

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

**ICES Headquarters  
28 April - 6 May 1998**

**PART 1 OF 2**

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## 1 INTRODUCTION

### 1.1 Participants

|                       |               |
|-----------------------|---------------|
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| S.A. Schopka          | Iceland       |
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### 1.2 Terms of Reference

The North Western Working Group (Chairman: J. Reinert, Faroe Islands) met at ICES Headquarters from 28 April to 6 May 1998 to:

- a) assess the status of and provide catch options for 1998 for the stocks of oceanic redfish in Sub-areas V, XII and XIV, Greenland halibut in Sub-areas V and XIV, cod in Sub-area XIV, NAFO Sub-area 1 and Divisions Va and Vb, saithe in Divisions Va and Vb and haddock in Division Vb;
- b) for cod, haddock and saithe in Division Vb, where an effort control management system is in effect, estimate the probability profile of fishing mortalities which would be generated under the current effort control scheme and provide effort options which have a high probability (>80 %) that the realised fishing mortalities in 1998 would correspond to the fishing mortality identified as within safe biological limits under items d) and e);
- c) update survey and fishery information on the stocks of redfish in Sub-areas V, VI, XII and XIV;
- d) consider the reference points proposed by the SGPAFM, adopting those reference points or presenting alternatives with reasons for the alternative selection;
- e) consider the harvest control rules proposed by the SGPAFM, taking into account uncertainties in the data, in the assessments and in the biological processes, and assuming a stock-recruitment relationship, to estimate the probability of avoiding limit reference points;
- f) update information on quantities of discards by gear type for the stocks and fisheries considered by this group using the format proposed by the WGECC with a view to establishing a time series;
- g) provide a detailed description of the various fleets (i.e., gears, seasons, main fishing grounds, and main species) and, where possible, provide the landings, selection parameters, annual mortalities and predicted catches by fleet and species;
- h) update information on the stock composition, distribution and migration of the redfish stocks in Sub-areas V and XIV and comment on the possible relationship between pelagic "deep sea" *Sebastes mentella* and the *S. mentella* fished in demersal fisheries on the continental shelf and slope.

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

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

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

- i) provide information on the relationship between pelagic "deep sea" *Sebastes mentella* and the *S. mentella* fished in demersal fisheries on the continental shelf and slope;
- j) provide advice on the medium-term consequences of an adaptive harvesting strategy, based on a constant annual catch within each 5 year period, set at a level required to obtain sustainable yields of "Oceanic" *S. mentella* and "deep sea *S. mentella*;
- k) describe the depth distribution of the pelagic components of *S. mentella* by season, area and year and provide information on the stock identity of the deep sea type and oceanic type *S. mentella*;
- l) advice NEAFC on an appropriate scientific monitoring scheme for the pelagic fishery for *S. mentella* in the Irminger Sea considering the current knowledge of the stock complexity and respond not later than 1 May 1998.

### 1.3 General comments

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

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

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

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

### 1.4 Recommendations

- Studies on stock identification of *S. mentella* and *S. marinus* should be continued. It is important to work further on genetic methods and morphological methods should also be applied. The Working Group recommends that all available genetic results related to the stock structure of *S. mentella* in the Irminger Sea should be dealt with as a Term of reference by the ICES Working Group on the Application of Genetics in Fisheries and Mariculture in 1999. A suggested Term of reference might be: Review all available genetic results to make conclusions about how the *S. mentella* types in the Irminger Sea and adjacent waters should be structured into stocks or populations in order to make an optimal biological management.
- An operational manual for the identification of different *S. mentella* types is urgently required.
- Reproductive biology – both spawning and larval drift—of *S. marinus* in the area between Iceland and the Faroe Islands needs to be studied in order to determine whether these fish might constitute a separate stock element.
- Age readings. In order to assess the redfish stocks successfully, it is important to investigate further the possibility of developing a reliable age reading technique. Iceland has just started to investigate the otoliths of *S. marinus* collected

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

- An Acoustic survey on Irminger Sea should be conducted in June/July 1999. Due to the decreasing catch rates in the fishery on oceanic redfish (ICES C.M. 1997/Assess 13) as well as low biomass estimate in most recent acoustic surveys (ICES C.M. 1996/G:8; WD7) the Study Group on Redfish Stocks (ICES C.M. 1998/G:3) recommended a more frequent monitoring of oceanic redfish abundance in the Irminger sea in the future. The frequency of joint international surveys should be increased and conducted at least every second year. In the light of the recent shift in fishing effort towards deeper water on the Reykjanes Ridge (ICES, C.M. 1997/Assess:13) the Study Group finds the need for further deep-sea hauls (>500) in future surveys. Furthermore, it is important prior to the survey to investigate the possibilities of applying narrow beam transducers, and new development in technology, in order to give an estimate of fish deeper than 500 meters.
- In order to have the catch statistics for the international fishery of *S. mentella* in the Irminger Sea as complete and updated as possible (also by depth) in advance of the North Western Working Group meeting every year, the Working Group recommends ICES to put forward a formal request both to NEAFC and FAO to send their statistics as a routine to ICES since not all countries report directly to ICES. Otherwise the quality of the advice from ICES may be of reduced quality.
- Countries participating should analyse and present effort and CPUE data together with catch statistics and biological data from this international fishery to ICES.
- The Working Group reiterates its recommendation that each country should investigate and conduct scientific work to find the best factors for a particular product and fishery, and that the results are published/documented and made available for the assessment work.
- In order to gain important knowledge on the location of the nursery areas for the Oceanic redfish stock and of the recruitment to the Irminger Sea, a joint international synoptic trawl survey for 0-group and/or juvenile redfish covering the entire distribution area would be necessary.
- A different approach to this would be to follow the extruded larvae from the spawning grounds in the Irminger Sea on their way to the nursery grounds by conducting e.g., monthly surveys covering the larvae/0-group as they drift/swim.

## **2 DEMERSAL STOCKS IN THE FAROE AREA (DIVISIONS VB AND IIA)**

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

Tables 2.1.1 to 2.1.3 show the yields of cod, haddock and saithe for Faroese fleet categories. The fishery at the Faroes may be considered a multi-fleet and multi-species fishery. The catches of cod have been very low in recent years but in 1995–1997 most fleet categories have increased their catches. The cod catches increased by 10 000 t (gutted weight) in 1995 and 20 000 t (gutted weight) in 1996 but dropped again by 4 000 t (gutted weight) in 1997. The haddock catches doubled from 1995 to 1996 and from 1996 to 1997 reaching more than 8 500 t and 15 900 t (gutted weight), respectively. The saithe catches declined to 24 000 t (gutted weight) in 1995 and again to 17 000 t (gutted weight) in 1996 but increased slightly again in 1997 to 19 500 t (gutted weight). In 1995–1997 most fleets increased their effort (Table 2.1.4).

In 1977 an EEZ was introduced in the Faroe area, (Figure 2.1.1). The demersal fishery by foreign nations have since decreased. The fishing mortalities on cod remained at a high level in the first years, increased considerably during the 1980s and decreased then to a very low level in the first half of the 1990s. In 1995 and especially in 1996 the fishing mortalities increased again substantially, declined again in 1997, but is still on a high level. For saithe there has been a substantial increase in the fishing mortalities during most of the period but from 1995 it has decreased to a relatively low level. The increase was mainly due to the introduction of pair trawlers whereas the decrease is because of the reduction in the availability of saithe and the increased availability of cod. The haddock catches decreased to a very low level due to poor recruitment but has in 1995–1997 increased again as the recruitment has increased in recent years.

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

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

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

#### **Revised management system**

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

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

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

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

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

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

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

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

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

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

| Year | Open boats | Longliner: < 100 GR1 | Singletraw Gill net | Jiggers | Singletraw 400-1000H | Pairtrawl <1000 HP | Pairtrawl >1000HP | Longliner: > 100 GR1 | Industrial Others | Total |     |    |       |
|------|------------|----------------------|---------------------|---------|----------------------|--------------------|-------------------|----------------------|-------------------|-------|-----|----|-------|
| 1985 | 903        | 5294                 | 196                 | 18      | 86                   | 780                | 1055              | 2546                 | 832               | 1816  | 15  | 28 | 13570 |
| 1986 | 951        | 5038                 | 250                 | 4       | 62                   | 354                | 664               | 2654                 | 1313              | 1535  | 87  | 56 | 12967 |
| 1987 | 1520       | 5414                 | 313                 | 3       | 47                   | 639                | 274               | 2340                 | 1251              | 1796  | 204 | 29 | 13829 |
| 1988 | 201        | 5219                 | 167                 | 2       | 50                   | 436                | 253               | 1205                 | 914               | 2076  | 161 | 13 | 10697 |
| 1989 | 476        | 7399                 | 122                 | 2       | 173                  | 425                | 213               | 862                  | 749               | 2257  | 180 | 5  | 12866 |
| 1990 | 278        | 6109                 | 63                  | 1       | 132                  | 308                | 192               | 534                  | 800               | 1815  | 68  | 18 | 10316 |
| 1991 | 213        | 4206                 | 86                  | 0       | 41                   | 125                | 126               | 495                  | 799               | 1321  | 52  | 5  | 7469  |
| 1992 | 76         | 1893                 | 57                  | 0       | 13                   | 38                 | 44                | 439                  | 576               | 917   | 41  | 8  | 4103  |
| 1993 | 27         | 783                  | 217                 | 0       | 6                    | 145                | 37                | 424                  | 713               | 821   | 98  | 4  | 3275  |
| 1994 | 34         | 631                  | 247                 | 0       | 4                    | 136                | 121               | 363                  | 1046              | 952   | 93  | 3  | 3629  |
| 1995 | 46         | 1010                 | 296                 | 0       | 15                   | 207                | 91                | 370                  | 695               | 1630  | 11  | 0  | 4371  |
| 1996 | 124        | 2351                 | 487                 | 0       | 60                   | 572                | 163               | 562                  | 1141              | 3068  | 6   | 2  | 8535  |
| 1997 | 231        | 4860                 | 447                 | 0       | 72                   | 966                | 405               | 973                  | 1850              | 6059  | 27  | 0  | 15890 |

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

| Year | Open boats | Longliner: < 100 GR1 | Singletrawl Gill net | Jiggers | Singletrawl 400-1000h | Singletrawl >1000 HP | Pairtrawl <1000 HP | Pairtrawl >1000HP | Longliner: > 100 GR1 trawlers | Industrial Others | Total |     |       |
|------|------------|----------------------|----------------------|---------|-----------------------|----------------------|--------------------|-------------------|-------------------------------|-------------------|-------|-----|-------|
| 1985 | 89         | 38                   | 23                   | 13      | 982                   | 2515                 | 12923              | 10822             | 10805                         | 28                | 60    | 79  | 38377 |
| 1986 | 107        | 67                   | 31                   | 54      | 1296                  | 1004                 | 9872               | 9921              | 13173                         | 21                | 254   | 330 | 36132 |
| 1987 | 244        | 52                   | 116                  | 157     | 1985                  | 1468                 | 7279               | 8134              | 15790                         | 37                | 408   | 1   | 35700 |
| 1988 | 173        | 101                  | 40                   | 113     | 2575                  | 2693                 | 8224               | 7748              | 17266                         | 31                | 501   | 21  | 39586 |
| 1989 | 356        | 52                   | 129                  | 90      | 3717                  | 2148                 | 7118               | 9440              | 16513                         | 60                | 504   | 5   | 40132 |
| 1990 | 309        | 131                  | 84                   | 122     | 4038                  | 2123                 | 10742              | 13127             | 23442                         | 101               | 495   | 8   | 54721 |
| 1991 | 287        | 55                   | 40                   | 281     | 4795                  | 625                  | 6791               | 12978             | 22584                         | 64                | 404   | 7   | 48910 |
| 1992 | 124        | 121                  | 8                    | 0       | 3300                  | 151                  | 2248               | 7677              | 17486                         | 37                | 320   | 1   | 31472 |
| 1993 | 168        | 56                   | 39                   | 0       | 2696                  | 164                  | 1879               | 6234              | 17639                         | 29                | 203   | 3   | 29111 |
| 1994 | 131        | 112                  | 37                   | 2       | 3666                  | 335                  | 1995               | 5408              | 17243                         | 63                | 202   | 0   | 29194 |
| 1995 | 49         | 15                   | 91                   | 5       | 2320                  | 215                  | 2406               | 4288              | 14776                         | 75                | 6     | 0   | 24248 |
| 1996 | 5          | 6                    | 24                   | 5       | 1590                  | 213                  | 1178               | 4118              | 10173                         | 37                | 4     | 0   | 17353 |
| 1997 | 9          | 14                   | 27                   | 3       | 1746                  | 495                  | 2098               | 3491              | 11529                         | 72                | 76    | 1   | 19561 |

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

| Year | Open boats | Longliners < 100 GRT | Singletrawl < 400 HP | Gill net | Jiggers | Singletrawl 400-1000HP | Singletrawl > 1000 HP | Pairtrawl < 1000 HP | Pairtrawl > 1000 HP | Longliners > 100 GRT |
|------|------------|----------------------|----------------------|----------|---------|------------------------|-----------------------|---------------------|---------------------|----------------------|
| 1985 | 372        | 7558                 | 2171                 | 108      | 3348    | 2077                   | 5565                  | 5389                | 3193                | 2973                 |
| 1986 | 453        | 6692                 | 1509                 | 123      | 2745    | 1221                   | 5402                  | 6573                | 4433                | 2176                 |
| 1987 | 556        | 6728                 | 1297                 | 201      | 2973    | 1531                   | 4389                  | 6314                | 5546                | 2915                 |
| 1988 | 2650       | 8753                 | 1261                 | 234      | 8072    | 2204                   | 4964                  | 6026                | 6034                | 3203                 |
| 1989 | 3831       | 12804                | 1445                 | 208      | 10670   | 1993                   | 4939                  | 5175                | 5127                | 3369                 |
| 1990 | 3060       | 14543                | 1159                 | 157      | 9611    | 1853                   | 4020                  | 5444                | 7491                | 3521                 |
| 1991 | 3146       | 14801                | 1141                 | 183      | 10332   | 1038                   | 4005                  | 5828                | 7875                | 3573                 |
| 1992 | 1885       | 10599                | 1150                 | 181      | 10128   | 495                    | 4174                  | 3985                | 7243                | 2892                 |
| 1993 | 1572       | 7497                 | 2045                 | 561      | 8056    | 1008                   | 3577                  | 2851                | 6335                | 2046                 |
| 1994 | 2227       | 7625                 | 2029                 | 1833     | 13410   | 677                    | 3825                  | 2120                | 6227                | 2925                 |
| 1995 | 3289       | 9742                 | 1985                 | 2052     | 18744   | 1342                   | 4317                  | 2594                | 6752                | 3959                 |
| 1996 | 3733       | 12636                | 1475                 | 2407     | 23663   | 1311                   | 3780                  | 3396                | 7285                | 4285                 |
| 1997 | 3278       | 13968                | 1704                 | 2315     | 13379   | 1307                   | 3704                  | 3236                | 7718                | 5851                 |

**Table 2.1.5.**

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

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

## **2.2 Faroe Plateau Cod**

### **2.2.1 Trends in landings**

The nominal landings of cod (1986–1997) from the Faroe Plateau by nations as officially reported to ICES, are given in Table 2.2.1.1. The relatively high recruitment in 1980–83 maintained the good fishery for cod from 1983 to 1986 when the catches have steadily decreased from 1986 to only 6,000 t in 1993, the lowest catch on record (Figure 2.2.6.1.5). In 1995 the officially reported catches increased to slightly above 19,000 t. Landings increased spectacularly in 1996, to above 40,000 t., the highest value during the 1961 to 1996 time period. This increase is believed to be due to a combination of increased stock size, increased availability, and increased effective fishing effort as a result of the new management system introduced June 1, 1996. The catches decreased slightly in 1997 to 34,000 t.

In recent years, statistics for the Faroese fishery in that part of Sub-division IIa (i.e. IIa4) (see Figure 2.2.1 in last year's report) which is within the Faroese EEZ, have become available. It is expected that these catches are taken from the Faroe Plateau area so they are included in the total catches used in the assessment. This is depicted in Table 2.2.1.2 under the row labelled "Total used in the assessment". No information on the Faroese catches in IIa were available for 1993–1996, however. The French catches of Faroe Plateau cod in 1989 and 1990 as reported to the Faroese authorities are also included.

The fishery for Faroe Plateau cod in 1995–1997 has been considerably better than in previous years, and preliminary information for 1998 continues to indicate good fishing success, especially for the longliners. Informal reports from the fishing industry indicate misreported 1995 nominal catches in the order of 3,330 t. (3,000t. gutted weight) which were added to the officially reported catches in Table 2.2.1.2. Misreporting is not suspected to have been a problem in 1996 or 1997.

During the last 15 years, the Faroe Plateau Cod has almost entirely been exploited by the Faroese fishing fleet. Tables 2.2.1.3 and 2.2.1.4 show the landings for the most important fleet categories. In recent years, the long liners and the pair trawlers have taken most of the catches. The long liners, at least those lesser than 100 GRT, have a directed fishery for cod during the entire year and have increased their part of the catch substantially from 1993–97. Up to 1995 the pair trawlers took cod mainly as by-catch in the saithe fishery, but in 1996 they directed more towards for cod. In 1997, however, their part of the catch decreased. The jiggers increased their part of the catch from less than 10 % in 1993 to 25 % in 1995, but have not been successful in 1997 (Table 2.2.1.4).

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

### **2.2.2 Catch-at-age**

Catch in numbers-at-age were updated to account for a change in the nominal catches for 1992, 93, 95, and 1996. Catch at age for 1997 is provided for the Faroese fishery in Table 2.2.2.1. Faroese landings from most of the fleet categories were sampled (Table 2.2.2.2). The catch-in-numbers for the fleets covered by the sampling scheme were calculated from the age composition in each fleet category and raised by their respective catches. The age composition of the combined Faroese catch was used to raise the foreign catches. Catch in numbers at age from 1961 to 1997 is shown in Table 2.2.2.3.

### **2.2.3 Mean weight-at-age**

Mean weights-at-age data for 1961–1997 are provided for the Faroese fishery in Table 2.2.3.1. These were calculated using the length/weight relationship based on individual length/weight measurements of samples from the landings. The values from 1961 to 1976, which were calculated, are replaced by actual values taken from Jákupsstovu and Reinert (1994). The sum-of-products-check for 1997 showed a discrepancy of 1 %.

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

## 2.2.4 Maturity-at-age

The proportion of mature cod by age are given in Table 2.2.4.1 and shown in Figure 2.2.4.1 for 1983 to 1998. The data were obtained during the Faroese groundfish surveys carried out during the spawning period (March). The average maturity at age for 1983 to 1996 were used in years prior to 1983.

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

## 2.2.5 Ground fish surveys

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

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

## 2.2.6 Stock assessment

### 2.2.6.1 Tuning and estimates of fishing mortality

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

The other catch and effort series available are obtained from long liners and trawlers (Table 2.2.6.1.1). The series consist of catch-at-age in numbers and the corresponding effort estimated as number of days at sea. Catches are broken down using the age composition from the sampling of the corresponding fleet categories. No attempt has been made to select those trips where the cod catches exceeded a certain percentage of the total catches. The same series were also available to the North Western Working Group in 1995-97.

In 1995 the North-Western Working Group scrutinised the tuning data series and decided not to use pairtrawlers series nor the single trawlers > 1000 HP in the assessment, to remove age group 2 from all of the commercial series and age group 3 for the single trawlers 400–999 HP. The decision not to use these series was based on trends in the catchabilities. In 1997, examination of the residuals from ADAPT calibrations showed trends similar to those which had led to the rejection of those series and these series were not used.

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

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

The remaining fleets, the longliners > 100 GRT and the single trawlers 400–999 HP, are not expected to have been affected by misreporting of catches to any degree and the tuning data are not adjusted for misreporting in 1995.

A multiplicative analysis of the survey results by ACFM in the autumn of 1995 and again in May 1996 indicated that the 1995 and 1996 survey results should be considered as outliers. In 1996, the NWWG further evaluated the usefulness of the survey series as a consistent index of stock size by doing ADAPT calibrations by 5 year periods and calculating the catchability coefficient of the survey for each period. This showed a marked increase in catchability during the last period, 1991 to 1995 and therefore the survey results were not used in the assessment. In 1997, the analysis was extended to include 1992 to 1996 and the results suggested that the availability to the survey may be returning to more average values, but was still above typical values observed during 1983 to 1993. No attempt to use the survey result in calibrations this year as it is expected that the higher catchabilities/availabilities in 91 to 95 (years of the last catch at age available) would still influence the results.

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

Fishing for cod on Faroe Plateau in 1995-97 and in the first part of 1998 has been very successful and it is possible that the commercial indices of stock size used in the calibrations have also been affected by increased availability. The increase in CPUE for these fleets is less than that for the surveys, possibly because the increased availability would be particularly high during spawning time, when the survey is conducted. In addition, the change in management regime is likely to have increased the efficiency of the fleets by allowing them to fish when the conditions were most favourable. If the commercial indices were also rejected, there would be no basis to conduct a calibrated VPA assessment. The Working Group therefore went ahead with the calibrations using the two commercial indices, bearing in mind that their efficiency has probably increased in 1996 and 1997.

An XSA run (Table 2.2.6.1.2) was made with the same parameters and assumptions as in 1997 with updated data: the catchability of age groups < 3 years being dependent of year class strength, the catchability being independent of age for age groups 6 and older, and survivors estimates shrunk towards the mean  $F$  of the final 5 years or the 5 oldest ages. As last year, runs with shrinkage of 0.5 and 2.0 were compared (Table 2.2.6.1.5 and Figure 2.2.6.1.2). Lighter shrinkage (2.0) gave higher  $F$ 's and lower spawning biomass, and is considered to be more realistic than 0.5, consistent with the observation that the introduction of the new management system is changing the conditions for the fleets. This light shrinkage, however, results in very high fishing mortalities on age-groups 7 to 9 in 1996 and 1997.

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

The residuals of log catchabilities are shown in Figure 2.2.6.1.3. There are clear trends in residuals: those for the longliners have a sinusoidal form, with nearly all the 1996 and 1997 values being positive; the 1997 values for the trawlers are more balanced, but the overall slope of the trend is negative from 1986 to 1995. The XSA run shows that the standard error of the mean log catchability coefficients are relatively high. This is not surprising considering that the number of days fished is used as a measure of fishing effort to calculate CPUE for all fleets. Days fished is not a very precise, and perhaps not very reliable measure of the actual effective fishing effort, especially with changes in management approaches as implemented in the Faroes in 1996.

The Working Group considered that the assessment was a useful reconstruction of the history of the stocks, but it concluded that the results were not sufficiently precise to be used for short term predictions. The Working Group noted that the results suggest that the 1996 and 1997 spawning stock biomasses are about equal to the 1985 spawning stock biomass, consistent with the available CPUE series (Table 2.2.6.1.3).

The results from the retrospective analysis of the XSA (Figure 2.2.6.1.4) show that a light shrinkage does not result in poorer performance of XSA. The retrospective analysis shows that the tendency has been to consistently underestimate

stock size and therefore overestimate fishing mortality. From a conservation point of view, such a retrospective pattern is less worrying than when the tendency is to underestimate  $F$  and overestimate stock size.

The estimated fishing mortalities are shown in Table 2.2.6.1.4 and in Figure 2.2.6.1.6. The average  $F$  for age groups 3 to 7 in 1997 ( $F_{(3-7)}$ ) is estimated at 0.43, above  $F_{\max}=0.34$ .

#### **2.2.6.2 Stock estimates and recruitment**

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

The assessment confirms the poor recruitment observed in the Faroe Plateau cod stock for the 1984 to 1991 year classes, but the 1992 and 1993 year classes are estimated to be well above the long term average. Due to the continuous poor recruitment from 1984 to 1991 and the high fishing mortalities, the spawning stock biomass declined steadily from 1983 to 1992 when it was lowest on record at 21,800 t. It has increased sharply since, with the increase in 1994 being partly due to a very high proportion mature for ages 2 and 3 (Table 2.2.4.1) to 109,000 t in 1996. The spawning stock biomass was on the same level in 1997, but is expected to decrease in the medium term as the strong 1992 and 1993 year classes pass through the fishery, unless new strong year classes show up.

#### **2.2.7 Predictions of catch and biomass**

##### **2.2.7.1 Short-term prediction**

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

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

No medium term projection was carried out.

##### **2.2.7.3 Biological reference points**

The stock-recruitment scatterplot (Figure 2.2.7.3.1) was examined to identify biomass thresholds below which the recruitment appears to decline. Similar to last year's analysis, there are no clear breaking point where the probability of average or above average year-class is decreased. In 1996, the WG observed that no strong year-class have been produced at SSB's lower than 70,000t, but this has changed now with the 1992 and 1993 year class being produced by a spawning stock biomass of about 22,000t and 36,000t, respectively.

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

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

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

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

#### 2.2.7.4 Long-term prediction

The input data for the yield-per-recruit calculations (long-term predictions) are given in Table 2.2.7.4.1. The average values for the period 1961-97 were used as estimates of exploitation pattern and mean weight-at-age and for the maturity ogive the period 1983-97.

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

#### 2.2.8 Management considerations

In 1996, the Working Group estimated that the new management system proposed by the Faroese government could reduce the fishing mortality on cod in 1996 by a maximum of about 23 % if all the factors relating nominal fishing effort to fishing mortality were the same in 1996 as in 1995 except for the number of days fished. The Working Group expected that it was highly unlikely, however, that all factors would remain the same, and it speculated that the decrease in fishing mortality would probably be less than 23 %, or that perhaps fishing mortality would not decrease at all. The current assessment suggests that the fishing mortality doubled from  $F = .27$  in 1995 to  $F = .52$  in 1996, as did the catch.

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

In order to evaluate the fishing mortality that could be generated in the 1998/1999 fishing year from the present number of fishing days allocated to each fishing fleets, the partial fishing mortalities by age (3 to 7) and year were calculated for each fleet from the catch at age ratios for 1985 to 1997. The days are used as shown in Figure 2.2.8.1. The partial  $F$ 's were divided by each fleet's yearly fishing effort to obtain estimates of the catchability coefficient by age, year and fleet. These catchability coefficients thus calculated represent the variability observed in the period covered and it is assumed that the same variability will be observed in the future. Therefore, knowing the number of fishing days allocated, it is possible to estimate the fishing mortality in a given year by multiplying the number of days allocated by the each catchability, adding up the results across fleets and then calculating the frequency distribution of the resulting  $F$ .

The longliners less than 100 feet, the jiggers and the single trawlers less than 400HP have been allocated collectively 8155 fishing days, because they have the flexibility to change from one type of fishing to the other. The longliners are considered twice as efficient as the jiggers (this is supported by the catchability analysis (Table 2.2.8.1)), and if they decide to fish as jiggers rather than longliners, they could double their number of days fished. In principle, the  $ST < 400$  could also double their number of days allocated by changing to fish as jiggers. Figure 2.2.8.2 shows the average partial  $F$  at age by fleets for 1993 to 1997 and shows that the  $F$ s depend on, which fleet is using the days.

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

| Gear       | Trial allocation | Optional change                                                                                                |
|------------|------------------|----------------------------------------------------------------------------------------------------------------|
| LL<100     | 8155             | There are 8155 days to be shared/chosen to be fished either by longlining (<100), jigging or trawling (<400hp) |
| ST<400     | 0                | There are 8155 days to be shared/chosen to be fished either by longlining (<100), jigging or trawling (<400hp) |
| ST400–1000 | 0                | No effort limitation, assumed to catch less than 4 % cod.                                                      |
| ST>1000    | 0                | No effort limitation, assumed to catch less than 4 % cod.                                                      |
| PT400–1000 | 2673             |                                                                                                                |
| PT>1000    | 4524             |                                                                                                                |
| LL>100     | 2660             |                                                                                                                |
| OPEN       | 19250            |                                                                                                                |
| JIGGERS    |                  | There are 8155 days to be shared/chosen to be fished either by longlining (<100), jigging or trawling (<400hp) |

The probability density function of the potential fishing mortalities in 1998 given the allocated number of days to each fleets is given in Figure 2.2.8.3. The fishing mortality referred to so far do not include the partial F exerted by the ST 400–1000 and ST > 1000 that have not been allocated cod fishing days. These two fleets should be expected to exert at least a fishing mortality of 0.04. Therefore, in examining table 2.2.8.1 a fishing mortality of 0.03 should be added to the fishing mortality columns to reflect the activities of these two fleets. It is not presently known by what gear(s) the 8155 days allocated collectively to the LL<100, the ST<400, and the jiggers will be used. The greatest fishing mortality would occur if all the days were fished by the ST<400. If that was the case, there would be an approximately 80 % probability that the 1998 F would be equal to or less than 0.80. If the 12 % reduction is achieved, and the days are fished either by the jiggers (16310 days) or by the LL<100, there is an approximately 80 % probability that the F in 1998 would be equal to or less than 0.64 and 0.69, respectively, that is lower than Flim suggested earlier, but almost double the suggested Fpa. (Table 2.2.8.1). Therefore a substantial reduction in the number of days would be required to achieve Fpa in 1998 or 1999. Current biomass is estimated to be above Bpa.

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

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

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

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

In order to constrain fishing mortality within reasonable limits, it will therefore be necessary to adjust the number of days periodically. For this purpose, there is a need for a mechanism to monitor changes in efficiency, and detailed

information on the activities of the fleets, on the physical characteristics of the boats and their equipment should therefore be collected.

### 2.2.9 Comments on the assessment

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

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

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

The assessment of the Faroe Plateau cod presented in this report indicate that the stock size has increased substantially from its previous very low level. Some of this increase can be attributed to the average 1992 year-class and the above average 1993 year-class, but the current assessment also shows several other year-classes as being more abundant than in the previous assessment. It is therefore possible that a part of the observed increase is a result of increased availability.

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

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

<sup>1)</sup> Preliminary

<sup>1)</sup> Included in Vb2.

<sup>2)</sup> Quantity unknown 1991.

<sup>3)</sup> Reported as Vb.

<sup>A)</sup> Reported to the Faroese Coastal Guard.

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

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

<sup>1)</sup> Preliminary

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

| Year | Open<br>boats | Longliner: Singletrawl<br>< 100 GR1 | Gill<br>< 400 HP | net | Jiggers | Singletrawl<br>400-1000h | Singletrawl<br>> 1000 HP | Pairtrawl<br>< 1000 HP | Pairtrawl<br>> 1000HP | Longliner: Industrial<br>> 100 GR1 | Others | Total |
|------|---------------|-------------------------------------|------------------|-----|---------|--------------------------|--------------------------|------------------------|-----------------------|------------------------------------|--------|-------|
| 1985 | 5650          | 9659                                | 2506             | 291 | 1522    | 3051                     | 4352                     | 5393                   | 2223                  | 3133                               | 54     | 38037 |
| 1986 | 2946          | 4707                                | 1643             | 443 | 919     | 2049                     | 2840                     | 10132                  | 4793                  | 1700                               | 141    | 32704 |
| 1987 | 2151          | 3231                                | 1393             | 283 | 638     | 1546                     | 1791                     | 6361                   | 3273                  | 2586                               | 112    | 23407 |
| 1988 | 591           | 3049                                | 1114             | 568 | 1647    | 1660                     | 1501                     | 6065                   | 3455                  | 3201                               | 137    | 23022 |
| 1989 | 964           | 5986                                | 1102             | 692 | 1913    | 1314                     | 1157                     | 2278                   | 1729                  | 3840                               | 148    | 21135 |
| 1990 | 511           | 4225                                | 507              | 201 | 988     | 517                      | 568                      | 863                    | 1259                  | 2440                               | 79     | 12184 |
| 1991 | 342           | 2474                                | 439              | 160 | 624     | 413                      | 371                      | 663                    | 1038                  | 1394                               | 45     | 7969  |
| 1992 | 142           | 1359                                | 325              | 1   | 376     | 161                      | 192                      | 634                    | 1119                  | 708                                | 258    | 5295  |
| 1993 | 113           | 809                                 | 699              | 0   | 452     | 323                      | 178                      | 717                    | 1141                  | 701                                | 40     | 5194  |
| 1994 | 244           | 1090                                | 914              | 58  | 1507    | 332                      | 448                      | 651                    | 1950                  | 1259                               | 50     | 8508  |
| 1995 | 732           | 3108                                | 1135             | 55  | 4348    | 713                      | 865                      | 1164                   | 2203                  | 3328                               | 8      | 17662 |
| 1996 | 1345          | 6849                                | 1562             | 95  | 7388    | 1317                     | 666                      | 3313                   | 7253                  | 7340                               | 67     | 37225 |
| 1997 | 956           | 8569                                | 1326             | 191 | 3287    | 1659                     | 983                      | 1966                   | 4585                  | 9571                               | 20     | 33135 |

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

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

**Table 2.2.2.1.** Catch in numbers at age for Faroe Plateau cod for each fleet in 1997. Numbers are in thousands and the catch is in tonnes, round weight.

| Fleet Age | Open boats | LL <100 GRT | S.trawl. <400 HP | Jiggers | S.trawl. 400-999 HP | S.trawl. >1000 HP | P.trawl. <1000 HP | P.trawl. >1000 HP | LL >100 GRT | Others | Total Far.fleets | Foreign fleets | Total |
|-----------|------------|-------------|------------------|---------|---------------------|-------------------|-------------------|-------------------|-------------|--------|------------------|----------------|-------|
| 0         | 0          | 0           | 0                | 0       | 0                   | 0                 | 0                 | 0                 | 0           | 0      | 0                | 0              | 0     |
| 1         | 0          | 2           | 0                | 0       | 0                   | 0                 | 0                 | 0                 | 0           | 0      | 0                | 2              | 0     |
| 2         | 16         | 126         | 7                | 19      | 0                   | 0                 | 0                 | 2                 | 21          | 2      | 193              | 6              | 200   |
| 3         | 74         | 553         | 55               | 206     | 18                  | 10                | 15                | 59                | 239         | 8      | 1237             | 40             | 1277  |
| 4         | 261        | 2295        | 341              | 814     | 231                 | 140               | 215               | 512               | 1651        | 37     | 6498             | 210            | 6707  |
| 5         | 126        | 1043        | 140              | 311     | 200                 | 116               | 177               | 429               | 1053        | 19     | 3613             | 117            | 3730  |
| 6         | 13         | 125         | 29               | 56      | 41                  | 23                | 34                | 77                | 236         | 3      | 637              | 21             | 657   |
| 7         | 22         | 231         | 16               | 35      | 16                  | 10                | 15                | 39                | 231         | 2      | 619              | 20             | 639   |
| 8         | 5          | 57          | 4                | 13      | 4                   | 2                 | 3                 | 8                 | 69          | 1      | 165              | 5              | 171   |
| 9         | 1          | 15          | 1                | 1       | 1                   | 0                 | 1                 | 0                 | 29          | 0      | 50               | 2              | 52    |
| 10        | 3          | 31          | 3                | 4       | 1                   | 1                 | 1                 | 5                 | 43          | 0      | 93               | 3              | 96    |
| 11        | 0          | 5           | 0                | 0       | 0                   | 0                 | 0                 | 0                 | 11          | 0      | 17               | 1              | 17    |
| 12        | 0          | 1           | 0                | 0       | 1                   | 0                 | 0                 | 0                 | 2           | 0      | 5                | 0              | 5     |
| 13        | 0          | 0           | 0                | 0       | 0                   | 0                 | 0                 | 0                 | 0           | 0      | 1                | 0              | 1     |
| 14        | 0          | 0           | 0                | 0       | 0                   | 0                 | 0                 | 0                 | 1           | 0      | 1                | 0              | 1     |
| 15        | 0          | 0           | 0                | 0       | 0                   | 0                 | 0                 | 0                 | 0           | 0      | 0                | 0              | 0     |
| Tot.num.  | 522        | 4483        | 598              | 1459    | 512                 | 302               | 461               | 1132              | 3588        | 73     | 13131            | 424            | 13555 |
| Catch, t  | 1048       | 9430        | 1457             | 3228    | 1688                | 981               | 1665              | 3766              | 9893        | 184    | 33280            | 1010           | 34290 |

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

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

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

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

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

At 1-May-98 10:10:19

| Table 1     |  | Catch numbers at age |        |        | Numbers*10**-3 |        |        |        |
|-------------|--|----------------------|--------|--------|----------------|--------|--------|--------|
| YEAR,       |  | 1961,                | 1962,  | 1963,  | 1964,          | 1965,  | 1966,  | 1967,  |
| AGE         |  |                      |        |        |                |        |        |        |
| 2,          |  | 3093,                | 4424,  | 4110,  | 2033,          | 852,   | 1337,  | 1609,  |
| 3,          |  | 2686,                | 2500,  | 3958,  | 3021,          | 3230,  | 970,   | 2690,  |
| 4,          |  | 1331,                | 1255,  | 1280,  | 2300,          | 2564,  | 2080,  | 860,   |
| 5,          |  | 1066,                | 855,   | 662,   | 630,           | 1416,  | 1339,  | 1706,  |
| 6,          |  | 232,                 | 481,   | 284,   | 350,           | 363,   | 606,   | 847,   |
| 7,          |  | 372,                 | 93,    | 204,   | 158,           | 155,   | 197,   | 309,   |
| 8,          |  | 78,                  | 94,    | 48,    | 79,            | 48,    | 104,   | 64,    |
| 9,          |  | 29,                  | 22,    | 30,    | 41,            | 63,    | 33,    | 27,    |
| +gp,        |  | 0,                   | 0,     | 0,     | 0,             | 0,     | 0,     | 0,     |
| 0 TOTALNUM, |  | 8887,                | 9724,  | 10576, | 8612,          | 8691,  | 6666,  | 8112,  |
| TONSLAND,   |  | 21598,               | 20967, | 22215, | 21078,         | 24212, | 20418, | 23562, |
| SOPCOF %,   |  | 91,                  | 94,    | 96,    | 98,            | 113,   | 109,   | 102,   |

| Table 1 |           | Catch numbers at age |        |        | Numbers*10**-3 |        |        |        |        |        |        |
|---------|-----------|----------------------|--------|--------|----------------|--------|--------|--------|--------|--------|--------|
| YEAR,   |           | 1968,                | 1969,  | 1970,  | 1971,          | 1972,  | 1973,  | 1974,  | 1975,  | 1976,  | 1977,  |
| AGE     |           |                      |        |        |                |        |        |        |        |        |        |
| 2,      |           | 1529,                | 878,   | 402,   | 328,           | 875,   | 723,   | 2161,  | 2584,  | 1497,  | 425,   |
| 3,      |           | 3322,                | 3106,  | 1163,  | 757,           | 1176,  | 3124,  | 1266,  | 5689,  | 4158,  | 3282,  |
| 4,      |           | 2663,                | 3300,  | 2172,  | 821,           | 810,   | 1590,  | 1811,  | 2157,  | 3799,  | 6844,  |
| 5,      |           | 945,                 | 1538,  | 1685,  | 1287,          | 596,   | 707,   | 934,   | 2211,  | 1380,  | 3718,  |
| 6,      |           | 1226,                | 477,   | 752,   | 1451,          | 1021,  | 384,   | 563,   | 813,   | 1427,  | 788,   |
| 7,      |           | 452,                 | 713,   | 244,   | 510,           | 596,   | 312,   | 452,   | 295,   | 617,   | 1160,  |
| 8,      |           | 105,                 | 203,   | 300,   | 114,           | 154,   | 227,   | 149,   | 190,   | 273,   | 239,   |
| 9,      |           | 11,                  | 92,    | 44,    | 179,           | 25,    | 120,   | 141,   | 118,   | 120,   | 134,   |
| +gp,    |           | 0,                   | 0,     | 0,     | 0,             | 0,     | 97,    | 91,    | 150,   | 186,   | 9,     |
| 0       | TOTALNUM, | 10253,               | 10307, | 6762,  | 5447,          | 5253,  | 7284,  | 7568,  | 14207, | 13457, | 16599, |
|         | TONSLAND, | 29930,               | 32371, | 24183, | 23010,         | 18727, | 22228, | 24581, | 36775, | 39799, | 34927, |
|         | SOPCOF %, | 106,                 | 109,   | 99,    | 123,           | 125,   | 101,   | 101,   | 97,    | 97,    | 70,    |

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

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| Table 1     |  | Catch numbers at age |        |        | Numbers*10**-3 |        |        |        |        |        |        |
|-------------|--|----------------------|--------|--------|----------------|--------|--------|--------|--------|--------|--------|
| YEAR,       |  | 1978,                | 1979,  | 1980,  | 1981,          | 1982,  | 1983,  | 1984,  | 1985,  | 1986,  | 1987,  |
| AGE         |  |                      |        |        |                |        |        |        |        |        |        |
| 2,          |  | 555,                 | 575,   | 1129,  | 646,           | 1139,  | 2149,  | 4396,  | 998,   | 210,   | 257,   |
| 3,          |  | 1219,                | 1732,  | 2263,  | 4137,          | 1965,  | 5771,  | 5234,  | 9484,  | 3586,  | 1362,  |
| 4,          |  | 2643,                | 1673,  | 1461,  | 1981,          | 3073,  | 2760,  | 3487,  | 3795,  | 8462,  | 2611,  |
| 5,          |  | 3216,                | 1601,  | 895,   | 947,           | 1286,  | 2746,  | 1461,  | 1669,  | 2373,  | 3083,  |
| 6,          |  | 1041,                | 1906,  | 807,   | 582,           | 471,   | 1204,  | 912,   | 770,   | 907,   | 812,   |
| 7,          |  | 268,                 | 493,   | 832,   | 487,           | 314,   | 510,   | 314,   | 872,   | 236,   | 224,   |
| 8,          |  | 201,                 | 134,   | 339,   | 527,           | 169,   | 157,   | 82,    | 309,   | 147,   | 68,    |
| 9,          |  | 66,                  | 87,    | 42,    | 123,           | 254,   | 104,   | 34,    | 65,    | 47,    | 69,    |
| +gp,        |  | 56,                  | 38,    | 18,    | 55,            | 122,   | 102,   | 66,    | 80,    | 38,    | 26,    |
| 0 TOTALNUM, |  | 9265,                | 8239,  | 7786,  | 9485,          | 8793,  | 15503, | 15986, | 18042, | 16006, | 8512,  |
| TONSLAND,   |  | 26585,               | 23112, | 20513, | 22963,         | 21489, | 38133, | 36979, | 39484, | 34595, | 21391, |
| SOPCOF %    |  | 100,                 | 98,    | 106,   | 104,           | 100,   | 97,    | 97,    | 95,    | 96,    | 96,    |

| Table 1 |           | Catch numbers at age |        | Numbers*10**~3 |       |       |       |       |        |        |        |
|---------|-----------|----------------------|--------|----------------|-------|-------|-------|-------|--------|--------|--------|
| YEAR,   |           | 1988,                | 1989,  | 1990,          | 1991, | 1992, | 1993, | 1994, | 1995,  | 1996,  | 1997,  |
| AGE     |           |                      |        |                |       |       |       |       |        |        |        |
| 2,      |           | 509,                 | 2237,  | 243,           | 190,  | 209,  | 118,  | 559,  | 2552,  | 348,   | 200,   |
| 3,      |           | 2122,                | 2151,  | 2849,          | 446,  | 465,  | 786,  | 768,  | 2651,  | 5124,  | 1277,  |
| 4,      |           | 1945,                | 2187,  | 1481,          | 2130, | 476,  | 591,  | 1035, | 1960,  | 4572,  | 6707,  |
| 5,      |           | 1484,                | 1121,  | 852,           | 616,  | 931,  | 218,  | 519,  | 988,   | 1530,  | 3730,  |
| 6,      |           | 2178,                | 1026,  | 404,           | 300,  | 300,  | 323,  | 122,  | 454,   | 1514,  | 657,   |
| 7,      |           | 492,                 | 997,   | 294,           | 141,  | 135,  | 94,   | 172,  | 115,   | 591,   | 639,   |
| 8,      |           | 168,                 | 220,   | 291,           | 92,   | 55,   | 32,   | 38,   | 171,   | 146,   | 171,   |
| 9,      |           | 33,                  | 61,    | 50,            | 52,   | 30,   | 22,   | 22,   | 43,    | 344,   | 52,    |
| +gp,    |           | 25,                  | 9,     | 26,            | 24,   | 35,   | 25,   | 16,   | 48,    | 47,    | 120,   |
| 0       | TOTALNUM, | 8956,                | 10009, | 6490,          | 3991, | 2636, | 2209, | 3251, | 8982,  | 14216, | 13553, |
|         | TONSLAND, | 23182,               | 22068, | 13487,         | 8660, | 6535, | 5988, | 8818, | 22494, | 40106, | 34290, |
|         | SOPCOF %, | 101,                 | 98,    | 99,            | 106,  | 102,  | 102,  | 101,  | 101,   | 99,    | 101,   |

Table 2.2.3.1. Catch weight at age 1961-97.

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

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

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

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

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

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

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

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

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| Table 5 | Proportion mature at age |         |         |         |         |         |         |
|---------|--------------------------|---------|---------|---------|---------|---------|---------|
| YEAR,   | 1961,                    | 1962,   | 1963,   | 1964,   | 1965,   | 1966,   | 1967,   |
| AGE     |                          |         |         |         |         |         |         |
| 2,      | .1700,                   | .1700,  | .1700,  | .1700,  | .1700,  | .1700,  | .1700,  |
| 3,      | .6400,                   | .6400,  | .6400,  | .6400,  | .6400,  | .6400,  | .6400,  |
| 4,      | .8700,                   | .8700,  | .8700,  | .8700,  | .8700,  | .8700,  | .8700,  |
| 5,      | .9500,                   | .9500,  | .9500,  | .9500,  | .9500,  | .9500,  | .9500,  |
| 6,      | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 7,      | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 8,      | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 9,      | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| +gp,    | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |

| Table 5 | Proportion mature at age |         |         |         |         |         |         |         |         |         |
|---------|--------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| YEAR,   | 1968,                    | 1969,   | 1970,   | 1971,   | 1972,   | 1973,   | 1974,   | 1975,   | 1976,   | 1977,   |
| AGE     |                          |         |         |         |         |         |         |         |         |         |
| 2,      | .1700,                   | .1700,  | .1700,  | .1700,  | .1700,  | .1700,  | .1700,  | .1700,  | .1700,  | .1700,  |
| 3,      | .6400,                   | .6400,  | .6400,  | .6400,  | .6400,  | .6400,  | .6400,  | .6400,  | .6400,  | .6400,  |
| 4,      | .8700,                   | .8700,  | .8700,  | .8700,  | .8700,  | .8700,  | .8700,  | .8700,  | .8700,  | .8700,  |
| 5,      | .9500,                   | .9500,  | .9500,  | .9500,  | .9500,  | .9500,  | .9500,  | .9500,  | .9500,  | .9500,  |
| 6,      | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 7,      | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 8,      | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 9,      | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| +gp,    | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |

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

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| Table 5 | Proportion mature at age |         |         |         |         |         |         |         |         |         |
|---------|--------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| YEAR,   | 1978,                    | 1979,   | 1980,   | 1981,   | 1982,   | 1983,   | 1984,   | 1985,   | 1986,   | 1987,   |
| AGE     |                          |         |         |         |         |         |         |         |         |         |
| 2,      | .1700,                   | .1700,  | .1700,  | .1700,  | .1700,  | .6300,  | .4000,  | .0000,  | .0000,  | .0000,  |
| 3,      | .6400,                   | .6400,  | .6400,  | .6400,  | .6400,  | .7100,  | .9600,  | .5000,  | .3800,  | .6700,  |
| 4,      | .8700,                   | .8700,  | .8700,  | .8700,  | .8700,  | .9300,  | .9800,  | .9600,  | .9300,  | .9100,  |
| 5,      | .9500,                   | .9500,  | .9500,  | .9500,  | .9500,  | .9400,  | .9700,  | .9600,  | 1.0000, | 1.0000, |
| 6,      | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 7,      | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | .9600,  | 1.0000, |
| 8,      | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | .9400,  | 1.0000, |
| 9,      | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| +gp,    | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |

| Table 5 | Proportion mature at age |         |         |         |         |         |         |         |         |         |
|---------|--------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| YEAR,   | 1988,                    | 1989,   | 1990,   | 1991,   | 1992,   | 1993,   | 1994,   | 1995,   | 1996,   | 1997,   |
| AGE     |                          |         |         |         |         |         |         |         |         |         |
| 2,      | .0600,                   | .0500,  | .0000,  | .0000,  | .0600,  | .2500,  | .7200,  | .2100,  | .0400,  | .0000,  |
| 3,      | .7200,                   | .5400,  | .6800,  | .7200,  | .5000,  | .7300,  | .8900,  | .5300,  | .4400,  | .7400,  |
| 4,      | .9000,                   | .9800,  | .9000,  | .8600,  | .8200,  | .7800,  | .9800,  | .5500,  | .7500,  | .9300,  |
| 5,      | .9700,                   | 1.0000, | .9900,  | 1.0000, | .9800,  | .9100,  | .9900,  | .7400,  | .8700,  | .9900,  |
| 6,      | 1.0000,                  | 1.0000, | .9600,  | 1.0000, | 1.0000, | .9900,  | 1.0000, | .9700,  | .9400,  | 1.0000, |
| 7,      | 1.0000,                  | 1.0000, | .9800,  | 1.0000, | 1.0000, | 1.0000, | .9800,  | 1.0000, | 1.0000, | 1.0000, |
| 8,      | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 9,      | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| +gp,    | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |

**Table 2.2.6.1.1**

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

**a)**

FAROE PLATEAU COD (ICES SUBDIVISION VB1)

108

R/V Magnus Heinason (Groundfish surveys) shifted back by 3 months

1982 1997

1 1 .9 1.0

2 8

|     |       |       |       |       |      |      |      |
|-----|-------|-------|-------|-------|------|------|------|
| 100 | 25.92 | 17.84 | 14.41 | 5.28  | 1.46 | 0.51 | 0.08 |
| 100 | 21.84 | 16.19 | 5.08  | 3.29  | 1.31 | 0.13 | 0.01 |
| 100 | 42.96 | 15.46 | 6.21  | 1.31  | 1.57 | 0.60 | 0.01 |
| 100 | 26.69 | 94.23 | 26.49 | 11.13 | 5.45 | 3.52 | 1.07 |
| 100 | 15.39 | 34.48 | 45.95 | 7.22  | 0.91 | 1.15 | 0.10 |
| 100 | 12.65 | 16.62 | 12.84 | 14.27 | 2.75 | 0.72 | 0.18 |
| 100 | 6.02  | 10.06 | 8.24  | 4.05  | 6.61 | 0.66 | 0.09 |
| 100 | 6.38  | 15.22 | 13.78 | 4.36  | 5.45 | 3.70 | 0.62 |
| 100 | 3.52  | 12.22 | 3.15  | 1.50  | 0.51 | 0.12 | 0.23 |
| 100 | 2.10  | 4.72  | 18.10 | 3.94  | 1.26 | 0.65 | 0.13 |
| 100 | 4.48  | 2.32  | 1.63  | 3.29  | 1.18 | 0.44 | 0.12 |
| 100 | 3.74  | 13.74 | 7.83  | 2.11  | 3.05 | 0.32 | 0.01 |
| 100 | 9.77  | 20.89 | 29.13 | 27.54 | 7.55 | 9.04 | 1.27 |
| 100 | 52.93 | 68.85 | 37.41 | 28.04 | 8.14 | 1.54 | 3.16 |
| 100 | 13.98 | 84.47 | 35.21 | 4.76  | 3.23 | 0.80 | 0.22 |
| 100 | 9.99  | 34.38 | 96.62 | 19.70 | 1.31 | 0.63 | 0.56 |

**b)**

LONGLINERS &lt; 100 GRT

1985 1997

1 1 0 1

2 9

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

c)

TRAWLERS < 400 HP

1985 1997

1 1 0 1

2 9

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

d)

SINGLE TRAWLERS 400-1000 HP

1985 1997

1 1 0 1

2 9

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

e)

SINGLE TRAWLERS > 1000 HP

1985 1997

1 1 0 1

2 9

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

**f)**

PAIR TRAWLERS 400-1000 HP

1985 1997

1 1 0 1

2 9

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

**g)**

PAIR TRAWLERS > 1000 HP

1985 1997

1 1 0 1

2 9

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

**h)**

LONGLINERS > 100 GRT

1985 1997

1 1 0 1

2 9

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

# Table 2.2.6.1.2. XSA run for Faroe Plateau cod.

Lowestoft VPA Version 3.1

1-May-98 10:08:58

Extended Survivors Analysis

Cod FaroePlateau Vb1 (run: XSAPE02/X02)

CPUE data from file /users/fish/ifad/ifapwork/nwwg/cod\_farp/FLEET.X02

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

Fleet, First, Last, First, Last, Alpha, Beta  
, year, year, age, age

FLT17: SINGLE TRAWLE, 1985, 1997, 4, 9, .000, 1.000  
FLT18: LONGLINERS >, 1985, 1997, 3, 9, .000, 1.000

Time series weights:

Tapered time weighting applied  
Power = 3 over 20 years

Catchability analysis:

Catchability dependent on stock size for ages < 3

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

Catchability independent of age for ages >= 6

Terminal population estimation:

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

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

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

Prior weighting not applied

Tuning converged after 25 iterations

1

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

Fishing mortalities

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

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

1

XSA population numbers (Thousands)

AGE

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

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

Estimated population abundance at 1st Jan 1998

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

Taper weighted geometric mean of the VPA populations:

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

Standard error of the weighted Log(VPA populations):

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

1

Log catchability residuals.

Fleet : FLT17: SINGLE TRAWLE

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

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

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

| Age          | 4,        | 5,        | 6,        | 7,        | 8,        | 9         |
|--------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Mean Log q,  | -11.2292, | -11.0241, | -10.9422, | -10.9422, | -10.9422, | -10.9422, |
| S.E.(Log q), | .5802,    | .4212,    | .4279,    | .4371,    | .5926,    | .1344,    |

Regression statistics :

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

| Age | Slope | t-value | Intercept | RSquare | No Pts | Reg s.e. | Mean Q  |
|-----|-------|---------|-----------|---------|--------|----------|---------|
| 4,  | 1.06, | -.244,  | 11.38,    | .62,    | 13,    | .65,     | -11.23, |
| 5,  | .85,  | .925,   | 10.60,    | .81,    | 13,    | .36,     | -11.02, |
| 6,  | 1.00, | -.020,  | 10.96,    | .67,    | 13,    | .45,     | -10.94, |
| 7,  | 1.01, | -.023,  | 10.97,    | .65,    | 13,    | .46,     | -10.94, |
| 8,  | .97,  | .086,   | 11.09,    | .54,    | 13,    | .52,     | -11.24, |
| 9,  | .91,  | 1.424,  | 10.47,    | .97,    | 13,    | .10,     | -11.01, |

1

Fleet : FLT18: LONGLINERS >

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

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

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

| Age          | 3,        | 4,        | 5,        | 6,        | 7,        | 8,        | 9         |
|--------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Mean Log q,  | -12.0158, | -11.2522, | -10.9256, | -10.5342, | -10.5342, | -10.5342, | -10.5342, |
| S.E.(Log q), | .5847,    | .4740,    | .4370,    | .4692,    | .5971,    | .6710,    | .9325,    |

Regression statistics :

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

| Age | Slope | t-value | Intercept | RSquare | No Pts | Reg s.e. | Mean Q  |
|-----|-------|---------|-----------|---------|--------|----------|---------|
| 3,  | 1.05, | -.200,  | 12.16,    | .60,    | 13,    | .65,     | -12.02, |
| 4,  | 1.14, | -.647,  | 11.59,    | .69,    | 13,    | .56,     | -11.25, |
| 5,  | 1.14, | -.619,  | 11.32,    | .68,    | 13,    | .52,     | -10.93, |
| 6,  | .79,  | 1.091,  | 9.87,     | .76,    | 13,    | .37,     | -10.53, |
| 7,  | .76,  | 1.163,  | 9.38,     | .73,    | 13,    | .39,     | -10.25, |
| 8,  | .82,  | .766,   | 9.30,     | .67,    | 13,    | .39,     | -10.07, |
| 9,  | .75,  | .666,   | 8.76,     | .45,    | 13,    | .59,     | -10.02, |

1

Fleet disaggregated estimates of survivors:

Age 2 Catchability dependent on age and year class strength

Year class = 1995

FLT17: SINGLE TRAWLE

Age, 2,  
Survivors, 0.,  
Raw Weights,.000,

FLT18: LONGLINERS >

Age, 2,  
Survivors, 0.,  
Raw Weights,.000,

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

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

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

Weighted prediction:

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

1

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

Year class = 1994

FLT17: SINGLE TRAWLE

Age, 3, 2,  
Survivors, 0., 0.,  
Raw Weights,.000,.000,

FLT18: LONGLINERS >

Age, 3, 2,  
Survivors, 6178., 0.,  
Raw Weights, 2.275,.000,

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

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

Weighted prediction:

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

1

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

Year class = 1993

FLT17: SINGLE TRAWLE

Age, 4, 3, 2,  
Survivors, 12471., 0., 0.,  
Raw Weights, 1.961,.000,.000,

FLT18: LONGLINERS >

Age, 4, 3, 2,  
Survivors, 18208., 14844., 0.,  
Raw Weights, 2.937, 1.642,.000,

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

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

Weighted prediction:

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

1

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

Year class = 1992

FLT17: SINGLE TRAWLE

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

FLT18: LONGLINERS >

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

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

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

Weighted prediction:

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

1

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

Year class = 1991

FLT17: SINGLE TRAWLE

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

FLT18: LONGLINERS >

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

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

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

Weighted prediction:

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

1

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

Year class = 1990

FLT17: SINGLE TRAWLE

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

FLT18: LONGLINERS >

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

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

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

Weighted prediction:

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

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

Year class = 1989

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

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

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

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

Weighted prediction:

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

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

Year class = 1988

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

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

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

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

Weighted prediction:

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

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

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

**Table 2.2.6.1.4. Results from XSA run.**

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

At 3-May-98 15:28:23

Terminal Fs derived using XSA (With F shrinkage)

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

| Table 8      | Fishing mortality (F) at age |        |        |        |        |        |        |        |        |         |
|--------------|------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
| YEAR,        | 1968,                        | 1969,  | 1970,  | 1971,  | 1972,  | 1973,  | 1974,  | 1975,  | 1976,  | 1977,   |
| AGE          |                              |        |        |        |        |        |        |        |        |         |
| 2,           | .1010,                       | .1099, | .0530, | .0309, | .0464, | .0657, | .0816, | .0774, | .0933, | .0481,  |
| 3,           | .2318,                       | .3063, | .2081, | .1337, | .1476, | .2322, | .1568, | .3193, | .1723, | .3036,  |
| 4,           | .3949,                       | .3806, | .3654, | .2225, | .2070, | .3048, | .2046, | .4359, | .3665, | .4747,  |
| 5,           | .5339,                       | .4180, | .3409, | .3845, | .2497, | .2813, | .2953, | .4134, | .5569, | .7532,  |
| 6,           | .4472,                       | .5709, | .3709, | .5572, | .6058, | .2526, | .3797, | .4544, | .5167, | .7334,  |
| 7,           | .7132,                       | .5118, | .6559, | .4651, | .4686, | .3722, | .5330, | .3504, | .7619, | 1.1137, |
| 8,           | .3331,                       | .8457, | .4208, | .7528, | .2464, | .3259, | .3052, | .4485, | .6429, | .7776,  |
| 9,           | .4882,                       | .5499, | .4339, | .4800, | .3578, | .3091, | .3457, | .4235, | .5738, | .7782,  |
| +gp,         | .4882,                       | .5499, | .4339, | .4800, | .3578, | .3091, | .3457, | .4235, | .5738, | .7782,  |
| 0 FBAR 3- 7, | .4642,                       | .4375, | .3882, | .3526, | .3358, | .2886, | .3139, | .3947, | .4748, | .6757,  |

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

At 3-May-98 15:28:23

Terminal Fs derived using XSA (With F shrinkage)

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

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

**Table 2.2.6.1.5. Terminal Fs from XSA.**

Run title : Cod FaroePlateau Vb1 (run: XSA PET02/X02)

At 1-May-98 10:10:19

Terminal Fs derived using XSA (With F shrinkage)

| Table 10 | Stock number at age (start of year) |        |        |        |        | Numbers*10** <sup>-3</sup> |        |
|----------|-------------------------------------|--------|--------|--------|--------|----------------------------|--------|
| YEAR,    | 1961,                               | 1962,  | 1963,  | 1964,  | 1965,  | 1966,                      | 1967,  |
| AGE      |                                     |        |        |        |        |                            |        |
| 2,       | 12019,                              | 20654, | 20290, | 21834, | 8269,  | 18566,                     | 23451, |
| 3,       | 7385,                               | 7042,  | 12907, | 12893, | 16037, | 5999,                      | 13990, |
| 4,       | 3747,                               | 3616,  | 3503,  | 6986,  | 7823,  | 10207,                     | 4034,  |
| 5,       | 2699,                               | 1863,  | 1825,  | 1710,  | 3639,  | 4085,                      | 6475,  |
| 6,       | 666,                                | 1245,  | 752,   | 895,   | 830,   | 1698,                      | 2133,  |
| 7,       | 668,                                | 335,   | 584,   | 358,   | 416,   | 351,                       | 842,   |
| 8,       | 155,                                | 210,   | 190,   | 294,   | 151,   | 200,                       | 109,   |
| 9,       | 66,                                 | 56,    | 87,    | 112,   | 169,   | 80,                        | 70,    |
| +gp,     | 0,                                  | 0,     | 0,     | 0,     | 0,     | 0,                         | 0,     |
| 0 TOTAL, | 27403,                              | 35021, | 40138, | 45083, | 37332, | 41186,                     | 51104, |

| Table 10 | Stock number at age (start of year) |        |        |        |        | Numbers*10** <sup>-3</sup> |        |        |        |        |
|----------|-------------------------------------|--------|--------|--------|--------|----------------------------|--------|--------|--------|--------|
| YEAR,    | 1968,                               | 1969,  | 1970,  | 1971,  | 1972,  | 1973,                      | 1974,  | 1975,  | 1976,  | 1977,  |
| AGE      |                                     |        |        |        |        |                            |        |        |        |        |
| 2,       | 17582,                              | 9325,  | 8609,  | 11928, | 21320, | 12573,                     | 30481, | 38323, | 18575, | 9998,  |
| 3,       | 17744,                              | 13012, | 6840,  | 6684,  | 9469,  | 16664,                     | 9639,  | 23001, | 29038, | 13854, |
| 4,       | 9020,                               | 11522, | 7843,  | 4548,  | 4788,  | 6689,                      | 10817, | 6746,  | 13684, | 20012, |
| 5,       | 2525,                               | 4976,  | 6447,  | 4456,  | 2981,  | 3187,                      | 4037,  | 7217,  | 3572,  | 7766,  |
| 6,       | 3757,                               | 1212,  | 2682,  | 3754,  | 2483,  | 1901,                      | 1970,  | 2460,  | 3908,  | 1676,  |
| 7,       | 980,                                | 1967,  | 561,   | 1516,  | 1760,  | 1109,                      | 1209,  | 1103,  | 1279,  | 1909,  |
| 8,       | 410,                                | 393,   | 965,   | 238,   | 779,   | 902,                       | 626,   | 581,   | 636,   | 489,   |
| 9,       | 31,                                 | 240,   | 138,   | 519,   | 92,    | 499,                       | 533,   | 378,   | 304,   | 274,   |
| +gp,     | 0,                                  | 0,     | 0,     | 0,     | 0,     | 400,                       | 342,   | 476,   | 466,   | 18,    |
| 0 TOTAL, | 52050,                              | 42647, | 34085, | 33643, | 43673, | 43924,                     | 59654, | 80286, | 71462, | 55994, |

Run title : Cod FaroePlateau Vb1 (run: XSA PET02/X02)

At 1-May-98 10:10:19

Terminal Fs derived using XSA (With F shrinkage)

| Table 10 | Stock number at age (start of year) |        |        |        |        | Numbers*10** <sup>-3</sup> |        |        |        |        |
|----------|-------------------------------------|--------|--------|--------|--------|----------------------------|--------|--------|--------|--------|
| YEAR,    | 1978,                               | 1979,  | 1980,  | 1981,  | 1982,  | 1983,                      | 1984,  | 1985,  | 1986,  | 1987,  |
| AGE      |                                     |        |        |        |        |                            |        |        |        |        |
| 2,       | 10709,                              | 15137, | 23579, | 14071, | 22379, | 25217,                     | 48163, | 17572, | 9504,  | 10167, |
| 3,       | 7801,                               | 8266,  | 11873, | 18283, | 10936, | 17292,                     | 18701, | 35455, | 13484, | 7591,  |
| 4,       | 8373,                               | 5284,  | 5200,  | 7673,  | 11226, | 7176,                      | 8936,  | 10575, | 20446, | 7795,  |
| 5,       | 10192,                              | 4464,  | 2812,  | 2936,  | 4490,  | 6410,                      | 3378,  | 4161,  | 5225,  | 9083,  |
| 6,       | 2994,                               | 5434,  | 2206,  | 1493,  | 1547,  | 2512,                      | 2764,  | 1443,  | 1896,  | 2130,  |
| 7,       | 659,                                | 1509,  | 2725,  | 1076,  | 695,   | 840,                       | 967,   | 1438,  | 485,   | 732,   |
| 8,       | 513,                                | 297,   | 790,   | 1478,  | 440,   | 285,                       | 226,   | 508,   | 388,   | 184,   |
| 9,       | 184,                                | 238,   | 122,   | 340,   | 733,   | 207,                       | 91,    | 111,   | 136,   | 185,   |
| +gp,     | 154,                                | 103,   | 52,    | 150,   | 349,   | 200,                       | 176,   | 134,   | 109,   | 69,    |
| 0 TOTAL, | 41579,                              | 40732, | 49358, | 47500, | 52795, | 60140,                     | 83402, | 71397, | 51673, | 37935, |

| Table 10 | Stock number at age (start of year) |        |        |        |        | Numbers*10** <sup>-3</sup> |        |        |        |        | GMST 61-95 | AMST 61-95 |
|----------|-------------------------------------|--------|--------|--------|--------|----------------------------|--------|--------|--------|--------|------------|------------|
| YEAR,    | 1988,                               | 1989,  | 1990,  | 1991,  | 1992,  | 1993,                      | 1994,  | 1995,  | 1996,  | 1997,  | 1998,      |            |
| AGE      |                                     |        |        |        |        |                            |        |        |        |        |            |            |
| 2,       | 8661,                               | 15394, | 3630,  | 6869,  | 11938, | 12834,                     | 34348, | 49220, | 11760, | 12809, | 0,         | 15764,     |
| 3,       | 8091,                               | 6631,  | 10579, | 2752,  | 5452,  | 9585,                      | 10401, | 27616, | 37989, | 9314,  | 10306,     | 11304,     |
| 4,       | 4983,                               | 4704,  | 3483,  | 6084,  | 1850,  | 4043,                      | 7137,  | 7821,  | 20211, | 26466, | 6470,      | 6761,      |
| 5,       | 4019,                               | 2320,  | 1873,  | 1511,  | 3054,  | 1084,                      | 2775,  | 4906,  | 4629,  | 12411, | 15600,     | 3620,      |
| 6,       | 4647,                               | 1948,  | 885,   | 762,   | 680,   | 1658,                      | 690,   | 1803,  | 3123,  | 2406,  | 6766,      | 1751,      |
| 7,       | 1009,                               | 1834,  | 666,   | 359,   | 353,   | 285,                       | 1065,  | 455,   | 1065,  | 1187,  | 1375,      | 823,       |
| 8,       | 397,                                | 381,   | 599,   | 280,   | 166,   | 167,                       | 148,   | 716,   | 268,   | 337,   | 394,       | 358,       |
| 9,       | 89,                                 | 173,   | 113,   | 227,   | 146,   | 86,                        | 107,   | 87,    | 432,   | 87,    | 121,       | 155,       |
| +gp,     | 67,                                 | 25,    | 58,    | 104,   | 169,   | 97,                        | 78,    | 96,    | 57,    | 198,   | 80,        |            |
| 0 TOTAL, | 31963,                              | 33410, | 21887, | 18949, | 23808, | 29839,                     | 56749, | 92720, | 79535, | 65215, | 41132,     |            |

**Table 2.2.6.1.6. Summary table from XSA.**

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

At 3-May-98 15:28:23

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

|          | RECRUITS,<br>Age 2 | TOTALBIO, | TOTSPBIO, | LANDINGS, | YIELD/SSB, | FBAR | 3- 7,  |
|----------|--------------------|-----------|-----------|-----------|------------|------|--------|
| 1961,    | 12019,             | 65428,    | 46439,    | 21598,    | .4651,     |      | .6059, |
| 1962,    | 20654,             | 68225,    | 43326,    | 20967,    | .4839,     |      | .5226, |
| 1963,    | 20290,             | 77602,    | 49054,    | 22215,    | .4529,     |      | .4944, |
| 1964,    | 21834,             | 84666,    | 55362,    | 21078,    | .3807,     |      | .5017, |
| 1965,    | 8269,              | 75043,    | 57057,    | 24212,    | .4244,     |      | .4909, |
| 1966,    | 18566,             | 83919,    | 60629,    | 20418,    | .3368,     |      | .4743, |
| 1967,    | 23451,             | 105289,   | 73934,    | 23562,    | .3187,     |      | .3900, |
| 1968,    | 17582,             | 110433,   | 82484,    | 29930,    | .3629,     |      | .4642, |
| 1969,    | 9325,              | 105537,   | 83487,    | 32371,    | .3877,     |      | .4375, |
| 1970,    | 8609,              | 98398,    | 82035,    | 24183,    | .2948,     |      | .3882, |
| 1971,    | 11928,             | 78218,    | 63308,    | 23010,    | .3635,     |      | .3526, |
| 1972,    | 21320,             | 76439,    | 57180,    | 18727,    | .3275,     |      | .3358, |
| 1973,    | 12573,             | 110714,   | 83548,    | 22228,    | .2661,     |      | .2886, |
| 1974,    | 30481,             | 139267,   | 98434,    | 24581,    | .2497,     |      | .3139, |
| 1975,    | 38323,             | 153668,   | 109567,   | 36775,    | .3356,     |      | .3947, |
| 1976,    | 18575,             | 161268,   | 123082,   | 39799,    | .3234,     |      | .4748, |
| 1977,    | 9998,              | 136223,   | 112066,   | 34927,    | .3117,     |      | .6757, |
| 1978,    | 10709,             | 96207,    | 78512,    | 26585,    | .3386,     |      | .4259, |
| 1979,    | 15137,             | 85197,    | 66722,    | 23112,    | .3464,     |      | .4274, |
| 1980,    | 23579,             | 85153,    | 58953,    | 20513,    | .3480,     |      | .3943, |
| 1981,    | 14071,             | 88632,    | 63697,    | 22963,    | .3605,     |      | .4644, |
| 1982,    | 22379,             | 99531,    | 67304,    | 21489,    | .3193,     |      | .4128, |
| 1983,    | 25217,             | 124031,   | 99367,    | 38133,    | .3838,     |      | .7042, |
| 1984,    | 48163,             | 153579,   | 116728,   | 36979,    | .3168,     |      | .4965, |
| 1985,    | 17572,             | 132690,   | 85719,    | 39484,    | .4606,     |      | .6884, |
| 1986,    | 9504,              | 101318,   | 75519,    | 34595,    | .4581,     |      | .6360, |
| 1987,    | 10167,             | 80321,    | 63893,    | 21391,    | .3348,     |      | .4227, |
| 1988,    | 8661,              | 68097,    | 53999,    | 23182,    | .4293,     |      | .5869, |
| 1989,    | 15394,             | 60002,    | 40153,    | 22068,    | .5496,     |      | .7439, |
| 1990,    | 3630,              | 38857,    | 30118,    | 13487,    | .4478,     |      | .6116, |
| 1991,    | 6869,              | 29900,    | 22232,    | 8660,     | .3895,     |      | .4851, |
| 1992,    | 11938,             | 37358,    | 21808,    | 6535,     | .2997,     |      | .4126, |
| 1993,    | 12834,             | 54546,    | 36498,    | 5988,     | .1641,     |      | .2436, |
| 1994,    | 34348,             | 100097,   | 85925,    | 8818,     | .1026,     |      | .1811, |
| 1995,    | 49220,             | 172636,   | 84984,    | 22494,    | .2647,     |      | .2685, |
| 1996,    | 11760,             | 174477,   | 109062,   | 40106,    | .3677,     |      | .5242, |
| 1997,    | 12809,             | 132294,   | 113505,   | 34290,    | .3021,     |      | .4319, |
| Arith.   |                    |           |           |           |            |      |        |
| Mean     | 18048,             | 98521,    | 71775,    | 24634,    | .3532,     |      | .4640, |
| 0 Units, | (Thousands),       | (Tonnes), | (Tonnes), | (Tonnes), |            |      |        |
| 1        |                    |           |           |           |            |      |        |

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

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

**Table 2.2.7.4.1. Input data to yield per recruit calculations.**

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

Yield per recruit: Input data

| Age  | Recruit-<br>ment | Natural<br>mortality | Maturity<br>ogive | Prop.of F<br>bef.spaw. | Prop.of M<br>bef.spaw. | Weight<br>in stock | Exploit.<br>pattern | Weight<br>in catch |
|------|------------------|----------------------|-------------------|------------------------|------------------------|--------------------|---------------------|--------------------|
| 2    | 1.000            | 0.2000               | 0.1613            | 0.0000                 | 0.0000                 | 1.008              | 0.1400              | 1.027              |
| 3    | .                | 0.2000               | 0.6473            | 0.0000                 | 0.0000                 | 1.725              | 0.4300              | 1.589              |
| 4    | .                | 0.2000               | 0.8773            | 0.0000                 | 0.0000                 | 2.609              | 0.6600              | 2.217              |
| 5    | .                | 0.2000               | 0.9540            | 0.0000                 | 0.0000                 | 3.531              | 0.7900              | 3.074              |
| 6    | .                | 0.2000               | 0.9907            | 0.0000                 | 0.0000                 | 4.426              | 0.8900              | 3.861              |
| 7    | .                | 0.2000               | 0.9947            | 0.0000                 | 0.0000                 | 5.453              | 1.0000              | 4.650              |
| 8    | .                | 0.2000               | 0.9960            | 0.0000                 | 0.0000                 | 6.481              | 1.0000              | 5.639              |
| 9    | .                | 0.2000               | 1.0000            | 0.0000                 | 0.0000                 | 7.814              | 1.0000              | 6.925              |
| 10+  | .                | 0.2000               | 1.0000            | 0.0000                 | 0.0000                 | 9.934              | 1.0000              | 8.555              |
| Unit | Numbers          | -                    | -                 | -                      | -                      | Kilograms          | -                   | Kilograms          |

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

Table 2.2.7.4.2. Output data from yield per recruit calculations.

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

## Yield per recruit: Summary table

| F Factor | Reference F | Catch in numbers | Catch in weight | Stock size | Stock biomass | 1 January     |                  | Spawning time |                  |
|----------|-------------|------------------|-----------------|------------|---------------|---------------|------------------|---------------|------------------|
|          |             |                  |                 |            |               | Sp.stock size | Sp.stock biomass | Sp.stock size | Sp.stock biomass |
| 0.0000   | 0.0000      | 0.000            | 0.000           | 5.517      | 25045.803     | 4.274         | 23361.757        | 4.274         | 23361.757        |
| 0.0200   | 0.0154      | 0.063            | 304.666         | 5.204      | 22415.116     | 3.964         | 20738.988        | 3.964         | 20738.988        |
| 0.0400   | 0.0307      | 0.116            | 538.551         | 4.941      | 20260.660     | 3.704         | 18592.259        | 3.704         | 18592.259        |
| 0.0600   | 0.0461      | 0.161            | 720.127         | 4.717      | 18469.375     | 3.483         | 16808.517        | 3.483         | 16808.517        |
| 0.0800   | 0.0614      | 0.200            | 862.351         | 4.523      | 16960.775     | 3.292         | 15307.285        | 3.292         | 15307.285        |
| 0.1000   | 0.0768      | 0.234            | 974.533         | 4.354      | 15676.069     | 3.125         | 14029.776        | 3.125         | 14029.776        |
| 0.1200   | 0.0921      | 0.264            | 1063.493        | 4.205      | 14571.356     | 2.978         | 12932.100        | 2.978         | 12932.100        |
| 0.1400   | 0.1075      | 0.290            | 1134.313        | 4.072      | 13613.233     | 2.848         | 11980.858        | 2.848         | 11980.858        |
| 0.1600   | 0.1228      | 0.315            | 1190.835        | 3.952      | 12775.862     | 2.731         | 11150.218        | 2.731         | 11150.218        |
| 0.1800   | 0.1382      | 0.336            | 1236.003        | 3.845      | 12038.967     | 2.625         | 10419.911        | 2.625         | 10419.911        |
| 0.2000   | 0.1536      | 0.356            | 1272.091        | 3.747      | 11386.432     | 2.530         | 9773.825         | 2.530         | 9773.825         |
| 0.2200   | 0.1689      | 0.374            | 1300.879        | 3.658      | 10805.303     | 2.443         | 9199.011         | 2.443         | 9199.011         |
| 0.2400   | 0.1843      | 0.391            | 1323.766        | 3.576      | 10285.057     | 2.363         | 8684.953         | 2.363         | 8684.953         |
| 0.2600   | 0.1996      | 0.406            | 1341.863        | 3.500      | 9817.072      | 2.290         | 8223.032         | 2.290         | 8223.032         |
| 0.2800   | 0.2150      | 0.420            | 1356.060        | 3.430      | 9394.221      | 2.222         | 7806.125         | 2.222         | 7806.125         |
| 0.3000   | 0.2303      | 0.433            | 1367.067        | 3.365      | 9010.570      | 2.159         | 7428.304         | 2.159         | 7428.304         |
| 0.3200   | 0.2457      | 0.446            | 1375.463        | 3.305      | 8661.141      | 2.101         | 7084.594         | 2.101         | 7084.594         |
| 0.3400   | 0.2610      | 0.457            | 1381.712        | 3.248      | 8341.735      | 2.047         | 6770.799         | 2.047         | 6770.799         |
| 0.3600   | 0.2764      | 0.468            | 1386.197        | 3.195      | 8048.786      | 1.996         | 6483.358         | 1.996         | 6483.358         |
| 0.3800   | 0.2918      | 0.478            | 1389.228        | 3.145      | 7779.250      | 1.948         | 6219.229         | 1.948         | 6219.229         |
| 0.4000   | 0.3071      | 0.487            | 1391.061        | 3.098      | 7530.515      | 1.903         | 5975.806         | 1.903         | 5975.806         |
| 0.4200   | 0.3225      | 0.496            | 1391.906        | 3.054      | 7300.331      | 1.861         | 5750.839         | 1.861         | 5750.839         |
| 0.4400   | 0.3378      | 0.505            | 1391.937        | 3.012      | 7086.749      | 1.821         | 5542.383         | 1.821         | 5542.383         |
| 0.4600   | 0.3532      | 0.513            | 1391.296        | 2.972      | 6888.073      | 1.783         | 5348.745         | 1.783         | 5348.745         |
| 0.4800   | 0.3685      | 0.521            | 1390.104        | 2.934      | 6702.823      | 1.747         | 5168.449         | 1.747         | 5168.449         |
| 0.5000   | 0.3839      | 0.528            | 1388.459        | 2.898      | 6529.704      | 1.713         | 5000.201         | 1.713         | 5000.201         |
| 0.5200   | 0.3992      | 0.535            | 1386.444        | 2.864      | 6367.574      | 1.680         | 4842.862         | 1.680         | 4842.862         |
| 0.5400   | 0.4146      | 0.542            | 1384.127        | 2.831      | 6215.429      | 1.650         | 4695.430         | 1.650         | 4695.430         |
| 0.5600   | 0.4300      | 0.548            | 1381.565        | 2.800      | 6072.377      | 1.620         | 4557.016         | 1.620         | 4557.016         |
| 0.5800   | 0.4453      | 0.554            | 1378.807        | 2.770      | 5937.629      | 1.592         | 4426.833         | 1.592         | 4426.833         |
| 0.6000   | 0.4607      | 0.560            | 1375.892        | 2.742      | 5810.481      | 1.565         | 4304.179         | 1.565         | 4304.179         |
| 0.6200   | 0.4760      | 0.566            | 1372.855        | 2.714      | 5690.305      | 1.540         | 4188.427         | 1.540         | 4188.427         |
| 0.6400   | 0.4914      | 0.571            | 1369.723        | 2.688      | 5576.539      | 1.515         | 4079.018         | 1.515         | 4079.018         |
| 0.6600   | 0.5067      | 0.576            | 1366.519        | 2.662      | 5468.677      | 1.491         | 3975.448         | 1.491         | 3975.448         |
| 0.6800   | 0.5221      | 0.581            | 1363.264        | 2.638      | 5366.266      | 1.468         | 3877.266         | 1.468         | 3877.266         |
| 0.7000   | 0.5374      | 0.586            | 1359.974        | 2.614      | 5268.897      | 1.447         | 3784.063         | 1.447         | 3784.063         |
| 0.7200   | 0.5528      | 0.591            | 1356.663        | 2.591      | 5176.199      | 1.425         | 3695.471         | 1.425         | 3695.471         |
| 0.7400   | 0.5682      | 0.596            | 1353.342        | 2.570      | 5087.838      | 1.405         | 3611.157         | 1.405         | 3611.157         |
| 0.7600   | 0.5835      | 0.600            | 1350.021        | 2.548      | 5003.508      | 1.386         | 3530.819         | 1.386         | 3530.819         |
| 0.7800   | 0.5989      | 0.604            | 1346.708        | 2.528      | 4922.935      | 1.367         | 3454.180         | 1.367         | 3454.180         |
| 0.8000   | 0.6142      | 0.608            | 1343.410        | 2.508      | 4845.865      | 1.349         | 3380.990         | 1.349         | 3380.990         |
| 0.8200   | 0.6296      | 0.612            | 1340.131        | 2.489      | 4772.068      | 1.331         | 3311.021         | 1.331         | 3311.021         |
| 0.8400   | 0.6449      | 0.616            | 1336.877        | 2.470      | 4701.335      | 1.314         | 3244.063         | 1.314         | 3244.063         |
| 0.8600   | 0.6603      | 0.620            | 1333.652        | 2.452      | 4633.471      | 1.297         | 3179.925         | 1.297         | 3179.925         |
| 0.8800   | 0.6756      | 0.623            | 1330.458        | 2.435      | 4568.301      | 1.281         | 3118.431         | 1.281         | 3118.431         |
| 0.9000   | 0.6910      | 0.627            | 1327.298        | 2.418      | 4505.661      | 1.266         | 3059.419         | 1.266         | 3059.419         |
| 0.9200   | 0.7064      | 0.630            | 1324.173        | 2.401      | 4445.402      | 1.251         | 3002.740         | 1.251         | 3002.740         |
| 0.9400   | 0.7217      | 0.634            | 1321.086        | 2.385      | 4387.384      | 1.236         | 2948.258         | 1.236         | 2948.258         |
| 0.9600   | 0.7371      | 0.637            | 1318.037        | 2.370      | 4331.482      | 1.222         | 2895.846         | 1.222         | 2895.846         |
| 0.9800   | 0.7524      | 0.640            | 1315.027        | 2.354      | 4277.576      | 1.209         | 2845.386         | 1.209         | 2845.386         |
| 1.0000   | 0.7678      | 0.643            | 1312.058        | 2.340      | 4225.557      | 1.195         | 2796.771         | 1.195         | 2796.771         |
| 1.0200   | 0.7831      | 0.646            | 1309.128        | 2.325      | 4175.324      | 1.182         | 2749.900         | 1.182         | 2749.900         |
| 1.0400   | 0.7985      | 0.649            | 1306.240        | 2.311      | 4126.782      | 1.170         | 2704.679         | 1.170         | 2704.679         |
| 1.0600   | 0.8138      | 0.652            | 1303.391        | 2.297      | 4079.844      | 1.157         | 2661.021         | 1.157         | 2661.021         |
| 1.0800   | 0.8292      | 0.655            | 1300.584        | 2.284      | 4034.428      | 1.146         | 2618.847         | 1.146         | 2618.847         |
| 1.1000   | 0.8446      | 0.657            | 1297.816        | 2.271      | 3990.458      | 1.134         | 2578.080         | 1.134         | 2578.080         |
| 1.1200   | 0.8599      | 0.660            | 1295.089        | 2.258      | 3947.863      | 1.123         | 2538.650         | 1.123         | 2538.650         |
| 1.1400   | 0.8753      | 0.662            | 1292.402        | 2.246      | 3906.576      | 1.112         | 2500.493         | 1.112         | 2500.493         |
| 1.1600   | 0.8906      | 0.665            | 1289.754        | 2.234      | 3866.536      | 1.101         | 2463.545         | 1.101         | 2463.545         |
| 1.1800   | 0.9060      | 0.667            | 1287.145        | 2.222      | 3827.684      | 1.090         | 2427.750         | 1.090         | 2427.750         |
| 1.2000   | 0.9213      | 0.670            | 1284.574        | 2.210      | 3789.965      | 1.080         | 2393.054         | 1.080         | 2393.054         |
| 1.2200   | 0.9367      | 0.672            | 1282.042        | 2.199      | 3753.329      | 1.070         | 2359.406         | 1.070         | 2359.406         |
| 1.2400   | 0.9520      | 0.675            | 1279.547        | 2.188      | 3717.726      | 1.060         | 2326.759         | 1.060         | 2326.759         |
| 1.2600   | 0.9674      | 0.677            | 1277.088        | 2.177      | 3683.113      | 1.051         | 2295.069         | 1.051         | 2295.069         |
| 1.2800   | 0.9828      | 0.679            | 1274.667        | 2.167      | 3649.446      | 1.041         | 2264.292         | 1.041         | 2264.292         |
| 1.3000   | 0.9981      | 0.681            | 1272.280        | 2.156      | 3616.684      | 1.032         | 2234.391         | 1.032         | 2234.391         |
| 1.3200   | 1.0135      | 0.683            | 1269.929        | 2.146      | 3584.791      | 1.023         | 2205.326         | 1.023         | 2205.326         |
| 1.3400   | 1.0288      | 0.685            | 1267.613        | 2.136      | 3553.731      | 1.015         | 2177.064         | 1.015         | 2177.064         |
| -        | -           | Numbers          | Grams           | Numbers    | Grams         | Numbers       | Grams            | Numbers       | Grams            |

(cont.)

Table 2.2.7.4.2 continued.

Tuesday, May 5, 1998

Cod in the Faroe Plateau (Fishing Area Vb1)

## Yield per recruit: Summary table

| (cont.)  |             |                  |                 |            |               | 1 January     |                  | Spawning time |                  |
|----------|-------------|------------------|-----------------|------------|---------------|---------------|------------------|---------------|------------------|
| F Factor | Reference F | Catch in numbers | Catch in weight | Stock size | Stock biomass | Sp.stock size | Sp.stock biomass | Sp.stock size | Sp.stock biomass |
| 1.3600   | 1.0442      | 0.688            | 1265.330        | 2.126      | 3523.469      | 1.006         | 2149.571         | 1.006         | 2149.571         |
| 1.3800   | 1.0595      | 0.690            | 1263.081        | 2.117      | 3493.973      | 0.998         | 2122.816         | 0.998         | 2122.816         |
| 1.4000   | 1.0749      | 0.691            | 1260.865        | 2.107      | 3465.214      | 0.989         | 2096.768         | 0.989         | 2096.768         |
| 1.4200   | 1.0902      | 0.693            | 1258.681        | 2.098      | 3437.163      | 0.981         | 2071.400         | 0.981         | 2071.400         |
| 1.4400   | 1.1056      | 0.695            | 1256.528        | 2.089      | 3409.793      | 0.974         | 2046.686         | 0.974         | 2046.686         |
| 1.4600   | 1.1210      | 0.697            | 1254.406        | 2.080      | 3383.077      | 0.966         | 2022.599         | 0.966         | 2022.599         |
| 1.4800   | 1.1363      | 0.699            | 1252.315        | 2.071      | 3356.992      | 0.958         | 1999.116         | 0.958         | 1999.116         |
| 1.5000   | 1.1517      | 0.701            | 1250.254        | 2.063      | 3331.514      | 0.951         | 1976.214         | 0.951         | 1976.214         |
| 1.5200   | 1.1670      | 0.703            | 1248.222        | 2.054      | 3306.621      | 0.944         | 1953.872         | 0.944         | 1953.872         |
| 1.5400   | 1.1824      | 0.704            | 1246.218        | 2.046      | 3282.292      | 0.937         | 1932.069         | 0.937         | 1932.069         |
| 1.5600   | 1.1977      | 0.706            | 1244.243        | 2.038      | 3258.508      | 0.930         | 1910.785         | 0.930         | 1910.785         |
| 1.5800   | 1.2131      | 0.708            | 1242.296        | 2.030      | 3235.249      | 0.923         | 1890.002         | 0.923         | 1890.002         |
| 1.6000   | 1.2284      | 0.709            | 1240.375        | 2.022      | 3212.497      | 0.916         | 1869.703         | 0.916         | 1869.703         |
| 1.6200   | 1.2438      | 0.711            | 1238.481        | 2.015      | 3190.234      | 0.910         | 1849.869         | 0.910         | 1849.869         |
| 1.6400   | 1.2592      | 0.713            | 1236.614        | 2.007      | 3168.445      | 0.903         | 1830.486         | 0.903         | 1830.486         |
| 1.6600   | 1.2745      | 0.714            | 1234.772        | 2.000      | 3147.114      | 0.897         | 1811.538         | 0.897         | 1811.538         |
| 1.6800   | 1.2899      | 0.716            | 1232.955        | 1.992      | 3126.225      | 0.890         | 1793.010         | 0.890         | 1793.010         |
| 1.7000   | 1.3052      | 0.717            | 1231.163        | 1.985      | 3105.764      | 0.884         | 1774.888         | 0.884         | 1774.888         |
| 1.7200   | 1.3206      | 0.719            | 1229.394        | 1.978      | 3085.717      | 0.878         | 1757.158         | 0.878         | 1757.158         |
| 1.7400   | 1.3359      | 0.720            | 1227.650        | 1.971      | 3066.071      | 0.872         | 1739.809         | 0.872         | 1739.809         |
| 1.7600   | 1.3513      | 0.722            | 1225.929        | 1.964      | 3046.815      | 0.867         | 1722.827         | 0.867         | 1722.827         |
| 1.7800   | 1.3666      | 0.723            | 1224.231        | 1.957      | 3027.934      | 0.861         | 1706.201         | 0.861         | 1706.201         |
| 1.8000   | 1.3820      | 0.725            | 1222.555        | 1.951      | 3009.419      | 0.855         | 1689.920         | 0.855         | 1689.920         |
| 1.8200   | 1.3974      | 0.726            | 1220.901        | 1.944      | 2991.258      | 0.850         | 1673.973         | 0.850         | 1673.973         |
| 1.8400   | 1.4127      | 0.727            | 1219.268        | 1.938      | 2973.440      | 0.844         | 1658.349         | 0.844         | 1658.349         |
| 1.8600   | 1.4281      | 0.729            | 1217.657        | 1.931      | 2955.955      | 0.839         | 1643.039         | 0.839         | 1643.039         |
| 1.8800   | 1.4434      | 0.730            | 1216.066        | 1.925      | 2938.793      | 0.834         | 1628.034         | 0.834         | 1628.034         |
| 1.9000   | 1.4588      | 0.731            | 1214.496        | 1.919      | 2921.945      | 0.828         | 1613.323         | 0.828         | 1613.323         |
| 1.9200   | 1.4741      | 0.733            | 1212.946        | 1.913      | 2905.402      | 0.823         | 1598.899         | 0.823         | 1598.899         |
| 1.9400   | 1.4895      | 0.734            | 1211.415        | 1.907      | 2889.155      | 0.818         | 1584.753         | 0.818         | 1584.753         |
| 1.9600   | 1.5048      | 0.735            | 1209.904        | 1.901      | 2873.196      | 0.813         | 1570.877         | 0.813         | 1570.877         |
| 1.9800   | 1.5202      | 0.736            | 1208.411        | 1.895      | 2857.517      | 0.809         | 1557.263         | 0.809         | 1557.263         |
| 2.0000   | 1.5356      | 0.738            | 1206.937        | 1.889      | 2842.110      | 0.804         | 1543.904         | 0.804         | 1543.904         |
| -        | -           | Numbers          | Grams           | Numbers    | Grams         | Numbers       | Grams            | Numbers       | Grams            |

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

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

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

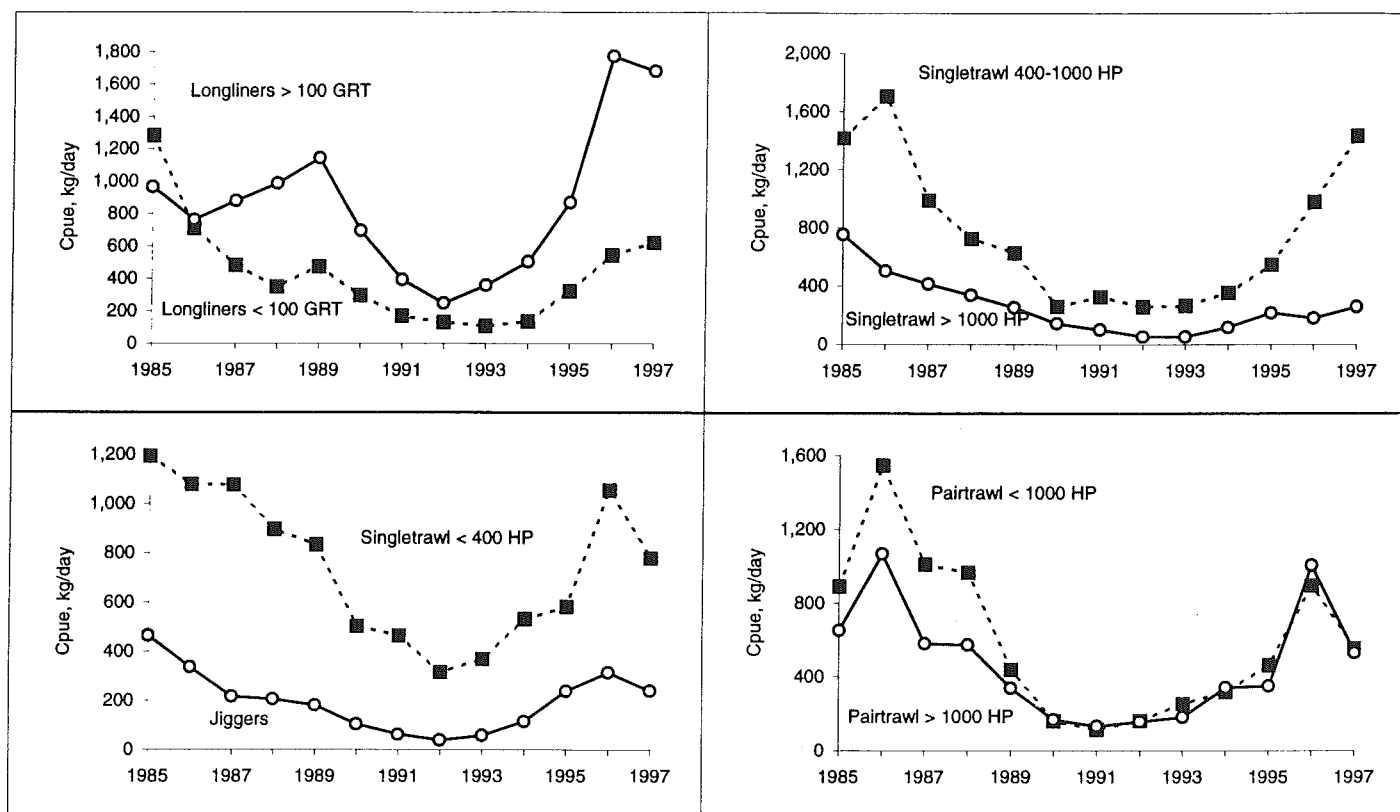


Figure 2.2.1.1. Catch per unit effort (kg/day) of Faroe Plateau Cod Januar-December.

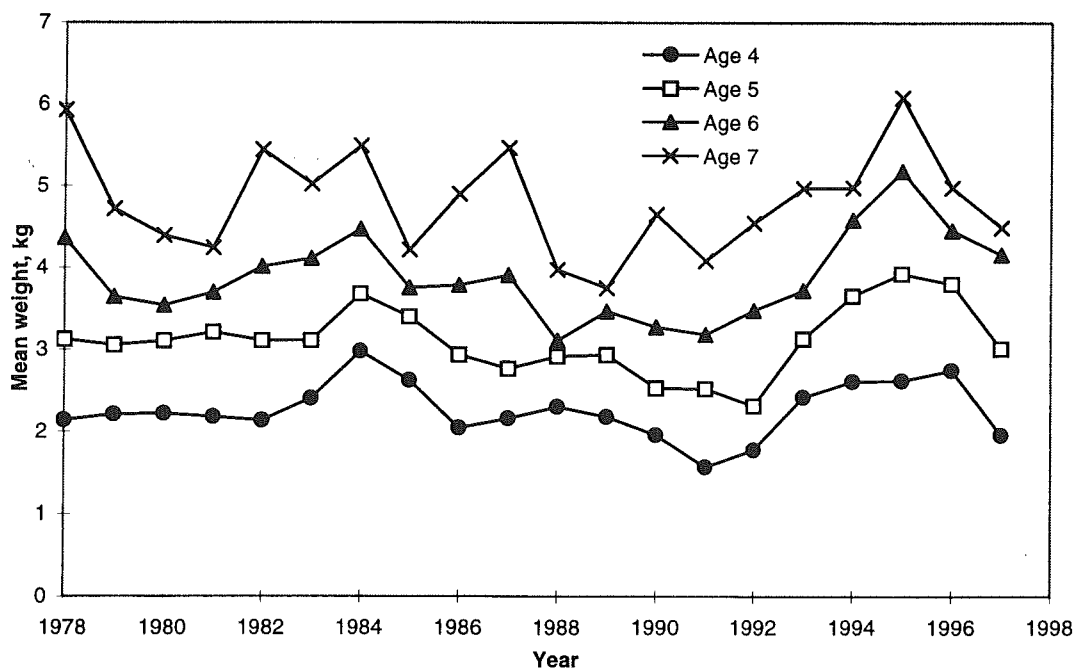
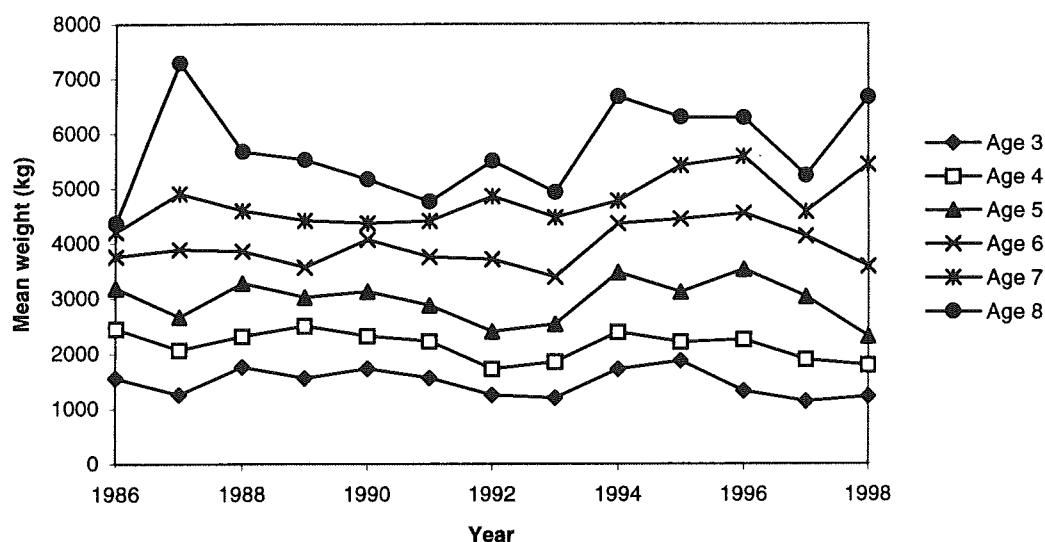
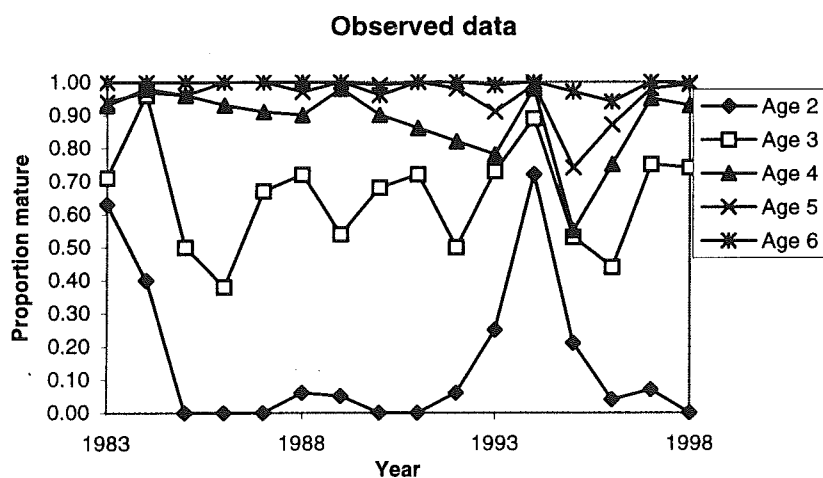


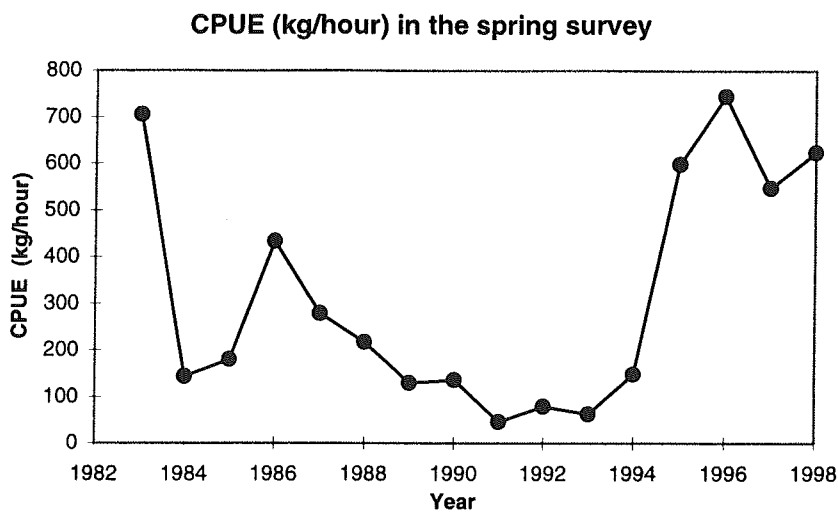
Figure 2.2.3.1. Mean weight at age for Faroe Plateau cod 1978–1997.



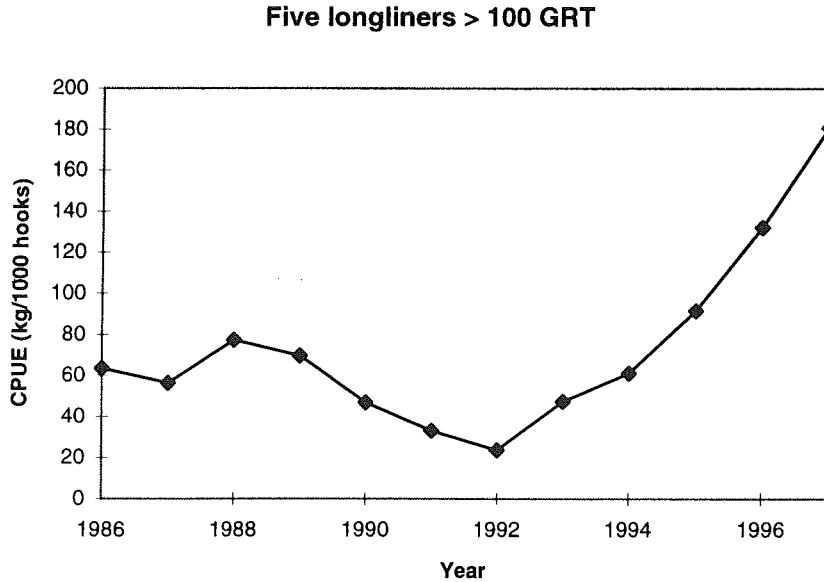
**Figure 2.2.3.2.** Faroe Plateau cod mean weight at age 1<sup>st</sup> quarter 1986-98. Commercial data.



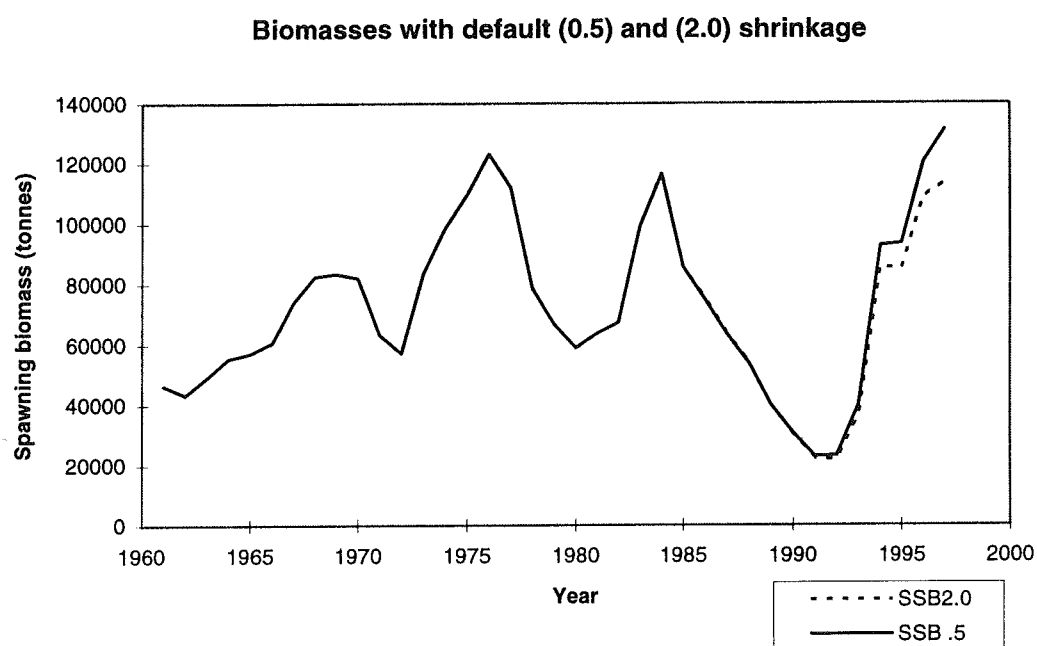
**Figure 2.2.4.1.** Faroe Plateau cod. Proportion mature at age as observed in the spring groundfish survey.



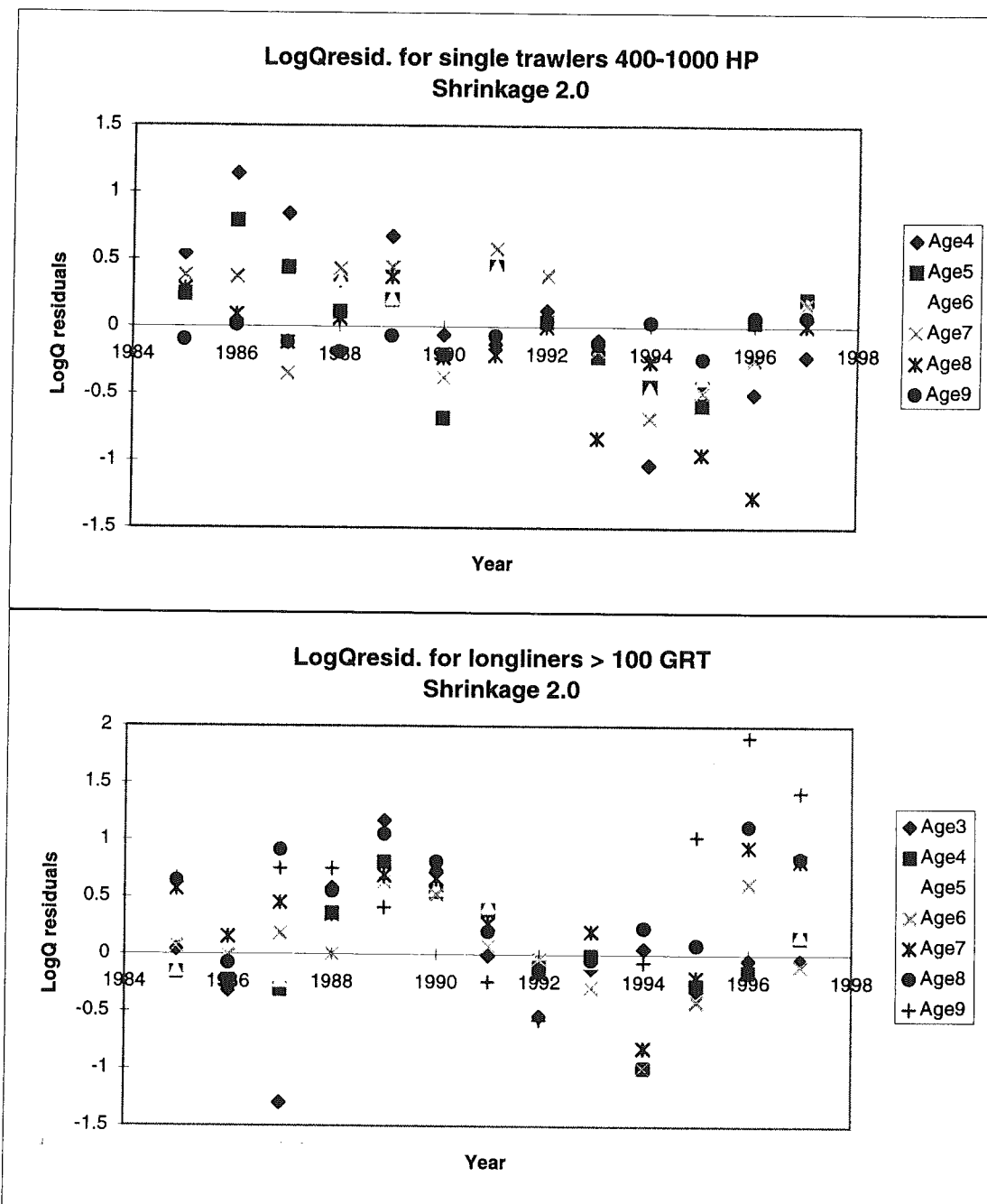
**Figure 2.2.5.1.** Catch per unit effort of Faroe Plateau cod in the groundfish survey.



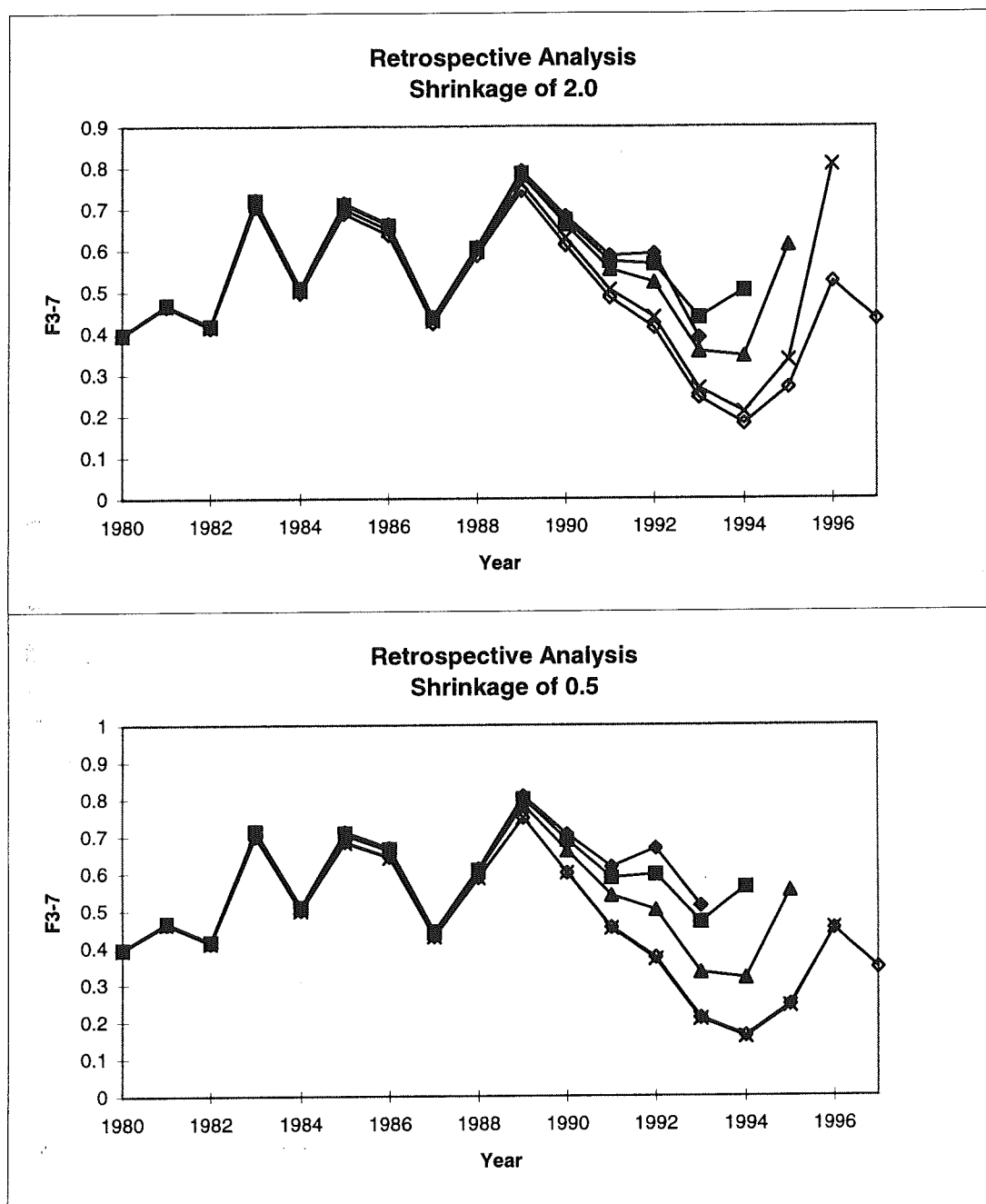
**Figure 2.2.6.1.1.** Catch per unit effort of Faroe Plateau cod for five longliners > 100 GRT.



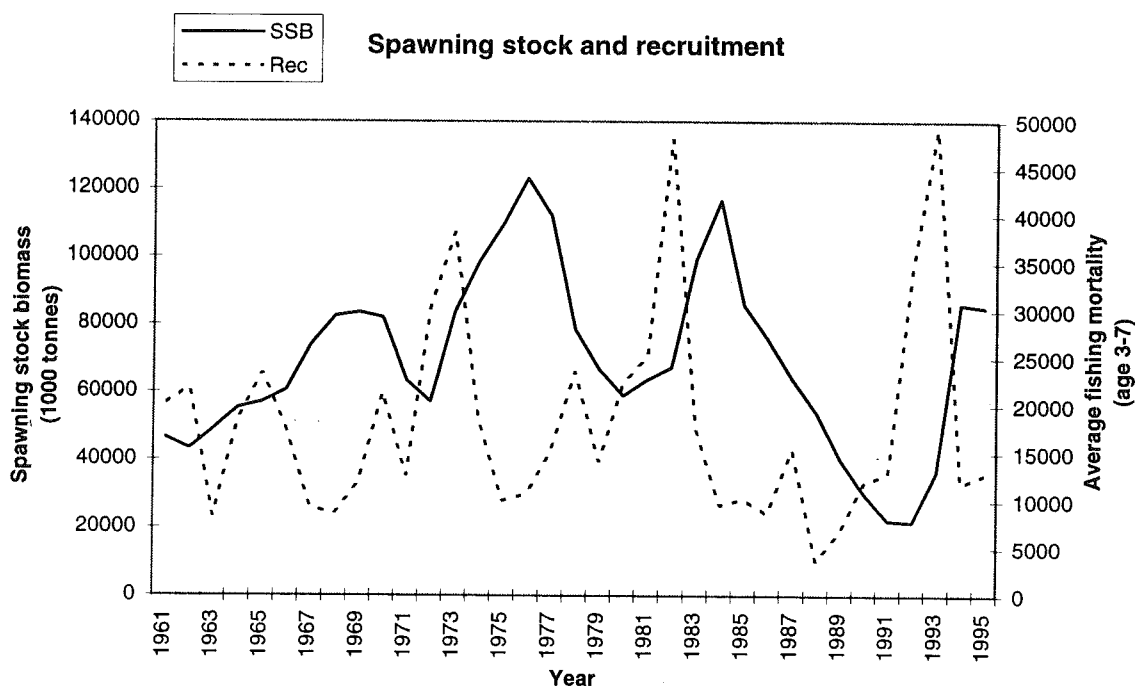
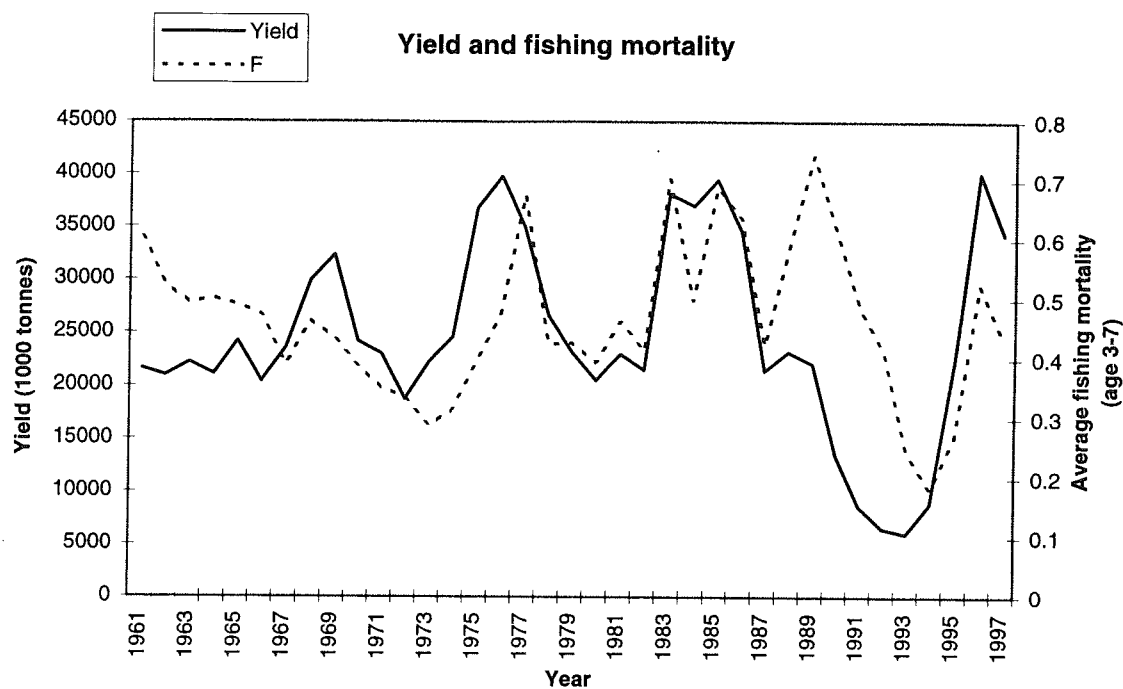
**Figure 2.2.6.1.2.** Spawning biomass of Faroe Plateau cod estimated from XSA with shrinkage of 0.5 and shrinkage of 2.0.



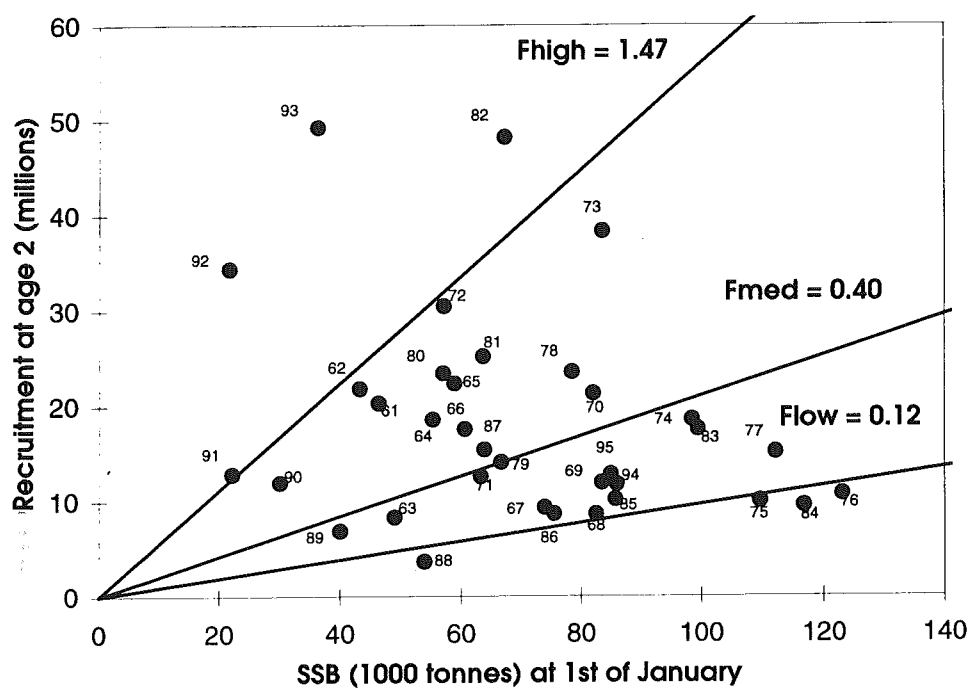
**Figure 2.2.6.1.3.** Faroe Plateau cod. Residuals from XSA using LL>100 and OTB 400–1000 with shrinkage 2.0.



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

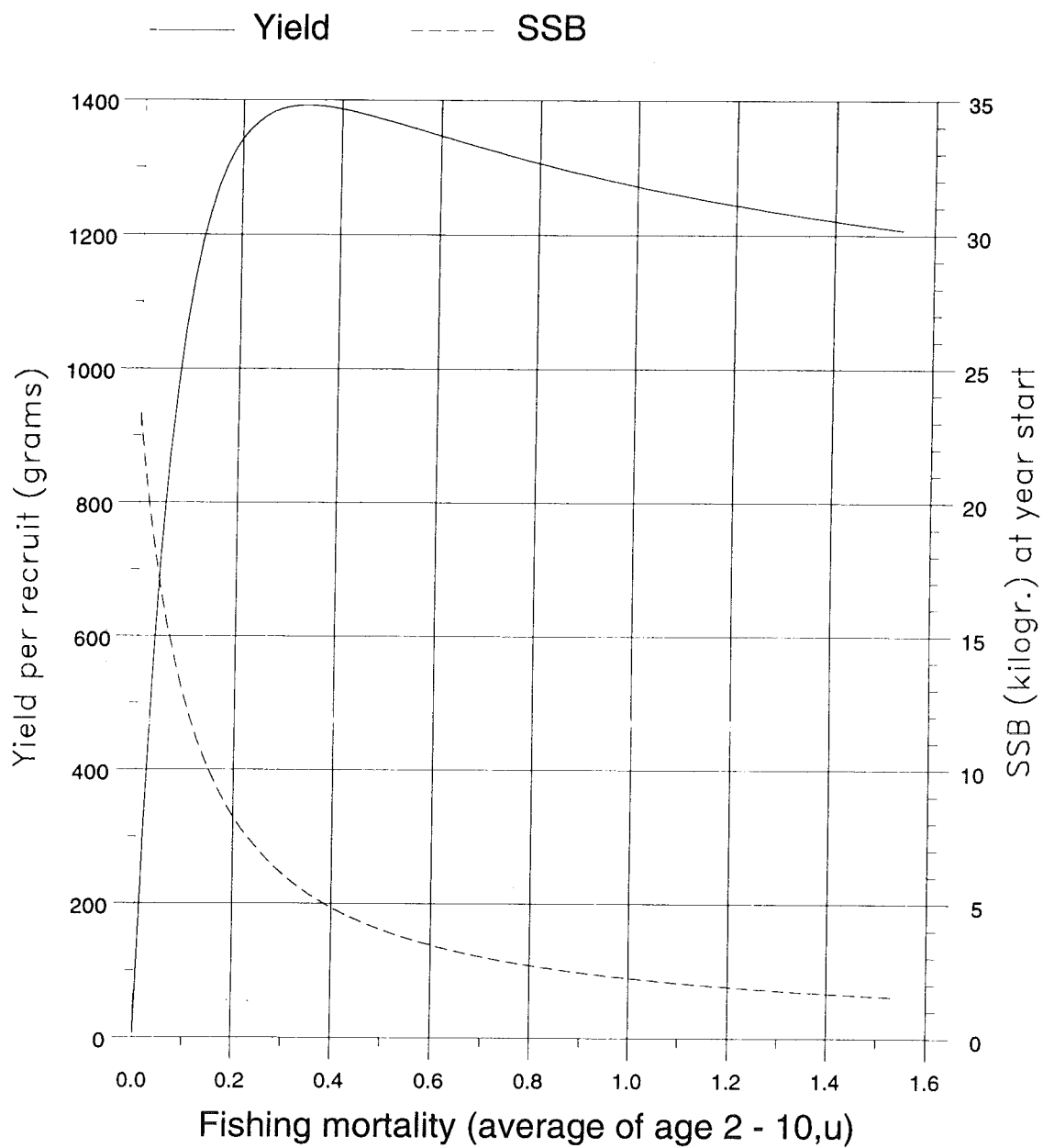


**Figure 2.2.6.1.5.** Yield and average fishing mortality (age 3 - 7) versus years. Spawning stock biomass (SSB) and fishing mortality (F) versus years.



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

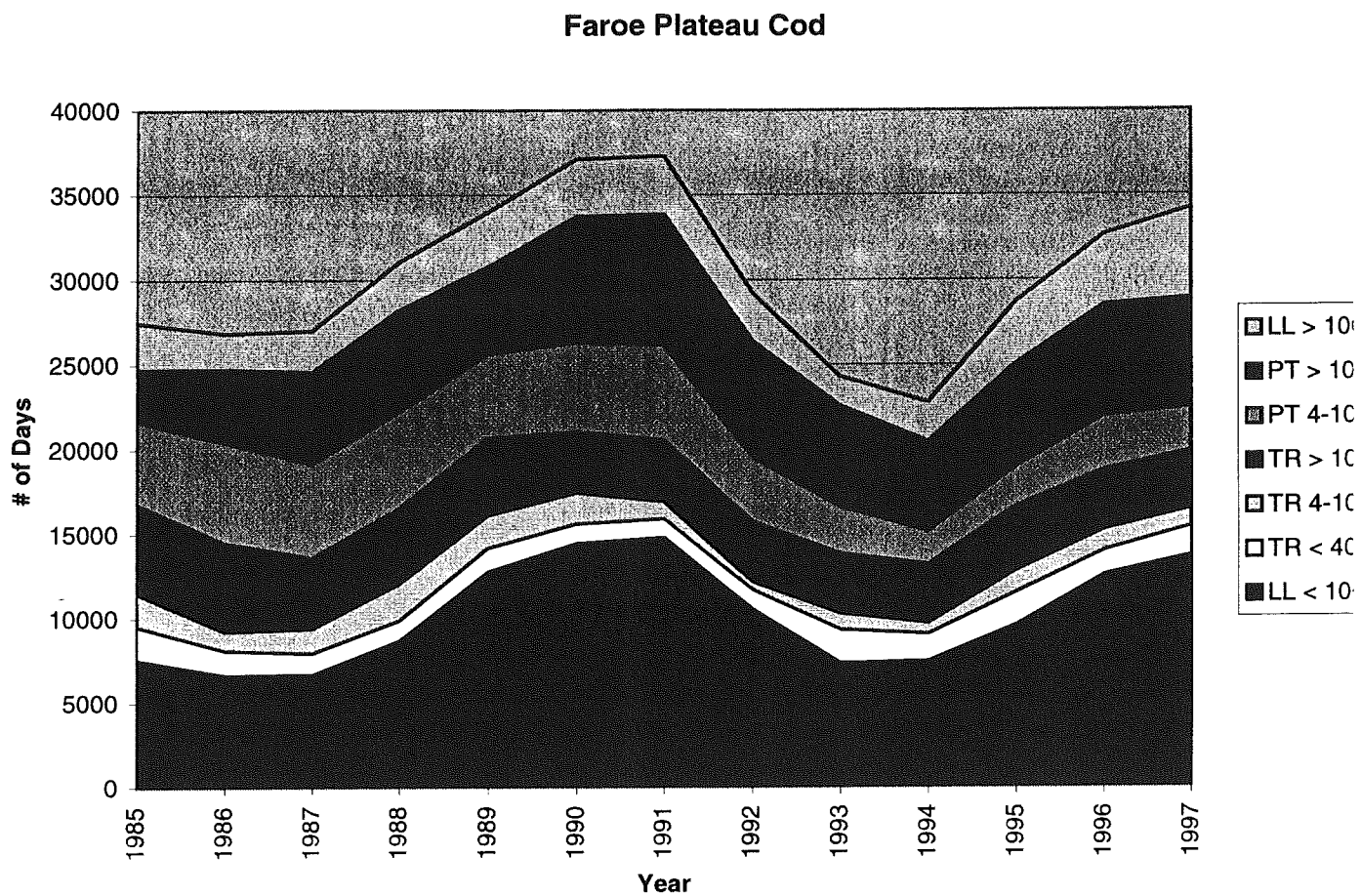
## Long term yield and spawning stock biomass



(run: YLDPET04)

C

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



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

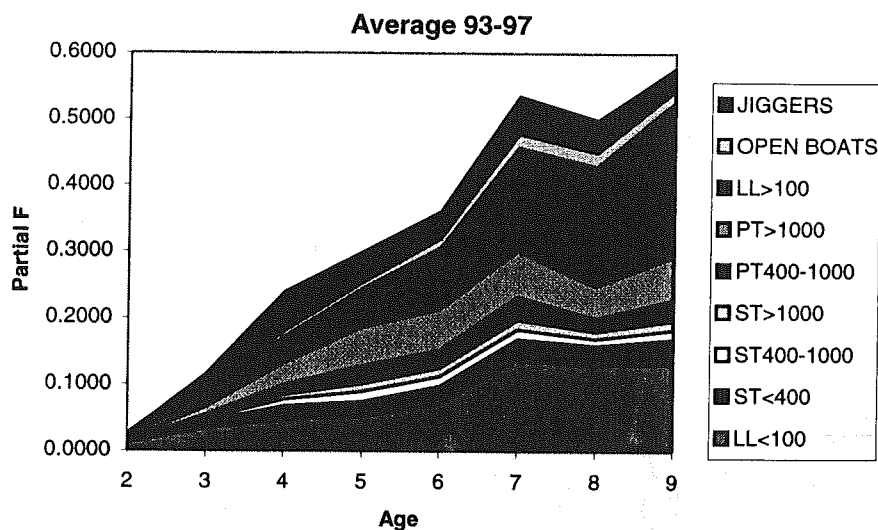


Figure 2.2.8.2. Partial F at age for faroese fleets as an average for the years 1993-97.

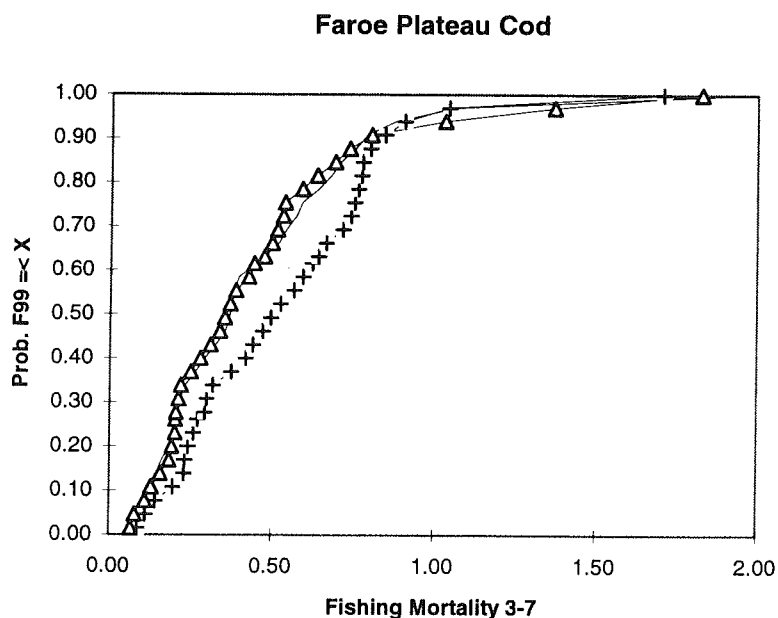


Figure 2.2.8.3. Faroe Plateau Cod. Cumulative probability distribution of the 1998 fishing mortalities under the current number of fishing days allocated for the LL<100, ST<400, PT>1000, LL>100, OPEN, and JIGGERS. Three options are presented where the 8155 days allocated to the LL<100, jiggers and ST<400 is either used intirely by the LL (solid line), the ST<400 (line with +) or by the jiggers (line with triangles, with 18640 days). The probability does not reach 1.0 on the graph because of a few very high catchabilities in 1985 for some of the fleets.

## 2.3 Faroe Bank Cod

### 2.3.1 Trends in landings and effort

Total nominal landings of the Faroe Bank cod from 1986 to 1997 as officially reported to ICES are given in Table 2.3.1.1. The catches reached a maximum of 5,000 t in 1973. In recent years the catches have declined from about 3,500 t in 1987 to only 330 t in 1992 and increased to 3,600 t in 1997.

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

### 2.3.2 Stock assessment

Biological sampling has been taken in the most recent years from commercial landings (the 1997 sampling level is shown in Table 2.3.1.2) and from the groundfish survey. The available data for the Faroe Bank cod are not adequate to allow for a detailed analytical assessment of the stock, but the results of a tentative general production model are presented.

The Faroese groundfish surveys cover waters on the Faroe Bank. Cod is mainly taken within the 200 m depth contour. The catches of cod per trawl hour in water shallower than 200 m are shown in Figure 2.3.2.1. The CPUE declined from 202 kg/hour in 1984 to only 22 kg/hour in 1990. The index of stock size has increased in recent years, reaching its highest value in 1998.

The length distributions in the survey 1983–1998 are shown in Figure 2.3.2.2 and seem to reflect the development in the catches by having a wider range when catches are on a high level.

A Schaefer General Production model was fit to the Faroe Bank cod landings data using the research vessel survey CPUE for 1983 to 1997 in kg/hour as an index of stock biomass. The Schaefer model is defined by three parameters, the intrinsic rate of growth of the stock ( $r$ ), the virgin biomass or carrying capacity ( $k$ ) and the initial biomass at the start of the time series. The catchability coefficient ( $q$ ) is derived analytically as the average (exponential of the average  $\ln (CPUE/B)$ )  $q$  estimated in the period covered.

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

$$CPUE_{pred,t} = B_t \cdot q$$

the biomass is:

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

and  $C$  is catch.

Parameter values obtained last year were used as starting values.

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

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

### **2.3.3 Target reference points and limit reference points**

No specific values can be put forward as reference points.

### **2.3.4 Management considerations**

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

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

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

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

\*) Preliminary.

1) Includes Vb1

2) Included in Vb1

3) See cod Vb1

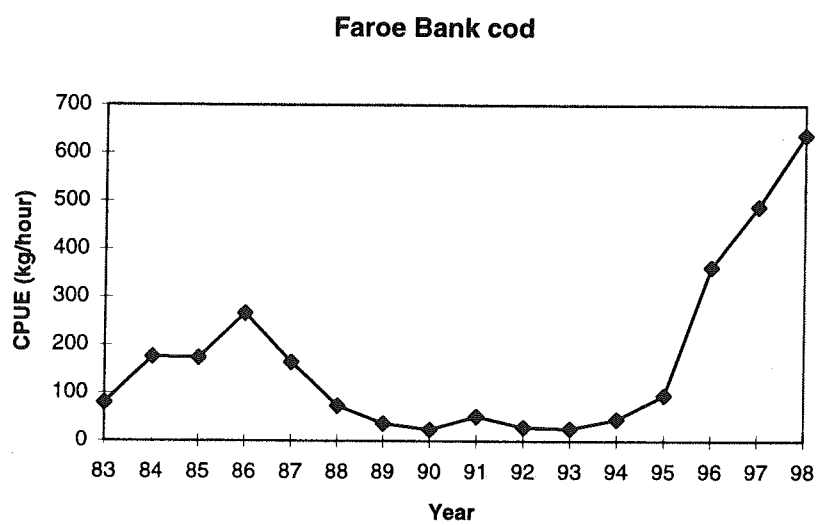
**Table 2.3.1.2.** Samples of lengths, otoliths, and individual weights of Faroe Bank cod in 1997.

| Fleet          | Size        | Samples | Length | Otoliths | Weights |
|----------------|-------------|---------|--------|----------|---------|
| Longliners     | <100 GRT    | 0       | 0      | 0        | 0       |
| Longliners     | >100 GRT    | 14      | 1,814  | 778      | 600     |
| Jiggers        |             | 15      | 1,956  | 890      | 840     |
| Sing. trawlers | <400 HP     | 0       | 0      | 0        | 0       |
| Sing. trawlers | 400-1000 HP | 0       | 0      | 0        | 0       |
| Sing. trawlers | >1000 HP    | 0       | 0      | 0        | 0       |
| Pair trawlers  | <1000 HP    | 1       | 47     | 50       | 0       |
| Pair trawlers  | >1000 HP    | 2       | 348    | 60       | 60      |
| Total          |             | 32      | 4,165  | 1,778    | 1,500   |

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

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

\*) Predicted



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

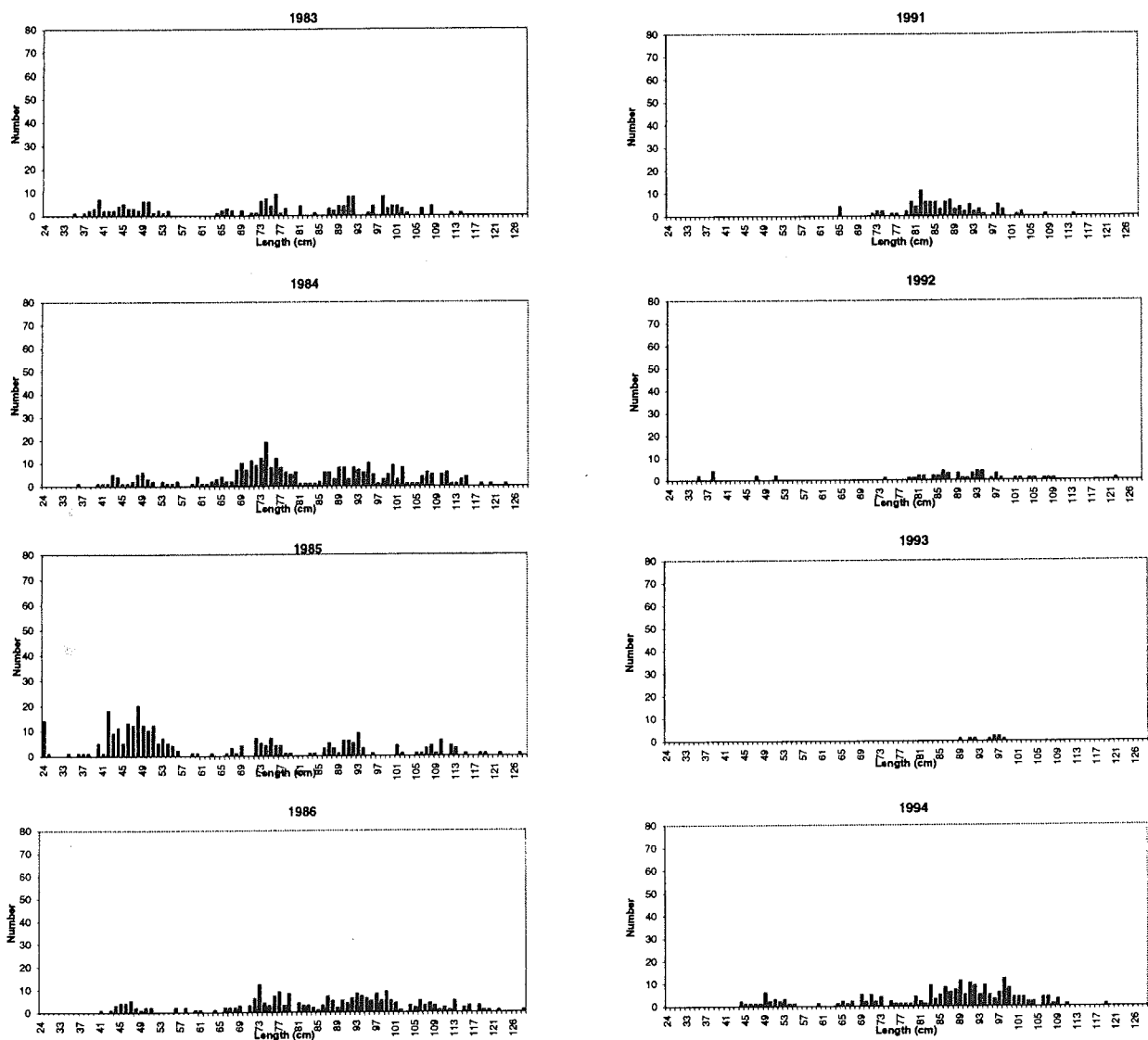


Figure 2.3.2.2. Length distributions of Faroe Bank cod in the spring survey 1983-98.

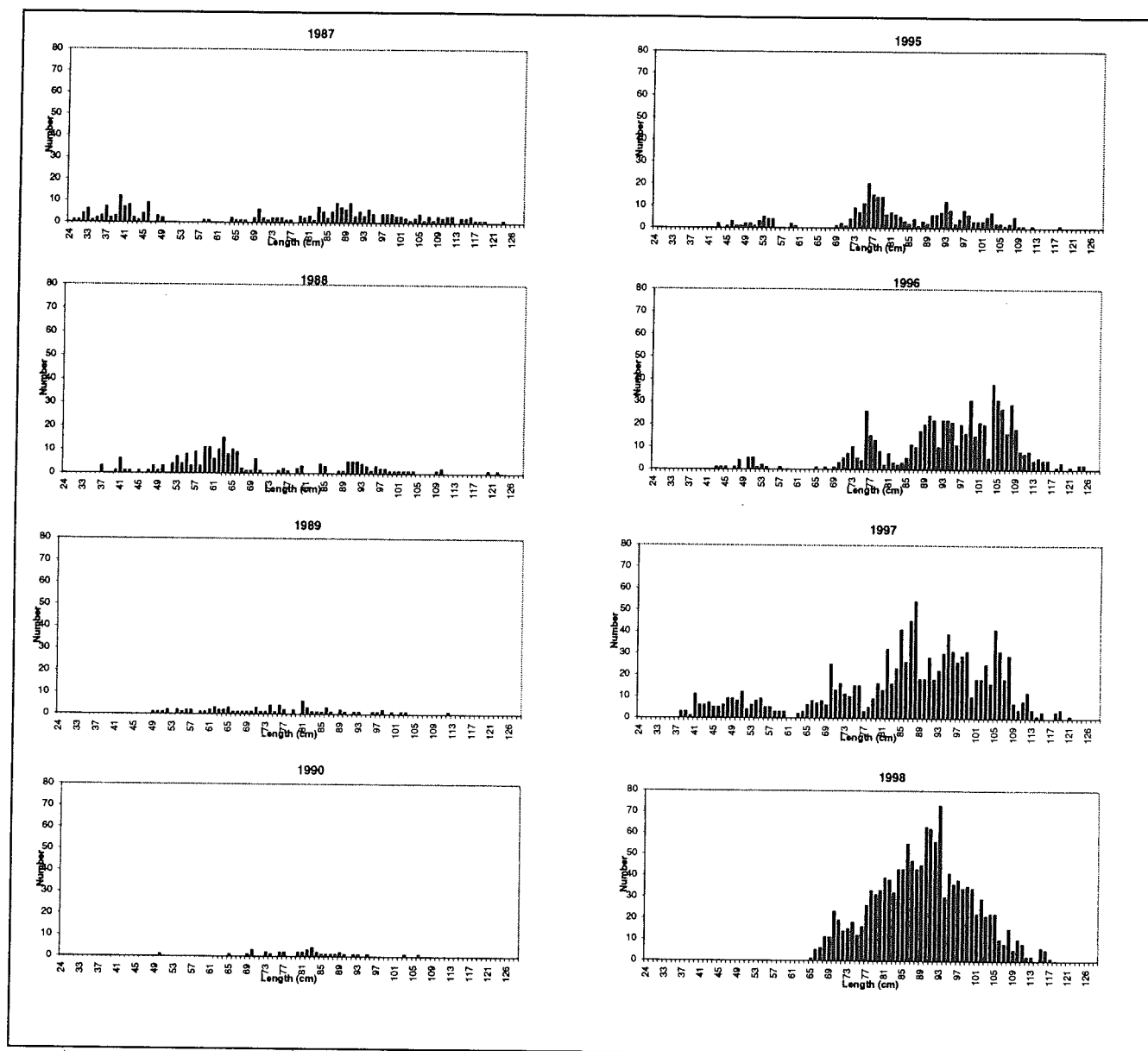


Figure 2.3.2.2 (Cont'd). Length distributions of Faroe Bank cod in the spring survey 1983-98.

## 2.4 Faroe Haddock

### 2.4.1 Landings and trends in the fishery

Officially reported catches of haddock from the Faroe Plateau increased from a low level of 10,000 t in 1982 to 14,000 t in 1987, but later decreased to a very low level in 1993 and 1994 below 4,000 t; a slight increase to about 4,600 t was noted for 1995 but in 1996 and 1997 catches almost doubled each year to about 9,300 t and 16,800 t, respectively (Table 2.4.1). Officially reported catches for 1981–1992 from the Faroe Bank have varied between 500 and 1,600 t (on average 1,000 t), but dropped in 1993–1996 to 300–500 t. The closure of the fishery on the shallower parts of the Bank in 1990 and the introduction of a controlled fishery there since 1993, as described in Section 2.1, reduced the Faroese catches (Table 2.4.2) whereas Scottish catches remained relatively high in 1990–92. However, in the assessment only the fraction of the Scottish catches which have been reported to the Faroese authorities are included. In addition, some minor French catches in Division Vb, reported to the Faroese authorities, and minor Faroese catches of haddock in ICES Sub-Division IIa4 close to the boundary with Sub-Division (see Figure 2.1.15 in last years report), are used in the assessment (Table 2.4.1). In 1997, catches increased again to 1,100 t.

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

The 1997 monthly Faroese landings of haddock by fleet category from Sub-Divisions Vb1 and Vb2, are shown on Figure 2.4.2. On the Plateau the catches are fairly evenly distributed throughout the year with peaks during the spawning season in April and in the winter. On the Faroe Bank the monthly catches show a similar pattern. Although haddock is a bycatch in the pairtrawlers directed fishery for saithe, the pairtrawlers take a very large proportion of the haddock catches on the Faroe Bank; the longliners larger than 100 GRT come in second place. On the Faroe Plateau the longliner catches are substantial except during the summer months when most of the longliners fish in deeper waters and/or outside the Faroese EEZ. The longline fishery mostly targets both cod and haddock, while trawler catches of haddock in the most recent years must be regarded as a by-catch.

### 2.4.2 Catch at age

For the Faroese landings, catch-at-age data were provided for fish taken from the Faroe Plateau and the Faroe Bank. Data from the two areas are combined as the fish are believed to belong to the same stock. The sampling intensity in 1997 was:

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

Samples from each fleet category were disaggregated by season and then raised by the catch proportions to give the 1997 catch at age in numbers for each fleet (Table 2.4.4). Catches of some minor fleets have been included under the others heading. No catch-at-age data were available from other nations fishing in Faroese waters. Therefore, catches by UK trawlers were assumed to have the same age composition as Faroese otter board trawlers greater than 1000 HP. The Norwegian longliners were assumed to have the same age distribution as the Faroese longliners greater than 100 GRT. The most recent data were revised according to the final catch figures. The resulting total catch at age in numbers are given in Table 2.4.4 and Table 2.4.5.

### 2.4.3 Weight at age

Mean weight-at-age data are provided for the Faroese fishery (Table 2.4.6). The sum-of-products check for 1997 was 1.03. Figure 2.4.3 shows that the mean weights-at-age for most age groups, which were declining since the mid-1980s, stabilised at a low level for 2–3 years, increased again in 1993–1995 but have since decreased. By comparing the mean weights at age

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

#### **2.4.4 Maturity at age**

Maturity-at-age data were available from the Faroese Groundfish Surveys 1982–1998. The surveys are carried out in February–March, so the maturity at age is determined just prior to the spawning of haddock in Faroese waters and the determinations of the different maturity stages should be relatively easy. In order to reduce eventual year to year effects due to possible inadequate sampling and at the same time allow for trends in the series, a 3 year running average was used in the assessment at the 1996 meeting of the Working Group.

In 1996, a model described in the 1993 North Western Working Group Report (ICES C.M 1993/Assess:18) was used in order to predict maturity at age. The basic model used was a GLM with a Logit link function describing maturity at age as a function of age, year class strength, mean weight at age and a year effect. Of those factors age, mean weight at age and year were significant and no other variables were needed. However, the predicted maturity at age values from the model were not very different from the observed values so the procedure with running 3 years average was used in the assessment and repeated this year. A comparison of the observed maturity at age series and the running 3 years average series is shown in Figure 2.4.5.

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

#### **2.4.5 Assessment**

##### **2.4.5.1 Tuning and estimates of fishing mortality**

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

Following numerous analyses of all available series of catch and effort data, it was decided at the 1995 meeting of the North Western Working Group to reduce the number of fleets to five and omit some years and ages from the series. Last year only 4 reduced series were used for tuning of the assessment but when the same updated series was used for tuning of this years assessment they resulted in very unlikely low fishing mortalities and very high year class strengths of the most recent year classes (Working Document No.1).

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

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

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

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

The diagnostics from the XSA are shown in Table 2.4.9.

The fishing mortalities from the final XSA run are given in Table 2.4.10 and in Figure 2.4.10A. Up to 1989-91 there was an increase in fishing mortality. This is consistent with the decreasing stock sizes and the information on increased effort (more hooks per set) and decreased hook sizes in the long line fishery. However, from 1992, the mean  $F$  for ages 3-7 decreased again which may be partly explained by the introduction of a fishing ban on the cod spawning grounds before and during the cod spawning season, and the poor economic situation for most fleets which is reflected in the decline in number of fishing days in 1993 and 1994 as seen in Table 2.1.4. In those years, the fishing mortality is estimated to be below the natural mortality of 0.2. A slight increase in mean  $F$  is noted in 1995 but in 1996 and 1997 the fishing mortality increased considerably which also is in agreement with the increased number of fishing days as seen in Table 2.1.4. The mean fishing mortality for ages 3-7 in these two years is estimated at 0.28 and 0.32, respectively.

#### **2.4.5.2 Stock estimates and recruitment**

The stock size in numbers is given in Table 2.4.11 and a summary of the "VPA" with the biomass estimates is given in Table 2.4.12. The spawning stock biomass decreased from over 68 000 t in 1987 to 26 000 t in 1994, increased to 25 000 t in 1995 but have since increased considerably to almost 60 000t in 1997. The decline in the spawning stock began in the late 1970s due to very poor recruitment in those years. The stabilisation in the spawning stock biomass at a relatively high level in the mid-1980s was due to the relatively good 1982 and 1983 year classes, but the decline since then was partly due to poor year classes since the mid-1980s, as well as the pronounced decline in the mean weights at age in the stock. The mean weights at age increased for most ages from 1993-95 but are now decreasing again (Figure 2.4.3). The 1993 year class is estimated to be the second best in the series and the 1994 year class just below the long term average.

#### **2.4.6 Prediction of catch and biomass**

##### **2.4.6.1 Input data**

###### **2.4.6.1.1 Short-term prediction**

The input data for the short-term predictions are given in Table 2.4.15.

The year classes up to 1995 inclusive are from the final VPA while the 1996-97 year classes at age 2 were predicted using the RCT3 program. As input for RCT3, stratified mean-catch-per-hour of age groups 1-3 in the Faroese groundfish survey 1986-98 were used (Table 2.4.13). In order to have the most recent information in the prediction, the survey estimates from the spring were shifted back to the end of the year before. The output from the RCT3 is given in Table 2.4.14. The large discrepancies between the XSA and the RCT3 values for the year classes, especially the 1993 and the 1994 year classes, was discussed in last years report and will not be repeated here. The 1998 year class at age 2 was estimated as the average of the 2 year olds in 1986-99, i.e., 1984-95 year classes from the final VPA, the 1996-97 year classes from the RCT3.

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

The mean weight at age for ages 3-9 in 1998 was predicted using a multiple regression analysis. The mean weight at age was predicted by the parameters age, catch in numbers from the final VPA and the mean weights for the preceding year and the preceding age. The regression analysis showed a significant relationship for the above ages. The mean weight at age for the two year olds in 1998 was calculated as the average weight at age for age 2 in 1995-97. The 1998 mean weights at age were also applied for 1999 and 2000.

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

###### **2.4.6.1.2 Medium-term prediction**

The working group did not make any medium-term predictions.

### 2.4.6.1.3 Long-term Prediction

The input data for the long-term yield and spawning stock biomass (yield per recruit calculations) are listed in Table 2.4.17. Mean weights-at-age are averages for the 1977–1997 period. The maturity ogives are averages for the years 1983–97. The exploitation pattern was derived from the fishing mortality matrix from the final VPA as average  $F$ -values for the long time period. Before averaging the annual fishing mortalities were scaled to let the  $F_{\text{bar}}(\text{age}3-7)$  equal 1.0. In the input table the values are rescaled again to the  $F_{\text{bar}}(\text{age}3-7)$  long term average.

### 2.4.6.2 Biological reference points

The yield- and spawning stock biomass per recruit (age 2) based on the long-term data are shown in Table 2.4.18 and Figure 2.4.10C.  $F_{\text{max}}$  and  $F_{0.1}$  are indicated here as 0.53 and 0.19, respectively. From Figure 2.4.11, showing the recruit/spawning stock relationship, and from Table 2.4.18,  $F_{\text{med}}$  and  $F_{\text{high}}$  were calculated to be 0.25 and 0.83, respectively.

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

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

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

### 2.4.6.3 Projections of catch and biomass

#### 2.4.6.3.1 Short-term prediction

In the light of the performance of the new management system (Section 2.4.7), it is not unrealistic to assume the same level of fishing mortalities in 1998 as in 1997. The prediction was therefore run with a status quo reference  $F$  in 1998. The catch in 1998 is then predicted to be about 14 000 t and continuing with this fishing mortality will result in a 1999 catch of 11 000 t. The SSB will in this case decrease from 50 000 t in 1997 to 42 000 t in 1999, and 36 000 t in 2000. The results of the short-term prediction are shown in Table 2.4.16 and in Figure 2.4.10D.

#### 2.4.6.3.2 Medium-term considerations

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

### 2.4.7 Managements considerations

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

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

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

**Table 2.4.1** Faroe Plateau (Sub-division Vb1) HADDOCK. Nominal catches (tonnes) by countries 1982-1997, as officially reported to ICES, and the total Working Group estimate in Vb.

| Country                               | 1982   | 1983   | 1984   | 1985   | 1986   | 1987   | 1988   | 1989   |
|---------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| Denmark                               | -      | -      | -      | -      | 1      | 8      | 4      | -      |
| Faroe Islands                         | 10,319 | 11,898 | 11,418 | 13,597 | 13,359 | 13,954 | 10,867 | 13,506 |
| France <sup>1</sup>                   | 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) <sup>3</sup>            | 1      | -      | -      | -      | -      | -      | -      | -      |
| United Kingdom                        |        |        |        |        |        |        |        |        |
| Total                                 | 10,335 | 11,912 | 11,448 | 13,641 | 13,391 | 14,000 | 10,939 | 13,617 |
| Working Group estimate <sup>4,5</sup> | 11,937 | 12,894 | 12,378 | 15,143 | 14,477 | 14,882 | 12,178 | 14,325 |

| Country                               | 1990   | 1991  | 1992  | 1993            | 1994            | 1995            | 1996  | 1997 <sup>2</sup> |
|---------------------------------------|--------|-------|-------|-----------------|-----------------|-----------------|-------|-------------------|
| Denmark                               | -      | -     | -     | -               | -               | -               | -     | -                 |
| Faroe Islands                         | 11,106 | 8,074 | 4,655 | 3,622           | 3,675           | 4,549           | 9,152 | 16,585            |
| France <sup>1</sup>                   | -      | -     | 164   | -               | -               | -               | -     | -                 |
| Germany                               | +      | +     | -     | -               | -               | 5               | -     | -                 |
| Norway                                | 94     | 125   | 71    | 28 <sup>2</sup> | 22 <sup>2</sup> | 28 <sup>2</sup> | 164   | 45                |
| UK (Engl. and Wales)                  | 7      | -     | 54    | 81              | 31              | 23              | 5     | ...               |
| UK (Scotland) <sup>3</sup>            | -      | -     | -     | -               | -               | -               | ...   | ...               |
| United Kingdom                        |        |       |       |                 |                 |                 |       | 156 <sup>6</sup>  |
| Total                                 | 11,207 | 8,199 | 4,944 | 3,731           | 3,728           | 4,605           | 9,321 | 16,786            |
| Working Group estimate <sup>4,5</sup> | 11,726 | 8,429 | 5,476 | 4,026           | 4,252           | 4,967           | 9,761 | 17,923            |

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

2) Provisional data

3) From 1983 to 1996 catches included in Sub-division Vb2.

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

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

6) Reported as Division Vb.

**Table 2.4.2** Faroe Bank ( Sub-division Vb2) HADDOCK. Nominal catches (tonnes) by countries, 1982-1997, as officially reported to ICES.

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

| Country                    | 1990         | 1991       | 1992         | 1993           | 1994             | 1995             | 1996             | 1997 <sup>2</sup> |
|----------------------------|--------------|------------|--------------|----------------|------------------|------------------|------------------|-------------------|
| Faroe Islands              | 325          | 217        | 338          | 185            | 353              | 303              | 338              | 1133              |
| France <sup>1</sup>        | -            | -          | -            | -              | -                | -                | -                | -                 |
| Norway                     | 97           | 4          | 23           | 8 <sup>2</sup> | 1 <sup>2</sup>   | 20 <sup>2</sup>  | 40               | 4                 |
| UK (Engl. and Wales)       | -            | -          | +            | +              | ... <sup>1</sup> | ... <sup>1</sup> | ... <sup>1</sup> | ... <sup>1</sup>  |
| UK (Scotland) <sup>3</sup> | 725          | 287        | 869          | 102            | 170              | 39               | 62               | ... <sup>1</sup>  |
| <b>Total</b>               | <b>1,147</b> | <b>508</b> | <b>1,230</b> | <b>295</b>     | <b>524</b>       | <b>362</b>       | <b>440</b>       | <b>1,137</b>      |

1) Catches included in Sub-division Vb1.

2) Provisional data

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

**Table 2.4.3**

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

|                                   | 1985         | 1986         | 1987         | 1988         | 1989         | 1990         | 1991        | 1992        | 1993        | 1994        | 1995        | 1996        | 1997         | Haddock % |
|-----------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|-----------|
| Open boats                        | 7            | 7            | 11           | 2            | 3            | 2            | 3           | 2           | 1           | 1           | 1           | 2           | 2            | 18        |
| Longliners < 100GRT               | 39           | 39           | 39           | 49           | 58           | 60           | 56          | 46          | 24          | 18          | 23          | 28          | 31           | 38        |
| Longliners > 100GRT               | 13           | 12           | 13           | 19           | 18           | 18           | 18          | 22          | 25          | 25          | 38          | 36          | 38           | 21        |
| Otterboard trawlers < 400HP       | 1            | 2            | 2            | 2            | 1            | 1            | 2           | 2           | 8           | 8           | 7           | 6           | 3            | 11        |
| Otter board trawlers 400-999HP    | 6            | 3            | 5            | 4            | 3            | 3            | 1           | 1           | 3           | 2           | 5           | 7           | 6            | 12        |
| Otterboard trawlers > 1000HP      | 8            | 5            | 2            | 2            | 2            | 2            | 2           | 1           | 1           | 3           | 2           | 2           | 3            | 1         |
| Pairtrawlers < 1000HP             | 19           | 20           | 17           | 11           | 7            | 5            | 7           | 11          | 13          | 10          | 8           | 7           | 6            | 7         |
| Pairtrawlers > 1000HP             | 6            | 10           | 9            | 9            | 6            | 8            | 11          | 14          | 22          | 29          | 16          | 13          | 12           | 4         |
| Nets                              | 0            | 0            | 0            | 0            | 0            | 0            | 0           | 0           | 0           | 0           | 0           | 0           | 0            | 0         |
| Jigging                           | 1            | 0            | 0            | 0            | 1            | 1            | 1           | 0           | 0           | 0           | 0           | 1           | 1            | 1         |
| Industry trawlers                 | 0            | 1            | 1            | 2            | 1            | 1            | 1           | 1           | 3           | 3           | 0           | 0           | 0            | 5         |
| Other gears                       | 0            | 0            | 0            | 0            | 0            | 0            | 0           | 0           | 0           | 0           | 0           | 0           | 0            | 1         |
| <b>Total catch, tonnes gutted</b> | <b>13570</b> | <b>12967</b> | <b>13829</b> | <b>10697</b> | <b>12866</b> | <b>10319</b> | <b>7469</b> | <b>4103</b> | <b>3275</b> | <b>3629</b> | <b>4371</b> | <b>8535</b> | <b>15890</b> |           |

Table 2.4.4

**Haddock in ICES Division Vb 1997**  
**Catch at age in numbers by fleet category**

| Age       | Vb1<br>Open<br>Boats | Vb1<br>LLiners<br>< 100GRT | Vb1<br>LLiners<br>> 100GRT | Vb1<br>OB. trawl.<br>< 400HP | Vb1<br>OB. trawl.<br>400-999HP | Vb1<br>OB. trawl.<br>> 1000HP | Vb1<br>Pair trawl.<br>< 1000HP | Vb1<br>Pair trawl.<br>> 1000HP | Vb1<br>Others | Vb1<br>All Faroese<br>Fleets | Vb2<br>LLiners | Vb2<br>OB. Trawl. | Vb2<br>All<br>Pair trawl. | Vb2<br>All<br>Others |
|-----------|----------------------|----------------------------|----------------------------|------------------------------|--------------------------------|-------------------------------|--------------------------------|--------------------------------|---------------|------------------------------|----------------|-------------------|---------------------------|----------------------|
| 1         | 0                    | 0                          | 0                          | 0                            | 0                              | 0                             | 0                              | 0                              | 0             | 0                            | 0              | 0                 | 0                         | 0                    |
| 2         | 1                    | 26                         | 26                         | 1                            | 9                              | 0                             | 0                              | 0                              | 1             | 63                           | 13             | 0                 | 0                         | 1                    |
| 3         | 60                   | 1139                       | 919                        | 48                           | 287                            | 38                            | 69                             | 114                            | 25            | 2701                         | 82             | 14                | 92                        | 4                    |
| 4         | 160                  | 3499                       | 3552                       | 271                          | 593                            | 257                           | 597                            | 952                            | 108           | 9987                         | 134            | 34                | 232                       | 6                    |
| 5         | 6                    | 126                        | 304                        | 12                           | 19                             | 22                            | 56                             | 84                             | 7             | 635                          | 12             | 8                 | 43                        | 1                    |
| 6         | 1                    | 11                         | 56                         | 4                            | 6                              | 2                             | 6                              | 5                              | 1             | 94                           | 4              | 2                 | 14                        | 0                    |
| 7         | 1                    | 14                         | 65                         | 3                            | 5                              | 2                             | 6                              | 11                             | 1             | 108                          | 3              | 1                 | 9                         | 0                    |
| 8         | 1                    | 17                         | 41                         | 7                            | 6                              | 2                             | 4                              | 11                             | 1             | 91                           | 1              | 0                 | 1                         | 0                    |
| 9         | 2                    | 37                         | 109                        | 12                           | 12                             | 4                             | 8                              | 22                             | 2             | 210                          | 2              | 1                 | 4                         | 0                    |
| 10        | 3                    | 46                         | 85                         | 9                            | 13                             | 5                             | 5                              | 25                             | 2             | 193                          | 5              | 1                 | 8                         | 0                    |
| 11        | 1                    | 14                         | 78                         | 6                            | 5                              | 2                             | 7                              | 8                              | 1             | 123                          | 4              | 1                 | 8                         | 0                    |
| 12        | 1                    | 10                         | 24                         | 1                            | 4                              | 1                             | 1                              | 4                              | 1             | 47                           | 2              | 0                 | 4                         | 0                    |
| 13        | 0                    | 14                         | 18                         | 1                            | 4                              | 1                             | 3                              | 4                              | 1             | 46                           | 0              | 0                 | 2                         | 0                    |
| 14        | 1                    | 11                         | 28                         | 4                            | 3                              | 0                             | 1                              | 2                              | 1             | 51                           | 0              | 0                 | 0                         | 0                    |
| 15        | 0                    | 5                          | 5                          | 0                            | 1                              | 0                             | 0                              | 4                              | 0             | 15                           | 0              | 0                 | 0                         | 0                    |
| Total no. | 238                  | 4969                       | 5310                       | 378                          | 966                            | 337                           | 765                            | 1247                           | 152           | 14363                        | 263            | 62                | 417                       | 13                   |
| Catch, t. | 230                  | 4834                       | 5737                       | 443                          | 910                            | 378                           | 826                            | 1424                           | 158           | 14940                        | 345            | 86                | 574                       | 17                   |

Notes:

Numbers in 1000'

Catch, gutted weight in tonnes

Others includes netters, jiggers, other small categories and catches not otherwise accounted for

LLiners = Longliners OB. trawl. = Otterboard trawlers

Pair Trawl. = Pair trawlers

Table 2.4.5

Run title : Haddock Faroes Vb (run: XSAJAK10/X10)

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| Table 1 |          | Catch numbers at age |       | Numbers*10**-3 |       |       |       |       |       |  |
|---------|----------|----------------------|-------|----------------|-------|-------|-------|-------|-------|--|
| YEAR    |          | 1961                 | 1962  | 1963           | 1964  | 1965  | 1966  | 1967  |       |  |
| 0       | AGE      | 2                    | 7932  | 9631           | 13552 | 2284  | 1368  | 1081  | 1425  |  |
|         |          | 3                    | 7330  | 13977          | 8907  | 7457  | 4286  | 3304  | 2405  |  |
|         |          | 4                    | 5134  | 5233           | 7403  | 3899  | 5133  | 4804  | 2599  |  |
|         |          | 5                    | 1937  | 2361           | 2242  | 2360  | 1443  | 2710  | 1785  |  |
|         |          | 6                    | 1305  | 1407           | 1539  | 1120  | 1209  | 1112  | 1426  |  |
|         |          | 7                    | 838   | 868            | 860   | 728   | 673   | 740   | 631   |  |
|         |          | 8                    | 236   | 270            | 257   | 198   | 1345  | 180   | 197   |  |
|         |          | 9                    | 59    | 72             | 75    | 49    | 43    | 54    | 52    |  |
|         |          | +gp                  | 0     | 0              | 0     | 0     | 0     | 0     | 0     |  |
|         |          | TOTALNUM             | 24771 | 33819          | 34835 | 18095 | 15500 | 13985 | 10520 |  |
|         | TONSLAND | 20831                | 27151 | 27571          | 19490 | 18479 | 18766 | 13381 |       |  |
|         | SOPCOF % | 89                   | 90    | 90             | 101   | 94    | 109   | 102   |       |  |

| Table 1 |          | Catch numbers at age |       | Numbers*10**-3 |       |       |       |       |       |       |       |       |
|---------|----------|----------------------|-------|----------------|-------|-------|-------|-------|-------|-------|-------|-------|
| YEAR    |          | 1968                 | 1969  | 1970           | 1971  | 1972  | 1973  | 1974  | 1975  | 1976  | 1977  |       |
| 0       | AGE      | 2                    | 5881  | 2384           | 1728  | 717   | 750   | 3300  | 5633  | 7337  | 4396  | 255   |
|         |          | 3                    | 4097  | 7539           | 4855  | 4393  | 3744  | 8388  | 2899  | 7952  | 7858  | 4039  |
|         |          | 4                    | 2812  | 4567           | 6581  | 4727  | 4179  | 1236  | 3970  | 2097  | 6798  | 5168  |
|         |          | 5                    | 1524  | 1565           | 1624  | 3267  | 2706  | 2786  | 451   | 1371  | 1251  | 4918  |
|         |          | 6                    | 1526  | 1485           | 1383  | 1292  | 1171  | 916   | 976   | 247   | 1189  | 2128  |
|         |          | 7                    | 923   | 1224           | 1099  | 864   | 696   | 1051  | 466   | 352   | 298   | 946   |
|         |          | 8                    | 230   | 378            | 326   | 222   | 180   | 150   | 535   | 237   | 720   | 443   |
|         |          | 9                    | 68    | 114            | 68    | 147   | 113   | 68    | 68    | 419   | 258   | 731   |
|         |          | +gp                  | 0     | 0              | 0     | 0     | 0     | 11    | 147   | 187   | 318   | 855   |
|         |          | TOTALNUM             | 17061 | 19256          | 17664 | 15629 | 13539 | 17906 | 15145 | 20199 | 23086 | 19483 |
|         | TONSLAND | 17852                | 23272 | 21361          | 19393 | 16485 | 17976 | 14773 | 20715 | 26211 | 25555 |       |
|         | SOPCOF % | 103                  | 108   | 103            | 99    | 98    | 98    | 97    | 117   | 107   | 98    |       |

| Table 1 |          | Catch numbers at age |       | Numbers*10**-3 |       |       |       |       |       |       |       |       |
|---------|----------|----------------------|-------|----------------|-------|-------|-------|-------|-------|-------|-------|-------|
| YEAR    |          | 1978                 | 1979  | 1980           | 1981  | 1982  | 1983  | 1984  | 1985  | 1986  | 1987  |       |
| 0       | AGE      | 2                    | 32    | 1              | 143   | 74    | 539   | 441   | 1195  | 985   | 230   | 283   |
|         |          | 3                    | 1022  | 1161           | 58    | 455   | 934   | 1969  | 1561  | 4553  | 2549  | 1718  |
|         |          | 4                    | 4248  | 1754           | 3724  | 202   | 784   | 383   | 2462  | 2196  | 4452  | 3565  |
|         |          | 5                    | 4054  | 3341           | 2583  | 2586  | 298   | 422   | 147   | 1242  | 1522  | 2972  |
|         |          | 6                    | 1841  | 1850           | 2496  | 1354  | 2182  | 93    | 234   | 169   | 738   | 1114  |
|         |          | 7                    | 717   | 772            | 1568  | 1559  | 973   | 1444  | 42    | 91    | 39    | 529   |
|         |          | 8                    | 635   | 212            | 660   | 608   | 1166  | 740   | 861   | 61    | 130   | 83    |
|         |          | 9                    | 243   | 155            | 99    | 177   | 1283  | 947   | 388   | 503   | 71    | 48    |
|         |          | +gp                  | 312   | 74             | 86    | 36    | 214   | 795   | 968   | 973   | 712   | 334   |
|         |          | TOTALNUM             | 13104 | 9320           | 11417 | 7051  | 8373  | 7234  | 7858  | 10773 | 10443 | 10646 |
|         | TONSLAND | 19200                | 12418 | 15016          | 12233 | 11937 | 12894 | 12378 | 15143 | 14477 | 14882 |       |
|         | SOPCOF % | 99                   | 104   | 100            | 109   | 92    | 106   | 106   | 106   | 101   | 102   |       |

| Table 1 |          | Catch numbers at age |       | Numbers*10**-3 |      |      |      |      |      |      |       |       |
|---------|----------|----------------------|-------|----------------|------|------|------|------|------|------|-------|-------|
| YEAR    |          | 1988                 | 1989  | 1990           | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997  |       |
| 0       | AGE      | 2                    | 655   | 63             | 105  | 77   | 40   | 113  | 277  | 810  | 330   | 77    |
|         |          | 3                    | 444   | 1518           | 1275 | 1044 | 154  | 298  | 191  | 456  | 5298  | 2913  |
|         |          | 4                    | 2463  | 658            | 1921 | 1774 | 776  | 274  | 307  | 237  | 1032  | 10517 |
|         |          | 5                    | 3036  | 2787           | 768  | 1248 | 1120 | 554  | 153  | 227  | 181   | 710   |
|         |          | 6                    | 2140  | 2554           | 1737 | 651  | 959  | 538  | 423  | 133  | 165   | 116   |
|         |          | 7                    | 475   | 1976           | 1909 | 1101 | 335  | 474  | 427  | 298  | 163   | 123   |
|         |          | 8                    | 151   | 541            | 885  | 698  | 373  | 131  | 383  | 293  | 273   | 93    |
|         |          | 9                    | 18    | 133            | 270  | 317  | 401  | 201  | 125  | 264  | 237   | 220   |
|         |          | +gp                  | 128   | 81             | 108  | 32   | 162  | 185  | 301  | 298  | 399   | 517   |
|         |          | TOTALNUM             | 9510  | 10311          | 8978 | 6942 | 4320 | 2768 | 2587 | 3016 | 8078  | 15286 |
|         | TONSLAND | 12178                | 14325 | 11726          | 8429 | 5476 | 4026 | 4252 | 4967 | 9761 | 17923 |       |
|         | SOPCOF % | 97                   | 100   | 102            | 106  | 106  | 104  | 100  | 103  | 100  | 103   |       |

**Table 2.4.6**

Run title : Haddock Faroes Vb (run: XSAJAK10/X10)

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| Table 2 |          | Catch weights at age (kg) |        |        |        |        |       |        |
|---------|----------|---------------------------|--------|--------|--------|--------|-------|--------|
| YEAR    |          | 1961                      | 1962   | 1963   | 1964   | 1965   | 1966  | 1967   |
| AGE     | 2        | 0.47                      | 0.47   | 0.47   | 0.47   | 0.47   | 0.47  | 0.47   |
|         | 3        | 0.73                      | 0.73   | 0.73   | 0.73   | 0.73   | 0.73  | 0.73   |
|         | 4        | 1.13                      | 1.13   | 1.13   | 1.13   | 1.13   | 1.13  | 1.13   |
|         | 5        | 1.55                      | 1.55   | 1.55   | 1.55   | 1.55   | 1.55  | 1.55   |
|         | 6        | 1.97                      | 1.97   | 1.97   | 1.97   | 1.97   | 1.97  | 1.97   |
|         | 7        | 2.41                      | 2.41   | 2.41   | 2.41   | 2.41   | 2.41  | 2.41   |
|         | 8        | 2.76                      | 2.76   | 2.76   | 2.76   | 2.76   | 2.76  | 2.76   |
|         | 9        | 3.07                      | 3.07   | 3.07   | 3.07   | 3.07   | 3.07  | 3.07   |
|         | +gp      | 3.55                      | 3.55   | 3.55   | 3.55   | 3.55   | 3.55  | 3.55   |
| 0       | SOPCOFAC | 0.8938                    | 0.9011 | 0.8964 | 1.0131 | 0.9401 | 1.092 | 1.0166 |

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

Table 2.4.6 (Continued)

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

| Table 2 |          | Catch weights at age (kg) |        |        |        |        |        |        |        |        |       |
|---------|----------|---------------------------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| YEAR    |          | 1988                      | 1989   | 1990   | 1991   | 1992   | 1993   | 1994   | 1995   | 1996   | 1997  |
| AGE     | 2        | 0.501                     | 0.58   | 0.438  | 0.547  | 0.525  | 0.755  | 0.754  | 0.666  | 0.534  | 0.519 |
|         | 3        | 0.781                     | 0.779  | 0.699  | 0.693  | 0.724  | 0.982  | 1.103  | 1.054  | 0.858  | 0.771 |
|         | 4        | 0.974                     | 0.923  | 0.939  | 0.884  | 0.817  | 1.027  | 1.254  | 1.489  | 1.459  | 1.066 |
|         | 5        | 1.363                     | 1.207  | 1.204  | 1.086  | 1.038  | 1.192  | 1.465  | 1.779  | 1.993  | 1.799 |
|         | 6        | 1.68                      | 1.564  | 1.384  | 1.276  | 1.249  | 1.378  | 1.593  | 1.94   | 2.33   | 2.27  |
|         | 7        | 1.975                     | 1.746  | 1.564  | 1.477  | 1.43   | 1.643  | 1.804  | 2.182  | 2.351  | 2.34  |
|         | 8        | 2.344                     | 2.086  | 1.818  | 1.574  | 1.564  | 1.796  | 2.049  | 2.357  | 2.469  | 2.475 |
|         | 9        | 2.248                     | 2.424  | 2.168  | 1.93   | 1.633  | 1.971  | 2.225  | 2.49   | 2.777  | 2.501 |
|         | +gp      | 3.295                     | 2.514  | 2.335  | 2.153  | 2.126  | 2.24   | 2.423  | 2.678  | 2.582  | 2.669 |
| 0       | SOPCOFAC | 0.9695                    | 1.0025 | 1.0195 | 1.0635 | 1.0554 | 1.0361 | 0.9969 | 1.0281 | 1.0044 | 1.025 |

**Table 2.4.7**

Run title : Haddock Faroes Vb (run: XSAJAK10/X10)

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Table 5 Proportion mature at age

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

Table 5 Proportion mature at age

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

Table 5 Proportion mature at age

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

Table 5 Proportion mature at age

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

**Table 2.4.8**

Haddock in the Faroe Grounds (Fishing Area Vb)

(run name : XSAJAK10)

| 103    |              |                         |         |            |          |          |        |
|--------|--------------|-------------------------|---------|------------|----------|----------|--------|
| FLT35: | LL94A:       | lline<100GRT            | (Catch: | Thousands) | (Effort: | 1)       |        |
| 1985   | 1997         |                         |         |            |          |          |        |
| 1      | 1            | 0                       | 1       |            |          |          |        |
| 2      | 4            |                         |         |            |          |          |        |
|        | 7558         | 613                     | 2542    | 787        |          |          |        |
|        | 6692         | 167                     | 1435    | 1747       |          |          |        |
|        | 6728         | 200                     | 1027    | 1819       |          |          |        |
|        | 8753         | 599                     | 311     | 1557       |          |          |        |
|        | 12804        | 48                      | 1042    | 433        |          |          |        |
|        | 14543        | 94                      | 993     | 1141       |          |          |        |
|        | 14801        | 53                      | 733     | 1165       |          |          |        |
|        | 10599        | 35                      | 103     | 419        |          |          |        |
|        | 7497         | 31                      | 92      | 80         |          |          |        |
|        | 7625         | 127                     | 47      | 50         |          |          |        |
|        | 9582         | 470                     | 133     | 45         |          |          |        |
|        | 12546        | 154                     | 2169    | 198        |          |          |        |
|        | 13706        | 26                      | 1140    | 3501       |          |          |        |
| FLT38: | PT97:        | Pair trawlers > 1000 HP | (Catch: | Thousands) | (Effort: | 1)       |        |
| 1988   | 1997         |                         |         |            |          |          |        |
| 1      | 1            | 0                       | 1       |            |          |          |        |
| 5      | 6            |                         |         |            |          |          |        |
|        | 6034         | 251                     | 194     |            |          |          |        |
|        | 5127         | 162                     | 156     |            |          |          |        |
|        | 7491         | 57                      | 156     |            |          |          |        |
|        | 7875         | 181                     | 104     |            |          |          |        |
|        | 7243         | 107                     | 150     |            |          |          |        |
|        | 6335         | 82                      | 111     |            |          |          |        |
|        | 6227         | 32                      | 133     |            |          |          |        |
|        | 6069         | 33                      | 18      |            |          |          |        |
|        | 6551         | 21                      | 18      |            |          |          |        |
|        | 6406         | 84                      | 5       |            |          |          |        |
| FLT41: | 5 longliners | reduced                 | (Catch: | Thousands) | (Effort: | Unknown) |        |
| 1990   | 1997         |                         |         |            |          |          |        |
| 1      | 1            | 0                       | 1       |            |          |          |        |
| 4      | 9            |                         |         |            |          |          |        |
|        | 4066         | 34.229                  | 15.815  | 33.796     | 41.161   | 20.256   | 4.983  |
|        | 3516         | 38.99                   | 33.442  | 19.045     | 33.442   | 19.945   | 10.647 |
|        | 3308         | 13.634                  | 32.011  | 27.862     | 14.079   | 10.522   | 9.04   |
|        | 3684         | 10.355                  | 23.345  | 25.227     | 23.533   | 3.765    | 8.095  |
|        | 1601         | 7.729                   | 3.612   | 8.233      | 8.569    | 7.309    | 2.604  |
|        | 1297         | 3.035                   | 3.771   | 2.529      | 4.737    | 4.967    | 3.633  |
|        | 3915         | 28.012                  | 5.198   | 4.765      | 3.249    | 8.014    | 7.003  |
|        | 3240         | 125.759                 | 10.763  | 1.983      | 2.301    | 1.452    | 3.859  |

**Table 2.4.9**

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

Extended Survivors Analysis

Haddock Faroes Vb (run: XSAJAK10/X10)

CPUE data from file /users/fish/ifad/ifapwork/nwwg/had\_faro/FLEET.X10

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

| Fleet,                | First, Last, | First, Last, | Alpha, | Beta  |
|-----------------------|--------------|--------------|--------|-------|
|                       | year, year,  | age, age     |        |       |
| FLT35: LL94A: lline<, | 1985, 1997,  | 2, 4,        | .000,  | 1.000 |
| FLT38: PT97: Pair tr, | 1988, 1997,  | 5, 6,        | .000,  | 1.000 |
| FLT41: 5 longliners , | 1990, 1997,  | 4, 9,        | .000,  | 1.000 |

Time series weights :

Tapered time weighting applied  
Power = 3 over 20 years

Catchability analysis :

Catchability dependent on stock size for ages < 3

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

Catchability independent of age for ages >= 6

Terminal population estimation :

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

S.E. of the mean to which the estimates are shrunk = .700

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

Prior weighting not applied

Tuning converged after 58 iterations

Regression weights

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

Fishing mortalities

| Age, | 1988, | 1989, | 1990, | 1991, | 1992, | 1993, | 1994, | 1995, | 1996, | 1997 |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 2,   | .037, | .004, | .011, | .028, | .014, | .062, | .042, | .014, | .015, | .026 |
| 3,   | .067, | .112, | .116, | .149, | .073, | .133, | .142, | .091, | .123, | .179 |
| 4,   | .182, | .134, | .201, | .235, | .157, | .180, | .197, | .263, | .307, | .381 |
| 5,   | .240, | .324, | .228, | .195, | .228, | .161, | .144, | .219, | .330, | .359 |
| 6,   | .278, | .327, | .344, | .308, | .226, | .163, | .177, | .180, | .245, | .365 |
| 7,   | .227, | .448, | .435, | .382, | .258, | .166, | .188, | .183, | .351, | .291 |
| 8,   | .235, | .438, | .370, | .279, | .214, | .151, | .196, | .191, | .254, | .347 |
| 9,   | .234, | .336, | .408, | .218, | .256, | .171, | .211, | .201, | .233, | .335 |

**Table 2.4.9 (Cont'd)**

XSA population numbers (Thousands)

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

Estimated population abundance at 1st Jan 1998

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

Taper weighted geometric mean of the VPA populations:

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

Standard error of the weighted Log(VPA populations) :

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

Log catchability residuals.

Fleet : FLT35: LL94A: lline<100GRT

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

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

| Age ,       | 3,        | 4         |
|-------------|-----------|-----------|
| Mean Log q, | -12.1319, | -11.7575, |
| S.E(Log q), | .3423,    | .4051,    |

Regression statistics :

Ages with q dependent on year class strength

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

2, 1.14, -.513, 14.26, .61, 13, .93, -13.66,

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

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

3, .91, 1.080, 11.85, .94, 13, .31, -12.13,  
4, .78, 3.968, 11.10, .97, 13, .20, -11.76,

**Table 2.4.9 (Cont'd)**

Fleet : FLT38: PT97: Pair trawler > 1000 HP

|     |                                      |       |       |       |       |       |       |       |       |      |
|-----|--------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| Age | , 1988,                              | 1989, | 1990, | 1991, | 1992, | 1993, | 1994, | 1995, | 1996, | 1997 |
| 2   | , No data for this fleet at this age |       |       |       |       |       |       |       |       |      |
| 3   | , No data for this fleet at this age |       |       |       |       |       |       |       |       |      |
| 4   | , No data for this fleet at this age |       |       |       |       |       |       |       |       |      |
| 5   | , -.22,                              | -.11, | -.59, | -.13, | -.31, | -.08, | .17,  | .25,  | .36,  | .48  |
| 6   | , -.09,                              | -.16, | -.11, | .31,  | .06,  | .15,  | .67,  | -.13, | -.11, | -.62 |
| 7   | , No data for this fleet at this age |       |       |       |       |       |       |       |       |      |
| 8   | , No data for this fleet at this age |       |       |       |       |       |       |       |       |      |
| 9   | , No data for this fleet at this age |       |       |       |       |       |       |       |       |      |

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

|             |           |           |   |
|-------------|-----------|-----------|---|
| Age         | ,         | 5,        | 6 |
| Mean Log q, | -12.4141, | -12.3010, |   |
| S.E(Log q), | .3323,    | .3509,    |   |

Regression statistics :

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

|            |           |              |          |         |          |              |
|------------|-----------|--------------|----------|---------|----------|--------------|
| Age, Slope | , t-value | , Intercept, | RSquare, | No Pts, | Reg s.e, | Mean Q       |
| 5,         | 1.28,     | -2.407,      | 13.62,   | .91,    | 10,      | .34, -12.41, |
| 6,         | .89,      | 1.123,       | 11.82,   | .94,    | 10,      | .31, -12.30, |

Fleet : FLT41: 5 longliners

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

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

|             |           |           |           |           |           |           |           |
|-------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Age         | ,         | 4,        | 5,        | 6,        | 7,        | 8,        | 9         |
| Mean Log q, | -13.3237, | -13.1845, | -13.0896, | -13.0896, | -13.0896, | -13.0896, | -13.0896, |
| S.E(Log q), | .4724,    | .2762,    | .1623,    | .2716,    | .2554,    | .1629,    |           |

Regression statistics :

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

|            |           |              |          |         |          |              |
|------------|-----------|--------------|----------|---------|----------|--------------|
| Age, Slope | , t-value | , Intercept, | RSquare, | No Pts, | Reg s.e, | Mean Q       |
| 4,         | 1.35,     | -2.020,      | 15.03,   | .85,    | 8,       | .53, -13.32, |
| 5,         | 1.29,     | -2.342,      | 14.74,   | .92,    | 8,       | .28, -13.18, |
| 6,         | 1.03,     | -.380,       | 13.23,   | .97,    | 8,       | .18, -13.09, |
| 7,         | .85,      | 1.818,       | 12.19,   | .96,    | 8,       | .18, -12.98, |
| 8,         | .84,      | 1.661,       | 12.25,   | .95,    | 8,       | .18, -13.17, |
| 9,         | 1.19,     | -1.006,      | 14.29,   | .83,    | 8,       | .18, -13.14, |

**Table 2.4.9 (Cont'd)**

Terminal year survivor and F summaries :

Age 2 Catchability dependent on age and year class strength

Year class = 1995

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

Weighted prediction :

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

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

Year class = 1994

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

Weighted prediction :

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

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

Year class = 1993

| Fleet,                | Estimated,<br>Survivors, | Int,<br>s.e, | Ext,<br>s.e, | Var,<br>Ratio, | N, Scaled,<br>, Weights, | Estimated<br>F |
|-----------------------|--------------------------|--------------|--------------|----------------|--------------------------|----------------|
| FLT35: LL94A: lline<, | 18670.,                  | .265,        | .156,        | .59,           | 3, .657,                 | .412           |
| FLT38: PT97: Pair tr, | 1.,                      | .000,        | .000,        | .00,           | 0, .000,                 | .000           |
| FLT41: 5 longliners , | 17501.,                  | .502,        | .000,        | .00,           | 1, .196,                 | .434           |
| F shrinkage mean ,    | 38303.,                  | .70,,,,      |              |                | .147,                    | .222           |

Weighted prediction :

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

**Table 2.4.9 (Cont'd)**

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

Year class = 1992

| Fleet,                | Estimated, | Int,    | Ext,  | Var,   | N, Scaled, | Estimated |
|-----------------------|------------|---------|-------|--------|------------|-----------|
| ,                     | Survivors, | s.e,    | s.e,  | Ratio, | , Weights, | F         |
| FLT35: LL94A: lline<, | 898.,      | .264,   | .259, | .98,   | 3, .285,   | .540      |
| FLT38: PT97: Pair tr, | 2410.,     | .350,   | .000, | .00,   | 1, .233,   | .236      |
| FLT41: 5 longliners , | 1426.,     | .260,   | .153, | .59,   | 2, .399,   | .372      |
| F shrinkage mean ,    | 2645.,     | .70,,,, |       |        | .083,      | .217      |

Weighted prediction :

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

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

Year class = 1991

| Fleet,                | Estimated, | Int,    | Ext,  | Var,   | N, Scaled, | Estimated |
|-----------------------|------------|---------|-------|--------|------------|-----------|
| ,                     | Survivors, | s.e,    | s.e,  | Ratio, | , Weights, | F         |
| FLT35: LL94A: lline<, | 190.,      | .265,   | .163, | .61,   | 3, .162,   | .440      |
| FLT38: PT97: Pair tr, | 198.,      | .257,   | .487, | 1.89,  | 2, .296,   | .426      |
| FLT41: 5 longliners , | 263.,      | .200,   | .137, | .69,   | 3, .476,   | .336      |
| F shrinkage mean ,    | 476.,      | .70,,,, |       |        | .066,      | .199      |

Weighted prediction :

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

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

Year class = 1990

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

Weighted prediction :

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

**Table 2.4.9 (Cont'd)**

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

Year class = 1989

| Fleet,                | Estimated, | Int,    | Ext,  | Var,   | N, Scaled, | Estimated |
|-----------------------|------------|---------|-------|--------|------------|-----------|
| ,                     | Survivors, | s.e,    | s.e,  | Ratio, | , Weights, | F         |
| FLT35: LL94A: lline<, | 178.,      | .269,   | .024, | .09,   | 3, .113,   | .387      |
| FLT38: PT97: Pair tr, | 207.,      | .255,   | .151, | .59,   | 2, .170,   | .341      |
| FLT41: 5 longliners , | 196.,      | .150,   | .094, | .63,   | 5, .659,   | .357      |
| F shrinkage mean ,    | 376.,      | .70,,,, |       |        | .058,      | .202      |

Weighted prediction :

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

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

Year class = 1988

| Fleet,                | Estimated, | Int,    | Ext,  | Var,   | N, Scaled, | Estimated |
|-----------------------|------------|---------|-------|--------|------------|-----------|
| ,                     | Survivors, | s.e,    | s.e,  | Ratio, | , Weights, | F         |
| FLT35: LL94A: lline<, | 555.,      | .273,   | .153, | .56,   | 3, .089,   | .306      |
| FLT38: PT97: Pair tr, | 681.,      | .257,   | .378, | 1.47,  | 2, .139,   | .257      |
| FLT41: 5 longliners , | 468.,      | .136,   | .065, | .48,   | 6, .720,   | .355      |
| F shrinkage mean ,    | 474.,      | .70,,,, |       |        | .052,      | .351      |

Weighted prediction :

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

Table 2.4.10

Run title : Haddock Faroes Vb (run: XSAJAK10/X10)

At 1-May-98 16:38:21

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

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

Table 8 Fishing mortality (F) at age

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

Table 8 Fishing mortality (F) at age

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

Table 8 Fishing mortality (F) at age

| YEAR   |      | 1988   | 1989   | 1990   | 1991   | 1992   | 1993   | 1994   | 1995   | 1996   | 1997   |
|--------|------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| AGE    | 2    | 0.0366 | 0.0044 | 0.0113 | 0.0284 | 0.0136 | 0.0622 | 0.0425 | 0.0144 | 0.0151 | 0.0257 |
|        | 3    | 0.0669 | 0.1116 | 0.1161 | 0.1486 | 0.0731 | 0.1329 | 0.1421 | 0.0913 | 0.1229 | 0.1787 |
|        | 4    | 0.1823 | 0.1338 | 0.2014 | 0.2347 | 0.1571 | 0.1800 | 0.1970 | 0.2632 | 0.3068 | 0.3814 |
|        | 5    | 0.2400 | 0.3236 | 0.2282 | 0.1948 | 0.2282 | 0.1606 | 0.1445 | 0.2190 | 0.3297 | 0.3592 |
|        | 6    | 0.2777 | 0.3267 | 0.3436 | 0.3084 | 0.2255 | 0.1630 | 0.1773 | 0.1804 | 0.2450 | 0.3649 |
|        | 7    | 0.2271 | 0.4478 | 0.4349 | 0.3820 | 0.2575 | 0.1657 | 0.1882 | 0.1827 | 0.3508 | 0.2914 |
|        | 8    | 0.2353 | 0.4379 | 0.3696 | 0.2788 | 0.2138 | 0.1512 | 0.1959 | 0.1907 | 0.2539 | 0.3465 |
|        | 9    | 0.2336 | 0.3360 | 0.4078 | 0.2177 | 0.2557 | 0.1707 | 0.2109 | 0.2011 | 0.2326 | 0.3348 |
|        | +gp  | 0.2336 | 0.3360 | 0.4078 | 0.2177 | 0.2557 | 0.1707 | 0.2109 | 0.2011 | 0.2326 | 0.3348 |
| 0 FBAR | 3- 7 | 0.1988 | 0.2687 | 0.2649 | 0.2537 | 0.1883 | 0.1604 | 0.1698 | 0.1873 | 0.2711 | 0.3151 |

Table 2.4.11

Run title : Haddock Faroes Vb (run: XSAJAK10/X10)

At 1-May-98 16:38:21

Terminal Fs derived using XSA (With F shrinkage)

| Table 10 |       | Stock number at age (start of year) |        |       | Numbers*10**-3 |       |       |       |
|----------|-------|-------------------------------------|--------|-------|----------------|-------|-------|-------|
| YEAR     |       | 1961                                | 1962   | 1963  | 1964           | 1965  | 1966  | 1967  |
| AGE      | 2     | 51279                               | 38537  | 47362 | 30110          | 22644 | 20206 | 25356 |
|          | 3     | 23796                               | 34806  | 22837 | 26515          | 22586 | 17302 | 15565 |
|          | 4     | 16517                               | 12850  | 15850 | 10638          | 14961 | 14613 | 11176 |
|          | 5     | 6028                                | 8877   | 5786  | 6278           | 5182  | 7605  | 7618  |
|          | 6     | 3245                                | 3182   | 5132  | 2708           | 3005  | 2937  | 3774  |
|          | 7     | 1512                                | 1476   | 1332  | 2809           | 1204  | 1366  | 1398  |
|          | 8     | 448                                 | 480    | 423   | 313            | 1641  | 377   | 449   |
|          | 9     | 135                                 | 153    | 148   | 114            | 77    | 127   | 146   |
|          | +gp   | 0                                   | 0      | 0     | 0              | 0     | 0     | 0     |
| 0        | TOTAL | 102958                              | 100361 | 98871 | 79485          | 71299 | 64532 | 65481 |

| Table 10 |       | Stock number at age (start of year) |       |       | Numbers*10**-3 |       |       |        |        |        |        |
|----------|-------|-------------------------------------|-------|-------|----------------|-------|-------|--------|--------|--------|--------|
| YEAR     |       | 1968                                | 1969  | 1970  | 1971           | 1972  | 1973  | 1974   | 1975   | 1976   | 1977   |
| AGE      | 2     | 54843                               | 31968 | 35582 | 15450          | 33176 | 23690 | 52333  | 70054  | 55974  | 26196  |
|          | 3     | 19470                               | 39580 | 24016 | 27568          | 12001 | 26483 | 16410  | 37750  | 50717  | 41850  |
|          | 4     | 10567                               | 12234 | 25584 | 15270          | 18596 | 6438  | 14093  | 10812  | 23712  | 34413  |
|          | 5     | 6798                                | 6107  | 5884  | 14992          | 8225  | 11444 | 4152   | 7946   | 6955   | 13263  |
|          | 6     | 4622                                | 4187  | 3584  | 3348           | 9318  | 4285  | 6849   | 2992   | 5265   | 4562   |
|          | 7     | 1800                                | 2403  | 2084  | 1683           | 1572  | 6569  | 2680   | 4724   | 2226   | 3235   |
|          | 8     | 574                                 | 638   | 860   | 712            | 596   | 657   | 4428   | 1772   | 3549   | 1553   |
|          | 9     | 189                                 | 262   | 180   | 409            | 382   | 325   | 402    | 3141   | 1237   | 2254   |
|          | +gp   | 0                                   | 0     | 0     | 0              | 0     | 52    | 865    | 1396   | 1515   | 2613   |
| 0        | TOTAL | 98863                               | 97379 | 97775 | 79432          | 83866 | 79945 | 102212 | 140587 | 151149 | 129938 |

| Table 10 |       | Stock number at age (start of year) |       |       | Numbers*10**-3 |       |       |       |       |       |       |
|----------|-------|-------------------------------------|-------|-------|----------------|-------|-------|-------|-------|-------|-------|
| YEAR     |       | 1978                                | 1979  | 1980  | 1981           | 1982  | 1983  | 1984  | 1985  | 1986  | 1987  |
| AGE      | 2     | 35063                               | 2787  | 4945  | 3495           | 15861 | 19045 | 42501 | 39063 | 26937 | 9578  |
|          | 3     | 21217                               | 28678 | 2281  | 3919           | 2794  | 12498 | 15194 | 33715 | 31091 | 21846 |
|          | 4     | 30609                               | 16446 | 22429 | 1815           | 2797  | 1443  | 8451  | 11027 | 23484 | 23149 |
|          | 5     | 23499                               | 21217 | 11878 | 14994          | 1303  | 1581  | 835   | 4691  | 7041  | 15199 |
|          | 6     | 6408                                | 15571 | 14348 | 7387           | 9936  | 797   | 912   | 550   | 2717  | 4388  |
|          | 7     | 1810                                | 3581  | 11074 | 9488           | 4823  | 6161  | 568   | 535   | 298   | 1557  |
|          | 8     | 1793                                | 833   | 2233  | 7648           | 6358  | 3068  | 3737  | 427   | 356   | 208   |
|          | 9     | 870                                 | 893   | 490   | 1231           | 5712  | 4150  | 1843  | 2281  | 295   | 174   |
|          | +gp   | 1109                                | 424   | 423   | 249            | 947   | 3462  | 4569  | 4384  | 2936  | 1199  |
| 0        | TOTAL | 122377                              | 90430 | 70101 | 50227          | 50531 | 52205 | 78610 | 96675 | 95154 | 77297 |

| Table 10 |       | Stock number at age (start of year) |       |       | Numbers*10**-3 |       |       |       |       |       |       |
|----------|-------|-------------------------------------|-------|-------|----------------|-------|-------|-------|-------|-------|-------|
| YEAR     |       | 1988                                | 1989  | 1990  | 1991           | 1992  | 1993  | 1994  | 1995  | 1996  | 1997  |
| AGE      | 2     | 20137                               | 15770 | 10323 | 3035           | 3277  | 2071  | 7362  | 62731 | 24388 | 3356  |
|          | 3     | 7585                                | 15894 | 12855 | 8357           | 2415  | 2647  | 1593  | 5777  | 50627 | 19668 |
|          | 4     | 16331                               | 5809  | 11639 | 9371           | 5898  | 1838  | 1897  | 1132  | 4317  | 36656 |
|          | 5     | 15727                               | 11142 | 4160  | 7791           | 6067  | 4126  | 1257  | 1276  | 712   | 2601  |
|          | 6     | 9755                                | 10129 | 6601  | 2711           | 5250  | 3954  | 2877  | 891   | 839   | 419   |
|          | 7     | 2584                                | 6050  | 5982  | 3833           | 1631  | 3430  | 2750  | 1973  | 609   | 538   |
|          | 8     | 796                                 | 1686  | 3165  | 3170           | 2142  | 1032  | 2380  | 1865  | 1346  | 351   |
|          | 9     | 95                                  | 515   | 891   | 1791           | 1964  | 1416  | 726   | 1602  | 1262  | 855   |
|          | +gp   | 675                                 | 311   | 353   | 180            | 789   | 1297  | 1740  | 1799  | 2113  | 1994  |
| 0        | TOTAL | 73686                               | 67307 | 55970 | 40239          | 29431 | 21812 | 22583 | 79045 | 86213 | 66437 |

**Table 2.4.12**

Run title : Haddock Faroes Vb (run: XSAJAK10/X10)

At 1-May-98 16:38:21

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

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

Arith.  
Mean  
0 Units

|             |          |          |          |        |        |
|-------------|----------|----------|----------|--------|--------|
| 26662       | 78923    | 57165    | 15754    | 0.2808 | 0.3265 |
| (Thousands) | (Tonnes) | (Tonnes) | (Tonnes) |        |        |

**Table 2.4.13** Input data for RCT3

Faroe Haddock: VPA and groundfish survey data

3 13 2

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

**Table 2.4.14**

Analysis by RCT3 ver3.1 of data from file :

rct3c97.dat

Faroe Haddock: VPA and groundfish survey data

Data for 3 surveys over 13 years : 1985 - 1997

Regression type = C

Tapered time weighting applied

power = 3 over 20 years

Survey weighting not applied

Final estimates shrunk towards mean

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

Minimum of 3 points used for regression

Forecast/Hindcast variance correction used.

Yearclass = 1990

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

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

Yearclass = 1991

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

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

Yearclass = 1992

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

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

**Table 2.4.14 (Cont'd)**

Yearclass = 1993

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

Yearclass = 1994

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

Yearclass = 1995

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

Yearclass = 1996

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

**Table 2.4.14 (Cont'd)**

Yearclass = 1997

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

| Survey/<br>Series | Slope | Inter-<br>cept | Std<br>Error | Rsquare | No. Pts | Index<br>Value | Predicted<br>Value | Std<br>Error | WAP<br>Weights |
|-------------------|-------|----------------|--------------|---------|---------|----------------|--------------------|--------------|----------------|
| Survage1          | .81   | 6.31           | .61          | .795    | 10      | 3.51           | 9.17               | .737         | .698           |
| Survage2          |       |                |              |         |         |                |                    |              |                |
| Survage3          |       |                |              |         |         |                |                    |              |                |

VPA Mean = 9.17 1.120 .302

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

Table 2.4.15

The SAS System  
Haddock in the Faroe Grounds (Fishing Area Vb)

14:43 Tuesday, May 5, 1998

Prediction with management option table: Input data

| Year: 1998 |            |                   |                |                     |                     |                 |                  |                 |
|------------|------------|-------------------|----------------|---------------------|---------------------|-----------------|------------------|-----------------|
| Age        | Stock size | Natural mortality | Maturity ogive | Prop.of F bef.spaw. | Prop.of M bef.spaw. | Weight in stock | Exploit. pattern | Weight in catch |
| 2          | 1965.000   | 0.2000            | 0.0300         | 0.0000              | 0.0000              | 0.573           | 0.0225           | 0.573           |
| 3          | 2678.000   | 0.2000            | 0.5600         | 0.0000              | 0.0000              | 0.877           | 0.1602           | 0.877           |
| 4          | 13467.000  | 0.2000            | 0.9300         | 0.0000              | 0.0000              | 1.063           | 0.3876           | 1.063           |
| 5          | 20496.000  | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 1.240           | 0.3699           | 1.240           |
| 6          | 1487.000   | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 2.047           | 0.3220           | 2.047           |
| 7          | 238.000    | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 2.493           | 0.3360           | 2.493           |
| 8          | 329.000    | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 2.573           | 0.3223           | 2.573           |
| 9          | 203.000    | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 2.714           | 0.3131           | 2.714           |
| 10+        | 1669.000   | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 2.643           | 0.3131           | 2.643           |
| Unit       | Thousands  | -                 | -              | -                   | -                   | Kilograms       | -                | Kilograms       |

| Year: 1999 |              |                   |                |                     |                     |                 |                  |                 |
|------------|--------------|-------------------|----------------|---------------------|---------------------|-----------------|------------------|-----------------|
| Age        | Recruit-ment | Natural mortality | Maturity ogive | Prop.of F bef.spaw. | Prop.of M bef.spaw. | Weight in stock | Exploit. pattern | Weight in catch |
| 2          | 9578.000     | 0.2000            | 0.0300         | 0.0000              | 0.0000              | 0.573           | 0.0225           | 0.573           |
| 3          | .            | 0.2000            | 0.5600         | 0.0000              | 0.0000              | 0.877           | 0.1602           | 0.877           |
| 4          | .            | 0.2000            | 0.9300         | 0.0000              | 0.0000              | 1.063           | 0.3876           | 1.063           |
| 5          | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 1.240           | 0.3699           | 1.240           |
| 6          | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 2.047           | 0.3220           | 2.047           |
| 7          | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 2.493           | 0.3360           | 2.493           |
| 8          | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 2.573           | 0.3223           | 2.573           |
| 9          | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 2.714           | 0.3131           | 2.714           |
| 10+        | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 2.643           | 0.3131           | 2.643           |
| Unit       | Thousands    | -                 | -              | -                   | -                   | Kilograms       | -                | Kilograms       |

| Year: 2000 |              |                   |                |                     |                     |                 |                  |                 |
|------------|--------------|-------------------|----------------|---------------------|---------------------|-----------------|------------------|-----------------|
| Age        | Recruit-ment | Natural mortality | Maturity ogive | Prop.of F bef.spaw. | Prop.of M bef.spaw. | Weight in stock | Exploit. pattern | Weight in catch |
| 2          | 14322.000    | 0.2000            | 0.0300         | 0.0000              | 0.0000              | 0.573           | 0.0225           | 0.573           |
| 3          | .            | 0.2000            | 0.5600         | 0.0000              | 0.0000              | 0.877           | 0.1602           | 0.877           |
| 4          | .            | 0.2000            | 0.9300         | 0.0000              | 0.0000              | 1.063           | 0.3876           | 1.063           |
| 5          | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 1.240           | 0.3699           | 1.240           |
| 6          | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 2.047           | 0.3220           | 2.047           |
| 7          | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 2.493           | 0.3360           | 2.493           |
| 8          | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 2.573           | 0.3223           | 2.573           |
| 9          | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 2.714           | 0.3131           | 2.714           |
| 10+        | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 2.643           | 0.3131           | 2.643           |
| Unit       | Thousands    | -                 | -              | -                   | -                   | Kilograms       | -                | Kilograms       |

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

Table 2.4.16

The SAS System

14:43 Tuesday, May 5, 1998

## Haddock in the Faroe Grounds (Fishing Area Vb)

## Prediction with management option table

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

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

Table 2.4.17

The SAS System

14:43 Tuesday, May 5, 1998

## Haddock in the Faroe Grounds (Fishing Area Vb)

## Yield per recruit: Input data

| Age  | Recruit-ment | Natural mortality | Maturity ogive | Prop.of F bef.spaw. | Prop.of M bef.spaw. | Weight in stock | Exploit. pattern | Weight in catch |
|------|--------------|-------------------|----------------|---------------------|---------------------|-----------------|------------------|-----------------|
| 2    | 1.000        | 0.2000            | 0.0800         | 0.0000              | 0.0000              | 0.549           | 0.0630           | 0.549           |
| 3    | .            | 0.2000            | 0.5000         | 0.0000              | 0.0000              | 0.819           | 0.2070           | 0.819           |
| 4    | .            | 0.2000            | 0.9200         | 0.0000              | 0.0000              | 1.086           | 0.3210           | 1.086           |
| 5    | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 1.426           | 0.3220           | 1.426           |
| 6    | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 1.741           | 0.3600           | 1.741           |
| 7    | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 2.002           | 0.4220           | 2.002           |
| 8    | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 2.189           | 0.4620           | 2.189           |
| 9    | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 2.425           | 0.3820           | 2.425           |
| 10+  | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 2.749           | 0.3820           | 2.749           |
| Unit | Numbers      | -                 | -              | -                   | -                   | Kilograms       | -                | Kilograms       |

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

Table 2.4.18

The SAS System

18:57 Thursday, May 21, 1998

## Haddock in the Faroe Grounds (Fishing Area Vb)

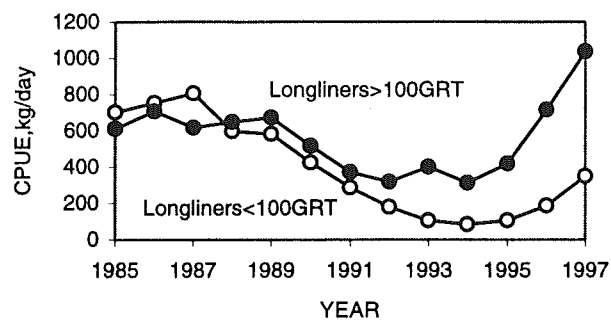
## Yield per recruit: Summary table

| F Factor | Reference F | Catch in numbers | Catch in weight | Stock size | Stock biomass | 1 January     |                  | Spawning time |                  |
|----------|-------------|------------------|-----------------|------------|---------------|---------------|------------------|---------------|------------------|
|          |             |                  |                 |            |               | Sp.stock size | Sp.stock biomass | Sp.stock size | Sp.stock biomass |
| 0.0000   | 0.0000      | 0.000            | 0.000           | 5.517      | 8568.020      | 4.134         | 7669.432         | 4.134         | 7669.432         |
| 0.0500   | 0.0163      | 0.066            | 118.707         | 5.187      | 7760.989      | 3.806         | 6864.237         | 3.806         | 6864.237         |
| 0.1000   | 0.0326      | 0.122            | 212.421         | 4.909      | 7093.960      | 3.530         | 6199.029         | 3.530         | 6199.029         |
| 0.1500   | 0.0490      | 0.169            | 287.308         | 4.673      | 6534.767      | 3.296         | 5641.644         | 3.296         | 5641.644         |
| 0.2000   | 0.0653      | 0.211            | 347.765         | 4.469      | 6060.231      | 3.094         | 5168.902         | 3.094         | 5168.902         |
| 0.2500   | 0.0816      | 0.246            | 396.997         | 4.290      | 5653.242      | 2.917         | 4763.695         | 2.917         | 4763.695         |
| 0.3000   | 0.0979      | 0.278            | 437.386         | 4.133      | 5300.916      | 2.762         | 4413.137         | 2.762         | 4413.137         |
| 0.3500   | 0.1142      | 0.306            | 470.731         | 3.994      | 4993.372      | 2.625         | 4107.347         | 2.625         | 4107.347         |
| 0.4000   | 0.1306      | 0.331            | 498.413         | 3.869      | 4722.917      | 2.502         | 3838.634         | 2.502         | 3838.634         |
| 0.4500   | 0.1469      | 0.354            | 521.502         | 3.757      | 4483.480      | 2.391         | 3600.927         | 2.391         | 3600.927         |
| 0.5000   | 0.1632      | 0.375            | 540.836         | 3.655      | 4270.211      | 2.291         | 3389.374         | 2.291         | 3389.374         |
| 0.5500   | 0.1795      | 0.393            | 557.082         | 3.562      | 4079.191      | 2.201         | 3200.059         | 2.201         | 3200.059         |
| 0.6000   | 0.1958      | 0.410            | 570.771         | 3.477      | 3907.228      | 2.117         | 3029.787         | 2.117         | 3029.787         |
| 0.6500   | 0.2122      | 0.426            | 582.332         | 3.399      | 3751.692      | 2.041         | 2875.930         | 2.041         | 2875.930         |
| 0.7000   | 0.2285      | 0.441            | 592.112         | 3.327      | 3610.403      | 1.971         | 2736.309         | 1.971         | 2736.309         |
| 0.7500   | 0.2448      | 0.454            | 600.395         | 3.260      | 3481.540      | 1.906         | 2609.101         | 1.906         | 2609.101         |
| 0.8000   | 0.2611      | 0.467            | 607.415         | 3.198      | 3363.571      | 1.846         | 2492.776         | 1.846         | 2492.776         |
| 0.8500   | 0.2774      | 0.479            | 613.364         | 3.140      | 3255.198      | 1.790         | 2386.035         | 1.790         | 2386.035         |
| 0.9000   | 0.2938      | 0.490            | 618.402         | 3.086      | 3155.318      | 1.737         | 2287.775         | 1.737         | 2287.775         |
| 0.9500   | 0.3101      | 0.500            | 622.663         | 3.035      | 3062.984      | 1.688         | 2197.050         | 1.688         | 2197.050         |
| 1.0000   | 0.3264      | 0.510            | 626.258         | 2.988      | 2977.383      | 1.642         | 2113.046         | 1.642         | 2113.046         |
| 1.0500   | 0.3427      | 0.519            | 629.282         | 2.943      | 2897.812      | 1.599         | 2035.061         | 1.599         | 2035.061         |
| 1.1000   | 0.3590      | 0.528            | 631.815         | 2.900      | 2823.660      | 1.558         | 1962.484         | 1.558         | 1962.484         |
| 1.1500   | 0.3754      | 0.536            | 633.923         | 2.860      | 2754.395      | 1.520         | 1894.783         | 1.520         | 1894.783         |
| 1.2000   | 0.3917      | 0.544            | 635.665         | 2.822      | 2689.549      | 1.484         | 1831.490         | 1.484         | 1831.490         |
| 1.2500   | 0.4080      | 0.551            | 637.089         | 2.786      | 2628.713      | 1.449         | 1772.197         | 1.449         | 1772.197         |
| 1.3000   | 0.4243      | 0.558            | 638.236         | 2.751      | 2571.527      | 1.416         | 1716.543         | 1.416         | 1716.543         |
| 1.3500   | 0.4406      | 0.565            | 639.145         | 2.718      | 2517.669      | 1.385         | 1664.206         | 1.385         | 1664.206         |
| 1.4000   | 0.4570      | 0.571            | 639.844         | 2.687      | 2466.856      | 1.356         | 1614.904         | 1.356         | 1614.904         |
| 1.4500   | 0.4733      | 0.577            | 640.361         | 2.657      | 2418.835      | 1.327         | 1568.384         | 1.327         | 1568.384         |
| 1.5000   | 0.4896      | 0.583            | 640.720         | 2.629      | 2373.380      | 1.300         | 1524.419         | 1.300         | 1524.419         |
| 1.5500   | 0.5059      | 0.589            | 640.940         | 2.601      | 2330.289      | 1.275         | 1482.808         | 1.275         | 1482.808         |
| 1.6000   | 0.5222      | 0.594            | 641.038         | 2.575      | 2289.379      | 1.250         | 1443.368         | 1.250         | 1443.368         |
| 1.6500   | 0.5386      | 0.600            | 641.031         | 2.550      | 2250.488      | 1.226         | 1405.937         | 1.226         | 1405.937         |
| 1.7000   | 0.5549      | 0.605            | 640.930         | 2.525      | 2213.467      | 1.204         | 1370.367         | 1.204         | 1370.367         |
| 1.7500   | 0.5712      | 0.609            | 640.749         | 2.502      | 2178.182      | 1.182         | 1336.523         | 1.182         | 1336.523         |
| 1.8000   | 0.5875      | 0.614            | 640.497         | 2.480      | 2144.513      | 1.161         | 1304.285         | 1.161         | 1304.285         |
| 1.8500   | 0.6038      | 0.618            | 640.183         | 2.458      | 2112.348      | 1.141         | 1273.542         | 1.141         | 1273.542         |
| 1.9000   | 0.6202      | 0.623            | 639.815         | 2.437      | 2081.589      | 1.122         | 1244.195         | 1.122         | 1244.195         |
| 1.9500   | 0.6365      | 0.627            | 639.399         | 2.417      | 2052.142      | 1.103         | 1216.151         | 1.103         | 1216.151         |
| 2.0000   | 0.6528      | 0.631            | 638.943         | 2.397      | 2023.924      | 1.085         | 1189.327         | 1.085         | 1189.327         |
| 2.0500   | 0.6691      | 0.635            | 638.451         | 2.379      | 1996.858      | 1.068         | 1163.646         | 1.068         | 1163.646         |
| 2.1000   | 0.6854      | 0.639            | 637.929         | 2.360      | 1970.873      | 1.051         | 1139.037         | 1.051         | 1139.037         |
| 2.1500   | 0.7018      | 0.642            | 637.380         | 2.343      | 1945.906      | 1.035         | 1115.436         | 1.035         | 1115.436         |
| 2.2000   | 0.7181      | 0.646            | 636.808         | 2.326      | 1921.895      | 1.020         | 1092.783         | 1.020         | 1092.783         |
| 2.2500   | 0.7344      | 0.649            | 636.216         | 2.309      | 1898.785      | 1.005         | 1071.022         | 1.005         | 1071.022         |
| 2.3000   | 0.7507      | 0.653            | 635.608         | 2.293      | 1876.526      | 0.990         | 1050.104         | 0.990         | 1050.104         |
| 2.3500   | 0.7670      | 0.656            | 634.986         | 2.277      | 1855.071      | 0.976         | 1029.980         | 0.976         | 1029.980         |
| 2.4000   | 0.7834      | 0.659            | 634.352         | 2.262      | 1834.375      | 0.962         | 1010.608         | 0.962         | 1010.608         |
| 2.4500   | 0.7997      | 0.662            | 633.709         | 2.247      | 1814.398      | 0.949         | 991.946          | 0.949         | 991.946          |
| 2.5000   | 0.8160      | 0.665            | 633.058         | 2.233      | 1795.102      | 0.936         | 973.957          | 0.936         | 973.957          |
| 2.5500   | 0.8323      | 0.668            | 632.401         | 2.219      | 1776.453      | 0.924         | 956.606          | 0.924         | 956.606          |
| 2.6000   | 0.8486      | 0.671            | 631.739         | 2.206      | 1758.416      | 0.911         | 939.860          | 0.911         | 939.860          |
| 2.6500   | 0.8650      | 0.674            | 631.074         | 2.192      | 1740.963      | 0.900         | 923.688          | 0.900         | 923.688          |
| 2.7000   | 0.8813      | 0.676            | 630.406         | 2.179      | 1724.063      | 0.888         | 908.062          | 0.888         | 908.062          |
| 2.7500   | 0.8976      | 0.679            | 629.738         | 2.167      | 1707.691      | 0.877         | 892.956          | 0.877         | 892.956          |
| 2.8000   | 0.9139      | 0.682            | 629.069         | 2.155      | 1691.821      | 0.866         | 878.345          | 0.866         | 878.345          |
| 2.8500   | 0.9302      | 0.684            | 628.401         | 2.143      | 1676.429      | 0.856         | 864.204          | 0.856         | 864.204          |
| 2.9000   | 0.9466      | 0.687            | 627.734         | 2.131      | 1661.495      | 0.846         | 850.512          | 0.846         | 850.512          |
| 2.9500   | 0.9629      | 0.689            | 627.069         | 2.120      | 1646.996      | 0.836         | 837.249          | 0.836         | 837.249          |
| 3.0000   | 0.9792      | 0.691            | 626.407         | 2.109      | 1632.915      | 0.826         | 824.395          | 0.826         | 824.395          |
| -        | -           | Numbers          | Grams           | Numbers    | Grams         | Numbers       | Grams            | Numbers       | Grams            |

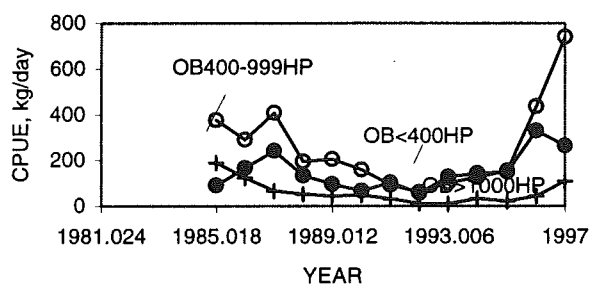
Notes: Run name : YLDJAK02  
Date and time : 21MAY98:19:01  
Computation of ref. F: Simple mean, age 3 - 7  
F-0.1 factor : 0.5812  
F-max factor : 1.6209  
F-0.1 reference F : 0.1897  
F-max reference F : 0.5291  
Recruitment : Single recruit

**Table 2.4.19**

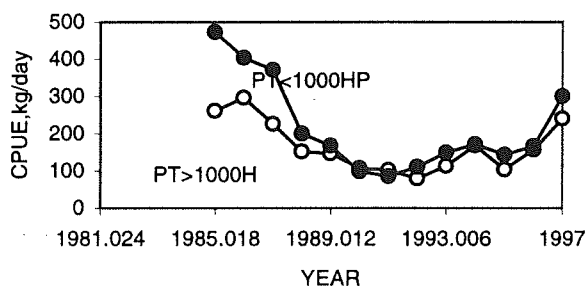
| If the 8202 days are<br>allocated to the LL<100. |          | If the 8202 days are<br>allocated to the ST<400. |          | If the 8202 X 2 days are<br>allocated to the Jiggers. |          |
|--------------------------------------------------|----------|--------------------------------------------------|----------|----------------------------------------------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



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

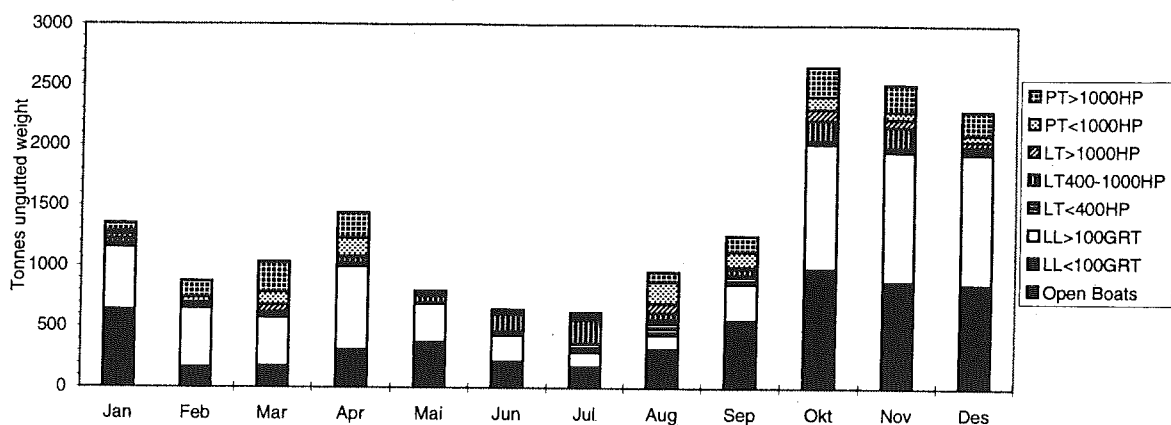


**Fig.: B.** Haddock in Division Vb 1985-1997.  
Catch per day for otter board trawlers.

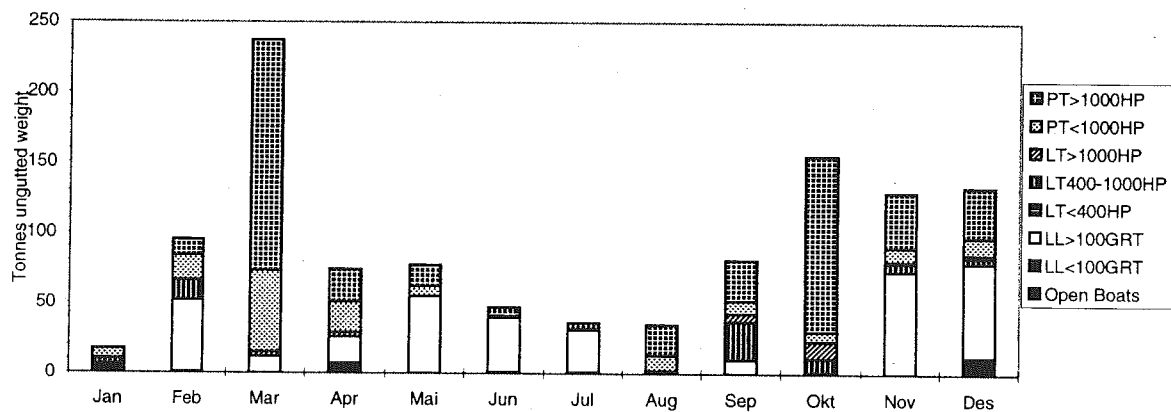


**Fig.: C.** Haddock in Division Vb 1985-1997.  
Catch per day for pair trawlers.

**Figure 2.4.1.** Faroe haddock. CPUE for selected fleets.

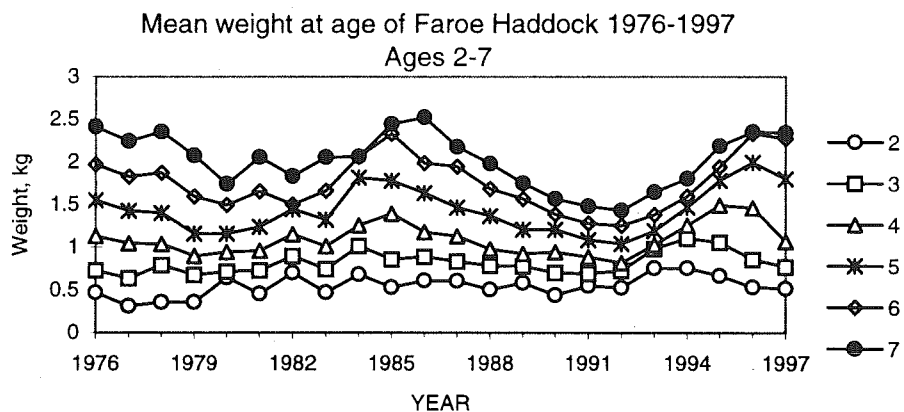


**Figure A.** Faroe haddock. Landings in 1997 by fleet and month.

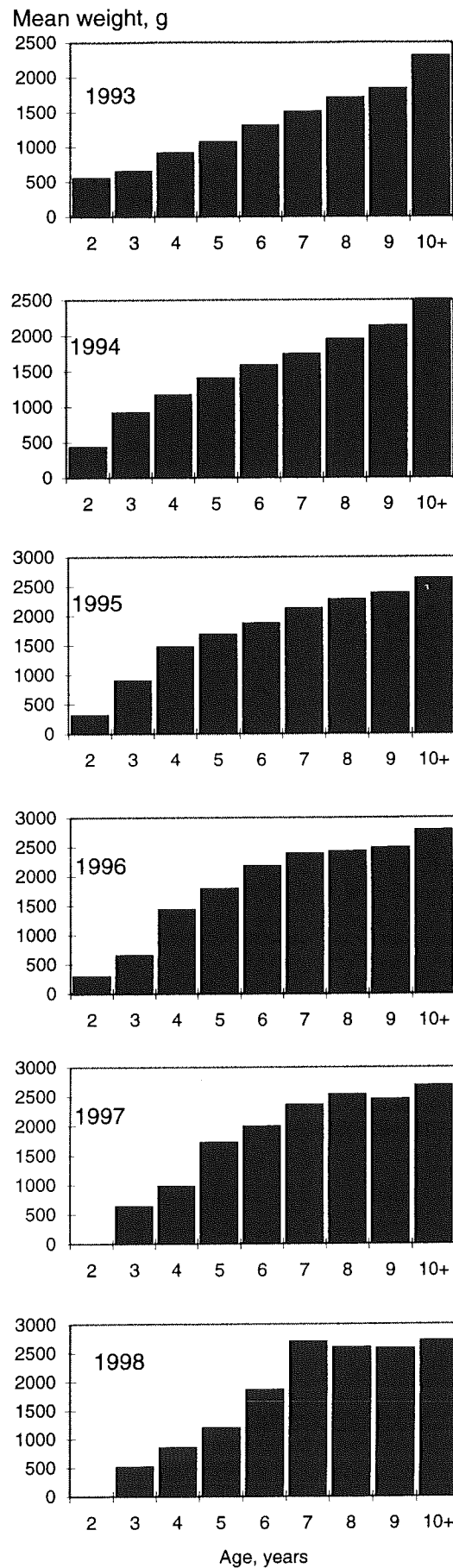


**Figure B.** Faroe haddock. Landings in 1997 by fleet and month.

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

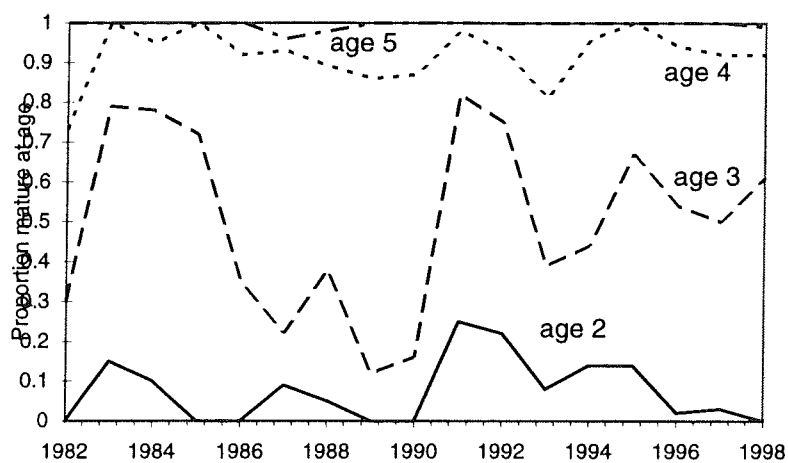


**Figure 2.4.3.** Faroe haddock. Mean weight at age for ages 2-7 in the years 1976-1997.

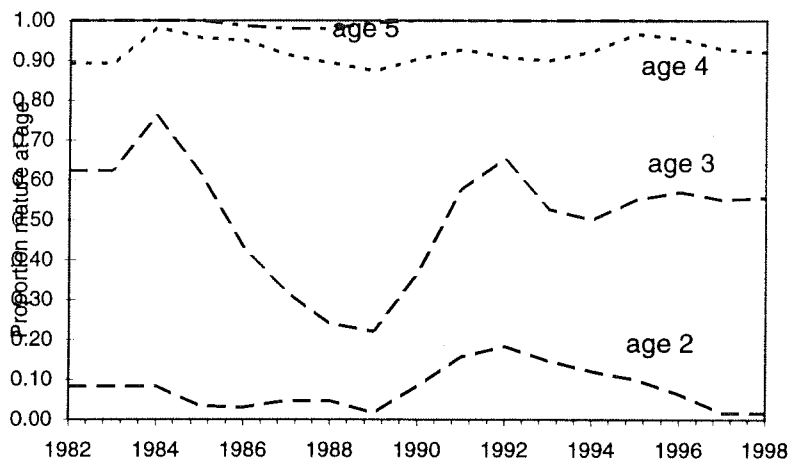


**Fig.: 2.4.4.**

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

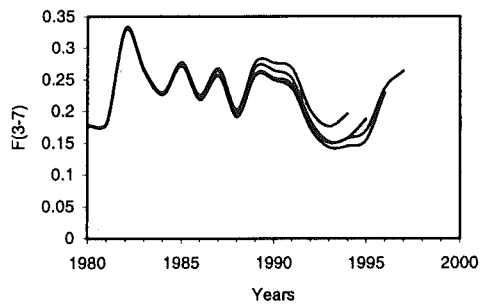


**A:** Faroe haddock. Maturity ogives. Observed values from the spring survey.

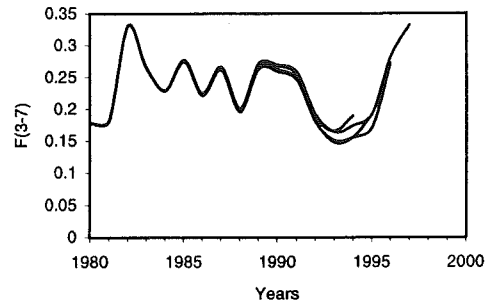


**B:** Faroe haddock. Maturity ogives. Running 3 years average from the spring survey.

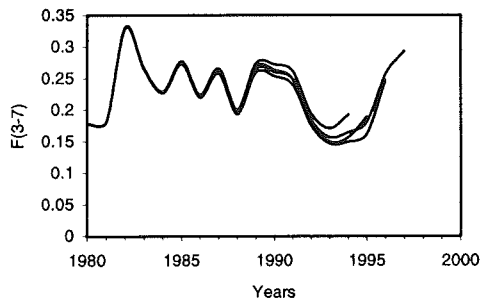
**Figure 2.4.5.** Faroe haddock. Maturity ogives estimated from spring surveys.



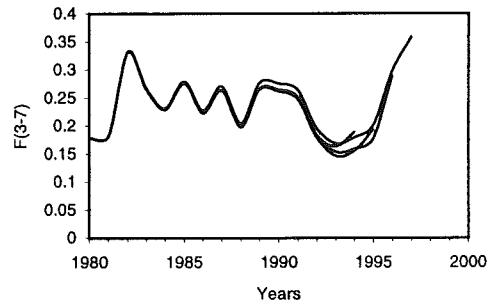
A: Retrospective analysis of XSA (X08) shrunk 0.5



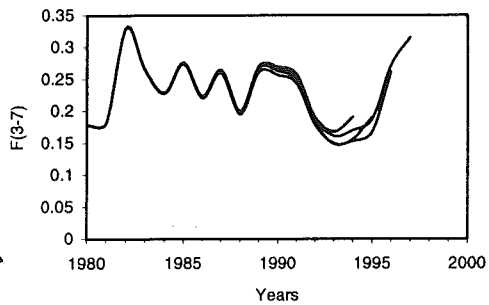
D: Retrospective analysis of XSA (X08) shrunk 0.8



B: Retrospective analysis of XSA (X08) shrunk 0.6



E: Retrospective analysis of XSA (X08) shrunk 1.0

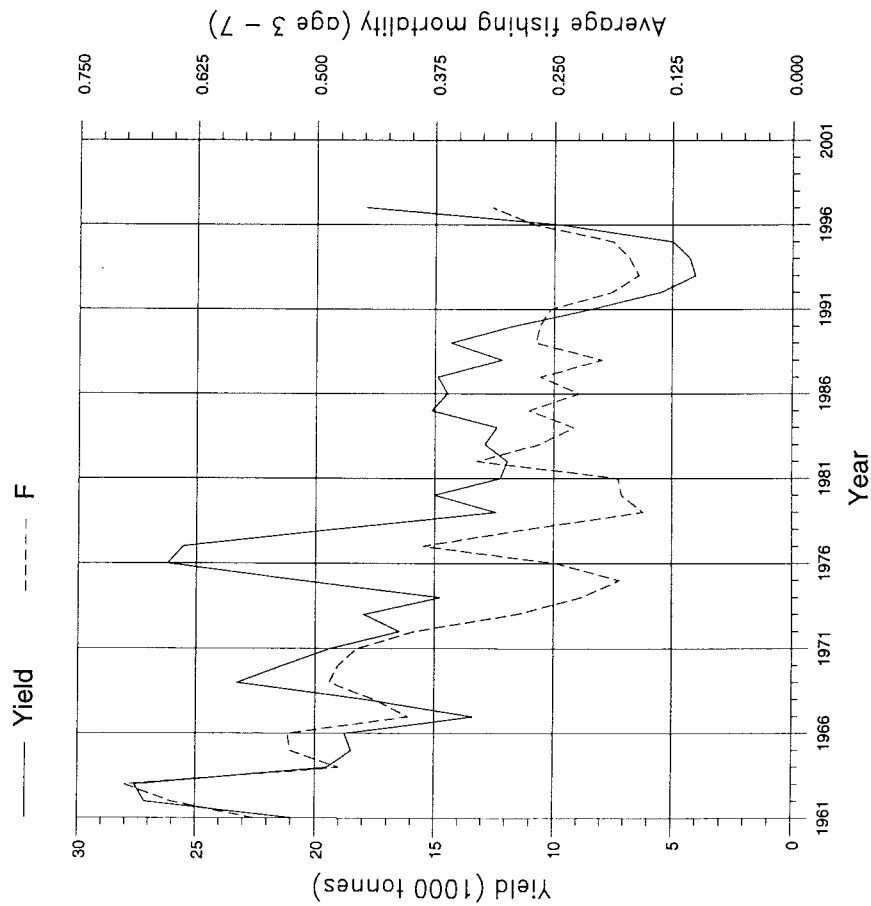


C: Retrospective analysis of XSA (X08) shrunk 0.7

**Figure 2.4.7. Faroe Haddock. Retrospective analysis of  $F_{bar}(3-7)$  from XSA-runs**

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

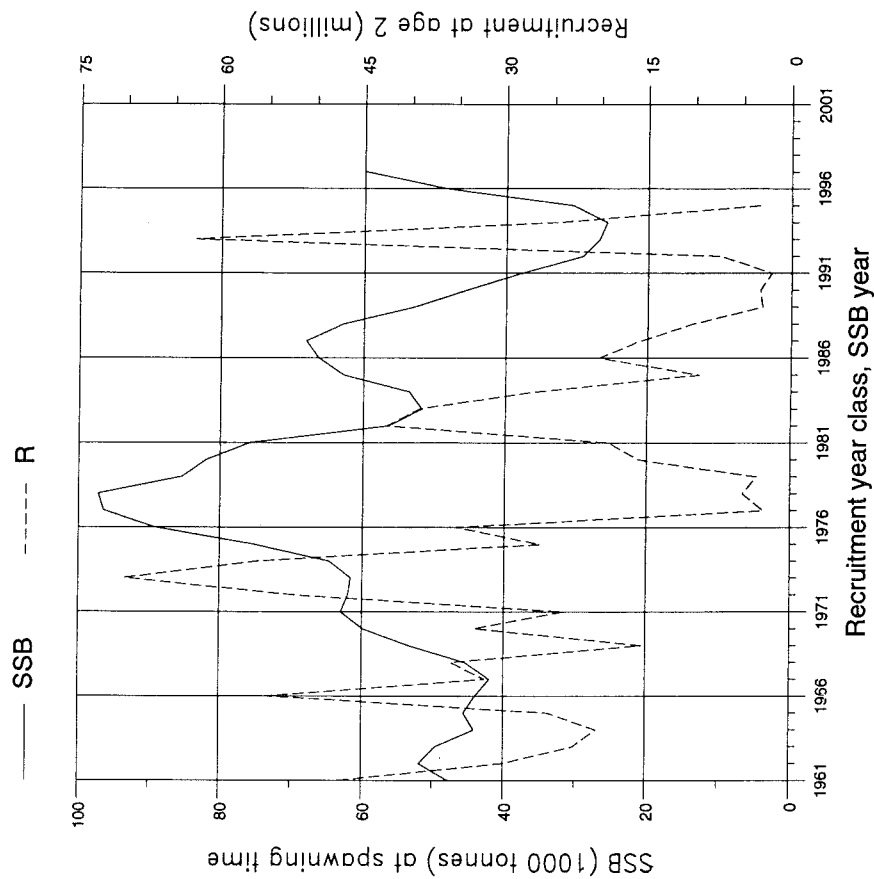
**Yield and fishing mortality**



(run: XSAJAK10)

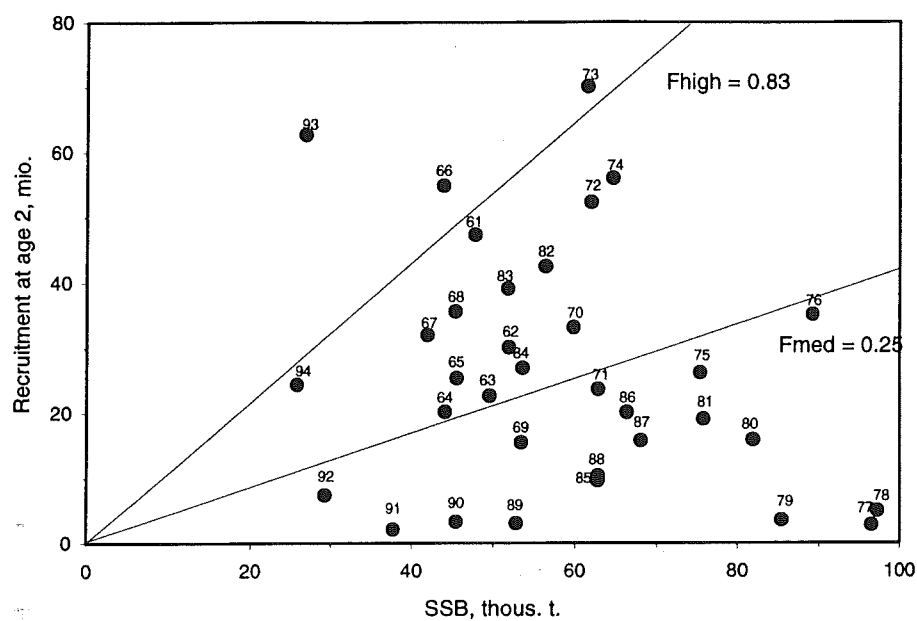
**A**

**Spawning stock and recruitment**

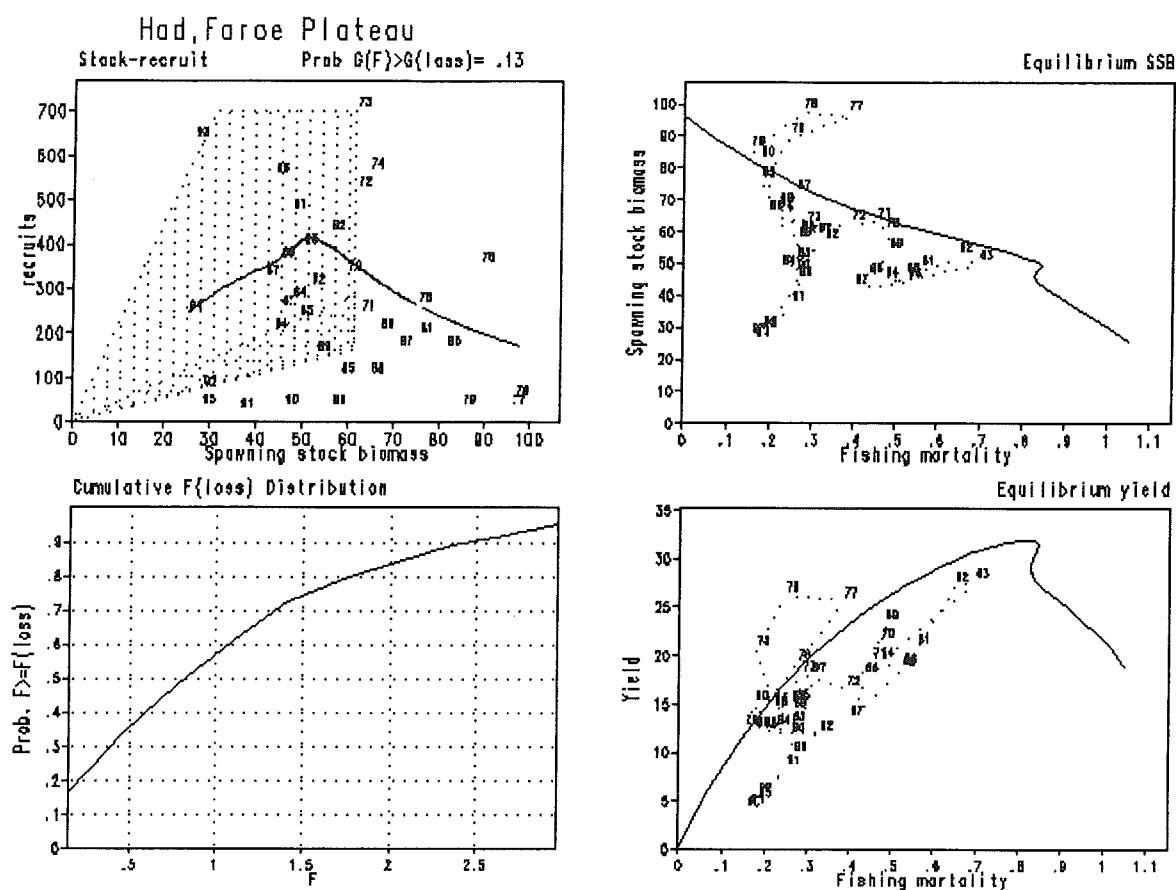


(run: XSAJAK10)

**B**



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



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

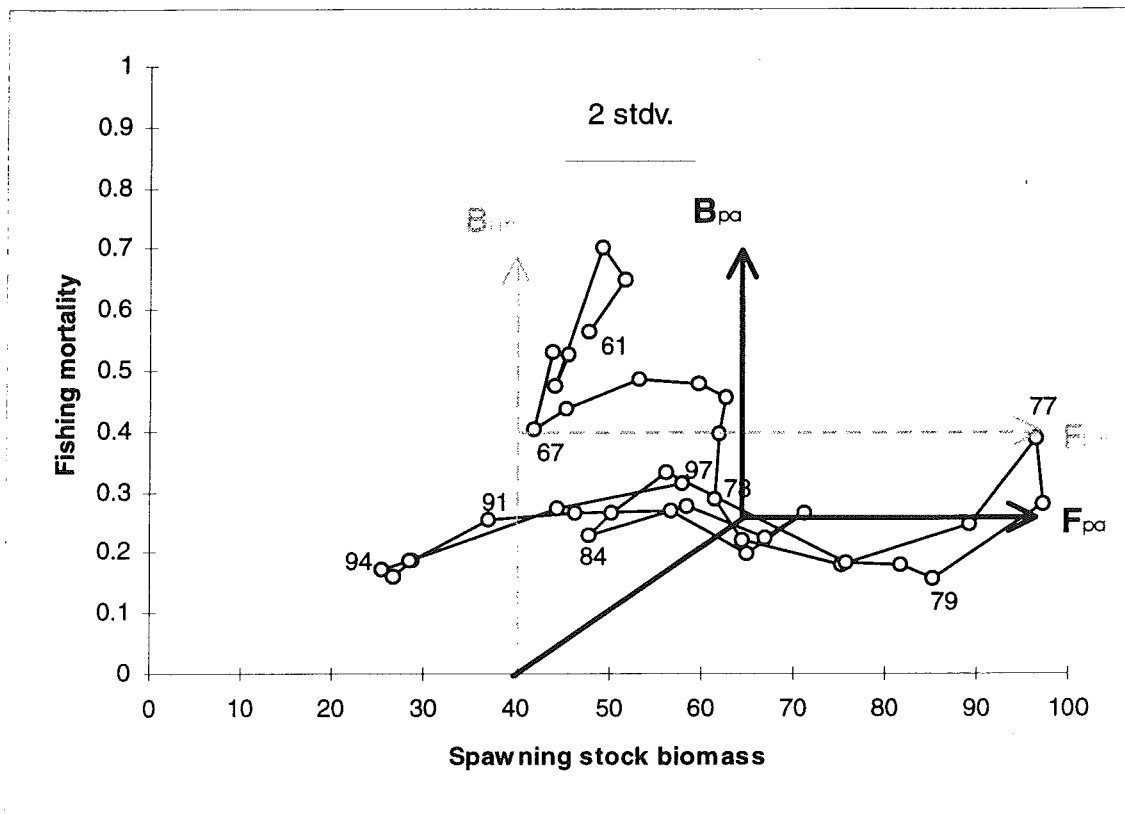


Figure 2.4.13. Faroe haddock.

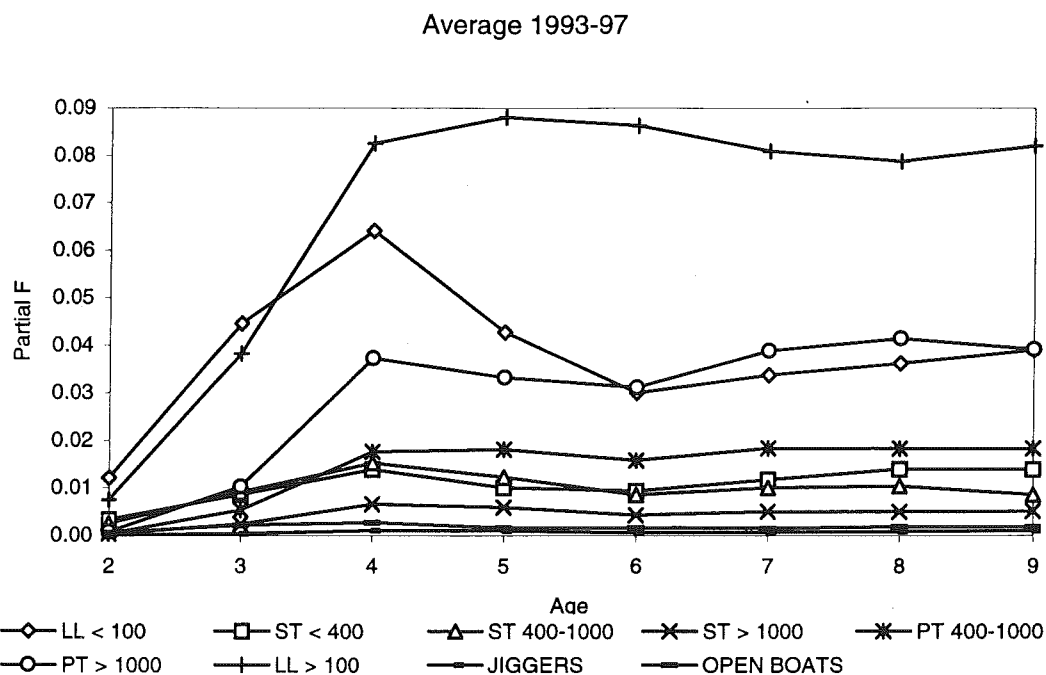


Figure 2.4.14. The average age-specific Partial F for each fleet.

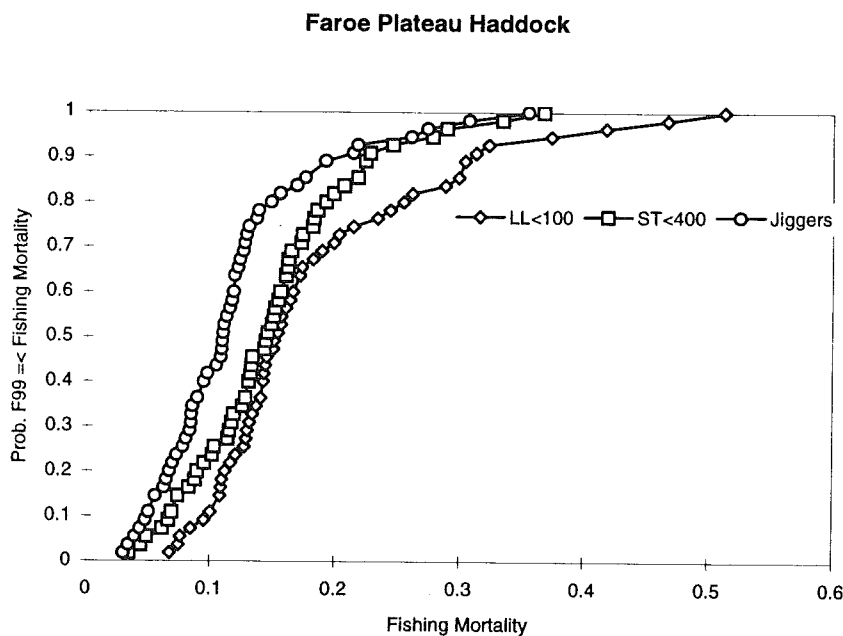


Figure 2.4.15. Faroe Haddock. Cumulative probability distribution of the 1998-1999 fishing mortalities under the current number of fishing days allocated for the LL<100, ST<400, PT400-1000, PT>1000 and LL>100.

## **2.5 Faroe Saithe**

### **2.5.1 Landings and trends in the fishery**

Landings of saithe from the Faroese grounds (Division Vb) varied between around 40 000 - 45 000 t in the period 1985–1989 (Table 2.5.1). In 1990 record high catches were reached at about 60 000 t and since then catches have steadily decreased to about 20 000 t in 1996 and maintained this level in 1997.

With the introduction of the 200 miles EEZ in 1977 saithe has, for all practical purposes, only been fished by Faroese vessels. The principal fleet consists of large pair trawlers, with engines larger than 1000 HP, accounting for about 60% of the catches in 1993-97. In the same period the smaller pair trawlers (<1000 HP) caught about 20%, jiggers 10% and larger single trawlers about 8% (Tables 2.5.3 and 2.5.4). All other vessels only have small catches of saithe as by-catch.

Generally speaking effort has increased in the period 1994-96 (Table 2.5.5). For the period 1985-91 the effort of the larger pair trawlers increased from around 3 200 days at sea to 7 900 days. Thereafter the effort decreased to 6 200 days in 1994 but increased again to 7 700 days in 1997. In the smaller pair trawler fleet the effort fluctuated between 5 200-6 500 days in the period 1985–1991 then dropped to 2 100 days in 1994 but then increased to 3 400 days in 1996 and dropped to 3200 days in 1977. Since 1985 the effort of the large single trawlers have declined from 5 600 days to 4 000 days in 1991 and fluctuated between 3 600-4 300 days in the period 1992-97. The effort of jiggers has increased in the period 1985-96 from 3 300 days to 8 000–10 600 days in 1988-93 and increased further to 23 700 days in 1996 but dropped again to 13 000 days in 1997.

In terms of CPUE there has been a general downwards trend in the period 1994-96 but a slight increase in 1997 (Table 2.5.6 and Figure 2.5.1). Looking at the whole period 1985-96 the range of CPUE for larger pair trawlers has decreased from 3.4 t/day to 1.4 t/day but went up slightly to 1.5 t/day in 1997. CPUE for smaller pair trawlers has varied between about 1.2 t/day to 2.5 t/day and has more than halved in the last four years. The jiggers have had a decline in CPUE from 0.5 t/day to 0.1 t/day in the period 1991-97. For larger single trawlers there has been a decline from 2.3 t/day to 0.6 t/day in the period 1985-97.

In the last ten years many single trawlers have switched to pair trawling and an increasing proportion of the catches are caught by larger vessels. Jiggers, on the other hand, have increased their effort substantially from about 3 300 days to some 23 700 days in the period 1985-96 but have decreased their effort to 13 000 days in 1997.

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

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

### **2.5.2 Catch at age**

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

Catch at age data in previous years were revised according to the final catch statistics. Catch in numbers at age in 1997 reflects the age composition in the Faroese catches (Table 2.5.7). In 1997 109 samples were taken from landings of saithe with 19 176 length measurements, 3 936 otoliths, and 3 130 individual weights. The SOP for 1997 shows no discrepancy (Table 2.5.7).

### **2.5.3 Weight at age**

Through the recorded period 1961–1997 mean weight at age has varied by a factor of about 2, e.g. with mean weights for age 5 between about 1.6 kg to 3.3 kg and for age 7 between 2.6 kg and 5.3 kg (Table 2.5.8 and Figure 2.5.2). In the period 1984–1986 mean weight at age values were generally high and dropped to a low level in the years 1990–1991. The mean weights have been increasing in the period 1992-96 and have since decreased.

## **2.5.4 Maturity at age**

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

## **2.5.5 Stock assessment**

### **2.5.5.1 Tuning and estimation of fishing mortality**

Two tuning series representing the same vessels were tried in the XSA runs. The first one was the commercial Cuba series consisting of total saithe catch at age and total effort in days, hereafter referred to as the Cuba Beta series. The series extends back to 1982 and consists of data from 8 pair trawlers greater than 1000 HP (Cuba trawlers) which specialise in fishing on saithe and account for 5 000–8 000 t of saithe each year (Table 2.5.11). In the 1993 Working Group report (ICES C.M.1993/Assess:18) a description is provided as to how and why this particular series was chosen. The second series is new and consists of saithe catch at age and effort in hours, hereafter referred to as the Cuba Logbook series. In the Cuba Logbook series information for each haul was supplied and only those hauls where saithe consisted of more than 50% of the total catches of cod, haddock and saithe were used (Table 2.5.16). Indices of CPUE and effort of the two series is presented in Figs. 2.5.7a and b and they show major differences for some years. In Fig. 2.5.7a the higher values in the Cuba Beta series in 1995–96 might be explained by the fact that more effort was directed towards cod in these years. As the hauls targeting cod were excluded in the Cuba logbook series CPUE values for these years were higher in this series. The difference in the effort indices in 1993–94 could not be explained. Both XSA runs were made with the same parameters as last year. The output from the first XSA run using the Cuba Beta series is presented in Tables 2.5.12–15 and the output from the second using the Cuba Logbooks is shown in Tables 2.5.17–20. The diagnostics from these runs are shown in Tables 2.5.12 and 2.5.17, respectively. The values of the S.E. log  $q$  are reasonably low for the principal year classes in both runs so there was no reason for choosing the Cuba Beta tuning series instead of Cuba Logbook series. The average fishing mortality for age groups 4–8 years for these two series are shown in Figs. 2.5.6a and b. Both series give results that converge reasonably well and there is little difference between the results of the two. Still it was agreed the new series should be analysed statistically by fitting a multivariate model to it taken in to account factor like year, season and area. In the following only the XSA run using Cuba Beta will be discussed.

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

### **2.5.5.2 Stock estimates and recruitment**

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

Stock in numbers at age as estimated by the VPA is presented in Table 2.5.14. The high numbers in the stock in 1986–1990 are due to very good recruitment. Mean number of recruits as 3 year olds in the period 1980–1989 is about 33 million. The recruits in 1993 are about 23 million, equal to the long term mean, whereas the recruits in 1994 are half long term the mean level.

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

## 2.5.6 Prediction of catch and biomass

### 2.5.6.1 Input data

Input data for prediction with management options are presented in Table 2.5.21 and input data for the yield per recruit calculations are given in Table 2.5.23.

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

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

In the short term prediction the fitted proportion mature values for 1998 were used for that year and for 1999 and 2000 the average of fitted values for 1983–1997 were used. This long term mean was also used in the long term prediction.

For all three years in the short term prediction the average exploitation pattern in the final VPA for 1995–97 rescaled to  $F_{bar}$  (age 4–8) in 1997 was used. In the long term prediction the exploitation pattern was the average of exploitation patterns for 1961–1997 which were rescaled to  $F_{bar}$  (ages 4–8) in 1997.

### 2.5.6.2 Biological reference points

The yield per recruit and spawning stock biomass per recruit curves are presented in Figure 2.5.9C. Compared to the fishing mortality level in age groups 4–8 in 1997 of 0.44, the reference values for  $F_{max}$  is 0.42 and  $F_{0.1}$  is 0.17.  $F_{med}$  and  $F_{high}$  were estimated at 0.28 and 0.56, respectively, (Table 2.5.24, Figure 2.5.9C and Figure 2.5.10). The average fishing mortality for age 4–8 in 1997 thus is a little higher than  $F_{max}$ .

The stock-recruitment scatter plot shows that the probability of above average recruitment is substantially diminished when the spawning stock biomass is below 85 000 t which suggests that this is the level of the minimum biologically acceptable level (MBAL) (Figure 2.5.10). The spawning stock has been below this level since 1991 and in 1997 reached a record low of 52 000 t.

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

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

### **2.5.6.3 Projection of catch and biomass**

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

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

### **2.5.7 Management considerations**

The spawning stock biomass is continuing its downward trend and is at a record-low level which is far below Blim. If the present fishing mortality level is maintained the spawning stock will drop even further. Even with a drastic reduction in fishing mortality, say to half of the 1997 level, the spawning stock will still not recover in the short term.

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

### **2.5.8 Comments on the assessment**

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

The commercial pair trawler series (Cuba trawlers) is still the only useable tuning series and shows reasonable low variation even if the unit of effort (day) is rather crude. A new Cuba series based on logbooks with the unit of effort in days was presented but needs to be analysed further with respect to the influence of season, area, etc.

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

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

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

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

<sup>1</sup> Preliminary.<sup>2</sup> As from 1991.<sup>3</sup> Quantity unknown 1989-91.<sup>4</sup> Includes catches from Sub-division Vb2 and Division IIa in Faroese waters.<sup>5</sup> Includes French catches from Division Vb, as reported to the Faroese coastal guard service.

Table 2.5.2. Catches of saithe in the Faroe grounds by various faroese fleet categories. Tonnes gutted weight.

| Year | Open boats | Long-liners < 100 GRT | Single trawl < 400 HP | Gill | Jiggers | Single trawl 400-1000HP | Single trawl >1000 HP | Pair trawl <1000 HP | Pair trawl >1000HP | Long-liners > 100 GRT | Industrial trawlers | Others | Total gutted weight |
|------|------------|-----------------------|-----------------------|------|---------|-------------------------|-----------------------|---------------------|--------------------|-----------------------|---------------------|--------|---------------------|
| 1985 | 89         | 38                    | 23                    | 13   | 982     | 2515                    | 12923                 | 10822               | 10805              | 28                    | 60                  | 79     | 38377               |
| 1986 | 107        | 67                    | 31                    | 54   | 1296    | 1004                    | 9872                  | 9921                | 13173              | 21                    | 254                 | 330    | 36132               |
| 1987 | 244        | 52                    | 116                   | 157  | 1985    | 1468                    | 7279                  | 8134                | 15790              | 37                    | 408                 | 1      | 35700               |
| 1988 | 173        | 101                   | 40                    | 113  | 2575    | 2693                    | 8224                  | 7748                | 17266              | 31                    | 501                 | 21     | 39586               |
| 1989 | 356        | 52                    | 129                   | 90   | 3717    | 2148                    | 7118                  | 9440                | 16513              | 60                    | 504                 | 5      | 40132               |
| 1990 | 309        | 131                   | 84                    | 122  | 4038    | 2123                    | 10742                 | 13127               | 23442              | 101                   | 495                 | 8      | 54721               |
| 1991 | 287        | 55                    | 40                    | 281  | 4795    | 625                     | 6791                  | 12978               | 22584              | 64                    | 404                 | 7      | 48910               |
| 1992 | 124        | 121                   | 8                     | 0    | 3300    | 151                     | 2248                  | 7677                | 17486              | 37                    | 320                 | 1      | 31472               |
| 1993 | 168        | 56                    | 39                    | 0    | 2696    | 164                     | 1879                  | 6234                | 17639              | 29                    | 203                 | 3      | 29111               |
| 1994 | 131        | 112                   | 37                    | 2    | 3666    | 335                     | 1995                  | 5408                | 17243              | 63                    | 202                 | 0      | 29194               |
| 1995 | 49         | 15                    | 91                    | 5    | 2320    | 215                     | 2406                  | 4288                | 14776              | 75                    | 6                   | 0      | 24248               |
| 1996 | 5          | 6                     | 24                    | 5    | 1590    | 213                     | 1178                  | 4118                | 10173              | 37                    | 4                   | 0      | 17353               |
| 1997 | 9          | 14                    | 27                    | 3    | 1746    | 495                     | 2098                  | 3491                | 11529              | 72                    | 76                  | 1      | 19561               |

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

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

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

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

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

| Year | Open boats | Long-liners < 100 GRT | Single trawl < 400 HP | Gill | Jiggers | Single trawl 400-1000 HP | Single trawl >1000 HP | Pair trawl <1000 HP | Pair trawl >1000 HP | Long-liners > 100 GRT | Industrial trawlers | Others | Total |
|------|------------|-----------------------|-----------------------|------|---------|--------------------------|-----------------------|---------------------|---------------------|-----------------------|---------------------|--------|-------|
| 1985 | 2941       | 7558                  | 2171                  | 108  | 3348    | 2077                     | 5565                  | 5389                | 3193                | 2973                  |                     |        | 35323 |
| 1986 | 2941       | 6892                  | 1509                  | 123  | 2745    | 1221                     | 5402                  | 6573                | 4433                | 2176                  |                     |        | 33815 |
| 1987 | 2941       | 6728                  | 1297                  | 201  | 2973    | 1531                     | 4389                  | 6314                | 5546                | 2915                  |                     |        | 34835 |
| 1988 | 2660       | 8760                  | 1261                  | 234  | 8104    | 2261                     | 4907                  | 6026                | 6034                | 3203                  |                     |        | 43450 |
| 1989 | 3948       | 12677                 | 1345                  | 208  | 10663   | 2093                     | 4939                  | 5175                | 5127                | 3369                  |                     |        | 49544 |
| 1990 | 3228       | 14321                 | 1013                  | 157  | 9510    | 1999                     | 4020                  | 5444                | 7491                | 3521                  |                     |        | 50704 |
| 1991 | 3204       | 14656                 | 940                   | 183  | 10215   | 1239                     | 4005                  | 5828                | 7875                | 3573                  |                     |        | 51718 |
| 1992 | 1913       | 10508                 | 1032                  | 181  | 10030   | 628                      | 4159                  | 3985                | 7243                | 2892                  |                     |        | 42571 |
| 1993 | 1611       | 7424                  | 1853                  | 561  | 7940    | 1211                     | 3566                  | 2851                | 6335                | 2046                  |                     |        | 35398 |
| 1994 | 2283       | 7979                  | 1722                  | 1883 | 13484   | 885                      | 3828                  | 2148                | 6262                | 2841                  |                     |        | 43315 |
| 1995 | 3321       | 9742                  | 1985                  | 2052 | 18721   | 1342                     | 4317                  | 2594                | 6752                | 3959                  |                     |        | 54785 |
| 1996 | 3959       | 12636                 | 1475                  | 2407 | 23663   | 1309                     | 3780                  | 3396                | 7285                | 4285                  |                     |        | 64195 |
| 1997 | 3278       | 13968                 | 1704                  | 2315 | 13379   | 1311                     | 3704                  | 3222                | 7707                | 5851                  |                     |        | 56439 |

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

| Year | Open<br>boats | Long-<br>liners <<br>100 GRT | Single<br>trawl <<br>400 HP | Gill  | Jiggers | Single<br>trawl 400-<br>1000HP | Single<br>trawl >1000 HP | Pair trawl<br><1000 HP | Pair trawl<br>>1000 HP | Long-<br>liners ><br>100 GRT | Indust-<br>rial<br>trawlers | Others |
|------|---------------|------------------------------|-----------------------------|-------|---------|--------------------------------|--------------------------|------------------------|------------------------|------------------------------|-----------------------------|--------|
| 1985 |               | 0.005                        | 0.011                       | 0.120 | 0.293   | 1.211                          | 2.322                    | 2.008                  | 3.384                  | 0.009                        |                             |        |
| 1986 |               | 0.010                        | 0.021                       | 0.439 | 0.472   | 0.822                          | 1.827                    | 1.509                  | 2.972                  | 0.010                        |                             |        |
| 1987 |               | 0.008                        | 0.089                       | 0.781 | 0.668   | 0.959                          | 1.658                    | 1.288                  | 2.847                  | 0.013                        |                             |        |
| 1988 |               | 0.012                        | 0.032                       | 0.483 | 0.318   | 1.191                          | 1.676                    | 1.286                  | 2.861                  | 0.010                        |                             |        |
| 1989 |               | 0.004                        | 0.096                       | 0.433 | 0.349   | 1.026                          | 1.441                    | 1.824                  | 3.221                  | 0.018                        |                             |        |
| 1990 |               | 0.009                        | 0.083                       | 0.777 | 0.425   | 1.062                          | 2.672                    | 2.411                  | 3.129                  | 0.029                        |                             |        |
| 1991 |               | 0.004                        | 0.043                       | 1.536 | 0.469   | 0.504                          | 1.696                    | 2.227                  | 2.868                  | 0.018                        |                             |        |
| 1992 |               | 0.012                        | 0.008                       | 0.000 | 0.329   | 0.240                          | 0.541                    | 1.926                  | 2.414                  | 0.013                        |                             |        |
| 1993 |               | 0.008                        | 0.021                       | 0.000 | 0.340   | 0.135                          | 0.527                    | 2.187                  | 2.784                  | 0.014                        |                             |        |
| 1994 |               | 0.014                        | 0.021                       | 0.001 | 0.272   | 0.379                          | 0.521                    | 2.518                  | 2.754                  | 0.022                        |                             |        |
| 1995 |               | 0.002                        | 0.046                       | 0.002 | 0.124   | 0.160                          | 0.557                    | 1.653                  | 2.188                  | 0.019                        |                             |        |
| 1996 |               | 0.000                        | 0.016                       | 0.002 | 0.067   | 0.163                          | 0.312                    | 1.213                  | 1.396                  | 0.009                        |                             |        |
| 1997 |               | 0.001                        | 0.016                       | 0.001 | 0.131   | 0.378                          | 0.566                    | 1.083                  | 1.496                  | 0.012                        |                             |        |

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

| Table 1   | Catch numbers at age |        |        | Numbers*10**-3 |        |        |        |
|-----------|----------------------|--------|--------|----------------|--------|--------|--------|
| YEAR,     | 1961,                | 1962,  | 1963,  | 1964,          | 1965,  | 1966,  | 1967,  |
| AGE       |                      |        |        |                |        |        |        |
| 3,        | 183,                 | 562,   | 614,   | 684,           | 996,   | 488,   | 595,   |
| 4,        | 379,                 | 542,   | 340,   | 1908,          | 850,   | 1540,  | 796,   |
| 5,        | 483,                 | 617,   | 340,   | 1506,          | 1708,  | 1201,  | 1364,  |
| 6,        | 403,                 | 495,   | 415,   | 617,           | 965,   | 1686,  | 792,   |
| 7,        | 216,                 | 286,   | 406,   | 572,           | 510,   | 806,   | 1192,  |
| 8,        | 129,                 | 131,   | 202,   | 424,           | 407,   | 377,   | 473,   |
| 9,        | 116,                 | 129,   | 174,   | 179,           | 306,   | 294,   | 217,   |
| 10,       | 82,                  | 113,   | 158,   | 150,           | 201,   | 205,   | 190,   |
| 11,       | 45,                  | 71,    | 94,    | 100,           | 156,   | 156,   | 97,    |
| +gp,      | 82,                  | 105,   | 274,   | 174,           | 285,   | 225,   | 140,   |
| TOTALNUM, | 2118,                | 3051,  | 3017,  | 6314,          | 6384,  | 6978,  | 5856,  |
| TONSLAND, | 9592,                | 10454, | 12693, | 21893,         | 22181, | 25563, | 21319, |
| SOPCOF %, | 108,                 | 93,    | 96,    | 99,            | 92,    | 98,    | 104,   |

| Table 1   | Catch numbers at age |        |        | Numbers*10**-3 |        |        |        |        |        |        |
|-----------|----------------------|--------|--------|----------------|--------|--------|--------|--------|--------|--------|
| YEAR,     | 1968,                | 1969,  | 1970,  | 1971,          | 1972,  | 1973,  | 1974,  | 1975,  | 1976,  | 1977,  |
| AGE       |                      |        |        |                |        |        |        |        |        |        |
| 3,        | 614,                 | 1191,  | 1445,  | 2857,          | 2714,  | 2515,  | 3504,  | 2062,  | 3178,  | 1609,  |
| 4,        | 1689,                | 2086,  | 6577,  | 3316,          | 1774,  | 6253,  | 4126,  | 3361,  | 3217,  | 2937,  |
| 5,        | 1116,                | 2294,  | 1558,  | 5585,          | 2588,  | 7075,  | 4011,  | 3801,  | 1720,  | 2034,  |
| 6,        | 1095,                | 1414,  | 1478,  | 1005,          | 2742,  | 3478,  | 2784,  | 1939,  | 1250,  | 1288,  |
| 7,        | 548,                 | 1118,  | 899,   | 828,           | 1529,  | 1634,  | 1401,  | 1045,  | 877,   | 767,   |
| 8,        | 655,                 | 589,   | 730,   | 469,           | 1305,  | 693,   | 640,   | 714,   | 641,   | 708,   |
| 9,        | 254,                 | 580,   | 316,   | 326,           | 1017,  | 550,   | 368,   | 302,   | 468,   | 498,   |
| 10,       | 128,                 | 239,   | 241,   | 164,           | 743,   | 403,   | 340,   | 192,   | 223,   | 338,   |
| 11,       | 89,                  | 115,   | 86,    | 100,           | 330,   | 215,   | 197,   | 193,   | 141,   | 272,   |
| +gp,      | 187,                 | 190,   | 132,   | 100,           | 210,   | 186,   | 265,   | 298,   | 287,   | 330,   |
| TOTALNUM, | 6375,                | 9816,  | 13462, | 14750,         | 14952, | 23002, | 17636, | 13907, | 12002, | 10781, |
| TONSLAND, | 20387,               | 27437, | 29110, | 32706,         | 42663, | 57431, | 47188, | 41576, | 33065, | 34835, |
| SOPCOF %, | 102,                 | 97,    | 96,    | 109,           | 100,   | 120,   | 113,   | 116,   | 107,   | 104,   |

| Table 1   | Catch numbers at age |        |        | Numbers*10**-3 |        |        |        |        |        |        |
|-----------|----------------------|--------|--------|----------------|--------|--------|--------|--------|--------|--------|
| YEAR,     | 1978,                | 1979,  | 1980,  | 1981,          | 1982,  | 1983,  | 1984,  | 1985,  | 1986,  | 1987,  |
| AGE       |                      |        |        |                |        |        |        |        |        |        |
| 3,        | 611,                 | 287,   | 996,   | 411,           | 387,   | 2483,  | 368,   | 1224,  | 1167,  | 1581,  |
| 4,        | 1743,                | 933,   | 877,   | 1804,          | 4076,  | 1103,  | 11067, | 3990,  | 1997,  | 5793,  |
| 5,        | 1736,                | 1341,  | 720,   | 769,           | 994,   | 5052,  | 2359,  | 5583,  | 4473,  | 3827,  |
| 6,        | 548,                 | 1033,  | 673,   | 932,           | 1114,  | 1343,  | 4093,  | 1182,  | 3730,  | 2785,  |
| 7,        | 373,                 | 584,   | 726,   | 908,           | 380,   | 575,   | 875,   | 1898,  | 953,   | 990,   |
| 8,        | 479,                 | 414,   | 284,   | 734,           | 417,   | 339,   | 273,   | 273,   | 1077,  | 532,   |
| 9,        | 466,                 | 247,   | 212,   | 343,           | 296,   | 273,   | 161,   | 103,   | 245,   | 333,   |
| 10,       | 473,                 | 473,   | 171,   | 192,           | 105,   | 98,    | 52,    | 38,    | 104,   | 81,    |
| 11,       | 407,                 | 368,   | 196,   | 92,            | 88,    | 98,    | 65,    | 26,    | 67,    | 43,    |
| +gp,      | 535,                 | 691,   | 786,   | 1021,          | 902,   | 540,   | 253,   | 275,   | 158,   | 97,    |
| TOTALNUM, | 7371,                | 6371,  | 5641,  | 7206,          | 8759,  | 11904, | 19566, | 14592, | 13971, | 16062, |
| TONSLAND, | 28138,               | 27246, | 25230, | 30103,         | 30964, | 39176, | 54665, | 44605, | 41716, | 40020, |
| SOPCOF %, | 100,                 | 102,   | 99,    | 96,            | 96,    | 100,   | 100,   | 94,    | 94,    | 96,    |

| Table 1   | Catch numbers at age |        |        | Numbers*10**-3 |        |        |        |        |        |        |
|-----------|----------------------|--------|--------|----------------|--------|--------|--------|--------|--------|--------|
| YEAR,     | 1988,                | 1989,  | 1990,  | 1991,          | 1992,  | 1993,  | 1994,  | 1995,  | 1996,  | 1997,  |
| AGE       |                      |        |        |                |        |        |        |        |        |        |
| 3,        | 866,                 | 451,   | 294,   | 1030,          | 548,   | 1316,  | 690,   | 398,   | 297,   | 343,   |
| 4,        | 2950,                | 5981,  | 3833,  | 5125,          | 4281,  | 2611,  | 3961,  | 1019,  | 1087,  | 829,   |
| 5,        | 9555,                | 5300,  | 10120, | 7452,          | 3860,  | 4689,  | 2663,  | 3469,  | 1146,  | 2432,  |
| 6,        | 2784,                | 7136,  | 9219,  | 5544,          | 2820,  | 1665,  | 2368,  | 1836,  | 1449,  | 1761,  |
| 7,        | 1300,                | 793,   | 5070,  | 3487,          | 1445,  | 858,   | 746,   | 1177,  | 1156,  | 1330,  |
| 8,        | 621,                 | 546,   | 477,   | 1630,          | 941,   | 492,   | 500,   | 345,   | 521,   | 622,   |
| 9,        | 363,                 | 185,   | 123,   | 405,           | 645,   | 448,   | 307,   | 241,   | 132,   | 164,   |
| 10,       | 159,                 | 83,    | 61,    | 238,           | 129,   | 245,   | 303,   | 192,   | 77,    | 71,    |
| 11,       | 27,                  | 55,    | 60,    | 128,           | 66,    | 54,    | 150,   | 104,   | 64,    | 29,    |
| +gp,      | 60,                  | 39,    | 79,    | 118,           | 114,   | 52,    | 49,    | 117,   | 82,    | 100,   |
| TOTALNUM, | 18685,               | 20569, | 29336, | 25157,         | 14849, | 12430, | 11737, | 8898,  | 6011,  | 7681,  |
| TONSLAND, | 45285,               | 44477, | 61561, | 54863,         | 38366, | 33543, | 33182, | 27213, | 20025, | 22229, |
| SOPCOF %, | 99,                  | 97,    | 98,    | 99,            | 105,   | 102,   | 102,   | 102,   | 103,   | 100,   |

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

| Table 2<br>YEAR, | Catch weights at age (kg) |         |         |         |         |         |         |
|------------------|---------------------------|---------|---------|---------|---------|---------|---------|
|                  | 1961,                     | 1962,   | 1963,   | 1964,   | 1965,   | 1966,   | 1967,   |
| AGE              |                           |         |         |         |         |         |         |
| 3,               | 1.4300,                   | 1.2730, | 1.2800, | 1.1750, | 1.1810, | 1.3610, | 1.2730, |
| 4,               | 2.3020,                   | 2.0450, | 2.1970, | 2.0550, | 2.1250, | 2.0260, | 1.7800, |
| 5,               | 3.3480,                   | 3.2930, | 3.2120, | 3.2660, | 2.9410, | 3.0550, | 2.5340, |
| 6,               | 4.2870,                   | 4.1910, | 4.5680, | 4.2550, | 4.0960, | 3.6580, | 3.5720, |
| 7,               | 5.1280,                   | 5.1460, | 5.0560, | 5.0380, | 4.8780, | 4.5850, | 4.3680, |
| 8,               | 6.1550,                   | 5.6550, | 5.9320, | 5.6940, | 5.9320, | 5.5200, | 5.3130, |
| 9,               | 7.0600,                   | 6.4690, | 6.2590, | 6.6620, | 6.3210, | 6.8370, | 5.8120, |
| 10,              | 7.2650,                   | 6.7060, | 8.0000, | 6.8370, | 7.2880, | 7.2650, | 6.5540, |
| 11,              | 7.4970,                   | 7.1500, | 7.2650, | 7.6860, | 8.0740, | 7.6620, | 7.8060, |
| +gp,             | 9.3400,                   | 9.0240, | 8.8590, | 8.5590, | 8.9040, | 9.2230, | 8.1490, |
| SOPCOFAC,        | 1.0779,                   | .9342,  | .9590,  | .9933,  | .9220,  | .9769,  | 1.0357, |

| Table 2<br>YEAR, | Catch weights at age (kg) |         |         |         |         |         |         |         |         |         |
|------------------|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
|                  | 1968,                     | 1969,   | 1970,   | 1971,   | 1972,   | 1973,   | 1974,   | 1975,   | 1976,   | 1977,   |
| AGE              |                           |         |         |         |         |         |         |         |         |         |
| 3,               | 1.3020,                   | 1.1880, | 1.2440, | 1.1010, | 1.0430, | 1.0880, | 1.4300, | 1.1140, | 1.0880, | 1.2230, |
| 4,               | 1.7370,                   | 1.6670, | 1.4450, | 1.3160, | 1.4850, | 1.4610, | 1.5250, | 1.6580, | 1.6760, | 1.6410, |
| 5,               | 2.0360,                   | 2.3020, | 2.2490, | 1.8180, | 2.0550, | 1.5820, | 2.2070, | 2.2600, | 2.8780, | 2.6600, |
| 6,               | 3.1200,                   | 2.8530, | 2.8530, | 2.9780, | 2.8290, | 2.2490, | 2.5000, | 3.1200, | 3.0810, | 3.7900, |
| 7,               | 4.0490,                   | 3.6730, | 3.5150, | 3.7020, | 3.7910, | 3.6870, | 3.1200, | 3.5570, | 4.2870, | 4.2390, |
| 8,               | 5.1830,                   | 5.0020, | 4.4180, | 4.2710, | 4.1750, | 4.3850, | 4.6010, | 4.0960, | 4.3520, | 5.5970, |
| 9,               | 6.2380,                   | 5.7140, | 5.4440, | 5.3880, | 4.8080, | 5.1280, | 5.5590, | 5.1280, | 4.7900, | 5.3500, |
| 10,              | 7.5200,                   | 6.4050, | 5.7330, | 5.9720, | 5.2940, | 5.2760, | 5.7140, | 6.0940, | 5.9120, | 5.9120, |
| 11,              | 8.0490,                   | 6.5540, | 6.6620, | 6.4900, | 6.9480, | 6.7270, | 6.2590, | 7.1960, | 6.6190, | 6.8370, |
| +gp,             | 9.0920,                   | 8.0870, | 8.5840, | 8.0050, | 7.5150, | 8.0310, | 8.0100, | 8.5980, | 7.8940, | 7.7080, |
| SOPCOFAC,        | 1.0194,                   | .9663,  | .9634,  | 1.0935, | 1.0043, | 1.2006, | 1.1296, | 1.1607, | 1.0680, | 1.0442, |

| Table 2<br>YEAR, | Catch weights at age (kg) |         |         |         |          |          |          |          |          |          |
|------------------|---------------------------|---------|---------|---------|----------|----------|----------|----------|----------|----------|
|                  | 1978,                     | 1979,   | 1980,   | 1981,   | 1982,    | 1983,    | 1984,    | 1985,    | 1986,    | 1987,    |
| AGE              |                           |         |         |         |          |          |          |          |          |          |
| 3,               | 1.4930,                   | 1.2200, | 1.2300, | 1.3100, | 1.3370,  | 1.2080,  | 1.4310,  | 1.4010,  | 1.7180,  | 1.6090,  |
| 4,               | 2.3240,                   | 1.8800, | 2.1200, | 2.1300, | 1.8510,  | 2.0290,  | 1.9530,  | 2.0320,  | 1.9860,  | 1.8350,  |
| 5,               | 3.0680,                   | 2.6200, | 3.3200, | 3.0000, | 2.9510,  | 2.9650,  | 2.4700,  | 2.9650,  | 2.6180,  | 2.3950,  |
| 6,               | 3.7460,                   | 3.4000, | 4.2800, | 3.8100, | 3.5770,  | 4.1430,  | 3.8500,  | 3.5960,  | 3.2770,  | 3.1820,  |
| 7,               | 4.9130,                   | 4.1800, | 5.1600, | 4.7500, | 4.9270,  | 4.7240,  | 5.1770,  | 5.3360,  | 4.1860,  | 4.0670,  |
| 8,               | 4.3680,                   | 4.9500, | 6.4200, | 5.2500, | 6.2430,  | 5.9010,  | 6.3470,  | 7.2020,  | 5.5890,  | 5.1490,  |
| 9,               | 5.2760,                   | 5.6900, | 6.8700, | 5.9500, | 7.2320,  | 6.8110,  | 7.8250,  | 6.9660,  | 6.0500,  | 5.5010,  |
| 10,              | 5.8320,                   | 6.3800, | 7.0900, | 6.4300, | 7.2390,  | 7.0510,  | 6.7460,  | 9.8620,  | 6.1500,  | 6.6260,  |
| 11,              | 6.0530,                   | 7.0200, | 7.9300, | 7.0000, | 8.3460,  | 7.2480,  | 8.6360,  | 10.6700, | 9.5360,  | 6.3430,  |
| +gp,             | 7.5760,                   | 8.6260, | 9.2150, | 8.9620, | 10.0410, | 10.0550, | 10.0980, | 11.9500, | 10.2180, | 10.2440, |
| SOPCOFAC,        | 1.0049,                   | 1.0248, | .9937,  | .9564,  | .9632,   | .9997,   | .9991,   | .9415,   | .9419,   | .9620,   |

| Table 2<br>YEAR, | Catch weights at age (kg) |         |         |         |         |         |         |         |         |         |
|------------------|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
|                  | 1988,                     | 1989,   | 1990,   | 1991,   | 1992,   | 1993,   | 1994,   | 1995,   | 1996,   | 1997,   |
| AGE              |                           |         |         |         |         |         |         |         |         |         |
| 3,               | 1.5000,                   | 1.3090, | 1.2230, | 1.2400, | 1.2640, | 1.4080, | 1.5030, | 1.4560, | 1.4320, | 1.4760, |
| 4,               | 1.9750,                   | 1.7350, | 1.6330, | 1.5680, | 1.6020, | 1.8600, | 1.9510, | 2.1770, | 1.8750, | 1.7830, |
| 5,               | 1.9780,                   | 1.9070, | 1.8300, | 1.8640, | 2.0690, | 2.3230, | 2.2670, | 2.4200, | 2.4960, | 2.0320, |
| 6,               | 2.9370,                   | 2.3730, | 2.0520, | 2.2110, | 2.5540, | 3.1310, | 2.9360, | 2.8950, | 3.2290, | 2.7780, |
| 7,               | 3.7980,                   | 3.8100, | 2.8660, | 2.6480, | 3.0570, | 3.7300, | 4.2140, | 3.6510, | 3.7440, | 3.5980, |
| 8,               | 4.4190,                   | 4.6670, | 4.4740, | 3.3800, | 4.0780, | 4.3940, | 4.9710, | 5.0640, | 4.9640, | 4.7660, |
| 9,               | 5.1150,                   | 5.5090, | 5.4240, | 4.8160, | 5.0120, | 5.2090, | 5.6570, | 5.4400, | 6.3750, | 5.9820, |
| 10,              | 6.7120,                   | 5.9720, | 6.4690, | 5.5160, | 6.7680, | 6.5400, | 5.9500, | 6.1670, | 6.7450, | 7.6580, |
| 11,              | 9.0400,                   | 6.9390, | 6.3430, | 6.4070, | 7.7540, | 8.4030, | 6.8910, | 7.0800, | 7.4660, | 7.8820, |
| +gp,             | 9.3370,                   | 9.9360, | 8.2870, | 7.7290, | 8.2270, | 8.0500, | 9.1090, | 7.5390, | 7.9810, | 9.2450, |
| SOPCOFAC,        | .9928,                    | .9698,  | .9800,  | .9939,  | 1.0497, | 1.0169, | 1.0240, | 1.0205, | 1.0317, | .9992,  |

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

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

1983-1998

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

| Table 5 | Proportion mature at age |         |         |         |         |         |         |
|---------|--------------------------|---------|---------|---------|---------|---------|---------|
| YEAR,   | 1961,                    | 1962,   | 1963,   | 1964,   | 1965,   | 1966,   | 1967,   |
| AGE     |                          |         |         |         |         |         |         |
| 3,      | .0400,                   | .0400,  | .0400,  | .0400,  | .0400,  | .0400,  | .0400,  |
| 4,      | .2600,                   | .2600,  | .2600,  | .2600,  | .2600,  | .2600,  | .2600,  |
| 5,      | .5700,                   | .5700,  | .5700,  | .5700,  | .5700,  | .5700,  | .5700,  |
| 6,      | .8200,                   | .8200,  | .8200,  | .8200,  | .8200,  | .8200,  | .8200,  |
| 7,      | .9100,                   | .9100,  | .9100,  | .9100,  | .9100,  | .9100,  | .9100,  |
| 8,      | .9800,                   | .9800,  | .9800,  | .9800,  | .9800,  | .9800,  | .9800,  |
| 9,      | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 10,     | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 11,     | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| +gp,    | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |

| Table 5 | Proportion mature at age |         |         |         |         |         |         |         |         |         |
|---------|--------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| YEAR,   | 1968,                    | 1969,   | 1970,   | 1971,   | 1972,   | 1973,   | 1974,   | 1975,   | 1976,   | 1977,   |
| AGE     |                          |         |         |         |         |         |         |         |         |         |
| 3,      | .0400,                   | .0400,  | .0400,  | .0400,  | .0400,  | .0400,  | .0400,  | .0400,  | .0400,  | .0400,  |
| 4,      | .2600,                   | .2600,  | .2600,  | .2600,  | .2600,  | .2600,  | .2600,  | .2600,  | .2600,  | .2600,  |
| 5,      | .5700,                   | .5700,  | .5700,  | .5700,  | .5700,  | .5700,  | .5700,  | .5700,  | .5700,  | .5700,  |
| 6,      | .8200,                   | .8200,  | .8200,  | .8200,  | .8200,  | .8200,  | .8200,  | .8200,  | .8200,  | .8200,  |
| 7,      | .9100,                   | .9100,  | .9100,  | .9100,  | .9100,  | .9100,  | .9100,  | .9100,  | .9100,  | .9100,  |
| 8,      | .9800,                   | .9800,  | .9800,  | .9800,  | .9800,  | .9800,  | .9800,  | .9800,  | .9800,  | .9800,  |
| 9,      | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 10,     | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 11,     | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| +gp,    | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |

| Table 5 | Proportion mature at age |         |         |         |         |         |         |         |         |         |
|---------|--------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| YEAR,   | 1978,                    | 1979,   | 1980,   | 1981,   | 1982,   | 1983,   | 1984,   | 1985,   | 1986,   | 1987,   |
| AGE     |                          |         |         |         |         |         |         |         |         |         |
| 3,      | .0400,                   | .0400,  | .0400,  | .0400,  | .0400,  | .1000,  | .1200,  | .1100,  | .1500,  | .1300,  |
| 4,      | .2600,                   | .2600,  | .2600,  | .2600,  | .2600,  | .3100,  | .3000,  | .3100,  | .3000,  | .2700,  |
| 5,      | .5700,                   | .5700,  | .5700,  | .5700,  | .5700,  | .6800,  | .5700,  | .6800,  | .6000,  | .5500,  |
| 6,      | .8200,                   | .8200,  | .8200,  | .8200,  | .8200,  | .9200,  | .9000,  | .8800,  | .8500,  | .8400,  |
| 7,      | .9100,                   | .9100,  | .9100,  | .9100,  | .9100,  | .9800,  | .9800,  | .9900,  | .9600,  | .9600,  |
| 8,      | .9800,                   | .9800,  | .9800,  | .9800,  | .9800,  | 1.0000, | 1.0000, | 1.0000, | .9900,  | .9900,  |
| 9,      | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 10,     | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 11,     | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| +gp,    | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |

| Table 5 | Proportion mature at age |         |         |         |         |         |         |         |         |         |
|---------|--------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| YEAR,   | 1988,                    | 1989,   | 1990,   | 1991,   | 1992,   | 1993,   | 1994,   | 1995,   | 1996,   | 1997,   |
| AGE     |                          |         |         |         |         |         |         |         |         |         |
| 3,      | .1200,                   | .1100,  | .1000,  | .1000,  | .1000,  | .1100,  | .1200,  | .1200,  | .1200,  | .1200,  |
| 4,      | .3000,                   | .2600,  | .2400,  | .2300,  | .2300,  | .2800,  | .3000,  | .3400,  | .2800,  | .2600,  |
| 5,      | .4600,                   | .4400,  | .4300,  | .4400,  | .4800,  | .5400,  | .5300,  | .5600,  | .5800,  | .4700,  |
| 6,      | .8000,                   | .7100,  | .6400,  | .6800,  | .7400,  | .8300,  | .8000,  | .8000,  | .8400,  | .7800,  |
| 7,      | .9500,                   | .9500,  | .8800,  | .8600,  | .9000,  | .9400,  | .9600,  | .9400,  | .9400,  | .9400,  |
| 8,      | .9800,                   | .9900,  | .9800,  | .9600,  | .9800,  | .9800,  | .9900,  | .9900,  | .9900,  | .9900,  |
| 9,      | 1.0000,                  | 1.0000, | 1.0000, | .9900,  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 10,     | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| 11,     | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |
| +gp,    | 1.0000,                  | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, | 1.0000, |

Table 2.5.11. Saithe in the Faroes Grounds. Effort (fishing days) and catch at age (thousands) for commercial Cuba Beta trawlers.

| Year | Effort, days | Age | 3 | 4    | 5    | 6    | 7   | 8   | 9   | 10 | 11 | 12 | 13 | 14 |
|------|--------------|-----|---|------|------|------|-----|-----|-----|----|----|----|----|----|
| 1982 | 1805         | 0   |   | 984  | 275  | 516  | 107 | 47  | 37  | 34 | 14 | 12 | 9  | 17 |
| 1983 | 1792         | 225 |   | 231  | 1052 | 312  | 116 | 85  | 73  | 15 | 31 | 32 | 2  | 36 |
| 1984 | 1714         | 77  |   | 1780 | 328  | 762  | 182 | 49  | 19  | 3  | 8  | 17 | 2  | 5  |
| 1985 | 1224         | 93  |   | 518  | 1196 | 249  | 313 | 41  | 16  | 3  | 6  | 12 | 4  | 1  |
| 1986 | 1341         | 170 |   | 324  | 891  | 638  | 177 | 188 | 45  | 17 | 9  | 6  | 16 | 1  |
| 1987 | 1762         | 239 |   | 943  | 798  | 633  | 237 | 125 | 65  | 15 | 10 | 1  | 3  | 4  |
| 1988 | 1705         | 129 |   | 539  | 1706 | 599  | 244 | 102 | 67  | 16 | 2  | 2  | 3  | 4  |
| 1989 | 1473         | 96  |   | 1096 | 931  | 1178 | 133 | 79  | 26  | 15 | 10 | 2  | 0  | 2  |
| 1990 | 1820         | 44  |   | 477  | 1442 | 1395 | 768 | 71  | 19  | 8  | 8  | 3  | 2  | 1  |
| 1991 | 1985         | 72  |   | 594  | 1035 | 837  | 528 | 258 | 31  | 29 | 21 | 11 | 0  | 0  |
| 1992 | 1932         | 19  |   | 464  | 488  | 413  | 207 | 120 | 104 | 20 | 10 | 4  | 6  | 1  |
| 1993 | 1649         | 144 |   | 559  | 906  | 326  | 174 | 103 | 77  | 46 | 10 | 7  | 0  | 0  |
| 1994 | 1638         | 122 |   | 906  | 558  | 524  | 167 | 117 | 76  | 70 | 34 | 4  | 5  | 0  |
| 1995 | 1872         | 79  |   | 299  | 957  | 392  | 242 | 82  | 41  | 30 | 23 | 13 | 2  | 3  |
| 1996 | 1492         | 44  |   | 66   | 236  | 244  | 298 | 228 | 109 | 28 | 15 | 14 | 10 | 2  |
| 1997 | 1514         | 101 |   | 197  | 515  | 379  | 291 | 131 | 31  | 15 | 6  | 12 | 7  | 3  |

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

Lowestoft VPA Version 3.1

6-May-98 15:06:15

Extended Survivors Analysis

Saithe Faroes Vb (run: XSAARN03/X03)

CPUE data from file /users/fish/ifad/ifapwork/nwwg/sai\_faro/FLEET.X03

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

| Fleet,                | First, | Last, | First, | Last, | Alpha, | Beta  |
|-----------------------|--------|-------|--------|-------|--------|-------|
| , year,               | year,  | age,  | age,   |       |        |       |
| FLT11: Cuba Beta ser, | 1982,  | 1997, | 3,     | 11,   | .000,  | 1.000 |

Time series weights :

Tapered time weighting applied  
Power = 3 over 20 years

Catchability analysis :

Catchability dependent on stock size for ages < 4

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

Catchability independent of age for ages >= 9

Terminal population estimation :

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

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

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

Prior weighting not applied

Tuning converged after 29 iterations

1

Regression weights

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

Fishing mortalities

| Age, | 1988, | 1989, | 1990, | 1991, | 1992, | 1993, | 1994, | 1995, | 1996, | 1997 |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 3,   | .022, | .017, | .015, | .045, | .031, | .065, | .063, | .035, | .044, | .029 |
| 4,   | .088, | .203, | .201, | .401, | .266, | .203, | .282, | .125, | .125, | .166 |
| 5,   | .352, | .227, | .625, | .749, | .604, | .525, | .329, | .428, | .202, | .453 |
| 6,   | .644, | .487, | .778, | .871, | .725, | .574, | .554, | .398, | .319, | .544 |
| 7,   | .597, | .378, | .785, | .785, | .584, | .503, | .553, | .597, | .471, | .546 |
| 8,   | .608, | .542, | .412, | .631, | .500, | .400, | .626, | .539, | .583, | .503 |
| 9,   | .739, | .363, | .221, | .751, | .554, | .473, | .471, | .719, | .406, | .363 |
| 10,  | .612, | .364, | .194, | .877, | .571, | .421, | .693, | .614, | .529, | .399 |
| 11,  | .838, | .441, | .491, | .793, | .646, | .501, | .496, | .543, | .424, | .386 |

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

XSA population numbers (Thousands)

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

Estimated population abundance at 1st Jan 1998

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

Taper weighted geometric mean of the VPA populations:

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

Standard error of the weighted Log(VPA populations) :

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

Log catchability residuals.

Fleet : FLT11: Cuba Beta ser

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

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

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

| Age ,       | 4,        | 5,       | 6,       | 7,       | 8,       | 9,       | 10,      | 11       |
|-------------|-----------|----------|----------|----------|----------|----------|----------|----------|
| Mean Log q, | -10.9157, | -9.9878, | -9.6848, | -9.6725, | -9.7010, | -9.8048, | -9.8048, | -9.8048, |
| S.E(Log q), | .5727,    | .3385,   | .2725,   | .2060,   | .4537,   | .6461,   | .6739,   | .2433,   |

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

Regression statistics :

Ages with q dependent on year class strength

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

3, 1.83, -1.256, 15.21, .19, 15, 1.26, -12.82,

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

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

4, 1.00, -.012, 10.92, .51, 16, .60, -10.92,  
5, 1.05, -.235, 10.01, .67, 16, .37, -9.99,  
6, 1.05, -.288, 9.73, .76, 16, .30, -9.68,  
7, 1.00, -.023, 9.68, .84, 16, .22, -9.67,  
8, 1.45, -.938, 10.75, .31, 16, .66, -9.70,  
9, 2.06, -1.111, 13.24, .10, 16, 1.32, -9.80,  
10, .99, .017, 9.91, .35, 16, .69, -9.94,  
11, .81, 1.857, 8.89, .90, 16, .18, -9.79,

1

Terminal year survivor and F summaries :

Age 3 Catchability dependent on age and year class strength

Year class = 1994

| Fleet,                | Estimated,<br>Survivors, | Int,<br>s.e, | Ext,<br>s.e, | Var,<br>Ratio, | N, Scaled,<br>, Weights, | Estimated<br>F |
|-----------------------|--------------------------|--------------|--------------|----------------|--------------------------|----------------|
| FLT11: Cuba Beta ser, | 27461.,                  | 1.320,       | .000,        | .00,           | 1, .075,                 | .011           |
| P shrinkage mean ,    | 17601.,                  | .59,,,       |              |                | .386,                    | .017           |
| F shrinkage mean ,    | 6371.,                   | .50,,,       |              |                | .539,                    | .048           |

Weighted prediction :

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

1

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

Year class = 1993

| Fleet,                | Estimated,<br>Survivors, | Int,<br>s.e, | Ext,<br>s.e, | Var,<br>Ratio, | N, Scaled,<br>, Weights, | Estimated<br>F |
|-----------------------|--------------------------|--------------|--------------|----------------|--------------------------|----------------|
| FLT11: Cuba Beta ser, | 5628.,                   | .545,        | .121,        | .22,           | 2, .414,                 | .125           |
| F shrinkage mean ,    | 3366.,                   | .50,,,       |              |                | .586,                    | .201           |

Weighted prediction :

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

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

Year class = 1992

| Fleet,                | Estimated,<br>Survivors, | Int,<br>s.e, | Ext,<br>s.e, | Var,<br>Ratio, | N, Scaled,<br>, Weights, | Estimated<br>F |
|-----------------------|--------------------------|--------------|--------------|----------------|--------------------------|----------------|
| FLT11: Cuba Beta ser, | 3643.,                   | .296,        | .467,        | 1.58,          | 3, .637,                 | .472           |
| F shrinkage mean ,    | 4210.,                   | .50,,,       |              |                | .363,                    | .420           |

Weighted prediction :

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

1

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

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

Year class = 1991

| Fleet,                | Estimated,<br>Survivors, | Int,<br>s.e, | Ext,<br>s.e, | Var,<br>Ratio, | N,<br>Weights, | Scaled,<br>Weights, | Estimated<br>F |
|-----------------------|--------------------------|--------------|--------------|----------------|----------------|---------------------|----------------|
| FLT11: Cuba Beta ser, | 2160.,                   | .212,        | .214,        | 1.01,          | 4,             | .745,               | .553           |
| F shrinkage mean ,    | 2348.,                   | .50,,,       |              |                |                | .255,               | .518           |

Weighted prediction :

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

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

Year class = 1990

| Fleet,                | Estimated,<br>Survivors, | Int,<br>s.e, | Ext,<br>s.e, | Var,<br>Ratio, | N,<br>Weights, | Scaled,<br>Weights, | Estimated<br>F |
|-----------------------|--------------------------|--------------|--------------|----------------|----------------|---------------------|----------------|
| FLT11: Cuba Beta ser, | 1657.,                   | .181,        | .206,        | 1.14,          | 5,             | .778,               | .546           |
| F shrinkage mean ,    | 1656.,                   | .50,,,       |              |                |                | .222,               | .546           |

Weighted prediction :

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

1

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

Year class = 1989

| Fleet,                | Estimated,<br>Survivors, | Int,<br>s.e, | Ext,<br>s.e, | Var,<br>Ratio, | N,<br>Weights, | Scaled,<br>Weights, | Estimated<br>F |
|-----------------------|--------------------------|--------------|--------------|----------------|----------------|---------------------|----------------|
| FLT11: Cuba Beta ser, | 884.,                    | .178,        | .140,        | .79,           | 6,             | .744,               | .493           |
| F shrinkage mean ,    | 797.,                    | .50,,,       |              |                |                | .256,               | .534           |

Weighted prediction :

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

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

Year class = 1988

| Fleet,                | Estimated,<br>Survivors, | Int,<br>s.e, | Ext,<br>s.e, | Var,<br>Ratio, | N,<br>Weights, | Scaled,<br>Weights, | Estimated<br>F |
|-----------------------|--------------------------|--------------|--------------|----------------|----------------|---------------------|----------------|
| FLT11: Cuba Beta ser, | 432.,                    | .203,        | .181,        | .89,           | 7,             | .659,               | .296           |
| F shrinkage mean ,    | 213.,                    | .50,,,       |              |                |                | .341,               | .529           |

Weighted prediction :

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

1

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

Year class = 1987

| Fleet,                | Estimated,<br>Survivors, | Int,<br>s.e, | Ext,<br>s.e, | Var,<br>Ratio, | N,<br>Weights, | Scaled,<br>Weights, | Estimated<br>F |
|-----------------------|--------------------------|--------------|--------------|----------------|----------------|---------------------|----------------|
| FLT11: Cuba Beta ser, | 172.,                    | .217,        | .183,        | .85,           | 8,             | .620,               | .317           |
| F shrinkage mean ,    | 84.,                     | .50,,,       |              |                |                | .380,               | .570           |

Weighted prediction :

| Survivors,<br>at end of year, | Int,<br>s.e, | Ext,<br>s.e, | N,<br>, | Var,<br>Ratio, | F    |
|-------------------------------|--------------|--------------|---------|----------------|------|
| 131.,                         | .23,         | .21,         | 9,      | .892,          | .399 |

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

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

Year class = 1986

| Fleet,                | Estimated, | Int,    | Ext,  | Var,   | N, Scaled, | Estimated |
|-----------------------|------------|---------|-------|--------|------------|-----------|
|                       | Survivors, | s.e,    | s.e,  | Ratio, | Weights,   | F         |
| FLT11: Cuba Beta ser, | 58.,       | .228,   | .089, | .39,   | 9, .722,   | .372      |
| F shrinkage mean ,    | 50.,       | .50,,,, |       |        | .278,      | .425      |

Weighted prediction :

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

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

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

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

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

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

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

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

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

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

| Table 10<br>YEAR, | Stock number at age (start of year) |         |         |        |        | Numbers*10** <sup>-3</sup> |        |        |        |        | GMST 61-95 | AMST 61-95 |
|-------------------|-------------------------------------|---------|---------|--------|--------|----------------------------|--------|--------|--------|--------|------------|------------|
|                   | 1988,                               | 1989,   | 1990,   | 1991,  | 1992,  | 1993,                      | 1994,  | 1995,  | 1996,  | 1997,  | 1998,      |            |
| AGE               |                                     |         |         |        |        |                            |        |        |        |        |            |            |
| 3,                | 44913,                              | 28975,  | 21282,  | 25854, | 19788, | 23214,                     | 12484, | 12914, | 7661,  | 13228, | 0,         | 21755,     |
| 4,                | 38520,                              | 35988,  | 23314,  | 17158, | 20235, | 15705,                     | 17815, | 9597,  | 10213, | 6004,  | 10520,     | 16614,     |
| 5,                | 35564,                              | 28868,  | 24053,  | 15620, | 9411,  | 12694,                     | 10496, | 11002, | 6935,  | 7378,  | 4166,      | 11135,     |
| 6,                | 6478,                               | 20471,  | 18840,  | 10536, | 6046,  | 4212,                      | 6150,  | 6183,  | 5869,  | 4641,  | 3840,      | 6557,      |
| 7,                | 3197,                               | 2785,   | 10304,  | 7083,  | 3610,  | 2398,                      | 1942,  | 2893,  | 3401,  | 3494,  | 2206,      | 3665,      |
| 8,                | 1507,                               | 1441,   | 1563,   | 3848,  | 2644,  | 1648,                      | 1187,  | 915,   | 1303,  | 1739,  | 1657,      | 2104,      |
| 9,                | 768,                                | 672,    | 686,    | 848,   | 1676,  | 1313,                      | 904,   | 520,   | 437,   | 596,   | 861,       | 1245,      |
| 10,               | 384,                                | 300,    | 383,    | 450,   | 328,   | 789,                       | 670,   | 462,   | 207,   | 238,   | 339,       | 738,       |
| 11,               | 53,                                 | 171,    | 171,    | 258,   | 153,   | 152,                       | 424,   | 274,   | 205,   | 100,   | 131,       | 434,       |
| +gp,              | 115,                                | 120,    | 223,    | 235,   | 262,   | 144,                       | 137,   | 305,   | 260,   | 342,   | 246,       |            |
| 0 TOTAL,          | 131500,                             | 119792, | 100818, | 81890, | 64151, | 62269,                     | 52209, | 45065, | 36492, | 37760, | 23966,     |            |

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

Table 16 Summary (without SOP correction)

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

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

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

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

Lowestoft VPA Version 3.1

29-Apr-98 13:12:23

Extended Survivors Analysis

Saithe Faroes Vb (run: XSAARN07/X07)

CPUE data from file /users/fish/ifad/ifapwork/nwwg/sai\_faro/FLEET.X07

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

|                      |   |        |       |        |       |        |       |
|----------------------|---|--------|-------|--------|-------|--------|-------|
| Fleet,               |   | First, | Last, | First, | Last, | Alpha, | Beta  |
|                      | , | year,  | year, | age,   | age   |        |       |
| FLT12: Cuba Logbook, |   | 1985,  | 1997, | 3,     | 11,   | .000,  | 1.000 |

Time series weights :

Tapered time weighting applied  
Power = 3 over 20 years

Catchability analysis :

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

Catchability independent of age for ages >= 9

Terminal population estimation :

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

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

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

Prior weighting not applied

Tuning converged after 41 iterations

1

Regression weights

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

Fishing mortalities

|      |       |       |       |       |       |       |       |       |       |      |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| Age, | 1988, | 1989, | 1990, | 1991, | 1992, | 1993, | 1994, | 1995, | 1996, | 1997 |
| 3,   | .021, | .017, | .015, | .045, | .030, | .062, | .060, | .035, | .042, | .029 |
| 4,   | .088, | .202, | .201, | .400, | .264, | .193, | .270, | .118, | .127, | .158 |
| 5,   | .352, | .226, | .621, | .750, | .603, | .518, | .309, | .403, | .189, | .464 |
| 6,   | .645, | .486, | .771, | .858, | .726, | .573, | .543, | .363, | .292, | .496 |
| 7,   | .594, | .378, | .783, | .769, | .567, | .505, | .550, | .575, | .410, | .477 |
| 8,   | .610, | .537, | .412, | .628, | .481, | .382, | .631, | .534, | .546, | .406 |
| 9,   | .755, | .365, | .218, | .753, | .548, | .445, | .437, | .730, | .401, | .327 |
| 10,  | .647, | .378, | .195, | .856, | .575, | .414, | .622, | .543, | .544, | .391 |
| 11,  | .870, | .485, | .520, | .805, | .614, | .507, | .484, | .449, | .348, | .404 |

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

|                                         |           |           |           |           |           |           |           |           |           |
|-----------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1<br>XSA population numbers (Thousands) |           |           |           |           |           |           |           |           |           |
|                                         | AGE       |           |           |           |           |           |           |           |           |
| YEAR ,                                  | 3,        | 4,        | 5,        | 6,        | 7,        | 8,        | 9,        | 10,       |           |
| 11,                                     |           |           |           |           |           |           |           |           |           |
| 1988 ,                                  | 4.51E+04, | 3.87E+04, | 3.56E+04, | 6.47E+03, | 3.21E+03, | 1.50E+03, | 7.57E+02, | 3.69E+02, | 5.14E+01, |
| 1989 ,                                  | 2.90E+04, | 3.61E+04, | 2.90E+04, | 2.05E+04, | 2.78E+03, | 1.45E+03, | 6.69E+02, | 2.91E+02, | 1.58E+02, |
| 1990 ,                                  | 2.13E+04, | 2.33E+04, | 2.42E+04, | 1.90E+04, | 1.03E+04, | 1.56E+03, | 6.94E+02, | 3.80E+02, | 1.63E+02, |
| 1991 ,                                  | 2.60E+04, | 1.72E+04, | 1.56E+04, | 1.06E+04, | 7.18E+03, | 3.86E+03, | 8.46E+02, | 4.57E+02, | 2.56E+02, |
| 1992 ,                                  | 2.07E+04, | 2.04E+04, | 9.42E+03, | 6.04E+03, | 3.69E+03, | 2.72E+03, | 1.69E+03, | 3.26E+02, | 1.59E+02, |
| 1993 ,                                  | 2.41E+04, | 1.64E+04, | 1.28E+04, | 4.22E+03, | 2.39E+03, | 1.71E+03, | 1.38E+03, | 7.99E+02, | 1.50E+02, |
| 1994 ,                                  | 1.31E+04, | 1.85E+04, | 1.11E+04, | 6.25E+03, | 1.95E+03, | 1.18E+03, | 9.58E+02, | 7.23E+02, | 4.32E+02, |
| 1995 ,                                  | 1.27E+04, | 1.01E+04, | 1.16E+04, | 6.66E+03, | 2.97E+03, | 9.21E+02, | 5.14E+02, | 5.06E+02, | 3.18E+02, |
| 1996 ,                                  | 8.00E+03, | 1.01E+04, | 7.34E+03, | 6.33E+03, | 3.80E+03, | 1.37E+03, | 4.42E+02, | 2.03E+02, | 2.41E+02, |
| 1997 ,                                  | 1.31E+04, | 6.28E+03, | 7.24E+03, | 4.97E+03, | 3.87E+03, | 2.06E+03, | 6.50E+02, | 2.42E+02, | 9.64E+01, |

Estimated population abundance at 1st Jan 1998

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

Taper weighted geometric mean of the VPA populations:

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

Standard error of the weighted Log(VPA populations) :

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

1

Log catchability residuals.

Fleet : FLT12: Cuba Logbook

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

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

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

| Age ,       | 4,        | 5,        | 6,        | 7,        | 8,        | 9,        | 10,       | 11        |
|-------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Mean Log q, | -13.0013, | -12.0197, | -11.7630, | -11.7430, | -11.7591, | -11.8599, | -11.8599, | -11.8599, |
| S.E(Log q), | .4924,    | .3441,    | .2150,    | .2625,    | .5639,    | .7644,    | .7106,    | .2625,    |

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

Regression statistics :

Ages with q dependent on year class strength

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

3, 2.66, -1.620, 23.04, .10, 13, 1.88, -14.87,

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

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

4, 1.17, -.535, 13.56, .51, 13, .60, -13.00,  
5, 1.33, -1.146, 12.84, .57, 13, .45, -12.02,  
6, 1.09, -.576, 12.02, .82, 13, .24, -11.76,  
7, 1.09, -.429, 12.05, .73, 13, .30, -11.74,  
8, 2.19, -1.310, 16.95, .12, 13, 1.19, -11.76,  
9, 3.63, -1.329, 25.65, .03, 13, 2.68, -11.86,  
10, 1.23, -.402, 13.35, .25, 13, .90, -11.95,  
11, .77, 2.413, 10.34, .93, 13, .17, -11.86,

1

Terminal year survivor and F summaries :

Age 3 Catchability dependent on age and year class strength

Year class = 1994

| Fleet,                | Estimated,<br>Survivors, | Int,<br>s.e, | Ext,<br>s.e, | Var,<br>Ratio, | N, Scaled,<br>, Weights, | Estimated<br>F |
|-----------------------|--------------------------|--------------|--------------|----------------|--------------------------|----------------|
| FLT12: Cuba Logbook , | 20415.,                  | .797,        | .000,        | .00,           | 1, .180,                 | .015           |
| P shrinkage mean ,    | 17856.,                  | .58,,,       |              |                | .349,                    | .017           |
| F shrinkage mean ,    | 6599.,                   | .50,,,       |              |                | .471,                    | .046           |

Weighted prediction :

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

1

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

Year class = 1993

| Fleet,                | Estimated,<br>Survivors, | Int,<br>s.e, | Ext,<br>s.e, | Var,<br>Ratio, | N, Scaled,<br>, Weights, | Estimated<br>F |
|-----------------------|--------------------------|--------------|--------------|----------------|--------------------------|----------------|
| FLT12: Cuba Logbook , | 6530.,                   | .432,        | .200,        | .46,           | 2, .530,                 | .109           |
| F shrinkage mean ,    | 3475.,                   | .50,,,       |              |                | .470,                    | .195           |

Weighted prediction :

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

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

Year class = 1992

| Fleet,                | Estimated,<br>Survivors, | Int,<br>s.e, | Ext,<br>s.e, | Var,<br>Ratio, | N, Scaled,<br>, Weights, | Estimated<br>F |
|-----------------------|--------------------------|--------------|--------------|----------------|--------------------------|----------------|
| FLT12: Cuba Logbook , | 3622.,                   | .277,        | .399,        | 1.44,          | 3, .661,                 | .475           |
| F shrinkage mean ,    | 4379.,                   | .50,,,       |              |                | .339,                    | .407           |

Weighted prediction :

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

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

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

Year class = 1991

| Fleet,                | Estimated, | Int,    | Ext,  | Var,   | N, Scaled, | Estimated |
|-----------------------|------------|---------|-------|--------|------------|-----------|
| '                     | Survivors, | s.e,    | s.e,  | Ratio, | , Weights, | F         |
| FLT12: Cuba Logbook , | 2574.,     | .205,   | .171, | .84,   | 4, .765,   | .482      |
| F shrinkage mean ,    | 2437.,     | .50,,,, |       |        | .235,      | .503      |

Weighted prediction :

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

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

Year class = 1990

| Fleet,                | Estimated, | Int,    | Ext,  | Var,   | N, Scaled, | Estimated |
|-----------------------|------------|---------|-------|--------|------------|-----------|
| '                     | Survivors, | s.e,    | s.e,  | Ratio, | , Weights, | F         |
| FLT12: Cuba Logbook , | 2037.,     | .177,   | .172, | .97,   | 5, .797,   | .464      |
| F shrinkage mean ,    | 1740.,     | .50,,,, |       |        | .203,      | .526      |

Weighted prediction :

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

1

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

Year class = 1989

| Fleet,                | Estimated, | Int,    | Ext,  | Var,   | N, Scaled, | Estimated |
|-----------------------|------------|---------|-------|--------|------------|-----------|
| '                     | Survivors, | s.e,    | s.e,  | Ratio, | , Weights, | F         |
| FLT12: Cuba Logbook , | 1209.,     | .174,   | .156, | .89,   | 6, .764,   | .382      |
| F shrinkage mean ,    | 827.,      | .50,,,, |       |        | .236,      | .519      |

Weighted prediction :

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

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

Year class = 1988

| Fleet,                | Estimated, | Int,    | Ext,  | Var,   | N, Scaled, | Estimated |
|-----------------------|------------|---------|-------|--------|------------|-----------|
| '                     | Survivors, | s.e,    | s.e,  | Ratio, | , Weights, | F         |
| FLT12: Cuba Logbook , | 517.,      | .202,   | .198, | .98,   | 7, .648,   | .253      |
| F shrinkage mean ,    | 220.,      | .50,,,, |       |        | .352,      | .516      |

Weighted prediction :

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

1

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

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

Year class = 1987

| Fleet,                | Estimated,<br>Survivors, | Int,<br>s.e, | Ext,<br>s.e, | Var,<br>Ratio, | N, Scaled,<br>, Weights, | Estimated<br>F |
|-----------------------|--------------------------|--------------|--------------|----------------|--------------------------|----------------|
| FLT12: Cuba Logbook , | 177.,                    | .225,        | .210,        | .93,           | 8, .593,                 | .309           |
| F shrinkage mean ,    | 89.,                     | .50,,,,      |              |                | .407,                    | .544           |

Weighted prediction :

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

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

Year class = 1986

| Fleet,                | Estimated,<br>Survivors, | Int,<br>s.e, | Ext,<br>s.e, | Var,<br>Ratio, | N, Scaled,<br>, Weights, | Estimated<br>F |
|-----------------------|--------------------------|--------------|--------------|----------------|--------------------------|----------------|
| FLT12: Cuba Logbook , | 51.,                     | .236,        | .127,        | .54,           | 9, .710,                 | .416           |
| F shrinkage mean ,    | 57.,                     | .50,,,,      |              |                | .290,                    | .377           |

Weighted prediction :

| Survivors,<br>at end of year, | Int,<br>s.e, | Ext,<br>s.e, | N,<br>, | Var,<br>Ratio, | F    |
|-------------------------------|--------------|--------------|---------|----------------|------|
| 53.,                          | .22,         | .10,         | 10,     | .466,          | .404 |

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

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

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

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

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

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

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

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

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

| Table 10 | Stock number at age (start of year) |         |         |        |        | Numbers*10**-3 |        |        |        |        |        |            |            |
|----------|-------------------------------------|---------|---------|--------|--------|----------------|--------|--------|--------|--------|--------|------------|------------|
| YEAR,    | 1988,                               | 1989,   | 1990,   | 1991,  | 1992,  | 1993,          | 1994,  | 1995,  | 1996,  | 1997,  | 1998,  | GMST 61-95 | AMST 61-95 |
| AGE      |                                     |         |         |        |        |                |        |        |        |        |        |            |            |
| 3,       | 45092,                              | 28957,  | 21298,  | 26033, | 20665, | 24059,         | 13090, | 12715, | 7998,  | 13138, | 0,     | 21836,     | 24568,     |
| 4,       | 38697,                              | 36135,  | 23300,  | 17172, | 20382, | 16423,         | 18507, | 10093, | 10050, | 6279,  | 11443, | 16687,     | 18990,     |
| 5,       | 35592,                              | 29013,  | 24173,  | 15608, | 9422,  | 12814,         | 11084, | 11568, | 7342,  | 7245,  | 4856,  | 11177,     | 12789,     |
| 6,       | 6475,                               | 20494,  | 18959,  | 10634, | 6036,  | 4221,          | 6248,  | 6665,  | 6332,  | 4974,  | 3863,  | 6578,      | 7481,      |
| 7,       | 3210,                               | 2782,   | 10322,  | 7180,  | 3690,  | 2390,          | 1949,  | 2973,  | 3795,  | 3873,  | 2541,  | 3673,      | 4163,      |
| 8,       | 1503,                               | 1452,   | 1560,   | 3864,  | 2724,  | 1714,          | 1180,  | 921,   | 1369,  | 2061,  | 1972,  | 2108,      | 2442,      |
| 9,       | 757,                                | 669,    | 694,    | 846,   | 1688,  | 1378,          | 958,   | 514,   | 442,   | 650,   | 1105,  | 1249,      | 1518,      |
| 10,      | 369,                                | 291,    | 380,    | 457,   | 326,   | 799,           | 723,   | 506,   | 203,   | 242,   | 382,   | 742,       | 970,       |
| 11,      | 51,                                 | 158,    | 163,    | 256,   | 159,   | 150,           | 432,   | 318,   | 241,   | 96,    | 134,   | 436,       | 615,       |
| +gp,     | 112,                                | 111,    | 213,    | 232,   | 271,   | 143,           | 140,   | 354,   | 306,   | 329,   | 233,   |            |            |
| TOTAL,   | 131858,                             | 120062, | 101063, | 82282, | 65363, | 64091,         | 54312, | 46628, | 38078, | 38888, | 26529, |            |            |

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

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

|          | RECRUITS,<br>Age 3 | TOTALBIO, | TOTSPBIO, | LANDINGS, | YIELD/SSB, | FBAR 4- 8, |
|----------|--------------------|-----------|-----------|-----------|------------|------------|
| 1961,    | 9047,              | 121972,   | 83798,    | 9592,     | .1145,     | .0911,     |
| 1962,    | 13663,             | 126463,   | 85636,    | 10454,    | .1221,     | .1083,     |
| 1963,    | 22431,             | 158239,   | 100632,   | 12693,    | .1261,     | .0996,     |
| 1964,    | 16192,             | 160429,   | 98383,    | 21893,    | .2225,     | .2007,     |
| 1965,    | 22803,             | 174778,   | 107216,   | 22181,    | .2069,     | .1827,     |
| 1966,    | 21830,             | 184152,   | 108779,   | 25563,    | .2350,     | .2029,     |
| 1967,    | 26879,             | 181652,   | 104635,   | 21319,    | .2037,     | .1660,     |
| 1968,    | 21515,             | 189804,   | 115962,   | 20387,    | .1758,     | .1350,     |
| 1969,    | 40798,             | 215031,   | 123796,   | 27437,    | .2216,     | .1790,     |
| 1970,    | 34136,             | 224448,   | 129143,   | 29110,    | .2254,     | .1832,     |
| 1971,    | 37285,             | 228427,   | 139502,   | 32706,    | .2344,     | .1769,     |
| 1972,    | 33607,             | 237050,   | 147570,   | 42663,    | .2891,     | .2329,     |
| 1973,    | 23282,             | 210529,   | 136683,   | 57431,    | .4202,     | .3328,     |
| 1974,    | 18897,             | 204074,   | 137612,   | 47188,    | .3429,     | .2811,     |
| 1975,    | 16305,             | 187422,   | 137888,   | 41576,    | .3015,     | .3127,     |
| 1976,    | 18913,             | 169754,   | 122019,   | 33065,    | .2710,     | .2821,     |
| 1977,    | 12938,             | 156336,   | 114099,   | 34835,    | .3053,     | .3514,     |
| 1978,    | 8411,              | 137397,   | 96030,    | 28138,    | .2930,     | .2657,     |
| 1979,    | 8657,              | 113076,   | 83560,    | 27246,    | .3261,     | .2846,     |
| 1980,    | 12368,             | 124784,   | 88947,    | 25230,    | .2837,     | .2324,     |
| 1981,    | 33150,             | 141906,   | 76310,    | 30103,    | .3945,     | .4128,     |
| 1982,    | 14642,             | 149087,   | 83216,    | 30964,    | .3721,     | .3456,     |
| 1983,    | 40919,             | 177757,   | 98218,    | 39176,    | .3989,     | .3937,     |
| 1984,    | 25919,             | 188796,   | 100173,   | 54665,    | .5457,     | .5094,     |
| 1985,    | 22156,             | 188143,   | 114105,   | 44605,    | .3909,     | .4133,     |
| 1986,    | 62206,             | 234659,   | 101620,   | 41716,    | .4105,     | .5193,     |
| 1987,    | 49012,             | 250276,   | 97659,    | 40020,    | .4098,     | .4210,     |
| 1988,    | 45092,             | 260176,   | 104593,   | 45285,    | .4330,     | .4577,     |
| 1989,    | 28957,             | 229558,   | 103745,   | 44477,    | .4287,     | .3658,     |
| 1990,    | 21298,             | 192826,   | 97557,    | 61561,    | .6310,     | .5576,     |
| 1991,    | 26033,             | 153914,   | 77088,    | 54863,    | .7117,     | .6812,     |
| 1992,    | 20665,             | 130203,   | 66057,    | 38366,    | .5808,     | .5283,     |
| 1993,    | 24059,             | 138667,   | 69900,    | 33543,    | .4799,     | .4342,     |
| 1994,    | 13090,             | 127310,   | 68855,    | 33182,    | .4819,     | .4605,     |
| 1995,    | 12715,             | 114136,   | 66468,    | 27213,    | .4094,     | .3987,     |
| 1996,    | 7998,              | 98502,    | 62968,    | 20025,    | .3180,     | .3129,     |
| 1997,    | 13138,             | 92434,    | 55308,    | 22229,    | .4019,     | .4001,     |
| Arith.   |                    |           |           |           |            |            |
| Mean     | 23811,             | 172275,   | 100155,   | 33316,    | .3438,     | .3220,     |
| 0 Units, | (Thousands),       | (Tonnes), | (Tonnes), | (Tonnes), |            |            |

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

The SAS System

18:26 Saturday, May 2, 1998

Saithe in the Faroes Grounds (Fishing Area Vb)

Prediction with management option table: Input data

| Year: 1998 |            |                   |                |                     |                     |                 |                  |                 |
|------------|------------|-------------------|----------------|---------------------|---------------------|-----------------|------------------|-----------------|
| Age        | Stock size | Natural mortality | Maturity ogive | Prop.of F bef.spaw. | Prop.of M bef.spaw. | Weight in stock | Exploit. pattern | Weight in catch |
| 3          | 11268.000  | 0.2000            | 0.1200         | 0.0000              | 0.0000              | 1.455           | 0.0400           | 1.455           |
| 4          | 10520.000  | 0.2000            | 0.2800         | 0.0000              | 0.0000              | 1.945           | 0.1530           | 1.945           |
| 5          | 4166.000   | 0.2000            | 0.5500         | 0.0000              | 0.0000              | 2.316           | 0.3990           | 2.316           |
| 6          | 3840.000   | 0.2000            | 0.7900         | 0.0000              | 0.0000              | 3.331           | 0.4640           | 3.331           |
| 7          | 2206.000   | 0.2000            | 0.9400         | 0.0000              | 0.0000              | 4.046           | 0.5950           | 4.046           |
| 8          | 1657.000   | 0.2000            | 0.9800         | 0.0000              | 0.0000              | 4.979           | 0.5990           | 4.979           |
| 9          | 861.000    | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 5.766           | 0.5480           | 5.766           |
| 10         | 339.000    | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 7.004           | 0.5690           | 7.004           |
| 11         | 131.000    | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 7.716           | 0.4990           | 7.716           |
| 12+        | 246.000    | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 8.154           | 0.4990           | 8.154           |
| Unit       | Thousands  | -                 | -              | -                   | -                   | Kilograms       | -                | Kilograms       |

| Year: 1999 |              |                   |                |                     |                     |                 |                  |                 |
|------------|--------------|-------------------|----------------|---------------------|---------------------|-----------------|------------------|-----------------|
| Age        | Recruit-ment | Natural mortality | Maturity ogive | Prop.of F bef.spaw. | Prop.of M bef.spaw. | Weight in stock | Exploit. pattern | Weight in catch |
| 3          | 11268.000    | 0.2000            | 0.1200         | 0.0000              | 0.0000              | 1.455           | 0.0400           | 1.455           |
| 4          | .            | 0.2000            | 0.2800         | 0.0000              | 0.0000              | 1.847           | 0.1530           | 1.847           |
| 5          | .            | 0.2000            | 0.5200         | 0.0000              | 0.0000              | 2.323           | 0.3990           | 2.323           |
| 6          | .            | 0.2000            | 0.7900         | 0.0000              | 0.0000              | 2.979           | 0.4640           | 2.979           |
| 7          | .            | 0.2000            | 0.9400         | 0.0000              | 0.0000              | 4.061           | 0.5950           | 4.061           |
| 8          | .            | 0.2000            | 0.9900         | 0.0000              | 0.0000              | 5.160           | 0.5990           | 5.160           |
| 9          | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 6.068           | 0.5480           | 6.068           |
| 10         | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 6.912           | 0.5690           | 6.912           |
| 11         | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 8.019           | 0.4990           | 8.019           |
| 12+        | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 9.378           | 0.4990           | 9.378           |
| Unit       | Thousands    | -                 | -              | -                   | -                   | Kilograms       | -                | Kilograms       |

| Year: 2000 |              |                   |                |                     |                     |                 |                  |                 |
|------------|--------------|-------------------|----------------|---------------------|---------------------|-----------------|------------------|-----------------|
| Age        | Recruit-ment | Natural mortality | Maturity ogive | Prop.of F bef.spaw. | Prop.of M bef.spaw. | Weight in stock | Exploit. pattern | Weight in catch |
| 3          | 11268.000    | 0.2000            | 0.1200         | 0.0000              | 0.0000              | 1.455           | 0.0400           | 1.455           |
| 4          | .            | 0.2000            | 0.2800         | 0.0000              | 0.0000              | 1.847           | 0.1530           | 1.874           |
| 5          | .            | 0.2000            | 0.5200         | 0.0000              | 0.0000              | 2.225           | 0.3990           | 2.225           |
| 6          | .            | 0.2000            | 0.7900         | 0.0000              | 0.0000              | 2.986           | 0.4640           | 2.986           |
| 7          | .            | 0.2000            | 0.9400         | 0.0000              | 0.0000              | 3.709           | 0.5950           | 3.709           |
| 8          | .            | 0.2000            | 0.9900         | 0.0000              | 0.0000              | 5.175           | 0.5990           | 5.175           |
| 9          | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 6.249           | 0.5480           | 6.249           |
| 10         | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 7.214           | 0.5690           | 7.214           |
| 11         | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 7.927           | 0.4990           | 7.927           |
| 12+        | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 9.681           | 0.4990           | 9.681           |
| Unit       | Thousands    | -                 | -              | -                   | -                   | Kilograms       | -                | Kilograms       |

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

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

Saithe in the Faroes Grounds (Fishing Area Vb)

The SAS System

18:26 Saturday, May 2, 1998

Prediction with management option table

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

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

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

The SAS System

18:26 Saturday, May 2, 1998

Saithe in the Faroes Grounds (Fishing Area Vb)

Yield per recruit: Input data

| Age  | Recruit-ment | Natural mortality | Maturity ogive | Prop.of F bef.spaw. | Prop.of M bef.spaw. | Weight in stock | Exploit. pattern | Weight in catch |
|------|--------------|-------------------|----------------|---------------------|---------------------|-----------------|------------------|-----------------|
| 3    | 1.000        | 0.2000            | 0.1200         | 0.0000              | 0.0000              | 1.312           | 0.0820           | 1.312           |
| 4    | .            | 0.2000            | 0.2800         | 0.0000              | 0.0000              | 1.850           | 0.2600           | 1.850           |
| 5    | .            | 0.2000            | 0.5200         | 0.0000              | 0.0000              | 2.520           | 0.4330           | 2.520           |
| 6    | .            | 0.2000            | 0.7900         | 0.0000              | 0.0000              | 3.296           | 0.5140           | 3.296           |
| 7    | .            | 0.2000            | 0.9400         | 0.0000              | 0.0000              | 4.172           | 0.5050           | 4.172           |
| 8    | .            | 0.2000            | 0.9900         | 0.0000              | 0.0000              | 5.105           | 0.4990           | 5.105           |
| 9    | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 5.883           | 0.5030           | 5.883           |
| 10   | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 6.585           | 0.4970           | 6.585           |
| 11   | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 7.418           | 0.5100           | 7.418           |
| 12+  | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 8.947           | 0.5100           | 8.947           |
| Unit | Numbers      | -                 | -              | -                   | -                   | Kilograms       | -                | Kilograms       |

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

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

The SAS System

18:26 Satur

May 2, 1998

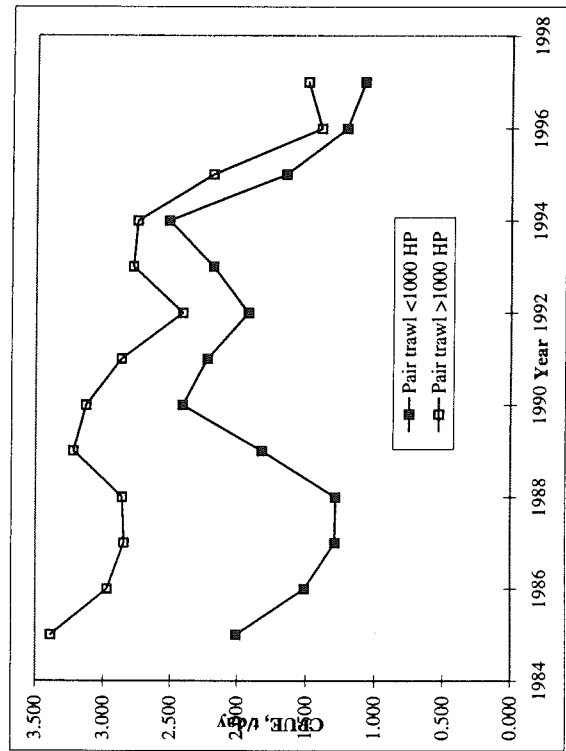
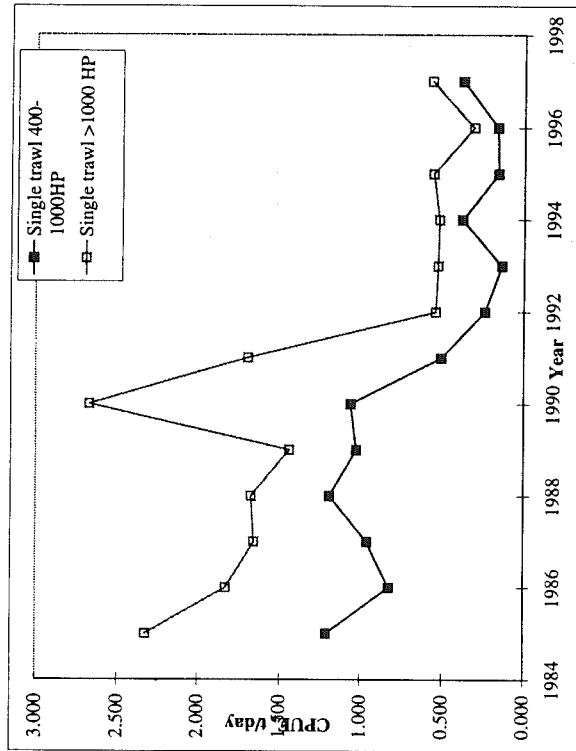
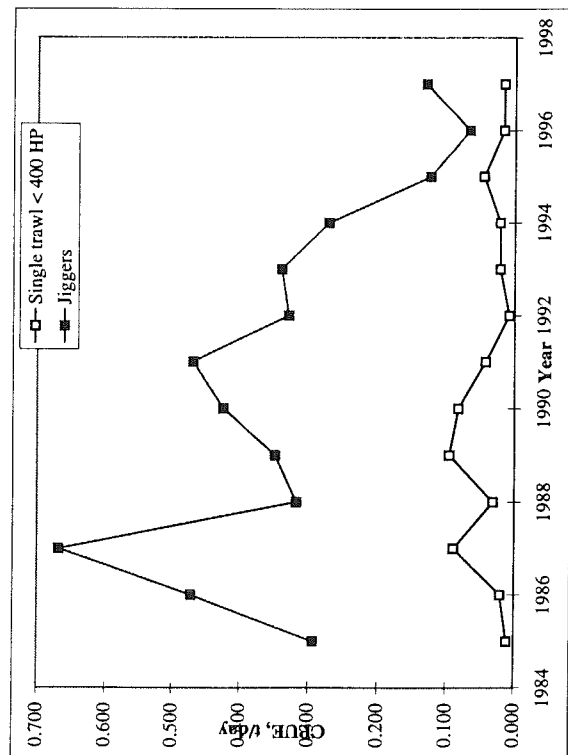
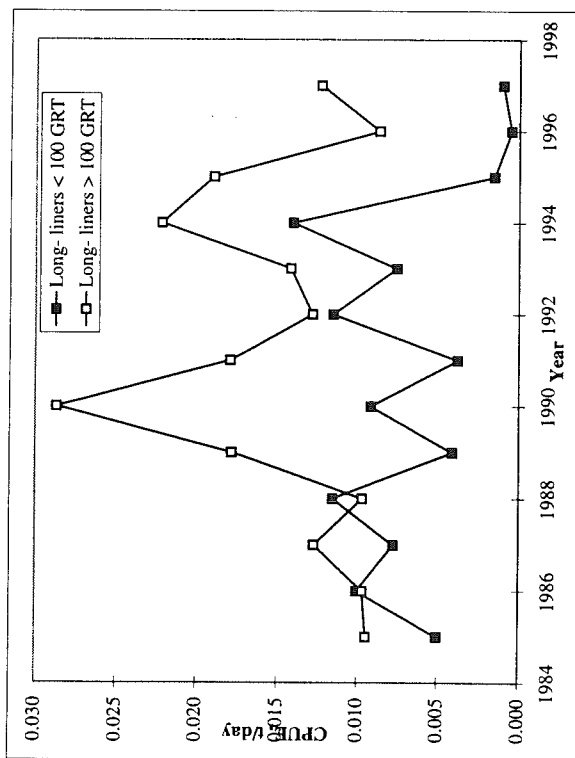
Saithe in the Faroes Grounds (Fishing Area Vb)

Yield per recruit: Summary table

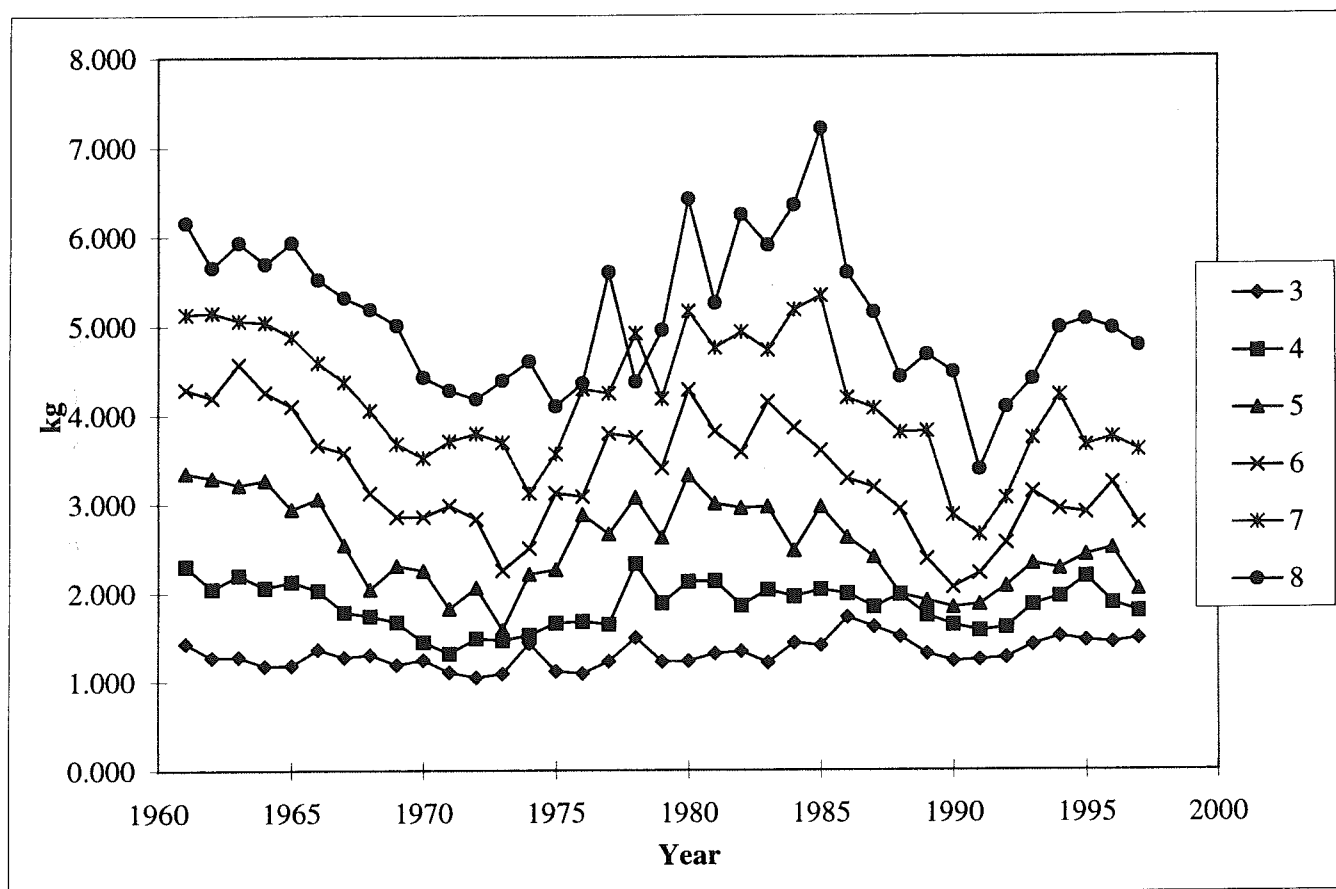
| F<br>Factor | Reference<br>F | Catch in<br>numbers | Catch in<br>weight | Stock<br>size | Stock<br>biomass | 1 January        |                     | Spawning time    |                     |
|-------------|----------------|---------------------|--------------------|---------------|------------------|------------------|---------------------|------------------|-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

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

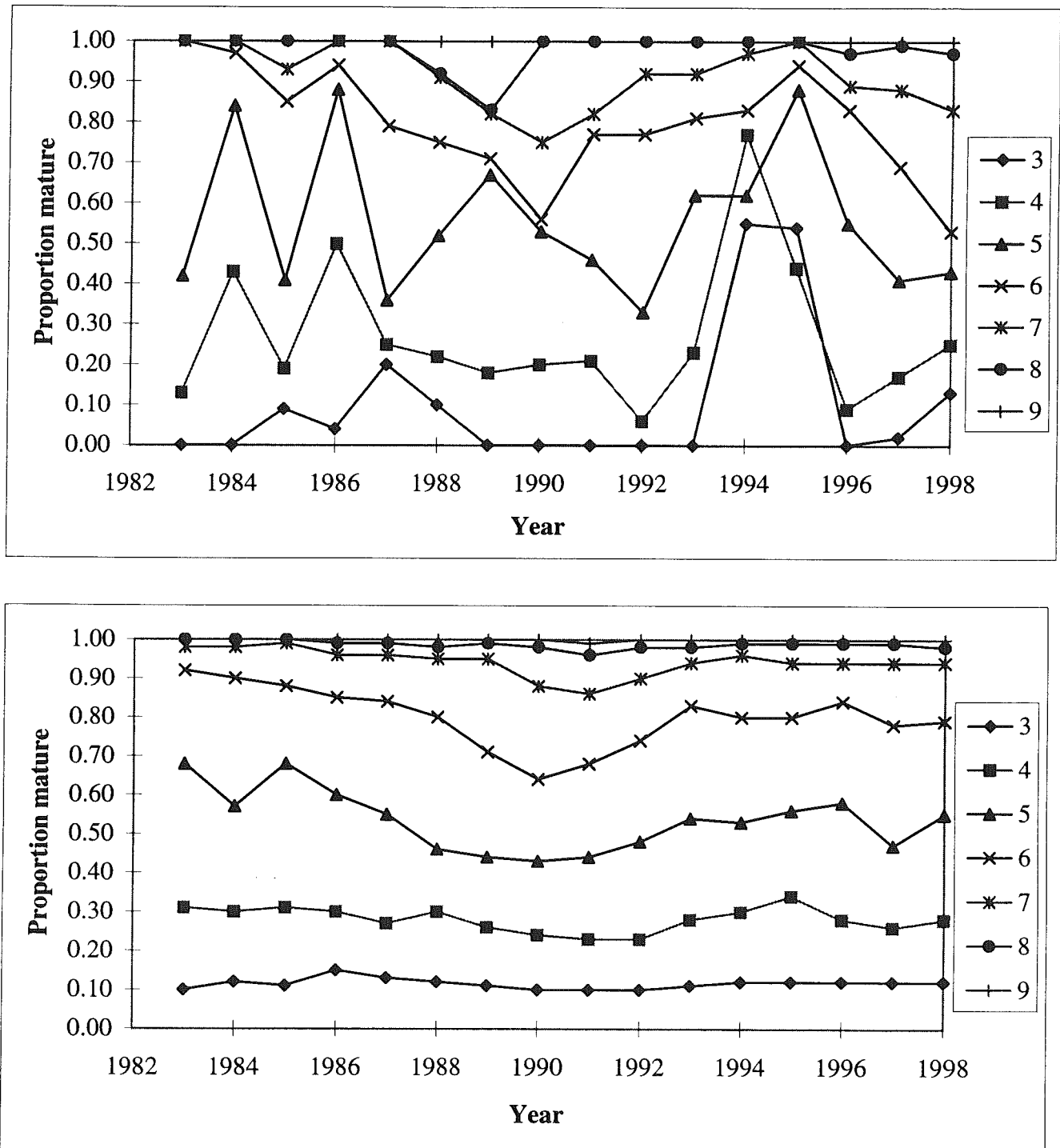
Figure 2.5.1. CPUE (t/day) by various Faroese fleet categories in the Faroe grounds.



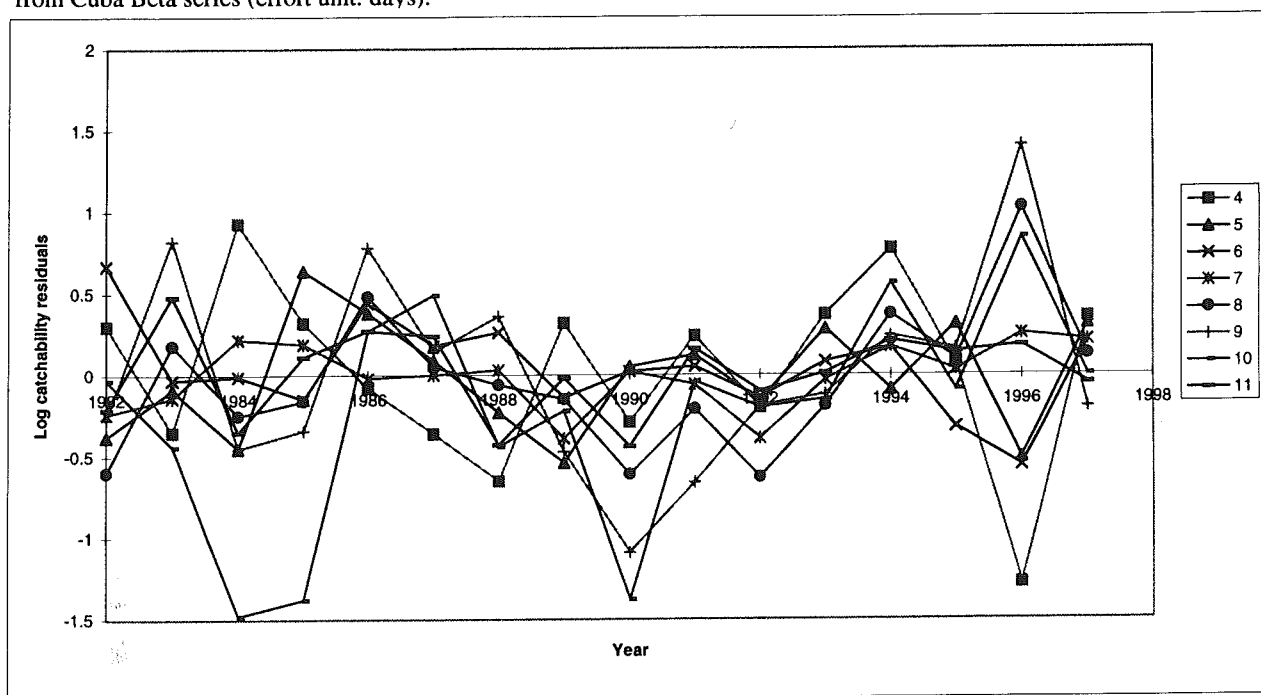
**Figure 2.5.2.** Saithe in the Faroes Grounds. Mean weight (kg) at age in the catches in the period 1991-1997.



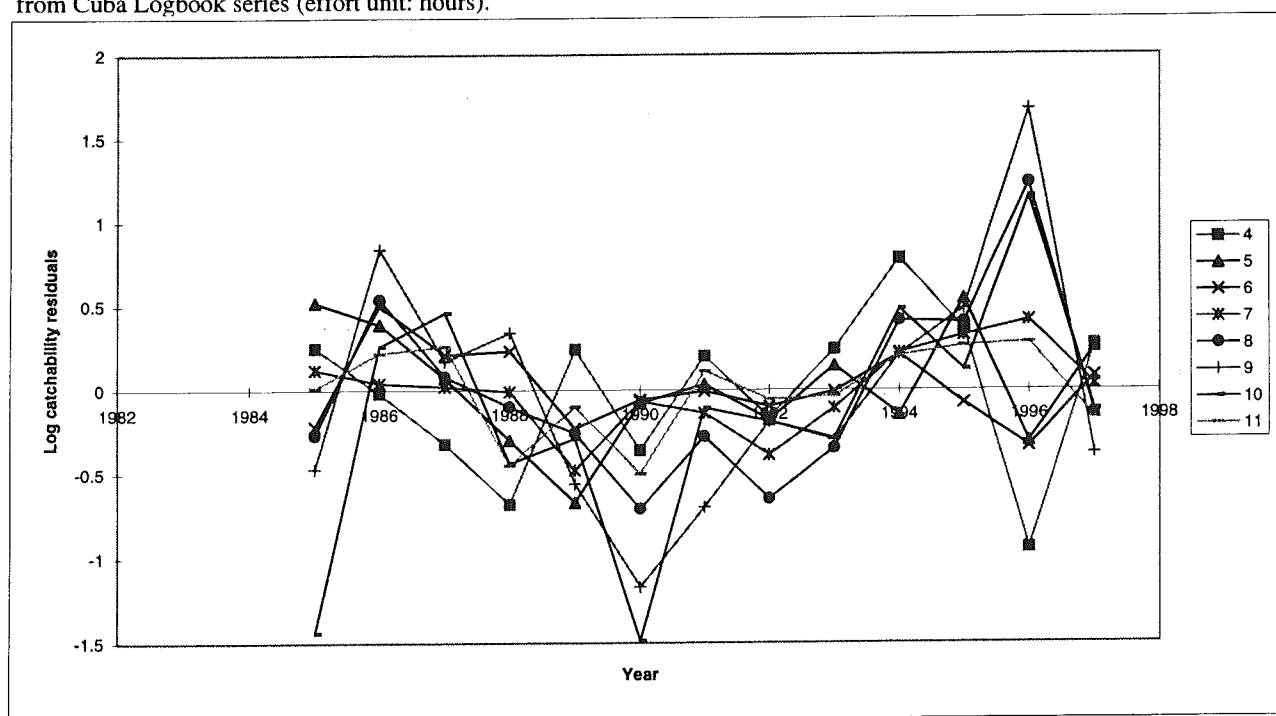
**Figure 2.5.3.** Saithe in the Faroes Grounds. Observed (upper panel) and fitted values (lower panel) proportion mature for the period 1983-1997.



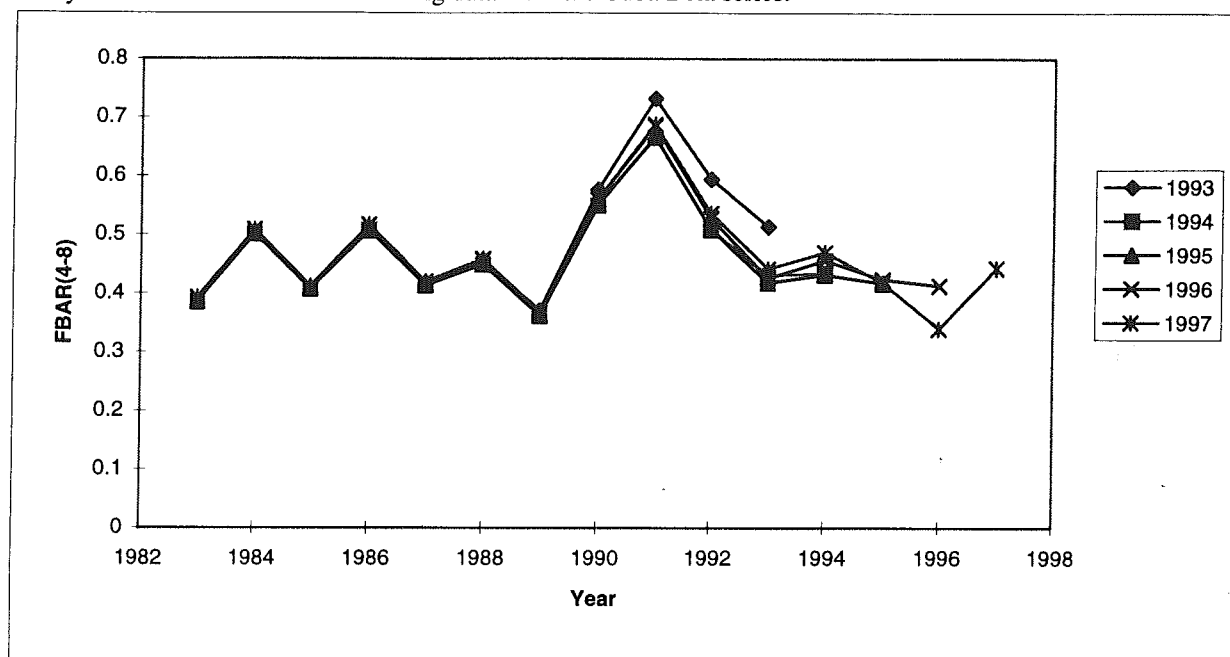
**Figure 2.5.4.** Saithe in the Faroe Grounds. Log catchability residuals for age groups 4-11 yrs from XSA run. Tuning data from Cuba Beta series (effort unit: days).



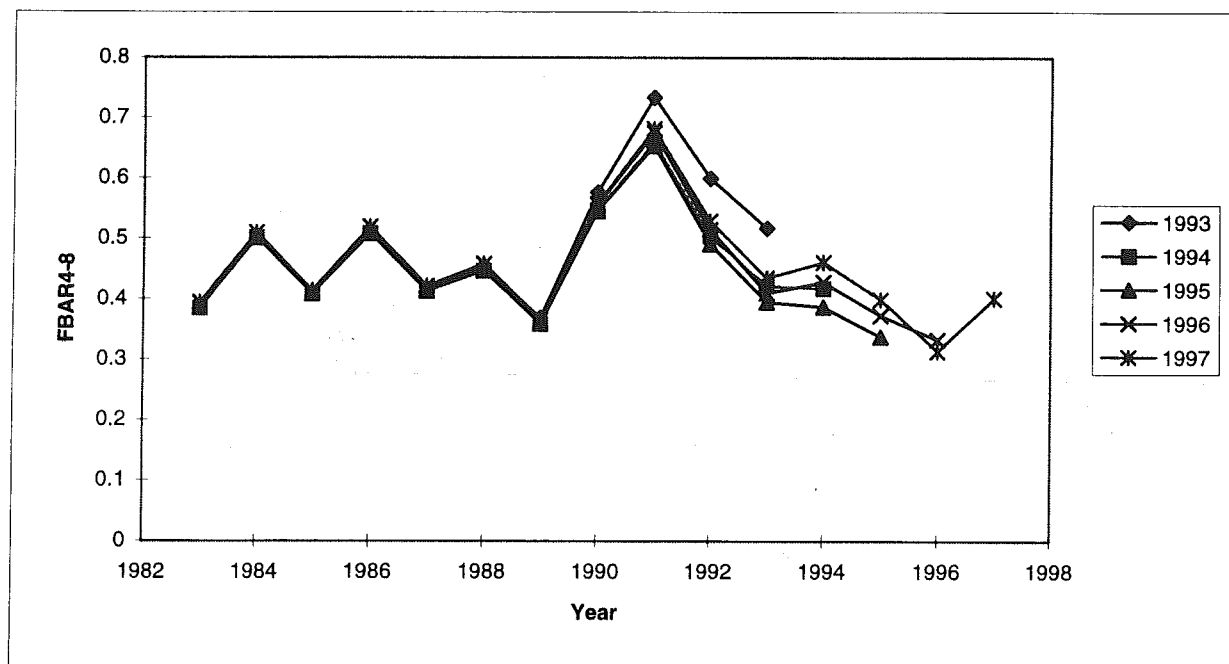
**Figure 2.5.5.** Saithe in the Faroe Grounds. Log catchability residuals for age groups 4-11 yrs from XSA run. Tuning data from Cuba Logbook series (effort unit: hours).



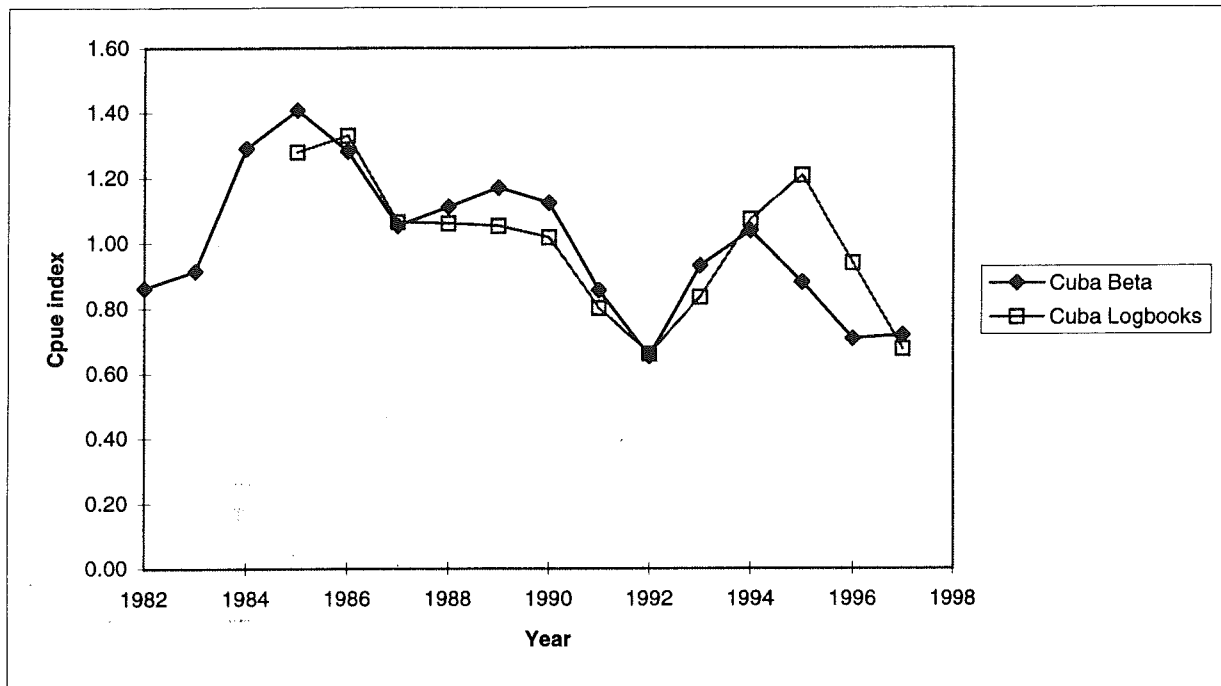
**Figure 2.5.6a.** Saithe in the Faroes Grounds. Retrospective analysis of average fishing mortality of age groups 4-8 yrs from XSA for 1993-97. Tuning data from the Cuba Beta series.



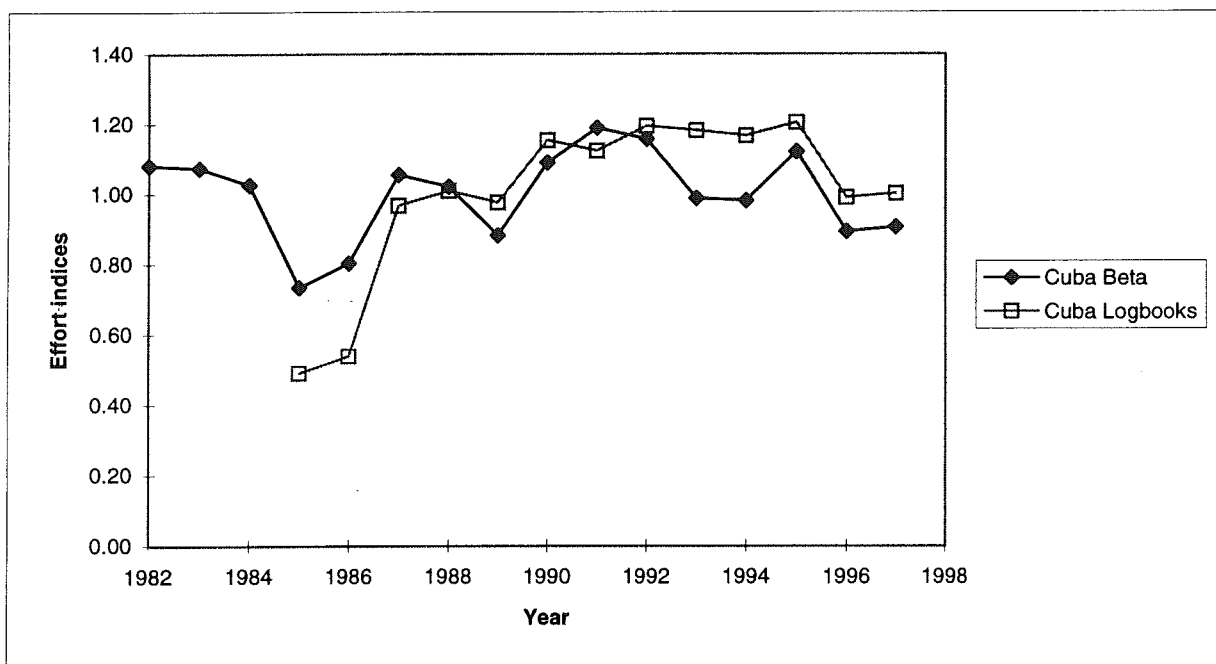
**Figure 2.5.6b.** Saithe in the Faroes Grounds. Retrospective analysis of average fishing mortality of age groups 4-8 yrs from XSA for 1993-97. Tuning data from the Cuba Logbooks series.

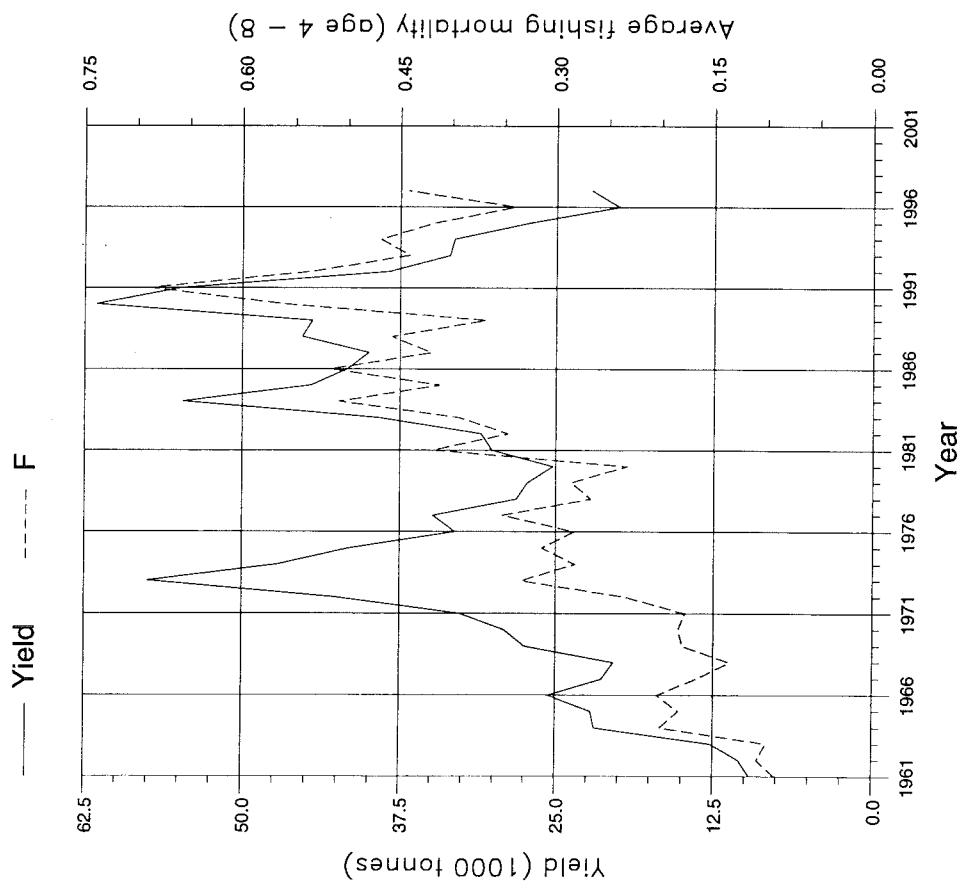


**Figure 2.5.7a.** Saithe in the Faroes Grounds. Comparison of the two tuning series CPUE indices: Cuba Beta and Cuba Logbooks.

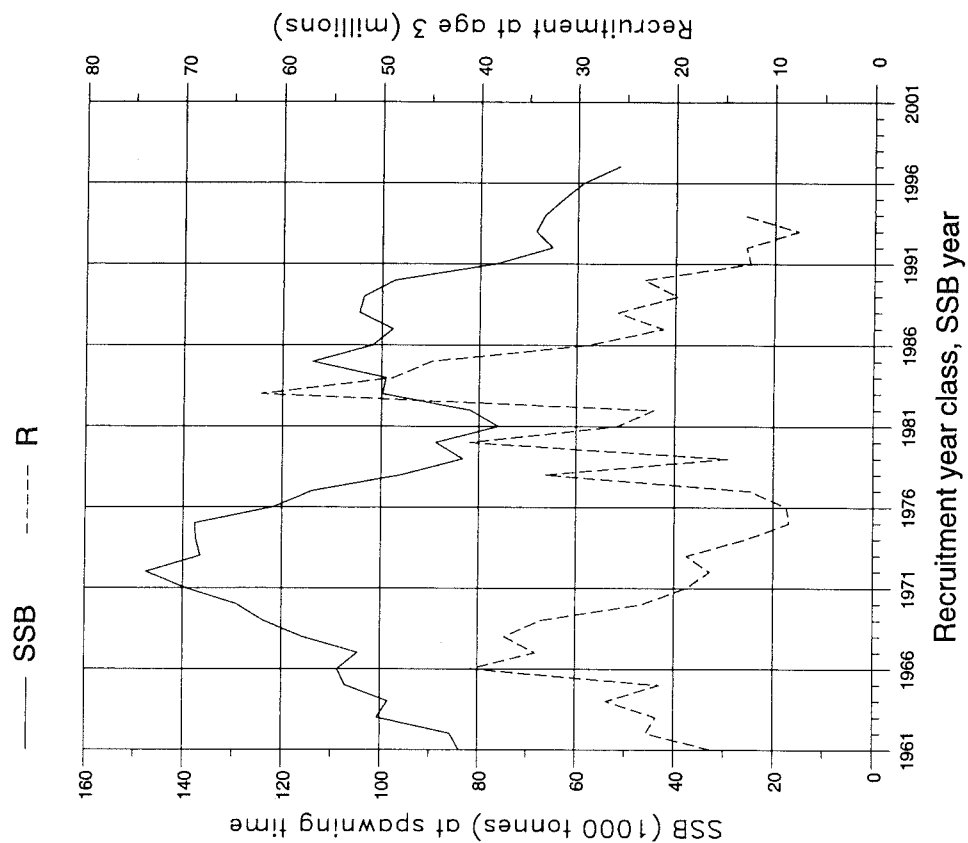


**Figure 2.5.7b.** Saithe in the Faroes Grounds. Comparison of the two tuning series effort indices: Cuba Beta and Cuba Logbooks.



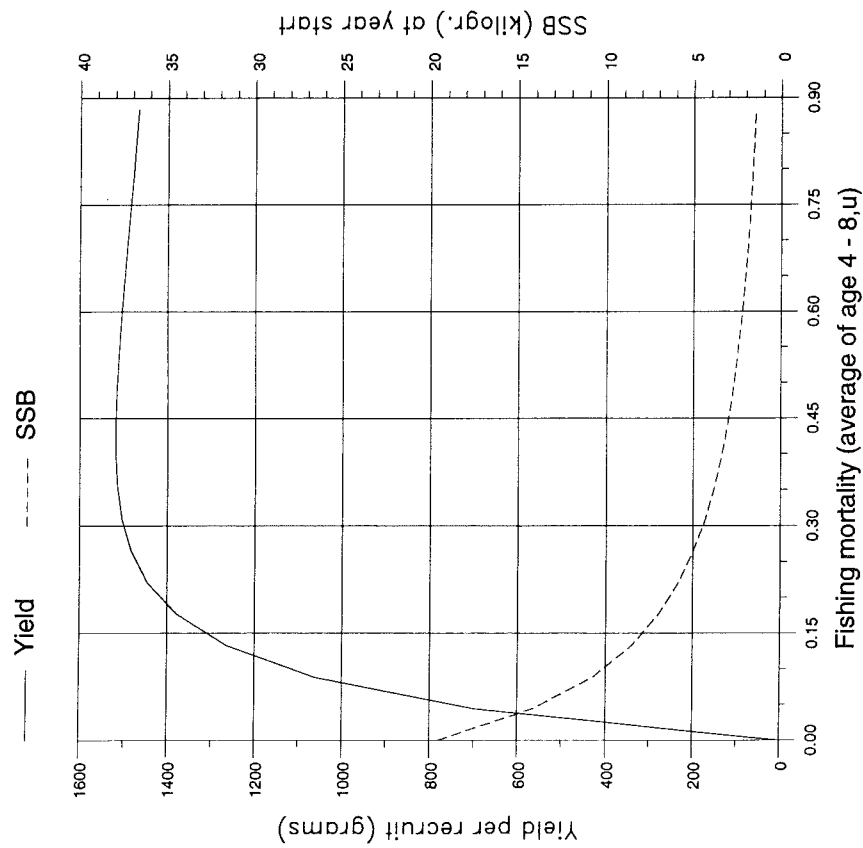


A



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

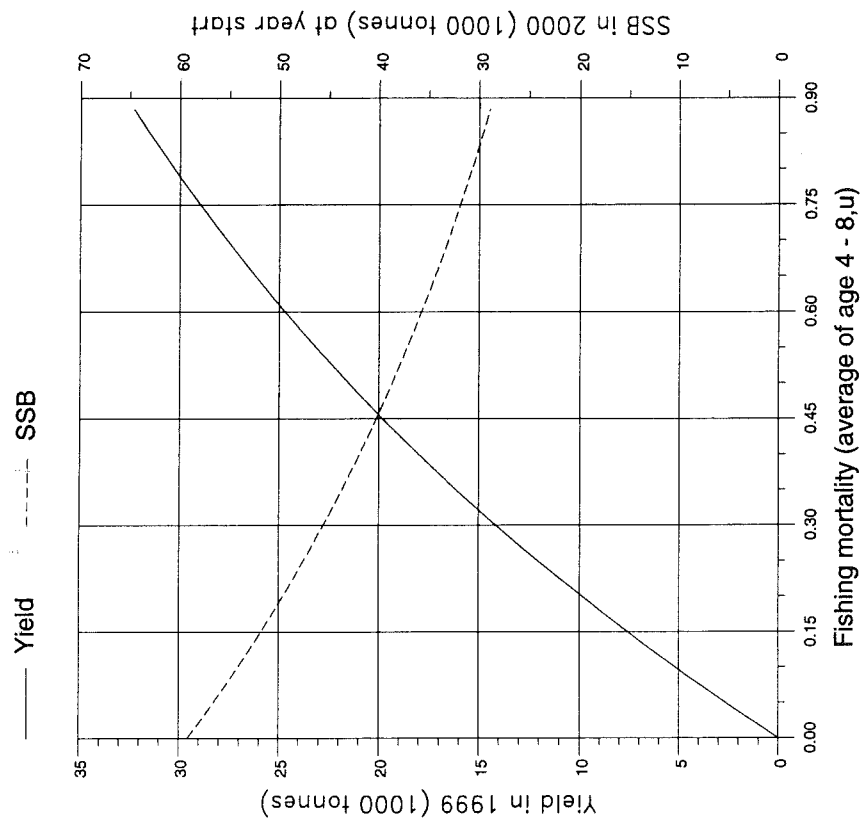
### Long term yield and spawning stock biomass



(run: YLDARN02)

**C**

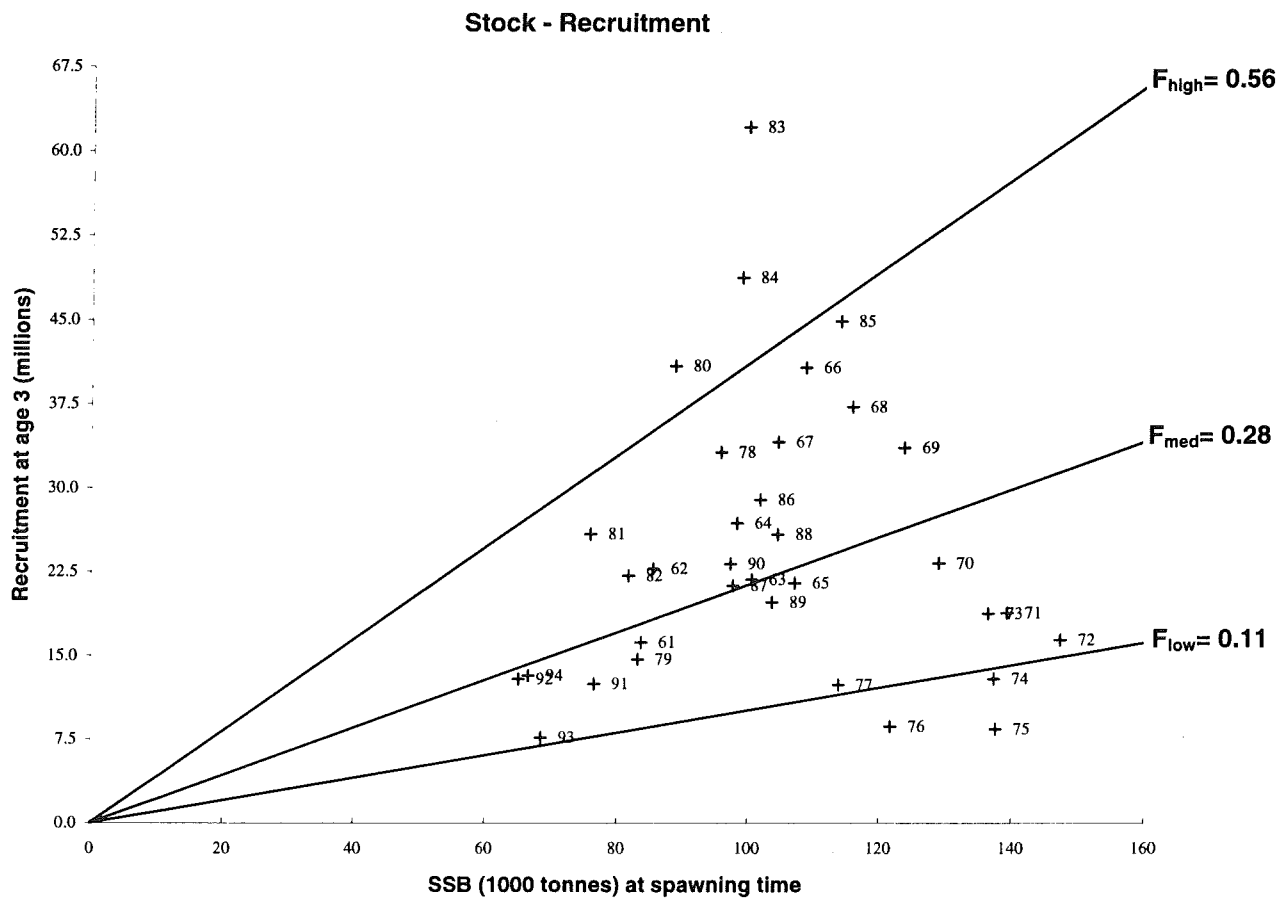
### Short term yield and spawning stock biomass



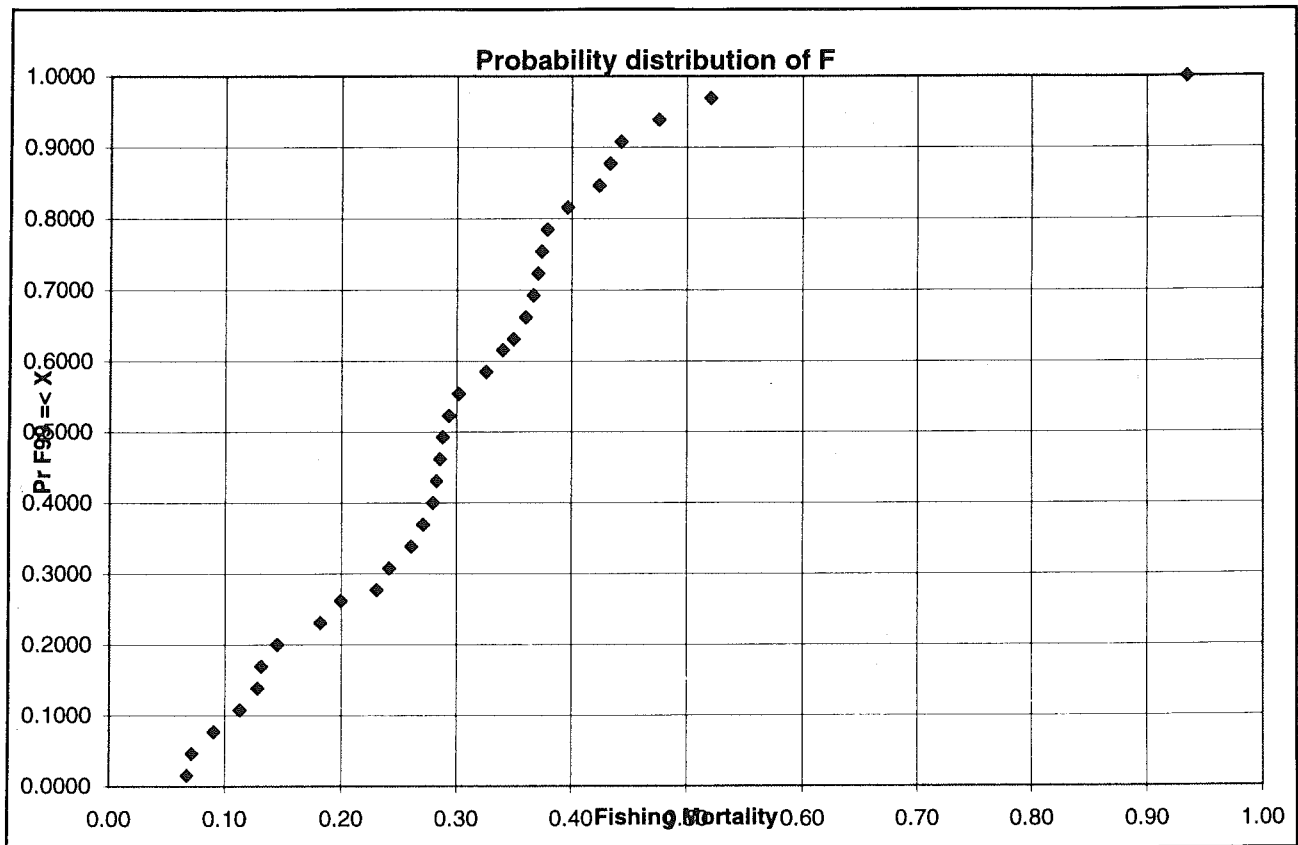
(run: MANARN02)

**D**

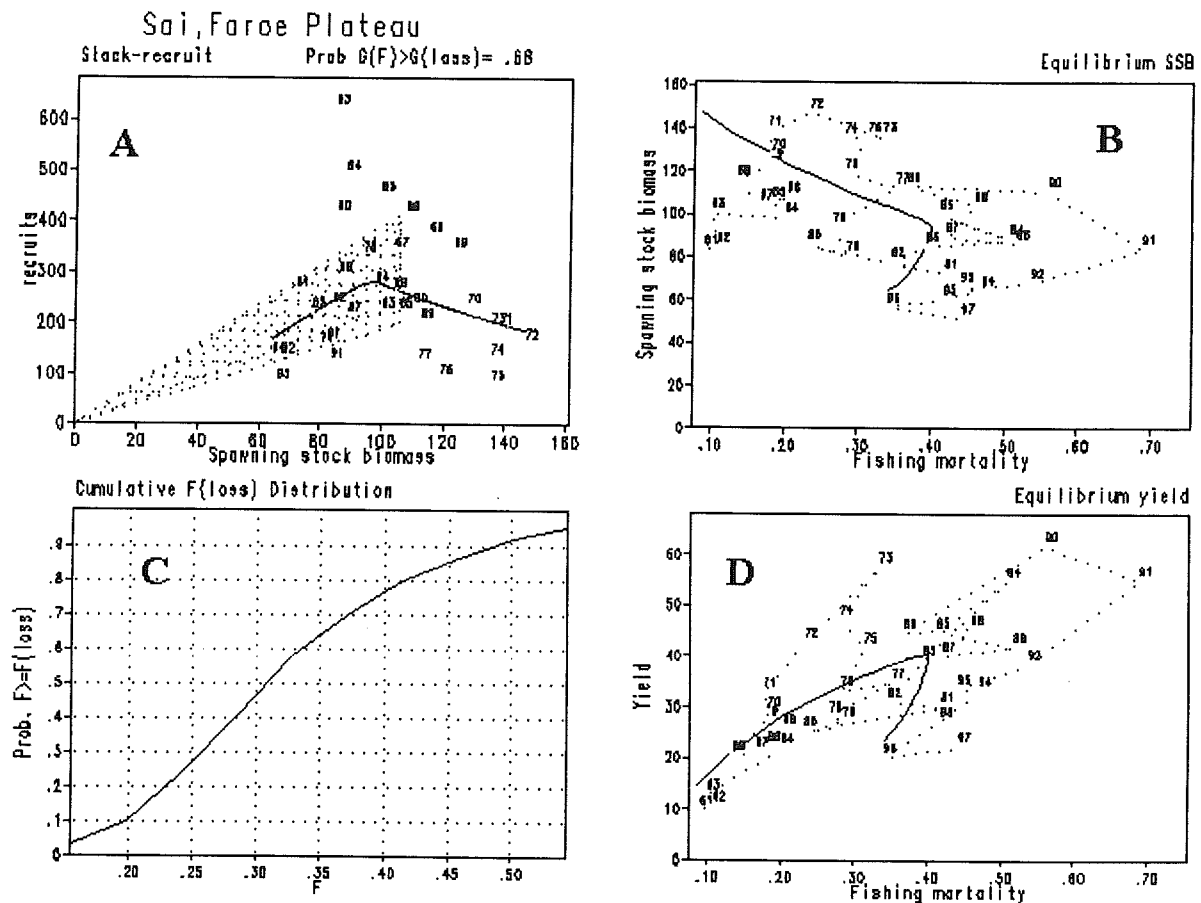
**Figure 2.5.10.** Saithe in the Faroes Grounds. Stock-recruitment relationship scatter plot with number for year class year at each point. R/SSB lines for  $F_{low}$ ,  $F_{med}$  and  $F_{high}$  are shown with their respective F-values.



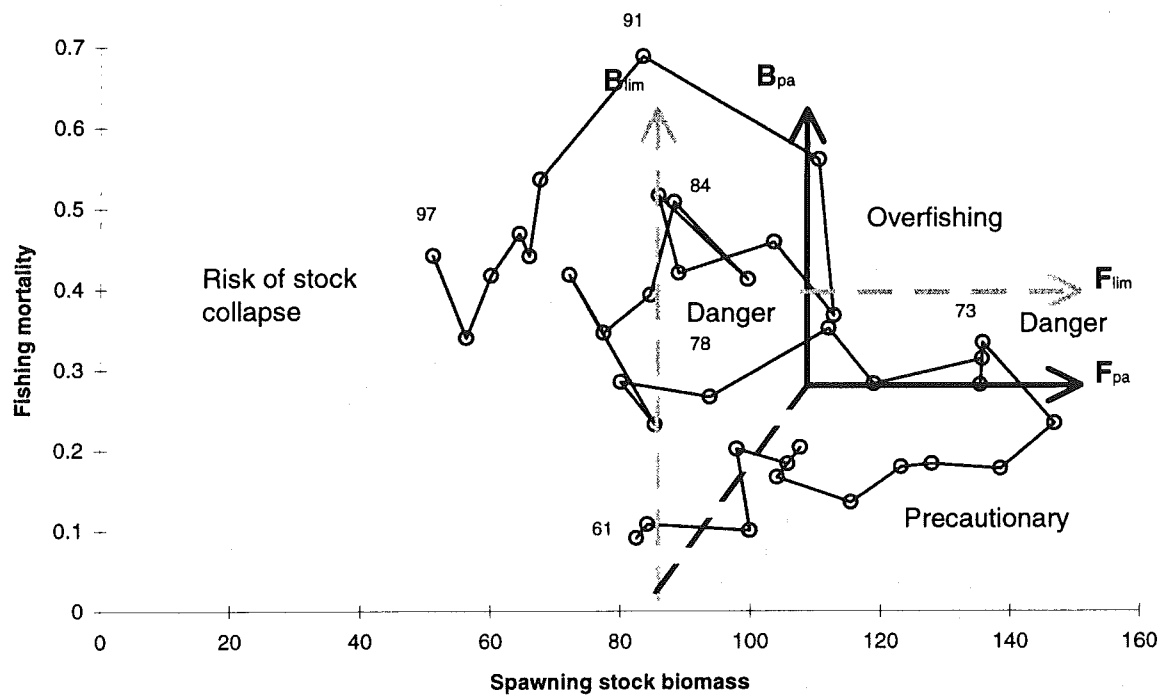
**Figure 2.5.11.** Saithe in the Faroes Grounds. Probability distribution of fishing mortalities (age 4-8 yrs).



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



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



### 3 DEMERSAL STOCKS AT ICELAND (DIVISION VA)

#### 3.1 Regulation of Demersal Fisheries

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

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

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

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

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

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

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

#### 3.2 Saithe in Icelandic waters

##### 3.2.1 Trends in landings

Saithe landings from Icelandic grounds (Division Va) fluctuated between 57,000 t and 69,000 t during the period 1982–1986 (Table 3.2.1). From 1987 to 1989, annual landings were about 80,000 t. In 1990, landings increased by more than 20% to 98 000 t and in 1991 the catches reached 103 000 t. Since 1991, landings have decreased to a historically low level in 1997. In 1997 preliminary reported landings for saithe in Division Va are 37,158 t (Table 3.2.1) close to the 37 000 t expected by the working group last year. Landings of 798 t reported by the Faroe Islands to Icelandic authorities were used in the working group estimate.

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

##### 3.2.2 Fleets and fishing grounds

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

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

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

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

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

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

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

### **3.2.3 Catch in numbers**

Minor adjustments were made to the catch in numbers at age in 1996 to account for revised total landings.

Data from bottom trawls, gillnets, and Danish seine (see text table below), which represented more than 92% of the Icelandic landings in 1997, were used to calculate the catch at age for the total landings and used as input for the assessment (Table 3.2.2).

| Gear         | Number of<br>otoliths read | Length<br>measurements |
|--------------|----------------------------|------------------------|
| Bottom trawl | 3626                       | 15404                  |
| Gillnets     | 1195                       | 3537                   |
| Danish seine | 99                         | 698                    |
| Total        | 4920                       | 19639                  |

Compared to last years prognosis higher proportions of age groups 4 and age groups older than 7 were observed in the 1997 landings and lower for other age groups. The difference between last years prognosis and the present estimate was less than 3% for all age groups (Figure 3.2.7)

### **3.2.4 Mean weight at age in the landings**

Mean weight at age in the landings are computed on the basis of samples of otoliths and lengths along with length distributions and length-weight relationships. The mean weights at age are computed for the same categories as the catch numbers at age and are then weighted together across the fleets. A general increase in mean weight at age was observed in 1997. Exceptions of note are age groups 5 and 13, the year classes from 1992 and 1984 (Figure 3.2.8 and Table 3.2.3). These weights at age were also used as weight at age in the stock.

### **3.2.5 Maturity at age in the landings**

In 1997 a sharp increase in the proportion mature at age was observed for age groups 3 through 6, while in 1996 a sharp decrease was observed for age groups 5 and 7 (Table 3.2.4). As has been pointed out in earlier reports of this working group, the raw maturity at age data for saithe can be misleading due to the nature of the fishery and of the species. A GLM model, described in the 1993 Working Group report (ICES. C.M.1993/Assess:18), was used to explain maturity at age as a function of age and year class strength. The raw data given in Table 3.2.4 was then used to predict the entire

maturity at age table for 1980–1997 (Table 3.2.4 and 3.2.5 and Figure 3.2.9). The maturity at age prior to 1980 is derived from ICES C.M. 1979/G:6.

### 3.2.6 Stock Assessment

### 3.2.7 Tuning input

CPUE data, based on Icelandic trawler logbooks from 1970–1997 and from the gillnet fleet from 1988 are available. The basic method for computing an aggregate CPUE index from bottom trawl, consists of first selecting individual tows where the catch contains more than 70 % saithe (lower proportions show similar pattern in CPUE). The catches and towing times are then added and the ratio computed. As the CPUE series from bottom trawls, derived from the first part of the year, showed markedly different behaviour in recent years from the series based on the latter part of the year, the two series were age-disaggregated separately (Table 3.2.6) and both used in the tuning module. The age-disaggregation was based on otolith samples taken from commercial trawlers in the respective time periods. The second bottom trawl data set was based on trawler effort (Table 3.2.6), calculated by dividing trawler landings to the annual CPUE. A tuning data set was then constructed from the effort measure along with catch-in-numbers from the same fleet. For the gillnet fleet, individual settings, where the catch contained more than 70% saithe were selected. The catches and number of nets were then added and the ratio computed. The age-disaggregation was based on otolith samples taken from gillnet landings (Table 3.2.6).

### 3.2.8 Estimates of fishing mortality

Two different runs were tried with XSA based on the two different fleet categories. Tuning diagnostics were relatively poor in both cases (Tables 3.2.7 and 3.2.8). The resulting mean  $F$  in 1997 for age groups 4-9 from these runs was 0.21 using the trawler effort data, and 0.20 using the trawler and gillnet CPUE data.

The time series analysis was carried out as described in "Time series analysis of catch-at-age observations" (Gudmundsson 1994).

The fishing mortality rates are represented by a time series model where the properties of the model are given by a few parameters. The values of  $F(a,y)$  and  $N(a,y)$  are estimated from the data by means of a linear approximation to the Kalman filter and the parameters are estimated by the likelihood function of the catch prediction errors of the filter.

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

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

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

The magnitude of the random variations,  $\varepsilon(a,y)$ , is estimated assuming that the variances of  $\varepsilon(a,y)$  and the measurement errors of  $\log C(a,y)$  are equal in ages 5-9. In principle the two kinds of variations can be estimated separately but in practice the estimated ratio between them is very inaccurate. By fixing it as 1 we ensure that neither measurement errors nor irregular variations of  $F(a,y)$  are ignored. (In VPA the measurement errors are implicitly assumed to be zero, and in non-linear least squares estimation, e.g. CAGEAN, where  $F(a,y)$  are fully specified by a parametric model,  $\varepsilon(a,y)$  are assumed to be zero).

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

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

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.

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

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

The estimated variances of  $\epsilon(a,t)$  and  $\log C(a,t)$  are  $0.17^2$  for ages 5–9. For 4, 10 and 11 years ages the variability was higher. This was ascribed to higher variance of  $\epsilon(a,t)$  for the 4 years old where catchability could be higher than for older ages, e.g. because of variations in growth. For 10 and 11 years old fish bigger variability was assigned to the measurement errors. The estimated model for joint variations, ( $V(t)$  in the model above), was random walk with an annual random element with standard deviation 0.06. This was little affected by the trend estimate. No permanent variation in the pattern of selectivity was detected.

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

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

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

The resulting reference  $F$ 's from the TSA runs vary from 0.34 (both catch at age only and including CPUE data, with trend) to 0.46 (catch at age data and CPUE with trend estimated). According to the estimated standard deviations and other diagnostics from the TSA-runs there is no significant difference between the four results.

A retrospective analysis was performed for the different methods and fleets (Figure 3.2.10). As in previous years assessments the TSA-runs seem to be more consistent than the XSA-runs. From the TSA-runs, the analysis of catch at age data only, with no trend estimated, appears to be the most consistent one and was adopted by the working group.

Both XSA and TSA seem to consistently underestimate the present fishing mortalities. This has lead to an overestimation of the stock size in recent years reflected in the fact that the national TAC has not been reached in the last three quota years. In order to correct for this effect the estimated  $F$ 's were raised by factor of 1.19 which corresponds to the average underestimation in the last three years according to retrospective analysis. The same approach was used by the WG last year, when a raising factor of 1.32 from the retrospective pattern was used.

The raised terminal fishing mortalities from the TSA were used to run a traditional VPA, where the  $F$ 's for the age groups 8–14 were taken as the mean of age groups 8–11 in the TSA. Natural mortality was set to a value of 0.2. The results of this run are given in Tables 3.2.10 - 3.2.12 and Figures 3.2.11.A and 3.2.11.B.

### 3.2.8.1 Spawning stock and recruitment

The spawning stock biomass is shown in Figure 3.2.11.B and Table 3.2.12. After a decline from 1970–1977, the spawning stock biomass averaged between 160–180 000 t in 1978–1989 and increased to about 190 000 t in 1990. Since 1992 the spawning stock biomass has declined to a minimum of about 90 000 t in 1996, which is the lowest recorded level. The estimated spawning stock biomass in the beginning of 1998 is only 93 000 t.

Estimates of recruitment at age 3 are plotted in Figure 3.2.11.B. The 1983–1985 year classes are all well above the 1967–1987 long-term average (about 40 million). The 1984 year class is the highest on record at 108 million recruits. All year classes after 1985 are well below average. Since no information is available for the more recent year classes, the 1993–1996 year classes were set at the rounded average for the 1985–1991 year classes, i.e. at 25 million recruits.

### 3.2.9 Prediction of catch and biomass

#### 3.2.9.1 Input data

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

For catch predictions and stock biomass calculations, the mean weight at ages 4–9 were predicted using a multiple regression analysis, where the mean weight at age was predicted by the mean weight of the year class in the previous year and the year class strength. Regression analysis showed significant relationships for the age groups 4–9, mean weights at age for other age groups were averaged over the three most recent years, excluding the strong 1984 year class as it had much lower weight at age than average.

For short-term predictions, maturity at age was predicted as described in Section 3.2.5. For long term predictions of maturity at age, averages over the period 1980–1997 were used. The rounded average of the 1985–1992 year class strengths was used as recruitment.

For long-term yield and spawning stock biomass per recruit, the exploitation pattern was taken as the average of fishing mortalities during 1980–1997 from the standard VPA run. Averages over 1980–1997 for maturity and mean weight at age for all age groups were used, along with a natural mortality of 0.2 (Table 3.2.15).

#### 3.2.9.2 Biological reference points

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

Compared to the estimated 1997 fishing mortality level of  $F_{4.9} = 0.37$ , the reference values for  $F_{\max}$  and  $F_{0.1}$  are 0.43 and 0.18, respectively (Table 3.2.16). From Figure 3.2.12, showing the stock recruitment relationship, and Figure 3.2.11.C, showing the spawning stock biomass-per-recruit relationship,  $F_{\text{med}} = 0.22$  and  $F_{\text{high}} = 0.79$  were estimated.

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

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

If  $F_{\text{pa}}$  is to be interpreted as an upper bound on fishing mortality while at low SSB levels, setting  $F_{\text{pa}}$  at the  $F_{\text{med}}$  value of 0.24 (now revised to 0.22) as proposed by the ACFM study group on the precautionary approach to fishery management (SGPAFM) appears too conservative (ICES C. M. 1998/ACFM:10). Reference  $F$  values have been at or above  $F_{\text{med}}$  for the whole time series in the assessment (one exception). The long term average  $F_{4.9}$  is 0.32 (close to  $F_{\text{MSY}}$ ). Therefore the WG suggests that the SGPAFM changes the  $F_{\text{pa}}$  from  $F_{\text{med}}$  to  $F_{\text{MSY}}$  ( $\approx 0.3$ ), but keep  $F_{\text{lim}}$  unchanged at 0.47.

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

### **3.2.9.3 Projections of catch and biomass**

Based on the input data given in Table 3.2.13, options for 1999 were calculated and are given in Table 3.2.14 and Figure 3.2.11.D.

As can be seen from the prediction (Table 3.2.14), total catch in 1998 is assumed 30 000 t which is the most likely result of unchanged TAC of 30 000 t for the 1998/99 quota year. The resulting stock size in the beginning of 1999 will be about 207 000 t which is a little higher than in the beginning of 1999 (190 000 t). The spawning stock biomass in the beginning of 1999 will also show a slight increase as compared to 1998, i.e. about 97 000 t. The same reference F in 1998, as compared to 1997, will result in a yield of about 40 000 t, and both total and spawning stock biomass in 1999 will increase from the 1997 level. Total and spawning stock biomass are at the lowest level observed and will remain at a low level in coming years, even at very low fishing mortalities, unless an increase in recruitment occurs.

### **3.2.10 Management considerations**

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

### **3.2.11 Comments on the assessment**

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

**Table 3.2.1.** Nominal catch (tonnes) of SAITHE in Division Va by countries, 1982-1997, as officially reported to ICES.

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

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

1) Provisional

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

3) Additional catch of 451 t by Iceland included

4) Additional catch of 82 t by Faroe Islands included

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

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

At 2-May-98 17:49:43

| Table 1 |          | Catch numbers at age |       | Numbers*10**-3 |        |       |       |       |       |       |       |
|---------|----------|----------------------|-------|----------------|--------|-------|-------|-------|-------|-------|-------|
| YEAR    |          | 1978                 | 1979  | 1980           | 1981   | 1982  | 1983  | 1984  | 1985  | 1986  | 1987  |
| AGE     |          |                      |       |                |        |       |       |       |       |       |       |
|         | 3        | 548                  | 480   | 275            | 203    | 508   | 107   | 53    | 376   | 3108  | 956   |
|         | 4        | 1145                 | 3764  | 2540           | 1325   | 1092  | 1750  | 657   | 4014  | 1400  | 5135  |
|         | 5        | 2435                 | 1991  | 5214           | 3503   | 2804  | 1065  | 800   | 3366  | 4170  | 4428  |
|         | 6        | 1556                 | 3616  | 2596           | 5404   | 4845  | 2455  | 1825  | 1958  | 2665  | 5409  |
|         | 7        | 1275                 | 1566  | 2169           | 1457   | 4293  | 4454  | 2184  | 1536  | 1550  | 2915  |
|         | 8        | 961                  | 718   | 1341           | 1415   | 1215  | 2311  | 3610  | 1172  | 1116  | 1348  |
|         | 9        | 537                  | 292   | 387            | 578    | 975   | 501   | 844   | 747   | 628   | 661   |
|         | 10       | 575                  | 669   | 262            | 242    | 306   | 251   | 376   | 479   | 1549  | 496   |
|         | 11       | 476                  | 589   | 155            | 61     | 59    | 38    | 291   | 74    | 216   | 498   |
|         | 12       | 279                  | 489   | 112            | 154    | 35    | 12    | 135   | 23    | 51    | 58    |
|         | +gp      | 285                  | 222   | 155            | 404    | 193   | 180   | 601   | 434   | 139   | 97    |
| 0       | TOTALNUM | 10072                | 14396 | 15206          | 14746  | 16325 | 13124 | 11376 | 14179 | 16592 | 22001 |
|         | TONSLAND | 49672                | 63504 | 58347          | 58986  | 68615 | 58266 | 62719 | 57101 | 66376 | 80559 |
|         | SOPCOF % | 97                   | 98    | 100            | 99     | 99    | 99    | 100   | 99    | 100   | 100   |
| YEAR    |          | 1988                 | 1989  | 1990           | 1991   | 1992  | 1993  | 1994  | 1995  | 1996  | 1997  |
| AGE     |          |                      |       |                |        |       |       |       |       |       |       |
|         | 3        | 1318                 | 315   | 143            | 198    | 242   | 657   | 702   | 1573  | 2118  | 603   |
|         | 4        | 5067                 | 4313  | 1692           | 874    | 2928  | 1083  | 2955  | 1853  | 3465  | 2960  |
|         | 5        | 6619                 | 8471  | 5471           | 3613   | 3844  | 2841  | 1770  | 2661  | 2327  | 2766  |
|         | 6        | 3678                 | 7309  | 10112          | 6844   | 4355  | 2252  | 2603  | 1807  | 1838  | 1651  |
|         | 7        | 2859                 | 1794  | 6174           | 10772  | 3884  | 2247  | 1377  | 2370  | 814   | 1178  |
|         | 8        | 1775                 | 1928  | 1816           | 3223   | 4046  | 2314  | 1243  | 905   | 1129  | 599   |
|         | 9        | 845                  | 848   | 1087           | 858    | 1290  | 3671  | 1263  | 574   | 321   | 454   |
|         | 10       | 226                  | 270   | 380            | 838    | 350   | 830   | 2009  | 482   | 209   | 125   |
|         | 11       | 270                  | 191   | 151            | 228    | 196   | 223   | 454   | 521   | 144   | 95    |
|         | 12       | 107                  | 135   | 55             | 40     | 56    | 188   | 158   | 106   | 168   | 114   |
|         | +gp      | 26                   | 94    | 155            | 53     | 70    | 94    | 321   | 65    | 148   | 161   |
| 0       | TOTALNUM | 22790                | 25668 | 27236          | 27541  | 21261 | 16400 | 14855 | 12917 | 12681 | 10706 |
|         | TONSLAND | 77247                | 82425 | 98130          | 102737 | 79597 | 71648 | 64338 | 48650 | 40099 | 37158 |
|         | SOPCOF % | 100                  | 100   | 100            | 100    | 100   | 100   | 100   | 100   | 100   | 100   |

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

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

At 2-May-98 17:49:43

Table 2 Catch weights at age (kg)

| YEAR |          | 1978   | 1979   | 1980   | 1981   | 1982   | 1983   | 1984   | 1985   | 1986   | 1987   |
|------|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| AGE  |          |        |        |        |        |        |        |        |        |        |        |
|      | 3        | 1.12   | 1.12   | 1.428  | 1.585  | 1.547  | 1.53   | 1.653  | 1.609  | 1.45   | 1.516  |
|      | 4        | 1.76   | 1.76   | 1.983  | 2.037  | 2.194  | 2.221  | 2.432  | 2.172  | 2.19   | 1.715  |
|      | 5        | 2.73   | 2.73   | 2.667  | 2.696  | 3.015  | 3.171  | 3.33   | 3.169  | 2.959  | 2.67   |
|      | 6        | 4.29   | 4.29   | 3.689  | 3.525  | 3.183  | 4.27   | 4.681  | 3.922  | 4.402  | 3.839  |
|      | 7        | 5.54   | 5.54   | 5.409  | 4.541  | 5.114  | 4.107  | 5.466  | 4.697  | 5.488  | 5.081  |
|      | 8        | 7.27   | 7.27   | 6.321  | 6.247  | 6.202  | 5.984  | 4.973  | 6.411  | 6.406  | 6.185  |
|      | 9        | 8.42   | 8.42   | 7.213  | 6.991  | 7.256  | 7.565  | 7.407  | 6.492  | 7.57   | 7.33   |
|      | 10       | 9.41   | 9.41   | 8.565  | 8.202  | 7.922  | 8.673  | 8.179  | 8.346  | 6.487  | 8.025  |
|      | 11       | 10     | 10     | 9.147  | 9.537  | 8.924  | 8.801  | 8.77   | 9.401  | 9.616  | 7.974  |
|      | 12       | 10.56  | 10.56  | 9.617  | 9.089  | 10.134 | 9.039  | 8.831  | 10.335 | 10.462 | 9.615  |
|      | +gp      | 12.68  | 12.275 | 11.371 | 10.902 | 11.529 | 12.909 | 11.683 | 12.287 | 12.619 | 12.125 |
| 0    | SOPCOFAC | 0.9691 | 0.984  | 0.9989 | 0.9933 | 0.9922 | 0.9915 | 0.9975 | 0.9929 | 0.9987 | 1.0005 |
|      |          |        |        |        |        |        |        |        |        |        |        |
| YEAR |          | 1988   | 1989   | 1990   | 1991   | 1992   | 1993   | 1994   | 1995   | 1996   | 1997   |
| AGE  |          |        |        |        |        |        |        |        |        |        |        |
|      | 3        | 1.261  | 1.403  | 1.647  | 1.224  | 1.269  | 1.381  | 1.444  | 1.37   | 1.21   | 1.325  |
|      | 4        | 2.017  | 2.021  | 1.983  | 1.939  | 1.909  | 2.143  | 1.836  | 1.977  | 1.745  | 1.936  |
|      | 5        | 2.513  | 2.194  | 2.566  | 2.432  | 2.578  | 2.742  | 2.649  | 2.769  | 2.684  | 2.409  |
|      | 6        | 3.476  | 3.047  | 3.021  | 3.16   | 3.288  | 3.636  | 3.512  | 3.722  | 3.741  | 3.906  |
|      | 7        | 4.719  | 4.505  | 4.077  | 3.634  | 4.15   | 4.398  | 4.906  | 4.621  | 4.85   | 5.032  |
|      | 8        | 5.932  | 5.889  | 5.744  | 4.967  | 4.865  | 5.421  | 5.539  | 5.854  | 5.62   | 6.171  |
|      | 9        | 7.523  | 7.172  | 7.038  | 6.629  | 6.168  | 5.319  | 6.818  | 6.416  | 6.966  | 7.202  |
|      | 10       | 8.439  | 8.852  | 7.564  | 7.704  | 7.926  | 7.006  | 6.374  | 7.356  | 7.43   | 7.883  |
|      | 11       | 8.748  | 10.17  | 8.854  | 9.061  | 8.349  | 8.07   | 8.341  | 6.815  | 8.884  | 8.856  |
|      | 12       | 9.559  | 10.392 | 10.645 | 9.117  | 9.029  | 10.048 | 9.77   | 8.312  | 8.025  | 9.649  |
|      | +gp      | 11.034 | 12.499 | 11.975 | 12.608 | 11.143 | 9.465  | 11.107 | 10.692 | 11.235 | 10.817 |
| 0    | SOPCOFAC | 0.9999 | 0.9998 | 1.0005 | 0.9999 | 1.0002 | 1.0013 | 1.0018 | 1.0027 | 0.9999 | 0.9988 |

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

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

| <b>Data:</b>    |          |          |          |          |          |          |          |
|-----------------|----------|----------|----------|----------|----------|----------|----------|
| <b>Year/age</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> | <b>7</b> | <b>8</b> | <b>9</b> |
| 1980            | 0.00     | 0.05     | 0.21     | 0.53     | 0.90     | 0.98     | 0.99     |
| 1981            | 0.04     | 0.06     | 0.32     | 0.60     | 0.76     | 0.97     | 1.00     |
| 1982            | 0.00     | 0.00     | 0.31     | 0.53     | 0.77     | 0.84     | 1.00     |
| 1983            | 0.33     | 0.50     | 0.45     | 0.86     | 0.54     | 0.97     | 0.97     |
| 1984            | 0.39     | 0.14     | 0.40     | 0.77     | 0.91     | 0.79     | 0.99     |
| 1985            | 0.00     | 0.76     | 0.62     | 0.65     | 0.67     | 0.83     | 0.84     |
| 1986            | 0.00     | 0.01     | 0.10     | 0.71     | 0.90     | 0.79     | 0.82     |
| 1987            | 0.00     | 0.00     | 0.13     | 0.52     | 0.73     | 0.97     | 0.98     |
| 1988            | 0.00     | 0.01     | 0.09     | 0.20     | 0.79     | 0.79     | 1.00     |
| 1989            | 0.00     | 0.04     | 0.13     | 0.38     | 0.79     | 0.97     | 0.99     |
| 1990            | 0.00     | 0.10     | 0.36     | 0.45     | 0.75     | 0.90     | 1.00     |
| 1991            | 0.00     | 0.06     | 0.24     | 0.42     | 0.40     | 0.58     | 0.79     |
| 1992            | 0.00     | 0.16     | 0.44     | 0.60     | 0.73     | 0.78     | 0.95     |
| 1993            | 0.14     | 0.54     | 0.82     | 0.94     | 0.96     | 0.99     | 0.95     |
| 1994            | 0.00     | 0.68     | 0.92     | 0.97     | 0.99     | 0.99     | 1.00     |
| 1995            | 0.24     | 0.49     | 0.46     | 0.41     | 0.41     | 0.55     | 0.70     |
| 1996            | 0.00     | 0.00     | 0.08     | 0.50     | 0.18     | 0.96     | 1.00     |
| 1997            | 0.32     | 0.73     | 0.68     | 0.95     | 1.00     | 0.99     | 0.98     |

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

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

At 2-May-98 17:49:43

**Table 5 Proportion mature at age**

| YEAR | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|------|------|------|------|------|------|------|------|------|------|------|
| AGE  |      |      |      |      |      |      |      |      |      |      |
| 3    | 0    | 0    | 0.12 | 0.13 | 0.13 | 0.11 | 0.08 | 0.1  | 0.06 | 0.03 |
| 4    | 0.06 | 0.06 | 0.16 | 0.23 | 0.26 | 0.25 | 0.22 | 0.18 | 0.21 | 0.12 |
| 5    | 0.27 | 0.27 | 0.33 | 0.31 | 0.41 | 0.45 | 0.44 | 0.39 | 0.33 | 0.39 |
| 6    | 0.63 | 0.63 | 0.63 | 0.53 | 0.51 | 0.62 | 0.66 | 0.65 | 0.6  | 0.54 |
| 7    | 0.81 | 0.81 | 0.78 | 0.81 | 0.73 | 0.71 | 0.79 | 0.82 | 0.81 | 0.78 |
| 8    | 0.97 | 0.97 | 0.9  | 0.89 | 0.91 | 0.86 | 0.85 | 0.9  | 0.91 | 0.91 |
| 9    | 1    | 1    | 0.96 | 0.96 | 0.95 | 0.96 | 0.94 | 0.93 | 0.95 | 0.96 |
| 10   | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| 11   | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| 12   | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| +gp  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| YEAR | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
| AGE  |      |      |      |      |      |      |      |      |      |      |
| 3    | 0.07 | 0.11 | 0.13 | 0.12 | 0.14 | 0.13 | 0.13 | 0.11 | 0.12 | 0.12 |
| 4    | 0.07 | 0.16 | 0.22 | 0.26 | 0.24 | 0.28 | 0.26 | 0.27 | 0.23 | 0.24 |
| 5    | 0.24 | 0.15 | 0.3  | 0.4  | 0.44 | 0.42 | 0.47 | 0.45 | 0.46 | 0.41 |
| 6    | 0.59 | 0.43 | 0.29 | 0.5  | 0.61 | 0.65 | 0.63 | 0.67 | 0.65 | 0.66 |
| 7    | 0.73 | 0.77 | 0.63 | 0.49 | 0.7  | 0.78 | 0.81 | 0.8  | 0.83 | 0.82 |
| 8    | 0.89 | 0.86 | 0.89 | 0.8  | 0.69 | 0.85 | 0.89 | 0.91 | 0.9  | 0.92 |
| 9    | 0.96 | 0.95 | 0.94 | 0.95 | 0.9  | 0.84 | 0.93 | 0.95 | 0.96 | 0.95 |
| 10   | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| 11   | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| 12   | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| +gp  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |

**Table 3.2.6. Saithe in Division Va. Tuning data series.**

**Trawlers Effort in division Va:**

| Year | Effort | Catch,<br>age 3 | Catch,<br>age 4 | Catch,<br>age 5 | Catch,<br>age 6 | Catch,<br>age 7 | Catch,<br>age 8 | Catch,<br>age 9 | Catch,<br>age 10 | Catch,<br>age 11 | Catch,<br>age 12 | Catch,<br>age 13 |
|------|--------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|------------------|------------------|
| 1980 | 26     | 275             | 2534            | 5153            | 2320            | 1525            | 704             | 176             | 154              | 101              | 67               | 132              |
| 1981 | 23     | 203             | 1325            | 3499            | 5232            | 1117            | 384             | 127             | 98               | 6                | 13               | 37               |
| 1982 | 26     | 508             | 1092            | 2483            | 4404            | 1857            | 400             | 181             | 92               | 26               | 29               | 176              |
| 1983 | 29     | 103             | 1589            | 996             | 1991            | 3563            | 1106            | 196             | 61               | 1                | 1                | 307              |
| 1984 | 35     | 53              | 657             | 680             | 1463            | 981             | 2705            | 331             | 361              | 279              | 135              | 616              |
| 1985 | 34     | 376             | 3934            | 3145            | 1765            | 1204            | 672             | 488             | 266              | 21               | 1                | 361              |
| 1986 | 32     | 3104            | 1370            | 4021            | 1965            | 1121            | 552             | 343             | 536              | 145              | 42               | 118              |
| 1987 | 43     | 956             | 5116            | 4289            | 4805            | 2008            | 842             | 337             | 239              | 141              | 27               | 85               |
| 1988 | 46     | 1318            | 5066            | 6596            | 3526            | 2368            | 959             | 447             | 90               | 127              | 35               | 19               |
| 1989 | 50     | 315             | 4302            | 8328            | 6944            | 1279            | 774             | 434             | 171              | 137              | 112              | 103              |
| 1990 | 62     | 143             | 1681            | 5378            | 9655            | 5381            | 1099            | 571             | 217              | 127              | 41               | 146              |
| 1991 | 59     | 191             | 848             | 3542            | 6664            | 10126           | 2484            | 496             | 575              | 152              | 20               | 5                |
| 1992 | 47     | 242             | 2928            | 3712            | 4167            | 3480            | 3184            | 895             | 231              | 96               | 24               | 49               |
| 1993 | 36     | 631             | 963             | 2509            | 1911            | 1649            | 1251            | 2206            | 458              | 105              | 132              | 67               |
| 1994 | 35     | 678             | 2830            | 1623            | 1944            | 715             | 602             | 616             | 1216             | 274              | 91               | 199              |
| 1995 | 28     | 1571            | 1819            | 2452            | 1489            | 1635            | 462             | 251             | 200              | 236              | 54               | 30               |
| 1996 | 27     | 1135            | 2484            | 1801            | 1513            | 578             | 776             | 169             | 109              | 62               | 88               | 66               |
| 1997 | 20     | 464             | 2301            | 2048            | 956             | 811             | 404             | 275             | 71               | 56               | 74               | 106              |

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

| Jan.-May:<br>Year | Fishing<br>effort | Catch,<br>age 4 | Catch,<br>age 5 | Catch,<br>age 6 | Catch,<br>age 7 | Catch,<br>age 8 | Catch,<br>age 9 | Catch,<br>age 10 | Catch,<br>age 11 |
|-------------------|-------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|
| 80                | 100               | 0.0534          | 0.1119          | 0.0512          | 0.0280          | 0.0191          | 0.0040          | 0.0066           | 0.0052           |
| 81                | 100               | 0.0279          | 0.1012          | 0.2176          | 0.0473          | 0.0140          | 0.0035          | 0.0013           | 0.0003           |
| 82                | 100               | 0.0211          | 0.1364          | 0.0552          | 0.0633          | 0.0260          | 0.0162          | 0.0032           | 0.0016           |
| 83                | 100               | 0.0095          | 0.0278          | 0.0723          | 0.1359          | 0.0380          | 0.0037          | 0.0007           | 0.0000           |
| 84                | 100               | 0.0394          | 0.0516          | 0.0446          | 0.0298          | 0.0840          | 0.0053          | 0.0026           | 0.0000           |
| 85                | 100               | 0.0094          | 0.0584          | 0.0361          | 0.0519          | 0.0346          | 0.0180          | 0.0043           | 0.0007           |
| 86                | 100               | 0.0277          | 0.2478          | 0.0703          | 0.0203          | 0.0018          | 0.0000          | 0.0018           | 0.0000           |
| 87                | 100               | 0.1257          | 0.0864          | 0.1132          | 0.0440          | 0.0149          | 0.0039          | 0.0031           | 0.0016           |
| 88                | 100               | 0.0189          | 0.1013          | 0.0774          | 0.0700          | 0.0280          | 0.0206          | 0.0049           | 0.0074           |
| 89                | 100               | 0.0097          | 0.0434          | 0.1263          | 0.0531          | 0.0381          | 0.0179          | 0.0060           | 0.0022           |
| 90                | 100               | 0.0208          | 0.0477          | 0.1024          | 0.0887          | 0.0189          | 0.0122          | 0.0061           | 0.0051           |
| 91                | 100               | 0.0059          | 0.0387          | 0.0783          | 0.1292          | 0.0412          | 0.0135          | 0.0126           | 0.0042           |
| 92                | 100               | 0.0235          | 0.0483          | 0.0713          | 0.0736          | 0.0734          | 0.0185          | 0.0037           | 0.0016           |
| 93                | 100               | 0.0048          | 0.0242          | 0.0546          | 0.0710          | 0.0520          | 0.0480          | 0.0112           | 0.0026           |
| 94                | 100               | 0.0369          | 0.0316          | 0.0632          | 0.0298          | 0.0265          | 0.0222          | 0.0392           | 0.0056           |
| 95                | 100               | 0.0278          | 0.0421          | 0.0421          | 0.0603          | 0.0194          | 0.0090          | 0.0081           | 0.0096           |
| 96                | 100               | 0.0628          | 0.0426          | 0.0469          | 0.0235          | 0.0336          | 0.0070          | 0.0047           | 0.0023           |
| 97                | 100               | 0.0930          | 0.0417          | 0.0401          | 0.0613          | 0.0321          | 0.0208          | 0.0052           | 0.0032           |

| June-Dec.:<br>Year | Fishing<br>effort | Catch,<br>age 3 | Catch,<br>age 4 | Catch,<br>age 5 | Catch,<br>age 6 | Catch,<br>age 7 | Catch,<br>age 8 | Catch,<br>age 9 | Catch,<br>age 10 | Catch,<br>age 11 | Catch,<br>age 12 |
|--------------------|-------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|------------------|
| 80                 | 100               | 0.0007          | 0.0203          | 0.0721          | 0.0413          | 0.0518          | 0.0243          | 0.0105          | 0.0098           | 0.0058           | 0.0040           |
| 81                 | 100               | 0.0114          | 0.0517          | 0.1159          | 0.1249          | 0.0270          | 0.0098          | 0.0031          | 0.0023           | 0.0000           | 0.0008           |
| 82                 | 100               | 0.0098          | 0.0242          | 0.0600          | 0.1590          | 0.0585          | 0.0103          | 0.0025          | 0.0015           | 0.0003           | 0.0008           |
| 83                 | 100               | 0.0045          | 0.1249          | 0.0382          | 0.0376          | 0.0924          | 0.0185          | 0.0013          | 0.0006           | 0.0000           | 0.0000           |
| 84                 | 100               | 0.0019          | 0.0137          | 0.0056          | 0.0361          | 0.0149          | 0.0766          | 0.0062          | 0.0081           | 0.0075           | 0.0037           |
| 85                 | 100               | 0.0105          | 0.1504          | 0.0900          | 0.0561          | 0.0197          | 0.0055          | 0.0105          | 0.0055           | 0.0000           | 0.0000           |
| 86                 | 100               | 0.0716          | 0.0284          | 0.0734          | 0.0400          | 0.0248          | 0.0144          | 0.0122          | 0.0160           | 0.0077           | 0.0025           |
| 87                 | 100               | 0.0236          | 0.0721          | 0.0676          | 0.0575          | 0.0409          | 0.0216          | 0.0112          | 0.0070           | 0.0039           | 0.0008           |
| 88                 | 100               | 0.0173          | 0.1087          | 0.1042          | 0.0592          | 0.0343          | 0.0159          | 0.0048          | 0.0007           | 0.0007           | 0.0003           |
| 89                 | 100               | 0.0022          | 0.0557          | 0.1058          | 0.0947          | 0.0156          | 0.0118          | 0.0088          | 0.0037           | 0.0033           | 0.0028           |
| 90                 | 100               | 0.0047          | 0.0307          | 0.0936          | 0.1436          | 0.0439          | 0.0064          | 0.0022          | 0.0006           | 0.0006           | 0.0000           |
| 91                 | 100               | 0.0026          | 0.0118          | 0.0440          | 0.0875          | 0.1380          | 0.0353          | 0.0041          | 0.0041           | 0.0002           | 0.0000           |
| 92                 | 100               | 0.0027          | 0.0501          | 0.0698          | 0.0682          | 0.0546          | 0.0526          | 0.0141          | 0.0023           | 0.0011           | 0.0002           |
| 93                 | 100               | 0.0142          | 0.0232          | 0.0628          | 0.0383          | 0.0261          | 0.0211          | 0.0540          | 0.0105           | 0.0023           | 0.0008           |
| 94                 | 100               | 0.0200          | 0.0432          | 0.0324          | 0.0381          | 0.0162          | 0.0140          | 0.0127          | 0.0386           | 0.0057           | 0.0014           |
| 95                 | 100               | 0.0841          | 0.0310          | 0.0515          | 0.0310          | 0.0335          | 0.0111          | 0.0085          | 0.0060           | 0.0063           | 0.0028           |
| 96                 | 100               | 0.0936          | 0.1121          | 0.0856          | 0.0543          | 0.0097          | 0.0110          | 0.0026          | 0.0013           | 0.0004           | 0.0009           |
| 97                 | 100               | 0.0226          | 0.0794          | 0.0400          | 0.0379          | 0.0462          | 0.0245          | 0.0113          | 0.0026           | 0.0009           | 0.0012           |

**Table 3.2.6 (continued)**

Disaggregated gillnet CPUE.

| Year | Fishing effort | Catch, age 5 | Catch, age 6 | Catch, age 7 | Catch, age 8 | Catch, age 9 | Catch, age 10 | Catch, age 11 | Catch, age 12 |
|------|----------------|--------------|--------------|--------------|--------------|--------------|---------------|---------------|---------------|
| 88   | 100            | 0.0174       | 0.1046       | 0.2267       | 0.3027       | 0.1271       | 0.0361        | 0.0399        | 0.0187        |
| 89   | 100            | 0.0675       | 0.1665       | 0.2268       | 0.587        | 0.2584       | 0.0646        | 0.0373        | 0.0129        |
| 90   | 100            | 0.0213       | 0.125        | 0.235        | 0.2329       | 0.1789       | 0.0646        | 0.0107        | 0.0064        |
| 91   | 100            | 0.0263       | 0.0572       | 0.2318       | 0.3213       | 0.1866       | 0.1452        | 0.0436        | 0.0128        |
| 92   | 100            | 0.0134       | 0.0433       | 0.1671       | 0.4298       | 0.2209       | 0.0701        | 0.0612        | 0.0164        |
| 93   | 100            | 0.0661       | 0.1014       | 0.1861       | 0.3825       | 0.3657       | 0.1135        | 0.04          | 0.0223        |
| 94   | 100            | 0.0343       | 0.1487       | 0.1655       | 0.1617       | 0.1846       | 0.1625        | 0.0481        | 0.0168        |
| 95   | 100            | 0.0812       | 0.1212       | 0.2798       | 0.1749       | 0.135        | 0.1324        | 0.1291        | 0.0275        |
| 96   | 100            | 0.1364       | 0.176        | 0.1428       | 0.2211       | 0.0921       | 0.0562        | 0.0359        | 0.0405        |
| 97   | 100            | 0.2653       | 0.4976       | 0.2005       | 0.1112       | 0.1198       | 0.0379        | 0.0257        | 0.0208        |

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

Lowestoft VPA Version 3.1

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Extended Survivors Analysis

Saithe Iceland Va (run: XSASTJ01/X01)

CPUE data from file /users/fish/ifad/ifapwork/nwwg/sai\_icel/FLEET.X01

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

| Fleet,                | First, | Last, | First, | Last, | Alpha, | Beta  |
|-----------------------|--------|-------|--------|-------|--------|-------|
| ,                     | year,  | year, | age,   | age   |        |       |
| FLT04: TRW EFFORT (C, | 1980,  | 1997, | 3,     | 12,   | .000,  | 1.000 |

Time series weights :

Tapered time weighting applied  
Power = 3 over 20 years

Catchability analysis :

Catchability dependent on stock size for ages < 4

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

Catchability independent of age for ages >= 11

Terminal population estimation :

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

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

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

Prior weighting not applied

Tuning converged after 39 iterations

1

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

| Fishing mortalities | Age, | 1988, | 1989, | 1990, | 1991, | 1992, | 1993, | 1994, | 1995, | 1996, | 1997 |
|---------------------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
|                     | 3,   | .026, | .011, | .007, | .007, | .016, | .027, | .034, | .044, | .047, | .023 |
|                     | 4,   | .065, | .111, | .077, | .057, | .141, | .089, | .164, | .117, | .128, | .086 |
|                     | 5,   | .189, | .147, | .200, | .232, | .378, | .198, | .206, | .218, | .211, | .143 |
|                     | 6,   | .348, | .330, | .262, | .413, | .487, | .398, | .280, | .336, | .230, | .227 |
|                     | 7,   | .340, | .285, | .517, | .494, | .437, | .503, | .454, | .446, | .249, | .226 |
|                     | 8,   | .564, | .410, | .525, | .565, | .347, | .509, | .582, | .618, | .396, | .292 |
|                     | 9,   | .784, | .584, | .429, | .508, | .464, | .616, | .584, | .590, | .463, | .272 |
|                     | 10,  | .439, | .625, | .569, | .703, | .400, | .623, | .843, | .461, | .442, | .329 |
|                     | 11,  | .552, | .843, | .899, | .824, | .344, | .482, | .860, | .543, | .241, | .369 |
|                     | 12,  | .587, | .598, | .626, | .637, | .485, | .657, | .769, | .493, | .334, | .305 |

XSA population numbers (Thousands)

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

Estimated population abundance at 1st Jan 1998

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

Taper weighted geometric mean of the VPA populations:

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

Standard error of the weighted Log(VPA populations) :

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

Log catchability residuals.

Fleet : FLT04: TRW EFFORT (C

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

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

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

| Age ,       | 4,       | 5,       | 6,       | 7,       | 8,       | 9,       | 10,      | 11,      | 12       |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Mean Log q, | -6.0513, | -5.3376, | -4.9527, | -4.8998, | -4.9087, | -4.9792, | -4.8410, | -4.9049, | -4.9049, |
| S.E(Log q), | .5229,   | .3520,   | .2620,   | .2617,   | .3377,   | .3117,   | .4332,   | .9188,   | .7478,   |

Regression statistics :

Ages with q dependent on year class strength

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

3, .80, .393, 8.29, .27, 18, .84, -7.74,

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

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

|     |       |         |       |      |     |       |        |
|-----|-------|---------|-------|------|-----|-------|--------|
| 4,  | 1.08, | -.227,  | 5.72, | .45, | 18, | .59,  | -6.05, |
| 5,  | 1.47, | -1.697, | 3.19, | .57, | 18, | .48,  | -5.34, |
| 6,  | 1.39, | -2.372, | 3.18, | .79, | 18, | .31,  | -4.95, |
| 7,  | .97,  | .217,   | 5.02, | .84, | 18, | .27,  | -4.90, |
| 8,  | 1.39, | -1.626, | 3.52, | .63, | 18, | .44,  | -4.91, |
| 9,  | 1.08, | -.431,  | 4.76, | .75, | 18, | .35,  | -4.98, |
| 10, | .85,  | .829,   | 5.17, | .76, | 18, | .37,  | -4.84, |
| 11, | 1.12, | -.200,  | 4.74, | .22, | 18, | 1.07, | -4.90, |
| 12, | .65,  | 1.952,  | 5.11, | .76, | 18, | .43,  | -4.95, |

1

Terminal year survivor and F summaries :

Age 3 Catchability dependent on age and year class strength

Year class = 1994

| Fleet,                | Estimated,<br>Survivors, | Int,<br>s.e., | Ext,<br>s.e., | Var,<br>Ratio, | N, | Scaled,<br>Weights, | Estimated<br>F |
|-----------------------|--------------------------|---------------|---------------|----------------|----|---------------------|----------------|
| FLT04: TRW EFFORT (C, | 42477.,                  | .878,         | .000,         | .00,           | 1, | .138,               | .013           |
| P shrinkage mean ,    | 28313.,                  | .50,,,        |               |                |    | .427,               | .019           |
| F shrinkage mean ,    | 16003.,                  | .50,,,        |               |                |    | .435,               | .034           |

Weighted prediction :

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

1

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

Year class = 1993

| Fleet,                | Estimated,<br>Survivors, | Int,<br>s.e., | Ext,<br>s.e., | Var,<br>Ratio, | N, | Scaled,<br>Weights, | Estimated<br>F |
|-----------------------|--------------------------|---------------|---------------|----------------|----|---------------------|----------------|
| FLT04: TRW EFFORT (C, | 44175.,                  | .466,         | .078,         | .17,           | 2, | .510,               | .059           |
| F shrinkage mean ,    | 19588.,                  | .50,,,        |               |                |    | .490,               | .128           |

Weighted prediction :

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

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

Year class = 1992

| Fleet,                | Estimated,<br>Survivors, | Int,<br>s.e., | Ext,<br>s.e., | Var,<br>Ratio, | N, | Scaled,<br>Weights, | Estimated<br>F |
|-----------------------|--------------------------|---------------|---------------|----------------|----|---------------------|----------------|
| FLT04: TRW EFFORT (C, | 20697.,                  | .289,         | .181,         | .63,           | 3, | .712,               | .114           |
| F shrinkage mean ,    | 9089.,                   | .50,,,        |               |                |    | .288,               | .243           |

Weighted prediction :

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

1

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

Year class = 1991

| Fleet,                | Estimated,<br>Survivors, | Int,<br>s.e., | Ext,<br>s.e., | Var,<br>Ratio, | N, | Scaled,<br>Weights, | Estimated<br>F |
|-----------------------|--------------------------|---------------|---------------|----------------|----|---------------------|----------------|
| FLT04: TRW EFFORT (C, | 6595.,                   | .209,         | .141,         | .67,           | 4, | .803,               | .204           |
| F shrinkage mean ,    | 3585.,                   | .50,,,        |               |                |    | .197,               | .348           |

Weighted prediction :

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

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

Year class = 1990

| Fleet,                | Estimated,<br>Survivors, | Int,<br>s.e., | Ext,<br>s.e., | Var,<br>Ratio, | N, | Scaled,<br>Weights, | Estimated<br>F |
|-----------------------|--------------------------|---------------|---------------|----------------|----|---------------------|----------------|
| FLT04: TRW EFFORT (C, | 4807.,                   | .175,         | .103,         | .59,           | 5, | .844,               | .200           |
| F shrinkage mean ,    | 2039.,                   | .50,,,        |               |                |    | .156,               | .421           |

Weighted prediction :

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

1

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

Year class = 1989

| Fleet,                | Estimated,<br>Survivors, | Int,<br>s.e., | Ext,<br>s.e., | Var,<br>Ratio, | N, Scaled,<br>, Weights, | Estimated<br>F |
|-----------------------|--------------------------|---------------|---------------|----------------|--------------------------|----------------|
| FLT04: TRW EFFORT (C, | 1800.,                   | .161,         | .090,         | .56,           | 6, .840,                 | .263           |
| F shrinkage mean ,    | 848.,                    | .50,,,,       |               |                | .160,                    | .494           |

Weighted prediction :

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

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

Lowestoft VPA Version 3.1

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Extended Survivors Analysis

Saithe Iceland Va (run: XSASTJ02/X02)

CPUE data from file /users/fish/ifad/ifapwork/nwwg/sai\_icel/FLEET.X02

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

| Fleet,                | First, | Last, | First, | Last, | Alpha, | Beta  |
|-----------------------|--------|-------|--------|-------|--------|-------|
|                       | year,  | year, | age,   | age   |        |       |
| FLT06: TRW CPU JAN.-, | 1980,  | 1997, | 4,     | 11,   | .000,  | .420  |
| FLT08: TRW CPU JUNE,  | 1980,  | 1997, | 3,     | 12,   | .420,  | 1.000 |
| GN1: GILLNET JAN-DES, | 1988,  | 1997, | 5,     | 12,   | .000,  | 1.000 |

Time series weights :

Tapered time weighting applied  
Power = 3 over 20 years

Catchability analysis :

Catchability dependent on stock size for ages < 4

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

Catchability independent of age for ages >= 11

Terminal population estimation :

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

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

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

Prior weighting not applied

Tuning converged after 39 iterations

1

Regression weights

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

Fishing mortalities

| Age, | 1988, | 1989, | 1990, | 1991, | 1992, | 1993, | 1994, | 1995, | 1996, | 1997 |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 3,   | .026, | .011, | .007, | .007, | .016, | .024, | .031, | .042, | .040, | .022 |
| 4,   | .065, | .112, | .076, | .056, | .143, | .092, | .144, | .107, | .122, | .072 |
| 5,   | .189, | .148, | .203, | .231, | .372, | .202, | .214, | .187, | .191, | .135 |
| 6,   | .350, | .329, | .264, | .421, | .481, | .389, | .288, | .353, | .191, | .201 |
| 7,   | .346, | .288, | .515, | .499, | .452, | .494, | .439, | .464, | .265, | .180 |
| 8,   | .548, | .416, | .531, | .561, | .352, | .537, | .564, | .583, | .421, | .318 |
| 9,   | .739, | .555, | .438, | .518, | .458, | .632, | .641, | .558, | .420, | .297 |
| 10,  | .445, | .557, | .520, | .729, | .412, | .611, | .888, | .543, | .404, | .286 |
| 11,  | .610, | .865, | .712, | .694, | .366, | .506, | .827, | .604, | .306, | .324 |
| 12,  | .590, | .721, | .660, | .409, | .357, | .731, | .844, | .457, | .395, | .424 |

XSA population numbers (Thousands)

| YEAR , | AGE       | 3,        | 4,        | 5,        | 6,        | 7,        | 8,        | 9,        |           |           |
|--------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 10,    | 11,       | 12,       |           |           |           |           |           |           |           |           |
| 1988 , | 5.64E+04, | 8.89E+04, | 4.25E+04, | 1.38E+04, | 1.08E+04, | 4.65E+03, | 1.79E+03, | 6.95E+02, | 6.53E+02, | 2.65E+02, |
| 1989 , | 3.15E+04, | 4.50E+04, | 6.82E+04, | 2.88E+04, | 7.93E+03, | 6.27E+03, | 2.20E+03, | 6.99E+02, | 3.65E+02, | 2.91E+02, |
| 1990 , | 2.17E+04, | 2.55E+04, | 3.29E+04, | 4.82E+04, | 1.70E+04, | 4.87E+03, | 3.39E+03, | 1.04E+03, | 3.28E+02, | 1.26E+02, |
| 1991 , | 2.98E+04, | 1.77E+04, | 1.94E+04, | 2.20E+04, | 3.03E+04, | 8.30E+03, | 2.35E+03, | 1.79E+03, | 5.04E+02, | 1.32E+02, |
| 1992 , | 1.69E+04, | 2.42E+04, | 1.37E+04, | 1.26E+04, | 1.18E+04, | 1.51E+04, | 3.88E+03, | 1.14E+03, | 7.06E+02, | 2.06E+02, |
| 1993 , | 3.04E+04, | 1.36E+04, | 1.72E+04, | 7.72E+03, | 6.37E+03, | 6.16E+03, | 8.66E+03, | 2.01E+03, | 6.21E+02, | 4.01E+02, |
| 1994 , | 2.54E+04, | 2.43E+04, | 1.02E+04, | 1.15E+04, | 4.29E+03, | 3.18E+03, | 2.95E+03, | 3.77E+03, | 8.92E+02, | 3.06E+02, |
| 1995 , | 4.25E+04, | 2.01E+04, | 1.72E+04, | 6.72E+03, | 7.06E+03, | 2.26E+03, | 1.48E+03, | 1.27E+03, | 1.27E+03, | 3.19E+02, |
| 1996 , | 5.98E+04, | 3.34E+04, | 1.48E+04, | 1.17E+04, | 3.86E+03, | 3.63E+03, | 1.03E+03, | 6.95E+02, | 6.04E+02, | 5.69E+02, |
| 1997 , | 3.13E+04, | 4.70E+04, | 2.42E+04, | 1.00E+04, | 7.90E+03, | 2.43E+03, | 1.95E+03, | 5.56E+02, | 3.80E+02, | 3.65E+02, |

Estimated population abundance at 1st Jan 1998

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

Taper weighted geometric mean of the VPA populations:

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

Standard error of the weighted Log(VPA populations) :

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

1

Log catchability residuals.

Fleet : FLT06: TRW CPU JAN.-

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

| Age | 1988                               | 1989  | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|-----|------------------------------------|-------|------|------|------|------|------|------|------|------|
| 3   | No data for this fleet at this age |       |      |      |      |      |      |      |      |      |
| 4   | -1.33                              | -1.31 | .03  | -.88 | .20  | -.82 | .65  | .55  | .86  | .90  |
| 5   | .00                                | -1.33 | -.48 | -.17 | .43  | -.53 | .27  | .02  | .19  | -.34 |
| 6   | .19                                | -.07  | -.79 | -.26 | .22  | .42  | .15  | .30  | -.18 | -.18 |
| 7   | .00                                | .02   | -.17 | -.39 | -.02 | .57  | .09  | .30  | -.08 | .15  |
| 8   | -.01                               | -.02  | -.43 | -.20 | -.26 | .33  | .32  | .35  | .40  | .73  |
| 9   | .74                                | .36   | -.47 | .00  | -.20 | -.01 | .30  | .06  | .15  | .57  |
| 10  | .29                                | .51   | .14  | .34  | -.50 | .09  | .76  | .21  | .24  | .54  |
| 11  | .69                                | .11   | 1.05 | .40  | -.97 | -.32 | .14  | .29  | -.46 | .34  |
| 12  | No data for this fleet at this age |       |      |      |      |      |      |      |      |      |

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

| Age        | 4        | 5        | 6        | 7        | 8        | 9        | 10       | 11       |
|------------|----------|----------|----------|----------|----------|----------|----------|----------|
| Mean Log q | -18.5814 | -17.4682 | -16.7671 | -16.4388 | -16.4661 | -16.5274 | -16.6230 | -16.5198 |
| S.E(Log q) | .8539    | .5959    | .3462    | .3195    | .6630    | .4692    | .6984    | .6559    |

Regression statistics :

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

| Age | Slope | t-value | Intercept | RSquare | No Pts | Reg s.e. | Mean Q |
|-----|-------|---------|-----------|---------|--------|----------|--------|
| 4   | 1.04  | -.078   | 18.94     | .25     | 18     | .93      | -18.58 |
| 5   | 2.49  | -1.896  | 28.67     | .14     | 18     | 1.34     | -17.47 |
| 6   | 1.73  | -2.861  | 22.05     | .60     | 18     | .47      | -16.77 |
| 7   | 1.24  | -1.161  | 18.21     | .70     | 18     | .39      | -16.44 |
| 8   | 1.22  | -.481   | 18.26     | .31     | 18     | .84      | -16.47 |
| 9   | 1.10  | -.349   | 17.41     | .56     | 17     | .54      | -16.53 |
| 10  | 1.17  | -.402   | 18.29     | .35     | 18     | .85      | -16.62 |
| 11  | 1.40  | -.691   | 20.57     | .26     | 15     | .94      | -16.52 |

Fleet : FLT08: TRW CPU JUNE

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

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

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

| Age        | 4        | 5        | 6        | 7        | 8        | 9        | 10       | 11       | 12       |
|------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Mean Log q | -17.7689 | -17.1004 | -16.6650 | -16.6871 | -16.6337 | -16.7413 | -16.6925 | -16.8215 | -16.8215 |
| S.E(Log q) | .5585    | .5508    | .2570    | .3561    | .5645    | .7069    | .9405    | 1.2383   | 1.1485   |

Regression statistics :

Ages with q dependent on year class strength

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

|   |     |      |       |     |    |     |        |
|---|-----|------|-------|-----|----|-----|--------|
| 3 | .62 | .856 | 15.96 | .34 | 18 | .72 | -19.29 |
|---|-----|------|-------|-----|----|-----|--------|

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

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

|    |      |        |       |     |    |      |        |
|----|------|--------|-------|-----|----|------|--------|
| 4  | 1.02 | -.046  | 17.89 | .45 | 18 | .59  | -17.77 |
| 5  | 1.63 | -1.223 | 21.63 | .27 | 18 | .88  | -17.10 |
| 6  | 1.28 | -1.671 | 18.65 | .78 | 18 | .30  | -16.67 |
| 7  | .86  | .866   | 15.60 | .79 | 18 | .31  | -16.69 |
| 8  | 1.42 | -.947  | 20.10 | .33 | 18 | .81  | -16.63 |
| 9  | .94  | .165   | 16.19 | .42 | 18 | .69  | -16.74 |
| 10 | .59  | 1.504  | 12.79 | .58 | 18 | .53  | -16.69 |
| 11 | .97  | .041   | 16.46 | .13 | 15 | 1.26 | -16.82 |
| 12 | 5.42 | -1.002 | 64.43 | .01 | 14 | 5.92 | -16.48 |

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Fleet : GN1: GILLNET JAN-DES

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

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

| Age        | 5        | 6        | 7        | 8        | 9        | 10       | 11       | 12       |
|------------|----------|----------|----------|----------|----------|----------|----------|----------|
| Mean Log q | -17.3756 | -15.9727 | -14.9985 | -14.1154 | -13.8478 | -13.8546 | -13.8364 | -13.8364 |
| S.E(Log q) | 1.1118   | .9441    | .5271    | .3581    | .3050    | .2629    | .3493    | .2104    |

Regression statistics :

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

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

|    |        |        |        |     |    |       |        |
|----|--------|--------|--------|-----|----|-------|--------|
| 5  | -34.69 | -1.641 | *****  | .00 | 10 | 35.15 | -17.38 |
| 6  | -6.43  | -2.971 | -31.83 | .02 | 10 | 4.36  | -15.97 |
| 7  | 4.66   | -7.067 | 36.67  | .34 | 10 | .93   | -15.00 |
| 8  | 1.46   | -1.643 | 16.70  | .64 | 10 | .48   | -14.12 |
| 9  | 1.57   | -2.788 | 17.29  | .77 | 10 | .36   | -13.85 |
| 10 | 1.10   | -.567  | 14.52  | .82 | 10 | .30   | -13.85 |
| 11 | .78    | .979   | 12.21  | .73 | 10 | .27   | -13.84 |
| 12 | 1.10   | -.621  | 14.76  | .83 | 10 | .23   | -13.89 |

1

Fleet disaggregated estimates of survivors :

Age 3 Catchability dependent on age and year class strength

Year class = 1994

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

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

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

| Fleet,                | Estimated,<br>Survivors, | Int,<br>s.e., | Ext,<br>s.e., | Var,<br>Ratio, | N, | Scaled,<br>Weights, | Estimated<br>F |
|-----------------------|--------------------------|---------------|---------------|----------------|----|---------------------|----------------|
| FLT06: TRW CPU JAN.-, | 1.,                      | .000,         | .000,         | .00,           | 0, | .000,               | .000           |
| FLT08: TRW CPU JUNE , | 40894.,                  | .759,         | .000,         | .00,           | 1, | .178,               | .013           |
| GN1: GILLNET JAN-DES, | 1.,                      | .000,         | .000,         | .00,           | 0, | .000,               | .000           |
| P shrinkage mean ,    | 29207.,                  | .51,,,        |               |                |    | .404,               | .019           |
| F shrinkage mean ,    | 17534.,                  | .50,,,        |               |                |    | .419,               | .031           |

Weighted prediction :

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

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

Year class = 1993

FLT06: TRW CPU JAN.-  
Age, 4,  
Survivors, 88043.,  
Raw Weights, 1.178,

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

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

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

Weighted prediction :

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

1

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

Year class = 1992

FLT06: TRW CPU JAN.-

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

FLT08: TRW CPU JUNE

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

GN1: GILLNET JAN-DES

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

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

Weighted prediction :

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

1

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

Year class = 1991

FLT06: TRW CPU JAN.-

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

FLT08: TRW CPU JUNE

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

GN1: GILLNET JAN-DES

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

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

Weighted prediction :

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

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

Year class = 1990

FLT06: TRW CPU JAN.-

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

FLT08: TRW CPU JUNE

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

GN1: GILLNET JAN-DES

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

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

Weighted prediction :

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

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

Year class = 1989

FLT06: TRW CPU JAN.-

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

FLT08: TRW CPU JUNE

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

GN1: GILLNET JAN-DES

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

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

Weighted prediction :

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

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

Year class = 1988

FLT06: TRW CPU JAN.-

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

FLT08: TRW CPU JUNE

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

GN1: GILLNET JAN-DES

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

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

Weighted prediction :

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

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

Year class = 1987

FLT06: TRW CPU JAN.-

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

FLT08: TRW CPU JUNE

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

GN1: GILLNET JAN-DES

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

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

Weighted prediction :

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

1

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

Year class = 1986

FLT06: TRW CPU JAN.-

Age, 11,  
Survivors, 316.,  
Raw Weights, 1.539,

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

FLT08: TRW CPU JUNE

Age, 11,  
Survivors, 156.,  
Raw Weights, .433,

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

GN1: GILLNET JAN-DES

Age, 11,  
Survivors, 200.,  
Raw Weights, 5.352,

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

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

Weighted prediction :

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

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

Year class = 1985

FLT06: TRW CPU JAN.-

Age, 12,  
Survivors, 0.,  
Raw Weights, .000,

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

FLT08: TRW CPU JUNE

Age, 11,  
Survivors, 201.,  
Raw Weights, .449,

|              |       |       |       |       |       |       |       |       |
|--------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Age,         | 10,   | 9,    | 8,    | 7,    | 6,    | 5,    | 4,    | 3,    |
| Survivors,   | 275., | 282., | 188., | 254., | 208., | 195., | 157., | 150., |
| Raw Weights, | .291, | .270, | .244, | .381, | .369, | .078, | .064, | .034, |

GN1: GILLNET JAN-DES

Age, 12,  
Survivors, 153.,

Raw Weights, 7.271, 3.565,

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

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

Weighted prediction :

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

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

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

STOCK IN NUMBERS:

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

STANDARD DEVIATION OF STOCK ESTIMATES:

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

FISHING MORTALITY RATES:

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

STANDARD DEVIATIONS OF LOG(F):

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

Table 3.2.9 (continued)

**B. TSA - Catch at age, trend estimated.****STOCK IN NUMBERS:**

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

**STANDARD DEVIATION OF STOCK ESTIMATES:**

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

**FISHING MORTALITY RATES:**

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

**STANDARD DEVIATIONS OF LOG(F):**

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

Table 3.2.9 (continued)

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

## STOCK IN NUMBERS:

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

## STANDARD DEVIATION OF STOCK ESTIMATES:

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

## FISHING MORTALITY RATES:

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

## STANDARD DEVIATIONS OF LOG(F):

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

Table 3.2.9 (continued)

**D. TSA - Catch at age and trawler-CPUE, June-Dec.. Trend estimated.****STOCK IN NUMBERS:**

| Age/year | 1982  | 1983  | 1984  | 1985  | 1986  | 1987  | 1988  | 1989  | 1990  | 1991  | 1992  | 1993  | 1994  | 1995  | 1996  | 1997  |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 4        | 16519 | 18527 | 27000 | 38322 | 28369 | 56662 | 86244 | 44212 | 24921 | 18033 | 21516 | 10706 | 15212 | 12937 | 21493 | 28446 |
| 5        | 17660 | 12466 | 13887 | 20898 | 28036 | 21669 | 41713 | 64771 | 32615 | 18703 | 13617 | 14863 | 7760  | 9883  | 9079  | 14703 |
| 6        | 23225 | 12008 | 8676  | 9902  | 14176 | 19241 | 13814 | 28121 | 43613 | 21756 | 12041 | 7415  | 9491  | 4859  | 5893  | 5558  |
| 7        | 12053 | 14500 | 7602  | 5576  | 6230  | 9013  | 10896 | 8092  | 16972 | 26325 | 11737 | 6057  | 3873  | 5349  | 2428  | 3202  |
| 8        | 3188  | 6236  | 8255  | 4321  | 3244  | 3683  | 4813  | 6026  | 4646  | 8782  | 13472 | 6010  | 2873  | 1864  | 2393  | 1182  |
| 9        | 2748  | 1590  | 3123  | 4086  | 2376  | 1742  | 1862  | 2322  | 3092  | 2197  | 4064  | 6920  | 2619  | 1195  | 720   | 1007  |
| 10       | 565   | 1371  | 844   | 1629  | 2354  | 1308  | 852   | 840   | 1151  | 1529  | 998   | 2037  | 2948  | 1003  | 476   | 305   |
| 11       | 180   | 254   | 762   | 418   | 901   | 1253  | 651   | 437   | 417   | 572   | 642   | 481   | 893   | 1098  | 393   | 202   |

**STANDARD DEVIATION OF STOCK ESTIMATES:**

| Age/year | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997  |
|----------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| 4        | 1133 | 1183 | 1534 | 2453 | 1663 | 3909 | 5916 | 2669 | 1332 | 922  | 1554 | 983  | 1952 | 2346 | 5436 | 10376 |
| 5        | 1200 | 864  | 896  | 1196 | 1777 | 1286 | 2883 | 4411 | 1913 | 1025 | 716  | 1185 | 772  | 1540 | 1849 | 4304  |
| 6        | 1614 | 891  | 606  | 661  | 821  | 1300 | 902  | 2052 | 2984 | 1371 | 738  | 501  | 877  | 561  | 1136 | 1321  |
| 7        | 861  | 1183 | 579  | 394  | 414  | 557  | 847  | 602  | 1300 | 1859 | 875  | 455  | 357  | 587  | 380  | 731   |
| 8        | 385  | 552  | 734  | 374  | 236  | 257  | 355  | 553  | 382  | 772  | 1098 | 537  | 296  | 239  | 367  | 225   |
| 9        | 283  | 203  | 334  | 480  | 224  | 143  | 160  | 225  | 329  | 221  | 468  | 631  | 338  | 184  | 150  | 206   |
| 10       | 134  | 197  | 124  | 246  | 317  | 150  | 103  | 112  | 151  | 213  | 152  | 294  | 438  | 228  | 119  | 87    |
| 11       | 84   | 84   | 116  | 85   | 161  | 189  | 101  | 69   | 72   | 96   | 139  | 92   | 187  | 281  | 140  | 63    |

**FISHING MORTALITY RATES:**

| Age/year | 1982  | 1983  | 1984  | 1985  | 1986  | 1987  | 1988  | 1989  | 1990  | 1991  | 1992  | 1993  | 1994  | 1995  | 1996  | 1997  |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 4        | 0.08  | 0.086 | 0.053 | 0.110 | 0.069 | 0.108 | 0.080 | 0.105 | 0.087 | 0.081 | 0.152 | 0.104 | 0.171 | 0.132 | 0.165 | 0.123 |
| 5        | 0.183 | 0.143 | 0.134 | 0.188 | 0.175 | 0.240 | 0.194 | 0.183 | 0.205 | 0.239 | 0.367 | 0.238 | 0.260 | 0.283 | 0.287 | 0.263 |
| 6        | 0.271 | 0.255 | 0.240 | 0.255 | 0.253 | 0.355 | 0.323 | 0.305 | 0.290 | 0.410 | 0.474 | 0.398 | 0.369 | 0.473 | 0.410 | 0.417 |
| 7        | 0.435 | 0.360 | 0.365 | 0.330 | 0.315 | 0.426 | 0.386 | 0.355 | 0.459 | 0.466 | 0.468 | 0.516 | 0.490 | 0.588 | 0.518 | 0.540 |
| 8        | 0.483 | 0.490 | 0.504 | 0.384 | 0.407 | 0.479 | 0.526 | 0.466 | 0.549 | 0.569 | 0.444 | 0.618 | 0.637 | 0.696 | 0.666 | 0.706 |
| 9        | 0.491 | 0.420 | 0.446 | 0.341 | 0.385 | 0.515 | 0.595 | 0.502 | 0.502 | 0.587 | 0.487 | 0.653 | 0.715 | 0.681 | 0.657 | 0.691 |
| 10       | 0.535 | 0.358 | 0.496 | 0.392 | 0.423 | 0.497 | 0.467 | 0.500 | 0.498 | 0.658 | 0.530 | 0.622 | 0.763 | 0.689 | 0.656 | 0.683 |
| 11       | 0.460 | 0.352 | 0.455 | 0.368 | 0.406 | 0.504 | 0.514 | 0.541 | 0.516 | 0.593 | 0.544 | 0.640 | 0.707 | 0.677 | 0.651 | 0.690 |
| F(4-9)   | 0.324 | 0.292 | 0.290 | 0.268 | 0.267 | 0.354 | 0.351 | 0.319 | 0.349 | 0.392 | 0.399 | 0.421 | 0.440 | 0.475 | 0.450 | 0.457 |

**STANDARD DEVIATIONS OF LOG(F):**

| Age/year | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|----------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 4        | 0.24 | 0.17 | 0.18 | 0.23 | 0.19 | 0.27 | 0.30 | 0.22 | 0.14 | 0.10 | 0.15 | 0.09 | 0.14 | 0.14 | 0.22 | 0.31 |
| 5        | 0.10 | 0.11 | 0.09 | 0.13 | 0.10 | 0.11 | 0.12 | 0.14 | 0.10 | 0.10 | 0.09 | 0.08 | 0.08 | 0.09 | 0.12 | 0.18 |
| 6        | 0.11 | 0.11 | 0.14 | 0.13 | 0.10 | 0.10 | 0.09 | 0.11 | 0.13 | 0.10 | 0.09 | 0.07 | 0.10 | 0.11 | 0.13 | 0.19 |
| 7        | 0.10 | 0.12 | 0.12 | 0.12 | 0.12 | 0.10 | 0.10 | 0.10 | 0.11 | 0.12 | 0.10 | 0.09 | 0.08 | 0.12 | 0.14 | 0.20 |
| 8        | 0.14 | 0.10 | 0.13 | 0.12 | 0.12 | 0.11 | 0.10 | 0.11 | 0.11 | 0.11 | 0.13 | 0.11 | 0.10 | 0.11 | 0.14 | 0.20 |
| 9        | 0.12 | 0.12 | 0.13 | 0.15 | 0.15 | 0.13 | 0.12 | 0.12 | 0.14 | 0.13 | 0.14 | 0.14 | 0.13 | 0.13 | 0.15 | 0.21 |
| 10       | 0.15 | 0.15 | 0.17 | 0.15 | 0.18 | 0.16 | 0.15 | 0.15 | 0.15 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.17 | 0.21 |
| 11       | 0.18 | 0.17 | 0.18 | 0.17 | 0.18 | 0.18 | 0.17 | 0.17 | 0.18 | 0.18 | 0.17 | 0.18 | 0.18 | 0.18 | 0.19 | 0.21 |

Table 3.2.10. Saithe in Division Va. Fishing mortality.

Run title : Saithe Iceland Va (run: SVPSTJ01/V01)

At 4-May-98 10:24:52

Traditional vpa using file input for terminal F

| Table 8 Fishing mortality (F) at age |       |       |       |       |       |       |       |       |       |       |  |
|--------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| YEAR                                 | 1978  | 1979  | 1980  | 1981  | 1982  | 1983  | 1984  | 1985  | 1986  | 1987  |  |
| AGE                                  |       |       |       |       |       |       |       |       |       |       |  |
| 3                                    | 0.012 | 0.010 | 0.011 | 0.012 | 0.026 | 0.004 | 0.001 | 0.012 | 0.048 | 0.010 |  |
| 4                                    | 0.074 | 0.109 | 0.064 | 0.066 | 0.079 | 0.115 | 0.027 | 0.120 | 0.056 | 0.104 |  |
| 5                                    | 0.154 | 0.178 | 0.217 | 0.119 | 0.195 | 0.103 | 0.071 | 0.185 | 0.177 | 0.251 |  |
| 6                                    | 0.212 | 0.357 | 0.369 | 0.366 | 0.239 | 0.261 | 0.257 | 0.247 | 0.219 | 0.365 |  |
| 7                                    | 0.329 | 0.342 | 0.378 | 0.366 | 0.558 | 0.361 | 0.391 | 0.358 | 0.315 | 0.395 |  |
| 8                                    | 0.353 | 0.312 | 0.553 | 0.454 | 0.594 | 0.674 | 0.560 | 0.376 | 0.480 | 0.497 |  |
| 9                                    | 0.303 | 0.171 | 0.276 | 0.493 | 0.658 | 0.526 | 0.562 | 0.211 | 0.355 | 0.588 |  |
| 10                                   | 0.331 | 0.763 | 0.229 | 0.278 | 0.531 | 0.349 | 0.994 | 0.736 | 0.891 | 0.528 |  |
| 11                                   | 0.304 | 0.670 | 0.394 | 0.076 | 0.101 | 0.113 | 0.881 | 0.531 | 0.908 | 0.833 |  |
| 12                                   | 0.525 | 0.586 | 0.252 | 0.871 | 0.057 | 0.027 | 0.724 | 0.149 | 0.883 | 0.668 |  |
| 13                                   | 0.566 | 0.603 | 0.137 | 0.546 | 0.754 | 0.004 | 0.699 | 1.162 | 0.294 | 2.283 |  |
| 14                                   | 0.431 | 0.655 | 0.253 | 0.443 | 0.361 | 0.123 | 0.824 | 0.644 | 0.744 | 1.078 |  |
| +gp                                  | 0.431 | 0.655 | 0.253 | 0.443 | 0.361 | 0.123 | 0.824 | 0.644 | 0.744 | 1.078 |  |
| FBAR 4- 9                            | 0.237 | 0.245 | 0.310 | 0.311 | 0.387 | 0.340 | 0.311 | 0.250 | 0.267 | 0.367 |  |

| Table 8 Fishing mortality (F) at age |       |       |       |       |       |       |       |       |       |       |         |
|--------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| YEAR                                 | 1988  | 1989  | 1990  | 1991  | 1992  | 1993  | 1994  | 1995  | 1996  | 1997  | FBAR 95 |
| AGE                                  |       |       |       |       |       |       |       |       |       |       |         |
| 3                                    | 0.027 | 0.011 | 0.008 | 0.008 | 0.018 | 0.037 | 0.044 | 0.062 | 0.060 | 0.027 | 0.050   |
| 4                                    | 0.066 | 0.113 | 0.078 | 0.059 | 0.157 | 0.107 | 0.228 | 0.158 | 0.188 | 0.112 | 0.153   |
| 5                                    | 0.188 | 0.150 | 0.205 | 0.237 | 0.392 | 0.225 | 0.254 | 0.330 | 0.304 | 0.225 | 0.286   |
| 6                                    | 0.342 | 0.326 | 0.268 | 0.426 | 0.498 | 0.421 | 0.332 | 0.445 | 0.400 | 0.367 | 0.404   |
| 7                                    | 0.334 | 0.278 | 0.506 | 0.507 | 0.459 | 0.522 | 0.495 | 0.572 | 0.369 | 0.486 | 0.476   |
| 8                                    | 0.447 | 0.396 | 0.503 | 0.543 | 0.362 | 0.550 | 0.621 | 0.719 | 0.596 | 0.512 | 0.609   |
| 9                                    | 0.676 | 0.399 | 0.407 | 0.474 | 0.436 | 0.657 | 0.669 | 0.663 | 0.610 | 0.512 | 0.595   |
| 10                                   | 0.408 | 0.475 | 0.313 | 0.636 | 0.361 | 0.560 | 0.961 | 0.589 | 0.543 | 0.512 | 0.548   |
| 11                                   | 0.619 | 0.729 | 0.536 | 0.313 | 0.295 | 0.412 | 0.694 | 0.721 | 0.348 | 0.512 | 0.527   |
| 12                                   | 0.420 | 0.739 | 0.476 | 0.262 | 0.117 | 0.511 | 0.579 | 0.338 | 0.540 | 0.512 | 0.463   |
| 13                                   | 0.655 | 0.601 | 1.367 | 0.085 | 0.676 | 0.248 | 1.616 | 0.240 | 0.500 | 0.512 | 0.417   |
| 14                                   | 0.526 | 0.636 | 0.673 | 0.273 | 0.316 | 0.306 | 0.426 | 0.426 | 0.374 | 0.512 | 0.437   |
| +gp                                  | 0.526 | 0.636 | 0.673 | 0.273 | 0.316 | 0.306 | 0.426 | 0.426 | 0.374 | 0.512 |         |
| FBAR 4- 9                            | 0.342 | 0.277 | 0.328 | 0.375 | 0.384 | 0.414 | 0.433 | 0.481 | 0.411 | 0.369 |         |

Table 3.2.11. Saithe in Division Va. Stock in numbers

Run title : Saithe Iceland Va (run: SVPSTJ01/V01)

At 4-May-98 10:24:52

Traditional vpa using file input for terminal F

| Table 10 Stock number at age (start of year) |        |        |        |        |       | Numbers*10**-3 |        |        |        |        |
|----------------------------------------------|--------|--------|--------|--------|-------|----------------|--------|--------|--------|--------|
| YEAR                                         | 1978   | 1979   | 1980   | 1981   | 1982  | 1983           | 1984   | 1985   | 1986   | 1987   |
| AGE                                          |        |        |        |        |       |                |        |        |        |        |
| 3                                            | 49446  | 55312  | 28074  | 19562  | 22175 | 33645          | 47675  | 34957  | 73698  | 107944 |
| 4                                            | 17691  | 39988  | 44852  | 22737  | 15833 | 17697          | 27449  | 38985  | 28281  | 57534  |
| 5                                            | 18806  | 13451  | 29346  | 34430  | 17420 | 11978          | 12911  | 21880  | 28300  | 21891  |
| 6                                            | 8956   | 13203  | 9220   | 19333  | 25031 | 11737          | 8846   | 9849   | 14883  | 19414  |
| 7                                            | 4993   | 5932   | 7562   | 5218   | 10977 | 16134          | 7402   | 5601   | 6302   | 9786   |
| 8                                            | 3546   | 2942   | 3450   | 4244   | 2964  | 5144           | 9210   | 4100   | 3206   | 3767   |
| 9                                            | 2258   | 2040   | 1764   | 1624   | 2206  | 1340           | 2147   | 4310   | 2305   | 1625   |
| 10                                           | 2239   | 1366   | 1407   | 1096   | 812   | 935            | 648    | 1003   | 2856   | 1323   |
| 11                                           | 1994   | 1317   | 522    | 916    | 680   | 391            | 540    | 196    | 393    | 959    |
| 12                                           | 747    | 1205   | 552    | 288    | 695   | 503            | 286    | 183    | 95     | 130    |
| 13                                           | 352    | 362    | 549    | 351    | 99    | 537            | 401    | 113    | 129    | 32     |
| 14                                           | 285    | 164    | 162    | 392    | 166   | 38             | 438    | 163    | 29     | 79     |
| +gp                                          | 172    | 0      | 285    | 432    | 358   | 1655           | 368    | 669    | 197    | 36     |
| TOTAL                                        | 111484 | 137282 | 127745 | 110623 | 99416 | 101735         | 118323 | 122010 | 160674 | 224520 |

| Table 10 Stock number at age (start of year) |        |        |        |        |       | Numbers*10**-3 |       |       |       |       |           |            |       |
|----------------------------------------------|--------|--------|--------|--------|-------|----------------|-------|-------|-------|-------|-----------|------------|-------|
| YEAR                                         | 1988   | 1989   | 1990   | 1991   | 1992  | 1993           | 1994  | 1995  | 1996  | 1997  | 1998 GMST | 78-95 AMST |       |
| AGE                                          |        |        |        |        |       |                |       |       |       |       |           |            |       |
| 3                                            | 55611  | 30683  | 20700  | 27250  | 14663 | 20173          | 17815 | 28901 | 39912 | 24964 | 0         | 33020      | 38238 |
| 4                                            | 87514  | 44340  | 24837  | 16819  | 22132 | 11787          | 15923 | 13952 | 22242 | 30765 | 19894     | 26166      | 30464 |
| 5                                            | 42474  | 67078  | 32414  | 18808  | 12981 | 15482          | 8674  | 10377 | 9753  | 15090 | 22520     | 20125      | 23261 |
| 6                                            | 13940  | 28814  | 47286  | 21613  | 12148 | 7178           | 10119 | 5509  | 6106  | 5894  | 9865      | 13756      | 15949 |
| 7                                            | 11038  | 8109   | 17024  | 29620  | 11556 | 6044           | 3857  | 5946  | 2890  | 3350  | 3343      | 8342       | 9617  |
| 8                                            | 5396   | 6469   | 5026   | 8408   | 14602 | 5980           | 2936  | 1924  | 2747  | 1635  | 1687      | 4576       | 5184  |
| 9                                            | 1876   | 2827   | 3566   | 2488   | 3998  | 8322           | 2824  | 1293  | 767   | 1240  | 802       | 2414       | 2712  |
| 10                                           | 739    | 781    | 1553   | 1944   | 1268  | 2116           | 3533  | 1184  | 545   | 341   | 608       | 1331       | 1489  |
| 11                                           | 639    | 402    | 398    | 930    | 843   | 724            | 990   | 1106  | 538   | 259   | 167       | 675        | 774   |
| 12                                           | 342    | 282    | 159    | 190    | 557   | 514            | 393   | 405   | 440   | 311   | 127       | 343        | 418   |
| 13                                           | 55     | 184    | 110    | 81     | 120   | 405            | 252   | 180   | 236   | 210   | 153       | 182        | 240   |
| 14                                           | 3      | 23     | 82     | 23     | 61    | 50             | 259   | 41    | 116   | 117   | 103       | 78         | 137   |
| +gp                                          | 3      | 19     | 94     | 193    | 4     | 4              | 161   | 54    | 105   | 112   | 113       |            |       |
| TOTAL                                        | 219629 | 190011 | 153250 | 128368 | 94933 | 78779          | 67736 | 70872 | 86400 | 84289 | 59383     |            |       |

**Table 3.2.12. Saithe in Division Va. Stock summary table.**

Run title : Saithe Iceland Va (run: SVPSTJ02/V02)

At 4-May-98 10:59:55

Table 16 Summary (without SOP correction)

Traditional vpa using file input for terminal F

|         | RECRUITS    | TOTALBIO | TOTSPBIO | LANDINGS | YIELD/SSB | FBAR | 4- 9   |
|---------|-------------|----------|----------|----------|-----------|------|--------|
| Age 3   |             |          |          |          |           |      |        |
| 1962    | 30999       | 277003   | 142184   | 50514    | 0.355     |      | 0.287  |
| 1963    | 84106       | 336274   | 144613   | 48011    | 0.332     |      | 0.304  |
| 1964    | 55195       | 380521   | 141947   | 60257    | 0.425     |      | 0.250  |
| 1965    | 94062       | 465836   | 165999   | 60177    | 0.363     |      | 0.231  |
| 1966    | 70223       | 550397   | 214136   | 52003    | 0.243     |      | 0.178  |
| 1967    | 68332       | 648019   | 279292   | 75712    | 0.271     |      | 0.238  |
| 1968    | 59672       | 697092   | 345778   | 77549    | 0.224     |      | 0.210  |
| 1969    | 88751       | 762546   | 395280   | 115853   | 0.293     |      | 0.295  |
| 1970    | 66328       | 755885   | 399454   | 116601   | 0.292     |      | 0.323  |
| 1971    | 50638       | 717074   | 381384   | 136764   | 0.359     |      | 0.443  |
| 1972    | 26456       | 603752   | 334676   | 111301   | 0.333     |      | 0.361  |
| 1973    | 26109       | 516607   | 313690   | 110888   | 0.354     |      | 0.345  |
| 1974    | 25128       | 434176   | 288073   | 97568    | 0.339     |      | 0.288  |
| 1975    | 25929       | 387997   | 264701   | 87954    | 0.332     |      | 0.278  |
| 1976    | 31242       | 347177   | 227245   | 82003    | 0.361     |      | 0.326  |
| 1977    | 21673       | 300274   | 186683   | 62026    | 0.332     |      | 0.282  |
| 1978    | 49446       | 307948   | 165578   | 49672    | 0.300     |      | 0.237  |
| 1979    | 55312       | 342306   | 159551   | 63504    | 0.398     |      | 0.245  |
| 1980    | 28074       | 349895   | 163194   | 58347    | 0.358     |      | 0.310  |
| 1981    | 19562       | 333100   | 166512   | 58986    | 0.354     |      | 0.311  |
| 1982    | 22175       | 318648   | 175459   | 68615    | 0.391     |      | 0.387  |
| 1983    | 33645       | 330042   | 190884   | 58266    | 0.305     |      | 0.340  |
| 1984    | 47675       | 358777   | 179728   | 62719    | 0.349     |      | 0.311  |
| 1985    | 34957       | 353254   | 168059   | 57101    | 0.340     |      | 0.250  |
| 1986    | 73698       | 418352   | 177369   | 66376    | 0.374     |      | 0.267  |
| 1987    | 107944      | 501524   | 172509   | 80559    | 0.467     |      | 0.367  |
| 1988    | 55611       | 515803   | 167291   | 77247    | 0.462     |      | 0.342  |
| 1989    | 30683       | 479280   | 175806   | 82425    | 0.469     |      | 0.277  |
| 1990    | 20700       | 453153   | 195067   | 98130    | 0.503     |      | 0.328  |
| 1991    | 27250       | 374698   | 195547   | 102737   | 0.525     |      | 0.375  |
| 1992    | 14663       | 302053   | 180747   | 79597    | 0.440     |      | 0.384  |
| 1993    | 20173       | 255089   | 161116   | 71648    | 0.445     |      | 0.414  |
| 1994    | 17815       | 210193   | 134121   | 64338    | 0.480     |      | 0.433  |
| 1995    | 28901       | 185893   | 101024   | 48650    | 0.482     |      | 0.481  |
| 1996    | 39912       | 188501   | 89846    | 40099    | 0.446     |      | 0.411  |
| 1997    | 24964       | 200633   | 92695    | 37158    | 0.401     |      | 0.369  |
| Arith.  |             |          |          |          |           |      |        |
| Mean    | 43833       | 415549   | 206590   | 74204    | 0.3749    |      | 0.3187 |
| 0 Units | (Thousands) | (Tonnes) | (Tonnes) | (Tonnes) |           |      |        |

**Table 3.2.13. Saithe in Division Va. Prediction with management option - Input data.**

The SAS System

12:23 Monday,

May 4, 1998

Saithe in the Iceland Grounds (Fishing Area Va)

Prediction with management option table: Input data

| Year: 1998 |            |                   |                |                     |                     |                 |                  |                 |
|------------|------------|-------------------|----------------|---------------------|---------------------|-----------------|------------------|-----------------|
| Age        | Stock size | Natural mortality | Maturity ogive | Prop.of F bef.spaw. | Prop.of M bef.spaw. | Weight in stock | Exploit. pattern | Weight in catch |
| 3          | 25.000     | 0.2000            | 0.1200         | 0.0000              | 0.0000              | 1.302           | 0.0440           | 1.302           |
| 4          | 19.923     | 0.2000            | 0.2400         | 0.0000              | 0.0000              | 2.009           | 0.1340           | 2.009           |
| 5          | 14.106     | 0.2000            | 0.4300         | 0.0000              | 0.0000              | 2.747           | 0.2510           | 2.747           |
| 6          | 9.865      | 0.2000            | 0.6200         | 0.0000              | 0.0000              | 3.537           | 0.3550           | 3.537           |
| 7          | 3.343      | 0.2000            | 0.8200         | 0.0000              | 0.0000              | 4.973           | 0.4170           | 4.973           |
| 8          | 1.687      | 0.2000            | 0.9100         | 0.0000              | 0.0000              | 6.152           | 0.5340           | 6.152           |
| 9          | 0.802      | 0.2000            | 0.9600         | 0.0000              | 0.0000              | 7.642           | 0.5220           | 7.642           |
| 10         | 0.608      | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 7.556           | 0.4810           | 7.556           |
| 11         | 0.167      | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 8.694           | 0.4630           | 8.694           |
| 12         | 0.127      | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 9.244           | 0.4070           | 9.244           |
| 13         | 0.153      | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 9.964           | 0.3800           | 9.964           |
| 14+        | 0.103      | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 11.655          | 0.4330           | 11.655          |
| Unit       | Millions   | -                 | -              | -                   | -                   | Kilograms       | -                | Kilograms       |

| Year: 1999 |              |                   |                |                     |                     |                 |                  |                 |
|------------|--------------|-------------------|----------------|---------------------|---------------------|-----------------|------------------|-----------------|
| Age        | Recruit-ment | Natural mortality | Maturity ogive | Prop.of F bef.spaw. | Prop.of M bef.spaw. | Weight in stock | Exploit. pattern | Weight in catch |
| 3          | 25.000       | 0.2000            | 0.1200         | 0.0000              | 0.0000              | 1.302           | 0.0440           | 1.302           |
| 4          | .            | 0.2000            | 0.2400         | 0.0000              | 0.0000              | 1.993           | 0.1340           | 1.993           |
| 5          | .            | 0.2000            | 0.4300         | 0.0000              | 0.0000              | 2.799           | 0.2510           | 2.799           |
| 6          | .            | 0.2000            | 0.6300         | 0.0000              | 0.0000              | 3.745           | 0.3550           | 3.745           |
| 7          | .            | 0.2000            | 0.7900         | 0.0000              | 0.0000              | 4.701           | 0.4170           | 4.701           |
| 8          | .            | 0.2000            | 0.9100         | 0.0000              | 0.0000              | 6.116           | 0.5340           | 6.116           |
| 9          | .            | 0.2000            | 0.9600         | 0.0000              | 0.0000              | 7.592           | 0.5220           | 7.592           |
| 10         | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 7.556           | 0.4810           | 7.556           |
| 11         | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 8.694           | 0.4630           | 8.694           |
| 12         | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 9.244           | 0.4070           | 9.244           |
| 13         | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 9.964           | 0.3800           | 9.964           |
| 14+        | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 11.655          | 0.4330           | 11.655          |
| Unit       | Millions     | -                 | -              | -                   | -                   | Kilograms       | -                | Kilograms       |

| Year: 2000 |              |                   |                |                     |                     |                 |                  |                 |
|------------|--------------|-------------------|----------------|---------------------|---------------------|-----------------|------------------|-----------------|
| Age        | Recruit-ment | Natural mortality | Maturity ogive | Prop.of F bef.spaw. | Prop.of M bef.spaw. | Weight in stock | Exploit. pattern | Weight in catch |
| 3          | 25.000       | 0.2000            | 0.1200         | 0.0000              | 0.0000              | 1.302           | 0.0440           | 1.302           |
| 4          | .            | 0.2000            | 0.2400         | 0.0000              | 0.0000              | 1.993           | 0.1340           | 1.993           |
| 5          | .            | 0.2000            | 0.4300         | 0.0000              | 0.0000              | 2.787           | 0.2510           | 2.787           |
| 6          | .            | 0.2000            | 0.6300         | 0.0000              | 0.0000              | 3.781           | 0.3550           | 3.781           |
| 7          | .            | 0.2000            | 0.8000         | 0.0000              | 0.0000              | 4.817           | 0.4170           | 4.817           |
| 8          | .            | 0.2000            | 0.9000         | 0.0000              | 0.0000              | 5.913           | 0.5340           | 5.913           |
| 9          | .            | 0.2000            | 0.9600         | 0.0000              | 0.0000              | 6.920           | 0.5220           | 6.920           |
| 10         | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 7.556           | 0.4810           | 7.556           |
| 11         | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 8.694           | 0.4630           | 8.694           |
| 12         | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 9.244           | 0.4070           | 9.244           |
| 13         | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 9.964           | 0.3800           | 9.964           |
| 14+        | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 11.655          | 0.4330           | 11.655          |
| Unit       | Millions     | -                 | -              | -                   | -                   | Kilograms       | -                | Kilograms       |

Notes: Run name : MANSTJ01  
Date and time: 04MAY98:12:36

**Table 3.2.14. Saithe in Division Va. Prediction with management option table.**

Saithe in the Iceland Grounds (Fishing Area Va) The SAS System 12:23 Monday, May 4, 1998  
Prediction with management option table

| Year: 1998 |             |               |                  |                 | Year: 1999 |             |               |                  |                 | Year: 2000    |                  |
|------------|-------------|---------------|------------------|-----------------|------------|-------------|---------------|------------------|-----------------|---------------|------------------|
| F Factor   | Reference F | Stock biomass | Sp.stock biomass | Catch in weight | F Factor   | Reference F | Stock biomass | Sp.stock biomass | Catch in weight | Stock biomass | Sp.stock biomass |
| 0.7647     | 0.2820      | 189294        | 90713            | 30000           | 0.0000     | 0.0000      | 206752        | 103981           | 0               | 257156        | 143955           |
| .          | .           | .             | .                | .               | 0.1000     | 0.0369      | .             | 103981           | 5020            | 251457        | 139560           |
| .          | .           | .             | .                | .               | 0.2000     | 0.0738      | .             | 103981           | 9870            | 245952        | 135328           |
| .          | .           | .             | .                | .               | 0.3000     | 0.1107      | .             | 103981           | 14555           | 240634        | 131254           |
| .          | .           | .             | .                | .               | 0.4000     | 0.1475      | .             | 103981           | 19082           | 235496        | 127330           |
| .          | .           | .             | .                | .               | 0.5000     | 0.1844      | .             | 103981           | 23458           | 230531        | 123551           |
| .          | .           | .             | .                | .               | 0.6000     | 0.2213      | .             | 103981           | 27688           | 225732        | 119911           |
| .          | .           | .             | .                | .               | 0.7000     | 0.2582      | .             | 103981           | 31778           | 221093        | 116404           |
| .          | .           | .             | .                | .               | 0.8000     | 0.2951      | .             | 103981           | 35733           | 216608        | 113025           |
| .          | .           | .             | .                | .               | 0.9000     | 0.3320      | .             | 103981           | 39558           | 212271        | 109769           |
| .          | .           | .             | .                | .               | 1.0000     | 0.3688      | .             | 103981           | 43259           | 208076        | 106631           |
| .          | .           | .             | .                | .               | 1.1000     | 0.4057      | .             | 103981           | 46839           | 204018        | 103606           |
| .          | .           | .             | .                | .               | 1.2000     | 0.4426      | .             | 103981           | 50304           | 200092        | 100690           |
| -          | -           | Tonnes        | Tonnes           | Tonnes          | -          | -           | Tonnes        | Tonnes           | Tonnes          | Tonnes        | Tonnes           |

Notes: Run name : MANSTJ01  
Date and time : 04MAY98:12:36  
Computation of ref. F: Simple mean, age 4 - 9  
Basis for 1998 : TAC constraints

**Table 3.2.15. Saithe in Division Va. Yield per recruit - Input data.**

May 4, 1998 The SAS System 12:23 Monday,  
Saithe in the Iceland Grounds (Fishing Area Va)

Yield per recruit: Input data

| Age  | Recruit-ment | Natural mortality | Maturity ogive | Prop.of F bef.spaw. | Prop.of M bef.spaw. | Weight in stock | Exploit. pattern | Weight in catch |
|------|--------------|-------------------|----------------|---------------------|---------------------|-----------------|------------------|-----------------|
| 3    | 1.000        | 0.2000            | 0.1078         | 0.0000              | 0.0000              | 1.436           | 0.0700           | 1.436           |
| 4    | .            | 0.2000            | 0.2144         | 0.0000              | 0.0000              | 2.025           | 0.2900           | 2.025           |
| 5    | .            | 0.2000            | 0.3772         | 0.0000              | 0.0000              | 2.734           | 0.5700           | 2.734           |
| 6    | .            | 0.2000            | 0.5789         | 0.0000              | 0.0000              | 3.668           | 0.9100           | 3.668           |
| 7    | .            | 0.2000            | 0.7550         | 0.0000              | 0.0000              | 4.711           | 1.1500           | 4.711           |
| 8    | .            | 0.2000            | 0.8739         | 0.0000              | 0.0000              | 5.818           | 1.5300           | 5.818           |
| 9    | .            | 0.2000            | 0.9411         | 0.0000              | 0.0000              | 6.949           | 1.5300           | 6.949           |
| 10   | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 7.830           | 1.5300           | 7.830           |
| 11   | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 8.795           | 1.5300           | 8.795           |
| 12   | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 9.537           | 1.5300           | 9.537           |
| 13   | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 10.676          | 1.5300           | 10.676          |
| 14   | .            | 0.2000            | 1.0000         | 0.0000              | 0.0000              | 12.219          | 1.5300           | 12.219          |
| Unit | Numbers      | -                 | -              | -                   | -                   | Kilograms       | -                | Kilograms       |

Notes: Run name : YIELD3  
Date and time: 04MAY98:12:30

Table 3.2.16. Saithe in Division Va. Yield per recruit - Summary table.

Saithe in the Iceland Grounds (Fishing Area Va)

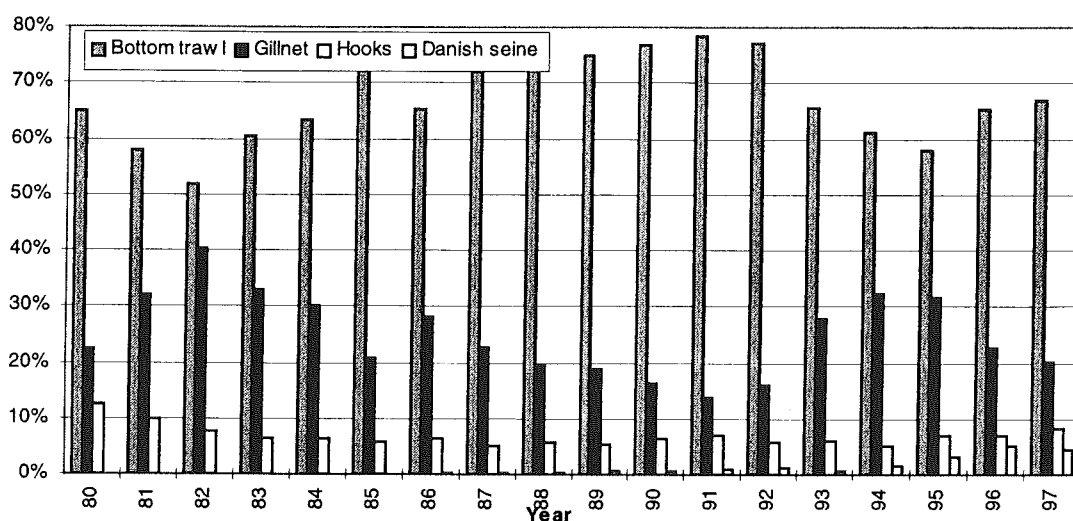
The SAS System

12:23 Monday, May 4, 1998

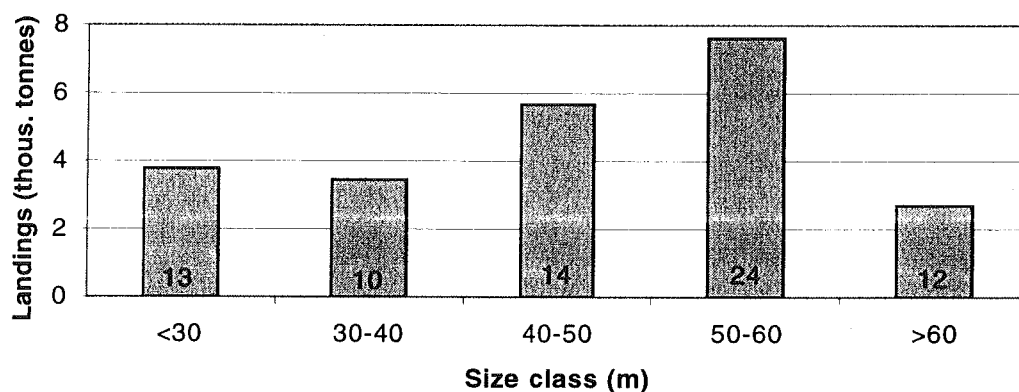
Yield per recruit: Summary table

| F Factor | Reference F | Catch in numbers | Catch in weight | Stock size | Stock biomass | 1 January     |                  | Spawning time |                  |
|----------|-------------|------------------|-----------------|------------|---------------|---------------|------------------|---------------|------------------|
|          |             |                  |                 |            |               | Sp.stock size | Sp.stock biomass | Sp.stock size | Sp.stock biomass |
| 0.0000   | 0.0000      | 0.000            | 0.000           | 5.016      | 21371.527     | 2.658         | 15886.899        | 2.658         | 15886.899        |
| 0.0200   | 0.0199      | 0.067            | 396.196         | 4.803      | 19635.480     | 2.461         | 14221.542        | 2.461         | 14221.542        |
| 0.0400   | 0.0399      | 0.123            | 704.184         | 4.615      | 18146.054     | 2.289         | 12799.951        | 2.289         | 12799.951        |
| 0.1200   | 0.1196      | 0.274            | 1390.000        | 4.057      | 13939.934     | 1.789         | 8839.693         | 1.789         | 8839.693         |
| 0.1400   | 0.1395      | 0.300            | 1478.768        | 3.952      | 13198.378     | 1.698         | 8153.921         | 1.698         | 8153.921         |
| 0.1600   | 0.1595      | 0.323            | 1548.082        | 3.857      | 12544.289     | 1.616         | 7553.586         | 1.616         | 7553.586         |
| 0.1800   | 0.1794      | 0.343            | 1602.176        | 3.771      | 11964.674     | 1.543         | 7025.802         | 1.543         | 7025.802         |
| 0.2000   | 0.1993      | 0.361            | 1644.337        | 3.692      | 11448.701     | 1.477         | 6559.840         | 1.477         | 6559.840         |
| 0.2200   | 0.2193      | 0.377            | 1677.121        | 3.621      | 10987.316     | 1.417         | 6146.740         | 1.417         | 6146.740         |
| 0.2400   | 0.2392      | 0.391            | 1702.519        | 3.555      | 10572.929     | 1.363         | 5778.999         | 1.363         | 5778.999         |
| 0.2600   | 0.2591      | 0.405            | 1722.087        | 3.494      | 10199.156     | 1.313         | 5450.319         | 1.313         | 5450.319         |
| 0.2800   | 0.2791      | 0.417            | 1737.041        | 3.437      | 9860.617      | 1.268         | 5155.395         | 1.268         | 5155.395         |
| 0.3000   | 0.2990      | 0.428            | 1748.336        | 3.385      | 9552.760      | 1.227         | 4889.749         | 1.227         | 4889.749         |
| 0.3200   | 0.3189      | 0.438            | 1756.721        | 3.336      | 9271.721      | 1.188         | 4649.585         | 1.188         | 4649.585         |
| 0.3400   | 0.3389      | 0.448            | 1762.786        | 3.291      | 9014.213      | 1.153         | 4431.683         | 1.153         | 4431.683         |
| 0.3600   | 0.3588      | 0.457            | 1767.000        | 3.248      | 8777.431      | 1.120         | 4233.295         | 1.120         | 4233.295         |
| 0.3800   | 0.3787      | 0.465            | 1769.732        | 3.207      | 8558.968      | 1.090         | 4052.073         | 1.090         | 4052.073         |
| 0.4000   | 0.3987      | 0.473            | 1771.277        | 3.170      | 8356.760      | 1.061         | 3886.005         | 1.061         | 3886.005         |
| 0.4200   | 0.4186      | 0.481            | 1771.869        | 3.134      | 8169.024      | 1.035         | 3733.360         | 1.035         | 3733.360         |
| 0.4400   | 0.4385      | 0.488            | 1771.696        | 3.100      | 7994.219      | 1.010         | 3592.644         | 1.010         | 3592.644         |
| 0.4600   | 0.4585      | 0.494            | 1770.908        | 3.067      | 7831.007      | 0.987         | 3462.564         | 0.987         | 3462.564         |
| 0.4800   | 0.4784      | 0.501            | 1769.626        | 3.037      | 7678.225      | 0.965         | 3341.998         | 0.965         | 3341.998         |
| 0.5000   | 0.4983      | 0.507            | 1767.949        | 3.007      | 7534.854      | 0.944         | 3229.968         | 0.944         | 3229.968         |
| 0.5200   | 0.5183      | 0.512            | 1765.955        | 2.979      | 7400.004      | 0.925         | 3125.621         | 0.925         | 3125.621         |
| 0.5400   | 0.5382      | 0.518            | 1763.708        | 2.953      | 7272.890      | 0.906         | 3028.209         | 0.906         | 3028.209         |
| 0.5600   | 0.5581      | 0.523            | 1761.262        | 2.927      | 7152.821      | 0.889         | 2937.073         | 0.889         | 2937.073         |
| 0.5800   | 0.5781      | 0.528            | 1758.658        | 2.903      | 7039.187      | 0.872         | 2851.635         | 0.872         | 2851.635         |
| 0.6000   | 0.5980      | 0.533            | 1755.933        | 2.879      | 6931.445      | 0.856         | 2771.381         | 0.856         | 2771.381         |
| 0.6200   | 0.6179      | 0.538            | 1753.114        | 2.856      | 6829.111      | 0.841         | 2695.858         | 0.841         | 2695.858         |
| 0.6400   | 0.6379      | 0.542            | 1750.226        | 2.835      | 6731.756      | 0.827         | 2624.662         | 0.827         | 2624.662         |
| 0.6600   | 0.6578      | 0.546            | 1747.289        | 2.814      | 6638.994      | 0.813         | 2557.433         | 0.813         | 2557.433         |
| 0.6800   | 0.6777      | 0.551            | 1744.318        | 2.793      | 6550.478      | 0.800         | 2493.850         | 0.800         | 2493.850         |
| 0.7000   | 0.6977      | 0.555            | 1741.327        | 2.774      | 6465.898      | 0.787         | 2433.623         | 0.787         | 2433.623         |
| 0.7200   | 0.7176      | 0.559            | 1738.326        | 2.755      | 6384.972      | 0.775         | 2376.494         | 0.775         | 2376.494         |
| 0.7400   | 0.7375      | 0.562            | 1735.326        | 2.737      | 6307.447      | 0.764         | 2322.229         | 0.764         | 2322.229         |
| 0.7600   | 0.7575      | 0.566            | 1732.333        | 2.719      | 6233.093      | 0.753         | 2270.618         | 0.753         | 2270.618         |
| 0.7800   | 0.7774      | 0.570            | 1729.354        | 2.702      | 6161.699      | 0.742         | 2221.471         | 0.742         | 2221.471         |
| 0.8000   | 0.7973      | 0.573            | 1726.394        | 2.685      | 6093.075      | 0.732         | 2174.614         | 0.732         | 2174.614         |
| 0.8200   | 0.8173      | 0.576            | 1723.457        | 2.669      | 6027.048      | 0.722         | 2129.891         | 0.722         | 2129.891         |
| 0.8400   | 0.8372      | 0.580            | 1720.547        | 2.653      | 5963.457      | 0.712         | 2087.158         | 0.712         | 2087.158         |
| 0.8600   | 0.8571      | 0.583            | 1717.666        | 2.638      | 5902.158      | 0.703         | 2046.285         | 0.703         | 2046.285         |
| 0.8800   | 0.8771      | 0.586            | 1714.817        | 2.623      | 5843.015      | 0.694         | 2007.153         | 0.694         | 2007.153         |
| 0.9000   | 0.8970      | 0.589            | 1712.001        | 2.608      | 5785.906      | 0.686         | 1969.652         | 0.686         | 1969.652         |
| 0.9200   | 0.9169      | 0.592            | 1709.220        | 2.594      | 5730.717      | 0.678         | 1933.681         | 0.678         | 1933.681         |
| 0.9400   | 0.9369      | 0.595            | 1706.475        | 2.581      | 5677.343      | 0.670         | 1899.150         | 0.670         | 1899.150         |
| 0.9600   | 0.9568      | 0.597            | 1703.767        | 2.567      | 5625.686      | 0.662         | 1865.972         | 0.662         | 1865.972         |
| 0.9800   | 0.9767      | 0.600            | 1701.096        | 2.554      | 5575.657      | 0.654         | 1834.069         | 0.654         | 1834.069         |
| 1.0000   | 0.9967      | 0.603            | 1698.462        | 2.541      | 5527.172      | 0.647         | 1803.369         | 0.647         | 1803.369         |
| 1.0200   | 1.0166      | 0.605            | 1695.867        | 2.529      | 5480.153      | 0.640         | 1773.804         | 0.640         | 1773.804         |
| 1.0400   | 1.0365      | 0.608            | 1693.309        | 2.517      | 5434.528      | 0.633         | 1745.314         | 0.633         | 1745.314         |
| 1.0600   | 1.0565      | 0.610            | 1690.789        | 2.505      | 5390.229      | 0.627         | 1717.839         | 0.627         | 1717.839         |
| 1.0800   | 1.0764      | 0.613            | 1688.307        | 2.493      | 5347.193      | 0.620         | 1691.326         | 0.620         | 1691.326         |
| 1.1200   | 1.1163      | 0.617            | 1683.453        | 2.471      | 5264.681      | 0.608         | 1640.993         | 0.608         | 1640.993         |
| 1.1400   | 1.1362      | 0.620            | 1681.082        | 2.460      | 5225.097      | 0.602         | 1617.081         | 0.602         | 1617.081         |
| 1.1600   | 1.1561      | 0.622            | 1678.747        | 2.449      | 5186.563      | 0.596         | 1593.952         | 0.596         | 1593.952         |
| 1.1800   | 1.1761      | 0.624            | 1676.447        | 2.439      | 5149.033      | 0.591         | 1571.568         | 0.591         | 1571.568         |
| 1.2200   | 1.2159      | 0.628            | 1671.953        | 2.419      | 5076.815      | 0.580         | 1528.892         | 0.580         | 1528.892         |
| 1.2600   | 1.2558      | 0.632            | 1667.596        | 2.399      | 5008.131      | 0.570         | 1488.795         | 0.570         | 1488.795         |
| 1.2800   | 1.2757      | 0.634            | 1665.467        | 2.390      | 4975.025      | 0.565         | 1469.642         | 0.565         | 1469.642         |
| 1.3000   | 1.2957      | 0.636            | 1663.370        | 2.381      | 4942.701      | 0.560         | 1451.050         | 0.560         | 1451.050         |
| 1.3200   | 1.3156      | 0.638            | 1661.306        | 2.372      | 4911.128      | 0.555         | 1432.996         | 0.555         | 1432.996         |
| 1.3400   | 1.3355      | 0.640            | 1659.272        | 2.363      | 4880.277      | 0.551         | 1415.456         | 0.551         | 1415.456         |
| 1.3600   | 1.3555      | 0.642            | 1657.269        | 2.354      | 4850.121      | 0.546         | 1398.408         | 0.546         | 1398.408         |
| 1.4200   | 1.4153      | 0.647            | 1651.438        | 2.329      | 4763.575      | 0.533         | 1350.021         | 0.533         | 1350.021         |
| 1.4400   | 1.4352      | 0.649            | 1649.552        | 2.320      | 4735.956      | 0.529         | 1334.749         | 0.529         | 1334.749         |
| 1.4600   | 1.4551      | 0.650            | 1647.694        | 2.312      | 4708.916      | 0.525         | 1319.877         | 0.525         | 1319.877         |
| 1.4800   | 1.4751      | 0.652            | 1645.863        | 2.304      | 4682.435      | 0.521         | 1305.390         | 0.521         | 1305.390         |
| 1.5000   | 1.4950      | 0.654            | 1644.058        | 2.297      | 4656.494      | 0.517         | 1291.274         | 0.517         | 1291.274         |
| -        | -           | Numbers          | Grams           | Numbers    | Grams         | Numbers       | Grams            | Numbers       | Grams            |

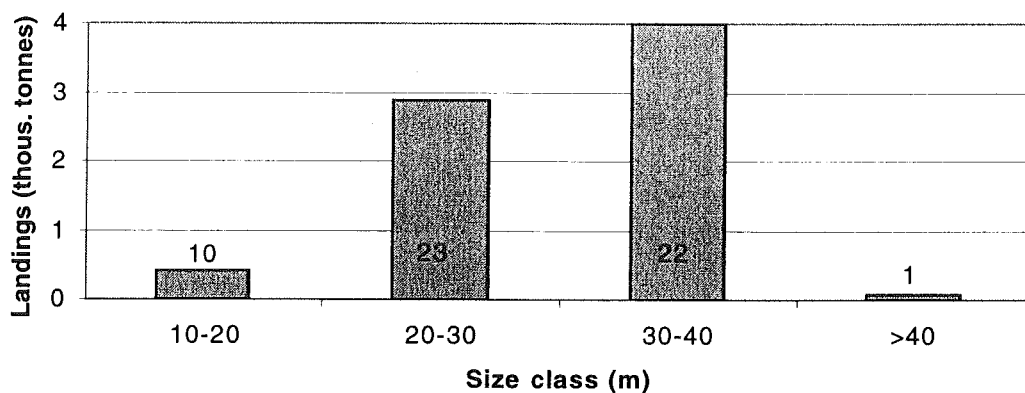
Notes: Run name : YIELD3  
Date and time : 04MAY98:12:30  
Computation of ref. F: Simple mean, age 4 - 9  
F-0.1 factor : 0.1849  
F-max factor : 0.4249  
F-0.1 reference F : 0.1843  
F-max reference F : 0.4235  
Recruitment : Single recruit



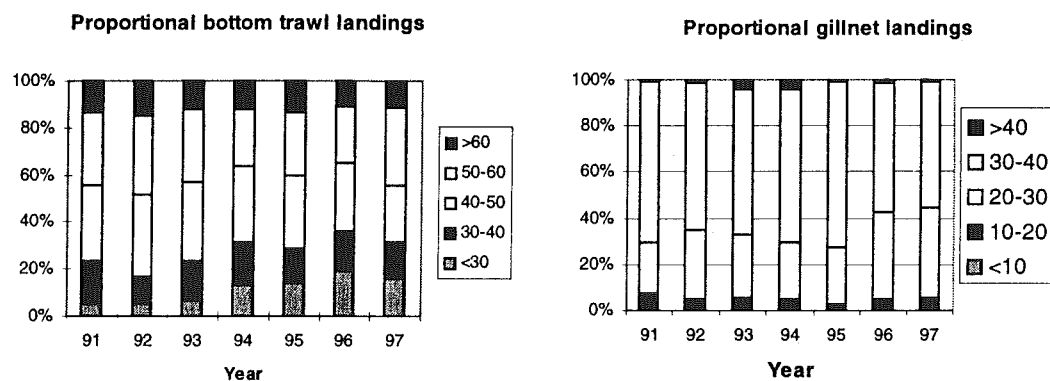
**Figure 3.2.1.** Saithe in Division Va. Proportional catches in different gears 1980-1997



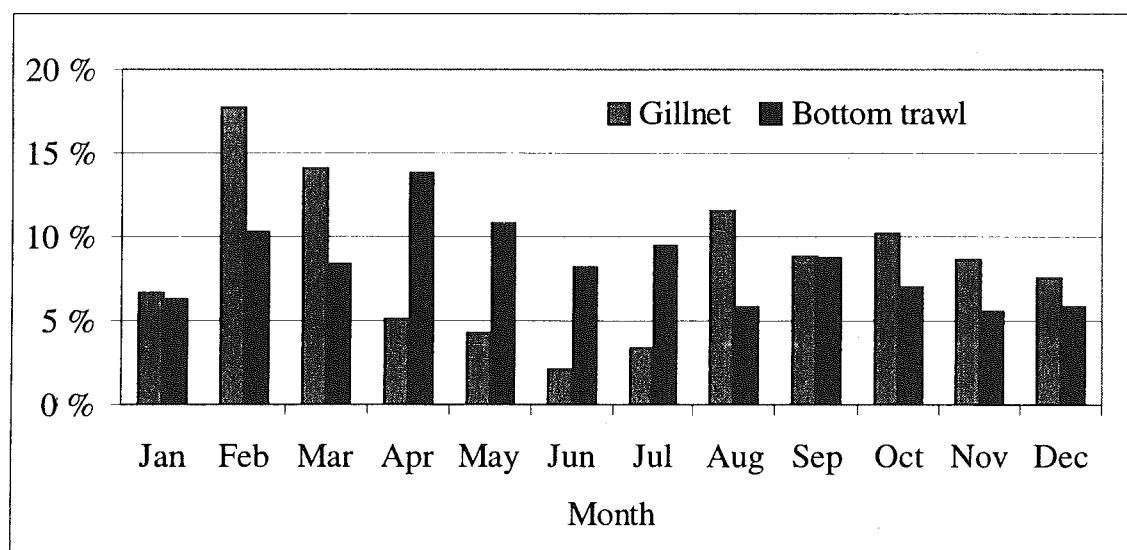
**Figure 3.2.2.** Bottom trawl landings of saithe in Division Va categorised by size classes of vessels and the number of vessels in each size class (only vessels with more than 50 t annual landings).



**Figure 3.2.3.** Gillnet landings of saithe in Division Va categorised by size classes of vessels and number of vessels in each size class (only vessels with more than 10 t annual landings).

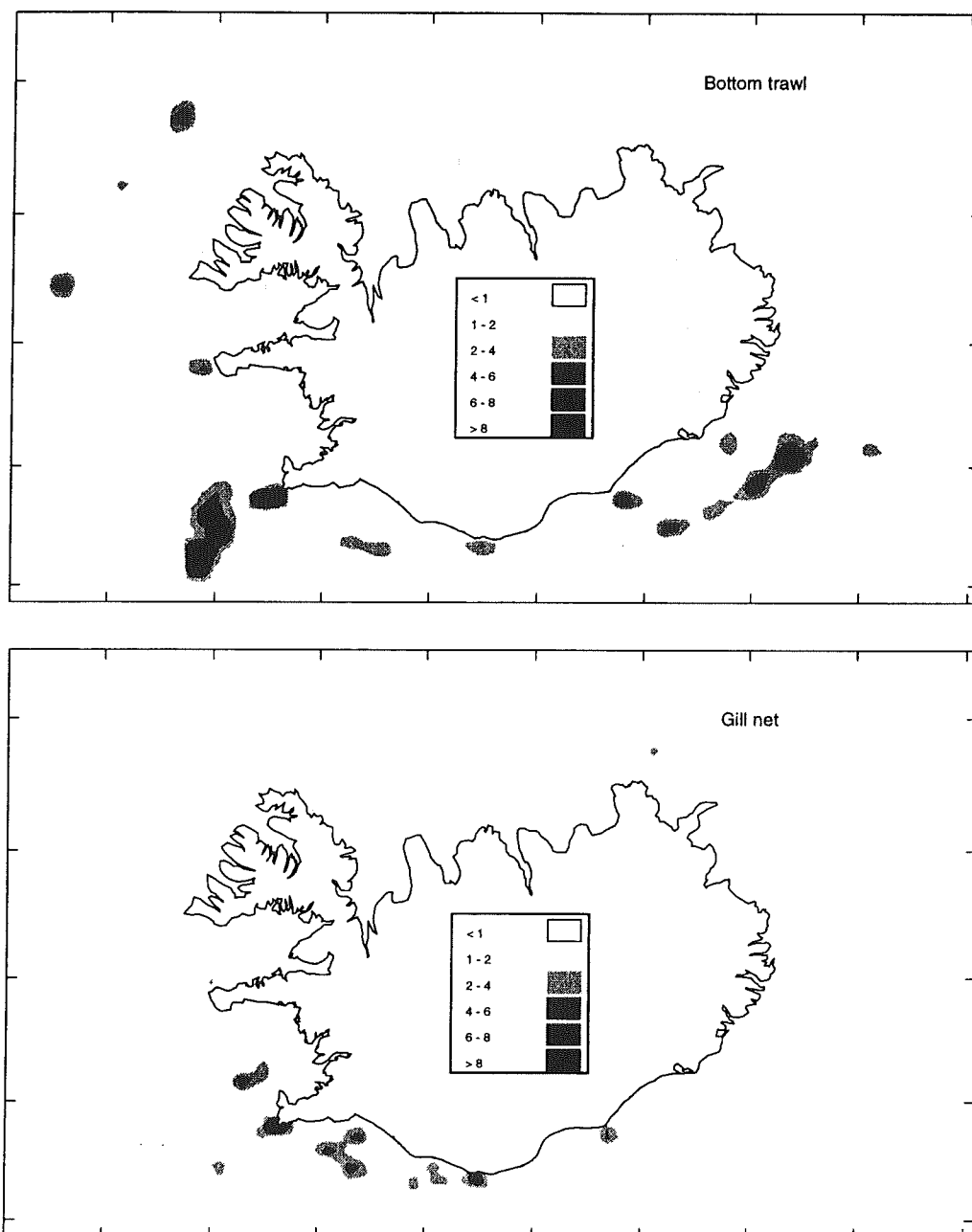


**Figure 3.2.4.** Saithe landings in Division Va categorised by vessel size classes for 1991-1997.

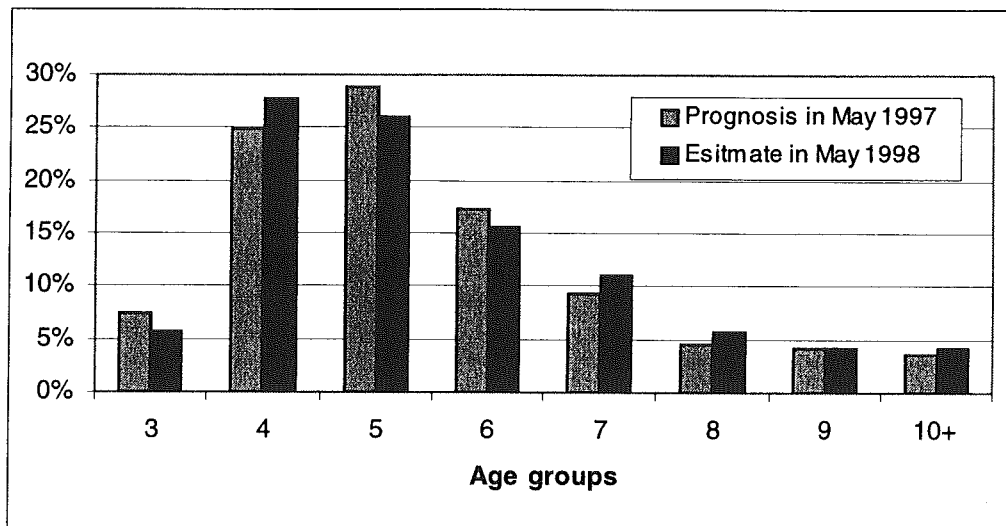


**Figure 3.2.5.** Proportional landings of saithe in Division Va by gear and months in 1997.

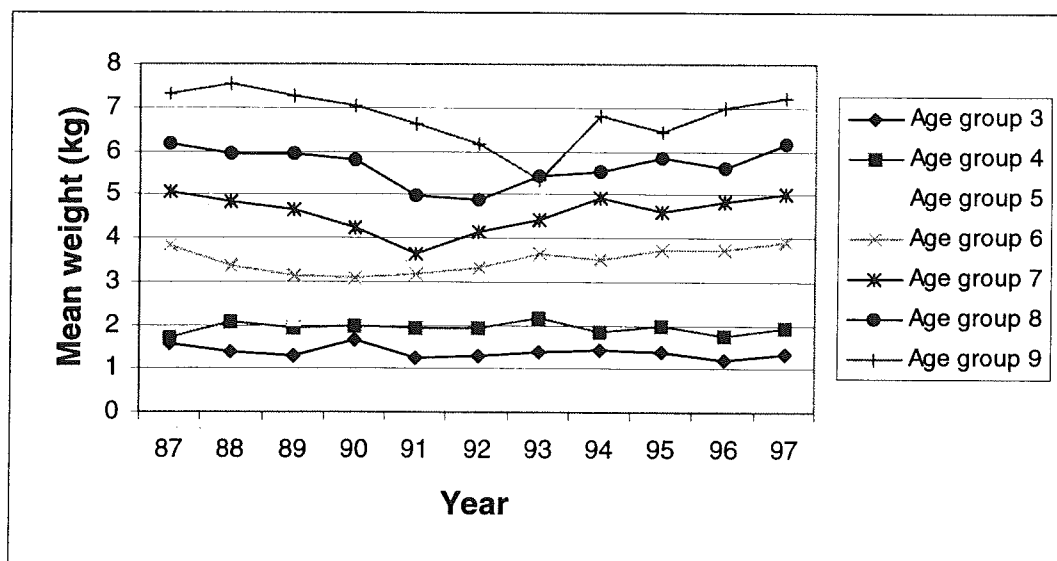
Saithe catches in Icelandic waters in 1997 by main gear types (tonnes/square nm)



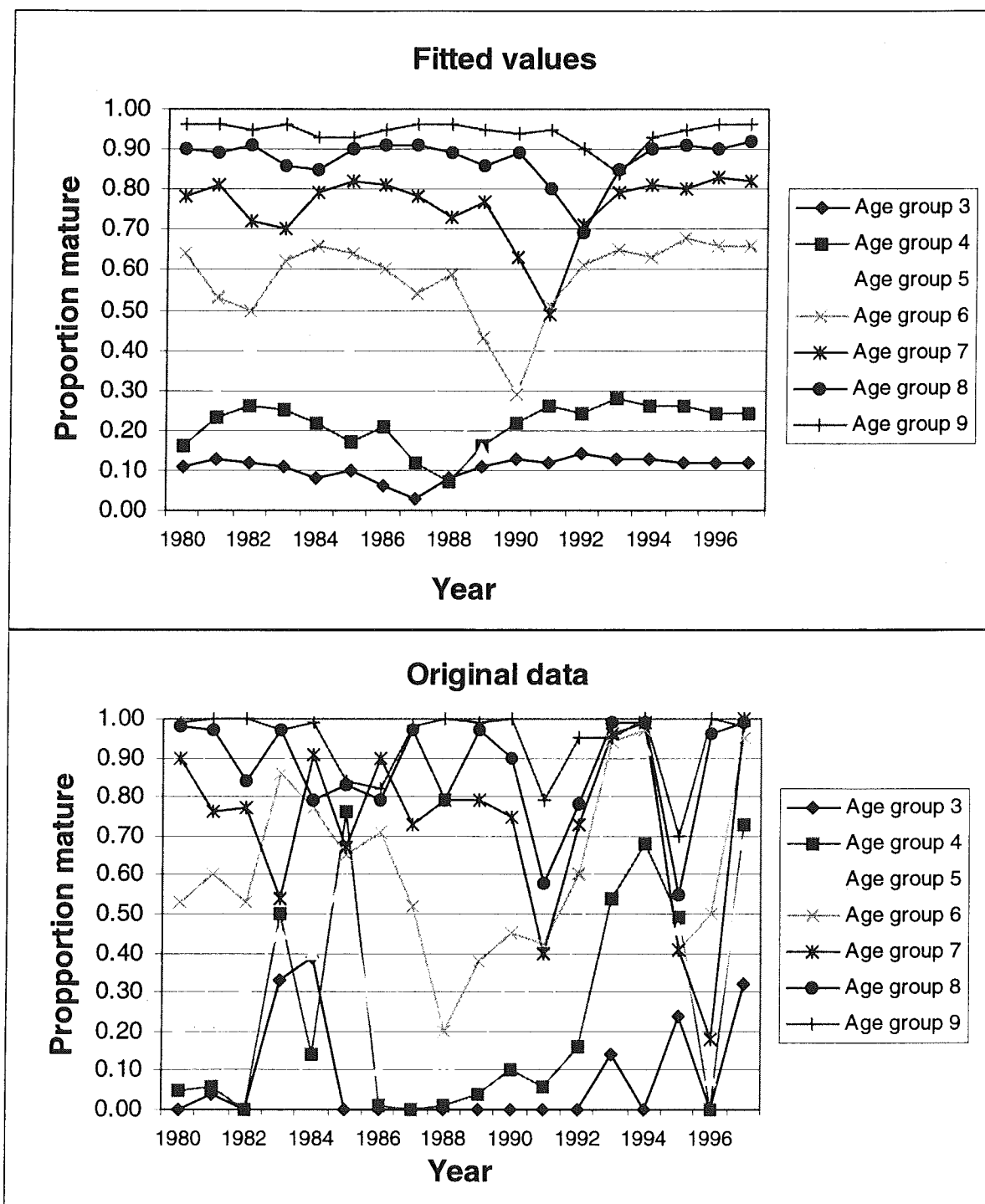
**Figure 3.2.6.** Icelandic saithe catches in Division Va in 1997 (tonnes/square nm).



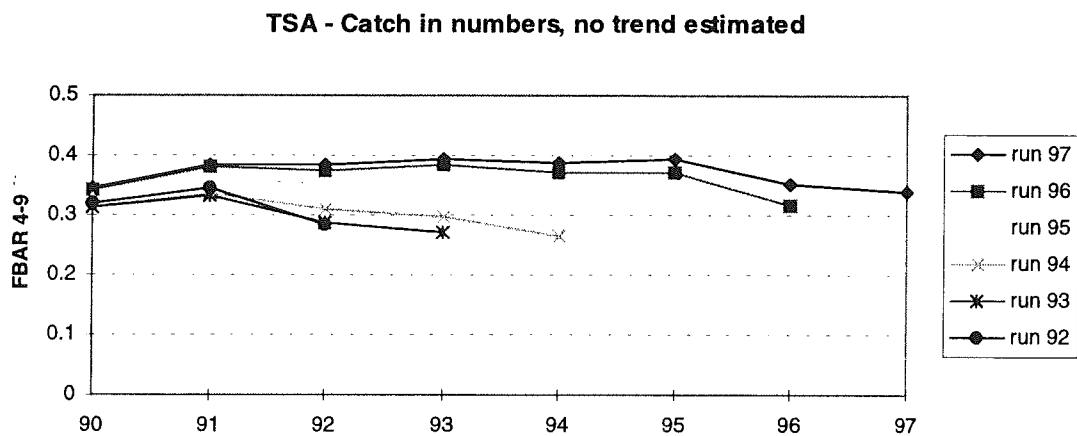
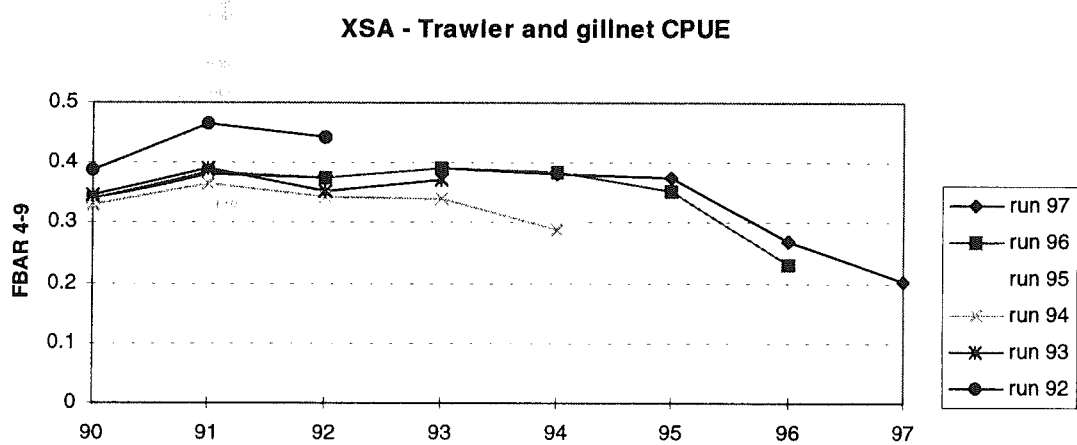
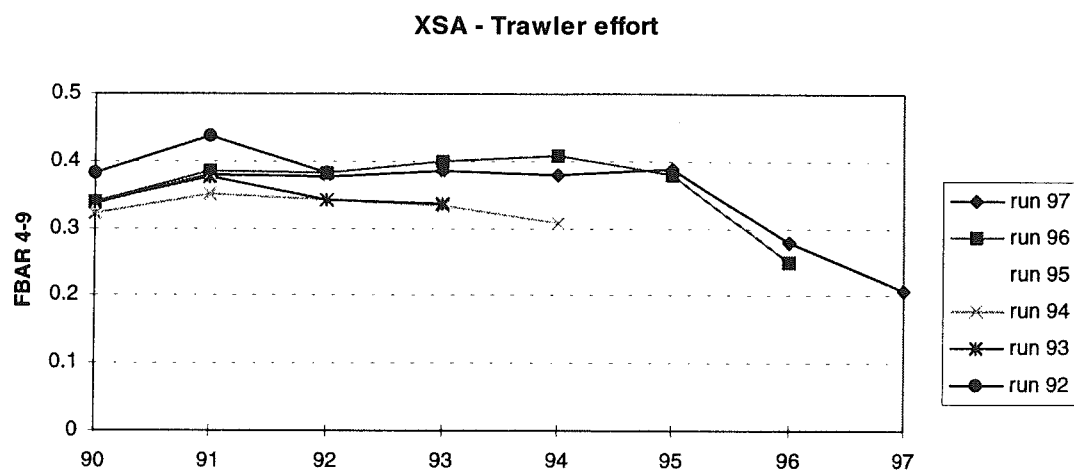
**Figure 3.2.7.** Saithe in Division Va. Prognosis in May 1997 and estimate in April 1998 for percent (by number) age distribution in the 1997 landings.



**Figure 3.2.8.** Saithe in Division Va. Mean weight at age in the catches 1987-1997.



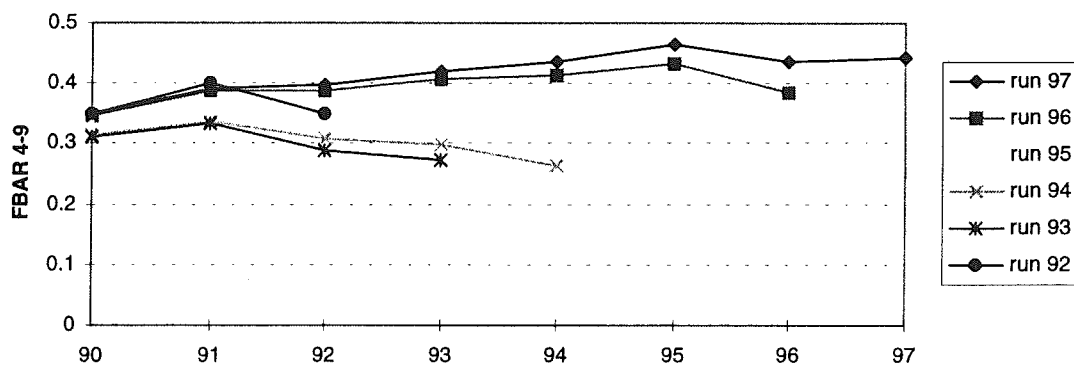
**Figure 3.2.9.** Saithe in Division Va. Maturity at age, data and fitted values 1980-1997



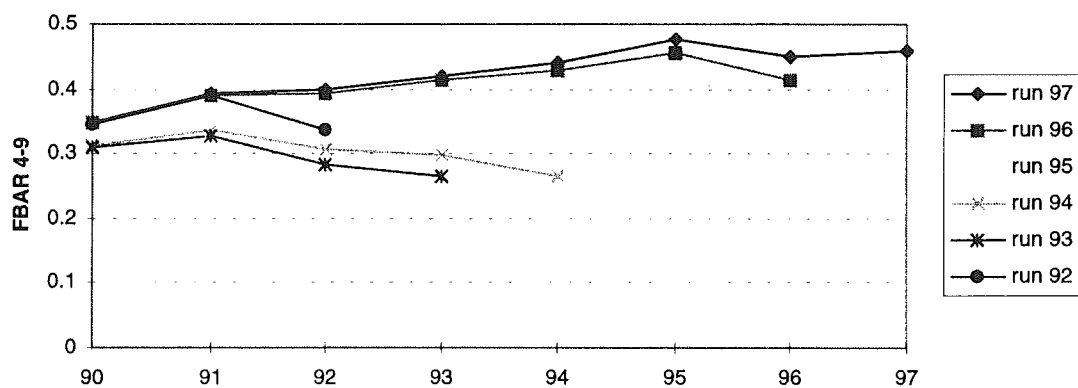
**Figure 3.2.10** Saithe in Division Va. Retrospective analysis of XSA and TSA results.

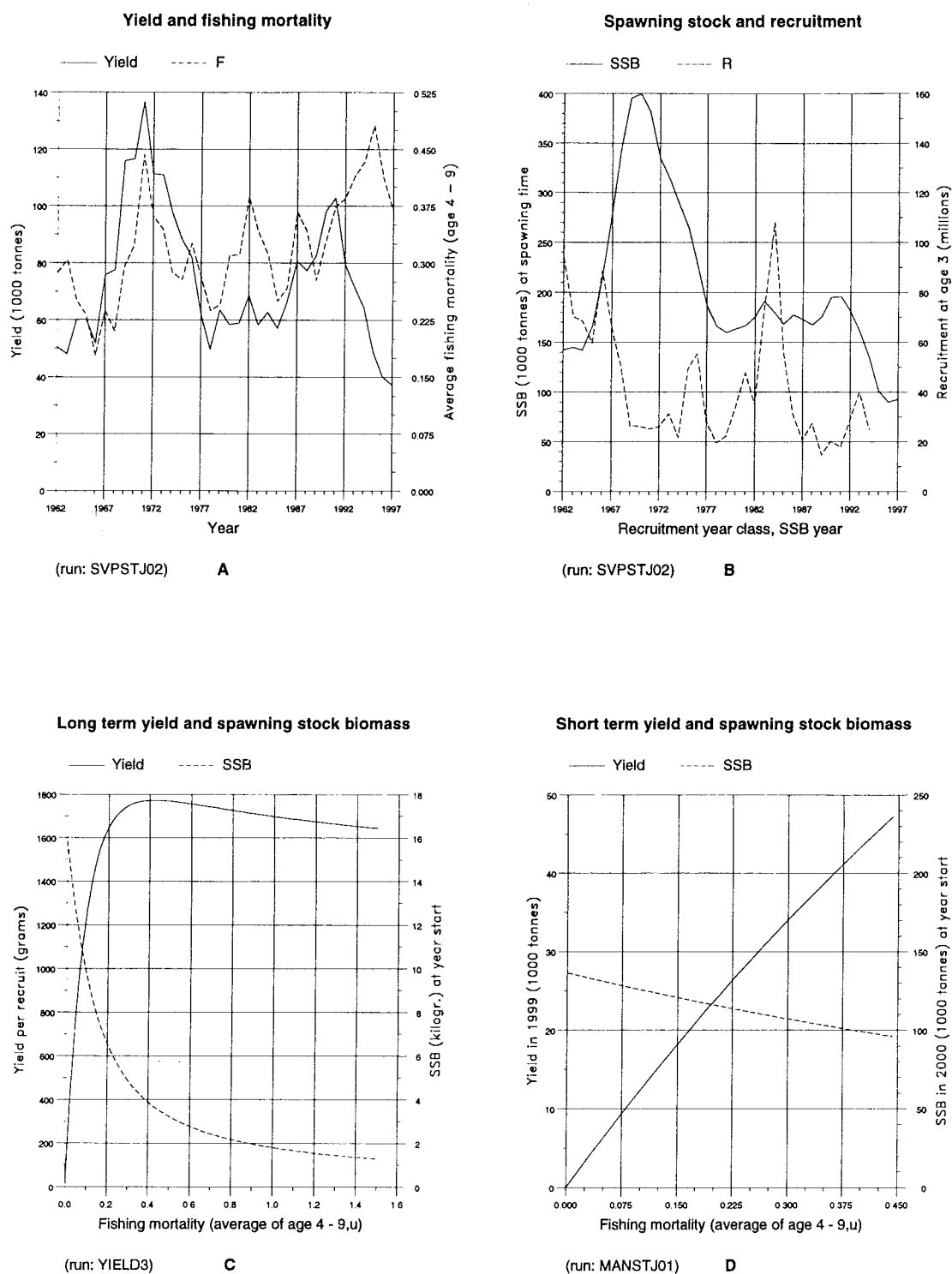
Figure 3.2.10 (Cont'd)

TSA - Catch in numbers, trend estimated

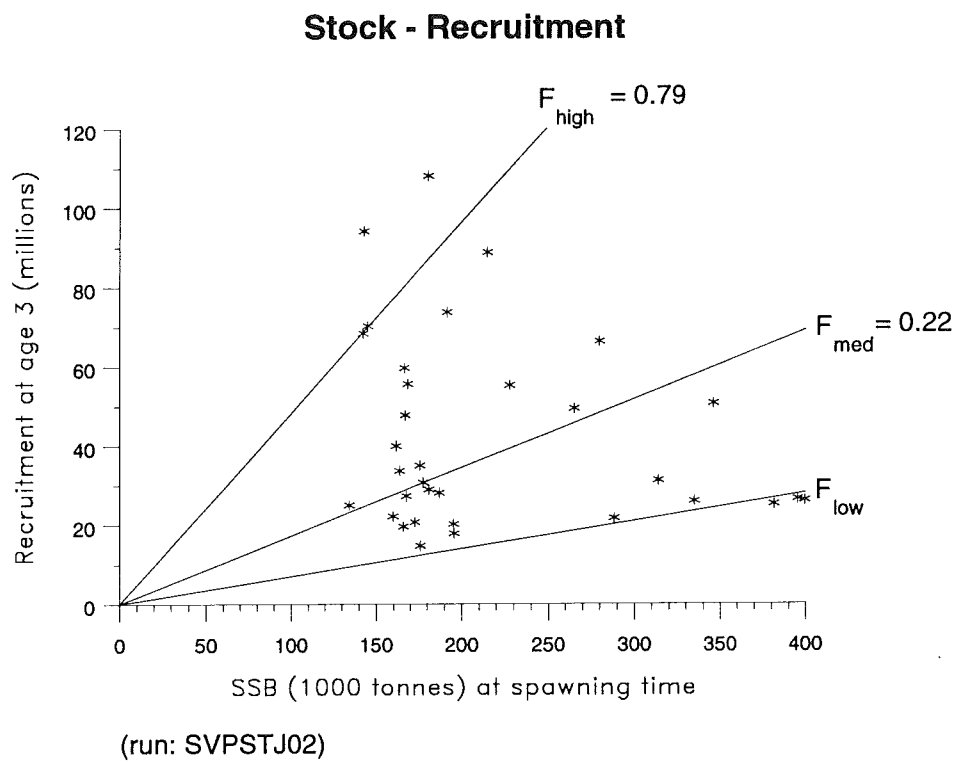


TSA - Catch in numbers and trawler CPUE (Jun-Dec), trend estimated





**Figure 3.2.11. Saithe in Division Va. Fish stock summary**



**Figure 3.2.12.** Saithe in Division Va. Stock and recruitment.



