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2 INTRODUCTION

2.1 Terms of Reference

In the 82nd statutory meeting of ICES in 1994 it was decided (C.Res.1994/2.6.1) that:

The Arctic Fisheries Working Group (Chairman: Mr Knut Sunnanå, Norway) will meet at ICES Headquarters from 23-31 August 1995 to:

a) assess the status of and provide catch options for 1996 for the stocks of cod, haddock, saithe, redfish and Greenland halibut in Sub-areas I and II taking into account interactions with other species;

b) for those stocks and/or fisheries where data permit, provide the information required to give advice or guidance on

   i) medium-term management objectives (in terms of spawning stock biomass and mortality rates) and options,

   ii) the appropriateness of controls on catch (or landings) and fishing effort,

   iii) the potential for multispecies and multi-annual catch options.

The above terms of reference are set up to provide ACFM with the information required to respond to the request for advice from the North-East Atlantic Fisheries Commission and the European Commission.

To answer the terms of reference as they are set up, some changes to the report have been necessary. The Working Group have discussed some changes in the sections and some standardisation so that all the species follow the same layout. Also a section on Principles of Management has been provided. This include the answers to Section b) part i) of the terms of reference. Section b) part ii) of the terms of reference is treated in the sections on the status of the fisheries, especially on the expected catch in 1995. For some of the stocks Section b) part iii) is answered in the Section 9: Stock summary.

2.2 Comments by ACFM

At the November 1994 meeting, ACFM has provided some comments on the work of the Arctic Fisheries Working Group. We appreciate the positive comments on our effort to improve the assessments. It will always be the first aim of this Working Group to improve our assessments at any opportunity.

Concerning the use of two VPA, both tuning and traditional, the Working Group this year decided to use only the tuning VPA and to edit the summary table to reflect the desired age span of the stock. For North-East Arctic cod, the procedure is somewhat different, due to the inclusion of cannibalism into the tuning.

The Working Group has also put effort into including tuning data for the oldest age groups. This is necessary in order to maintain the robustness of the VPA calculation by setting the oldest true age to an age where errors do not influence the results to any great extent. The Working Group also notes that a change has been made in the XSA-tuning program to overcome the earlier error that allowed settings that did not include fixing the catchabilities of the older ages in the tuning data. This is probably the main reason for the instability problem this Working Group has experienced in using the XSA-method in earlier years.

Some comments are needed about the work done to calculate weights at age. The sensitivity analysis carried out to investigate the importance of the settings of the weights are obviously interpreted in a wrong way. It is quite clear that the settings of the weights are very important to the TAC and thus to the assessment. When the F turns out to be more sensitive than any of the weights it is because the F value represent all ages, but each weight only represent one age group. The sum of the sensitivities of all the weights is equal to the sensitivity of F and clearly show the importance of setting correct weights.

This years report will also show that the predicted weights are consistent with the observed and the method is well documented in separate papers. The Working Group takes pride in having achieved the ability to predict the weights with precision.

With respect to documentation of the assumed catches in the present year, the Working Group this year has presented documentation to explain why we have confidence in the estimates. This relates to the terms of reference Section b) part ii) about the appropriateness of controls on catch and fishing effort. The countries regulating fishing in areas I and II have improved the control on landings and also on monitoring the fishing fleet at sea. This also includes monitoring the fleet in international waters and rather reliable estimates of catch are available from these areas. The Working Group has doubts as to adding any unreported and unobserved catches to the expected, but concern have been given not to underestimate the expected catches in the present year. It is the opinion of the Working Group that some catches are still kept outside the reporting system based on anecdotal information. The Working Group have evaluated the expected catches under *status quo* F to ensure that the expected catches do not imply a substantial reduction, or increase, in effort, which would be unexpected as the quotas are rather constant.

Special attention this year have been given to the Greenland halibut and *S. mentella* assessments. Comments to the ACFM minutes are given under each species.

2.3 Comments by the Multispecies Assessment Working Group

In its report the MSAWG gives a description of the problems we addressed last year in Section 9 on Ecological Considerations. This section is left out this year and some general considerations are given in this Section.

The MSAWG also gives advice on how to handle the mentioned problems. These specific advice are discussed in the relevant sections. However, in general the MSAWG is not able to give very specific advice and is for the most referring to earlier reports of the MSAWG. One member of the Working Group is also a member of this Working Group and have provided some data and information on both growth and cannibalism of cod that is included in the present report.

Concerning growth of cod, we used the same method this year as last year, but with some improvements on the documentation. This is in line with the advice of the MSAWG.

Concerning the cannibalism of cod, data were presented to the working group enabling us to estimate mortalities on the recruiting year classes back to 1984. Nevertheless, the stock is presented as a 3+ stock, thus avoiding problems with the yield per recruit calculations.

We ask the MSAWG to advice us on the choice of the basic natural mortality to use in the stock assessments. It is our hope that information of this kind will arise from the work of the MSAWG. Multispecies models should be the best way of exploring different scenarios of natural mortality with the aim of finding mortalities that explain observed stock interactions and dynamics.

We would also like to be advised as how our assessment of the cod stock fits in with the results from the work of the MSAWG and how to improve the assessments on all the stocks. The work that we have done this year might very well give indications to other working groups as to how they may make their own assessments to be used in calculations of predation by species treated in this Working Group. The age groups 3-7 in the cod stock is responsible for most of the predation on capelin. It is therefore important to have absolute estimates of the numbers of these ages. Cod is also predating on the Atlanto Scandian herring and absolute stock estimates is also needed to calculate predation on herring.

2.4 Environmental Aspects

At this meeting some information was presented about the influence of oceanographic condition on the development of stocks in this area (Tretyak *et al.*, 1995). There is also available some information on the expected development of the temperature in the region. Although not entirely consistent, the Working Group has based its predictions on an assumption that the temperature will stay close to the long term average in the near future, however with an indication of some decrease.

Due to the high abundance of predatory fish in the area, it is expected that the growth will be somewhat influenced and be below average in the near future.

3 NORTH-EAST ARCTIC COD (SUB-AREAS I AND II)

3.1 Status of the Fisheries

3.1.1 Landings prior to 1995 (Tables 3.1-3.3 and 9.1, Figure 3.1A)

The final reported landings of 1993 amounts to 581,611 t (Table 3.1), excluding 43,625 t of Norwegian coastal cod (Table 9.1). The provisional figures for 1994 are 750,293 t excluding 47,713 t of Norwegian coastal cod. This is close to the estimate of 745,000 t used by the Working Group last year. The agreed TAC on North-East Arctic cod was exceeded by 50,293 t, and the total quota including 40,000 t of Norwegian coastal cod was exceeded by 58,006 t. Catches in excess of the agreed TAC in 1994 are mainly catches by countries without a quota (Iceland and 'others'). The catch by 'other' countries was estimated to 23,326 t in 1994 based on data from Norwegian authorities. When added to the Icelandic catch this gives a total catch by countries with no quota of 60,043 t, of which 50,954 t was taken in the international waters (a part of Sub-area I) in the Barents Sea, and 9,089 t was taken in Division IIb. Landings reported to Norwegian authorities were used to determine the catches by some ICES countries for which

ICES had not received data on landings. Table 3.1 shows that the landings increased in all areas.

From a level of about 900,000 t in the mid-1970s, landings steadily declined to around 300,000 t in 1983-1985. Then the landings increased to above 500,000 t in 1987 before dropping to 212,000 t, the lowest level recorded in the post-war period, in 1990. The catches have increased rapidly from 1991 onwards, and the total catch in 1994 was the highest since 1977. The 1994 catch is also above the mean level for the period 1946-1994.

The fishery is conducted both with an international trawler fleet and with coastal vessels using traditional fishing gears. In 1978 quotas were introduced in the trawler fleets and in 1989 in the coastal fleets. In addition to quotas the fishery is regulated by a minimum landing size, a minimum mesh size in trawls and Danish seines, a maximum by-catch of undersized fish, closure of areas with high density of juveniles and by seasonal and areal restrictions.

The estimates of unreported landings in excess of the quota set in 1990-1993 made by the Working Group last year (Table 3.1) were not changed. The unreported landings in 1994 was estimated to 25,000 t, based on information from Working Group members. This figure is the same as was used in last year's report. This gives an estimated total catch in 1994 of 775,293 t, which is only 5,000 t more than the Working Group expected to be taken in last year's report.

The catch by area split into trawl and other gears is given in Table 3.2 and the nominal catch by country is given in Table 3.3.

3.1.2 Expected landings in 1995

The mixed Norwegian-Russian fisheries commission agreed on a TAC for North-East Arctic cod and Norwegian coastal cod combined for 1995 of 740,000 t. Of this, 40,000 t is assumed to be Norwegian coastal cod. According to the agreement between Norway and Russia, this total TAC should be divided equally between the two countries. For 1995, 88,000 t was allocated to third countries, and 12,000 t transferred from Russia to Norway, giving a Norwegian TAC of 338,000 t (coastal cod included) and a Russian TAC of 314,000 t. Of the Norwegian TAC, 226,460 t (67%) was allocated to the fishery with conventional gears and 111,540 t (33%) to the trawl fishery.

The catches by countries with no quota are expected to be of the same magnitude as in 1994 (60,000 t). The Working Group has no information on the size of expected unreported landings in 1995, but believe this problem will still exist. The Working Group assume that there will be no reported landings in excess of the TAC for countries with a quota. The total landings of North-East Arctic cod and Norwegian coastal cod combined in 1995 will thus be 800,000 t. Of this, 50,000 t are expected to be Norwegian coastal cod, giving a catch of North-East Arctic cod of 750,000 t.

The Working Group believes that the catch control and reporting of catches is sufficient to make these predictions based on the assumption of a catch constraint for the current year (1995). The Working Group bases this on information from the Norwegian and Russian authorities. A comprehensive program by the coast guards, including counting of vessels at sea, and also including checkpoints for catch control and reporting, has been initiated, and is fully operating.

3.2 Status of Research

3.2.1 Fishing effort and CPUE (Table 3.4)

In order to obtain CPUE indices for tuning of the older age groups in the VPA, CPUE series of the Norwegian and Russian trawl fisheries were updated and are given in Table 3.4. The figures show an increase in CPUE in all areas. The data reflect the total trawl effort, both for Norway and Russia.

3.2.2 Survey results - number at age and weight at age (Appendix I - Tables A1-A12, Figures 3.2-3.3)

The results from the Norwegian survey on demersal fish in the Barents Sea in winter 1995 are described by Korsbrekke *et al.* (1995). Tables A1 and A2 shows the time series of abundance estimates (acoustic and bottom trawl, respectively) from this survey. These time series have now been recalculated using a formula for length-dependent effective spread of the trawl. The methodology for the conversions is described by Aglen and Nakken (1994). This formula gives a higher number of age 1 and 2 fish and a smaller number of age 4 and older fish compared to the old time series. These and earlier revisions of the survey indices are part of a continuous work to remove bias and to improve the quality of these survey indices. This work is performed independently of the work of this Working Group.

The length at age and weight at age from this survey is given in Tables A5 and A6. For this survey it should be noted that the same age-length keys are used to calculate the age distribution for both the acoustic and the bottom trawl abundance estimate. It should also be noted that the survey in 1993 and later years covered a larger area than in previous years. In 1991 and 1992, the number of young cod (particularly 1-and 2-year old fish) was probably underestimated, as cod of these ages were distributed at the edge of the old survey area.

The abundance estimate from the Norwegian bottom trawl survey in the Svalbard area in the autumn is given in Table A3. These data have not been recalculated using the above-mentioned formula for length-dependent effective spread of the trawl.

The Norwegian trawler survey (Table A4), has been discontinued. However, Norway this year started a new survey in August, which will cover the entire cod stock.

The Russian survey on demersal fish in the Barents Sea in late autumn is described in Lepesevich *et al.* (1994), where the survey results for the years up to 1993 are given. The trawl/acoustic estimate from the November 1994-January 1995 survey is given in Table A7 and the bottom trawl abundance estimate in Table A8. The length at age and weight at age from this survey is given in Tables A9 and A10.

The abundance of 0-group cod as estimated in the International 0-group survey (Anon., 1995a), is given in Tables A11 and A12.

The Norwegian bottom trawl and acoustic surveys in winter 1995 both indicate that the abundance of 1-group (the 1994 year class) is the highest observed in the time series (1981-1995). The Russian surveys in autumn 1994 and the 0-group survey also indicate that this year class is stronger than average. All surveys indicate the 1991-1993 year classes to be average or above average, but weaker than the 1983 year class. The 1990 year class is strong according to all surveys, and the Norwegian Barents Sea survey indicate that this is strongest year class at age 5 in the time series. The 1988 and 1989 year classes are also average or above average according to all the surveys, and in the Norwegian Svalbard survey and the Russian surveys these year classes are the strongest in the time series at the given age.

After a period of large differences in the length and weight at age between the Norwegian and Russian survey data due to discrepancies in the age reading, there was a good correspondence between the data from the two countries from the autumn 1992/winter 1993 and autumn 1993/winter 1994 surveys. However, there is a large discrepancy between the length and weight at age data from the Russian survey in autumn 1994 and the Norwegian survey in winter 1995 for age groups 3-7 (age at January 1, 1995). According to the Norwegian data, the size at age of these age groups in 1995 is only marginally lower than in 1994, indicating that the growth increment during 1994 was larger than during 1993 for these age groups. However, according to the Russian data, the size at age for the same age groups has decreased, while the growth increment has decreased for some of the age groups 3-7 and increased for others. The low condition factor observed in 1987-1989 has not yet been observed. The growth increments for ages 3-7 from both the Norwegian and Russian surveys are plotted in Figures 3.2 and 3.3.

3.2.3 Data on the cod diet (Table A13)

The consumption by cod of various prey species is described in WD1. Such data can be used to assess the impact of predation by cod on the cod, haddock and redfish stocks, and also to study the relationship between food consumption and individual growth of cod.

The cod stomach content data are taken from the joint PINRO-IMR stomach content data base (Mehl and Yaragina 1992). The consumption is calculated mainly in the same way as in Bogstad and Mehl (1992), but the stomach evacuation rate model is revised.

The Barents Sea is divided into three areas (west, east and north), and the consumption by cod is calculated from the average stomach content of each prey group by area, half-year and cod age group (ages 1-6 separately and 7-9 as one group). The oldest age group used is 7-10 years in 1993 and 7-11 years in 1994, in order to include samples taken of the abundant 1983 year class. For 1993 and 1994, not all the collected data are currently available for analysis. Thus, the calculations for these years should be considered preliminary. For these years, it should be noted that due to the small number of samples available, the western and eastern areas are aggregated.

The number at age and weight at age of cod is taken from the 1994 Arctic Fisheries Working Group report (Anon., 1995c). The number of cod at ages 1 and 2 is found by back-calculating the abundance at age 3 using M=0.2. It is assumed that the mature part of the cod stock is found outside the Barents Sea for three months during the first half of the year. We have very few samples of the stomach content of cod in the spawning areas, and thus the consumption by cod in the spawning period is omitted from the calculations. It is believed that the cod generally eats very little during spawning time, but some predation by cod on herring has been observed close to the spawning areas. The geographical distribution of the cod stock by season is based on Norwegian survey data.

The consumption rate model is based on the work by dos Santos and Jobling (1995). A discussion of the problems related to the use of evacuation rate models when calculating the consumption from field samples can be found in the last report of the Multispecies Assessment Working group (Anon., 1995b).

Table A13 shows the consumption by cod of various prey species in 1984-1994. The cod's consumption of capelin is seen to decrease by about 50% from 1993 to 1994. However, the consumption in 1994 is high compared to the acoustic abundance estimate in the autumn 1993 and 1994 (796 and 199 thousand tonnes, respectively). The same phenomenon was also observed in 1986, when the capelin stock also was low. We also see that the annual consumption of shrimp by cod more than doubled from 1992 to 1994. The consumption of cod by cod (cannibalism) showed a strong increase from 1992 to 1993 and stayed at the same level in 1994. The fraction of cod in the diet is, however, not higher than the few stomach content data from the 1950s (Bogstad *et al.* 1994) indicate. It should also be taken into account that the fraction of cod in cod diet generally increases with increasing cod size (Bogstad *et al.* 1994) , and that the biomass of old cod has increased strongly in the most recent years. The amount of redfish consumed drops to almost zero in 1994. The amount of amphipods consumed increased in 1994, but has not yet reached the level observed during the previous capelin stock collapse in 1986-1989, when the cod switched from capelin to amphipods as prey. The fraction of herring in the diet is relatively low, and decreases from 1992 to 1994. Very few of the stomach samples are from pelagic trawl hauls, and thus the consumption of prey like herring, which are distributed in the upper layers of the sea, may be underestimated. The increase in the consumption of 'other food' in 1994 is to a large extent due to an increase in the consumption of polar cod (*Boreogadus saida*).

The table below shows the variation by year in the ratio of energy consumed to the energy content of the cod biomass in the age groups used in the consumption calculations at January 1 (subtracting one fourth of the mature biomass to account for the fact that this is not included in the consumption calculations for three months during the first half of the year). These values are obtained using the consumption figures given in Table A13 and applying the values for energy content of the various prey species given by Ajiad *et al.* (1994).

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Ratio	2.85	4.38	3.43	2.74	3.81	3.29	4.29	3.88	3.37	3.32	3.36

This consumption/biomass (C/B) ratio seems to be in line with values reported in the literature.

In Figures 3.2 and 3.3, this ratio is plotted together with the growth of cod, as calculated from values used by Norwegian and Russian survey data, respectively. In general, the fluctuations in the C/B ratio are similar to the growth fluctuations.

It seems as if the cod in 1994 was able to compensate for the decrease in the capelin stock, which generally is the most important prey item for cod, to a higher degree than in the late 1980s. The capelin stock will, however, be at a very low level for at least the next 2-3 years, and it is unknown whether the cod will be able to compensate for the lack of capelin during this period. Models for prediction of cod growth will have to take into account the abundance of several prey items, as well as the sea temperature.

How cannibalism can be included in the VPA for cod, is discussed in Section 3.4.2. Predation by cod on haddock can be included in a similar way, but the data on consumption of haddock by cod divided on length groups could not be transferred to numbers consumed by age group in time for the Working Group meeting.

Before the meeting of the ICES Atlanto-Scandian Herring, Capelin and Blue Whiting Working Group (12-18 October 1995), the consumption calculations for 1993 and 1994 will be revised utilising all the data collected. Also, krill and polar cod will be separated out from the 'other' group.

3.3 Data used in the Assessment

3.3.1 Catch at age (Table 3.12)

For 1991, revised age compositions in the Russian fishery were used to revise the number at age in the 1991 landings, while for 1993, revised age compositions in the Norwegian fishery together with final total landings for all countries were used to revise the number at age in the 1993 landings. For 1994, age compositions for all areas were available from Norway (all gears) and Russia (trawl only). The Russian long-line catches in Sub-area I and Division IIb were age distributed using the age distributions from the Norwegian long-line catches. From the UK (England & Wales) and Germany, age compositions from Divisions IIa and IIb were available. Spain provided age compositions for Division IIb, while Iceland provided age compositions from the fishery in Sub-area I and Division IIb combined. Age compositions of the total landings were calculated separately in Sub-area I and Division IIa and IIb by using the age compositions provided and raising the landings from other countries (Denmark, Faroes, France, Greenland, Ireland, Portugal, UK (England & Wales)(area I only), UK(Scotland) and 'other' countries by Icelandic trawl (Sub-area I and Division IIa combined) in Sub-area I, by UK trawl in Division IIa and by Spanish trawl in Division IIb.

A SOP check gave a deviation of 1% for 1993 and < 1% for 1994, respectively. The number at age was adjusted to make the SOP fit exactly to the nominal catch for these years.

The age composition of cod in 1994 is made up of several year classes (mainly 1983-1991) with those of 1988-1990 (age 4-6) together contributing 80% of the catch in numbers. It should also be noted that the numbers caught of fish at age 12 and 13 is the highest since the 1970s. When comparing the catch in numbers at age to the values predicted in last year's assessment, the catch of age 3 is about one fourth of what was predicted while the catch of age 7 cod is about twice as high as predicted. For the other age groups the catch in number deviates 30% or less from the predicted number. The low catch of age 3 cod may be due to the small size at age of this year class (1991).

3.3.2 Weight at age (Tables 3.5-3.7)

The mean weight at age in the catch (Table 3.6) is calculated as a weighted average of the weight at age in the catch for Norway, Russia (trawl only), Germany, Spain and Iceland for 1993 and 1994. The weight at age in the catch for Norway and Russia is given in Table 3.5. The mean weight at age in the Russian catch for 1991 has been revised (Table 3.5), and the mean weight at age in the total catch for 1991 was revised correspondingly (Table 3.6).

The weight at age in the catch in 1994 was higher than what was assumed by the Working Group last year for ages 3-10, and lower for the older age groups. Stock weights (Table 3.7) used from 1985 to 1995 for ages 3-8 are averages of values derived from Norwegian surveys in January-February for the years 1985-1995 (Table A6) and Russian surveys in autumn during 1984-1994 (Table A10) to give representative values for the beginning of the year for ages 3-8. For the older age groups the time series weights have been used, except for the year classes of 1982 and later, where the survey weights have been derived in the same way for ages 9 and older as was the case for the younger ages, if data were available. If data from only one of the surveys were available, this value was used.

The stock weight at age in 1995 is in good agreement with the prognosis made by the Working Group last year.

3.3.3 Maturity at age (Table 3.8)

As in 1994, only Russia provided a maturity ogive. This indicates a slightly later onset of maturation than in 1994.

3.3.4 Data for tuning (Table 3.9)

Both survey and commercial CPUE data were considered for use in the tuning. The following data sets were used (Table 3.9):

1) Russian trawl survey, autumn
2) Russian acoustic survey, autumn
3) Norwegian Svalbard trawl survey, autumn
4) Norwegian CPUE data
5) Russian CPUE data
6) Norwegian Barents Sea trawl survey, January-March
7) Norwegian acoustic survey, January-March

In addition, the Norwegian trawler survey in October-November (Table A5) was included in some of the trial tuning runs, but was excluded from the final run.

Surveys that were conducted during winter were allocated to the end of the previous year. This was done so that data from the 1995 surveys could be included in the assessment. For the Russian surveys ages 1-8 were included in the tuning. For the Norwegian Barents Sea surveys ages 2-9 were included in the tuning shifted one year earlier and one year younger.

Some of the survey indices have been multiplied by a factor 10 or 100. This is done to keep the dynamics of the surveys even for very low indices, because 1.0 is added to the indices before the logarithm is taken.

3.3.5 Recruitment indices (Table 3.10)

There were 16 indices of recruitment available for review: the Russian bottom trawl index by area, the Norwegian Barents Sea and Svalbard area trawl surveys as well as the Norwegian Barents Sea acoustic surveys all for ages 1-3. In addition, there is an index of recruitment from the International 0-group survey.

3.4 Methods Used in the Assessment

3.4.1 VPA and tuning (Tables 3.13 -3.14, Figures 3.4-3.5)

Tuning of the VPA was carried out using Extended Survivors Analysis (XSA). It was decided first to carry out the analysis without taking cannibalism into account, using M=0.2 for ages 1 and 2, and then to investigate the effects of cannibalism.

Last year, the VPA was run on ages 1-12+, because the lack of tuning data for ages 12 and older caused very low Fs on these age groups when running the VPA on ages 1-15+. The reason for this is that the estimation of input F on the oldest age is stabilised by assuming that catchability is constant for ages above a certain age. This implies that there are tuning data for those ages. Otherwise the XSA method will use different values of q for all ages with tuning data and no actual estimation of F at the oldest ages takes place. F on the oldest ages will in this case be estimated by an unstable iteration process. The diagnostic output does not give a warning when this takes place. In the manual it is recommended to make a plus-group of all ages above the oldest for which there is tuning data. Choosing age 12 as the first in the plus-group leaves us with an oldest true age that contributes significantly to the catch, which may have a negative influence on the robustness of the VPA and makes comparisons with earlier periods of the long time series for this stock doubtful.

In order to avoid running the VPA only for ages 1-12+, tuning data must be added for all true age groups, even if they are not of the best quality, so that the final true age contributes with a catch that is small. The possible large error of estimation on F caused by very noisy tuning data will be down weighted by the low contribution of the last age group. The gain is that the iteration process is stable, and this will improve the consistency of the retrospective analysis.

The default settings for the XSA were used, except that, as last year, the shrinkage was set to 2 years and 5 ages, using a SE of 2.0 for the mean, and the catchability was set to be dependent on stock size for ages 3 and younger. Last year, the catchability was set to be independent of age for ages 11 and older. It was not possible to rerun the VPA with this setting this year, because the computer program now demands that the catchability should be set independent of age for the two oldest true age groups. Rerunning the VPA up to 1993 with the same tuning data as last year (surveys 1-3 and 6-7 (without swept area correction) from the list in Section 3.3.4, and in addition the Norwegian Trawler survey (Table A5)) and setting the catchability independent of age for ages 10 and older gave a F_{5-10} of 0.46 in 1993. This is slightly higher than the value 0.43 obtained in last year's assessment. When the swept area corrected data from the Norwegian Barents Sea winter survey were substituted for the uncorrected values used last year, F_{5-10} in 1993 increased to 0.47 i.e. marginally. Keeping these new indices, running the VPA on ages 1-15+ with catchability independent of age for age 13 and older and introducing the two CPUE series in the tuning, in order to have tuning data on all age groups for reasons mentioned above, changed F_{5-10} in 1993 only slightly, to 0.49. Thus, the effect of including the CPUE series in the tuning are very similar to the effect of running the VPA on ages 1-12+, but the former approach is the most practical and it was decided to use this approach when running the VPA up to 1994.

It was attempted to decrease the minimum age for which catchability is age-dependent from 13 to 12 (the default setting), this led to an increase of F_{5-10} to 0.52, and hence increased the deviation from the run on ages 1-12+. It was thus decided to use 13 as the minimum age for which the catchability is age-dependent. Because the Norwegian trawler survey was not carried out in 1994, it was also checked whether the results changed dependent on whether the Norwegian Trawler survey was included or not. Excluding the survey decreased F_{5-10} to 0.48, i.e. marginally.

The VPA up to 1994 was then run on ages 1-15+ using the seven surveys listed in Section 3.3.4 in the tuning, with a constant catchability for ages 13 and older. The age below which catchability is dependent on stock size was varied from 4 to 7, and the tuning diagnostics indicated that it was appropriate to set this age at 5. Including the Norwegian trawler survey gave a larger change in F than was found when 1993 was the last year in the VPA. The reason for the larger impact of including this survey with 1994 as the last year in the VPA is probably that this survey was not carried out in the last VPA year. It was thus decided to exclude this survey from the VPA, this also makes the ıetrospective analysis easier.

In order to investigate the effect of the level of shrinkage, a retrospective analysis was carried out both with shrinkage (SE) 2.0, the level used in all the runs mentioned above, and 1.0. The results are shown in Figures 3.4 and 3.5. The retrospective analysis showed an inconsistent picture among the time series which changed substantially dependent on the level of shrinkage. The lowest level of shrinkage (2.0) gave the highest F_{5-10} and terminal F was consistently overestimated in the last 4 years. In addition to this, convergence among series was poor. Setting the shrinkage SE to 1.0, i.e. a medium level, seems to give a more consistent picture, although there still remains a clear drop in the retrospective history and the convergence still is far from good. It was decided to use a level of shrinkage of 1.0 in the final non-cannibalism VPA. The fishing mortalities and population numbers from this VPA are given in Tables 3.13 and 3.14. The F_{5-10} in 1993 then decreased from 0.43 in last years assessment to 0.39, and the F_{5-10} in 1994 was found to be 0.50.

3.4.2 Including cannibalism in the VPA (Tables 3.15-3.17, Figures 3.6 A-G)

Cannibalism in North-East Arctic cod may have a significant influence on the recruitment to the fishery, and should thus be taken into account in the assessment. Inclusion of cannibalism into the VPA for North-East Arctic cod has been discussed by Korzhev and Tretyak (1992). Tretyak (1984) discusses the age-dependency of natural mortality in general. At the last meeting of the Multispecies Assessment Working Group (Anon., 1995b), a multispecies VPA for the Barents Sea for the period 1980-1993 including cod as predator and cod, herring, capelin and shrimp as prey was presented. This MSVPA was run on a quarterly basis, with stomach data fetched from the joint PINRO-IMR stomach content data base. Possible discrepancies between the VPA with cannibalism presented here and the Barents Sea MSVPA may be due to different aggregation of data, use of different age -length keys and weight at age data, and differences in the stomach evacuation rate model used. Such discrepancies are readily apparent when the estimates for the cod stock's total consumption of various species made in WD1 are compared with those from WD2. The VPA will here be run on ages 1-15+, so that predation on 0-group is not considered here, while this was taken into account in the MSVPA.

As it was not possible to run the XSA with cannibalism included directly, the following approach was taken in order to include cannibalism in the assessment.

1. The consumption in tonnes of each prey length group (0-5 cm, 5-10 cm, 10-15 cm, 15-20 cm, 20-30 cm, 30 cm and longer) by each predator age group (age 1-6 and 7 + (7-9 in 1984-1992, 7-10 in 1993 and 7-11 in 1994) for each half-year and area is calculated as described in WD1. As a starting point, the number of cod (as predator) at age from last years assessment is used, later the number at age from the XSA is used to update the consumption figure.

2. Convert consumption on length groups to consumption in numbers by prey age group, using age-length keys and weight at age data from Norwegian surveys.

3. Enter this as an additional catch in the VPA, maintaining M=0.2 for age groups 1 and 2.

4. Run XSA, using tuning data only for those years for which we have stomach content data (1984-1994). Effect of this exclusion of the 1980-1983 tuning data was checked on VPA without cannibalism, and gave only minor changes.

5. Repeat until convergence.

This iteration procedure seemed to converge rather quickly, as $F_{5\text{-}10}$ in 1994 only changed by < 0.001 from the first to the second iteration. Thus, the procedure was stopped after two iterations.

The tuning diagnostics from VPA with cannibalism, are given in Table 3.15 and the fishing mortalities and population numbers in Tables 3.16 and 3.17. The survey indices are plotted against the VPA in Figures 3.6A-G. The fit to the surveys for ages 1 and 2 was better (higher R^2) than in the VPA without cannibalism.

The change in the reference F was small (a increase from 0.50 to 0.51). The relative strength of the year classes is somewhat changed, however. Also, the mortalities induced by cannibalism on age 1 in 1993 and 1994 seem extraordinarily high (above 2.0):

The total number (million) consumed of cod ages 1-3 and the corresponding predation mortalities (M2 in MSVPA terminology) (the part of the F on ages 1-3 in Table 3.16 which is due to predation). Also, the number of 0-group consumed as calculated directly from the stomach content data are given.

Year	Age 0 cons.	Age 1 cons.	Age 2 cons.	Age 3 cons.	Age 1 M2	Age 2 M2	Age 3 M2
1984	0	383	37	1	0.21	0.06	0.00
1985	1334	235	111	4	0.28	0.09	0.01
1986	53	448	245	168	0.50	0.54	0.19
1987	653	203	311	14	0.55	0.79	0.08
1988	33	450	27	0	0.93	0.13	0.00
1989	966	184	0	0	0.22	0.00	0.00
1990	0	139	31	0	0.11	0.05	0.00
0.08	126	175	61	38	0.09	0.07	0.09
1992	20213	1280	161	0	0.39	0.11	0.00
1993	13222	12580	1102	406	2.41	0.69	0.47
1994	11304	14353	398	486	2.36	0.47	0.79

The cannibalism is seen to be very variable within this time period, on all prey age groups. Thus, cannibalism will be difficult to predict. The numbers consumed of age 1 in 1993 and 1994 are an order of magnitude higher than what the size of a cod year class at age 1 and 2 earlier was believed to be. The figures for 1993 and 1994 will be somewhat changed when all the stomach data for these years are included in the calculations. Because of the better fit to the survey data, it was decided to adopt the VPA with cannibalism as the final VPA, despite these large numbers of age 1 cod consumed in the last years according to the calculations.

The final VPA was then run as an ordinary VPA on ages 3-15, with the input values for F in the last year and for the oldest age taken from the XSA. The natural mortality for age 3 in 1984-1994 was increased by the M2 values from the table above, so that predation in the final run was accounted for by an increased M instead of entering it as an extra 'fleet'. Cannibalism on age 3 may of course also have occurred before 1984, and thus there will be an inconsistency in the recruitment time series.

3.4.3 Recruitment (Table 3.11)

The strength of the 1993 year class at age 3 was calculated from the XSA estimate at age 2, applying a natural mortality of 0.9, which is approximately equal to 0.2 + the M2 value obtained for 1993 when cannibalism was included (text table in section 3.4.2). The only year class which need to be estimated by the RCT3 program is thus the 1994 year class. Only the age 1 survey indices and the index from the international 0-group survey were included in the estimation. The RCT3 program estimated the strength of the 1994 year class to be 1227 million at age 3.

3.5 Results of the Assessment

3.5.1 Fishing mortality and VPA (Tables 3.18-3.22, Figures 3.1A and 3.1B)

The average age 5-10 fishing mortalities for the years 1981-1989 were in the range 0.69 to 1.01. The lowest of these Fs occurred during 1989 and the highest in 1987. In 1990 fishing mortality dropped to 0.27 as a result of management measures brought into effect to control the amount of fishing effort. Age 5-10 F then increased, reaching 0.40 in 1993 and 0.51 in 1994 as catches increased.

The fishing mortalities and stock numbers are given in Tables 3.18-3.19, while the stock biomass at age and the spawning stock biomass at age are given in Tables 3.20-3.21. A summary of landings, fishing mortality, stock biomass, spawning stock biomass and recruitment since 1946 is given in Table 3.22 and Figures 3.1A and 3.1B. Due to the large SOP discrepancies, the SOP corrected values are given.

3.5.2 Recruitment (Table 3.11)

The results of the RCT3 analysis are given in Table 3.11. The estimates of the 1992, 1993 and 1994 year classes, calculated as described in Section 3.4.2 and 3.4.3 are 558, 540 and 1227 million individuals, respectively. In order to account for cannibalism at age 3, the numbers are reduced by a predation mortality of 0.46 at age 3 (the 1993 M2 value) instead of introducing a natural mortality higher than 0.2 in the prediction. This give final figures of 372, 347 and 767 million individuals at age 3 for the 1992, 1993 and 1994 year classes, respectively.

3.5.3 State of stock

From an average level of about 1 million t in the 1980s, the total stock biomass increased rapidly to 2.9 million tonnes in 1993, and then it decreased to 2.5 million tonnes in 1994. Total biomass is currently similar to that of the mid-1970s, and slightly above the long-term average value for this stock.

The spawning stock in 1995 is 734 thousand tonnes, a slight decrease from 1994, but still higher than any values in the period 1959-1989 (Table 3.22).

3.6 Principles for Management

3.6.1 Biological reference points (Figure 3.1C)

The yield per recruit analysis using the fishing pattern and stock parameters for 1996 from the management option table gave estimates of $F_{0.1}$ = 0.11 and F_{max} = 0.21 which is lower than the values obtained last year. Jakobsen (1992) gives the values of F_{low} = 0.32, F_{med} = 0.46 and F_{high} = 0.78. The present exploitation level is F_{94} = 0.49 (*status quo*) which is slightly above F_{med}=0.46. F_{low}, F_{med} and F_{high} will not be recalculated until the time series on weight at age have been updated, as commented upon in Section 3.8.

3.6.2 MBAL level and advised exploitation rate (Figure 3.7)

Jakobsen (1993) discusses past, present and future management of North-East Arctic Cod. In that paper, it is indicated that to avoid poor year classes, the spawning stock biomass should be kept above a level of 500,000 t (MBAL). This can also be seen from the stock/recruitment plot given in Figure 3.7. The fishing mortality should also be kept at or below F_{med} = 0.46.

3.7 Prediction of Catch and Stock

3.7.1 Input data to the prediction (Table 3.23)

The input data to the short-term prediction with management option table (1995-1997) and to the medium-term single option prediction (1995-2000) are given in Table 3.23. The data used for 1995-1997 in the short-term prediction are also used for these years in the medium-term prediction.

The stock number at age is taken from the final VPA (Table 3.18) and the recruitment of the 1992-1994 year classes at age 3 is calculated as described in Section 3.5.2. The recruitment of the 1995 and later year classes is set equal to the long-term arithmetic average, i.e. 623 million. The fishing pattern is the average of the last 3 years from the final VPA, scaled to the 1994 level. The maturity ogive is the average of the years 1993-1995 and is used for 1996 onwards. The weight at age in the catch in 1995 for ages 3-8 was calculated assuming the same ratio between weight at age in the catch and in the stock as the average of the ratio in 1992-1994. The weight at ages in the stock and in the catch in 1996 and later years was set equal to the average of the period 1987-1990, i.e. at a low level. This assumption is based on knowledge about the development of the capelin stock (which will be at a very low level for at least 2-3 years) and the temperature (see Section 2.4). The growth prediction methods by Ozhigin *et al.* (1994) and Ajiad *et al.* (1994) (results given in WD 3 and WD4) give results similar to the low weight at age in the stock level for 1996 and 1997.

3.7.2 Projections of catch and biomass (Tables 3.24-3.26 and Figure 3.1D)

The management option table (Table 3.24) shows that the expected catches in 1995 will give a decrease of F_{5-10} from 0.51 in 1994 to 0.50 in 1995. The *status quo* F in 1996 (F_{96} =F_{94}) gives a catch of 746,000 t , which is slightly below the expected catch in 1995 of 750,000 t. F *status quo* in 1996 will stabilise the spawning stock biomass slightly above 700,000 t in 1977 which is a high level.

In Figure 3.1D the catch level in 1996 and spawning stock biomass level in 1997 are plotted against the fishing mortality, F, in 1996.

In Table 3.25, the results of the medium-term prediction are given, for the biological reference points F_{low} and F_{med}, and for 0.8*F_{med} and 1.2*F_{med}. Detailed output of the prediction for F_{med} is given in Table 3.26. Medium-term predictions are also made for TACs of 700,000 t and 750,000 t in the period 1996-2000.

In the medium term, the stock will stabilise around 1.8 million tonnes when fishing at F_{med}. The catches will also be rather stable at a level of between 600,000 t and 700,000 t, and the spawning stock biomass will be between 700,000 t and 800,000 t, which is a high level. The values are all close to the 1995 values. Fishing at 1.2* F_{med} will give a decline in the spawning stock biomass to about 500,000 t in year 2000, while fishing at F_{low} will increase the spawning stock biomass to 1.1 million tonnes in year 2000. A fixed catch level of 700,000 t in 1996-2000 will cause a decrease of the spawning stock to about 460,000 t in year 2000, while a fixed catch level of 750,000 t, which is equal to the 1995 level, will cause the spawning stock biomass in year 2000 to be 310,000 t, which is below MBAL.

3.8 Comments to the Assessment and the Predictions

Cannibalism was included into the assessment for the first time, and this improved the fit to the survey data. The stock estimate did not change very much, however. It was also attempted to account for cannibalism in the prediction, but due to the very variable level of cannibalism, such predictions are very uncertain. It should be possible to improve the predictions of cod cannibalism by taking the abundance of the major prey species into account using multispecies models. Computer programs that make it possible to easily combine XSA and VPA with cannibalism, should be developed.

Updating of the time series on weight at age in the catch and in the stock and the maturation ogive for the period 1946-1981 is still in progress, but is expected to be finished before the next Working Group meeting. This will solve the problem with the SOP discrepancies mentioned in Section 3.5.1.

3.9 Stock Summary

The stock situation from last year's assessment is confirmed in this year's assessment. The spawning stock is still at a high level. The prognosis is based on a rather high level of cod cannibalism in the coming years, thus giving a conservative estimate of the recruitment. The individual growth seems to have stabilised at a relatively low level, although it is still well above the very low level experienced in 1987-1988. The stock is inside safe biological limits.

4 NORTH-EAST ARCTIC HADDOCK (SUB-AREAS I AND II)

4.1 Status of the Fisheries

4.1.1 Landings prior to 1994 (Tables 4.1-4.3, Figure 4.1)

Haddock is mainly fished by trawl, in periods only as a by-catch in the fishery for cod. Some haddock is taken by conventional gear in the first half of the year in connection with the spawning fisheries for cod. A long-line fishery in early autumn also gives substantial landings. The fishery is restricted by quotas for the traditional gears. It is also regulated by a minimum landing size, a minimum mesh size in trawls and Danish seine, a maximum by-catch of undersized fish, closure of areas with high density of juveniles and other seasonal and areal restrictions.

Historical landings of the fishery show a cyclical pattern (Figure 4.1A). The historical record catch level of 320,000 t in 1973 divide the time series in two periods. Formerly, highs were close to 200,000 t around 1956, 1961 and 1968, and lows were between 75,000 and 100,000 t in 1959, 1964 and 1971. The second period shows a steady decline since the peak of 1973 down to the historical low level of only 17,700 t in 1984. Afterwards they increase to 151,000 t and decline again to 26,000 t in 1990. Landings are increasing since then.

In periods of low abundance, the haddock is often exploited at very high F levels. This partly is the result of the by-catch in the cod fishery. However, the stock very often produces a good year class in periods of low abundance and frequently coincident with cod. These good year classes precipitate an increase in directed effort.

Final reported landings of 1993 are 77,355 t (Table 4.1) which is close to the figure used in last year's assessment. The provisional landings for 1994 are 121,111 t which is very close to the agreed TAC of 120,000 t. An increase in catch was recorded in all areas.

The catch by area broken down by trawl and other gears is given in Table 4.2 and the nominal catch by country is given in Table 4.3.

4.1.2 Expected landings in 1995

Given previous observation and provisional reports it is expected that the TAC of 130,000 t will probably be taken.

4.2 Status of Research

4.2.1 Fishing effort and CPUE (Tables 4.4)

There has been very little trawl fishery targeted to haddock in recent years, although it might be currently increasing. In order to obtain CPUE indices for tuning of the older ages in the VPA, it was decided to update the CPUE series of Norwegian trawl fisheries (Table 4.4), even if the data are scarce and noisy. The figures show an increase of CPUE in all areas and in particular in sub-area I. The data series use the total effort in the Norwegian trawl fishery, mainly directed to cod.

4.2.2 Survey results (Appendix II - Tables B1-B6)

Norway provided indices from the 1995 Barents Sea bottom trawl and acoustic survey in January-March. The results of this survey are described by Korsbrekke *et al.* (1995). Tables B1 and B3 shows the time series of abundance estimates (acoustic and bottom trawl, respectively) from this survey. These time series have now been recalculated in the same way as for cod (see section 3.2.2) (Aglen and Nakken 1994).

Russia provided indices from 1994 trawl and acoustic survey (autumn) in the Barents Sea (Tables B2 and B4). The results from this survey are described in Lepesevich *et al.* (1994).

The abundance of 0-group haddock as estimated in the International 0-group survey (Anon., 1995), is given in Tables A11 and A12.

The weight at age in the stock has declined from last year in the range from 2 to 6 year older and increased from 7 to 11 years older according to Norwegian and Russian surveys (Table B6). The weight at age from these two surveys are in good agreement with each other.

4.3 Data Used in the Assessment

4.3.1 Catch at age (Table 4.13)

A revised age composition in the Norwegian landings together with final total landings from all countries were used to revise the number at age in the 1993 landings.

Age compositions of the catches for 1994 were available from Norway and Russia in Sub-area I, from Norway, Russia, Germany and UK (England and Wales) in Division IIa, and from Norway, Germany, UK (England and Wales) in Division IIb. The catches of the other countries were distributed on ages using the combined Norwegian, Russian age composition in Sub-area I, the

UK (England and Wales) age composition in Division IIa and the German age composition in Division IIb.

A SOP check gave a deviation of 1 % and 2 % from the nominal catch for 1993 and for 1994, respectively. The number at age was adjusted to make the SOP fit to the nominal catch for these years.

4.3.2 Weight at age (Tables 4.5-4.7 and 4.19)

The mean weights at age in the catch (Table 4.7) were calculated as weighted averages of the weights in the catch of Norway, Russia and Germany (Table 4.5).

The general decline in weight at age in the catch continues from 1993 to 1994 as was reported from 1992 to 1993. The strongest decline was observed in ages 4 and 5. The weight at age in the catch in 1994 is slightly higher than the weights used for prediction in 1994 AFWG report.

Stock weights used from 1985 to 1995 for ages 3-7 are averages of values derived from Norwegian surveys in January-February for each of the years 1985-1995 and Russian surveys in autumn for each of the years 1984-1994 (Table B8) to give representative values for the beginning of the year for ages 3-7 (Table 4.6). For the older age groups the time series weights have been used, except for the year classes of 1982 and later, where the surveys weights have been derived in the same way for ages 8 and older as was the case for the younger ages. For some of the years only Russian data were available. The stock weight at age in 1995 (Table 4.19) is slightly lower in ages 3 to 6 and higher in age 8 to 11 than the 'low' growth prognosis given by the Working Group in the last year's (1994) report.

4.3.3 Maturity at age (Table 4.8)

A maturity ogive was available from Russia for 1995 and is given in Table 4.8. This ogive indicates a similar maturation pattern as in 1994, except for age 7 which percentage of maturation substantially drops. As a result of this, the proportion of mature 5, 6 and 7 year old fish is the lowest in the time series (1981-1995).

4.3.4 Data for tuning (Table 4.9)

The following surveys and CPUE series are included in the data for tuning:

Name	Place	Season	Age	Year
Russian bottom trawl	Total area	Autumn	1-7	1983-1994
Russian acoustic	Total area	Autumn	1-7	1985-1994
Norwegian bottom trawl	Barents Sea	Winter	1-7	1980-1994
Norwegian acoustic	Barents Sea	Winter	1-7	1980-1994
Norwegian trawl fleet	Total area	All year	8-13	1985-1994

Some of the survey indices have been multiplied by a factor 10 or 100.

4.3.5 Recruitment indices (Table 4.10).

10 indices of recruitment were updated with data from 1994 and are given in the Table 4.10. These are from the autumn Russian bottom trawl survey (age 0+, 1+ and 2+), International 0-group survey (age 0), and the winter Norwegian bottom trawl and acoustic surveys (age 1-3 for both).

4.4 Methods Used in the Assessment

4.4.1 VPA and tuning (Figure 4.2).

Tuning of the VPA was carried out using Extended Survivors Analysis (XSA). The XSA was initially run on the updated 1993 data in the same way as last year, shrinkage to 2 years and 5 ages, using a SE of 0.7 for the mean. Catchability was set to be dependent on stock size for ages older than 4, and to be independent of age for ages older than 8. The VPA was run on ages 1-11+, because the lack of tuning data for ages 11 and older due to very low Fs on these age groups when running the VPA on ages 1-14+. (see section 3.4.1 on cod). The results were similar to those of the last year, with a F_{4-7} of 0.57 in 1993 this year compared to 0.56 in the 1994 Working Group. In addition to this run, a similar run was made but using calibration regression instead of prediction regression, as it is the standard procedure. The resulting F_{4-7} value was 0.55.

The ACFM made a new run over the one made by the Working Group in 1994, truncating the age span to 11 years and using the calibration regression. In this analysis the catchability was set dependent on stock size for ages younger than 9 because the slopes of the regressions were lower than 1 in most tuned ages, showing some dependence of catchability on stock size. Catchability was set independent of age for ages 9 and older. F_{4-7} resulted to be 0.53 in this run and fishing mortalities were similar although slightly higher in the older ages.

Following the conclusions of the Working Group discussion on the use of commercial CPUE data to stabilise fishing mortality in older ages (see cod section 3.4.1), it was decided to run an XSA on the whole age span 1-14, using the new tuning data presented in section 4.3.4. Catchability was set dependent on abundance for ages younger than 8, and independent of age for ages 11 and older.

The retrospective analysis showed an inconsistent picture among the time series of fishing mortalities which changed substantially depending on the level of shrinkage (Figure 4.2). For low levels of shrinkage (SE=2.0), F_{4-7} were generally higher and terminal F were consistently overestimated in the last 4 year's runs. In addition to this, convergence among series was poor. For high levels of shrinkage (SE=0.5), F_{4-7} were lower and convergence was even weaker. There appear two different retrospective F_{4-7} levels corresponding to two different stocks levels. 1993's and 1994's analysis show a much lower historical level of mortality than the remainder year's analysis.

Setting the shrinkage SE to a medium level (1.0) seems to give a more consistent picture, although there still remains a clear drop in the retrospective history and the convergence still is far from good.

An explanation for the inconsistencies in the retrospective analysis arise from the fact that the 1986 and 1987 year classes are currently occurring in relatively important numbers as 6 and 7 year old catches in 1993 and 1994, whereas they have been consistently shown as weak year classes in all surveys.

It was then decided to run a final XSA using a SE values of 1.0 for the mean to which the estimates are shrunk.

4.4.2 Recruitment (Tables 4.11)

The strength of the 1992 year class at age 3 was estimated directly by the XSA as age 3 in 1995. The strength of the 1993 year class at age 3 was calculated from the XSA estimate at age 2 in the terminal year, applying a natural mortality of 0.2. The only year class estimated by the RCT3 program was thus the 1994 year class. Only the age 1 survey indices and the indices form the International 0-group surveys were included in the estimation, together with estimates of year class strength at age 3 from the VPA.

4.5 Results of the Assessment

4.5.1 Fishing mortality and VPA (Tables 4.12–4.18 and Figures 4.1A and 4.1B

The tuning diagnostics are given in Table 4.12 and the fishing mortalities and population numbers in Tables 4.14 and 4.15. The F_{4-7} in 1993 was then estimated to 0.44, and the F_{4-7} in 1994 to 0.63. The Working Group believes that this figure overestimates the actual value of average fishing mortality due to the high F values of ages 6 and 7 in the VPA run.

The highest level of fishing mortality (F_{4-7}) since 1980 occurred in 1981 (0.62) and decreased to half this level in 1984, rising again to 0.55 in 1987 and dropping afterwards down to the historical low of 0.16 in 1990. Mortality has sharply increased since then to reach a level of 0.63 in 1994. There are no apparent trends in the fishing pattern since 1985. The stock biomass at age and spawning stock biomass at age are given in Tables 4.16 and 4.17. A summary of landings, fishing mortality (F_{4-7}), biomass and recruitment since 1950 is given in Table 4.18 and Figures 4.1A and 4.1B.

Figure 4.3 shows the plots of survey/CPUE abundance indices against VPA numbers for all the tuned ages used in the assessment. They all reflect a general good fit, with signals of some lack of relationship at low levels of stock abundance as reflected by the VPA.

4.5.2 Recruitment (Tables 4.10–4.11)

The XSA estimates of the 1992 and 1993 year classes are 74 and 85 million of individuals at age 3, respectively (Table 4.10). The RCT3 estimate of the 1994 year class is 111 million at age 3 (Table 4.11), which is above the long-term geometric mean of 88 million. The long term arithmetic mean is 178 millions of individuals.

4.5.3 State of stock

After a steady increase from 1985 to 1993, the spawning stock biomass decreased in 1994 to 79,490 t, a level below the long term arithmetic average. This decrease was anticipated in the last year's Working Group report based on delayed maturation and revision of weight at age on the oldest groups. The total stock biomass is, however, about the same in 1994 as in 1993. Fishing mortality steadily increased from 1989 to 1994 to 0.63, almost twice F_{med} (0.35). As mentioned earlier, however, the Working Group considered the level of average F as slightly overestimated due to the noise caused by the sudden occurrence of the 1987 and 1988 year classes in the catches of 1993 and 1994.

4.6 Principles for Management

4.6.1 Biological reference points

The yield per recruit analysis using the fishing pattern and stock parameters for 1996 and 1997 from the management option table gave estimates of $F_{0.1}$= 0.19 and F_{max}= 0.52 which is very similar to the values obtained last year. Jakobsen (1992) gives the values of F_{low}=0.02, F_{med}=0.35 and F_{high}=1.11. The present exploitation level is F_{94} = 0.63 (*status quo*).

4.6.2 MBAL level (Figure 4.4)

From the spawning stock - recruitment plot it is seen that at SSB levels below 140,000 t the probability of very low recruitment is higher than above this level. Apart from the two points of recruitment above 1 billion and the three points above average at a SSB of 70,000 t, the recruitment seems to be fairly proportional to the SSB up to 140,000t. Setting the Minimum Biological Acceptable Level of the spawning stock to this size would ensure a good recruitment over most years.

4.7 Prediction of Catch and Stock

4.7.1 Input data to the prediction (Tables 4.19)

The input data to the short-term prediction with management option table (1995-1997) are given in Table 4.19. The data used for 1995-1997 in the short-term prediction are also used for these years in the medium-term prediction (1995-1999), whereas the 1997 data was extended forward to 1998 and 1999 for this purpose.

The stock number at age is taken from the final VPA (Table 4.15) and the recruitment of the 1994 year class from the RCT3 analysis (Table 4.11). The recruitment of the 1995 and later year classes is set at the long-term geometric mean of 88 million individuals at age 3.

The fishing pattern is the average of the last 5 years from the final VPA, scaled to the 1994 level. The reason for taking a longer time span is to remove the noise coming from the high mortalities given to the 1987 and 1988 year classes in the last two years of the assessment.

The maturity ogive is the average of the years 1994-1995 and is used for 1996 onwards.

The weight at age in the catch in 1995 for ages 3-10 was calculated assuming the same ratio between weight at age in the catch and in the stock as the average of the ratio in 1992-1994. The weight at ages in the stock and in the catch in 1996 and later years was set equal to the average of the period 1987-1990, i.e. at a low level, for ages 1 to 7. The weight at age of 1995 was applied for ages 8 and older.

4.7.2 Projections of catch and biomass (Tables 4.20–4.22 and Figure 4.1D and 4.1C)

The management option table (Table 4.20) shows that the expected catches in 1995 will give a decrease of F_{4-7} from 0.63 in 1994 to 0.4 in 1995. The *status quo* F in 1996 (F_{96}=F_{94}) gives a catch of 264,167 t, which is well above the expected catch in 1995 of 130.000 t. The same catch in weight in 1996 as in 1995 will give an F of 0.26, which is well below F_{med}. $F_{status\ quo}$ in 1996 would allow for increasing the spawning stock biomass to 160,000 t, which is the highest level since 1977.

In Figure 4.1D the catch level in 1996 and spawning stock biomass level in 1997 are plotted against the fishing mortality, F, in 1996.

In Table 4.21, the results of the medium-term prediction are given, for different levels of F. Detailed output of this prediction for F_{med} is given in Table 4.22.

A fishing intensity settled at F_{med} would maintain the SSB high and stable in the medium term. *Status quo* F would reduce the SSB to a low level of 83,000 t at the end of the period after a increase in 1996 and 1997.

A medium term prediction run based on constant catch at the current TAC of 1995 (130,000 t) is also presented. It results in a substantial increase of SSB up to a level of around 200,000 t in 1999, well above the long term arithmetic mean of 120,000 t.

4.8 Comments to the Assessment and the Predictions

The retrospective analysis (Figure 4.2) shows a two pattern history. This may very well point to some instability in the process of estimation, but may also arise from the weak year class of 1987 entering into the fishery somewhat more than the survey indices would point to. This is not believed to be due to age reading errors, because that would also have been showing in the surveys, as they are read by the same people.

In Figure 4.3 it is seen that the tuning data fit rather well to the VPA thus indicating that the surveys are giving the trends in the recruiting ages. Some stock dependency in the catchability is seen for the younger ages leading to calculating a somewhat better recruitment than observed at low abundance of the recruiting year classes.

A slight overestimate of F in 1994 is assumed to take place. Using the fishing pattern averaged over 5 resent years in the prediction helps overcome this problem. However, *status quo* F should, in all practical considerations, be regarded lower than this and closer to the assumed 1995 level.

Revision of the available time series for basic data is in progress. This will provide updated weights-at-age and maturity figures which may change the perception of the historical development of the stock.

4.9 Stock Summary

The stock level and the landings are fluctuating a lot for this stock. In the 1980s the catches and the stock level were generally lower then in earlier periods. The current assessment show an improvement in the stock situation in the recent years. Recruitment seems to be maintained at a level above or close to the long term geometric mean. The spawning stock was at the MBAL level in 1993 but have been reduced to a lower level in 1994 and 1995. The SSB is expected to increase to above MBAL level in 1996.

The fishing mortality is at present above F_{med} and is expected to be above also in 1995. The medium term projections show that there is a potential of keeping the SSB above the MBAL level from 1996 onwards if fishing at F_{med} or below. A fixed 130,000 t TAC projection shows that maintaining the same TAC as for 1995 will keep the SSB well above the MBAL level.

5 NORTH-EAST ARCTIC SAITHE (SUB-AREAS I AND II)

5.1 Status of the Fishery

5.1.1 Landings prior to 1995 (Tables 5.1 and 5.2, Figure 5.1A)

Landings of saithe were highest in the years 1970-1976 with an average of 238,000 t and a maximum of 262,000 t in 1975. This was followed by a sharp decline to a level of about 160,000 t in the years 1978-1984. A new decline followed and from 1985 to 1992 the landings were in the range 70,000-124,000 t (Table 5.1). An increasing trend is seen after 1990, and in 1993 the revised landings were 145,918 t. Provisional reports of landings in 1994 indicate a decrease of about 4,000 t. These give a total of 141,994 t compared to 145,000 t expected by last year's Working Group, which was the target set by Norwegian authorities.

The decline in the catches after 1976 was to some extent caused by the introduction of national economical zones. The stock was accepted as exclusively Norwegian and quota restrictions were put on the fishery of other countries while the Norwegian fishery for some years remained unrestricted. However, in more recent years the purse seine and trawl fisheries have been regulated by quotas where account has been taken of expected landings from other gears. Quotas can be transferred between purse seine and trawl if it becomes clear that the quota allocated to one of the gears will not be taken. The target set for the total landings has generally been consistent with the scientific recommendations. Norway presently accounts for about 95% of the landings.

The fishery has since the early 1960s been dominated by purse seine and trawl, usually accounting for about 75% of the landings (Table 5.2). A traditional gill net fishery for spawning saithe accounts for about 15%. Other catches are mostly by-catches or from mixed fisheries. The purse seine fishery is based on schools of immature saithe in coastal areas and fjords. The trawlers operate on the coastal banks and catch both immature and mature fish.. Over the years purse seine and trawl have taken roughly equal shares of the catches, but in the most recent years trawls have taken a bigger share while purse seine landings have declined. Thus, the purse seine landings in 1992-1994 have only been slightly in excess of 20% of the total while trawl accounts for more than half of the landings. The decline in purse seine landings appears to have been caused predominantly by market mechanisms.

5.1.2 Expected landings in 1995

Norwegian authorities have set quotas for other countries and for purse seine and trawl in the Norwegian fishery. The aim is to limit Norwegian landings to 160,000 t. In addition, about 5,000 t can be expected from other countries, giving a target of 165,000 t for the total fishery. Enforcement of the regulations have gradually improved and the directed trawl and purse seine fisheries are stopped when it is clear that their quota has been taken. Deviations from the target have been relatively small in recent years (-3,000 t in 1994). There is no basis for assuming another catch level than 165,000 t in 1995.

5.2 Status of Research

5.2.1 Fishing effort and catch-per-unit-effort (Tables 5.3-5.5)

Table 5.3 shows the number of vessels of different size categories that have taken part in the purse seine fishery for saithe since 1977, with corresponding catches and catch per vessel. On the basis of these data, indices of effort have been calculated. The unit of effort is the number of vessels of 20-24.9 m. This category presently accounts for about half of the purse seine landings and constitutes most of the specialised saithe purse seiners. The effort of this category is raised by the catches to represent the total purse seine effort. A decreasing trend in the purse seine effort is seen after 1991, giving a reduction of about 29% from 1991 to 1994 (Table 5.5). The 1994 figure is the lowest recorded.

Table 5.4 gives catch, effort and catch per unit effort for Norwegian trawlers since 1976, including only hauls where the effort has almost certainly been directed towards saithe, i.e., hauls on days with more than 50% saithe and only on trips with more than 50% saithe in the catch. The effort thus calculated for the directed fishery is raised by the catches to represent total effort of Norwegian trawlers (Table 5.5). The index has increased by about 55% from 1991 to 1994 and is presently close to the maximum recorded level.

Catches from purse seine and trawl have historically on the average been on the same level. The fleets can therefore be assumed to have represented roughly equal shares of the effort and together they account for a relatively stable proportion of the total landings. Using 1977-1990 as reference period and multiplying the trawl indices by 2.75 raises them to the same level as the purse seine indices. The indices are then added to give a combined effort index which should reflect the main trends in total effort (Table 5.5). The recent decline in purse seine effort is more than compensated for by the increase in trawl effort and since 1992 there is an increasing trend in the total effort.

5.3 Data Used in the Assessment

5.3.1 Catch at age (Table 5.8)

The numbers at age in 1992 were increased slightly to account for revised Norwegian landings. The age composition of Norwegian landings in 1993 was revised, resulting in a substantial increase for age 3 and a corresponding decrease for age 5. Age composition for 1994 was available from Norway, accounting for 95% of the landings. A Russian length composition was also available and an age-length key for Norwegian trawl in Sub-area I was applied to this. Other countries were assumed to have the same age composition as Norwegian trawlers.

5.3.2 Weight at age (Table 5.9)

A constant set of weight-at-age data is used for all years in the period 1960-1979. For subsequent years, annual estimates of weight-at-age in the catches are used. Weight at age in the stock is assumed to be the same as weight at age in the catch.

5.3.3 Maturity at age

Traditionally, knife-edge maturity at age 6 has been used for this stock. Following last year's note on the desirability of a re-evaluation of historical data on maturity, the data on spawning zones recorded in otoliths in Norway have been investigated. The details are available in a working document presented to the Working Group. There is not sufficient evidence of change in maturity over the period in the assessment, and it was decided to use the same ogive for all the years. This ogive is given in Table 5.15 and in the text figure below and is based on the distribution of age at first spawning among 8 year and older fish. It represents a crude average of the data from 1973 to 1994, with most weight given to recent observations.

Age	4	5	6	7	8
% Mature	1	55	85	98	100

5.3.4 Tuning data (Table 5.6)

The series of commercial data from purse seine has been extended to include age 2 in order to improve the estimates of the youngest year classes. The series for trawl has been extended to include ages 9 and 10 to cover all the age groups in the VPA. The survey data have been revised by changing the formula for target strength to the one used for cod and haddock. The basis for this change was an evaluation by acoustic experts at IMR, Bergen. This substantially reduces the overall level of the values, but the basic relationship between years and ages is retained.

5.3.5 Recruitment indices

Reliable recruitment indices are crucial for the predictions. Attempts at establishing year class strength at age 0 or 1 have so far failed, but the acoustic survey now shows promise of an improvement in the estimate of year class strength at age 2.

5.4 Methods Used in the Assessment

Extended Survivors Analysis (XSA) was used for the assessment with the same settings as last year, except that catchablity was assumed independent of stock size for all ages. Age 2 was assumed to be dependent last year, and the reason for the change is the inclusion of purse seine CPUE at that age, which performed badly assuming dependence on catchability. The tuning diagnostics are given in Table 5.7. Figure 5.2A-C shows plots of the tuning indices versus stock numbers from the VPA.

Trial runs showed that the changes made to the input data had very little effect on the assessment, except for a substantial increase in the estimate of the 1990 year class. However, the overall performance of the tuning data seems to be improved, especially on the younger age groups, which indicates that the assessment and the predictions may be more reliable than they have been in the past.

5.5 Results of the Assessment

5.5.1 Fishing mortalities and VPA (Tables 5.10-5.14, Figure 5.1A and 5.1B)

The fishing mortality (F_{3-6}) in 1994 is 0.38 and the agreement with last year's assessment in the development of the stock up to the beginning of 1994 is exceptionally good, as shown by the retrospective analysis (Figure 5.3A). However, reduced growth gave a higher fishing mortality in 1994 than expected last year.

There is a marked change in the exploitation pattern with reduced mortality on the youngest ages. This is caused mainly by the decrease in the purse seine fishery which has been responsible for most of the catches of immature saithe. There has been uncertainty regarding the size of the 1990 year class, which now is established as being abundant. Thus, there have been three consecutive good year classes (1988,1989 and 1990) recruiting to the stock in recent years.
The spawning stock biomass estimates have on average increased by 13% because of the new maturity ogive. The recent trend in SSB has become smoother, but still shows a marked increase due to the improved recruitment. It was chosen to present the SOP corrected stock biomass tables. There are considerable SOP discrepancies in the early part of the time series which are caused by the fixed weights in the data base prior to 1980. SOP correction should therefore give better estimates of biomass, but it is not advisable to recalculate the weights on this basis because they could be interpreted as observed values. There is, however, work in progress to try to reconstruct the weight-at-age time series.

5.6 Prediction of Catch and Biomass

5.6.1 Data used in the predictions (Table 5.15 and 5.16, Figures 5.3B and 5.3C)

The input data to the prediction are given in Table 5.16. For the exploitation pattern the average of 1992-1994 has been used, scaled to the 1994 (*status quo*) level. Also for weight at age in the catch and stock, the average for the last three years in the VPA has normally been used. However, there is a sharp decline in weight at age in 1994 for the three abundant year classes 1988-1990 and using the recent average in the prediction will almost certainly give large overestimates of weights for these year classes. The weight reduction could be caused by density dependence, but could also have environmental causes. The last incident of severe reduction in weight at age was in 1986-1987, but the year after growth was normal. It is assumed that the present situation also will be short-lasting and the year classes 1988-1990 are assumed to have approximately normal growth up to age 7, i.e. an increment of 0.6 kg per year. Otherwise, the 1992-1994 average is used and this was also the basis for yield and SSB per recruit calculations. Table 5.15 shows the recent development in weight at age and the weights used for the prediction period.

The estimates of the recruiting year classes up to the 1991 year class from the VPA was accepted. Although the estimate for the 1991 year class is uncertain, a retrospective analysis showed that accepting estimates of stock number at age 3 in the last VPA year usually will be better than using the long-term average, whereas the estimates at age 2 are unreliable (Figures 5.3B and 5.3C). The long-term geometric mean recruitment of 210 million was used for the 1992 and subsequent year classes.

5.6.2 Biological reference points (Figures 5.4 and 5.1C)

Yield and SSB per recruit were based on the parameters in Table 5.16, except that the 1992-1994 average of weights at age (Table 5.15) were used for all age groups. Both $F_{0.1}$=0.09 and F_{max}=0.19 (Figure 5.1C) were markedly reduced compared to last year. The main reason for this is the change in exploitation pattern, with reduced mortality on the youngest ages. The plot of SSB versus recruitment is shown in Figure 5.4. The new maturity ogive did not change the main pattern in the plot. F_{low}=0.20 was unchanged, but F_{med}=0.36 increased slightly and F_{high}=0.63 considerably, but these estimates are also affected by changes in exploitation pattern and growth.

5.6.3 Projection of catch and biomass (Tables 5.17-5.19, Figure 51D)

The management option table (Table 5.17) shows that the expected catch of 165,000 t in 1995 will give a slight increase in fishing mortality to 0.40. Single option predictions for $F_{0.1}$, F_{max}, F_{med}, $F_{status\ quo}$ and F_{high} up to 1988 are given in Table 5.18. The *status quo* catch in 1996 is 158,000 t compared to a catch at F_{med} of 150,000 t. SSB will increase to 238,000 t in 1995 and further to 240,000 t in 1996, but will decrease in 1997 for fishing mortalities higher than 0.29, corresponding to a catch of

126,000 t. For *status quo* catch SSB in 1997 will be reduced to 212,000 t. However, this level is except for 1995 and 1996 still the highest since 1976. A further decline in SSB in 1998 is indicated for fishing mortality in excess of F_{med}. Detailed prediction for *status quo* F is given in Table 5.19.

5.7 MBAL (Minimum Biological Acceptable Level) (Figure 5.4)

In last year's report an MBAL of 150,000 t was suggested, based on the frequent occurrence of poor year classes below this level of SSB. The new maturity ogive gives somewhat higher historical SSB estimates and 150,000 t therefore now represents a less restrictive MBAL. It is not entirely inconsistent with last year's arguments, but 170,000 t would correspond better.

5.8 Comments on the Stock Assessment

The good agreement with last year's assessment is comforting, but should probably not be given too much weight. Nevertheless, the quality of the assessment seems to have improved. Prediction of growth has not usually been a problem for this stock, but may become one in the short term and some uncertainty about recruitment levels is likely to continue. Prediction of catches beyond the TAC year will to a large extent be dependent on assumptions of average recruitment. In view of this, management advice for longer periods than one year must be considered unreliable. However, if the fishing mortality is reduced this dependence will be less and multi-annual TAC advice might then be considered.

5.9 State of the Stock and Management Considerations

The stock has recovered after a long period of low stock size and is presently within safe biological limits. However, this trend is likely to be reversed in 1997 and some reduction in fishing mortality is advisable to prevent the SSB from being reduced to previous low levels. Reduction in the fishing mortality would also improve the stability in the fishery and increase the long-term yield.

6 *SEBASTES MENTELLA* IN SUB-AREAS I AND II

6.1 Status of the Fisheries

6.1.1 Historical development of the fishery

The only directed fishery for *Sebastes mentella* is a trawl fishery. By-catches are taken in the cod and especially the shrimp-trawl fisheries. Traditionally this fishery was conducted by Russia and other East European countries on grounds from south of Bear Island towards Spitsbergen. In the mid-1980s Norwegian trawlers started fishing along the continental slope (along 500 m depth) further southwards, on grounds never harvested before, and nearly only inhabited by mature fish. After a decrease in the landings up to 1987, this new fishery resulted in an increase in the landings until 1991, before the landings in 1992 declined to the present level.

6.1.2 Landings prior to 1995 (Tables 6.1-6.4, D1-D2, and Figure 6.1A)

Nominal catches of *S.mentella* by country for Sub-areas I and II combined are presented in Table 6.1, and for both redfish species in Table D1. The nominal catches by country for Sub-area I and Divisions IIa and IIb separately are shown in Tables 6.2-6.4. The total landings of *S. mentella* declined progressively from 115,383 t in 1982 to only 10,518 t in 1987, but showed an increase to 48,735 t in 1991. In 1992 the landings decreased again to only 15,587 t. The provisional total catch figure for *S.mentella* in 1994 is 12,114 t, which is close to the recent three years average level, but only 20% of the long-term (1965-1994) level. It is also close to what was expected by last year's Working Group.

The national landings statistics of redfish for Russia and Norway in all areas, and Germany in Sub-area IIb, are split into species by the respective national laboratories. For other countries (and areas), the Working Group has split the landings into *Sebastes mentella* and *Sebastes marinus* based on reports from different fleets to the Norwegian fisheries authorities. From this year's Working Group onwards the historical landings from Eastern and Western Germany have been added and presented under Germany.

Reliable estimates of species breakdown by area were available to the Working Group back to 1989. The landings of *S.mentella* have been decreasing in Sub-area I and Division IIb during the last three years, while the bulk of the catches, which are taken in Division IIa have remained fairly constant at the same time.

The redfish population in Sub-area IV (North Sea) is believed to belong to the North-East Arctic stock. Since this area is outside the traditional areas handled by this Working Group, the catches have not been included in the assessment. The landings from Sub-area IV have been about 1,000-2,000 t per year (Table D2). In 1992, however, the landings increased to 2,599 t due to an increase in the French fishery. Only preliminary total catch figures exist for the two most recent years due to no information from the French fishery. Historically these landings have been *S. marinus*, but since the mid-1980s trawlers have also caught *S.mentella* along the northern slope of this Sub-area.

6.1.3 Expected landings in 1995

On the basis of reports of landings from the first seven months of the year, landings expected for the whole 1995 are estimated to be at nearly the same level as in 1994 for *S. mentella*, i.e., 13,500 t. This will slightly increase the spawning stock, and thus be in accordance with the recommendation.

6.2 Status of Research

6.2.1 Fishing effort and catch-per-unit-effort (Tables 6.5-6.6)

Catch-per-hour-trawling data for the *S. mentella* fishery were available for the Russian PST vessels fishing in ICES Divisions IIa and IIb in 1993 and 1994, accounting for 37% and 39% of the total international trawl catch these years (Table 6.5). There is an increase from 1987 to 1990, while a 40% decrease is observed from 1990 to 1992. The fishery in 1993 which shows a higher CPUE is, however, not comparable with the years before since it was conducted by a low effort limited to the historically best fishing area and season. The decrease in 1994 to 0.74 tonnes/hour should, however, be comparable to 1993 since the fishery has been conducted in a similar way these two years.

Changes in CPUE are to a large extent caused by changes in effort. Estimates of total effort are based on Russian PST units raised to total international catch, showing an increase from 1987 to 1991, but a strong decline since then.

Catch-per-hour-trawling data from the Norwegian trawl fishery were available to the Working Group as a short series up to 1993, restricted to only one trawler that has long experience in the Norwegian fishery for *S.mentella* (Table 6.6). The average catch-rates show a decreasing trend since 1989, and was in 1993 about 68% of the 1989-level.

6.2.2 Survey results (Tables D4-D8, Figure 6.3A)

The results from the following research vessel survey series were evaluated by the Working Group:

1) The international 0-group survey in the Svalbard and Barents Sea areas in autumn (Table D4).
2) Russian bottom trawl survey in the Svalbard and Barents Sea areas in October-December from1978-94 in fishing depths of 100-900m (Table D5).
3) Norwegian Svalbard bottom trawl survey (autumn) from 1986-94 in fishing depths of <100-500m. Data disagregated on age only for the years 1992-94 (Table D6).
4) Norwegian Barents Sea bottom trawl survey (winter) from 1986-95 in fishing depths of <100-500m, and an acoustic survey at the same time. Data disagregated only on length (Table D7).
5) Russian acoustic survey in April-May from 1992-95 (except 1994) on spawning grounds in the western Barents Sea (Table D8).

The international 0-group fish survey carried out in the Barents Sea in August-September since 1965 does not distinguish between the species of redfish (Table D4). The survey design has improved, and the indices earlier than 1979 should, therefore, not be directly compared with subsequent years. A considerable reduction in the abundance of 0-group redfish was observed during the 1991 survey, down to only 1/4 of the 1979-1990 average. This was followed by further declines in both 1992 and 1993 before increasing in 1994 to about 1/2 the long term average.

The Russian bottom trawl survey shows weak and strong year classes (Tables D4-D5). The most recent estimates are among the lowest observed. The area outside Spitsbergen was not properly covered in 1993, and this may account for some lower values this year. These survey results are the only age disaggregated survey data used in the VPA-tuning and as the basis for estimating the recruitment in the assessment in recent years (Figure 6.3a).

Since 1981, a stratified random bottom trawl survey, aimed at cod and haddock, has been carried out by Norway in September in the Svalbard and Bear Island areas. Reliable splitting of the redfish specie s has been done since 1986, but until 1992 only data on length were available to the Working Group. After some good year classes 1988-1989, the survey shows weak 1991-1992 year classes. The time series on age was considered too short (only three years) to be included in this year's assessment.

Since 1981, a stratified random bottom trawl survey, aimed at cod and haddock, has been carried out by Norway in February in the Barents Sea. This has been combined with an acoustic survey. The results for *S.mentella* are only available on length. Based on length frequencies, year classes from 1987-1990 dominate, 1991-1993 year classes are weak, while an improvement is observed in the smallest length-group in 1995.

Russian acoustic surveys estimating the commercial sized and mature *S.mentella* stock has been conducted in April-May on the Malangen , Kopytov, and Bear Island Banks since 1986. Since 1992 the area covered has been larger, and data on age were available for the Working Group for this recent time period (except 1994). Table D8 shows a rather stable spawning stock biomass (90,000 - 114,000 tonnes) during the three survey years, and that the 1982-year class now appears in the spawning stock..

All youngfish surveys show the same year classes as strong and weak ones, and the weakness of the 1991-1993 year classes first observed as weak ones during the 0-group survey, has been confirmed.

6.2.3 Age readings

As a result of the process on harmonising the international age readings on redfish, all catches of redfish in 1992-1994 have been distributed on age according to otolith readings. An ICES Workshop continuing this work will be held in Bremerhaven 4-8 December 1995.

6.3 Data Used in the Assessment

6.3.1 Catch at Age (Table 6.7)

Since 1992, catch in numbers at age of *S.mentella* from Russia is based on otolith readings. The Norwegian catch-at-age back to 1990 is based on otoliths. Before 1990, when the Norwegian catches of *S. mentella* were smaller, Russian scale-based age-length keys were used to convert the Norwegian length distribution to age.

Catch at age for 1992 were revised according to new catch data. Catch at age for 1993 were revised according to new catch data and an updated catch at age distribution from Norway. Data for 1994 for *S. mentella* were only available from Norway, corresponding to 49% of the total landings. For Division IIa, German and Russian length distributions were available , and these were converted to age using Norwegian age-length keys. The landings from other countries were for each area distributed on age according to the available age distribution.

There is a reduction in the catches of ages 6-9 in 1993 and 1994 (Table 6.7). This is a result of a change in the Russian fishery from fishing in a wide area including the northern grounds with young fish in 1992, to a limited fishery on the spawning grounds in 1993 and 1994 (ref. chapter 6.2.1). The 19+ group is also becoming less. This probably has to do with the Norwegian fishery around 1990 fishing rather heavily on an old part of the stock accumulated over long time.

6.3.2 Weight at age (Tables 6.8)

Catch weight-at-age data for 1994 were available from Norway for ages 3-20+. Overall individual mean weights were available for the German and Russian catches in Division IIa. The weight-at-age data used in the assessment were weighted by the numbers caught at age by the countries (Table 6.8). As in previous assessments weight at age in the stock was taken to be the same as the weight at age in the catch.

6.3.3 Maturity at age (Tables 6.9 and D3)

Maturity-at-age ogives for *S.mentella*, sexes combined, are available from Russian research vessels in spring (Table D3). The same input as in last year's assessment was used for the years prior to 1993 (Table 6.9). For 1993 and 1994 an average of the 1992 and 1993 ogives was used.

6.3.4 CPUE-data for tuning (Table 6.10)

Regarding *S.mentella*, trawl effort and corresponding catch-at-age data were available for Russian PST-trawlers for the years 1982-1993, and these data were used for ages 9-18 (Table 6.10a). For 1994, the converted Russian catch-at-length data were used together with the available trawl effort.

Catch rates from the Russian bottom trawl survey in October-December are available on age back to 1978 (see Table D5), and the whole time series was used for ages 1-10 (Table 6.10b).

On the basis of catch-per-unit-effort from one Norwegian trawler for the years 1989-1993, total Norwegian trawl effort was calculated, and corresponding catch-at-age data were used for ages 8-18 (Table 6.10c).

Figure 6.3 A-C show the survey and CPUE indices used as input for the tuning plotted against VPA stock numbers.

The Russian acoustic series (Table D8) did only contain two useful years for the tuning, and the series was therefore considered too short to be included in this year's assessment.

A three year series from the Norwegian Svalbard survey (Table D6) was also considered too short a time series to be included this year. Some initial tuning runs, however, including this series did not change the VPA results, and in order to be able of running a retrospective analysis this series was omitted.

6.3.5 Recruitment indices (Tables 6.10b and D5)

In order to use the only data on recruitment of *S.mentella* available on age (Tables D5 and 6.10b), the Working Group decided to run the tuning VPA down at age 1. The strength of the 1990-1992 year classes in the prediction were set according to the VPA estimate and projected forward to age 6 taking account of natural mortality.

6.4 Methods Used in the Assessment

6.4.1 VPA and tuning (Tables 6.11, Figure 6.2)

For *S.mentella* the Extended Survivors Analysis (XSA) was used to tune the VPA (1-19+) to CPUE data down to age 1 (Table 6.11). The XSA analysis used survivor estimates shrunk towards the mean F of the final 2 years and 5 ages. The standard error of the mean to which the estimates were shrunk was set to 2.0. The catchability was fixed to be constant and equal above age 17. Catchability was set dependent on stock size for all ages younger than 7. The main reason for this was the observed regression slope of the Russian survey vs. VPA being clearly different from 1. The retrospective analysis showed that the assessment was fairly consistent (Figure 6.2).

6.5 Result of the Assessment

6.5.1 Fishing mortalities and VPA (Tables 6.12-6.16, Figures 6.1A,B)

The reference ages for presenting of the fishing mortality was changed from ages 10-15 to ages 10-16 in this year's assessment. This was done in order for the average mortality over ages to better reflect the fishery. A detailed Y/R-output showed that with the present fishing pattern ages 10-16 contributed 50-70% of the Y/R dependent on fishing mortality, while ages 10-15 contributed 40-55%.
Fishing mortalities, stock numbers, and stock biomasses from the tuning VPA are given in Tables 6.12-6.16 and Figure 6.1A and B. The fishing mortality ($F_{10\text{-}16}$) in 1994 is 0.085. The large variations in F in recent years is consistent with changes in the fisheries.

The assessment confirmed that the 1981-1983 year classes are stronger than those just before and after. Running the VPA down to age 1 also estimated the strength of the 1988-1989 year classes at a similar level as the 1981-1983 ones. This is consistent with survey observations not used in the tuning. Norwegian acoustic and bottom trawl surveys on length show that these year classes are stronger than the surrounding ones. Russian qualitative observations of young redfish in cod stomachs indicate, however, that the 1988-1989 year classes may be slightly weaker than the 1981-1983. A slight improvement of the spawning stock is observed due to the 1981-1983 year classes now entering the spawning stock.

6.6 MBAL - Minimum Biological Acceptable Level (Figures 6.1B and 6.4)

The stock and recruitment plots (Figures 6.1b and 6.4) reveal a fairly close relationship between recruitment and SSB. Some deviations from this close relationship seem to have occurred in the 1960s and 1970s, but this may well be due to an imprecise maturity ogive. The plus-group also contribute a great deal to the SSB, and the contribution is variable from year to year, up to 30-40% in some years. If the plus-group is not included in the recruitment-SSB plot the relationship between recruitment and SSB will be even closer. A SSB of about 300,000 t seems to be required to consistently produce average or good year classes.

6.7 Prediction of Catch and Biomass

6.7.1 Data used in the prediction (Table 6.17)

Input to the prediction is shown in Table 6.17. Population numbers in 1995 are those calculated by VPA. For the 1989-1991 year classes the strength at age 6 has been set equal to that from the VPA run down to age 1, and projected forward to age 6 accounting for natural mortality only. The average fishing mortalities for the years 1992-1994, scaled to the 1994 level so that this level corresponds to an F-factor of 1, were used as the input exploitation pattern. A new maturity ogive was available for 1995. Since the relatively strong 1982-year class now contributes more and more to the spawning stock (see Table D8) and thus may have an impact on the ogive in near future, a recent 1994-1995 average maturity ogive was used as input to the prediction. Weight-at-age in the catch has been set equal to the average weight-at-age from the catches in 1992-1994. Weight-at-age in the stock has been set equal to the weight-at-age in the catch.

6.7.2 Biological reference points (Figures 6.1C and 6.4)

Yield and SSB per recruit were based on the parameters in Table 6.17. The calculations gave $F_{0.1}$=0.06 while the F_{max}=0.76 was hardly defined (Figure 6.1C). From a stock and recruitment plot (Figure 6.4) the reference points F_{low}=0.022, F_{med}=0.076, and F_{high}=0.187 were calculated. The different $F_{0.1}$ and F_{max} compared to last year's assessment is due to the different reference ages, and to a minor degree a change of the input exploitation pattern.

6.7.3 Projections of catch and biomass (Tables 6.18-6.19 and Figure 6.1D)

A *status quo* fishing mortality in 1995 will yield a catch (13,834 t) at the same level as that expected from the reportings during the seven first months. The management options (Table 6.18) show that such a *status quo* fishing mortality (=F_{94}) will lead to a slight increase of the spawning stock.. Table 6.19 show predictions up to 1998 with no fishing and the single options F_{low}, F_{med}, and F_{94} (*status quo*) . The catch in 1996 and SSB in 1997 for various levels of F in 1996 are shown in Figure 6.1D.

6.8 Comments on the Stock Assessment

The fact that the catch-at-age data now are based on the same age reading method improves the assessment. Although there seem to be some "leakage" of strong year classes to adjacent ones, thus making it difficult to estimate the exact size of each of these, it is possible to see the same year classes appearing as stronger ones also in the catch at age data. The three series used for tuning the VPA gave consistent results compared to last year's assessment and as seen from the retrospective analysis. Running the VPA down to age 1 to get direct advantage of the survey results is making the assessment more consistent. In fact, the present assessment reflects the survey where strong year classes appear to be identifiable (e.g., the 1981-1983 and 1988-1989 cohorts). The work has also shown that research surveys should be promoted and results presented on age. At least two more survey series will probably be available for next year's Working Group to consider as input.

6.9 Stock Summary

6.9.1 State of the stock

The Working Group concluded that this stock is below acceptable biological limits. The analytical assessment indicates that the spawning stock is at a historical low level, less than 30% of the anticipated MBAL of 250,000-350,000 t, although a slight improvement may be expected in the near future due to the 1981-1983 year classes. Relatively abundant 1988-1989 year classes were observed in the surveys, but these will not recruit to the spawning stock for many years. The historical low 0-group indices in 1991-1993, which also have been confirmed in more recent bottom trawl and acoustic surveys, give additional cause for concern. It was shown that these weak year classes will give recruitment estimates at age 6 of less than 100 mill. specimens. This low level has only been observed four times before in the time series of 30 years.

6.9.2 Management considerations

The assessment indicates a strong stock-recruitment relationship, and increasing the spawning stock should directly result in increased recruitment. The Working Group advises that the spawning stock biomass should be rebuilt to the MBAL of 250,000-350,000 t, and it is important that necessary steps be taken to reach this goal while some good year classes are observed in the stock. Nevertheless, slow individual growth typical of redfish will make rebuilding a lengthy process.

The Working Group therefore advises that a cessation of fishing is the most appropriate measure to allow for rebuilding of this stock from its currently low level.

In order to monitor the stock in such a rebuilding phase, it is of vital importance that scientific surveys be encouraged. The surveys should be either stratified-random bottom trawl surveys or acoustic surveys covering the entire area of the stock distribution.

7 *SEBASTES MARINUS* IN SUB-AREAS I AND II

7.1 Status of the Fisheries

7.1.1 Historical development of the fishery

The fishery is mainly conducted by Norway accounting for 80-90% of the total catch. Germany has also long traditions in a trawl fishery for this species. The fish are mainly caught by trawl and gillnet, and to a lesser extent by longline and handline. Some of the catches are taken in mixed fisheries together with saithe and cod. Important fishing grounds are the Moere area (Svinoey), Halten Bank, outside Lofoten and Vesteraalen, and at Sleppen outside Finnmark. Traditionally, this is the most popular and best paid redfish species.

7.1.2 Landings prior to 1995 (Tables 7.1-7.4, D1)

Nominal catches of *S.marinus* by country for Sub-areas I and II combined are presented in Table 7.1, and for both redfish species in Table D1. Landings of *S. marinus* showed a decrease in 1991 from a level of 23,000-30,000 t in 1984-1990 to less than 20,000 t in 1991-1993. The provisional total catch figure for *S.marinus* in 1994 is 16,817 t, which is close to the recent four years average level, and 70% of the long-term (1965-1994) level. It is also close to what was expected by last year's Working Group.

Regarding splitting of the redfish landings on species and area, see chapter 6.

7.1.3 Expected landings in 1995

On the basis of reports of landings from the first seven months of the year, landings of *S.marinus* expected for the whole 1995 are estimated to be at nearly the same level as in the three most recent years, i.e., 16,500 t. This will be in accordance with the recommendations.

7.2 Status of Research

7.2.1 Fishing effort and catch-per-unit-effort (Tables 7.5)

Data for *S. marinus* were available for Norwegian fresh fish trawlers since 1981 (Table 7.5) from which the total international effort was estimated. This series is based on GLIM analysis on data from each month from five Norwegian statistical areas along the Norwegian coast. Difficulties related to the splitting of the redfish species in the catches may still be the reason for big fluctuations in the series although typical *S.mentella* grounds have been sorted out. A somewhat lower effort is observed since 1991, and except for a few years with high catch-rates and a low catch-rate in 1989 (very high effort), the CPUE has been rather stable. Provisional figures for 1992 -1994 are close to the 1981-1993 average of 0.42 t/hour.

7.2.2 Survey results (Tables D9-D11)

The results from the following research vessel survey series were evaluated by the Working Group:

1) Norwegian Svalbard bottom trawl survey (autumn) from 1986-94 in fishing depths of <100-500m. Data disagregated on age only for the years 1992-94 (Table D9). This survey covers thenorthernmost part of the species' distribution.
2) Norwegian Barents Sea bottom trawl survey (winter) from 1986-95 in fishing depths of <100-500m, survey covers important nursery areas for the stock. Data disagregated on age for the years 1992-94 are shown in Table D10, and on length for the years 1986-95 in Table D11.

These surveys were also described in chapter 6. Both surveys show a fairly stable stock situation.

7.2.3 Age readings

An ICES Workshop on harmonizing the international age readings on redfish, incl. *S.marinus*, will be held in Bremerhaven 4-8 December 1995.

7.3 Data Used in the Assessment

7.3.1 Catch at age (Tables 7.6)

Age composition data for 1994 (based on otoliths) were only provided by Norway, accounting for 83% of the total landings. In Subarea I the catches were distributed on age according to the Norwegian age distribution. In Division IIa German and Russian catch-at-length were converted to age by using a Norwegian age-length key for trawl, and other countries' landings were distributed on age using the German age distribution. In Division IIb, landings by Russia and other countries were distributed on age according to the German length distribution converted to age using the Norwegian age-length key for trawl in this Division.

The total catch-at-age data back to 1991 are based on Norwegian otolith readings. In 1989-1990 it is a combination of the German scale readings on the German catches, and Norwegian otolith readings for the rest. In 1984-1989 only German scale readings are available, while in the years prior to 1984 also Russian scale readings exist.

7.3.2 Weight at age (Tables 7.7)

Weight-at-age data for ages 7-24+ were available from the Norwegian landings in 1994 (Table 7.27).

7.3.3 Maturity at age

A maturity ogive was not available for *S. marinus*, and a knife-edge maturity at age 15 was assumed.

7.3.4 CPUE-data for tuning (Table D9-D10)

Two preliminary series of *S.marinus* catch rates from the Norwegian bottom trawl surveys at Svalbard (August-September) and the Barents Sea (February) are available on age for three years back to 1992. For both surveys the whole time series was used for ages 2-15 (Tables D9-D10).

On the basis of catch-per-unit-effort from Norwegian fresh fish trawlers since 1981 (Table 7.5), total Norwegian trawl effort was calculated, and corresponding catch-at-age data were used for ages 9-23.

7.4 Methods Used in the Assessment

Attempts were made to evaluate the status of the *S.marinus* stock using an Extended Survivors Analysis (XSA), however, without success.

7.5 Result of the Assessment

Variations in the survey indices from year to year clearly did not confirm the changes in the catch matrix, and thus the indices only lead to an estimation of constant VPA figures. No reliable assessment were therefore possible to make.

7.6 Comments on the Stock Assessment

Regarding *S.marinus*, an improvement of the CPUE-series from the Norwegian trawl fishery by further analyses of changes in CPUE in fishery sub-areas should be further investigated. Although the survey data on age available for three years were not sufficient for conducting an assessment this year, further improvements of the time series are encouraged.

7.7 State of the Stock and Management Considerations

The survey abundance at age time series is too short (3 years) to relate the recent recruitment to any average level. However, modal length data from surveys available for a 10 year period show no indication of recruitment failure or changes in the overall stock level in the area surveyed. The Working Group therefore advises that a precautionary catch similar to recent catch levels could be taken in 1996.

8 GREENLAND HALIBUT IN SUB-AREAS I AND II

8.1 Status of the fisheries

8.1.1 Landings prior to 1994 (Tables 8.1 - 8.5, E7, Figure 8.1A)

Before the mid 1960s the fishery for Greenland halibut was mainly a coastal long line fishery off the coasts of eastern Finnmark and Vesterålen in Norway. The annual catch level of this fishery has been about 3,000 t and this level has been maintained into recent years, although gillnets are used now also in the fishery. Following the introduction of international trawlers in the fishery in the mid 1960s, the landings increased to a level of about 80,000 t in the early 1970s. However, the landings decreased steadily to a level of about 20,000 t during the early 1980s. This level was maintained until 1991, when the catch increased sharply to 30,000 t.

From 1992-95 this fishery has been regulated by allowing only the long line and gillnet fisheries to be directed for Greenland halibut and only using vessels smaller than 27.5m. Trawl catches were limited to by-catch only at a level of 10% in weight in each haul up to the autumn of 1994. A level of 5% by-catch of Greenland halibut onboard at any time has been put into effect for Norwegian vessels in 1995. This has reduced the overall landings to about 10,000 t. In the Russian trawl fishery for cod and redfish the by-catch of Greenland halibut is less than 1,000 t.

Nominal catches by country for Sub-areas I and II combined are presented in Table 8.1. For most countries the catches listed in the table are similar to those officially reported to ICES. However, for Norway the values in the table vary slightly from the official statistics and Russian catches for 1990-1991 represent those presented to the Working Group by Russian scientists. Landings separated by gear type are presented in Table 8.5.

The nominal catches by country for Sub-area I and Divisions IIa and IIb separately are shown in Tables 8.2-8.4. The revised total catch for 1993 is 11,879 t which is virtually unchanged from that used in the previous assessment. The preliminary estimate of total catch for 1994 is 8,831 t. This is considerably lower than the projected catch of 14,500 t estimated by the Working Group during its 1994 meeting. This large discrepancy is believed to be mainly a result of the new and more limited by-catch restrictions (from 10% to 5%) introduced to the Norwegian trawler fishery in the autumn of 1994 although the Russian catch is also down by about 1,000 t compared to 1993. Nominal catches decreased in both Division IIa and Sub-area I while in Division IIb the catch increased somewhat compared to 1993.

The landings of Greenland halibut caught by shrimp trawl have been reduced in recent years by the use of sorting-grids.

In recent years, some fishing for Greenland halibut has taken place in the northern part of Division IVa. In the period 1986-1990, the catch in Division IVa was well below 100 t each year, but increased to 267 t in 1991, 645 t in 1992, 875 t in 1993 and 833 in 1994 (Table E7). The increase up to 1991 was mainly due to a gill-net fishery, but in the recent years nearly 50% has been taken by trawl. This fishery is in another management area, and is not restricted by any TAC regulations. Although there is a continuous distribution of this species from the southern part of Division IIa along the continental slope towards the Shetland area, little is known about the stock structure, and the catch taken from this area has therefore not been added to the catch from Subareas I and II.

Also around Jan Mayen small catches of Greenland halibut have been taken in some years. In 1992, 56 t were taken, while nothing was reported taken in this area in 1993. In 1994, 140 t was reported. The fishery is mainly by gillnets. Jan Mayen is within Sub-area IIa, but little is known about the relationship with the stock assessed by Working Group. Therefore, the catches from this area have not been included in the catches given for Sub-area II.

8.1.2 Expected landings in 1995

Quotas were set by Norwegian authorities to limit the landings in 1995 as much as possible, allowing a fixed gear fishery of about 2.5 thousand t and a by-catch in the trawl fishery not to exceed 5% of catches onboard any vessel at any time. It is anticipated that about 8,000 t will be caught by Norway. An additional 1,000 t is expected to be caught by Russian vessels.

The catches from Division IVa is expected to be maintained at the same level as in recent years.

8.2 Status of Research

8.2.1 Fishing effort and catch-per-unit-effort (Table 8.6 and E5, Figure 8.2D)

The severe regulations imposed on the trawl fishery after 1991 resulted in a disruption of the traditional time series of commercial CPUE data. However, an attempt to continue the series was made by a research programme using trawlers in a limited commercial fishery (Tables 8.6 and E5, figure 8.2D). This comprises fishing during two weeks in May-June and October, representing an effort somewhat less than 20% of the 1991 level. This fishery was, to the extent possible, conducted in the same way as the commercial fishery in the previous years.

The CPUE from this experimental fishery was found, however, to be considerably higher than in the traditional fishery and has shown an increasing trend since its inception in 1992 up to and including the first half of 1995. Although it is difficult to fully reconcile this trend in terms of other stock indicators all of which suggest a declining stock, there are some possible reasons that could explain this increase, at least in part. They are: 1) less competition in the traditional fishing areas for Greenland halibut as a result of a substantial reduction in directed fishing effort since 1991, 2) increased availability of the fishable stock (mainly ages 6-10) also due to much reduced effort in recent years, and 3) since the experimental fishery occurs mainly in deeper water (600-800m) the catch rates may be more reflective of higher density if a shift in distribution to deeper water has taken place. The latter, of course, requires further investigation to fully evaluate its merits.

Although the Working Group could not treat the CPUE from this fishery as an extension of the commercial time series it did feel that the new data series alone would be helpful in stabilizing the VPA in the older ages. Its overall effect on the assessment would still be relatively small as it is the size of the pre-recruit year-classes that is of utmost concern.

8.2.2 Survey results (Tables A12, E1-E4, Figures 8.2A-C)

The results from the following research vessel survey series were evaluated by the Working Group:

1) Norwegian Svalbard bottom trawl survey (autumn) from 1984-94 in fishing depths of <100-500m. (Table E1, figure 8.2A)
2) Russian bottom trawl survey in the Barents Sea from 1990-94 (except 1991) in fishing depths of 100-900m. (Table E3, figure 8.2B)
3) Norwegian Svalbard shrimp trawl survey from 1988-94 in fishing depths of 200-600m. (Table E4, figure 8.2C)

The age compositions from the Norwegian Svalbard bottom trawl survey indicate that the survey caught Greenland halibut mainly in the range of 1-8 years old although in most cases age 1 was poorly represented. The age distribution in the earlier period was highly variable, however, for the period 1984-91 the overall abundance in most years was relatively high compared to 1992-94. Beginning in 1989 the cohorts at ages 2 and 3 began to decline considerably compared to earlier years. Ages 4-6, nevertheless, remained rather stable until about 1991 after which they also declined to much lower levels in 1992 and has remained at the lower levels since then. Ages 7-8 did not vary greatly throughout the entire period which is difficult to fully explain in light of the apparent declines in year-class strengths at younger ages unless the survey measures the abundance of these older ages less effectively.

The Russian Barents Sea bottom trawl survey caught fish mainly in the range of 4-9 years old. The overall abundance declined rather systematically from 1990-94 largely as a result of declines in the presence of Greenland halibut in the age range of 4-6. The abundance of ages 7-9 showed little variation from 1992-94.

The Norwegian Svalbard shrimp survey caught fish mainly in the age range of 1-8, however, it appeared to be particularly effective in measuring the abundance of Greenland halibut younger than age 6. Cohorts at ages 1 and 2 began to decline significantly since about 1989. All subsequent year-classes and these cohorts at older ages were estimated to be in extremely low abundance in recent years.

All three surveys showed some evidence that the 1985-87 year-classes are much stronger than any subsequent year-classes. There is no suggestion, however, that these are any stronger than average and that they only appear so relative to the extreme weakness of the ensuing year-classes.

8.2.3 Ageing discrepancies

Considerable concern has been raised regarding the age interpretations of Greenland halibut. This was particularly evident throughout the course of evaluating the current assessment data with respect to estimates of abundance of age 9 especially. Although a solution to the problem was not readily apparent it was noted that the age reading problem with Greenland halibut was not restricted to the North East Arctic stock but is an issue of concern Atlantic wide. In order to correct the problem some steps have already been taken including otolith exchanges among various countries. It is generally believed, however, that an age reading workshop is the best potential solution for consistency among ageing interpretations of the species and eliminating bias.

8.3 Data Used in the Assessment

8.3.1 Catch at age (Table 8.7, Figures 8.3 A and B)

The catch-at-age data for 1993 were updated using revised catch figures and revised Norwegian age composition. Catch-at-age data for 1994 were available from both the Norwegian and Russian fisheries. These were combined and adjusted to reflect the total international landings (Table 8.7). The commercial age compositions are shown in Figure 8.3A for 1984-94 Greenland halibut are usually caught in the range of 3-16 years old, but the catch is mainly dominated by ages 6-10. In some years (especially 1989-91) ages 4 and 5 were caught also in significant numbers. Generally, fish older than age 12 have comprised a very low proportion of the catch during this period although they are proportionately higher in the most recent years (Figure 8.3B). The Working Group observed that there is an apparent ageing discrepancy in the data particularly related to age 9 similar to that seen in the survey data.

8.3.2 Weight at age (Table 8.8)

A constant set of weight-at-age data was used for all years in the period 1970-1978. For subsequent years annual estimates were used. The mean weight at age in the catch in 1994 (Table 8.8) was calculated as a weighted average of the weight in the catch from Norway and Russia. The weight-at-age in the stock is set equal to the weight at age in the catch for all years.

The weights at ages 1 and 2 are set to 0 to indicate that the ages are only used for tuning and are not included in the stock biomass.

8.3.3 Maturity at age (Tables 8.9 and E6)

An average maturity ogive derived from Russian data (Table E6) from 1983-1987 was used for 1970-1987. For 1988 and 1989 a three-year running average was used. As no appropriate data were available for 1991 and 1992, the average of the 1989 and 1990 ogives was adopted for 1990-1992. Russian maturity ogives, sampled in November-January, 1993-1994 and December-January, 1994-95 were averaged and used to represent both 1993 and 1994.

8.3.4 CPUE-data for tuning (Table 8.10)

The following abundance indices were used for tuning the VPA:

1) Norwegian Svalbard bottom trawl survey (autumn) from 1984-94 for ages 1-8.
2) Russian bottom trawl survey in the Barents Sea from 1990-94 (except 1991) for ages 4-9.
3) Norwegian Svalbard shrimp trawl survey from 1988-94 for ages 1-8.
4) Experimental commercial fishery from 1992-94 for ages 5-14.

8.3.5 Recruitment indices (Tables A12,E1-E4)

In addition to the indices mentioned in section 8.3.4 the 0-group indices from the International 0-group survey (Table A11) were available for recruitment estimation. All the indices seem to indicate extremely low recruitment in the last few years. The indices of age groups 1-4 from the 1993 Svalbard trawl survey are at the same low level as in 1992 and much lower than in the years prior to 1992. This picture is also confirmed by the Svalbard Shrimp survey, and this survey covers deeper waters where Greenland halibut is expected to be found. The 0-group indices of the 1989-1993 year classes are also less than half of any of the indices in the 1978-1987 period, when the recruitment was stable. This indicates that the recruitment of the year classes 1988 and later appear much lower than the level experienced in the period 1978-1987. There are indications of improved recruitment in the 0-group indices of the 1993 and 1994 year-classes, however, further observations at older ages are desired before full confidence in their strength can be established.

The recruitment indices, except for the 0-group survey, are included in the CPUE data used for tuning. The 0-group survey is used to estimate the year class strength of the 1994 year-class and the average to use in the predictions.

8.4 Methods used in the Assessment

8.4.1 PA and tuning (Table 8.11, 8.12)

The Extended Survivors analysis (XSA) was used to tune the VPA to the indices identified above. The analysis used survivor estimates shrunk towards the mean of the final 2 years and 5 ages and the standard error of the mean to which the estimates were shrunk was set at 2.0. These values are similar to those used in the previous assessment and the Working Group considered them still to be most appropriate for this stock.

The catchability was assumed to be dependent on stock size for ages 1-3 and independent on stock size for all other ages. This was evaluated in trial runs allowing all ages to have stock dependent catchabilities. The catchability was fixed to be constant above age 12 compared to age 8 in the 1994 assessment. The Working Group felt that with an apparent ageing discrepancy at age 9 in nearly all data and the inclusion of a new tuning index with many older age groups, it was more realistic to allow the catchability of these older ages to be determined empirically by the data analysis.

The diagnostics of the tuning are given in Table 8.11. The results of this analysis continue to show that there is no indication of stock dependency in the survey indices of the recruiting ages. The population numbers from the XSA extended to age 1 is given in Table 8.12.

8.5 Results of the Assessment

8.5.1 Fishing mortalities and VPA (Tables 8.13-8.15, Figures 8.1A, B)

The fishing mortality (F) matrix indicates that Greenland halibut were fully recruited to the fishery historically at about age 6 while in recent years it appears full recruitment is more in the range of age 10. This is likely due to a substantial proportionate reduction in trawler effort since 1991 which catches more young fish compared to gillnets and longlines which usually catch larger fish. Nevertheless, F on ages 6-10 still represents the average fishing mortality on the major age groups represented in the fishery.

The fishing mortality (F_{6-10}) was relatively high in 1970-71 (about F=0.42) then generally declined until 1981, when it reached a level of about F=0.15. From that time it increased until 1991, when it peaked at F= 0.62. Following the drop in the catches and more importantly effort in 1992, the F_{6-10} in that year was estimated to be about F=0.20 and remained near that level (F=0.23) in 1993. The fishing mortality levels estimated in the current assessment are quite similar to those presented by the Working Group in 1994. The F level estimated for the 1994 fishery is $F_{6-10} = 0.15$ which is consistent with a further reduction in catch and fishing effort in the last quarter of the year with the introduction of stricter by-catch regulations in the Norwegian trawler fishery.

8.5.2 Recruitment (Table A12)

The inclusion of surveys in the tuning and extending the ages down to age 1 seem to give results that fully reflects the trends in the surveys. The earlier recruitment of this stock seems to have been quite stable until it virtually collapsed in recent years. The 1989 - 1993 year classes are estimated to be 8.1, 2.9, 4.3, 3.5 and 4.6 million individuals at age 3 respectively compared to the long term average of about 27 million individuals. These figures are somewhat higher than those estimated last year. This is well explained by allowing the catchability of the surveys to be dependent on stock size for ages 1-3. In general, this will increase the estimated level of recruitment of weak year-classes and this is also seen in the analysis.

Concerning the 1994 year class, only the 0-group index is available (Table A12) and the RCT3 program was run using these indices and the XSA figures at age 1 from 1974 - 1994, the 0-group index shifted one year to age 1. This did not give a believable estimate of recruitment and it was decided to use the recent average recruitment estimated from the RCT3 program. This gave a logarithmic value of 9.72. Reduced by natural mortality this gives an recent average recruitment at age 3 of 12.1 million individuals. This is also used for the following year classes in the prediction. It is somewhat higher than in the recent years, but an increased recruitment at least, is supported by the 0-group survey.

8.5.3 State of the stock (Table 8.16)

A summary of the historical series of landings, fishing mortalities, stock biomasses and recruitment from 1970-1994 is given in Table 8.16.

The spawning stock was stable at around 60,000 t in the period 1976-1987 but was subsequently reduced to a level around 40,000 t in 1992-1994. This is the lowest level experienced in the time series. The lack of recruitment observed in the recent years indicates that the spawning stock biomass is currently below the level required to ensure historic recruitment level. This may be seen in the stock and recruitment plot in Figure 8.2B. The total biomass of the stock has been relatively stable (around 100,000 t) since 1982, but the recent low recruitment have led to a decrease to about 60,000 t in 1994.

The stock is clearly below safe biological limits and the spawning stock will be further reduced as the series of poor year-classes mature.

8.6 Principles for Management

8.6.1 MBAL considerations (Figure 8.5)

Considering the spawning stock- recruitment relationship (Figure 8.5) it is clear that a spawning stock below 65,000 t results in recruitment failure. Although there are uncertainties associated with the recruitment estimates of this stock, a Minimum Biological Acceptable Level for this spawning stock should be set to 65,000 t as a conservative measure.

8.6.2 Biological reference points (Figure 8.1C and D)

Yield and spawning stock biomass-per-recruit have been calculated using the data which are input to the prediction, and the results have been presented in Figure 8.1 C. The values of $F_{0.1}$ and F_{max} are 0.04 and 0.08, respectively, which are lower than last years estimates.

Using the stock-recruitment relationship shown in Figure 8.5 the values of F_{low}, F_{med} and F_{high} were calculated as 0.01, 0.12 and 0.25, respectively. The F_{med} is the same value as estimated last year, whereas F_{high} is somewhat lower. F_{low} was not estimated last year.

For managing the stock in consideration of these biological reference points, only the F_{low} value is advised, as this value has proven to be a good reference measure for rebuilding other stocks, e.g.. North East Arctic Cod. However, the value of F_{low}=0.01 estimated from the spawning stock - recruitment relationship is very close to zero. This catch level is probably equal to the level of by-catch that can not be avoided what ever restrictive regulatory regime that may be enforced.

8.7 Prediction of Catch and Stock

8.7.1 Data used in the prediction (Table 8.17)

In order to predict the stock development and potential catches only recent average values of the parameters needed are available. It would be preferable to have predictions of both recruitment and growth, but at present projecting these parameters into the future for Greenland halibut is not possible.

Input data used in the short-term prediction for 1994-1996 are shown in Table 8.17. Population numbers in 1994 are taken from the VPA. The recruitment is as estimated in the VPA and the RCT3 program. For unobserved year classes a recent average estimated from the RCT3 programme is used (see section 8.5.2).

The exploitation pattern used is the average of 1992-1994 scaled to give an F-factor of 1.0 corresponding to the 1994 fishing level. The maturity ogive is the average of the 1992-1994 ogives. Weight at age in both the catch and the stock has been set equal to the weight at age in the catch averaged for the years 1992-1994.

8.7.2 Projections of catches and biomass (Table 8.18, 8.19, Fig. 8.1D)

The expected catch in 1995 is very close to *status quo* catch, i.e. 8900 t. Therefore *status quo* F=0.15 is used in 1995 in the prediction and in the management option table. The spawning stock biomass will continue to remain at the recent low level in 1996, i.e. 43.4 thousand t but will be reduced in 1997 at fishing levels about *status quo*.

Medium-term predictions from 1995 to 1999 were run using the same input as in the short-term prediction, for no fishing, 0.2**status quo*, 0.6**status quo* and *status quo* F , giving F's of 0.0, 0.03, 0.09 and 0.15 respectively. In addition F_{med}=0.12 (0.83**status quo*) have been used. The results are given in Table 8.19 and Figure 8.1D. If fishing at F *status quo* the spawning stock biomass will be reduced from 44.5 thousand t in 1995 to below 30 thousand t in 1999, while the spawning stock biomass will increase to above 60 thousand t if no fishing is conducted. Still the spawning stock will be below the advised MBAL level in 1999.

8.8 Comments on the Results of the Assessments and Predictions (Figure 8.6)

This assessment is relies mainly on observations from the surveys for the younger, recruiting ages, i.e. the upper right corner of the VPA tables. In Figure 8.4 is shown the relationship, as a result of tuning procedures, between the survey indices and the resulting VPA. Also included is the CPUE series for the older ages, but they are mainly included to allow for use of the full age range. It is clear from these plots that the surveys generate the trend in the younger ages, whereas no reliable trend at all is generated from the CPUE index. However, technically, these CPUE indices give the necessary input to providing stability in the tuning iterations, thus providing estimates of input F values for the VPA.

The spawning stock versus recruitment (SSB/R) plot shows a strong S-shaped relationship. The recruitment seem to drop very rapidly at a spawning stock levels below 65 thousand t. The maturity ogives that have been used are a combined maturity of both sexes. However, for Greenland halibut there is a considerable difference in maturation between the sexes. Some data provided by Working Group-members is presented in Figure 8.6 in order to illustrate this. These data are insufficient to construct a separate maturity ogives for males and females for use in the assessment, but they give an indication that the production of eggs may very well not be in accordance with the spawning stock estimates given in this years report. The data show that 50% of males are mature at an age of about 6 years, whereas females are about 10 years old at 50% maturity. The Working Group expects to provide estimates of the female component of the spawning stock at next years meeting. These estimates could very well alter the level of MBAL set earlier in this report but would not change the conclusions about the overall state of the stock at present.

The average recruitment used in the prediction, i.e. 12.1 million individuals, is somewhat higher than the recent recruitment level. There are very early indications of improved recruitment in the most recent years. With regards to the above mentioned aspects of the spawning stock, it is quite clear that great care must be taken to ensure that there are females surviving to recruit to the spawning stock.

Both the 1994 and 1995 assessments have given consistent results. No retrospective analyses have been performed due to the short time series of the tuning data used in the assessment. The Working Group is confident that the assessment is reliable and consistent and could form the basis of management advice.

8.9 Stock Summary

It is concluded that the stock is at a level below acceptable biological limits. Due to the recent series of extremely poor recruiting year-classes observed for this stock, and in order to allow for rebuilding the spawning stock, a cessation of fishing is advised for at least a two year period.

8.9.1 Multiannual catch options

The current assessment is consistent with that of 1994 and indicates that recruitment to the stock still continues to be extremely poor. Considering that the advice recommends cessation of fishing for at least two years (1996 and 1997) it is believed to be of little value to provide catch options for future years until significant improvement in the well-being of this stock can be demonstrated. Since the fishery is ongoing in 1995 a detailed assessment in 1996 is warranted. However, should a cessation of fishing be implemented as advised, a detailed annual analytical assessment without a fishery is thought to be unnecessary. Nevertheless, the stock status should be closely monitored through research surveys and the data fully evaluated to detect changes.

9 COASTAL COD IN SUB-AREA I AND II

During the autumn 1994 the coastal areas off Trondelag and Møre were surveyed (Figure 9.1), (ICES Sub-area IIa - Norwegian statistical areas 06 and 07) (Figure 9.2). This concluded the investigation on distribution of Coastal cod from the Russian border to 62° N carried out over a three year period. In 1992 the Finnmark and Troms coastal areas were surveyed and resulted in a biomass estimation of 78,000 tonnes of Coastal cod. In 1993 the coastal and shelf areas off Nordland were surveyed and similarly 100,000 tonnes was estimated, however, those two areas were not investigated in 1994 (Eliassen *et al.*, 1993; 1994; 1995).

The Trøndelag and Møre area surveyed in 1994 covered an area off middle Norway between 66° and 62° N. This autumn survey targeting cod, was expected to comprise mostly Coastal cod compared to the general seasonal distribution pattern of the North-East Arctic cod. The previous two surveys in 1992 and 1993 were also conducted in autumn for similar reasons (Anon 1994; 1995). In the assessment of the Coastal cod the 1994 acoustic trawl survey results will be evaluated in addition to the data from 1993 and 1992.

During the most recent years Norway and Russia has increased the investigations on the Norwegian Coastal cod and the Murman cod. The two parties are cooperating in this research.

9.1 Data from the Landings (Table 9.1)

Catches from the high seas, fjords and coastal areas in ICES Division I, IIa and II b are used in the North East Arctic cod stock assessments, except from the catches in ICES Division IIa, Norwegian statistical areas 05 and 00 (Quarter 3 & 4), 06 and 07 (all year) (Table 9.1). The catches given in table 9.1 are not separated into Coastal cod and North-East Arctic cod, but are allocated to Coastal cod due to a Working Group definition (Anon 1975).

9.2 Survey Results

9.2.1 Length and weight in the stock (Tables 9.2 to 9.5)

Up to 6 years of age the weights of the Coastal cod seem to be rather similar for the three areas (Table 9.5). Generally the length and weight of Coastal cod in the Nordland and Trøndelag-Møre area were found to be larger than the Coastal cod in Finnmark for the age group 7 and older (Tables 9.2 to 9.5) (Eliassen *et al.*, 1993; 1994; 1995). Compared to the investigations in Finnmark-Troms in 1992, there were fewer specimens present in Nordland, Trøndelag and Møre older than 7 years. As in the northern areas, there are variations in both length and weight of Coastal cod among the different areas off Trøndelag and Møre.

9.2.2 Maturity ogives (Table 9.6)

The maturity ogive for the Coastal cod in the Trøndelag-Møre area indicate an average age at 50 % maturity of 4.5 years of age (Table 9.6), and this was also the general indications in the more Northern areas when surveyed in 1992 and 1993 (table 9.6). To few data from Trøndelag-Møre were available to allow a reliable calculation of an age at 50 % maturity by area. Based on the data available during the period 1992-1994 for the coastal area from the Russian border to 62° N, the Coastal cod do seem to have a significant lower age of 50 % maturity of about 4.5 years compared to about 7 years for the North-East Arctic cod (Anon, 1994; 1995; Eliassen *et al.*, 1993; 1994; 1995).

9.3 Stock Assessment

9.3.1 The acoustic trawl survey (Tables 9.7 to 9.14)

The 1994 coastal acoustic trawl survey was conducted in the period September-October. The details for this survey, the methods used in the biomass calculations, the estimation of age and the differentiating into Coastal and North-East Arctic cod types are given in Eliassen *et al.* (1993; 1994; 1995). A total of 113 demersal trawl hauls and 87 pelagic trawl hauls, each lasting for one half hour, was conducted during the 1994 survey. The 1994 survey covered 66,300 km^2 (19,300 $n.miles^2$). When adjusting the total biomass/numbers into age-groups for cod that were not aged, age/length-weight keys were used to allocate to age groups.

All otoliths (690) sampled in the Trøndelag-Møre area were classified to be of the coastal cod type. Consequently, no North-East Arctic cod specimens were found along this southern area of the Norwegian coast.

The total biomass of Coastal cod was estimated to be about 23,000 tonnes (12 million fish) for the Trøndelag-Møre area in 1994 (Tables 9.7 to 9.10). The spawning biomass of Coastal cod in this area was estimated to be 18,000 tonnes (6,5 million fish) (Tables 9.11 to 9.14).

The coastal cod was distributed along the entire area surveyed, except for the Outer Halten area, where no cod were found, although a considerable number of trawl hauls were made (Figure 9.1). The highest biomass estimates were associated with the areas Leka, Folla, Halten and Møre. A rather low biomass (about 200 tonnes) of cod was estimated for one of the largest fjords: Tronheimsfjorden.

The overall estimated biomass of Coastal cod in the surveyed area from the Russian border to 62° N is about 201,000 tonnes including a rather large spawning stock of 153,000 tonnes (Table 9.7 - 9.15).

9.4 Comments on the Stock Status and the Assessment (Table 9.15)

The entire coastline from the Russian border to 62° N has been surveyed during 1992-1994. The surveys were carried out within the 12 n.mile limit along the coast of Finnmark, but for the areas South of Finnmark the surveys were extended outwards to the 900 m depth contour, including the wide areas of the continental shelf, especially outside Nordland and Trøndelag. An outer area between 62° 30' N to 64° N (figure 9.1) was not covered in the 1994 survey due to poor weather conditions during the survey period.

Generally, the results of these investigations showed that the proportion of Coastal cod increased moving from offshore to the fjords, and from North to South along the Norwegian coast, similar to that reported by the Working Group 25 years ago (Anon, 1970; Eliassen *et al.*, 1993; 1994; 1995). This general picture is also shown on a larger scale for the Norwegian coast in Table 9.15 where the proportion of Coastal cod to the total cod biomass is smallest in Finnmark (70 %), larger in Nordland (83 %) and exclusively coastal cod is found in the Trøndelag-Møre area at this time of the year.

The total biomass estimated for the Trøndelag-Møre area is significantly lower than the biomass of cod for Finnmark-Troms and Nordland areas (Table 9.15). The overall estimated biomass of Coastal cod in the surveyed area from the Russian border to 62° N is about 201,000 tonnes compared to 55,000 tonnes for the North-East Arctic cod (Table 9.15), although it may be questioned whether the results should be additive due to migratory patterns of Coastal and North-East Arctic cod. A tagging programme on cod is presently being conducted in the coastal areas off Nordland to investigate whether the general migratory pattern, with rather limited migrations seen inside the regions in Finnmark and Troms, will also be found in Nordland.

The results for the Norwegian Coastal cod indicate that this stock has an age of 50 % maturity of about 4.5 years compared to about 7 years for cod in the North-East Arctic. The size of the spawning stock biomass (SSB) for the coastal cod was rather large compared to the total stock size (Table 9.15). The average ratio of SSB/Total stock biomass for the North-East Arctic cod during the period 1992-1994 was estimated to 0.48, compared to 0.74 for the Coastal cod. These relations are both based on trawl acoustic survey results.

The data on landings of Norwegian Coastal cod (Table 9.1) indicated a gradually increase from 17,000 tonnes in 1989 to at about 48,000 tonnes in 1994, which is about 8,000 tonnes over the recommended quota. The last 3 years surveys on the Norwegian Coastal cod have shown that this stock is distributed from the Russian border to 62° N. The Norwegian landings statistics are still organized as given in chapter 9.1, thus omitting the landings of Coastal cod in Nort-hern Troms and Finnmark Counties; i.e. Norwegian statistical areas 04 (ICES division IIa) and 03 (ICES division I).

The proportion of the total Coastal cod standing biomass to the total cod biomass in Nordland and Trøndelag-Møre is 0.865 (Table 9.15), and this area is approximately the same as that covering the landings statistics of the Coastal cod (Figure 9.2). A conservative assumption would then be to say that only a 0.75 proportion of the given landings are Coastal cod in this area, due to the possibility that spawning migrating North-East Arctic cod will be included into the landing statistics. The average landings of Coastal cod during the last three years is 42,300 tonnes (Table 9.1), with 75 % of this being 31,700 tonnes of Coastal cod (Table 9.16). This is to say that a standing biomass of 123, 000 tonnes of Coastal cod in Nordland and Trøndelag-Møre gives 32,000 tonnes in the landing statistics, that is a yield/standing biomass ratio of 0.245. If the same ratio is used for the biomass of Coastal cod found in Finnmark and Troms, the landings would then amount to 20,000 t (Table 9.16). It follows that if the all these assumed landings of Coastal cod were included in the statistics it would result in a value over 50,000 tonnes.

9.5 Catch Statistics and Sampling the Landings

Based upon the results of the recent investigations it is considered necessesary in future assessments of Coastal cod to include landing statistics and sampling data for Norwegian areas 03 and 04 in order to more fully evaluate the status of this resource, as well as sampling the landings in areas 00, 05, 06 and 07. «The sampling especially needs also to be improved South of Vestfjord because the spawning stock of the North-East Arctic cod are increasing, and extending its distribution» (Anon, 1994). The Working Group will underline that the landings statistics and sampling the landings must be done in the whole distribution area for the Coastal cod, to exclude North-East Arctic cod in the Southern areas, and to include the Coastal cod in the Northern areas of the coast.

9.6 Stock Summary

The total stock and the spawning stock of the Norwegian Coastal cod were estimated to 201,000 and 153,000 tonnes (Table 9.15). The Norwegian Coastal cod stock size are probably underestimated, as for other stocks, due to the trawl acoustic method used in this assessment. The acoustic trawl survey results from the period 1992-1994, has covered three different parts of the coast in three different years. The results may therefore be regarded as a preliminary indication of the stock size, and has given more accurate knowledge of the actual distribution area, the maturity ogives and the level of the spawning stock size to the total stock size, and the length and weight at age at different areas of the coast. The Working Group will advise to conduct annually surveys to the whole distribution area for the Norwegian Coastal cod stock and to increase the samples from the landings to make sure that Coastal cod may be extracted from the total landings.

A prediction for Coastal cod catches has not been calculated for 1996. Expected landings in 1996 are assumed to be in the level similar to the reported Coastal cod landings in 1994 (48,000 t) (Table 9.1).

The status of the Norwegian Coastal cod and the Murman cod should be *discussed* in an extended Scientific meeting. New survey results and other research on those stocks has been made since the last meeting in 1990. The Working Group is still in line with the previous Arctic Fisheries Working Group and ACFM documents. At the present time these guiding lines are:

- that there is no evidence that the Norwegian Coastal cod and the Murman cod are reproductively isolated from the North East Arctic cod.
- cod in the North East Arctic is managed as one unit.
- the forecast for the Coastal cod should be included in a total cod TAC for the area to avoid overshooting of the stock.

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Table 3.1 North-East Arctic COD. Total catch (t) by fishing areas and unreported catch. (Data provided by Working Group members)

Year	Sub-area I	Division IIa	Division IIb	Unreported catches	Total catch
1961	409,694	153,019	220,508		783,221
1962	548,621	139,848	220,797		909,266
1963	547,469	117,100	111,768		776,337
1964	206,883	104,698	126,114		437,695
1965	241,489	100,011	103,430		444,983
1966	292,253	134,805	56,653		483,711
1967	322,798	128,747	121,060		572,605
1968	642,452	162,472	269,254		1,074,084
1969	679,373	255,599	262,254		1,197,226
1970	603,855	243,835	85,556		933,246
1971	312,505	319,623	56,920		689,048
1972	197,015	335,257	32,982		565,254
1973	492,716	211,762	88,207		792,685
1974	723,489	124,214	254,730		1,102,433
1975	561,701	120,276	147,400		829,377
1976	526,685	237,245	103,533		867,463
1977	538,231	257,073	109,997		905,301
1978	418,265	263,157	17,293		698,715
1979	195,166	235,449	9,923		440,538
1980	168,671	199,313	12,450		380,434
1981	137,033	245,167	16,837		399,037
1982	96,576	236,125	31,029		363,730
1983	64,803	200,279	24,910		289,992
1984	54,317	197,573	25,761		277,651
1985	112,605	173,559	21,756		307,920
1986	157,631	202,688	69,794		430,113
1987	146,106	245,387	131,578		523,071
1988	166,649	209,930	58,360		434,939
1989	164,512	149,360	18,609		332,481
1990	62,272	99,465	25,263	25,000	212,000
1991	70,970	156,966	41,222	50,000	319,158
1992	124,219	172,792	86,483	130,000	513,494
1993	195,771	269,383	66,457	50,000	581,611
1994[1]	334,847	311,585	103,861	25,000	775,293

[1]Provisional figures.

Table 3.2 North-East Arctic COD. Total nominal catch ('000 t) by trawl and other gear for each area. (Data provided by Working Group members)

Year	Sub-area I		Division IIa		Division IIb	
	Trawl	Others	Trawl	Others	Trawl	Others
1967	238.0	84.8	38.7	90.0	121.1	-
1968	588.1	54.4	44.2	118.3	269.2	-
1969	633.5	45.9	119.7	135.9	262.3	-
1970	524.5	79.4	90.5	153.3	85.6	-
1971	253.1	59.4	74.5	245.1	56.9	-
1972	158.1	38.9	49.9	285.4	33.0	-
1973	459.0	33.7	39.4	172.4	88.2	-
1974	677.0	46.5	41.0	83.2	254.7	-
1975	526.3	35.4	33.7	86.6	147.4	-
1976	466.5	60.2	112.3	124.9	103.5	-
1977	471.5	66.7	100.9	156.2	110.0	-
1978	360.4	57.9	117.0	146.2	17.3	-
1979	161.5	33.7	114.9	120.5	8.1	-
1980	133.3	35.4	83.7	115.6	12.5	-
1981	91.5	45.1	77.2	167.9	17.2	-
1982	44.8	51.8	65.1	171.0	21.0	-
1983	36.6	28.2	56.6	143.7	24.9	-
1984	24.5	29.8	46.9	150.7	25.6	-
1985	72.4	40.2	60.7	112.8	21.5	-
1986	109.5	48.1	116.3	86.4	69.8	-
1987	126.3	19.8	167.9	77.5	129.9	1.7
1988	149.1	17.6	122.0	88.0	58.2	0.2
1989	144.4	19.5	68.9	81.2	19.1	0.1
1990	51.4	10.9	47.4	52.1	24.5	0.8
1991	58.9	12.1	73.0	84.0	40.0	1.2
1992	103.7	20.5	80.0	92.8	85.6	0.9
1993	165.1	30.7	155.5	113.9	66.3	0.2
1994[1]	293.6	41.2	170.8	140.8	102.0	1.9

[1]Provisional.

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Table 3.3 North-East Arctic COD. Nominal catch (t) by countries (Sub-area I and Divisions IIa and IIb combined). (Data provided by Working Group members.)

Year	Faroe Islands	France	German Dem.Rep.	Fed.Rep Germany	Norway	Poland	United Kingdom	Russia[2]		Others	Total all countries
1961	3,934	13,755	3,921	8,129	268,377	-	158,113	325,780		1,212	783,221
1962	3,109	20,482	1,532	6,503	225,615	-	175,020	476,760		245	909,266
1963	-	18,318	129	4,223	205,056	108	129,779	417,964		-	775,577
1964	-	8,634	297	3,202	149,878	-	94,549	180,550		585	437,695
1965	-	526	91	3,670	197,085	-	89,962	152,780		816	444,930
1966	-	2,967	228	4,284	203,792	-	103,012	169,300		121	483,704
1967	-	664	45	3,632	218,910	-	87,008	262,340		6	572,605
1968	-	-	225	1,073	255,611	-	140,387	676,758		-	1,074,084
1969	29,374	-	5,907	5,543	305,241	7,856	231,066	612,215		133	1,197,226
1970	26,265	44,245	12,413	9,451	377,606	5,153	181,481	276,632		-	933,246
1971	5,877	34,772	4,998	9,726	407,044	1,512	80,102	144,802		215	689,048
1972	1,393	8,915	1,300	3,405	394,181	892	58,382	96,653		166	565,287
1973	1,916	17,028	4,684	16,751	285,184	843	78,808	387,196		276	792,686
1974	5,717	46,028	4,860	78,507	287,276	9,898	90,894	540,801		38,453	1,102,434
1975	11,309	28,734	9,981	30,037	277,099	7,435	101,843	343,580		19,368	829,377
1976	11,511	20,941	8,946	24,369	344,502	6,986	89,061	343,057		18,090	867,463
1977	9,167	15,414	3,463	12,763	388,982	1,084	86,781	369,876		17,771	905,301
1978	9,092	9,394	3,029	5,434	363,088	566	35,449	267,138		5,525	698,715
1979	6,320	3,046	547	2,513	294,821	15	17,991	105,846		9,439	440,538
1980	9,981	1,705	233	1,921	232,242	3	10,366	115,194		8,789	380,434
						Spain					
1981	12,825	3,106	298	2,228	277,818	14,500	5,262	83,000		-	399,037
1982	11,998	761	302	1,717	287,525	14,515	6,601	40,311		-	363,730
1983	11,106	126	473	1,243	234,000	14,229	5,840	22,975		-	289,992
1984	10,674	11	686	1,010	230,743	8,608	3,663	22,256		-	277,651
1985	13,418	23	1,019	4,395	211,065	7,846	3,335	62,489		4,330	307,920
1986	18,667	591	1,543	10,092	232,096	5,497	7,581	150,541		3,505	430,113
1987	15,036	1	986	7,035	268,004	16,223	10,957	202,314		2,515	523,071
1988	15,329	2,551	605	2,803	223,412	10,905	8,107	169,365		1,862	434,939
1989	15,625	3,231	326	3,291	158,684	7,802	7,056	134,593		1,273	332,481
1990	9,584	592	169	1,437	88,737	7,950	3,412	74,609		510	187,000
1991	8,981	975	Greenland	2,613	126,226	3,677	3,981	119,427[3]		3,278	269,158
1992	11,663	262	3,337	3,911	168,460	6,217	6,120	182,315	Iceland	1,209	383,494
1993	17,435	3,572	5,389	5,887	221,051	8,800	11,336	244,860	9,374	3,907	531,611
1994[1]	22,826	5,384	6,881	8,283	317,932	14,929	15,579	291,925	36,737	29,817	775,193

[1]Provisional figures.
[2]USSR prior to 1991.
[3]Includes Baltic countries.

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Table 3.4 North-East Arctic COD. Catch per unit effort.

	Sub-area I			Division IIb			Division IIa		
Year	Norway[2]	UK[3]	Russia[4]	Norway[2]	UK[3]	Russia[4]	Norway[2]	UK[3]	Norway[5]
1960	-	0.075	0.42	-	0.105	0.31	-	0.067	3.0
1961	-	0.079	0.38	-	0.129	0.44	-	0.058	3.7
1962	-	0.092	0.59	-	0.133	0.74	-	0.066	4.0
1963	-	0.085	0.60	-	0.098	0.55	-	0.066	3.1
1964	-	0.056	0.37	-	0.092	0.39	-	0.070	4.8
1965	-	0.066	0.39	-	0.109	0.49	-	0.066	2.9
1966	-	0.074	0.42	-	0.078	0.19	-	0.067	4.0
1967	-	0.081	0.53	-	0.106	0.87	-	0.052	3.5
1968	-	0.110	1.09	-	0.173	1.21	-	0.056	5.1
1969	-	0.113	1.00	-	0.135	1.17	-	0.094	5.9
1970	-	0.100	0.80	-	0.100	0.80	-	0.066	6.4
1971	-	0.056	0.43	-	0.071	0.16	-	0.062	10.6
1972	0.90	0.047	0.34	0.59	0.051	0.18	1.08	0.055	11.5
1973	1.05	0.057	0.56	0.43	0.054	0.57	0.71	0.043	6.8
1974	1.75	0.079	0.86	1.94	0.106	0.77	0.19	0.028	3.4
1975	1.82	0.077	0.94	1.67	0.100	0.43	1.36	0.033	3.4
1976	1.69	0.060	0.84	1.20	0.081	0.30	1.69	0.035	3.8
1977	1.54	0.052	0.63	0.91	0.056	0.25	1.16	0.044	5.0
1978	1.37	0.062	0.52	0.56	0.044	0.08	1.12	0.037	7.1
1979	0.85	0.046	0.43	0.62	-	0.06	1.06	0.042	6.4
1980	1.47	-	0.49	0.41	-	0.16	1.27	-	5.0
					Spain			**Russia[4]**	
1981	1.42	-	0.41	(0.96)	-	0.07	1.02	0.35	6.2
1982	1.30	-	0.35	-	0.86	0.26	1.01	0.34	6.4
1983	1.58	-	0.31	(1.31)	0.92	0.36	1.05	0.38	7.6
1984	1.40	-	0.45	1.20	0.78	0.35	0.73	0.27	7.0
1985	1.86	-	1.04	1.51	1.37	0.50	0.90	0.39	5.1
1986	1.97	-	1.00	2.39	1.73	0.84	1.36	1.14	4.1
1987	1.77	-	0.97	2.00	1.82	1.05	1.73	0.67	3.3
1988	1.58	-	0.66	1.61	(1.36)	0.54	0.97	0.55	2.2
1989	1.49	-	0.71	0.41	2.70	0.45	0.78	0.43	3.6
1990	1.35	-	0.70	0.39	2.69	0.80	0.38	0.60	4.8
1991	1.38	-	0.67	0.29	4.96	0.76	0.50	0.90	-
1992	2.19	-	0.79	3.06	2.47	0.23	0.98	0.65	-
1993	2.33	-	0.85	2.98	3.38	1.00	1.74	1.03	-
1994[1]	3.04	-	1.01	3.36	1.44	1.14	1.79	0.86	-

[1]Preliminary figures.
[2]Norwegian data - t per 1,000 t*hrs fishing.
[3]United Kingdom data - t per 100 t*hrs fishing.
[4]Russia data - t per hr fishing.

Period	Sub-area I	Divisions IIa and IIb
1960–1973	RT	RT
1974–1980	PST	RT
1981–	PST	PST

Vessel type:
RT = side trawlers, 800–1000 HP.
PST = stern trawlers, up to 2000 HP.

[5]Norwegian data - t per gillnet boat week in Lofoten.
[6]Spanish data - t per hr fishing.

Table 3.5 North-East Arctic COD. Weights at age (kg) in Norwegian and Russian landings.

Norway

Year	Age													
	2	3	4	5	6	7	8	9	10	11	12	13	14	15+
1984	1.16	1.47	1.97	2.53	3.13	3.82	4.81	5.95	7.19	7.86	8.46	7.99	9.78	10.64
1985	0.76	1.47	1.90	2.49	3.32	4.21	5.01	5.94	7.10	8.20	8.92	9.73	9.85	9.26
1986	(1.20)	1.24	1.94	2.53	3.36	4.54	5.60	5.94	6.73	8.20	8.76	9.94	7.80	8.23
1987	0.56	0.92	1.45	2.24	3.04	4.17	5.33	6.62	6.99	8.33	8.58	9.58	8.27	10.67
1988	0.54	0.55	0.82	1.36	2.38	3.75	5.84	7.05	8.55	11.28	11.63	14.10	-	-
1989	0.36	0.86	1.06	1.34	1.96	3.22	5.07	8.09	9.45	11.60	10.54	-	18.61	17.11
1990	1.19	1.62	1.73	1.95	2.54	3.42	5.07	8.18	10.48	14.16	17.85	-	14.34	-
1991	1.05	1.47	1.86	2.34	3.00	3.66	4.60	6.02	8.97	11.75	17.32	-	-	-
1992	0.39	1.25	1.85	2.54	3.29	4.35	5.29	6.20	8.27	12.21	11.72	-	14.66	20.58
1993	0.53	0.87	1.73	2.44	3.39	4.30	5.47	6.29	7.10	7.78	10.00	16.14	18.99	17.41
1994	0.66	0.93	1.45	2.29	3.36	4.35	5.53	7.10	7.50	8.37	9.45	10.79	9.11	19.80

Russia

Year	Age													
	2	3	4	5	6	7	8	9	10	11	12	13	14	15+
1984	0.22	0.76	1.30	2.04	2.90	4.12	5.56	8.76	13.55	14.95	14.85	19.52	19.31	22.37
1985	0.29	0.77	1.23	1.75	2.64	3.93	5.35	6.72	9.87	9.00	13.72	15.10	15.20	19.25
1986	0.22	0.63	1.15	1.75	2.44	4.09	6.19	8.15	10.31	11.73	17.29	-	27.30	-
1987	0.24	0.41	0.92	1.51	2.14	2.95	5.62	7.13	11.17	10.90	12.29	-	-	-
1988	0.11	0.48	0.82	1.33	2.07	3.04	4.93	7.08	9.68	-	17.50	22.10	-	-
1989	0.22	0.46	0.87	1.25	1.84	2.71	4.34	6.59	9.14	12.47	14.32	13.60	-	-
1990	0.34	0.77	1.33	1.86	2.27	3.31	4.36	7.20	9.34	8.53	12.87	-	-	-
1991[1]	0.26	0.55	0.93	1.59	2.45	3.37	4.78	6.74	11.61	17.63	9.45	19.20	15.40	19.40
1992	0.26	0.92	1.40	2.14	3.24	4.62	5.81	7.49	10.16	17.45	19.00	-	23.00	-
1993	0.20	0.65	1.30	2.03	2.76	4.36	5.97	6.94	8.15	11.12	15.24	17.28	-	22.30
1994	0.17	0.35	1.09	1.85	2.82	3.67	5.95	7.82	8.58	11.12	17.90	23.35	-	-

[1]Revised.

Table 3.6

COD-ARCT: Cod in the North-East Arctic (Fishing Areas I and II)

WECA: Mean Weight in Catch (Kilograms)

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15
1946	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1947	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1948	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1949	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1950	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1951	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1952	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1953	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1954	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1955	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1956	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1957	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1958	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1959	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1960	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1961	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1962	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1963	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1964	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1965	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1966	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1967	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1968	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1969	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1970	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1971	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1972	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1973	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1974	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1975	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1976	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1977	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1978	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1979	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1980	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1981	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1982	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1983	-1.00	-1.00	0.90	1.46	2.19	2.78	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1984	-1.00	-1.00	1.35	1.84	2.43	3.11	3.84	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1985	-1.00	-1.00	1.25	1.56	2.14	3.19	4.18	5.06	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1986	-1.00	-1.00	0.97	1.61	2.21	2.99	4.31	5.73	6.82	7.70	9.25	10.85	12.50	13.90	15.00
1987	-1.00	-1.00	0.65	1.10	1.92	2.56	3.44	5.41	6.69	7.70	9.25	10.85	12.50	13.90	15.00
1988	-1.00	-1.00	0.52	0.82	1.34	2.27	3.48	5.38	7.06	8.90	9.25	10.85	12.50	13.90	15.00
1989	-1.00	-1.00	0.52	0.90	1.27	1.91	3.01	4.89	7.68	9.36	10.57	10.85	12.50	13.90	15.00
1990	-1.00	0.85	1.10	1.53	1.89	2.36	3.38	4.75	7.89	10.14	13.24	16.94	12.50	13.90	15.00
1991	0.09	0.33	0.98	1.49	1.98	2.63	3.45	4.67	6.30	9.62	11.75	17.32	19.20	15.40	19.40
1992	0.05	0.32	1.01	1.55	2.30	3.26	4.51	5.60	6.58	8.86	12.21	11.72	12.50	14.66	20.58
1993	0.35	0.47	0.74	1.48	2.15	2.90	4.22	5.64	6.51	7.30	8.30	10.36	14.71	12.80	11.75
1994	0.36	0.59	0.64	1.21	2.09	3.04	3.85	5.54	7.18	7.77	8.49	9.30	10.24	10.13	19.80
1995	-1.00	-1.00	0.47	0.74	1.50	2.24	3.55	5.13	6.61	7.29	8.91	10.85	12.50	13.90	15.00
1996	-1.00	-1.00	0.77	1.06	1.55	2.27	3.57	5.12	6.61	7.29	8.91	10.85	12.50	13.90	15.00
1997	-1.00	-1.00	0.77	1.06	1.55	2.27	3.57	5.12	6.61	7.29	8.91	10.85	12.50	13.90	15.00

Table 3.7

COD-ARCT: Cod in the North-East Arctic (Fishing Areas I and II)

WEST: Mean Weight in Stock (Kilograms)

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15
1946	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1947	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1948	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1949	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1950	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1951	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1952	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1953	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1954	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1955	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1956	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1957	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1958	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1959	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1960	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1961	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1962	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1963	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1964	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1965	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1966	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1967	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1968	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1969	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1970	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1971	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1972	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1973	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1974	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1975	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1976	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1977	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1978	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1979	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1980	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1981	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1982	-1.00	-1.00	0.65	1.00	1.55	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1983	-1.00	-1.00	0.36	1.01	1.63	2.53	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1984	-1.00	-1.00	0.53	1.20	1.90	2.91	3.97	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1985	0.03	0.09	0.46	0.91	1.71	2.94	4.17	5.04	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1986	0.03	0.08	0.32	0.93	1.57	2.52	3.83	5.30	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1987	0.02	0.06	0.21	0.50	1.25	2.12	3.46	5.22	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1988	0.02	0.07	0.19	0.36	0.70	1.58	2.70	4.30	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1989	0.01	0.07	0.30	0.51	0.86	1.47	2.62	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1990	0.03	0.15	0.40	0.68	1.16	1.72	2.66	4.51	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1991	0.02	0.15	0.48	1.14	1.73	2.47	3.28	4.38	7.37	7.70	9.25	10.85	12.50	13.90	15.00
1992	0.02	0.11	0.45	0.93	1.74	2.73	3.90	4.98	6.62	11.18	9.25	10.85	12.50	13.90	15.00
1993	0.01	0.08	0.35	1.18	1.83	2.87	4.14	5.56	6.73	8.45	10.66	10.85	12.50	13.90	15.00
1994	0.01	0.05	0.24	0.76	1.37	2.28	3.44	4.98	6.84	7.78	8.59	8.60	12.50	13.90	15.00
1995	0.01	0.06	0.20	0.50	1.13	1.93	3.25	4.74	7.04	8.37	9.81	10.85	12.50	13.90	15.00
1996	-1.00	-1.00	0.28	0.51	0.99	1.72	2.86	4.68	6.61	7.29	8.91	10.85	12.50	13.90	15.00
1997	-1.00	-1.00	0.28	0.51	0.99	1.72	2.86	4.68	6.61	7.29	8.91	10.85	12.50	13.90	15.00

Table 3.8 North-East Arctic COD. Basis for maturity ogives (percent) used in the assessment. Norwegian and Russian data.

Year	Percentage mature							
	Age							
	3	4	5	6	7	8	9	10
Norway								
1982	-	5	10	34	65	82	92	100
1983	5	8	10	30	73	88	97	100
Russia								
1984	-	5	18	31	56	90	99	100
1985	-	1	10	33	59	85	92	100
1986	-	2	9	19	56	76	89	100
1987	-	1	9	23	27	61	81	80
1988	-	1	3	25	53	79	100	100
1989	-	-	2	15	39	59	83	100
1990	-	2	6	20	47	62	81	95
1991	-	3	1	23	66	82	96	100
1992	-	1	8	31	73	92	95	100
1993	-	3	7	21	56	89	95	99
1994	-	1	8	30	55	84	95	98
1995	-	-	4	23	67	75	94	97

Table 3.9

North East Arctic Cod Tuning Data for the 1995 Assessment.

FLT43: Russian trawl acoustic survey (ages 1-8).

Year	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8
1982	6	181	141	51	13	26	7	2
1983	89	43	56	73	47	20	8	11
1984	92	142	162	86	50	31	11	4
1985	49	430	303	405	188	49	19	6
1986	22	91	565	161	106	30	8	3
1987	2	40	59	426	54	31	6	1
1988	2	25	77	78	190	25	6	1
1989	1	6	34	88	111	155	114	26
1990	31	78	38	44	66	60	113	18
1991	59	98	110	62	68	77	56	46
1992	78	395	485	182	69	53	52	40
1993	28	131	647	597	334	91	34	33
1994	112	33	120	300	475	500	180	61

FLT44: Russian acoustic survey (ages 1-8).

Year	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8
1985	1050	8950	4220	2550	830	440	500	210
1986	530	1410	9800	4440	1830	560	620	190
1987	150	1700	1700	7380	990	670	420	200
1988	5	430	1610	1060	2450	340	100	20
1989	10	40	170	440	560	990	820	200
1990	220	570	290	350	520	460	890	140
1991	440	750	890	510	530	610	450	430
1992	610	3330	3170	1100	450	370	380	290
1993	100	450	2150	2430	1360	430	140	140
1994	580	1100	2080	2820	2770	1200	440	80

FLT45: Norwegian Svalbard Bottom trawl survey (ages 1-8).

Year	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8
1983	145	26.8	10.7	9.5	2.4	1.9	1	1.3
1984	499	113	7.3	4.3	4.7	1.8	0.4	0.4
1985	239	452	99.1	28.4	13.6	5.4	1	0.4
1986	40.9	181	297	42.8	15.3	2.6	1	0.3
1987	41.5	108	141	125	17.1	5.4	0.5	0.1
1988	3.1	16.6	33.2	31.8	37.1	9.5	0.6	0.6
1989	3.6	2.7	15.4	12.8	11.9	19.2	3.2	0.4
1990	70.1	9.4	8.6	14.6	23.4	16.5	20	2
1991	116	101	25.3	8.5	13.9	16	13.5	19
1992	91.8	130	105	56	16.2	7.3	5.7	3.3
1993	122.3	120.9	148.6	65.6	29.6	3.4	3.8	2.4
1994	68.6	166.5	102.4	56.4	54.1	25.9	5.9	2.3

Continued

Table 3.9 Continued

FLT52: Norwegian trawl CPUE (000s of fish) ages 9-14.

Year	Age9	Age10	Age11	Age12	Age13	Age14
1985	269	84	13	18	25	9
1986	93	100	44	21	3	0
1987	277	121	25	70	7	13
1988	167	73	13	14	33	0
1989	156	73	20	0	0	4
1990	34	16	0	0	0	0
1991	149	5	1	0	0	0
1992	1506	185	34	17	0	2
1993	814	2060	466	58	5	1
1994	1033	739	1594	260	9	3

FLT53: Russian trawl CPUE (000s of fish) ages 9-14.

Year	Age9	Age10	Age11	Age12	Age13	Age14
1985	178	99	2	1	0	1
1986	184	0	29	0	0	0
1987	174	43	0	0	0	0
1988	271	78	0	0	0	0
1989	266	91	15	2	1	0
1990	346	61	13	3	0	0
1991	953	56	2	1	2	0
1992	3871	482	0	0	0	0
1993	1818	2042	245	33	2	1
1994	1296	963	479	3	1	0

FLT54: Norwegian Barents Sea Trawl survey shifted swept area correction (Catch: Millions).

Year	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8
1980	343	164	233	400	384	48	10	3
1981	29	283	277	236	155	160	14	2
1982	190	223	371	333	135	46	30	6
1983	3932	1159	262	189	106	32	5	2
1984	7276	1444	995	157	64	25	2	1
1985	4615	6571	1371	750	233	55	6	2
1986	4574	2334	3655	461	113	14	4	1
1987	729	1852	953	1895	191	36	6	1
1988	136	365	649	352	779	87	8	2
1989	508	233	301	336	197	239	13	4
1990	2247	323	191	175	161	93	97	5
1991	5289	1496	495	184	118	75	40	27
1992	3310	3118	1526	690	142	69	42	22
1993	4968	2763	2976	1459	469	88	23	12
1994	5038	2882	2312	2492	704	180	22	7

FLT55: Norwegian Barents Sea acoustic survey (swept area corrected) (Catch: millions).

Year	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8
1980	820	400	630	1060	1030	160	30	10
1981	50	490	430	400	260	280	20	3
1982	190	130	230	270	140	70	40	10
1983	1500	310	110	70	50	20	3	3
1984	7680	1790	1270	210	90	60	3	3
1985	5900	5950	1240	560	70	20	3	3
1986	720	960	2560	460	120	10	10	3
1987	290	640	420	750	90	20	3	3
1988	90	200	430	270	570	80	10	3
1989	450	160	240	270	220	400	30	10
1990	2340	550	310	270	250	140	160	10
1991	5790	1820	480	180	110	80	40	20
1992	4320	3000	1630	800	140	70	30	10
1993	6860	3580	3430	1590	430	90	20	10
1994	2800	1810	1610	2140	690	180	20	10

Table 3.10

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NORTHEAST ARCTIC COD : recruits as 3 year-olds (inc. data for ages 0,1,2 & 3)
16,38,2        (No. of surveys, No. of years, VPA Column No.)
1957,  790, -11, -11, -11, -11,12, 16,-11, -11, -11, -11, -11, -11, -11, -11, -11, -11
1958,  919, -11, -11, -11, -11,16, 24,-11, -11, -11, -11, -11, -11, -11, -11, -11, -11
1959,  730, -11, -11, -11, -11,18, 14,-11, -11, -11, -11, -11, -11, -11, -11, -11, -11
1960,  473, -11, -11, -11, -11, 9, 19,-11, -11, -11, -11, -11, -11, -11, -11, -11, -11
1961,  339, -11, -11, -11, -11, 2,  2,-11, -11, -11, -11, -11, -11, -11, -11, -11, -11
1962,  778, -11, -11, -11, -11, 7,  4,-11, -11, -11, -11, -11, -11, -11, -11, -11, -11
1963, 1582, -11, -11, -11, -11,21,120,-11, -11, -11, -11, -11, -11, -11, -11, -11, -11
1964, 1293, -11, -11, -11, -11,49, 45,-11, -11, -11, -11, -11, -11, -11, -11, -11, -11
1965,  170, -11, -11, -11, -11, 1,  1,-11, -11, -11, -11, -11, -11, -11, -11, -11, -11
1966,  112, -11, -11, -11, -11, 2,  1,002, -11, -11, -11, -11, -11, -11, -11, -11, -11
1967,  197, -11, -11, -11, -11, 1,  1,004, -11, -11, -11, -11, -11, -11, -11, -11, -11
1968,  405, -11, -11, -11, -11, 7,  1,002, -11, -11, -11, -11, -11, -11, -11, -11, -11
1969, 1016, -11, -11, -11, -11,11,  6,025, -11, -11, -11, -11, -11, -11, -11, -11, -11
1970, 1818,  23,  64,  60,  42,70, 85,251, -11, -11, -11, -11, -11, -11, -11, -11, -11
1971,  525,   7,   9,   6,   3,37, 24,077, -11, -11, -11, -11, -11, -11, -11, -11, -11
1972,  622,   5,   4,  34,  15,54, 17,052, -11, -11, -11, -11, -11, -11, -11, -11, -11
1973,  614,  16,   5,  15,   2,70,  5,148, -11, -11, -11, -11, -11, -11, -11, -11, -11
1974,  348,   1,   1,   4,   1, 6,  1,029, -11, -11, -11, -11, -11, -11, -11, -11, -11
1975,  640,  60,   1,  44,   1,93,  4,090, -11, -11, -11, -11, -11, -11, -11, -11, -11
1976,  199,   1,   1,   1,   1, 4,  1,013, -11, -11, -11, -11, -11, -11, -11, -11, -11
1977,  140,   1,   1,   2,   1, 2,  1,049, -11, -11, -11, -11, -11, -11, -11, -11, -11
1978,  158,   1,   2,   1,   1, 1,  3,022, -11, -11, 16.4, -11, -11, -11, -11, -11,  40
1979,  158,   1,   1,   1,   1, 1,  8,040, -11, 34.3, 28.3, -11, -11, -11, -11,  82,  49
1980,  169,   1,   1,   1,   1, 1,  8,013, 4.6, 2.9, 22.3, -11, -11, 10.7,   8,   5,  13
1981,  383,   1,   1,   1,   1, 4,  4,010, 0.8, 19.0,115.9, -11, 26.8, 7.3,   4,  19,  31
1982,  502,   1,   8,   8,  13, 8, 10,059,341.9,393.2,144.4,145.0,113.0, 99.1, -11, 150, 179
1983, 1114,   4,   9,  11,   7,45, 41,169,2864.4,727.6,657.1,499.0,452.0,297.0, 1807, 768, 595
1984,  297,   1,   1,   2,   8, 7, 15,155, 51.5,461.5,233.4,239.0,181.0,141.0, 108, 590,  96
1985,  239,   3,  10,   2,   3, 4,  6,246,741.8,457.4,185.2, 40.9,108.0, 33.2, 1302,  72,  64
1986,  185,   1,   2,   1,   1, 2,  5,137, 33.4, 72.9, 36.5, 41.5, 16.6, 15.4,   3,  29,  20
1987,  222,   1,   1,   1,   1, 1,  1,017,  5.0, 13.6, 23.3,  3.1,  2.7,  8.6,   2,   9,  16
1988,  522,   1,   1,   1,   1, 7,  1,033,  9.4, 50.8, 32.3,  3.6,  9.4, 25.3,   9,  45,  55
1989,  823,   1,   1,   4,   1, 7, 10,038,161.0,224.7,149.6, 70.1,101.0,105.0, 350, 234, 182
1990, 1236,   6,   1,   4,   4,26, 72,123,470.8,528.9,311.8,116.0,130.0,148.6, 187, 579, 300
1991,  962,   3,   6,   3,  15, 8, 24,230,131.6,331.0,276.3, 91.8,120.9,102.4, 348, 432, 358
1992,  558,  10,  60,   1,   6,11, 20,294,534.1,496.8,288.2,122.3,166.5, -11, 1686, 686, 181
1993,  666,   2,   5,   3,   6,-11,-11,209,861.8,503.8, -11, 68.6, -11, -11, 1083, 280, -11
1994,  -11,  16,   3, -11, -11,-11,-11,227,4892.4, -11, -11, -11, -11, -11, 2644, -11, -11
R-1-1    Russian Bottom trawl survey, area I,  age 1
R-2B-1   Russian  "   "   "   " IIb, age 1
R-1-2    Russian  "   "   "   " I,  age 2
R-2B-2   Russian  "   "   "   " IIb, age 2
R-1-3    Russian  "   "   "   " I,  age 3
R-2B-3   Russian  "   "   "   " IIb, age 3
INT0GP   International 0-group survey
N-BST1   Norwegian Barents Sea,  Bottom trawl survey, age 1
N-BST2   Norwegian  "   "   "   "   "   age 2
N-BST3   Norwegian  "   "   "   "   "   age 3
N-SVT1   Norwegian Svalbard area  "   "   "   age 1
N-SVT2   Norwegian  "   "   "   "   "   age 2
N-SVT3   Norwegian  "   "   "   "   "   age 3
N-BSA1   Norwegian Barents Sea   Acoustic survey    age 1
N-BSA2   Norwegian  "   "   "   "   age 2
N-BSA3   Norwegian  "   "   "   "   age 3
```

Table 3.11

Analysis by RCT3 ver3.1 of data from file :

cod.rct

NORTHEAST ARCTIC COD : recruits as 3 year-olds (inc. data for ages 0,1,2 & 3)

Data for 16 surveys over 38 years : 1957 - 1994

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

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

Forecast/Hindcast variance correction used.

Yearclass = 1992

	I-----------Regression----------I					I-----------Prediction---------I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
R-1-1	2.45	3.55	1.19	.306	22	2.40	9.42	1.677	.020
R-2B-1	4.71	.47	3.39	.052	22	4.11	19.84	6.037	.002
R-1-2	1.72	3.91	.86	.458	22	.69	5.10	1.011	.056
R-2B-2	1.82	3.61	1.33	.262	22	1.95	7.16	1.554	.024
R-1-3	.90	4.32	.47	.739	35	2.48	6.54	.544	.192
R-2B-3	.99	3.83	.87	.455	35	3.04	6.85	1.011	.056
INT0GP	2.03	-2.43	2.11	.124	26	5.69	9.10	2.604	.008
N-BST1	.60	3.56	1.15	.306	12	6.28	7.30	1.386	.030
N-BST2	.75	2.44	.99	.383	13	6.21	7.10	1.181	.041
N-BST3	.88	1.99	.70	.559	14	5.67	6.95	.835	.082
N-SVT1	1.01	2.19	1.49	.211	10	4.81	7.03	1.799	.018
N-SVT2	.83	2.83	1.04	.335	11	5.12	7.08	1.258	.036
N-SVT3									
N-BSA1	.52	3.94	1.08	.354	11	7.43	7.83	1.383	.030
N-BSA2	.62	3.20	.71	.550	13	6.53	7.26	.865	.076
N-BSA3	.70	2.93	.42	.776	14	5.20	6.59	.496	.231
					VPA Mean =		6.01	.756	.100

Yearclass = 1993

	I-----------Regression----------I					I-----------Prediction---------I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
R-1-1	2.20	3.61	1.26	.269	23	1.10	6.03	1.430	.063
R-2B-1	3.18	1.53	3.53	.045	23	1.79	7.23	4.036	.008
R-1-2	1.85	3.89	.91	.410	23	1.39	6.46	1.047	.117
R-2B-2	1.78	3.59	1.29	.260	23	1.95	7.06	1.495	.057
R-1-3									
R-2B-3									
INT0GP	1.91	-2.20	2.06	.120	27	5.35	8.02	2.433	.022
N-BST1	.59	3.51	1.11	.302	13	6.76	7.48	1.341	.071
N-BST2	.75	2.38	.96	.378	14	6.22	7.03	1.127	.101
N-BST3									
N-SVT1	.99	2.20	1.40	.212	11	4.24	6.41	1.644	.047
N-SVT2									
N-SVT3									
N-BSA1	.50	3.91	1.08	.331	12	6.99	7.39	1.313	.074
N-BSA2	.60	3.24	.69	.535	14	5.64	6.61	.807	.197
N-BSA3									

Continued

Table 3.11 Continued

				VPA Mean =		6.07	.727	.243

Yearclass = 1994

Survey/ Series	I-----------Regression----------I Slope	Inter- cept	Std Error	Rsquare	No. Pts	I-----------Prediction---------I Index Value	Predicted Value	Std Error	WAP Weights
R-1-1	2.29	3.55	1.24	.258	24	2.83	10.04	1.826	.079
R-2B-1	3.37	1.14	3.68	.038	24	1.39	5.81	4.198	.015
R-1-2									
R-2B-2									
R-1-3									
R-2B-3									
INTOGP	1.85	-2.10	1.96	.122	28	5.43	7.94	2.307	.050
N-BST1	.57	3.52	1.04	.310	14	8.50	8.33	1.354	.144
N-BST2									
N-BST3									
N-SVT1									
N-SVT2									
N-SVT3									
N-BSA1	.47	3.94	1.01	.340	13	7.88	7.68	1.247	.170
N-BSA2									
N-BSA3									
					VPA Mean =		6.14	.698	.542

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1992	855	6.75	.24	.23	.89	558	6.33
1993	764	6.64	.36	.16	.21	666	6.50
1994	1227	7.11	.51	.55	1.15		

Table 3.12

COD-ARCT: Cod in the North-East Arctic (Fishing Areas I and II)

CANUM: Catch in Numbers (Thousands)

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15
1946	1	16	4008	10387	18906	16596	13843	15370	59845	22618	10093	9573	5460	1927	750
1947	1	1	710	13192	43890	52017	45501	13075	19718	47678	31392	9348	9330	4622	4103
1948	1	16	140	3872	31054	55983	77375	21482	15237	9815	30041	7945	4491	3899	4205
1949	1	7	991	6808	35214	100497	83283	29727	13207	5606	8617	13154	3657	1895	2167
1950	1	79	1281	10954	29045	45233	62579	30037	19481	9172	6019	4133	6750	1662	1450
1951	1615	1625	24687	77924	64013	46867	37535	33673	23510	10589	4221	1288	1002	3322	611
1952	1	1202	24099	120704	113203	73827	49389	20562	24367	15651	8327	3565	647	467	1044
1953	1	81	47413	107659	112040	55500	22742	16863	10559	10553	5637	1752	468	173	156
1954	1	9	11473	155171	146395	100751	40635	10713	11791	8557	6751	2370	896	268	123
1955	1	322	3902	37652	201834	161336	84031	30451	13713	9481	4140	2406	867	355	128
1956	81	1498	10614	24172	129803	250472	86784	51091	14987	7465	3952	1655	1292	448	166
1957	987	3487	17321	33931	27182	70702	87033	39213	17747	6219	3232	1220	347	299	173
1958	1	2600	31219	133576	71051	40737	38380	35786	13338	10475	3289	1070	252	40	141
1959	590	2601	32308	77942	148285	53480	18498	17735	23118	9483	3748	997	254	161	98
1960	465	7147	37882	97865	64222	67425	23117	8429	7240	11675	4504	1843	354	102	226
1961	1	1699	45478	132655	123458	51167	38740	17376	5791	6778	5560	1682	910	280	108
1962	1	1713	42416	170566	167241	89460	28297	21996	7956	2728	2603	1647	392	280	103
1963	1	4	13196	106984	205549	95498	35518	16221	11894	3884	1021	1025	498	129	157
1964	103	675	5298	45912	97950	58575	19642	9162	6196	3553	783	172	387	264	131
1965	1	2522	15725	25999	78299	68511	25444	8438	3569	1467	1161	131	67	91	179
1966	1	869	55937	55644	34676	42539	37169	18500	5077	1495	380	403	77	9	70
1967	1	151	34467	160048	69235	22061	26295	25139	11323	2329	687	316	225	40	14
1968	1	1	3709	174585	267961	107051	26701	16399	11597	3657	657	122	124	70	[illegible]
1969	1	275	2307	24545	238511	181239	79363	26989	13463	5092	1913	414	121	23	46
1970	1	591	7164	10792	25813	137829	96420	31920	8933	3249	1232	260	106	39	35
1971	38	2210	7754	13739	11831	9527	59290	52003	12093	2434	762	418	149	42	25
1972	1	4701	35536	45431	26832	12089	7918	34885	22315	4572	1215	353	315	121	40
1973	1	8277	294262	131493	61000	20569	7248	8328	19130	4499	677	195	81	59	55
1974	115	21347	91855	437377	203772	47006	12630	4370	2523	5607	2127	322	151	83	62
1975	1	1184	45282	59798	226646	118567	29522	9353	2617	1555	1928	575	231	15	37
1976	706	1908	85337	114341	79993	118236	47872	13962	4051	936	558	442	139	26	53
1977	1	11288	39594	168609	136335	52925	61821	23338	5659	1521	610	271	122	92	54
1978	3	802	78822	45400	88495	56823	25407	31821	9408	1227	913	446	748	48	51
1979	0	224	8600	77484	43677	31943	16815	8274	10974	1785	427	103	59	38	45
1980	31	403	3911	17086	81986	40061	17664	7442	3508	3196	678	79	24	26	8
1981	1	212	3407	9466	20803	63433	21788	9933	4267	1311	882	109	37	3	1
1982	2	94	8948	20933	19345	28084	42496	8395	2878	708	271	260	27	5	5
1983	13	86	3108	19594	20473	17656	17004	18329	2545	646	229	74	58	20	5
1984	6	922	7027	14165	18839	20350	15415	8359	6054	764	221	153	56	12	12
1985	1	1699	19282	38322	27216	20342	13588	4385	1904	1062	163	59	51	45	38
1986	11	66	16942	55859	75486	27772	13337	4587	1082	559	455	124	29	32	1
1987	53	216	5570	100391	97318	62371	12901	3942	1021	435	140	233	17	21	8
1988	1	129	3988	21234	144215	59397	21302	3415	1200	320	67	60	51	7	15
1989	1	135	3874	19833	28126	83802	23501	4943	917	321	46	8	1	9	7
1990	1	161	1541	5171	10615	15467	31161	6665	830	163	41	14	9	5	2
1991	27	1106	4927	8489	15565	18995	20909	27404	4193	410	32	8	1	1	5
1992	1086	1037	23082	37919	25781	21304	18390	13199	18518	2282	185	73	3	8	4
1993	85	870	10706	46750	63886	32692	14562	9418	6359	12920	1931	394	59	23	[illegible]
1994	149	444	5177	61495	104123	56991	23628	9370	6387	4371	8426	1162	89	19	3

Table 3.13

Run title : Arctic Cod (run: H43/H43)

At 9-Oct-95 15:56:11

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
AGE										
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0001,
2,	.0014,	.0006,	.0008,	.0000,	.0013,	.0013,	.0019,	.0023,	.0140,	.0302,
3,	.0223,	.0394,	.0296,	.0242,	.0228,	.0406,	.0212,	.0390,	.1949,	.2124,
4,	.1101,	.1028,	.1515,	.2057,	.2209,	.1416,	.1022,	.1661,	.1981,	.4952,
5,	.3883,	.2103,	.1797,	.4073,	.4798,	.3821,	.2277,	.2965,	.3516,	.5356,
6,	.4458,	.3781,	.2007,	.4649,	.5367,	.5703,	.2355,	.3844,	.3903,	.5050,
7,	.3962,	.4655,	.4261,	.3984,	.7676,	.6192,	.5174,	.3140,	.4205,	.4432,
8,	.5204,	.5652,	.6729,	.5186,	.9268,	.8375,	.8320,	.6674,	.6424,	.4861,
9,	.6973,	.6965,	.8392,	.7784,	1.1442,	.9598,	.9326,	1.1402,	1.0097,	.4055,
10,	.7804,	.7255,	.8304,	.7309,	.9990,	.9964,	.7684,	1.2436,	.7421,	.9799,
11,	.7376,	.4685,	.9118,	.5904,	1.1652,	.7073,	.6722,	1.2207,	.5912,	1.0088,
12,	.5132,	.6208,	.9341,	.3900,	.9659,	.4561,	.5555,	.7818,	.6319,	.6318,
13,	1.3556,	.6567,	.8836,	1.3487,	.8623,	.7110,	.5185,	1.1510,	.4038,	1.7923,
14,	.8253,	.6393,	.8893,	.7754,	1.0392,	.7738,	.6959,	1.1206,	.6821,	.9745,
+gp,	.8253,	.6393,	.8893,	.7754,	1.0392,	.7738,	.6959,	1.1206,	.6821,	.9745,
FBAR 5-10,	.5381,	.5069,	.5248,	.5497,	.8090,	.7276,	.5856,	.6743,	.5928,	.5592,

Table 8 Fishing mortality (F) at age

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
1,	.0000,	.0008,	.0000,	.0000,	.0000,	.0001,	.0000,	.0000,	.0000,	.0000,
2,	.0017,	.0049,	.0157,	.0036,	.0014,	.0023,	.0012,	.0005,	.0002,	.0017,
3,	.0829,	.1647,	.1330,	.1449,	.0484,	.0309,	.0238,	.0640,	.0203,	.0203,
4,	.2084,	.3098,	.5658,	.2223,	.2072,	.1282,	.0973,	.1995,	.1944,	.1212,
5,	.5202,	.4759,	.7526,	.6690,	.3460,	.3532,	.2274,	.2945,	.3062,	.2903,
6,	.7002,	.5706,	.6782,	.8474,	.5444,	.6219,	.5114,	.5466,	.4810,	.5708,
7,	.7011,	.6935,	.6759,	.8415,	.6578,	.6708,	.8507,	.7904,	.7719,	1.0747,
8,	.7020,	.8841,	.9059,	.9344,	.7445,	.6993,	1.0686,	.9975,	1.0063,	1.2001,
9,	.6121,	.7731,	1.2153,	1.2942,	1.0530,	.8495,	1.2342,	1.1282,	1.0044,	1.2046,
10,	.4724,	.4602,	.7655,	.9889,	.9511,	1.0901,	.9441,	.6804,	.8511,	1.0063,
11,	1.2006,	.3074,	.6259,	1.8531,	1.2645,	1.3356,	1.0953,	.5051,	.4862,	.8229,
12,	.8564,	1.0504,	.2401,	1.5000,	1.3521,	.8539,	.7990,	1.2605,	.2474,	.7153,
13,	1.4780,	.5108,	.9851,	2.4651,	.8267,	1.6900,	1.4767,	.4623,	1.1666,	.3003,
14,	.9340,	.6259,	.7741,	1.6423,	1.1024,	1.1780,	1.1231,	.8156,	.7586,	.8182,
+gp,	.9340,	.6259,	.7741,	1.6423,	1.1024,	1.1780,	1.1231,	.8156,	.7586,	.8182,
FBAR 5-10,	.6180,	.6429,	.8323,	.9292,	.7161,	.7141,	.8061,	.7396,	.7368,	.8911,

Table 8 Fishing mortality (F) at age

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	FBAR 92-94
AGE											
1,	.0000,	.0000,	.0002,	.0000,	.0000,	.0000,	.0000,	.0013,	.0001,	.0002,	.0005,
2,	.0016,	.0002,	.0008,	.0006,	.0006,	.0003,	.0013,	.0012,	.0013,	.0007,	.0010,
3,	.0433,	.0201,	.0213,	.0185,	.0237,	.0079,	.0120,	.0345,	.0147,	.0093,	.0195,
4,	.1468,	.1704,	.1590,	.1058,	.1202,	.0398,	.0548,	.1207,	.0909,	.1099,	.1072,
5,	.3602,	.4788,	.5029,	.3601,	.1990,	.0871,	.1617,	.2346,	.3064,	.2996,	.2802,
6,	.5875,	.7776,	.9671,	.6678,	.3677,	.1601,	.2219,	.3473,	.5268,	.4955,	.4565,
7,	.9880,	1.0223,	1.1006,	1.1396,	.6144,	.2254,	.3377,	.3479,	.4256,	.9471,	.5735,
8,	1.1095,	1.1879,	1.0285,	1.0457,	.9224,	.3481,	.3169,	.3707,	.3014,	.5394,	.4039,
9,	1.0372,	.9485,	.9674,	1.1029,	.9294,	.3722,	.3855,	.3678,	.3066,	.3445,	.3396,
10,	.6939,	1.0588,	1.4995,	.9791,	1.0718,	.4047,	.3176,	.3750,	.4762,	.3585,	.4032,
11,	.6019,	.7424,	.8580,	1.0629,	.3451,	.3562,	.1274,	.2307,	.6353,	.6652,	.5104,
12,	.5386,	1.4574,	1.1669,	1.2418,	.3234,	.1663,	.1075,	.4757,	1.1235,	1.0567,	.8853,
13,	.5540,	.5593,	.8023,	.8949,	.0514,	.7438,	.0159,	.0534,	.9196,	.8502,	.6077,
14,	.4214,	.8376,	1.0870,	.9647,	.3739,	.3889,	.1623,	.1704,	.7209,	.8995,	.5970,
+gp,	.4214,	.8376,	1.0870,	.9647,	.3739,	.3889,	.1623,	.1704,	.7209,	.8995,	
FBAR 5-10,	.7961,	.9123,	1.0110,	.8825,	.6841,	.2663,	.2902,	.3405,	.3905,	.4974,	

Table 3.14

Run title : Arctic Cod (run: H43/H43)

At 9-Oct-95 15:56:11

Terminal Fs derived using XSA (With F shrinkage)

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

YEAR	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
AGE										
1	1948900	255661	168426	297086	611258	1534957	2746687	802638	967764	928206
2	1955047	1595625	209317	137895	243232	500455	1256715	2248761	657143	792338
3	786474	1598375	1305600	171237	112898	198893	409203	1026912	1836877	530534
4	275556	629682	1258025	1037748	136841	90346	156358	328011	808610	1237649
5	268919	202081	465191	885167	691665	89827	64204	115583	227445	543054
6	210514	149324	134074	318220	482252	350474	50188	41860	70353	131021
7	85963	110363	83766	89809	163673	230843	162231	32470	23334	38988
8	22986	47358	56726	44789	49369	62193	101753	79176	19419	12546
9	7856	11184	22034	23696	21831	16000	22037	36254	33258	8364
10	2992	3202	4563	7794	8908	5692	5016	7100	9491	9920
11	2459	1123	1269	1628	3072	2685	1721	1905	1676	3700
12	361	963	575	418	739	784	1084	719	460	760
13	100	177	424	185	231	230	407	509	269	200
14	179	21	75	143	39	80	93	198	132	147
+gp	347	162	26	93	77	71	54	64	121	108
TOTAL	5568656	4605299	3710091	3015909	2526087	3083530	4977749	4722160	4656355	4237534

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

YEAR	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
AGE										
1	526611	979628	301206	212320	239237	238414	255086	576848	751185	1405393
2	759846	431152	801413	246605	173830	195871	195169	208846	472282	615006
3	629395	621039	351271	645928	201178	142118	160001	159599	170903	386594
4	351251	474333	431247	251770	457520	156929	112817	127915	122572	137112
5	617545	233472	284891	200512	165052	304475	113022	83802	85787	82624
6	260235	300526	118770	109888	84091	95613	175099	73712	51107	51711
7	64738	105778	139065	49352	38553	39945	42033	85962	34938	25867
8	20493	26290	43287	57919	17417	16350	16721	14699	31928	13219
9	6318	8315	8891	14324	18627	6773	6652	4702	4438	9556
10	4565	2804	3142	2159	3215	5321	2371	1585	1246	1331
11	3048	2330	1449	1197	658	1017	1465	755	657	436
12	1105	751	1403	634	154	152	219	401	373	331
13	331	384	215	903	116	33	53	81	93	239
14	27	62	189	66	63	42	5	10	42	24
+gp	66	124	109	68	73	13	2	10	10	23
TOTAL	3245574	3186990	2486548	1793645	1399783	1203063	1080715	1338926	1727562	2729466

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

YEAR	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	GMST
AGE												
1	435365	359651	273472	323074	680040	1122854	1209345	925743	872995	841777	0	7245
2	1150633	356446	294448	223852	264509	556769	919314	990104	756951	714671	687323	5883
3	502690	940521	291774	240878	183158	216440	455698	751670	809690	618952	582561	4794
4	310158	394121	754704	233844	193606	146452	175812	368636	594530	653231	500225	3753
5	99440	219260	272135	527062	172242	140565	115226	136261	267503	444459	476176	2626
6	50601	56789	111213	134749	301031	115570	105480	80255	88234	161206	267457	1552
7	23924	23022	21366	34618	56578	170636	80626	69173	46430	42659	79579	791
8	7230	7293	6781	5819	9068	25058	111509	47092	39994	24838	13496	365
9	3260	1952	1820	1985	1675	2951	14485	66500	26613	24222	11887	160
10	2346	946	619	566	539	541	1665	8065	37690	16035	14118	62
11	398	960	269	113	174	151	296	993	4538	19167	9234	24
12	157	179	374	93	32	101	87	213	645	1968	8017	9
13	133	75	34	95	22	19	70	64	108	172	560	4
14	145	62	35	12	32	17	7	56	49	35	60	1
+gp	121	2	13	26	25	7	37	28	4	5	14	
TOTAL	2586600	2361279	2029057	1726788	1862731	2498131	3189657	3444851	3545975	3563399	2650706	

Table 3.15

Lowestoft VPA Version 3.1

9-Oct-95 15:54:18

Extended Survivors Analysis

Arctic Cod (run: H43/H43)

CPUE data from file /users/fish/ifad/ifapwork/afwg/cod_arct/FLEET.H43

Catch data for 49 years. 1946 to 1994. Ages 1 to 15.

Fleet,	First, year,	Last, year,	First, age ,	Last, age	Alpha,	Beta
FLT43: Russian Trawl,	1982,	1994,	1,	8,	.900,	1.000
FLT44: Russian acous,	1985,	1994,	1,	8,	.900,	1.000
FLT45: Norwegian Sva,	1983,	1994,	1,	8,	.750,	.850
FLT52: Norwegian tra,	1985,	1994,	9,	14,	.000,	1.000
FLT53: Russian trawl,	1985,	1994,	9,	14,	.000,	1.000
FLT54: Norwegian Bar,	1980,	1994,	1,	8,	.990,	1.000
FLT55: Norwegian Bar,	1980,	1994,	1,	8,	.990,	1.000

Time series weights :

Tapered time weighting applied
Power = 3 over 20 years

Catchability analysis :

Catchability dependent on stock size for ages < 5

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

Catchability independent of age for ages >= 13

Terminal population estimation :

Survivor estimates shrunk towards the mean F
of the final 2 years or the 5 oldest ages.

S.E. of the mean to which the estimates are shrunk = 1.000

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

Prior weighting not applied

Tuning had not converged after 120 iterations

Total absolute residual between iterations

19 and 120 = .02030

Final year F values

Age ,	1,	2,	3,	4,	5,	6,	7,	8,	9,	10
Iteration **,	.0002,	.0007,	.0092,	.1090,	.2969,	.4907,	.9447,	.5409,	.3461,	.3608
Iteration **,	.0002,	.0007,	.0093,	.1099,	.2996,	.4955,	.9471,	.5394,	.3445,	.3585

Age ,	11,	12,	13,	14
Iteration **,	.6618,	1.0569,	.8504,	.8998
Iteration **,	.6652,	1.0567,	.8502,	.8995

Continued

Table 3.15 Continued

Regression weights

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

Fishing mortalities

Age,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994
1,	.000,	.000,	.000,	.000,	.000,	.000,	.000,	.001,	.000,	.000
2,	.002,	.000,	.001,	.001,	.001,	.000,	.001,	.001,	.001,	.001
3,	.043,	.020,	.021,	.018,	.024,	.008,	.012,	.035,	.015,	.009
4,	.147,	.170,	.159,	.106,	.120,	.040,	.055,	.121,	.091,	.110
5,	.360,	.479,	.503,	.360,	.199,	.087,	.162,	.235,	.306,	.300
6,	.588,	.778,	.967,	.668,	.368,	.160,	.222,	.347,	.527,	.495
7,	.988,	1.022,	1.101,	1.140,	.614,	.225,	.338,	.348,	.426,	.947
8,	1.110,	1.188,	1.028,	1.046,	.922,	.348,	.317,	.371,	.301,	.539
9,	1.037,	.949,	.967,	1.103,	.929,	.372,	.386,	.368,	.307,	.344
10,	.694,	1.059,	1.499,	.979,	1.072,	.405,	.318,	.375,	.476,	.358
11,	.602,	.742,	.858,	1.063,	.345,	.356,	.127,	.231,	.635,	.665
12,	.539,	1.457,	1.167,	1.242,	.323,	.166,	.108,	.476,	1.124,	1.057
13,	.554,	.559,	.802,	.895,	.051,	.744,	.016,	.053,	.920,	.850
14,	.421,	.838,	1.087,	.965,	.374,	.389,	.162,	.170,	.721,	.900

XSA population numbers (Thousands)

	AGE									
YEAR ,	1,	2,	3,	4,	5,	6,	7,	8,		
1985 ,	4.35E+05,	1.15E+06,	5.03E+05,	3.10E+05,	9.94E+04,	5.06E+04,	2.39E+04,	7.23E+03,	3.26E+03,	2.35E+03,
1986 ,	3.60E+05,	3.56E+05,	9.41E+05,	3.94E+05,	2.19E+05,	5.68E+04,	2.30E+04,	7.29E+03,	1.95E+03,	9.46E+02,
1987 ,	2.73E+05,	2.94E+05,	2.92E+05,	7.55E+05,	2.72E+05,	1.11E+05,	2.14E+04,	6.78E+03,	1.82E+03,	6.19E+02,
1988 ,	3.23E+05,	2.24E+05,	2.41E+05,	2.34E+05,	5.27E+05,	1.35E+05,	3.46E+04,	5.82E+03,	1.99E+03,	5.66E+02,
1989 ,	6.80E+05,	2.65E+05,	1.83E+05,	1.94E+05,	1.72E+05,	3.01E+05,	5.66E+04,	9.07E+03,	1.67E+03,	5.39E+02,
1990 ,	1.12E+06,	5.57E+05,	2.16E+05,	1.46E+05,	1.41E+05,	1.16E+05,	1.71E+05,	2.51E+04,	2.95E+03,	5.41E+02,
1991 ,	1.21E+06,	9.19E+05,	4.56E+05,	1.76E+05,	1.15E+05,	1.05E+05,	8.06E+04,	1.12E+05,	1.45E+04,	1.67E+03,
1992 ,	9.26E+05,	9.90E+05,	7.52E+05,	3.69E+05,	1.36E+05,	8.03E+04,	6.92E+04,	4.71E+04,	6.65E+04,	8.07E+03,
1993 ,	8.73E+05,	7.57E+05,	8.10E+05,	5.95E+05,	2.68E+05,	8.82E+04,	4.64E+04,	4.00E+04,	2.66E+04,	3.77E+04,
1994 ,	8.42E+05,	7.15E+05,	6.19E+05,	6.53E+05,	4.44E+05,	1.61E+05,	4.27E+04,	2.48E+04,	2.42E+04,	1.60E+04,

Estimated population abundance at 1st Jan 1995

, .00E+00, 6.87E+05, 5.83E+05, 5.00E+05, 4.76E+05, 2.67E+05, 7.96E+04, 1.35E+04, 1.19E+04, 1.41E+04,

Taper weighted geometric mean of the VPA populations:

, 6.21E+05, 4.80E+05, 3.68E+05, 2.75E+05, 1.81E+05, 1.00E+05, 4.65E+04, 1.86E+04, 6.65E+03, 2.14E+03,

Standard error of the weighted Log(VPA populations) :

, .5902, .6187, .6380, .6454, .6016, .5144, .6055, .9159, 1.2351, 1.4074,

	AGE			
YEAR ,	11,	12,	13,	14,
1985 ,	3.98E+02,	1.57E+02,	1.33E+02,	1.45E+02,
1986 ,	9.60E+02,	1.79E+02,	7.48E+01,	6.23E+01,
1987 ,	2.69E+02,	3.74E+02,	3.41E+01,	3.50E+01,
1988 ,	1.13E+02,	9.32E+01,	9.53E+01,	1.25E+01,
1989 ,	1.74E+02,	3.20E+01,	2.21E+01,	3.19E+01,
1990 ,	1.51E+02,	1.01E+02,	1.90E+01,	1.72E+01,
1991 ,	2.96E+02,	8.67E+01,	7.00E+01,	7.38E+00,
1992 ,	9.93E+02,	2.13E+02,	6.38E+01,	5.64E+01,
1993 ,	4.54E+03,	6.45E+02,	1.08E+02,	4.95E+01,
1994 ,	1.92E+04,	1.97E+03,	1.72E+02,	3.54E+01,

Estimated population abundance at 1st Jan 1995

, 9.23E+03, 8.02E+03, 5.60E+02, 6.01E+01,

Taper weighted geometric mean of the VPA populations:

, 6.64E+02, 2.18E+02, 7.16E+01, 2.95E+01,

Standard error of the weighted Log(VPA populations) :

, 1.4753, 1.0786, .7950, .8660,

Continued

Table 3.15 Continued

Log catchability residuals.

Fleet : FLT43: Russian Trawl

Age	1980	1981	1982	1983	1984
1	99.99	99.99	-.45	.65	.04
2	99.99	99.99	1.56	-.29	.31
3	99.99	99.99	.94	.22	.12
4	99.99	99.99	.04	.36	.33
5	99.99	99.99	-1.31	-.03	.05
6	99.99	99.99	-.51	-.47	.05
7	99.99	99.99	-1.93	-.92	-.01
8	99.99	99.99	-1.20	-.26	-.21
9	No data for this fleet at this age				
10	No data for this fleet at this age				
11	No data for this fleet at this age				
12	No data for this fleet at this age				
13	No data for this fleet at this age				
14	No data for this fleet at this age				

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	.89	.68	-.25	-.42	-1.51	-.28	-.03	.37	-.08	.65
2	.48	.53	.13	.06	-1.14	-.03	-.36	.57	.04	-.90
3	.30	.08	-.28	.09	-.19	-.29	-.31	.21	.32	-.56
4	.76	-.20	-.08	-.30	.00	-.33	-.23	-.07	.37	-.25
5	1.26	.01	-.86	-.40	.03	-.39	-.10	-.18	.79	.63
6	.54	.11	-.34	-1.04	-.30	-.49	-.09	-.07	.55	1.62
7	.53	-.26	-.40	-.85	1.11	-.37	-.22	-.13	-.08	2.16
8	.72	.09	-1.09	-.92	1.78	-.15	-.74	.04	-.06	1.26
9	No data for this fleet at this age									
10	No data for this fleet at this age									
11	No data for this fleet at this age									
12	No data for this fleet at this age									
13	No data for this fleet at this age									
14	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	7	8
Mean Log q	-6.9961	-6.7325	-6.5413	-6.5666
S.E(Log q)	.6339	.6936	.9696	.9012

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
1	.50	1.207	11.82	.40	13	.70	-10.24
2	.72	.743	9.91	.44	13	.68	-8.67
3	.68	1.674	9.40	.75	13	.38	-7.75
4	.79	1.227	8.38	.80	13	.34	-7.29

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
5	.93	.206	7.33	.52	13	.62	-7.00
6	1.03	-.066	6.59	.35	13	.75	-6.73
7	1.20	-.323	5.71	.23	13	1.22	-6.54
8	1.09	-.259	6.28	.49	13	1.03	-6.57

Continued

Table 3.15 Continued

Fleet : FLT44: Russian acous

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	2.27	1.78	.80	-2.77	-2.82	-.24	.38	.98	-.77	1.02
2	.98	.80	1.13	.41	-1.49	-.30	-.60	.41	-.78	-.07
3	.51	.38	.48	.64	-.45	-.30	-.36	-.07	-.40	-.15
4	.44	.56	.22	.16	-.19	-.10	-.04	-.27	-.27	-.26
5	.63	.74	-.06	.05	-.46	-.44	-.15	-.41	.08	.28
6	.60	.91	.60	-.56	-.58	-.58	-.15	-.26	-.03	.36
7	1.21	1.50	1.26	-.63	.49	-.90	-.73	-.73	-1.26	.46
8	1.67	1.63	1.60	-.53	1.21	-.71	-1.11	-.59	-1.22	-1.08
9	No data for this fleet at this age									
10	No data for this fleet at this age									
11	No data for this fleet at this age									
12	No data for this fleet at this age									
13	No data for this fleet at this age									
14	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	7	8
Mean Log q	-4.8855	-4.5998	-3.9500	-3.9608
S.E(Log q)	.4164	.5407	1.0166	1.2458

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
1	1.00	.001	8.12	.09	10	1.83	-8.11
2	.73	.522	8.18	.33	10	.90	-6.29
3	.61	1.482	8.40	.66	10	.45	-5.48
4	.62	2.048	8.03	.80	10	.32	-5.15

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	.85	.657	5.98	.73	10	.37	-4.89
6	2.58	-1.881	-6.45	.16	10	1.22	-4.60
7	-7.92	-2.792	64.85	.01	10	5.97	-3.95
8	11.91	-3.139	-60.01	.01	10	10.32	-3.96

Continued

Table 3.15 Continued

Fleet : FLT45: Norwegian Sva

Age	1980	1981	1982	1983	1984
1	99.99	99.99	99.99	.61	.88
2	99.99	99.99	99.99	-.35	.25
3	99.99	99.99	99.99	-.06	-1.12
4	99.99	99.99	99.99	.20	-.49
5	99.99	99.99	99.99	-1.16	-.46
6	99.99	99.99	99.99	-.72	-.71
7	99.99	99.99	99.99	-.63	-1.00
8	99.99	99.99	99.99	-.16	-.30
9	No data for this fleet at this age				
10	No data for this fleet at this age				
11	No data for this fleet at this age				
12	No data for this fleet at this age				
13	No data for this fleet at this age				
14	No data for this fleet at this age				

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	1.52	.43	.72	-1.33	-1.97	-.32	-.03	.07	.34	-.04
2	.45	1.08	.96	.11	-1.14	-1.14	-.22	-.14	.08	.33
3	.27	.31	1.02	.30	.10	-.44	-.51	-.10	.03	.06
4	.00	.06	.14	.34	-.09	.24	-.31	.28	-.10	-.29
5	.47	-.11	-.19	-.19	-.34	.45	.19	.23	.22	.31
6	.42	-.27	-.06	.07	-.27	.37	.48	.07	-.64	.76
7	-.08	-.01	-.57	-.84	-.07	.34	.79	.09	.15	1.09
8	.23	.00	-1.16	.80	-.15	-.01	.72	-.12	-.33	.29
9	No data for this fleet at this age									
10	No data for this fleet at this age									
11	No data for this fleet at this age									
12	No data for this fleet at this age									
13	No data for this fleet at this age									
14	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	7	8
Mean Log q	-8.9214	-8.9397	-9.0556	-8.9859
S.E(Log q)	.4222	.4877	.6299	.5249

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
1	.73	.462	10.42	.25	12	1.01	-9.27
2	.60	.928	10.66	.38	12	.74	-8.95
3	.63	1.299	10.40	.59	12	.53	-8.89
4	.69	2.214	10.15	.86	12	.28	-9.05

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	.90	.450	9.23	.72	12	.40	-8.92
6	.79	.911	9.49	.68	12	.39	-8.94
7	.66	1.765	9.62	.76	12	.38	-9.06
8	.89	.684	9.08	.82	12	.48	-8.99

Continued

Table 3.15 Continued

Fleet : FLT52: Norwegian tra

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	No data for this fleet at this age									
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	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	.95	.37	1.04	.41	.88	-1.30	-1.49	-.25	-.04	-.10
10	-.20	1.04	1.33	.62	1.14	-.51	-2.92	-.40	.45	-.18
11	-.33	.07	.33	.54	.67	99.99	-2.89	-.07	1.15	.55
12	-.17	.22	.08	-.20	99.99	99.99	99.99	-.19	.14	.10
13	.66	-.88	.36	.83	99.99	99.99	99.99	99.99	-.28	-.58
14	-.51	99.99	1.07	99.99	.03	99.99	99.99	-.81	-1.18	-.08

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

Age	9	10	11	12	13	14
Mean Log q	-13.8318	-13.6643	-13.6642	-12.5908	-12.9217	-12.9217
S.E(Log q)	.8885	1.2597	1.2137	.1773	.6990	.8424

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
9	1.39	-1.322	15.77	.62	10	1.18	-13.83
10	1.14	-.428	14.50	.56	10	1.51	-13.66
11	.83	.778	12.44	.76	9	1.03	-13.66
12	.91	1.421	12.01	.98	7	.15	-12.59
13	1.35	-.393	15.82	.28	6	1.05	-12.92
14	3.00	-.944	31.81	.06	6	2.40	-13.19

Continued

Table 3.15 Continued

Fleet : FLT53: Russian trawl

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	No data for this fleet at this age									
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	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	.81	.54	.10	.38	.72	.82	-.09	-1.24	-.62	-1.03
10	.59	99.99	.17	.51	1.02	.97	-.61	-1.04	-.60	-.74
11	-.78	.30	99.99	99.99	.84	1.48	-1.51	99.99	.26	-.68
12	.05	99.99	99.99	99.99	1.12	.95	-.37	99.99	1.03	-2.70
13	99.99	99.99	99.99	99.99	.77	99.99	.59	99.99	.02	-1.34
14	.17	99.99	99.99	99.99	99.99	99.99	99.99	99.99	.03	99.99

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

Age	9	10	11	12	13	14
Mean Log q	-14.3148	-14.4913	-15.2920	-15.9078	-16.0042	-16.0042
S.E(Log q)	.7799	.8007	1.0554	1.5022	.9613	.1758

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
9	2.01	-5.830	19.92	.82	10	.70	-14.31
10	1.61	-3.268	18.60	.81	9	.85	-14.49
11	1.21	-.693	17.10	.70	7	1.34	-15.29
12	2.95	-1.751	36.54	.18	6	3.68	-15.91
13	10.67	-2.037	129.06	.02	4	7.13	-16.00
14	.00	.000	.00	.00	0	.00	.00

Continued

Table 3.15 Continued

Fleet : FLT54: Norwegian Bar

Age	1980	1981	1982	1983	1984
1	.05	-1.47	-1.18	.33	.07
2	-.44	-.06	-.29	.05	-.06
3	.07	.07	.31	-.04	.10
4	.41	.33	.53	.16	-.14
5	.13	.09	.32	.07	-.42
6	-.19	.30	-.05	-.11	-.28
7	-.28	.19	.17	-.74	-1.05
8	-.28	-.34	.82	-1.05	-.66
9	No data for this fleet at this age				
10	No data for this fleet at this age				
11	No data for this fleet at this age				
12	No data for this fleet at this age				
13	No data for this fleet at this age				
14	No data for this fleet at this age				

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	.97	1.16	.36	-.80	-.77	-.40	.03	.02	.32	.36
2	.39	.83	.86	-.01	-.50	-1.01	-.43	.01	.19	.28
3	.08	.14	.35	.26	-.01	-.51	-.57	-.25	.14	.22
4	.19	-.38	-.01	-.10	.06	-.19	-.32	-.06	-.01	.30
5	.76	-.64	-.30	.30	-.12	-.23	-.27	-.18	.42	.31
6	.55	-.75	-.29	.11	.02	-.18	-.24	.07	.40	.48
7	.04	-.29	.26	.11	-.42	.10	.07	.29	.16	.72
8	.54	-.08	-.17	.70	.82	-.54	-.38	.33	-.18	-.01
9	No data for this fleet at this age									
10	No data for this fleet at this age									
11	No data for this fleet at this age									
12	No data for this fleet at this age									
13	No data for this fleet at this age									
14	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	7	8
Mean Log q	-6.2590	-6.5891	-7.1481	-7.4326
S.E(Log q)	.3794	.3565	.4388	.5500

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
1	.59	1.074	8.89	.41	15	.72	-5.73
2	.70	1.065	8.01	.57	15	.55	-5.87
3	.71	1.903	7.87	.82	15	.31	-5.90
4	.73	2.262	7.78	.88	15	.26	-6.00

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	.89	.626	6.90	.77	15	.35	-6.26
6	.87	.726	7.25	.75	15	.32	-6.59
7	.86	.750	7.67	.74	15	.38	-7.15
8	1.36	-1.530	6.58	.65	15	.70	-7.43

Continued

Table 3.15 Continued

Fleet : FLT55: Norwegian Bar

Age	1980	1981	1982	1983	1984
1	.75	-.66	-.84	-.11	.04
2	.45	.57	-.27	-.58	.16
3	.87	.48	.07	-.55	.36
4	1.29	.76	.38	-.74	.03
5	1.22	.71	.46	-.58	.02
6	.98	.82	.34	-.62	.56
7	.73	.45	.37	-1.34	-.74
8	.51	-.35	.91	-1.06	.02
9	No data for this fleet at this age				
10	No data for this fleet at this age				
11	No data for this fleet at this age				
12	No data for this fleet at this age				
13	No data for this fleet at this age				
14	No data for this fleet at this age				

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	1.09	.27	.11	-.61	-.59	-.30	.06	.18	.46	.07
2	.23	.35	.31	-.09	-.38	-.42	-.23	-.01	.36	.02
3	.10	-.04	-.14	.07	-.07	-.06	-.50	-.12	.32	.05
4	.08	-.31	-.55	-.30	-.10	.11	-.41	.19	.27	.45
5	-.34	-.48	-.96	.09	.09	.31	-.24	-.09	.43	.39
6	-.50	-1.12	-.91	-.01	.49	.19	-.21	.05	.39	.45
7	-.75	.53	-.52	.24	.32	.50	-.02	-.14	-.07	.53
8	.53	.60	.51	.68	1.32	-.27	-1.10	-.88	-.78	-.07
9	No data for this fleet at this age									
10	No data for this fleet at this age									
11	No data for this fleet at this age									
12	No data for this fleet at this age									
13	No data for this fleet at this age									
14	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	7	8
Mean Log q	-6.3591	-6.5519	-7.0534	-7.0133
S.E(Log q)	.4835	.5822	.5556	.7885

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
1	.48	1.868	9.83	.57	15	.52	-5.95
2	.58	2.451	9.06	.78	15	.34	-6.09
3	.71	1.953	8.03	.82	15	.32	-6.03
4	.86	.667	7.00	.69	15	.46	-6.08

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	.89	.511	7.01	.68	15	.44	-6.36
6	.66	1.601	8.23	.70	15	.36	-6.55
7	.72	1.443	8.08	.74	15	.38	-7.05
8	4.01	-5.703	-1.41	.27	15	1.59	-7.01

Continued

Table 3.15 Continued

Terminal year survivor and F summaries :

Age 1 Catchability dependent on age and year class strength

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT43: Russian Trawl,	1321732.,	.761,	.000,	.00,	1,	.150,	.000
FLT44: Russian acous,	1913005.,	1.982,	.000,	.00,	1,	.022,	.000
FLT45: Norwegian Sva,	659574.,	1.053,	.000,	.00,	1,	.078,	.000
FLT52: Norwegian tra,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT53: Russian trawl,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT54: Norwegian Bar,	992310.,	.767,	.000,	.00,	1,	.148,	.000
FLT55: Norwegian Bar,	739462.,	.550,	.000,	.00,	1,	.287,	.000
P shrinkage mean ,	479566.,	.62,,,,				.227,	.000
F shrinkage mean ,	191541.,	1.00,,,,				.087,	.001

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
687323.,	.29,	.24,	7,	.830,	.000

Age 2 Catchability dependent on age and year class strength

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT43: Russian Trawl,	357767.,	.515,	.407,	.79,	2,	.143,	.001
FLT44: Russian acous,	475367.,	.850,	.275,	.32,	2,	.053,	.001
FLT45: Norwegian Sva,	817267.,	.638,	.003,	.01,	2,	.094,	.000
FLT52: Norwegian tra,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT53: Russian trawl,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT54: Norwegian Bar,	785479.,	.469,	.019,	.04,	2,	.173,	.001
FLT55: Norwegian Bar,	678407.,	.307,	.200,	.65,	2,	.405,	.001
P shrinkage mean ,	368437.,	.64,,,,				.094,	.001
F shrinkage mean ,	330028.,	1.00,,,,				.038,	.001

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
582561.,	.20,	.12,	12,	.605,	.001

Age 3 Catchability dependent on age and year class strength

Year class = 1991

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT43: Russian Trawl,	378933.,	.314,	.268,	.85,	3,	.178,	.012
FLT44: Russian acous,	401767.,	.419,	.252,	.60,	3,	.100,	.012
FLT45: Norwegian Sva,	538189.,	.423,	.007,	.02,	3,	.098,	.009
FLT52: Norwegian tra,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT53: Russian trawl,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT54: Norwegian Bar,	606820.,	.276,	.046,	.17,	3,	.231,	.008
FLT55: Norwegian Bar,	603995.,	.230,	.099,	.43,	3,	.332,	.008
P shrinkage mean ,	274540.,	.65,,,,				.043,	.017
F shrinkage mean ,	187516.,	1.00,,,,				.018,	.025

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
500225.,	.13,	.09,	17,	.653,	.009

Continued

Table 3.15 Continued

Age 4 Catchability dependent on age and year class strength

Year class = 1990

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT43: Russian Trawl,	500861.,	.249,	.177,	.71,	4,	.168,	.105
FLT44: Russian acous,	375011.,	.265,	.121,	.46,	4,	.149,	.138
FLT45: Norwegian Sva,	390062.,	.246,	.074,	.30,	4,	.172,	.133
FLT52: Norwegian tra,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT53: Russian trawl,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT54: Norwegian Bar,	579295.,	.205,	.063,	.31,	4,	.246,	.092
FLT55: Norwegian Bar,	580510.,	.216,	.106,	.49,	4,	.221,	.092
P shrinkage mean ,	180728.,	.60,,,,				.032,	.268
F shrinkage mean ,	496909.,	1.00,,,,				.012,	.106

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
476176.,	.10,	.07,	22,	.679,	.110

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

Year class = 1989

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT43: Russian Trawl,	335307.,	.235,	.151,	.64,	5,	.150,	.248
FLT44: Russian acous,	246299.,	.226,	.131,	.58,	5,	.166,	.324
FLT45: Norwegian Sva,	265605.,	.214,	.097,	.45,	5,	.185,	.304
FLT52: Norwegian tra,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT53: Russian trawl,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT54: Norwegian Bar,	252496.,	.179,	.123,	.68,	5,	.262,	.317
FLT55: Norwegian Bar,	261108.,	.192,	.125,	.65,	5,	.225,	.308
F shrinkage mean ,	301429.,	1.00,,,,				.012,	.272

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
267457.,	.09,	.05,	26,	.584,	.300

Continued

Table 3.15 Continued

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

Year class = 1988

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT43: Russian Trawl,	88353.,	.218,	.336,	1.54,	6,	.149,	.460
FLT44: Russian acous,	72452.,	.212,	.162,	.76,	6,	.164,	.538
FLT45: Norwegian Sva,	94358.,	.202,	.253,	1.25,	6,	.182,	.436
FLT52: Norwegian tra,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT53: Russian trawl,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT54: Norwegian Bar,	78115.,	.165,	.221,	1.34,	6,	.278,	.507
FLT55: Norwegian Bar,	69469.,	.183,	.187,	1.02,	6,	.211,	.555
F shrinkage mean ,	93256.,	1.00,,,,				.016,	.440

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
79579.,	.09,	.10,	31,	1.121,	.495

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

Year class = 1987

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT43: Russian Trawl,	13776.,	.228,	.322,	1.41,	7,	.134,	.937
FLT44: Russian acous,	11264.,	.221,	.162,	.74,	7,	.143,	1.064
FLT45: Norwegian Sva,	12329.,	.205,	.259,	1.27,	7,	.182,	1.006
FLT52: Norwegian tra,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT53: Russian trawl,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT54: Norwegian Bar,	13761.,	.165,	.200,	1.22,	7,	.295,	.938
FLT55: Norwegian Bar,	13005.,	.189,	.152,	.80,	7,	.212,	.972
F shrinkage mean ,	44915.,	1.00,,,,				.035,	.389

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
13496.,	.09,	.10,	36,	1.067,	.947

Continued

Table 3.15 Continued

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

Year class = 1986

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT43: Russian Trawl,	11798.,	.230,	.185,	.80,	8,	.131,	.542
FLT44: Russian acous,	8875.,	.224,	.146,	.65,	8,	.130,	.671
FLT45: Norwegian Sva,	14598.,	.196,	.039,	.20,	8,	.211,	.458
FLT52: Norwegian tra,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT53: Russian trawl,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT54: Norwegian Bar,	11551.,	.160,	.058,	.36,	8,	.299,	.550
FLT55: Norwegian Bar,	11318.,	.186,	.038,	.20,	8,	.204,	.559
F shrinkage mean ,	21072.,	1.00,,,,				.025,	.338

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
11887.,	.09,	.05,	41,	.541,	.539

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

Year class = 1985

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT43: Russian Trawl,	14174.,	.218,	.084,	.39,	8,	.132,	.342
FLT44: Russian acous,	12402.,	.215,	.203,	.94,	8,	.132,	.383
FLT45: Norwegian Sva,	15800.,	.190,	.130,	.68,	8,	.195,	.312
FLT52: Norwegian tra,	12755.,	.935,	.000,	.00,	1,	.018,	.374
FLT53: Russian trawl,	4993.,	.821,	.000,	.00,	1,	.023,	.769
FLT54: Norwegian Bar,	15120.,	.155,	.125,	.80,	8,	.281,	.324
FLT55: Norwegian Bar,	14199.,	.180,	.117,	.65,	8,	.197,	.341
F shrinkage mean ,	14306.,	1.00,,,,				.022,	.339

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
14118.,	.09,	.06,	43,	.696,	.344

Continued

Table 3.15 Continued

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

Year class = 1984

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT43: Russian Trawl,	8141.,	.224,	.131,	.58,	8,	.122,	.396
FLT44: Russian acous,	8318.,	.215,	.185,	.86,	8,	.129,	.389
FLT45: Norwegian Sva,	12223.,	.195,	.172,	.88,	8,	.183,	.280
FLT52: Norwegian tra,	8316.,	.773,	.068,	.09,	2,	.031,	.389
FLT53: Russian trawl,	4616.,	.596,	.056,	.09,	2,	.055,	.619
FLT54: Norwegian Bar,	10130.,	.158,	.111,	.70,	8,	.266,	.330
FLT55: Norwegian Bar,	9307.,	.185,	.163,	.88,	8,	.182,	.354
F shrinkage mean ,	7391.,	1.00,,,,				.032,	.429

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
9234.,	.09,	.07,	45,	.716,	.358

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

Year class = 1983

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT43: Russian Trawl,	6612.,	.252,	.115,	.46,	8,	.101,	.767
FLT44: Russian acous,	7008.,	.246,	.209,	.85,	7,	.101,	.736
FLT45: Norwegian Sva,	10182.,	.217,	.139,	.64,	8,	.166,	.559
FLT52: Norwegian tra,	10372.,	.702,	.256,	.37,	3,	.059,	.551
FLT53: Russian trawl,	3603.,	.553,	.193,	.35,	3,	.093,	1.137
FLT54: Norwegian Bar,	8269.,	.174,	.077,	.44,	8,	.244,	.653
FLT55: Norwegian Bar,	8079.,	.208,	.193,	.93,	8,	.156,	.665
F shrinkage mean ,	13947.,	1.00,,,,				.080,	.436

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
8017.,	.13,	.07,	46,	.563,	.665

Continued

Table 3.15 Continued

Age 12 Catchability constant w.r.t. time and dependent on age

Year class = 1982

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT43: Russian Trawl,	528.,	.317,	.229,	.72,	8,	.033,	1.095
FLT44: Russian acous,	568.,	.297,	.230,	.77,	6,	.031,	1.048
FLT45: Norwegian Sva,	563.,	.267,	.043,	.16,	8,	.062,	1.053
FLT52: Norwegian tra,	606.,	.284,	.176,	.62,	4,	.534,	1.006
FLT53: Russian trawl,	232.,	.562,	.638,	1.13,	4,	.074,	1.711
FLT54: Norwegian Bar,	420.,	.213,	.098,	.46,	8,	.085,	1.253
FLT55: Norwegian Bar,	524.,	.256,	.135,	.53,	8,	.052,	1.101
F shrinkage mean ,	846.,	1.00,,,,				.129,	.808

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
560.,	.21,	.08,	47,	.371,	1.057

Age 13 Catchability constant w.r.t. time and dependent on age

Year class = 1981

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT43: Russian Trawl,	128.,	.457,	.379,	.83,	8,	.012,	.489
FLT44: Russian acous,	110.,	.452,	.284,	.63,	5,	.009,	.551
FLT45: Norwegian Sva,	48.,	.354,	.113,	.32,	7,	.026,	.990
FLT52: Norwegian tra,	50.,	.301,	.266,	.89,	5,	.545,	.953
FLT53: Russian trawl,	29.,	.690,	.519,	.75,	4,	.136,	1.326
FLT54: Norwegian Bar,	84.,	.286,	.185,	.65,	8,	.032,	.675
FLT55: Norwegian Bar,	92.,	.355,	.296,	.83,	8,	.018,	.628
F shrinkage mean ,	127.,	1.00,,,,				.222,	.490

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
60.,	.29,	.11,	46,	.388,	.850

Age 14 Catchability constant w.r.t. time and age (fixed at the value for age) 13

Year class = 1980

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT43: Russian Trawl,	10.,	.429,	.299,	.70,	7,	.006,	1.006
FLT44: Russian acous,	18.,	.534,	.402,	.75,	4,	.004,	.678
FLT45: Norwegian Sva,	17.,	.348,	.261,	.75,	6,	.013,	.710
FLT52: Norwegian tra,	9.,	.302,	.206,	.68,	6,	.572,	1.047
FLT53: Russian trawl,	12.,	.575,	.508,	.88,	4,	.092,	.895
FLT54: Norwegian Bar,	15.,	.273,	.197,	.72,	8,	.016,	.752
FLT55: Norwegian Bar,	11.,	.347,	.233,	.67,	8,	.009,	.953
F shrinkage mean ,	18.,	1.00,,,,				.287,	.661

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
12.,	.34,	.09,	44,	.260,	.900

Table 3.16

Run title : Arctic Cod (run: H52/H52)

At 9-Oct-95 16:23:35

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
AGE										
1	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0001
2	.0014	.0006	.0008	.0000	.0013	.0013	.0019	.0023	.0140	.0302
3	.0223	.0394	.0296	.0242	.0228	.0406	.0212	.0390	.1949	.2124
4	.1101	.1028	.1515	.2057	.2209	.1416	.1022	.1661	.1981	.4952
5	.3883	.2103	.1797	.4073	.4798	.3821	.2277	.2965	.3516	.5356
6	.4458	.3781	.2007	.4649	.5367	.5703	.2355	.3844	.3903	.5050
7	.3962	.4655	.4261	.3984	.7676	.6192	.5174	.3140	.4205	.4432
8	.5204	.5652	.6729	.5186	.9268	.8375	.8320	.6674	.6424	.4861
9	.6973	.6965	.8392	.7784	1.1442	.9598	.9326	1.1402	1.0097	.4055
10	.7804	.7255	.8304	.7309	.9990	.9964	.7684	1.2436	.7421	.9799
11	.7376	.4685	.9118	.5904	1.1652	.7073	.6722	1.2207	.5912	1.0088
12	.5132	.6208	.9341	.3900	.9659	.4561	.5555	.7818	.6319	.6318
13	1.3556	.6567	.8836	1.3487	.8623	.7110	.5185	1.1510	.4038	1.7923
14	.8253	.6393	.8893	.7754	1.0392	.7738	.6959	1.1206	.6821	.9745
+gp	.8253	.6393	.8893	.7754	1.0392	.7738	.6959	1.1206	.6821	.9745
FBAR 5-10	.5381	.5069	.5248	.5497	.8090	.7276	.5856	.6743	.5928	.5592

Table 8 Fishing mortality (F) at age

YEAR	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
AGE										
1	.0000	.0008	.0000	.0000	.0000	.0001	.0000	.0000	.0000	.2078
2	.0017	.0049	.0157	.0036	.0014	.0023	.0012	.0005	.0002	.0655
3	.0829	.1647	.1330	.1449	.0484	.0309	.0238	.0640	.0203	.0231
4	.2084	.3098	.5658	.2223	.2072	.1282	.0973	.1995	.1944	.1212
5	.5202	.4759	.7526	.6690	.3460	.3532	.2274	.2945	.3062	.2903
6	.7002	.5706	.6782	.8474	.5444	.6219	.5114	.5466	.4810	.5708
7	.7012	.6935	.6759	.8416	.6578	.6708	.8507	.7904	.7719	1.0747
8	.7020	.8842	.9059	.9344	.7447	.6993	1.0686	.9975	1.0064	1.2001
9	.6121	.7731	1.2159	1.2942	1.0530	.8501	1.2342	1.1283	1.0044	1.2047
10	.4724	.4602	.7655	.9902	.9511	1.0901	.9457	.6804	.8511	1.0064
11	1.2006	.3074	.6259	1.8531	1.2697	1.3356	1.0953	.5067	.4863	.8230
12	.8564	1.0504	.2401	1.4998	1.3521	.8467	.7991	1.2606	.2485	.7154
13	1.4780	.5108	.9852	2.4655	.8264	1.6901	1.4769	.4624	1.1669	.3022
14	.9340	.6259	.7742	1.6426	1.1034	1.1767	1.1235	.8160	.7589	.8187
+gp	.9340	.6259	.7742	1.6426	1.1034	1.1767	1.1235	.8160	.7589	.8187
FBAR 5-10	.6180	.6429	.8324	.9295	.7162	.7142	.8063	.7396	.7368	.8912

Run title : Arctic Cod (run: H52/H52)

At 9-Oct-95 16:23:35

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	FBAR 92-94
AGE											
1	.2830	.4986	.5468	.9267	.2238	.1132	.0919	.3906	2.3741	2.3589	1.7079
2	.0866	.5389	.7951	.1264	.0006	.0533	.0676	.1153	.6981	.4730	.4288
3	.0521	.2038	.1167	.0192	.0238	.0078	.0966	.0323	.4841	.7971	.4378
4	.1468	.1704	.1595	.1095	.1252	.0400	.0544	.1158	.0846	.1191	.1065
5	.3602	.4788	.5030	.3616	.2073	.0913	.1627	.2322	.2914	.2748	.2661
6	.5875	.7776	.9671	.6680	.3699	.1681	.2342	.3501	.5188	.4597	.4429
7	.9883	1.0224	1.1008	1.1398	.6148	.2273	.3599	.3741	.4308	.9171	.5740
8	1.1096	1.1888	1.0289	1.0463	.9229	.3484	.3203	.4065	.3338	.5503	.4302
9	1.0374	.9486	.9694	1.1040	.9308	.3726	.3860	.3734	.3498	.3979	.3737
10	.6940	1.0592	1.4999	.9845	1.0752	.4059	.3180	.3756	.4873	.4332	.4321
11	.6021	.7428	.8589	1.0640	.3487	.3584	.1279	.2311	.6372	.6936	.5206
12	.5387	1.4583	1.1682	1.2454	.3241	.1685	.1084	.4781	1.1274	1.0641	.8899
13	.5542	.5596	.8037	.8978	.0517	.7464	.0161	.0539	.9294	.8581	.6138
14	.4251	.8383	1.0885	.9690	.3760	.3915	.1632	.1732	.7302	.9238	.6090
+gp	.4251	.8383	1.0885	.9690	.3760	.3915	.1632	.1732	.7302	.9238	
FBAR 5-10	.7962	.9126	1.0115	.8840	.6868	.2689	.2969	.3520	.4020	.5055	

Table 3.17

Run title : Arctic Cod (run: H52/H52)

At 9-Oct-95 16:23:35

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year) Numbers*10**-4

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
AGE										
1,	194890,	25566,	16843,	29709,	61125,	153496,	274669,	80262,	96776,	92821,
2,	195505,	159562,	20932,	13790,	24323,	50045,	125671,	224876,	65713,	79234,
3,	78647,	159837,	130560,	17124,	11290,	19889,	40920,	102691,	183688,	53053,
4,	27556,	62968,	125802,	103775,	13684,	9035,	15636,	32801,	80861,	123765,
5,	26892,	20208,	46519,	88517,	69166,	8983,	6420,	11558,	22744,	54305,
6,	21051,	14932,	13407,	31822,	48225,	35047,	5019,	4186,	7035,	13102,
7,	8596,	11036,	8377,	8981,	16367,	23084,	16223,	3247,	2333,	3899,
8,	2299,	4736,	5673,	4479,	4937,	6219,	10175,	7918,	1942,	1255,
9,	786,	1118,	2203,	2370,	2183,	1600,	2204,	3625,	3326,	836,
10,	299,	320,	456,	779,	891,	569,	502,	710,	949,	992,
11,	246,	112,	127,	163,	307,	269,	172,	190,	168,	370,
12,	36,	96,	58,	42,	74,	78,	108,	72,	46,	76,
13,	10,	18,	42,	19,	23,	23,	41,	51,	27,	20,
14,	18,	2,	8,	14,	4,	8,	9,	20,	13,	15,
+gp,	35,	16,	3,	9,	8,	7,	5,	6,	12,	11,
TOTAL,	556866,	460530,	371009,	301591,	252608,	308352,	497775,	472214,	465634,	423752,

Table 10 Stock number at age (start of year) Numbers*10**-4

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
1,	52661,	97963,	30120,	21232,	23923,	23841,	25508,	57849,	80765,	225637,
2,	75985,	43115,	80141,	24660,	17383,	19586,	19516,	20884,	47362,	66124,
3,	62939,	62104,	35127,	64593,	20118,	14212,	15999,	15960,	17090,	38769,
4,	35124,	47433,	43125,	25177,	45752,	15693,	11282,	12791,	12257,	13711,
5,	61754,	23347,	28489,	20051,	16505,	30447,	11302,	8380,	8578,	8262,
6,	26023,	30053,	11877,	10989,	8409,	9561,	17510,	7371,	5111,	5171,
7,	6474,	10578,	13907,	4935,	3855,	3994,	4203,	8596,	3494,	2587,
8,	2049,	2629,	4329,	5792,	1741,	1635,	1672,	1470,	3193,	1322,
9,	632,	832,	889,	1432,	1863,	677,	665,	470,	444,	956,
10,	456,	280,	314,	216,	321,	532,	237,	159,	125,	133,
11,	305,	233,	145,	120,	66,	102,	146,	75,	66,	44,
12,	110,	75,	140,	63,	15,	15,	22,	40,	37,	33,
13,	33,	38,	22,	90,	12,	3,	5,	8,	9,	24,
14,	3,	6,	19,	7,	6,	4,	0,	1,	4,	2,
+gp,	7,	12,	11,	7,	7,	1,	0,	1,	1,	2,
TOTAL,	324556,	318698,	248654,	179364,	139977,	120304,	108069,	134055,	178535,	362775,

Run title : Arctic Cod (run: H52/H52)

At 9-Oct-95 16:23:35

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year) Numbers*10**-4

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	GMST
AGE												
1,	105375,	126111,	53276,	82319,	101425,	143546,	220249,	437863,	1533038,	1751856,	0,	736
2,	150080,	65010,	62713,	25246,	26679,	66391,	104948,	164487,	242574,	116852,	135219,	532
3,	50706,	112677,	31051,	23185,	18215,	21831,	51537,	80305,	120000,	98811,	59457,	400
4,	31015,	39408,	75247,	22623,	18622,	14563,	17734,	38311,	63659,	60543,	36234,	297
5,	9944,	21926,	27210,	52523,	16601,	13452,	11455,	13751,	27935,	47890,	43763,	202
6,	5060,	5679,	11121,	13472,	29953,	11047,	10053,	7970,	8926,	17091,	29642,	119
7,	2392,	2302,	2136,	3461,	5656,	16941,	7645,	6512,	4598,	4350,	8781,	59
8,	723,	729,	678,	582,	907,	2504,	11050,	4367,	3667,	2447,	1420,	25
9,	326,	195,	182,	198,	167,	295,	1447,	6568,	2381,	2150,	1156,	8
10,	235,	95,	62,	56,	54,	54,	166,	805,	3702,	1374,	1184,	2
11,	40,	96,	27,	11,	17,	15,	29,	99,	453,	1862,	731,	
12,	16,	18,	37,	9,	3,	10,	9,	21,	64,	196,	758,	
13,	13,	7,	3,	10,	2,	2,	7,	6,	11,	17,	55,	
14,	14,	6,	3,	1,	3,	2,	1,	6,	5,	3,	6,	
+gp,	12,	0,	1,	3,	2,	1,	4,	3,	0,	1,	1,	
TOTAL,	355951,	374259,	263750,	223701,	218307,	290652,	436334,	761074,	2011012,	2105442,	318409,	

Table 3.18

Run title : Arctic Cod (run: H54/H54)

At 18-Oct-95 14:55:16

Traditional vpa using screen input for terminal F

Table 8 Fishing mortality (F) at age

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
AGE										
3,	.0225,	.0398,	.0298,	.0244,	.0230,	.0409,	.0213,	.0393,	.1960,	.2135,
4,	.1109,	.1036,	.1525,	.2069,	.2218,	.1422,	.1028,	.1672,	.1995,	.4961,
5,	.3894,	.2117,	.1811,	.4088,	.4809,	.3829,	.2286,	.2977,	.3533,	.5373,
6,	.4470,	.3797,	.2024,	.4671,	.5384,	.5713,	.2368,	.3853,	.3919,	.5072,
7,	.3980,	.4673,	.4284,	.4012,	.7688,	.6214,	.5195,	.3159,	.4217,	.4455,
8,	.5218,	.5672,	.6742,	.5221,	.9271,	.8390,	.8338,	.6701,	.6437,	.4875,
9,	.6979,	.6973,	.8395,	.7795,	1.1416,	.9599,	.9343,	1.1369,	1.0102,	.4089,
10,	.7809,	.7263,	.8296,	.7333,	.9966,	.9938,	.7720,	1.2387,	.7436,	.9818,
11,	.7375,	.4721,	.9097,	.5924,	1.1604,	.7081,	.6731,	1.2199,	.5939,	1.0065,
12,	.5148,	.6223,	.9372,	.3923,	.9634,	.4587,	.5585,	.7819,	.6391,	.6365,
13,	1.3471,	.6584,	.8824,	1.3452,	.8615,	.7109,	.5224,	1.1459,	.4069,	1.7817,
14,	.8250,	.6390,	.8890,	.7750,	1.0390,	.7740,	.6960,	1.1210,	.6820,	.9750,
+gp,	.8250,	.6390,	.8890,	.7750,	1.0390,	.7740,	.6960,	1.1210,	.6820,	.9750,
FBAR 5-10,	.5392,	.5082,	.5259,	.5520,	.8089,	.7281,	.5875,	.6741,	.5941,	.5614,

Table 8 Fishing mortality (F) at age

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
3,	.0836,	.1659,	.1339,	.1458,	.0488,	.0312,	.0240,	.0645,	.0205,	.0205,
4,	.2098,	.3119,	.5668,	.2237,	.2085,	.1293,	.0982,	.2010,	.1958,	.1224,
5,	.5215,	.4775,	.7532,	.6694,	.3480,	.3551,	.2293,	.2968,	.3084,	.2926,
6,	.7015,	.5724,	.6793,	.8467,	.5466,	.6240,	.5139,	.5493,	.4846,	.5740,
7,	.7035,	.6962,	.6783,	.8410,	.6595,	.6738,	.8520,	.7925,	.7751,	1.0751,
8,	.7042,	.8867,	.9088,	.9357,	.7452,	.7021,	1.0682,	.9976,	1.0070,	1.1983,
9,	.6136,	.7769,	1.2138,	1.2914,	1.0535,	.8492,	1.2278,	1.1250,	1.0044,	1.2000,
10,	.4778,	.4635,	.7737,	.9910,	.9532,	1.0905,	.9409,	.6800,	.8504,	1.0063,
11,	1.1997,	.3136,	.6313,	1.8478,	1.2622,	1.3288,	1.0964,	.5062,	.4877,	.8220,
12,	.8546,	1.0522,	.2469,	1.4937,	1.3545,	.8580,	.7978,	1.2584,	.2494,	.7154,
13,	1.4679,	.5124,	.9914,	2.4481,	.8296,	1.6835,	1.4692,	.4642,	1.1634,	.3032,
14,	.9340,	.6260,	.7740,	1.6430,	1.1030,	1.1770,	1.1240,	.8160,	.7590,	.8190,
+gp,	.9340,	.6260,	.7740,	1.6430,	1.1030,	1.1770,	1.1240,	.8160,	.7590,	.8190,
FBAR 5-10,	.6204,	.6455,	.8345,	.9292,	.7177,	.7158,	.8053,	.7402,	.7383,	.8910,

Table 8 Fishing mortality (F) at age

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	FBAR 92-94
AGE											
3,	.0434,	.0184,	.0212,	.0193,	.0239,	.0079,	.0111,	.0324,	.0124,	.0090,	.0179,
4,	.1483,	.1714,	.1601,	.1099,	.1256,	.0403,	.0549,	.1164,	.0849,	.1191,	.1068,
5,	.3629,	.4819,	.5037,	.3619,	.2078,	.0916,	.1635,	.2340,	.2920,	.2748,	.2669,
6,	.5906,	.7799,	.9677,	.6672,	.3702,	.1687,	.2347,	.3509,	.5214,	.4597,	.4440,
7,	.9894,	1.0226,	1.0993,	1.1362,	.6141,	.2281,	.3602,	.3742,	.4315,	.9171,	.5743,
8,	1.1095,	1.1858,	1.0290,	1.0437,	.9199,	.3496,	.3213,	.4065,	.3341,	.5503,	.4303,
9,	1.0371,	.9523,	.9680,	1.1023,	.9275,	.3743,	.3877,	.3746,	.3502,	.3979,	.3742,
10,	.6953,	1.0578,	1.4925,	.9804,	1.0712,	.4073,	.3204,	.3781,	.4886,	.4332,	.4333,
11,	.6072,	.7448,	.8602,	1.0584,	.3501,	.3607,	.1291,	.2338,	.6404,	.6936,	.5226,
12,	.5407,	1.4519,	1.1623,	1.2364,	.3253,	.1700,	.1097,	.4809,	1.1246,	1.0641,	.8899,
13,	.5561,	.5628,	.8058,	.8915,	.0520,	.7438,	.0163,	.0546,	.9294,	.8581,	.6140,
14,	.4260,	.8380,	1.0870,	.9710,	.3750,	.3920,	.1640,	.1750,	.7340,	.9238,	.6109,
+gp,	.4260,	.8380,	1.0870,	.9710,	.3750,	.3920,	.1640,	.1750,	.7340,	.9238,	
FBAR 5-10,	.7975,	.9134,	1.0100,	.8819,	.6851,	.2699,	.2980,	.3530,	.4030,	.5055,	

Table 3.19

Run title : Arctic Cod (run: H54/H54)

At 18-Oct-95 14:55:16

Traditional vpa using screen input for terminal F

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

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
AGE										
3,	778090,	1582377,	1292664,	169748,	111970,	197051,	404981,	1015587,	1818303,	525330,
4,	272729,	622846,	1245045,	1027225,	135629,	89590,	154865,	324568,	799413,	1223750,
5,	266135,	199849,	459765,	875147,	683854,	88953,	63625,	114403,	224809,	536116,
6,	208175,	147618,	132409,	314070,	476086,	346146,	49659,	41445,	69546,	129276,
7,	84947,	109007,	82674,	88545,	161181,	227518,	160064,	32085,	23081,	38479,
8,	22702,	46716,	55931,	44102,	48535,	61173,	100065,	77949,	19154,	12396,
9,	7749,	11030,	21692,	23334,	21422,	15724,	21644,	35588,	32653,	8238,
10,	2948,	3157,	4496,	7671,	8762,	5600,	4930,	6962,	9348,	9735,
11,	2426,	1105,	1250,	1606,	3017,	2648,	1697,	1865,	1652,	3638,
12,	356,	950,	564,	412,	727,	774,	1068,	709,	451,	747,
13,	98,	174,	417,	181,	228,	227,	401,	500,	266,	195,
14,	176,	21,	74,	141,	39,	79,	91,	194,	130,	145,
+gp,	347,	162,	26,	93,	77,	71,	54,	64,	121,	108,
TOTAL,	1646877,	2725013,	3297008,	2552278,	1651526,	1035554,	963142,	1651920,	2998927,	2488152,

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

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
3,	622068,	614203,	347736,	639616,	198956,	140412,	158188,	157838,	168789,	382683,
4,	347422,	468458,	425991,	249016,	452643,	155129,	111428,	126437,	121152,	135387,
5,	610055,	230616,	280787,	197882,	163018,	300842,	111608,	82693,	84672,	81549,
6,	256488,	296492,	117121,	108248,	82949,	94240,	172683,	72656,	50314,	50924,
7,	63735,	104119,	136946,	48614,	38004,	39317,	41339,	84565,	34346,	25372,
8,	20179,	25821,	42494,	56898,	17165,	16090,	16410,	14437,	31344,	12954,
9,	6233,	8170,	8710,	14021,	18275,	6670,	6528,	4617,	4359,	9375,
10,	4481,	2763,	3076,	2119,	3156,	5218,	2336,	1566,	1227,	1307,
11,	2986,	2275,	1423,	1162,	644,	996,	1436,	747,	649,	429,
12,	1089,	737,	1361,	620,	150,	149,	216,	393,	368,	326,
13,	323,	379,	211,	871,	114,	32,	52,	80,	91,	235,
14,	27,	61,	186,	64,	62,	41,	5,	10,	41,	23,
+gp,	66,	124,	109,	68,	73,	13,	2,	10,	10,	23,
TOTAL,	1935152,	1754218,	1366151,	1319196,	975207,	759147,	622230,	546046,	497363,	700587,

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

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	GMST
AGE												
3,	502168,	1117817,	304595,	230326,	180669,	215767,	511540,	798397,	1195624,	908848,	0,	4788
4,	306071,	390133,	746738,	224701,	184974,	144421,	175263,	380046,	632832,	603085,	335351,	3712
5,	98075,	216058,	269098,	520932,	164824,	133565,	113574,	135832,	276968,	475948,	438324,	2593
6,	49831,	55860,	109246,	133138,	297009,	109627,	99780,	78964,	88011,	169331,	296044,	1530
7,	23484,	22601,	20966,	33984,	55936,	167933,	75822,	64601,	45518,	42779,	87545,	779
8,	7089,	7149,	6655,	5718,	8933,	24781,	109450,	43303,	36381,	24206,	13999,	359
9,	3200,	1914,	1788,	1947,	1649,	2915,	14303,	64986,	23610,	21326,	11431,	158
10,	2312,	929,	605,	556,	529,	534,	1641,	7947,	36582,	13619,	11728,	61
11,	391,	944,	264,	111,	171,	149,	291,	975,	4458,	18374,	7230,	24
12,	154,	175,	367,	91,	32,	99,	85,	209,	632,	1924,	7518,	9
13,	131,	74,	33,	94,	22,	19,	68,	62,	106,	168,	543,	4
14,	142,	61,	34,	12,	32,	17,	7,	55,	48,	34,	58,	1
+gp,	120,	2,	13,	26,	25,	7,	36,	27,	4,	5,	13,	
TOTAL,	993169,	1813715,	1460404,	1151639,	894802,	799832,	1101860,	1575406,	2340778,	2279649,	1209786,	

Table 3.20

Run title : Arctic Cod (run: H54/H54)

At 18-Oct-95 14:55:16

Traditional vpa using screen input for terminal F

Table 14 Stock biomass at age with SOP (start of year) Tonnes

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
AGE										
3,	453419,	968383,	738326,	105490,	63635,	124673,	294343,	712129,	1350918,	350705,
4,	244505,	586415,	1094041,	982109,	118587,	87205,	173164,	350134,	913735,	1256865,
5,	369820,	291647,	626205,	1296900,	926783,	134206,	110271,	191292,	398285,	853466,
6,	438584,	326611,	273421,	705648,	978220,	791785,	130487,	105066,	186806,	312021,
7,	262739,	354078,	250631,	292065,	486201,	764038,	617475,	119411,	91018,	136347,
8,	95656,	206720,	230991,	198178,	199451,	279857,	525879,	395218,	102896,	59835,
9,	42861,	64072,	117605,	137648,	115564,	94433,	149321,	236875,	230278,	52204,
10,	20352,	22886,	30424,	56473,	58988,	41973,	42443,	57829,	82270,	76990,
11,	20116,	9627,	10162,	14203,	24397,	23841,	17554,	18610,	17463,	34567,
12,	3464,	9704,	5382,	4275,	6898,	8173,	12956,	8296,	5591,	8321,
13,	1096,	2051,	4585,	2164,	2491,	2764,	5598,	6745,	3794,	2501,
14,	2197,	272,	902,	1879,	469,	1067,	1420,	2916,	2069,	2066,
+gp,	4664,	2286,	341,	1333,	1013,	1033,	912,	1040,	2081,	1665,
TOTALBIO,	1959473,	2844753,	3383015,	3798363,	2982694,	2355048,	2081823,	2205562,	3387202,	3147551,

Table 14 Stock biomass at age with SOP (start of year) Tonnes

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
3,	364191,	408642,	224409,	417306,	138547,	88817,	113616,	110464,	59771,	193461,
4,	312921,	479500,	422940,	249947,	484937,	150963,	123126,	136135,	120364,	154966,
5,	851683,	365881,	432101,	307864,	270705,	453783,	191151,	138006,	135759,	147791,
6,	542891,	713180,	273263,	255336,	208836,	215517,	448403,	183838,	125215,	141349,
7,	198051,	367679,	469078,	168345,	140468,	132001,	157592,	314126,	116556,	96078,
8,	85424,	124220,	198292,	268419,	86431,	73591,	85222,	73058,	144909,	58074,
9,	34637,	51596,	53356,	86831,	120802,	40051,	44504,	30671,	26455,	55172,
10,	31078,	21774,	23514,	16374,	26031,	39097,	19877,	12980,	9295,	9600,
11,	24878,	21541,	13067,	10786,	6381,	8965,	14673,	7435,	5909,	3787,
12,	10640,	8181,	14664,	6748,	1742,	1575,	2589,	4587,	3932,	3379,
13,	3642,	4852,	2613,	10925,	1525,	385,	715,	1071,	1123,	2803,
14,	336,	868,	2567,	893,	918,	550,	74,	146,	560,	310,
+gp,	895,	1910,	1626,	1023,	1173,	183,	27,	158,	151,	334,
TOTALBIO,	2461266,	2569824,	2131493,	1800797,	1488496,	1205480,	1201568,	1012676,	749998,	867104,

Table 14 Stock biomass at age with SOP (start of year) Tonnes

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
3,	229514,	335881,	61856,	41960,	56066,	86165,	237925,	359550,	419016,	214625,
4,	276736,	340691,	361059,	77561,	97584,	98046,	193604,	353710,	747719,	456828,
5,	166632,	318518,	325283,	349636,	146627,	154682,	190391,	236526,	507514,	650561,
6,	145562,	132180,	223965,	201696,	451631,	188249,	238813,	215736,	252923,	386830,
7,	97297,	81281,	70151,	87979,	151596,	445970,	240985,	252133,	188690,	147212,
8,	35500,	35577,	33595,	23575,	43428,	111580,	464523,	215810,	202544,	120672,
9,	19616,	11088,	10669,	11519,	10522,	17955,	102146,	430535,	159105,	145983,
10,	17686,	6715,	4502,	4106,	4217,	4104,	12247,	88915,	309523,	105986,
11,	3596,	8202,	2362,	987,	1634,	1371,	2607,	9030,	47584,	157932,
12,	1665,	1778,	3852,	951,	355,	1067,	891,	2273,	6868,	16556,
13,	1623,	864,	404,	1127,	281,	233,	824,	778,	1326,	2102,
14,	1963,	801,	462,	163,	454,	235,	98,	763,	671,	476,
+gp,	1789,	27,	190,	377,	381,	101,	529,	411,	63,	81,
TOTALBIO,	999181,	1273602,	1098350,	801637,	964776,	1109760,	1685582,	2166171,	2843546,	2405848,

Table 3.21

Run title : Arctic Cod (run: H54/H54)

At 18-Oct-95 14:55:16

Traditional vpa using screen input for terminal F

Table 15 Spawning stock biomass with SOP (spawning time) Tonnes

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
AGE										
3,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
4,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
5,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
6,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
7,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
8,	95656,	206720,	230991,	198178,	199451,	279857,	525879,	395218,	102896,	59835,
9,	42861,	64072,	117605,	137648,	115564,	94433,	149321,	236875,	230278,	52204,
10,	20352,	22886,	30424,	56473,	58988,	41973,	42443,	57829,	82270,	76990,
11,	20116,	9627,	10162,	14203,	24397,	23841,	17554,	18610,	17463,	34567,
12,	3464,	9704,	5382,	4275,	6898,	8173,	12956,	8296,	5591,	8321,
13,	1096,	2051,	4585,	2164,	2491,	2764,	5598,	6745,	3794,	2501,
14,	2197,	272,	902,	1879,	469,	1067,	1420,	2916,	2069,	2066,
+gp,	4664,	2286,	341,	1333,	1013,	1033,	912,	1040,	2081,	1665,
TOTSPBIO,	190406,	317618,	400391,	416152,	409271,	453141,	756083,	727531,	446441,	238149,

Table 15 Spawning stock biomass with SOP (spawning time) Tonnes

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
3,	0,	0,	0,	0,	0,	0,	0,	0,	598,	0,
4,	0,	0,	0,	0,	0,	0,	0,	6807,	9629,	7748,
5,	0,	0,	0,	0,	0,	0,	0,	13801,	13576,	26602,
6,	0,	0,	0,	0,	0,	0,	0,	62505,	37564,	43818,
7,	0,	0,	0,	0,	0,	0,	0,	204182,	85086,	53804,
8,	85424,	124220,	198292,	268419,	86431,	73591,	85222,	59908,	127520,	52267,
9,	34637,	51596,	53356,	86831,	120802,	40051,	44504,	28217,	25661,	54621,
10,	31078,	21774,	23514,	16374,	26031,	39097,	19877,	12980,	9295,	9600,
11,	24878,	21541,	13067,	10786,	6381,	8965,	14673,	7435,	5909,	3787,
12,	10640,	8181,	14664,	6748,	1742,	1575,	2589,	4587,	3932,	3379,
13,	3642,	4852,	2613,	10925,	1525,	385,	715,	1071,	1123,	2803,
14,	336,	868,	2567,	893,	918,	550,	74,	146,	560,	310,
+gp,	895,	1910,	1626,	1023,	1173,	183,	27,	158,	151,	334,
TOTSPBIO,	191530,	234942,	309701,	401998,	245004,	164398,	167680,	401796,	320604,	259073,

Table 15 Spawning stock biomass with SOP (spawning time) Tonnes

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
3,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
4,	2767,	6814,	3611,	776,	0,	1961,	5808,	3537,	22432,	4568,
5,	16663,	28667,	29275,	10489,	2933,	9281,	1904,	18922,	35526,	52045,
6,	48036,	25114,	51512,	50424,	67745,	37650,	54927,	66878,	53114,	116049,
7,	57405,	45517,	18941,	46629,	59122,	209606,	159050,	184057,	105666,	80967,
8,	30175,	27038,	20493,	18624,	25623,	69180,	380909,	198545,	180264,	101365,
9,	18047,	9868,	8642,	11519,	8733,	14544,	98060,	409009,	151150,	138684,
10,	17686,	6715,	3601,	4106,	4217,	3899,	12247,	88915,	306428,	103866,
11,	3596,	8202,	2362,	987,	1634,	1371,	2607,	9030,	47584,	157932,
12,	1665,	1778,	3852,	951,	355,	1067,	891,	2273,	6868,	16556,
13,	1623,	864,	404,	1127,	281,	233,	824,	778,	1326,	2102,
14,	1963,	801,	462,	163,	454,	235,	98,	763,	671,	476,
+gp,	1789,	27,	190,	377,	381,	101,	529,	411,	63,	81,
TOTSPBIO,	201416,	161406,	143344,	146172,	171478,	349128,	717855,	983118,	911092,	774693,

Table 3.22

Run title : Arctic Cod (run: H54/H54)

At 18-Oct-95 14:55:16

Table 17 Summary (with SOP correction)

Traditional vpa using screen input for terminal F

	RECRUITS, Age 3	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	SOPCOFAC,	FBAR 5-10,
1946,	729759,	4231927,	2585409,	706000,	.2731,	.6735,	.1928,
1947,	419945,	3410905,	1805121,	882017,	.4886,	.5708,	.3130,
1948,	440690,	3129347,	1355197,	774295,	.5714,	.6152,	.3521,
1949,	466659,	3007242,	1153489,	800122,	.6937,	.6799,	.3705,
1950,	705512,	3106404,	1197239,	731982,	.6114,	.7781,	.3652,
1951,	1085887,	3613344,	1271431,	827180,	.6506,	.8813,	.3983,
1952,	1190838,	3245128,	876072,	876795,	1.0008,	.7499,	.5386,
1953,	1592006,	3918483,	760081,	695546,	.9151,	.8396,	.3605,
1954,	644331,	3858692,	643244,	826021,	1.2841,	.7790,	.4006,
1955,	272941,	3874768,	708237,	1147841,	1.6207,	.8170,	.5498,
1956,	440230,	3463563,	835948,	1343068,	1.6066,	.8448,	.6431,
1957,	805056,	2752695,	771019,	792557,	1.0279,	.8346,	.5059,
1958,	497100,	2629141,	894000,	769313,	.8605,	.8831,	.5123,
1959,	684731,	2418065,	731957,	744607,	1.0173,	.8562,	.5602,
1960,	790432,	2410924,	527354,	622042,	1.1796,	.8819,	.4727,
1961,	918947,	2667130,	462188,	783221,	1.6946,	.9069,	.6226,
1962,	729959,	2651070,	430028,	909266,	2.1144,	.9175,	.7515,
1963,	473302,	1960799,	291642,	776337,	2.6620,	.7829,	.9697,
1964,	338955,	1605043,	196777,	437695,	2.2243,	.8184,	.6693,
1965,	778090,	1959472,	190406,	444930,	2.3367,	.8965,	.5392,
1966,	1582377,	2844752,	317618,	483711,	1.5229,	.9415,	.5082,
1967,	1292665,	3383014,	400391,	572605,	1.4301,	.8787,	.5259,
1968,	169748,	3798364,	416152,	1074084,	2.5810,	.9561,	.5520,
1969,	111970,	2982696,	409271,	1197226,	2.9253,	.8743,	.8089,
1970,	197051,	2355048,	453141,	933246,	2.0595,	.9734,	.7281,
1971,	404980,	2081824,	756084,	689048,	.9113,	1.1182,	.5875,
1972,	1015587,	2205563,	727531,	565254,	.7769,	1.0788,	.6741,
1973,	1818303,	3387203,	446441,	792685,	1.7756,	1.1430,	.5941,
1974,	525330,	3147552,	238149,	1102433,	4.6292,	1.0271,	.5614,
1975,	622068,	2461267,	191530,	829377,	4.3303,	.9007,	.6204,
1976,	614203,	2569825,	234942,	867463,	3.6922,	1.0236,	.6455,
1977,	347736,	2131492,	309700,	905301,	2.9232,	.9928,	.8345,
1978,	639616,	1800797,	401998,	698715,	1.7381,	1.0037,	.9292,
1979,	198956,	1488497,	245003,	440538,	1.7981,	1.0713,	.7177,
1980,	140412,	1205479,	164398,	380434,	2.3141,	.9731,	.7158,
1981,	158188,	1201568,	167680,	399038,	2.3798,	1.1050,	.8053,
1982,	157837,	1012676,	401797,	363730,	.9053,	1.0767,	.7402,
1983,	168789,	749999,	320604,	289992,	.9045,	.9837,	.7383,
1984,	382683,	867104,	259073,	277651,	1.0717,	.9538,	.8910,
1985,	502168,	999181,	201416,	307920,	1.5288,	.9936,	.7975,
1986,	1117817,	1273603,	161406,	430113,	2.6648,	.9390,	.9134,
1987,	304595,	1098350,	143344,	523071,	3.6491,	.9670,	1.0100,
1988,	230326,	801637,	146172,	434939,	2.9755,	.9588,	.8819,
1989,	180669,	964776,	171478,	332481,	1.9389,	1.0344,	.6851,
1990,	215767,	1109760,	349128,	212000,	.6072,	.9984,	.2699,
1991,	511540,	1685583,	717854,	319158,	.4446,	.9690,	.2980,
1992,	798397,	2166170,	983119,	513494,	.5223,	1.0008,	.3530,
1993,	1195625,	2843546,	911092,	581611,	.6384,	1.0013,	.4030,
1994,	908848,	2405847,	774693,	775293,	1.0008,	1.0006,	.5055,
Arith. Mean ,	622849,	2386476,	594042,	677213,	1.6627		.5997,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),			

Table 3.23

Cod in the North-East Arctic (Fishing Areas I and II)

Single option prediction: Input data

Year: 1995								
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	372000.00	0.2000	0.0000	0.0000	0.0000	0.202	0.0215	0.467
4	335351.00	0.2000	0.0000	0.0000	0.0000	0.496	0.1284	0.736
5	438324.00	0.2000	0.0400	0.0000	0.0000	1.133	0.3209	1.500
6	296044.00	0.2000	0.2300	0.0000	0.0000	1.931	0.5338	2.250
7	87545.000	0.2000	0.6100	0.0000	0.0000	3.245	0.6904	3.550
8	13999.000	0.2000	0.7500	0.0000	0.0000	4.740	0.5173	5.130
9	11431.000	0.2000	0.9400	0.0000	0.0000	7.041	0.4498	6.610
10	11728.000	0.2000	0.9700	0.0000	0.0000	8.367	0.5209	7.290
11	7230.000	0.2000	0.9900	0.0000	0.0000	9.812	0.6282	8.910
12	7518.000	0.2000	1.0000	0.0000	0.0000	10.850	1.0698	10.850
13	543.000	0.2000	1.0000	0.0000	0.0000	12.500	0.7381	12.500
14	58.000	0.2000	1.0000	0.0000	0.0000	13.900	0.7344	13.900
15+	13.000	0.2000	1.0000	0.0000	0.0000	15.000	0.7344	15.000
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1996								
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	347000.00	0.2000	0.0000	0.0000	0.0000	0.280	0.0215	0.770
4	.	0.2000	0.0000	0.0000	0.0000	0.510	0.1284	1.060
5	.	0.2000	0.0500	0.0000	0.0000	0.990	0.3209	1.550
6	.	0.2000	0.2500	0.0000	0.0000	1.720	0.5338	2.270
7	.	0.2000	0.5700	0.0000	0.0000	2.860	0.6904	3.570
8	.	0.2000	0.8300	0.0000	0.0000	4.680	0.5173	5.120
9	.	0.2000	0.9500	0.0000	0.0000	6.610	0.4498	6.610
10	.	0.2000	0.9800	0.0000	0.0000	7.290	0.5209	7.290
11	.	0.2000	0.9900	0.0000	0.0000	8.910	0.6282	8.910
12	.	0.2000	1.0000	0.0000	0.0000	10.850	1.0698	10.850
13	.	0.2000	1.0000	0.0000	0.0000	12.500	0.7381	12.500
14	.	0.2000	1.0000	0.0000	0.0000	13.900	0.7344	13.900
15+	.	0.2000	1.0000	0.0000	0.0000	15.000	0.7344	15.000
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1997								
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	767000.00	0.2000	0.0000	0.0000	0.0000	0.280	0.0215	0.770
4	.	0.2000	0.0000	0.0000	0.0000	0.510	0.1284	1.060
5	.	0.2000	0.0500	0.0000	0.0000	0.990	0.3209	1.550
6	.	0.2000	0.2500	0.0000	0.0000	1.720	0.5338	2.270
7	.	0.2000	0.5700	0.0000	0.0000	2.860	0.6904	3.570
8	.	0.2000	0.8300	0.0000	0.0000	4.680	0.5173	5.120
9	.	0.2000	0.9500	0.0000	0.0000	6.610	0.4498	6.610
10	.	0.2000	0.9800	0.0000	0.0000	7.290	0.5209	7.290
11	.	0.2000	0.9900	0.0000	0.0000	8.910	0.6282	8.910
12	.	0.2000	1.0000	0.0000	0.0000	10.850	1.0698	10.850
13	.	0.2000	1.0000	0.0000	0.0000	12.500	0.7381	12.500
14	.	0.2000	1.0000	0.0000	0.0000	13.900	0.7344	13.900
15+	.	0.2000	1.0000	0.0000	0.0000	15.000	0.7344	15.000
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

(cont.)

Table 3.23 Continued

Cod in the North-East Arctic (Fishing Areas I and II)

Single option prediction: Input data

(cont.)

Year: 1998

Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
3	623000.00	0.2000	0.0000	0.0000	0.0000	0.280	0.0215	0.770
4	.	0.2000	0.0000	0.0000	0.0000	0.510	0.1284	1.060
5	.	0.2000	0.0500	0.0000	0.0000	0.990	0.3209	1.550
6	.	0.2000	0.2500	0.0000	0.0000	1.720	0.5338	2.270
7	.	0.2000	0.5700	0.0000	0.0000	2.860	0.6904	3.570
8	.	0.2000	0.8300	0.0000	0.0000	4.680	0.5173	5.120
9	.	0.2000	0.9500	0.0000	0.0000	6.610	0.4498	6.610
10	.	0.2000	0.9800	0.0000	0.0000	7.290	0.5209	7.290
11	.	0.2000	0.9900	0.0000	0.0000	8.910	0.6282	8.910
12	.	0.2000	1.0000	0.0000	0.0000	10.850	1.0698	10.850
13	.	0.2000	1.0000	0.0000	0.0000	12.500	0.7381	12.500
14	.	0.2000	1.0000	0.0000	0.0000	13.900	0.7344	13.900
15+	.	0.2000	1.0000	0.0000	0.0000	15.000	0.7344	15.000
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	623000.00	0.2000	0.0000	0.0000	0.0000	0.280	0.0215	0.770
4	.	0.2000	0.0000	0.0000	0.0000	0.510	0.1284	1.060
5	.	0.2000	0.0500	0.0000	0.0000	0.990	0.3209	1.550
6	.	0.2000	0.2500	0.0000	0.0000	1.720	0.5338	2.270
7	.	0.2000	0.5700	0.0000	0.0000	2.860	0.6904	3.570
8	.	0.2000	0.8300	0.0000	0.0000	4.680	0.5173	5.120
9	.	0.2000	0.9500	0.0000	0.0000	6.610	0.4498	6.610
10	.	0.2000	0.9800	0.0000	0.0000	7.290	0.5209	7.290
11	.	0.2000	0.9900	0.0000	0.0000	8.910	0.6282	8.910
12	.	0.2000	1.0000	0.0000	0.0000	10.850	1.0698	10.850
13	.	0.2000	1.0000	0.0000	0.0000	12.500	0.7381	12.500
14	.	0.2000	1.0000	0.0000	0.0000	13.900	0.7344	13.900
15+	.	0.2000	1.0000	0.0000	0.0000	15.000	0.7344	15.000
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	623000.00	0.2000	0.0000	0.0000	0.0000	0.280	0.0215	0.770
4	.	0.2000	0.0000	0.0000	0.0000	0.510	0.1284	1.060
5	.	0.2000	0.0500	0.0000	0.0000	0.990	0.3209	1.550
6	.	0.2000	0.2500	0.0000	0.0000	1.720	0.5338	2.270
7	.	0.2000	0.5700	0.0000	0.0000	2.860	0.6904	3.570
8	.	0.2000	0.8300	0.0000	0.0000	4.680	0.5173	5.120
9	.	0.2000	0.9500	0.0000	0.0000	6.610	0.4498	6.610
10	.	0.2000	0.9800	0.0000	0.0000	7.290	0.5209	7.290
11	.	0.2000	0.9900	0.0000	0.0000	8.910	0.6282	8.910
12	.	0.2000	1.0000	0.0000	0.0000	10.850	1.0698	10.850
13	.	0.2000	1.0000	0.0000	0.0000	12.500	0.7381	12.500
14	.	0.2000	1.0000	0.0000	0.0000	13.900	0.7344	13.900
15+	.	0.2000	1.0000	0.0000	0.0000	15.000	0.7344	15.000
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : H2
Date and time: 20OCT95:18:28

Table 3.24

Cod in the North-East Arctic (Fishing Areas I and II)

Prediction with management option table

Year: 1995					Year: 1996					Year: 1997	
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
0.9953	0.5032	1999113	704835	750000	0.0000	0.0000	1717218	696852	0	2487992	1277230
.	.	.	.	.	0.0500	0.0253	.	696852	47522	2435016	1240283
.	.	.	.	.	0.1000	0.0506	.	696852	93767	2383537	1204462
.	.	.	.	.	0.1500	0.0758	.	696852	138773	2333508	1169732
.	.	.	.	.	0.2000	0.1011	.	696852	182577	2284886	1136057
.	.	.	.	.	0.2500	0.1264	.	696852	225215	2237628	1103404
.	.	.	.	.	0.3000	0.1517	.	696852	266721	2191693	1071740
.	.	.	.	.	0.3500	0.1769	.	696852	307129	2147040	1041034
.	.	.	.	.	0.4000	0.2022	.	696852	346472	2103630	1011256
.	.	.	.	.	0.4500	0.2275	.	696852	384781	2061427	982376
.	.	.	.	.	0.5000	0.2528	.	696852	422086	2020393	954366
.	.	.	.	.	0.5500	0.2780	.	696852	458417	1980493	927198
.	.	.	.	.	0.6000	0.3033	.	696852	493803	1941694	900846
.	.	.	.	.	0.6500	0.3286	.	696852	528270	1903962	875284
.	.	.	.	.	0.7000	0.3539	.	696852	561847	1867266	850487
.	.	.	.	.	0.7500	0.3791	.	696852	594559	1831574	826432
.	.	.	.	.	0.8000	0.4044	.	696852	626430	1796857	803094
.	.	.	.	.	0.8500	0.4297	.	696852	657487	1763086	780452
.	.	.	.	.	0.9000	0.4550	.	696852	687751	1730232	758485
.	.	.	.	.	0.9500	0.4802	.	696852	717245	1698269	737170
.	.	.	.	.	1.0000	0.5055	.	696852	745993	1667169	716487
.	.	.	.	.	1.0500	0.5308	.	696852	774016	1636908	696418
.	.	.	.	.	1.1000	0.5561	.	696852	801333	1607461	676942
.	.	.	.	.	1.1500	0.5813	.	696852	827966	1578804	658042
.	.	.	.	.	1.2000	0.6066	.	696852	853934	1550913	639700
.	.	.	.	.	1.2500	0.6319	.	696852	879255	1523767	621898
.	.	.	.	.	1.3000	0.6572	.	696852	903949	1497343	604620
.	.	.	.	.	1.3500	0.6824	.	696852	928033	1471621	587849
.	.	.	.	.	1.4000	0.7077	.	696852	951524	1446579	571571
.	.	.	.	.	1.4500	0.7330	.	696852	974439	1422199	555769
.	.	.	.	.	1.5000	0.7583	.	696852	996793	1398460	540430
.	.	.	.	.	1.5500	0.7836	.	696852	1018604	1375345	525539
.	.	.	.	.	1.6000	0.8088	.	696852	1039886	1352835	511083
.	.	.	.	.	1.6500	0.8341	.	696852	1060654	1330913	497047
.	.	.	.	.	1.7000	0.8594	.	696852	1080922	1309562	483421
.	.	.	.	.	1.7500	0.8847	.	696852	1100704	1288765	470190
.	.	.	.	.	1.8000	0.9099	.	696852	1120013	1268507	457342
.	.	.	.	.	1.8500	0.9352	.	696852	1138864	1248772	444868
.	.	.	.	.	1.9000	0.9605	.	696852	1157267	1229545	432754
.	.	.	.	.	1.9500	0.9858	.	696852	1175236	1210812	420990
.	.	.	.	.	2.0000	1.0110	.	696852	1192783	1192559	409565
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : H1
Date and time : 20OCT95:18:48
Computation of ref. F: Simple mean, age 5 - 10
Basis for 1995 : TAC constraints

Table 3.25

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Cod in the North-East Arctic (Fishing Areas I and II)

Single option prediction: Summary table

Year	F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1995	0.9953	0.5032	325498	750000	1581784	1999113	186936	704835	186936	704835
1996	0.6330	0.3200	196158	516653	1350104	1717218	211966	696852	211966	696852
1997	0.6330	0.3200	186674	532025	1696059	1916674	234461	883888	234461	883888
1998	0.6330	0.3200	193044	528955	1843808	2072682	230842	992521	230842	992521
1999	0.6330	0.3200	220854	574229	1958939	2248377	233293	1027143	233293	1027143
2000	0.6330	0.3200	248373	653353	2028161	2418687	261218	1073452	261218	1073452
Unit	-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : H2
Date and time : 20OCT95:20:10
Computation of ref. F: Simple mean, age 5 - 10
Prediction basis : F factors

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Cod in the North-East Arctic (Fishing Areas I and II)

Single option prediction: Summary table

Year	F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1995	0.9953	0.5032	325498	750000	1581784	1999113	186936	704835	186936	704835
1996	0.7280	0.3680	221039	580271	1350104	1717218	211966	696852	211966	696852
1997	0.7280	0.3680	203843	572222	1673840	1847157	223148	836926	223148	836926
1998	0.7280	0.3680	208606	553548	1810303	1946352	211086	895612	211086	895612
1999	0.7280	0.3680	238200	593731	1917607	2082416	208883	894011	208883	894011
2000	0.7280	0.3680	266213	668936	1978827	2220290	233056	915732	233056	915732
Unit	-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : H2
Date and time : 20OCT95:20:10
Computation of ref. F: Simple mean, age 5 - 10
Prediction basis : F factors

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Cod in the North-East Arctic (Fishing Areas I and II)

Single option prediction: Summary table

Year	F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1995	0.9953	0.5032	325498	750000	1581784	1999113	186936	704835	186936	704835
1996	0.9100	0.4600	265891	693711	1350104	1717218	211966	696852	211966	696852
1997	0.9100	0.4600	231391	630707	1633882	1723769	203103	754170	203103	754170
1998	0.9100	0.4600	233068	581600	1753090	1736848	178357	736905	178357	736905
1999	0.9100	0.4600	265831	613377	1848968	1820896	170430	688637	170430	688637
2000	0.9100	0.4600	293996	681592	1898004	1918015	189907	683306	189907	683306
Unit	-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : H2
Date and time : 20OCT95:20:10
Computation of ref. F: Simple mean, age 5 - 10
Prediction basis : F factors

Continued

Table 3.25 Continued

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Cod in the North-East Arctic (Fishing Areas I and II)

Single option prediction: Summary table

							1 January		Spawning time	
Year	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
1995	0.9953	0.5032	325498	750000	1581784	1999113	186936	704835	186936	704835
1996	1.0918	0.5519	307290	796901	1350104	1717218	211966	696852	211966	696852
1997	1.0918	0.5519	253098	669556	1597119	1612236	185028	680096	185028	680096
1998	1.0918	0.5519	252201	592249	1703771	1563472	151333	607934	151333	607934
1999	1.0918	0.5519	288048	618833	1791591	1617943	140654	534340	140654	534340
2000	1.0918	0.5519	315647	681730	1831283	1692252	157498	518437	157498	518437
Unit	-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : H2
Date and time : 20OCT95:20:10
Computation of ref. F: Simple mean, age 5 - 10
Prediction basis : F factors

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Cod in the North-East Arctic (Fishing Areas I and II)

Single option prediction: Summary table

							1 January		Spawning time	
Year	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
1995	0.9953	0.5032	325498	750000	1581784	1999113	186936	704835	186936	704835
1996	0.9206	0.4654	268398	700000	1350104	1717218	211966	696852	211966	696852
1997	1.0482	0.5299	258534	700000	1631652	1716951	201996	749621	201996	749621
1998	1.2456	0.6297	291028	700000	1727132	1654460	165562	678597	165562	678597
1999	1.3027	0.6585	327031	700000	1776129	1605164	139053	539012	139053	539012
2000	1.2528	0.6333	333055	700000	1783958	1587702	142049	464569	142049	464569
Unit	-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : H2
Date and time : 20OCT95:20:10
Computation of ref. F: Simple mean, age 5 - 10
Prediction basis : F factors

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Cod in the North-East Arctic (Fishing Areas I and II)

Single option prediction: Summary table

							1 January		Spawning time	
Year	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
1995	0.9953	0.5032	325498	750000	1581784	1999113	186936	704835	186936	704835
1996	1.0071	0.5091	288399	750000	1350104	1717218	211966	696852	211966	696852
1997	1.2111	0.6122	281790	750000	1613880	1662840	193223	713612	193223	713612
1998	1.5459	0.7815	327623	750000	1691997	1537487	147401	593691	147401	593691
1999	1.7387	0.8789	378654	750000	1714962	1425279	113158	414155	113158	414155
2000	1.8360	0.9281	394396	750000	1688240	1339825	106798	312452	106798	312452
Unit	-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : H2
Date and time : 20OCT95:20:10
Computation of ref. F: Simple mean, age 5 - 10
Prediction basis : F factors

Table 3.26

Cod in the North-East Arctic (Fishing Areas I and II)

Single option prediction: Detailed tables

Year: 1995	F-factor: 0.9953		Reference F: 0.5032			1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
3	0.0214	7141	3335	372000	75144	0	0	0	0
4	0.1278	36542	26895	335351	166334	0	0	0	0
5	0.3194	109197	163796	438324	496621	17533	19865	17533	19865
6	0.5313	111566	251024	296044	571661	68090	131482	68090	131482
7	0.6872	39884	141588	87545	284084	53402	173291	53402	173291
8	0.5149	5150	26418	13999	66355	10499	49766	10499	49766
9	0.4477	3767	24899	11431	80486	10745	75657	10745	75657
10	0.5185	4337	31620	11728	98128	11376	95184	11376	95184
11	0.6253	3078	27424	7230	70941	7158	70231	7158	70231
12	1.0648	4542	49286	7518	81570	7518	81570	7518	81570
13	0.7346	259	3240	543	6788	543	6788	543	6788
14	0.7310	28	383	58	806	58	806	58	806
15+	0.7310	6	93	13	195	13	195	13	195
Total		325498	750000	1581784	1999113	186936	704835	186936	704835
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1996	F-factor: 0.9100		Reference F: 0.4600			1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
3	0.0196	6095	4693	347000	97160	0	0	0	0
4	0.1168	29855	31646	298120	152041	0	0	0	0
5	0.2920	55729	86380	241623	239207	12081	11960	12081	11960
6	0.4858	91666	208082	260749	448489	65187	112122	65187	112122
7	0.6283	60868	217298	142481	407495	81214	232272	81214	232272
8	0.4707	12365	63307	36053	168727	29924	140043	29924	140043
9	0.4093	2099	13876	6849	45272	6507	43008	6507	43008
10	0.4740	2063	15036	5981	43604	5862	42731	5862	42731
11	0.5717	2278	20294	5717	50942	5660	50433	5660	50433
12	0.9735	1815	19693	3168	34369	3168	34369	3168	34369
13	0.6717	951	11892	2122	26529	2122	26529	2122	26529
14	0.6683	95	1324	213	2964	213	2964	213	2964
15+	0.6683	13	188	28	420	28	420	28	420
Total		265891	693711	1350104	1717218	211966	696852	211966	696852
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1997	F-factor: 0.9100		Reference F: 0.4600			1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
3	0.0196	13473	10374	767000	214760	0	0	0	0
4	0.1168	27899	29573	278595	142084	0	0	0	0
5	0.2920	50087	77636	217163	214992	10858	10750	10858	10750
6	0.4858	51933	117888	147726	254089	36932	63522	36932	63522
7	0.6283	56109	200309	131342	375637	74865	214113	74865	214113
8	0.4707	21345	109285	62237	291267	51656	241752	51656	241752
9	0.4093	5650	37350	18435	121854	17513	115761	17513	115761
10	0.4740	1284	9362	3724	27148	3649	26605	3649	26605
11	0.5717	1214	10820	3048	27161	3018	26890	3018	26890
12	0.9735	1514	16431	2643	28675	2643	28675	2643	28675
13	0.6717	439	5489	980	12246	980	12246	980	12246
14	0.6683	396	5511	888	12339	888	12339	888	12339
15+	0.6683	45	678	101	1519	101	1519	101	1519
Total		231391	630707	1633882	1723769	203103	754170	203103	754170
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

(cont.)

Table 3.26 Continued

Cod in the North-East Arctic (Fishing Areas I and II)

Single option prediction: Detailed tables

(cont.)

Year: 1998	F-factor: 0.9100		Reference F: 0.4600			1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
3	0.0196	10944	8427	623000	174440	0	0	0	0
4	0.1168	61668	65368	615800	314058	0	0	0	0
5	0.2920	46807	72551	202941	200912	10147	10046	10147	10046
6	0.4858	46676	105954	132772	228367	33193	57092	33193	57092
7	0.6283	31788	113484	74411	212815	42414	121305	42414	121305
8	0.4707	19676	100741	57371	268496	47618	222852	47618	222852
9	0.4093	9754	64475	31823	210352	30232	199835	30232	199835
10	0.4740	3457	25198	10023	73071	9823	71609	9823	71609
11	0.5717	756	6737	1898	16911	1879	16742	1879	16742
12	0.9735	807	8761	1409	15289	1409	15289	1409	15289
13	0.6717	366	4580	817	10217	817	10217	817	10217
14	0.6683	183	2544	410	5696	410	5696	410	5696
15+	0.6683	185	2781	415	6225	415	6225	415	6225
Total		233068	581600	1753090	1736848	178357	736905	178357	736905
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1999	F-factor: 0.9100		Reference F: 0.4600			1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
3	0.0196	10944	8427	623000	174440	0	0	0	0
4	0.1168	50090	53096	500187	255095	0	0	0	0
5	0.2920	103461	160365	448576	444090	22429	22205	22429	22205
6	0.4858	43619	99015	124076	213411	31019	53353	31019	53353
7	0.6283	28570	101996	66878	191272	38121	109025	38121	109025
8	0.4707	11147	57074	32503	152115	26978	126255	26978	126255
9	0.4093	8992	59435	29335	193907	27869	184212	27869	184212
10	0.4740	5967	43498	17303	126139	16957	123616	16957	123616
11	0.5717	2035	18133	5108	45517	5057	45061	5057	45061
12	0.9735	503	5454	877	9519	877	9519	877	9519
13	0.6717	195	2442	436	5448	436	5448	436	5448
14	0.6683	153	2123	342	4752	342	4752	342	4752
15+	0.6683	155	2319	346	5192	346	5192	346	5192
Total		265831	613377	1848968	1820896	170430	688637	170430	688637
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 2000	F-factor: 0.9100		Reference F: 0.4600			1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
3	0.0196	10944	8427	623000	174440	0	0	0	0
4	0.1168	50090	53096	500187	255095	0	0	0	0
5	0.2920	84037	130257	364358	360715	18218	18036	18218	18036
6	0.4858	96414	218860	274255	471719	68564	117930	68564	117930
7	0.6283	26699	95316	62498	178745	35624	101885	35624	101885
8	0.4707	10019	51297	29213	136716	24247	113474	24247	113474
9	0.4093	5094	33672	16620	109857	15789	104364	15789	104364
10	0.4740	5500	40098	15950	116278	15631	113952	15631	113952
11	0.5717	3513	31302	8819	78574	8730	77788	8730	77788
12	0.9735	1353	14681	2361	25621	2361	25621	2361	25621
13	0.6717	122	1520	271	3392	271	3392	271	3392
14	0.6683	81	1132	182	2534	182	2534	182	2534
15+	0.6683	129	1934	289	4331	289	4331	289	4331
Total		293996	681592	1898004	1918015	189907	683306	189907	683306
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Table 4.1 North-East Arctic HADDOCK. Total nominal catch (t) by fishing areas. (Data provided by Working Group members).

Year	Sub-area I	Division IIa	Division IIb	Total
1960	125,657	27,925	1,854	155,434
1961	165,165	25,642	2,427	193,234
1962	160,972	25,189	1,727	187,888
1963	124,774	21,031	939	146,744
1964	79,056	18,735	1,109	98,900
1965	98,505	18,640	939	118,079
1966	124,115	34,892	1,614	160,621
1967	108,066	27,980	440	136,486
1968	140,970	40,031	725	181,726
1969	88,960	40,208	1,341	130,509
1970	59,493	26,611	497	86,601
1971	56,300	21,567	435	78,302
1972	221,183	41,979	2,155	265,317
1973	283,728	23,348	2,989	320,065
1974	159,037	47,033	5,068	221,138
1975	121,686	44,330	9,726	175,742
1976	94,065	37,566	5,649	137,279
1977	72,159	28,452	9,547	110,158
1978	63,965	30,478	979	95,422
1979	63,841	39,167	615	103,623
1980	54,205	33,616	68	87,889
1981	36,834	39,864	455	77,153
1982	17,948	29,005	2	46,955
1983	7,550	13,872	185	21,607
1984	4,000	13,247	71	17,318
1985	30,385	10,774	111	41,270
1986	69,865	26,006	714	96,585
1987	109,429	38,182	3,048	150,659
1988	43,990	47,086	668	91,744
1989	31,265	23,502	355	55,122
1990	15,138	10,375	304	25,817
1991	18,772	14,417	416	33,605
1992	30,746	22,177	964	53,887
1993	47,753	27,009	3,037	77,619
1994[1]	68,148	44,820	8,142	121,111

[1]Provisional figures.

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Table 4.2 North-East Arctic HADDOCK. Total nominal catch ('000 t) by trawl and other gear for each area.

Year	Sub-area I		Division IIa		Division IIb
	Trawl	Others	Trawl	Others	Trawl
1967	73.8	34.3	20.5	7.5	0.4
1968	98.1	42.9	31.4	8.6	0.7
1969	41.3	47.7	33.1	7.1	1.3
1970	36.7	22.8	20.2	6.4	0.5
1971	27.3	29.0	15.0	6.6	0.4
1972	193.4	27.8	34.4	7.6	2.2
1973	241.2	42.5	13.9	9.4	13.0
1974	133.1	25.9	39.9	7.1	15.1
1975	103.5	18.2	34.6	9.7	9.7
1976	77.7	16.4	28.1	9.5	5.6
1977	57.6	14.6	19.9	8.6	9.5
1978	53.9	10.1	15.7	14.8	1.0
1979	47.8	16.0	20.3	18.9	0.6
1980	30.5	23.7	14.8	18.9	0.1
1981	19.0	17.9	21.8	18.7	0.5
1982	9.0	8.9	18.5	10.5	-
1983	3.7	3.8	7.6	6.3	0.2
1984	1.6	2.4	6.4	6.9	0.1
1985	24.4	6.0	4.5	6.3	0.1
1986	51.7	18.1	12.8	13.2	0.7
1987	77.8	31.6	22.1	16.1	3.0
1988	27.5	16.5	33.6	13.5	0.7
1989	21.5	9.8	11.7	11.8	0.4
1990	5.9	9.2	4.8	5.6	0.3
1991	9.8	9.0	7.8	6.6	0.4
1992	21.2	9.5	9.3	12.9	1.0
1993	34.8	12.9	12.9	14.0	3.0
1994[1]	49.0	19.2	24.3	20.5	8.1

[1]Provisional

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Table 4.3 North-East Arctic HADDOCK. Nominal catch (t) by countries (Sub-area I and Divisions IIa and IIb combined). (Data provided by Working Group members).

Year	Faroe Islands	France	German Dem.Rep.	Germany, Fed.Rep.	Norway	Poland	United Kingdom	Russia[2]	Others	Total
1960	172	-	-	5,597	46,263	-	45,469	57,025	125	155,651
1961	285	220	-	6,304	60,862	-	39,650	85,345	558	193,234
1962	83	409	-	2,895	54,567	-	37,486	91,910	58	187,438
1963	17	363	-	2,554	59,955	-	19,809	63,526	-	146,224
1964	-	208	-	1,482	38,695	-	14,653	43,870	250	99,158
1965	-	226	-	1,568	60,447	-	14,345	41,750	242	118,578
1966	-	1,072	11	2,098	82,090	-	27,723	48,710	74	161,778
1967	-	1,208	3	1,705	51,954	-	24,158	57,346	23	136,397
1968	-	-	-	1,867	64,076	-	40,129	75,654	-	181,726
1969	2	-	309	1,490	67,549	-	37,234	24,211	25	130,820
1970	541	-	656	2,119	37,716	-	20,423	26,802	-	87,257
1971	81	-	16	896	45,715	43	16,373	15,778	3	78,905
1972	137	-	829	1,433	46,700	1,433	17,166	196,224	2,231	266,15[illegible]
1973	1,212	3,214	22	9,534	86,767	34	32,408	186,534	2,501	322,626
1974	925	3,601	454	23,409	66,164	3,045	37,663	78,548	7,348	221,157
1975	299	5,191	437	15,930	55,966	1,080	28,677	65,015	3,163	175,758
1976	536	4,459	348	16,660	49,492	986	16,940	42,485	5,358	137,265
1977	213	1,510	144	4,798	40,118	-	10,878	52,210	287	110,158
1978	466	1,411	369	1,521	39,955	1	5,766	45,895	38	95,422
1979	343	1,198	10	1,948	66,849	2	6,454	26,365	454	103,623
1980	497	226	15	1,365	61,886	-	2,948	20,706	246	87,889
1981	381	414	22	2,398	58,856	Spain	1,682	13,400	-	77,153
1982	496	53	-	1,258	41,421	-	827	2,900	-	46,955
1983	428	-	1	729	19,371	139	259	680	-	21,607
1984	297	15	4	400	15,186	37	276	1,103	-	17,318
1985	424	21	20	395	17,490	77	153	22,690	-	41,270
1986	893	33	75	1,079	48,314	22	431	45,738	-	96,585
1987	464	26	83	3,106	69,333	99	563	76,980	-	150,654
1988	1,113	116	78	1,324	57,273	72	435	31,293	41	91,745
1989	1,218	125	26	171	31,825	1	853	20,903	-	55,122
1990	875	-	5	128	17,634	-	569	6,605	-	25,816
1991	1,117	60	Greenland	219	19,285	-	514	12,388	22	33,605
1992	1,093	151	1,719	387	30,203	38	596	19,699	1	53,887
1993	546	1,215	880	1,165	36,590	76	1,794	34,700	654	77,619
1994[1]	2,761	678	770	2,395	64,467	22	4,339	44,468	1,211	121,111

[1]Provisional figures.
[2]USSR prior to 1991.

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Table 4.4 North-East Arctic HADDOCK. Catch per unit effort.

	Sub-area I			Division II		Division II	
Year	Norway[2]	USSR[4]	UK[3]	Norway[2]	UK[3]	Norway[2]	UK[3]
1960	-	-	33	-	2.8	-	34
1961	-	-	29	-	3.3	-	36
1962	-	-	23	-	2.5	-	42
1963	-	-	13	-	0.9	-	33
1964	-	-	18	-	1.6	-	18
1965	-	-	18	-	2.0	-	18
1966	-	-	17	-	2.8	-	34
1967	-	-	18	-	2.4	-	25
1968	-	-	19	-	1.0	-	50
1969	-	-	13	-	2.0	-	42
1970	-	-	7	-	1.0	-	31
1971	-	-	8	-	3.0	-	25
1972	0.06	-	14	0.02	23.0	0.09	18
1973	0.35	-	22	0.18	20.0	0.39	20
1974	0.27	-	20	0.09	15.0	0.51	74
1975	0.26	-	15	0.06	4.0	0.44	60
1976	0.27	-	10	+	3.0	0.24	38
1977	0.11	-	4	+	0.2	0.14	16
1978	0.13	-	5	+	4.0	0.14	15
1979	0.36	-	-	-.07	-	0.18	-
1980	0.45	-	-	+	-	0.22	-
1981	0.64	-	-	-	-	0.37	-
1982	0.51	-	-	-	-	0.38	-
1983	0.27	-	-	0.04	-	0.17	-
1984	0.13	-	-	0.01	-	0.12	-
1985	0.27	1.00	-	0.01	-	0.11	-
1986	0.56	1.05	-	0.02	-	0.20	-
1987	0.63	0.90	-	0.01	-	0.28	-
1988	0.38	0.70	-	0.02	-	0.40	-
1989	0.22	-	-	0.01	-	0.15	-
1990[1]	0.19	-	-	0.01	-	0.05	-
1991	0.22	-	-	0.01	-	0.07	-
1992	0.46	-	-	0.06	-	0.20	-
1993	0.43	-	-	0.08	-	0.20	-
1994	0.86	-	-	0.31	-	0.33	-

[1]Preliminary figures.
[2]Norwegian data - t per 1,000 t/hrs fishing.
[3]United Kingdom data - t per 100 t/hrs fishing.
[4]USSR data - t per hour fishing.

Table 4.5 North-East Arctic HADDOCK. Weight at age (kg) in Norwegian, Russian and German landings.

Norway

	Age												
Age	2	3	4	5	6	7	8	9	10	11	12	13	14+
1984	1.17	1.58	1.99	2.42	2.64	2.89	3.16	3.41	3.51	4.04	4.04	3.84	4.36
1985	0.81	1.32	1.91	2.35	2.66	2.85	3.14	3.38	3.72	3.81	3.22	3.72	4.19
1986	0.62	1.17	1.51	2.24	2.54	2.62	3.04	3.17	3.51	3.72	3.98	4.06	4.14
1987	0.43	1.02	1.32	1.72	2.60	2.99	3.24	3.14	3.51	3.93	4.00	3.48	5.28
1988	0.61	0.77	0.87	1.10	1.48	2.05	2.52	2.83	3.14	3.32	3.71	3.66	4.78
1989	0.77	1.01	1.15	1.38	1.44	1.71	1.66	1.99	3.21	3.23	5.03	4.73	5.61
1990	0.79	0.95	1.24	1.39	1.58	1.72	2.10	2.24	2.44	2.95	3.19	3.59	4.59
1991	0.57	0.97	1.29	1.46	1.73	1.78	1.93	2.29	2.34	-	4.41	-	3.33
1992	0.36	0.93	1.37	1.62	1.84	1.98	2.09	2.20	2.72	3.14	2.92	2.28	3.29
1993	0.39	0.79	1.18	1.57	1.74	1.96	1.99	2.31	2.39	2.48	3.29	2.86	4.31
1994[1]	0.46	0.71	0.97	1.38	1.72	1.95	2.24	2.34	2.58	2.56	2.66	3.15	-

Russia

	Age												
Age	2	3	4	5	6	7	8	9	10	11	12	13	14+
1984	0.66	1.35	1.90	2.48	3.13	3.12	3.57	3.86	3.98	4.77	-	-	5.37
1985	0.25	0.81	1.46	2.51	2.84	3.23	3.29	3.90	4.03	6.75	(5.20)	4.78	-
1986	0.27	0.54	0.98	1.50	2.25	2.63	3.03	3.65	3.80	-	-	-	6.45
1987	-	0.47	0.69	1.09	1.93	2.75	2.72	3.34	2.83	2.40	-	-	4.52
1988	0.18	0.44	0.74	0.98	1.35	1.52	-	4.04	-	3.80	3.70	-	-
1989	0.42	0.41	0.64	0.98	1.28	1.72	2.48	-	-	-	-	-	-
1990	0.45	0.68	1.19	1.41	1.64	1.99	2.59	-	-	-	-	-	4.85
1991	0.25	0.64	1.32	1.70	1.95	2.33	2.61	3.43	-	-	-	-	-
1992	0.24	0.77	1.33	1.91	2.17	2.56	2.78	3.13	3.77	-	-	-	-
1993[1]	0.16	0.45	0.98	1.44	1.93	2.41	2.62	2.88	3.27	3.73	4.14	-	-
1994[1]	0.111	0.29	0.76	1.25	1.75	2.11	2.30	2.71	2.78	3.13	3.17	-	-
1995[2]	0.10	0.20	0.38	0.87	1.5	2.26	2.5	2.83	2.92	3.57	3.65	4.81	5.0

Germany

	Age												
Age	2	3	4	5	6	7	8	9	10	11	12	13	14+
1994	-	0.41	0.88	1.38	1.74	1.97	2.55	2.54	2.68	2.77	-	-	-

[1]Provisional.
[2]Data from January–June.

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Haddock in the North-East Arctic (Fishing Areas I and II)

Mean Weight of Stock (Kilograms)

(WEST)

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1950	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1951	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1952	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1953	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1954	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1955	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1956	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1957	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1958	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1959	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1960	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1961	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1962	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1963	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1964	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1965	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1966	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1967	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1968	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1969	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1970	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1971	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1972	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1973	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1974	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1975	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1976	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1977	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1978	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1979	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1980	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1981	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1982	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1983	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1984	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1985	.	.	0.440	0.820	1.780	2.400	2.690	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1986	.	.	0.280	0.820	1.530	2.260	2.260	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1987	.	.	0.240	0.480	0.930	2.220	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1988	0.025	0.108	0.273	0.390	0.614	1.098	1.560	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1989	0.038	0.103	0.284	0.444	0.704	1.019	1.436	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1990	0.047	0.127	0.276	0.717	0.946	1.267	1.506	2.004	3.700	4.410	5.400	6.700	7.400	8.000
1991	0.051	0.142	0.389	0.754	1.484	1.622	1.689	2.047	2.606	4.410	5.400	6.700	7.400	8.000
1992	0.044	0.142	0.371	0.815	1.540	2.072	2.358	2.245	2.774	4.198	5.400	6.700	7.400	8.000
1993	0.034	0.103	0.304	0.819	1.437	2.115	2.344	3.045	3.391	3.400	4.200	6.700	7.400	8.000
1994	0.028	0.094	0.234	0.545	1.052	1.536	1.954	2.509	2.374	2.621	3.160	6.700	7.400	8.000

Table 4.7 HAD-ARCT: Haddock in the North-East Arctic (Fishing Areas I and II)

WECA: Mean Weight in Catch (Kilograms)

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1950	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1951	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1952	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1953	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1954	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1955	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1956	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1957	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1958	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1959	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1960	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1961	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1962	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1963	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1964	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1965	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1966	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1967	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1968	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1969	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1970	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1971	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1972	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1973	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1974	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1975	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1976	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1977	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1978	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1979	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1980	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1981	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1982	.	.	0.660	1.030	1.790	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1983	.	.	1.520	1.860	2.100	2.380	2.860	3.330	3.700	4.410	5.400	6.700	7.400	8.000
1984	.	.	1.570	1.990	2.420	2.680	2.930	3.370	3.700	4.410	5.400	6.700	7.400	8.000
1985	.	.	0.920	1.660	2.390	2.710	2.890	3.220	3.700	4.410	5.400	6.700	7.400	8.000
1986	.	.	0.860	1.250	1.880	2.410	2.660	3.040	3.700	4.410	5.400	6.700	7.400	8.000
1987	.	.	0.640	0.860	1.330	2.450	2.980	2.980	3.700	4.410	5.400	6.700	7.400	8.000
1988	.	.	0.580	0.840	1.050	1.430	1.970	2.520	3.700	4.410	5.400	6.700	7.400	8.000
1989	.	.	0.800	0.890	1.170	1.370	1.710	2.010	3.700	4.410	5.400	6.700	7.400	8.000
1990	0.250	0.640	0.890	1.220	1.400	1.600	1.770	2.160	3.700	4.410	5.400	6.700	7.400	8.000
1991	.	.	0.770	1.310	1.610	1.860	2.110	2.340	2.930	2.340	5.400	6.700	7.400	8.000
1992	0.040	0.280	0.840	1.360	1.700	1.960	2.290	2.390	2.320	2.880	3.140	2.920	2.280	3.290
1993	0.090	0.300	0.590	1.060	1.520	1.840	2.180	2.300	2.520	2.640	3.110	3.800	2.860	4.310
1994	0.080	0.450	0.530	0.870	1.330	1.730	2.020	2.260	2.490	2.650	2.880	2.830	3.150	3.150

Table 4.8 North-East Arctic HADDOCK. Maturity at age in percent from Russian data.

Year	Maturity at age in percent									
	Age									
	3	4	5	6	7	8	9	10	11	12
1981	1	12	64	73	96	100	100	-		
1982	9	55	73	93	96	100	93	-		
1983	17	70	100	99	99	100	-	-		
1984	7	14	35	47	74	82	89	-		
1985	2	8	80	93	96	91	96	-		
1986	+	22	53	86	86	100	83	100		
1987	-	1	21	53	100	100	-	100		
1988	-	3	33	51	-	-	-	-		
1989	-	4	30	63	82	100	-	-		
1990	-	2	30	54	77	87	80	100		
1991	-	7	30	50	80	92	100	100		
1992	2	13	50	62	77	80	94	100		
1993	2	24	50	79	80	89	87	87		
1994	-	2	13	41	90	88	100	100		
1995	-	1.4	14	46.5	78	83	100	87	100	95

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Table 4.9

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Haddock in the North-East Arctic (Fishing Areas I and II)

Russian bottom trawl, total area, Nov-Dec, age 1-7, calendar (code: FLT23)

Year	Effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
1983	1	592	95	5	4	0	0	0
1984	1	586	584	15	2	1	0	0
1985	1	144	1343	900	4	1	1	0
1986	1	14	107	363	164	1	0	0
1987	1	9	17	83	225	57	0	0
1988	1	3	7	17	40	76	8	0
1989	1	18	24	4	14	41	81	11
1990	1	143	106	73	42	73	74	57
1991	1	429	176	62	9	3	6	18
1992	1	282	1286	346	50	4	6	9
1993	1	48	357	1985	356	48	8	4
1994	1	49	58	442	1014	116	15	1

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Haddock in the North-East Arctic (Fishing Areas I and II)

Russian acoustic survey, total area, Oct-Dec, age 1-7, calendar (code: FLT24)

Year	Effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
1985	1	4340	14680	6360	30	10	1	0
1986	1	370	2080	9170	9100	20	1	1
1987	1	160	290	620	1970	610	1	0
1988	1	10	30	180	830	3010	460	0
1989	1	320	940	20	140	350	670	90
1990	1	1760	750	280	170	230	430	440
1991	1	3680	1430	650	110	40	70	210
1992	1	2450	7580	2180	350	30	40	70
1993	1	260	1990	10760	2280	310	50	20
1994	1	510	390	2520	5910	760	90	1

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Haddock in the North-East Arctic (Fishing Areas I and II)

Norwegian trawl, catch and effort, ages 8 -13 (code: FLT29) (Catch: Thousands)

Year	Effort	Catch, age 8	Catch, age 9	Catch, age 10	Catch, age 11	Catch, age 12	Catch, age 13
1985	0.40	166	365	26	7	3	1
1986	0.65	57	142	236	27	23	2
1987	1.06	28	41	41	69	43	1
1988	0.78	16	1	8	79	54	8
1989	0.63	127	1	9	3	8	1
1990	0.55	149	3	0	0	1	1
1991	0.55	703	58	7	0	1	1
1992	0.33	394	599	96	2	2	0
1993	0.41	200	279	282	36	9	1
1994	0.61	217	176	509	95	47	1

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Haddock in the North-East Arctic (Fishing Areas I and II)

Norway bottom trawl survey, Jan-Mar, age 1-7, shifted, reviced94 (code: FLT30) (Catch: Thousands)

Year	Effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
1980	1	73	23	78	18	53	5	2
1981	1	15	17	18	19	48	24	2
1982	1	66	27	27	13	13	28	13
1983	1	6834	149	16	7	2	3	3
1984	1	13622	3848	63	4	2	3	3
1985	1	3602	3398	1268	45	5	1	1
1986	1	952	1741	2723	506	1	20	0
1987	1	161	288	674	1107	157	2	0
1988	1	7	9	154	269	274	29	0
1989	1	514	41	34	52	94	121	17
1990	1	4209	724	126	31	24	30	56
1991	1	11912	2835	599	41	9	13	51
1992	1	5851	4678	1056	103	5	5	22
1993	1	2003	2960	4482	508	32	2	11
1994	1	1820	426	1634	3416	313	20	5

Continued

Table 4.9 (continued)

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Haddock in the North-East Arctic (Fishing Areas I and II)

Norway acoustic surv, Barents sea, Jan-Mar, age 1-7, shift, rev94 (code: FLT31) (Catch: Number)

Year	Effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
1980	1	140	50	210	600	180	10	3
1981	1	20	30	40	40	100	60	3
1982	1	50	20	30	10	10	40	20
1983	1	1730	60	20	10	3	3	3
1984	1	8390	2740	60	3	3	3	10
1985	1	3120	4880	1620	3	3	3	3
1986	1	260	710	1900	470	3	3	3
1987	1	50	80	200	380	60	3	3
1988	1	60	80	100	170	190	20	3
1989	1	440	40	30	40	70	110	10
1990	1	2650	490	70	20	20	20	40
1991	1	6850	1100	190	20	3	3	10
1992	1	6900	5650	990	100	3	3	10
1993	1	2280	2400	5060	770	80	3	3
1994	1	2850	360	1130	3910	400	20	3

Table 4.10 North-East Arctic Haddock: Recruits as 3 year-olds (revised)

NORTHEAST ARCTIC HADDOCK : recruits as 3 year-olds (inc. data for ages 0,1,2 & 3)
10,38,2 (No. of surveys, No. of years, VPA Column No.)

1957,	243,	38,	9,	14,	-11,	-11,	-11,	-11,	-11,	-11,	-11
1958,	109,	2,	4,	5,	-11,	-11,	-11,	-11,	-11,	-11,	-11
1959,	241,	7,	14,	33,	-11,	-11,	-11,	-11,	-11,	-11,	-11
1960,	275,	30,	40,	72,	-11,	-11,	-11,	-11,	-11,	-11,	-11
1961,	320,	32,	50,	34,	-11,	-11,	-11,	-11,	-11,	-11,	-11
1962,	100,	5,	3,	4,	-11,	-11,	-11,	-11,	-11,	-11,	-11
1963,	240,	16,	9,	12,	-11,	-11,	-11,	-11,	-11,	-11,	-11
1964,	291,	11,	12,	15,	-11,	-11,	-11,	-11,	-11,	-11,	-11
1965,	20,	0.3,	0.3,	0.3,	-11,	-11,	-11,	-11,	-11,	-11,	-11
1966,	17,	0.3,	0.3,	0.3,	001,	-11,	-11,	-11,	-11,	-11,	-11
1967,	164,	3,	13,	8,	008,	-11,	-11,	-11,	-11,	-11,	-11
1968,	95,	0.3,	0.3,	3,	000.3,	-11,	-11,	-11,	-11,	-11,	-11
1969,	1018,	31,	69,	120,	029,	-11,	-11,	-11,	-11,	-11,	-11
1970,	270,	10,	33,	31,	064,	-11,	-11,	-11,	-11,	-11,	-11
1971,	54,	3,	3,	9,	026,	-11,	-11,	-11,	-11,	-11,	-11
1972,	49,	2,	9,	3,	016,	-11,	-11,	-11,	-11,	-11,	-11
1973,	56,	13,	8,	5,	026,	-11,	-11,	-11,	-11,	-11,	-11
1974,	114,	15,	35,	14,	051,	-11,	-11,	-11,	-11,	-11,	-11
1975,	172,	163,	96,	59,	060,	-11,	-11,	-11,	-11,	-11,	-11
1976,	135,	6,	13,	4,	038,	-11,	-11,	-11,	-11,	-11,	-11
1977,	19,	1,	1,	0.3,	033,	-11,	-11,	-11,	-11,	-11,	-11
1978,	6,	0.3,	0.3,	1,	012,	-11,	-11,	2.3,	-11,	-11,	5
1979,	8,	0.3,	0.3,	0.3,	020,	-11,	7.3,	1.7,	-11,	14,	3
1980,	5,	0.3,	0.3,	0.3,	015,	3.1,	1.5,	2.7,	7,	2,	2
1981,	9,	0.3,	0.3,	8,	003,	3.9,	6.6,	14.9,	9,	5,	6
1982,	256,	23,	59,	63,	038,	2776.8,	683.4,	384.8,	0.3,	173,	274
1983,	342,	40,	79,	239,	062,	5382.0,	1362.2,	339.8,	1685,	839,	488
1984,	91,	9,	19,	18,	078,	1421.2,	360.2,	174.1,	1809,	312,	71
1985,	31,	5,	2,	3,	027,	649.0,	95.2,	28.8,	680,	26,	8
1986,	15,	0.3,	1,	1,	039,	134.3,	16.1,	9.0,	111,	5,	8
1987,	17,	0.3,	0.3,	4,	010,	44.6,	7.0,	4.1,	20,	6,	4
1988,	66,	2,	3,	21,	013,	80.8,	51.4,	72.4,	58,	44,	49
1989,	160,	3,	25,	30,	014,	555.4,	420.9,	283.5,	493,	265,	110
1990,	272,	81,	67,	173,	058,	1526.0,	1191.2,	467.8,	1938,	685,	565
1991,	153,	17,	44,	69,	117,	1282.2,	585.1,	296.0,	859,	690,	240
1992,	74,	20,	8,	9,	087,	717.5,	200.3,	42.6,	1424,	228,	36
1993,	85,	6,	7,	-11,	064,	587.5,	182.0,	-11,	848,	285,	-11
1994,	-11,	14,	-11,	-11,	064,	1271.8,	-11,	-11,	1380,	-11,	-11

R-T-1 Russian Bottom Trawl Survey, age 0+
R-T-2 Russian Bottom Trawl Survey, age 1+
R-T-3 Russian Bottom Trawl Survey, age 2+
INTOGP International 0 Group Survey, (scaled x 100)
N-BST1 Norwegian Barents Sea Bottom Trawl Survey, age 1
N-BST2 Norwegian Barents Sea Bottom Trawl Survey, age 2
N-BST3 Norwegian Barents Sea Bottom Trawl Survey, age 3
N-BSA1 Norwegian Barents Sea Acoustic Survey, age 1
N-BSA2 Norwegian Barents Sea Acoustic Survey, age 2
N-BSA3 Norwegian Barents Sea Acoustic Survey, age 3

Table 4.11 North-East Arctic Haddock: Recruits as 3 year-olds

Analysis by RCT3 ver3.1 of data from file : G:/ACFM/AFWG95/HAD_ARCT/HAD.RCT

NORTHEAST ARCTIC HADDOCK : recruits as 3 year-olds (inc. data for ages 0,1,2 & 3

Data for 10 surveys over 38 years : 1957 - 1994

Regression type = P
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.

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1963	182	5.21	.18	.06	.10	241	5.48
1964	197	5.29	.18	.01	.01	292	5.68
1965	106	4.67	.24	.25	1.12	21	3.04
1966	47	3.86	.34	.29	.74	18	2.89
1967	120	4.79	.31	.22	.50	165	5.11
1968	47	3.86	.32	.28	.73	96	4.56
1969	498	6.21	.36	.31	.74	1019	6.93
1970	310	5.74	.33	.19	.35	271	5.60
1971	118	4.78	.31	.14	.22	55	4.01
1972	93	4.53	.33	.21	.40	50	3.91
1973	127	4.85	.34	.22	.44	56	4.04
1974	197	5.29	.35	.16	.21	115	4.74
1975	433	6.07	.38	.33	.72	173	5.15
1976	92	4.53	.38	.16	.18	135	4.91
1977	51	3.94	.40	.30	.58	20	3.00
1978	42	3.74	.40	.22	.30	6	1.95
1979	28	3.35	.48	.29	.37	9	2.20
1980	22	3.10	.48	.26	.29	6	1.79
1981	1	.52	.18	.52	8.44	10	2.30
1982	80	4.39	.39	.38	.95	256	5.55
1983	327	5.79	.25	.29	1.30	342	5.84
1984	121	4.80	.16	.11	.51	92	4.52
1985	29	3.39	.17	.22	1.69	32	3.47
1986	16	2.81	.20	.13	.40	16	2.77
1987	11	2.42	.19	.11	.31	18	2.89
1988	40	3.70	.19	.13	.50	67	4.20
1989	109	4.70	.20	.17	.71	160	5.08
1990	288	5.66	.20	.15	.56	273	5.61
1991	190	5.25	.19	.09	.22	153	5.04
1992	69	4.24	.17	.13	.57	75	4.32
1993	80	4.39	.22	.12	.29	85	4.45
1994	111	4.72	.42	.11	.07		

Yearclass = 1994

Survey/ Series	Slope (Regression)	Inter-cept (Regression)	Std Error (Regression)	Rsquare (Regression)	No. Pts (Regression)	Index Value (Prediction)	Predicted Value (Prediction)	Std Error (Prediction)	WAP Weights (Prediction)
R-T-1	.75	2.72	.66	.731	37	2.71	4.75	.766	.301
R-T-2									
R-T-3									
INTOGP	.76	1.49	1.06	.320	28	4.17	4.65	1.226	.117
N-BST1	.54	1.05	.60	.758	14	7.15	4.90	.706	.354
N-BST2									
N-BST3									
N-BSA1	.26	2.85	1.07	.234	14	7.23	4.69	1.265	.110
N-BSA2									
N-BSA3									
						VPA Mean =	4.17	1.221	.118

Table 4.12

Lowestoft VPA Version 3.1

6-Oct-95 09:19:09

Extended Survivors Analysis

Arctic Haddock (run: FINH1/H1S)

CPUE data from file /users/fish/ifad/ifapwork/afwg/had_arct/FLEET.H1S

Catch data for 45 years. 1950 to 1994. Ages 1 to 14.

Fleet,	First, year,	Last, year,	First, age ,	Last, age	Alpha,	Beta
FLT23: Russian botto,	1983,	1994,	1,	7,	.900,	1.000
FLT24: Russian acous,	1985,	1994,	1,	7,	.900,	1.000
FLT29: Norwegian tra,	1985,	1994,	8,	13,	.000,	1.000
FLT30: Norway bottom,	1980,	1994,	1,	7,	.100,	.300
FLT31: Norway acoust,	1980,	1994,	1,	7,	.100,	.300

Time series weights :

Tapered time weighting applied
Power = 3 over 20 years

Catchability analysis :

Catchability dependent on stock size for ages < 8

Regression type = C
Minimum of 5 points used for regression
Survivor estimates shrunk to the population mean for ages < 8

Catchability independent of age for ages >= 11

Terminal population estimation :

Survivor estimates shrunk towards the mean F
of the final 2 years or the 5 oldest ages.

S.E. of the mean to which the estimates are shrunk = 1.000

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

Prior weighting not applied

Tuning had not converged after 270 iterations

Total absolute residual between iterations
269 and 270 = .02517

Final year F values

Age ,	1,	2,	3,	4,	5,	6,	7,	8,	9,	10
Iteration **,	.0003,	.0054,	.0156,	.1384,	.4631,	.8338,	1.0764,	.4670,	.5734,	.4580
Iteration **,	.0003,	.0054,	.0157,	.1398,	.4676,	.8382,	1.0735,	.4647,	.5728,	.4608

Age ,	11,	12,	13
Iteration **,	.4450,	.4596,	1.4324
Iteration **,	.4490,	.4602,	1.4338

Continued

Table 4.12 Continued

Regression weights

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

Fishing mortalities

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	.000	.002	.000	.000	.000	.000	.000	.004	.001	.000
2	.006	.007	.004	.002	.009	.004	.002	.005	.002	.005
3	.134	.084	.047	.027	.070	.031	.060	.073	.029	.016
4	.206	.451	.464	.147	.179	.104	.160	.277	.209	.140
5	.380	.282	.905	.536	.305	.120	.243	.301	.519	.468
6	.632	.492	.262	1.094	.498	.158	.274	.370	.685	.838
7	.535	.736	.557	.273	.556	.263	.254	.324	.366	1.074
8	.534	.501	.639	.337	.284	.256	.276	.234	.346	.465
9	.758	.512	.524	.372	.086	1.002	.183	.274	.304	.573
10	.710	.716	.400	.694	.836	.696	.121	.160	.333	.461
11	.635	.416	.620	1.263	.406	.143	.025	.094	.324	.449
12	.190	1.421	.672	1.660	.654	.166	.575	.131	.800	.460
13	.076	.166	.577	.351	1.065	.618	.159	.146	.487	1.434

XSA population numbers (Thousands)

YEAR	AGE 1	2	3	4	5	6	7	8		
1985	1.41E+05	4.29E+05	2.61E+05	6.83E+03	1.91E+03	1.69E+03	8.43E+02	1.69E+03	2.73E+03	9.04E+02
1986	5.03E+04	1.15E+05	3.49E+05	1.87E+05	4.55E+03	1.07E+03	7.34E+02	4.04E+02	8.13E+02	1.05E+03
1987	2.57E+04	4.11E+04	9.38E+04	2.63E+05	9.76E+04	2.81E+03	5.36E+02	2.88E+02	2.00E+02	3.99E+02
1988	2.79E+04	2.10E+04	3.35E+04	7.32E+04	1.35E+05	3.23E+04	1.77E+03	2.51E+02	1.24E+02	9.71E+01
1989	1.12E+05	2.28E+04	1.72E+04	2.67E+04	5.18E+04	6.48E+04	8.87E+03	1.10E+03	1.47E+02	7.02E+01
1990	2.89E+05	9.19E+04	1.85E+04	1.31E+04	1.83E+04	3.13E+04	3.22E+04	4.16E+03	6.79E+02	1.10E+02
1991	7.79E+05	2.36E+05	7.50E+04	1.47E+04	9.67E+03	1.33E+04	2.19E+04	2.03E+04	2.64E+03	2.04E+02
1992	3.52E+05	6.38E+05	1.93E+05	5.78E+04	1.02E+04	6.21E+03	8.27E+03	1.39E+04	1.26E+04	1.80E+03
1993	1.12E+05	2.87E+05	5.20E+05	1.47E+05	3.59E+04	6.21E+03	3.51E+03	4.90E+03	8.99E+03	7.85E+03
1994	1.28E+05	9.15E+04	2.35E+05	4.13E+05	9.76E+04	1.75E+04	2.56E+03	2.00E+03	2.84E+03	5.43E+03

Estimated population abundance at 1st Jan 1995

, .00E+00, 1.04E+05, 7.43E+04, 1.88E+05, 2.92E+05, 4.96E+04, 6.15E+03, 7.19E+02, 1.03E+03, 1.31E+03,

Taper weighted geometric mean of the VPA populations:

, 1.08E+05, 8.12E+04, 6.17E+04, 3.95E+04, 1.92E+04, 8.54E+03, 3.83E+03, 2.04E+03, 1.09E+03, 5.28E+02,

Standard error of the weighted Log(VPA populations) :

, 1.3661, 1.4583, 1.5418, 1.5599, 1.4090, 1.2909, 1.3012, 1.4399, 1.5704, 1.6063,

YEAR	AGE 11	12	13
1985	1.18E+02	3.20E+01	1.52E+01
1986	3.64E+02	5.10E+01	2.17E+01
1987	4.18E+02	1.97E+02	1.01E+01
1988	2.19E+02	1.84E+02	8.22E+01
1989	3.97E+01	5.07E+01	2.87E+01
1990	2.49E+01	2.17E+01	2.16E+01
1991	4.50E+01	1.77E+01	1.50E+01
1992	1.48E+02	3.60E+01	8.15E+00
1993	1.25E+03	1.10E+02	2.58E+01
1994	4.61E+03	7.43E+02	4.06E+01

Estimated population abundance at 1st Jan 1995

, 2.78E+03, 2.38E+03, 3.83E+02,

Taper weighted geometric mean of the VPA populations:

, 2.19E+02, 9.00E+01, 3.11E+01,

Standard error of the weighted Log(VPA populations) :

, 1.5746, 1.2587, 1.0402,

Continued

Table 4.12 Continued

Log catchability residuals.

Fleet : FLT23: Russian botto

Age	1980	1981	1982	1983	1984
1	99.99	99.99	99.99	.53	.23
2	99.99	99.99	99.99	2.10	.29
3	99.99	99.99	99.99	.41	.59
4	99.99	99.99	99.99	.16	.04
5	99.99	99.99	99.99	99.99	-.09
6	99.99	99.99	99.99	99.99	99.99
7	99.99	99.99	99.99	99.99	99.99
8	No data for this fleet at this age				
9	No data for this fleet at this age				
10	No data for this fleet at this age				
11	No data for this fleet at this age				
12	No data for this fleet at this age				
13	No data for this fleet at this age				

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	.59	.04	.41	-.42	-.60	-.13	-.38	.13	.07	-.04
2	.72	-.16	-.73	-.83	.17	.06	-.45	.29	-.03	-.46
3	.60	-.46	-.38	-.66	-1.14	1.12	-.39	.08	.48	.04
4	-.22	-.16	-.21	-.67	-.53	1.06	-.33	-.14	.55	.36
5	.36	-.58	-.10	-.48	-.16	1.19	-.52	-.32	.49	.12
6	-.12	99.99	99.99	-.72	.21	.56	-.83	.02	.56	.25
7	99.99	99.99	99.99	99.99	.29	.22	-.43	-.02	.14	-.19
8	No data for this fleet at this age									
9	No data for this fleet at this age									
10	No data for this fleet at this age									
11	No data for this fleet at this age									
12	No data for this fleet at this age									
13	No data for this fleet at this age									

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
1	.68	2.848	8.94	.90	12	.39	-7.55
2	.87	.704	7.27	.77	12	.74	-6.62
3	.82	1.217	7.27	.84	12	.70	-6.38
4	.85	1.326	7.10	.91	12	.53	-6.49
5	.76	1.778	7.50	.88	11	.57	-6.74
6	.93	.334	6.58	.81	8	.58	-6.36
7	.90	.729	6.58	.93	6	.31	-6.29

Continued

Table 4.12 Continued

Fleet : FLT24: Russian acous

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	1.42	.66	.72	-1.38	-.25	.04	-.41	.09	-.40	-.04
2	.92	.59	-.03	-1.28	1.55	-.04	-.44	-.03	-.36	-.59
3	.34	.26	-.22	-.02	-.77	.87	.04	-.10	-.07	-.24
4	-.17	1.11	-.41	-.03	-.37	.44	.03	-.36	.10	-.25
5	.43	.01	-.08	.52	-.28	.32	-.25	-.48	.15	-.22
6	-.19	.19	-.89	.40	-.40	-.08	-.15	.36	.64	.00
7	99.99	.24	99.99	99.99	.40	-.09	-.16	.18	.29	-.82
8	No data for this fleet at this age									
9	No data for this fleet at this age									
10	No data for this fleet at this age									
11	No data for this fleet at this age									
12	No data for this fleet at this age									
13	No data for this fleet at this age									

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
1	.73	1.101	7.04	.69	10	.78	-5.28
2	.84	.632	5.65	.69	10	.86	-4.53
3	.66	2.653	6.85	.89	10	.46	-4.40
4	.77	1.892	5.73	.90	10	.48	-4.18
5	.74	2.848	5.87	.94	10	.36	-4.41
6	.54	3.731	6.81	.90	10	.47	-4.80
7	.61	2.533	6.29	.90	7	.46	-4.73

Continued

Table 4.12 Continued

Fleet : FLT29: Norwegian tra

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	No data for this fleet at this age									
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	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	.84	.70	-.10	-.35	.43	-.61	-.63	-.34	-.14	.49
9	1.90	1.58	1.25	-1.75	-1.83	-1.73	-.48	.85	.22	.63
10	-.44	1.14	-.28	-.06	.65	99.99	-.85	.12	-.41	.21
11	.45	.09	.49	1.84	.13	99.99	99.99	-1.09	-.45	-1.12
12	.70	2.30	.79	1.77	.98	-.34	.05	.34	.81	.01
13	.29	.19	-.04	.15	-.36	-.13	.03	99.99	-.07	-.54

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

Age	8	9	10	11	12	13
Mean Log q	-1.9016	-2.5565	-1.7701	-1.9635	-1.9635	-1.9635
S.E(Log q)	.5357	1.4084	.5987	.9838	1.0961	.2754

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
8	1.18	-1.371	.85	.88	10	.60	-1.90
9	.71	1.500	3.87	.79	10	.93	-2.56
10	1.01	-.099	1.70	.89	9	.65	-1.77
11	1.36	-1.032	.57	.61	8	1.33	-1.96
12	.90	.433	1.55	.74	10	.76	-1.26
13	1.10	-.560	1.91	.82	9	.31	-2.03

Continued

Table 4.12 Continued

Fleet : FLT30: Norway bottom

Age	1980	1981	1982	1983	1984
1	.56	.08	.39	-.03	.11
2	.28	-.29	.58	1.19	.20
3	-.08	-.13	-.12	-.03	.50
4	-2.38	-.51	.44	-.37	-.30
5	-.17	-.43	.27	.12	-.01
6	-.32	.36	.20	-.91	.39
7	.35	-.49	.17	-1.79	-.50
8	No data for this fleet at this age				
9	No data for this fleet at this age				
10	No data for this fleet at this age				
11	No data for this fleet at this age				
12	No data for this fleet at this age				
13	No data for this fleet at this age				

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	.58	.77	.31	-1.77	-.43	-.03	-.37	-.02	.44	.25
2	-.19	.64	.35	-1.51	-.48	.22	.27	-.35	.11	-.16
3	-.30	.06	.17	-.07	-.69	.35	.29	-.16	.08	.01
4	1.01	-.18	.15	.16	-.23	.02	.16	-.40	.02	.61
5	1.16	-.99	.02	.07	.15	.09	-.02	-.53	-.29	.49
6	-1.06	2.96	-.82	.14	1.02	-.01	-.13	-.49	-1.52	.25
7	-.31	99.99	99.99	99.99	.13	-.04	.26	.41	.59	.27
8	No data for this fleet at this age									
9	No data for this fleet at this age									
10	No data for this fleet at this age									
11	No data for this fleet at this age									
12	No data for this fleet at this age									
13	No data for this fleet at this age									

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
1	.64	2.350	7.20	.81	15	.68	-4.67
2	.73	1.987	6.81	.85	15	.65	-5.15
3	.86	2.289	5.99	.96	15	.32	-5.16
4	.86	1.258	6.51	.89	15	.59	-5.83
5	.79	1.925	7.35	.89	15	.52	-6.67
6	1.20	-.737	6.17	.58	15	1.16	-6.66
7	.99	.074	6.28	.78	12	.64	-6.25

Continued

Table 4.12 Continued

Fleet : FLT31: Norway acoust

Age	1980	1981	1982	1983	1984
1	.90	.02	.05	-.76	.08
2	.82	.06	.26	.51	.17
3	.98	.69	.09	.25	.61
4	.63	.43	.67	.38	.04
5	.89	.23	.09	.43	.29
6	.72	1.63	.81	-.68	.61
7	.17	-.59	1.91	-2.37	1.27
8	No data for this fleet at this age				
9	No data for this fleet at this age				
10	No data for this fleet at this age				
11	No data for this fleet at this age				
12	No data for this fleet at this age				
13	No data for this fleet at this age				

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	.69	-.08	-.60	-.55	-.50	-.15	-.46	.34	.69	.72
2	.33	.12	-.58	.08	-.55	.05	-.25	.05	.17	-.19
3	.22	.07	-.66	-.27	-.68	.00	-.49	.07	.55	-.02
4	-.72	-.21	-.71	-.08	-.15	.03	-.07	-.22	.36	.54
5	.74	-.14	-.67	-.12	-.01	-.02	-.91	-.95	.50	.80
6	.49	.91	-.11	-.11	1.07	-.30	-1.66	-.88	-.80	.44
7	.22	.43	.68	-.62	.24	1.56	-.78	.22	-1.27	-.69
8	No data for this fleet at this age									
9	No data for this fleet at this age									
10	No data for this fleet at this age									
11	No data for this fleet at this age									
12	No data for this fleet at this age									
13	No data for this fleet at this age									

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
1	.72	2.153	6.70	.86	15	.57	-4.80
2	.79	2.805	6.53	.95	15	.35	-5.28
3	.91	.997	5.94	.92	15	.48	-5.41
4	.75	2.963	7.22	.94	15	.44	-6.10
5	.81	1.373	7.31	.85	15	.63	-6.72
6	1.18	-.841	6.42	.68	15	.93	-6.83
7	1.97	-3.662	4.51	.60	15	1.13	-6.35

Continued

Table 4.12 Continued

Terminal year survivor and F summaries :

Age 1 Catchability dependent on age and year class strength

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT23: Russian botto,	100039.,	.407,	.000,	.00,	1,	.438,	.000
FLT24: Russian acous,	100206.,	.825,	.000,	.00,	1,	.107,	.000
FLT29: Norwegian tra,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT30: Norway bottom,	133786.,	.707,	.000,	.00,	1,	.145,	.000
FLT31: Norway acoust,	214301.,	.597,	.000,	.00,	1,	.204,	.000
P shrinkage mean ,	81238.,	1.46,,,,				.034,	.000
F shrinkage mean ,	12710.,	1.00,,,,				.073,	.003

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
104166.,	.27,	.31,	6,	1.140,	.000

Age 2 Catchability dependent on age and year class strength

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT23: Russian botto,	71564.,	.361,	.220,	.61,	2,	.294,	.006
FLT24: Russian acous,	45968.,	.617,	.092,	.15,	2,	.101,	.009
FLT29: Norwegian tra,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT30: Norway bottom,	84654.,	.491,	.300,	.61,	2,	.159,	.005
FLT31: Norway acoust,	78527.,	.313,	.394,	1.26,	2,	.391,	.005
P shrinkage mean ,	61731.,	1.54,,,,				.016,	.007
F shrinkage mean ,	126536.,	1.00,,,,				.039,	.003

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
74339.,	.20,	.12,	10,	.613,	.005

Age 3 Catchability dependent on age and year class strength

Year class = 1991

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT23: Russian botto,	206094.,	.333,	.045,	.14,	3,	.209,	.014
FLT24: Russian acous,	155899.,	.386,	.105,	.27,	3,	.156,	.019
FLT29: Norwegian tra,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT30: Norway bottom,	192830.,	.283,	.029,	.10,	3,	.292,	.015
FLT31: Norway acoust,	219793.,	.274,	.088,	.32,	3,	.309,	.014
P shrinkage mean ,	39473.,	1.56,,,,				.010,	.073
F shrinkage mean ,	56975.,	1.00,,,,				.024,	.051

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
188418.,	.15,	.08,	14,	.527,	.016

Continued

Table 4.12 Continued

Age 4 Catchability dependent on age and year class strength

Year class = 1990

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT23: Russian botto,	296243.,	.303,	.219,	.72,	4,	.210,	.139
FLT24: Russian acous,	246542.,	.326,	.073,	.23,	4,	.183,	.165
FLT29: Norwegian tra,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT30: Norway bottom,	306681.,	.271,	.177,	.66,	4,	.264,	.135
FLT31: Norway acoust,	355068.,	.251,	.209,	.83,	4,	.308,	.117
P shrinkage mean ,	19189.,	1.41,,,,				.011,	1.194
F shrinkage mean ,	159611.,	1.00,,,,				.023,	.244

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
292064.,	.14,	.11,	18,	.800,	.140

Age 5 Catchability dependent on age and year class strength

Year class = 1989

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT23: Russian botto,	52555.,	.264,	.150,	.57,	5,	.198,	.450
FLT24: Russian acous,	44260.,	.245,	.076,	.31,	5,	.246,	.515
FLT29: Norwegian tra,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT30: Norway bottom,	52836.,	.236,	.129,	.55,	5,	.246,	.448
FLT31: Norway acoust,	54569.,	.225,	.178,	.79,	5,	.267,	.436
P shrinkage mean ,	8544.,	1.29,,,,				.016,	1.503
F shrinkage mean ,	58348.,	1.00,,,,				.027,	.413

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
49619.,	.12,	.08,	22,	.659,	.468

Continued

Table 4.12 Continued

Age 6 Catchability dependent on age and year class strength

Year class = 1988

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT23: Russian botto,	5909.,	.256,	.178,	.69,	6,	.206,	.865
FLT24: Russian acous,	6143.,	.229,	.075,	.33,	6,	.279,	.843
FLT29: Norwegian tra,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT30: Norway bottom,	6235.,	.232,	.141,	.61,	6,	.207,	.834
FLT31: Norway acoust,	5832.,	.221,	.158,	.71,	6,	.228,	.873
P shrinkage mean ,	3835.,	1.30,,,,				.030,	1.137
F shrinkage mean ,	11572.,	1.00,,,,				.051,	.532

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
6151.,	.13,	.07,	26,	.546,	.838

Age 7 Catchability dependent on age and year class strength

Year class = 1987

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT23: Russian botto,	662.,	.240,	.152,	.63,	7,	.291,	1.127
FLT24: Russian acous,	640.,	.232,	.300,	1.29,	7,	.248,	1.149
FLT29: Norwegian tra,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT30: Norway bottom,	677.,	.250,	.246,	.99,	7,	.190,	1.112
FLT31: Norway acoust,	462.,	.234,	.133,	.57,	7,	.169,	1.383
P shrinkage mean ,	2044.,	1.44,,,,				.033,	.516
F shrinkage mean ,	3330.,	1.00,,,,				.068,	.347

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
719.,	.14,	.13,	30,	.973,	1.074

Continued

Table 4.12 Continued

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

Year class = 1986

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT23: Russian botto,	1144.,	.217,	.193,	.89,	7,	.280,	.426
FLT24: Russian acous,	1103.,	.218,	.182,	.83,	7,	.245,	.439
FLT29: Norwegian tra,	1678.,	.564,	.000,	.00,	1,	.078,	.309
FLT30: Norway bottom,	834.,	.236,	.243,	1.03,	7,	.183,	.547
FLT31: Norway acoust,	703.,	.227,	.191,	.84,	7,	.175,	.622
F shrinkage mean ,	1792.,	1.00,,,,				.039,	.292

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1031.,	.12,	.10,	30,	.850,	.465

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

Year class = 1985

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT23: Russian botto,	1205.,	.209,	.209,	1.00,	7,	.268,	.610
FLT24: Russian acous,	1425.,	.209,	.105,	.50,	7,	.244,	.537
FLT29: Norwegian tra,	1293.,	.532,	.292,	.55,	2,	.076,	.578
FLT30: Norway bottom,	1463.,	.227,	.113,	.50,	7,	.185,	.526
FLT31: Norway acoust,	934.,	.224,	.170,	.76,	7,	.176,	.734
F shrinkage mean ,	3001.,	1.00,,,,				.050,	.291

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1310.,	.11,	.08,	31,	.710,	.573

Continued

Table 4.12 Continued.

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

Year class = 1984

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT23: Russian botto,	2349.,	.213,	.177,	.83,	7,	.253,	.530
FLT24: Russian acous,	2558.,	.215,	.128,	.60,	7,	.226,	.496
FLT29: Norwegian tra,	2785.,	.419,	.191,	.46,	3,	.147,	.463
FLT30: Norway bottom,	3548.,	.236,	.067,	.28,	7,	.163,	.380
FLT31: Norway acoust,	2541.,	.229,	.161,	.70,	7,	.161,	.498
F shrinkage mean ,	5836.,	1.00,,,,				.050,	.248

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
2784.,	.12,	.07,	32,	.597,	.461

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

Year class = 1983

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT23: Russian botto,	2746.,	.272,	.101,	.37,	7,	.218,	.403
FLT24: Russian acous,	2361.,	.271,	.161,	.60,	6,	.184,	.456
FLT29: Norwegian tra,	1379.,	.400,	.254,	.64,	4,	.282,	.688
FLT30: Norway bottom,	2608.,	.307,	.100,	.33,	7,	.116,	.421
FLT31: Norway acoust,	2980.,	.284,	.281,	.99,	7,	.095,	.377
F shrinkage mean ,	5846.,	1.00,,,,				.104,	.210

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
2384.,	.18,	.10,	32,	.583,	.449

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

Year class = 1982

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT23: Russian botto,	467.,	.290,	.117,	.40,	7,	.214,	.392
FLT24: Russian acous,	553.,	.342,	.107,	.31,	5,	.124,	.341
FLT29: Norwegian tra,	309.,	.379,	.161,	.42,	5,	.400,	.546
FLT30: Norway bottom,	400.,	.430,	.065,	.15,	7,	.072,	.445
FLT31: Norway acoust,	365.,	.420,	.140,	.33,	7,	.046,	.479
F shrinkage mean ,	375.,	1.00,,,,				.144,	.469

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
383.,	.23,	.06,	32,	.271,	.460

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

Year class = 1981

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT23: Russian botto,	9.,	.407,	.517,	1.27,	4,	.012,	1.346
FLT24: Russian acous,	6.,	.319,	.292,	.92,	3,	.025,	1.703
FLT29: Norwegian tra,	5.,	.262,	.134,	.51,	6,	.689,	1.855
FLT30: Norway bottom,	10.,	.285,	.348,	1.22,	6,	.025,	1.274
FLT31: Norway acoust,	8.,	.277,	.210,	.76,	7,	.029,	1.439
F shrinkage mean ,	41.,	1.00,,,,				.221,	.485

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
8.,	.29,	.21,	27,	.718,	1.434

Table 4.13

HAD-ARCT: Haddock in the North-East Arctic (Fishing Areas I and II)

CANUM: Catch in Numbers (Thousands)

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1950	1	4446	3190	37949	35344	18849	27869	9199	1980	1093	853	868	712	258
1951	4069	222	65644	9178	18014	13551	6808	6849	3321	1182	734	177	81	82
1952	1	13673	6012	151996	13634	9851	4693	3237	2434	606	534	185	138	1
1953	392	8031	64527	13014	70780	5431	2866	1079	424	315	393	202	121	176
1954	1726	493	6563	154695	5884	27590	3233	1302	711	319	126	69	51	34
1955	1	989	1154	10689	176678	4994	28278	1445	272	100	50	30	15	5
1956	97	3012	16436	5922	14714	127879	3182	8003	450	200	80	60	30	15
1957	828	243	2074	24704	7942	12535	46619	1087	1970	356	17	1	33	36
1958	153	2312	1727	5913	31437	5821	12748	17565	822	1072	226	79	89	18
1959	169	2425	20317	7826	7244	14039	3153	2237	5918	285	316	70	4	23
1960	2319	3632	40117	71280	13717	7138	6267	1587	2352	2015	497	70	30	12
1961	362	5531	15430	56859	63354	8706	3578	4407	787	527	1287	67	60	20
1962	1	4536	39604	30947	49028	33922	3209	1344	1778	243	247	482	20	8
1963	3	2151	28567	72995	19035	13627	9290	1243	561	409	79	84	169	41
1964	149	831	22305	49162	30592	5800	3519	2709	832	104	206	234	121	67
1965	1	3483	5911	46161	40032	12578	1672	970	893	122	204	123	14	205
1966	1	2559	26157	22469	62724	28840	5711	578	435	188	186	25	8	7
1967	1	53	15918	41373	13505	25736	8878	1617	218	176	155	76	27	7
1968	1	33	657	67632	41267	7748	15599	5292	655	182	101	115	18	19
1969	1	1058	1520	1963	44526	18956	3611	4925	1624	315	43	43	14	2
1970	480	276	23004	2408	1870	21995	7948	1974	1978	726	166	26	52	19
1971	15	3535	1979	24359	1258	918	9279	3056	826	1043	369	130	27	4
1972	133	9369	230229	22246	42849	3196	1606	6736	2630	896	988	538	53	42
1973	1	5915	70204	258773	24018	6872	418	422	1680	525	146	340	68	13
1974	281	3713	9684	41701	88111	5827	4138	382	617	2043	935	276	458	143
1975	1321	4355	10037	14089	33871	49712	2135	1236	92	131	500	147	53	92
1976	3475	7496	13989	13449	6808	20789	40044	1247	1349	193	279	652	331	46
1977	184	18456	55967	22043	7368	2586	7781	11043	311	388	96	101	84	98
1978	46	2033	47311	18812	4076	1389	1626	2596	6215	162	258	3	74	65
1979	0	48	17540	35290	10645	1429	812	546	1466	2310	181	87	2	53
1980	0	0	627	22878	21794	2971	250	504	230	842	1299	111	35	15
1981	1	68	486	2561	22124	10685	1034	162	162	72	330	564	27	42
1982	2	29	883	900	3372	12203	2625	344	75	80	91	320	204	34
1983	0	162	704	1930	884	1374	3282	906	52	37	29	21	21	91
1984	0	252	456	841	836	307	765	2250	499	70	25	36	44	185
1985	1	2288	29548	1153	546	715	316	634	1312	416	50	5	1	57
1986	96	690	25596	61470	1013	376	346	144	295	484	112	35	3	7
1987	8	154	3928	88297	52611	586	207	123	74	119	175	87	4	19
1988	0	46	794	9031	50868	19465	382	65	35	44	142	135	22	11
1989	0	180	1050	3951	12305	23032	3423	247	11	36	12	22	17	15
1990	6	294	518	1174	1871	4138	6754	851	389	50	3	3	9	15
1991	21	329	3968	1967	1886	2876	4442	4422	398	21	1	7	2	7
1992	1258	2668	12342	12652	2411	1740	2070	2619	2737	241	12	4	1	1
1993	117	455	13398	25092	13154	2784	973	1297	2131	2011	314	55	9	6
1994	36	448	3308	48798	32983	8978	1526	671	1119	1814	1508	248	28	2

Table 4.14

Run title : Arctic Haddock (run: FINH1/H1S)

At 6-Oct-95 09:21:22

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
AGE										
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0003,	.0000,	.0016,	.0000,	.0034,
2,	.0129,	.0079,	.0024,	.0017,	.0058,	.0026,	.0031,	.0307,	.0939,	.0661,
3,	.0668,	.1270,	.0619,	.0369,	.1015,	.1663,	.0229,	.2843,	.3354,	.2192,
4,	.2341,	.3866,	.3032,	.4022,	.1474,	.2316,	.2665,	.3823,	.6006,	.3413,
5,	.4587,	.5757,	.4253,	.5649,	.5077,	.2043,	.1819,	1.0678,	.9520,	.4191,
6,	.6910,	.7177,	.4944,	.4643,	.5550,	.5092,	.1461,	.9649,	.4683,	.6375,
7,	.6516,	.8034,	.5019,	.6415,	.4101,	.4780,	.4188,	.4095,	.3004,	.5786,
8,	.4812,	.4908,	.5559,	.6437,	.4259,	.4132,	.3394,	.6183,	.1773,	.4962,
9,	.7633,	.4132,	.3451,	.4586,	.4135,	.3017,	.3031,	.5531,	.3021,	.4252,
10,	.2588,	.3489,	.2915,	.5453,	.4182,	.3279,	.2572,	.6332,	.1986,	.7419,
11,	.9579,	.7987,	.5454,	.2708,	.2348,	.4067,	.2756,	.4146,	.1934,	.6496,
12,	1.7424,	.2750,	.9422,	1.0710,	.1764,	.2174,	.6541,	.8329,	.2433,	.6787,
13,	.8495,	.4688,	.5404,	.6031,	.3358,	.3354,	.3683,	.6158,	.2240,	.6035,
+gp,	.8495,	.4688,	.5404,	.6031,	.3358,	.3354,	.3683,	.6158,	.2240,	.6035,
FBAR 4- 7,	.5088,	.6208,	.4312,	.5182,	.4050,	.3558,	.2533,	.7061,	.5803,	.4941,

Table 8 Fishing mortality (F) at age

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
1,	.0080,	.0135,	.0010,	.0018,	.0000,	.0000,	.0002,	.0002,	.0000,	.0000,
2,	.0672,	.0571,	.0926,	.0135,	.0023,	.0000,	.0076,	.0055,	.0164,	.0009,
3,	.2557,	.3185,	.7674,	.3623,	.1548,	.0372,	.0989,	.1295,	.1784,	.0586,
4,	.5718,	.6478,	1.2793,	.6422,	.5071,	.3101,	.2098,	.2681,	.4607,	.3354,
5,	.5167,	.6075,	.9411,	.8815,	.9740,	.6895,	.5612,	.4705,	.4603,	.3705,
6,	.4443,	.7076,	.4906,	.4460,	.9307,	.8255,	.9027,	.7074,	.3553,	.2849,
7,	.5093,	.7992,	.6357,	.6663,	.5131,	.3979,	.7883,	.5797,	.4124,	.3426,
8,	.3366,	.6421,	.5314,	.4495,	.4917,	.7099,	.4891,	.6683,	.4022,	.5576,
9,	.2095,	.7626,	.3206,	.6580,	.4966,	.3956,	.5206,	.4412,	.1931,	.4051,
10,	.1478,	.9092,	.5139,	.2751,	.5492,	.6000,	.2052,	.5310,	.4067,	.4311,
11,	.3987,	.5350,	2.3077,	.7888,	.5658,	.6985,	.5001,	.4334,	.3714,	.5347,
12,	.1932,	1.5153,	.3752,	.4238,	.6823,	.8438,	.7679,	1.4636,	.1660,	1.1453,
13,	.2585,	.8822,	.8181,	.5232,	.5618,	.6554,	.5004,	.7141,	.3095,	.6198,
+gp,	.2585,	.8822,	.8181,	.5232,	.5618,	.6554,	.5004,	.7141,	.3095,	.6198,
FBAR 4- 7,	.5105,	.6905,	.8367,	.6590,	.7312,	.5558,	.6155,	.5064,	.4222,	.3334,

Table 8 Fishing mortality (F) at age

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	FBAR 92-94
AGE											
1,	.0000,	.0021,	.0003,	.0000,	.0000,	.0000,	.0000,	.0040,	.0012,	.0003,	.0018,
2,	.0059,	.0066,	.0042,	.0024,	.0088,	.0035,	.0015,	.0046,	.0018,	.0054,	.0039,
3,	.1335,	.0844,	.0474,	.0266,	.0700,	.0314,	.0602,	.0733,	.0289,	.0157,	.0393,
4,	.2065,	.4508,	.4637,	.1465,	.1786,	.1042,	.1602,	.2768,	.2091,	.1398,	.2086,
5,	.3797,	.2825,	.9050,	.5364,	.3047,	.1200,	.2427,	.3012,	.5193,	.4676,	.4294,
6,	.6320,	.4918,	.2622,	1.0942,	.4985,	.1582,	.2736,	.3704,	.6847,	.8382,	.6311,
7,	.5352,	.7359,	.5572,	.2727,	.5564,	.2633,	.2545,	.3239,	.3655,	1.0735,	.5876,
8,	.5339,	.5008,	.6389,	.3369,	.2845,	.2562,	.2755,	.2340,	.3463,	.4647,	.3484,
9,	.7585,	.5125,	.5243,	.3723,	.0864,	1.0022,	.1825,	.2742,	.3039,	.5728,	.3836,
10,	.7103,	.7162,	.4002,	.6943,	.8361,	.6956,	.1207,	.1603,	.3329,	.4608,	.3180,
11,	.6351,	.4159,	.6204,	1.2631,	.4063,	.1428,	.0249,	.0938,	.3238,	.4490,	.2889,
12,	.1896,	1.4213,	.6719,	1.6603,	.6539,	.1661,	.5752,	.1312,	.7997,	.4602,	.4637,
13,	.0755,	.1660,	.5775,	.3508,	1.0653,	.6184,	.1592,	.1458,	.4866,	1.4338,	.6887,
+gp,	.0755,	.1660,	.5775,	.3508,	1.0653,	.6184,	.1592,	.1458,	.4866,	1.4338,	
FBAR 4- 7,	.4383,	.4903,	.5470,	.5124,	.3845,	.1614,	.2327,	.3181,	.4447,	.6298,	

Table 4.15

Run title : Arctic Haddock (run: FINH1/H1S)

At 6-Oct-95 09:21:22

Terminal Fs derived using XSA (With F shrinkage)

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

YEAR,	1950,	1951,	1952,	1953,	1954,
AGE					
1,	94092,	1576082,	195454,	79840,	257970,
2,	687398,	77035,	1286705,	160024,	65012,
3,	67027,	558771,	62870,	1041093,	123750,
4,	93593,	51991,	398086,	46034,	793989,
5,	70365,	42289,	34262,	188393,	25914,
6,	37878,	25629,	18324,	15715,	90199,
7,	45346,	13957,	8722,	6089,	7952,
8,	16757,	11909,	5267,	2895,	2392,
9,	5305,	5396,	3553,	1383,	1394,
10,	2952,	2552,	1413,	707,	749,
11,	1558,	1428,	1020,	608,	294,
12,	1150,	504,	505,	352,	142,
13,	1280,	157,	253,	246,	105,
+gp,	456,	156,	2,	353,	69,
TOTAL,	1125158,	2367855,	2016434,	1543730,	1369930,

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

YEAR,	1955,	1956,	1957,	1958,	1959,	1960,	1961,	1962,	1963,	1964,
AGE										
1,	84276,	104412,	494191,	369906,	169905,	373300,	420269,	485111,	151999,	366502,
2,	209646,	68999,	85397,	403860,	302715,	138954,	303533,	343760,	397174,	124444,
3,	52782,	170749,	53766,	69697,	328561,	245647,	110479,	243508,	277343,	323233,
4,	95379,	42170,	124925,	42143,	55501,	250619,	164820,	76491,	163532,	201220,
5,	510089,	68418,	29167,	79927,	29154,	38359,	140693,	83495,	34624,	67840,
6,	15892,	257761,	42702,	16694,	36993,	17314,	18994,	57864,	23997,	11124,
7,	48884,	8493,	95327,	23619,	8401,	17585,	7717,	7673,	16682,	7317,
8,	3585,	14436,	4074,	35864,	7803,	4025,	8726,	3081,	3379,	5252,
9,	780,	1628,	4578,	2352,	13470,	4364,	1859,	3157,	1306,	1642,
10,	498,	393,	926,	1965,	1182,	5673,	1445,	810,	976,	562,
11,	324,	317,	140,	436,	639,	710,	2822,	706,	444,	429,
12,	126,	220,	187,	100,	152,	237,	131,	1146,	355,	292,
13,	54,	76,	126,	152,	10,	61,	131,	47,	502,	214,
+gp,	18,	38,	136,	30,	57,	24,	43,	19,	121,	117,
TOTAL,	1022334,	738107,	935643,	1046747,	954543,	1096873,	1181664,	1306868,	1072432,	1110186,

Continued

Table 4.15 continued

Run title : Arctic Haddock (run: FINH1/H1S)

At 6-Oct-95 09:21:22

Terminal Fs derived using XSA (With F shrinkage)

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

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
AGE										
1,	440996,	30002,	26007,	249009,	144643,	1539044,	418836,	89250,	78363,	90755,
2,	299932,	361056,	24563,	21292,	203870,	118423,	1259629,	342900,	72951,	64157,
3,	101134,	242412,	293292,	20062,	17402,	165957,	96707,	1028098,	272266,	54375,
4,	244458,	77453,	174802,	225724,	15831,	12872,	115060,	77386,	633416,	159389,
5,	120262,	158377,	43082,	105680,	123611,	11185,	8360,	72162,	43229,	284449,
6,	27862,	62239,	72913,	23053,	49184,	60916,	7466,	5706,	20310,	13661,
7,	3859,	11430,	24862,	36409,	11864,	23116,	29972,	5282,	1780,	10410,
8,	2807,	1647,	4191,	12322,	15695,	6446,	11734,	16143,	2871,	1079,
9,	1849,	1420,	825,	1968,	5300,	8394,	3491,	6842,	7122,	1969,
10,	591,	705,	769,	479,	1019,	2870,	5082,	2111,	3222,	4311,
11,	366,	374,	407,	471,	227,	549,	1693,	3217,	918,	2163,
12,	165,	115,	138,	193,	294,	147,	299,	1052,	1740,	619,
13,	27,	24,	71,	44,	54,	202,	97,	127,	374,	1117,
+gp,	390,	20,	18,	46,	8,	73,	14,	100,	71,	345,
TOTAL,	1244697,	947275,	665942,	696751,	589002,	1950194,	1958439,	1650375,	1138632,	688799,

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

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
1,	183800,	285419,	204649,	28404,	8508,	12076,	7145,	13419,	390154,	524475,
2,	74050,	149287,	230537,	167386,	23213,	6966,	9887,	5849,	10985,	319431,
3,	49168,	56686,	115443,	172048,	135204,	18962,	5703,	8033,	4762,	8847,
4,	35756,	31173,	33753,	43876,	98052,	94825,	14957,	4229,	5778,	3262,
5,	92764,	16526,	13353,	7689,	18901,	48347,	56935,	9929,	2648,	2984,
6,	153161,	45301,	7371,	4266,	2607,	5843,	19863,	26596,	5078,	1368,
7,	5912,	80417,	18279,	3695,	2236,	842,	2095,	6594,	10733,	2914,
8,	4779,	2909,	29606,	7925,	1554,	1096,	463,	780,	3024,	5818,
9,	538,	2794,	1253,	14247,	4139,	778,	441,	232,	327,	1656,
10,	1054,	357,	1067,	744,	6041,	2062,	429,	215,	122,	221,
11,	1681,	744,	118,	523,	463,	2856,	927,	286,	103,	67,
12,	925,	924,	357,	10,	194,	215,	1163,	460,	152,	58,
13,	257,	624,	166,	201,	5,	80,	76,	442,	87,	105,
+gp,	444,	85,	191,	175,	135,	34,	117,	73,	375,	437,
TOTAL,	604287,	673247,	656143,	451187,	301253,	194981,	120201,	77137,	434330,	871645,

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

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	GMST
AGE												
1,	140840,	50276,	25693,	27859,	112295,	288542,	779028,	352258,	111940,	127644,	0,	1377
2,	429404,	115309,	41076,	21028,	22809,	91939,	236233,	637794,	287266,	91543,	104166,	1149
3,	261300,	349496,	93782,	33491,	17175,	18512,	75007,	193114,	519768,	234782,	74339,	881
4,	6831,	187198,	262983,	73228,	26701,	13112,	14687,	57820,	146941,	413427,	188418,	624
5,	1910,	4549,	97645,	135418,	51783,	18286,	9673,	10245,	35891,	97601,	292064,	359
6,	1687,	1070,	2808,	32340,	64843,	31262,	13279,	6213,	6206,	17483,	49619,	177
7,	843,	734,	536,	1769,	8865,	32249,	21851,	8269,	3512,	2562,	6151,	84
8,	1694,	404,	288,	251,	1103,	4161,	20292,	13871,	4897,	1995,	719,	39
9,	2728,	813,	200,	124,	147,	679,	2637,	12613,	8987,	2836,	1031,	18
10,	904,	1046,	399,	97,	70,	110,	204,	1799,	7850,	5429,	1310,	8
11,	118,	364,	418,	219,	40,	25,	45,	148,	1255,	4607,	2784,	4
12,	32,	51,	197,	184,	51,	22,	18,	36,	110,	743,	2384,	1
13,	15,	22,	10,	82,	29,	22,	15,	8,	26,	41,	383,	
+gp,	864,	50,	47,	41,	25,	36,	52,	8,	17,	3,	8,	
TOTAL,	849168,	711382,	526082,	326132,	305935,	498956,	1173020,	1294196,	1134666,	1000696,	723376,	

Table 4.16

Run title : Arctic Haddock (run: FINH1/H1S)

At 6-Oct-95 09:32:56

Terminal Fs derived using XSA (With F shrinkage)

Table 14 Stock biomass at age with SOP (start of year) Tonnes

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
AGE										
1,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
2,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
3,	46757,	105620,	153154,	10486,	9218,	82634,	63830,	581594,	148606,	30909,
4,	176381,	52665,	142452,	184126,	13087,	10003,	118517,	68319,	539544,	141393,
5,	150796,	187152,	61015,	149812,	177587,	15105,	14965,	110714,	63993,	438523,
6,	46451,	97790,	137299,	43451,	93950,	109376,	17769,	11641,	39974,	28002,
7,	7732,	21581,	56258,	82467,	27232,	49876,	85723,	12948,	4210,	25642,
8,	6547,	3621,	11042,	32496,	41947,	16193,	39076,	46075,	7907,	3095,
9,	4791,	3469,	2416,	5767,	15739,	23430,	12918,	21698,	21791,	6274,
10,	1826,	2054,	2684,	1671,	3606,	9548,	22414,	7979,	11751,	16372,
11,	1384,	1332,	1741,	2012,	984,	2237,	9141,	14891,	4097,	10059,
12,	773,	508,	730,	1026,	1580,	743,	2005,	6041,	9642,	3572,
13,	140,	115,	418,	257,	322,	1126,	717,	808,	2292,	7119,
+gp,	2184,	108,	116,	290,	49,	442,	114,	684,	471,	2375,
TOTALBIO,	445763,	476017,	569324,	513862,	385303,	320711,	387190,	883391,	854278,	713337,

Table 14 Stock biomass at age with SOP (start of year) Tonnes

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
1,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
2,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
3,	26399,	23564,	58500,	107611,	100365,	12917,	3699,	4950,	2862,	5317,
4,	29960,	20223,	26692,	42828,	113591,	100805,	15142,	4068,	5420,	3059,
5,	135079,	18632,	18352,	13044,	38053,	89319,	100164,	16594,	4317,	4864,
6,	296539,	67906,	13468,	9622,	6979,	14352,	46462,	59102,	11006,	2966,
7,	13755,	144855,	40137,	10014,	7192,	2484,	5890,	17609,	27955,	7589,
8,	12946,	6100,	75695,	25009,	5819,	3766,	1515,	2425,	9169,	17641,
9,	1619,	6512,	3560,	49958,	17226,	2971,	1604,	803,	1103,	5578,
10,	3780,	992,	3613,	3111,	29965,	9387,	1859,	884,	491,	887,
11,	7383,	2531,	488,	2674,	2812,	15917,	4918,	1442,	508,	328,
12,	5040,	3897,	1836,	61,	1465,	1488,	7657,	2879,	926,	356,
13,	1548,	2909,	944,	1408,	43,	614,	551,	3052,	587,	709,
+gp,	2887,	430,	1173,	1323,	1213,	281,	918,	543,	2734,	3186,
TOTALBIO,	536935,	298550,	244458,	266663,	324721,	254303,	190379,	114350,	67080,	52480,

Table 14 Stock biomass at age with SOP (start of year) Tonnes

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
1,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
2,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
3,	110988,	88200,	22113,	9073,	4691,	4885,	27954,	71522,	159722,	54924,
4,	5407,	138352,	124017,	28339,	11402,	8989,	10610,	47042,	121649,	225258,
5,	3282,	6274,	89217,	82507,	35061,	16541,	13752,	15750,	52135,	102649,
6,	3908,	2179,	6125,	35237,	63548,	37874,	20634,	12850,	13269,	26847,
7,	2188,	1495,	1505,	2738,	12244,	46440,	35358,	19465,	8322,	5005,
8,	5445,	1212,	942,	830,	3531,	7974,	39795,	31086,	15074,	5004,
9,	9742,	2711,	729,	457,	522,	2403,	6583,	34927,	30804,	6731,
10,	3849,	4157,	1728,	425,	298,	465,	862,	7538,	26978,	14227,
11,	613,	1771,	2220,	1172,	206,	129,	233,	798,	5326,	14555,
12,	207,	308,	1294,	1225,	326,	139,	114,	240,	748,	4977,
13,	109,	145,	73,	603,	204,	153,	106,	60,	193,	301,
+gp,	6670,	363,	372,	324,	191,	272,	401,	65,	138,	23,
TOTALBIO,	152408,	247166,	250333,	162931,	132224,	126263,	156403,	241345,	434359,	460501,

Table 4.17

Run title : Arctic Haddock (run: FINH1/H1S)

At 6-Oct-95 09:32:56

Terminal Fs derived using XSA (With F shrinkage)

Table 15 Spawning stock biomass with SOP (spawning time) Tonnes

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
AGE										
1,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
2,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
3,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
4,	8819,	2633,	7123,	9206,	654,	500,	5926,	3416,	26977,	7070,
5,	34683,	43045,	14033,	34457,	40845,	3474,	3442,	25464,	14718,	100860,
6,	24619,	51829,	72768,	23029,	49793,	57969,	9418,	6170,	21186,	14841,
7,	6804,	18992,	49507,	72571,	23964,	43891,	75436,	11394,	3705,	22565,
8,	6416,	3548,	10821,	31846,	41108,	15869,	38295,	45153,	7749,	3033,
9,	4791,	3469,	2416,	5767,	15739,	23430,	12918,	21698,	21791,	6274,
10,	1826,	2054,	2684,	1671,	3606,	9548,	22414,	7979,	11751,	16372,
11,	1384,	1332,	1741,	2012,	984,	2237,	9141,	14891,	4097,	10059,
12,	773,	508,	730,	1026,	1580,	743,	2005,	6041,	9642,	3572,
13,	140,	115,	418,	257,	322,	1126,	717,	808,	2292,	7119,
+gp,	2184,	108,	116,	290,	49,	442,	114,	684,	471,	2375,
TOTSPBIO,	92441,	127633,	162357,	182133,	178646,	159229,	179826,	143698,	124379,	194142,

Table 15 Spawning stock biomass with SOP (spawning time) Tonnes

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
1,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
2,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
3,	0,	0,	0,	0,	0,	0,	37,	446,	487,	372,
4,	1498,	1011,	1335,	2141,	5680,	5040,	1817,	2237,	3794,	428,
5,	31068,	4285,	4221,	3000,	8752,	20543,	64105,	12114,	4317,	1702,
6,	157165,	35990,	7138,	5100,	3699,	7607,	33917,	54965,	11006,	1394,
7,	12104,	127472,	35321,	8812,	6329,	2186,	5654,	16905,	27955,	5616,
8,	12687,	5978,	74181,	24509,	5703,	3691,	1515,	2425,	9169,	17641,
9,	1619,	6512,	3560,	49958,	17226,	2971,	1604,	803,	1103,	5578,
10,	3780,	992,	3613,	3111,	29965,	9387,	1859,	884,	491,	887,
11,	7383,	2531,	488,	2674,	2812,	15917,	4918,	1442,	508,	328,
12,	5040,	3897,	1836,	61,	1465,	1488,	7657,	2879,	926,	356,
13,	1548,	2909,	944,	1408,	43,	614,	551,	3052,	587,	709,
+gp,	2887,	430,	1173,	1323,	1213,	281,	918,	543,	2734,	3186,
TOTSPBIO,	236781,	192008,	133809,	102097,	82885,	69727,	124553,	98693,	63078,	38198,

Table 15 Spawning stock biomass with SOP (spawning time) Tonnes

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
1,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
2,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
3,	2220,	0,	0,	0,	0,	0,	0,	1430,	3194,	0,
4,	433,	30437,	1240,	850,	456,	180,	743,	6116,	26763,	4505,
5,	2625,	3325,	18735,	27227,	10518,	4962,	4126,	7875,	25546,	13344,
6,	3634,	1874,	3246,	17971,	40035,	20452,	10317,	7967,	10084,	11007,
7,	2101,	1286,	1505,	2738,	10040,	35759,	28287,	14988,	6574,	4505,
8,	5445,	1212,	942,	830,	3531,	6937,	36612,	24869,	13265,	4404,
9,	9742,	2711,	729,	457,	522,	1922,	6583,	32831,	26800,	6731,
10,	3849,	4157,	1728,	425,	298,	465,	862,	7538,	23471,	14227,
11,	613,	1771,	2220,	1172,	206,	129,	233,	798,	5326,	14118,
12,	207,	308,	1294,	1225,	326,	139,	114,	240,	748,	4977,
13,	109,	145,	73,	603,	204,	153,	106,	60,	193,	301,
+gp,	6670,	363,	372,	324,	191,	272,	401,	65,	138,	23,
TOTSPBIO,	37647,	47589,	32083,	53823,	66328,	71369,	88383,	104779,	142103,	78142,

Table 4.18 Haddock in the North-East Arctic (Fishing Areas I and II)

Run title : Arctic Haddock (run: FINH1/H1S)

At 6-Oct-95 09:21:22

Table 17 Summary (with SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS, Age 1	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	SOPCOFAC,	FBAR 4- 7,
1950,	94092,	274844,	142067,	131733,	.9273,	.4549,	.8350,
1951,	1576082,	447173,	111983,	120057,	1.0721,	.6544,	.6265,
1952,	195454,	322006,	65010,	127660,	1.9637,	.5119,	.7331,
1953,	79840,	659514,	81697,	123447,	1.5110,	.5711,	.5317,
1954,	257970,	726244,	123990,	156448,	1.2618,	.6034,	.3851,
1955,	84276,	589712,	179159,	202745,	1.1316,	.4741,	.5153,
1956,	104412,	537858,	240089,	213279,	.8883,	.5510,	.4423,
1957,	494191,	355324,	197961,	122705,	.6198,	.5647,	.4436,
1958,	369905,	296719,	156938,	112672,	.7179,	.6169,	.5333,
1959,	169905,	420842,	134997,	88179,	.6532,	.8027,	.3925,
1960,	373300,	536640,	129893,	155454,	1.1968,	.8371,	.4972,
1961,	420269,	498312,	135458,	193234,	1.4265,	.8017,	.6483,
1962,	485111,	435987,	124901,	187888,	1.5043,	.7439,	.8259,
1963,	151999,	406847,	92444,	146744,	1.5874,	.7423,	.8897,
1964,	366502,	383063,	63543,	98900,	1.5564,	.6156,	.6554,
1965,	440996,	445763,	92441,	118079,	1.2773,	.7005,	.5088,
1966,	30002,	476017,	127633,	160621,	1.2585,	.6602,	.6208,
1967,	26007,	569324,	162357,	136486,	.8407,	.7912,	.4312,
1968,	249009,	513862,	182133,	181726,	.9978,	.7920,	.5182,
1969,	144643,	385303,	178646,	130509,	.7305,	.8026,	.4050,
1970,	1539044,	320711,	159229,	86601,	.5439,	.7544,	.3558,
1971,	418836,	387190,	179826,	78302,	.4354,	1.0000,	.2533,
1972,	89250,	883391,	143698,	265317,	1.8463,	.8571,	.7061,
1973,	78363,	854278,	124379,	320065,	2.5733,	.8270,	.5803,
1974,	90755,	713337,	194142,	221138,	1.1391,	.8613,	.4941,
1975,	183800,	536935,	236781,	175742,	.7422,	.8135,	.5105,
1976,	285419,	298550,	192008,	137279,	.7150,	.6298,	.6905,
1977,	204649,	244458,	133809,	110158,	.8232,	.7678,	.8367,
1978,	28404,	266663,	102097,	95422,	.9346,	.9477,	.6590,
1979,	8508,	324721,	82885,	103623,	1.2502,	1.1247,	.7312,
1980,	12076,	254303,	69727,	87889,	1.2605,	1.0321,	.5558,
1981,	7145,	190379,	124553,	77153,	.6194,	.9828,	.6155,
1982,	13419,	114350,	98692,	46955,	.4758,	.9337,	.5064,
1983,	390154,	67080,	63078,	21607,	.3425,	.9107,	.4222,
1984,	524475,	52480,	38198,	17661,	.4624,	.9105,	.3334,
1985,	140839,	152408,	37647,	41270,	1.0962,	.9654,	.4383,
1986,	50276,	247166,	47589,	96585,	2.0296,	.9013,	.4903,
1987,	25693,	250333,	32083,	150659,	4.6959,	.9825,	.5470,
1988,	27859,	162931,	53823,	91744,	1.7046,	.9923,	.5124,
1989,	112295,	132224,	66328,	55122,	.8310,	.9617,	.3845,
1990,	288543,	126263,	71369,	25816,	.3617,	.9562,	.1614,
1991,	779027,	156403,	88383,	33605,	.3802,	.9581,	.2327,
1992,	352258,	241345,	104779,	53886,	.5143,	.9983,	.3181,
1993,	111940,	434359,	142103,	77619,	.5462,	1.0108,	.4447,
1994,	127644,	460501,	78142,	121111,	1.5499,	.9997,	.6298,
Arith. Mean ,	266770,	381203,	119749,	122242,	1.1333		.5300,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),			

Table 4.19 Input data to short-term prediction.

Haddock in the North-East Arctic (Fishing Areas I and II)

Single option prediction: Input data

Year: 1995								
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	74339.000	0.2000	0.0000	0.0000	0.0000	0.206	0.0533	0.442
4	188418.00	0.2000	0.0135	0.0000	0.0000	0.356	0.2830	0.534
5	292064.00	0.2000	0.1350	0.0000	0.0000	0.796	0.5826	0.897
6	49619.000	0.2000	0.4400	0.0000	0.0000	1.440	0.8563	1.481
7	6151.000	0.2000	0.8400	0.0000	0.0000	1.953	0.7973	1.970
8	719.000	0.2000	0.8550	0.0000	0.0000	2.444	0.4727	2.480
9	1031.000	0.2000	1.0000	0.0000	0.0000	2.934	0.5205	2.989
10	1310.000	0.2000	0.9350	0.0000	0.0000	3.033	0.4315	3.033
11	2784.000	0.2000	0.9850	0.0000	0.0000	3.203	0.3920	3.203
12	2384.000	0.2000	0.9750	0.0000	0.0000	3.425	0.6292	3.425
13	383.000	0.2000	1.0000	0.0000	0.0000	3.600	0.9344	3.600
14+	8.000	0.2000	1.0000	0.0000	0.0000	3.870	0.9344	3.870
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1996								
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	85000.000	0.2000	0.0000	0.0000	0.0000	0.268	0.0533	0.728
4	.	0.2000	0.0135	0.0000	0.0000	0.508	0.2830	0.953
5	.	0.2000	0.1350	0.0000	0.0000	0.799	0.5826	1.237
6	.	0.2000	0.4400	0.0000	0.0000	1.401	0.8563	1.713
7	.	0.2000	0.8400	0.0000	0.0000	1.841	0.7973	2.108
8	.	0.2000	0.8550	0.0000	0.0000	2.444	0.4727	2.480
9	.	0.2000	1.0000	0.0000	0.0000	2.934	0.5205	2.989
10	.	0.2000	0.9350	0.0000	0.0000	3.033	0.4315	3.033
11	.	0.2000	0.9850	0.0000	0.0000	3.203	0.3920	3.203
12	.	0.2000	0.9750	0.0000	0.0000	3.425	0.6292	3.425
13	.	0.2000	1.0000	0.0000	0.0000	3.600	0.9344	3.600
14+	.	0.2000	1.0000	0.0000	0.0000	3.870	0.9344	3.870
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1997								
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	111000.00	0.2000	0.0000	0.0000	0.0000	0.268	0.0533	0.728
4	.	0.2000	0.0135	0.0000	0.0000	0.508	0.2830	0.953
5	.	0.2000	0.1350	0.0000	0.0000	0.799	0.5826	1.237
6	.	0.2000	0.4400	0.0000	0.0000	1.401	0.8563	1.713
7	.	0.2000	0.8400	0.0000	0.0000	1.841	0.7973	2.108
8	.	0.2000	0.8550	0.0000	0.0000	2.444	0.4727	2.480
9	.	0.2000	1.0000	0.0000	0.0000	2.934	0.5205	2.989
10	.	0.2000	0.9350	0.0000	0.0000	3.033	0.4315	3.033
11	.	0.2000	0.9850	0.0000	0.0000	3.203	0.3920	3.203
12	.	0.2000	0.9750	0.0000	0.0000	3.425	0.6292	3.425
13	.	0.2000	1.0000	0.0000	0.0000	3.600	0.9344	3.600
14+	.	0.2000	1.0000	0.0000	0.0000	3.870	0.9344	3.870
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

(cont.)

Table 4.19 Continued

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Haddock in the North-East Arctic (Fishing Areas I and II)

Single option prediction: Input data

(cont.)

Year: 1998								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
3	88200.000	0.2000	0.0000	0.0000	0.0000	0.268	0.0533	0.728
4	.	0.2000	0.0135	0.0000	0.0000	0.508	0.2830	0.953
5	.	0.2000	0.1350	0.0000	0.0000	0.799	0.5826	1.237
6	.	0.2000	0.4400	0.0000	0.0000	1.401	0.8563	1.713
7	.	0.2000	0.8400	0.0000	0.0000	1.841	0.7973	2.108
8	.	0.2000	0.8550	0.0000	0.0000	2.444	0.4727	2.480
9	.	0.2000	1.0000	0.0000	0.0000	2.934	0.5205	2.989
10	.	0.2000	0.9350	0.0000	0.0000	3.033	0.4315	3.033
11	.	0.2000	0.9850	0.0000	0.0000	3.203	0.3920	3.203
12	.	0.2000	0.9750	0.0000	0.0000	3.425	0.6292	3.425
13	.	0.2000	1.0000	0.0000	0.0000	3.600	0.9344	3.600
14+	.	0.2000	1.0000	0.0000	0.0000	3.870	0.9344	3.870
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	88200.000	0.2000	0.0000	0.0000	0.0000	0.268	0.0533	0.728
4	.	0.2000	0.0135	0.0000	0.0000	0.508	0.2830	0.953
5	.	0.2000	0.1350	0.0000	0.0000	0.799	0.5826	1.237
6	.	0.2000	0.4400	0.0000	0.0000	1.401	0.8563	1.713
7	.	0.2000	0.8400	0.0000	0.0000	1.841	0.7973	2.108
8	.	0.2000	0.8550	0.0000	0.0000	2.444	0.4727	2.480
9	.	0.2000	1.0000	0.0000	0.0000	2.934	0.5205	2.989
10	.	0.2000	0.9350	0.0000	0.0000	3.033	0.4315	3.033
11	.	0.2000	0.9850	0.0000	0.0000	3.203	0.3920	3.203
12	.	0.2000	0.9750	0.0000	0.0000	3.425	0.6292	3.425
13	.	0.2000	1.0000	0.0000	0.0000	3.600	0.9344	3.600
14+	.	0.2000	1.0000	0.0000	0.0000	3.870	0.9344	3.870
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : H3
Date and time: 06OCT95:10:33

Table 4.20 Short-term prediction.

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Haddock in the North-East Arctic (Fishing Areas I and II)

Prediction with management option table

Year: 1995					Year: 1996					Year: 1997	
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
0.6386	0.4022	425585	100217	130000	0.0000	0.0000	454276	175444	0	568847	341523
.	.	.	.	.	0.1000	0.0630	.	175444	35677	533954	316216
.	.	.	.	.	0.2000	0.1260	.	175444	68863	501596	292844
.	.	.	.	.	0.3000	0.1889	.	175444	99743	471581	271255
.	.	.	.	.	0.4000	0.2519	.	175444	128487	443731	251311
.	.	.	.	.	0.5000	0.3149	.	175444	155254	417885	232883
.	.	.	.	.	0.6000	0.3779	.	175444	180190	393890	215855
.	.	.	.	.	0.7000	0.4409	.	175444	203430	371609	200117
.	.	.	.	.	0.8000	0.5038	.	175444	225097	350913	185569
.	.	.	.	.	0.9000	0.5668	.	175444	245307	331683	172119
.	.	.	.	.	1.0000	0.6298	.	175444	264167	313810	159682
.	.	.	.	.	1.1000	0.6928	.	175444	281773	297194	148180
.	.	.	.	.	1.2000	0.7558	.	175444	298218	281741	137541
.	.	.	.	.	1.3000	0.8187	.	175444	313584	267366	127698
.	.	.	.	.	1.4000	0.8817	.	175444	327950	253987	118591
.	.	.	.	.	1.5000	0.9447	.	175444	341388	241533	110162
.	.	.	.	.	1.6000	1.0077	.	175444	353963	229936	102360
.	.	.	.	.	1.7000	1.0707	.	175444	365737	219131	95137
.	.	.	.	.	1.8000	1.1336	.	175444	376767	209063	88449
.	.	.	.	.	1.9000	1.1966	.	175444	387105	199676	82254
.	.	.	.	.	2.0000	1.2596	.	175444	396801	190922	76516
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : H1
Date and time : 06OCT95:09:53
Computation of ref. F: Simple mean, age 4 - 7
Basis for 1995 : TAC constraints

Table 4.21 Medium-term prediction.

Haddock in the North-East Arctic (Fishing Areas I and II)

Single option prediction: Summary table

Year	F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1995	0.6386	0.4022	136848	130005	619210	425585	77300	100217	77300	100217
1996	1.0000	0.6298	171478	264194	469068	454338	118057	175459	118057	175459
1997	1.0000	0.6298	99361	163218	341914	313842	91006	159706	91006	159706
1998	1.0000	0.6298	68644	103915	279343	231042	55245	109382	55245	109382
1999	1.0000	0.6298	61336	88771	255428	196749	41121	82637	41121	82637
Unit	-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : H3
Date and time : 06OCT95:10:33
Computation of ref. F: Simple mean, age 4 - 7
Prediction basis : F factors

Year	F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1995	0.6386	0.4022	136848	130005	619210	425585	77300	100217	77300	100217
1996	0.8000	0.5038	145682	225121	469068	454338	118057	175459	118057	175459
1997	0.8000	0.5038	93489	156876	364660	350951	105219	185597	105219	185597
1998	0.8000	0.5038	65932	105113	303054	276215	71535	144690	71535	144690
1999	0.8000	0.5038	58827	90864	277188	240748	55796	118368	55796	118368
Unit	-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year	F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1995	0.6386	0.4022	136848	130005	619210	425585	77300	100217	77300	100217
1996	0.5557	0.3500	109201	169379	469068	454338	118057	175459	118057	175459
1997	0.5557	0.3500	79973	137458	397038	404347	125837	223267	125837	223267
1998	0.5557	0.3500	58829	99686	341484	351742	99029	204789	99029	204789
1999	0.5557	0.3500	52887	88865	314920	321878	83229	186619	83229	186619
Unit	-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year	F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1995	0.6386	0.4022	136848	130005	619210	425585	77300	100217	77300	100217
1996	0.3000	0.1889	64055	99754	469068	454338	118057	175459	118057	175459
1997	0.3000	0.1889	54308	95494	437383	471638	152042	271297	152042	271297
1998	0.3000	0.1889	42621	76589	397414	464928	140564	296320	140564	296320
1999	0.3000	0.1889	39222	71997	375189	458859	130037	305308	130037	305308
Unit	-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year	F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1995	0.6386	0.4022	136843	130000	619210	425585	77300	100217	77300	100217
1996	0.4054	0.2553	83616	130000	469073	454345	118059	175462	118059	175462
1997	0.4625	0.2913	74682	130000	419873	442342	140607	250320	140607	250320
1998	0.6564	0.4134	74796	130000	364862	399581	116574	243689	116574	243689
1999	0.8388	0.5282	75865	130000	319780	340217	89750	205854	89750	205854
Unit	-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : H3
Date and time : 06OCT95:10:33
Computation of ref. F: Simple mean, age 4 - 7
Prediction basis : TAC constraints

Table 4.22 Medium term, detailed output.

Haddock in the North-East Arctic (Fishing Areas I and II)

Single option prediction: Detailed tables

Year: 1995 F-factor: 0.6386 Reference F: 0.4022

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
3	0.0340	2256	997	74339	15314	0	0	0	0
4	0.1807	28319	15123	188418	67077	2544	906	2544	906
5	0.3720	82749	74226	292064	232483	39429	31385	39429	31385
6	0.5468	19115	28309	49619	71451	21832	31439	21832	31439
7	0.5092	2243	4419	6151	12013	5167	10091	5167	10091
8	0.3019	171	423	719	1757	615	1502	615	1502
9	0.3324	266	794	1031	3025	1031	3025	1031	3025
10	0.2756	287	871	1310	3973	1225	3715	1225	3715
11	0.2503	561	1797	2784	8917	2742	8783	2742	8783
12	0.4018	720	2465	2384	8165	2324	7961	2324	7961
13	0.5967	158	567	383	1379	383	1379	383	1379
14+	0.5967	3	13	8	31	8	31	8	31
Total		136848	130005	619210	425585	77300	100217	77300	100217
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1996 F-factor: 0.5557 Reference F: 0.3500

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
3	0.0296	2249	1638	85000	22780	0	0	0	0
4	0.1573	7779	7414	58827	29884	794	403	794	403
5	0.3238	32450	40140	128759	102878	17382	13889	17382	13889
6	0.4758	57014	97665	164832	230929	72526	101609	72526	101609
7	0.4431	7684	16198	23513	43287	19751	36361	19751	36361
8	0.2627	636	1578	3027	7397	2588	6325	2588	6325
9	0.2892	100	298	435	1277	435	1277	435	1277
10	0.2398	117	356	605	1836	566	1717	566	1717
11	0.2178	145	464	814	2608	802	2569	802	2569
12	0.3496	477	1635	1775	6078	1730	5926	1730	5926
13	0.5192	484	1741	1306	4702	1306	4702	1306	4702
14+	0.5192	65	253	176	682	176	682	176	682
Total		109201	169379	469068	454338	118057	175459	118057	175459
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1997 F-factor: 0.5557 Reference F: 0.3500

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
3	0.0296	2938	2139	111000	29748	0	0	0	0
4	0.1573	8934	8514	67561	34321	912	463	912	463
5	0.3238	10372	12830	41155	32883	5556	4439	5556	4439
6	0.4758	26379	45187	76263	106845	33556	47012	33556	47012
7	0.4431	27403	57766	83854	154375	70437	129675	70437	129675
8	0.2627	2599	6446	12360	30208	10568	25828	10568	25828
9	0.2892	436	1303	1906	5591	1906	5591	1906	5591
10	0.2398	52	157	267	809	250	757	250	757
11	0.2178	69	222	390	1249	384	1230	384	1230
12	0.3496	144	494	536	1836	523	1790	523	1790
13	0.5192	379	1365	1024	3687	1024	3687	1024	3687
14+	0.5192	267	1035	722	2794	722	2794	722	2794
Total		79973	137458	397038	404347	125837	223267	125837	223267
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

(cont.)

Table 4.22 Continued

Haddock in the North-East Arctic (Fishing Areas I and II)

Single option prediction: Detailed tables

(cont.)

Year: 1998	F-factor: 0.5557	Reference F: 0.3500				1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
3	0.0296	2334	1699	88200	23638	0	0	0	0
4	0.1573	11667	11119	88227	44819	1191	605	1191	605
5	0.3238	11912	14735	47265	37765	6381	5098	6381	5098
6	0.4758	8431	14443	24376	34150	10725	15026	10725	15026
7	0.4431	12679	26727	38797	71425	32589	59997	32589	59997
8	0.2627	9270	22989	44081	107733	37689	92112	37689	92112
9	0.2892	1780	5321	7782	22832	7782	22832	7782	22832
10	0.2398	227	687	1168	3543	1092	3313	1092	3313
11	0.2178	31	98	172	551	169	542	169	542
12	0.3496	69	237	257	880	250	858	250	858
13	0.5192	115	412	309	1114	309	1114	309	1114
14+	0.5192	315	1219	851	3292	851	3292	851	3292
Total		58829	99686	341484	351742	99029	204789	99029	204789
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1999	F-factor: 0.5557	Reference F: 0.3500				1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
3	0.0296	2334	1699	88200	23638	0	0	0	0
4	0.1573	9270	8835	70105	35613	946	481	946	481
5	0.3238	15555	19242	61722	49316	8333	6658	8333	6658
6	0.4758	9683	16587	27995	39221	12318	17257	12318	17257
7	0.4431	4052	8543	12401	22829	10416	19177	10416	19177
8	0.2627	4289	10636	20395	49845	17438	42618	17438	42618
9	0.2892	6348	18975	27753	81427	27753	81427	27753	81427
10	0.2398	926	2807	4771	14470	4461	13530	4461	13530
11	0.2178	134	429	753	2411	741	2374	741	2374
12	0.3496	30	104	113	388	110	378	110	378
13	0.5192	55	198	148	534	148	534	148	534
14+	0.5192	209	810	565	2187	565	2187	565	2187
Total		52887	88865	314920	321878	83229	186619	83229	186619
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : H3
Date and time : 06OCT95:10:33
Computation of ref. F: Simple mean, age 4 - 7
Prediction basis : F factors

Table 5.1 North-East Arctic SAITHE. Nominal catch (tonnes) by countries in Sub-area I and Divisions IIa and IIb combined as officially reported to ICES.

Country	1985	1986	1987	1988	1989
Denmark	-	-	1	-	-
Faroe Islands	490	426	712	441	388
France	657	308	576	411	460[2]
German Dem.Rep.	11	-	-	17	-
Germany, Fed.Rep.	1,837	3,470	4,909	4,557	606
Greenland	-	-	-	-	-
Iceland	-	-	-	-	-
Ireland	-	-	-	-	-
Norway	103,899	63,090	85,710	108,244	119,625
Portugal	-	-	-	-	-
Spain	-	-	-	-	506
UK (Engl.& Wales)	202	54	54	436	-
UK (Scotland)	+	21	3	6	702
USSR	51	27	426	130	23
Total	107,147	67,396	92,391	114,242	122,310

Country	1990	1991	1992	1993[1]	1994[1]
Denmark	-	5	-	2	-
Faroe Islands	1,207	963	165	31	67
France	340[2]	77[2]	1,980	307[2]	151[2]
German Dem.Rep.	14	-	-	-	-
Germany, Fed.Rep	1,129	2,003	3,451	3,687	1,606
Greenland	-	-	734	78	15
Iceland	-	-	-	3	4
Ireland	-	-	-	139,181	2
Norway	92,397	103,283	119,765[1]	-	137,295
Portugal	-	-	-	1	1
Russia[3]	52	504[4]	964	2,209	1,640
Spain	-	-	6	4	655
UK (Engl.& Wales)	681	449	516	408	549
UK (Scotland)	28	42	25	7	9
Total	95,848	107,326	127,606	145,918	141,994

[1]Provisional figures.
[2]As reported to Norwegian authorities.
[3]USSR prior to 1991.
[4]Includes Estonia.

Table 5.2 North-East Arctic SAITHE. Landings ('000 tonnes) by gear category in Sub-area I, Division IIa and Division IIb combined.

Year	Purse Seine	Trawl	Gill Net	Others	Total
1977	75.2	69.5	19.3	12.7	176.7[2]
1978	62.9	57.7	21.1	13.9	155.6[2]
1979	74.7	52.0	21.6	15.8	164.1
1980	61.3	46.8	21.1	15.4	144.6
1981	64.3	72.4	24.0	14.8	175.5
1982	76.4	59.4	16.7	15.6	168.0
1983	54.1	68.2	19.6	15.1	156.9
1984	36.4	85.6	23.7	13.1	158.8
1985	31.1	49.9	14.6	11.5	107.1
1986	7.9	36.2	12.3	8.2	64.6[2]
1987	34.9	28.0	19.0	10.8	92.7[2]
1988	43.5	45.4	15.3	10.0	114.2
1989	48.6	44.8	16.8	12.4	122.7
1990	24.6	44.0	19.3	7.9	95.8
1991	38.9	40.1	18.9	9.4	107.3
1992	27.1	66.9	21.2	12.4	127.6
1993	33.1	75,9	21.2	15.7	145,9
1994[1]	29.3	79,1	20.5	13.0	142,0

[1]Preliminary.
[2]Unresolved discrepancy between Norwegian catch by gear figures and the total reported to ICES for these years.

Table 5.3 North-East Arctic SAITHE. Norwegian purse seiners taking part in the saithe fishery. (Number of vessels, catch in tonnes, catch per vessel).

Year	Vessel size (m)								
	-19.9			20.0-24.9			25.0-		
	Number	Catch	C/V	Number	Catch	C/V	Number	Catch	C/V
1977	208	21,398	103	66	25,324	384	19	5,655	298
1978	184	16,288	89	72	21,224	295	19	6,094	321
1979	250	21,224	85	72	27,057	376	25	9,122	365
1980	269	21,243	79	96	27,551	287	39	10,234	262
1981	312	25,984	83	89	29,108	327	23	7,354	320
1982	308	30,228	98	98	35,969	367	23	9,303	404
1983	222	19,925	90	80	28,348	354	12	5,524	460
1984	168	8,834	53	69	20,668	300	15	6,713	448
1985	90	4,150	46	57	18,328	322	16	8,391	524
1986	55	1,281	23	43	3,581	83	21	2,643	126
1987	106	9,084	86	46	16,766	364	15	8,185	546
1988	120	13,111	109	48	20,413	425	13	8,981	691
1989	195	14,993	77	61	23,000	377	13	10,466	805
1990	89	2,533	28	53	13,360	257	19	8,406	442
1991	122	8,726	72	56	20,378	364	19	9,797	516
1992	100	7,076	71	49	14,783	302	20	5,020	251
1993	48	6,110	127	45	19,502	433	19	7,433	391
1994[1]	76	9,086	120	39	14,579	374	18	5,672	315

[1] Preliminary

Table 5.4 North-East Arctic SAITHE. Catch, effort, and catch per unit effort for Norwegian trawlers fishing directly for Saithe.

Year	Catch[1] (t)	Effort[1] (h)	CPUE[1] (kg/h)
1976	12,982	21,615	601
1977	15,583	29,308	532
1978	12,506	27,094	462
1979	16,609	24,258	685
1980	27,618	39,290	703
1981	43,682	49,191	888
1982	30,358	33,164	915
1983	38,846	37,856	1,026
1984	56,128	60,282	931
1985	29,260	39,894	733
1986	20,897	25,037	835
1987	8,631	11,860	728
1988	16,589	21,034	789
1989	28,753	40,813	705
1990	28,445	42,689	666
1991	26,362	35,680	739
1992	42,785	43,885	975
1993	47,468	46,613	1,018
1994[2]	52,257	56,100	931

[1] Including only days with more than 50% saithe on trips with more than 50% saithe in the catches.

[2] Preliminary.

Table 5.5 North-East Arctic SAITHE. Norwegian effort indices.

Year	Purse seine[1]	Trawl[2]	Combined[3]
1976	-	36.8	-
1977	206	52.7	351
1978	214	51.3	355
1979	199	42.7	316
1980	215	57.4	373
1981	203	71.0	398
1982	213	58.2	373
1983	161	57.7	320
1984	124	85.5	359
1985	98	63.7	273
1986	96	45.2	220
1987	94	30.1	177
1988	103	50.4	242
1989	131	59.8	295
1990	96	60.4	262
1991	107	51.5	249
1992	90	57.6	248
1993	79	68.0	266
1994	76	79.8	296

[1] No. of vessels 20-24.9 m.

[2] Hours trawling ('000).

[3] Trawl indices scaled up to give the same average for 1977-1990 as the purse seine indices (i.e. x 2.75) before adding the two.

Effort indices for both categories raised to represent total Norwegian landings for the gear.

Table 5.6

Saithe in the North-East Arctic (Fishing Areas I and II) 09:25 Tuesday, August 29, 1995

Norway Ac Survey (code: FLT06) (Catch: Thousands)

Year	Effort	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5
1988	1	15.7	22.5	19.0	7.1
1989	1	24.8	28.4	17.0	10.1
1990	1	99.6	31.9	14.7	5.1
1991	1	87.8	104.0	4.6	4.0
1992	1	163.5	273.6	57.5	6.2
1993	1	106.9	227.7	103.9	12.7
1994	1	34.4	87.8	112.4	39.5

Saithe in the North-East Arctic (Fishing Areas I and II) 09:25 Tuesday, August 29, 1995

Norway Purse Seine (code: FLT07) (Catch: thousand) (Effort: Number of vessels)

Year	Effort	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
1977	206	30547	81152	8964	2144	133	9
1978	214	43402	37652	8788	2126	456	88
1979	199	23054	41942	6706	6575	1362	363
1980	215	15615	23353	15280	3280	1683	681
1981	203	10325	68716	5770	2219	154	36
1982	213	14490	28360	43980	250	140	0
1983	161	8924	12402	9775	12090	463	179
1984	124	8576	21699	3842	2144	1363	21
1985	98	632	28815	2688	1096	340	95
1986	96	1408	9869	593	181	108	51
1987	94	1848	12364	32183	386	19	2
1988	103	875	3253	27063	13169	72	6
1989	131	4231	5250	8521	18211	2880	24
1990	96	8551	7207	3319	2582	1845	673
1991	107	3694	43110	1907	453	162	95
1992	90	3954	29527	5214	89	45	38
1993	79	1762	8010	24251	1302	39	23
1994	76	5237	8281	14076	5388	1191	105

Saithe in the North-East Arctic (Fishing Areas I and II) 09:25 Tuesday, August 29, 1995

Norway Trawl (code: FLT08) (Catch: thousand) (Effort: Trawl hours)

Year	Effort	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10
1976	37	11184	583	1080	1137	869	612	332	284
1977	53	4557	9047	3260	202	660	322	361	209
1978	51	488	3104	3440	1400	319	591	254	304
1979	43	7374	6538	2340	762	845	419	294	129
1980	57	10270	10301	1726	2891	1392	406	24	108
1981	71	5698	12137	10877	1901	1053	1351	83	108
1982	58	1719	10344	10006	5519	420	306	215	134
1983	58	3341	10024	14949	2189	1720	535	181	60
1984	86	14876	25819	7038	7161	656	744	180	176
1985	64	10070	6177	3844	3877	2446	441	564	66
1986	45	4388	8150	4078	3172	2044	779	208	215
1987	30	470	7862	2452	1169	1405	189	153	67
1988	50	1539	2241	14077	3031	1438	609	346	137
1989	60	3923	9038	9226	8659	1154	178	83	150
1990	60	8909	7960	3932	3722	3967	479	54	66
1991	52	20741	7106	2683	2456	1516	1044	139	37
1992	58	10361	13228	3067	2269	2660	2029	890	214
1993	68	10746	26279	17961	1947	657	604	190	240
1994	80	10426	20783	21869	9561	934	149	35	44

Table 5.7

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Lowestoft VPA Version 3.1

  29-Aug-95  19:23:30

Extended Survivors Analysis

Arctic Saithe (run: FIN95/095)

CPUE data from file /users/fish/ifad/ifapwork/afwg/sai_arct/FLEET.095

Catch data for  35 years. 1960 to 1994. Ages  2 to  11.

     Fleet,             First, Last, First, Last, Alpha,  Beta
                    ,    year, year,  age ,  age
FLT06: Norway Ac Sur,    1988, 1994,   2,     5,   .750,   .850
FLT07: Norway Purse ,    1977, 1994,   2,     7,   .000,  1.000
FLT08: Norway Trawl ,    1976, 1994,   3,    10,   .000,  1.000


Time series weights :

     Tapered time weighting applied
     Power =     3 over  20 years


Catchability analysis :

     Catchability independent of stock size for all ages

     Catchability independent of age for ages >=    8


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   20 iterations
```

Continued

Table 5.7 Continued

Log catchability residuals.

Fleet : FLT06: Norway Ac Sur

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
2	99.99	99.99	99.99	-.46	-.06	.05	-.36	.44	.58	-.24
3	99.99	99.99	99.99	-.81	-.14	.09	-.04	.43	.37	.04
4	99.99	99.99	99.99	-.73	-.09	.26	-.74	.29	.42	.52
5	99.99	99.99	99.99	-.85	.01	-.25	.01	.64	-.14	.51
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									
10	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	2	3	4	5
Mean Log q	-7.8290	-7.1229	-7.5249	-7.9564
S.E(Log q)	.3975	.4056	.5292	.4905

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
2	.83	.760	8.56	.80	7	.34	-7.83
3	.74	1.671	8.35	.89	7	.26	-7.12
4	.74	1.291	8.53	.83	7	.37	-7.52
5	1.23	-.710	7.31	.66	7	.63	-7.96

Continued

Table 5.7 Continued

Fleet : FLT07: Norway Purse

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984
2	99.99	1.54	1.38	1.35	.06	.56	.97	.91	.99
3	99.99	.97	.62	.24	.15	.33	.26	-.22	.98
4	99.99	-.31	-.41	-.18	-.16	-.44	.56	.15	-.44
5	99.99	-.02	-.19	.89	.66	-.48	-1.96	1.25	.41
6	99.99	-.65	.02	1.06	1.14	-.60	-1.54	.79	1.28
7	99.99	-3.05	.27	1.37	1.74	-1.18	99.99	.47	-.61
8	No data for this fleet at this age								
9	No data for this fleet at this age								
10	No data for this fleet at this age								

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
2	-2.11	-1.01	-.02	-.56	.69	.47	-.76	-.35	-.45	.98
3	1.37	-.77	-.23	-.95	-.33	.34	.72	.11	-.91	-.25
4	-.02	-1.63	.90	.93	.26	.11	-.39	-.63	.54	.10
5	.15	-1.23	-.68	1.36	1.84	.78	-.56	-1.84	-.55	.45
6	.50	-.57	-1.80	-.90	1.35	1.71	-.56	-.93	-.90	1.08
7	.58	.17	-2.90	-1.28	-.73	1.89	.08	-.25	.41	1.73
8	No data for this fleet at this age									
9	No data for this fleet at this age									
10	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	2	3	4	5	6	7
Mean Log q	-8.4299	-6.7436	-6.7517	-7.5176	-8.4472	-9.2118
S.E(Log q)	.9229	.6906	.6746	1.1505	1.1700	1.3423

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
2	3.16	-1.344	.57	.04	18	2.82	-8.43
3	1.17	-.371	5.90	.33	18	.84	-6.74
4	.65	2.018	8.31	.77	18	.39	-6.75
5	.49	2.668	9.05	.73	18	.45	-7.52
6	.40	3.263	9.17	.74	18	.34	-8.45
7	.64	.656	9.06	.26	17	.89	-9.21

Continued

Table 5.7 Continued

Fleet : FLT08: Norway Trawl

Age	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984
2 ,	No data for this fleet at this age								
3 ,	.86,	-.30,	-2.05,	.29,	.89,	-.86,	-.99,	-.25,	1.22
4 ,	-2.13,	.12,	-.96,	.39,	-.17,	.41,	-.52,	.26,	.90
5 ,	-.58,	-.32,	-.36,	-.69,	-.75,	.07,	.95,	.41,	-.11
6 ,	-1.15,	-2.09,	-.65,	-1.20,	-.22,	-.26,	.22,	.16,	.10
7 ,	-.46,	-1.43,	-1.04,	-.28,	-.26,	-.78,	-.96,	-.27,	-.83
8 ,	-.67,	-.91,	-.67,	.38,	-.23,	.64,	-.98,	.19,	-.62
9 ,	-.81,	-.92,	-.43,	-.54,	-2.13,	-1.27,	-.04,	-.86,	-.31
10 ,	-.62,	-.89,	-.40,	-.15,	-1.08,	-.23,	.09,	-.51,	-.47

Age	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994
2 ,	No data for this fleet at this age									
3 ,	1.00,	-.58,	-2.11,	-.73,	.42,	1.27,	.97,	-.24,	-.22,	.18
4 ,	.30,	.80,	-.31,	-1.79,	.16,	.51,	.71,	-.20,	-.17,	-.50
5 ,	-.25,	.56,	.23,	.06,	-.13,	-.42,	-.14,	.06,	.14,	-.28
6 ,	.15,	.35,	.25,	.34,	.02,	-.34,	-.33,	.22,	-.06,	-.10
7 ,	.23,	.58,	.77,	.88,	-.10,	.10,	-.45,	.41,	-.12,	-.17
8 ,	-.11,	.50,	-.47,	.79,	-.09,	.00,	-.06,	.75,	-.03,	-.54
9 ,	.10,	.11,	.09,	.45,	-.39,	-.60,	-.38,	.40,	-.73,	-2.18
10 ,	-.06,	.20,	.05,	.34,	.45,	.04,	-.19,	.62,	-.20,	-1.34

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,	10
Mean Log q,	-6.9933,	-5.8134,	-5.4344,	-5.2310,	-5.1811,	-5.3933,	-5.3933,	-5.3933,
S.E(Log q),	.9865,	.7199,	.3651,	.3350,	.5579,	.5112,	.8928,	.5484,

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,	2.41,	-1.129,	.18,	.06,	19,	2.35,	-6.99,
4,	3.44,	-2.889,	-7.48,	.12,	19,	1.92,	-5.81,
5,	1.09,	-.487,	5.00,	.76,	19,	.41,	-5.43,
6,	1.15,	-.707,	4.56,	.68,	19,	.40,	-5.23,
7,	.96,	.115,	5.32,	.47,	19,	.56,	-5.18,
8,	.88,	.494,	5.70,	.63,	19,	.47,	-5.39,
9,	.75,	.829,	6.18,	.51,	19,	.58,	-5.83,
10,	1.28,	-.765,	5.22,	.43,	19,	.70,	-5.50,

Continued

Table 5.7 Continued

Terminal year survivor and F summaries :

Age 2 Catchability constant w.r.t. time and dependent on age

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT06: Norway Ac Sur,	82034.,	.426,	.000,	.00,	1,	.509,	.076
FLT07: Norway Purse ,	276384.,	.960,	.000,	.00,	1,	.100,	.023
FLT08: Norway Trawl ,	1.,	.000,	.000,	.00,	0,	.000,	.000
F shrinkage mean ,	110059.,	.50,,,,				.391,	.057

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
103906.,	.31,	.25,	3,	.819,	.061

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

Year class = 1991

Fleet, ,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT06: Norway Ac Sur,	132799.,	.304,	.274,	.90,	2,	.550,	.142
FLT07: Norway Purse ,	70465.,	.575,	.096,	.17,	2,	.154,	.252
FLT08: Norway Trawl ,	116435.,	1.027,	.000,	.00,	1,	.049,	.160
F shrinkage mean ,	57257.,	.50,,,,				.248,	.302

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
97158.,	.23,	.21,	6,	.892,	.189

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

Year class = 1990

Fleet, ,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT06: Norway Ac Sur,	173211.,	.269,	.041,	.15,	3,	.497,	.195
FLT07: Norway Purse ,	77722.,	.446,	.319,	.71,	3,	.186,	.392
FLT08: Norway Trawl ,	74043.,	.606,	.132,	.22,	2,	.105,	.408
F shrinkage mean ,	67599.,	.50,,,,				.213,	.439

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
111787.,	.20,	.18,	9,	.886,	.288

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

Year class = 1989

Fleet, ,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FLT06: Norway Ac Sur,	76803.,	.248,	.208,	.84,	4,	.385,	.350
FLT07: Norway Purse ,	72547.,	.428,	.259,	.61,	4,	.123,	.367
FLT08: Norway Trawl ,	45877.,	.327,	.028,	.08,	3,	.287,	.532
F shrinkage mean ,	48296.,	.50,,,,				.204,	.511

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
59831.,	.18,	.11,	12,	.631,	.431

Continued

Table 5.7 Continued

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

Year class = 1988

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT06: Norway Ac Sur,	16142.,	.254,	.091,	.36,	4,	.219,	.621
FLT07: Norway Purse ,	18560.,	.439,	.370,	.84,	5,	.094,	.559
FLT08: Norway Trawl ,	15767.,	.248,	.106,	.43,	4,	.442,	.632
F shrinkage mean ,	14906.,	.50,,,,				.245,	.659

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
15874.,	.18,	.08,	14,	.428,	.629

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

Year class = 1987

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT06: Norway Ac Sur,	1733.,	.269,	.296,	1.10,	4,	.138,	.612
FLT07: Norway Purse ,	1629.,	.504,	.541,	1.07,	6,	.082,	.641
FLT08: Norway Trawl ,	1524.,	.243,	.109,	.45,	5,	.446,	.673
F shrinkage mean ,	1495.,	.50,,,,				.333,	.683

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1550.,	.21,	.11,	16,	.531,	.665

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

Year class = 1986

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT06: Norway Ac Sur,	387.,	.261,	.138,	.53,	4,	.063,	.800
FLT07: Norway Purse ,	364.,	.546,	.223,	.41,	6,	.039,	.835
FLT08: Norway Trawl ,	326.,	.297,	.142,	.48,	6,	.407,	.897
F shrinkage mean ,	529.,	.50,,,,				.492,	.640

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
420.,	.28,	.10,	17,	.360,	.756

Age 9 Catchability constant w.r.t. time and age (fixed at the value for age) 8

Year class = 1985

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT06: Norway Ac Sur,	349.,	.307,	.210,	.68,	3,	.052,	.937
FLT07: Norway Purse ,	439.,	.454,	.242,	.53,	6,	.035,	.804
FLT08: Norway Trawl ,	307.,	.282,	.356,	1.26,	7,	.374,	1.018
F shrinkage mean ,	792.,	.50,,,,				.540,	.521

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
522.,	.29,	.22,	17,	.743,	.712

Continued

Table 5.7 Continued

Age 10 Catchability constant w.r.t. time and age (fixed at the value for age) 8

Year class = 1984

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT06: Norway Ac Sur,	199.,	.405,	.353,	.87,	2,	.011,	1.043
FLT07: Norway Purse ,	481.,	.537,	.400,	.74,	6,	.014,	.566
FLT08: Norway Trawl ,	113.,	.343,	.270,	.79,	8,	.352,	1.447
F shrinkage mean ,	405.,	.50,,,,				.622,	.644

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
257.,	.33,	.27,	17,	.796,	.887

Table 5.8

Run title : Arctic Saithe (run: FIN95/095)

At 29-Aug-95 19:24:19

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

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
AGE										
2,	30430,	7450,	6952,	5297,	4090,	25952,	19842,	11608,	13829,	21159,
3,	37115,	22392,	29664,	25196,	77333,	43540,	77019,	65178,	76296,	36782,
4,	5001,	54537,	24836,	18384,	11949,	62846,	59280,	52389,	25206,	44027,
5,	26300,	13124,	35956,	5101,	16939,	13987,	26961,	29146,	26911,	15671,
6,	10142,	12899,	4125,	8282,	4747,	16189,	9556,	10186,	16031,	20419,
7,	2861,	4652,	5616,	787,	4798,	5122,	9592,	5616,	7114,	12148,
8,	2110,	1374,	2916,	1913,	1126,	7950,	2901,	3547,	3935,	4802,
9,	2733,	933,	1413,	900,	1711,	2504,	4352,	1865,	2871,	3258,
10,	699,	965,	1397,	577,	675,	3697,	2195,	2140,	2610,	2505,
+gp,	3593,	2900,	3493,	1166,	511,	2799,	5490,	3149,	3924,	3821,
TOTALNUM,	120984,	121226,	116368,	67603,	123879,	184586,	217188,	184824,	178727,	164592,
TONSLAND,	184548,	201860,	191191,	107181,	140379,	260404,	244732,	210508,	215659,	262301,
SOPCOF %,	107,	110,	100,	113,	98,	96,	80,	82,	82,	97,

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

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
2,	81601,	54151,	31662,	45758,	28334,	18226,	10467,	17225,	11638,	14624,
3,	60832,	125030,	99049,	48969,	61963,	40796,	83954,	34733,	17244,	41466,
4,	11691,	30576,	34317,	27685,	23328,	36644,	21822,	65052,	23768,	33233,
5,	16366,	7947,	10140,	12476,	14122,	9211,	21528,	13060,	32700,	12064,
6,	4436,	8712,	2062,	4534,	4400,	6379,	3619,	8212,	3226,	11204,
7,	7808,	3435,	4332,	1468,	2901,	3200,	2550,	1054,	3008,	1135,
8,	6789,	3212,	1456,	1848,	963,	1338,	2008,	1251,	1177,	1772,
9,	2914,	2679,	1606,	938,	1356,	147,	369,	461,	760,	560,
10,	2350,	1724,	963,	976,	438,	730,	279,	263,	247,	557,
+gp,	4140,	2880,	1134,	2150,	1192,	1629,	629,	448,	760,	897,
TOTALNUM,	198927,	240346,	186721,	146802,	138997,	118300,	147225,	141759,	94528,	117512,
TONSLAND,	233453,	242486,	182808,	154465,	164234,	154379,	175516,	170903,	155405,	158796,
SOPCOF %,	102,	100,	101,	103,	114,	100,	100,	100,	100,	100,

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

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
2,	2216,	3311,	3867,	5017,	11157,	11543,	6135,	14333,	3375,	7175,
3,	48917,	22115,	17869,	8126,	12378,	21002,	73878,	49750,	25609,	22318,
4,	11974,	12895,	49829,	35847,	19915,	13463,	11619,	26640,	59999,	41224,
5,	7189,	6062,	4339,	32827,	32643,	8996,	5395,	4865,	25441,	35599,
6,	5279,	4525,	3118,	4560,	18751,	9152,	5066,	5594,	3390,	15370,
7,	3740,	2805,	3490,	2328,	1939,	7735,	2988,	4850,	1616,	1618,
8,	775,	1399,	755,	1219,	377,	1126,	2009,	3353,	1252,	524,
9,	878,	351,	620,	966,	191,	154,	272,	1480,	943,	599,
10,	134,	454,	257,	320,	179,	121,	81,	291,	648,	405,
+gp,	701,	285,	797,	102,	149,	253,	132,	267,	106,	455,
TOTALNUM,	81803,	54202,	84941,	91312,	97679,	73545,	107575,	111423,	122379,	125287,
TONSLAND,	107147,	70458,	91679,	114508,	122664,	95393,	107326,	127606,	145918,	141994,
SOPCOF %,	99,	99,	102,	99,	100,	100,	99,	100,	100,	100,

Table 5.9

Run title : Arctic Saithe (run: FIN95/095)

At 29-Aug-95 19:24:19

Table 2 Catch weights at age (kg)

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
AGE										
2,	.3400,	.3400,	.3400,	.3400,	.3400,	.3400,	.3400,	.3400,	.3400,	.3400,
3,	.7100,	.7100,	.7100,	.7100,	.7100,	.7100,	.7100,	.7100,	.7100,	.7100,
4,	1.1100,	1.1100,	1.1100,	1.1100,	1.1100,	1.1100,	1.1100,	1.1100,	1.1100,	1.1100,
5,	1.6300,	1.6300,	1.6300,	1.6300,	1.6300,	1.6300,	1.6300,	1.6300,	1.6300,	1.6300,
6,	2.3300,	2.3300,	2.3300,	2.3300,	2.3300,	2.3300,	2.3300,	2.3300,	2.3300,	2.3300,
7,	3.1600,	3.1600,	3.1600,	3.1600,	3.1600,	3.1600,	3.1600,	3.1600,	3.1600,	3.1600,
8,	4.0300,	4.0300,	4.0300,	4.0300,	4.0300,	4.0300,	4.0300,	4.0300,	4.0300,	4.0300,
9,	4.8700,	4.8700,	4.8700,	4.8700,	4.8700,	4.8700,	4.8700,	4.8700,	4.8700,	4.8700,
10,	5.6300,	5.6300,	5.6300,	5.6300,	5.6300,	5.6300,	5.6300,	5.6300,	5.6300,	5.6300,
+gp,	7.9590,	8.1060,	7.9940,	7.7160,	7.4790,	7.4040,	7.0520,	7.4770,	7.3850,	7.2170,
SOPCOFAC,	1.0721,	1.0963,	.9990,	1.1338,	.9756,	.9575,	.7953,	.8212,	.8167,	.9694,

Table 2 Catch weights at age (kg)

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
2,	.3400,	.3400,	.3400,	.3400,	.3400,	.4500,	.4300,	.5100,	.6000,	.5300,
3,	.7100,	.7100,	.7100,	.7100,	.7100,	.7900,	.7300,	.7700,	1.0500,	.7100,
4,	1.1100,	1.1100,	1.1100,	1.1100,	1.1100,	1.2700,	1.4000,	1.1200,	1.3300,	1.2600,
5,	1.6300,	1.6300,	1.6300,	1.6300,	1.6300,	2.0300,	2.0500,	2.0200,	1.8600,	2.0200,
6,	2.3300,	2.3300,	2.3300,	2.3300,	2.3300,	2.5500,	2.7600,	2.6100,	2.8000,	2.7000,
7,	3.1600,	3.1600,	3.1600,	3.1600,	3.1600,	3.2900,	3.3000,	3.2700,	4.0000,	3.8800,
8,	4.0300,	4.0300,	4.0300,	4.0300,	4.0300,	4.3400,	4.3800,	3.9100,	4.1800,	4.4700,
9,	4.8700,	4.8700,	4.8700,	4.8700,	4.8700,	5.1500,	5.9500,	4.6900,	5.3300,	5.3600,
10,	5.6300,	5.6300,	5.6300,	5.6300,	5.6300,	5.7500,	6.3900,	5.6300,	5.6800,	6.0600,
+gp,	7.1270,	7.3200,	7.3940,	7.5270,	7.8090,	6.9370,	6.8410,	7.5580,	8.6650,	7.1900,
SOPCOFAC,	1.0155,	1.0020,	1.0061,	1.0278,	1.1388,	.9991,	.9975,	.9961,	.9991,	.9997,

Table 2 Catch weights at age (kg)

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
2,	.3800,	.3200,	.3400,	.3300,	.4500,	.5400,	.4000,	.4500,	.4600,	.5500,
3,	.7500,	.5900,	.5300,	.6200,	.7400,	.7600,	.7200,	.7000,	.6200,	.6000,
4,	1.3300,	1.2200,	.8400,	.8700,	.9700,	1.0800,	1.1900,	1.1000,	1.0000,	.8000,
5,	2.0700,	1.9700,	1.6600,	1.3100,	1.3900,	1.5600,	1.7800,	1.9800,	1.6900,	1.2600,
6,	2.6300,	2.3000,	2.3200,	2.4300,	1.8100,	2.1200,	2.2400,	2.3400,	2.4900,	2.1400,
7,	3.2800,	2.8700,	2.9700,	3.8700,	3.0200,	2.4000,	2.8600,	2.8100,	2.8700,	3.1800,
8,	3.9600,	3.7200,	4.0000,	5.3800,	3.7600,	3.6500,	3.3200,	3.2500,	3.0800,	3.7900,
9,	4.5400,	4.3000,	4.7200,	5.8300,	4.6400,	3.6000,	4.5300,	4.0600,	3.6900,	4.0500,
10,	5.5500,	4.6900,	5.4400,	5.3600,	4.7500,	6.3700,	5.7000,	6.1900,	6.1900,	4.7400,
+gp,	8.0120,	6.5970,	6.9040,	7.4480,	7.5000,	4.7950,	7.1250,	7.3760,	8.1750,	5.5990,
SOPCOFAC,	.9930,	.9929,	1.0154,	.9902,	.9978,	1.0001,	.9912,	1.0000,	1.0014,	.9993,

Table 5.10

Run title : Arctic Saithe (run: FIN95/095)

At 29-Aug-95 19:24:19

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
AGE										
2,	.1744,	.0348,	.0409,	.0161,	.0131,	.0786,	.1054,	.0473,	.1400,	.1205,
3,	.1563,	.1878,	.1888,	.2045,	.3406,	.1883,	.3517,	.5902,	.4930,	.6695,
4,	.0806,	.3618,	.3284,	.1711,	.1409,	.5156,	.4225,	.4311,	.4780,	.5963,
5,	.3095,	.3135,	.4324,	.1026,	.2357,	.2439,	.4361,	.3794,	.4126,	.6261,
6,	.3560,	.2451,	.1524,	.1651,	.1310,	.3715,	.2620,	.2907,	.3710,	.6413,
7,	.1788,	.2739,	.1598,	.0391,	.1358,	.2040,	.3939,	.2420,	.3394,	.5374,
8,	.1773,	.1220,	.2760,	.0748,	.0723,	.3487,	.1702,	.2460,	.2670,	.4052,
9,	.3693,	.1107,	.1779,	.1276,	.0887,	.2276,	.3271,	.1575,	.3225,	.3704,
10,	.2797,	.2140,	.2409,	.1022,	.1332,	.2807,	.3198,	.2645,	.3447,	.5202,
+gp,	.2797,	.2140,	.2409,	.1022,	.1332,	.2807,	.3198,	.2645,	.3447,	.5202,
FBAR 3- 6,	.2256,	.2771,	.2755,	.1608,	.2121,	.3298,	.3681,	.4228,	.4387,	.6333,

Table 8 Fishing mortality (F) at age

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
2,	.2765,	.2187,	.2179,	.1964,	.2067,	.0582,	.0787,	.1460,	.1146,	.1247,
3,	.5970,	.9065,	.7902,	.6160,	.4445,	.5170,	.4108,	.4032,	.2135,	.7516,
4,	.4622,	.6958,	.6825,	.5292,	.6842,	.5180,	.5840,	.6554,	.5362,	.8212,
5,	.4623,	.6690,	.5229,	.5703,	.5703,	.6418,	.6674,	.8670,	.8404,	.5795,
6,	.3580,	.4815,	.3592,	.4703,	.4023,	.5520,	.5653,	.5838,	.5383,	.8013,
7,	.5445,	.5227,	.4711,	.4713,	.6335,	.5796,	.4458,	.3152,	.4380,	.3660,
8,	.6651,	.4520,	.4392,	.3762,	.6586,	.6892,	.9212,	.4104,	.7040,	.5033,
9,	.4625,	.6075,	.4292,	.5690,	.5264,	.1909,	.4068,	.5517,	.4724,	.9009,
10,	.5024,	.5533,	.4572,	.5072,	.5747,	.6081,	.6687,	.5745,	.6574,	.7777,
+gp,	.5024,	.5533,	.4572,	.5072,	.5747,	.6081,	.6687,	.5745,	.6574,	.7777,
FBAR 3- 6,	.4699,	.6882,	.5887,	.5465,	.5253,	.5572,	.5569,	.6273,	.5321,	.7384,

Table 8 Fishing mortality (F) at age

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	FBAR 92-94
AGE											
2,	.0091,	.0181,	.0423,	.0742,	.1510,	.0452,	.0181,	.0504,	.0211,	.0606,	.0440,
3,	.7823,	.1178,	.1280,	.1177,	.2640,	.4696,	.4487,	.1997,	.1198,	.1888,	.1695,
4,	.5027,	.4812,	.4218,	.4074,	.4680,	.5131,	.5192,	.2869,	.3940,	.2880,	.3230,
5,	.4101,	.5174,	.2931,	.5485,	.8195,	.3995,	.3978,	.4279,	.4903,	.4307,	.4497,
6,	.5441,	.4939,	.5547,	.5747,	.7128,	.5704,	.4121,	.9642,	.6061,	.6292,	.7331,
7,	.6949,	.6335,	.9204,	1.1274,	.5164,	.7420,	.3662,	.9071,	.8498,	.6650,	.8073,
8,	.4597,	.6133,	.3434,	1.0336,	.5326,	.6528,	.4293,	.9316,	.6269,	.7559,	.7714,
9,	.5040,	.3899,	.6129,	1.0226,	.4256,	.4321,	.3171,	.6586,	.7519,	.7121,	.7075,
10,	.5573,	.5343,	.5558,	.7619,	.5158,	.5285,	.4266,	.6685,	.6900,	.8868,	.7485,
+gp,	.5573,	.5343,	.5558,	.7619,	.5158,	.5285,	.4266,	.6685,	.6900,	.8868,	
FBAR 3- 6,	.5598,	.4026,	.3494,	.4121,	.5661,	.4881,	.4444,	.4697,	.4025,	.3842,	

Table 5.11

Run title : Arctic Saithe (run: FIN95/095)

At 29-Aug-95 19:24:19

Terminal Fs derived using XSA (With F shrinkage)

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

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
AGE										
2,	210148,	241020,	191551,	367462,	346930,	379305,	219286,	277434,	117018,	206054,
3,	283513,	144521,	190590,	150538,	296060,	280341,	287066,	161583,	216640,	83294,
4,	71349,	198538,	98062,	129201,	100452,	172419,	190127,	165340,	73317,	108334,
5,	109180,	53891,	113202,	57814,	89146,	71431,	84300,	102024,	87966,	37220,
6,	37422,	65592,	32247,	60147,	42719,	57659,	45827,	44623,	57158,	47670,
7,	19309,	21462,	42031,	22669,	41751,	30680,	32559,	28873,	27318,	32292,
8,	14350,	13220,	13362,	29330,	17848,	29841,	20484,	17978,	18558,	15929,
9,	9781,	9840,	9581,	8301,	22283,	13594,	17238,	14146,	11510,	11633,
10,	3166,	5535,	7212,	6565,	5982,	16695,	8864,	10176,	9894,	6826,
+gp,	16170,	16547,	17930,	13223,	4511,	12560,	22016,	14883,	14766,	10305,
TOTAL,	774389,	770165,	715767,	845251,	967680,	1064526,	927767,	837060,	634145,	559556,

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

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
2,	373335,	304619,	178716,	283655,	167721,	356561,	152875,	140139,	118797,	137850,
3,	149557,	231825,	200403,	117671,	190834,	111681,	275436,	115693,	99150,	86733,
4,	34913,	67404,	76670,	74453,	52032,	100175,	54523,	149543,	63294,	65574,
5,	48859,	18006,	27520,	31721,	35906,	21492,	48859,	24894,	63574,	30314,
6,	16293,	25194,	7551,	13356,	14682,	16620,	9262,	20523,	8564,	22462,
7,	20553,	9326,	12744,	4317,	6832,	8040,	7835,	4308,	9373,	4093,
8,	15446,	9762,	4527,	6514,	2206,	2969,	3687,	4107,	2574,	4952,
9,	8696,	6503,	5086,	2389,	3661,	935,	1220,	1202,	2231,	1042,
10,	6577,	4483,	2900,	2711,	1107,	1771,	632,	665,	567,	1139,
+gp,	11471,	7409,	3384,	5913,	2980,	3905,	1408,	1120,	1722,	1808,
TOTAL,	685701,	684532,	519503,	542701,	477963,	624149,	555737,	462195,	369846,	355967,

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

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	GMST
AGE												
2,	271039,	204403,	103087,	77553,	87979,	288590,	377698,	322056,	178794,	134840,	0,	2105
3,	99630,	219903,	164355,	80902,	58955,	61936,	225833,	303682,	250708,	143331,	103906,	1524
4,	33491,	37308,	160031,	118394,	58884,	37069,	31705,	118049,	203618,	182091,	97158,	833
5,	23617,	16585,	18877,	85935,	64497,	30190,	18167,	15445,	72545,	112419,	111787,	429
6,	13903,	12831,	8094,	11529,	40654,	23269,	16578,	9993,	8243,	36375,	59831,	230
7,	8253,	6606,	6411,	3805,	5313,	16318,	10770,	8989,	3120,	3681,	15874,	129
8,	2324,	3373,	2871,	2091,	1009,	2596,	6361,	6114,	2971,	1092,	1550,	70
9,	2451,	1202,	1495,	1667,	609,	485,	1106,	3391,	1972,	1300,	420,	39
10,	347,	1212,	666,	663,	491,	326,	258,	660,	1437,	761,	522,	22
+gp,	1794,	753,	2043,	208,	404,	674,	416,	598,	232,	841,	541,	
TOTAL,	456847,	504176,	467931,	382748,	318796,	461452,	688893,	788975,	723640,	616731,	391589,	

Table 5.12

Run title : Arctic Saithe (run: FIN95/095)

At 29-Aug-95 19:24:19

Terminal Fs derived using XSA (With F shrinkage)

Table 14 Stock biomass at age with SOP (start of year) Tonnes

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
AGE										
2,	76603,	89835,	65063,	141653,	115081,	123478,	59298,	77464,	32494,	67914,
3,	215810,	112486,	135185,	121183,	205080,	190576,	162101,	94214,	125621,	57328,
4,	84909,	241589,	108742,	162601,	108784,	183245,	167847,	150718,	66465,	116570,
5,	190798,	96297,	184337,	106846,	141767,	111480,	109285,	136570,	117102,	58811,
6,	93481,	167540,	75061,	158894,	97109,	128632,	84922,	85385,	108767,	107671,
7,	65417,	74347,	132686,	81219,	128717,	92825,	81829,	74928,	70501,	98917,
8,	62001,	58406,	53796,	134016,	70174,	115145,	65654,	59499,	61080,	62228,
9,	51069,	52531,	46611,	45837,	105872,	63386,	66769,	56575,	45778,	54920,
10,	19109,	34162,	40562,	41909,	32859,	89997,	39690,	47048,	45493,	37251,
+gp,	137982,	147044,	143191,	115678,	32917,	89041,	123478,	91387,	89058,	72094,
TOTALBIO,	997178,	1074238,	985233,	1109835,	1038360,	1187806,	960874,	873788,	762357,	733704,

Table 14 Stock biomass at age with SOP (start of year) Tonnes

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
2,	128904,	103775,	61134,	99123,	64940,	160303,	65574,	71194,	71214,	73042,
3,	107834,	164921,	143155,	85869,	154297,	88146,	200572,	88738,	104013,	61564,
4,	39355,	74966,	85624,	84939,	65772,	127104,	76144,	166839,	84104,	82603,
5,	80877,	29408,	45131,	53142,	66651,	43589,	99915,	50091,	118141,	61219,
6,	38552,	58818,	17702,	31984,	38958,	42341,	25500,	53358,	23959,	60632,
7,	65956,	29528,	40518,	14020,	24587,	26425,	25792,	14034,	37456,	15877,
8,	63214,	39420,	18356,	26983,	10124,	12874,	16108,	15998,	10749,	22129,
9,	43009,	31734,	24922,	11958,	20306,	4810,	7242,	5613,	11880,	5585,
10,	37601,	25291,	16429,	15689,	7100,	10172,	4031,	3730,	3215,	6900,
+gp,	83023,	54341,	25174,	45743,	26502,	27067,	9606,	8435,	14905,	12994,
TOTALBIO,	688325,	612203,	478145,	469450,	479234,	542829,	530483,	478030,	479636,	402545,

Table 14 Stock biomass at age with SOP (start of year) Tonnes

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
2,	102273,	64944,	35589,	25342,	39502,	155855,	149757,	144925,	82359,	74114,
3,	74199,	128821,	88448,	49668,	43530,	47076,	161177,	212576,	155654,	85942,
4,	45228,	45192,	136493,	101995,	56990,	40038,	37399,	129853,	203899,	145577,
5,	49014,	32441,	31818,	111474,	89451,	47102,	32055,	30581,	122770,	141555,
6,	36309,	29302,	19066,	27742,	73420,	49336,	36809,	23382,	20554,	77791,
7,	26879,	18825,	19334,	14583,	16010,	39168,	30533,	25258,	8965,	11699,
8,	9162,	12457,	11660,	11140,	3766,	9475,	20935,	19871,	9163,	4135,
9,	11025,	5130,	7166,	9625,	2819,	1746,	4968,	13765,	7286,	5260,
10,	1907,	5645,	3679,	3520,	2327,	2075,	1456,	4083,	8906,	3606,
+gp,	14587,	4932,	14325,	1537,	3027,	3233,	2941,	4408,	1899,	4708,
TOTALBIO,	370583,	347689,	367578,	356626,	330842,	395105,	478030,	608702,	621455,	554387,

Table 5.13

Run title : Arctic Saithe (run: FIN95/095)

At 29-Aug-95 19:24:19

- Terminal Fs derived using XSA (With F shrinkage)

Table 15 Spawning stock biomass with SOP (spawning time) Tonnes

YEAR,	1965,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,
AGE										
2,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
3,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
4,	849,	2416,	1087,	1626,	1088,	1832,	1678,	1507,	665,	1166,
5,	104939,	52964,	101385,	58765,	77972,	61314,	60107,	75113,	64406,	32346,
6,	79459,	142409,	63802,	135060,	82542,	109338,	72184,	72577,	92452,	91520,
7,	64109,	72860,	130032,	79595,	126143,	90968,	80192,	73430,	69091,	96939,
8,	62001,	58406,	53796,	134016,	70174,	115145,	65654,	59499,	61080,	62228,
9,	51069,	52531,	46611,	45837,	105872,	63386,	66769,	56575,	45778,	54920,
10,	19109,	34162,	40562,	41909,	32859,	89997,	39690,	47048,	45493,	37251,
+gp,	137982,	147044,	143191,	115678,	32917,	89041,	123478,	91387,	89058,	72094,
TOTSPBIO,	519516,	562792,	580467,	612485,	529567,	621020,	509753,	477136,	468022,	448464,

Table 15 Spawning stock biomass with SOP (spawning time) Tonnes

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
2,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
3,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
4,	394,	750,	856,	849,	658,	1271,	761,	1668,	841,	826,
5,	44482,	16174,	24822,	29228,	36658,	23974,	54953,	27550,	64977,	33671,
6,	32769,	49996,	15047,	27187,	33114,	35989,	21675,	45354,	20365,	51537,
7,	64637,	28937,	39707,	13740,	24095,	25897,	25276,	13753,	36707,	15559,
8,	63214,	39420,	18356,	26983,	10124,	12874,	16108,	15998,	10749,	22129,
9,	43009,	31734,	24922,	11958,	20306,	4810,	7242,	5613,	11880,	5585,
10,	37601,	25291,	16429,	15689,	7100,	10172,	4031,	3730,	3215,	6900,
+gp,	83023,	54341,	25174,	45743,	26502,	27067,	9606,	8435,	14905,	12994,
TOTSPBIO,	369129,	246643,	165314,	171377,	158556,	142053,	139652,	122102,	163640,	149201,

Table 15 Spawning stock biomass with SOP (spawning time) Tonnes

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
2,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
3,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
4,	452,	452,	1365,	1020,	570,	400,	374,	1299,	2039,	1456,
5,	26958,	17842,	17500,	61311,	49198,	25906,	17630,	16819,	67524,	77855,
6,	30863,	24907,	16206,	23581,	62407,	41935,	31288,	19875,	17471,	66123,
7,	26341,	18449,	18947,	14291,	15690,	38385,	29922,	24753,	8786,	11465,
8,	9162,	12457,	11660,	11140,	3766,	9475,	20935,	19871,	9163,	4135,
9,	11025,	5130,	7166,	9625,	2819,	1746,	4968,	13765,	7286,	5260,
10,	1907,	5645,	3679,	3520,	2327,	2075,	1456,	4083,	8906,	3606,
+gp,	14587,	4932,	14325,	1537,	3027,	3233,	2941,	4408,	1899,	4708,
TOTSPBIO,	121295,	89814,	90849,	126024,	139804,	123156,	109515,	104874,	123074,	174608,

Table 5.14

Run title : Arctic Saithe (run: FIN95/095)

At 29-Aug-95 19:24:19

Table 17 Summary (with SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

,	RECRUITS, Age 2	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	SOPCOFAC,	FBAR 3- 6,
1960,	121599,	622999,	320566,	136006,	.4243,	1.2793,	.2668,
1961,	213221,	776898,	406781,	109821,	.2700,	1.4354,	.2339,
1962,	355344,	863170,	422870,	122841,	.2905,	1.2489,	.2290,
1963,	121702,	924963,	439026,	148036,	.3372,	1.2026,	.2245,
1964,	368727,	1071959,	525076,	198110,	.3773,	1.1684,	.2264,
1965,	210148,	997179,	519516,	184548,	.3552,	1.0721,	.2256,
1966,	241020,	1074239,	562792,	201860,	.3587,	1.0963,	.2771,
1967,	191551,	985233,	580467,	191191,	.3294,	.9990,	.2755,
1968,	367462,	1109835,	612485,	107181,	.1750,	1.1338,	.1608,
1969,	346930,	1038360,	529567,	140379,	.2651,	.9756,	.2121,
1970,	379305,	1187806,	621021,	260404,	.4193,	.9575,	.3298,
1971,	219286,	960874,	509753,	244732,	.4801,	.7953,	.3681,
1972,	277434,	873789,	477136,	210508,	.4412,	.8212,	.4228,
1973,	117018,	762357,	468022,	215659,	.4608,	.8167,	.4387,
1974,	206054,	733704,	448464,	262301,	.5849,	.9694,	.6333,
1975,	373335,	688325,	369129,	233453,	.6324,	1.0155,	.4699,
1976,	304619,	612203,	246643,	242486,	.9831,	1.0020,	.6882,
1977,	178716,	478145,	165314,	182808,	1.1058,	1.0061,	.5887,
1978,	283655,	469450,	171377,	154465,	.9013,	1.0278,	.5465,
1979,	167721,	479234,	158556,	164234,	1.0358,	1.1388,	.5253,
1980,	356561,	542829,	142053,	154379,	1.0868,	.9991,	.5572,
1981,	152875,	530483,	139652,	175516,	1.2568,	.9975,	.5569,
1982,	140139,	478030,	122103,	170903,	1.3997,	.9961,	.6273,
1983,	118797,	479636,	163640,	155405,	.9497,	.9991,	.5321,
1984,	137850,	402546,	149201,	158796,	1.0643,	.9997,	.7384,
1985,	271039,	370584,	121295,	107147,	.8834,	.9930,	.5598,
1986,	204403,	347689,	89814,	70458,	.7845,	.9929,	.4026,
1987,	103087,	367578,	90849,	91679,	1.0091,	1.0154,	.3494,
1988,	77553,	356626,	126024,	114508,	.9086,	.9902,	.4121,
1989,	87979,	330842,	139804,	122664,	.8774,	.9978,	.5661,
1990,	288590,	395104,	123156,	95393,	.7746,	1.0001,	.4881,
1991,	377698,	478030,	109515,	107326,	.9800,	.9912,	.4444,
1992,	322056,	608702,	104874,	127606,	1.2168,	1.0000,	.4697,
1993,	178795,	621455,	123074,	145918,	1.1856,	1.0014,	.4025,
1994,	210000,	595725,	174608,	141994,	.8132,	.9993,	.3842,
Arith. Mean ,	230636,	676761,	299264,	161449,	.7262		.4238,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),			

Table 5.15. North-East Arctic Saithe
Estimation of weight at age in the prediction

	Observed weight-at-age in the catch[1]			
Age	1992	1993	1994	1992-94
2	0.45	0.46	0.55	0.49
3	0.70	0.62	0.60	0.64
4	1.10	1.00	0.80	0.97
5	1.98	1.69	1.26	1.64
6	2.34	2.49	2.14	2.32
7	2.81	2.87	3.18	2.95
8	3.25	3.08	3.79	3.37
9	4.06	3.69	4.05	3.93
10	6.19	6.19	4.74	5.71
11+	7.38	8.18	5.60	7.05

1) The abundant year classes 1988-1990 outlined

	Weight-at-age in VPA[1]			Weight-at-age used in the predictions[1,2]				
Age	92	93	94	95	96	97	98	99
2	0.45	0.46	0.55	0.49	0.49	0.49	0.49	0.49
3	0.70	0.62	0.60	0.64	0.64	0.64	0.64	0.64
4	1.09	1.00	0.80	0.97	0.97	0.97	0.97	0.97
5	1.98	1.69	1.26	1.40	1.64	1.64	1.64	1.64
6	2.34	2.49	2.14	1.86	2.00	2.32	2.32	2.32
7	2.81	2.87	3.18	2.74	2.46	2.60	2.95	2.95
8	3.25	3.08	3.79	3.37	3.37	3.37	3.37	3.37
9	4.06	3.69	4.05	3.93	3.93	3.93	3.93	3.93
10	6.19	6.19	4.74	5.71	5.71	5.71	5.71	5.71
11+	7.38	8.18	5.60	7.05	7.05	7.05	7.05	7.05

1) The abundant year classes 1988-1990 outlined
2) Values in the shaded area differ from the 1992-1994 mean

Table 5.16

Saithe in the North-East Arctic (Fishing Areas I and II)

Prediction with management option table: Input data

Year: 1995								
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	210000.00	0.2000	0.0000	0.0000	0.0000	0.490	0.0404	0.490
3	103906.00	0.2000	0.0000	0.0000	0.0000	0.640	0.1555	0.640
4	97158.000	0.2000	0.0100	0.0000	0.0000	0.970	0.2963	0.970
5	111787.00	0.2000	0.5500	0.0000	0.0000	1.400	0.4125	1.400
6	59831.000	0.2000	0.8500	0.0000	0.0000	1.860	0.6725	1.860
7	15874.000	0.2000	0.9800	0.0000	0.0000	2.740	0.7406	2.740
8	1550.000	0.2000	1.0000	0.0000	0.0000	3.370	0.7076	3.370
9	420.000	0.2000	1.0000	0.0000	0.0000	3.930	0.6490	3.930
10	522.000	0.2000	1.0000	0.0000	0.0000	5.710	0.6866	5.710
11+	541.000	0.2000	1.0000	0.0000	0.0000	7.050	0.6866	7.050
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1996								
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	210000.00	0.2000	0.0000	0.0000	0.0000	0.490	0.0404	0.490
3	.	0.2000	0.0000	0.0000	0.0000	0.640	0.1555	0.640
4	.	0.2000	0.0100	0.0000	0.0000	0.970	0.2963	0.970
5	.	0.2000	0.5500	0.0000	0.0000	1.640	0.4125	1.640
6	.	0.2000	0.8500	0.0000	0.0000	2.000	0.6725	2.000
7	.	0.2000	0.9800	0.0000	0.0000	2.460	0.7406	2.460
8	.	0.2000	1.0000	0.0000	0.0000	3.370	0.7076	3.370
9	.	0.2000	1.0000	0.0000	0.0000	3.930	0.6490	3.930
10	.	0.2000	1.0000	0.0000	0.0000	5.710	0.6866	5.710
11+	.	0.2000	1.0000	0.0000	0.0000	7.050	0.6866	7.050
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1997								
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	210000.00	0.2000	0.0000	0.0000	0.0000	0.490	0.0404	0.490
3	.	0.2000	0.0000	0.0000	0.0000	0.640	0.1555	0.640
4	.	0.2000	0.0100	0.0000	0.0000	0.970	0.2963	0.970
5	.	0.2000	0.5500	0.0000	0.0000	1.640	0.4125	1.640
6	.	0.2000	0.8500	0.0000	0.0000	2.320	0.6725	2.320
7	.	0.2000	0.9800	0.0000	0.0000	2.600	0.7406	2.600
8	.	0.2000	1.0000	0.0000	0.0000	3.370	0.7076	3.370
9	.	0.2000	1.0000	0.0000	0.0000	3.930	0.6490	3.930
10	.	0.2000	1.0000	0.0000	0.0000	5.710	0.6866	5.710
11+	.	0.2000	1.0000	0.0000	0.0000	7.050	0.6866	7.050
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : PRED95-1
Date and time: 31AUG95:19:40

Table 5.17

Saithe in the North-East Arctic (Fishing Areas I and II) 09:34 Wednesday, August 30, 1995

Prediction with management option table

Year: 1995					Year: 1996					Year: 1997	
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
1.0428	0.4006	588594	237905	165000	0.0000	0.0000	579781	239763	0	771279	365857
.	.	.	.	.	0.0500	0.0192	.	239763	10007	758844	355715
.	.	.	.	.	0.1000	0.0384	.	239763	19748	746743	345878
.	.	.	.	.	0.1500	0.0576	.	239763	29233	734963	336336
.	.	.	.	.	0.2000	0.0768	.	239763	38468	723497	327081
.	.	.	.	.	0.2500	0.0961	.	239763	47461	712334	318103
.	.	.	.	.	0.3000	0.1153	.	239763	56220	701465	309394
.	.	.	.	.	0.3500	0.1345	.	239763	64752	690882	300944
.	.	.	.	.	0.4000	0.1537	.	239763	73063	680575	292747
.	.	.	.	.	0.4500	0.1729	.	239763	81161	670536	284793
.	.	.	.	.	0.5000	0.1921	.	239763	89050	660758	277075
.	.	.	.	.	0.5500	0.2113	.	239763	96739	651232	269586
.	.	.	.	.	0.6000	0.2305	.	239763	104232	641951	262318
.	.	.	.	.	0.6500	0.2497	.	239763	111536	632908	255265
.	.	.	.	.	0.7000	0.2689	.	239763	118656	624095	248420
.	.	.	.	.	0.7500	0.2882	.	239763	125598	615505	241776
.	.	.	.	.	0.8000	0.3074	.	239763	132366	607133	235326
.	.	.	.	.	0.8500	0.3266	.	239763	138966	598971	229066
.	.	.	.	.	0.9000	0.3458	.	239763	145404	591013	222988
.	.	.	.	.	0.9500	0.3650	.	239763	151683	583254	217088
.	.	.	.	.	1.0000	0.3842	.	239763	157808	575687	211360
.	.	.	.	.	1.0500	0.4034	.	239763	163785	568307	205798
.	.	.	.	.	1.1000	0.4226	.	239763	169616	561108	200397
.	.	.	.	.	1.1500	0.4418	.	239763	175307	554085	195152
.	.	.	.	.	1.2000	0.4610	.	239763	180862	547233	190059
.	.	.	.	.	1.2500	0.4803	.	239763	186284	540548	185112
.	.	.	.	.	1.3000	0.4995	.	239763	191577	534023	180308
.	.	.	.	.	1.3500	0.5187	.	239763	196745	527654	175641
.	.	.	.	.	1.4000	0.5379	.	239763	201792	521438	171108
.	.	.	.	.	1.4500	0.5571	.	239763	206720	515369	166705
.	.	.	.	.	1.5000	0.5763	.	239763	211535	509444	162426
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : PRED95-1
Date and time : 30AUG95:09:47
Computation of ref. F: Simple mean, age 3 - 6
Basis for 1995 : TAC constraints

Table 5.18

Saithe in the North-East Arctic (Fishing Areas I and II)

Single option prediction: Summary table

Year	F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1995	1.0428	0.4006	118111	165000	601589	588594	131900	237905	131900	237905
1996	0.2491	0.0957	30551	47302	596615	579782	114464	239763	114464	239763
1997	0.2491	0.0957	36501	62412	670920	712533	130123	318263	130123	318263
1998	0.2491	0.0957	41609	77025	726391	845877	162333	416529	162333	416529
Unit	-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year	F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1995	1.0428	0.4006	118111	165000	601589	588594	131900	237905	131900	237905
1996	0.4879	0.1875	56969	87160	596615	579782	114464	239763	114464	239763
1997	0.4879	0.1875	63096	103099	647187	663101	115130	278922	115130	278922
1998	0.4879	0.1875	68318	116956	683074	741736	132345	329375	132345	329375
Unit	-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year	F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1995	1.0428	0.4006	118111	165000	601589	588594	131900	237905	131900	237905
1996	0.9370	0.3600	100238	150066	596615	579782	114464	239763	114464	239763
1997	0.9370	0.3600	97854	146727	608515	585253	91892	218606	91892	218606
1998	0.9370	0.3600	98725	146525	620354	601155	92229	216873	92229	216873
Unit	-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year	F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1995	1.0428	0.4006	118111	165000	601589	588594	131900	237905	131900	237905
1996	1.0000	0.3842	105723	157809	596615	579782	114464	239763	114464	239763
1997	1.0000	0.3842	101560	150467	603632	575687	89075	211360	89075	211360
1998	1.0000	0.3842	101688	148059	613059	585729	87874	205029	87874	205029
Unit	-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year	F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1995	1.0428	0.4006	118111	165000	601589	588594	131900	237905	131900	237905
1996	1.6398	0.6300	154762	224415	596615	579782	114464	239763	114464	239763
1997	1.6398	0.6300	128748	169364	560195	493603	65380	151098	65380	151098
1998	1.6398	0.6300	122184	149113	553421	468285	55328	119821	55328	119821
Unit	-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : PRED95-2
Date and time : 30AUG95:10:15
Computation of ref. F: Simple mean, age 3 - 6
Prediction basis : F factors

Table 5.19

Saithe in the North-East Arctic (Fishing Areas I and II)

22:43 Wednesday, August 30, 1995

Single option prediction: Detailed tables

Year: 1995	F-factor: 1.0428		Reference F: 0.4006			1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
2	0.0421	7857	3850	210000	102900	0	0	0	0
3	0.1622	14135	9046	103906	66500	0	0	0	0
4	0.3090	23526	22821	97158	94243	972	942	972	942
5	0.4301	35672	49941	111787	156502	61483	86076	61483	86076
6	0.7013	27650	51430	59831	111286	50856	94593	50856	94593
7	0.7723	7840	21481	15874	43495	15557	42625	15557	42625
8	0.7379	742	2501	1550	5224	1550	5224	1550	5224
9	0.6768	189	744	420	1651	420	1651	420	1651
10	0.7160	245	1398	522	2981	522	2981	522	2981
11+	0.7160	254	1788	541	3814	541	3814	541	3814
Total		118111	165000	601589	588594	131900	237905	131900	237905
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1996	F-factor: 1.0000		Reference F: 0.3842			1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
2	0.0404	7541	3695	210000	102900	0	0	0	0
3	0.1555	21572	13806	164841	105498	0	0	0	0
4	0.2963	16895	16389	72337	70167	723	702	723	702
5	0.4125	18015	29544	58403	95781	32122	52679	32122	52679
6	0.6725	26708	53416	59528	119057	50599	101198	50599	101198
7	0.7406	11661	28686	24295	59765	23809	58570	23809	58570
8	0.7076	2792	9410	6004	20233	6004	20233	6004	20233
9	0.6490	265	1043	607	2385	607	2385	607	2385
10	0.6866	80	454	175	998	175	998	175	998
11+	0.6866	194	1365	425	2999	425	2999	425	2999
Total		105723	157809	596615	579782	114464	239763	114464	239763
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1997	F-factor: 1.0000		Reference F: 0.3842			1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
2	0.0404	7541	3695	210000	102900	0	0	0	0
3	0.1555	21609	13830	165126	105681	0	0	0	0
4	0.2963	26983	26173	115524	112058	1155	1121	1155	1121
5	0.4125	13583	22277	44037	72221	24220	39722	24220	39722
6	0.6725	14202	32949	31654	73437	26906	62422	26906	62422
7	0.7406	11941	31046	24877	64681	24380	63387	24380	63387
8	0.7076	4411	14865	9485	31963	9485	31963	9485	31963
9	0.6490	1060	4164	2423	9520	2423	9520	2423	9520
10	0.6866	118	675	260	1482	260	1482	260	1482
11+	0.6866	113	794	247	1743	247	1743	247	1743
Total		101560	150467	603632	575687	89075	211360	89075	211360
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

(cont.)