Advisory Committee on Fishery Management ICES CM 1997/Assess:13



REPORT OF THE

# NORTH-WESTERN WORKING GROUP

**ICES, Headquarters**
**29 April - 7 May 1997**

## Part 1 of 2



International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

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# 1 INTRODUCTION

## 1.1 Participants

| | |
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## 1.2 Terms of Reference

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

a) assess the status of and provide catch options for 1998 for the stocks of oceanic redfish in Sub-areas V, XII and XIV, Greenland halibut in Sub-areas V and XIV, cod in Sub-area XIV, NAFO Sub-area 1 and Divisions Va and Vb, saithe in Divisions Va and Vb and haddock in Division Vb;

b) for cod, haddock and saithe in Division Vb, where an effort control management system is in effect, estimate the probability profile of fishing mortalities which would be generated under the current effort control scheme and provide effort options which have a high probability (>80%) that the realised fishing mortalities in 1998 would correspond to the fishing mortality identified as within safe biological limits under items d) and e);

c) update fishery information on the stocks of redfish in Sub-areas V, VI, XII and XIV;

d) propose a definition of safe biological limits using target reference points based, where appropriate, on biomass, fishing mortality, maturity, growth, age structure, exploitation pattern, geographic distribution and other relevant parameters; based on the above parameters, propose limit reference points to be avoided with a high probability;

e) prepare medium-term forecasts of yield and SSB, taking into account uncertainties in data and assessments and assuming a stock-recruitment relationship, to indicate the probability of attaining target reference points and avoiding limit reference points;

f) provide a detailed description of the various fleets (i.e. gears, seasons, main fishing grounds, and main species) and, where possible, provide the landings, selection parameters, annual mortalities and predicted catches by fleet and species;

g) update information on the stock composition, distribution and migration of the redfish stocks in Sub-areas V and XIV and comment on the possible relationship between pelagic "deep sea" *Sebastes mentella* and the *Sebastes mentella* fished in demersal fisheries on the continental shelf and slope;

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

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

i) provide information on the relationship between pelagic "deep sea" *Sebastes mentella* and the *S. mentella* fished in demersal fisheries on the continental shelf and slope;

j) provide advice on the medium-term consequences of an adaptive harvesting strategy, based on a constant annual catch within each 5 year period, set at a level required to obtain sustainable yields of "Oceanic" *S. mentella* and "deep sea" *S. mentella*;

k) describe the depth distribution of the pelagic components of *Sebastes mentella* by season, area and year and provide information on the stock identity of the deep sea type and oceanic type *S. mentella.*

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

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

## 2.1 General Trends in Demersal Fisheries in the Faroe Area

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

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

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

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

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

### 2.1.1 Revised management system

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

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

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

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

In addition to the number of days allocated in the law, it is also stated in the law what percentage of total catches of cod, haddock, saithe and redfish, respectively, each fleet category are allowed to fish. These percentages are as follows:

| Fleet category | Cod | Haddock | Saithe | Redfish |
|---|---|---|---|---|
| Longliners < 100GRT, jiggers, single trawl. < 400HP | 51% | 58% | 17.5% | 1% |
| Longliners > 100GRT | 23% | 28% | | |
| Pairtrawlers | 21% | 10.25% | 69% | 8.5% |
| Single trawlers > 400 HP | 4% | 1.75% | 13% | 90.5% |
| Others | 1% | 2% | 0.5% | 0.5% |

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

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



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

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

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

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

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

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

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

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

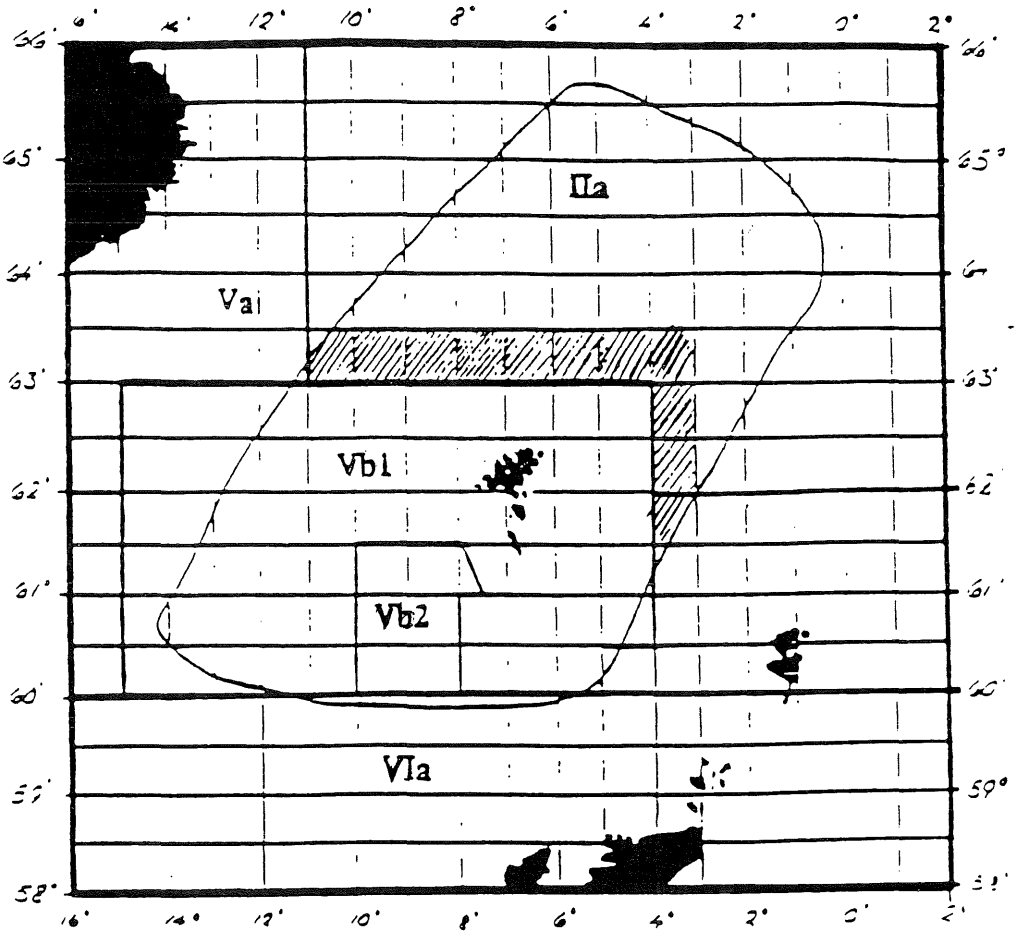
*) Includes effort used inside 12 nautical miles zone.

**) Included in the longliners and jiggers category.

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

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

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



## 2.2 Faroe Plateau Cod

### 2.2.1 Trends in landings

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

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

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

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

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

### 2.2.2 Catch-at-age

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

### 2.2.3 Mean weight-at-age

Mean weight-at-age data for 1961-1996 are provided for the Faroese fishery in Table 2.2.3.1. These were calculated using the length/weight relationship based on individual length/weight measurements of samples from the landings. The sum-of-products-check for 1996 showed a discrepancy of 0.6 %.

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

### 2.2.4 Maturity-at-age

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

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

### 2.2.5 Groundfish surveys

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

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

### 2.2.6 Stock assessment

#### 2.2.6.1 Tuning and estimates of fishing mortality

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

### 2.2.6.2 Stock estimates and recruitment

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

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

## 2.2.7 Predictions of catch and biomass

### 2.2.7.1 Short-term prediction

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

### 2.2.7.2 Medium-term prediction model and input data

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

There was insufficient time to run medium term projections.

### 2.2.7.3 Biological reference points

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

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

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

and the equilibrium recruits are simply:

SSB/(S/R).

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

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

### 2.2.7.4 Long-term prediction

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

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

## 2.2.8 Management considerations

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

### 2.2.9 Comments on the assessment

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

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

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

**Table 2.2.1.1** Faroe Plateau ( Sub-division Vb1) COD. Nominal catches (tonnes) by countries, 1986-1996, as officially reported to ICES.

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

*) Preliminary

1) Quantity unknown 1989-1991 and 1994.

2) Catches included in Sub-division Vb2

3) Reported as Vb.

4) Reported to Faroese Coastal Guard Service

5) Reported as Vb2

6) Updated in 1997

**Table 2.2.1.2** Nominal catch (tonnes) of COD in sub-division Vb1 (Faroe Plateau) 1986-1996, as used in the assessment.

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

*) Preliminary

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

*Table 2.2.1.3. Catch, tonnes landed weight.*

| Year | Open boats | Longliners < 100 GRT | Singletrawl < 400 HP | Gill nett | Jiggers | Singletrawl 400-1000HP | Singletrawl > 1000 HP | Pairtrawl < 1000 HP | Pairtrawl > 1000 HP | Longliners > 100 GRT | Industrial trawlers | Others | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1985** | 5650 | 9650 | 2372 | 202 | 1515 | 2787 | 3979 | 4367 | 1999 | 2643 | 54 | 202 | 35420 |
| **1986** | 2945 | 4697 | 1594 | 409 | 907 | 1930 | 2629 | 9203 | 4618 | 1590 | 137 | 392 | 31051 |
| **1987** | 2148 | 3209 | 1355 | 116 | 631 | 1445 | 1726 | 5631 | 3139 | 2146 | 112 | 31 | 21689 |
| **1988** | 584 | 3029 | 1072 | 564 | 1636 | 1612 | 1494 | 5542 | 3426 | 2788 | 135 | 33 | 21915 |
| **1989** | 932 | 6006 | 1174 | 654 | 1911 | 1179 | 1142 | 2185 | 1728 | 3674 | 148 | 6 | 20739 |
| **1990** | 472 | 4228 | 577 | 171 | 978 | 442 | 512 | 845 | 1247 | 2328 | 78 | 25 | 11903 |
| **1991** | 335 | 2477 | 554 | 160 | 623 | 262 | 366 | 652 | 1016 | 1349 | 44 | 8 | 7846 |
| **1992** | 136 | 1352 | 360 | 1 | 366 | 116 | 186 | 623 | 1079 | 697 | 257 | 22 | 5195 |
| **1993** | 109 | 792 | 763 | 0 | 444 | 204 | 179 | 704 | 1077 | 624 | 40 | 20 | 4956 |
| **1994** | 243 | 1032 | 764 | 41 | 1462 | 309 | 409 | 633 | 1811 | 1045 | 39 | 3 | 7791 |
| **1995** | 728 | 3093 | 1118 | 53 | 4289 | 713 | 817 | 1108 | 2122 | 3180 | 10 | 1 | 17232 |
| **1996** | 1302 | 6823 | 1503 | 93 | 6934 | 1226 | 636 | 2871 | 6577 | 7311 | 66 | 28 | 35373 |

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

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

Table 2.2.2.1 Catch in numbers at age for Faroe Plateau cod for each fleet in 1996.
Numbers are in thousands and the catch is in tonnes, round weight.

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

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

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

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

**Table 2.2.2.3**

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

At 3-May-97 17:22:20

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

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

**Table 2.2.2.3 (Continued)**

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

At 3-May-97 17:22:20

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**Table 2.2.6.1.10**

```
Lowestoft VPA Version 3.1

   3-May-97  17:21:20

Extended Survivors Analysis

Cod FaroePlateau Vb1 (run: XSAPET03/X03)

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

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

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


Time series weights :

     Tapered time weighting applied
     Power =    3 over  20 years


Catchability analysis :

     Catchability dependent on stock size for ages <    3

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


     Catchability independent of age for ages >=    6


Terminal population estimation :

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

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

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

     Prior weighting not applied


Tuning had not converged after   30 iterations


Total absolute residual between iterations
29 and  30 =     .00052

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




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


Fishing mortalities
   Age,  1987,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996

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

## Table 2.2.6.1.10 (Cont'd)

XSA population numbers (Thousands)

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

Estimated population abundance at 1st Jan 1997

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

Taper weighted geometric mean of the VPA populations:

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

Standard error of the weighted Log(VPA populations) :

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| .7040 | .7197 | .6313 | .5891 | .6055 | .6087 | .6000 | .5804 |

Log catchability residuals.

Fleet : LLGT: LONGLINERS > 1

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

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

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

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

Regression statistics :

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

| Age | Slope | t-value | Intercept | RSquare | No Pts | Reg s.e | Mean Q |
|---|---|---|---|---|---|---|---|
| 3 | 1.00 | -.004 | 11.94 | .61 | 12 | .64 | -11.94 |
| 4 | 1.19 | -.704 | 11.65 | .62 | 12 | .55 | -11.18 |
| 5 | 1.29 | -1.026 | 11.71 | .60 | 12 | .53 | -10.87 |
| 6 | .75 | 1.174 | 9.63 | .73 | 12 | .40 | -10.41 |
| 7 | .83 | .673 | 9.55 | .65 | 12 | .49 | -10.19 |
| 8 | .98 | .073 | 9.86 | .50 | 12 | .61 | -9.96 |
| 9 | .63 | 1.353 | 8.08 | .61 | 12 | .44 | -9.97 |

**Table 2.2.6.1.10 (Cont'd)**

Fleet : ST4AD: TRAWLERS 400-

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

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

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

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

Regression statistics :

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

| Age | Slope | t-value | Intercept | RSquare | No Pts | Reg s.e | Mean Q |
|---|---|---|---|---|---|---|---|
| 4 | .87 | .558 | 10.78 | .67 | 12 | .49 | -11.10 |
| 5 | .81 | 1.178 | 10.38 | .81 | 12 | .31 | -10.96 |
| 6 | .93 | .291 | 10.60 | .70 | 12 | .43 | -10.83 |
| 7 | 1.00 | -.020 | 10.86 | .67 | 12 | .46 | -10.84 |
| 8 | .99 | .051 | 11.05 | .65 | 12 | .45 | -11.12 |
| 9 | .84 | 2.848 | 9.89 | .97 | 12 | .09 | -10.87 |

**Table 2.2.6.1.10 (Cont'd)**

Terminal year survivor and F summaries :

Age 2 Catchability dependent on age and year class strength

Year class = 1994

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

Weighted prediction :

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

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

Year class = 1993

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

Weighted prediction :

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

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

Year class = 1992

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

Weighted prediction :

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

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

Year class = 1991

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

Weighted prediction :

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

**Table 2.2.6.1.10 (Cont'd)**

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

Year class = 1990

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

Weighted prediction :

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

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

Year class = 1989

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

Weighted prediction :

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

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

Year class = 1988

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

Weighted prediction :

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

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

Year class = 1987

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

Weighted prediction :

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

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

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

**Table 2.2.6.1.12**

At 3-May-97 17:22:20

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

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

**Table 2.2.6.2.1**

At 3-May-97 17:22:20

Terminal Fs derived using XSA (With F shrinkage)

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

| YEAR | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | +gp | 0 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1961 | 12019 | 7385 | 3747 | 2699 | 666 | 668 | 155 | 66 | 0 | | 27403 |
| 1962 | 20654 | 7042 | 3616 | 1863 | 1245 | 335 | 210 | 56 | 0 | | 35021 |
| 1963 | 20290 | 12907 | 3503 | 1825 | 752 | 584 | 190 | 87 | 0 | | 40138 |
| 1964 | 21834 | 12893 | 6986 | 1710 | 895 | 358 | 294 | 112 | 0 | | 45083 |
| 1965 | 8269 | 16037 | 7823 | 3639 | 830 | 416 | 151 | 169 | 0 | | 37332 |
| 1966 | 18566 | 5999 | 10207 | 4085 | 1698 | 351 | 200 | 80 | 0 | | 41186 |
| 1967 | 23451 | 13990 | 4034 | 6475 | 2133 | 842 | 109 | 70 | 0 | | 51103 |
| 1968 | 17582 | 17744 | 9020 | 2525 | 3757 | 980 | 410 | 31 | 0 | | 52049 |
| 1969 | 9325 | 13012 | 11522 | 4976 | 1212 | 1967 | 393 | 240 | 0 | | 42646 |
| 1970 | 8608 | 6840 | 7843 | 6447 | 2682 | 561 | 965 | 138 | 0 | | 34084 |
| 1971 | 11928 | 6684 | 4548 | 4456 | 3754 | 1515 | 238 | 519 | 0 | | 33642 |
| 1972 | 21320 | 9469 | 4788 | 2981 | 2483 | 1760 | 779 | 92 | 0 | | 43672 |
| 1973 | 12572 | 16663 | 6688 | 3187 | 1901 | 1109 | 902 | 499 | 400 | | 43922 |
| 1974 | 30478 | 9639 | 10816 | 4037 | 1969 | 1209 | 626 | 533 | 342 | | 59649 |
| 1975 | 38310 | 22998 | 6746 | 7217 | 2460 | 1103 | 581 | 378 | 476 | | 80268 |
| 1976 | 18569 | 29028 | 13681 | 3571 | 3908 | 1279 | 636 | 304 | 466 | | 71441 |
| 1977 | 9993 | 13849 | 20004 | 7764 | 1675 | 1908 | 489 | 274 | 18 | | 55973 |
| 1978 | 10687 | 7797 | 8369 | 10185 | 2992 | 659 | 513 | 184 | 154 | | 41539 |
| 1979 | 15089 | 8247 | 5280 | 4460 | 5429 | 1508 | 297 | 238 | 103 | | 40651 |
| 1980 | 23520 | 11833 | 5185 | 2809 | 2203 | 2720 | 788 | 122 | 52 | | 49233 |
| 1981 | 14036 | 18235 | 7641 | 2923 | 1490 | 1073 | 1474 | 339 | 150 | | 47362 |
| 1982 | 22309 | 10907 | 11186 | 4463 | 1536 | 694 | 438 | 730 | 347 | | 52611 |
| 1983 | 25178 | 17234 | 7152 | 6378 | 2491 | 832 | 284 | 206 | 199 | | 59953 |
| 1984 | 48048 | 18670 | 8889 | 3358 | 2737 | 950 | 220 | 90 | 173 | | 83134 |
| 1985 | 17496 | 35361 | 10549 | 4122 | 1428 | 1416 | 493 | 106 | 127 | | 71098 |
| 1986 | 9464 | 13421 | 20370 | 5203 | 1865 | 472 | 370 | 124 | 100 | | 51389 |
| 1987 | 10107 | 7558 | 7744 | 9020 | 2113 | 706 | 173 | 170 | 63 | | 37655 |
| 1988 | 8632 | 8042 | 4956 | 3977 | 4596 | 995 | 375 | 80 | 60 | | 31714 |
| 1989 | 15388 | 6607 | 4665 | 2298 | 1914 | 1792 | 370 | 155 | 23 | | 33210 |
| 1990 | 3397 | 10574 | 3463 | 1840 | 867 | 638 | 565 | 104 | 53 | | 21501 |
| 1991 | 6336 | 2561 | 6080 | 1495 | 736 | 344 | 257 | 199 | 91 | | 18099 |
| 1992 | 10084 | 5016 | 1693 | 3050 | 667 | 331 | 154 | 127 | 147 | | 21269 |
| 1993 | 12560 | 8067 | 3686 | 956 | 1654 | 274 | 149 | 76 | 86 | | 27508 |
| 1994 | 25542 | 10177 | 5892 | 2483 | 585 | 1062 | 140 | 93 | 67 | | 46041 |
| 1995 | 42107 | 20406 | 7637 | 3888 | 1563 | 369 | 714 | 80 | 88 | | 76851 |
| 1996 | 13087 | 32109 | 14250 | 4436 | 2267 | 859 | 195 | 426 | 56 | | 67684 |
| 1997 | 0 | 10396 | 21609 | 7491 | 2235 | 473 | 163 | 27 | 39 | | 42432 |
| Average | 17690 | 13194 | 7785 | 4078 | 2032 | 962 | 425 | 203 | | | |

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**Table 2.2.6.2.2**

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Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

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

**Table 2.2.7.4.1**



Cod in the Faroe Plateau (Fishing Area Vb1)

Yield per recruit: Input data

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

Notes: Run name : YLDJJM05
Date and time: 06MAY97:15:19

**Table 2.2.7.4.2**



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

(cont.)

**Table 2.2.7.4.2 (Cont'd)**



Cod in the Faroe Plateau (Fishing Area Vb1)

Yield per recruit: Summary table

(cont.)

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

Notes: Run name : YLDJJM05
Date and time : 06MAY97:15:19
Computation of ref. F: Simple mean, age 3 - 7
F-0.1 factor : 0.2944
F-max factor : 0.6426
F-0.1 reference F : 0.1411
F-max reference F : 0.3080
Recruitment : Single recruit

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

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

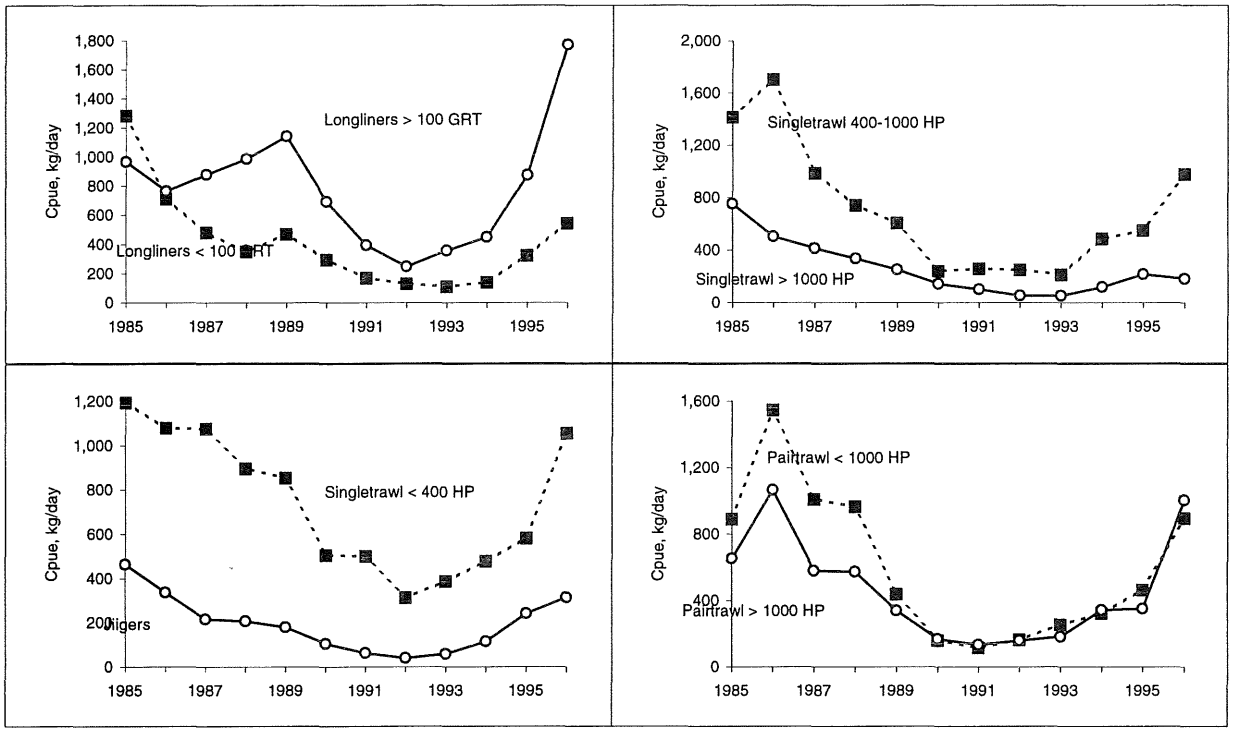



**Figure 2.2.1** Catch per unit effort of Faroe Plateau Cod January-December. (kg/day)

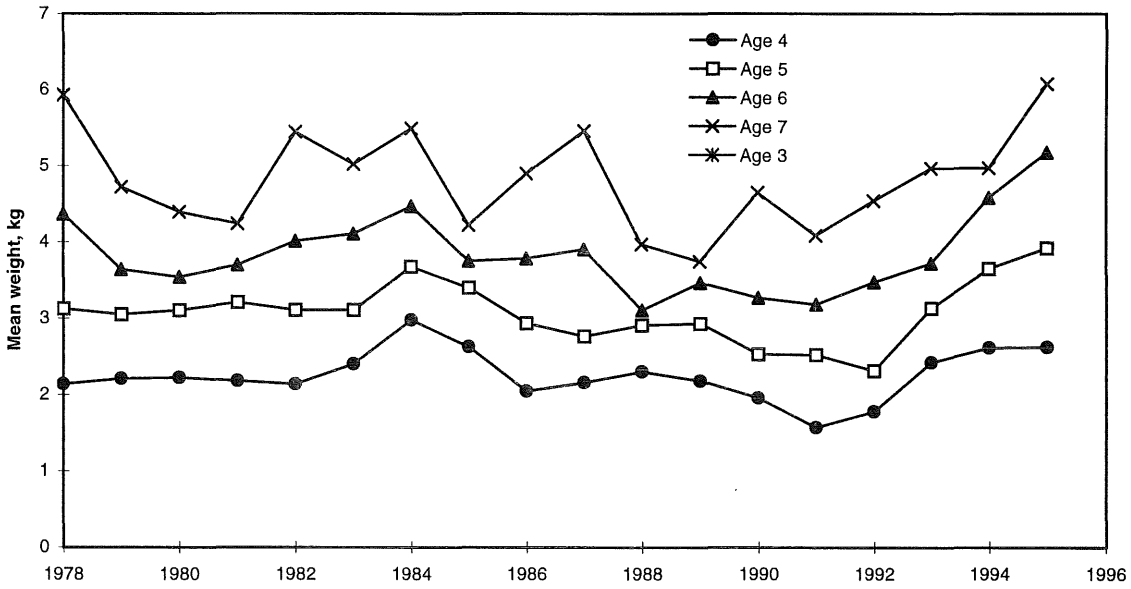



**Figure 2.2.2.** Mean weight at age for Faroe Plateau cod 1978-1995.

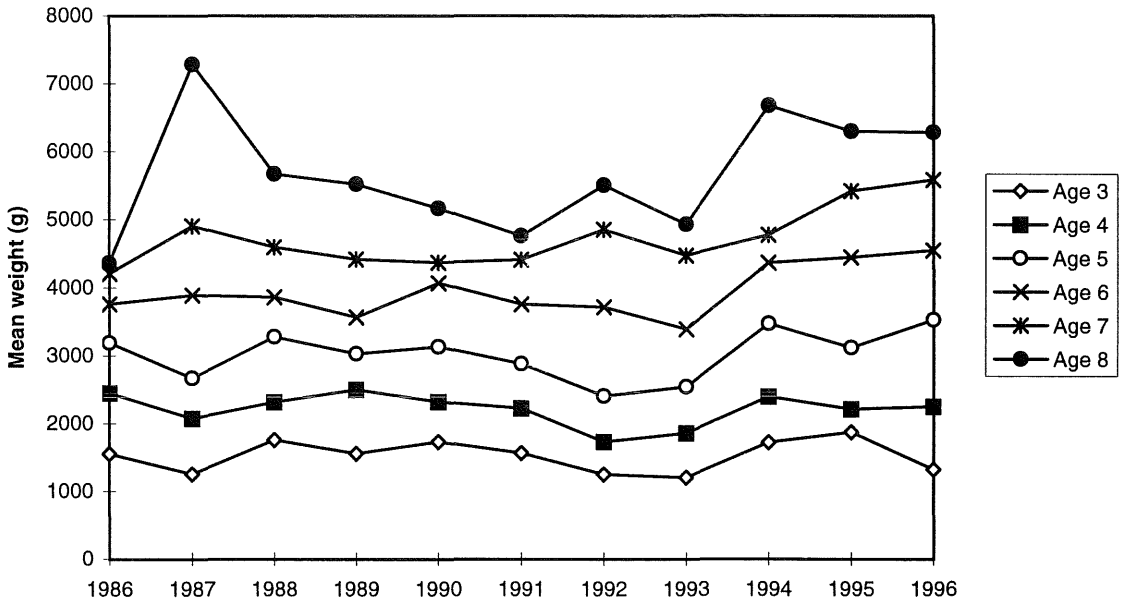



**Figure 2.2.3** Faroe Plateau cod mean weight at age 1st quarter 1986-1996. Commecial data.

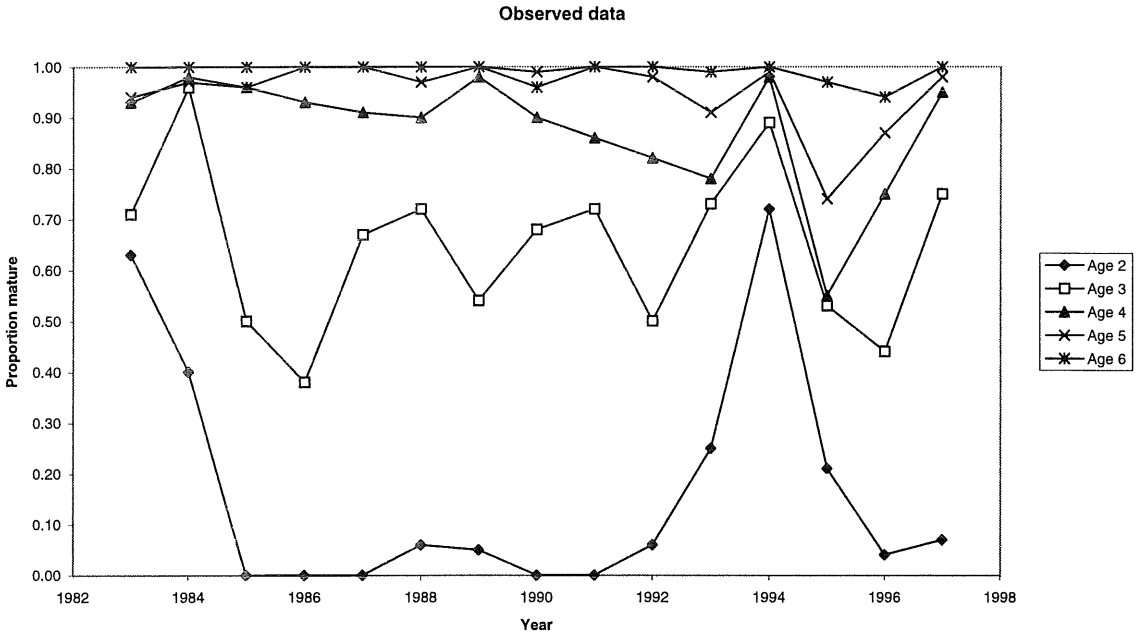



**Figure 2.2.4** Faroe Plateau cod. Proportion mature at age as observed in the groundfish survey.

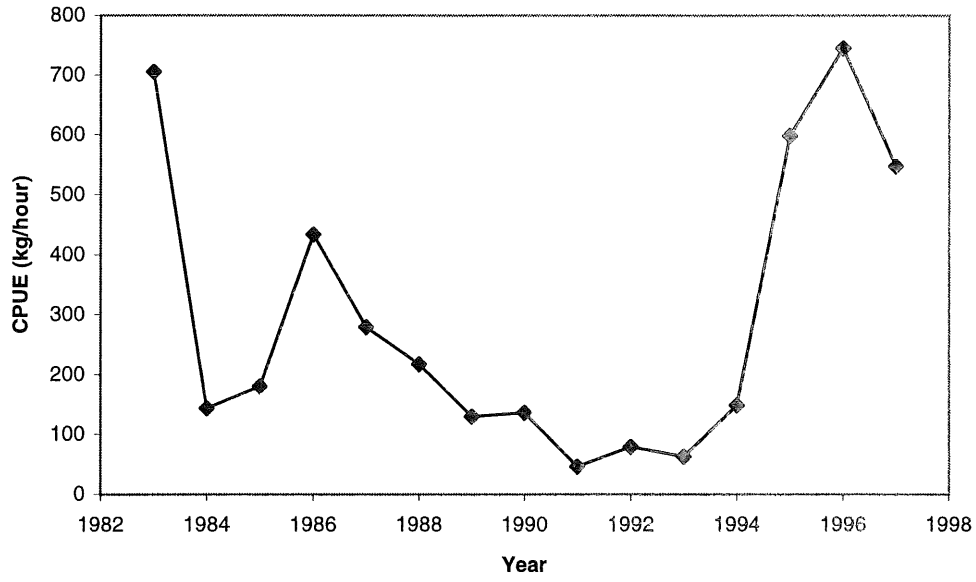



**Figure 2.2.5**. Catch per unit effort of Faroe Plateau cod in the groundfish survey.

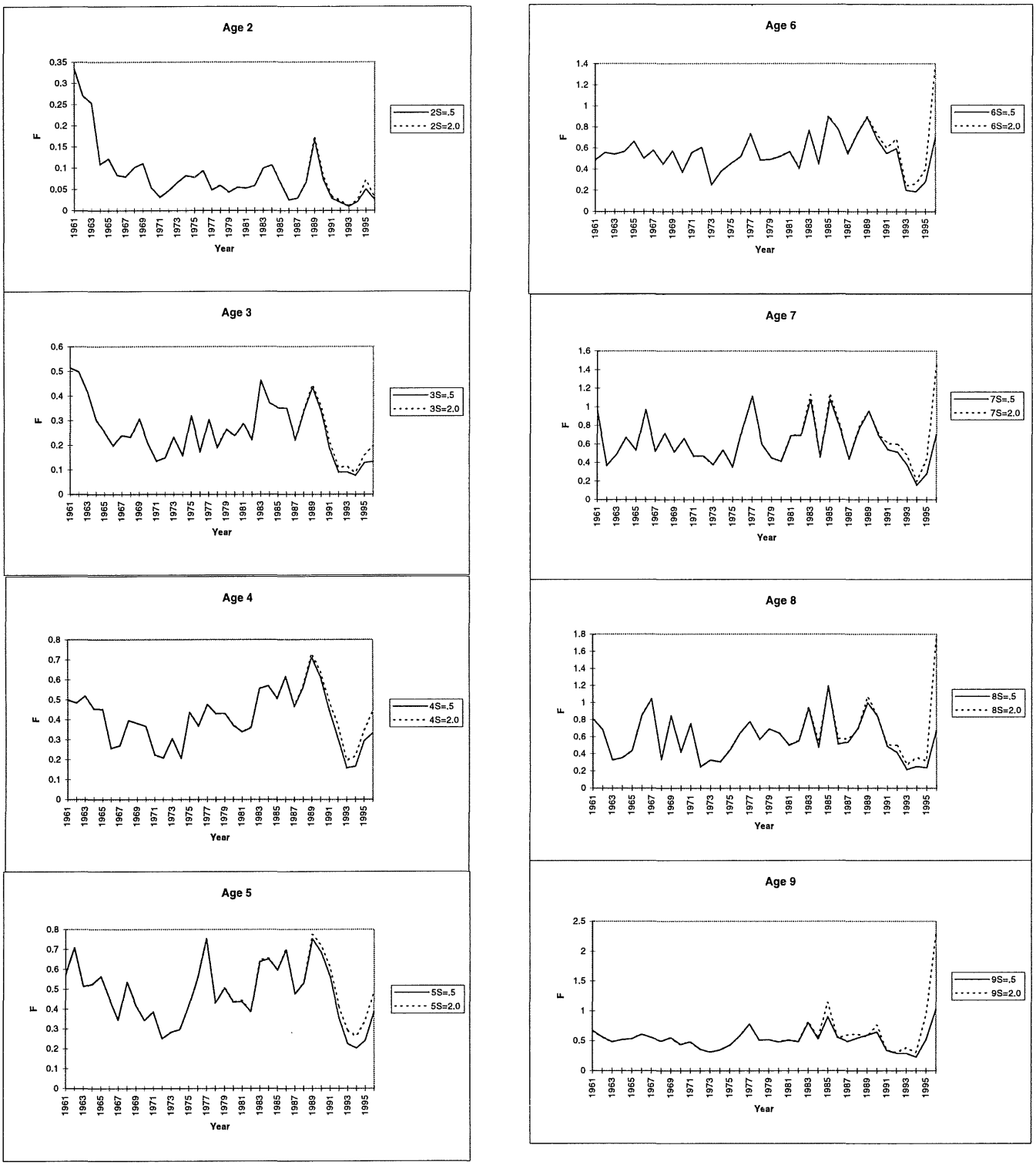



**Figure 2.2.6 Faroe Plateau cod. F at age with and without shrinkage**

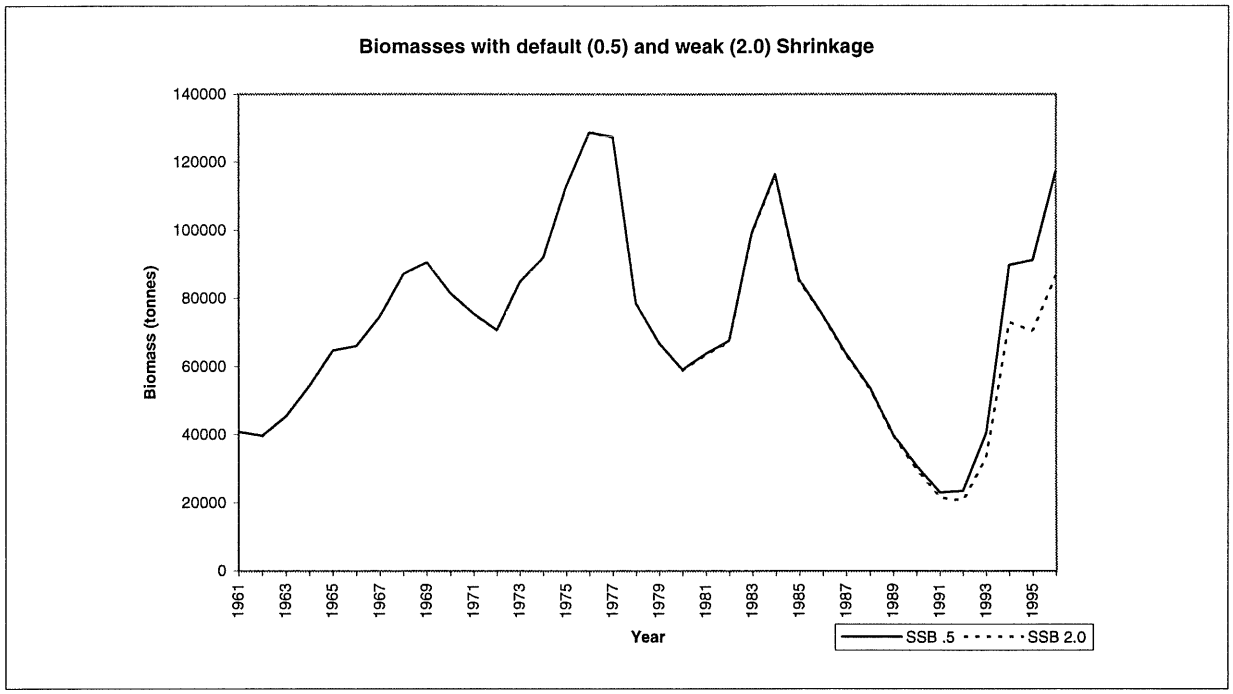
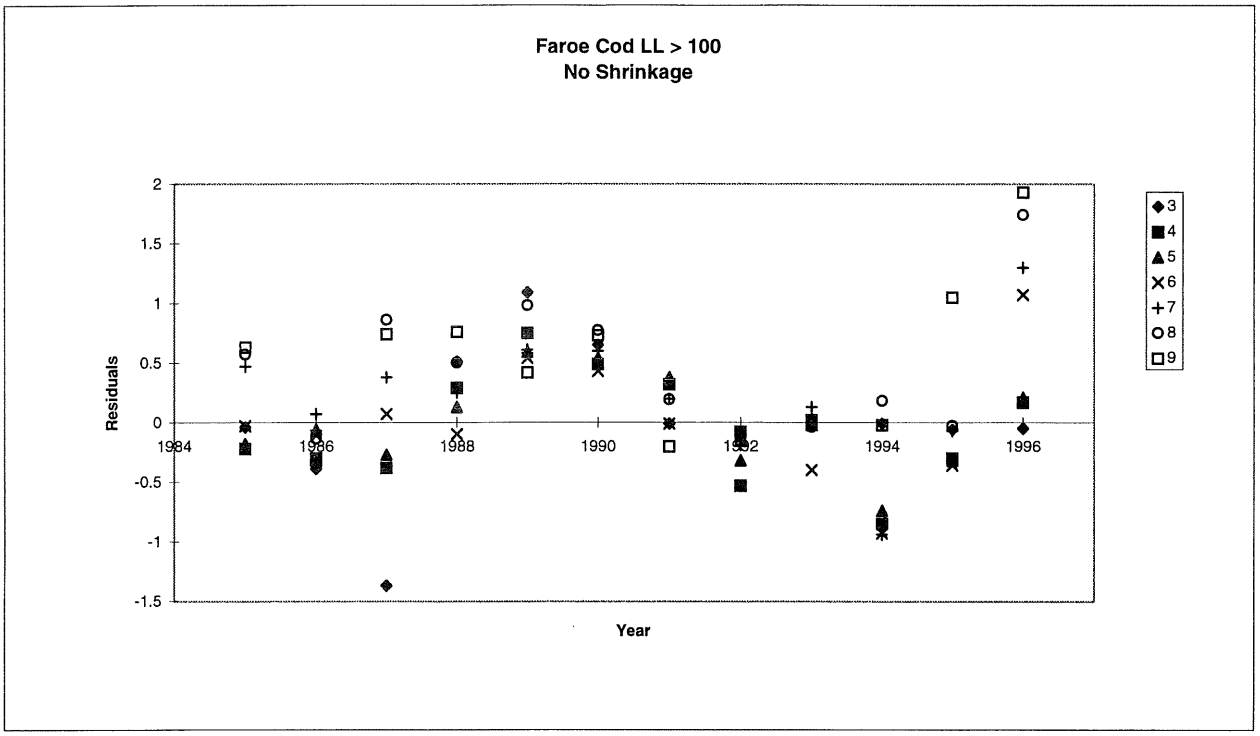



**Figure 2.2.7 Spawning biomass of Faroe Plateau cod estimated from XSA with shrinkage of 0.5 and shrinkage of 2.0**



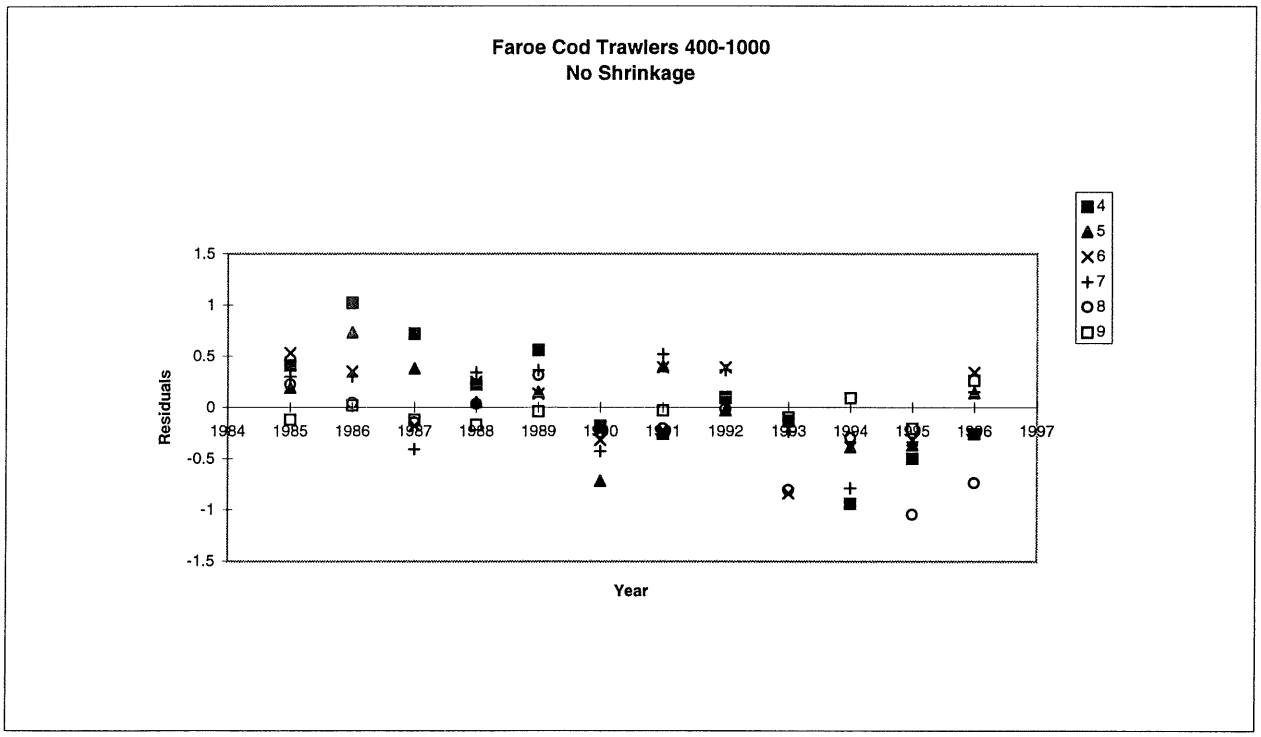
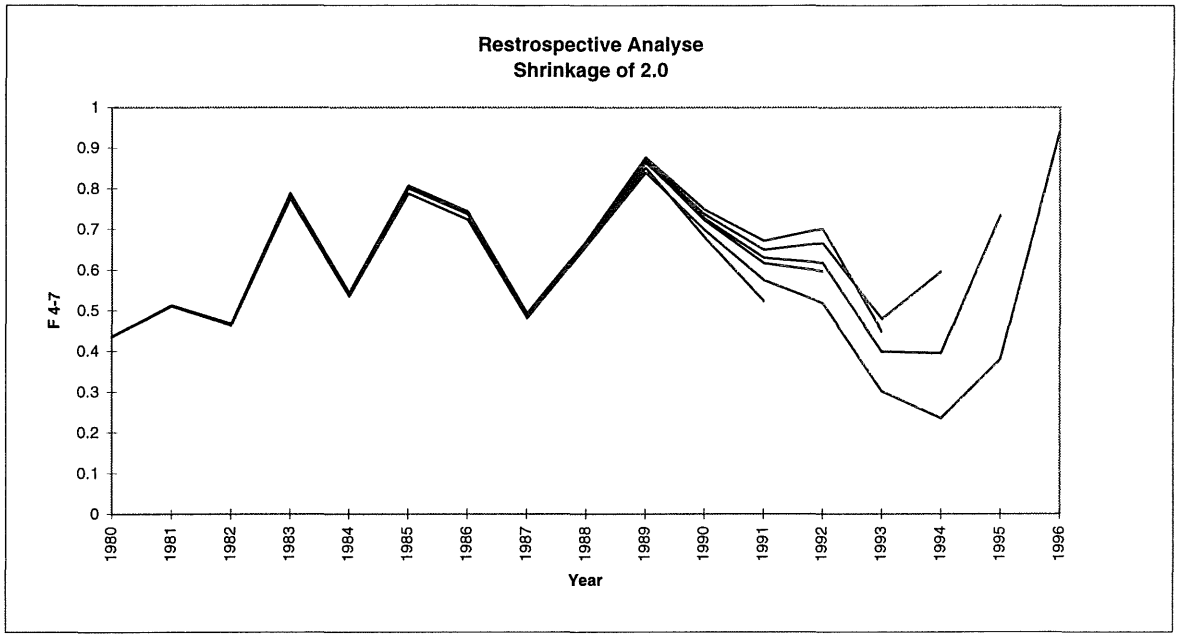




**Figure 2.2.8** **Faroe Plateau cod. Residuals from XSA using LL > 100 and OTB 400-1000 without shrinkage.**



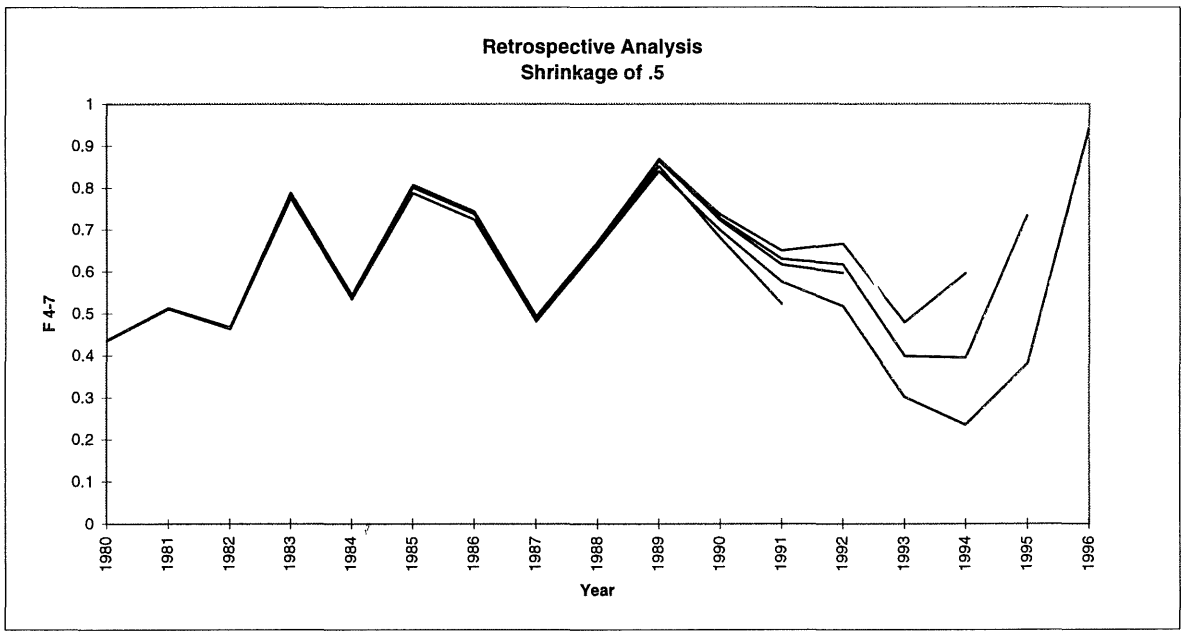
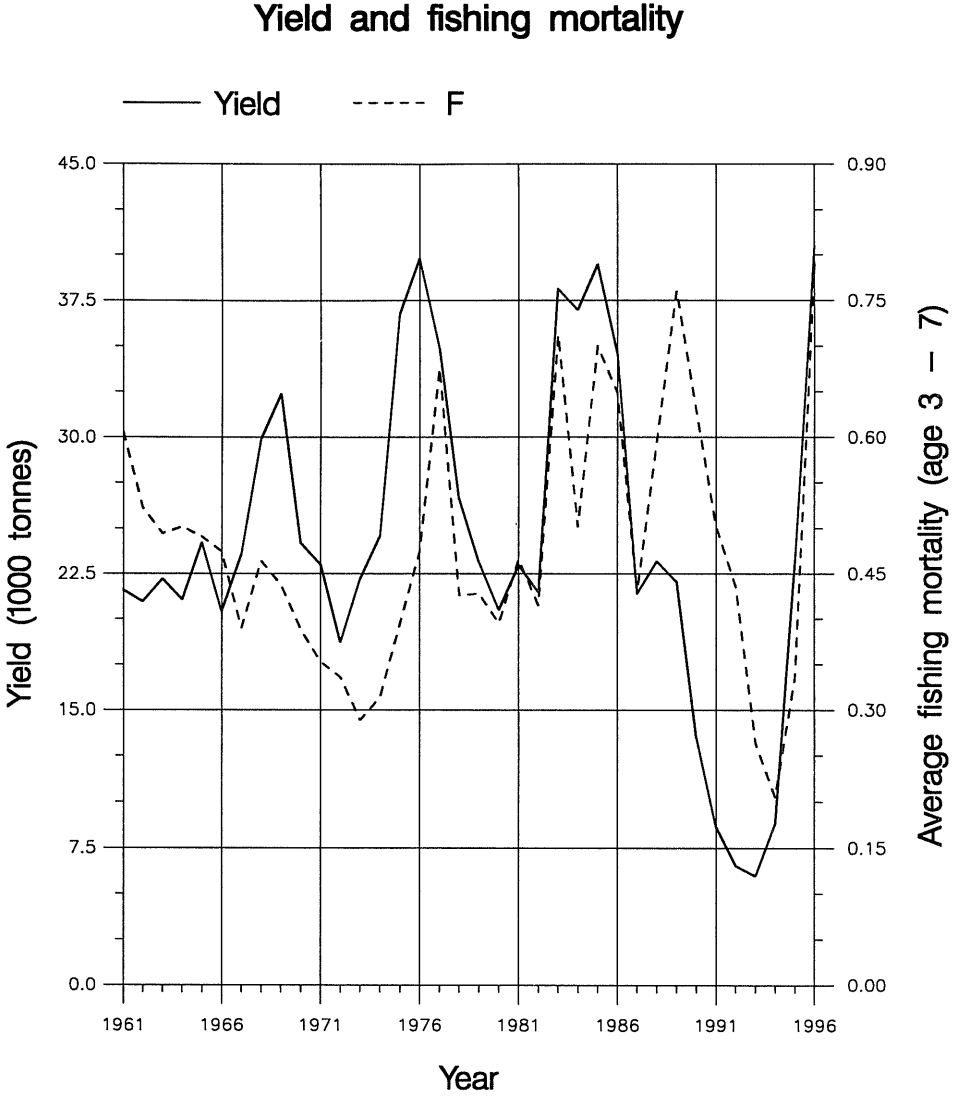



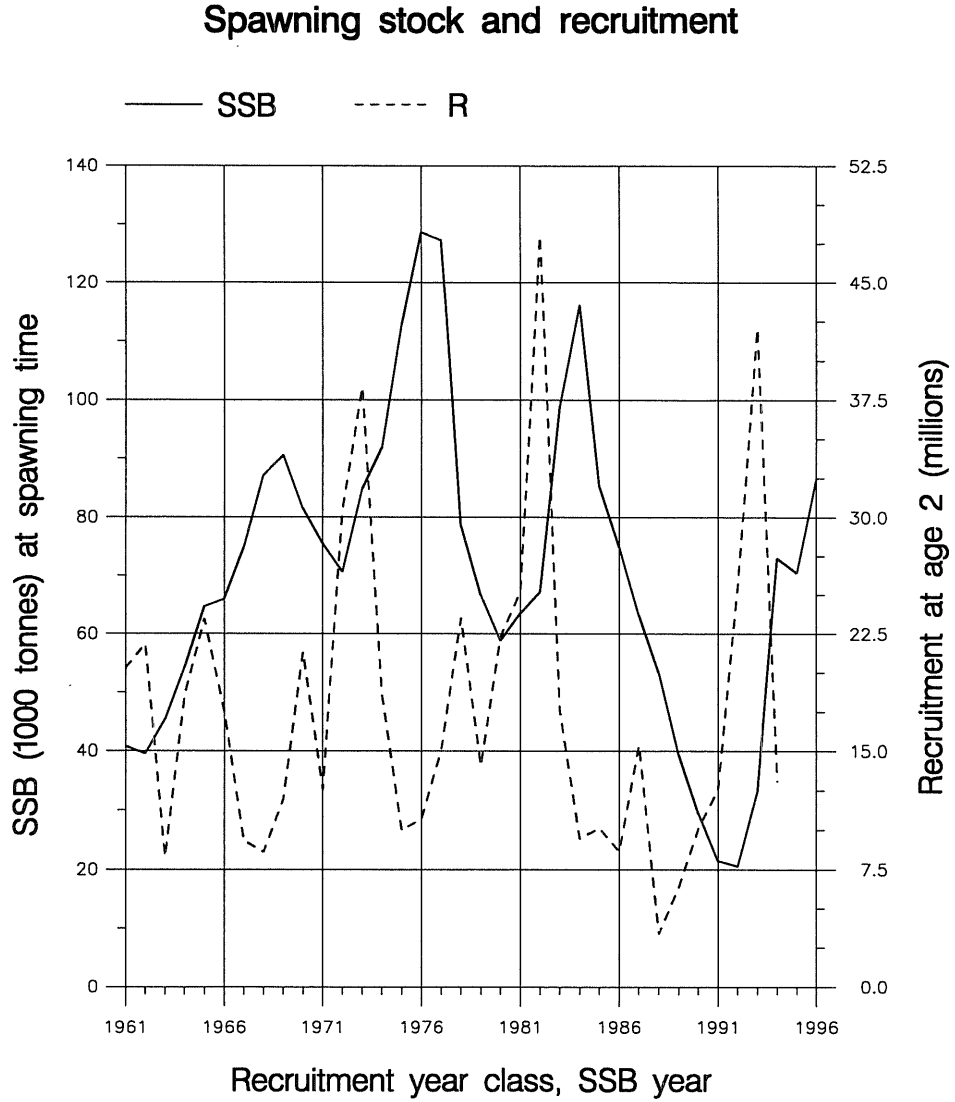

**Figure 2.2.9** **Faroe Plateau cod. Retrospective analyses with and without shrinkage.**

Figure 2.2.10

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




(run: XSAPET03) **A**




(run: XSAPET03) **B**

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

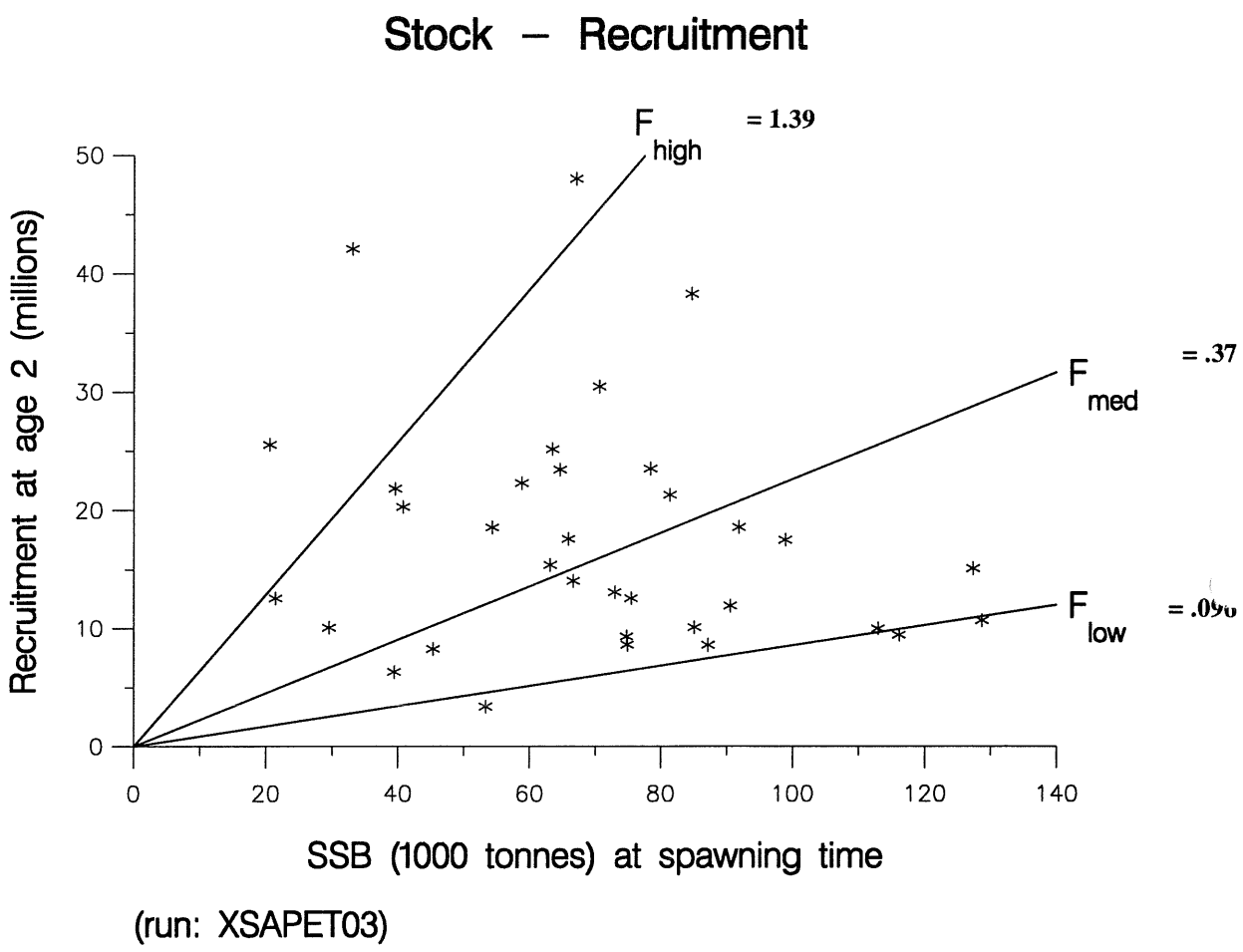



**Figure 2.2.11**

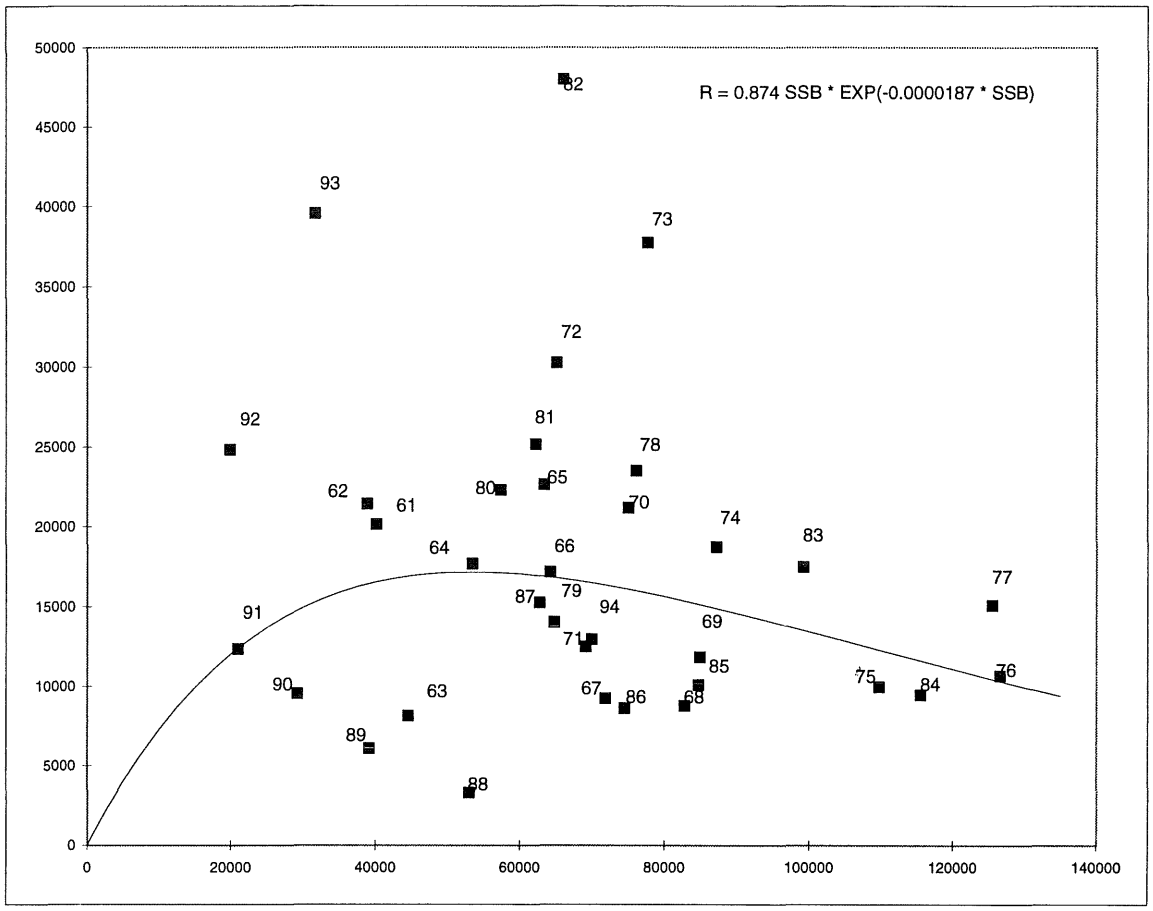



**Figure 2.2.12 Faroe Plateau cod. Ricker stock recruitment relationship fitted to 1961 to 1994 ssb and year-classes.**

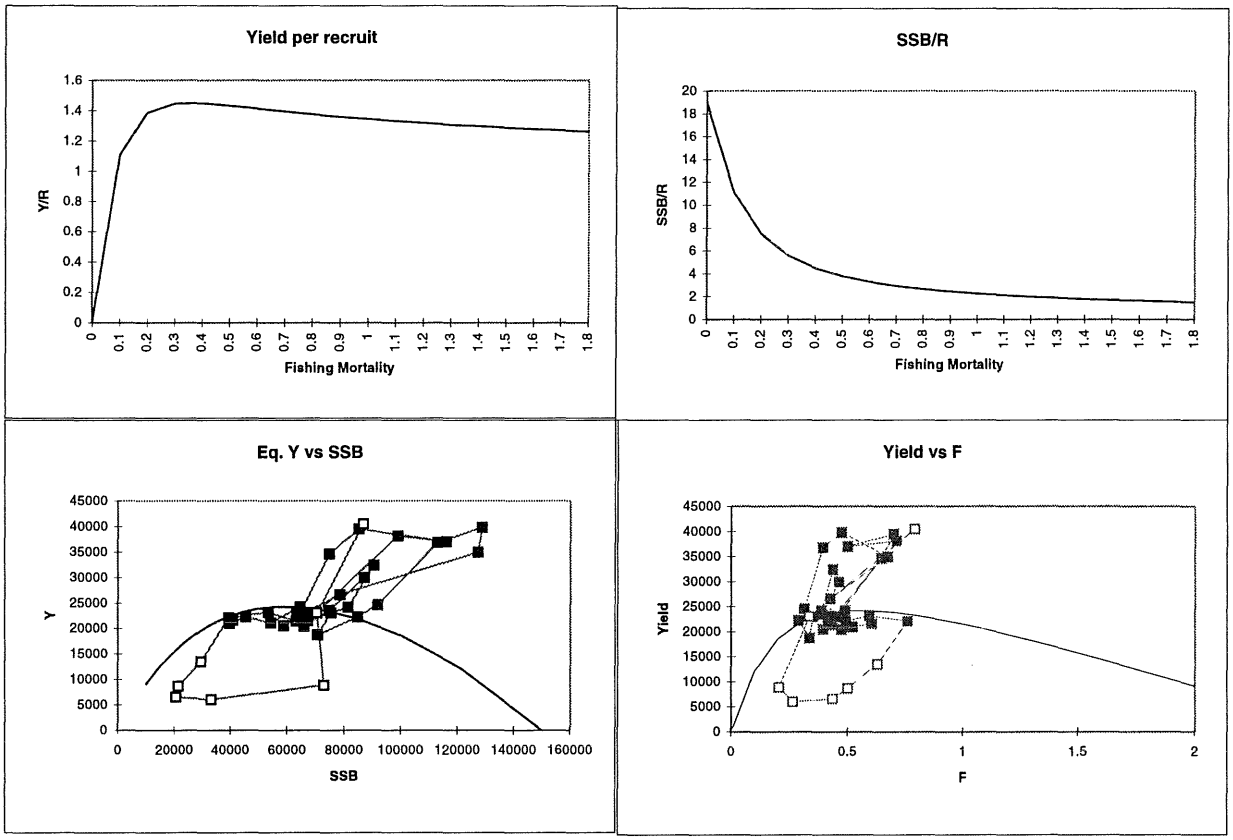
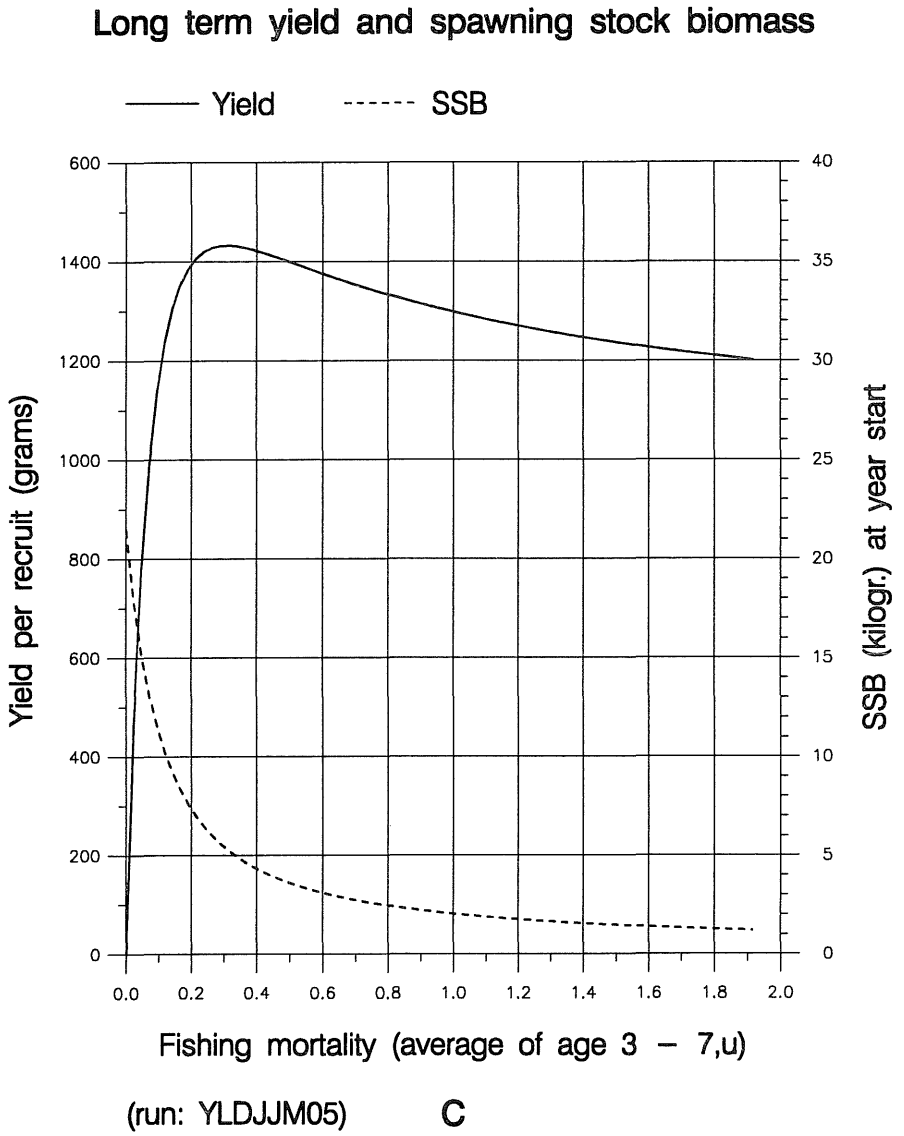



**Figure 2.2.13 Faroe Plateau cod. Results of age-structured production modelling with a Ricker stock recruitment relationship.**

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

Figure 2.2.14

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



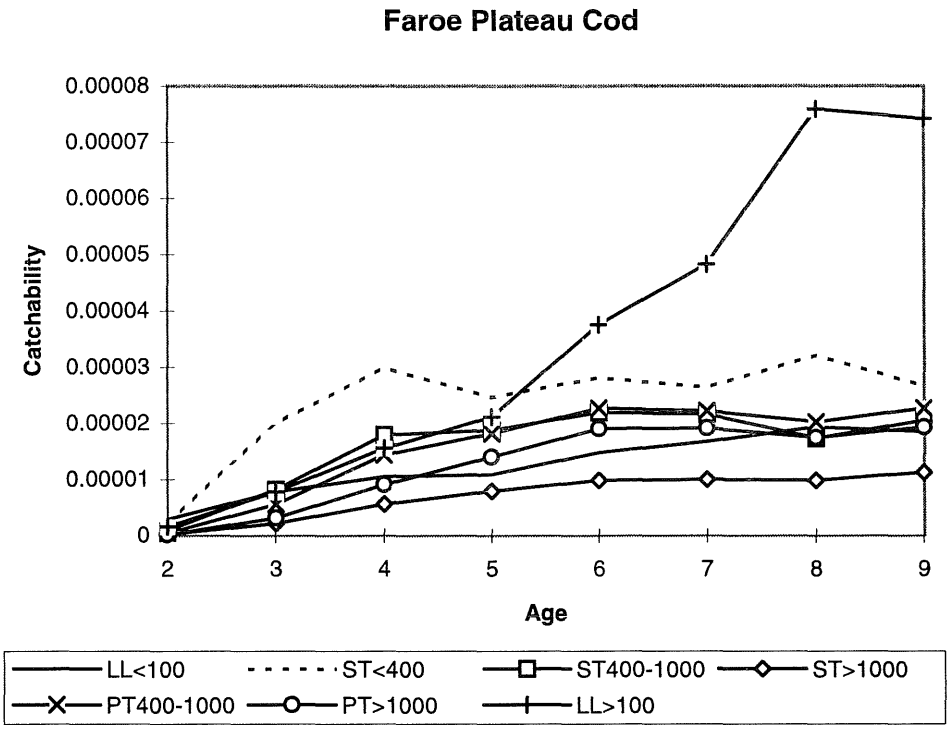



**Figure 2.2.15** Average age-specific catchabilities for different faroese fleets.

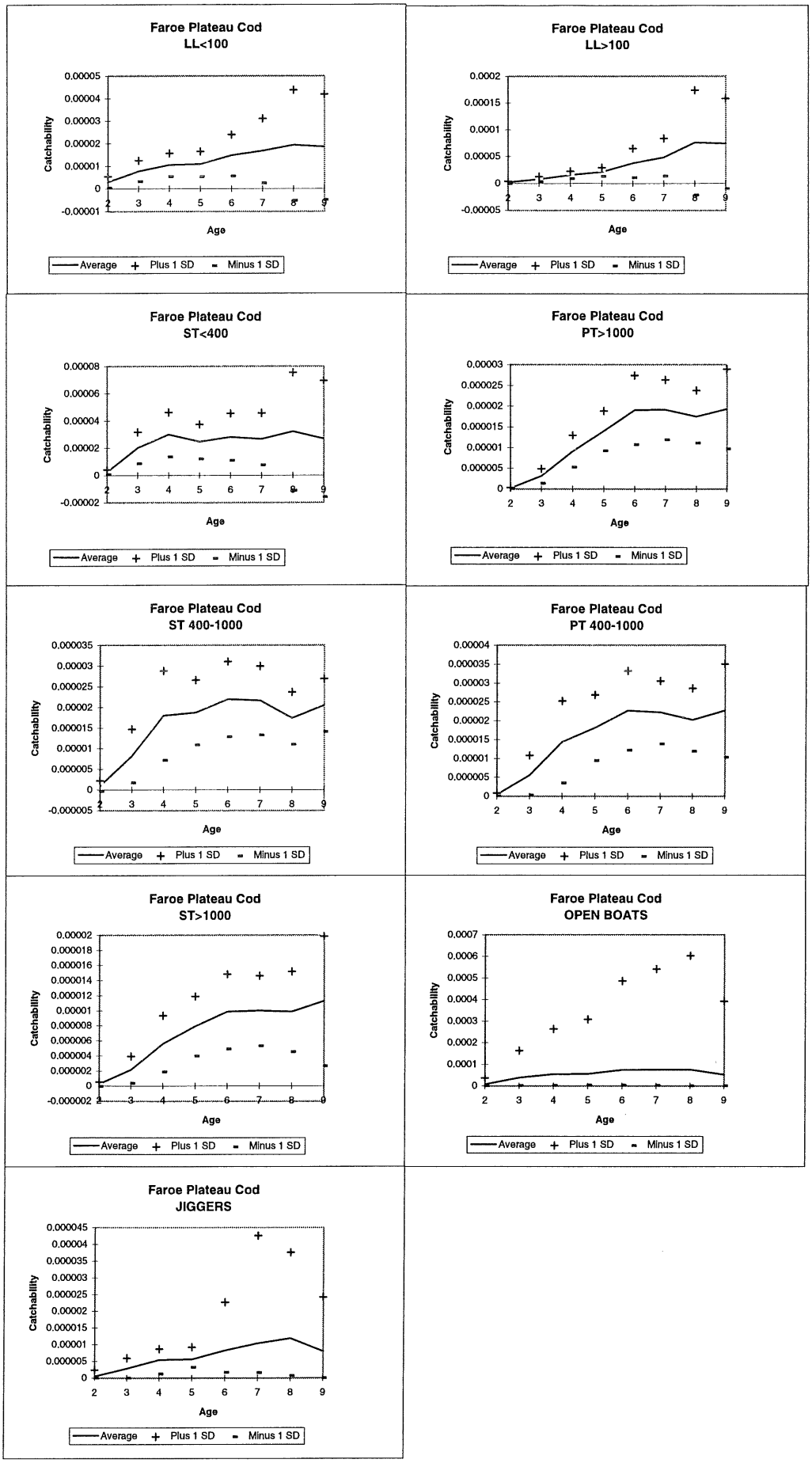



**Figure 2.216 Catchability at age (average,plus/minus 1 SD) for different faroese fleets 'from 1985 to 1996.**

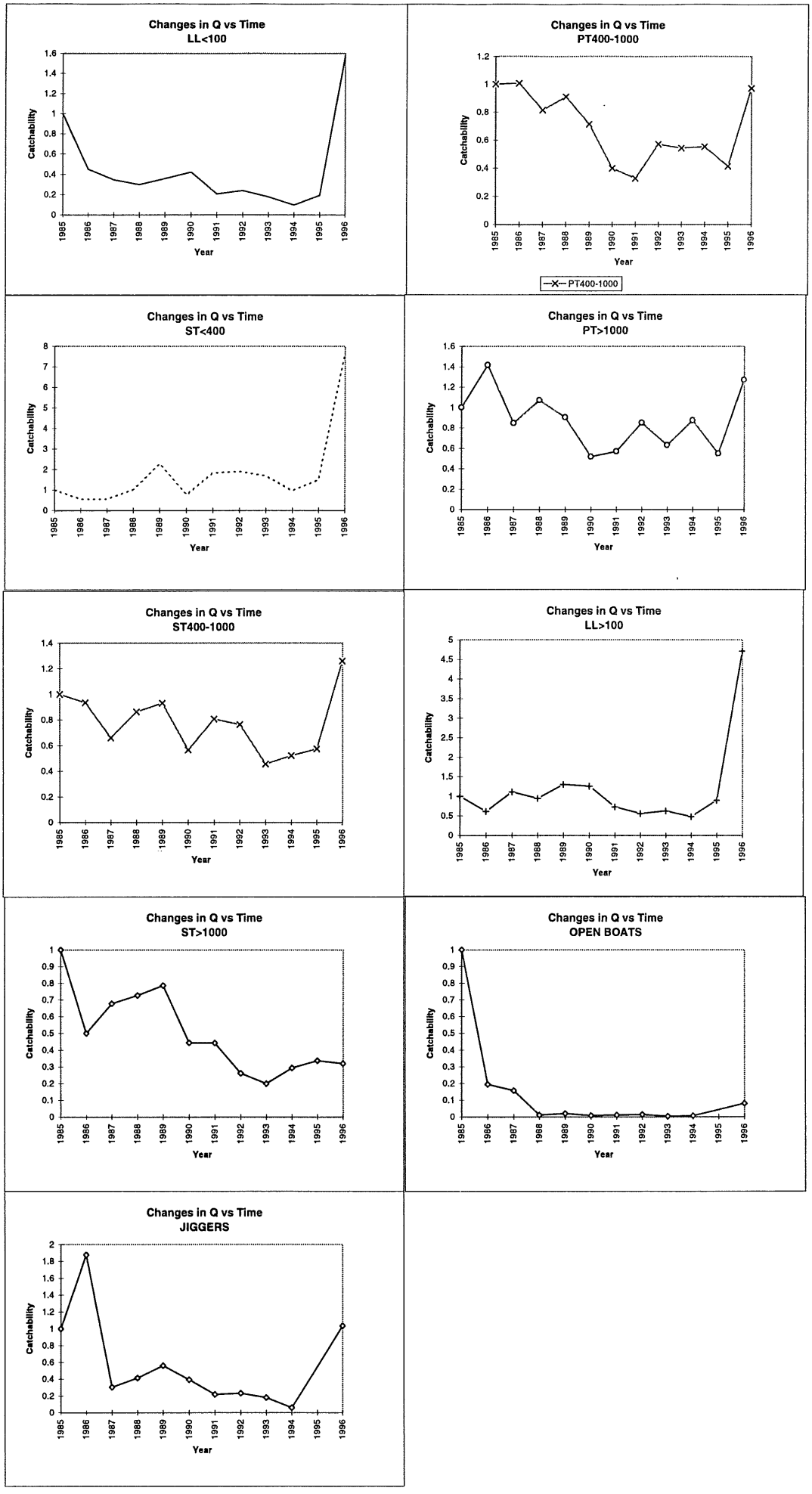



**Figure 2.2.17 Catchability of different faroese fleets versus time (1985 to 1996).**

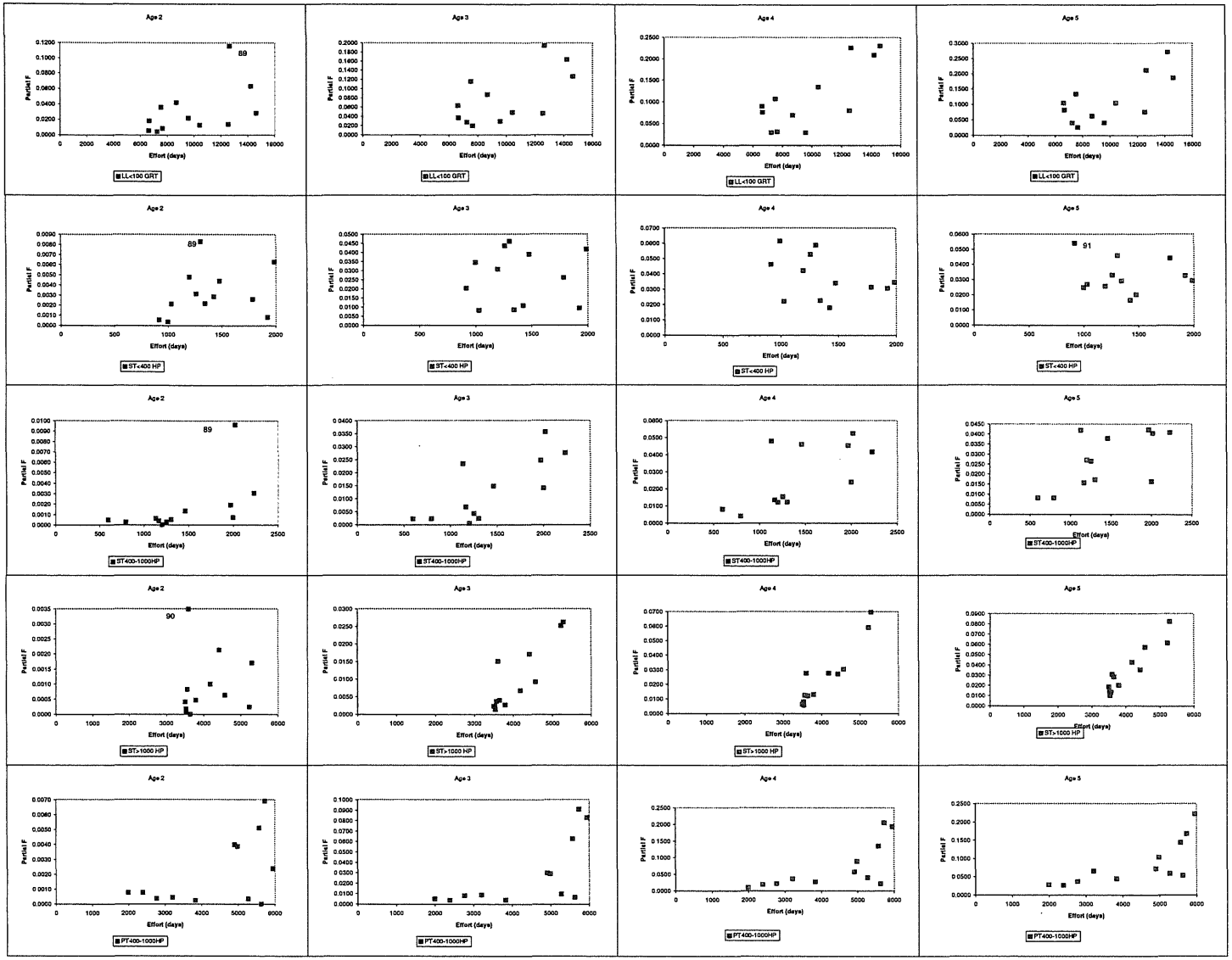



**Figure 2.2.18** Partial F at age versus effort (days) for different faroese fleets

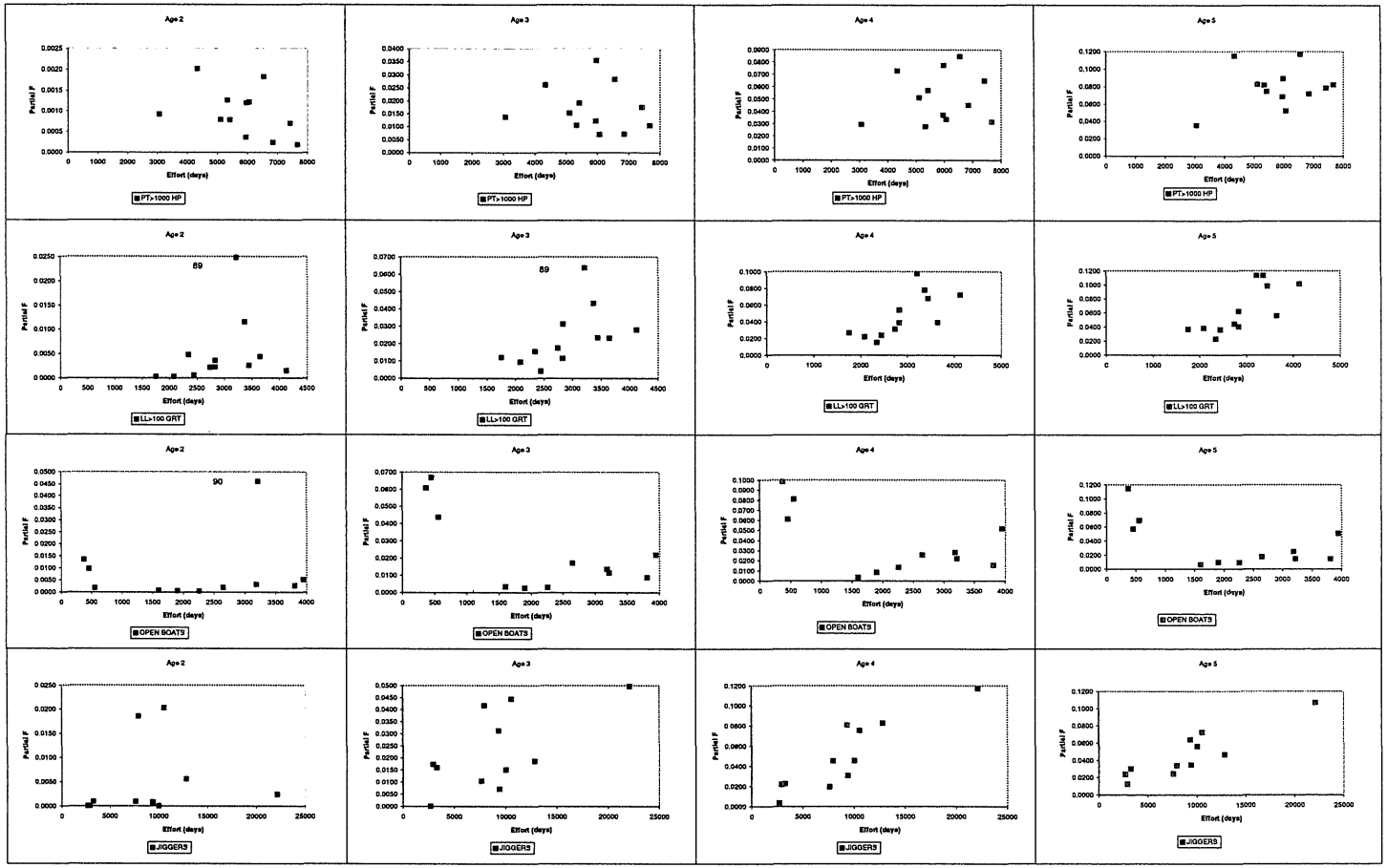



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**Figure 2.2.18 (Cont'd)**

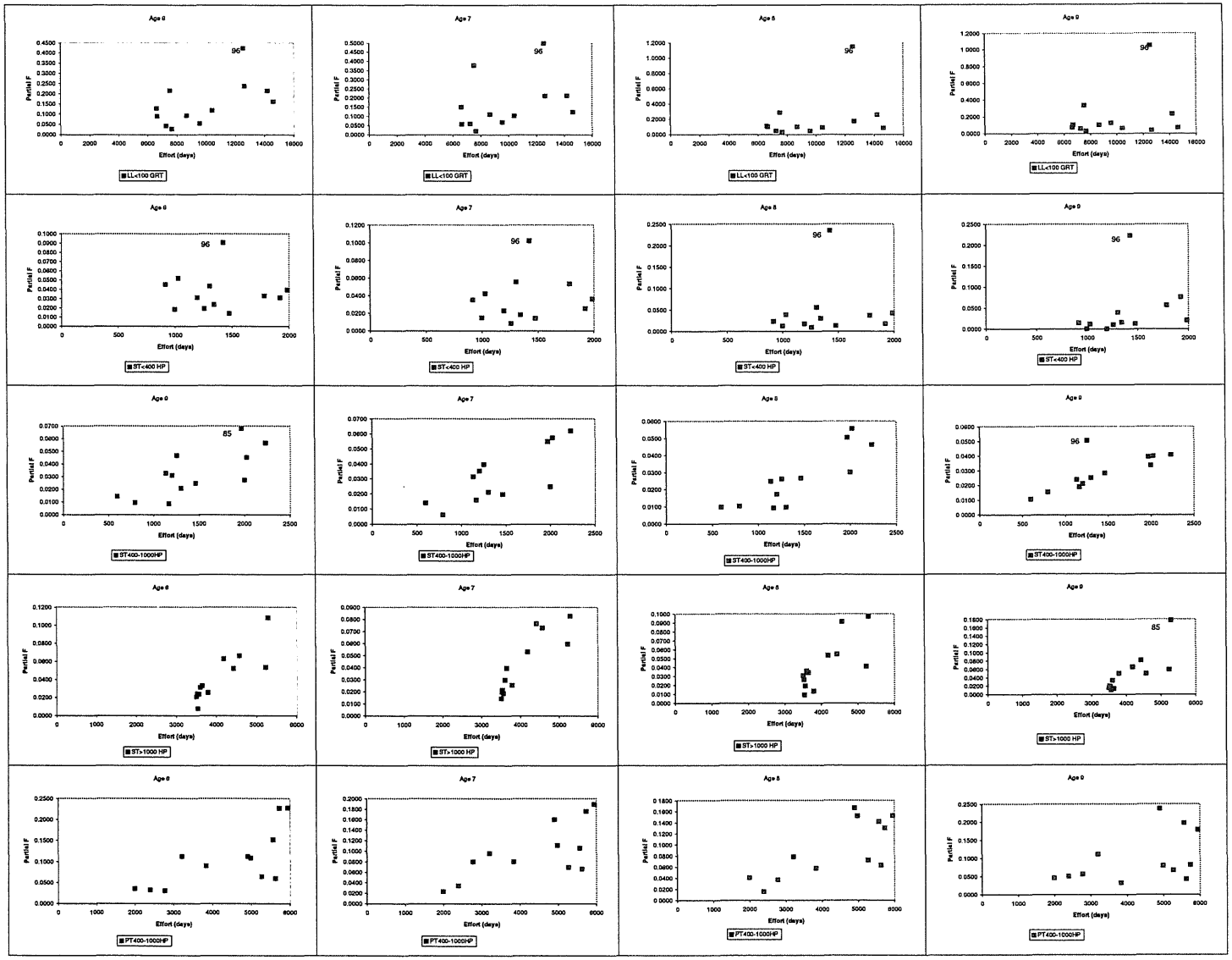


**Figure 2.2.18 (Cont'd)**

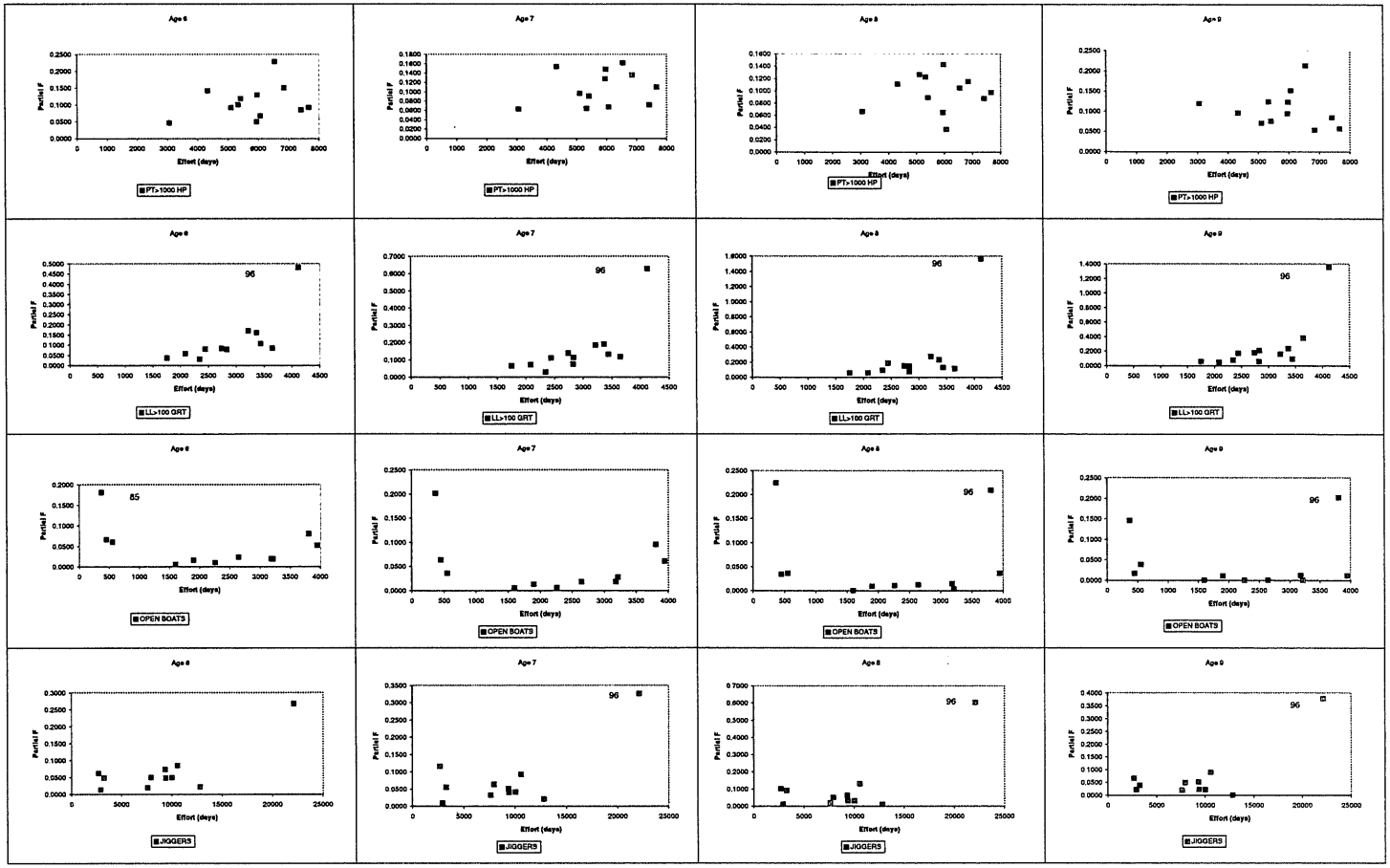


**Figure 2.2.18 (Cont'd)**

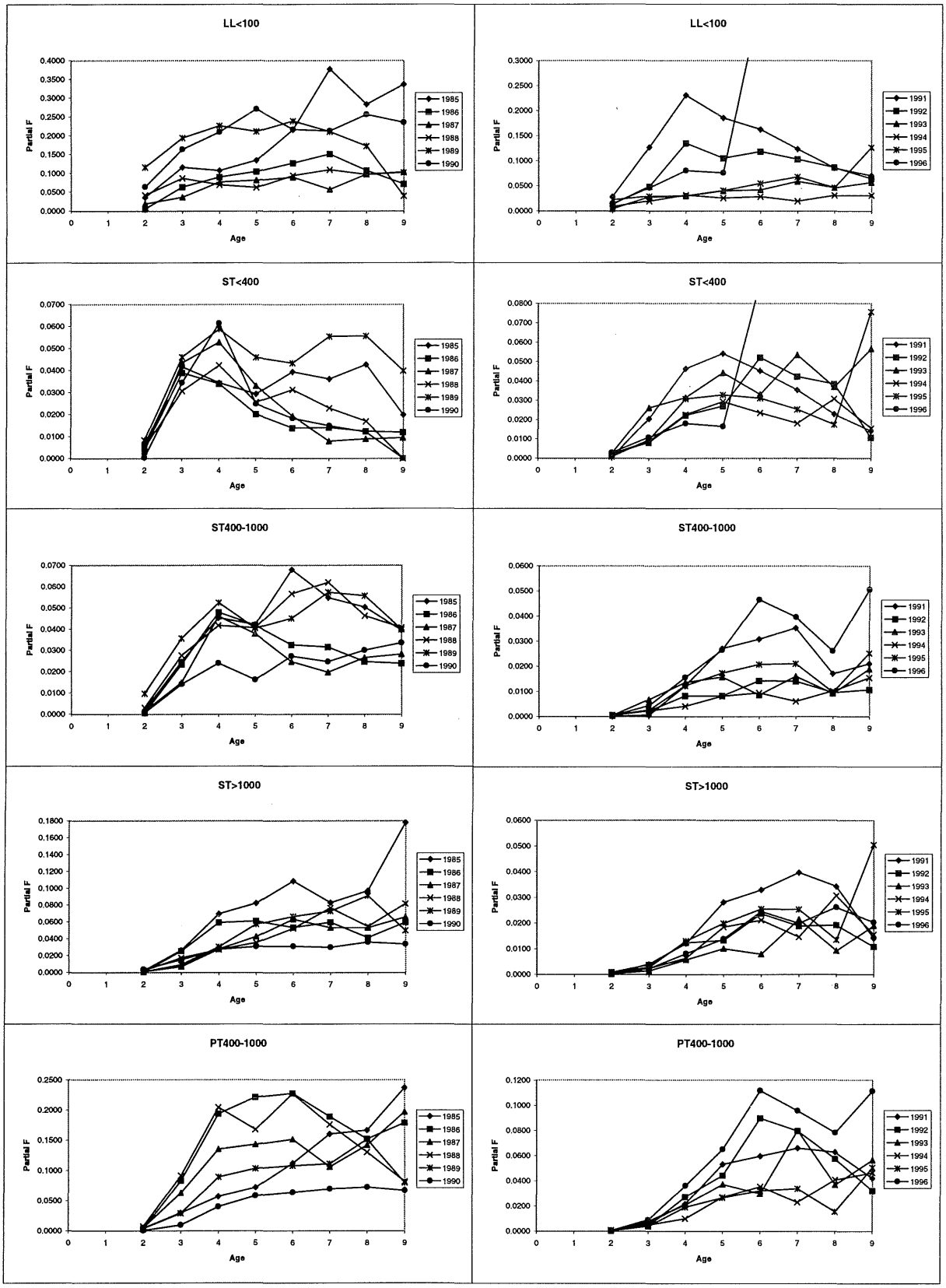


Figure 2.2.19 Partial F at age for different faroese fleets 1985-1996.

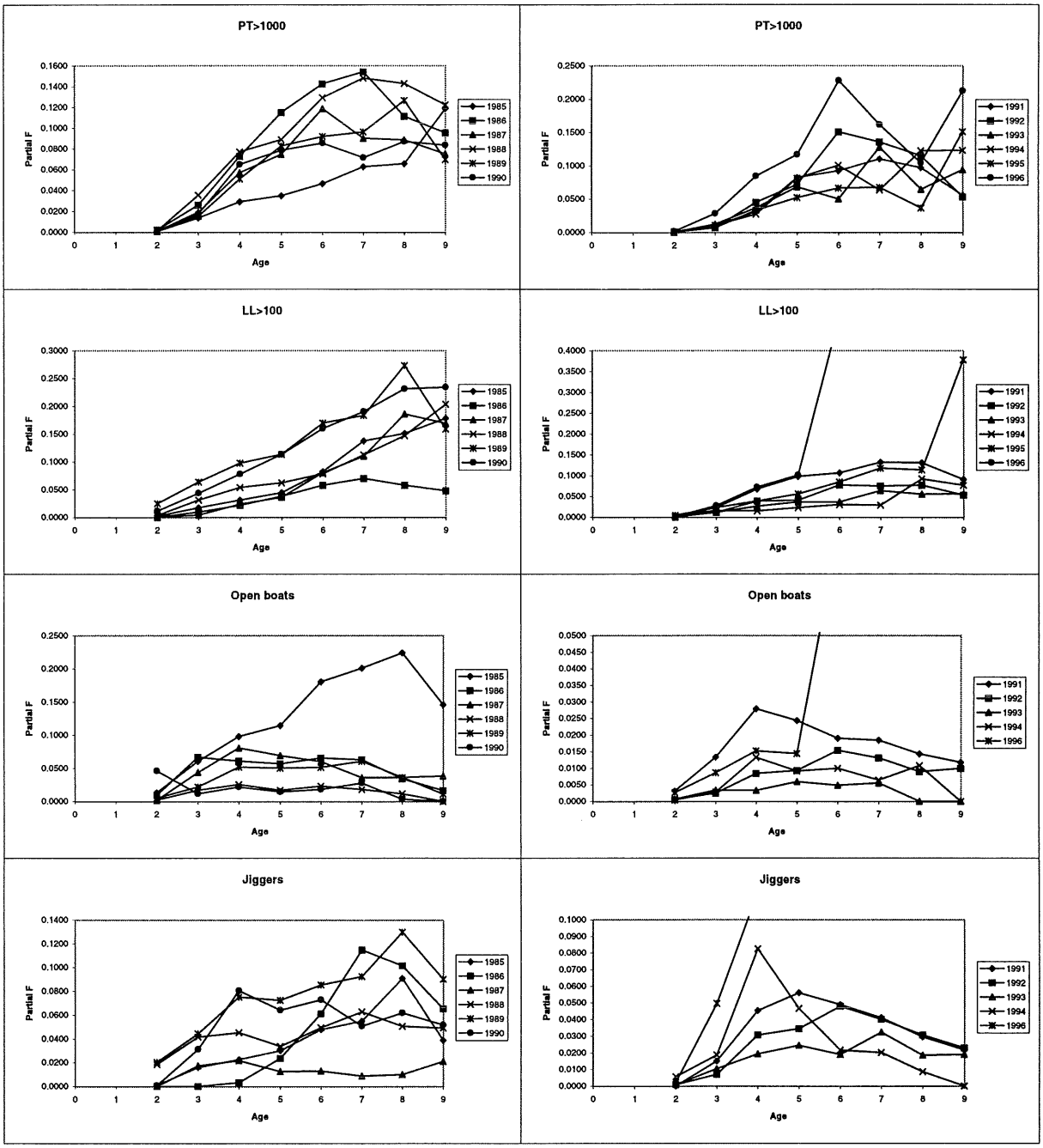


Figure 2.2.19 (continued) Partial F at age for different faroese fleets 1985-1996.

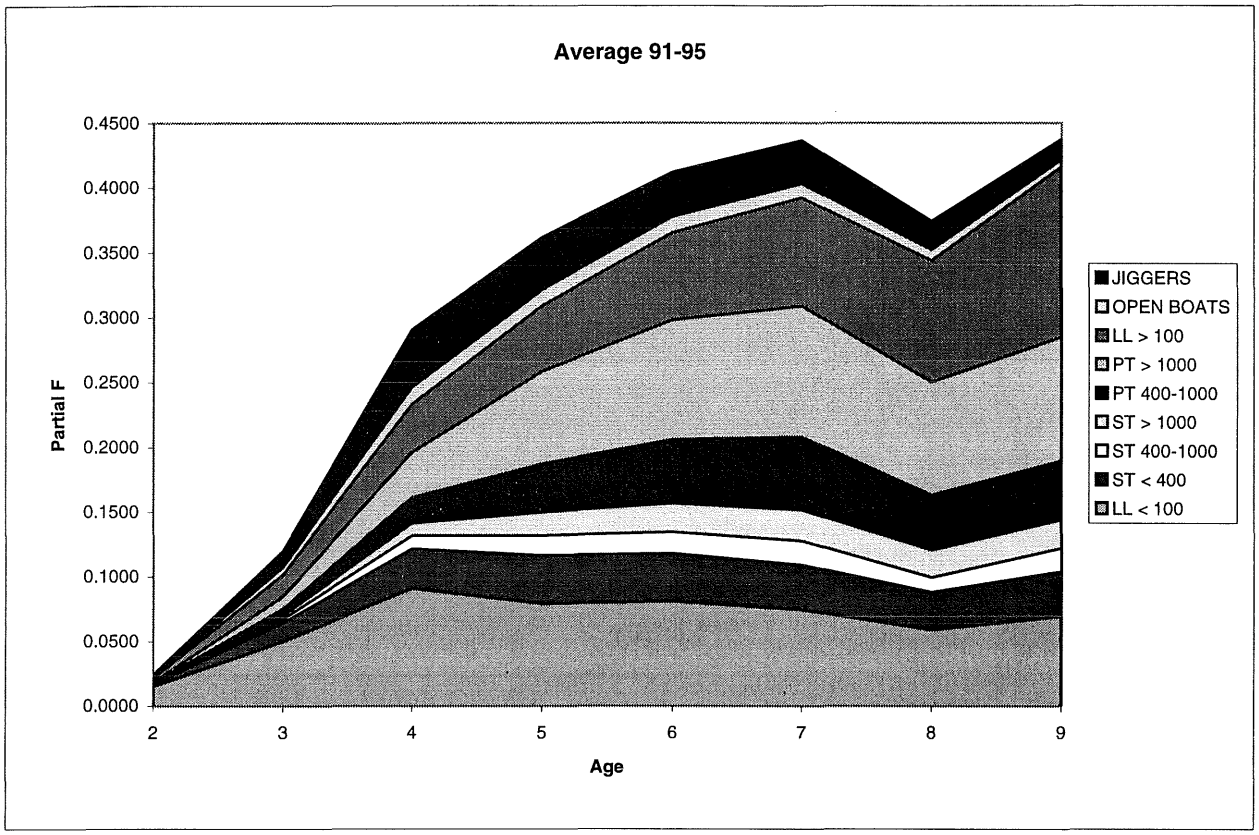


Figure 2.2.20 Partial F at age (average 1991-1995) for different faroese fleets.

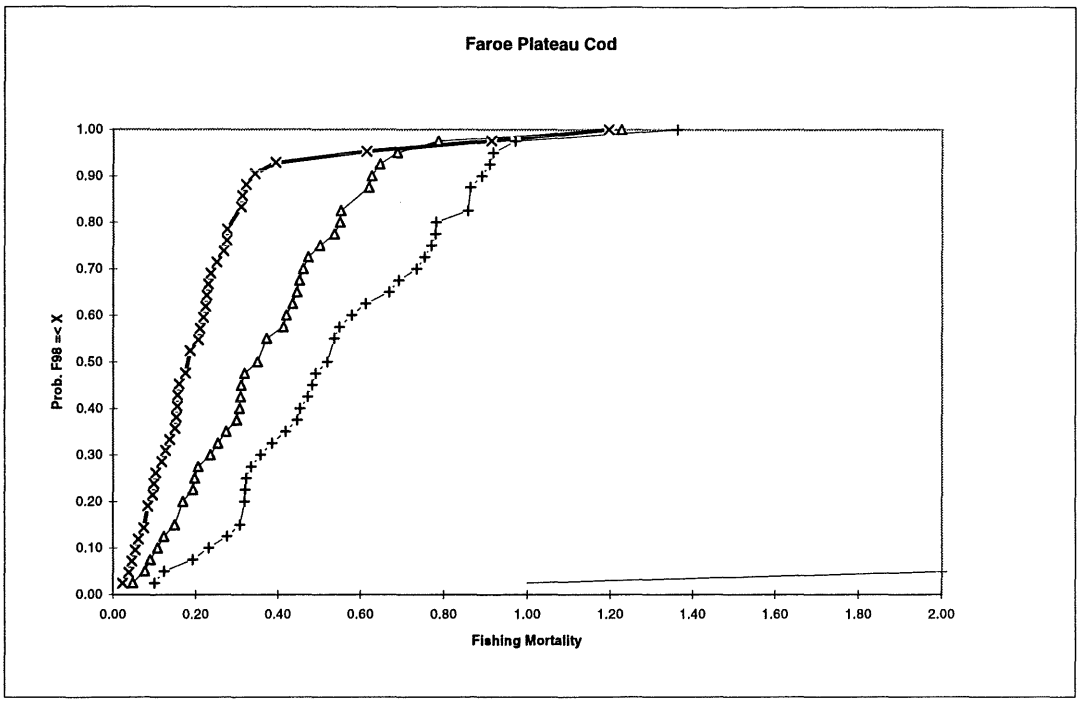


**Figure 2.2.21** Faroe Plateau Cod. Cumulative probability distribution of the 1998 fishing mortalities under the current number of fishing days allocated for the LL<100, ST<400, PT400-1000, PT>1000, LL>100, OPEN, and JIGGERS
Three options are presented where the 9320 days allocated to the LL < 100,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

## 2.3 Faroe Bank Cod

### 2.3.1 Trends in landings and effort

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

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

### 2.3.2 Stock assessment

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

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

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

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

$$CPUEpred_t = B_t \cdot q$$

the biomass is:

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

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 ($r \leq 0.99$, $k \leq 14\,000$ t. and $Bi \leq k$. The minimization was done for 1984 to 1996 with the initial biomass estimated for 1983. Once reasonably stable parameters had been obtained, the Excel Function Goal Seek was used to find the k that made MSY equal to the average landings of 1633 t. This changed the k slightly from 11194t. to the value in the table above. This implies

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

### 2.3.3 Target reference points and limit reference points

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

### 2.3.4 Management considerations

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

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

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

*) Provisional data

1) Includes Vb1

2) Included in Vb1 /UK

3) Revised

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

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

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

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

*) Predicted

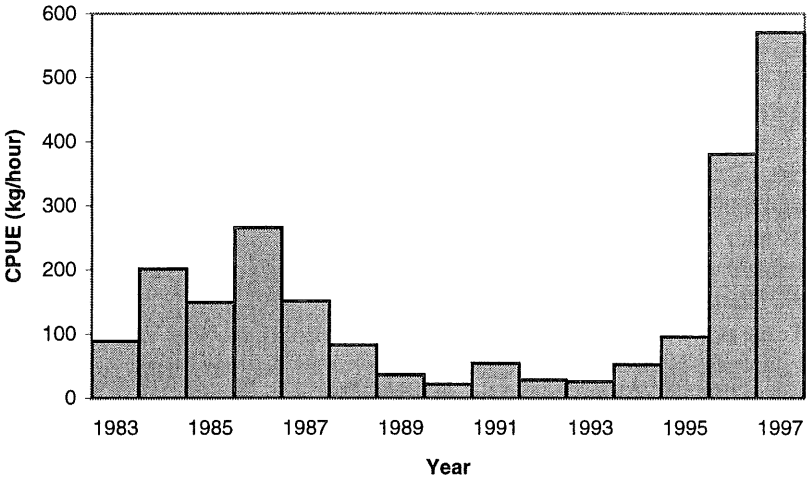


**Figure 2.3.2.1.** Catch per unit effort of Faroe Bank cod in the groundfish survey.

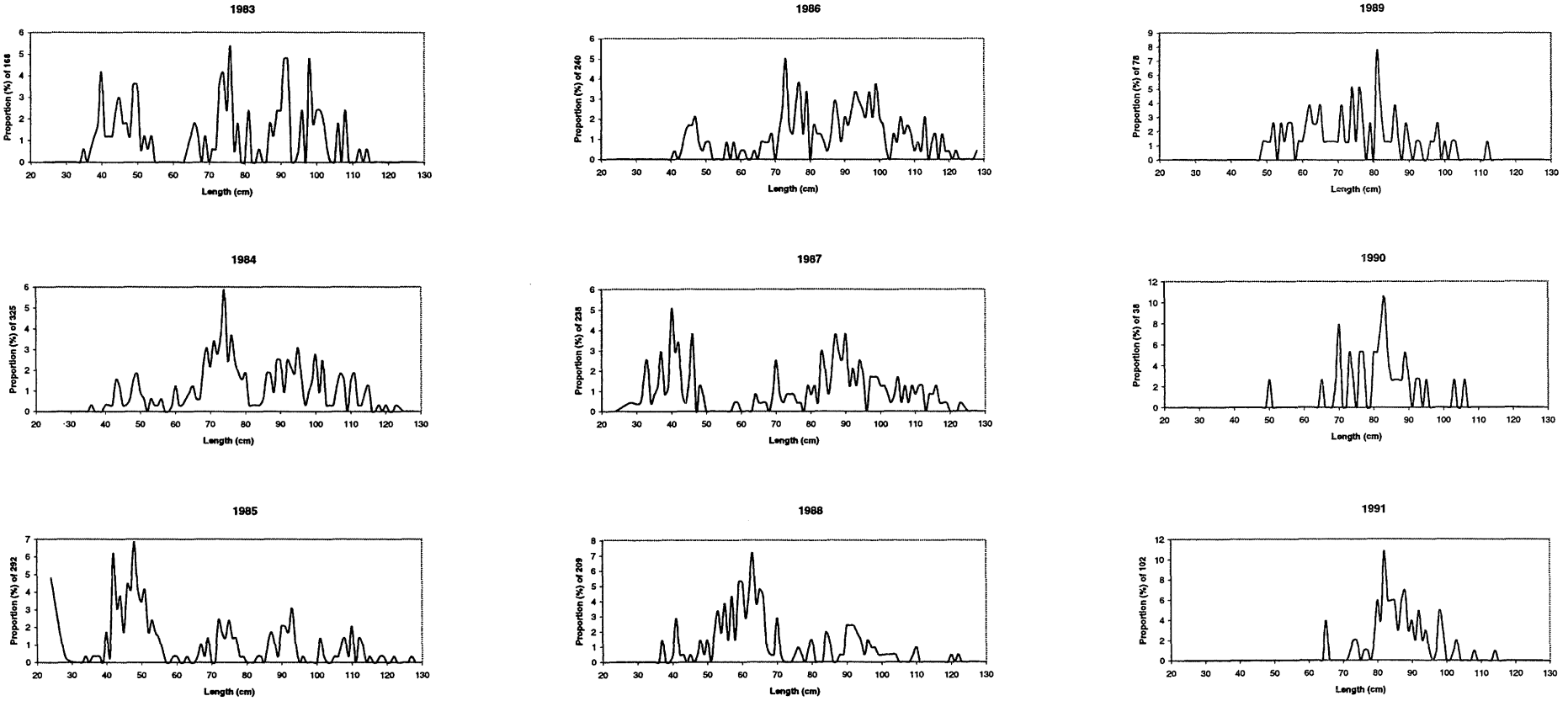


**Fig. 2.3.2.2** Length distributions of Faroe Bank cod in the groundfish surveys 1983-1997.

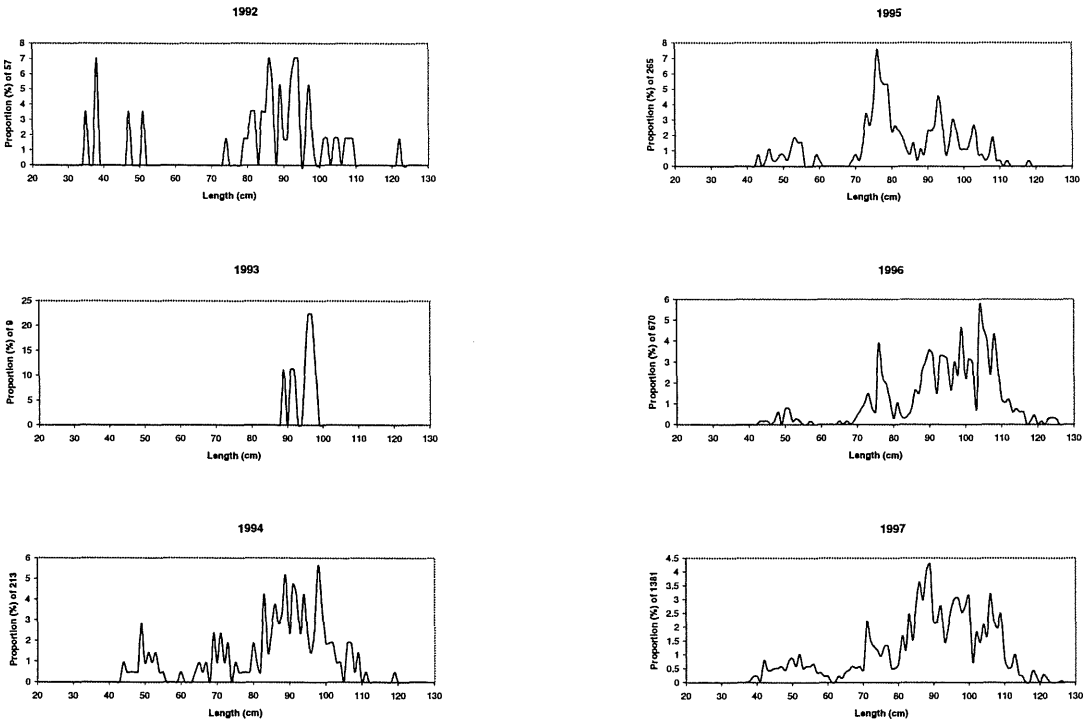


**Fig. 2.3.2.2** (continued) Length distributions of Faroe Bank cod in the groundfish surveys 1983-1997.

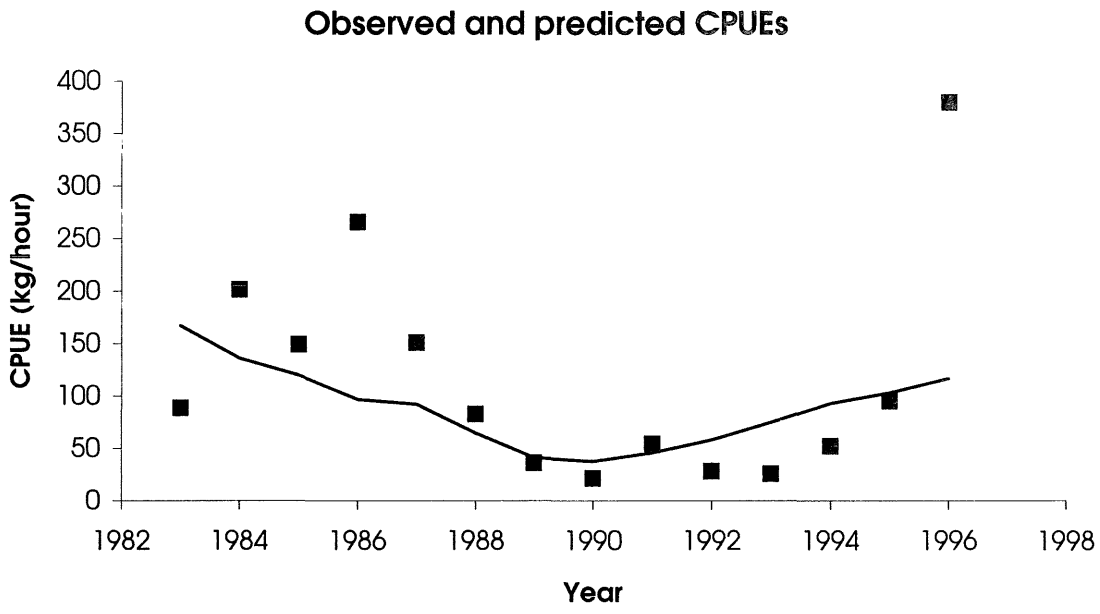


Fig. 2.3.2.3. Observed (points) and predicted (line) CPUEs of Faroe Bank cod.

## 2.4 Faroe Haddock

### 2.4.1 Landings and trends in the fishery

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

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

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

### 2.4.2 Catch at age

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

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

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

### 2.4.3 Weight at age

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

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

### 2.4.4 Maturity at age

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

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

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

### 2.4.5 Assessment

#### 2.4.5.1 Tuning and estimates of fishing mortality

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

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

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

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

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

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

#### 2.4.5.2 Stock estimates and recruitment

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

### 2.4.6 Prediction of catch and biomass

#### 2.4.6.1 Input data

##### 2.4.6.1.1 Short-term prediction

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

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

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

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

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

##### 2.4.6.1.2 Medium-term prediction

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

##### 2.4.6.1.3 Long-term Prediction

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

values for the long time period. Before averaging the annual fishing mortalities were scaled to let the 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 2.4.19 and Figure 2.4.10C. $F_{max}$ and $F_{0.1}$ are indicated here as 0.42 and 0.17, respectively. From Figure 2.4.11, showing the recruit/spawning stock relationship, and from Table 2.4.19, $F_{med}$ and $F_{high}$ were calculated to be 0.3 and 0.86, respectively.

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

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

#### 2.4.6.3 Projections of catch and biomass

##### 2.4.6.3.1 Short-term prediction

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

##### 2.4.6.3.2 Medium-term considerations

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

### 2.4.7 Managements considerations

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

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

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

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

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

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

(See Sections 2.1 and 2.2 for further explanation).

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

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

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

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

2) Provisional data

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

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

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

6) Reported as Division Vb.

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

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

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

1) Catches included in Sub-division Vb1.

2) Provisional data

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

**Table 2.4.3** Total Faroese landings of haddock from Division Vb and the contribution (%) by each fleet category (metier). In the column to the right are the average haddock percentages of the total landings of all species by each fleet category.

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

**Table 2.4.4** **Haddock in ICES Division Vb 1996**
**Catch at age in numbers by fleet category**

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

Notes: Numbers in 1000'
Catch, gutted weight in tonnes
Others includes netters, jiggers, other small categories and catches not otherwise accounted for
LLiners = Longliners OB.trawl. = Otterboard trawlers Pair Trawl. = Pair trawlers

**Table 2.4.5**

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

At 6-May-97 15:26:59

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

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

**Table 2.4.5 (Cont'd)**

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

At 6-May-97 15:26:59

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

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

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

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

**Table 2.4.6**

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

At 6-May-97 15:26:59

| Table 2 | Catch weights at age (kg) | | | | | |
|---|---|---|---|---|---|---|
| YEAR, | 1961, | 1962, | 1963, | 1964, | 1965, | 1966, |
| AGE | | | | | | |
| 2, | .4700, | .4700, | .4700, | .4700, | .4700, | .4700, |
| 3, | .7300, | .7300, | .7300, | .7300, | .7300, | .7300, |
| 4, | 1.1300, | 1.1300, | 1.1300, | 1.1300, | 1.1300, | 1.1300, |
| 5, | 1.5500, | 1.5500, | 1.5500, | 1.5500, | 1.5500, | 1.5500, |
| 6, | 1.9700, | 1.9700, | 1.9700, | 1.9700, | 1.9700, | 1.9700, |
| 7, | 2.4100, | 2.4100, | 2.4100, | 2.4100, | 2.4100, | 2.4100, |
| 8, | 2.7600, | 2.7600, | 2.7600, | 2.7600, | 2.7600, | 2.7600, |
| 9, | 3.0700, | 3.0700, | 3.0700, | 3.0700, | 3.0700, | 3.0700, |
| +gp, | 3.5500, | 3.5500, | 3.5500, | 3.5500, | 3.5500, | 3.5500, |
| SOPCOFAC, | .8938, | .9011, | .8964, | 1.0131, | .9401, | 1.0920, |

| Table 2 | Catch weights at age (kg) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| YEAR, | 1967, | 1968, | 1969, | 1970, | 1971, | 1972, | 1973, | 1974, | 1975, | 1976, |
| AGE | | | | | | | | | | |
| 2, | .4700, | .4700, | .4700, | .4700, | .4700, | .4700, | .4700, | .4700, | .4700, | .4700, |
| 3, | .7300, | .7300, | .7300, | .7300, | .7300, | .7300, | .7300, | .7300, | .7300, | .7300, |
| 4, | 1.1300, | 1.1300, | 1.1300, | 1.1300, | 1.1300, | 1.1300, | 1.1300, | 1.1300, | 1.1300, | 1.1300, |
| 5, | 1.5500, | 1.5500, | 1.5500, | 1.5500, | 1.5500, | 1.5500, | 1.5500, | 1.5500, | 1.5500, | 1.5500, |
| 6, | 1.9700, | 1.9700, | 1.9700, | 1.9700, | 1.9700, | 1.9700, | 1.9700, | 1.9700, | 1.9700, | 1.9700, |
| 7, | 2.4100, | 2.4100, | 2.4100, | 2.4100, | 2.4100, | 2.4100, | 2.4100, | 2.4100, | 2.4100, | 2.4100, |
| 8, | 2.7600, | 2.7600, | 2.7600, | 2.7600, | 2.7600, | 2.7600, | 2.7600, | 2.7600, | 2.7600, | 2.7600, |
| 9, | 3.0700, | 3.0700, | 3.0700, | 3.0700, | 3.0700, | 3.0700, | 3.0700, | 3.0700, | 3.0700, | 3.0700, |
| +gp, | 3.5500, | 3.5500, | 3.5500, | 3.5500, | 3.5500, | 3.5500, | 3.5500, | 3.5500, | 3.5500, | 3.5500, |
| SOPCOFAC, | 1.0166, | 1.0278, | 1.0835, | 1.0274, | .9874, | .9795, | .9776, | .9718, | 1.1712, | 1.0746, |

**Table 2.4.6 (Cont'd)**

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

At 6-May-97 15:26:59

| Table 2 Catch weights at age (kg) YEAR, | 1977, | 1978, | 1979, | 1980, | 1981, | 1982, | 1983, | 1984, | 1985, | 1986, |
|---|---|---|---|---|---|---|---|---|---|---|
| AGE | | | | | | | | | | |
| 2, | .3110, | .3570, | .3570, | .6430, | .4520, | .7000, | .4700, | .6810, | .5280, | .6080, |
| 3, | .6330, | .7900, | .6720, | .7130, | .7250, | .8960, | .7400, | 1.0110, | .8590, | .8870, |
| 4, | 1.0440, | 1.0350, | .8940, | .9410, | .9570, | 1.1500, | 1.0100, | 1.2550, | 1.3910, | 1.1750, |
| 5, | 1.4260, | 1.3980, | 1.1560, | 1.1570, | 1.2370, | 1.4440, | 1.3200, | 1.8120, | 1.7770, | 1.6310, |
| 6, | 1.8250, | 1.8700, | 1.5900, | 1.4930, | 1.6510, | 1.4980, | 1.6600, | 2.0610, | 2.3260, | 1.9840, |
| 7, | 2.2410, | 2.3500, | 2.0700, | 1.7390, | 2.0530, | 1.8290, | 2.0500, | 2.0590, | 2.4400, | 2.5190, |
| 8, | 2.2050, | 2.5970, | 2.5250, | 2.0950, | 2.4060, | 1.8870, | 2.2600, | 2.1370, | 2.4010, | 2.5830, |
| 9, | 2.5700, | 3.0140, | 2.6960, | 2.4650, | 2.7250, | 1.9610, | 2.5400, | 2.3680, | 2.5320, | 2.5700, |
| +gp, | 2.5910, | 2.9200, | 3.5190, | 3.3100, | 3.2500, | 2.8560, | 3.0400, | 2.6860, | 2.6860, | 2.9220, |
| SOPCOFAC, | .9784, | .9947, | 1.0380, | 1.0017, | 1.0870, | .9238, | 1.0554, | 1.0602, | 1.0559, | 1.0141, |

| Table 2 Catch weights at age (kg) YEAR, | 1987, | 1988, | 1989, | 1990, | 1991, | 1992, | 1993, | 1994, | 1995, | 1996, |
|---|---|---|---|---|---|---|---|---|---|---|
| AGE | | | | | | | | | | |
| 2, | .6050, | .5010, | .5800, | .4380, | .5470, | .5250, | .7550, | .7540, | .6660, | .5340, |
| 3, | .8310, | .7810, | .7790, | .6990, | .6930, | .7240, | .9820, | 1.1030, | 1.0540, | .8580, |
| 4, | 1.1260, | .9740, | .9230, | .9390, | .8840, | .8170, | 1.0270, | 1.2540, | 1.4890, | 1.4590, |
| 5, | 1.4620, | 1.3630, | 1.2070, | 1.2040, | 1.0860, | 1.0380, | 1.1920, | 1.4650, | 1.7790, | 1.9930, |
| 6, | 1.9410, | 1.6800, | 1.5640, | 1.3840, | 1.2760, | 1.2490, | 1.3780, | 1.5930, | 1.9400, | 2.3300, |
| 7, | 2.1730, | 1.9750, | 1.7460, | 1.5640, | 1.4770, | 1.4300, | 1.6430, | 1.8040, | 2.1820, | 2.3510, |
| 8, | 2.3470, | 2.3440, | 2.0860, | 1.8180, | 1.5740, | 1.5640, | 1.7960, | 2.0490, | 2.3570, | 2.4690, |
| 9, | 3.1180, | 2.2480, | 2.4240, | 2.1680, | 1.9300, | 1.6330, | 1.9710, | 2.2250, | 2.4900, | 2.7770, |
| +gp, | 2.9330, | 3.2950, | 2.5140, | 2.3350, | 2.1530, | 2.1260, | 2.2400, | 2.4230, | 2.6780, | 2.5820, |
| SOPCOFAC, | 1.0197, | .9695, | 1.0025, | 1.0195, | 1.0635, | 1.0554, | 1.0361, | .9967, | 1.0323, | 1.0044, |

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

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

**Table 2.4.8**

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

At 6-May-97 15:26:59

| Table 5 Proportion mature at age<br>YEAR, | 1961, | 1962, | 1963, | 1964, | 1965, | 1966, |
|---|---|---|---|---|---|---|
| AGE | | | | | | |
| 2, | .0600, | .0600, | .0600, | .0600, | .0600, | .0600, |
| 3, | .4800, | .4800, | .4800, | .4800, | .4800, | .4800, |
| 4, | .9100, | .9100, | .9100, | .9100, | .9100, | .9100, |
| 5, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 6, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 7, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 8, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 9, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| +gp, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |

| Table 5 Proportion mature at age<br>YEAR, | 1967, | 1968, | 1969, | 1970, | 1971, | 1972, | 1973, | 1974, | 1975, | 1976, |
|---|---|---|---|---|---|---|---|---|---|---|
| AGE | | | | | | | | | | |
| 2, | .0600, | .0600, | .0600, | .0600, | .0600, | .0600, | .0600, | .0600, | .0600, | .0600, |
| 3, | .4800, | .4800, | .4800, | .4800, | .4800, | .4800, | .4800, | .4800, | .4800, | .4800, |
| 4, | .9100, | .9100, | .9100, | .9100, | .9100, | .9100, | .9100, | .9100, | .9100, | .9100, |
| 5, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 6, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 7, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 8, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 9, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| +gp, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |

**Table 2.4.8 (Cont'd)**

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

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Table 5 Proportion mature at age

| YEAR, | 1977, | 1978, | 1979, | 1980, | 1981, | 1982, | 1983, | 1984, | 1985, | 1986, |
|---|---|---|---|---|---|---|---|---|---|---|
| AGE | | | | | | | | | | |
| 2, | .0600, | .0600, | .0600, | .0600, | .0600, | .0700, | .0800, | .0800, | .0300, | .0300, |
| 3, | .4800, | .4800, | .4800, | .4800, | .4800, | .5200, | .6200, | .7600, | .6200, | .4300, |
| 4, | .9100, | .9100, | .9100, | .9100, | .9100, | .8800, | .8900, | .9800, | .9600, | .9500, |
| 5, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | .9900, |
| 6, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 7, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 8, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 9, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| +gp, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |

Table 5 Proportion mature at age

| YEAR, | 1987, | 1988, | 1989, | 1990, | 1991, | 1992, | 1993, | 1994, | 1995, | 1996, |
|---|---|---|---|---|---|---|---|---|---|---|
| AGE | | | | | | | | | | |
| 2, | .0500, | .0500, | .0200, | .0800, | .1600, | .1800, | .1500, | .1200, | .1000, | .0600, |
| 3, | .3200, | .2400, | .2200, | .3700, | .5800, | .6500, | .5300, | .5000, | .5500, | .5700, |
| 4, | .9100, | .8900, | .8700, | .9000, | .9300, | .9100, | .9000, | .9200, | .9700, | .9500, |
| 5, | .9800, | .9800, | .9900, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 6, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 7, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 8, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 9, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| +gp, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |

**Table 2.4.9**

```
Haddock in the Faroe Grounds (Fishing Area Vb) (run name: XSAJAK17)
104
FLT35: LL94A: lline<100GRT (Catch: Thousands) (Effort: 1) (Catch: Unknown) (Effort: Unknown)
1985 1996
1 1 0.00 1.00
2 4
     7558     613    2542     787
     6692     167    1435    1747
     6728     200    1027    1819
     8753     599     311    1557
    12804      48    1042     433
    14543      94     993    1141
    14801      53     733    1165
    10599      35     103     419
     7497      31      92      80
     7625     127      47      50
     9582     470     133      45
    12546     154    2169     198
FLT36: MH93: Magnus Heinason revised95A shifted back (Catch: Number) (Eff (Catch: Unknown) (Effort: Unknown)
1985 1996
1 1 0.90 1.00
2 4
   100    46.5    21.7     4.2
   100    26.4    16.7     8.7
   100    11.8    21.2    10.7
   100   113.0     8.5    23.2
   100    64.0    23.9     2.5
   100    13.4     9.8     3.9
   100     8.5    15.5     6.8
   100     9.9     6.2     6.3
   100     3.1     4.0     2.0
   100    10.1     2.9     2.5
   100   137.1     6.1     0.9
   100   161.7   244.7     5.3
FLT37: LL97: Longliners > 100 GRT (Catch: Thousands) (Effort: 1) (Catch: Unknown) (Effort: Unknown)
1988 1996
1 1 0.00 1.00
5 6
    3203    470    504
    3369    421    492
    3521    146    312
    3573    223    127
    2892    216    188
    2046    124    134
    2925     43     98
    3648     82     55
    4126     72     67
FLT38: PT97: Pair trawlers > 1000 HP (Catch: Thousands) (Effort: 1) (Catch: Unknown) (Effort: Unknown)
1988 1996
1 1 0.00 1.00
5 6
    6034    251    194
    5127    162    156
    7491     57    156
    7875    181    104
    7243    107    150
    6335     82    111
    6227     32    133
    6069     33     18
    6551     21     18
```

**Table 2.4.10**

```
Lowestoft VPA Version 3.1

   6-May-97  15:25:53

Extended Survivors Analysis

Haddock Faroes Vb (run: XSAJAK17/X17)

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

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

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


Time series weights :

     Tapered time weighting applied
     Power =    3 over  20 years


Catchability analysis :

     Catchability dependent on stock size for ages <    3

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


     Catchability independent of age for ages >=    6


Terminal population estimation :

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

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

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

     Prior weighting not applied


Tuning had not converged after   50 iterations


Total absolute residual between iterations
49 and  50 =     .00681

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

**Table 2.4.10 (Cont'd)**

Regression weights

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

Fishing mortalities

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

XSA population numbers (Thousands)

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

Estimated population abundance at 1st Jan 1997

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

Taper weighted geometric mean of the VPA populations:

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

Standard error of the weighted Log(VPA populations) :

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

**Table 2.4.10 (Cont'd)**

Log catchability residuals.

Fleet : FLT35: LL94A: lline<

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

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

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

| Age | 3 | 4 |
|---|---|---|
| Mean Log q | -12.0326 | -11.6605 |
| S.E(Log q) | .3427 | .4472 |

Regression statistics :

Ages with q dependent on year class strength

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

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

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

**Table 2.4.10 (Cont'd)**

```
Fleet : FLT36: MH93: Magnus

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


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


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


   Age ,         3,         4
Mean Log q,  -10.7869,  -11.3146,
S.E(Log q),     .5819,     .5870,



Regression statistics :

Ages with q dependent on year class strength

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

 2,     .92,     .466,     10.32,     .79,     12,     .60,  -10.42,

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

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

 3,    1.03,    -.161,     10.84,     .78,     12,     .63,  -10.79,
 4,    1.36,   -1.448,     12.31,     .65,     12,     .76,  -11.31,
```

**Table 2.4.10 (Cont'd)**

```
Fleet : FLT37: LL97: Longlin

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


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


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



Regression statistics :


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

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

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



Fleet : FLT38: PT97: Pair tr

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


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


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



Regression statistics :


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

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

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

**Table 2.4.10 (Cont'd)**

Terminal year survivor and F summaries :

Age 2 Catchability dependent on age and year class strength

Year class = 1994

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

Weighted prediction :

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

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

Year class = 1993

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

Weighted prediction :

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

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

Year class = 1992

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

Weighted prediction :

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

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

Year class = 1991

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

Weighted prediction :

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

**Table 2.4.10 (Cont'd)**

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

Year class = 1990

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

Weighted prediction :

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

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

Year class = 1989

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

Weighted prediction :

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

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

Year class = 1988

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

Weighted prediction :

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

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

Year class = 1987

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

Weighted prediction :

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

**Table 2.4.11**

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

At 6-May-97 15:26:59

Terminal Fs derived using XSA (With F shrinkage)

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

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

**Table 2.4.11 (Cont'd)**

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

At 6-May-97 15:26:59

Terminal Fs derived using XSA (With F shrinkage)

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

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

**Table 2.4.12**

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

At 6-May-97 15:26:59

Terminal Fs derived using XSA (With F shrinkage)

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

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

**Table 2.4.12 (Cont'd)**

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

At 6-May-97 15:26:59

Terminal Fs derived using XSA (With F shrinkage)

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

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

**Table 2.4.13**

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

At 6-May-97 15:26:59

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

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

**Table 2.4.14** Input data for RCT3

```
Faroe Haddock: VPA and groundfish survey data
3 12 2
'Yearclass'  'VPAage2'    'Survage1'   'Survage2'   'Survage3'
1985         8288         23.6         11.8         11.8
1986         17600        40.6         88.1         113.0
1987         14679        40.5         146.6        64.0
1988         10275        43.8         43.1         13.4
1989         2846         6.1          16.5         8.5
1990         3287         4.0          26.9         9.9
1991         2362         6.2          9.2          3.1
1992         5323         28.1         21.3         10.1
1993         60300        186.3        252.6        137.1
1994         25664        486.9        244.2        161.7
1995         -11          65.6         84.7         -11
1996         -11          3.2          -11          -11
```

**Table 2.4.15**

Analysis by RCT3 ver3.1 of data from file :

rct3c97.dat

Faroe Haddock: VPA and groundfish survey data

Data for 3 surveys over 12 years : 1985 - 1996

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

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

Forecast/Hindcast variance correction used.

Yearclass = 1990

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

Yearclass = 1991

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

Yearclass = 1992

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

Yearclass = 1993

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

**Table 2.4.15 (Cont'd)**

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

Yearclass = 1994

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

Yearclass = 1995

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

Yearclass = 1996

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

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

**Table 2.4.16**



Haddock in the Faroe Grounds (Fishing Area Vb)

Prediction with management option table: Input data

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

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

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

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

**Table 2.4.17**



Haddock in the Faroe Grounds (Fishing Area Vb)

Prediction with management option table

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

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

**Table 2.4.18**

The SAS System 14:51 Tuesday, May 6, 1997

Haddock in the Faroe Grounds (Fishing Area Vb)

Yield per recruit: Input data

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

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

**Table 2.4.19**



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

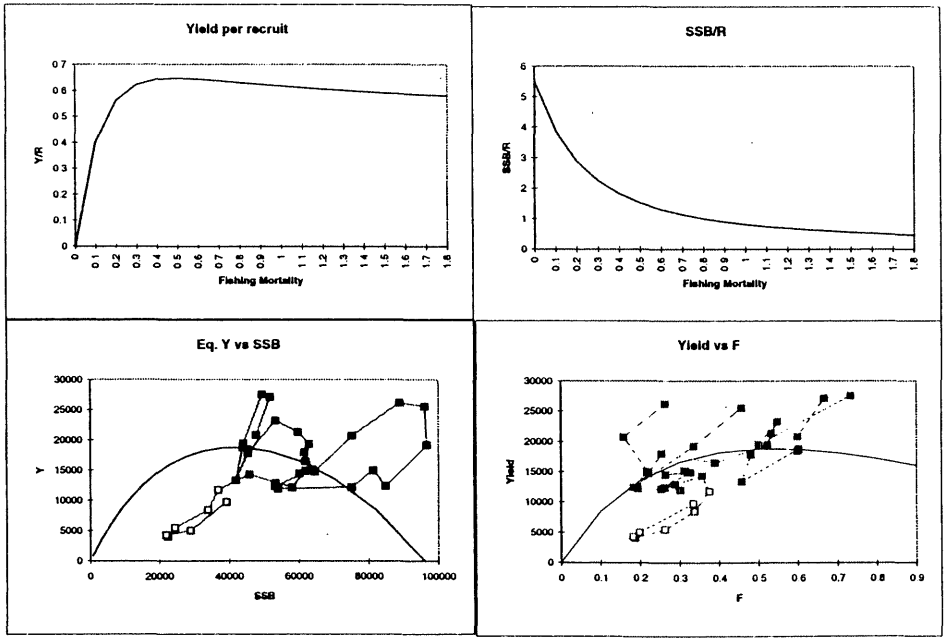
Notes: Run name : YLDJAK04
Date and time : 06MAY97:15:46
Computation of ref. F: Simple mean, age 3 - 7
F-0.1 factor : 0.5554
F-max factor : 1.3723
F-0.1 reference F : 0.1697
F-max reference F : 0.4193
Recruitment : Single recruit

# Table 2.4.20

Ref. Pts.

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

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




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Mean F | 1.629774 | | | | | | |
| 0.30552 | | | | | | | |

| F Diff | F Mult | F For |
|---|---|---|
| 0.000327 | 5.334428 | 1.629774 |
| | 5.334755 | |

| S/R | slope S/R | eq S | eq R |
|---|---|---|---|
| 0.510273 | -0.09228 | 5.42E-08 | 1.06E-07 |
| 0.510243 | | -2.39356 | -4.69103 |

| Y/R | slope Y/R | eq Y | slope Yield |
|---|---|---|---|
| 0.585855 | -0.01193 | 6.23E-08 | -8396.43 |
| 0.585851 | | -2.74824 | |

Stock Recruitment Parameters

| | |
|---|---|
| a | 1.959735 |
| b | 2.47E-05 |
| cc | |
| eqs | 700 |
| eqrs | 0.979868 |

| F | F Mult | Y/R | S/R | Slope Y/R | eq S | eq R | eq Y |
|---|---|---|---|---|---|---|---|
| | | 0.585855 | 0.510273 | -0.01193 | 5.42E-08 | 1.06E-07 | 6.23E-08 |
| 0 | 0.000 | 0 | 5.504395 | 1.856738 | 96168.9 | 17471.29 | 0 |
| 0.1 | 0.327 | 0.400596 | 3.890755 | 0.75161 | 82140.22 | 21111.64 | 8457.247 |
| 0.2 | 0.655 | 0.561306 | 2.900635 | 0.296121 | 70265.53 | 24224.19 | 13597.18 |
| 0.3 | 0.982 | 0.622906 | 2.262959 | 0.107393 | 60227.27 | 26614.39 | 16578.26 |
| 0.4 | 1.309 | 0.643396 | 1.832476 | 0.029099 | 51695.27 | 28210.61 | 18150.61 |
| 0.5 | 1.637 | 0.646883 | 1.528931 | -0.00305 | 44372.5 | 29021.92 | 18773.8 |
| 0.6 | 1.964 | 0.643483 | 1.306447 | -0.01572 | 38013.8 | 29097.09 | 18723.48 |
| 0.7 | 2.291 | 0.637479 | 1.137838 | -0.02011 | 32426.44 | 28498.29 | 18167.07 |
| 0.8 | 2.618 | 0.630695 | 1.006383 | -0.02098 | 27462.35 | 27288.16 | 17210.51 |
| 0.9 | 2.946 | 0.623899 | 0.901416 | -0.02039 | 23008.39 | 25524.71 | 15924.85 |
| 1 | 3.273 | 0.617406 | 0.815892 | -0.01923 | 18977.63 | 23259.97 | 14360.84 |
| 1.1 | 3.600 | 0.611325 | 0.745006 | -0.01791 | 15302.5 | 20540.1 | 12556.68 |
| 1.2 | 3.928 | 0.605683 | 0.685385 | -0.01658 | 11929.72 | 17405.87 | 10542.43 |
| 1.3 | 4.255 | 0.600463 | 0.634597 | -0.01533 | 8816.643 | 13893.29 | 8342.405 |
| 1.4 | 4.582 | 0.595637 | 0.590854 | -0.01418 | 5928.689 | 10034.11 | 5976.685 |
| 1.5 | 4.910 | 0.591171 | 0.552808 | -0.01313 | 3237.445 | 5856.361 | 3462.108 |
| 1.6 | 5.237 | 0.58703 | 0.519432 | -0.01219 | 719.3202 | 1384.822 | 812.9312 |
| 1.7 | 5.564 | 0.583182 | 0.489925 | -0.01134 | -1645.46 | -3358.59 | -1958.67 |
| 1.8 | 5.892 | 0.579598 | 0.463658 | -0.01057 | -3873.59 | -8354.41 | -4842.2 |
| 1.9 | 6.219 | 0.576252 | 0.44013 | -0.00988 | -5979.32 | -13585.3 | -7828.57 |
| 2 | 6.546 | 0.57312 | 0.418937 | -0.00926 | -7974.83 | -19035.9 | -10909.8 |

| | F | Y/R | S/R | %MaxS/R | eq S | eq R | eq Y | Goal seek | |
|---|---|---|---|---|---|---|---|---|---|
| F0.1 | 0.247645 | 0.598293 | 2.56381 | 11% | 65274.42 | 25459.93 | 15232.51 | 0.185674 | Slope Y/R |
| Fmax | 0.482447 | 0.646953 | 1.57535 | 12% | 45581.87 | 28934.44 | 18719.22 | 0 | Slope Y/R |
| Fmed | 0.279908 | 0.615013 | 2.370987 | 11% | 62112.88 | 26197.06 | 16111.54 | 2.37132 | S/R |
| Fhigh | 0.880879 | 0.625181 | 0.919805 | 11% | 23824.95 | 25902.18 | 16193.56 | 0.919778 | S/R |
| Fmsy | 0.540131 | 0.646025 | 1.43174 | 12% | 41716.82 | 29137.14 | 18823.32 | 0 | Slope Yield |
| Fcrash | 1.629774 | 0.585855 | 0.510273 | 11% | 5.42E-08 | 1.06E-07 | 6.23E-08 | 0 | eq Y |

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

**Table 2.4.21**

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

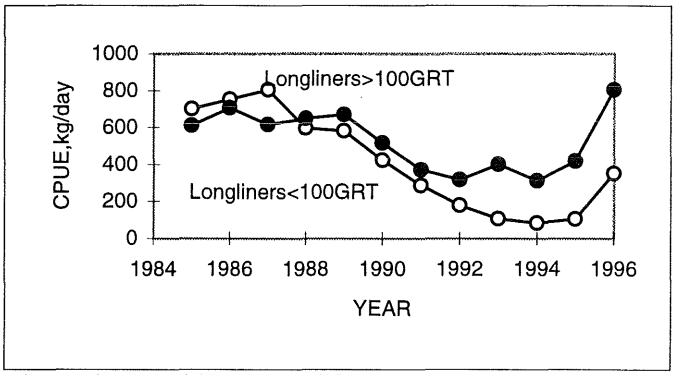



Figure A: Haddock in Division Vb 1985-1996.
Catch per day for longliners.

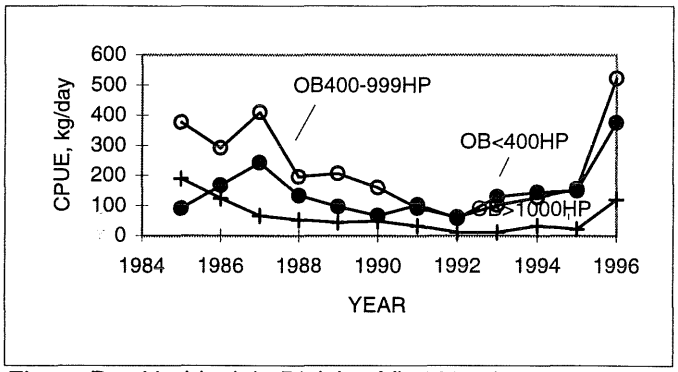



Figure B: Haddock in Division Vb 1985-1996.
Catch per day for otter board trawlers.

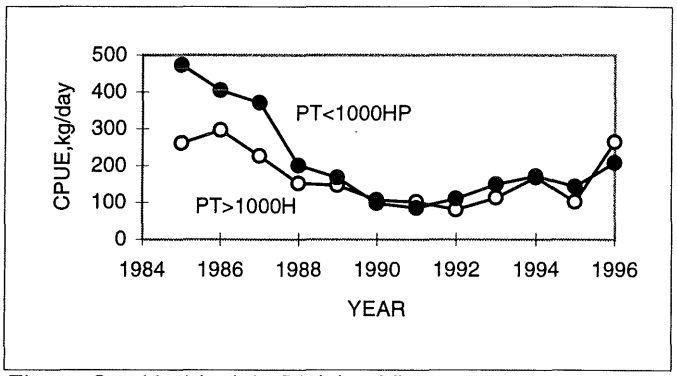



Figure C: Haddock in Division Vb 1985-1996.
Catch per day for pair trawlers.

**Figure 2.4.1**

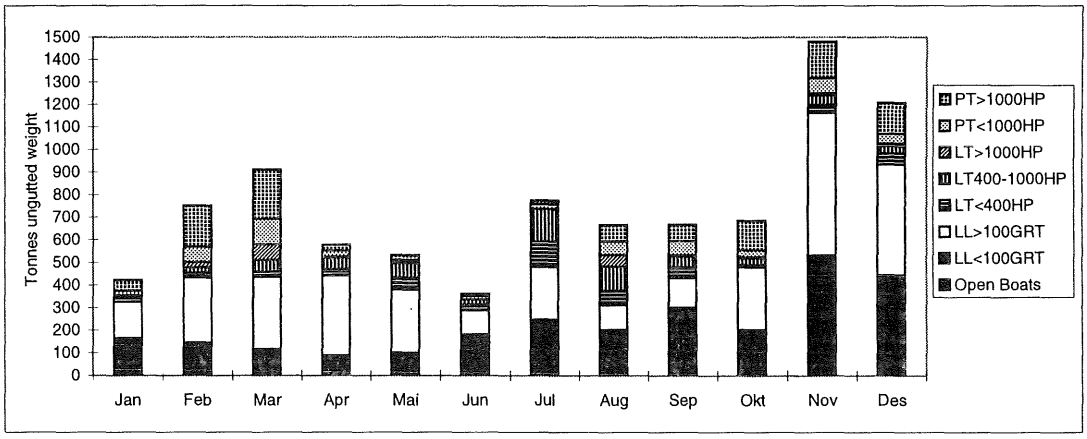



**Figure A Faroese landings of haddock from Vb1 in 1996 per fleet category. Tonnes ungutted weight.**

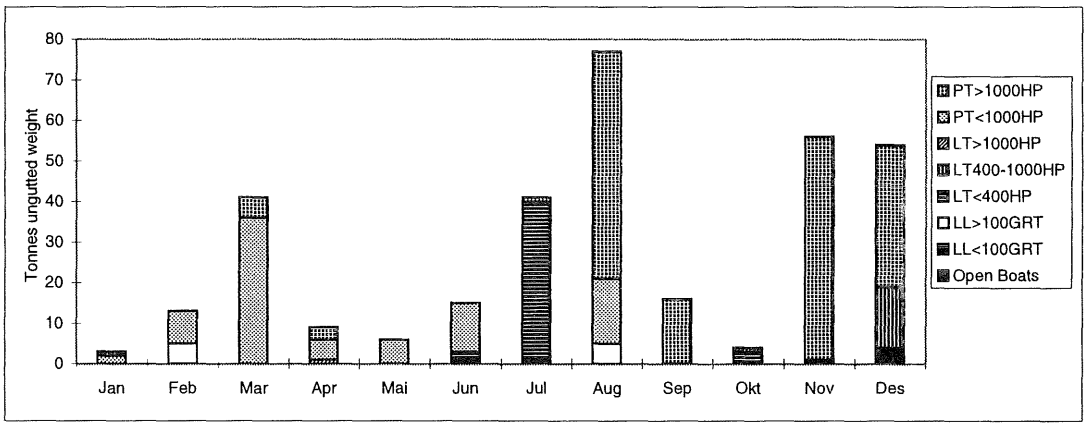



**Figure B Faroese landings of haddock from Vb2 in 1996 per fleet category. Tonnes ungutted weight.**

**Figure 2.4.2 Faroe Haddock.**

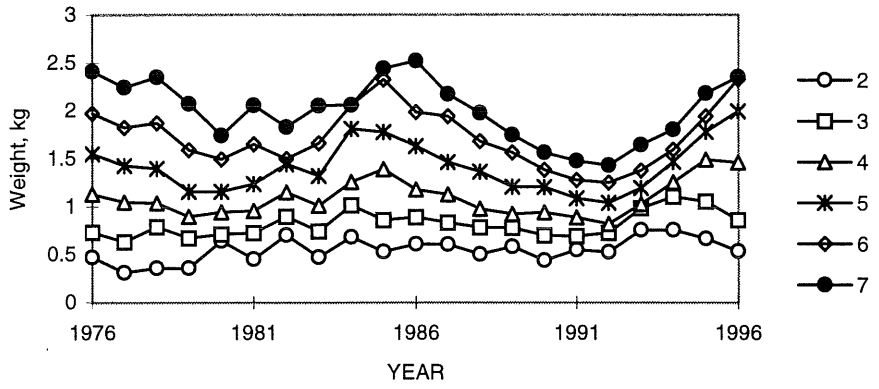



**Figure A:** Mean weight at age of Faroe haddock 1976-1996, as estimated from sampling of the commercial catches.

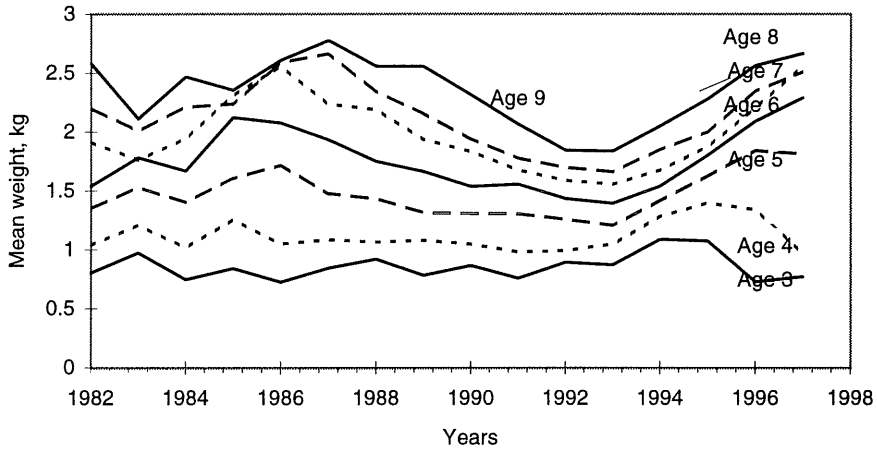
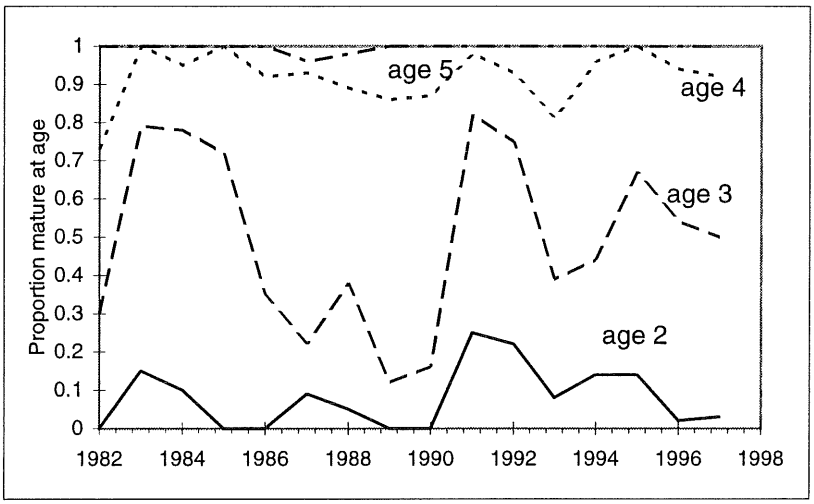
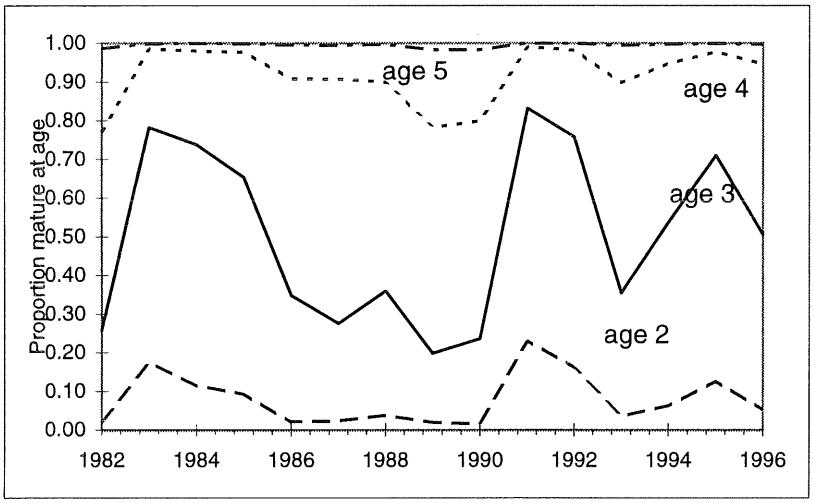



**Figure B:** Mean weight at age of Faroe haddock 1982-1997, as predicted from the model. Ages 3-9.

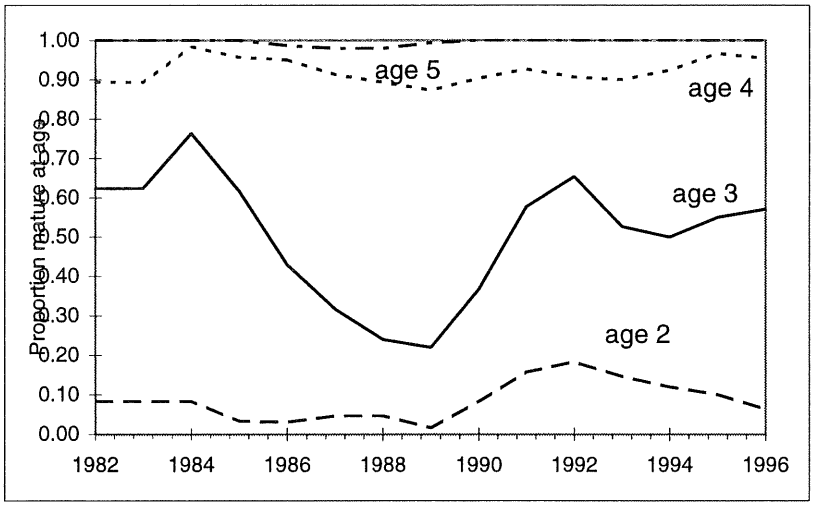
**Figure 2.4.3 Faroe Haddock.**




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




**B** 'Faroe haddock - runi. Maturity ogives. Fitted values from the model: pM = a + YC-strength + age + year.




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

**Figure 2.4.4**

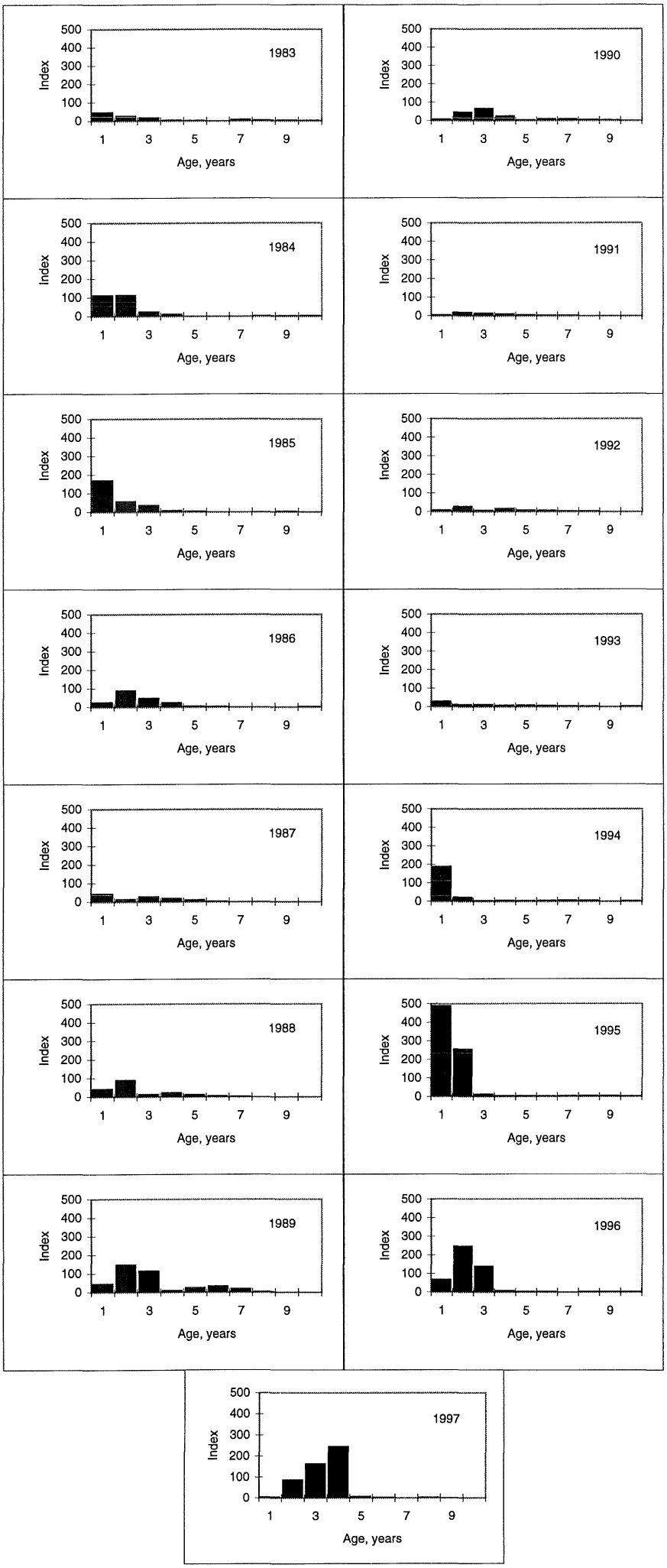



**Figure 2.4.5:** Faroe Plateau Haddock. Stratified mean catch in number at age per trawl hour from the Faroese Groundfish Surveys 1983-97

e:\acfm\nwwg97\F-245.xls

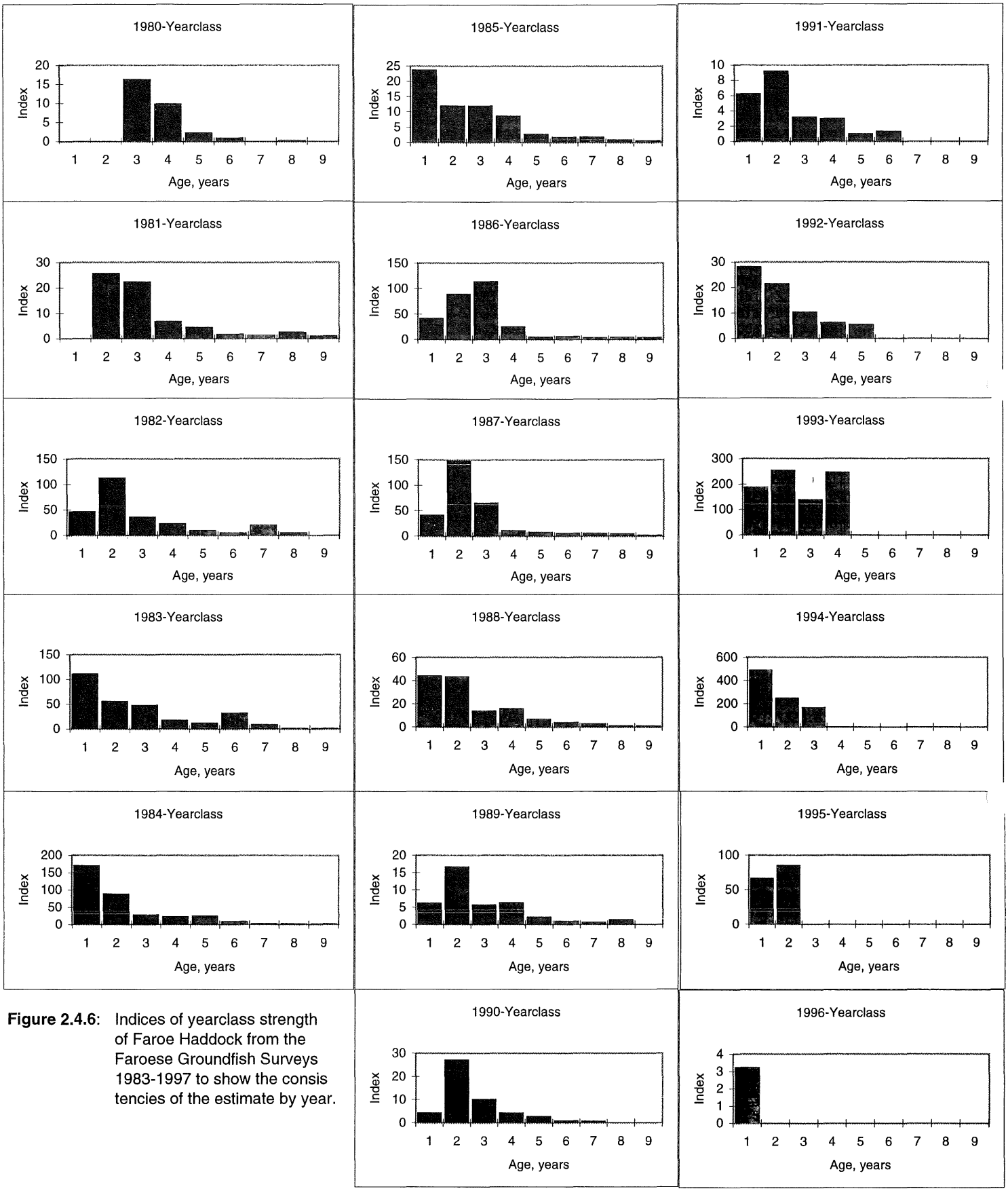



**Figure 2.4.6**: Indices of yearclass strength of Faroe Haddock from the Faroese Groundfish Surveys 1983-1997 to show the consis tencies of the estimate by year.

e:\acfm\nwwg97\F-246.xls

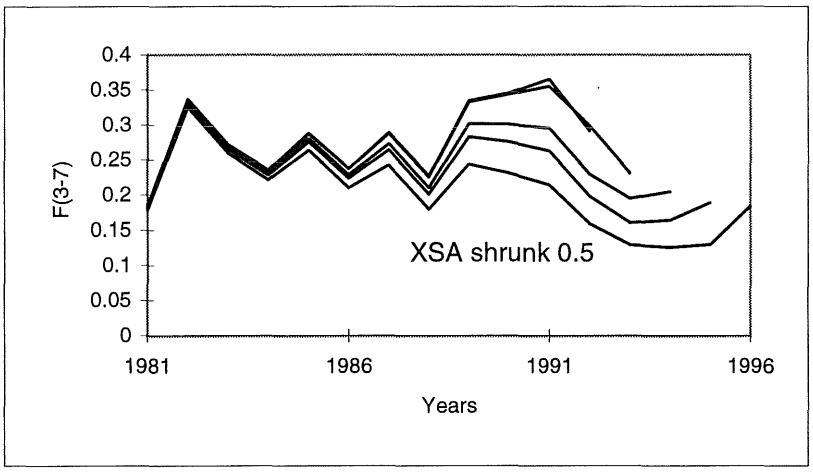



**Figure A:** Retrospective analysis of XSA (run x16 shrunk 0.5) of Faroe haddock

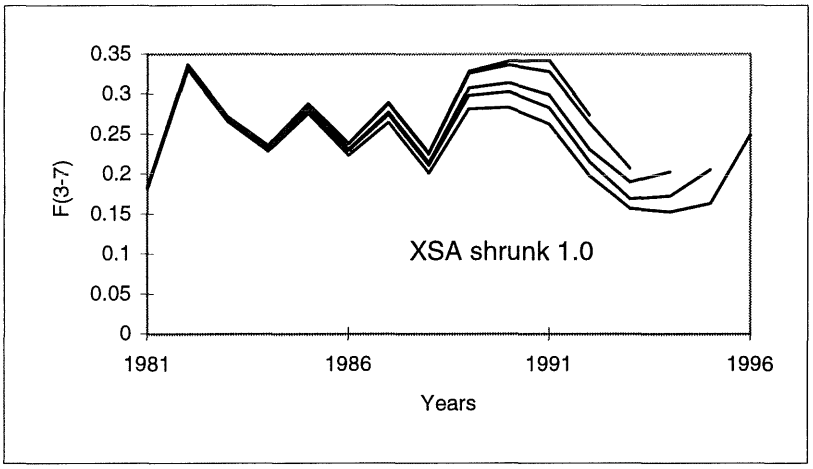



**Figure B:** Retrospective analysis of XSA (run x16 shrunk 1.0) of Faroe haddock

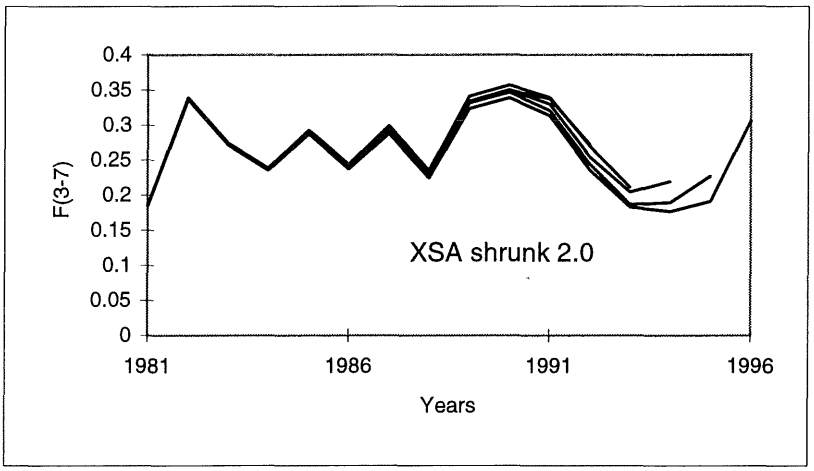



**Figure C:** Retrospective analysis of XSA (run x16 shrunk 2.0) of Faroe haddock

**Figure 2.4.7**

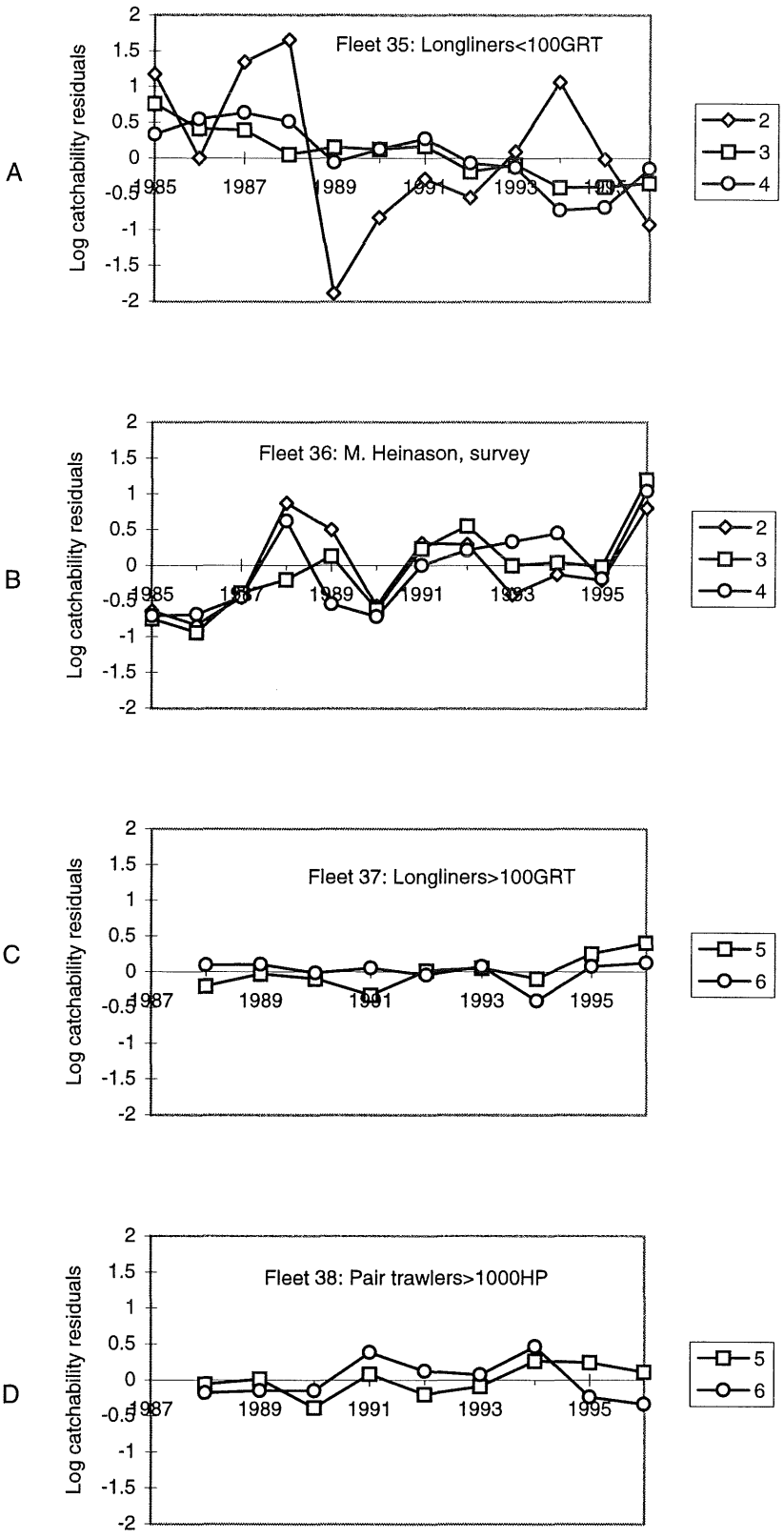



**Figure 2.4.8.** **Tuning fleets for Faroe haddock Vb. Log Catchability Residuals Plots.**

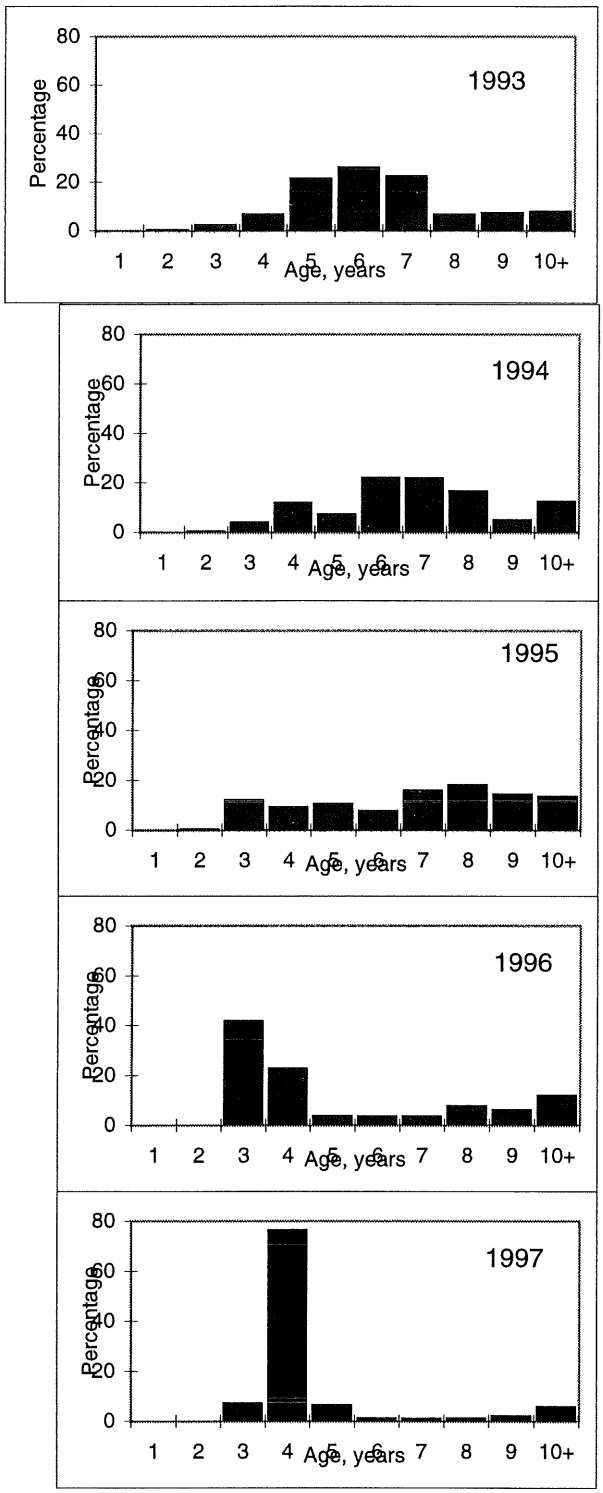
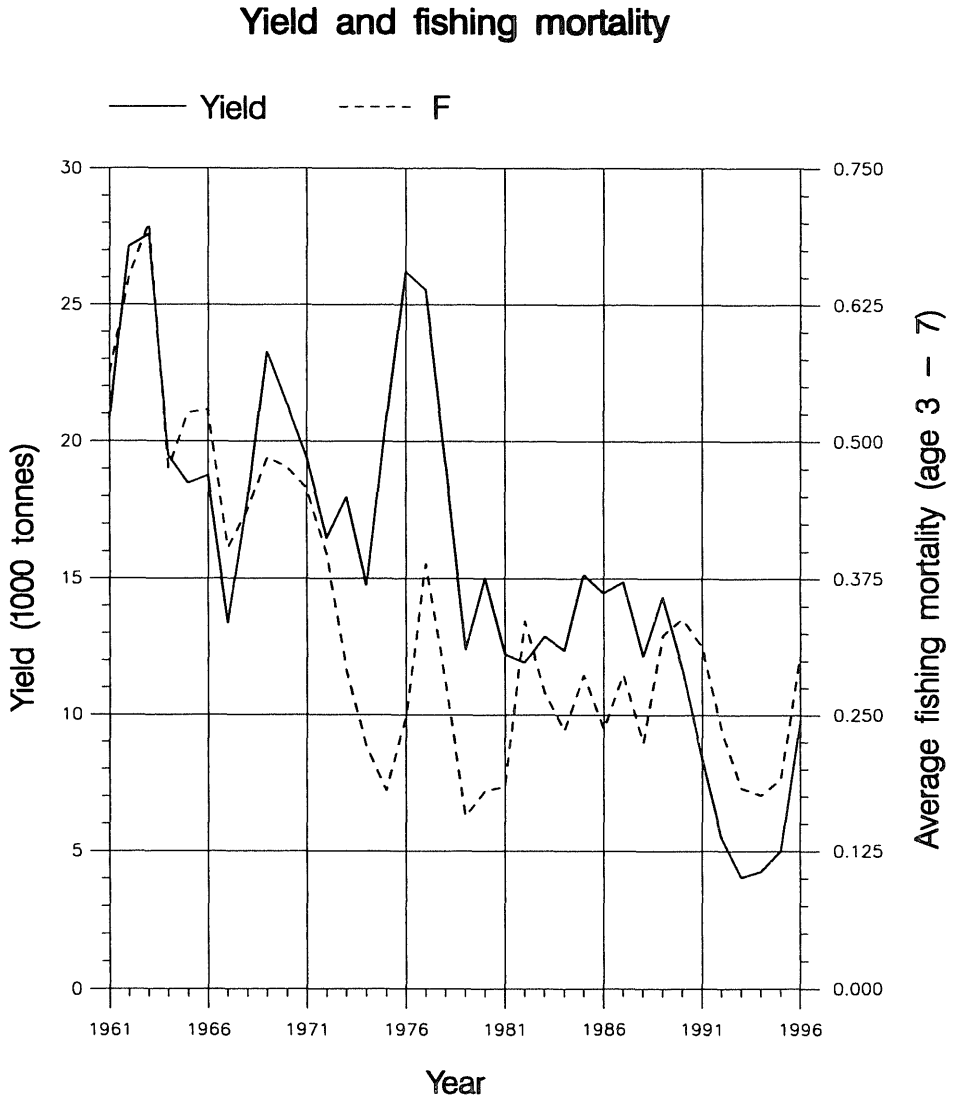



**Figure 2.4.9.**: Age distribution of Faroe haddock in the Faroese commercial catches the 1. quarter of the years 1993-1997.

Figure 2.4.10

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



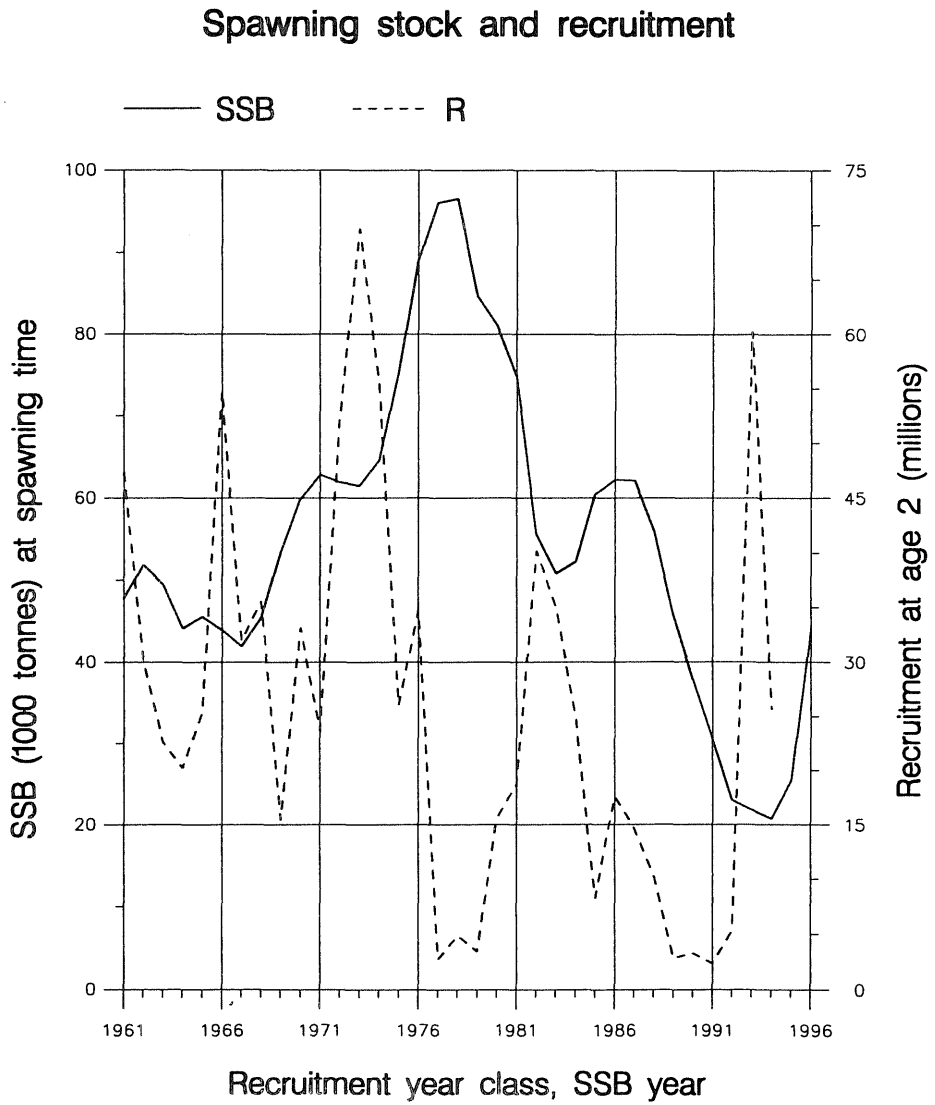
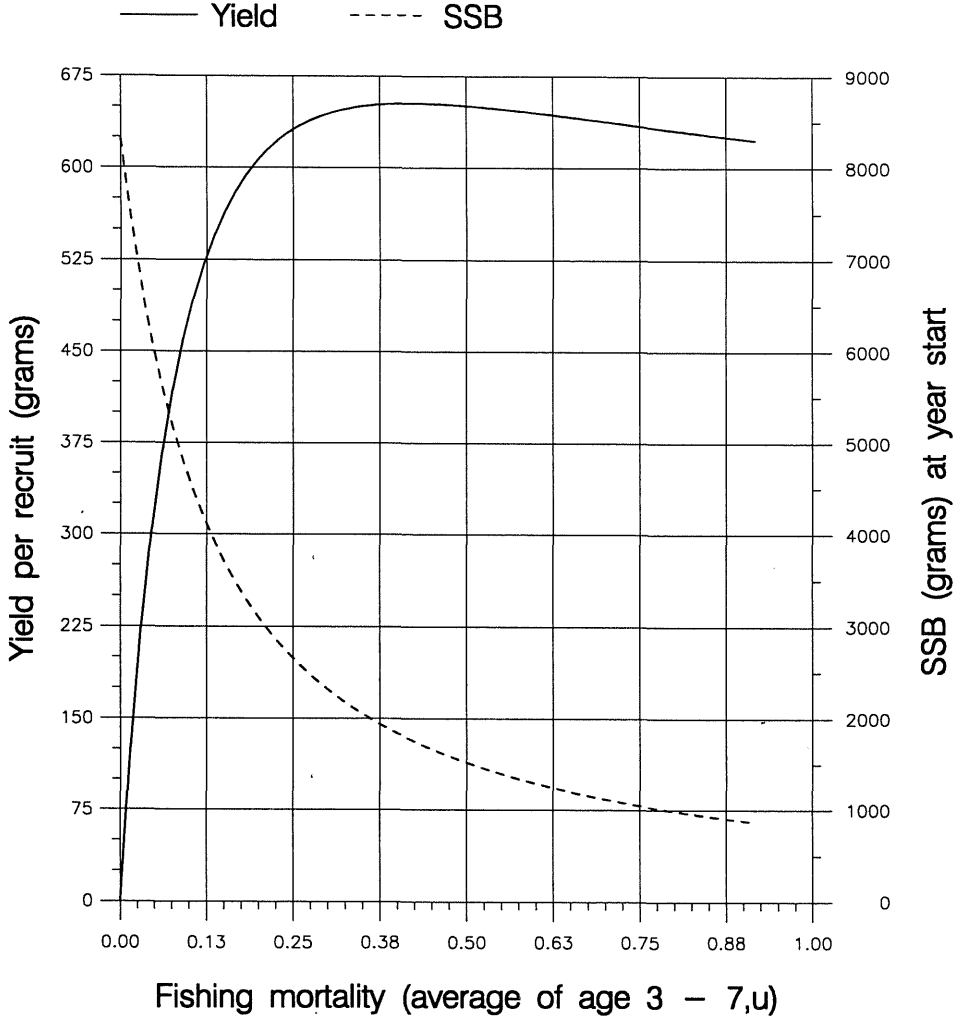



Figure 2.4.10 (Cont'd)

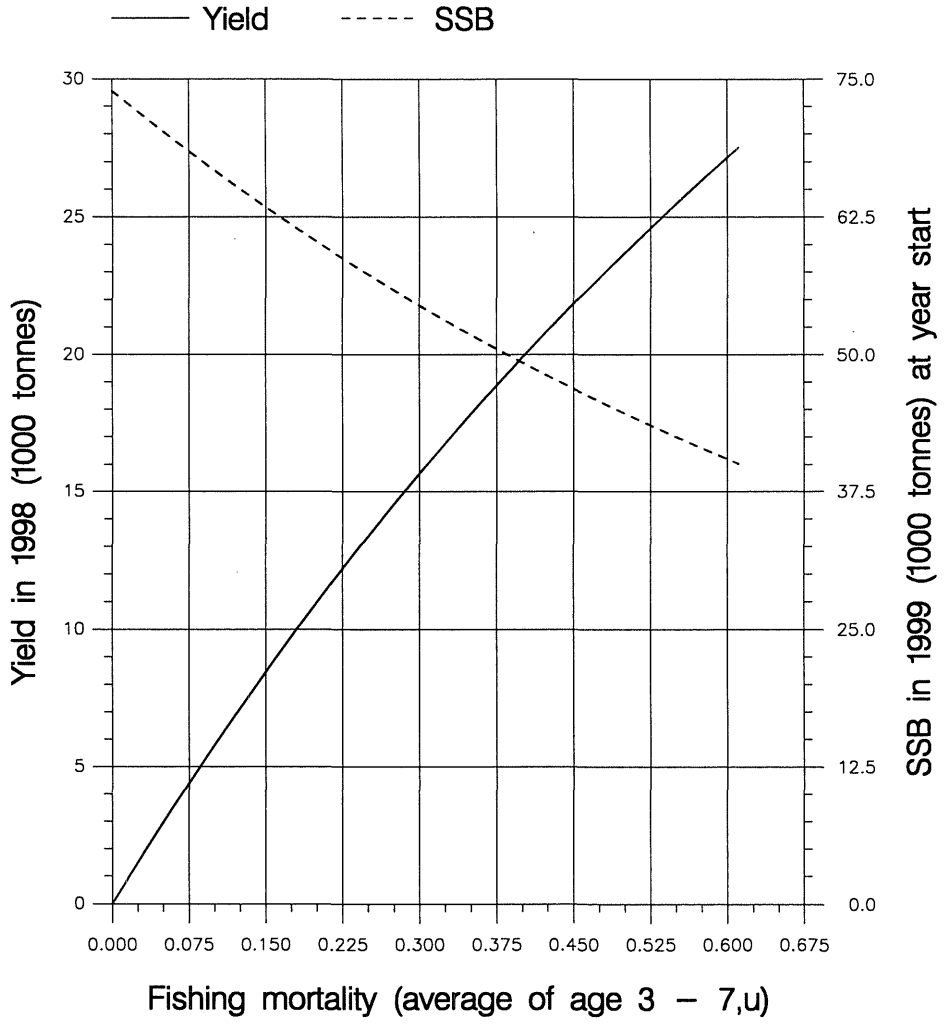
# Fish Stock Summary
# Haddock in the Faroe Grounds (Fishing Area Vb)
# 6 – 5 – 1997

## Long term yield and spawning stock biomass



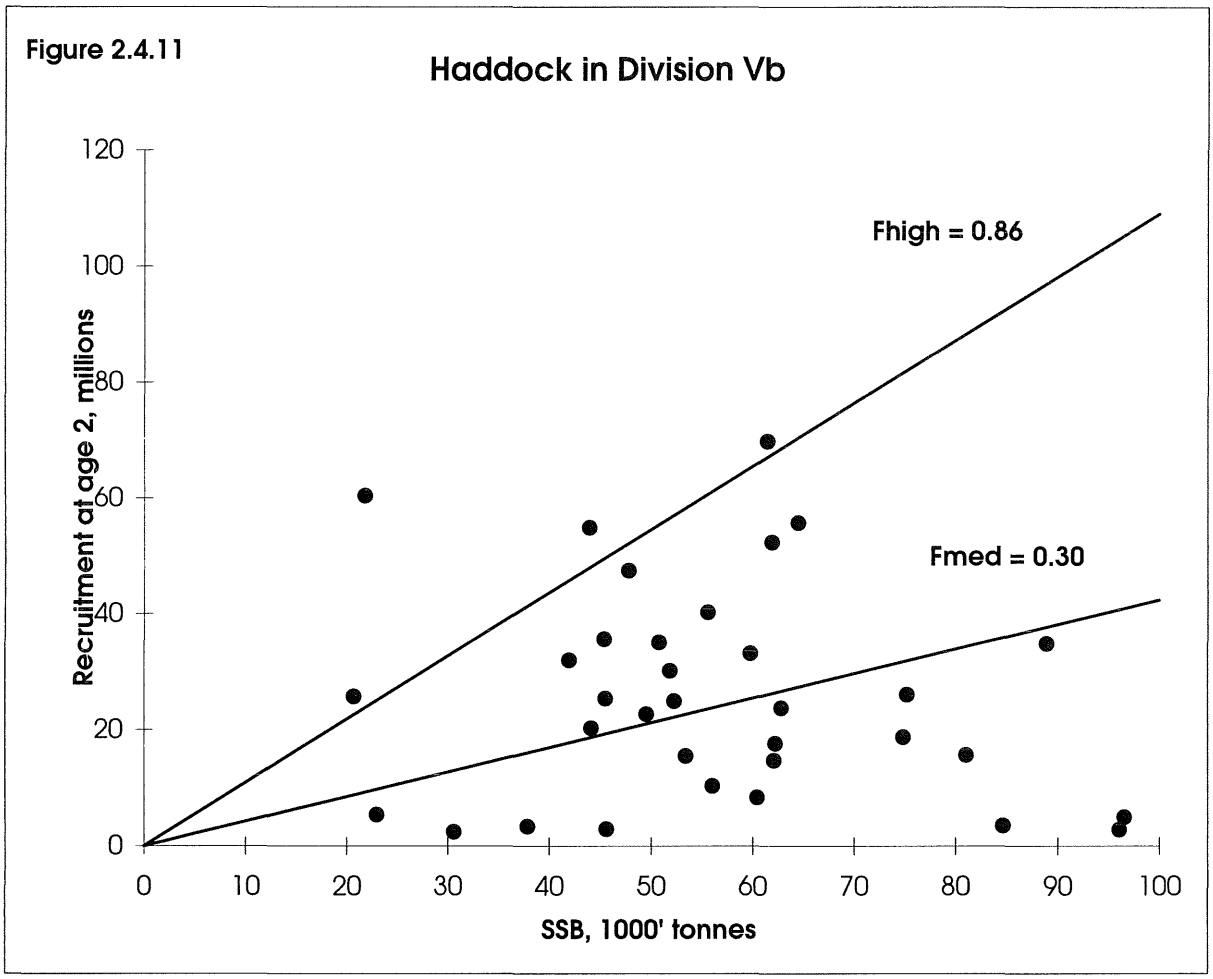

(run: YLDJAK04) C

## Short term yield and spawning stock biomass




(run: MANJAK01) D

Figure 2.4.11




e:\acfm\nwwg97\F-2411.xls

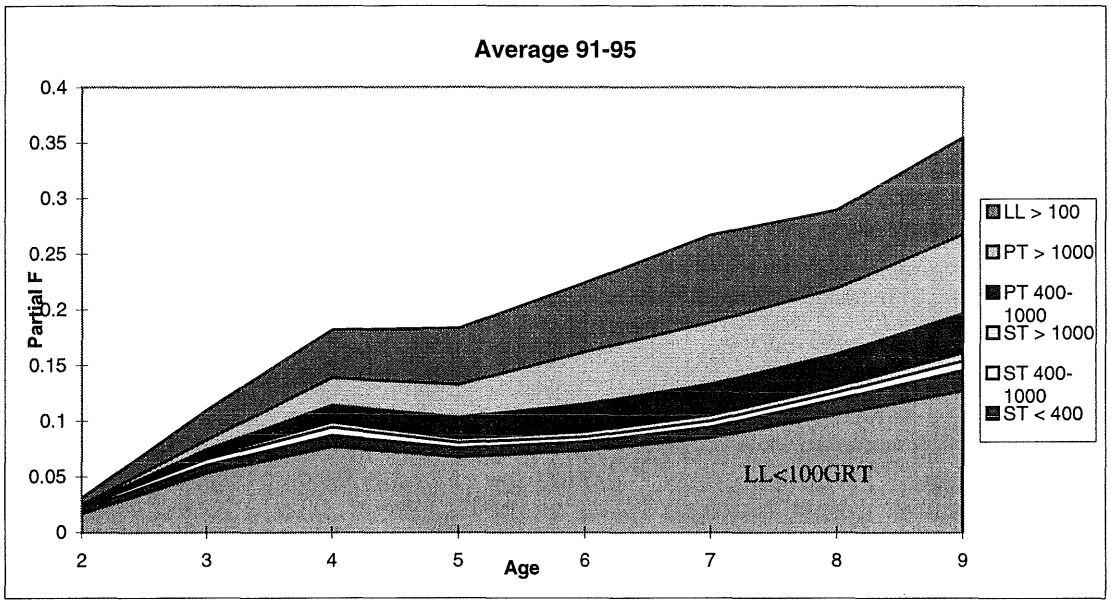



Figure 2.4.12. Partial F at age for different fleet categories.

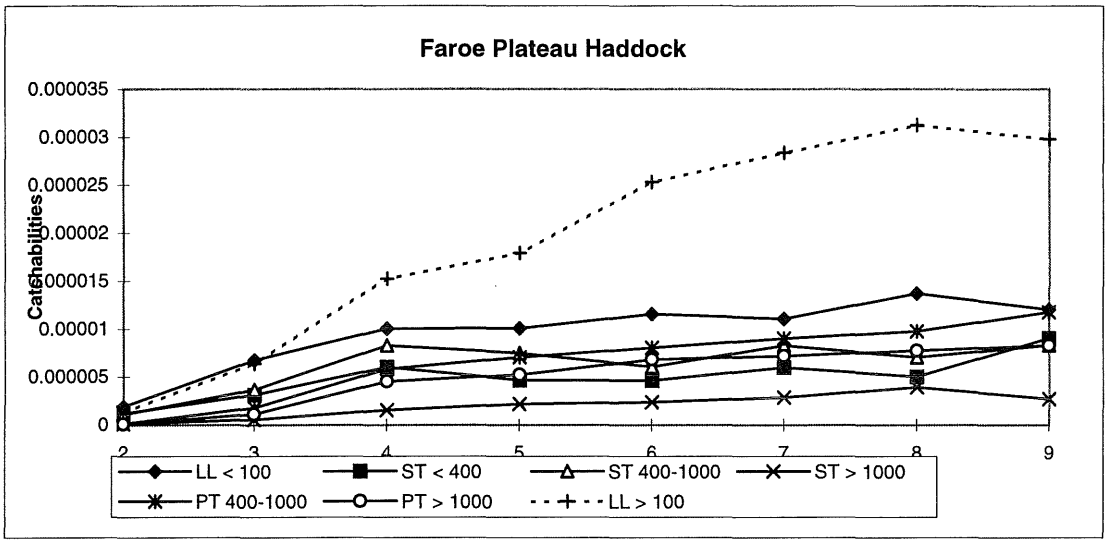



Figure 2.4.13. Catchabilities at age for different fleet categories.

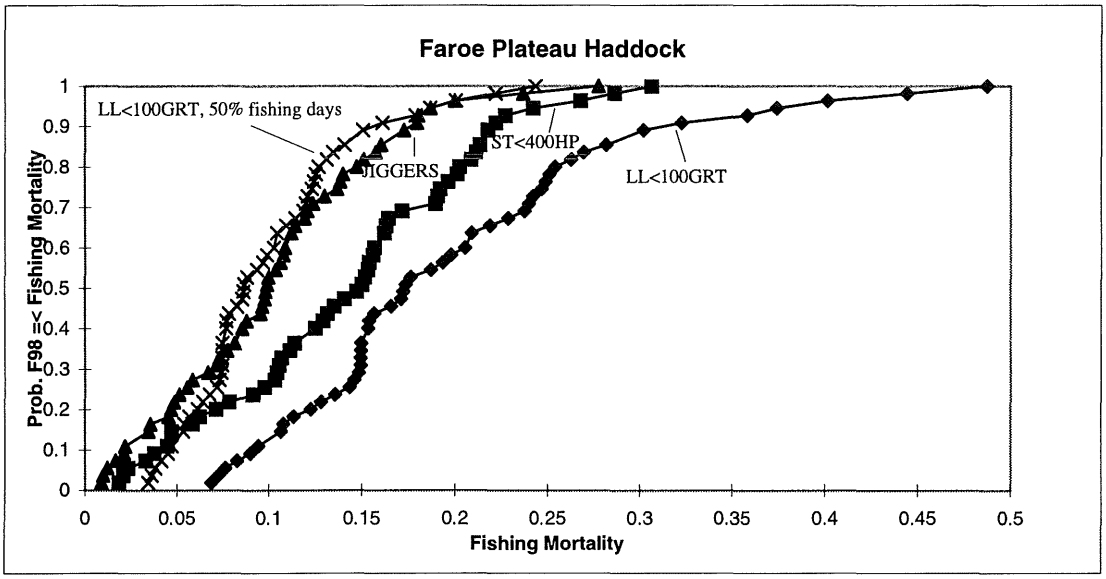



Figure 2.4.14. Probability profiles for fishing mortalities in 1998.

## 2.5 Faroe Saithe

### 2.5.1 Landings and trends in the fishery

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

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

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

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

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

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

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

### 2.5.2 Catch at age

Catch at age are based on length and otolith samples from Faroese landings mostly in the fleet categories small and large pair trawlers and jiggers and landing statistic by fleet provided by the Faroese Statistical Department for Faroese landings and the Faroese Coast Guard for catches by foreign vessels. Catch at age was calculated by each fleet and by each third of the year before the numbers 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 1996 reflects the age composition in the Faroese catches (Table 2.5.3). In 1996 167 samples were taken from landings of saithe with 28 662 length measurements, 4 467 otoliths, and 3 116 individual weights.

### 2.5.3 Weight at age

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

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

### 2.5.4 Maturity at age

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

### 2.5.5 Stock assessment

#### 2.5.5.1 Tuning and estimation of fishing mortality

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

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

#### 2.5.5.2 Stock estimates and recruitment

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

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

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

### 2.5.6 Prediction of catch and biomass

#### 2.5.6.1 Input data

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

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

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

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

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

#### 2.5.6.2 Biological reference points

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

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

#### 2.5.6.3 Projection of catch and biomass

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

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

### 2.5.7 Management considerations

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

### 2.5.8 Comments on the assessment

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

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

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

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

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

[1] Preliminary.

[2] As from 1991.

[3] Quantity unknown 1989-91 and 1994.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

| Table 5 Proportion mature at age<br>YEAR, | 1967, | 1968, | 1969, | 1970, | 1971, | 1972, | 1973, | 1974, | 1975, | 1976, |
|---|---|---|---|---|---|---|---|---|---|---|
| AGE | | | | | | | | | | |
| 3, | .0400, | .0400, | .0400, | .0400, | .0400, | .0400, | .0400, | .0400, | .0400, | .0400, |
| 4, | .2600, | .2600, | .2600, | .2600, | .2600, | .2600, | .2600, | .2600, | .2600, | .2600, |
| 5, | .5700, | .5700, | .5700, | .5700, | .5700, | .5700, | .5700, | .5700, | .5700, | .5700, |
| 6, | .8200, | .8200, | .8200, | .8200, | .8200, | .8200, | .8200, | .8200, | .8200, | .8200, |
| 7, | .9100, | .9100, | .9100, | .9100, | .9100, | .9100, | .9100, | .9100, | .9100, | .9100, |
| 8, | .9800, | .9800, | .9800, | .9800, | .9800, | .9800, | .9800, | .9800, | .9800, | .9800, |
| 9, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 10, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 11, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| +gp, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |

| Table 5 Proportion mature at age<br>YEAR, | 1977, | 1978, | 1979, | 1980, | 1981, | 1982, | 1983, | 1984, | 1985, | 1986, |
|---|---|---|---|---|---|---|---|---|---|---|
| AGE | | | | | | | | | | |
| 3, | .0400, | .0400, | .0400, | .0400, | .0400, | .0400, | .0900, | .1200, | .1200, | .1200, |
| 4, | .2600, | .2600, | .2600, | .2600, | .2600, | .2600, | .3300, | .2800, | .3100, | .3100, |
| 5, | .5700, | .5700, | .5700, | .5700, | .5700, | .5700, | .6600, | .5900, | .6600, | .6100, |
| 6, | .8200, | .8200, | .8200, | .8200, | .8200, | .8200, | .9300, | .9000, | .8900, | .8400, |
| 7, | .9100, | .9100, | .9100, | .9100, | .9100, | .9100, | .9800, | .9800, | .9800, | .9600, |
| 8, | .9800, | .9800, | .9800, | .9800, | .9800, | .9800, | 1.0000, | 1.0000, | 1.0000, | .9900, |
| 9, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 10, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 11, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| +gp, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |

| Table 5 Proportion mature at age<br>YEAR, | 1987, | 1988, | 1989, | 1990, | 1991, | 1992, | 1993, | 1994, | 1995, | 1996, |
|---|---|---|---|---|---|---|---|---|---|---|
| AGE | | | | | | | | | | |
| 3, | .1200, | .1100, | .1100, | .1000, | .1000, | .1100, | .1200, | .1300, | .1300, | .1200, |
| 4, | .2400, | .2800, | .2400, | .2400, | .2400, | .2400, | .2900, | .3000, | .3600, | .3000, |
| 5, | .5700, | .4200, | .4300, | .4200, | .4400, | .5000, | .5500, | .5500, | .5700, | .6000, |
| 6, | .8400, | .8100, | .6800, | .6300, | .6700, | .7500, | .8300, | .8100, | .8100, | .8400, |
| 7, | .9500, | .9500, | .9500, | .8700, | .8600, | .9000, | .9400, | .9600, | .9400, | .9500, |
| 8, | .9900, | .9800, | .9900, | .9900, | .9500, | .9800, | .9800, | .9900, | .9900, | .9900, |
| 9, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | .9900, | .9900, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 10, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 11, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| +gp, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |

**Table 2.5.6** Saithe in Faroes Grounds. Effort (fishing days) and catch at age (thousands) for commercial Cuba pair trawlers.

| | *Effort* | *Age* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Year* | *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 |

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

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

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


 Time series weights :

      Tapered time weighting applied
      Power =    3 over  20 years


 Catchability analysis :

      Catchability dependent on stock size for ages <    4

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


      Catchability independent of age for ages >=    9


 Terminal population estimation :

      Survivor estimates shrunk towards the mean F
      of the final   5 years or the   3 oldest ages.

      S.E. of the mean to which the estimates  are shrunk =    .500

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

      Prior weighting not applied

 Lowestoft VPA Version 3.1

 2-May-97  11:43:39

 Retrospective XSA run

 Saithe Faroes Vb (run: XSAFRS05/X05)

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

 Terminal year for this assessment : 1996


 Tuning converged after   27 iterations

1


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



 Fishing mortalities
    Age,  1987,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996

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

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

XSA population numbers (Thousands)

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

Estimated population abundance at 1st Jan 1997

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

Taper weighted geometric mean of the VPA populations:

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

Standard error of the weighted Log(VPA populations) :

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| , | .7326, | .7175, | .6123, | .5439, | .4965, | .4257, | .4145, | .4908, | .5567, |

1

Log catchability residuals.

Fleet : FLT01: COMMERCIAL CU

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

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

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

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

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

```
Regression statistics :

 Ages with q dependent on year class strength

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

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

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

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

  4,    1.14,    -.553,     10.94,     .63,     15,     .58,  -10.80,
  5,    1.17,    -.855,     10.03,     .71,     15,     .40,   -9.95,
  6,    1.03,    -.208,      9.70,     .85,     15,     .23,   -9.68,
  7,     .99,     .063,      9.71,     .85,     15,     .23,   -9.72,
  8,    1.13,    -.415,     10.09,     .51,     15,     .45,   -9.77,
  9,    1.77,    -.926,     12.29,     .13,     15,    1.14,   -9.81,
 10,     .92,     .189,      9.66,     .37,     15,     .66,   -9.99,
 11,     .81,    1.812,      8.92,     .90,     15,     .18,   -9.80,
1

 Fleet disaggregated estimates of survivors :


 Age  3   Catchability dependent on age and year class strength

 Year class = 1993

 FLT01: COMMERCIAL CU
        Age,          3,
  Survivors,     3727.,
 Raw Weights,     .219,




 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 FLT01: COMMERCIAL CU,     3727.,  2.094,       .000,    .00,   1,  .035,     .070

   P shrinkage mean  ,    17210.,    .72,,,,                          .315,     .016

   F shrinkage mean  ,     3924.,    .50,,,,                          .649,     .066

 Weighted prediction :

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


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

 Year class = 1992

 FLT01: COMMERCIAL CU
        Age,          4,          3,
  Survivors,     1640.,      5683.,
 Raw Weights,    2.714,       .155,




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

   F shrinkage mean  ,     3041.,    .50,,,,                          .582,     .280

 Weighted prediction :

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

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

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

Year class = 1991

FLT01: COMMERCIAL CU
        Age,         5,          4,          3,
  Survivors,      2440.,      3546.,     16420.,
Raw Weights,      5.674,      2.107,       .116,



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

  F shrinkage mean   ,     1429.,    .50,,,,                          .336,     .546

Weighted prediction :

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


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

Year class = 1990

FLT01: COMMERCIAL CU
        Age,         6,          5,          4,          3,
  Survivors,      1822.,      3637.,      4902.,      9391.,
Raw Weights,      6.901,      2.955,       .968,       .053,



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

  F shrinkage mean   ,     1564.,    .50,,,,                          .269,     .609

Weighted prediction :

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


1
Age  7   Catchability constant w.r.t. time and dependent on age

Year class = 1989

FLT01: COMMERCIAL CU
        Age,         7,          6,          5,          4,          3,
  Survivors,      2306.,      1207.,      1460.,      2143.,       21.,
Raw Weights,      6.779,      4.482,      2.397,       .888,       .037,



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

  F shrinkage mean   ,     1358.,    .50,,,,                          .215,     .571

Weighted prediction :

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

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

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

Year class = 1988

FLT01: COMMERCIAL CU
       Age,          8,          7,          6,          5,          4,          3,
  Survivors,     1988.,       863.,      1052.,      1215.,       719.,       317.,
Raw Weights,     4.426,      4.867,      3.042,      1.409,       .497,       .029,



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

  F shrinkage mean  ,       677.,    .50,,,,                          .219,     .529

Weighted prediction :

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


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

Year class = 1987

FLT01: COMMERCIAL CU
       Age,          9,          8,          7,          6,          5,          4,          3,
  Survivors,      997.,       306.,       334.,       295.,       228.,       320.,        36.,
Raw Weights,     1.589,      2.749,      2.823,      1.607,       .657,       .198,       .011,



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

  F shrinkage mean  ,       149.,    .50,,,,                          .293,     .589

Weighted prediction :

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


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

Year class = 1986

FLT01: COMMERCIAL CU
       Age,         10,          9,          8,          7,          6,          5,          4,          3,
  Survivors,      237.,       123.,       165.,       110.,        94.,       118.,        73.,       142.,
Raw Weights,     1.110,       .687,      1.053,      1.103,       .530,       .184,       .067,       .004,



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

  F shrinkage mean  ,        79.,    .50,,,,                          .458,     .633

Weighted prediction :

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

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

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

Year class = 1985

FLT01: COMMERCIAL CU
       Age,        11,
  Survivors,      135.,
Raw Weights,     7.546,


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




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

  F shrinkage mean  ,       115.,    .50,,,,                          .259,     .408

Weighted prediction :

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

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

Terminal Fs derived using XSA (With F shrinkage)

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

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

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

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

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

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

| Table 10 | Stock number at age (start of year) | | | | | | | | | Numbers*10**-3 |
|---|---|---|---|---|---|---|---|---|---|---|
| YEAR, | 1967, | 1968, | 1969, | 1970, | 1971, | 1972, | 1973, | 1974, | 1975, | 1976, |
| AGE | | | | | | | | | | |
| 3, | 26869, | 21505, | 40787, | 34122, | 37251, | 33610, | 23276, | 18822, | 16487, | 18763, |
| 4, | 17426, | 21460, | 17051, | 32316, | 26629, | 27913, | 25062, | 16781, | 12240, | 11632, |
| 5, | 13151, | 13547, | 16042, | 12073, | 20507, | 18801, | 21248, | 14861, | 10006, | 6980, |
| 6, | 6753, | 9533, | 10081, | 11058, | 8474, | 11736, | 13052, | 10995, | 8538, | 4753, |
| 7, | 5825, | 4812, | 6814, | 6975, | 7716, | 6029, | 7128, | 7539, | 6483, | 5236, |
| 8, | 2271, | 3690, | 3444, | 4567, | 4897, | 5568, | 3553, | 4357, | 4905, | 4362, |
| 9, | 1181, | 1431, | 2429, | 2287, | 3079, | 3585, | 3378, | 2282, | 2988, | 3369, |
| 10, | 833, | 771, | 942, | 1464, | 1586, | 2226, | 2015, | 2268, | 1535, | 2173, |
| 11, | 467, | 510, | 515, | 555, | 980, | 1150, | 1150, | 1285, | 1549, | 1083, |
| +gp, | 670, | 1067, | 846, | 848, | 977, | 726, | 989, | 1720, | 2383, | 2195, |
| 0 TOTAL, | 75445, | 78326, | 98952, | 106264, | 112097, | 111346, | 100851, | 80911, | 67113, | 60547, |

| Table 10 | Stock number at age (start of year) | | | | | | | | | Numbers*10**-3 |
|---|---|---|---|---|---|---|---|---|---|---|
| YEAR, | 1977, | 1978, | 1979, | 1980, | 1981, | 1982, | 1983, | 1984, | 1985, | 1986, |
| AGE | | | | | | | | | | |
| 3, | 12928, | 8425, | 8664, | 12373, | 33221, | 14677, | 40946, | 25893, | 22166, | 62206, |
| 4, | 12486, | 9129, | 6345, | 6834, | 9229, | 26827, | 11666, | 31277, | 20867, | 17040, |
| 5, | 6613, | 7565, | 5897, | 4351, | 4802, | 5924, | 18276, | 8553, | 15594, | 13474, |
| 6, | 4158, | 3574, | 4623, | 3614, | 2911, | 3236, | 3950, | 10392, | 4868, | 7715, |
| 7, | 2760, | 2239, | 2430, | 2850, | 2350, | 1540, | 1641, | 2019, | 4805, | 2916, |
| 8, | 3493, | 1566, | 1496, | 1461, | 1677, | 1103, | 917, | 823, | 861, | 2216, |
| 9, | 2991, | 2219, | 849, | 850, | 939, | 709, | 525, | 444, | 427, | 458, |
| 10, | 2335, | 1999, | 1395, | 471, | 504, | 459, | 312, | 183, | 218, | 256, |
| 11, | 1578, | 1606, | 1208, | 714, | 231, | 239, | 281, | 167, | 103, | 144, |
| +gp, | 1904, | 2096, | 2250, | 2843, | 2536, | 2425, | 1531, | 643, | 1081, | 335, |
| 0 TOTAL, | 51247, | 40418, | 35157, | 36363, | 58400, | 57137, | 80046, | 80396, | 70990, | 106762, |

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

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

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

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

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

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

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

Output from RCT3.

```
Analysis by RCT3 ver3.1 of data from file :

 p.dat

 Faroe Saithe: VPA and groundfish survey data

 Data for    1 surveys over    9 years :  1986 - 1994

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

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

 Forecast/Hindcast variance correction used.

 Yearclass =   1989

          I----------Regression----------I  I----------Prediction---------I

 Survey/  Slope  Inter-   Std  Rsquare  No.  Index Predicted   Std     WAP
 Series           cept   Error          Pts  Value   Value    Error   Weights

 Survey    -.73  11.55    .60   .126      3    .02   11.54    2.545     .004

                                       VPA Mean =   10.16     .160     .996


 Yearclass =   1990

          I----------Regression----------I  I----------Prediction---------I

 Survey/  Slope  Inter-   Std  Rsquare  No.  Index Predicted   Std     WAP
 Series           cept   Error          Pts  Value   Value    Error   Weights

 Survey     .34   9.60    .38   .277      4   1.73   10.18     .603     .090

                                       VPA Mean =   10.09     .190     .910
```

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

Yearclass = 1991

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

Yearclass = 1992

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

Yearclass = 1993

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

Yearclass = 1994

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

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

# Table 2.5.12



Saithe in the Faroes Grounds (Fishing Area Vb)

Prediction with management option table: Input data

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

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

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

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

## Table 2.5.13



Saithe in the Faroes Grounds (Fishing Area Vb)

Prediction with management option table

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

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

## Table 2.5.14



Saithe in the Faroes Grounds (Fishing Area Vb)

Yield per recruit: Input data

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

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

# Table 2.5.15



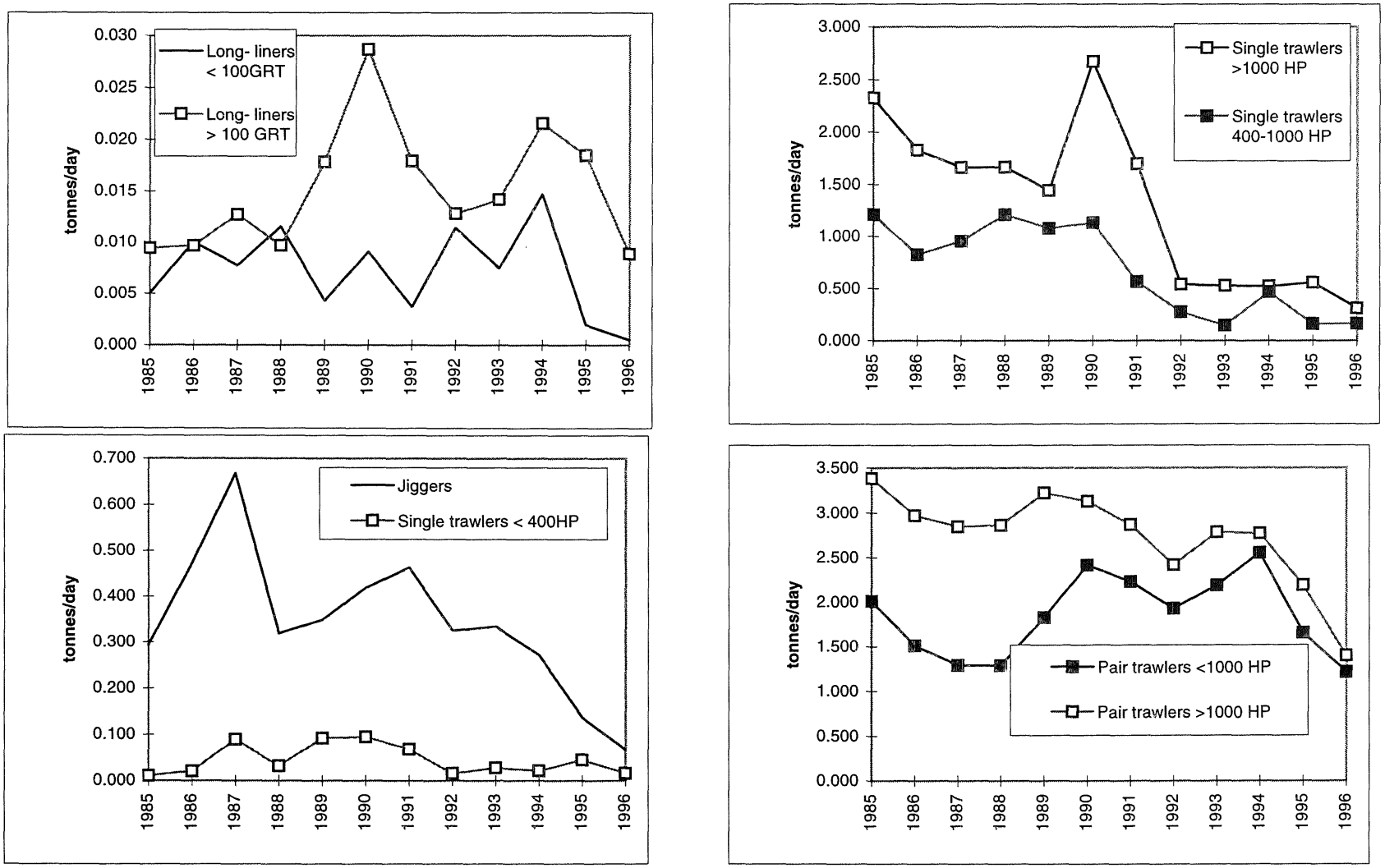
Saithe in the Faroes Grounds (Fishing Area Vb)

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

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

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






e:\acfm\nwwg97\F-251.xls

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

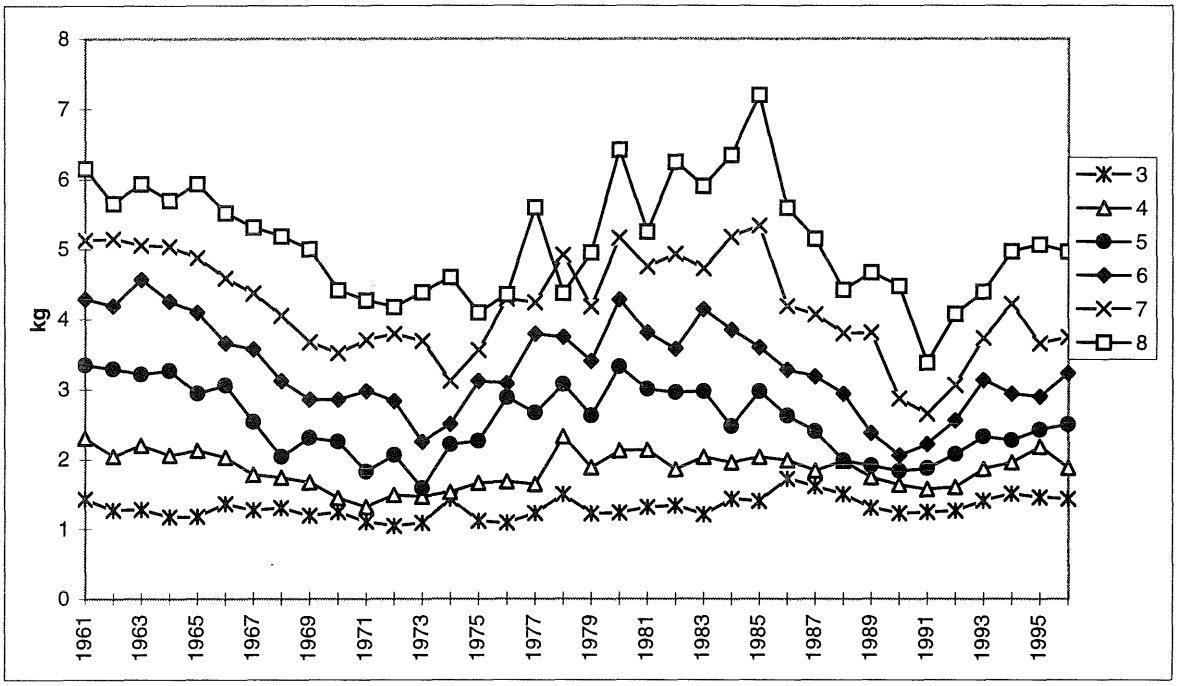
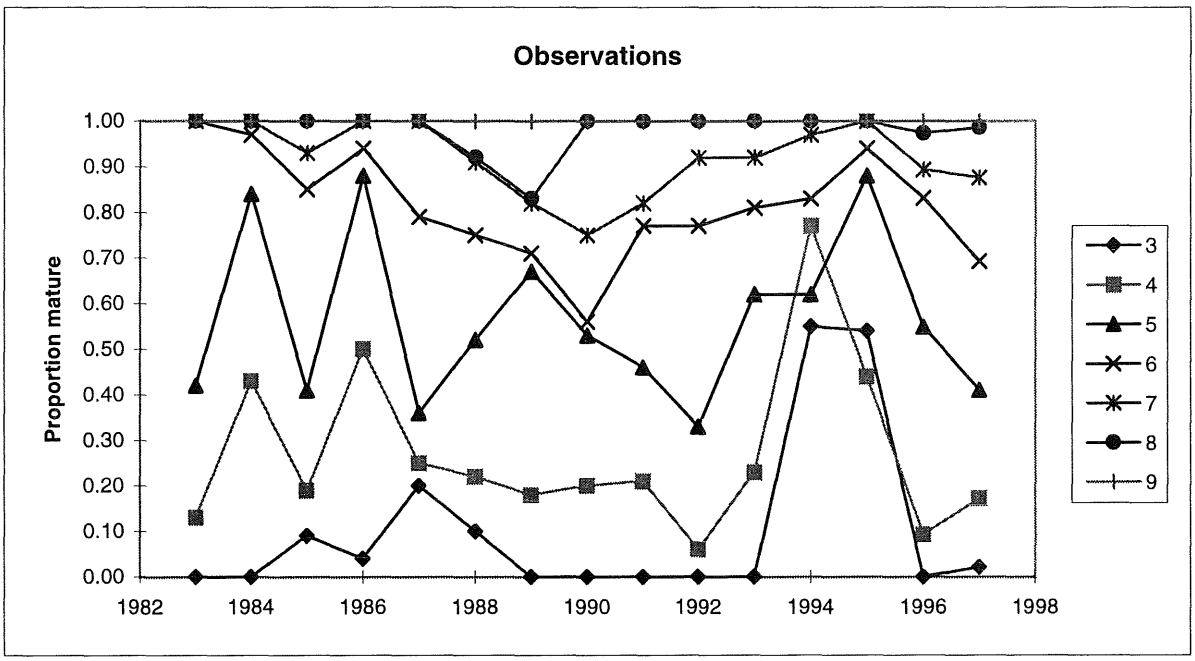


**Figure 2.5.3** Saithe in the Faroese Grounds. Observed and fitted values for the period 1983-1997.



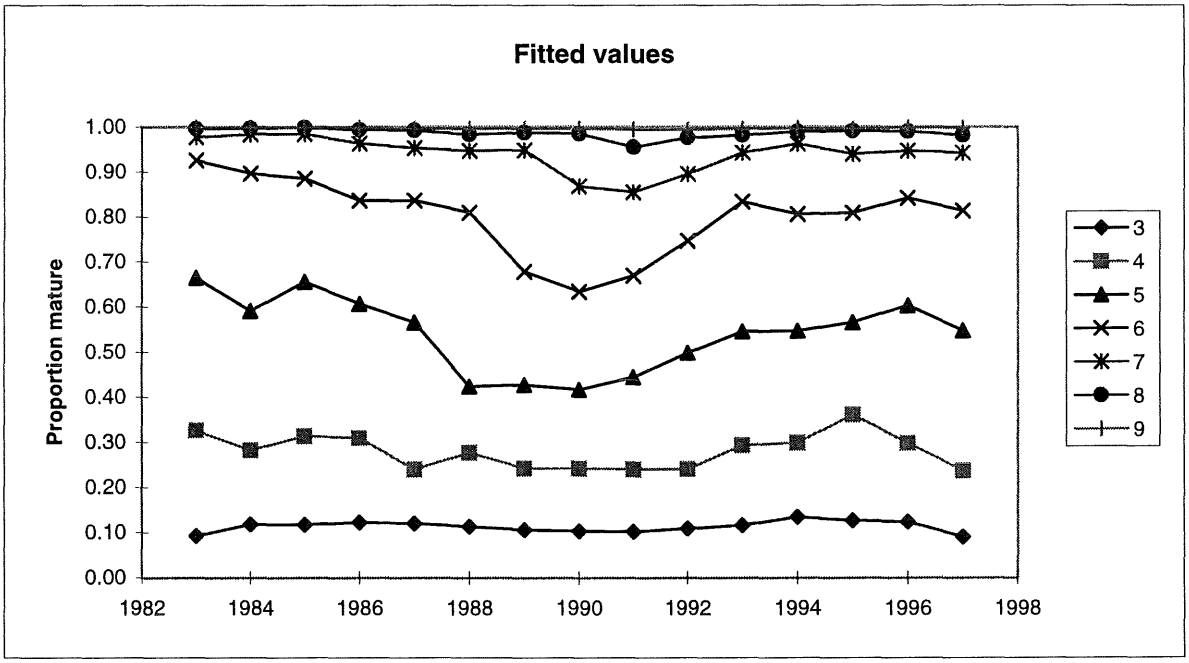



**Figure 2.5.4** Saithe in the Faroese Ground. Log catchability residuals for age groups 4-11 yrs from XSA tuning run. Data from the commercial Cuba pair trawlers.

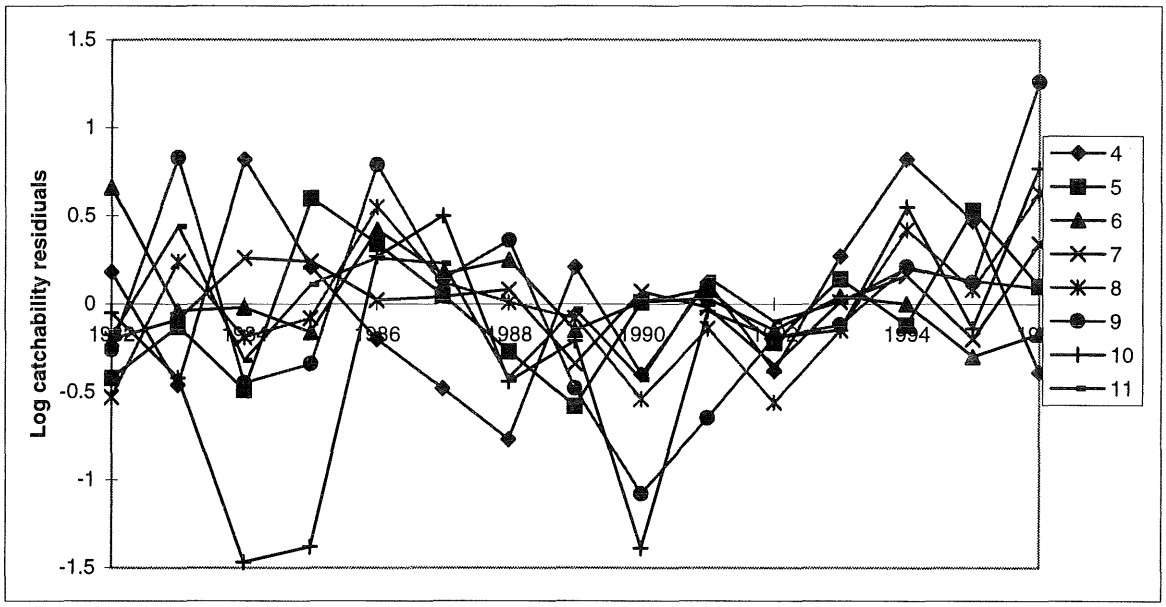


**Figure 2.5.5** Saithe in the Faroese Grounds. Retrospective analysis of fishing mortality from XSA run for 1992-1997.

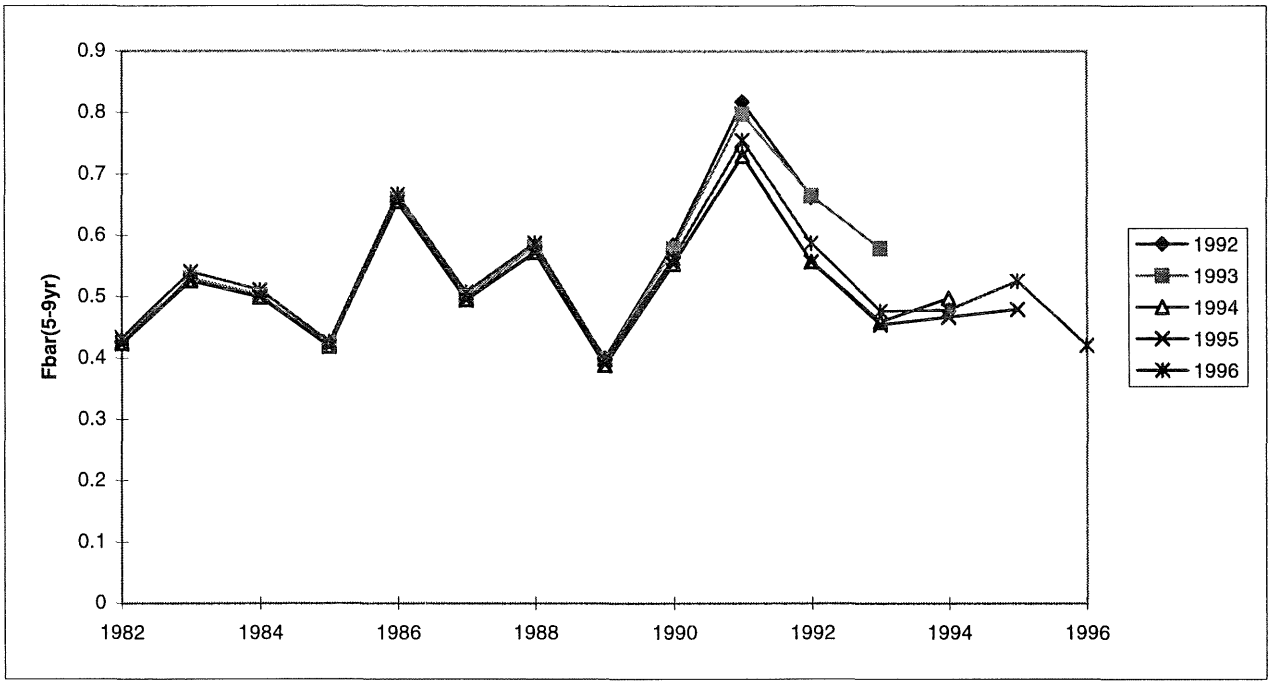
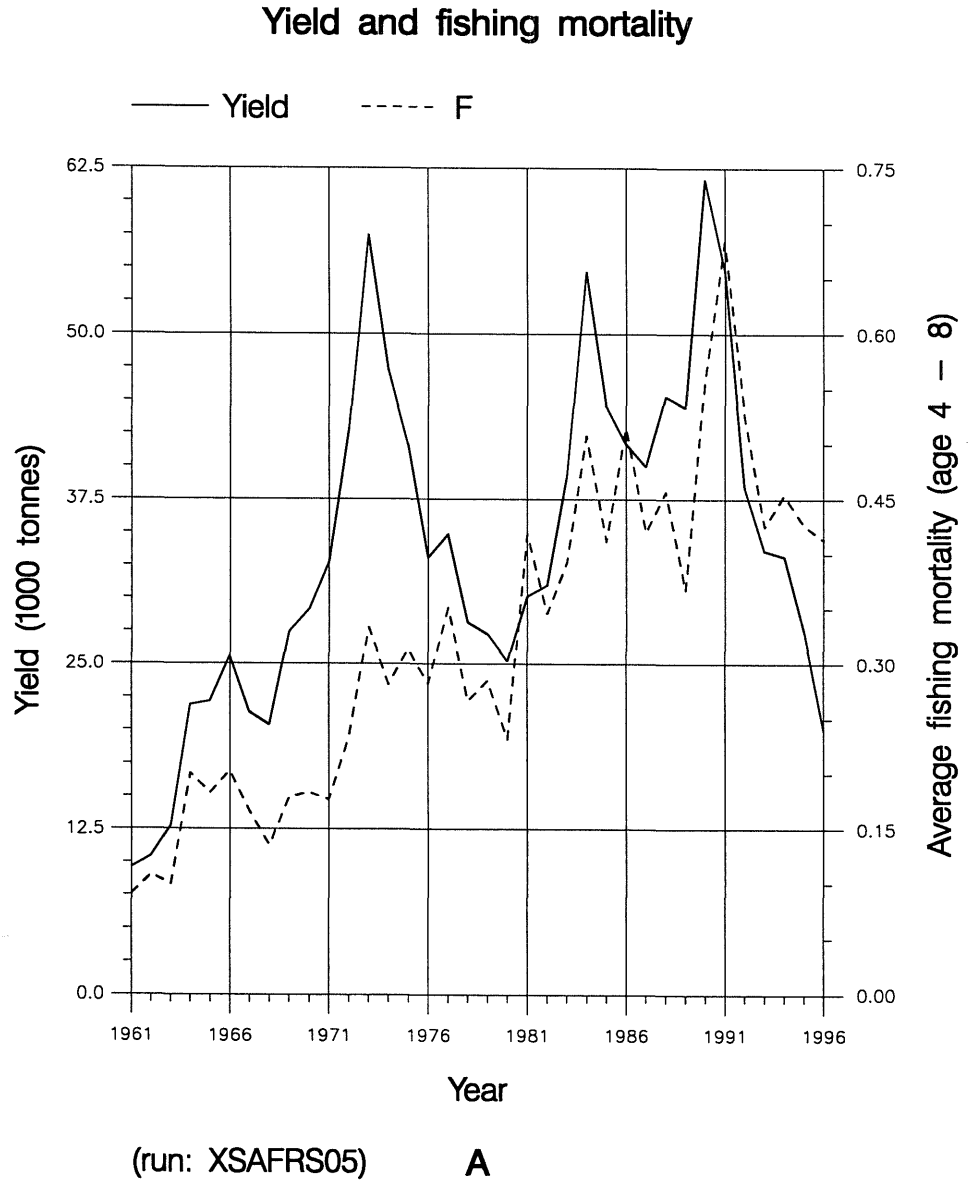


**Figure 2.5.6**

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



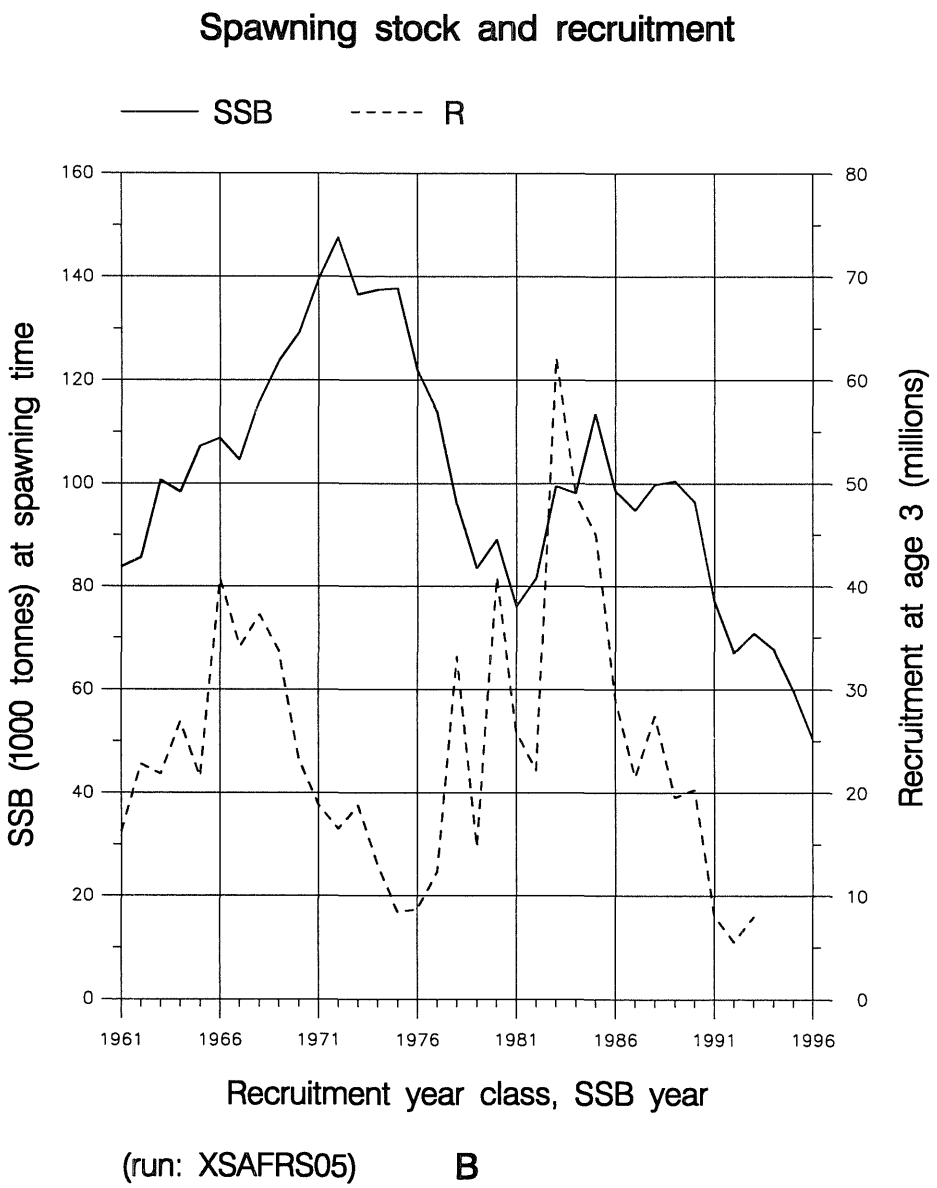
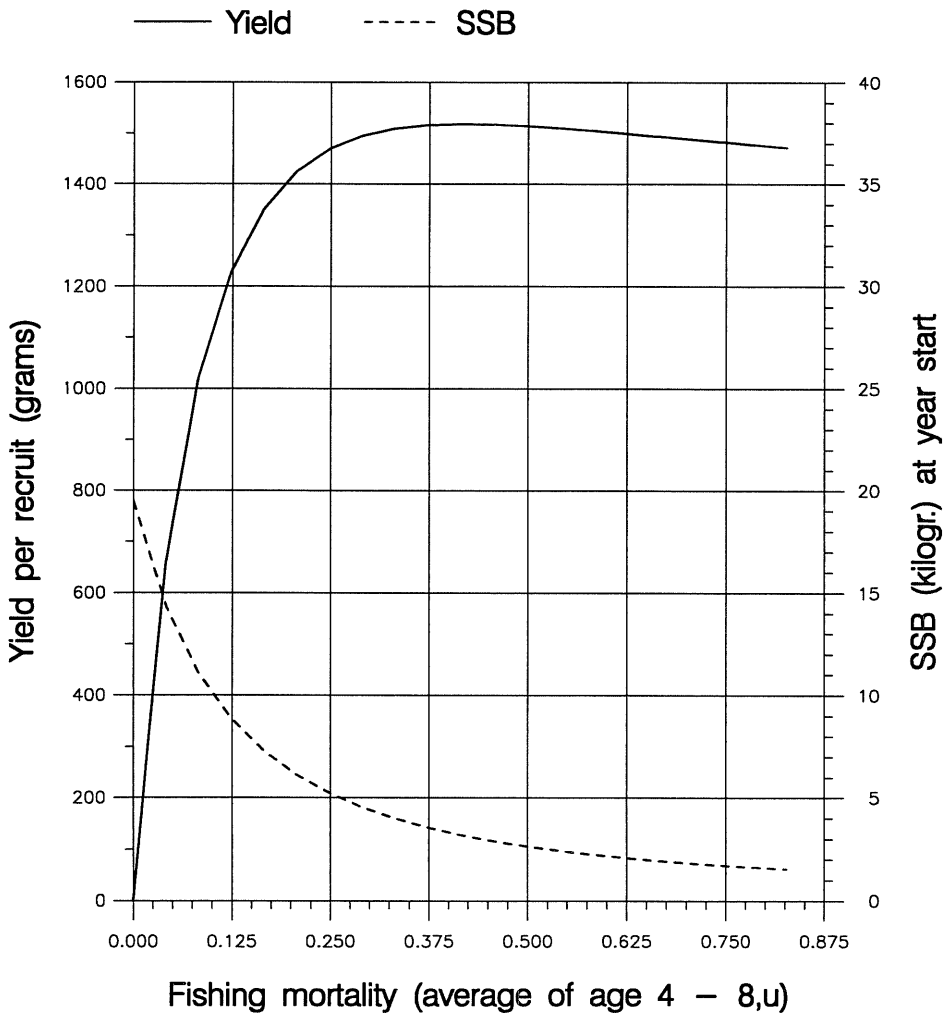



Figure 2.5.7

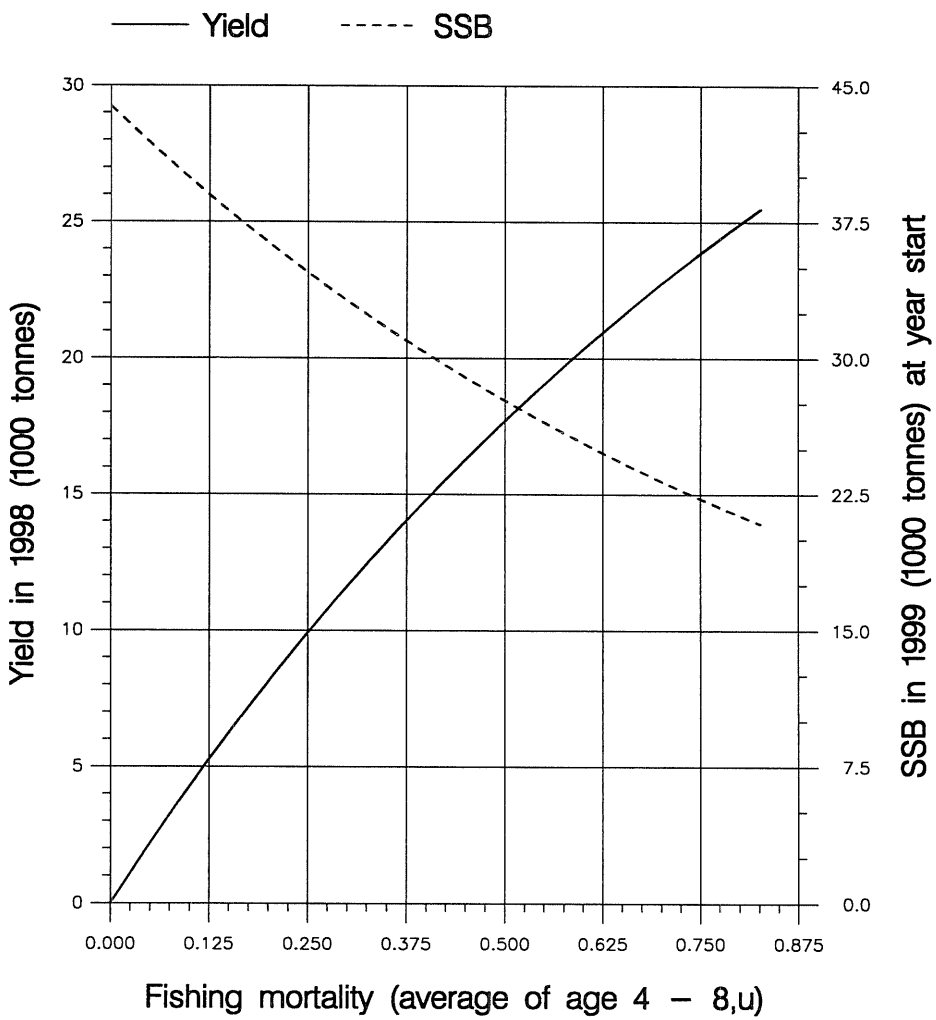
# Fish Stock Summary
# Saithe in the Faroes Grounds (Fishing Area Vb)
# 5 – 5 – 1997

## Long term yield and spawning stock biomass




(run: YLDFRS03) C

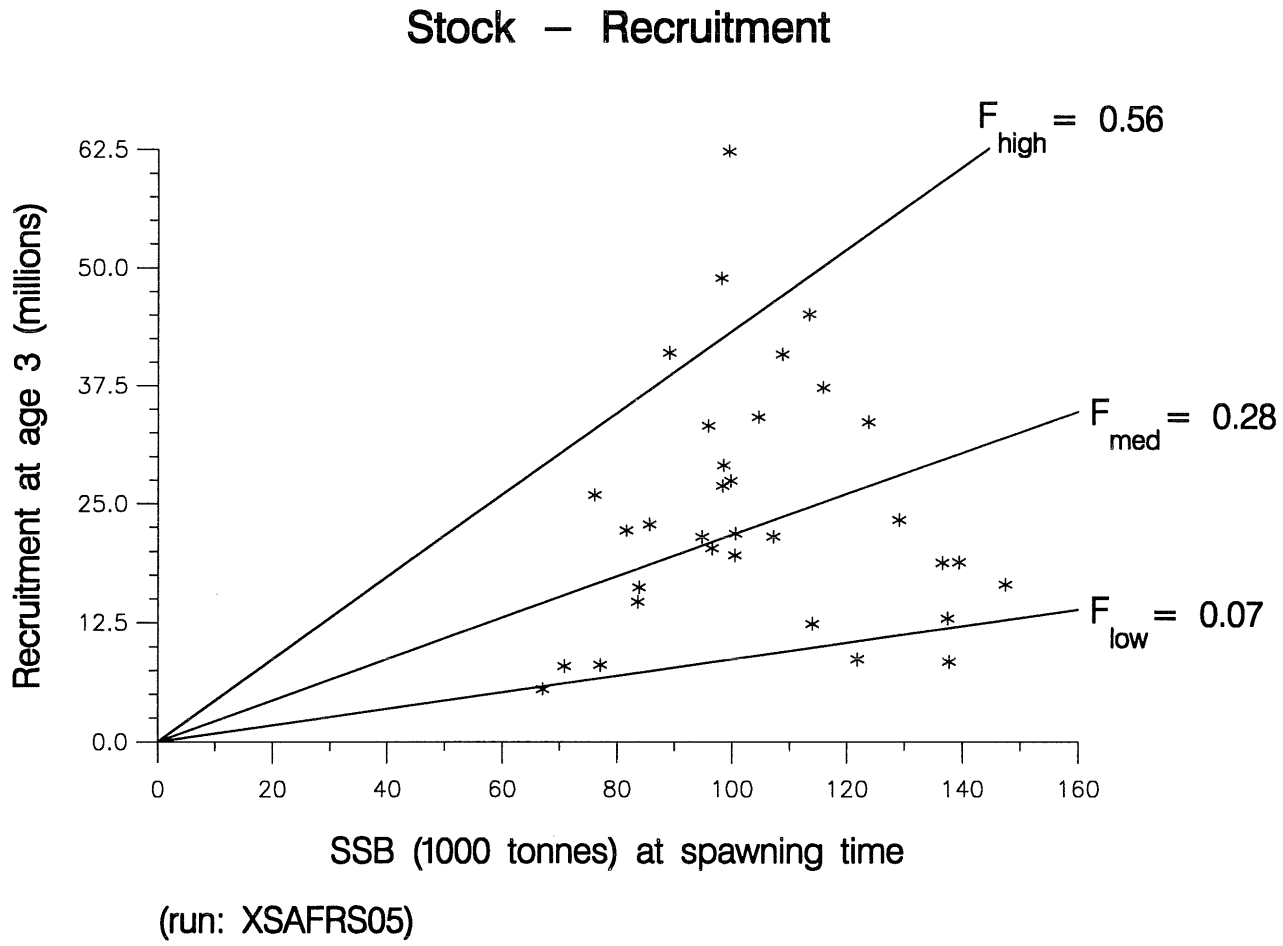
## Short term yield and spawning stock biomass




(run: MANFRS01) D

# Saithe in the Faroes Grounds (Fishing Area Vb)
## 2 – 5 – 1997

**Figure 2.5.8**



# 3 DEMERSAL STOCKS AT ICELAND (DIVISION VA)

## 3.1 Regulation of Demersal Fisheries

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

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

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

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

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

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

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

## 3.2 Icelandic Saithe

### 3.2.1 Trends in landings

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

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

### 3.2.2 Fleets and fishing grounds

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

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

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

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

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

### 3.2.3 Catch in numbers

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

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

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

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

### 3.2.4 Mean weight at age in the landings

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

### 3.2.5 Maturity at age in the landings

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

### 3.2.6 Stock Assessment

#### 3.2.6.1 Tuning input

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

#### 3.2.6.2 Estimates of fishing mortality

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

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

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

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

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

The joint variations of all 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 estimated variances of $\varepsilon(a,t)$ and logC(a,t) are $0.17^2$ for ages 5-9. For 4, 10 and 11 years ages the variability was higher. This was ascribed to higher variance of $\varepsilon(a,t)$ for the 4 years old where catchability could be higher than for older ages, e.g. because of variations in growth. For 10 and 11 years old fish, larger variability was assigned to the measurement errors.

CPUE is modelled as

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

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 $\tau$; $\delta(a,t)$ are random variations, produced by measurement errors and transitory irregularities in catchability.

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

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

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

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

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

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

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

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

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

### 3.2.6.3 Spawning stock and recruitment

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

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

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

## 3.2.7 Prediction of catch and biomass

### 3.2.7.1 Input data

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

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

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

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

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

### 3.2.7.2 Biological reference points

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

Compared to the estimated 1996 fishing mortality level of $F_{4-9} = 0.47$, the reference values for $F_{max}$ and $F_{0.1}$ are 0.43 and 0.18, respectively (Table 3.2.16). From Figure 3.2.12, showing the recruit/spawning stock relationship, and Figure 3.2.11.C, showing the spawning stock biomass-per-recruit relationship, $F_{med} = 0.23$ and $F_{high} = 0.8$ were estimated.

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

### 3.2.7.3 Projections of catch and biomass

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

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

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

### 3.2.8 Management considerations

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

### 3.2.9 Comments on the assessment

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

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

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

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

1) Provisional.

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

3) Additional catch by Iceland of 451 t included.

**Table 3.2.2**

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

At 2-May-97 15:37:34

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

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

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

**Table 3.2.3**

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

At 2-May-97 15:37:34

Table 2 Catch weights at age (kg)

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

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

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

Fitted:

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

Data:

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

**Table 3.2.5**

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

At 2-May-97 15:37:34

Table 5 Proportion mature at age

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

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

**Table 3.2.6** Tuning data series

Trawlers Effort in division Va:

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

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

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

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

**Table 3.2.6 (continued)**

Disaggregated gillnet cpue:

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

## Table 3.2.7

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Lowestoft VPA Version 3.1

    1-May-97  19:26:19

 Extended Survivors Analysis

 Saithe Iceland Va (run: XSABSI02/X02)

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

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

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


 Time series weights :

      Tapered time weighting applied
      Power =    3 over  20 years


 Catchability analysis :

      Catchability dependent on stock size for ages <    4

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


      Catchability independent of age for ages >=   11


 Terminal population estimation :

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

      S.E. of the mean to which the estimates  are shrunk =    .500

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

      Prior weighting not applied


 Tuning converged after   28 iterations
```

**Table 3.2.7 (continued)**

Regression weights

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

Fishing mortalities

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

XSA population numbers (Thousands)

| | AGE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| YEAR , | 3, | 4, | 5, | 6, | 7, | 8, | 9, | 10 | 12, |
| 1987 , | 1.10E+05, | 5.78E+04, | 2.19E+04, | 1.96E+04, | 9.36E+03, | 3.75E+03, | 1.60E+03, | 1.33E+03, | 9.62E+02, 1.32E+02, |
| 1988 , | 5.57E+04, | 8.92E+04, | 4.26E+04, | 1.39E+04, | 1.11E+04, | 5.03E+03, | 1.85E+03, | 7.09E+02, | 6.37E+02, 3.37E+02, |
| 1989 , | 3.14E+04, | 4.44E+04, | 6.84E+04, | 2.89E+04, | 8.08E+03, | 6.52E+03, | 2.51E+03, | 7.49E+02, | 3.76E+02, 2.77E+02, |
| 1990 , | 2.21E+04, | 2.54E+04, | 3.25E+04, | 4.84E+04, | 1.71E+04, | 5.00E+03, | 3.59E+03, | 1.29E+03, | 3.69E+02, 1.35E+02, |
| 1991 , | 3.17E+04, | 1.79E+04, | 1.93E+04, | 2.16E+04, | 3.04E+04, | 8.39E+03, | 2.45E+03, | 1.96E+03, | 7.11E+02, 1.66E+02, |
| 1992 , | 1.72E+04, | 2.58E+04, | 1.39E+04, | 1.25E+04, | 1.15E+04, | 1.52E+04, | 3.95E+03, | 1.23E+03, | 8.45E+02, 3.76E+02, |
| 1993 , | 3.05E+04, | 1.39E+04, | 1.85E+04, | 7.90E+03, | 6.32E+03, | 5.91E+03, | 8.76E+03, | 2.07E+03, | 6.88E+02, 5.14E+02, |
| 1994 , | 3.07E+04, | 2.44E+04, | 1.04E+04, | 1.26E+04, | 4.43E+03, | 3.14E+03, | 2.75E+03, | 3.85E+03, | 9.42E+02, 3.61E+02, |
| 1995 , | 6.39E+04, | 2.45E+04, | 1.73E+04, | 6.90E+03, | 7.93E+03, | 2.38E+03, | 1.45E+03, | 1.11E+03, | 1.34E+03, 3.61E+02, |
| 1996 , | 7.15E+04, | 5.09E+04, | 1.84E+04, | 1.17E+04, | 4.02E+03, | 4.35E+03, | 1.13E+03, | 6.64E+02, | 4.70E+02, 6.24E+02, |

Estimated population abundance at 1st Jan 1997

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

Taper weighted geometric mean of the VPA populations:

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

Standard error of the weighted Log(VPA populations) :

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

**Table 3.2.7 (continued)**

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

Estimated population abundance at 1st Jan 1997

| | | |
|---|---|---|
| | 3.59E+02 | 8.73E+01 |

Taper weighted geometric mean of the VPA populations:

| | | |
|---|---|---|
| | 1.38E+02 | 4.82E+01 |

Standard error of the weighted Log(VPA populations) :

| | | |
|---|---|---|
| | .7280 | 1.2031 |

1

Log catchability residuals.

Fleet : FLT04: TRW EFFORT (C

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

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

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

| Age | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Mean Log q | -6.1648 | -5.3665 | -4.9904 | -4.9317 | -5.0079 | -5.0320 | -4.9251 | -4.9470 | -4.9470 | -4.947( |
| S.E(Log q) | .4442 | .2785 | .2771 | .2576 | .3115 | .3581 | .4312 | .4955 | 1.1586 | 1.696( |

**Table 3.2.7 (continued)**

```
 Regression statistics :

 Ages with q dependent on year class strength

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

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

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

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

  4,    1.00,     .011,      6.18,     .59,     12,     .47,   -6.16,
  5,    1.65,   -3.146,      2.36,     .74,     12,     .33,   -5.37,
  6,    1.51,   -2.758,      2.66,     .78,     12,     .32,   -4.99,
  7,     .96,     .278,      5.09,     .85,     12,     .26,   -4.93,
  8,    1.38,   -1.500,      3.68,     .65,     12,     .40,   -5.01,
  9,    1.03,    -.153,      4.94,     .71,     12,     .39,   -5.03,
 10,     .71,    1.812,      5.58,     .82,     12,     .28,   -4.93,
 11,    1.09,    -.238,      4.82,     .47,     12,     .57,   -4.95,
 12,     .96,     .071,      5.27,     .23,     12,    1.12,   -5.25,
 13,    1.04,    -.055,      3.84,     .19,     12,    1.39,   -3.87,
1

 Terminal year survivor and F summaries :

 Age  3   Catchability dependent on age and year class strength

 Year class = 1993

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 FLT04: TRW EFFORT (C,     61281.,   .518,       .000,    .00,   1,  .319,     .031

   P shrinkage mean  ,     29944.,    .52,,,,                          .327,     .062

   F shrinkage mean  ,     95073.,    .50,,,,                          .354,     .020

 Weighted prediction :

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


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

 Year class = 1992

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

   F shrinkage mean  ,     29231.,    .50,,,,                          .348,     .102

 Weighted prediction :

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

**Table 3.2.7 (continued)**

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

Year class = 1991

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

  F shrinkage mean  ,       7935.,    .50,,,,                          .198,     .237

Weighted prediction :

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


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

Year class = 1990

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

  F shrinkage mean  ,       3610.,    .50,,,,                          .155,     .382

Weighted prediction :

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


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

Year class = 1989

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

  F shrinkage mean  ,       1270.,    .50,,,,                          .148,     .460

Weighted prediction :

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

**Table 3.2.7 (continued)**

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

Year class = 1988

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

  F shrinkage mean  ,      1503.,    .50,,,,                          .157,     .522

Weighted prediction :

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


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

Year class = 1987

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

  F shrinkage mean  ,       377.,    .50,,,,                          .204,     .574

Weighted prediction :

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


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

Year class = 1986

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

  F shrinkage mean  ,       217.,    .50,,,,                          .267,     .629

Weighted prediction :

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

**Table 3.2.7 (continued)**

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

Year class = 1985

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

Weighted prediction :

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

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

Year class = 1984

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

Weighted prediction :

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

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

Year class = 1983

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

Weighted prediction :

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

1
Age 14 Catchability constant w.r.t. time and age (fixed at the value for age) 11

Year class = 1982

| Fleet, | Estimated, Survivors, | Int, s.e, | Ext, s.e, | Var, Ratio, | N, | Scaled, Weights, | Estimated F |
|---|---|---|---|---|---|---|---|
| FLT04: TRW EFFORT (C, | 38., | .194, | .080, | .41, | 11, | .410, | .577 |
| F shrinkage mean , | 53., | .50,,,, | | | | .590, | .444 |

Weighted prediction :

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

**Table 3.2.8**

```
Lowestoft VPA Version 3.1

    2-May-97  15:36:38

 Extended Survivors Analysis

 Saithe Iceland Va (run: XSABSI03/X03)

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

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

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


 Time series weights :

     Tapered time weighting applied
     Power =    3 over  20 years


 Catchability analysis :

     Catchability dependent on stock size for ages <    4

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


     Catchability independent of age for ages >=   11

 Terminal population estimation :

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

     S.E. of the mean to which the estimates  are shrunk =    .500

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

     Prior weighting not applied


 Tuning converged after   41 iterations


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


 Fishing mortalities
   Age,  1987,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996

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

**Table 3.2.8 (Continued)**

```
1
 XSA population numbers (Thousands)

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

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

 Estimated population abundance at 1st Jan 1997

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

 Taper weighted geometric mean of the VPA populations:

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

 Standard error of the weighted Log(VPA populations) :

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



                                AGE
 YEAR ,           13,          14,

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

 Estimated population abundance at 1st Jan 1997

    ,     3.28E+02, 8.32E+01,

 Taper weighted geometric mean of the VPA populations:

    ,     1.36E+02, 4.77E+01,

 Standard error of the weighted Log(VPA populations) :

    ,         .7284,   1.2023,
```

**Table 3.2.8 (Continued)**

Log catchability residuals.

Fleet : FLT06: TRW CPU JAN.-

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

| Age | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | No data for this fleet at this age | | | | | | | | | |
| 4 | 1.26 | -1.08 | -1.05 | .27 | -.67 | .40 | -.57 | .89 | .41 | .37 |
| 5 | .58 | .06 | -1.27 | -.42 | -.12 | .44 | -.53 | .33 | .06 | -.20 |
| 6 | .24 | .19 | -.05 | -.77 | -.24 | .21 | .37 | .08 | .31 | -.20 |
| 7 | -.26 | .01 | .04 | -.13 | -.35 | .03 | .58 | .03 | .23 | -.05 |
| 8 | -.26 | .08 | .10 | -.29 | -.04 | -.09 | .50 | .43 | .36 | .38 |
| 9 | -.76 | .77 | .28 | -.47 | .03 | -.14 | .05 | .38 | .03 | -.05 |
| 10 | -.72 | .35 | .50 | -.02 | .31 | -.50 | .13 | .83 | .31 | .12 |
| 11 | -1.04 | .85 | .21 | 1.03 | .15 | -1.03 | -.30 | .22 | .40 | -.29 |
| 12 | No data for this fleet at this age | | | | | | | | | |

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

| Age | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|
| Mean Log q | -18.8385 | -17.5331 | -16.7842 | -16.4824 | -16.6334 | -16.5977 | -16.6982 | -16.6499 |
| S.E(Log q) | .7798 | .6240 | .3295 | .3175 | .6691 | .4000 | .6836 | .6671 |

Regression statistics :

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

| Age | Slope | t-value | Intercept | RSquare | No Pts | Reg s.e | Mean Q |
|---|---|---|---|---|---|---|---|
| 4 | 1.03 | -.062 | 19.10 | .33 | 12 | .85 | -18.84 |
| 5 | 2.47 | -1.644 | 28.52 | .13 | 12 | 1.42 | -17.53 |
| 6 | 1.77 | -3.286 | 22.34 | .68 | 12 | .41 | -16.78 |
| 7 | 1.23 | -1.073 | 18.16 | .72 | 12 | .39 | -16.48 |
| 8 | .91 | .207 | 15.93 | .40 | 12 | .64 | -16.63 |
| 9 | 1.04 | -.147 | 16.93 | .65 | 11 | .44 | -16.60 |
| 10 | 1.19 | -.368 | 18.50 | .30 | 12 | .85 | -16.70 |
| 11 | 1.37 | -.574 | 20.42 | .23 | 11 | .95 | -16.65 |

**Table 3.2.8 (Continued)**

Fleet : FLT08: TRW CPU JUNE

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

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

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

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

Regression statistics :

Ages with q dependent on year class strength

| Age | Slope | t-value | Intercept | RSquare | No Pts | Reg s.e | Mean Log q |
|---|---|---|---|---|---|---|---|
| 3 | .52 | 2.191 | 15.19 | .71 | 12 | .41 | -19.42 |

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

| Age | Slope | t-value | Intercept | RSquare | No Pts | Reg s.e | Mean Q |
|---|---|---|---|---|---|---|---|
| 4 | .93 | .272 | 17.41 | .67 | 12 | .42 | -17.90 |
| 5 | 1.83 | -2.956 | 22.86 | .60 | 12 | .45 | -17.05 |
| 6 | 1.37 | -2.032 | 19.32 | .78 | 12 | .32 | -16.69 |
| 7 | .84 | 1.127 | 15.51 | .85 | 12 | .27 | -16.77 |
| 8 | 1.16 | -.417 | 18.18 | .44 | 12 | .60 | -16.83 |
| 9 | .92 | .177 | 16.13 | .39 | 12 | .72 | -16.81 |
| 10 | .49 | 1.957 | 11.92 | .63 | 12 | .43 | -16.81 |
| 11 | 1.33 | -.221 | 20.50 | .05 | 11 | 1.86 | -16.99 |
| 12 | -1.72 | -1.994 | -13.07 | .08 | 9 | 2.03 | -16.68 |

1

**Table 3.2.8 (Continued)**

Fleet : GN1: GILLNET JAN-DES

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

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

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

Regression statistics :

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

| Age | Slope | t-value | Intercept | RSquare | No Pts | Reg s.e | Mean Q |
|---|---|---|---|---|---|---|---|
| 5 | 13.74 | -1.764 | 114.87 | .00 | 9 | 11.40 | -17.66 |
| 6 | 41.71 | -3.461 | 284.66 | .00 | 9 | 19.95 | -16.21 |
| 7 | 4.25 | -6.945 | 34.26 | .41 | 9 | .83 | -15.04 |
| 8 | 1.64 | -1.925 | 17.69 | .58 | 9 | .48 | -14.16 |
| 9 | 1.46 | -2.378 | 16.69 | .80 | 9 | .31 | -13.90 |
| 10 | 1.12 | -.554 | 14.77 | .75 | 9 | .34 | -13.93 |
| 11 | .75 | .957 | 12.08 | .69 | 9 | .29 | -13.93 |
| 12 | 1.07 | -.344 | 14.64 | .81 | 9 | .25 | -14.09 |

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**Table 3.2.8 (Continued)**

Terminal year survivor and F summaries :

Age 3 Catchability dependent on age and year class strength

Year class = 1993

| Fleet, | Estimated, Survivors, | Int, s.e, | Ext, s.e, | Var, Ratio, | N, | Scaled, Weights, | Estimated F |
|---|---|---|---|---|---|---|---|
| FLT06: TRW CPU JAN.-, | 1., | .000, | .000, | .00, | 0, | .000, | .000 |
| FLT08: TRW CPU JUNE , | 236488., | .989, | .000, | .00, | 1, | .120, | .008 |
| GN1: GILLNET JAN-DES, | 1., | .000, | .000, | .00, | 0, | .000, | .000 |
| P shrinkage mean , | 31310., | .55,,,, | | | | .399, | .060 |
| F shrinkage mean , | 107732., | .50,,,, | | | | .482, | .018 |

Weighted prediction :

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

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

Year class = 1992

| Fleet, | Estimated, Survivors, | Int, s.e, | Ext, s.e, | Var, Ratio, | N, | Scaled, Weights, | Estimated F |
|---|---|---|---|---|---|---|---|
| FLT06: TRW CPU JAN.-, | 76915., | .816, | .000, | .00, | 1, | .128, | .040 |
| FLT08: TRW CPU JUNE , | 72422., | .406, | .370, | .91, | 2, | .513, | .043 |
| GN1: GILLNET JAN-DES, | 1., | .000, | .000, | .00, | 0, | .000, | .000 |
| F shrinkage mean , | 30307., | .50,,,, | | | | .360, | .099 |

Weighted prediction :

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

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

Year class = 1991

| Fleet, | Estimated, Survivors, | Int, s.e, | Ext, s.e, | Var, Ratio, | N, | Scaled, Weights, | Estimated F |
|---|---|---|---|---|---|---|---|
| FLT06: TRW CPU JAN.-, | 16884., | .510, | .293, | .57, | 2, | .160, | .118 |
| FLT08: TRW CPU JUNE , | 17193., | .262, | .176, | .67, | 3, | .603, | .116 |
| GN1: GILLNET JAN-DES, | 53787., | .992, | .000, | .00, | 1, | .043, | .039 |
| F shrinkage mean , | 8059., | .50,,,, | | | | .193, | .234 |

Weighted prediction :

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

**Table 3.2.8 (Continued)**

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

Year class = 1990

| Fleet, | Estimated, Survivors, | Int, s.e, | Ext, s.e, | Var, Ratio, | N, Weights, | Scaled, | Estimated F |
|---|---|---|---|---|---|---|---|
| FLT06: TRW CPU JAN.-, | 7714., | .287, | .227, | .79, | 3, | .278, | .197 |
| FLT08: TRW CPU JUNE , | 8737., | .199, | .068, | .34, | 4, | .546, | .176 |
| GN1: GILLNET JAN-DES, | 17464., | .622, | .136, | .22, | 2, | .059, | .092 |
| F shrinkage mean , | 3679., | .50,,,, | | | | .117, | .376 |

Weighted prediction :

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

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

Year class = 1989

| Fleet, | Estimated, Survivors, | Int, s.e, | Ext, s.e, | Var, Ratio, | N, Weights, | Scaled, | Estimated F |
|---|---|---|---|---|---|---|---|
| FLT06: TRW CPU JAN.-, | 2634., | .222, | .131, | .59, | 4, | .330, | .248 |
| FLT08: TRW CPU JUNE , | 2274., | .176, | .146, | .83, | 5, | .473, | .282 |
| GN1: GILLNET JAN-DES, | 4378., | .423, | .143, | .34, | 3, | .095, | .157 |
| F shrinkage mean , | 1315., | .50,,,, | | | | .101, | .447 |

Weighted prediction :

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

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

Year class = 1988

| Fleet, | Estimated, Survivors, | Int, s.e, | Ext, s.e, | Var, Ratio, | N, Weights, | Scaled, | Estimated F |
|---|---|---|---|---|---|---|---|
| FLT06: TRW CPU JAN.-, | 2894., | .214, | .108, | .50, | 5, | .269, | .304 |
| FLT08: TRW CPU JUNE , | 2399., | .171, | .138, | .81, | 6, | .406, | .357 |
| GN1: GILLNET JAN-DES, | 2779., | .280, | .153, | .55, | 4, | .216, | .315 |
| F shrinkage mean , | 1609., | .50,,,, | | | | .109, | .495 |

Weighted prediction :

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

**Table 3.2.8 (Continued)**

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

Year class = 1987

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

Weighted prediction :

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

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

Year class = 1986

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

Weighted prediction :

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

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

Year class = 1985

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

Weighted prediction :

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

**Table 3.2.8 (Continued)**

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

Year class = 1984

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

Weighted prediction :

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

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

Year class = 1983

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

Weighted prediction :

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

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

Year class = 1982

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

Weighted prediction :

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

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

## TSA-Catch at age, no trend.

STOCK IN NUMBERS:

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

STANDARD DEVIATION OF STOCK ESTIMATES:

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

FISHING MORTALITY RATES:

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

STANDARD DEVIATIONS OF LOG(F):

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

**Table 3.2.9 (continued)**

## TSA-Catch at age, trend estimated.

STOCK IN NUMBERS:

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

STANDARD DEVIATION OF STOCK ESTIMATES:

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

FISHING MORTALITY RATES:

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

STANDARD DEVIATIONS OF LOG(F):

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

**Table 3.2.9 (Continued)**

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

STOCK IN NUMBERS:

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

STANDARD DEVIATION OF STOCK ESTIMATES:

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

FISHING MORTALITY RATES:

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

STANDARD DEVIATIONS OF LOG(F):

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

**Table 3.2.9 (Continued)**

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

STOCK IN NUMBERS:

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

STANDARD DEVIATION OF STOCK ESTIMATES:

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

FISHING MORTALITY RATES:

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

STANDARD DEVIATIONS OF LOG(F):

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

**Table 3.2.10**

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

At 3-May-97 15:47:02

Traditional vpa using screen input for terminal F

Table 8 Fishing mortality (F) at age

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

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

**Table 3.2.11**

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

At 3-May-97 15:47:02

Traditional vpa using screen input for terminal F

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

| Age/year | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 21672 | 49434 | 55231 | 28020 | 19421 | 22014 | 32487 | 47574 | 34539 | 73270 |
| 4 | 25276 | 17690 | 39978 | 44786 | 22693 | 15717 | 17565 | 26501 | 38903 | 27938 |
| 5 | 14078 | 18801 | 13451 | 29338 | 34376 | 17384 | 11883 | 12803 | 21104 | 28232 |
| 6 | 8074 | 8955 | 13199 | 9219 | 19327 | 24986 | 11708 | 8768 | 9761 | 14248 |
| 7 | 5466 | 4991 | 5931 | 7559 | 5217 | 10971 | 16098 | 7378 | 5537 | 6230 |
| 8 | 3930 | 3543 | 2941 | 3450 | 4242 | 2963 | 5140 | 9180 | 4080 | 3155 |
| 9 | 4407 | 2258 | 2038 | 1763 | 1624 | 2204 | 1339 | 2144 | 4285 | 2288 |
| 10 | 3486 | 2239 | 1366 | 1405 | 1095 | 812 | 934 | 648 | 1000 | 2836 |
| 11 | 1501 | 1994 | 1317 | 522 | 915 | 679 | 391 | 539 | 196 | 391 |
| 12 | 612 | 747 | 1205 | 552 | 288 | 694 | 503 | 286 | 182 | 94 |
| 13 | 426 | 352 | 362 | 549 | 351 | 99 | 537 | 401 | 113 | 128 |
| 14 | 44 | 285 | 164 | 162 | 392 | 166 | 38 | 438 | 163 | 29 |
| +gp | 181 | 172 | 0 | 285 | 432 | 358 | 1655 | 368 | 668 | 196 |
| TOTAL | 89154 | 111463 | 137183 | 127610 | 110372 | 99049 | 100277 | 117027 | 120531 | 159037 |

| Age/year | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | GMS -94 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 107441 | 54442 | 30290 | 20450 | 26417 | 13275 | 19088 | 18331 | 37599 | 81909 | 0 | 3E |
| 4 | 57183 | 87102 | 43383 | 24515 | 16614 | 21449 | 10650 | 15035 | 14375 | 29364 | 65144 | 31 |
| 5 | 21611 | 42187 | 66741 | 31630 | 18545 | 12814 | 14923 | 7743 | 9651 | 10099 | 20900 | 2C |
| 6 | 19359 | 13710 | 28580 | 47010 | 20972 | 11933 | 7042 | 9662 | 4748 | 5512 | 6162 | 1E |
| 7 | 9267 | 10993 | 7922 | 16833 | 29395 | 11033 | 5869 | 3745 | 5573 | 2270 | 2852 | 9 |
| 8 | 3708 | 4972 | 6432 | 4873 | 8251 | 14418 | 5553 | 2793 | 1833 | 2444 | 1124 | 5 |
| 9 | 1583 | 1828 | 2481 | 3536 | 2363 | 3871 | 8172 | 2477 | 1176 | 694 | 985 | 2 |
| 10 | 1310 | 705 | 742 | 1271 | 1920 | 1166 | 2013 | 3411 | 902 | 451 | 279 | 1 |
| 11 | 943 | 628 | 374 | 366 | 699 | 823 | 641 | 905 | 1008 | 309 | 182 | |
| 12 | 128 | 329 | 273 | 136 | 164 | 368 | 497 | 325 | 336 | 361 | 125 | |
| 13 | 32 | 53 | 173 | 103 | 62 | 99 | 251 | 239 | 125 | 180 | 145 | |
| 14 | 78 | 3 | 22 | 74 | 17 | 46 | 33 | 133 | 31 | 71 | 73 | |
| +gp | 36 | 3 | 18 | 84 | 146 | 3 | 3 | 83 | 40 | 62 | 54 | |
| TOTAL | 222678 | 216954 | 187431 | 150881 | 125567 | 91297 | 74734 | 64882 | 77397 | 133726 | 98025 | |

**Table 3.2.12**

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

At 3-May-97 15:47:03

Table 16 Summary (without SOP correction)

Traditional vpa using screen input for terminal F

| | RECRUITS Age 3 | TOTALBIO | TOTSPBIO | LANDINGS | YIELD/SSB | FBAR 4- 9 |
|---|---|---|---|---|---|---|
| 1962 | 30999 | 277003 | 142184 | 50514 | 0.3553 | 0.2867 |
| 1963 | 84106 | 336274 | 144613 | 48011 | 0.332 | 0.304 |
| 1964 | 55195 | 380521 | 141947 | 60257 | 0.4245 | 0.25 |
| 1965 | 94062 | 465836 | 165999 | 60177 | 0.3625 | 0.2313 |
| 1966 | 70223 | 550397 | 214136 | 52003 | 0.2429 | 0.1783 |
| 1967 | 68332 | 648019 | 279292 | 75712 | 0.2711 | 0.2375 |
| 1968 | 59672 | 697092 | 345778 | 77549 | 0.2243 | 0.2102 |
| 1969 | 88751 | 762546 | 395280 | 115853 | 0.2931 | 0.2947 |
| 1970 | 66328 | 755885 | 399454 | 116601 | 0.2919 | 0.3225 |
| 1971 | 50638 | 717074 | 381384 | 136764 | 0.3586 | 0.4429 |
| 1972 | 26456 | 603752 | 334676 | 111301 | 0.3326 | 0.3609 |
| 1973 | 26103 | 516600 | 313690 | 110888 | 0.3535 | 0.3446 |
| 1974 | 25125 | 434163 | 288072 | 97568 | 0.3387 | 0.2875 |
| 1975 | 25927 | 387979 | 264698 | 87954 | 0.3323 | 0.2779 |
| 1976 | 31235 | 347146 | 227234 | 82003 | 0.3609 | 0.3256 |
| 1977 | 21672 | 300238 | 186664 | 62026 | 0.3323 | 0.2823 |
| 1978 | 49434 | 307893 | 165549 | 49672 | 0.3 | 0.2374 |
| 1979 | 55231 | 342153 | 159512 | 63504 | 0.3981 | 0.245 |
| 1980 | 28020 | 349624 | 158991 | 58347 | 0.367 | 0.3097 |
| 1981 | 19421 | 332579 | 161706 | 58986 | 0.3648 | 0.3109 |
| 1982 | 22014 | 317833 | 170362 | 68615 | 0.4028 | 0.3877 |
| 1983 | 32487 | 327344 | 185286 | 58266 | 0.3145 | 0.3407 |
| 1984 | 47574 | 355241 | 174159 | 62719 | 0.3601 | 0.3126 |
| 1985 | 34539 | 348952 | 160696 | 57101 | 0.3553 | 0.2527 |
| 1986 | 73270 | 412957 | 169252 | 66376 | 0.3922 | 0.2718 |
| 1987 | 107441 | 495619 | 164665 | 80559 | 0.4892 | 0.3773 |
| 1988 | 54442 | 508362 | 161450 | 77247 | 0.4785 | 0.3562 |
| 1989 | 30290 | 470914 | 170746 | 82425 | 0.4827 | 0.2915 |
| 1990 | 20450 | 444416 | 190373 | 98130 | 0.5155 | 0.3345 |
| 1991 | 26417 | 364799 | 188882 | 102737 | 0.5439 | 0.3864 |
| 1992 | 13275 | 290918 | 171943 | 79597 | 0.4629 | 0.3966 |
| 1993 | 19088 | 242055 | 149815 | 71648 | 0.4782 | 0.4347 |
| 1994 | 18331 | 196803 | 120371 | 64338 | 0.5345 | 0.4787 |
| 1995 | 37599 | 186681 | 89370 | 48650 | 0.5444 | 0.5344 |
| 1996 | 81909 | 240164 | 83580 | 40099 | 0.4798 | 0.469 |
| Arith. Mean | 45602 | 420452 | 206337 | 75263 | 0.3849 | 0.3247 |
| Units | (Thousands) | (Tonnes) | (Tonnes) | (Tonnes) | | |

**Table 3.2.13**



Saithe in the Iceland Grounds (Fishing Area Va)

Prediction with management option table: Input data

| Year: 1997 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Age | Stock size | Natural mortality | Maturity ogive | Prop.of F bef.spaw. | Prop.of M bef.spaw. | Weight in stock | Exploit. pattern | Weight in catch |
| 3 | 25.000 | 0.2000 | 0.1000 | 0.0000 | 0.0000 | 1.341 | 0.0380 | 1.341 |
| 4 | 19.877 | 0.2000 | 0.2200 | 0.0000 | 0.0000 | 1.917 | 0.1700 | 1.917 |
| 5 | 13.897 | 0.2000 | 0.3900 | 0.0000 | 0.0000 | 2.613 | 0.2980 | 2.613 |
| 6 | 6.162 | 0.2000 | 0.6200 | 0.0000 | 0.0000 | 3.709 | 0.4260 | 3.709 |
| 7 | 2.852 | 0.2000 | 0.8000 | 0.0000 | 0.0000 | 4.825 | 0.5200 | 4.825 |
| 8 | 1.124 | 0.2000 | 0.9100 | 0.0000 | 0.0000 | 6.041 | 0.6790 | 6.041 |
| 9 | 0.985 | 0.2000 | 0.9500 | 0.0000 | 0.0000 | 7.268 | 0.7210 | 7.268 |
| 10 | 0.279 | 0.2000 | 1.0000 | 0.0000 | 0.0000 | 6.937 | 0.8220 | 6.934 |
| 11 | 0.182 | 0.2000 | 1.0000 | 0.0000 | 0.0000 | 7.742 | 0.7360 | 7.742 |
| 12 | 0.125 | 0.2000 | 1.0000 | 0.0000 | 0.0000 | 8.702 | 0.5970 | 8.702 |
| 13 | 0.145 | 0.2000 | 1.0000 | 0.0000 | 0.0000 | 9.964 | 0.9270 | 9.964 |
| 14+ | 0.073 | 0.2000 | 1.0000 | 0.0000 | 0.0000 | 11.781 | 0.7710 | 11.781 |
| Unit | Millions | - | - | - | - | Kilograms | - | Kilograms |

| Year: 1998 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Age | Recruit-ment | Natural mortality | Maturity ogive | Prop.of F bef.spaw. | Prop.of M bef.spaw. | Weight in stock | Exploit. pattern | Weight in catch |
| 3 | 25.000 | 0.2000 | 0.1000 | 0.0000 | 0.0000 | 1.341 | 0.0380 | 1.341 |
| 4 | . | 0.2000 | 0.2200 | 0.0000 | 0.0000 | 2.011 | 0.1700 | 2.011 |
| 5 | . | 0.2000 | 0.3900 | 0.0000 | 0.0000 | 2.736 | 0.2980 | 2.736 |
| 6 | . | 0.2000 | 0.6100 | 0.0000 | 0.0000 | 3.629 | 0.4260 | 3.629 |
| 7 | . | 0.2000 | 0.8000 | 0.0000 | 0.0000 | 4.801 | 0.5200 | 4.801 |
| 8 | . | 0.2000 | 0.9000 | 0.0000 | 0.0000 | 5.984 | 0.6790 | 5.984 |
| 9 | . | 0.2000 | 0.9600 | 0.0000 | 0.0000 | 7.648 | 0.7210 | 7.648 |
| 10 | . | 0.2000 | 1.0000 | 0.0000 | 0.0000 | 6.937 | 0.8220 | 6.937 |
| 11 | . | 0.2000 | 1.0000 | 0.0000 | 0.0000 | 7.472 | 0.7360 | 7.742 |
| 12 | . | 0.2000 | 1.0000 | 0.0000 | 0.0000 | 8.702 | 0.5970 | 8.702 |
| 13 | . | 0.2000 | 1.0000 | 0.0000 | 0.0000 | 9.964 | 0.9270 | 9.964 |
| 14+ | . | 0.2000 | 1.0000 | 0.0000 | 0.0000 | 11.781 | 0.7710 | 11.781 |
| Unit | Millions | - | - | - | - | Kilograms | - | Kilograms |

| Year: 1999 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Age | Recruit-ment | Natural mortality | Maturity ogive | Prop.of F bef.spaw. | Prop.of M bef.spaw. | Weight in stock | Exploit. pattern | Weight in catch |
| 3 | 25.000 | 0.2000 | 0.1000 | 0.0000 | 0.0000 | 1.341 | 0.0380 | 1.341 |
| 4 | . | 0.2000 | 0.2200 | 0.0000 | 0.0000 | 2.011 | 0.1700 | 2.011 |
| 5 | . | 0.2000 | 0.3900 | 0.0000 | 0.0000 | 2.804 | 0.2980 | 2.804 |
| 6 | . | 0.2000 | 0.6100 | 0.0000 | 0.0000 | 3.718 | 0.4260 | 3.718 |
| 7 | . | 0.2000 | 0.7800 | 0.0000 | 0.0000 | 4.716 | 0.5200 | 4.716 |
| 8 | . | 0.2000 | 0.9000 | 0.0000 | 0.0000 | 5.967 | 0.6790 | 5.967 |
| 9 | . | 0.2000 | 0.9600 | 0.0000 | 0.0000 | 6.817 | 0.7210 | 6.817 |
| 10 | . | 0.2000 | 1.0000 | 0.0000 | 0.0000 | 6.937 | 0.8220 | 6.937 |
| 11 | . | 0.2000 | 1.0000 | 0.0000 | 0.0000 | 7.742 | 0.7360 | 7.742 |
| 12 | . | 0.2000 | 1.0000 | 0.0000 | 0.0000 | 8.702 | 0.5970 | 8.702 |
| 13 | . | 0.2000 | 1.0000 | 0.0000 | 0.0000 | 9.964 | 0.9270 | 9.964 |
| 14+ | . | 0.2000 | 1.0000 | 0.0000 | 0.0000 | 11.781 | 0.7710 | 11.781 |
| Unit | Millions | - | - | - | - | Kilograms | - | Kilograms |

Notes: Run name : PRED94
Date and time: 03MAY97:14:06

**Table 3.2.14**



Saithe in the Iceland Grounds (Fishing Area Va)

Prediction with management option table

| Year: 1997 | | | | | Year: 1998 | | | | | Year: 1999 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| F Factor | Reference F | Stock biomass | Sp.stock biomass | Catch in weight | F Factor | Reference F | Stock biomass | Sp.stock biomass | Catch in weight | Stock biomass | Sp.stock biomass |
| 1.0000 | 0.4690 | 165244 | 70793 | 37194 | 0.6000 | 0.2814 | 174594 | 74507 | 25509 | 196623 | 89578 |
| . | . | . | . | . | 0.7000 | 0.3283 | . | 74507 | 29181 | 192410 | 86609 |
| . | . | . | . | . | 0.8000 | 0.3752 | . | 74507 | 32708 | 188363 | 83773 |
| . | . | . | . | . | 0.9000 | 0.4221 | . | 74507 | 36098 | 184472 | 81062 |
| . | . | . | . | . | 1.0000 | 0.4690 | . | 74507 | 39358 | 180731 | 78470 |
| . | . | . | . | . | 1.1000 | 0.5159 | . | 74507 | 42493 | 177133 | 75991 |
| . | . | . | . | . | 1.2000 | 0.5628 | . | 74507 | 45509 | 173671 | 73619 |
| . | . | . | . | . | 1.3000 | 0.6097 | . | 74507 | 48413 | 170339 | 71349 |
| . | . | . | . | . | 1.4000 | 0.6566 | . | 74507 | 51209 | 167130 | 69176 |
| - | - | Tonnes | Tonnes | Tonnes | - | - | Tonnes | Tonnes | Tonnes | Tonnes | Tonnes |

Notes: Run name : PRED94
Date and time : 03MAY97:14:06
Computation of ref. F: Simple mean, age 4 - 9
Basis for 1997 : F factors

**Table 3.2.15**



Saithe in the Iceland Grounds (Fishing Area Va)

Yield per recruit: Input data

| Age | Recruit-ment | Natural mortality | Maturity ogive | Prop.of F bef.spaw. | Prop.of M bef.spaw. | Weight in stock | Exploit. pattern | Weight in catch |
|---|---|---|---|---|---|---|---|---|
| 3 | 1.000 | 0.2000 | 0.0929 | 0.0000 | 0.0000 | 1.443 | 0.0600 | 1.443 |
| 4 | . | 0.2000 | 0.1924 | 0.0000 | 0.0000 | 2.030 | 0.2700 | 2.030 |
| 5 | . | 0.2000 | 0.3524 | 0.0000 | 0.0000 | 2.753 | 0.5700 | 2.753 |
| 6 | . | 0.2000 | 0.5582 | 0.0000 | 0.0000 | 3.654 | 0.9300 | 3.654 |
| 7 | . | 0.2000 | 0.7412 | 0.0000 | 0.0000 | 4.692 | 1.1500 | 4.692 |
| 8 | . | 0.2000 | 0.8682 | 0.0000 | 0.0000 | 5.798 | 1.5400 | 5.798 |
| 9 | . | 0.2000 | 0.9400 | 0.0000 | 0.0000 | 6.934 | 1.5400 | 6.934 |
| 10 | . | 0.2000 | 1.0000 | 0.0000 | 0.0000 | 7.826 | 1.5400 | 7.826 |
| 11 | . | 0.2000 | 1.0000 | 0.0000 | 0.0000 | 8.792 | 1.5400 | 8.792 |
| 12 | . | 0.2000 | 1.0000 | 0.0000 | 0.0000 | 9.531 | 1.5400 | 9.531 |
| 13 | . | 0.2000 | 1.0000 | 0.0000 | 0.0000 | 10.738 | 1.5400 | 10.738 |
| 14 | . | 0.2000 | 1.0000 | 0.0000 | 0.0000 | 12.236 | 1.5400 | 12.236 |
| Unit | Numbers | - | - | - | - | Kilograms | - | Kilograms |

Notes: Run name : YIELD3
Date and time: 03MAY97:14:21

**Table 3.2.16**



Saithe in the Iceland Grounds (Fishing Area Va)

Yield per recruit: Summary table

(cont.)

| | | | | | | 1 January | | Spawning time | |
|---|---|---|---|---|---|---|---|---|---|
| F Factor | Reference F | Catch in numbers | Catch in weight | Stock size | Stock biomass | Sp.stock size | Sp.stock biomass | Sp.stock size | Sp.stock biomass |
| 1.3600 | 1.3600 | 0.635 | 1669.875 | 2.388 | 4959.633 | 0.513 | 1339.711 | 0.513 | 1339.711 |
| 1.3800 | 1.3800 | 0.637 | 1668.032 | 2.380 | 4930.640 | 0.509 | 1323.802 | 0.509 | 1323.802 |
| 1.4000 | 1.4000 | 0.638 | 1666.215 | 2.372 | 4902.280 | 0.505 | 1308.330 | 0.505 | 1308.330 |
| 1.4200 | 1.4200 | 0.640 | 1664.425 | 2.364 | 4874.529 | 0.501 | 1293.278 | 0.501 | 1293.278 |
| 1.4400 | 1.4400 | 0.642 | 1662.661 | 2.356 | 4847.365 | 0.497 | 1278.629 | 0.497 | 1278.629 |
| 1.4600 | 1.4600 | 0.643 | 1660.921 | 2.348 | 4820.769 | 0.493 | 1264.367 | 0.493 | 1264.367 |
| 1.4800 | 1.4800 | 0.645 | 1659.207 | 2.340 | 4794.720 | 0.489 | 1250.476 | 0.489 | 1250.476 |
| 1.5000 | 1.5000 | 0.646 | 1657.517 | 2.333 | 4769.200 | 0.486 | 1236.943 | 0.486 | 1236.943 |
| - | - | Numbers | Grams | Numbers | Grams | Numbers | Grams | Numbers | Grams |

Notes: Run name : YIELD3
Date and time : 03MAY97:14:21
Computation of ref. F: Simple mean, age 4 - 9
F-0.1 factor : 0.1844
F-max factor : 0.4314
F-0.1 reference F : 0.1844
F-max reference F : 0.4314
Recruitment : Single recruit

**Figure 3.2.1** Isaithe in Division Va. Proportional catches in different gears 1980-1996

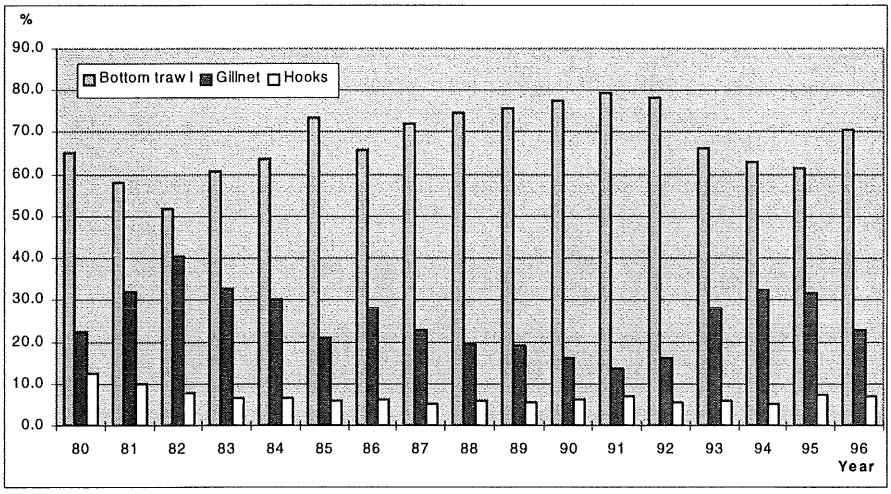



**Figure 3.2.2.** Bottom trawl landings categorised by different size classes of vessels and number of vessels in each size class (only vessels with more than 50 tonnes annual landings).

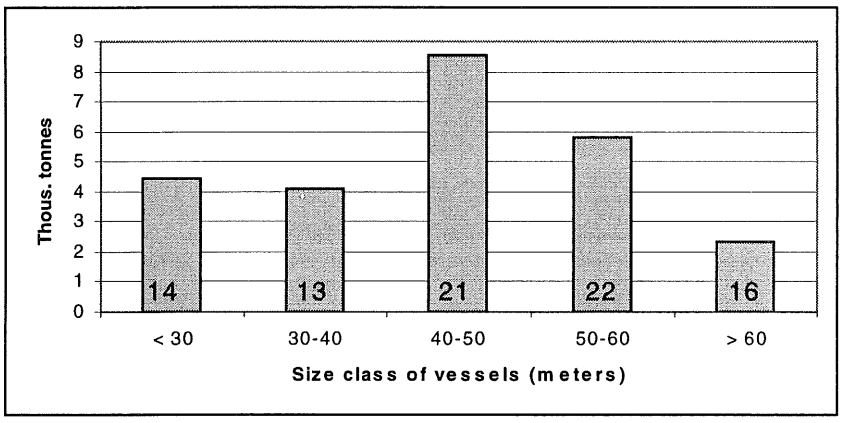



**Figure 3.2.3.** Gillnet landings categorised by different size classes of vessels and number of vessels in each size class (only vessels with more than 10 tonnes annual landings).

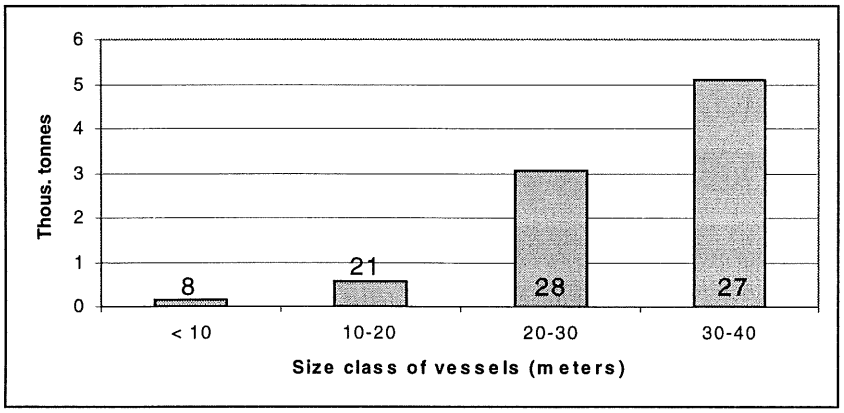


**Figure 3.2.4.** Proportional landings by gear and months in 1996.

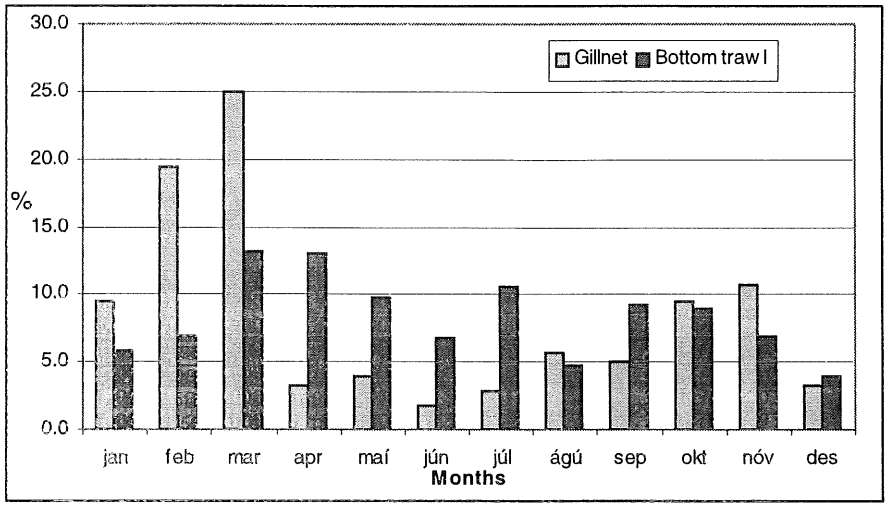



**Figure 3.2.5.** Bottom trawl catches in 1996 (tonnes/square nm).

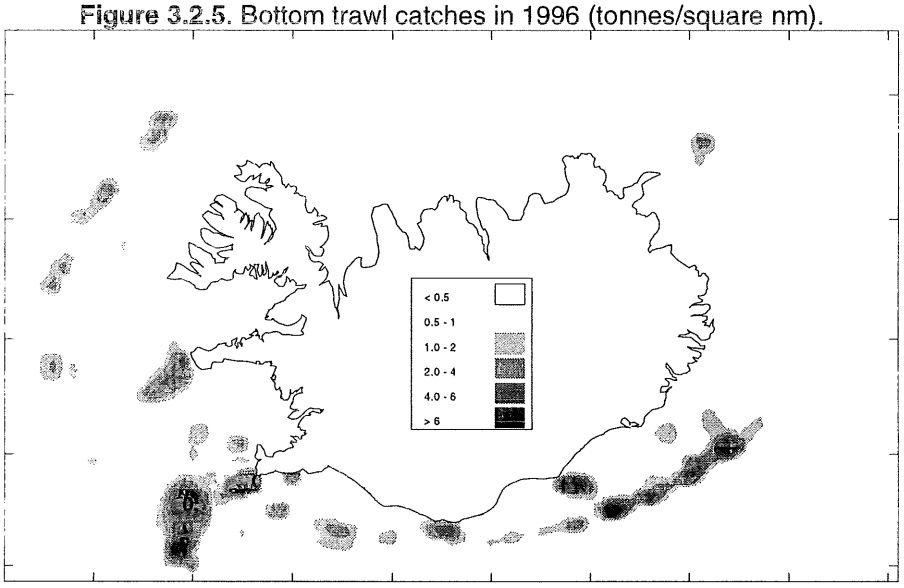



**Figure 3.2.6** Gillnet catches in 1996 (tonnes/square nm).

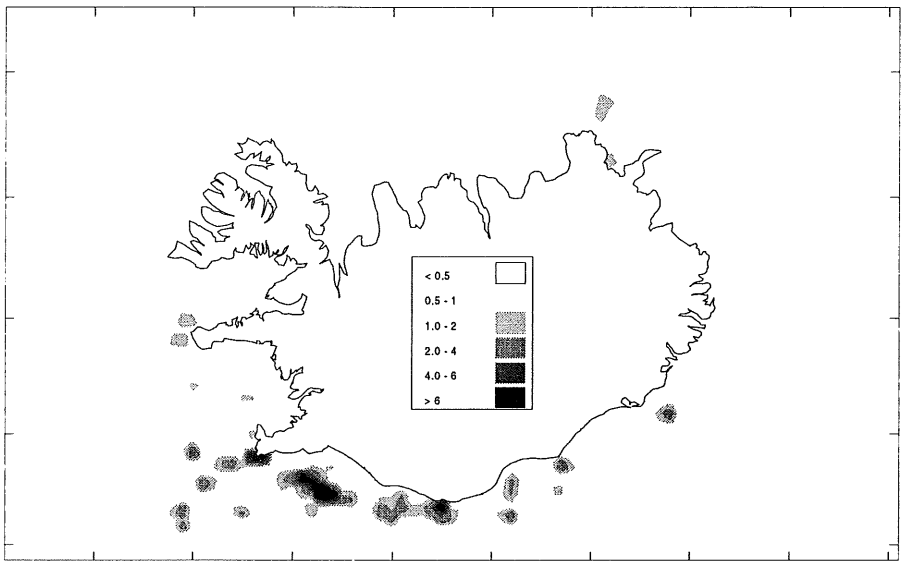


**Figure 3.2.7** Icelandic Saithe. Prognosis in May 1995 and estimate in April 1996 for percent (by number) age distribution in the 1996 landings.

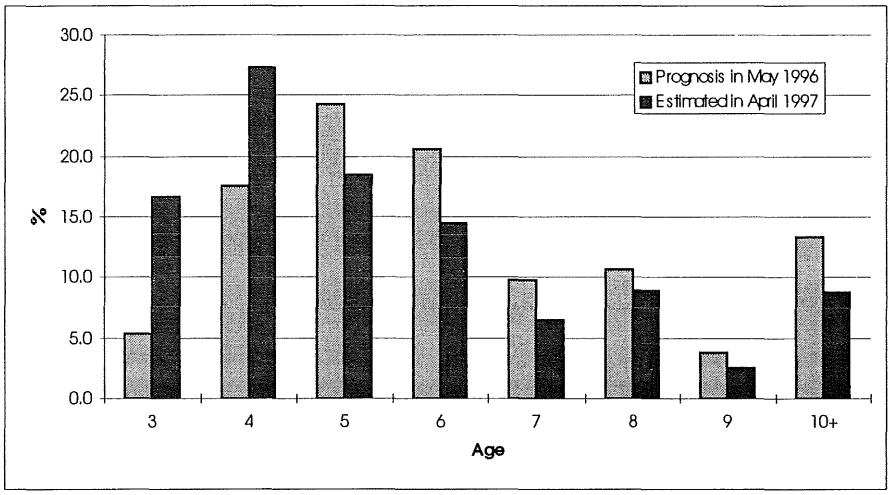
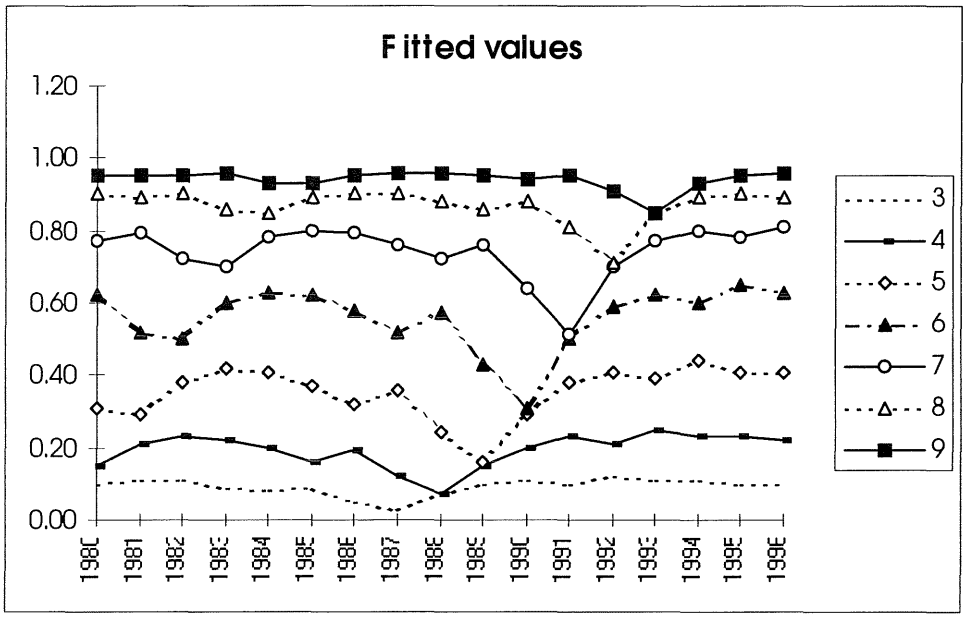



**Figure 3.2.8** Saithe in Division Va. Maturity at age, data and fitted values.



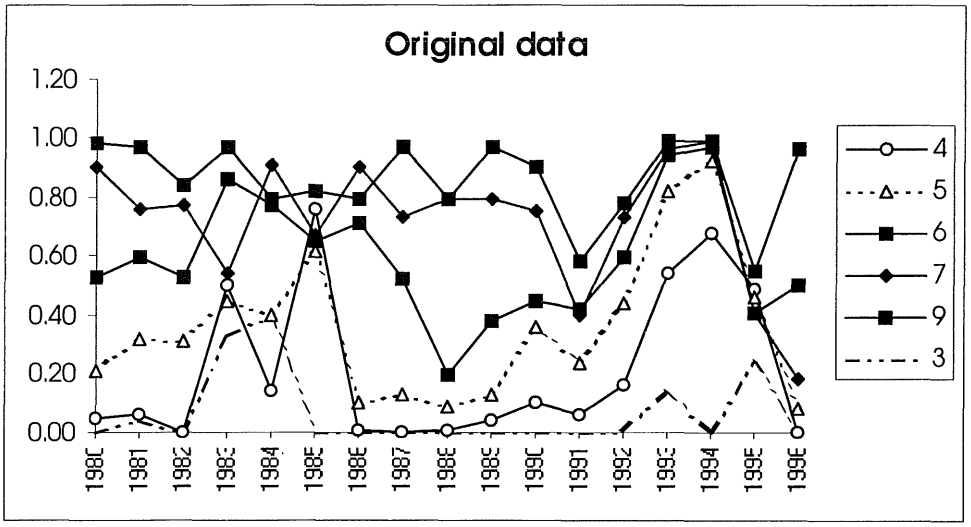
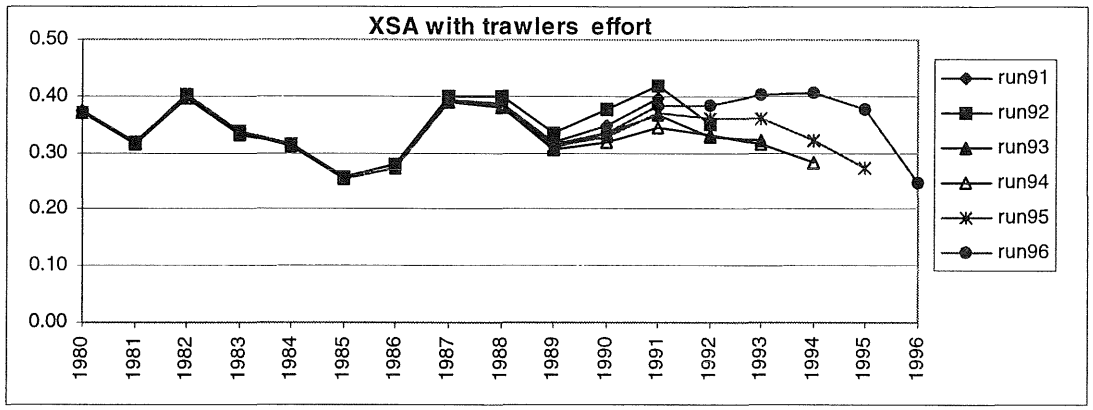
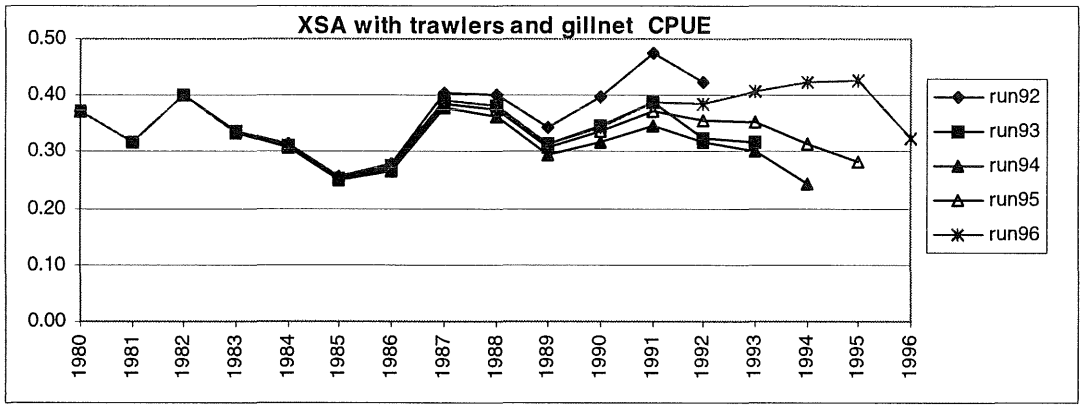
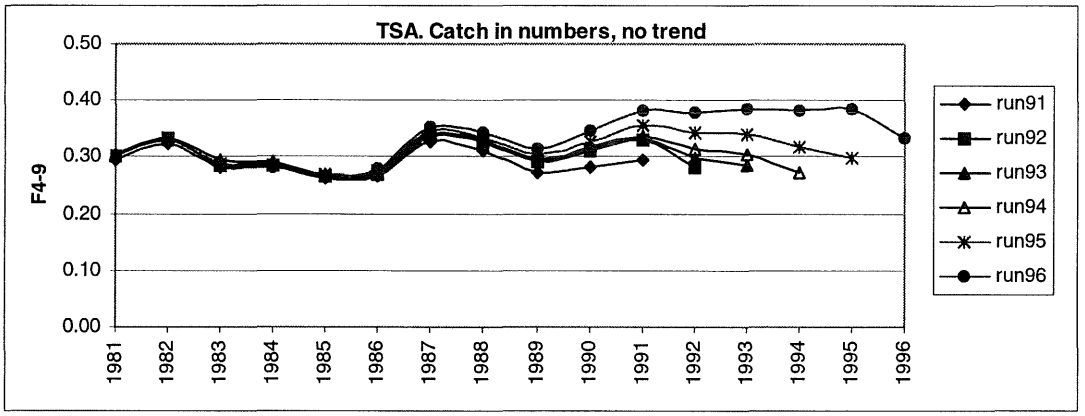



**Figure 3.2.9** Retrospective analysis



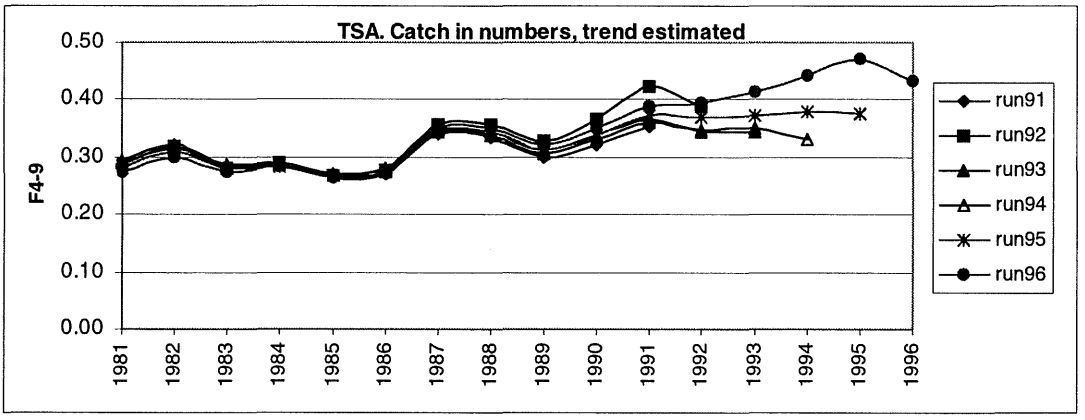
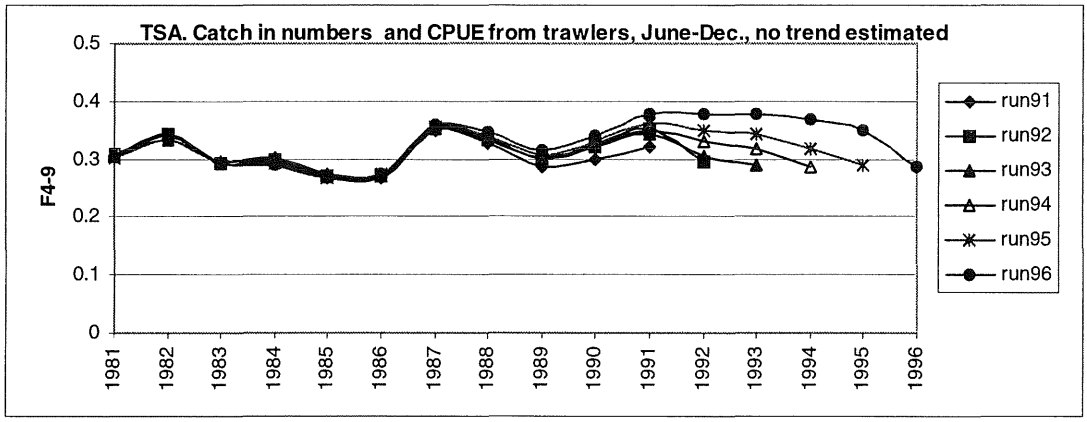



**Figure 3.2.9 (continued)**



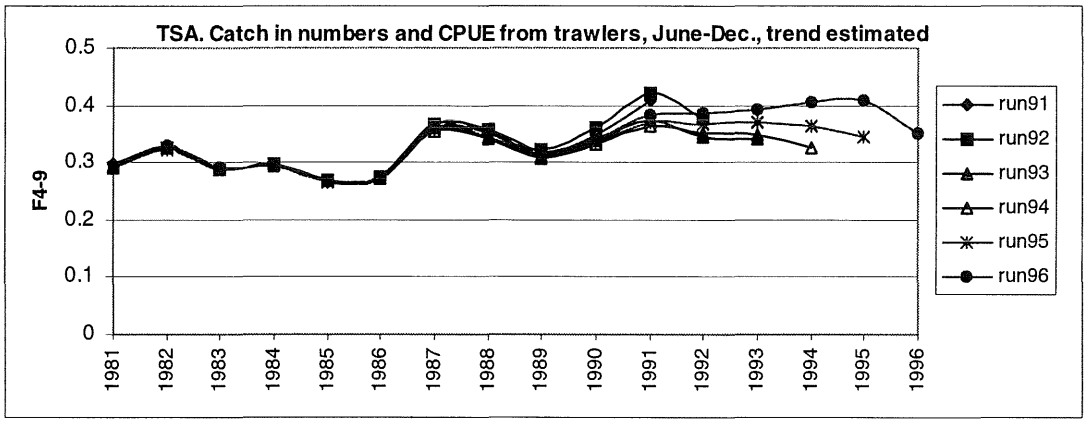
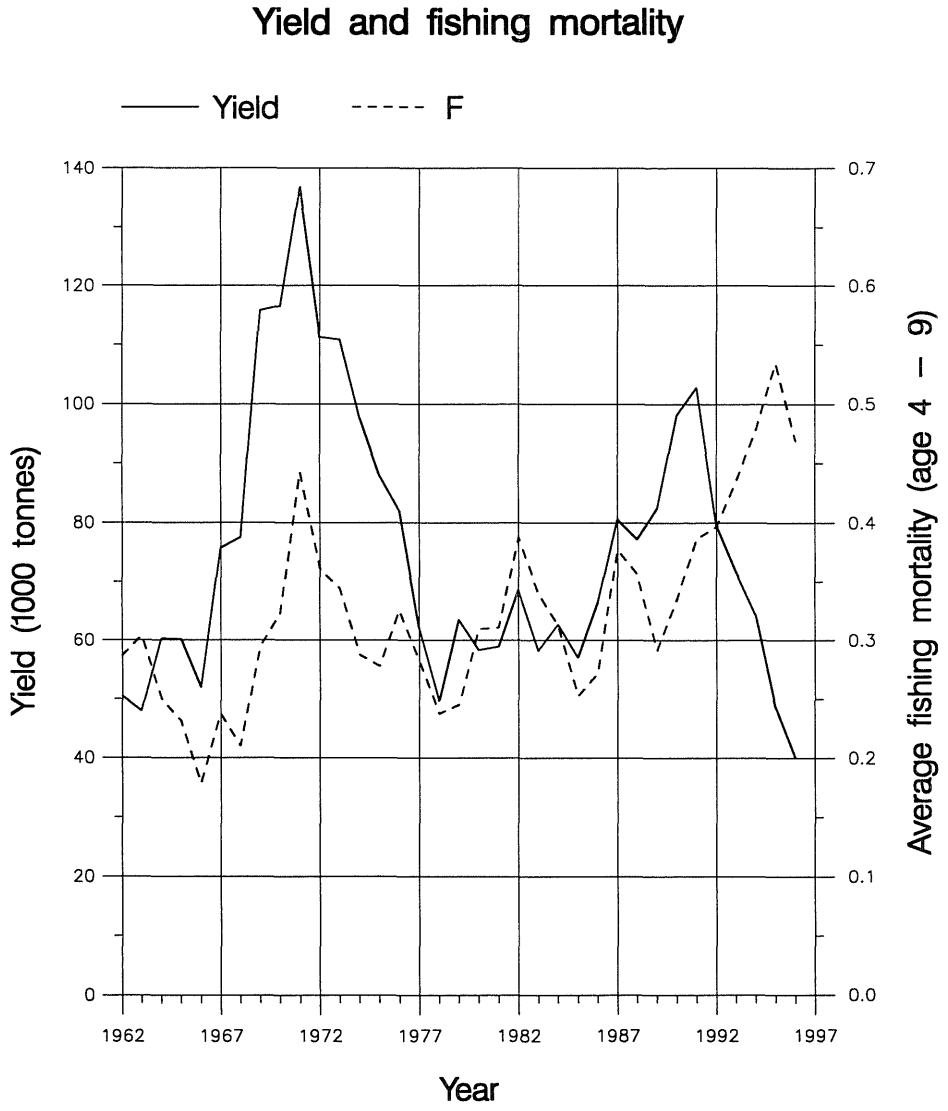



Figure 3.2.10

# Fish Stock Summary
# Saithe in the Iceland Grounds (Fishing Area Va)
# 3 – 5 – 1997



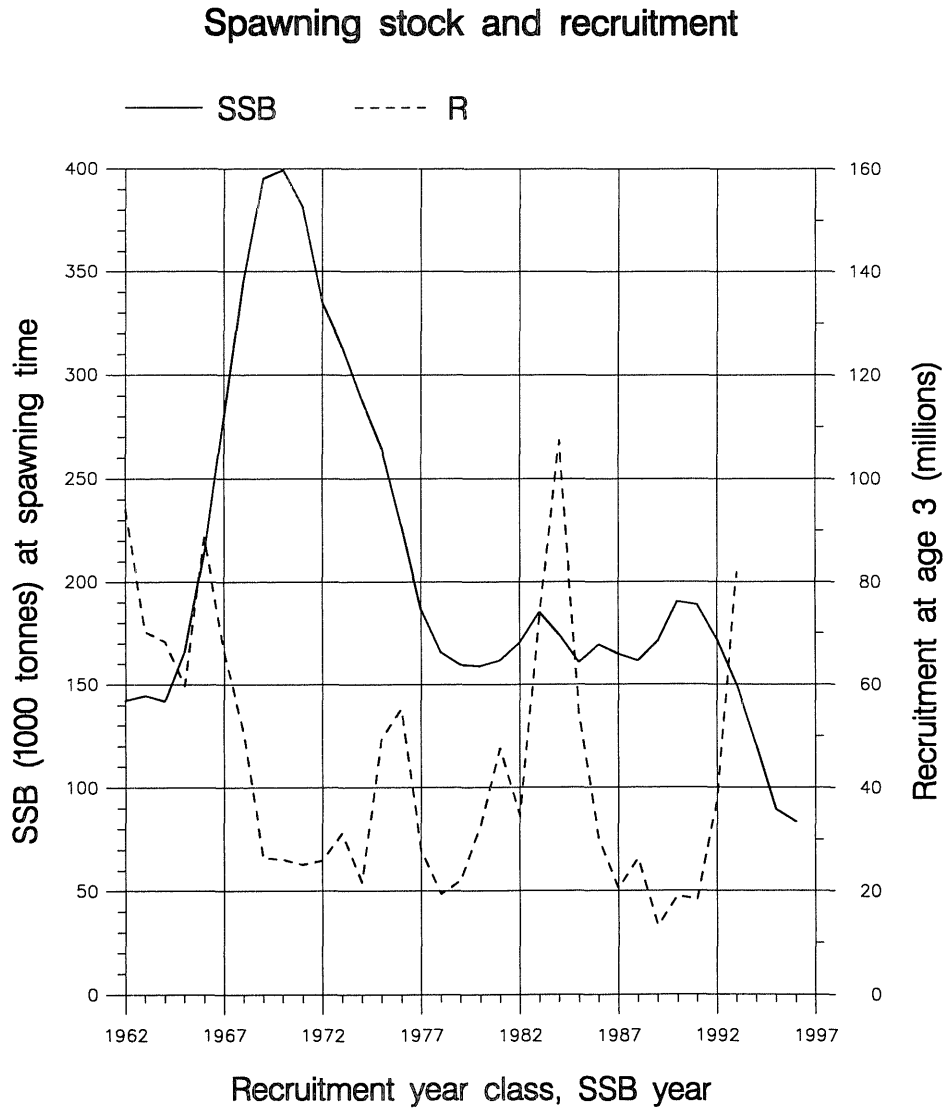
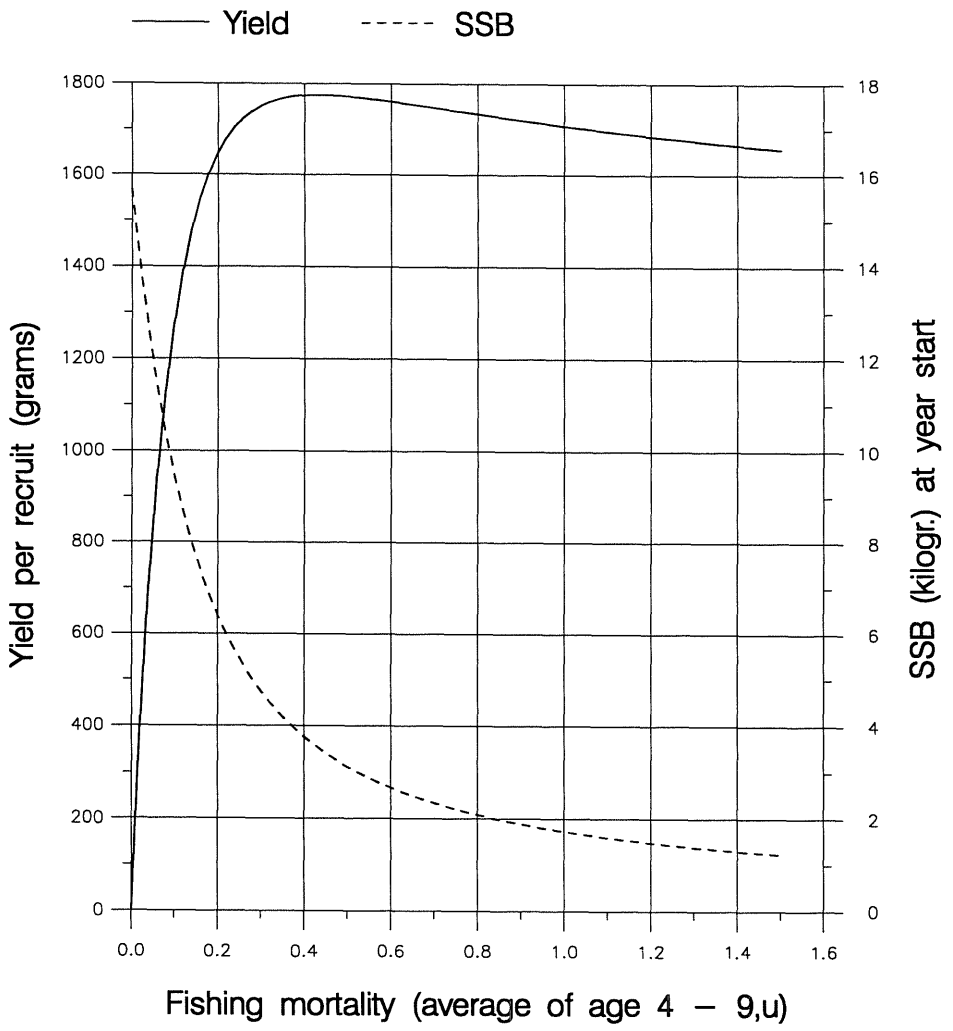



Figure 3.2.11

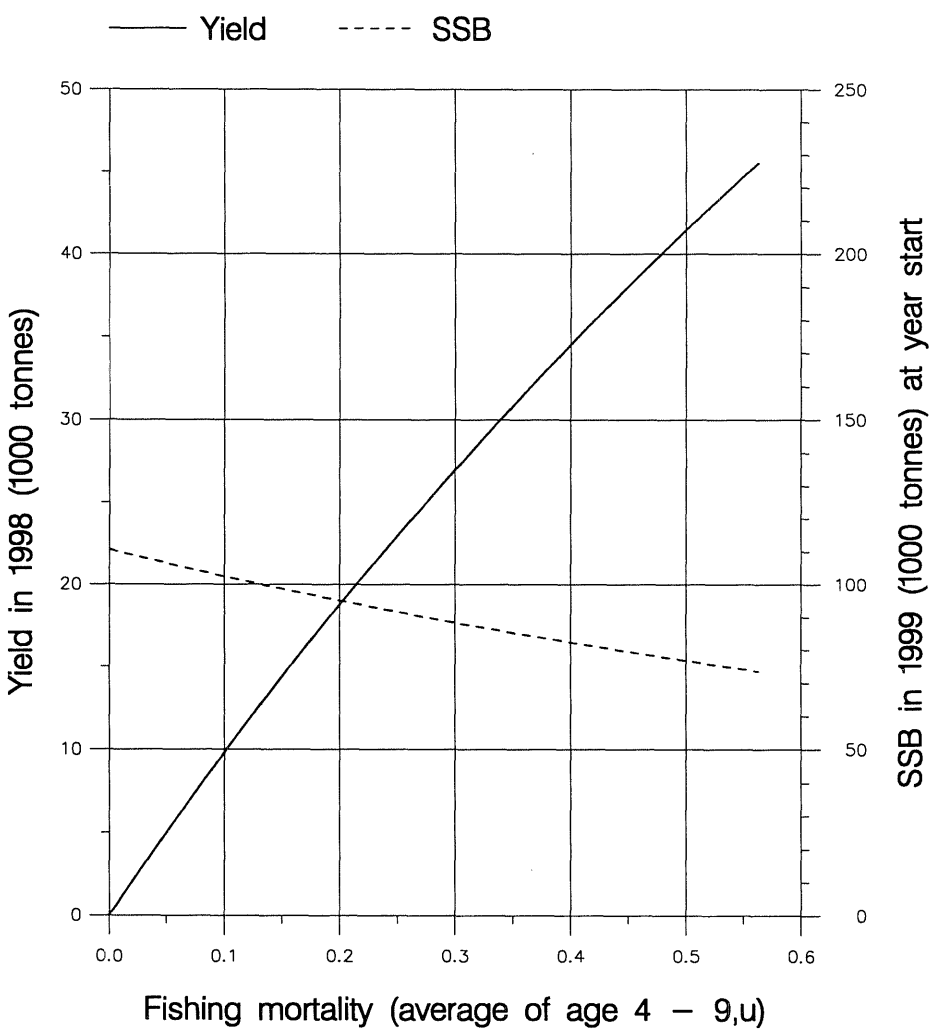
# Fish Stock Summary
# Saithe in the Iceland Grounds (Fishing Area Va)
# 3 – 5 – 1997

## Long term yield and spawning stock biomass



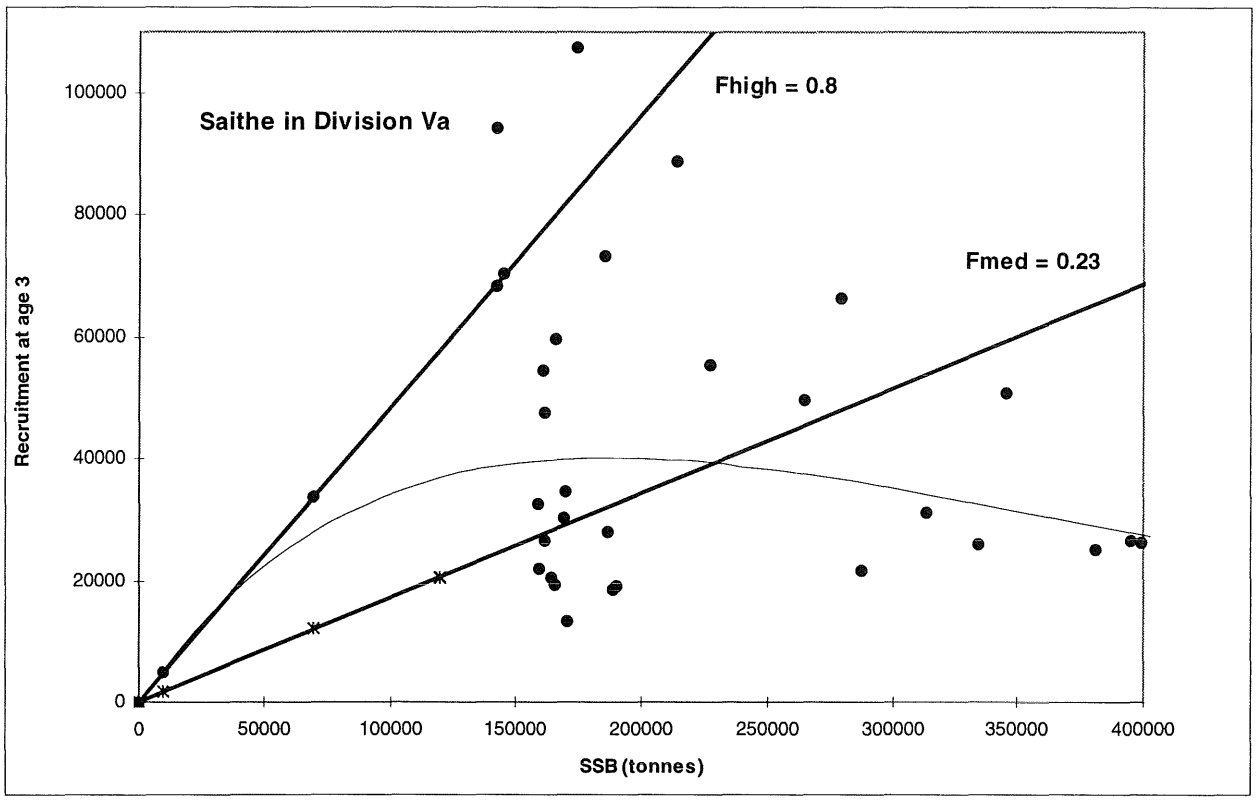

(run: YIELD3) **C**

## Short term yield and spawning stock biomass




(run: PRED94) **D**

**Figure 3.2.12**


Saithe in Division Va
Fhigh = 0.8
Fmed = 0.23
Recruitment at age 3
SSB (tonnes)
0
20000
40000
60000
80000
100000
0
50000
100000
150000
200000
250000
300000
350000
400000