.366	0.457	0.402	0.405
7	0.435	0.360	0.365	0.327	0.313	0.427	0.385	0.351	0.459	0.470	0.468	0.514	0.483	0.581	0.487	0.532
8	0.483	0.489	0.503	0.382	0.407	0.480	0.525	0.465	0.548	0.568	0.442	0.615	0.630	0.681	0.649	0.679
9	0.494	0.421	0.446	0.341	0.385	0.516	0.594	0.501	0.502	0.585	0.485	0.650	0.708	0.667	0.640	0.666
10	0.539	0.360	0.497	0.392	0.423	0.498	0.467	0.499	0.498	0.657	0.528	0.618	0.756	0.675	0.639	0.660
11	0.464	0.354	0.456	0.368	0.406	0.505	0.514	0.540	0.515	0.593	0.543	0.636	0.699	0.664	0.633	0.668
F(4-9)	0.325	0.292	0.291	0.268	0.267	0.355	0.350	0.318	0.349	0.392	0.398	0.420	0.435	0.465	0.436	0.442

STANDARD DEVIATIONS OF LOG(F):

Age/year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
4	0.24	0.16	0.17	0.22	0.18	0.26	0.29	0.22	0.14	0.10	0.15	0.09	0.14	0.13	0.21	0.30
5	0.10	0.11	0.09	0.12	0.10	0.11	0.12	0.14	0.10	0.10	0.09	0.08	0.08	0.09	0.12	0.18
6	0.10	0.11	0.14	0.12	0.10	0.10	0.09	0.11	0.13	0.10	0.08	0.07	0.10	0.11	0.13	0.19
7	0.09	0.12	0.11	0.11	0.11	0.09	0.10	0.10	0.11	0.12	0.09	0.09	0.08	0.12	0.13	0.20
8	0.13	0.09	0.13	0.11	0.12	0.11	0.09	0.11	0.10	0.11	0.12	0.11	0.10	0.10	0.14	0.20
9	0.12	0.12	0.12	0.14	0.14	0.13	0.12	0.11	0.13	0.13	0.13	0.14	0.13	0.12	0.15	0.20
10	0.15	0.15	0.16	0.15	0.17	0.16	0.15	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.17	0.21
11	0.18	0.17	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.17	0.18	0.19	0.21

Table 3.2.9 (continued)

C. TSA -Catch at age and trawler-CPUE, June-Dec., no trend estimated.

STOCK IN NUMBERS:

Age/year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
4	16492	18653	27069	38250	28445	57309	88953	44316	24960	18088	21902	11112	16590	15162	27570	35634
5	17763	12432	13948	20986	27885	21765	42086	67030	32542	18783	13727	15107	8089	10888	10866	19594
6	22503	12063	8676	9991	14205	19144	13719	28383	45449	21761	12084	7411	9737	5196	6754	7084
7	12146	13938	7607	5572	6300	9029	10749	8017	17181	27644	11657	6099	3859	5644	2747	3998
8	3220	6288	7916	4319	3258	3745	4785	5954	4665	8898	14184	6026	2889	1890	2679	1497
9	2720	1584	3122	3916	2392	1756	1876	2303	3096	2219	4131	7481	2620	1232	774	1282
10	553	1339	838	1628	2260	1324	849	841	1156	1544	1013	2126	3242	1033	526	375
11	166	241	741	412	903	1215	652	436	423	580	645	501	951	1271	434	256

STANDARD DEVIATION OF STOCK ESTIMATES:

Age/year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
4	1135	1172	1552	2508	1707	4025	6067	2781	1361	1005	1729	1175	2499	3149	7007	11530
5	1202	861	903	1219	1831	1331	2983	4569	1996	1055	789	1335	935	1998	2518	5603
6	1537	890	608	675	854	1358	940	2144	3137	1450	769	571	1015	702	1524	1863
7	852	1122	581	404	434	595	903	642	1385	2006	955	492	423	717	505	1042
8	385	548	703	386	249	281	390	607	418	854	1228	618	338	300	488	325
9	276	200	334	473	240	159	181	258	372	253	545	754	420	226	204	302
10	129	192	124	252	319	167	117	131	175	248	179	361	552	298	156	126
11	80	80	115	87	170	201	116	81	86	115	167	115	243	377	197	91

FISHING MORTALITY RATES:

Age/year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
4	0.083	0.087	0.054	0.111	0.068	0.112	0.082	0.108	0.084	0.075	0.145	0.091	0.153	0.109	0.131	0.094
5	0.186	0.144	0.133	0.189	0.171	0.240	0.193	0.184	0.201	0.232	0.348	0.213	0.222	0.228	0.223	0.192
6	0.279	0.259	0.242	0.258	0.252	0.349	0.311	0.302	0.292	0.403	0.450	0.358	0.325	0.395	0.322	0.312
7	0.447	0.361	0.365	0.329	0.317	0.424	0.373	0.341	0.454	0.468	0.447	0.475	0.424	0.502	0.407	0.408
8	0.504	0.500	0.504	0.383	0.414	0.492	0.516	0.454	0.541	0.555	0.434	0.582	0.556	0.580	0.534	0.531
9	0.506	0.423	0.445	0.344	0.389	0.525	0.588	0.487	0.496	0.569	0.464	0.626	0.625	0.564	0.520	0.513
10	0.563	0.365	0.499	0.389	0.422	0.507	0.463	0.485	0.488	0.640	0.501	0.581	0.676	0.567	0.518	0.511
11	0.489	0.362	0.463	0.366	0.405	0.515	0.510	0.531	0.503	0.577	0.512	0.590	0.618	0.553	0.510	0.518
F(4-9)	0.334	0.296	0.291	0.269	0.268	0.357	0.344	0.313	0.345	0.384	0.381	0.391	0.384	0.396	0.356	0.342

STANDARD DEVIATIONS OF LOG(F):

Age/year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
4	0.24	0.14	0.16	0.23	0.19	0.27	0.30	0.23	0.14	0.10	0.16	0.10	0.16	0.15	0.24	0.30
5	0.10	0.12	0.09	0.12	0.11	0.11	0.13	0.15	0.10	0.10	0.09	0.09	0.08	0.09	0.13	0.19
6	0.11	0.12	0.14	0.12	0.10	0.10	0.09	0.11	0.13	0.10	0.09	0.07	0.10	0.11	0.13	0.20
7	0.10	0.13	0.12	0.12	0.11	0.09	0.10	0.09	0.11	0.12	0.09	0.09	0.08	0.12	0.13	0.21
8	0.14	0.10	0.13	0.12	0.12	0.11	0.09	0.11	0.11	0.11	0.12	0.11	0.10	0.10	0.14	0.21
9	0.12	0.13	0.14	0.15	0.15	0.14	0.12	0.11	0.14	0.13	0.13	0.14	0.12	0.12	0.15	0.21
10	0.15	0.15	0.17	0.16	0.18	0.16	0.15	0.15	0.15	0.16	0.15	0.16	0.16	0.16	0.17	0.22
11	0.18	0.18	0.18	0.17	0.18	0.18	0.17	0.17	0.18	0.18	0.17	0.18	0.18	0.18	0.19	0.22

Table 3.2.9 (continued)

D. TSA - Catch at age and trawler-CPUE, June-Dec.. Trend estimated.

STOCK IN NUMBERS:

Age/year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
4	16519	18527	27000	38322	28369	56662	86244	44212	24921	18033	21516	10706	15212	12937	21493	28446
5	17660	12466	13887	20898	28036	21669	41713	64771	32615	18703	13617	14863	7760	9883	9079	14703
6	23225	12008	8676	9902	14176	19241	13814	28121	43613	21756	12041	7415	9491	4859	5893	5558
7	12053	14500	7602	5576	6230	9013	10896	8092	16972	26325	11737	6057	3873	5349	2428	3202
8	3188	6236	8255	4321	3244	3683	4813	6026	4646	8782	13472	6010	2873	1864	2393	1182
9	2748	1590	3123	4086	2376	1742	1862	2322	3092	2197	4064	6920	2619	1195	720	1007
10	565	1371	844	1629	2354	1308	852	840	1151	1529	998	2037	2948	1003	476	305
11	180	254	762	418	901	1253	651	437	417	572	642	481	893	1098	393	202

STANDARD DEVIATION OF STOCK ESTIMATES:

Age/year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
4	1133	1183	1534	2453	1663	3909	5916	2669	1332	922	1554	983	1952	2346	5436	10376
5	1200	864	896	1196	1777	1286	2883	4411	1913	1025	716	1185	772	1540	1849	4304
6	1614	891	606	661	821	1300	902	2052	2984	1371	738	501	877	561	1136	1321
7	861	1183	579	394	414	557	847	602	1300	1859	875	455	357	587	380	731
8	385	552	734	374	236	257	355	553	382	772	1098	537	296	239	367	225
9	283	203	334	480	224	143	160	225	329	221	468	631	338	184	150	206
10	134	197	124	246	317	150	103	112	151	213	152	294	438	228	119	87
11	84	84	116	85	161	189	101	69	72	96	139	92	187	281	140	63

FISHING MORTALITY RATES:

Age/year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
4	0.08	0.086	0.053	0.110	0.069	0.108	0.080	0.105	0.087	0.081	0.152	0.104	0.171	0.132	0.165	0.123
5	0.183	0.143	0.134	0.188	0.175	0.240	0.194	0.183	0.205	0.239	0.367	0.238	0.260	0.283	0.287	0.263
6	0.271	0.255	0.240	0.255	0.253	0.355	0.323	0.305	0.290	0.410	0.474	0.398	0.369	0.473	0.410	0.417
7	0.435	0.360	0.365	0.330	0.315	0.426	0.386	0.355	0.459	0.466	0.468	0.516	0.490	0.588	0.518	0.540
8	0.483	0.490	0.504	0.384	0.407	0.479	0.526	0.466	0.549	0.569	0.444	0.618	0.637	0.696	0.666	0.706
9	0.491	0.420	0.446	0.341	0.385	0.515	0.595	0.502	0.502	0.587	0.487	0.653	0.715	0.681	0.657	0.691
10	0.535	0.358	0.496	0.392	0.423	0.497	0.467	0.500	0.498	0.658	0.530	0.622	0.763	0.689	0.656	0.683
11	0.460	0.352	0.455	0.368	0.406	0.504	0.514	0.541	0.516	0.593	0.544	0.640	0.707	0.677	0.651	0.690
F(4-9)	0.324	0.292	0.290	0.268	0.267	0.354	0.351	0.319	0.349	0.392	0.399	0.421	0.440	0.475	0.450	0.457

STANDARD DEVIATIONS OF LOG(F):

Age/year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
4	0.24	0.17	0.18	0.23	0.19	0.27	0.30	0.22	0.14	0.10	0.15	0.09	0.14	0.14	0.22	0.31
5	0.10	0.11	0.09	0.13	0.10	0.11	0.12	0.14	0.10	0.10	0.09	0.08	0.08	0.09	0.12	0.18
6	0.11	0.11	0.14	0.13	0.10	0.10	0.09	0.11	0.13	0.10	0.09	0.07	0.10	0.11	0.13	0.19
7	0.10	0.12	0.12	0.12	0.12	0.10	0.10	0.10	0.11	0.12	0.10	0.09	0.08	0.12	0.14	0.20
8	0.14	0.10	0.13	0.12	0.12	0.11	0.10	0.11	0.11	0.11	0.13	0.11	0.10	0.11	0.14	0.20
9	0.12	0.12	0.13	0.15	0.15	0.13	0.12	0.12	0.14	0.13	0.14	0.14	0.13	0.13	0.15	0.21
10	0.15	0.15	0.17	0.15	0.18	0.16	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.17	0.21
11	0.18	0.17	0.18	0.17	0.18	0.18	0.17	0.17	0.18	0.18	0.17	0.18	0.18	0.18	0.19	0.21

Table 3.2.10. Saithe in Division Va. Fishing mortality.

Run title : Saithe Iceland Va (run: SVPSTJ01/V01)

At 4-May-98 10:24:52

Traditional vpa using file input for terminal F

Table 8 Fishing mortality (F) at age

YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE										
3	0.012	0.010	0.011	0.012	0.026	0.004	0.001	0.012	0.048	0.010
4	0.074	0.109	0.064	0.066	0.079	0.115	0.027	0.120	0.056	0.104
5	0.154	0.178	0.217	0.119	0.195	0.103	0.071	0.185	0.177	0.251
6	0.212	0.357	0.369	0.366	0.239	0.261	0.257	0.247	0.219	0.365
7	0.329	0.342	0.378	0.366	0.558	0.361	0.391	0.358	0.315	0.395
8	0.353	0.312	0.553	0.454	0.594	0.674	0.560	0.376	0.480	0.497
9	0.303	0.171	0.276	0.493	0.658	0.526	0.562	0.211	0.355	0.588
10	0.331	0.763	0.229	0.278	0.531	0.349	0.994	0.736	0.891	0.528
11	0.304	0.670	0.394	0.076	0.101	0.113	0.881	0.531	0.908	0.833
12	0.525	0.586	0.252	0.871	0.057	0.027	0.724	0.149	0.883	0.668
13	0.566	0.603	0.137	0.546	0.754	0.004	0.699	1.162	0.294	2.283
14	0.431	0.655	0.253	0.443	0.361	0.123	0.824	0.644	0.744	1.078
+gp	0.431	0.655	0.253	0.443	0.361	0.123	0.824	0.644	0.744	1.078
FBAR 4- 9	0.237	0.245	0.310	0.311	0.387	0.340	0.311	0.250	0.267	0.367

Table 8 Fishing mortality (F) at age

YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	FBAR 95
AGE											
3	0.027	0.011	0.008	0.008	0.018	0.037	0.044	0.062	0.060	0.027	0.050
4	0.066	0.113	0.078	0.059	0.157	0.107	0.228	0.158	0.188	0.112	0.153
5	0.188	0.150	0.205	0.237	0.392	0.225	0.254	0.330	0.304	0.225	0.286
6	0.342	0.326	0.268	0.426	0.498	0.421	0.332	0.445	0.400	0.367	0.404
7	0.334	0.278	0.506	0.507	0.459	0.522	0.495	0.572	0.369	0.486	0.476
8	0.447	0.396	0.503	0.543	0.362	0.550	0.621	0.719	0.596	0.512	0.609
9	0.676	0.399	0.407	0.474	0.436	0.657	0.669	0.663	0.610	0.512	0.595
10	0.408	0.475	0.313	0.636	0.361	0.560	0.961	0.589	0.543	0.512	0.548
11	0.619	0.729	0.536	0.313	0.295	0.412	0.694	0.721	0.348	0.512	0.527
12	0.420	0.739	0.476	0.262	0.117	0.511	0.579	0.338	0.540	0.512	0.463
13	0.655	0.601	1.367	0.085	0.676	0.248	1.616	0.240	0.500	0.512	0.417
14	0.526	0.636	0.673	0.273	0.316	0.306	0.426	0.426	0.374	0.512	0.437
+gp	0.526	0.636	0.673	0.273	0.316	0.306	0.426	0.426	0.374	0.512	
FBAR 4- 9	0.342	0.277	0.328	0.375	0.384	0.414	0.433	0.481	0.411	0.369	

Table 3.2.11. Saithe in Division Va, Stock in numbers

Run title : Saithe Iceland Va (run: SVPSTJ01/V01)

At 4-May-98 10:24:52

Traditional vpa using file input for terminal F

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

YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE										
3	49446	55312	28074	19562	22175	33645	47675	34957	73698	107944
4	17691	39988	44852	22737	15833	17697	27449	38985	28281	57534
5	18806	13451	29346	34430	17420	11978	12911	21880	28300	21891
6	8956	13203	9220	19333	25031	11737	8846	9849	14883	19414
7	4993	5932	7562	5218	10977	16134	7402	5601	6302	9786
8	3546	2942	3450	4244	2964	5144	9210	4100	3206	3767
9	2258	2040	1764	1624	2206	1340	2147	4310	2305	1625
10	2239	1366	1407	1096	812	935	648	1003	2856	1323
11	1994	1317	522	916	680	391	540	196	393	959
12	747	1205	552	288	695	503	286	183	95	130
13	352	362	549	351	99	537	401	113	129	32
14	285	164	162	392	166	38	438	163	29	79
+gp	172	0	285	432	358	1655	368	669	197	36
TOTAL	111484	137282	127745	110623	99416	101735	118323	122010	160674	224520

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

YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	GMST 78-95	AMST
AGE													
3	55611	30683	20700	27250	14663	20173	17815	28901	39912	24964	0	33020	38238
4	87514	44340	24837	16819	22132	11787	15923	13952	22242	30765	19894	26166	30464
5	42474	67078	32414	18808	12981	15482	8674	10377	9753	15090	22520	20125	23261
6	13940	28814	47286	21613	12148	7178	10119	5509	6106	5894	9865	13756	15949
7	11038	8109	17024	29620	11556	6044	3857	5946	2890	3350	3343	8342	9617
8	5396	6469	5026	8408	14602	5980	2936	1924	2747	1635	1687	4576	5184
9	1876	2827	3566	2488	3998	8322	2824	1293	767	1240	802	2414	2712
10	739	781	1553	1944	1268	2116	3533	1184	545	341	608	1331	1489
11	639	402	398	930	843	724	990	1106	538	259	167	675	774
12	342	282	159	190	557	514	393	405	440	311	127	343	418
13	55	184	110	81	120	405	252	180	236	210	153	182	240
14	3	23	82	23	61	50	259	41	116	117	103	78	137
+gp	3	19	94	193	4	4	161	54	105	112	113		
TOTAL	219629	190011	153250	128368	94933	78779	67736	70872	86400	84289	59383		

Table 3.2.12. Saithe in Division Va. Stock summary table.

Run title : Saithe Iceland Va (run: SVPSTJ02/V02)

At 4-May-98 10:59:55

Table 16 Summary (without SOP correction)

Traditional vpa using file input for terminal F

	RECRUITS Age 3	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 4- 9
1962	30999	277003	142184	50514	0.355	0.287
1963	84106	336274	144613	48011	0.332	0.304
1964	55195	380521	141947	60257	0.425	0.250
1965	94062	465836	165999	60177	0.363	0.231
1966	70223	550397	214136	52003	0.243	0.178
1967	68332	648019	279292	75712	0.271	0.238
1968	59672	697092	345778	77549	0.224	0.210
1969	88751	762546	395280	115853	0.293	0.295
1970	66328	755885	399454	116601	0.292	0.323
1971	50638	717074	381384	136764	0.359	0.443
1972	26456	603752	334676	111301	0.333	0.361
1973	26109	516607	313690	110888	0.354	0.345
1974	25128	434176	288073	97568	0.339	0.288
1975	25929	387997	264701	87954	0.332	0.278
1976	31242	347177	227245	82003	0.361	0.326
1977	21673	300274	186683	62026	0.332	0.282
1978	49446	307948	165578	49672	0.300	0.237
1979	55312	342306	159551	63504	0.398	0.245
1980	28074	349895	163194	58347	0.358	0.310
1981	19562	333100	166512	58986	0.354	0.311
1982	22175	318648	175459	68615	0.391	0.387
1983	33645	330042	190884	58266	0.305	0.340
1984	47675	358777	179728	62719	0.349	0.311
1985	34957	353254	168059	57101	0.340	0.250
1986	73698	418352	177369	66376	0.374	0.267
1987	107944	501524	172509	80559	0.467	0.367
1988	55611	515803	167291	77247	0.462	0.342
1989	30683	479280	175806	82425	0.469	0.277
1990	20700	453153	195067	98130	0.503	0.328
1991	27250	374698	195547	102737	0.525	0.375
1992	14663	302053	180747	79597	0.440	0.384
1993	20173	255089	161116	71648	0.445	0.414
1994	17815	210193	134121	64338	0.480	0.433
1995	28901	185893	101024	48650	0.482	0.481
1996	39912	188501	89846	40099	0.446	0.411
1997	24964	200633	92695	37158	0.401	0.369
Arith. Mean	43833	415549	206590	74204	0.3749	0.3187
0 Units	(Thousands	(Tonnes)	(Tonnes)	(Tonnes)		

Table 3.2.13. Saithe in Division Va. Prediction with management option - Input data.

The SAS System 12:23 Monday, May 4, 1998

Saithe in the Iceland Grounds (Fishing Area Va)

Prediction with management option table: Input data

Year: 1998								
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	0.1200	0.0000	0.0000	1.302	0.0440	1.302
4	19.923	0.2000	0.2400	0.0000	0.0000	2.009	0.1340	2.009
5	14.106	0.2000	0.4300	0.0000	0.0000	2.747	0.2510	2.747
6	9.865	0.2000	0.6200	0.0000	0.0000	3.537	0.3550	3.537
7	3.343	0.2000	0.8200	0.0000	0.0000	4.973	0.4170	4.973
8	1.687	0.2000	0.9100	0.0000	0.0000	6.152	0.5340	6.152
9	0.802	0.2000	0.9600	0.0000	0.0000	7.642	0.5220	7.642
10	0.608	0.2000	1.0000	0.0000	0.0000	7.556	0.4810	7.556
11	0.167	0.2000	1.0000	0.0000	0.0000	8.694	0.4630	8.694
12	0.127	0.2000	1.0000	0.0000	0.0000	9.244	0.4070	9.244
13	0.153	0.2000	1.0000	0.0000	0.0000	9.964	0.3800	9.964
14+	0.103	0.2000	1.0000	0.0000	0.0000	11.655	0.4330	11.655
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	0.1200	0.0000	0.0000	1.302	0.0440	1.302
4	.	0.2000	0.2400	0.0000	0.0000	1.993	0.1340	1.993
5	.	0.2000	0.4300	0.0000	0.0000	2.799	0.2510	2.799
6	.	0.2000	0.6300	0.0000	0.0000	3.745	0.3550	3.745
7	.	0.2000	0.7900	0.0000	0.0000	4.701	0.4170	4.701
8	.	0.2000	0.9100	0.0000	0.0000	6.116	0.5340	6.116
9	.	0.2000	0.9600	0.0000	0.0000	7.592	0.5220	7.592
10	.	0.2000	1.0000	0.0000	0.0000	7.556	0.4810	7.556
11	.	0.2000	1.0000	0.0000	0.0000	8.694	0.4630	8.694
12	.	0.2000	1.0000	0.0000	0.0000	9.244	0.4070	9.244
13	.	0.2000	1.0000	0.0000	0.0000	9.964	0.3800	9.964
14+	.	0.2000	1.0000	0.0000	0.0000	11.655	0.4330	11.655
Unit	Millions	-	-	-	-	Kilograms	-	Kilograms

Year: 2000								
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	0.1200	0.0000	0.0000	1.302	0.0440	1.302
4	.	0.2000	0.2400	0.0000	0.0000	1.993	0.1340	1.993
5	.	0.2000	0.4300	0.0000	0.0000	2.787	0.2510	2.787
6	.	0.2000	0.6300	0.0000	0.0000	3.781	0.3550	3.781
7	.	0.2000	0.8000	0.0000	0.0000	4.817	0.4170	4.817
8	.	0.2000	0.9000	0.0000	0.0000	5.913	0.5340	5.913
9	.	0.2000	0.9600	0.0000	0.0000	6.920	0.5220	6.920
10	.	0.2000	1.0000	0.0000	0.0000	7.556	0.4810	7.556
11	.	0.2000	1.0000	0.0000	0.0000	8.694	0.4630	8.694
12	.	0.2000	1.0000	0.0000	0.0000	9.244	0.4070	9.244
13	.	0.2000	1.0000	0.0000	0.0000	9.964	0.3800	9.964
14+	.	0.2000	1.0000	0.0000	0.0000	11.655	0.4330	11.655
Unit	Millions	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANSTJ01
Date and time: 04MAY98:12:36

Table 3.2.14. Saithe in Division Va. Prediction with management option table.

The SAS System 12:23 Monday, May 4, 1998

Saithe in the Iceland Grounds (Fishing Area Va)

Prediction with management option table

Year: 1998					Year: 1999					Year: 2000	
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
0.7647	0.2820	189294	90713	30000	0.0000	0.0000	206752	103981	0	257156	143955
.	.	.	.	.	0.1000	0.0369	.	103981	5020	251457	139560
.	.	.	.	.	0.2000	0.0738	.	103981	9870	245952	135328
.	.	.	.	.	0.3000	0.1107	.	103981	14555	240634	131254
.	.	.	.	.	0.4000	0.1475	.	103981	19082	235496	127330
.	.	.	.	.	0.5000	0.1844	.	103981	23458	230531	123551
.	.	.	.	.	0.6000	0.2213	.	103981	27688	225732	119911
.	.	.	.	.	0.7000	0.2582	.	103981	31778	221093	116404
.	.	.	.	.	0.8000	0.2951	.	103981	35733	216608	113025
.	.	.	.	.	0.9000	0.3320	.	103981	39558	212271	109769
.	.	.	.	.	1.0000	0.3688	.	103981	43259	208076	106631
.	.	.	.	.	1.1000	0.4057	.	103981	46839	204018	103606
.	.	.	.	.	1.2000	0.4426	.	103981	50304	200092	100690
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANSTJ01
Date and time : 04MAY98:12:36
Computation of ref. F: Simple mean, age 4 - 9
Basis for 1998 : TAC constraints

Table 3.2.15. Saithe in Division Va. Yield per recruit - Input data.

The SAS System 12:23 Monday, May 4, 1998

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	0.1078	0.0000	0.0000	1.436	0.0700	1.436
4	.	0.2000	0.2144	0.0000	0.0000	2.025	0.2900	2.025
5	.	0.2000	0.3772	0.0000	0.0000	2.734	0.5700	2.734
6	.	0.2000	0.5789	0.0000	0.0000	3.668	0.9100	3.668
7	.	0.2000	0.7550	0.0000	0.0000	4.711	1.1500	4.711
8	.	0.2000	0.8739	0.0000	0.0000	5.818	1.5300	5.818
9	.	0.2000	0.9411	0.0000	0.0000	6.949	1.5300	6.949
10	.	0.2000	1.0000	0.0000	0.0000	7.830	1.5300	7.830
11	.	0.2000	1.0000	0.0000	0.0000	8.795	1.5300	8.795
12	.	0.2000	1.0000	0.0000	0.0000	9.537	1.5300	9.537
13	.	0.2000	1.0000	0.0000	0.0000	10.676	1.5300	10.676
14	.	0.2000	1.0000	0.0000	0.0000	12.219	1.5300	12.219
Unit	Numbers	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : YIELD3
Date and time: 04MAY98:12:30

Table 3.2.16. Saithe in Division Va. Yield per recruit - Summary table.

The SAS System 12:23 Monday, May 4, 1998

Saithe in the Iceland Grounds (Fishing Area Va)

Yield per recruit: Summary table

						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
0.0000	0.0000	0.000	0.000	5.016	21371.527	2.658	15886.899	2.658	15886.899
0.0200	0.0199	0.067	396.196	4.803	19635.480	2.461	14221.542	2.461	14221.542
0.0400	0.0399	0.123	704.184	4.615	18146.054	2.289	12799.951	2.289	12799.951
0.1200	0.1196	0.274	1390.000	4.057	13939.934	1.789	8839.693	1.789	8839.693
0.1400	0.1395	0.300	1478.768	3.952	13198.378	1.698	8153.921	1.698	8153.921
0.1600	0.1595	0.323	1548.082	3.857	12544.289	1.616	7553.586	1.616	7553.586
0.1800	0.1794	0.343	1602.176	3.771	11964.674	1.543	7025.802	1.543	7025.802
0.2000	0.1993	0.361	1644.337	3.692	11448.701	1.477	6559.840	1.477	6559.840
0.2200	0.2193	0.377	1677.121	3.621	10987.316	1.417	6146.740	1.417	6146.740
0.2400	0.2392	0.391	1702.519	3.555	10572.929	1.363	5778.999	1.363	5778.999
0.2600	0.2591	0.405	1722.087	3.494	10199.156	1.313	5450.319	1.313	5450.319
0.2800	0.2791	0.417	1737.041	3.437	9860.617	1.268	5155.395	1.268	5155.395
0.3000	0.2990	0.428	1748.336	3.385	9552.760	1.227	4889.749	1.227	4889.749
0.3200	0.3189	0.438	1756.721	3.336	9271.721	1.188	4649.585	1.188	4649.585
0.3400	0.3389	0.448	1762.786	3.291	9014.213	1.153	4431.683	1.153	4431.683
0.3600	0.3588	0.457	1767.000	3.248	8777.431	1.120	4233.295	1.120	4233.295
0.3800	0.3787	0.465	1769.732	3.207	8558.968	1.090	4052.073	1.090	4052.073
0.4000	0.3987	0.473	1771.277	3.170	8356.760	1.061	3886.005	1.061	3886.005
0.4200	0.4186	0.481	1771.869	3.134	8169.024	1.035	3733.360	1.035	3733.360
0.4400	0.4385	0.488	1771.696	3.100	7994.219	1.010	3592.644	1.010	3592.644
0.4600	0.4585	0.494	1770.908	3.067	7831.007	0.987	3462.564	0.987	3462.564
0.4800	0.4784	0.501	1769.626	3.037	7678.225	0.965	3341.998	0.965	3341.998
0.5000	0.4983	0.507	1767.949	3.007	7534.854	0.944	3229.968	0.944	3229.968
0.5200	0.5183	0.512	1765.955	2.979	7400.004	0.925	3125.621	0.925	3125.621
0.5400	0.5382	0.518	1763.708	2.953	7272.890	0.906	3028.209	0.906	3028.209
0.5600	0.5581	0.523	1761.262	2.927	7152.821	0.889	2937.073	0.889	2937.073
0.5800	0.5781	0.528	1758.658	2.903	7039.187	0.872	2851.635	0.872	2851.635
0.6000	0.5980	0.533	1755.933	2.879	6931.445	0.856	2771.381	0.856	2771.381
0.6200	0.6179	0.538	1753.114	2.856	6829.111	0.841	2695.858	0.841	2695.858
0.6400	0.6379	0.542	1750.226	2.835	6731.756	0.827	2624.662	0.827	2624.662
0.6600	0.6578	0.546	1747.289	2.814	6638.994	0.813	2557.433	0.813	2557.433
0.6800	0.6777	0.551	1744.318	2.793	6550.478	0.800	2493.850	0.800	2493.850
0.7000	0.6977	0.555	1741.327	2.774	6465.898	0.787	2433.623	0.787	2433.623
0.7200	0.7176	0.559	1738.326	2.755	6384.972	0.775	2376.494	0.775	2376.494
0.7400	0.7375	0.562	1735.326	2.737	6307.447	0.764	2322.229	0.764	2322.229
0.7600	0.7575	0.566	1732.333	2.719	6233.093	0.753	2270.618	0.753	2270.618
0.7800	0.7774	0.570	1729.354	2.702	6161.699	0.742	2221.471	0.742	2221.471
0.8000	0.7973	0.573	1726.394	2.685	6093.075	0.732	2174.614	0.732	2174.614
0.8200	0.8173	0.576	1723.457	2.669	6027.048	0.722	2129.891	0.722	2129.891
0.8400	0.8372	0.580	1720.547	2.653	5963.457	0.712	2087.158	0.712	2087.158
0.8600	0.8571	0.583	1717.666	2.638	5902.158	0.703	2046.285	0.703	2046.285
0.8800	0.8771	0.586	1714.817	2.623	5843.015	0.694	2007.153	0.694	2007.153
0.9000	0.8970	0.589	1712.001	2.608	5785.906	0.686	1969.652	0.686	1969.652
0.9200	0.9169	0.592	1709.220	2.594	5730.717	0.678	1933.681	0.678	1933.681
0.9400	0.9369	0.595	1706.475	2.581	5677.343	0.670	1899.150	0.670	1899.150
0.9600	0.9568	0.597	1703.767	2.567	5625.686	0.662	1865.972	0.662	1865.972
0.9800	0.9767	0.600	1701.096	2.554	5575.657	0.654	1834.069	0.654	1834.069
1.0000	0.9967	0.603	1698.462	2.541	5527.172	0.647	1803.369	0.647	1803.369
1.0200	1.0166	0.605	1695.867	2.529	5480.153	0.640	1773.804	0.640	1773.804
1.0400	1.0365	0.608	1693.309	2.517	5434.528	0.633	1745.314	0.633	1745.314
1.0600	1.0565	0.610	1690.789	2.505	5390.229	0.627	1717.839	0.627	1717.839
1.0800	1.0764	0.613	1688.307	2.493	5347.193	0.620	1691.326	0.620	1691.326
1.1200	1.1163	0.617	1683.453	2.471	5264.681	0.608	1640.993	0.608	1640.993
1.1400	1.1362	0.620	1681.082	2.460	5225.097	0.602	1617.081	0.602	1617.081
1.1600	1.1561	0.622	1678.747	2.449	5186.563	0.596	1593.952	0.596	1593.952
1.1800	1.1761	0.624	1676.447	2.439	5149.033	0.591	1571.568	0.591	1571.568
1.2200	1.2159	0.628	1671.953	2.419	5076.815	0.580	1528.892	0.580	1528.892
1.2600	1.2558	0.632	1667.596	2.399	5008.131	0.570	1488.795	0.570	1488.795
1.2800	1.2757	0.634	1665.467	2.390	4975.025	0.565	1469.642	0.565	1469.642
1.3000	1.2957	0.636	1663.370	2.381	4942.701	0.560	1451.050	0.560	1451.050
1.3200	1.3156	0.638	1661.306	2.372	4911.128	0.555	1432.996	0.555	1432.996
1.3400	1.3355	0.640	1659.272	2.363	4880.277	0.551	1415.456	0.551	1415.456
1.3600	1.3555	0.642	1657.269	2.354	4850.121	0.546	1398.408	0.546	1398.408
1.4200	1.4153	0.647	1651.438	2.329	4763.575	0.533	1350.021	0.533	1350.021
1.4400	1.4352	0.649	1649.552	2.320	4735.956	0.529	1334.749	0.529	1334.749
1.4600	1.4551	0.650	1647.694	2.312	4708.916	0.525	1319.877	0.525	1319.877
1.4800	1.4751	0.652	1645.863	2.304	4682.435	0.521	1305.390	0.521	1305.390
1.5000	1.4950	0.654	1644.058	2.297	4656.494	0.517	1291.274	0.517	1291.274
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YIELD3
Date and time : 04MAY98:12:30
Computation of ref. F: Simple mean, age 4 - 9
F-0.1 factor : 0.1849
F-max factor : 0.4249
F-0.1 reference F : 0.1843
F-max reference F : 0.4235
Recruitment : Single recruit

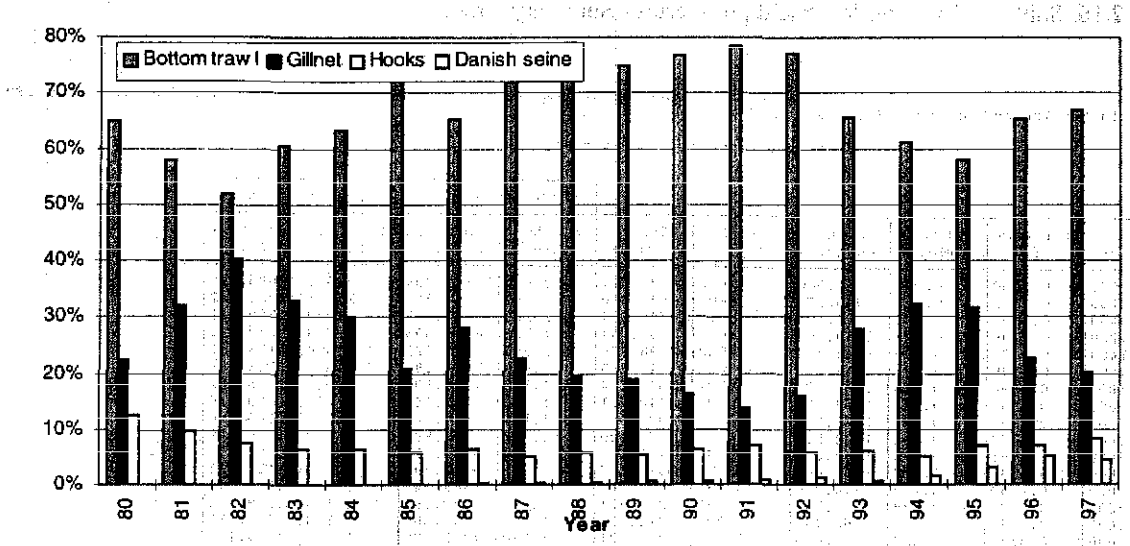


Figure 3.2.1. Saithe in Division Va. Proportional catches in different gears 1980-1997

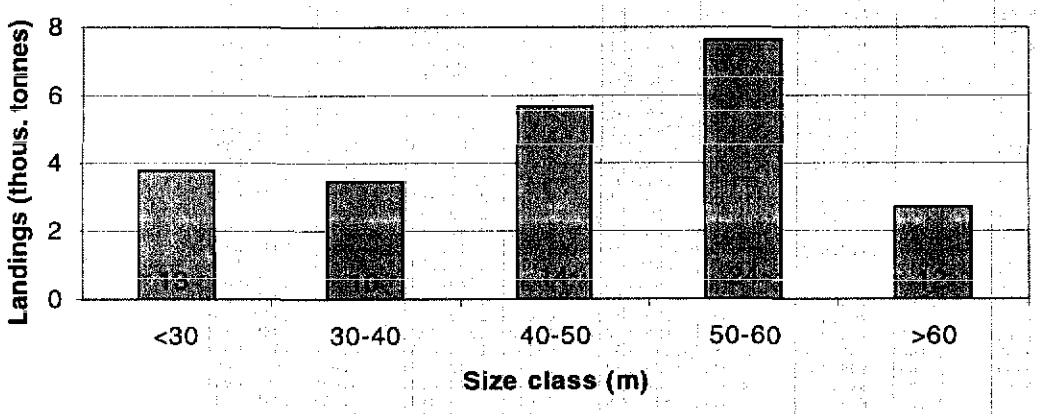


Figure 3.2.2. Bottom trawl landings of saithe in Division Va categorised by size classes of vessels and the number of vessels in each size class (only vessels with more than 50 t annual landings).

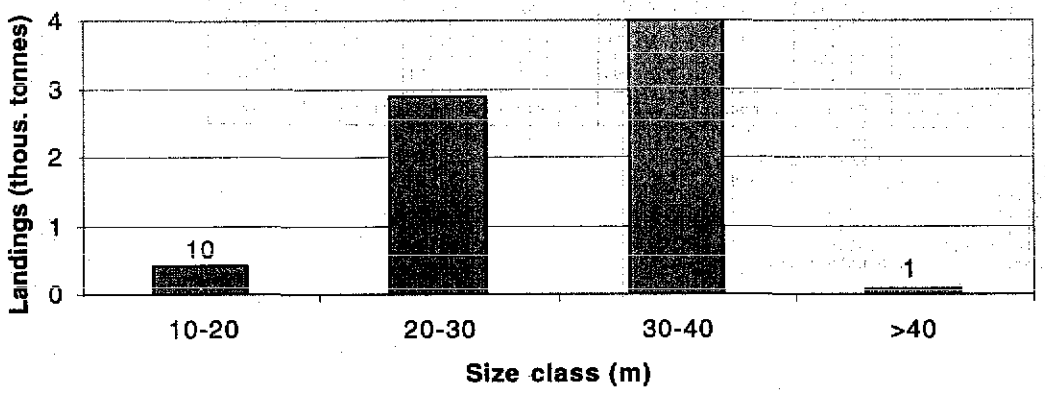


Figure 3.2.3. Gillnet landings of saithe in Division Va categorised by size classes of vessels and number of vessels in each size class (only vessels with more than 10 t annual landings).

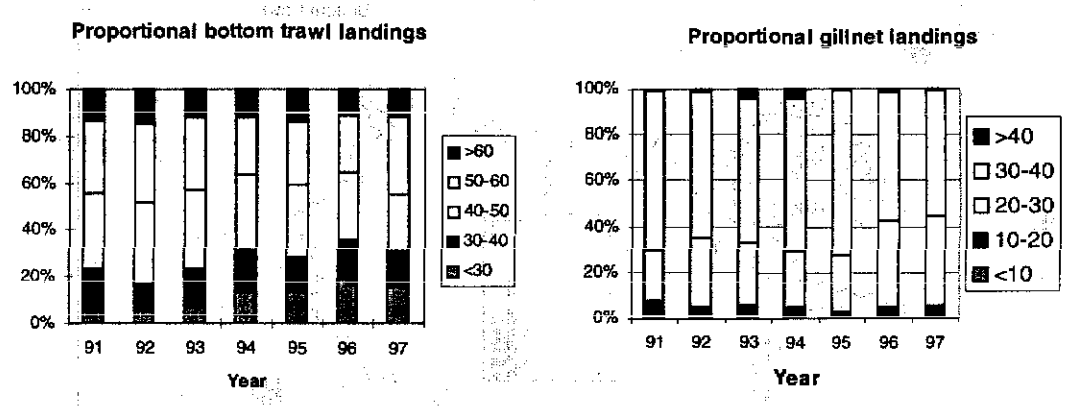


Figure 3.2.4. Saithe landings in Division Va categorised by vessel size classes for 1991-1997.

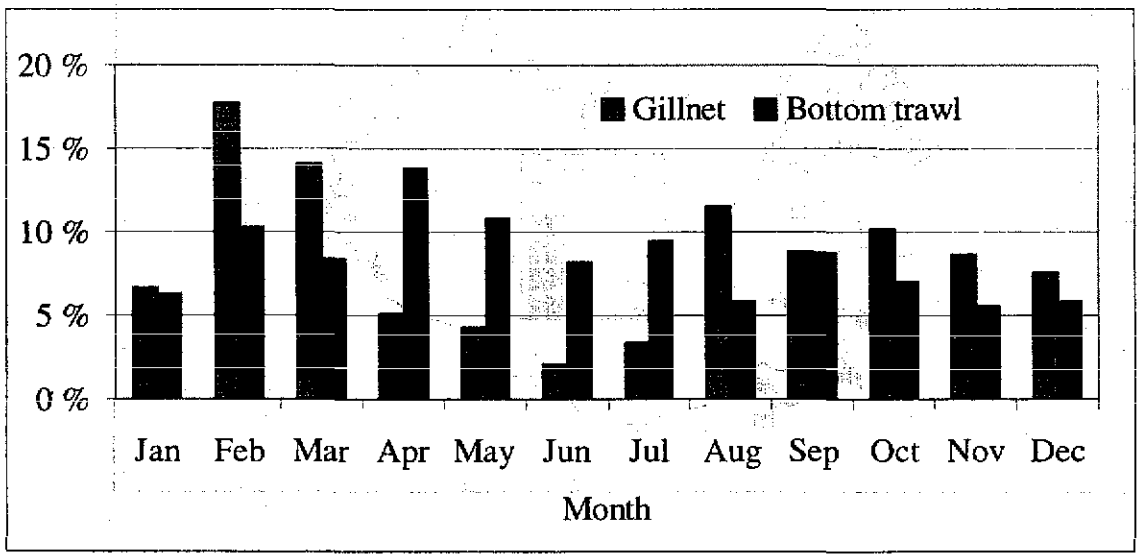


Figure 3.2.5. Proportional landings of saithe in Division Va by gear and months in 1997.

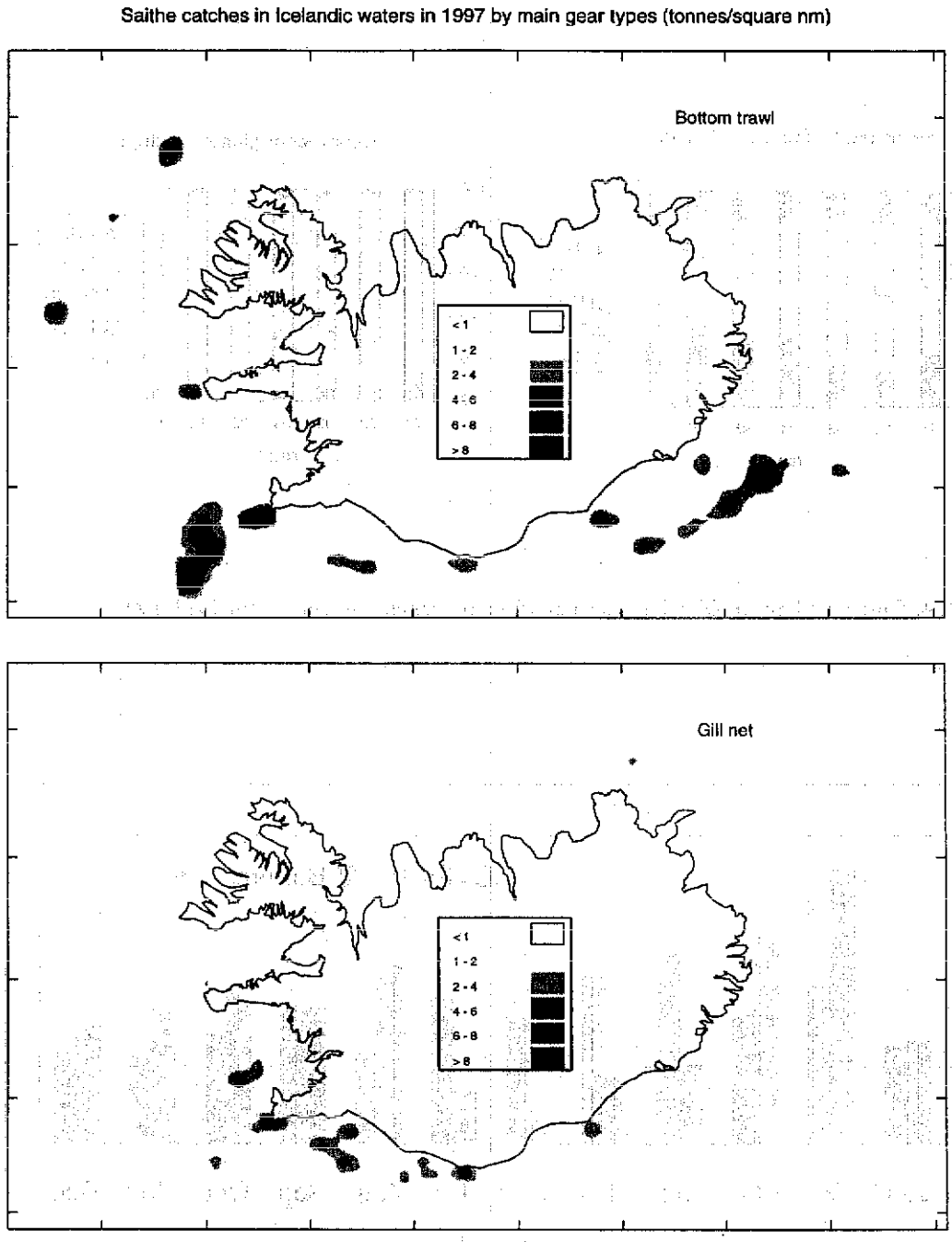


Figure 3.2.6. Icelandic saithe catches in Division Va in 1997 (tonnes/square nm).

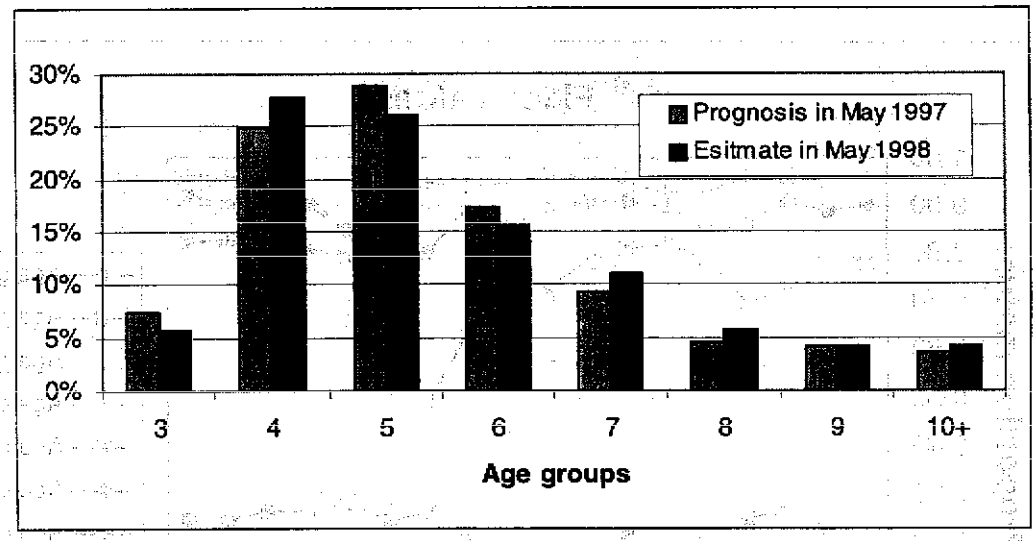


Figure 3.2.7. Saithe in Division Va. Prognosis in May 1997 and estimate in April 1998 for percent (by number) age distribution in the 1997 landings.

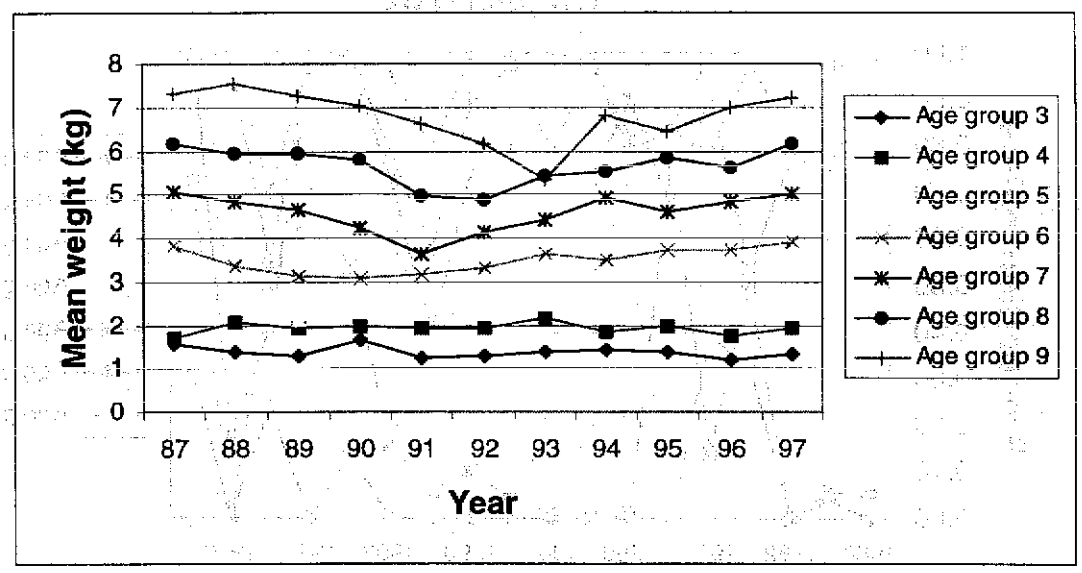


Figure 3.2.8. Saithe in Division Va. Mean weight at age in the catches 1987-1997.

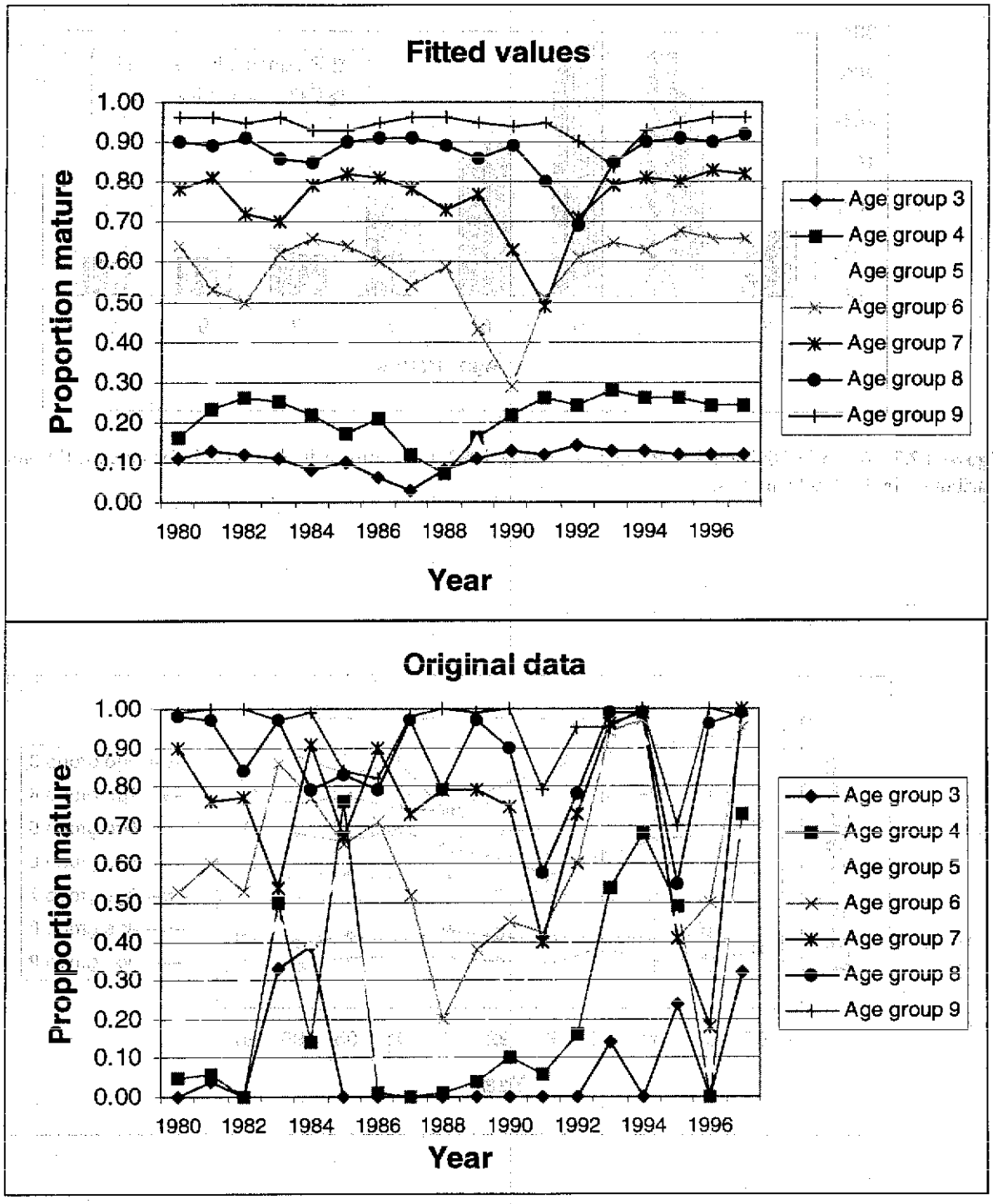


Figure 3.2.9. Saithe in Division Va. Maturity at age; data and fitted values 1980-1997

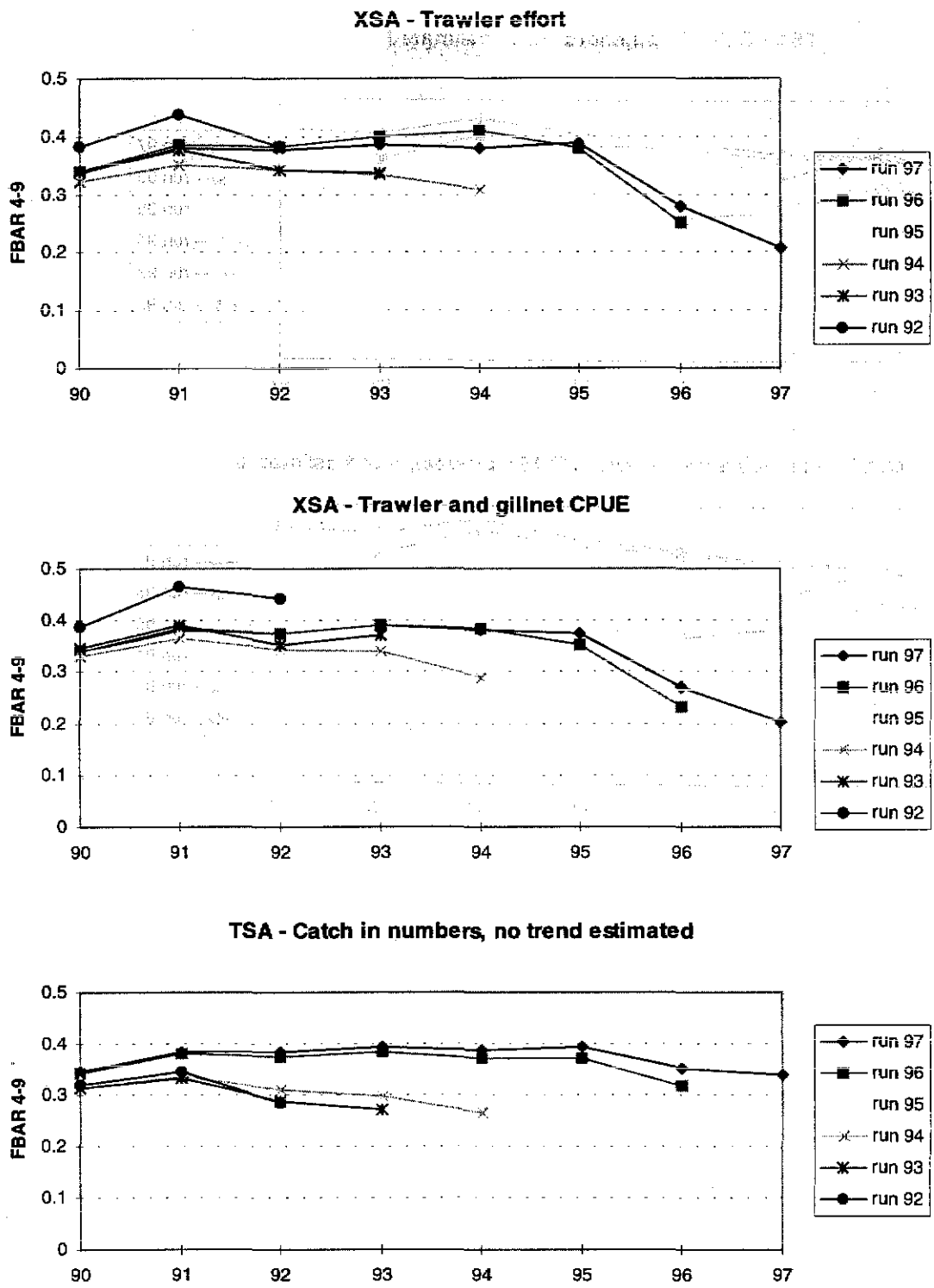
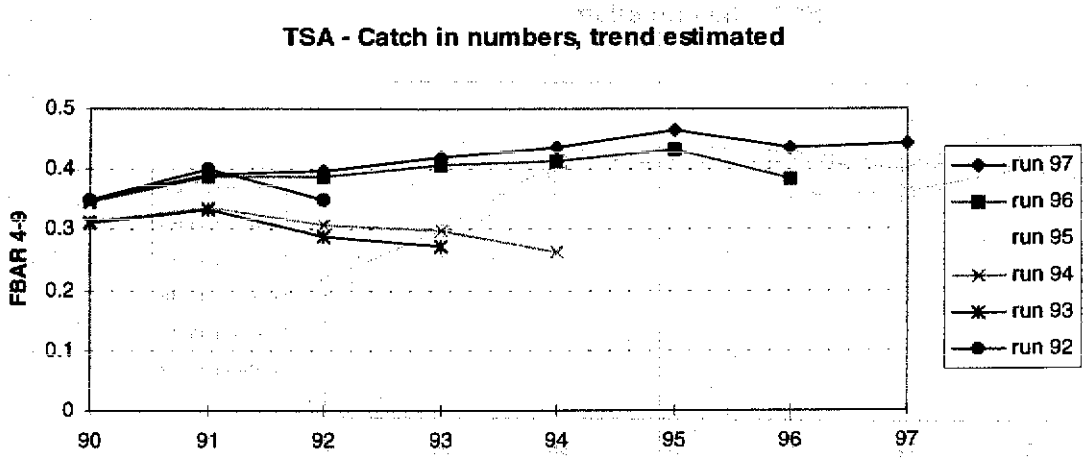
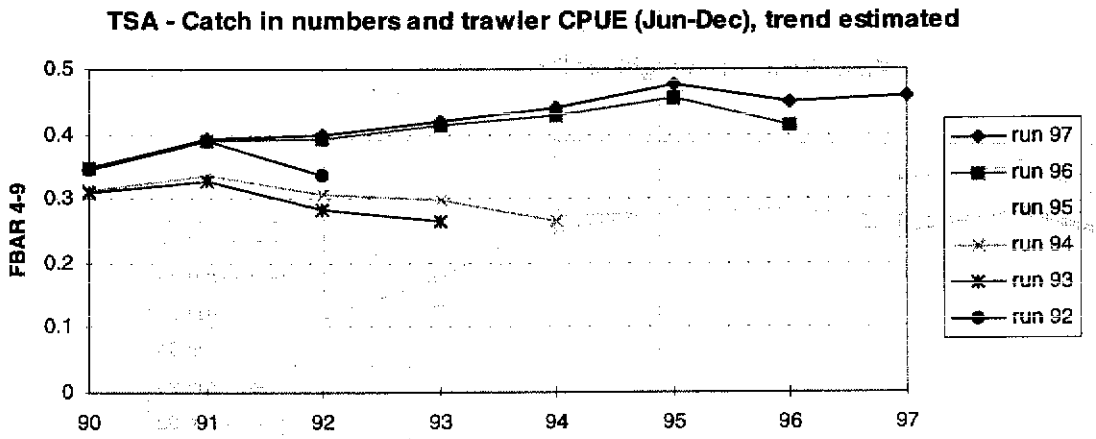


Figure 3.2.10 Saithe in Division Va. Retrospective analysis of XSA and TSA results.

Figure 3.2.10 (Cont'd)





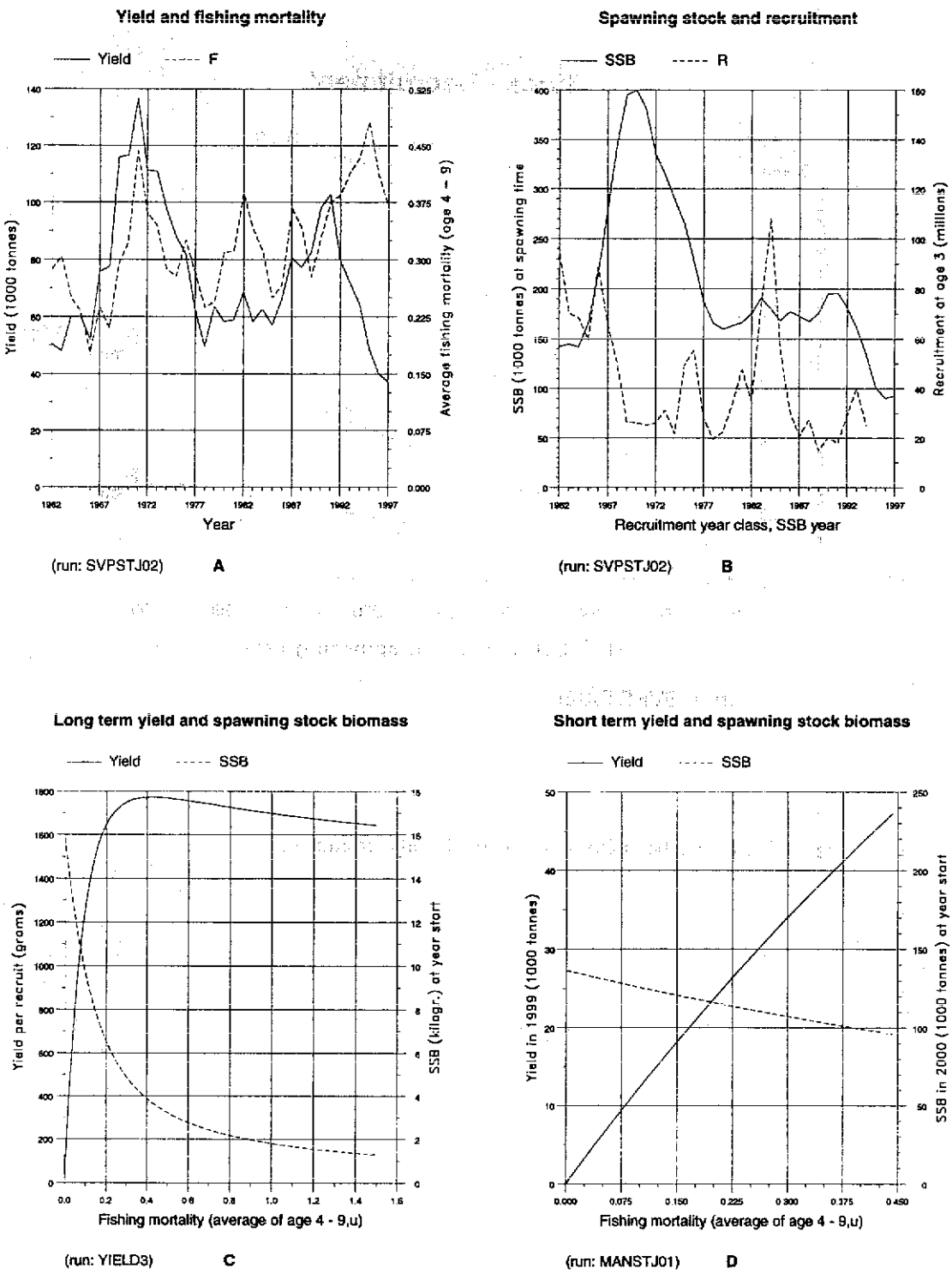


Figure 3.2.11. Saithe in Division Va. Fish stock summary

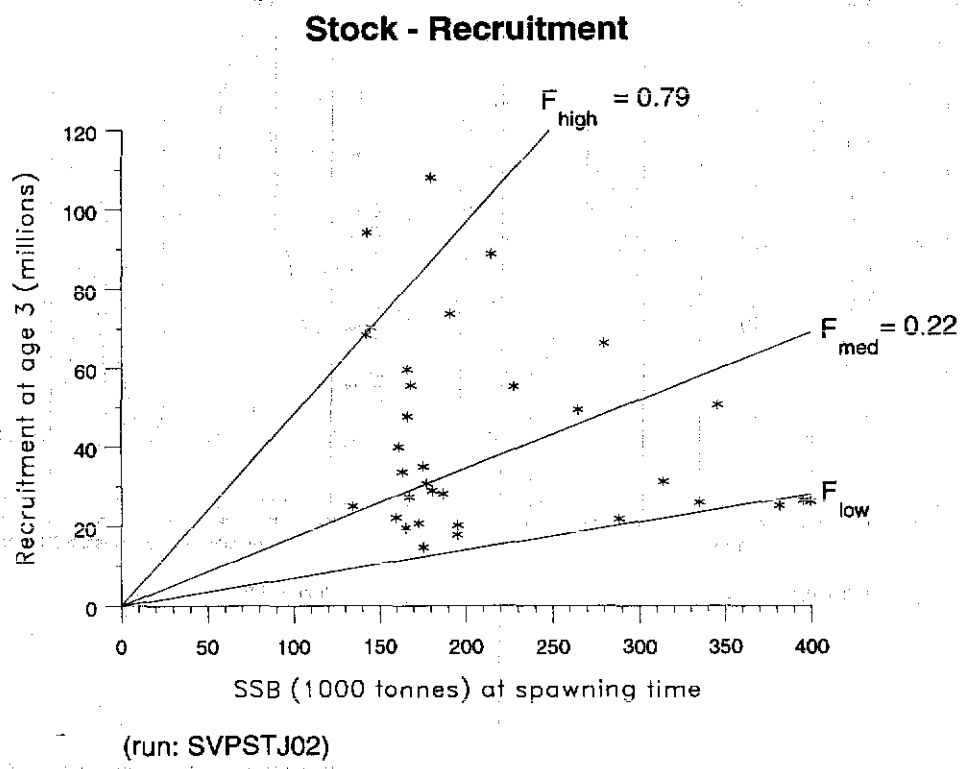


Figure 3.2.12. Saithe in Division Va. Stock and recruitment.