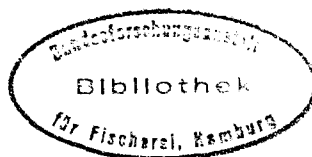


This report not to be quoted without prior reference to the Council*

International Council for the
Exploration of the Sea

C.M.1993/Assess 1
Ref.:G



REPORT OF THE ARCTIC FISHERIES WORKING GROUP

Copenhagen, 25 August - 3 September 1992

This document is a report of a Working Group of the International Council for the Exploration of the Sea and does not necessarily represent the views of the Council. Therefore, it should not be quoted without consultation with the General Secretary.

*General Secretary
ICES
Palægade 2-4
DK-1261 Copenhagen K
DENMARK

CONTENTS

1	PARTICIPANTS	1
2	INTRODUCTION	1
2.1	Terms of Reference	1
3	NORTH-EAST ARCTIC COD (SUB-AREAS I AND II)	1
3.1	3.1 Status of the Fisheries	1
3.1.1	Landings prior to 1992 (Tables 3.1-3.4, Figure 3.1A)	1
3.1.2	Expected landings in 1992	1
3.1.3	Effort and catch-per-unit-effort (Table 3.5)	1
3.2	Data from Catches	1
3.2.1	Catch in numbers at age (Table 3.25)	1
3.2.2	Weight at age in the landings (Tables 3.6 and 3.20)	2
3.3	Survey Results (Tables 3.7-3.12)	2
3.3.1	Recruitment indices (Tables 3.13 and 3.14)	2
3.3.2	Length and weight at age in the stock (Tables 3.15-3.19)	2
3.3.3	Discrepancies in age readings	2
3.3.4	Maturity ogives (Table 3.21)	2
3.4	Stock Assessment	3
3.4.1	Revised assessment using the revised data from 1991	3
3.4.2	Tuning the VPA to survey results (Tables 3.22-3.24)	3
3.4.3	Final VPA and present state of the stock (Tables 3.25-3.30)	3
3.5	Prediction of Catch and Stock Biomass	3
3.5.1	Input variables to the prediction (Table 3.31)	3
3.5.2	Biological reference points	4
3.5.3	Projections of catch and biomass (Tables 3.32-3.33)	4
3.5.4	Comments to the stock situation	4
3.6	SHOT Forecast for Coastal Cod (Table 3.34)	4
4	NORTH-EAST ARCTIC HADDOCK (SUB-AREAS I AND II)	4
4.1	Status of the Fisheries	4
4.1.1	Landings prior to 1992 (Tables 4.1, 4.2 and 4.3, Figure 4.1A)	4
4.1.2	Expected landings in 1992	4
4.1.3	Effort and catch per unit effort.	5
4.2	Data from Catches	5
4.2.1	Catch in numbers at age (Table 4.21)	5
4.2.2	Weight at age in the landings (Tables 4.4 and 4.16)	5
4.3	Survey Results (Tables 4.5 - 4.10)	5
4.3.1	Recruitment indices (Tables 4.11 and 4.12)	5
4.3.2	Length and weight at age in the stock (Tables 4.13 - 4.15)	5
4.3.3	Maturity ogives (Table 4.17)	5
4.4	Stock Assessment	5
4.4.1	Tuning the VPA to survey results (Tables 4.18 - 4.20)	5
4.4.2	Final VPA and state of the stock (Tables 4.21 - 4.26)	6
4.5	Prediction of Catch and Biomass	6
4.5.1	Input variables to the prediction (Table 4.27)	6
4.5.2	Biological reference points	7
4.5.3	Projection of catch and biomass (Tables 4.28 and 4.29)	7
4.5.4	Comments on the stock situation and the assessment.	7
5	NORTH-EAST ARCTIC SAITHE (SUB-AREAS I AND II)	7
5.1	Status of the Fishery	7
5.1.1	Landings prior to 1992 (Tables 5.1 and 5.2, Figure 5.1A)	7
5.1.2	Expected landings in 1992	7
5.1.3	Effort and catch-per-unit effort (Tables 5.3-5.5)	7

5.2	Catch in Numbers at Age (Table 5.10)	8
5.3	Weight-at-Age (Table 5.11)	8
5.4	Age at Maturity	8
5.5	Survey Results (Table 5.6)	8
5.6	Recruitment	8
5.7	Fishing Mortalities and VPA	8
5.8	Prediction of Catch and Biomass	8
5.8.1	Input variables to the predictions	8
5.8.2	Biological reference points	9
5.8.3	Results of the prediction (Tables 5.18-5.20)	9
5.9	Comments on the Assessment	9
6	REDFISH IN SUB-AREAS I AND II	9
6.1	Status of the Fisheries	9
6.1.1	Landings prior to 1992 (Tables 6.1-6.6, Figure 6.3A)	9
6.1.2	Expected landings in 1992	10
6.1.3	Effort and catch per unit effort (Tables 6.7 and 6.8)	10
6.2	Catch in Numbers at Age (Tables 6.16 and 6.25)	10
6.3	Weight at Age (Table 6.17)	10
6.4	Age at Maturity (Table 6.12)	10
6.5	Survey Results (Table 6.9-6.10)	11
6.6	Recruitment (Tables 6.9-6.11)	11
6.7	Assessment of <i>Sebastes mentella</i>	11
6.7.1	Fishing mortalities - VPA (Tables 6.18-6.22, Figures 6.3A-6.3B)	11
6.7.2	Projection of stock biomass and catch (Tables 6.23-6.24)	12
6.8	Assessment of <i>Sebastes marinus</i>	12
7	GREENLAND HALIBUT IN SUB-AREAS I AND II	12
7.1	7.1 Status of the Fisheries	12
7.1.1	Landings prior to 1991 (Tables 7.1-7.4, Fig. 7.3A)	12
7.1.2	Expected landings in 1992	13
7.1.3	Effort and catch-per-unit-effort (Table 7.5)	13
7.2	Catch in Numbers at Age (Table 7.11)	13
7.3	Weight-at-Age (Table 7.12)	13
7.4	Age at Maturity (Table 7.10)	13
7.5	Survey Results (Table 7.6)	13
7.6	Recruitment	14
7.7	Assessment	14
7.7.1	Estimation of fishing mortality (Tables 7.7-7.9, 7.13-7.17 and Figures 7.1-7.2)	14
7.7.2	State of the Stock	14
7.8	Catch Predictions (Table 7.18-7.22)	14
7.9	Comments on the Assessment	15
8	RECOMMENDATIONS	15
8.1	Age Readings	15
8.2	Methods Standardization	15
9	REFERENCES	15
	Tables 3.1 - 7.21	16
	Figures 3.1 - 7.3	147
	Appendix 1	154
	Figures A.1 - A.15	155

1 PARTICIPANTS

J.W. Baird	Canada
B. Bogstad	Norway
E. de Cardenas	Spain
H. Hovgard	Denmark
T. Jakobsen	Norway
K.H. Nedreaas	Norway
R. Nilsen	Norway
J. Paz	Spain
R. Schoene	Germany
K. Sunnanå (Chairman)	Norway
V. Tretiak	Russia
N.A. Yaraguina	Russia

2 INTRODUCTION

2.1 Terms of Reference

At the 79th Statutory Meeting of ICES in 1991 it was decided (C.Res.1991/2:7:13) that:

"The Arctic Fisheries Working Group (Chairman: Mr K. Sunnanå, Norway) will meet at ICES Headquarters from 25 August - 3 September 1992 to assess the status of and provide catch options for 1993 within safe biological limits for the stocks of cod, haddock, saithe, redfish and Greenland halibut in Sub-area I and II, taking into account of biological interactions between cod and capelin as far as possible."

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

3.1 Status of the Fisheries

3.1.1 Landings prior to 1992 (Tables 3.1-3.4, Figure 3.1A)

The final reported landings of 1990 amounts to 187,000 t (Table 3.1), excluding 24,263 t of Norwegian coastal cod (Table 3.2). The provisional figures for 1991 are 257,882 t excluding 24,749 t Norwegian coastal cod. The agreed TAC on North-East Arctic cod was exceeded by 42,882 t, and the total quota including 40,000 t Norwegian coastal cod was exceeded by 27,631 t. This is about 6,500 t more than expected by the Working Group last year.

Table 3.3 shows that the increase in the landings has taken place mainly in Divisions IIa and IIb.

3.1.2 Expected landings in 1992

The final agreed TAC of North-East Arctic cod for 1992 was 356,000 t after it had been increased by 56,000 t during the year. According to the agreement between Norway and Russia, Norway is allowed to take an additional 40,000 t Norwegian coastal cod. From earlier experience and provisional reports it is expected that the total landings of cod will be about 406,000 t including about 30,000 t Norwegian coastal cod.

3.1.3 Effort and catch-per-unit-effort (Table 3.5)

The catch-per-unit-effort (CPUE) is derived by dividing the total catch by the total effort involved in taking the catch over the year, except for 1992, for which the data are from the first half of the year. For Norway and Russia, this effort will include effort directed towards other species.

From 1990 to 1991, there was a marked increase in the Russian CPUE in Division IIa, and a slight decrease in Sub-area I and Division IIb. There was also a strong increase in the Spanish CPUE in Division IIb. The Norwegian CPUE decreased in Sub-Area I and Division IIb, while it increased in Division IIa.

3.2 Data from Catches

3.2.1 Catch in numbers at age (Table 3.25)

Revised age compositions in the Norwegian landings together with final total landings were used to revise the numbers at age in the 1990 landings. For 1991, age compositions for all areas were available from Norway and Russia. From the UK, the age composition from Division IIa was available. Spain and Germany provided age compositions from Division IIb. Age compositions of the total landings were calculated separately in Sub-area I and Divisions IIa and IIb by using the age compositions provided and raising the landings from other countries (Denmark, Faroe Islands, France, Greenland, Portugal, the UK (I and IIb) and Germany (IIa)) by Norwegian trawl in Sub-area I, by UK trawl in Division IIa and by Spanish trawl in Division IIb.

The 1983 year class (age 8 in 1991) is still dominant in the catches, but its proportion of the total numbers has been reduced from 43% in 1990 to 29% in 1991. The ages 5-7 comprise 53% of the catch in numbers in 1991.

The catch in numbers at age for 1991 predicted last year assuming the fishing pattern to be the same in 1991 as in 1990 turned out to be rather close to the catch at age calculated this year, except that the catch of age 10 and older fish was substantially smaller than predicted last year.

3.2.2 Weight at age in the landings (Tables 3.6 and 3.20)

The mean weight at age in the catch (Table 3.20) is calculated as a weighted average of the weight in the catch from Norway and Russia (Table 3.6). The time series weights are used for the older age groups for the year classes prior to 1978. The weight at age in the Norwegian catches in 1990 has increased compared to last year, because there was an error in the length-weight relationship used last year. For 1992 the unweighed average of Norwegian and Russian weights in the first half of the year has been used.

From 1988 the calculated length-weight relationship in the Norwegian catches is based on individual length-weight measurements. This is also the case for the German length-weight relationship and the 1991 data from Germany and Norway show similar weights at age by area. These weights of fish of ages 6 and older show good correspondence with the Russian data. However, there is still a large difference for the younger fish. These differences may in part be due to the discrepancies in the age reading (Section 3.3.3).

3.3 Survey Results (Tables 3.7-3.12)

The surveys were updated by data from the last year. The age distribution in the Norwegian acoustic survey in the Barents Sea in February-March 1991 (Table 3.10) has been revised. For the Norwegian bottom trawl surveys (Tables 3.7 and 3.8) back-calculations from bobbins to rock-hopper gear have not yet been done for the 1981 and 1982 data.

3.3.1 Recruitment indices (Tables 3.13 and 3.14)

The recruitment indices were updated with the last year's data and are given in Table 3.13. The sizes of the recruiting year classes were estimated using the indices of the year classes at ages 0, 1, 2 and 3 from surveys and the program RCT3. No 0-group index for 1992 was available because the 0-group survey was not finished at the time of the Working Group meeting. The analysis was performed using the final VPA as input up to the 1986 year class.

The estimates of the 1987-1991 year classes (Table 3.14) were all higher than the estimates made by the Working Group last year. The difference was greatest for the 1989-1991 year classes, where new survey indices have been included.

3.3.2 Length and weight at age in the stock (Tables 3.15-3.19)

The length and weight-at-age data from the Russian survey in November-December 1990 (Tables 3.16 and

3.18) have been revised.

Stock weights used from 1985 to 1992 for ages 3 to 8 are averages of values derived from Norwegian surveys in January - February 1985 - 1992 and Russian surveys in November - December 1984 - 1991 to give representative values at 1 January (Table 3.19). For ages 9 and older, the weights from the time series are used, except for 1991 (age 9) and 1992 (ages 9 and 10), where the average of the survey weights are used, in the same way as for the younger year classes.

3.3.3 Discrepancies in age readings

It is evident from Tables 3.15-3.18 that for some years there is a discrepancy in length at age and weight at age between the Russian survey in October-December and the Norwegian survey in February-March which cannot be explained only by growth in the intermediate time. In addition to influencing the assessment of cod, this discrepancy will influence the assessment of capelin because the consumption of mature capelin by immature cod is assumed to be directly related to the biomass of the immature cod stock. Also, research on how the individual growth of cod depends on food supply and temperature, which is very important for making better prognosis on the development of the cod biomass, is greatly hampered by these discrepancies.

A working document on "Discrepancy of length at age and weight at age by cod" was presented. In this document cross-reading experiments on otoliths are analyzed. In general, there seems to be some correlation between the year-to-year variation in size at age in the survey and the variation between years in the discrepancy of the otolith reading.

The Russian age readings for the second half of 1990 were in error (too high) because of a new and inexperienced Russian reader. The Russian data (both survey data and data from catches) for that period will be revised. Some inconsistencies in weight-at-age data between the 1990 and 1991 Russian surveys may be explained by these errors. Also, the differences in size at age between the Norwegian and Russian surveys will become smaller.

3.3.4 Maturity ogives (Table 3.21)

As in 1991, only Russia provided a maturity ogive. For the last three years, there has been a trend towards earlier maturation.

3.4 Stock Assessment

3.4.1 Revised assessment using the revised data from 1991

Running last year's assessment with revised catch data and survey data, and iterating the tuning and the separable VPA to produce the same reference F_{5-10} , we get $F_{5-10} = 0.22$ which is lower than the $F_{5-10} = 0.28$ from last year's assessment. However, the F_{5-8} , which was 0.23 in last year's assessment (tuning) and 0.25 (separable), drops only slightly, to 0.22. In the separable VPA an input $F_8 = 0.25$ and $S = 1.0$ was used, and the ratio of F_{old} to the average of the 4 younger ages in the tuning was set to 1.0.

3.4.2 Tuning the VPA to survey results (Tables 3.22-3.24)

It was decided to only use survey data as input to the tuning.

For age 9, the surveys give very low indices for most years, and a large part of the stock may be on the spawning grounds and hence outside the survey area for some of the surveys. Hence, it was decided to exclude this age group from the tuning. Also, it was decided not to exclude some year classes from the tuning for some of the surveys, as was done last year.

Earlier all the autumn surveys have been allocated to the year of the winter surveys. This was done because the tuning requires data for the last year for all indices used in the tuning. The Laurec-Shepherd tuning method compares the survey indices to the average population of the year but the surveys do not reflect the change in the average population caused by the fishing mortality in the year they are allocated to (i.e the year of the winter surveys). It is clear that the autumn surveys would compare best to the average population in the year they are conducted, and the winter surveys in the subsequent year are also reflecting the same stock level. In order to take account of the surveys conducted in the winter 1992, it was decided to allocate the autumn surveys to the year they are conducted, and to allocate the winter surveys to the year before they are conducted.

Running the tuning with the surveys in the calendar year, and iterating the separable VPA and the tuning in the way mentioned above, we get $F_{5-8} = 0.12$ and $F_{5-10} = 0.12$. The input to the tuning is given in table 3.22 and the results in Table 3.23. At this Working Group meeting, two other methods of tuning were available, the Extended Survivors Analysis (XSA) (Shepherd, 1992) and the ADAPT framework (Gavaris, 1988). Both were run on the same data and gave $F_{5-10} = 0.21$ and $F_{5-8} = 0.20$ (ADAPT) and $F_{5-8} = 0.20$ (XSA). XSA had to be run including only the ages 3-8, for which there are

tuning data. ADAPT was run with F at ages older than 8 equal to F at age 8.

The Working Group has little confidence in the F level obtained from the iteration of the Laurec-Shepherd tuning and the separable VPA. Because the XSA and the ADAPT gave the same F level, it was decided to accept this as the 1991 fishing level. The separable VPA and the ADAPT were iterated to produce the same reference F , using $S = 1.0$. The final F_8 was 0.24. The separable VPA gave F 's on younger ages lower than the ADAPT values while the F 's on ages 7 and 8 were slightly higher. Given that the two techniques which yielded the accepted F_{5-8} are relatively new to this Working Group, it was decided to use the separable VPA with $F_{5-8} = 0.20$. The resulting fishing pattern is given in Table 3.24.

3.4.3 Final VPA and present state of the stock (Tables 3.25-3.30)

It was decided not to accept the population size of the 1987 and 1988 year class from the separable VPA. These values were (at age 3) 184 and 725 million, respectively, while the RCT3 gave 139 and 226 million for these two year classes. The final VPA was run using the F s from the separable VPA as input, except for age 3 and 4, where these mortalities were adjusted to give the same population at age 3 as obtained from the RCT3 program. The fishing mortalities and stock numbers and biomasses are given in Tables 3.25-3.29. A summary of landings, fishing mortality and biomass since 1962 is given in Table 3.30.

3.5 Prediction of Catch and Stock Biomass

3.5.1 Input variables to the prediction (Table 3.31)

The stock number at age is taken from the final VPA (Table 3.27) and the recruitment of the 1989 year class from Table 3.14. The fishing pattern is taken from the separable VPA (Table 3.24). The maturity ogive is taken as the average of the recent 3 years (1990-1992) in Table 3.21 and is used for 1993 onwards.

The recruitment in the prediction is taken from the RCT3 analysis for the 1990 and 1991 year classes (Table 3.14). The recruitment of the 1992 and later year classes is set to the recent average (VPA mean = 5.67 = 290 million). For the management option table the weight at age in the stock and the catches is set to the average of the recent 3 years (1990-1992) for 1993 onwards. (Tables 3.19 and 3.20).

For the medium term prediction (1994-1997) 3 different scenarios were chosen to give an indication of the uncertainty of the predictions. Two biological reference points, F_{low} and F_{med} were given in each scenario. The

scenarios are only considering different weight at age, i.e. different growth, as the source of uncertainty. The scenarios are the following: Weight at age equal to the average in the years 1983-1986, i.e. high growth, weight at age equal to the average in the years 1983-1992, i.e. average growth, and weight at age are equal to the average in the years 1987-1990, i.e. low growth. The scenario weights are taken from Table 3.19 and 3.20. The weights given in Table 3.31 are used for 1992 and 1993 and the scenario weights are used from 1994 onwards.

3.5.2 Biological reference points

The yield per recruit analysis using the same fishing pattern and stock parameters as in the management option table resulted in estimates of $F_{0.1} = 0.14$ and $F_{max} = 0.25$. Jakobsen (1992) gives the values of $F_{low} = 0.32$, $F_{med} = 0.46$ and $F_{high} = 0.78$ for North-East Arctic Cod. The present exploitation level is $F_{92} = 0.31$. The exploitation level of $F = 0.19$ estimated for 1991 is influenced by the abnormal exploitation pattern in that year and is likely to be an underestimate.

3.5.3 Projections of catch and biomass (Tables 3.32-3.33)

The management options are given in Table 3.32 for the F-values $F_{0.1}$, F_{91} , F_{max} , F_{low} , F_{92} , F_{med} and F_{high} . In Figure 3.1D the catch level in 1993 and spawning stock biomass level in 1994 are plotted against the fishing mortality, F, in 1992.

In Table 3.33, the results of the three growth scenarios for the medium-term prediction are given, for the biological reference points F_{low} and F_{med} . It should be noted that these scenarios are not assessments, but calculations. The aim of these calculations is to demonstrate the uncertainty introduced in long term predictions because of the large change in growth experienced in this stock. The catches in the table must therefore not be taken as options for long term strategies.

3.5.4 Comments to the stock situation

The stock situation has improved much quicker than expected after the current severe management strategy was introduced in 1989. This rapid development is due mainly to good growth. Early maturity has given an additional growth in the spawning stock. The Working Group feels that the severe restrictions on the fishery, although in retrospect perhaps more severe than intended, have been very beneficial to the stock. In future management the main objective should be to maintain the spawning stock biomass at a high level to avoid further long periods of very poor recruitment.

3.6 SHOT Forecast for Coastal Cod (Table 3.34)

The Working Group had no new available information concerning coastal cod. As in last year, a SHOT forecast was made using the estimated catch of Norwegian coastal cod in 1991. However, it is the opinion of the Working Group that only a combined assessment should be made to avoid future overshooting of the North-East Arctic cod TAC. Norwegian and Russian scientists will consider arranging a study group to look more closely into the problems with carrying out a combined assessment.

The SHOT forecast was made according to the method described by Shepherd (1991). The input to the forecast was the catches in '000 tonnes (Table 3.2) The natural mortality was set to $M = 0.2$ and the growth rate, as estimated last year, to $G = 0.42$. The yield per biomass rate was calculated using input F values to adjust the estimated landings to be equal to the actual landings. No recruitment indices were available and the series were set to 1.0 The result is given in Table 3.34.

Under these assumptions the decrease in yield from about 40,000 t to about 30,000 t in the years 1984 to 1987 is caused by a reduction in F. The observed low growth in the North-East Arctic cod is also reflected in the low production estimates of 1988 and 1989. The low F level in 1989, due to a stop in the fishery, has been followed by an increase to the present level of $F = 0.21$. Continued fishing at this level will give a catch of 27,000 t in 1992 and 30,000 t in 1993.

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

4.1 Status of the Fisheries

4.1.1 Landings prior to 1992 (Tables 4.1, 4.2 and 4.3, Figure 4.1A)

The final landings figure for 1990 was 25,816 t which is close to the figure used in last year's assessment. This figure is 816 t more than the agreed TAC. The preliminary landings figure for 1991 is 33,214 t which is 5,214 t more than the agreed TAC and 4,714 t more than expected in last year's meeting. The increase in catch from 1990 to 1991 has taken place both in Sub-area I and Division IIa in almost equal quantities.

4.1.2 Expected landings in 1992

The agreed TAC of North-east Arctic haddock for 1992 is 63,000 t after it had been increased by 8,000 t during the year. Based on reports for the first half of the year, the expected landings in 1992 will be 54,000 t, which is 9,000 t below the agreed TAC.

4.1.3 Effort and catch per unit effort.

No new effort data were available at this meeting because the haddock caught by trawl in 1991 was only by-catch. The data on catch per unit effort are not used in the assessment and the table containing effort data is removed from this year's report.

4.2 Data from Catches

4.2.1 Catch in numbers at age (Table 4.21)

Revised age compositions in the Norwegian landings together with final total landings were used to revise the numbers at age in the 1990 landings.

For 1991, age compositions of the catches were available from Norway in all areas, from Russia in Sub-area I and Division IIa, from Germany in Division IIb and from UK (England and Wales) in Division IIa. The catches of other countries were distributed on ages using an average Norwegian and Russian age composition in area I, the UK (England and Wales) age composition in Division IIa and the German age composition in Division IIb.

As the catch in 1991 is 4,714 t more than expected in last year's meeting, the catch in numbers are also significantly different from the estimate made at that meeting. However, the relative distribution of numbers at age is also very different from the one predicted last year using the fishing pattern from the tuning. The catches of 3 and 4 year olds are larger than predicted. So is the catch of age 7 (1984 year class) whereas the catch of age 8 (1983 year class) is lower.

4.2.2 Weight at age in the landings (Tables 4.4 and 4.16)

There seems to be a reasonable correspondence between the Norwegian and Russian weights at age in the catches in recent years (Table 4.4). In general, for ages 3 and 4 the Norwegian weights are higher and for the older individuals the Russian weights are slightly higher. The mean weight at age in the catch (Table 4.16) is calculated as a weighted average of the weight in the catch from Norway and Russia. For 1992 the unweighed average of Norwegian and Russian weights in the first half of the year have been used.

4.3 Survey Results (Tables 4.5 - 4.10)

Results from the Barents Sea bottom trawl survey in the winter 1992, the Svalbard bottom trawl survey in the autumn 1991 (new table this year), the Barents Sea acoustic survey in winter 1992, and the Svalbard - Barents Sea acoustic survey in the autumn 1991 were available from Norway. From Russia the data from the trawl survey and the acoustic survey in the Barents Sea

and adjacent waters in late autumn 1991 were available.

4.3.1 Recruitment indices (Tables 4.11 and 4.12)

The recruitment indices were updated and the indices are given in Table 4.11. The analysis of recruitment is carried out using the final VPA as input up to 1988 year class. Because of the tendency of the C-type regression to overestimate the recruitment for haddock it was decided to use a P-type regression and not to shrink the estimates towards the mean.

4.3.2 Length and weight at age in the stock (Tables 4.13 - 4.15)

Weight at age is available from Russian autumn survey from 1984 representing weight at age from 1 January 1985. These weights seem to correspond fairly well with the old time series and are therefore used as weight at age in 1985 and 1986 for ages up to 7 year. From 1987 the weighted average of Norwegian weight at age in the winter survey and Russian weight at age on the same year class in the autumn survey the year before are used up to and including age 7.

Few fishes of older ages have been found in the surveys in the 1980s. The first year class showing up as older fish is the 1982 year class and it was decided to allow this year class to update the weight and length at age for the older fish in the Tables 4.13 and 4.14 showing the length and weight at age in the Norwegian bottom trawl survey in early winter and the Russian trawl acoustic survey in late autumn. The weight at age in the stock is calculated as the unweighed average of the Norwegian and Russian weights from the surveys up to the 1982 year class. For the older fish the old time series is used (Table 4.15)

4.3.3 Maturity ogives (Table 4.17)

Maturity ogives were available from Russia for 1991 and 1992 and is given in Table 4.17.

4.4 Stock Assessment

4.4.1 Tuning the VPA to survey results (Tables 4.18 - 4.20)

The tuning module in the VPA using the Laurec-Shepherd method was run using the updated 1991 catch at age data. The same procedure as last year was followed, iterating the tuning module and the separable module to give corresponding $F_{4.7}$. The terminal S-value in the separable was set to 0.7. The ratio of oldest F to the average of the 4 preceding ages in the tuning was also set to 0.7 and the input Fs to be given in the tuning were taken to be the Fs from the separable VPA. An $F_{4.7} = 0.20$ was found for 1990 and this is higher than the $F_{4.7}$

= 0.10 that was found in last year's assessment.

In last year's assessment the predicted catches in 1991 were included in the VPA in order to take account of the survey results obtained in 1991. The catch at age reported to the Working Group this year differ considerable from the ones predicted last year. Less fish are caught of the 1983 year class and more are caught of the 1984 year class. Also a considerably higher catch of 3 and 4 year olds was reported. This causes a higher $F_{4,7}$ to be estimated and a corresponding lower stock size. Doubts about the quality of the predicted catch at age data together with possible problems arising from using the estimated catches from a tuned VPA into a similar VPA, made the Working Group decide not to run the VPA including the year 1992.

The surveys are allocated to years in the same way and for the same reason as for cod, see Section 3.4.1 The tuning data are given in Table 4.18 for the ages 3 to 7. The year of the earliest survey index is 1980 for the Norwegian bottom trawl survey conducted in February 1981. The different surveys are the Norwegian bottom trawl survey in February (Fleet 1), the Norwegian acoustic survey at the same time (Fleet 2), the Russian bottom trawl survey in October - December (Fleet 3) and the Russian acoustic survey at the same time (Fleet 4).

The Laurec-Shepherd tuning was iterated with the separable VPA using $S = 0.7$ in the separable VPA, $r = 0.7$ in the tuning and the input F 's to the tuning taken from the separable VPA. It resulted in $F_{4,7} = 0.34$, which is considerably higher than the assessment of last year and the first run done on the revised catch data. It shows that introducing the survey indices of autumn 1991 and winter 1992 into the tuning give a somewhat lower abundance.

At this Working Group meeting, two other methods of tuning were available, the Extended Survivors Analysis (Shepherd, 1992) and the ADAPT framework (Gavaris, 1988). Both were run on the same data and gave $F_{4,7} = 0.32$ from the XSA and $F_{4,7} = 0.28$ from the ADAPT. Both these methods confirm the general level of F in 1991. Both the XSA and ADAPT allow the surveys to be allocated to the time of the year they were conducted, and runs performed on the last years assessment allocating the surveys as close to their time of performance as possible gave $F_{4,7}$ close to 0.3 for both methods. The XSA had to be run only including the ages for which there are survey indices. The theory behind XSA and ADAPT is new to the Working Group and since there is no major conflict between the F -level from any of the methods, it was decided to carry out the assessment this year as usual, using the Laurec-Shepherd tuning iterated with the separable VPA.

4.4.2 Final VPA and state of the stock (Tables 4.21 - 4.26)

The analysis of the residuals from the separable VPA indicate that the fishing pattern is fairly stable, except from the oldest ages in the later years. It was therefore decided to use the separable VPA as the final VPA. The final VPA was then run using the terminal F s from the separable VPA as input to the IFAP files, and then running a standard VPA back to 1962. The results are given in Tables 4.22 to 4.26.

The F s on the youngest ages are somewhat higher in the tuning (Table 4.19) than in the final VPA (Table 4.22). From the recruitment analysis (Table 4.12) it is seen that the 1988 year class (34 million individuals) is estimated as below average, but it is found to be abundant in the catches in 1991. It is clear from the data (Table 4.11) that all surveys show a year class strength at age 3 above average. However, the time series having the highest weight in the regression is for age 2 and fails to pick up this year class. The time series for age 3, estimates the 1988 year class to 76 million individuals. The figures of 3 year olds in the final VPA is left unchanged, but may be an overestimate of the 1988 year class as 3 year olds.

A summary of landings, fishing mortality, recruitment and biomass since 1962 is given in Table 4.26.

4.5 Prediction of Catch and Biomass

4.5.1 Input variables to the prediction (Table 4.27)

The recruitment in the prediction is taken from Table 4.12, showing that the 1989 and 1991 year classes are abundant and the 1990 is a strong year class. The somewhat high abundance in the VPA of the 1988 year class may be compensated by the following year classes due to the tendency of the P-type regression to underestimate strong recruitment. The recruitments of the 1992 and later year classes are taken as the recent average of 40 million individuals (log value of 3.65 as VPA mean in Table 4.12).

The stock size at age in 1992 is taken from the final VPA (Table 4.23) and the recruitment of the 1989 year class from Table 4.12. The fishing pattern to be used in the predictions is the separable fishing pattern (Table 4.20). The F pattern is calculated so that the F factors are equal to the average $F_{4,7}$.

The maturity is taken as the average of the recent 3 years in Table 4.17 For the management option table the weight at age in the catches and in the stock is taken as the value given for 1992 and as the average of the recent 3 years in Tables 4.15 and 4.16, i.e. 1990 - 1992 for 1993 and 1994.

For the medium term prediction, 3 different scenarios were chosen to give an indication of the uncertainty of the predictions. Two biological reference points, $F_{0.1}$ and F_{med} , were given in each scenario. The scenarios are only considering different weight at age, i.e. different growth, as the source of uncertainty. The scenarios are the following: Weight at age equal to the average in the years 1983 - 1986, i.e. high growth, weight at age equal to the average in the years 1983 - 1992, i.e. average growth, and weight at age equal to the average in the years 1987 - 1990, i.e. low growth. The scenario weights are taken from Tables 4.15 and 4.16 for the stock weights and catch weights respectively. The weights given in Table 4.27 are used for 1992 and 1993 and the scenario weights are used from 1994.

4.5.2 Biological reference points

The yield-per-recruit-analysis was performed with the fishing pattern used in the prediction and the 1992 weight at age in the stock and in the catches. This resulted in $F_{0.1} = 0.14$ and $F_{max} = 1.23$ (Figure 4.1C) Jakobsen (1992) gives the values of $F_{low} = 0.02$, $F_{med} = 0.35$ and $F_{high} = 1.11$ for the North-East Arctic haddock. The present exploitation level is $F_{92} = 0.35$, which is equal to F_{med} .

4.5.3 Projection of catch and biomass (Tables 4.28 and 4.29)

The management options table is given in Table 4.28, and the F-values of $F_{0.1}$, F_{90} , F_{91} and $F_{med} = F_{92}$ are shown. Figure 4.1D shows the plot of the catch and spawning stock biomass levels in 1993 by choice of fishing mortality, F.

The medium term scenarios are given in Table 4.29 and show that the spawning stock will increase in all the scenarios. The total biomass will also increase, but it will decrease somewhat at the end of the period. For one scenario, low growth and F_{med} fishing, the stock will be close to the present level in 1997. It should be noted that these scenarios are not assessments, but calculations. The aim of these calculations are to demonstrate the uncertainty introduced in long term predictions because of the large change in growth experienced in this stock. The catches in the table must therefore not be taken as options for long term strategies.

4.5.4 Comments on the stock situation and the assessment.

The recruitment of the year classes 1988 to 1991 does not seem to give as large a contribution to the stock as the year classes 1982 to 1984. Also, the recruitment is not yet showing up in the fishery and care should be taken not to increase the exploitation level above the present level.

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

5.1 Status of the Fishery

5.1.1 Landings prior to 1992 (Tables 5.1 and 5.2, Figure 5.1A)

Revised landings as reported to ICES for 1990 were 95,393 t, a decrease of 26,917 t from 1989 (Table 5.1). Provisional reports of landings in 1991 give a total of 109,221 t compared to 100,000 t expected by last year's Working Group. The increase is due to the purse seine fishery where landings went up to nearly the same level as from the trawlers (Table 5.2).

5.1.2 Expected landings in 1992

Norwegian authorities have introduced quota regulations for other countries and for purse seine and trawl in the Norwegian fisheries in order to limit the total landings in 1992 to the *status quo* F level of 115,000 t. Landings to date in 1992 do not give any basis for revising this figure.

5.1.3 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 catch and catch per vessel. On the basis of these data, indices of total purse seine effort have been calculated and are given in Table 5.5. The unit of effort is number of vessels of 20-24.9 m. This category currently accounts for about half of the purse seine landings and comprises most of the typical purse seiners, i.e., vessels having purse seining for saithe as main form of fishing. An increase in purse seine effort of 9% from 1990 to 1991 is indicated.

Table 5.4 gives catch, effort, and catch per unit effort for Norwegian trawlers since 1976, including only hauls where the effort almost certainly has been directed towards saithe, i.e., hauls with more than 50% saithe on trips with more than 50% saithe. Indices of total Norwegian trawl effort are given in Table 5.5 and show a decrease from 1990 to 1991 of 13%.

Combined effort has also been calculated (Table 5.5). Catches from the two gear categories have on average been at the same level (Table 5.2) and the indices have been given equal weight. Using 1977-1990 as a reference period, multiplying the trawl indices by 2.75 raises them to the same average level as the purse seine indices. The indices are then added to give the combined index. There is a decrease of 5% in the combined index from 1990 to 1991.

5.2 Catch in Numbers at Age (Table 5.10)

Age compositions of Norwegian landings in 1990 were revised. There were substantial changes, especially on age groups 2-4. The main reason for the changes is that some Norwegian age samples failed to show up in the data output prepared for last year's meeting. Data for 1991 were available from Germany and Norway, accounting for 98% of the landings. Landings by other countries were assumed to have the same age composition as that of Germany.

5.3 Weight-at-Age (Table 5.11)

A constant set of weight-at-age data is used for all years in the period 1962-1979. For subsequent years, annual estimates of weight-at-age in the catches are used. Data for 1990 were revised and for most age groups the revision gave an increase, at age 2 by as much as 46%. The main reason is the data problem mentioned in Section 5.2. New data were available for 1991. The weight-at-age in the stock is assumed to be equal to the weight-at-age in the catch.

5.4 Age at Maturity

No maturity ogive is available for this stock. As in the previous assessments, knife-edge maturity at age 6 has been assumed.

5.5 Survey Results (Table 5.6)

An acoustic survey for saithe in October-November was started in 1985. Indices of abundance of immature saithe are obtained (Table 5.6) and are used in the VPA tuning. The 1988 year class was abundant at age 2 in the 1990 survey, but the Working Group felt last year that more evidence was needed on the year-class strength. The 1988 year class was accordingly assumed to be average. The 1991 survey, however, confirmed that the 1988 year class is substantially stronger than the previous ones in the series. This is also evident from the catch-at-age data (Table 5.10). The 1991 survey indicates that the 1989 year class is also relatively abundant.

5.6 Recruitment

The index for the 1988 year class from the 0-group (post-larvae) survey is very low compared to the indices for the 1985-1987 year classes. The abundance indices for the year classes 1985-1992 are: 828, 545, 280, 165, 242, 58, 637, 443. Since the 1988 year class evidently is stronger than the preceding ones, the prospect of being able to estimate recruitment from this survey is poor even if some of the discrepancy can be explained by predation by seals during the invasion of seals in coastal areas in 1987 and 1988. Considering the good coverage of the survey, it is possible that the year class strength is

still not established at that time (around May).

5.7 Fishing Mortalities and VPA (Tables 5.7-5.16, Figures 5.1A and 5.1B)

In the assessment last year, catch and effort data for trawl and purse seine were combined in the VPA tuning. One reason for this was that tuning with the separate fleets gave results that were inconsistent with earlier assessment. Trial VPA tuning runs this year revealed that the inconsistency was caused by the catch-at-age data problem mentioned in Section 5.2. There is little difference in tuning results between separate and combined fleets for running VPA up to both 1990 and 1991. In spite of the substantial change in catch-at-age data, repetition of last year's assessment resulted in approximately the same level of fishing mortality. Although the tuning diagnostics for combined fleets are still somewhat better than for separate fleets, the Working Group decided on the basis of the comments made by ACFM to use separate fleets in the tuning. The two fleets are used together with the Norwegian acoustic survey (Table 5.7) and the results of the tuning are given in Table 5.8. $F_{3,6}$ for 1991 was estimated to be 0.40.

The fishing mortality levels from the tuning were carried forward to the separable VPA (Table 5.9). The resulting fishing mortalities were used as input to the conventional VPA and the results are given in Tables 5.12-5.15 and Figures 5.1A and 5.1B. The fishing mortality in the most recent years is markedly higher than in last year's assessment and biomass estimates correspondingly lower. Thus, the trend in spawning stock biomass after 1988 is no longer increasing.

Uncertainty about the size of the 1987 year class was expressed by the Working Group last year. After the revision of the catch-at-age data, this year class is now clearly established as a poor one. The 1988 year class, however, appears to be one of the strongest on record. A summary of landings, fishing mortality recruitment and biomass since 1962 is given in Table 5.16.

Runs were also made with ADAPT and the Extended Survivors Analysis. The former gave a lower fishing mortality ($F_{3,6} = 0.29$) than the Laurec-Shepherd tuning, whereas the XSA gave a slightly higher value ($F_{3,6} = 0.50$). Excluding age 8 in the tuning gave lower values for both methods, 0.25 for ADAPT and 0.42 for XSA, and indicates that these methods, like Laurec-Shepherd, are vulnerable to sample errors on the older age groups.

5.8 Prediction of Catch and Biomass

5.8.1 Input variables to the predictions (Table 5.17)

Input variables to the predictions are given in Table

5.17. The separable exploitation pattern and mean weights of 1990 and 1991 are used.

The estimates of recruiting year classes up to the 1988 year class, from the VPA, was accepted. Population numbers for these year classes in 1992 were used as inputs to the predictions. For the 1989 year class, evidence on the abundance is conflicting. The catches indicate a year class of below average strength, whereas the survey abundance at age 2 was nearly as high as for the 1988 year class. The size of the 1989 year class represents the largest uncertainty in the short-term prediction and three options are therefore presented, assuming the 1989 year class abundance to be low, medium and high, respectively. The low level (182 millions at age 1) is taken from the VPA, i.e., the one based on the catch at age 2 and the F at age 2 from terminal populations in the separable VPA. The high level (404 millions at age 1) is taken from tuning with age 2 in the survey included. The medium level (294 millions at age 1) is the mean of these two. For more recent year classes, 200 millions at age 1 was used, corresponding approximately to the average recruitment in the 1980s.

5.8.2 Biological reference points

Yield and SSB per recruit was based on the parameters in Table 5.17. The calculations gave $F_{0.1} = 0.18$ and $F_{max} = 0.32$ (Figure 5.1C). The values of F_{low} , F_{med} and F_{high} were not recalculated and the values estimated last year as 0.17, 0.31 and 0.46, respectively, are used.

5.8.3 Results of the prediction (Tables 5.18-5.20)

Tables 5.18, 5.19 and 5.20 represent options 1, 2 and 3 respectively, for the size of the 1989 year class. Fishing mortality ($F_{3.4}$) in 1991 for landings of 115,000 t will be in the range of 0.29-0.36, depending on the strength of the 1989 year class. Landings in 1993 at F_{med} will be in the range of 107,000-144,000 t, for the *status quo* F (1991) level in the range of 132,000-177,000 t and for the *status quo* F (1992) level in the range of 121,000-137,000 t. Because of the strong 1988 year class, spawning stock biomass estimates increase in 1994 for all options and will reach about 200,000 t, more than twice the 1992 level, assuming catches near recent levels in 1993.

5.9 Comments on the Assessment

The data from the commercial fleets have limitations and considerable year to year changes in the assessment are also likely to occur in the future. The design of the acoustic survey has been gradually established during its six years' history and the survey may become a stabilizing factor in the VPA tuning in the future. The survey gave strong signals about the 1988 year class which have

been confirmed in the fisheries. If the survey proves to be a good predictor of year class strength at age 2, it will reduce a lot of the uncertainty in the predictions.

6 REDFISH IN SUB-AREAS I AND II

6.1 Status of the Fisheries

6.1.1 Landings prior to 1992 (Tables 6.1-6.6, Figure 6.3A)

Nominal catches by country for Sub-areas I and II combined are presented in Table 6.1. 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 catch in 1991 was 61,526 t, nearly the same amount as in the year before.

The landings of 2,820 t from Sub-area I in 1991 were at the average level of the 1980s. Landings in Division IIa declined from 100,163 t in 1983 to 27,729 t in 1987, but show an increase to 47,389 t in 1991. This is accounted for by an increase in the Norwegian landings. Landings in Division IIb increased considerably in 1990 due to the German (former GDR), the Norwegian and the Russian fisheries. Although the Norwegian fishery continued to increase in 1991, the total landings of 11,317 t were less than the year before due to a decrease in the German and Russian fisheries.

The national landings statistics of redfish for Russia, Germany, Norway, and Spain are split into species by the respective national laboratories. For other countries, the Working Group has split the landings into *Sebastes mentella* and *Sebastes marinus* based on reports from their different fleets to the Norwegian fisheries authorities. The total landings of *S. mentella* declined progressively from 115,383 t in 1982 to only 10,518 t in 1987, but since showed an increase to 39,983 t in 1991. This is 7,983 t more than expected from last year's prediction, and is caused by a 150% increase in the Norwegian landings of this species since 1990. Landings of *S. marinus* in 1991 were 21,543 t, a decrease compared to 1990, and 10,457 t less than expected in the last year's prediction, and this may be attributed to revised Norwegian catch statistics.

The redfish population in Sub-area IV (North Sea) is believed to belong to the North-East Arctic stock. The landings from Sub-area IV have been about 1,000-2,000 t per year (Table 6.6). Historically these landings have been *S. marinus*, but in the most recent years Norwegian trawlers have also caught *S. mentella* along the northern slopes of this sub-area. The catches are not included in the assessment.

6.1.2 Expected landings in 1992

On the basis of reports of landings from the first seven months of the year, landings expected for the whole 1992 are estimated to decrease compared to 1991 for both species, i.e., 20,000 t and 12,000 t for *S. mentella* and *S. marinus*, respectively.

Although higher quotas of cod and haddock have reduced the pressure upon the redfish stocks, CPUE in the Russian fishery for *S. mentella* is decreasing. CPUE from the Norwegian trawl fishery, although variable, indicates a decreasing trend. This could be an indication of stock reduction. It is expected that both the Russian and the Norwegian landings will be about 10,000 t less than in 1991. Provided the expectations for 1992 hold, then the landings of *S. mentella* will be close to the recommended precautionary TAC of 22,000 t.

Regarding *S. marinus*, Norwegian fishermen are worried about the stock and say it must be declining. Provided the expectations for 1992 hold, then the landings of *S. marinus* will be 13,000 t below the recommended precautionary catch of 25,000 t.

6.1.3 Effort and catch per unit effort (Tables 6.7 and 6.8)

Catch-per-hour-trawling data for the *S. mentella* fishery were available for the Russian PST vessels. There is an increase from 1987 to 1990, while a 40% decrease is observed from 1990 to 1992. Estimates of total effort are based on Russian PST units raised to total international catch, showing an increasing trend for 1987 to 1991, but a decline in 1992.

Data for *S. marinus* were available for Norwegian fresh fish trawlers from 1981 (Table 6.8) from which the total international effort was estimated. This is a new series using GLIM analysis on data from each month and the statistical areas 03, 04, 05, 06 and 07 along the Norwegian coast. Difficulties related to the splitting of the redfish species in the catches should lead us to be careful when using this series, and the observed increasing trend may not be correct. This will be further investigated.

6.2 Catch in Numbers at Age (Tables 6.16 and 6.25)

Data for 1989 and 1990 were revised. Data for 1991 for *S. mentella* were available from Russia and Norway, corresponding to 35% and 63% of the total landings, respectively. The Norwegian age readings were based on otoliths and the catch-at-age from Norway were clearly different from the Russian. The Working Group decided last year to wait until at least five subsequent years with otolith readings are available before it should be tried to implement it in an assessment. The Norwegian catch-at-

length data were therefore converted to ages using the Russian age-length key from Division IIa. The landings from other countries were distributed on age according to the combined age distribution from these two countries.

For *S. marinus*, age composition data for 1991 (based on otoliths) were only provided by Norway, accounting for 88% of the total landings. From the German fishery, accounting for nearly 5% of the total, catch-at-length data were available, and these were converted to age by using a Norwegian age-length key for trawl from the area and time the German fishery was conducted. The landings from other countries were distributed on age according to the combined age distribution from Germany and Norway.

6.3 Weight at Age (Table 6.17)

Catch weight-at-age data were available from Russia for *S. mentella* for the ages 5-18 in 1991 and from Norway for the ages 10-24 based on otoliths. Mean length-at-age of the Norwegian landings coming out from using the Russian age-length key (scales) were converted to weight-at-age using the relationship W (kilogram) = $0.0000314 \times L^{2.75}$ (cm), which is based on Norwegian data for 1991. The weight at age in the catches were weighted by the numbers caught at age by these two countries. Finally the weights were somewhat adjusted to fit the SOP check. As in previous assessments weight at age in the stock was taken to be the same as the weight at age in the catch.

For *S. marinus*, weight-at-age data based on otoliths were available from the Norwegian landings in 1991. Mean weight-at-age for the German landings were found using the Norwegian age-length key and the weight-length relationship W (kilogram) = $0.0000294 \times L^{2.81}$ (cm). The weight at age in the catches were weighted by the numbers caught at age by Germany and Norway. A final SOP check showed a good fit with the nominal catch.

6.4 Age at Maturity (Table 6.12)

Maturity-at-age ogives for *S. mentella* from research vessels, sexes combined, have been made by Russia for several time periods. The average ogive for 1975-1983 has been used for the years 1976-1983. Then, for 1984-1990 a three-year running average has been used, while for 1991 an average of the 1990 and 1991 ogives in Table 6.12 was adopted.

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

6.5 Survey Results (Table 6.9-6.10)

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, and the survey design has also improved during the 27 years this survey has been conducted. The indices for the 1980s should, therefore, not be directly compared with those from the 1960s and early 1970s. A great reduction in the abundance of 0-group redfish was observed during the survey in 1991, and preliminary reports from the ongoing survey this year point to a similar low index for 1992 (Table 6.9).

The only surveys directed towards *S. mentella* are the Russian trawl/acoustic survey on the spawning grounds north of 70° N in March-April, and a pilot Norwegian trawl/acoustic survey in April 1992 on the spawning grounds from 62°N to 74°N. The other investigations on redfish are made during surveys mainly directed for other species.

Since 1981, a stratified random bottom trawl survey has been carried out by Norway in February in the Barents Sea. This has been combined with a synoptic acoustic survey. With regard to redfish, reliable comparable results from year to year from these investigations only exist back to 1987, so the time series is too short to tell whether the observed numbers are at a historical low or high level, and no age distribution has been presented. Furthermore, the bottom trawl indices have not been corrected for the change from bobbins to rock-hopper gear and this may have had an effect on the youngest fish. However, the estimate of total numbers for *S. mentella* in 1992 show little change from the year before. This is mainly caused by a promising high index for specimens less than 17 cm. The estimates from both surveys in 1992 also indicate a stable stock situation for *S. marinus* within the investigated area.

Since 1981, a stratified random bottom trawl survey has also been carried out by Norway in September in the Svalbard and Bear Island areas, and a combined trawl/acoustic survey is implemented into the 0-group survey covering both the Svalbard and the Barents Sea regions. The abundance indices for *S. mentella* in 1991 confirmed the improved recruitment earlier observed in the survey. Both surveys also indicate an improved stock situation of *S. marinus* in this area.

In the years 1986-1988, the USSR carried out a trawl/acoustic survey in March-June on the *S. mentella* spawning grounds near Bear Island. The results indicated a reduction in biomass from 90,000 t in 1986 to 60,000 t in 1987 and 30,000 t in 1988. In 1989 the USSR carried out a similar survey in March which estimated the biomass to be about 111,000 t. However, the surveyed area had been extended compared to previous

years, and a large proportion of immature fish are included in the 1989 estimate. In 1990, the USSR carried out this trawl/acoustic survey in the latter half of April on the *S. mentella* spawning grounds southwest of Bear Island. The investigated area was very limited, and the results are not presented in this report because of difficult and uncertain comparisons with previous years. In 1991 no such survey was conducted. In 1992 Russia conducted a survey in March-April, covering the area from the Fugloy Bank to 76°N and from 12°E to 25°E. The area investigated was larger than in previous years, and the total and spawning biomasses were estimated to 217,000 t and 113,000 t, respectively. The results confirmed that the 1982-year class is the strongest in the stock at the moment.

Young redfish is also covered during a Russian bottom trawl groundfish survey in the Barents Sea and Svalbard regions in October-November. These results have been used as the basis for estimating the recruitment in the assessment in recent years (Table 6.10).

6.6 Recruitment (Tables 6.9-6.11)

There are still large discrepancies between the international 0-group fish survey data (Table 6.8) and the data from the USSR bottom trawl survey on *S. mentella* concerning the 1+ - 6+ groups (Table 6.9). However, the strength of the 1963-1966 and 1969-1971 year classes has been confirmed by later years' assessments.

The data on *S. mentella* from the Russian bottom trawl survey (Table 6.10) were used as input to the recruitment program RCRT3. The results are given in Table 6.11 for two kinds of regressions between survey indices and VPA. The predictive (P) regression gave lower standard errors than the calibrated (C) regression. Problem with the age reading may also mask the real year class strengths. The abundances of the different year classes in the Russian survey last spring were back calculated to abundance at age 6, taking both natural mortality and landings into account (Table 6.10 and Figure 6.1). The resulting relative year class strengths were finally adjusted to the overall level from the RCT3 P-regression. The recruitment at age 6 in 1990 and later has been set to 80 millions.

6.7 Assessment of *Sebastes mentella*

6.7.1 Fishing mortalities - VPA (Tables 6.18-6.22, Figures 6.3A-6.3B)

Russian effort and catch data from the trawl fishery (Table 6.13) for ages 9-17 was used as input to the tuning method. The results from the tuning are shown in Table 6.14. A separable VPA for ages 9-19 was then run with terminal F adjusted to give a mean F for ages 10-15 equal to that from the tuning (Table 6.15). An automatic

weighting was adopted. A plot was made of average fishing mortality (ages 10-15) against total international effort in Russian PST units (Figure 6.2). The points for the years 1985-1991 indicate a linear relationship. The final VPA was made using the F_s estimated from terminal populations from the separable VPA for the ages 12-19. Input F_s for ages 6-11 were set to give the initial population numbers estimated as described in Section 6.6. Table 6.18 gives the final estimates of fishing mortality, and the corresponding estimates of stock numbers and biomass are given in Tables 6.19-6.21. Although the fishing mortality the last year seem to fluctuate from assessment to assessment, it converges fairly rapidly to a level that is confirmed from year to year, and the plots shown in Figure 6.3 also show reasonable biological and fishing relationships.

A summary of the historic series of landings, fishing mortality, stock biomass and recruitment is given in Table 6.22.

6.7.2 Projection of stock biomass and catch (Tables 6.23-6.24)

Input data used in the catch predictions are shown in Table 6.23. Population numbers in 1992 are those calculated by VPA for age groups 7 and older. For the 1985-1988 year classes the strength at age 6 has been set equal to 80 millions. The separable fishing pattern was used as input for ages 12 and older in the prediction. For ages 6-11 the fishing pattern for 1991 was used since this corresponded better to the expected stock level of these youngest ages. However, since the fishing mortality of age 9 in 1991 was low, probably due to the strength of the 1982-year class, the input for this age was set to the same level as that for ages 8 and 10, i.e. 0.07. The maturity ogive is the 1990-1991 average calculated from Table 6.11. Weight-at-age in the catch has been set equal to the average weight-at-age from the catches in 1990 and 1991. Weight-at-age in the stock has been set equal to the weight-at-age in the catch.

Yield and spawning stock biomass-per-recruit curves were calculated using the above data (Figure 6.3c). $F_{0.1}$ and F_{max} were estimated to be 0.09 and 0.23, respectively. In last year's assessment a stock-recruitment plot was made which estimated $F_{high}=0.31$, $F_{med}=0.18$, and $F_{low}=0.02$.

Results of the catch predictions are given in Table 6.24. If the expected catch of 20,000 t in 1992 is taken, the fishing mortality will be reduced compared with 1991. Catch predictions for 1993 have been made for the biological reference points and for fishing mortality being maintained at both the 1991 and 1992 levels.

6.8 Assessment of *Sebastes marinus*

Trawl effort and corresponding catch at age existed for Norwegian trawlers for 1986-1991 (Table 6.26). This time series shows artificial variations in catch at age due to variable availability of age-length keys to convert Norwegian catch at length, accounting for 90% of the total landings, to catch at age. The Working Group still considered the time series too short to give realistic stock estimates. A new series based on otolith readings is being built up. However, the existing data were used as input to the Laurec-Shepherd tuning. Although the summary statistics (Table 6.27) showed acceptable standard errors for some ages, the fishing mortalities from the tuning revealed no consistency compared to last year (Table 6.28). It was therefore again concluded that no meaningful assessment could be made.

SHOT forecasts for this stock are given in Tables 6.29 and 6.30 for two options of recruitment. In these forecasts the Y/B ratio has been set to make the estimated landings correspond with the actual ones. The actual landings have also been used as recruitment indices, i.e., the assumption has been made that the landings reflect the recruitment directly. As input for G-M (G is growth-rate and M is natural mortality, $M=0.1$) the growth rate of the ages 12 to 20 has been calculated. The result was $G-M = -0.05$, i.e. the fishery is based on the recruitment. Since for fish older than about 12 years the natural mortality (if correct) is higher than the growth (dependant on the age reading), fishing more than the recruitment will then reduce the stock.

Dependant on the choice of input for the recruitment, the results indicate that catches in the short term will decrease to a level of 10,000-16,000 t.

7 GREENLAND HALIBUT IN SUB-AREAS I AND II

7.1 Status of the Fisheries

7.1.1 Landings prior to 1991 (Tables 7.1-7.4, Fig. 7.3A)

Nominal catches by country for Sub-areas I and II combined are presented in Table 7.1. The nominal catches by country for Sub-area I and Divisions IIa and IIb separately are shown in Tables 7.2-7.4. Revised landings for 1990 were 22,755 t. The preliminary figure of total catch in 1991 is 27,152 t; an increase of about 33% and 19% compared with the 1989 and 1990 level, respectively. This is 1,152 t more than expected by last year's Working Group. Nominal catches increased in both sub-areas, and more than 50% of the total catch was taken in Division IIb.

7.1.2 Expected landings in 1992

Due to the low level of this stock the fishery in 1992 has been strongly regulated, and a direct trawl fishery has been forbidden. The catch in 1992 is therefore expected to be taken by long line and gill net in addition to a legal percentage by-catch in the trawl fishery for other species. Based upon reported catches from the first seven months of the year, it is estimated that the 1992 total catch will be about 7,000 t. It is expected that Russia will take 500 t and Norway 6,000 t of the total catch. The recommended and agreed TAC will therefore probably be overfished by about 1,000 t.

7.1.3 Effort and catch-per-unit-effort (Table 7.5)

Catch-per-unit-effort (CPUE) data for 1991 were only available for Norwegian trawlers. The CPUE shows a continuous decrease since 1988, and the level in 1991 was estimated to be 22% lower than the year before. The catch rate of seven years and older fish (CPUE 7+) is, however, at the same level as in 1990, but this is only 50% of the catch rates in the middle of the 1980s. A huge increase in the effort is observed in the most recent years.

7.2 Catch in Numbers at Age (Table 7.11)

The catch-at-age data for 1990 were updated by adjusting the age composition used in the previous assessment to final catch statistics for that year. Catch-at-age data for 1991 were available for the Norwegian fisheries accounting for about 89% of the landings. The Norwegian catch-at-age was finally raised to the total international landings, assuming that landings by other countries having the same age composition as that for Norway.

7.3 Weight-at-Age (Table 7.12)

A constant set of weight-at-age data is used for all years in the period 1970-1978. For subsequent years annual estimates, weighted by the numbers caught at age by each country, are used. Mean weight-at-age data from the Norwegian fishery in 1991 was used for the total catch. A final SOP check showed good fit with the nominal catch.

7.4 Age at Maturity (Table 7.10)

The spawning stock biomasses for 1983-1987 were calculated by application of an average maturity ogive derived from USSR data for the period 1983-1987. As explained in the Working Group report for 1990, the same ogive was applied to the period 1970-1982. For 1988 and 1989 a three-year running average has been used, while for 1990 and 1991 the average of the 1989 and 1990 ogives was adopted (Table 7.10). During the period 1984-1990 the USSR data on maturity have been

collected at different times of the year. According to the Russian scientists the best time of the year to sample such data on Greenland halibut is in August-February.

7.5 Survey Results (Table 7.6)

The index for 0-group Greenland halibut in the International 0-group survey in the Barents Sea and Svalbard area since 1970 showed a sudden drop in 1988 and was in 1991 at the lowest level ever recorded (see text table below). Since the survey design was improved at the end of the 1970s, the survey has been conducted at the same time and following the same procedures every year, although the timing of this survey with regard to Greenland halibut may not be optimal. The fact that four consecutive bad year class indices of this stock have never been observed before, gives cause for concern about the recruitment.

Year	78	79	80	81	82	83	84
0-group index	35	23	12	38	17	16	40

Year	85	86	87	88	89	90	91
0-group index	36	55	41	8	5	2	1

Norwegian stratified random bottom trawl surveys have been conducted annually in both the Svalbard and the Barents Sea since 1981. Whereas the surveys cover the main nursery area of Greenland halibut, they do not fish beyond depths of 600 m, and thus do not cover the whole geographical distribution of the stock. Abundance indices of the different age groups and of fish less than 20 cm in the Svalbard area are presented in Table 7.6. Some of the fluctuations observed clearly are not indicators of stock size and may be an artefact of incomplete survey coverage, migration, and the age-length key used. On the youngest fish there may also be an effect of the change from "bobbers" to "rock-hopper" gear from 1988 to 1989. The older data have not been adjusted to account for this change. However, the clear decrease of 1 and 2 year old fish corresponds to the drop in 0-group indices and should be taken as a warning of possible poor recruitment to the fishery in the near future.

Also indices (on length) from the Norwegian bottom trawl survey in the Barents Sea in February in 1990-1992 (unpublished data) show a decrease of fish less than 35 cm.

In October-November 1990 three USSR research vessels conducted a stratified bottom trawl survey directed towards Greenland halibut (Shevelev and Lepesevich 1991). This survey focused on the area along the conti-

nental slope between 71° - 80°N and 5° - 18°E, and depths down to 900 m. The numbers and biomass were estimated to 59 mill. specimens and 55,000 t, respectively. Fish 4-7 years old (36-55 cm) dominated. A similar survey was conducted by Russia at the same time in 1991 covering a wider area (east to 35°E). Comparable estimates to those from the 1990-survey gave 17 mill. specimens and a biomass of 17,000 t. No age distribution was available, but 36-50 cm fish dominated. Since the estimates of total number (63 mill.) and biomass (73,000 t) from the 1991 survey were higher than in 1990, i.e. a major part of the stock was in 1991 observed in the area (19°E to 35°E) not covered in 1990, this may be due to a change in distribution from one year to another.

7.6 Recruitment

The results for 1-6 year old fish from the Norwegian bottom trawl survey and the 0-group survey were used as input to the ICES RCT3 program to estimate the abundance of the 1986-1990 year classes. The results showed a bad and variable statistical fit between the survey indices and VPA, and the mean therefore contributed very much to the final estimates. Due to this lack of fit a simple average of the recruitment at age 3 from the VPA for the years 1982-1988, i.e., 27 millions, was taken as the recruitment at age 3 in 1989 to 1991.

7.7 Assessment

7.7.1 Estimation of fishing mortality (Tables 7.7-7.9, 7.13-7.17 and Figures 7.1-7.2)

Trawl effort data and the corresponding catch-at-age data were available for Norwegian trawlers for the years 1979-1991. The data (Table 7.7) for the Norwegian fleet for age groups 7-12 and the Norwegian Svalbard survey for age groups 3-7, were used in the VPA tuning module, and the results are given in Table 7.8. The Laurec-Shepherd method was used in the tuning. The reference ages of F used were 6-10. A plot was made of average fishing mortality (ages 6-10) against total international effort (Figure 7.1). The plot confirms the change in the fishery from 1989 and onwards. Figure 7.2 shows the development in effort and fishing mortality from 1982 and onwards.

A separable VPA was run with the input terminal F adjusted so that $F_{6,10}$ for 1991 was equal to $F_{6,10}$ for that year as indicated by the tuning. Weights from the automatic weighting were adopted. The matrix of residuals from the separable VPA is given in Table 7.9. The input F s in 1991 for ages 3 and 4 were finally adjusted to give the average (1982-1988) recruitment (27 millions at age 3) in 1989-1991.

The age range in the VPA was reduced by one year compared to previous assessments making age 15 the

plus group. The fishing mortalities on the older age groups for the years 1970-1980 were therefore adjusted by running separable VPA for different year ranges within that time period. Table 7.13 gives the final estimates of fishing mortality, and the corresponding estimates of stock numbers, stock biomass and spawning stock biomass are given in Tables 7.14 to 7.16, respectively.

A summary of the historic series of landings, fishing mortality, stock biomass and recruitment is given in Table 7.17.

Two additional tunings were run using the Extended Survivors Analysis and the ADAPT framework. The methods gave $F_{6,10} = 0.31$ and 0.42 , respectively. The effort in the Norwegian trawl fishery nearly doubled from 1989 to 1991 resulting in a substantial increase in the total effort. The fishing mortalities estimated by these two tuning methods did not reflect this recent trend in the fishing effort, and these analyses were therefore not used for the final assessment.

7.7.2 State of the Stock

The fishing mortality (ages 6-10) was relatively high in 1970-1971 and in 1976 when it was about 0.41 (Table 7.13). It then fell to less than 0.20 for three years before it started increasing again towards a peak in 1988 of 0.40. After a minor drop in 1989, an increase to well above the 1988-level is estimated for 1991. The level of the fishing mortality estimated this year is below that estimated by last year's Working Group, probably because of a revision of the landings and somewhat higher indices in last year's bottom trawl survey of 5-8 year old fish. Assuming that the expected catch of 7,000 t in 1992 will be taken, that will result in a fishing mortality of 0.15. This is a result of strong regulations of the fishery in order to rebuild the stock. Until 1976 the spawning stock was estimated at more than 100,000 t, and in the years 1977-1985 the spawning stock has been stable at a level of 60,000-80,000 t (Table 7.16, Figure 7.3B). However, from 1983, we observe a decreasing trend in spawning stock to a level of about 40,000 t at present. This reduction is consistent with the decline in the combined USSR and Norwegian CPUE from 1985 to 1991 (Table 7.5).

7.8 Catch Predictions (Table 7.18-7.22)

Input data used in the catch predictions are shown in Table 7.18. Population numbers in 1992 are those calculated by VPA for age groups 6 and older. For the 1989-1991 year classes the strength at age 3 has been set equal to the average level used in last year's assessment, i.e. 25 millions. In addition, an option with low recruitment of 10 million specimens has been given. The exploitation pattern used is that from the separable VPA

(Tables 7.9). The maturity ogive is the 1989-1990 average which also was used for 1990 in the VPA. 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 1990 and 1991.

Yield- and spawning stock biomass-per-recruit have been calculated using the above data, and the results have been plotted in Figure 7.3C. The values of $F_{0.1}$ and F_{max} are 0.13 and 0.29, respectively. Using the stock-recruitment plot from last year's assessment the values of F_{low} , F_{med} and F_{high} have been taken as 0.07, 0.23 and 0.32, respectively.

Short- (up to 1994) and medium term (up to 1997) catch predictions are given in Tables 7.19-7.22 and Figure 7.3D. To take the expected catch of 7,000 t in 1992 will reduce the fishing mortality to a low level. Catch predictions for 1993 have been made for the biological reference points and for fishing mortality being maintained at both the 1991 and the expected 1992 level.

Keeping the fishing mortality at a low level, a slight increase in the spawning stock is expected even with a low recruitment. On the other hand, if we go back to the 1991-level (F_{91}), we will get a further reduction in the spawning stock even with a high recruitment.

7.9 Comments on the Assessment

It is the unanimous opinion of the Working Group that the continuous large reduction in CPUE, declining spawning stock biomass, and indications of weak year classes in the 0-group survey in the four most recent years must be taken into account when TAC recommendations are made. It is also decisive for the near future development of the stock that the recommended TAC will be accepted and enforced, as was done in 1992.

8 RECOMMENDATIONS

8.1 Age Readings

The Working Group agreed that the preliminary work on the ageing problems for the North-East Arctic cod presented at the meeting had been very useful. Standardization of age readings between all readers involved is important for the precision of the assessment. The Working Group, therefore, recommends that this work be continued, both on a routine basis (e.g., exchange of otoliths) and through workshops for representatives of the institutes involved.

8.2 Methods Standardization

The experience of the Working Group in recent years is that too much time is spent on discussing methods,

procedures and technicalities during the meetings. Many of these things might have been standardized if a more thorough analysis and discussion had been undertaken, but at Working Group meetings with the pressure to produce a valid assessment, there is not sufficient time. Standardization would prevent year-to-year changes in the way assessments are carried out and would allow more time for other discussion, or, alternatively, shorter working group meetings. The Working Group suspects that the situation is similar in some other working groups and recommends that a workshop is arranged as soon as possible on standardization of assessment procedures for Arctic demersal stocks, primarily cod and haddock.

9 REFERENCES

- Gavaris, S. 1988. An adaptive framework for the estimation of population size. CAFSAC Research Document 88/29.
- Jakobsen, T. 1992. Biological reference points for the North-East Arctic cod and haddock. ICES, Journ. of Marine Science 49: 155-166.
- Shepherd, J.C. 1991. Simple methods for short-time forecasting of catch and biomass. ICES, Journ. Marine Science 48: 67-78.
- Shepherd, J.C. 1992. Extended Survivors Analysis: An improved method for the analysis of catch-at-age data and catch-per-unit-effort data. Draft paper.

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

Year	Sub-area I	Division IIa	Division IIb	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	163,849	150,074	19,240	333,163
1990	62,272	99,465	25,263	187,000
1991 ¹	65,339	155,088	37,455	257,882

¹Provisional figures.

Table 3.2 Coastal COD. Total nominal catch ('000 t) by Norway in Division IIa.
(Data provided by Working Group members).

Year	Division IIa
1980	40
1981	49
1982	42
1983	38
1984	33
1985	28
1986	26
1987	31
1988	22
1989	17
1990	24
1991 ¹	25

Table 3.3 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	Others
	Trawl	Others	Trawl	Others	Trawl	
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 ¹	53.2	12.1	69.8	85.3	36.1	1.4

¹Provisional.

Table 3.4 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.	Germany Fed. Rep.	Norway	Poland	United Kingdom	Russia	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
<u>Spain</u>										
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	15,685	1,853	326	3,290	159,939	7,802	8,666	134,329	1,273	333,163
1990	9,584	592	169	1,437	88,737	7,950	3,412	74,609	510	187,000
1991 ¹	8,981	975		2,493	125,999	3,677	3,978	108,501	3,278	257,882

¹Provisional figures.

Table 3.5 North-East Arctic COD. Catch per unit effort.

Year	Sub-area I			Division IIb			Division IIa		
	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 ⁶			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	-	-	0.41	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	1.24	-	0.67	0.24	4.96	0.76	0.47	0.90	-
1992 ⁷	-	-	0.79	-	-	0.23	-	0.65	-

¹Preliminary figures.

²Norwegian data - t per 1,000 t*hrs fishing.

³United Kingdom data - t per 100 t*hrs fishing.

⁴Russia 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.

⁵Norwegian data - t per gillnet boat week in Lofoten.

⁶Spanish data - t per hr fishing.

⁷Data for the first half of the year.

Table 3.6 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	0.89	1.53	2.07	2.67	3.41	3.93	4.78	6.15	8.77	11.65	16.69	-	14.17	-
1992 ¹	-	1.15	1.87	2.43	3.10	4.03	5.03	5.96	8.22	12.61	15.71	16.63	12.00	-

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	0.21	0.44	0.87	1.49	2.24	3.21	4.54	6.71	9.33	11.06	13.89	13.75	17.55	16.18
1991	0.24	0.54	0.98	1.79	2.62	3.69	5.19	7.41	11.17	15.38	13.78	18.50	15.40	19.40
1992 ¹	0.15	0.43	1.01	1.81	2.70	3.83	4.67	6.04	9.74	15.55	-	-	-	-

¹Weights from the period January-June.

Table 3.7 North-East Arctic COD. Results from the Norwegian Bottom trawl survey in the Barents Sea in January-March. Index of number of fish at each age. Rock-hopper gear¹.

Year	Age										Total
	1	2	3	4	5	6	7	8	9	10	
1983	259.0	17.7	23.2	45.4	44.1	18.9	6.0	3.9	0.8	0.2	419.2
1984	2170.0	366.0	122.0	32.7	25.4	14.4	4.2	0.6	0.3	0.1	2735.7
1985	39.0	647.0	162.0	126.0	21.7	8.4	3.3	0.3	0.1	0.1	1007.9
1986	562.0	403.0	679.0	173.0	102.0	30.6	7.3	0.8	0.2	0.1	1958.0
1987	25.3	387.0	233.0	415.0	61.1	15.4	1.8	0.5	+	-	1139.1
1988	3.8	63.5	180.0	102.0	231.0	25.7	4.8	0.8	0.1	-	611.8
1989	7.1	12.7	37.9	73.2	43.3	104.0	11.7	1.0	0.2	0.2	291.3
1990	122.0	48.9	25.8	37.0	43.8	27.0	31.4	1.7	0.5	0.1	338.2
1991	356.7	212.7	37.0	24.6	23.9	21.7	12.2	12.7	0.7	0.1	702.3
1992	99.7	482.2	170.4	62.7	25.0	15.7	9.9	5.2	3.5	0.3	874.6

¹1983-1988 back-calculated from bobbins gear.

Table 3.8 North-East Arctic COD. Results from the Norwegian Bottom trawl survey in the Svalbard Area in September-October. Index of number of fish at each age. Rock-hopper gear¹.

Year	Age										Total
	1	2	3	4	5	6	7	8	9	10	
1983	145.0	26.8	10.7	9.5	2.4	1.9	1.0	1.3	0.3	-	210.4
1984	499.0	113.0	7.3	4.3	4.7	1.8	0.4	0.4	0.3	0.1	631.1
1985	239.0	452.0	99.1	28.4	13.6	5.4	1.0	0.4	0.1	0.2	839.2
1986	40.9	181.0	297.0	42.8	15.3	2.6	1.0	0.3	0.1	0.1	581.1
1987	41.5	108.0	141.0	125.0	17.1	5.4	0.5	0.1	0.1	+	438.7
1988	3.1	16.6	33.2	31.8	37.1	9.5	0.6	0.6	0.6	-	133.3
1989	3.6	2.7	15.4	12.8	11.9	19.2	3.2	0.4	0.2	-	69.4
1990	61.5	8.3	8.2	14.6	24.3	17.8	21.7	2.8	0.5	-	159.7
1991	131.6	100.9	28.8	8.7	13.8	15.5	14.4	21.7	1.9	-	337.3

¹1983-1988 back-calculated from bobbins gear.

Table 3.9 North-East Arctic COD. Results from the Russian Bottom trawl survey in the Barents Sea and adjacent waters in November-December (numbers per hour trawling).

Year	Age										Older	Total
	0	1	2	3	4	5	6	7	8	9		
<u>Sub-area I</u>												
1982	1.4	0.2	6.9	13.2	7.4	-	-	-	-	-	5.1	34.2
1983	4.3	8.0	5.1	4.6	5.4	5.9	-	-	-	-	4.7	38.0
1984	0.7	12.3	11.6	25.5	13.7	6.5	4.0	-	-	-	2.5	76.8
1985	3.3	2.9	51.3	35.2	53.1	25.2	4.4	1.8	-	-	1.0	178.2
1986	0.3	2.2	7.0	60.4	15.8	8.2	1.8	0.6	0.1	-	0.1	96.5
1987	+	0.1	3.6	4.0	35.9	6.3	3.6	0.6	0.1	0.1	+	54.4
1988	0.2	0.1	1.7	5.7	5.2	17.2	2.6	0.6	0.2	0.1	+	33.4
1989	0.4	0.1	1.0	3.5	11.2	15.4	20.8	16.1	3.7	0.7	0.3	73.4
1990	6.2	4.0	6.8	2.1	5.7	8.0	16.1	15.4	4.8	0.8	0.2	70.2
1991	3.1	4.1	6.6	16.4	6.6	7.0	8.7	9.0	5.2	0.5	0.1	67.3
<u>Division IIa</u>												
1982	0.1	+	11.7	10.6	4.7	-	-	-	-	-	7.9	35.0
1983	0.7	0.4	0.3	1.5	6.4	5.0	-	-	-	-	4.9	19.2
1984	0.4	0.7	0.6	3.7	4.0	6.7	4.7	-	-	-	1.7	22.5
1985	0.2	0.2	1.4	3.7	9.5	12.6	6.4	2.5	-	-	0.8	37.6
1986	-	+	0.1	2.5	2.9	3.2	1.5	0.5	0.4	-	0.2	11.3
1987	-	-	-	-	3.0	1.7	2.3	0.9	0.1	-	0.1	8.1
1988	0.2	+	0.1	0.2	1.2	10.0	2.4	0.7	0.2	0.1	+	15.1
1989	-	+	0.1	0.3	0.9	1.3	3.9	3.9	1.2	0.5	0.2	12.3
1990	0.1	+	+	0.3	1.3	1.5	2.0	3.3	3.1	0.7	0.8	12.5
1991	1.0	0.1	0.3	1.0	1.0	2.4	2.1	2.8	2.2	0.3	0.1	13.3
<u>Division IIb</u>												
1982	9.9	1.7	42.5	17.8	1.1	-	-	-	-	-	2.2	75.2
1983	9.7	14.9	5.0	9.4	11.0	2.6	-	-	-	-	2.4	55.0
1984	1.4	7.7	22.7	7.4	2.7	2.4	1.3	-	-	-	0.8	46.4
1985	9.1	9.4	45.2	32.3	32.8	11.5	5.3	1.8	-	-	0.4	147.8
1986	1.6	2.9	14.8	67.2	19.9	16.4	5.4	1.3	0.6	-	0.1	127.1
1987	-	0.2	5.6	11.0	64.4	4.0	2.2	0.5	0.1	-	-	88.0
1988	0.1	0.4	4.8	13.7	15.1	25.0	2.5	0.6	0.1	0.2	-	62.8
1989	0.6	0.1	0.3	3.8	6.4	6.1	9.2	5.4	0.2	0.4	0.2	33.7
1990	1.3	0.7	0.6	1.0	2.0	2.9	3.8	6.8	4.7	1.1	0.5	25.4
1991	6.4	4.3	9.7	9.6	3.5	5.5	6.8	9.9	8.0	0.8	0.2	64.7
<u>Total (Sub-area I and Divisions IIa and IIb)</u>												
1982	3.7	0.6	18.1	14.1	5.1	-	-	-	-	-	4.7	46.3
1983	5.4	8.9	4.3	5.6	7.3	4.7	-	-	-	-	4.0	40.2
1984	0.9	9.2	14.2	16.2	8.6	5.0	3.1	-	-	-	1.9	59.1
1985	5.0	4.9	43.0	30.3	40.5	18.8	4.9	1.9	-	-	0.6	150.0
1986	0.7	2.2	9.1	56.5	16.1	10.6	3.0	0.8	0.3	-	0.1	99.4
1987	-	0.2	4.0	5.9	42.6	5.4	3.1	0.6	0.1	+	-	61.9
1988	0.1	0.2	2.5	7.7	7.8	19.0	2.5	0.6	0.1	0.2	-	40.8
1989	0.4	0.1	0.6	3.4	8.8	11.8	15.5	11.4	2.6	0.5	0.3	54.8
1990	3.9	2.4	4.0	1.5	4.0	5.6	10.5	11.2	4.6	0.9	0.3	49.0
1991	4.2	3.9	7.3	12.7	5.0	6.1	7.5	8.9	6.0	0.6	0.1	62.3

Table 3.10 North-East Arctic COD. Results from the Norwegian acoustic survey in the Barents Sea in January-March. Stock numbers in millions.

Year	Age										Total
	1	2	3	4	5	6	7	8	9	10	
1981	3	73	58	124	243	270	41	8	3	4	827
1982	1	4	71	86	93	73	74	5	1	-	408
1983	-	15	17	45	65	38	17	10	2	1	210
1984	2,382	506	174	80	63	46	16	1	+	+	3,269
1985	69	878	550	510	109	48	20	2	1	1	2,187
1986	625	578	1,246	424	225	27	9	-	-	-	3,136
1987	1	47	126	500	128	37	4	3	-	-	852
1988	1	23	79	74	179	26	6	+	+	-	389
1989	-	9	31	77	56	145	21	3	+	+	346
1990	145	58	32	61	81	73	138	10	2	+	599
1991	277	484	145	108	109	101	55	58	4	+	1,341
1992	250	1,004	490	205	67	46	28	15	11	+	2,117

Table 3.11 North-East Arctic COD. Results from the Russian acoustic trawl survey in the Barents Sea and adjacent waters in the autumn. Stock numbers in millions.

Year	Age										Older	Total
	0	1	2	3	4	5	6	7	8	9		
1985 ¹	45	105	895	422	255	83	44	50	-	-	39	1,939
1986 ¹	60	53	141	980	444	183	56	62	19	-	2	2,000
1987 ²	8	15	170	170	738	99	67	42	20	9	5	1,344
1988 ²	+	+	43	161	106	245	34	10	2	+	+	602
1989 ¹	2	1	4	17	44	56	99	82	20	6	4	335
1990 ¹	28	22	51	10	25	33	65	87	42	9	2	376
1991 ¹	33	29	53	101	43	50	58	70	51	6	+	494

¹October-December.

²September-October.

Table 3.12 North-East Arctic COD. Results from the Norwegian acoustic survey in the Barents Sea and the Svalbard Region September-October. Stock numbers in millions.

Year	Age									Total
	1	2	3	4	5	6	7	8	9	
<u>Sub-area I and Division IIa¹</u>										
1986	42	96	290	99	45	12	1	-	-	587
1987	2	49	42	302	90	26	3	+	-	516
1988	5	4	23	14	43	15	9	+	+	114
1989	4	6	12	19	19	67	11	3	+	142
1990	45	16	28	18	23	20	38	5	+	195
1991	312	199	142	80	36	17	47	64	8	935
<u>Division IIb</u>										
1986	10	68	125	42	19	5	12	-	-	281
1987	13	98	329	413	87	33	2	+	-	971
1988	+	16	22	24	50	18	6	+	+	138
1989	+	+	3	6	7	11	2	+	+	28
1990	5	+	1	1	1	1	4	1	+	15
1991	43	27	14	5	9	12	10	19	3	142
<u>Total</u>										
1986	52	164	415	141	64	17	13	-	-	868
1987	15	147	371	715	177	59	5	+	-	1,487
1988	5	20	45	38	93	33	15	+	+	252
1989	4	6	15	25	26	78	13	3	+	170
1990	50	17	29	19	25	21	42	7	+	211
1991	355	226	156	85	45	59	57	83	11	1,077

¹Northern part.

Table 3.13 Input data for RCT3 analysis for Northeast Arctic cod.

NORTHEAST ARCTIC COD : recruits as 3 year-olds (inc. data for ages 0,1,2 & 3)																		
16,35,2	(No. of surveys, No. of years, VPA Column No.)																	
1957,	791,	-11,	-11,	-11,	-11,	12,	16,	-11,	-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,	-11
1959,	730,	-11,	-11,	-11,	-11,	18,	14,	-11,	-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,	-11
1961,	339,	-11,	-11,	-11,	-11,	2,	2,	-11,	-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,	-11
1963,	1583,	-11,	-11,	-11,	-11,	21,	120,	-11,	-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,	-11
1965,	170,	-11,	-11,	-11,	-11,	1,	1,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11
1966,	112,	-11,	-11,	-11,	-11,	2,	1,	0.02,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11
1967,	197,	-11,	-11,	-11,	-11,	1,	1,	0.04,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11
1968,	405,	-11,	-11,	-11,	-11,	7,	1,	0.02,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11
1969,	1016,	-11,	-11,	-11,	-11,	11,	6,	0.25,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11
1970,	1818,	23,	64,	60,	42,	70,	85,	2.51,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11
1971,	525,	7,	9,	6,	3,	37,	24,	0.77,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11
1972,	622,	5,	4,	34,	15,	54,	17,	0.52,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11
1973,	614,	16,	5,	15,	2,	70,	5,	1.48,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11
1974,	348,	1,	1,	4,	1,	6,	1,	0.29,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	104
1975,	639,	60,	1,	44,	1,	93,	4,	0.90,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	882,	797
1976,	199,	1,	1,	1,	1,	4,	1,	0.13,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	45,	235,	109
1977,	140,	1,	1,	2,	1,	2,	1,	0.49,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	28,	14,	-11
1978,	158,	1,	2,	1,	1,	1,	3,	0.22,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	16,	-11,	58
1979,	158,	1,	1,	1,	1,	1,	8,	0.40,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	73,	71
1980,	169,	1,	1,	1,	1,	1,	8,	0.13,	-11,	-11,	23.2,	-11,	-11,	10.7,	3,	4,	17	
1981,	386,	1,	1,	1,	1,	4,	4,	0.10,	-11,	17.7,	122.0,	-11,	26.8,	7.3,	1,	15,	174	
1982,	508,	1,	8,	8,	13,	8,	10,	0.59,	259.0,	366.0,	162.0,	145.0,	113.0,	99.1,	-11,	506,	550	
1983,	894,	4,	9,	11,	7,	45,	41,	1.69,	2170.0,	647.0,	679.0,	499.0,	452.0,	297.0,	2382,	878,	1246	
1984,	282,	1,	1,	2,	8,	7,	15,	1.55,	39.0,	403.0,	233.0,	239.0,	181.0,	141.0,	69,	578,	126	
1985,	230,	3,	10,	2,	3,	4,	6,	2.46,	562.0,	387.0,	180.0,	40.9,	108.0,	33.2,	625,	47,	79	
1986,	216,	1,	2,	1,	1,	2,	5,	1.37,	25.3,	63.5,	37.9,	41.5,	16.6,	15.4,	1,	23,	31	
1987,	-11,	1,	1,	1,	1,	1,	1,	0.17,	3.8,	12.7,	25.8,	3.1,	2.7,	8.2,	1,	9,	32	
1988,	-11,	1,	1,	1,	1,	7,	1,	0.33,	7.1,	48.9,	37.0,	3.6,	8.3,	28.8,	-11,	58,	145	
1989,	-11,	1,	1,	4,	1,	7,	10,	0.38,	122.0,	212.7,	170.4,	61.5,	100.9,	-11,	145,	484,	490	
1990,	-11,	6,	1,	4,	4,	-11,	-11,	1.23,	356.7,	482.2,	-11,	131.6,	-11,	-11,	277,	1004,	-11	
1991,	-11,	3,	6,	-11,	-11,	-11,	-11,	2.30,	99.7,	-11,	-11,	-11,	-11,	-11,	250,	-11,	-11	
R-1-1	USSR Bottom trawl index, area I, age 1																	
R-2B-1	USSR " " " " I Ib, age 1																	
R-1-2	USSR " " " " I, age 2																	
R-2B-2	USSR " " " " I Ib, age 2																	
R-1-3	USSR " " " " I, age 3																	
R-2B-3	USSR " " " " I Ib, 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 3.14

Analysis by RCT3 ver3.1 of data from file :

rcrt-dat.rci

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

Data for 16 surveys over 35 years : 1957 - 1991

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 = 1987

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	1.15	4.40	.87	.365	17	.69	5.20	1.002	.030
R-2B-1	1.41	3.92	.94	.331	17	.69	4.90	1.093	.025
R-1-2	.75	4.63	.44	.695	17	.69	5.15	.510	.114
R-2B-2	1.26	4.14	.83	.389	17	.69	5.01	.961	.032
R-1-3	.56	4.62	.33	.805	30	.69	5.01	.387	.198
R-2B-3	1.19	3.33	.90	.352	30	.69	4.16	1.114	.024
INTOGP	4.63	3.13	1.81	.119	21	.16	3.86	2.144	.006
N-BST1	.45	3.49	.67	.523	5	1.57	4.20	1.294	.018
N-BST2	1.19	-.36	1.73	.110	6	2.62	2.76	2.947	.003
N-BST3	.63	2.73	.45	.663	7	3.29	4.81	.652	.070
N-SVT1	.67	2.68	.46	.695	5	1.41	3.62	1.151	.022
N-SVT2	.72	2.69	.75	.396	6	1.31	3.63	1.485	.013
N-SVT3	.62	3.48	.68	.461	7	2.22	4.85	.946	.033
N-BSA1	.44	4.02	1.05	.265	9	.69	4.32	1.371	.016
N-BSA2	.47	3.55	.68	.476	11	2.30	4.64	.853	.041
N-BSA3	.49	3.33	.26	.844	12	3.50	5.03	.325	.281
VPA Mean =						5.72	.633	.074	

Yearclass = 1988

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	1.26	4.32	.93	.330	17	.69	5.20	1.079	.024
R-2B-1	1.47	3.84	.98	.306	17	.69	4.86	1.157	.021
R-1-2	.78	4.61	.44	.681	17	.69	5.15	.525	.103
R-2B-2	1.27	4.10	.83	.379	17	.69	4.98	.981	.029
R-1-3	.56	4.63	.31	.811	30	2.08	5.79	.363	.214
R-2B-3	1.18	3.31	.88	.355	30	.69	4.13	1.113	.023
INTOGP	4.68	3.04	1.87	.108	21	.29	4.37	2.206	.006
N-BST1	.45	3.49	.67	.521	5	2.09	4.44	1.226	.019
N-BST2	1.19	-.37	1.73	.111	6	3.91	4.29	2.500	.005
N-BST3	.63	2.71	.45	.659	7	3.64	5.02	.633	.070
N-SVT1	.66	2.69	.46	.695	5	1.53	3.70	1.133	.022
N-SVT2	.71	2.69	.75	.398	6	2.23	4.28	1.278	.017
N-SVT3	.62	3.48	.68	.462	7	3.39	5.57	.878	.037
N-BSA1									
N-BSA2	.47	3.56	.68	.475	11	4.08	5.48	.810	.043
N-BSA3	.48	3.35	.26	.847	12	4.98	5.75	.310	.293
VPA Mean =						5.69	.618	.074	

Table 3.14 Continued

Yearclass = 1989

I-----Regression-----I					I-----Prediction-----I				
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
R-1-1	1.40	4.21	.99	.295	17	.69	5.19	1.176	.020
R-2B-1	1.50	3.78	1.01	.289	17	.69	4.82	1.216	.019
R-1-2	.81	4.59	.45	.672	17	1.61	5.90	.529	.100
R-2B-2	1.26	4.09	.83	.377	17	.69	4.96	.993	.028
R-1-3	.57	4.62	.31	.816	30	2.08	5.81	.359	.217
R-2B-3	1.16	3.31	.85	.365	30	2.40	6.10	1.002	.028
INTOGP	4.79	2.90	1.97	.096	21	.32	4.45	2.356	.005
N-BST1	.45	3.49	.68	.519	5	4.81	5.67	.980	.029
N-BST2	1.19	-.39	1.73	.113	6	5.36	6.02	2.326	.005
N-BST3	.64	2.69	.46	.655	7	5.14	5.97	.597	.078
N-SVT1	.66	2.70	.47	.695	5	4.14	5.44	.697	.058
N-SVT2	.71	2.69	.75	.400	6	4.62	5.99	1.016	.027
N-SVT3									
N-BSA1	.42	4.09	1.04	.275	9	4.98	6.19	1.330	.016
N-BSA2	.47	3.58	.68	.474	11	6.18	6.48	.859	.038
N-BSA3	.48	3.37	.26	.851	12	6.20	6.34	.330	.257
VPA Mean =						5.68		.607	.076

Yearclass = 1990

I-----Regression-----I					I-----Prediction-----I				
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
R-1-1	1.60	4.06	1.07	.265	17	1.95	7.17	1.390	.038
R-2B-1	1.50	3.75	1.03	.282	17	.69	4.79	1.264	.046
R-1-2	.85	4.57	.45	.671	17	1.61	5.94	.541	.252
R-2B-2	1.24	4.09	.81	.386	17	1.61	6.08	.977	.077
R-1-3									
R-2B-3									
INTOGP	4.98	2.71	2.12	.084	21	.80	6.70	2.562	.011
N-BST1	.45	3.49	.69	.516	5	5.88	6.16	1.010	.073
N-BST2	1.20	-.41	1.73	.115	6	6.18	6.98	2.447	.012
N-BST3									
N-SVT1	.66	2.71	.47	.696	5	4.89	5.93	.682	.159
N-SVT2									
N-SVT3									
N-BSA1	.41	4.13	1.04	.280	9	5.63	6.44	1.383	.039
N-BSA2	.47	3.59	.69	.473	11	6.91	6.82	.922	.087
N-BSA3									
VPA Mean =						5.67		.601	.205

Yearclass = 1991

I-----Regression-----I					I-----Prediction-----I				
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
R-1-1	1.84	3.88	1.14	.244	17	1.39	6.43	1.427	.092
R-2B-1	1.46	3.76	1.03	.284	17	1.95	6.61	1.309	.109
R-1-2									
R-2B-2									
R-1-3									
R-2B-3									
INTOGP	5.25	2.43	2.31	.073	21	1.19	8.70	3.137	.019
N-BST1	.45	3.48	.70	.512	5	4.61	5.58	1.050	.169
N-BST2									
N-BST3									
N-SVT1									
N-SVT2									
N-SVT3									
N-BSA1	.40	4.18	1.05	.287	9	5.53	6.38	1.415	.093
N-BSA2									
N-BSA3									
VPA Mean =						5.67		.600	.518

Table 3.14 Continued

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1962	509	6.23	.23	.14	.35	778	6.66
1963	870	6.77	.28	.31	1.24	1584	7.37
1964	1235	7.12	.31	.37	1.38	1294	7.17
1965	359	5.88	.31	.43	1.94	170	5.14
1966	284	5.65	.32	.30	.91	113	4.73
1967	187	5.24	.40	.39	.94	198	5.29
1968	324	5.78	.36	.36	1.04	406	6.01
1969	548	6.31	.35	.17	.24	1017	6.92
1970	2232	7.71	.42	.60	2.03	1818	7.51
1971	1222	7.11	.37	.24	.44	526	6.27
1972	1011	6.92	.40	.34	.69	622	6.43
1973	797	6.68	.31	.27	.76	615	6.42
1974	287	5.66	.30	.14	.21	349	5.86
1975	553	6.32	.22	.28	1.63	640	6.46
1976	288	5.66	.26	.15	.33	200	5.30
1977	260	5.56	.26	.14	.28	141	4.95
1978	212	5.36	.27	.16	.35	159	5.07
1979	205	5.33	.24	.16	.44	159	5.07
1980	144	4.98	.23	.18	.61	170	5.14
1981	197	5.29	.21	.12	.31	386	5.96
1982	471	6.16	.23	.19	.65	509	6.23
1983	840	6.73	.17	.18	1.04	894	6.80
1984	485	6.19	.12	.12	.94	282	5.65
1985	423	6.05	.13	.14	1.08	230	5.44
1986	166	5.12	.18	.09	.25	216	5.38
1987	139	4.94	.17	.10	.37		
1988	226	5.42	.17	.13	.60		
1989	370	5.91	.17	.10	.36		
1990	412	6.02	.27	.15	.31		
1991	383	5.95	.43	.24	.31		

Table 3.15 North-East Arctic COD. Length at age (cm) from Norwegian surveys in January-March.

Year	1	2	3	4	5	6	7	8	9	10
1978	14.2	24.0	32.1	45.7	54.2	64.6	67.6	76.9	-	-
1979	12.8	22.9	33.1	42.0	53.3	64.4	74.7	83.0	-	-
1980	17.6	24.8	34.2	42.5	52.5	63.5	73.6	83.6	-	-
1981	17.0	26.1	35.5	44.7	52.0	61.3	69.6	77.9	-	-
1982	14.8	25.8	37.6	46.3	54.7	63.1	70.8	82.9	-	-
1983	-	26.1	34.8	46.8	56.0	64.5	73.3	80.4	-	-
1984	13.8	26.2	35.8	49.2	57.9	67.4	79.6	82.2	-	-
1985	14.5	23.5	40.3	50.8	62.2	71.1	81.8	88.7	-	-
1986	13.3	22.6	34.4	50.4	60.0	70.2	82.3	95.2	-	-
1987	14.5	21.0	31.8	41.1	55.7	67.2	81.8	94.5	-	-
1988	14.7	22.5	29.7	37.0	46.4	58.0	70.1	81.1	-	-
1989	12.7	25.7	34.7	40.6	47.5	57.1	68.5	84.0	-	-
1990	14.3	29.0	39.4	47.4	59.9	60.9	70.9	87.5	-	-
1991	13.8	27.6	41.6	52.6	60.2	68.2	73.8	79.0	94.2	-
1992	13.4	24.7	41.3	50.7	59.9	69.2	77.0	82.7	85.3	106.8

Table 3.16 North-East Arctic COD. Length at age (cm) from Russian surveys in November-December.

Year	Age									
	0	1	2	3	4	5	6	7	8	9
1984	15.7	22.3	30.7	44.3	51.7	63.6	73.4	82.5	88.4	97.0
1985	15.0	21.1	30.6	43.2	53.7	61.2	72.8	83.0	92.8	101.3
1986	15.2	19.7	28.3	39.0	51.8	62.2	70.9	83.0	91.3	104.0
1987	-	19.2	27.9	33.4	41.4	59.1	69.2	80.1	95.7	102.6
1988	11.3	21.3	28.7	36.2	43.9	53.3	65.3	79.5	85.0	-
1989	-	20.8	28.8	34.8	46.0	53.9	61.8	69.8	78.7	88.6
1990	14.7	23.9	29.7	36.6	45.9	55.8	65.0	72.6	81.3	-
1991	11.5	21.9	29.5	39.2	52.1	62.8	71.7	79.4	88.9	99.5

Table 3.17 North-East Arctic COD. Weight (g) at age from Norwegian surveys in January-March.

Year	Age									
	1	2	3	4	5	6	7	8	9	10
1985	-	-	670	1,070	2,230	3,650	4,920	5,060	-	-
1986	-	-	390	1,090	1,850	3,110	4,320	5,509	-	-
1987	21	65	230	490	1,380	2,300	3,970	-	-	-
1988	20	80	203	410	793	1,473	2,706	4,613	-	-
1989	10	150	380	590	930	1,570	2,640	4,940	-	-
1990	28	229	570	1,030	1,460	1,930	2,890	4,370	-	-
1991	20	190	720	1,370	2,040	2,850	3,660	4,630	8,380	-
1992	20	130	640	1,120	1,850	2,830	3,980	4,990	6,040	11,200

Table 3.18 North-East Arctic COD. Weight (g) at age from USSR surveys in November-December.

Year	Age									
	0	1	2	3	4	5	6	7	8	9
1984	26	90	250	746	1,187	2,234	3,422	5,027	6,479	9,503
1985	26	80	245	762	1,296	1,924	3,346	5,094	7,360	6,833
1986	25	63	191	506	1,117	1,940	2,949	4,942	7,406	9,300
1987	-	54	182	316	672	1,691	2,688	3,959	8,353	10,583
1988	15	78	223	435	789	1,373	2,609	4,465	5,816	-
1989	-	73	216	401	928	1,427	2,200	3,133	4,649	6,801
1990	27	109	216	468	905	1,512	2,402	3,577	5,021	-
1991	26	87	241	557	1,320	2,351	3,588	5,040	7,452	10,507

Table 3.19 North-East Arctic COD. Input data to the assessment and prediction. Weight (kg) at age in the stock at 1 January.

Year	Age												
	3	4	5	6	7	8	9	10	11	12	13	14	15+
1982	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	0.36	1.01	1.63	2.35	3.45	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1984	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	0.46	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	0.32	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	0.21	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	0.19	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	0.30	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	0.40	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	0.47	0.92	1.47	2.18	3.03	4.10	6.70	7.70	9.25	10.85	12.50	13.90	15.00
1992	0.44	0.83	1.59	2.59	3.78	5.02	6.75	10.85	9.25	10.85	12.50	13.90	15.00

Table 3.20 North-East Arctic COD. Input data to the assessment and prediction. Weight (kg) at age in the catch.

Year	Age												
	3	4	5	6	7	8	9	10	11	12	13	14	15+
1982	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	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	1.04	1.68	2.52	3.20	3.97	4.70	6.17	7.70	9.25	10.85	12.50	13.90	15.00
1985	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	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	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	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	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	1.37	1.42	1.67	2.33	3.34	4.78	7.52	9.98	13.24	16.94	12.50	13.90	15.00
1991	0.99	1.54	2.17	2.88	3.76	4.91	6.57	9.33	11.65	16.69	18.50	13.90	15.00
1992 ¹	0.79	1.44	2.12	2.90	3.93	4.85	6.00	8.98	14.08	15.71	16.63	12.00	15.00

¹Arithmetic mean of Norwegian and Russian weights for the period January-June.

Table 3.21 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
<u>Norway</u>								
1982	-	5	10	34	65	82	92	100
1983	5	8	10	30	73	88	97	100
<u>Russia</u>								
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

Table 3.22

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

FLT28: Norwegian Svalbard Bottom Trawl Survey (Catch: Number)

Year	Effort	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8
1983	1	10.7	9.5	2.4	1.9	1.0	1.3
1984	1	7.3	4.3	4.7	1.8	0.4	0.4
1985	1	99.1	28.4	13.6	5.4	1.0	0.4
1986	1	297.0	42.8	15.3	2.6	1.0	0.3
1987	1	141.0	125.0	17.1	5.4	0.5	0.1
1988	1	33.2	31.8	37.1	9.5	0.6	0.6
1989	1	15.4	12.8	11.9	19.2	3.2	0.4
1990	1	8.2	14.6	24.3	17.8	21.7	2.8
1991	1	28.8	8.7	13.8	15.5	14.4	21.7

FLT29: Russian Trawl/Acoustic survey (Catch: Number)

Year	Effort	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8
1982	1	14.1	5.1	1.3	3.6	0.7	0.2
1983	1	5.6	7.3	4.7	2.0	0.8	1.1
1984	1	16.2	8.6	5.0	3.1	1.1	0.4
1985	1	30.3	40.5	18.8	4.9	1.9	0.6
1986	1	56.5	16.1	10.6	3.0	0.8	0.3
1987	1	5.9	42.6	5.4	3.1	0.6	0.1
1988	1	7.7	7.8	19.0	2.5	0.6	0.1
1989	1	3.4	8.8	11.8	15.5	11.4	2.6
1990	1	1.5	4.0	5.6	10.5	11.2	4.6
1991	1	12.7	5.0	6.1	7.5	8.9	6.0

FLT30: Russian acoustic survey (Catch: Number)

Year	Effort	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8
1985	1	422.0	255.0	83.0	44.0	50.0	21.0
1986	1	980.0	444.0	183.0	56.0	62.0	19.0
1987	1	170.0	738.0	99.0	67.0	42.0	20.0
1988	1	161.0	106.0	245.0	34.0	10.0	2.0
1989	1	17.0	44.0	56.0	99.0	82.0	20.0
1990	1	10.0	25.0	33.0	65.0	87.0	42.0
1991	1	101.0	43.0	50.0	58.0	70.0	51.0

FLT35: Norwegian Barents Sea acoustic survey shifted (Catch: Number)

Year	Effort	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8
1980	1	124.0	243.0	270.0	41.0	8.0	3.0
1981	1	86.0	93.0	73.0	74.0	5.0	1.0
1982	1	45.0	65.0	38.0	17.0	10.0	2.0
1983	1	80.0	63.0	46.0	16.0	1.0	0.5
1984	1	510.0	109.0	48.0	20.0	2.0	1.0
1985	1	424.0	225.0	27.0	9.0	0.1	0.1
1986	1	500.0	128.0	37.0	4.0	3.0	0.1
1987	1	74.0	179.0	26.0	6.0	0.5	0.5
1988	1	77.0	56.0	145.0	21.0	3.0	0.5
1989	1	61.0	81.0	73.0	138.0	10.0	2.0
1990	1	108.0	109.0	101.0	55.0	58.0	4.0
1991	1	205.0	67.0	46.0	28.0	15.0	11.0

FLT36: Norwegian Barents Sea trawl survey (shifted) (Catch: Number)

Year	Effort	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8
1982	1	45.4	44.1	18.9	6.0	3.9	0.8
1983	1	32.7	25.4	14.4	4.2	0.6	0.3
1984	1	126.0	21.7	8.4	3.3	0.3	0.1
1985	1	173.0	102.0	30.6	7.3	0.8	0.2
1986	1	415.0	61.1	15.4	1.8	0.5	0.1
1987	1	102.0	231.0	25.7	4.8	0.8	0.1
1988	1	73.2	43.3	104.0	11.7	1.0	0.2
1989	1	37.0	43.8	27.0	31.4	1.7	0.5
1990	1	24.6	23.9	21.7	12.2	12.7	0.7
1991	1	62.7	25.0	15.7	9.9	5.2	3.5

Table 3.23

VPA Version 3.0 (MSDOS) - Jan 1991

Cod in the North-East Arctic (Fishing Areas I and II) (run n
with cpue data from file J:\IFAPWORK\WG_108\COD_ARCT\FLEET.B22

Disaggregated Qs

Log transformation

The final F is the (reciprocal variance-weighted) mean of the raised fleet F's.

No trend in Q (mean used)

Terminal Fs estimated using Laurec-Shepherd method

Regression weights

, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000

Oldest age F = 1.000*average of 4 younger ages.

Fishing mortalities

Age,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3,	.031,	.024,	.064,	.020,	.020,	.041,	.018,	.013,	.014,	.021,	.007,	.014
4,	.129,	.098,	.201,	.196,	.122,	.144,	.158,	.144,	.061,	.089,	.025,	.055
5,	.355,	.229,	.297,	.309,	.292,	.360,	.465,	.450,	.316,	.107,	.047,	.091
6,	.624,	.514,	.549,	.484,	.577,	.589,	.770,	.900,	.550,	.307,	.077,	.108
7,	.674,	.852,	.793,	.775,	1.073,	1.000,	1.015,	1.063,	.937,	.438,	.156,	.107
8,	.703,	1.068,	.998,	1.008,	1.199,	1.105,	1.226,	1.010,	.951,	.585,	.213,	.178
9,	.869,	1.233,	1.125,	1.006,	1.204,	1.039,	.941,	1.067,	1.045,	.740,	.195,	.154
10,	1.089,	.996,	.687,	.851,	1.009,	.701,	1.064,	1.433,	1.300,	.925,	.292,	.101
11,	1.315,	1.092,	.569,	.497,	.823,	.611,	.757,	.873,	.929,	.641,	.338,	.070
12,	.848,	.775,	1.243,	.297,	.742,	.541,	1.482,	1.212,	1.292,	.256,	.445,	.073
13,	1.661,	1.416,	.440,	1.117,	.384,	.595,	.564,	.855,	1.002,	.056,	.252,	.047
14,	1.228,	1.070,	.735,	.690,	.739,	.612,	.967,	1.093,	1.131,	.470,	.332,	.073

Fleet 1 Norwegian Svalbard Bottom Trawl Survey

Fleet 2 Russian Trawl/Acoustic Survey

Fleet 3 Russian Acoustic Survey

Fleet 4 Norwegian Barents Sea Acoustic Survey

Fleet 5 Norwegian Barents Sea Bottom Trawl Survey

Log catchability residuals

Fleet 1

Age,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3,				.43,	1.65,	-.66,	-1.09,	-1.08,	-.07,	.28,	.54,	.00
4,				-.06,	.88,	-.19,	-.31,	-.70,	-.02,	.44,	-.09,	.05
5,				.85,	.15,	-.76,	-.11,	.07,	.04,	.63,	-.52,	-.34
6,				.44,	.47,	-.65,	.12,	.04,	-.08,	.15,	-.11,	-.38
7,				.21,	.70,	-.27,	-.30,	.31,	.75,	-.06,	-.78,	-.56
8,				.09,	.31,	-.26,	-.03,	1.11,	-.76,	.50,	-.13,	-.82

Fleet 2

Age,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3,			-1.08,	-.06,	-.29,	-.61,	-.58,	.95,	.25,	.64,	1.09,	-.32
4,			.04,	-.35,	-.36,	-1.09,	.12,	-.17,	.83,	.27,	.65,	.06
5,			.96,	-.31,	-.40,	-1.57,	-.23,	.73,	.22,	.15,	.46,	-.01
6,			-.14,	.11,	-.36,	-.84,	-.31,	.31,	.97,	.07,	.14,	.06
7,			1.46,	.44,	-.30,	-.91,	-.08,	.13,	.76,	-1.33,	-.12,	-.07
8,			1.02,	.09,	.14,	-.83,	-.19,	.95,	.86,	-1.54,	-.80,	.30

Fleet 3

Age,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3,						-.96,	-1.14,	-.12,	-.50,	1.32,	1.49,	-.10
4,						-.71,	-.98,	-.81,	.45,	.88,	1.04,	.12
5,						-.84,	-.87,	.03,	-.13,	.80,	.90,	.09
6,						-.73,	-.93,	-.46,	.66,	.52,	.62,	.32
7,						-.98,	-1.23,	-.92,	1.14,	-.10,	1.03,	1.06
8,						-1.01,	-.97,	-.97,	1.24,	-.20,	.37,	1.54

Table 3.23 Continued

Fleet 4

Age, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991

3	-.60	-.11	.52	.04	-.98	-.49	.00	1.18	.71	.51	-.43	-.35
4	-1.16	-.51	-.08	-.08	-.48	-.38	.47	.81	1.29	.47	-.23	-.12
5	-.97	-.60	-.27	-.45	-.52	.21	.66	1.30	.33	.47	-.29	.11
6	-.77	-.70	-.11	-.39	-.65	.13	.98	1.23	.42	-.53	.06	.32
7	-1.00	-.55	-.51	.90	-.22	2.73	-.71	1.00	-.16	-.51	-1.07	.10
8	-1.05	-.08	-.87	1.28	-.37	1.37	1.31	-.25	-.34	-.87	-.25	.10

Fleet 5

Age, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991

3			-.19	.23	-.28	-.29	-.51	.16	.06	.32	.36	.14
4			-.61	-.10	.21	-.51	.29	-.37	.62	.16	.37	-.05
5			-.56	-.28	.24	-.90	.55	.33	-.32	.48	.26	.20
6			-.22	-.20	.01	-.81	.63	.31	-.14	-.20	.42	.21
7			-.53	.45	.72	-.31	.12	-.43	-.02	.31	-.51	.20
8			-1.05	.70	.84	-.42	.22	.26	-.52	-.58	.40	.15

SUMMARY STATISTICS FOR AGE 3

Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-9.13	.917	.0001	.0138	.000E+00	.000E+00	-9.132	.290
2	-10.27	.753	.0000	.0100	.000E+00	.000E+00	-10.274	.227
3	-7.98	1.108	.0003	.0124	.000E+00	.000E+00	-7.983	.392
4	-7.52	.652	.0005	.0098	.000E+00	.000E+00	-7.516	.181
5	-8.21	.311	.0003	.0159	.000E+00	.000E+00	-8.213	.094
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
.014		.247		.102		.247		.170

SUMMARY STATISTICS FOR AGE 4

Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-9.33	.472	.0001	.0575	.000E+00	.000E+00	-9.328	.149
2	-9.88	.573	.0001	.0577	.000E+00	.000E+00	-9.877	.173
3	-7.66	.892	.0005	.0618	.000E+00	.000E+00	-7.657	.315
4	-7.45	.688	.0006	.0486	.000E+00	.000E+00	-7.455	.191
5	-8.38	.422	.0002	.0517	.000E+00	.000E+00	-8.378	.127
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
.055		.246		.361E-01		.246		.022

SUMMARY STATISTICS FOR AGE 5

Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-9.38	.541	.0001	.0648	.000E+00	.000E+00	-9.379	.171
2	-9.87	.742	.0001	.0901	.000E+00	.000E+00	-9.866	.224
3	-7.65	.748	.0005	.1004	.000E+00	.000E+00	-7.655	.265
4	-7.72	.663	.0004	.1020	.000E+00	.000E+00	-7.722	.184
5	-8.71	.508	.0002	.1113	.000E+00	.000E+00	-8.709	.153
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
.091		.276		.106		.276		.149

SUMMARY STATISTICS FOR AGE 6

Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-9.42	.381	.0001	.0736	.000E+00	.000E+00	-9.417	.120
2	-9.70	.499	.0001	.1143	.000E+00	.000E+00	-9.703	.150
3	-7.40	.732	.0006	.1481	.000E+00	.000E+00	-7.399	.259
4	-8.12	.683	.0003	.1488	.000E+00	.000E+00	-8.122	.189
5	-9.27	.431	.0001	.1334	.000E+00	.000E+00	-9.272	.130
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
.108		.222		.143		.222		.418

Table 3.23 Continued

SUMMARY STATISTICS FOR AGE 7									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	-9.79	.564	.0001	.0611	.000E+00	.000E+00	-9.787	.178	
2	-9.78	.829	.0001	.0995	.000E+00	.000E+00	-9.781	.250	
3	-6.59	1.141	.0014	.3087	.000E+00	.000E+00	-6.586	.403	
4	-9.09	1.123	.0001	.1174	.000E+00	.000E+00	-9.094	.311	
5	-10.05	.455	.0000	.1297	.000E+00	.000E+00	-10.054	.137	
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio	
.107		.302		.216		.302		.510	

SUMMARY STATISTICS FOR AGE 8									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	-9.46	.638	.0001	.0784	.000E+00	.000E+00	-9.460	.202	
2	-9.63	.893	.0001	.2402	.000E+00	.000E+00	-9.625	.269	
3	-6.25	1.153	.0019	.8276	.000E+00	.000E+00	-6.248	.408	
4	-9.22	.902	.0001	.1973	.000E+00	.000E+00	-9.216	.250	
5	-10.31	.642	.0000	.2071	.000E+00	.000E+00	-10.313	.194	
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio	
.178		.351		.333		.351		.903	

Table 3.24

Title : Cod in the North-East Arctic (Fishing Areas I and II) (run n

Separable analysis

from 1982 to 1991 on ages 3 to 14

with Terminal F of .240 on age 8 and Terminal S of 1.000

Initial sum of squared residuals was 110.085 and

final sum of squared residuals is 31.980 after 93 iterations

Matrix of Residuals

Years	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91		WTS
Ages											
3/ 4	.582	.069	-.297	.499	-.277	-.004	-.621	.664	-.616	.000	.351
4/ 5	.373	.604	-.280	-.149	-.102	-.073	-.301	.609	-.681	.000	.396
5/ 6	.000	.121	-.163	.040	.153	.295	.094	-.029	-.511	.000	.755
6/ 7	-.056	-.218	-.168	-.011	.205	.350	.019	.127	-.249	.000	.866
7/ 8	-.184	-.104	.201	.171	.145	.082	.077	-.099	-.289	.000	1.000
8/ 9	-.083	.050	.165	.230	.158	-.337	-.331	.136	.012	.000	.823
9/10	.200	.128	.406	.035	-.457	-.391	-.344	.102	.320	.000	.544
10/11	-.355	-.181	.026	-.518	-.158	.136	.068	.080	.902	.000	.432
11/12	.204	-.476	.196	-.709	-.474	-.472	.669	-.303	1.364	.000	.257
12/13	-.071	-1.054	-.496	-.721	.394	-.270	2.121	-1.499	1.596	.000	.146
13/14	-.311	1.165	-.414	-.033	-.315	.089	.782	-2.371	1.409	.000	.156
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	

WTS 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000

Fishing Mortalities (F)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
F-values	1.0410	.9560	1.1028	1.0536	1.1954	1.2867	1.1632	.7188	.3058	.2400

Selection-at-age (S)

	3	4	5	6	7	8	9	10	11	12	13	14
S-values	.0234	.1311										
S-values	.3052	.5617	.8437	1.0000	1.0256	1.0673	.8754	.9809	.6330	1.0000		

Table 3.25

Run title : Cod in the North-East Arctic (Fishing Areas I and II) (run n
Traditional vpa using file input for terminal F

Table 1	Catch numbers at age			Numbers*10**3						
YEAR	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
AGE										
3	42416	13196	5298	15725	55937	34467	3709	2307	7164	7754
4	170566	106984	45912	25999	55644	160048	174585	24545	10792	13739
5	167241	205549	97950	78299	34676	69235	267961	238511	25813	11831
6	89460	95498	58575	68511	42539	22061	107051	181239	137829	9527
7	28297	35518	19642	25444	37169	26295	26701	79363	96420	59290
8	21996	16221	9162	8438	18500	25139	16399	26989	31920	52003
9	7956	11894	6196	3569	5077	11323	11597	13463	8933	12093
10	2728	3884	3553	1467	1495	2329	3657	5092	3249	2434
11	2603	1021	783	1161	380	687	657	1913	1232	762
12	1647	1025	172	131	403	316	122	414	260	418
13	392	498	387	67	77	225	124	121	106	149
14	280	129	264	91	9	40	70	23	39	42
+gp	103	157	131	179	70	14	46	46	35	25
TOTALNUM	535685	491574	248025	229081	251976	352179	612679	574026	323792	170067
TONSLAND	909266	776337	437695	444930	483711	572605	1074084	1197226	933246	689048
SOPCOF %	92	78	82	90	94	88	96	87	97	112

Table 1	Catch numbers at age			Numbers*10**3						
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
3	35536	294262	91855	45282	85337	39594	78822	8600	3911	3407
4	45431	131493	437377	59798	114341	168609	45400	77484	17086	9466
5	26832	61000	203772	226646	79993	136335	88495	43677	81986	20803
6	12089	20569	47006	118567	118236	52925	56823	31943	40061	63433
7	7918	7248	12630	29522	47872	61821	25407	16815	17664	21788
8	34885	8328	4370	9353	13962	23338	31821	8274	7442	9933
9	22315	19130	2523	2617	4051	5659	9408	10974	3508	4267
10	4572	4499	5607	1555	936	1521	1227	1785	3196	1311
11	1215	677	2127	1928	558	610	913	427	678	882
12	353	195	322	575	442	271	446	103	79	109
13	315	81	151	231	139	122	748	59	24	37
14	121	59	83	15	26	92	48	38	26	3
+gp	40	55	62	37	53	54	51	45	8	1
TOTALNUM	191622	547596	807885	496126	465946	490951	339609	200224	175669	135440
TONSLAND	565254	792685	1102433	829377	867463	905301	698715	440538	380434	399038
SOPCOF %	108	114	103	90	102	99	100	107	97	110

Table 1	Catch numbers at age			Numbers*10**3						
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
3	8948	3108	7027	19282	16942	5570	3988	3874	859	3679
4	20933	19594	14165	38322	55859	100391	21234	19833	3788	5623
5	19345	20473	18839	27216	75486	97318	144215	28126	7970	10589
6	28084	17656	20350	20342	27772	62371	59397	83802	15250	14036
7	42496	17004	15415	13588	13337	12901	21302	23501	27552	15673
8	8395	18329	8359	4385	4587	3942	3415	4943	6677	21832
9	2878	2545	6054	1904	1082	1021	1200	917	898	3291
10	708	646	764	1062	559	435	320	321	172	327
11	271	229	221	163	455	140	67	46	49	28
12	260	74	153	59	124	233	60	8	15	7
13	27	53	56	51	29	17	51	1	5	1
14	5	20	12	45	32	21	7	9	4	1
+gp	5	5	12	38	1	8	15	7	2	1
TOTALNUM	132355	99741	91427	126457	196265	284368	255271	165388	63241	75088
TONSLAND	363730	289992	277651	307920	430113	523071	434939	332481	187000	257882
SOPCOF %	108	98	95	99	94	97	96	103	99	97

Table 3.20

Run title : Cod in the North-East Arctic (Fishing Areas I and II) (run n
Traditional vpa using file input for terminal F

Table 8	Fishing mortality (F) at age									
YEAR	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
AGE										
3	.0661	.0312	.0174	.0225	.0398	.0298	.0244	.0229	.0409	.0213
4	.3053	.2358	.1445	.1108	.1035	.1525	.2068	.2220	.1420	.1028
5	.6481	.7376	.3521	.3892	.2114	.1810	.4088	.4807	.3834	.2281
6	.8234	1.0008	.4802	.4463	.3795	.2021	.4668	.5384	.5709	.2372
7	.6059	.9636	.5713	.3967	.4662	.4280	.4004	.7680	.6216	.5189
8	.6510	.8692	.7190	.5186	.5643	.6713	.5213	.9234	.8369	.8343
9	.8021	.9245	1.0341	.6949	.6894	.8309	.7727	1.1377	.9501	.9287
10	.9700	1.3014	.8115	.7477	.7200	.8097	.7174	.9758	.9842	.7539
11	.7994	1.3635	1.0810	.6939	.4364	.8920	.5647	1.0972	.6752	.6587
12	.8101	.8867	.9234	.5135	.5543	.8040	.3783	.8705	.4080	.5120
13	.6734	.6206	1.0679	1.2668	.6553	.7011	.8935	.8054	.5730	.4346
14	.5000	.4900	.8100	.8000	.5500	.8800	.4900	.4000	.6700	.4700
+gp	.5000	.4900	.8100	.8000	.5500	.8800	.4900	.4000	.6700	.4700
FBAR 5-10	.7501	.9662	.6614	.5322	.5051	.5205	.5479	.8040	.7245	.5835

Table 8	Fishing mortality (F) at age									
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
3	.0393	.1960	.2138	.0836	.1659	.1339	.1458	.0488	.0312	.0241
4	.1673	.1995	.4961	.2102	.3120	.5669	.2237	.2086	.1293	.0983
5	.2977	.3533	.5373	.5215	.4790	.7537	.6697	.3480	.3553	.2294
6	.3841	.3919	.5073	.7017	.5724	.6829	.8480	.5469	.6241	.5142
7	.3166	.4196	.4455	.7036	.6965	.6782	.8506	.6616	.6746	.8522
8	.6687	.6460	.4837	.7041	.8870	.9098	.9353	.7638	.7064	1.0711
9	1.1385	1.0051	.4113	.6054	.7767	1.2148	1.2953	1.0523	.8975	1.2481
10	1.2171	.7462	.9687	.4822	.4531	.7734	.9934	.9617	1.0870	1.0833
11	1.1454	.5699	1.0152	1.1536	.3179	.6071	1.8446	1.2717	1.3669	1.0860
12	.7482	.5521	.5906	.8732	.9403	.2513	1.3368	1.3438	.8763	.8638
13	.9445	.3767	1.1714	1.1996	.5344	.7504	2.6565	.6137	1.6252	1.5772
14	.7700	.4500	.8400	.3200	.3900	.8400	.7700	1.7800	.6090	.9910
+gp	.7700	.4500	.8400	.3200	.3900	.8400	.7700	1.7800	.6090	.9910
FBAR 5-10	.6704	.5937	.5590	.6198	.6441	.8354	.9320	.7224	.7241	.8331

Table 8	Fishing mortality (F) at age									
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
3	.0645	.0205	.0203	.0427	.0211	.0220	.0193	.0200	.0068	.0180
4	.2015	.1957	.1222	.1465	.1674	.1673	.1092	.1257	.0244	.0560
5	.2969	.3095	.2924	.3623	.4741	.4873	.3833	.2062	.0681	.0880
6	.5496	.4848	.5770	.5900	.7776	.9353	.6292	.4026	.1646	.1640
7	.7933	.7761	1.0761	1.0006	1.0201	1.0910	1.0350	.5515	.2227	.2540
8	.9982	1.0096	1.2027	1.1126	1.2263	1.0223	1.0217	.7276	.2963	.2760
9	1.1341	1.0060	1.2092	1.0485	.9596	1.0683	1.0818	.8781	.2734	.2330
10	.7085	.8687	1.0104	.7087	1.0912	1.5325	1.3046	1.0155	.3926	.1510
11	.6863	.5251	.8633	.6127	.7745	.9328	1.1606	.6473	.4028	.1010
12	1.2212	.4013	.8231	.5959	1.4907	1.2932	1.6033	.3910	.4522	.0910
13	.5402	1.0589	.6066	.7357	.6705	.8712	1.2298	.0864	.4539	.0480
14	1.0200	1.0300	.6520	1.6390	1.7180	1.7760	1.1890	.7460	.5750	.1520
+gp	1.0200	1.0300	.6520	1.6390	1.7180	1.7760	1.1890	.7460	.5750	.1520
FBAR 5-10	.7468	.7424	.8946	.8038	.9248	1.0228	.9093	.6303	.2363	.1943

Table 3.27

Run title : Cod in the North-East Arctic (Fishing Areas I and II) (run n
Traditional vpa using file input for terminal F

Table 10	Stock number at age (start of year)					Numbers*10**-3				
YEAR	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
AGE										
3	730427	473439	339290	778364	1582280	1293001	169617	112179	197055	404967
4	711732	559749	375705	273003	623071	1244965	1027500	135522	89761	154868
5	382763	429418	362020	266227	200073	459949	875081	684079	88865	63764
6	173562	163911	168138	208431	147693	132592	314220	476033	346329	49587
7	68022	62373	49329	85166	109216	82735	88696	161304	227475	160214
8	50180	30384	19483	22811	46894	56101	44153	48658	61272	100030
9	15705	21427	10431	7772	11119	21837	23473	21463	15823	21724
10	4771	5766	6960	3036	3176	4569	7789	8874	5633	5009
11	5150	1481	1285	2531	1177	1266	1664	3112	2738	1724
12	3230	1896	310	357	1035	623	425	775	851	1141
13	873	1176	639	101	175	487	228	238	266	463
14	779	364	518	180	23	74	198	76	87	123
+gp	286	444	257	354	181	26	130	153	78	73
TOTAL	2147481	1751828	1334364	1648332	2726113	3298225	2553173	1652465	1036232	963686

Table 10	Stock number at age (start of year)					Numbers*10**-3				
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
3	1015513	1818345	524532	621874	614131	347723	639485	198885	140381	157834
4	324557	799352	1223784	346769	468300	425932	249004	452536	155071	111403
5	114405	224800	536066	610082	230082	280657	197834	163008	300754	111560
6	41559	69549	129269	256448	296515	116685	108144	82909	94232	172611
7	32026	23175	38481	63729	104087	136964	48260	37919	39285	41333
8	78071	19106	12472	20181	25816	42468	56912	16879	16021	16384
9	35560	32752	8199	6295	8171	8706	13999	18287	6438	6472
10	7027	9325	9815	4449	2813	3077	2115	3138	5227	2148
11	1930	1703	3620	3050	2249	1464	1162	641	982	1443
12	730	503	789	1074	788	1340	653	150	147	205
13	560	283	237	358	367	252	853	140	32	50
14	245	178	159	60	88	176	97	49	62	5
+gp	81	166	119	148	180	103	103	58	19	2
TOTAL	1652264	2999235	2487541	1934518	1753586	1365548	1318623	974601	758652	621451

Table 10	Stock number at age (start of year)					Numbers*10***-3					
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
AGE											
3	157910	168992	385803	508291	894468	282268	230221	215975	139957	227476	0
4	126147	121211	135552	309523	398748	717030	226072	184887	173327	113811	182919
5	82672	84435	81597	98211	218883	276148	496620	165945	133495	138488	88106
6	72617	50297	50730	49871	55971	111550	138887	277149	110544	102105	103833
7	84506	34314	25358	23326	22633	21056	35843	60609	151713	76768	70952
8	14432	31297	12928	7078	7022	6681	5790	10424	28586	99416	48754
9	4596	4355	9337	3179	1905	1687	1968	1707	4123	17402	61763
10	1521	1211	1304	2281	912	597	474	546	581	2568	11287
11	595	613	416	389	919	251	106	105	162	321	1808
12	399	245	297	144	172	347	81	27	45	89	238
13	71	96	134	107	65	32	78	13	15	24	66
14	8	34	27	60	42	27	11	19	10	8	18
+gp	8	8	27	51	1	10	23	15	5	8	11
TOTAL	545484	497108	703511	1002509	1601740	1417684	1136172	917422	742562	778482	569754

Table 3.28

Run title : Cod in the North-East Arctic (Fishing Areas I and II) (run n
Traditional vpa using file input for terminal F

Table 12	Stock biomass at age (start of year)					Tonnes				
YEAR	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
AGE										
3	474777	307736	220538	505936	1028482	840450	110251	72916	128086	263229
4	711732	559749	375705	273003	623071	1244965	1027500	135522	89761	154868
5	593283	665598	561131	412652	310113	712921	1356376	1060322	137741	98835
6	407871	385191	395124	489812	347080	311591	738417	1118678	813874	116529
7	234675	215186	170185	293822	376796	285437	306000	556497	784787	552737
8	235848	142806	91569	107210	220403	263674	207518	228690	287979	470139
9	96903	132203	64358	47954	68601	134735	144826	132424	97626	134037
10	36739	44395	53589	23380	24455	35179	59974	68329	43373	38572
11	47636	13698	11884	23412	10887	11708	15396	28788	25329	15944
12	35044	20567	3365	3872	11234	6758	4608	8406	9228	12383
13	10911	14703	7993	1260	2185	6087	2853	2978	3320	5788
14	10824	5066	7197	2501	323	1033	2749	1063	1211	1704
+gp	4297	6653	3854	5310	2714	390	1949	2294	1173	1095
TOTALBIO	2900540	2513553	1966492	2190125	3026345	3854929	3978416	3416907	2423489	1865859
EXPLTBIO	1321159	1026296	808676	932454	1017108	1251917	2050392	1703112	1323337	1056080

Table 12	Stock biomass at age (start of year)					Tonnes				
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
3	660083	1181924	340946	404218	399185	226020	415665	129275	91248	102592
4	324557	799352	1223784	346769	468300	425932	249004	452536	155071	111403
5	177328	348440	830902	945628	356627	435019	306642	252663	466168	172918
6	97664	163439	303783	602652	696809	274210	254138	194837	221446	405636
7	110489	79952	132760	219867	359099	472526	166496	130821	135533	142599
8	366933	89796	58617	94849	121336	199598	267488	79329	75297	77004
9	219403	202077	50588	38840	50415	53717	86374	112831	39723	39931
10	54106	71801	75574	34259	21663	23691	16288	24166	40251	16543
11	17850	15757	33485	28214	20805	13544	10753	5933	9085	13351
12	7924	5453	8559	11652	8549	14540	7087	1633	1597	2224
13	7000	3537	2961	4472	4590	3149	10667	1756	402	627
14	3412	2478	2209	836	1227	2449	1354	682	865	72
+gp	1217	2493	1781	2224	2699	1551	1552	871	287	26
TOTALBIO	2047967	2966499	3065948	2734478	2511302	2145946	1793509	1387333	1236974	1084926
EXPLTBIO	781547	1168180	1920338	1485788	1315780	1091438	746868	569228	539859	433502

Table 12	Stock biomass at age (start of year)					Tonnes				
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
3	102641	60837	204475	233814	286230	59276	43742	64792	55983	106914
4	126147	122423	162662	281666	370835	358515	81386	94293	117862	104706
5	128142	137628	155034	167941	343646	345185	347634	142713	154854	203577
6	170651	127252	147624	146620	141046	236486	219441	407409	190136	222588
7	291546	118384	100672	97268	86685	72854	96775	158797	403557	232607
8	67830	147094	60764	35674	37215	34876	24897	48994	128923	407604
9	28358	26869	57606	19617	11753	10406	12143	10529	25437	116596
10	11712	9321	10040	17565	7024	4600	3653	4206	4471	19772
11	5507	5672	3846	3595	8505	2320	977	975	1498	2970
12	4328	2662	3222	1558	1871	3765	877	294	490	962
13	884	1204	1681	1334	810	397	974	166	188	294
14	118	469	380	834	582	377	151	259	139	108
+gp	127	127	410	760	20	155	350	218	75	117
TOTALBIO	937991	759942	908418	1008247	1296222	1129213	833000	933645	1083613	1418815
EXPLTBIO	452362	397085	325369	385571	495291	528849	498888	509985	799555	1373888

Table 3.29

Run title : Cod in the North-East Arctic (Fishing Areas I and II) (run n
Traditional vpa using file input for terminal F

Table 13	Spawning stock biomass at age (spawning time)						Tonnes			
YEAR	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
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	235848	142806	91569	107210	220403	263674	207518	228690	287979	470139
9	96903	132203	64358	47954	68601	134735	144826	132424	97626	134037
10	36739	44395	53589	23380	24455	35179	59974	68329	43373	38572
11	47636	13698	11884	23412	10887	11708	15396	28788	25329	15944
12	35044	20567	3365	3872	11234	6758	4608	8406	9228	12383
13	10911	14703	7993	1260	2185	6087	2853	2978	3320	5788
14	10824	5066	7197	2501	323	1033	2749	1063	1211	1704
+gp	4297	6653	3854	5310	2714	390	1949	2294	1173	1095
TOTSPBIO	478202	380092	243808	214900	340803	459565	439872	472972	469240	679663

Table 13	Spawning stock biomass at age (spawning time)						Tonnes			
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
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	366933	89796	58617	94849	121336	199598	267488	79329	75297	77004
9	219403	202077	50588	38840	50415	53717	86374	112831	39723	39931
10	54106	71801	75574	34259	21663	23691	16288	24166	40251	16543
11	17850	15757	33485	28214	20805	13544	10753	5933	9085	13351
12	7924	5453	8559	11652	8549	14540	7087	1633	1597	2224
13	7000	3537	2961	4472	4590	3149	10667	1756	402	627
14	3412	2478	2209	836	1227	2449	1354	682	865	72
+gp	1217	2493	1781	2224	2699	1551	1552	871	287	26
TOTSPBIO	677845	393391	233774	215345	231283	312238	401564	227201	167508	149777

Table 13	Spawning stock biomass at age (spawning time)						Tonnes			
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
3	0	608	0	0	0	0	0	0	0	0
4	6307	9794	8133	2817	7417	3585	814	0	2357	3141
5	12814	13763	27906	16794	30928	31067	10429	2854	9291	2036
6	58021	38176	45764	48384	26799	54392	54860	61111	38027	51195
7	189505	86420	56376	57388	48544	19670	51291	61931	189672	153521
8	55621	129442	54687	30323	28283	21275	19669	28906	79933	334235
9	26089	26063	57030	18048	10461	8429	12143	8739	20604	111932
10	11712	9321	10040	17565	7024	3680	3653	4206	4248	19772
11	5507	5672	3846	3595	8505	2320	977	975	1498	2970
12	4328	2662	3222	1558	1871	3765	877	294	490	962
13	884	1204	1681	1334	810	397	974	166	188	294
14	118	469	380	834	582	377	151	259	139	108
+gp	127	127	410	760	20	155	350	218	75	117
TOTSPBIO	371033	323721	269476	199402	171243	149112	156188	169660	346521	680283

Table 3.30

Run title : Cod in the North-East Arctic (Fishing Areas I and II) (run n

Table 16 Summary (without SOP correction)
Traditional vpa using file input for terminal F

	RECRUITS	TOTALBIO	EXPLTBIO	TOTSPBIO	LANDINGS	FBAR 5-10
1962	730427	2900540	1321159	478202	909266	.7501
1963	473439	2513553	1026296	380092	776337	.9662
1964	339290	1966492	808676	243808	437695	.6614
1965	778364	2190125	932454	214900	444930	.5322
1966	1582280	3026345	1017108	340803	483711	.5051
1967	1293001	3854929	1251917	459565	572605	.5205
1968	169617	3978416	2050392	439872	1074084	.5479
1969	112179	3416907	1703112	472972	1197226	.8040
1970	197055	2423489	1323337	469240	933246	.7245
1971	404967	1865859	1056080	679663	689048	.5835
1972	1015513	2047967	781547	677845	565254	.6704
1973	1818345	2966499	1168180	393391	792685	.5937
1974	524532	3065948	1920338	233774	1102433	.5590
1975	621874	2734478	1485788	215345	829377	.6198
1976	614131	2511302	1315780	231283	867463	.6441
1977	347723	2145946	1091438	312238	905301	.8354
1978	639485	1793509	746868	401564	698715	.9320
1979	198885	1387333	569228	227201	440538	.7224
1980	140381	1236974	539859	167508	380434	.7241
1981	157834	1084926	433502	149777	399038	.8331
1982	157910	937991	452362	371033	363730	.7468
1983	168992	759942	397085	323721	289992	.7424
1984	385803	908418	325369	269476	277651	.8946
1985	508291	1008247	385571	199402	307920	.8038
1986	894468	1296222	495291	171243	430113	.9248
1987	282268	1129213	528849	149112	523071	1.0228
1988	230221	833000	498888	156188	434939	.9093
1989	215975	933645	509985	169660	332481	.6303
1990	139957	1083613	799555	346521	187000	.2363
1991	227476	1418815	1373888	680283	257882	.1943
Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)	(Tonnes)	

Table 3.31

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

Prediction run PRED-1: Initial stock size and Recruitment (Thousands)

Year	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
1992	370000	182919	88106	103833	70952	48754	61763	11287	1808	238	66	18	11
1993	412000	:	:	:	:	:	:	:	:	:	:	:	:
1994	383000	:	:	:	:	:	:	:	:	:	:	:	:

Weight in stock (Kilograms)

Year	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
1992	0.44	0.83	1.59	2.59	3.78	5.02	6.75	10.85	9.25	10.85	12.50	13.90	15.00
1993	0.44	0.81	1.41	2.16	3.16	4.54	6.54	8.75	9.25	10.85	12.50	13.90	15.00
1994	0.44	0.81	1.41	2.16	3.16	4.54	6.54	8.75	9.25	10.85	12.50	13.90	15.00

Natural mortality

Year	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
1992	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1993	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1994	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Maturity ogive

Year	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
1992	0.00	0.01	0.08	0.31	0.73	0.92	0.95	1.00	1.00	1.00	1.00	1.00	1.00
1993	0.00	0.02	0.05	0.25	0.62	0.79	0.91	0.98	1.00	1.00	1.00	1.00	1.00
1994	0.00	0.02	0.05	0.25	0.62	0.79	0.91	0.98	1.00	1.00	1.00	1.00	1.00

Proportion of F before spawning

Year	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
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0

Proportion of M before spawning

Year	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
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0

Exploitation pattern

Year	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
1992	0.0292	0.1638	0.3812	0.7016	1.0539	1.2491	1.2811	1.3332	1.0935	1.2252	0.7907	1.2491	1.2491
1993	0.0292	0.1638	0.3812	0.7016	1.0539	1.2491	1.2811	1.3332	1.0935	1.2252	0.7907	1.2491	1.2491
1994	0.0292	0.1638	0.3812	0.7016	1.0539	1.2491	1.2811	1.3332	1.0935	1.2252	0.7907	1.2491	1.2491

Weight in catch (Kilograms)

Year	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
1992	0.79	1.44	2.12	2.90	3.93	4.85	6.00	8.98	14.08	15.71	16.63	12.00	15.00
1993	1.05	1.47	1.99	2.70	3.68	4.85	6.70	9.43	12.99	16.45	15.88	13.27	15.00
1994	1.05	1.47	1.99	2.70	3.68	4.85	6.70	9.43	12.99	16.45	15.88	13.27	15.00

Table 3.32

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

Effects of different levels of fishing mortality on catch,
stock biomass and spawning stock biomass

F factor 1992	Reference F 1992	Stock biomass 1992	Sp.stock biomass 1992	Catch weight 1992	F factor 1993	Reference F 1993	Stock biomass 1993	Sp.stock biomass 1993	Catch weight 1993	Stock biomass 1994	Sp.stock biomass 1994
0.3090	0.3090	1796493	1056109	375901	0.0000	0.0000	1714528	857285	0	2202850	1107937
.	.	.	.	.	0.0500	0.0500	.	857285	70883	2130171	1048343
.	.	.	.	.	0.1000	0.1000	.	857285	138193	2061313	992173
.	.	.	.	.	0.1500	0.1500	.	857285	202134	1996058	939225
.	.	.	.	.	0.2000	0.2000	.	857285	262894	1934199	889308
.	.	.	.	.	0.2500	0.2500	.	857285	320652	1875543	842245
.	.	.	.	.	0.3000	0.3000	.	857285	375577	1819906	797866
.	.	.	.	.	0.3500	0.3500	.	857285	427826	1767117	756014
.	.	.	.	.	0.4000	0.4000	.	857285	477549	1717014	716540
.	.	.	.	.	0.4500	0.4500	.	857285	524886	1669445	679305
.	.	.	.	.	0.5000	0.5000	.	857285	569970	1624267	644177
.	.	.	.	.	0.5500	0.5500	.	857285	612924	1581345	611032
.	.	.	.	.	0.6000	0.6000	.	857285	653866	1540552	579755
.	.	.	.	.	0.6500	0.6500	.	857285	692907	1501769	550236
.	.	.	.	.	0.7000	0.7000	.	857285	730150	1464883	522374
.	.	.	.	.	0.7500	0.7500	.	857285	765694	1429788	496070
.	.	.	.	.	0.8000	0.8000	.	857285	799631	1396385	471234
.	.	.	.	.	0.8500	0.8500	.	857285	832048	1364580	447782
.	.	.	.	.	0.9000	0.9000	.	857285	863028	1334284	425632
.	.	.	.	.	0.9500	0.9500	.	857285	892646	1305414	404709
.	.	.	.	.	1.0000	1.0000	.	857285	920977	1277891	384943

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

Effects of different levels of fishing mortality on catch,
stock biomass and spawning stock biomass

Reference point 1993	Reference F 1992	Stock biomass 1992	Sp.stock biomass 1992	Catch weight 1992	F factor 1993	Reference F 1993	Stock biomass 1993	Sp.stock biomass 1993	Catch weight 1993	Stock biomass 1994	Sp.stock biomass 1994
F0.1	0.3090	1796493	1056109	375901	0.1370	0.1370	1714528	857285	185823	2012690	952692
F1991	0.3090	1796493	1056109	375901	0.1940	0.1940	1714528	857285	255765	1941450	895144
Fmax	0.3090	1796493	1056109	375901	0.2520	0.2520	1714528	857285	322902	1873260	840419
F1992	0.3090	1796493	1056109	375901	0.3090	0.3090	1714528	857285	385175	1810198	790151
Flow	0.3090	1796493	1056109	375901	0.3200	0.3200	1714528	857285	396789	1798458	780830
Fmed	0.3090	1796493	1056109	375901	0.4600	0.4600	1714528	857285	534079	1660223	672115
Fhigh	0.3090	1796493	1056109	375901	0.7800	0.7800	1714528	857285	786244	1409550	480998

Run name : PRED-1
 Computation of ref. F: Unweighted mean of age 5 - 10
 Unit of measurement : Tonnes

Table 3.33

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

			Prediction						
		Year	Reference F	Catch numbers	Catch weight	Stock size	Sp.stock Stock biomass	Sp.stock size 1. jan.	biomass 1. jan.
Scenario 1 High growth	Flow	1992	0.3090	93197	375920	942755	1797813	209817	1056109
		1993	0.3200	95660	397100	1100060	1718222	169858	857327
		1994	0.3200	102909	383800	1197614	2009910	159153	807623
		1995	0.3200	116522	420779	1177916	2172198	175322	834233
		1996	0.3200	126554	462780	1149535	2286634	205760	941467
		1997	0.3200	129775	498822	1117302	2328504	228597	1057122
	Fmed	1992	0.3090	93197	375920	942755	1797813	209817	1056109
		1993	0.4600	130677	534515	1100060	1718222	169858	857327
		1994	0.4600	131755	467862	1166328	1865770	141354	698426
		1995	0.4600	144146	484854	1126505	1932569	146532	656246
		1996	0.4600	151927	514417	1082751	1968955	166445	705128
		1997	0.4600	150930	532146	1039984	1945165	179320	763849
Scenario 2 Medium growth	Flow	1992	0.3090	93197	375920	942755	1797813	209817	1056109
		1993	0.3200	95660	397100	1100060	1718222	169858	857327
		1994	0.3200	102909	377167	1197614	1771341	159153	779079
		1995	0.3200	116522	407582	1177916	1893689	175322	791245
		1996	0.3200	126554	443143	1149535	1997568	205760	880653
		1997	0.3200	129775	479365	1117302	2053580	228597	991096
	Fmed	1992	0.3090	93197	375920	942755	1797813	209817	1056109
		1993	0.4600	130677	534515	1100060	1718222	169858	857327
		1994	0.4600	131755	455811	1166328	1633432	141354	671419
		1995	0.4600	144146	462754	1126505	1666149	146532	616669
		1996	0.4600	151927	484755	1082751	1697482	166445	650991
		1997	0.4600	150930	503068	1039984	1689380	179320	706197
Scenario 3 Low growth	Flow	1992	0.3090	93197	375920	942755	1797813	209817	1056109
		1993	0.3200	95660	397100	1100060	1718222	169858	857327
		1994	0.3200	102909	357359	1197614	1466037	159153	736603
		1995	0.3200	116522	377967	1177916	1547041	175322	733272
		1996	0.3200	126554	408210	1149535	1646849	205760	807427
		1997	0.3200	129775	448915	1117302	1725562	228597	916169
	Fmed	1992	0.3090	93197	375920	942755	1797813	209817	1056109
		1993	0.4600	130677	534515	1100060	1718222	169858	857327
		1994	0.4600	131755	427729	1166328	1337028	141354	632445
		1995	0.4600	144146	422378	1126505	1336303	146532	565555
		1996	0.4600	151927	438909	1082751	1369122	166445	587956
		1997	0.4600	150930	462347	1039984	1384264	179320	642401

Table 3.34 North-East Arctic COD.

Coastal cod W.G.1992 SHOT forecast spreadsheet version 3
Sub-area I and Divisions IIa September 1992

running recruitment weights

older .25 G-M = .22
central .50 exp(d) 1.25
younger .25 exp(d/2) 1.12

Year	Land -ings	Recrt Index	W'td Index	Y/B Ratio	Hang -over	Act'l Prodn	Est'd Prodn	Est'd SQC.	Act'l Expl Biom	Est'd Expl Biom	Est'd Land -ings	
1980	40	1		.61	.57				66			.8
1981	49	1	1	.61	.57	43			81			.8
1982	42	1	1	.61	.57	23			69			.8
1983	38	1	1	.61	.57	23			63			.8
1984	33	1	1	.50	.69	14	30	40	66	66	33	.6
1985	28	1	1	.40	.80	4	26	36	70	71	29	.45
1986	26	1	1	.33	.88	4	22	31	79	77	25	.35
1987	31	1	1	.37	.84	25	19	29	85	88	32	.4
1988	22	1	1	.25	.97	-33	20	33	89	91	22	.25
1989	17	1	1	.17	1.05	-35	13	25	98	100	17	.17
1990	24	1	1	.22	1.00	32	8	19	109	110	24	.22
1991	25	1	1	.21	1.01	4	10	26	118	119	25	.21
1992		1	1	.21	1.01		9	27		130	27	.21
1993		1	1	.21	1.01		9	30		141	30	.21

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	25,816
1991 ¹	18,690	14,122	402	33,214

¹Provisional figures.

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 ¹	9.7	9.0	7.5	6.6	0.4

¹Provisional

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

Year	Faroe Islands	France	German Dem. Rep.	Germany, Fed. Rep.	Norway	Poland	United Kingdom	USSR/ 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	-	101,726
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	266,153
1973	1,212	3,214	22	9,534	86,767	34	32,408	186,534	2,501	322,620
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	<u>Spain</u>	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	-	25,810
1991 ¹	1,117	60	-	219	18,894	-	514	12,388	22	33,214

¹Provisional figures.

²From 1990 onwards Russia.

Table 4.4 North-East Arctic HADDOCK. Weight at age (kg) in Norwegian and USSR 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 ¹	0.68	1.06	1.38	1.59	1.81	1.90	1.97	2.12	2.22	-	-	2.98	4.80
1992 ²	-	0.60	1.34	1.52	1.68	1.75	2.00	2.04	2.53	3.34	2.78	-	4.57

USSR													
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 ¹	0.25	0.64	1.32	1.70	1.95	2.33	2.61	3.43	-	-	-	-	-
1992 ²	0.18	0.54	1.09	1.56	1.93	2.15	2.40	2.78	3.60	-	-	-	-

¹Provisional.

²Data from January-June.

Table 4.5 North-East Arctic HADDOCK. Results from the Norwegian bottom trawl survey in the Barents Sea in January-March. Index of number of fish at age.

Year	Age								Total
	1	2	3	4	5	6	7	8	
1983	1,780.0	5.7	3.1	3.5	1.9	1.9	4.2	1.9	1,801.8
1984	3,450.0	592.0	16.9	2.1	1.0	0.3	0.4	0.4	4,063.1
1985	911.0	1,180.0	436.0	8.2	0.6	0.3	0.4	0.4	2,536.9
1986	416.0	312.0	385.0	166.0	6.7	0.7	0.2	0.2	1,286.8
1987	86.1	78.2	187.0	355.0	75.3	0.2	0.3	+	782.1
1988	28.6	15.0	30.3	83.0	155.0	23.8	0.3	-	336.0
1989	51.8	6.0	10.1	19.2	37.9	40.9	4.4	-	170.2
1990	356.0	49.2	4.8	4.9	7.7	14.3	18.4	2.6	457.9
1991	978.2	404.7	90.5	17.6	4.7	3.6	4.6	8.5	1,512.4
1992	821.9	1,168.8	351.1	89.9	6.2	1.3	2.0	7.8	2,449.0

1983-1988 back-calculated from bobbins gear to rockkopper gear.

Table 4.6 North east-Arctic HADDOCK. Results from the Norwegian bottom trawl survey in the Svalbard area in September-October. Index of number of fish at age.

Year	Age									Total
	1	2	3	4	5	6	7	8	9	
1985	21.8	33.0	1.1	+	0	0	0	0	0	55.9
1986	0.4	2.3	19.6	2.3	+	0	0	0	0	24.6
1987	0.1	+	0.1	0.1	+	+	0	0	0	0.3
1988	0.5	+	+	0.1	0.2	0.1	+	0	0	0.9
1989	0.0	0.5	0.6	+	+	0.4	0.8	0.1	0	2.4
1990	59.1	1.4	+	+	0.3	0.3	0.9	+	0	62.2
1991	214.1	30.1	3.2	0.7	2.3	0.8	0.8	0.2	0	252.2

1985-1988 back calculated from bobbins gear to rockhopper gear.

Table 4.7 North-East Arctic HADDOCK. Results from the Russian trawl survey in the Barents Sea and adjacent waters in November-December (numbers per hour trawling).

Year	Age										Older	Total	
	0	1	2	3	4	5	6	7	8	9			
<u>Sub-area 1</u>													
1983	39.9	97.3	16.5	0.8	0.7	+						1.1 156.3	
1984	9.7	100.2	110.6	2.8	0.4	0.2	+					0.7 224.6	
1985	3.9	19.1	213.4	168.8	0.8	0.2	0.1	-				0.3 406.6	
1986	0.2	2.3	16.6	58.1	27.6	0.1	+	+	+			- 105.0	
1987	0.4	1.4	2.5	12.5	34.2	8.6	+	+	-	+		- 59.8	
1988	1.9	0.4	1.1	2.8	6.2	11.6	1.1	+	+	+		- 25.2	
1989	3.3	3.0	3.6	0.7	2.5	7.1	13.9	1.8	0.1	+		- 36.0	
1990	71.7	22.2	18.6	13.2	7.5	13.2	13.3	10.3	0.6	0.1		- 170.7	
1991	15.9	61.5	27.5	10.8	1.6	0.6	1.0	3.3	2.6	0.3		- 125.1	
<u>Division IIa</u>													
1983	5.4	5.5	0.1	0.2	0.3	0.1						1.0 12.6	
1984	4.9	14.4	5.6	0.1	0.1	0.1	-					0.2 25.4	
1985	3.8	7.0	11.7	4.1	0.1	-	+	-				0.1 26.8	
1986	0.4	0.3	3.5	10.4	2.9	0.1	+	+	-			- 17.6	
1987	-	-	-	-	0.3	0.3	-	-	-	-		- 0.6	
1988	1.0	0.1	-	+	0.2	0.5	0.2	-	-	-		- 2.1	
1989	0.1	0.7	2.7	+	0.1	0.1	0.1	-	-	-		- 3.8	
1990	6.1	0.9	0.9	0.1	0.1	0.1	0.1	0.1	-	-		- 8.4	
1991	5.7	3.8	0.6	0.1	+	-	-	-	-	-		- 10.2	
<u>Division IIb</u>													
1983	22.1	9.9	0.2	0.1	+	+						0.1 32.4	
1984	2.2	14.3	1.8	-	-	-	-					+	18.3
1985	1.4	10.2	61.4	5.1	+	+	+	-				+	78.1
1986	+	0.2	3.1	7.2	1.4	-	-	+	+			-	12.0
1987	-	-	0.1	0.7	1.4	0.5	+	-	-	-		-	2.8
1988	0.2	-	-	+	0.3	1.1	0.2	-	+	-		-	1.9
1989	0.7	0.1	0.2	+	0.1	0.3	0.6	0.1	+	-		-	2.1
1990	12.9	5.4	0.8	+	+	0.2	0.1	0.1	+	-		-	19.5
1991	20.0	22.9	6.2	0.4	0.1	0.1	0.1	+	+	-		-	49.8
<u>Total - Sub-area I and Divisions IIa and IIb</u>													
1983	29.8	59.2	9.5	0.5	0.4	+						0.8 100.2	
1984	6.4	58.6	58.4	1.5	0.2	0.1	+					0.3 125.5	
1985	3.0	14.4	134.3	90.0	0.4	0.1	0.1	-				0.2 242.7	
1986	0.2	1.4	10.7	36.3	16.4	0.1	+	+	+			+	65.1
1987	0.3	0.9	1.7	8.3	22.5	5.7	+	+	-	+		-	39.4
1988	1.3	0.3	0.7	1.7	4.0	7.6	0.8	+	+	+		-	16.4
1989	2.2	1.8	2.4	0.4	1.4	4.1	8.1	1.1	0.1	+		-	21.6
1990	44.8	14.3	10.6	7.3	4.2	7.3	7.4	5.7	0.3	0.1		-	102.0
1991	16.7	42.9	17.6	6.2	0.9	0.3	0.6	1.8	1.5	0.2		-	88.7

Table 4.8 North-East Arctic HADDOCK. Results from the Norwegian acoustic survey in the Barents Sea in January-March. Index of number of fish at age.

Year	Age										Total
	1	2	3	4	5	6	7	8	9	10	
1981	2	25	14	66	160	50	2	1	+	+	320
1982	3	4	7	10	12	29	14	1	+	+	80
1983	-	10	7	9	5	4	10	5	+	+	50
1984	2,148	1,002	53	15	7	2	2	2	+	+	3,321
1985	1,034	1,972	1,187	33	2	1	1	1	1	1	4,233
1986	346	502	1,720	751	2	1	1	+	+	+	3,323
1987	37	29	175	640	166	+	+	+	-	+	1,049
1988	8	7	20	70	150	23	+	-	-	+	279
1989	20	8	19	34	61	64	6	-	-	+	213
1990	201	86	12	11	15	27	36	5	+	+	394
1991	1,662	914	217	36	9	9	11	20	+	-	2,876
1992	717	2,145	600	101	9	2	2	5	8	+	3,588

Table 4.9 North-East Arctic HADDOCK. Results from the Russian trawl acoustic survey in the Barents Sea and adjacent waters in the autumn 1985-1991. Index of number of fish at age.

Year	Age											Total
	0	1	2	3	4	5	6	7	8	9	Older	
1985 ¹	194	434	1,468	636	3	1	+	-	-	-	1	2,737
1986 ¹	34	37	208	917	910	2	+	+	+	-	+	2,109
1987 ²	6	16	29	62	197	61	+	-	-	+	12	383
1988 ²	2	1	3	18	83	301	46	-	-	-	+	454
1989 ¹	41	32	94	2	14	35	67	9	1	+	-	295
1990 ¹	594	176	75	28	17	23	43	44	4	1	-	1,004
1991	240	368	143	65	11	4	7	21	17	2	+	878

¹October-December.

²September-October.

Table 4.10 North-East Arctic HADDOCK. Results from the Norwegian acoustic survey in the Barents Sea and the Svalbard region in September-October. Index of number of fish at age.

Year	Age									Total
	1	2	3	4	5	6	7	8	Older	
1986	89	197	267	95	-	-			1	650
1987	5	25	89	276	69	+	+		+	463
1988	171	19	5	17	35	4	-	-	-	252
1989	38	5	+	2	6	5	+	-	-	58
1990	225	48	4	2	3	6	10	+	-	300
1991	890	317	30	4	7	5	9	11	+	1,273

Table 4.11 North East Arctic HADDOCK.
Indices of year class
strength.

NORTHEAST ARCTIC HADDOCK : recruits as 3 year-olds (inc. data for ages 0,1,2 & 3)											
10,35,2	(No. of surveys, No. of years, VPA Column No.)										
1957,	242,	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,	274,	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,	243,	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,	0.01,	-11,	-11,	-11,	-11,	-11,	-11
1966,	17,	0.3,	0.3,	0.3,	0.01,	-11,	-11,	-11,	-11,	-11,	-11
1967,	164,	3,	13,	8,	0.08,	-11,	-11,	-11,	-11,	-11,	-11
1968,	95,	0.3,	0.3,	3,	0.003,	-11,	-11,	-11,	-11,	-11,	-11
1969,	1018,	31,	69,	120,	0.29,	-11,	-11,	-11,	-11,	-11,	-11
1970,	270,	10,	33,	31,	0.64,	-11,	-11,	-11,	-11,	-11,	-11
1971,	54,	3,	3,	9,	0.26,	-11,	-11,	-11,	-11,	-11,	-11
1972,	48,	2,	9,	3,	0.16,	-11,	-11,	-11,	-11,	-11,	-11
1973,	56,	13,	8,	5,	0.26,	-11,	-11,	-11,	-11,	-11,	-11
1974,	114,	15,	35,	14,	0.51,	-11,	-11,	-11,	-11,	-11,	198
1975,	170,	163,	96,	59,	0.60,	-11,	-11,	-11,	-11,	755,	737
1976,	134,	6,	13,	4,	0.38,	-11,	-11,	-11,	267,	149,	181
1977,	19,	1,	1,	0.3,	0.33,	-11,	-11,	-11,	111,	11,	-11
1978,	6,	0.3,	0.3,	0.3,	0.12,	-11,	-11,	-11,	17,	-11,	14
1979,	8,	0.3,	0.3,	0.3,	0.20,	-11,	-11,	-11,	-11,	25,	7
1980,	5,	0.3,	0.3,	-11,	0.15,	-11,	-11,	3.1,	2,	4,	7
1981,	8,	0.3,	0.3,	8,	0.03,	-11,	5.3,	16.9,	3,	10,	53
1982,	263,	23,	59,	63,	0.38,	1780.0,	592.0,	436.0,	-11,	1002,	1187
1983,	345,	40,	79,	239,	0.62,	3450.0,	1180.0,	385.0,	2148,	1972,	1720
1984,	73,	9,	19,	18,	0.78,	911.0,	312.0,	187.0,	1034,	502,	175
1985,	25,	5,	2,	3,	0.27,	416.0,	78.2,	30.3,	346,	29,	20
1986,	16,	1,	1,	1,	0.39,	86.1,	15.0,	10.1,	37,	7,	19
1987,	17,	1,	1,	4,	0.10,	28.6,	6.0,	4.8,	8,	8,	12
1988,	129,	2,	3,	21,	0.13,	51.7,	49.2,	90.4,	20,	86,	217
1989,	-11,	3,	25,	30,	0.14,	356.0,	405.0,	351.1,	202,	914,	600
1990,	-11,	81,	67,	-11,	0.58,	977.0,	1168.8,	-11,	1662,	2145,	-11
1991,	-11,	17,	-11,	-11,	1.17,	821.9,	-11,	-11,	717,	-11,	-11
R-T-1	USSR Bottom Trawl Survey, age 1										
R-T-2	USSR Bottom Trawl Survey, age 2										
R-T-3	USSR Bottom Trawl Survey, age 3										
INTOGP	International O-group Survey										
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 4.12 North East Arctic HADDOCK.
Recruitment analysis.

Analysis by RCT3 ver3.1 of data from file :

had-1.rcr

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

Data for 10 surveys over 35 years : 1957 - 1991

Regression type = P

Tapered time weighting applied

power = 3 over 20 years

Survey weighting not applied

Final estimates not shrunk towards mean

Estimates with S.E.'s greater than that of mean included

Minimum S.E. for any survey taken as .00

Minimum of 5 points used for regression

Forecast/Hindcast variance correction used.

Yearclass = 1987

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-T-1	.90	2.12	.65	.821	30	.69	2.75	.752	.087
R-T-2	.83	2.07	.40	.930	30	.69	2.65	.470	.224
R-T-3	.70	2.31	.76	.734	29	1.61	3.43	.883	.063
INTOGP	6.70	1.73	1.03	.546	22	.10	2.37	1.241	.032
N-BST1	.89	-1.53	.50	.896	5	3.39	1.50	1.021	.047
N-BST2	.70	.73	.42	.936	6	1.95	2.08	.644	.119
N-BST3	.84	.41	.46	.931	7	1.76	1.88	.645	.119
N-BSA1	.53	1.00	.67	.805	9	2.20	2.16	.866	.066
N-BSA2	.63	.99	.51	.896	11	2.20	2.37	.628	.125
N-BSA3	.73	.42	.53	.894	12	2.56	2.30	.646	.118
VPA Mean =						3.67	1.457	.000	

Yearclass = 1988

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-T-1	.91	2.10	.58	.844	31	1.10	3.10	.670	.097
R-T-2	.83	2.09	.36	.939	31	1.39	3.24	.417	.251
R-T-3	.70	2.22	.74	.740	30	3.09	4.38	.860	.059
INTOGP	6.40	1.81	.98	.560	23	.12	2.60	1.159	.033
N-BST1	.67	.06	.62	.829	6	3.96	2.71	.916	.052
N-BST2	.63	1.15	.48	.905	7	3.92	3.60	.614	.116
N-BST3	.75	.85	.55	.885	8	4.52	4.25	.689	.092
N-BSA1	.49	1.23	.67	.778	10	3.04	2.72	.818	.065
N-BSA2	.61	1.13	.51	.889	12	4.47	3.84	.591	.125
N-BSA3	.71	.59	.53	.883	13	5.38	4.39	.630	.110
VPA Mean =						3.57	1.413	.000	

Yearclass = 1989

I-----Regression-----I						I-----Prediction-----I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
R-T-1	.89	2.27	.75	.741	32	1.39	3.51	.855	.095
R-T-2	.81	2.26	.59	.838	32	3.26	4.89	.701	.142
R-T-3	.72	2.20	.71	.755	31	3.43	4.66	.833	.100
INTOGP	5.28	2.27	1.15	.390	24	.13	2.96	1.345	.038
N-BST1	.48	1.48	.99	.488	7	5.88	4.28	1.260	.044
N-BST2	.61	1.39	.66	.798	8	6.01	5.04	.858	.095
N-BST3	.77	.86	.56	.873	9	5.86	5.38	.725	.132
N-BSA1	.44	1.68	.97	.550	11	5.31	4.00	1.163	.051
N-BSA2	.61	1.20	.58	.849	13	6.82	5.37	.722	.133
N-BSA3	.72	.59	.53	.882	14	6.40	5.17	.642	.169
VPA Mean =						3.65	1.406	.000	

Table 4.12 (Cont'd)

Yearclass = 1990

	I-----Regression-----I					I-----Prediction-----I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
R-T-1	.91	2.26	.75	.745	32	4.41	6.28	1.034	.133
R-T-2	.81	2.26	.61	.834	32	4.22	5.69	.775	.236
R-T-3									
INTOGP	5.12	2.31	1.18	.373	24	.46	4.65	1.441	.068
N-BST1	.47	1.49	1.00	.481	7	6.89	4.75	1.316	.082
N-BST2	.61	1.40	.67	.793	8	7.06	5.68	.936	.162
N-BST3									
N-BSA1	.43	1.73	.98	.539	11	7.42	4.90	1.306	.083
N-BSA2	.61	1.23	.58	.847	13	7.67	5.89	.774	.236
N-BSA3									
VPA Mean =						3.64	1.413	.000	

Yearclass = 1991

	I-----Regression-----I					I-----Prediction-----I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
R-T-1	.93	2.24	.75	.748	32	2.89	4.95	.931	.448
R-T-2									
R-T-3									
INTOGP	4.92	2.37	1.21	.353	24	.77	6.18	1.955	.102
N-BST1	.47	1.52	1.01	.473	7	6.71	4.66	1.333	.219
N-BST2									
N-BST3									
N-BSA1	.42	1.78	1.00	.524	11	6.58	4.53	1.296	.231
N-BSA2									
N-BSA3									
VPA Mean =						3.65	1.417	.000	

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1962	142	4.96	.24	.09	.14	100	4.62
1963	180	5.20	.19	.07	.13	243	5.50
1964	196	5.28	.19	.02	.01	292	5.68
1965	81	4.40	.28	.03	.01	21	3.04
1966	38	3.66	.36	.03	.01	18	2.89
1967	120	4.79	.33	.28	.75	165	5.11
1968	43	3.76	.34	.27	.61	96	4.56
1969	612	6.42	.39	.25	.40	1019	6.93
1970	347	5.85	.34	.38	1.22	271	5.60
1971	113	4.74	.32	.13	.16	55	4.01
1972	87	4.48	.35	.23	.44	48	3.89
1973	125	4.84	.35	.27	.58	56	4.04
1974	213	5.36	.37	.17	.20	115	4.74
1975	535	6.28	.41	.23	.31	170	5.14
1976	88	4.49	.41	.19	.22	135	4.91
1977	43	3.78	.43	.30	.47	20	3.00
1978	31	3.44	.44	.17	.15	6	1.95
1979	23	3.16	.49	.21	.18	9	2.20
1980	13	2.63	.51	.34	.44	6	1.79
1981	27	3.32	.36	.31	.78	9	2.20
1982	230	5.44	.44	.20	.22	264	5.58
1983	364	5.90	.39	.14	.14	346	5.85
1984	112	4.72	.31	.21	.46	74	4.30
1985	24	3.19	.27	.19	.49	25	3.26
1986	13	2.61	.24	.14	.32	16	2.83
1987	10	2.38	.22	.14	.40	18	2.89
1988	34	3.55	.21	.19	.84	130	4.87
1989	118	4.78	.26	.22	.72		
1990	269	5.60	.38	.20	.29		
1991	136	4.91	.62	.26	.18		

Table 4.13 North-East Arctic HADDOCK. Length data (cm) from Norwegian surveys in January-March and USSR surveys in November-December.

Year	Age									
	1	2	3	4	5	6	7	8	9	10
<u>Norway</u>										
1987	13.9	21.6	30.2	39.2	47.0	62.5	-	-	-	-
1988	13.5	24.3	29.3	36.2	42.7	50.1	56.6	-	-	-
1989	16.3	22.5	32.0	36.8	43.0	47.3	53.6	-	-	-
1990	16.3	24.9	33.8	44.2	46.9	50.7	53.0	-	-	-
1991	16.9	25.0	37.0	42.7	54.3	55.2	53.8	56.8	63.7	-
1992	15.6	25.4	36.5	45.9	53.9	61.6	62.9	59.8	66.9	77.5
	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+
<u>USSR</u>										
1984	-	24.1	35.8	44.4	56.4	62.8	64.8	-	-	-
1985	16.5	22.4	30.9	44.1	53.8	61.3	64.7	-	-	-
1986	16.1	20.7	28.1	35.4	46.7	62.0	-	-	-	-
1987	17.0	21.5	27.8	32.3	37.3	48.6	51.2	-	-	-
1988	17.3	23.2	29.7	33.7	39.3	46.2	53.0	-	-	-
1989	17.7	22.2	26.5	38.5	44.5	49.3	55.7	57.7	-	-
1990	18.8	24.5	30.9	40.4	50.6	53.2	58.3	59.7	63.8	-
1991	17.4	24.2	30.5	39.7	53.4	55.4		60.5	62.7	70.2

Table 4.14 North-East Arctic HADDOCK. Weight data (g) from Norwegian surveys in January-March and USSR surveys in November-December.

Year	Age									
	1	2	3	4	5	6	7	8	9	10
<u>Norway</u>										
1987	24	91	273	542	934	2,197	-	-	-	-
1988	25	120	350	450	730	1,140	1,560	-	-	-
1989	40	100	320	490	780	1,040	1,440	-	-	-
1990	42	148	370	827	988	1,247	1,425	-	-	-
1991	40	140	490	840	1,630	1,710	1,600	1,860	2,480	-
1992	30	150	450	940	1,510	2,280	2,810	2,170	2,980	4,870
	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+
<u>USSR</u>										
1984	36	127	438	815	1,777	2,395	2,688	-	-	-
1985	37	105	282	817	1,530	2,262	2,263	-	-	-
1986	38	88	209	419	919	2,240	-	-	-	-
1987	-	95	196	330	497	1,055	-	-	-	-
1988	35	106	248	398	627	997	1,431	-	-	-
1989	52	105	181	606	903	1,287	1,587	2,004	-	-
1990	62	143	288	667	1,337	1,533	1,778	2,233	2,731	-
1991	57	133	292	690	1,570	1,863	2,206	2,320	2,568	3,525

Table 4.15 North-East Arctic HADDOCK. Input data to the assessment. Weight at age (kg) in the stock.

Age	Age											
	3	4	5	6	7	8	9	10	11	12	13	14+
1982	0.66	1.03	1.79	2.38	2.86	3.33	3.70	4.41	5.40	6.70	7.40	8.00
1983	0.66	1.03	1.79	2.38	2.86	3.33	3.70	4.41	5.40	6.70	7.40	8.00
1984	0.66	1.03	1.79	2.38	2.86	3.33	3.70	4.41	5.40	6.70	7.40	8.00
1985	0.44	0.82	1.78	2.40	2.69	3.33	3.70	4.41	5.40	6.70	7.40	8.00
1986	0.28	0.82	1.53	2.26	2.26	3.33	3.70	4.41	5.40	6.70	7.40	8.00
1987	0.24	0.48	0.93	2.22	2.26	3.33	3.70	4.41	5.40	6.70	7.40	8.00
1988	0.27	0.39	0.61	1.10	1.56	3.33	3.70	4.41	5.40	6.70	7.40	8.00
1989	0.28	0.44	0.70	1.02	1.43	3.33	3.70	4.41	5.40	6.70	7.40	8.00
1990	0.28	0.72	0.95	1.27	1.51	1.90	3.70	4.41	5.40	6.70	7.40	8.00
1991	0.39	0.75	1.48	1.62	1.69	2.08	2.36	4.41	5.40	6.70	7.40	8.00
1992	0.37	0.82	1.54	2.07	2.36	2.24	2.77	4.20	5.40	6.70	7.40	8.00

Table 4.16 North-East Arctic HADDOCK. Input data to the assessment. Weight at age (kg) in the catch.

Age	Age											
	3	4	5	6	7	8	9	10	11	12	13	14+
1982	0.66	1.03	1.79	2.38	2.86	3.33	3.70	4.41	5.40	6.70	7.40	8.00
1983	1.52	1.86	2.10	2.38	2.86	3.33	3.70	4.41	5.40	6.70	7.40	8.00
1984	1.57	1.99	2.42	2.68	2.93	3.37	3.70	4.41	5.40	6.70	7.40	8.00
1985	0.92	1.66	2.39	2.89	2.71	3.22	3.70	4.41	5.40	6.70	7.40	8.00
1986	0.86	1.25	1.88	2.41	2.66	3.04	3.70	4.41	5.40	6.70	7.40	8.00
1987	0.64	0.86	1.33	2.45	2.98	2.98	3.70	4.41	5.40	6.70	7.40	8.00
1988	0.58	0.84	1.05	1.43	1.97	2.52	3.70	4.41	5.40	6.70	7.40	8.00
1989	0.80	0.89	1.17	1.37	1.71	2.01	3.70	4.41	5.40	6.70	7.40	8.00
1990	0.89	1.22	1.40	1.60	1.77	2.16	3.70	4.41	5.40	6.70	7.40	8.00
1991 ¹	0.99	1.35	1.65	1.89	2.13	2.05	2.21	4.41	5.40	6.70	7.40	8.00
1992 ²	0.57	1.22	1.54	1.81	1.95	2.20	2.41	3.06	5.40	6.70	7.40	8.00

¹Provisional.

²Calculated from January-June data.

Table 4.17 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
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	12	50	62	77	80	94	100

Table 4.18 North East Arctic HADDOCK.
Tuning Data.

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

flt24: Norway bott trawl survey, Barents sea, Jan-Mar, age 3-7, shifted (Catch: Number)

Fleet 1:	Year	Effort	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
	1982	1	3.50	1.90	1.90	4.20	1.90
	1983	1	2.10	1.00	0.30	0.40	0.40
	1984	1	8.20	0.60	0.30	0.40	0.40
	1985	1	166.00	6.70	0.70	0.20	0.20
	1986	1	355.00	75.30	0.20	0.30	0.05
	1987	1	83.00	155.00	23.80	0.30	0.01
	1988	1	19.20	37.90	40.90	4.40	0.01
	1989	1	4.90	7.70	14.30	18.40	2.60
	1990	1	17.60	4.70	3.60	4.60	8.50
	1991	1	89.90	6.20	1.30	2.00	7.80

flt25: Norway acoustic survey, Barents sea, Jan-Mar, age 3-7, shifted (Catch: Number)

Fleet 2:	Year	Effort	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
	1980	1	66.0	160.0	50.0	2.0	1.0
	1981	1	10.0	12.0	29.0	14.0	1.0
	1982	1	9.0	5.0	4.0	10.0	5.0
	1983	1	15.0	7.0	2.0	2.0	2.0
	1984	1	33.0	2.0	1.0	1.0	1.0
	1985	1	751.0	2.0	1.0	1.0	0.5
	1986	1	640.0	166.0	0.5	0.5	0.5
	1987	1	70.0	150.0	23.0	0.5	0.1
	1988	1	34.0	61.0	64.0	6.0	0.1
	1989	1	11.0	15.0	27.0	36.0	5.0
	1990	1	36.0	9.0	9.0	11.0	20.0
	1991	1	101.0	9.0	2.0	2.0	5.0

flt21: Russian bottom trawl, total area, Nov - Dec, age 3 - 7, calendar (Catch: Number)

Fleet 3:	Year	Effort	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
	1983	1	0.50	0.40	0.01	-11.00	-11.00
	1984	1	1.50	0.20	0.10	0.01	-11.00
	1985	1	90.00	0.40	0.10	0.10	-11.00
	1986	1	36.30	16.40	0.10	0.01	0.01
	1987	1	8.30	22.50	5.70	0.01	0.01
	1988	1	1.70	4.00	7.60	0.80	0.01
	1989	1	0.40	1.40	4.10	8.10	1.10
	1990	1	7.30	4.20	7.30	7.40	5.70
	1991	1	6.20	0.90	0.30	0.60	1.80

flt23: Russian acoustic survey, total area, Oct - Dec, age 3 - 7, calend (Catch: Number)

Fleet 4:	Year	Effort	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
	1985	1	636.0	3.0	1.0	0.1	-11.0
	1986	1	917.0	910.0	2.0	0.1	0.1
	1987	1	62.0	197.0	61.0	0.1	-11.0
	1988	1	18.0	83.0	301.0	46.0	-11.0
	1989	1	2.0	14.0	35.0	67.0	9.0
	1990	1	28.0	17.0	23.0	43.0	44.0
	1991	1	65.0	11.0	4.0	7.0	21.0

Table 4.19 North East Arctic HADDOCK.
Tuning analysis.

VPA Version 3.0 (MSDOS) - Jan 1991

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

with cpue data from file J:\IFAPWORK\WG_108\HAD_ARCT\FLEET.FI2

Disaggregated Qs

Log transformation

The final F is the (reciprocal variance-weighted) mean of the raised fleet F's.

No trend in Q (mean used)

Terminal Fs estimated using Laurec-Shepherd method

Regression weights

, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000

Oldest age F = .700*average of 4 younger ages.

Fishing mortalities

Age,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3,	.038,	.100,	.132,	.189,	.062,	.132,	.086,	.041,	.036,	.113,	.041,	.055
4,	.311,	.211,	.272,	.470,	.361,	.219,	.441,	.468,	.124,	.251,	.178,	.212
5,	.694,	.561,	.473,	.468,	.383,	.423,	.304,	.858,	.544,	.248,	.180,	.498
6,	.823,	.910,	.705,	.359,	.293,	.664,	.582,	.289,	.948,	.511,	.123,	.486
7,	.427,	.783,	.594,	.412,	.348,	.555,	.811,	.755,	.311,	.419,	.274,	.169
8,	.744,	.546,	.661,	.420,	.556,	.545,	.533,	.784,	.568,	.340,	.173,	.228
9,	.413,	.570,	.529,	.192,	.432,	.750,	.531,	.583,	.537,	.173,	1.445,	.088
10,	.588,	.218,	.622,	.544,	.424,	.793,	.700,	.425,	.849,	2.060,	4.928,	.286
11,	.639,	.484,	.471,	.482,	.900,	.616,	.511,	.594,	1.424,	.593,	1.222,	1.197
12,	.670,	.644,	1.301,	.187,	2.440,	.445,	1.274,	.987,	1.408,	.920,	.286,	.221
13,	.404,	.335,	.511,	.246,	.734,	.456,	.528,	.453,	.738,	.656,	1.379,	.313
FBAR 4- 7	.564	.612	.511	.426	.342	.455	.5117	.567	.482	.357	.189	.341

Log catchability residuals

Fleet 1

Age,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3,			.48,	.40,	-.28,	.13,	-.34,	-.02,	-.03,	.47,	-.50,	-.32
4,			-.04,	.81,	.76,	-.84,	.02,	-.40,	.05,	.12,	-.26,	-.21
5,			-.05,	.47,	.61,	-.76,	1.44,	-.43,	-.55,	-.13,	-.32,	-.27
6,			-.04,	.80,	-.49,	.23,	-.69,	.45,	.09,	-.56,	.53,	-.33
7,			-1.17,	.97,	-.31,	-.97,	.13,	1.29,	2.79,	-.87,	-.95,	-.90

Fleet 2

Age,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3,	-.64,	.01,	.44,	-.66,	-.76,	-.47,	-.02,	1.06,	.31,	.57,	-.31,	.47
4,	-.73,	.06,	-.36,	-.48,	.20,	1.02,	-.12,	.28,	.23,	.10,	-.26,	.07
5,	-.97,	-.20,	.07,	-.56,	.27,	-.25,	1.39,	.47,	-.13,	.10,	-.36,	.16
6,	.00,	-.77,	-.04,	.06,	-.54,	-.52,	-.33,	.81,	.64,	-.37,	.53,	.54
7,	-1.16,	-.35,	-.75,	.75,	.16,	-.50,	-.79,	.38,	1.88,	-.14,	-.42,	.93

Fleet 3

Age,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3,				.02,	-.39,	-1.07,	.13,	.47,	.58,	1.16,	-1.44,	.54
4,				.14,	.26,	.39,	-.05,	-.06,	.71,	.23,	-1.74,	.13
5,				2.50,	.34,	-.18,	.76,	-.37,	-.23,	-.25,	-2.39,	-.18
6,				3.90,	1.00,	-1.28,	.52,	1.66,	-.41,	-1.94,	-2.14,	-1.32
7,				3.97,	2.68,	1.33,	-.57,	-1.01,	.49,	-2.31,	-2.86,	-1.74

Fleet 4

Age,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3,						-.96,	-1.03,	.53,	.29,	1.62,	-.71,	.26
4,						.92,	-1.52,	.31,	.22,	.48,	-.59,	.17
5,						.38,	.63,	.13,	-1.05,	.47,	-.67,	.10
6,						1.57,	1.05,	2.20,	-1.62,	-1.21,	-1.06,	-.94
7,						1.78,	-.12,	1.05,	2.55,	-1.67,	-2.15,	-1.44

Table 4.19 (Cont'd)

SUMMARY STATISTICS FOR AGE 3								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-7.08	.380	.0008	.0398	.000E+00	.000E+00	-7.076	.114
2	-6.17	.602	.0021	.0878	.000E+00	.000E+00	-6.169	.167
3	-8.89	.881	.0001	.0941	.000E+00	.000E+00	-8.891	.278
4	-6.82	1.029	.0011	.0711	.000E+00	.000E+00	-6.821	.364
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.055	.290		.222		.290		.586

SUMMARY STATISTICS FOR AGE 4								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-7.51	.522	.0005	.1718	.000E+00	.000E+00	-7.506	.157
2	-6.86	.466	.0011	.2266	.000E+00	.000E+00	-6.857	.129
3	-9.10	.730	.0001	.2409	.000E+00	.000E+00	-9.098	.231
4	-6.55	.862	.0014	.2520	.000E+00	.000E+00	-6.550	.305
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.212	.295		.857E-01		.295		.084

SUMMARY STATISTICS FOR AGE 5								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-8.28	.692	.0003	.3788	.000E+00	.000E+00	-8.282	.209
2	-7.41	.611	.0006	.5868	.000E+00	.000E+00	-7.414	.169
3	-9.65	1.342	.0001	.4179	.000E+00	.000E+00	-9.651	.424
4	-6.78	.668	.0011	.5511	.000E+00	.000E+00	-6.784	.236
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.498	.363		.109		.363		.090

SUMMARY STATISTICS FOR AGE 6								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-8.36	.534	.0002	.3502	.000E+00	.000E+00	-8.362	.161
2	-7.50	.546	.0006	.8313	.000E+00	.000E+00	-7.498	.151
3	-10.56	2.079	.0000	.1297	.000E+00	.000E+00	-10.560	.657
4	-7.72	1.660	.0004	.1906	.000E+00	.000E+00	-7.718	.587
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.486	.366		.304		.366		.688

SUMMARY STATISTICS FOR AGE 7								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-8.93	1.370	.0001	.0686	.000E+00	.000E+00	-8.925	.413
2	-7.54	.901	.0005	.4295	.000E+00	.000E+00	-7.536	.250
3	-11.23	2.439	.0000	.0298	.000E+00	.000E+00	-11.226	.771
4	-8.48	1.965	.0002	.0399	.000E+00	.000E+00	-8.477	.695
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.169	.675		.623		.675		.850

Table 4.20

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

Separable analysis

from 1981 to 1991 on ages 3 to 13

with Terminal F of .255 on age 6 and Terminal S of .700

Initial sum of squared residuals was 120.541 and

final sum of squared residuals is 83.911 after 103 iterations

Matrix of Residuals

Years	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91		WTS
Ages												
3/ 4	.320	-.217	.790	.111	.234	-.305	-.029	-.808	.470	-.566	.000	.622
4/ 5	-.397	-.456	.806	.461	.068	.051	.321	-.524	.355	-.684	.000	.611
5/ 6	.017	-.027	.615	-.235	-.122	.001	.322	.152	.295	-1.019	.000	.696
6/ 7	.615	.177	-.050	-.615	.030	-.154	-.451	.899	.242	-.693	.000	.590
7/ 8	.292	-.091	-.272	-.413	.073	.265	.262	-.419	.395	-.092	.000	1.000
8/ 9	-.103	.667	-.116	-.124	-.011	-.167	.295	.857	-1.516	.218	.000	.473
9/10	.176	-.123	-.625	-.112	.584	.433	-.068	-.558	-2.147	2.440	.000	.263
10/11	-1.652	-.748	-.778	-.798	.036	-.332	-1.657	-.106	.983	5.053	.000	.156
11/12	-1.032	.063	-1.078	.790	-.589	-.756	-.877	.786	.189	2.504	.000	.268
12/13	-.361	.963	-1.966	2.414	-.774	.827	-.107	.629	-.707	-.919	.000	.244
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	
WTS	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		
Fishing Mortalities (F)												
1981												
F-values	.6528											
1982 1983 1984 1985 1986 1987 1988 1989 1990 1991												
F-values	.6934	.4846	.5006	.5643	.6000	.6222	.5589	.4878	.3286	.2550		
Selection-at-age (S)												
3												
S-values	.1441											
4 5 6 7 8 9 10 11 12 13												
S-values	.5265	.8407	1.0000	1.0314	1.0656	1.0369	1.6927	1.3181	1.2371	.7000		

Table 4.21 Sum of Products Check.

Run title : Haddock in the North-East Arctic (Fishing Areas I and II)
Traditional vpa using file input for terminal F

YEAR AGE	Catch numbers at age			Numbers*10**-3		1967	1968	1969	1970	1971
	1962	1963	1964	1965	1966					
3	39604	28567	22305	5911	26157	15918	657	1520	23004	1979
4	30947	72995	49162	46161	22469	41373	67632	1963	2408	24359
5	49028	19035	30592	40032	62724	13505	41267	44526	1870	1258
6	33922	13627	5800	12578	28840	25736	7748	18956	21995	918
7	3209	9290	3519	1672	5711	8878	15599	3611	7948	9279
8	1344	1243	2709	970	578	1617	5292	4925	1974	3056
9	1778	561	832	893	435	218	655	1624	1978	826
10	243	409	104	122	188	176	182	315	726	1043
11	247	79	206	204	186	155	101	43	166	369
12	482	84	234	123	25	76	115	43	26	130
13	20	169	121	14	8	27	18	14	52	27
+gp	8	41	67	205	7	7	19	2	19	4
TOTALNUM	160832	146100	115651	108885	147328	107686	139285	77542	62166	43248
TONSLAND	187888	146744	98900	118079	160621	136486	181726	130509	86601	78302
SOPCOF %	74	74	62	70	66	79	79	80	75	100

YEAR AGE	Catch numbers at age			Numbers*10**-3		1977	1978	1979	1980	1981
	1972	1973	1974	1975	1976					
3	230229	70204	9684	10037	13989	55967	47311	17540	627	486
4	22246	258773	41701	14089	13449	22043	18812	35290	22878	2561
5	42849	24018	88111	33871	6808	7368	4076	10645	21794	22124
6	3196	6872	5827	49712	20789	2586	1389	1429	2971	10685
7	1606	418	4138	2135	40044	7781	1626	812	250	1034
8	6736	422	382	1236	1247	11043	2596	546	504	162
9	2630	1680	617	92	1349	311	6215	1466	230	162
10	896	525	2043	131	193	388	162	2310	842	72
11	988	146	935	500	279	96	258	181	1299	330
12	538	340	276	147	652	101	3	87	111	564
13	53	68	458	53	331	84	74	2	35	27
+gp	42	13	143	92	46	98	65	53	15	42
TOTALNUM	312009	363479	154315	112095	99176	107866	82587	70361	51556	38249
TONSLAND	265317	320065	221138	175742	137279	110158	95422	103623	87889	77153
SOPCOF %	86	83	86	81	63	77	95	112	103	98

YEAR AGE	Catch numbers at age			Numbers*10**-3		1987	1988	1989	1990	1991
	1982	1983	1984	1985	1986					
3	883	704	456	29548	25596	3928	794	1050	518	4237
4	900	1930	841	1153	61470	88297	9031	3951	1174	1938
5	3372	884	836	546	1013	52611	50868	12305	1871	1947
6	12203	1374	307	715	376	586	19465	23032	4138	3000
7	2625	3282	765	316	346	207	382	3423	6754	4023
8	344	906	2250	634	144	123	65	247	851	3573
9	75	52	499	1312	295	74	35	11	389	310
10	80	37	70	416	484	119	44	36	50	24
11	91	29	25	50	112	175	142	12	3	0
12	320	21	36	5	35	87	135	22	3	0
13	204	21	44	1	3	4	22	17	9	2
+gp	34	91	185	57	7	19	11	15	15	5
TOTALNUM	21131	9331	6314	34753	89881	146230	80994	44121	15775	19059
TONSLAND	46955	21607	17661	41270	96585	150659	91744	55122	25816	33214
SOPCOF %	93	91	91	97	90	98	99	97	96	102

Table 4.22 Virtual Population Analysis

Run title : Haddock in the North-East Arctic (Fishing Areas I and II)
Traditional vpa using file input for terminal F

YEAR AGE	Fishing mortality (F) at age									
	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
3	.1996	.1216	.0799	.0671	.1278	.0623	.0371	.1024	.1677	.0231
4	.5945	.6799	.3161	.2353	.3862	.3046	.4030	.1481	.2334	.2689
5	1.0437	.9334	.6898	.4602	.5758	.4243	.5655	.5082	.2053	.1838
6	1.0417	.9813	.8558	.6907	.7176	.4954	.4623	.5562	.5101	.1471
7	.6198	.9527	.7509	.6502	.8005	.5041	.6415	.4077	.4804	.4207
8	.6562	.5223	.8400	.4754	.4906	.5550	.6466	.4277	.4097	.3429
9	.9781	.6405	.8166	.7565	.4061	.3459	.4583	.4186	.3043	.3001
10	.4000	.6327	.2289	.2591	.3464	.2851	.5448	.4181	.3344	.2604
11	.4004	.2180	.7802	.9395	.7896	.5370	.2631	.2358	.4068	.2833
12	.7186	.2295	1.9529	1.8825	.2690	.9137	1.0196	.1705	.2187	.6505
13	.6000	.6000	.6000	.6000	.6000	.5200	.5700	.3100	.3200	.3700
+gp	.6000	.6000	.6000	.6000	.6000	.5200	.5700	.3100	.3200	.3700
FBAR 4- 7	.8249	.8868	.6531	.5091	.6200	.4321	.5181	.4051	.3573	.2551

YEAR AGE	Fishing mortality (F) at age									
	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
3	.2853	.3361	.2216	.2578	.3229	.7675	.3643	.1554	.0375	.1005
4	.3846	.5995	.3423	.5767	.6503	1.2816	.6441	.5100	.3107	.2108
5	1.0626	.9492	.4193	.5170	.6164	.9420	.8947	.9720	.6937	.5598
6	.9627	.4692	.6380	.4445	.7053	.5043	.4514	.9643	.8242	.9099
7	.4110	.3030	.5791	.5113	.7930	.6327	.6974	.5223	.4305	.7864
8	.6203	.1789	.5004	.3387	.6446	.5265	.4475	.5357	.7304	.5533
9	.5594	.3054	.4282	.2131	.7628	.3246	.6452	.4927	.4543	.5510
10	.6185	.2032	.7480	.1500	.9204	.5168	.2800	.5315	.5905	.2493
11	.4205	.1883	.6661	.4072	.5415	2.2980	.7921	.5776	.6555	.4876
12	.8621	.2489	.6438	.2023	1.5436	.3835	.4329	.6899	.8742	.6751
13	.6100	.2400	.6200	.2400	.9400	.8800	.5400	.5800	.6700	.5400
+gp	.6100	.2400	.6200	.2400	.9400	.8800	.5400	.5800	.6700	.5400
FBAR 4- 7	.7052	.5802	.4947	.5124	.6912	.8402	.6719	.7421	.5648	.6167

YEAR AGE	Fishing mortality (F) at age									
	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
3	.1310	.1846	.0619	.1320	.0852	.0608	.0361	.0755	.0345	.0367
4	.2725	.4648	.3495	.2190	.4412	.4661	.1931	.2515	.1132	.1745
5	.4711	.4693	.3762	.4027	.3043	.8576	.5400	.4355	.1811	.2773
6	.7017	.3568	.2940	.6444	.5381	.2895	.9483	.5046	.2546	.4890
7	.5935	.4091	.3448	.5584	.7631	.6509	.3109	.4194	.2692	.4207
8	.6669	.4194	.5487	.5368	.5386	.6886	.4355	.3395	.1730	.2228
9	.5411	.1941	.4315	.7320	.5175	.5933	.4245	.1204	1.4445	.0879
10	.5854	.5664	.4320	.7903	.6670	.4073	.8808	1.0713	1.1969	.2859
11	.5704	.4356	.9798	.6347	.5071	.5442	1.2823	.6395	.2207	.0000
12	1.3263	.2458	1.6714	.5267	1.3826	.9726	1.1243	.6882	.3214	.0000
13	.5566	.2557	1.2111	.1626	.7064	.5485	.7136	.3907	.6828	.3688
+gp	.5566	.2557	1.2111	.1626	.7064	.5485	.7136	.3907	.6828	.3688
FBAR 4- 7	.5097	.4250	.3411	.4561	.5117	.5660	.4981	.4027	.2045	.3404

Table 4.23 Virtual Population Analysis.

Run title : Haddock in the North-East Arctic (Fishing Areas I and II)
Traditional vpa using file input for terminal F

YEAR AGE	Stock number at age (start of year)					Numbers*10**-3		1969	1970	1971
	1962	1963	1964	1965	1966	1967	1968			
3	240734	274647	320168	100433	240080	290491	19893	17203	163914	95474
4	75445	161439	199108	242009	76894	172983	223470	15694	12714	113479
5	82090	34087	66971	118839	156604	42788	104441	122274	11080	8243
6	56863	23667	10973	27508	61409	72092	22918	48578	60225	7388
7	7586	16428	7263	3818	11288	24532	35966	11818	22805	29606
8	3049	3342	5188	2806	1632	4151	12132	15504	6436	11549
9	3094	1295	1623	1834	1428	818	1951	5203	8276	3498
10	808	953	559	587	704	779	474	1010	2803	4998
11	821	443	414	364	371	408	480	225	544	1643
12	1025	450	292	155	116	138	195	302	146	297
13	48	409	293	34	19	73	45	58	208	96
+gp	19	99	162	496	17	19	48	8	76	14
TOTAL	471582	517258	613013	498884	550565	609271	422013	237877	289228	276284

YEAR AGE	Stock number at age (start of year)					Numbers*10**-3		1979	1980	1981
	1972	1973	1974	1975	1976	1977	1978			
3	1018609	269823	53561	48530	55632	113801	169931	134147	18788	5597
4	76381	626977	157848	35136	30705	32979	43249	96648	94026	14817
5	71003	42567	281869	91778	16160	13120	7496	18596	47518	56422
6	5616	20089	13489	151732	44805	7143	4187	2508	5760	19441
7	5222	1756	10288	5835	79651	18121	3532	2183	783	2068
8	15915	2834	1062	4720	2865	29508	7880	1440	1060	417
9	6710	7008	1941	527	2754	1231	14270	4124	690	418
10	2122	3140	4227	1035	349	1052	729	6128	2063	359
11	3154	936	2098	1638	730	114	514	451	2949	936
12	1013	1696	635	882	893	348	9	190	207	1254
13	127	350	1083	273	590	156	194	5	78	71
+gp	100	67	338	474	82	182	170	132	34	110
TOTAL	1205972	977242	528437	342562	235216	217754	252161	266551	173956	101909

YEAR AGE	Stock number at age (start of year)					Numbers*10**-3		1989	1990	1991	1992
	1982	1983	1984	1985	1986	1987	1988				
3	7915	4594	8374	263051	345145	73419	24717	15909	16834	129652	0
4	4144	5684	3127	6445	188735	259492	56565	19519	12077	13315	102325
5	9825	2584	2924	1805	4239	99399	133305	38180	12427	8830	9156
6	26393	5022	1323	1643	988	2560	34519	63599	20224	8489	5478
7	6407	10712	2878	807	706	472	1569	10949	31438	12835	4262
8	771	2898	5826	1669	378	270	202	941	5894	19665	6900
9	196	324	1560	2756	799	181	111	107	549	4059	12885
10	197	94	219	829	1085	390	82	59	78	106	3043
11	229	90	43	116	308	456	212	28	17	19	65
12	471	106	48	13	50	152	217	48	12	11	16
13	522	102	68	7	6	10	47	58	20	7	9
+gp	87	443	285	418	15	49	24	51	33	18	14
TOTAL	57159	32653	26674	279560	542454	436849	251570	149448	99602	197006	144153

Table 4.24 Virtual Population Analysis

Run title : Haddock in the North-East Arctic (Fishing Areas I and II)
Traditional vpa using file input for terminal F

YEAR AGE	Stock biomass at age (start of year)					Tonnes				
	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
3	158884	181267	211311	66286	158453	191724	13130	11354	108184	63013
4	77708	166282	205082	249269	79201	178172	230174	16165	13095	116884
5	146941	61015	119878	212722	280322	76591	186950	218871	19834	14754
6	135333	56327	26116	65470	146155	171580	54545	115616	143335	17584
7	21697	46983	20771	10919	32285	70160	102862	33800	65224	84673
8	10152	11129	17275	9345	5433	13822	40398	51627	21431	38457
9	11448	4791	6005	6784	5285	3026	7218	19250	30620	12943
10	3562	4201	2464	2590	3107	3436	2089	4454	12360	22040
11	4431	2394	2237	1965	2004	2203	2590	1215	2940	8870
12	6870	3016	1955	1041	780	924	1308	2022	975	1988
13	358	3028	2168	251	143	539	335	427	1542	708
+gp	155	794	1298	3971	136	151	382	66	609	113
TOTALBIO	577540	541228	616560	630613	713302	712328	641982	474866	420149	382029
EXPLTBIO	306194	222927	245982	331109	392419	399220	442929	401448	321274	306928

YEAR AGE	Stock biomass at age (start of year)					Tonnes				
	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
3	672282	178083	35350	32030	36717	75109	112155	88537	12400	3694
4	78672	645786	162583	36190	31626	33968	44547	99547	96847	15261
5	127095	76196	504545	164283	28927	23484	13417	33286	85057	100996
6	13365	47811	32104	361123	106637	17001	9966	5970	13709	46269
7	14935	5021	29423	16689	227801	51826	10101	6243	2239	5915
8	52998	9439	3535	15719	9541	98260	26242	4794	3530	1388
9	24828	25928	7180	1950	10191	4555	52798	15259	2552	1547
10	9356	13848	18643	4566	1538	4638	3213	27025	9098	1581
11	17030	5053	11330	8846	3940	614	2773	2434	15924	5054
12	6787	11362	4253	5913	5980	2329	63	1276	1388	8399
13	938	2592	8011	2020	4367	1155	1435	37	579	524
+gp	804	536	2704	3791	656	1457	1363	1053	268	881
TOTALBIO	1019091	1021654	819660	653118	467922	314397	278072	285462	243592	191508
EXPLTBIO	438923	667030	519077	421634	315322	170772	149860	124143	150774	127290

YEAR AGE	Stock biomass at age (start of year)					Tonnes				
	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
3	5224	3032	5527	115742	96640	17620	6673	4454	4714	50564
4	4269	5855	3221	5285	154762	124556	22061	8589	8696	9986
5	17587	4625	5233	3213	6485	92441	81316	26726	11806	13068
6	62816	11952	3149	3944	2233	5683	37971	64871	25684	13753
7	18325	30637	8231	2172	1596	1351	2448	15657	47471	21692
8	2569	9649	19400	5558	1259	898	672	3135	11198	40904
9	726	1199	5771	10196	2956	668	410	395	2031	9579
10	870	412	964	3658	4785	1719	360	262	342	467
11	1235	486	235	627	1664	2462	1147	150	90	104
12	3152	709	319	89	338	1018	1451	323	80	73
13	3866	757	502	54	48	77	348	426	147	53
+gp	697	3545	2281	3344	121	394	188	407	265	142
TOTALBIO	121336	72859	54832	153881	272887	248887	155046	125395	112522	160384
EXPLTBIO	98661	55826	56857	93724	209431	270918	185622	140786	131082	95286

Table 4.25 Virtual Population Analysis.

Run title : Haddock in the North-East Arctic (Fishing Areas I and II)
Traditional vpa using file input for terminal F

YEAR AGE	Spawning stock biomass at age (spawning time)						Tonnes			
	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
3	0	0	0	0	0	0	0	0	0	0
4	3885	8314	10254	12463	3960	8909	11509	808	655	5844
5	33796	14034	27572	48926	64474	17616	42998	50340	4562	3393
6	71727	29854	13842	34699	77462	90937	28909	61276	75967	9320
7	19094	41345	18279	9609	28411	61741	90519	29744	57397	74512
8	9949	10906	16929	9158	5324	13545	39590	50594	21003	37688
9	11448	4791	6005	6784	5285	3026	7218	19250	30620	12943
10	3562	4201	2464	2590	3107	3436	2089	4454	12360	22040
11	4431	2394	2237	1965	2004	2203	2590	1215	2940	8870
12	6870	3016	1955	1041	780	924	1308	2022	975	1988
13	358	3028	2168	251	143	539	335	427	1542	708
+gp	155	794	1298	3971	136	151	382	66	609	113
TOTSPBIO	165275	122677	103003	131457	191085	203027	227448	220197	208630	177421

YEAR AGE	Spawning stock biomass at age (spawning time)						Tonnes			
	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
3	0	0	0	0	0	0	0	0	0	37
4	3934	32289	8129	1810	1581	1698	2227	4977	4842	1831
5	29232	17525	116045	37785	6653	5401	3086	7656	19563	64637
6	7083	25340	17015	191395	56518	9011	5282	3164	7266	33776
7	13142	4418	25892	14686	200465	45607	8889	5494	1971	5679
8	51939	9250	3465	15404	9350	96295	25717	4698	3460	1388
9	24828	25928	7180	1950	10191	4555	52798	15259	2552	1547
10	9356	13848	18643	4566	1538	4638	3213	27025	9098	1581
11	17030	5053	11330	8846	3940	614	2773	2434	15924	5054
12	6787	11362	4253	5913	5980	2329	63	1276	1388	8399
13	938	2592	8011	2020	4367	1155	1435	37	579	524
+gp	804	536	2704	3791	656	1457	1363	1053	268	881
TOTSPBIO	165074	148141	222666	288165	301240	172761	106846	73074	66911	125333

YEAR AGE	Spawning stock biomass at age (spawning time)						Tonnes			
	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
3	470	515	387	2315	0	0	0	0	0	0
4	2348	4098	451	423	34048	1246	662	344	174	699
5	12839	4625	1832	2571	3437	19413	26834	8018	3542	3920
6	58419	11952	1480	3668	1920	3012	19365	40869	13869	6876
7	17592	30637	6091	2085	1373	1351	2448	12839	36553	17354
8	2569	9649	19400	5558	1259	898	672	3135	9742	37631
9	726	1199	5771	10196	2956	668	410	395	1625	9579
10	870	412	964	3658	4785	1719	360	262	342	467
11	1235	486	235	627	1664	2462	1147	150	90	104
12	3152	709	319	89	338	1018	1451	323	80	73
13	3866	757	502	54	48	77	348	426	147	53
+gp	697	3545	2281	3344	121	394	188	407	265	142
TOTSPBIO	104783	68586	39711	34586	51948	32257	53886	67167	66428	76898

Table 4.26 Virtual Population
Analysis

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

Summary (with SOP correction)
Traditional vpa using file input for terminal F

	RECRUITS	TOTALBIO	EXPLTBIO	TOTSPBIO	LANDINGS	SOPCOFAC	FBAR 4- 7
1962	240734	429606	227764	122941	187888	.7439	.8249
1963	274647	401730	165469	91058	146744	.7423	.8868
1964	320168	379555	151427	63409	98900	.6156	.6531
1965	100433	441746	231942	92086	118079	.7005	.5091
1966	240080	470894	259060	126147	160621	.6602	.6200
1967	290491	563590	315861	160634	136486	.7912	.4321
1968	19893	508420	350779	180128	181726	.7920	.5181
1969	17203	381129	322203	176731	130509	.8026	.4051
1970	163914	316971	242377	157396	86601	.7544	.3573
1971	95474	382047	306943	177429	78302	1.0000	.2551
1972	1018609	873483	376209	141488	265317	.8571	.7052
1973	269823	844898	551627	122511	320065	.8270	.5802
1974	53561	705940	447060	191773	221138	.8613	.4947
1975	48530	531309	342998	234421	175742	.8135	.5124
1976	55632	294711	198599	189730	137279	.6298	.6912
1977	113801	241389	131116	132643	110158	.7678	.8402
1978	169931	263525	142020	101257	95422	.9477	.6719
1979	134147	321068	139627	82189	103623	1.1247	.7421
1980	18788	251413	155614	69059	87889	1.0321	.5648
1981	5597	188219	125104	123181	77153	.9828	.6167
1982	7915	113292	92119	97836	46955	.9337	.5097
1983	4594	66351	50839	62460	21607	.9107	.4250
1984	8374	49926	51771	36158	17661	.9105	.3411
1985	263051	148549	90477	33388	41270	.9654	.4561
1986	345145	245952	188759	46820	96585	.9013	.5117
1987	73419	244521	266165	31691	150659	.9825	.5660
1988	24717	153854	184195	53472	91744	.9923	.4981
1989	15909	121904	136866	65297	55122	.9722	.4027
1990	16834	108354	126227	63967	25816	.9630	.2045
1991	129652	164247	97581	78750	33214	1.0241	.3404
Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)	(Tonnes)		

Table 4.27

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

Prediction run MAN-OPT-2: Initial stock size and Recruitment (Thousands)

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1992	118000	102325	9156	5478	4262	6900	12885	3043	65	16	9	14
1993	269000	.	.	.	.	.	.	.	.	.	.	.
1994	136000	.	.	.	.	.	.	.	.	.	.	.

Prediction run MAN-OPT-2: Weight in stock (Kilograms)

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1992	0.37	0.82	1.54	2.07	2.36	2.24	2.77	4.20	5.40	6.70	7.40	8.00
1993	0.35	0.76	1.32	1.65	1.85	2.07	2.94	4.34	5.40	6.70	7.40	8.00
1994	0.35	0.76	1.32	1.65	1.85	2.07	2.94	4.34	5.40	6.70	7.40	8.00

Prediction run MAN-OPT-2: Natural mortality

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1992	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1993	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1994	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Prediction run MAN-OPT-2: Maturity ogive

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1992	0.01	0.07	0.37	0.55	0.78	0.86	0.91	1.00	1.00	1.00	1.00	1.00
1993	0.01	0.07	0.37	0.55	0.78	0.86	0.91	1.00	1.00	1.00	1.00	1.00
1994	0.01	0.07	0.37	0.55	0.78	0.86	0.91	1.00	1.00	1.00	1.00	1.00

Prediction run MAN-OPT-2: Proportion of F before spawning

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1992	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0

Prediction run MAN-OPT-2: Proportion of M before spawning

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1992	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0

Prediction run MAN-OPT-2: Exploitation pattern

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1992	0.1696	0.6193	0.9895	1.177	1.2139	1.2542	1.2204	1.9922	1.5513	1.456	0.8239	0.8239
1993	0.1696	0.6193	0.9895	1.177	1.2139	1.2542	1.2204	1.9922	1.5513	1.456	0.8239	0.8239
1994	0.1696	0.6193	0.9895	1.177	1.2139	1.2542	1.2204	1.9922	1.5513	1.456	0.8239	0.8239

Prediction run MAN-OPT-2: Weight in catch (Kilograms)

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1992	0.57	1.22	1.54	1.81	1.95	2.20	2.41	3.06	5.40	6.70	7.40	8.00
1993	0.82	1.26	1.53	1.77	1.95	2.14	2.77	3.96	5.40	6.70	7.40	8.00
1994	0.82	1.26	1.53	1.77	1.95	2.14	2.77	3.96	5.40	6.70	7.40	8.00

Table 4.28

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

Effects of different levels of fishing mortality on catch,
stock biomass and spawning stock biomass

F factor 1992	Reference F 1992	Stock biomass 1992	Sp.stock biomass 1992	Catch weight 1992	Biologic. reference point	Reference F 1993	Stock biomass 1993	Sp.stock biomass 1993	Catch weight 1993	Stock biomass 1994	Sp.stock biomass 1994
0.3470	0.3470	227629	85094	53970	F0.1	0.1400	319132	98708	37096	437042	142702
.	.	.	.	.		0.1500	.	98708	39559	434555	141206
.	.	.	.	.		0.1600	.	98708	41998	432093	139730
.	.	.	.	.		0.1700	.	98708	44415	429658	138273
.	.	.	.	.		0.1800	.	98708	46809	427247	136836
.	.	.	.	.		0.1900	.	98708	49181	424862	135416
.	.	.	.	.	F90	0.2000	.	98708	51530	422501	134015
.	.	.	.	.		0.2100	.	98708	53858	420164	132632
.	.	.	.	.		0.2200	.	98708	56164	417851	131267
.	.	.	.	.		0.2300	.	98708	58449	415562	129919
.	.	.	.	.		0.2400	.	98708	60713	413295	128588
.	.	.	.	.		0.2500	.	98708	62956	411052	127275
.	.	.	.	.		0.2600	.	98708	65178	408832	125978
.	.	.	.	.		0.2700	.	98708	67380	406634	124698
.	.	.	.	.		0.2800	.	98708	69563	404458	123434
.	.	.	.	.		0.2900	.	98708	71725	402303	122186
.	.	.	.	.		0.3000	.	98708	73868	400171	120953
.	.	.	.	.		0.3100	.	98708	75991	398059	119737
.	.	.	.	.		0.3200	.	98708	78095	395969	118535
.	.	.	.	.		0.3300	.	98708	80181	393899	117349
.	.	.	.	.	F91	0.3400	.	98708	82248	391849	116178
.	.	.	.	.	Fmed=F92	0.3500	.	98708	84296	389820	115021

Run name : MAN-OPT-2
 Computation of ref. F: Unweighted mean of age 4 - 7
 Unit of measurement : Tonnes

Table 4.29

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

Year	Scenario	Reference F	Catch numbers	Catch weight	Prediction		Sp.stock size 1. jan.	Sp.stock biomass 1. jan.	Sp.stock size sp. time	Sp.stock biomass sp. time
					Stock size	Stock biomass				
1992	Low	0.3471	37276	53984	262153	227629	38876	85094	38876	85094
1993	growth	0.1400	24305	37092	450109	319436	52039	98563	52039	98563
1994		0.1400	36306	48523	482603	326366	82157	121537	82157	121537
1995	F0.1 =	0.1400	41129	61016	402388	373745	130035	184867	130035	184867
1996	0.14	0.1400	37929	65653	332379	422987	149148	260343	149148	260343
1997		0.1400	31843	64782	277952	433001	145238	311823	145238	311823
1992	Low	0.3471	37276	53984	262153	227629	38876	85094	38876	85094
1993	growth	0.3500	56398	84289	450109	319436	52039	98563	52039	98563
1994		0.3500	75997	95296	453795	287003	69914	96219	69914	96219
1995	Fmed =	0.3500	76547	105303	343200	286980	99104	126638	99104	126638
1996	0.35	0.3500	60978	97447	252215	276428	98921	154215	98921	154215
1997		0.3500	44561	80768	191747	239261	81292	155343	81292	155343
1992	Average	0.3471	37276	53984	262153	227629	38876	85094	38876	85094
1993	growth	0.1400	24305	37092	450109	319436	52039	98563	52039	98563
1994		0.1400	36306	61458	482603	449040	82157	151164	82157	151164
1995	F0.1 =	0.1400	41129	76696	402388	520266	130035	238918	130035	238918
1996	0.14	0.1400	37929	78987	332379	542340	149148	315078	149148	315078
1997		0.1400	31843	73457	277952	509843	145238	351233	145238	351233
1992	Average	0.3471	37276	53984	262153	227629	38876	85094	38876	85094
1993	growth	0.3500	56398	84289	450109	319436	52039	98563	52039	98563
1994		0.3500	75997	122644	453795	399292	69914	121671	69914	121671
1995	Fmed =	0.3500	76547	135160	343200	409119	99104	168999	99104	168999
1996	0.35	0.3500	60978	119739	252215	367240	98921	193371	98921	193371
1997		0.3500	44561	94323	191747	294378	81292	181014	81292	181014
1992	High	0.3471	37276	53984	262153	227629	38876	85094	38876	85094
1993	growth	0.1400	24305	37092	450109	319436	52039	98563	52039	98563
1994		0.1400	36306	76329	482603	562061	82157	179939	82157	179939
1995	F0.1 =	0.1400	41129	95296	402388	653207	130035	291085	130035	291085
1996	0.14	0.1400	37929	96631	332379	667436	149148	378706	149148	378706
1997		0.1400	31843	87508	277952	608166	145238	410469	145238	410469
1992	High	0.3471	37276	53984	262153	227629	38876	85094	38876	85094
1993	growth	0.3500	56398	84289	450109	319436	52039	98563	52039	98563
1994		0.3500	75997	153706	453795	502400	69914	146134	69914	146134
1995	Fmed =	0.3500	76547	169848	343200	518263	99104	208812	99104	208812
1996	0.35	0.3500	60978	148122	252215	458112	98921	236111	98921	236111
1997		0.3500	44561	114093	191747	357965	81292	215201	81292	215201

Run name : HIGH-4
 Computation of ref. F: Unweighted mean of age 4 - 7
 Catch in numbers : Thousands
 Catch in weight : Tonnes
 Stock size : Thousands
 Biomass : Tonnes

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	1982	1983	1984	1985	1986
Denmark	-	-	-	-	-
Faroe Islands	339	539	503	490	426
France	82	418	431	657	308
German Dem.Rep.	-	-	6	11	-
Germany, Fed.Rep.	7,224	4,933	4,532	1,837	3,470
Norway	159,643	149,556	152,818	103,899	63,090
Spain	-	33	-	-	-
UK (Engl. & Wales)	731	1,251	335	202	54
UK (Scotland)	1	-	-	+	21
USSR	14	206	161	51	27
Total	168,034	156,936	158,786	107,147	67,396

Country	1987	1988	1989	1990	1991 ¹
Denmark	1	-	-	-	5
Faroe Islands	712	441	388	1,207	963
France	576	411	460 ²	340 ²	77 ²
German Dem.Rep.	-	17	-	14	-
Germany, Fed.Rep	4,909	4,557	606	1,126	1,805
Norway	85,710	108,244	119,625	91,945 ¹	105,445
Spain	-	-	-	-	-
UK (Engl. & Wales)	54	436	702	681	408 ²
UK (Scotland)	3	6	23	28	-
USSR	426	130	506	52	518 ²
Total	92,391	114,242	122,310	95,393	109,221

¹Provisional figures.

²As reported to Norwegian authorities.

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 ¹	24.6	43.3	19.3	8.2	95.4
1991 ¹	38.8	41.9	18.9	9.6	109.2

¹Preliminary.

²Unresolved 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.

Year	Vessel size (m)						
	<9.9	10.0-14.9	15.0-19.9	20.0-24.9	25.0-29.9	30.0-34.9	>35
1977	85 ²	35	88	66	9	6	4
1978	62 ²	42	80	72	6	8	5
1979	105 ²	51	94	72	11	8	6
1980	78	73	118	96	18	11	10
1981	122	81	109	89	7	6	10
1982	101	100	107	98	11	7	5
1983	49	85	88	80	4	4	4
1984	34	62	72	69	5	6	4
1985	15	30	45	57	9	4	3
1986	11	14	30	43	9	5	7
1987	32	30	44	46	10	3	2
1988	29	44	47	48	10	3	-
1989	40	91	64	61	10	3	-
1990	17	38	34	53	13	4	2
1991 ¹	16	58	47	54	14	2	1
Catch (tonnes)							
1977	1,137 ²	1,082	19,179	25,324	1,709	3,705	241
1978	629 ²	1,485	14,174	21,224	1,596	3,808	690
1979	1,246 ²	2,195	17,783	27,057	2,798	5,730	594
1980	924	3,481	16,838	27,551	3,710	5,224	1,300
1981	1,599	4,834	19,551	29,108	1,924	4,647	783
1982	1,991	5,699	22,538	35,969	3,028	5,334	941
1983	805	4,692	14,428	28,348	1,447	3,516	561
1984	186	1,553	7,095	20,668	1,638	2,239	2,836
1985	204	874	3,072	18,328	3,011	2,908	2,472
1986	50	275	956	3,581	1,000	1,383	260
1987	606	1,585	6,893	16,766	4,052	3,424	709
1988	1,029	2,606	9,476	20,413	5,535	3,446	-
1989	722	4,937	9,334	23,000	7,975	2,491	-
1990	88	618	1,827	13,630	5,592	1,710	1,104
1991 ¹	143	3,213	5,473	19,875	5,906	2,011	1,103
Catch per vessel (tonnes)							
1977	13 ²	31	218	384	190	618	60
1978	10 ²	35	177	295	266	476	138
1979	12 ²	43	189	376	254	716	99
1980	12	48	143	287	206	475	130
1981	13	60	179	327	275	775	78
1982	20	57	211	367	275	762	188
1983	16	55	164	354	362	879	140
1984	5	25	99	300	328	373	709
1985	14	29	68	322	335	727	824
1986	5	20	32	83	111	277	37
1987	19	53	157	364	405	1,141	355
1988	35	59	202	425	554	1,149	-
1989	18	54	146	377	798	830	-
1990	5	16	54	257	430	428	552
1991 ¹	9	55	116	368	422	1,006	1,103

Table 5.4 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 ²	22,751	31,187	730

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	105	52.3	249

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 North-East Arctic SAITHE. Results from the Norwegian acoustic survey in October-November. Numbers in millions.

Year	Ages					Total
	2	3	4	5	6+	
1985 ¹	7.8	12.3	6.1	1.2	+	27.4
1986	49.5	108.5	9.0	4.5	6.5	178.0
1987	4.5	54.0	118.5	4.4	4.5	185.9
1988	40.0	54.0	26.5	7.9	0.5	128.9
1989	60.9	68.6	37.0	21.6	21.0	209.1
1990	248.0	43.1	19.4	8.9	16.4	335.8
1991	218.4	219.4	10.8	8.1	15.9	472.6

¹ Only northern part of area covered, the year excluded from VPA tuning. Abundance estimates from the Halten Bank area covered only in 1988-1991 are not included in the Table.

Table 5.7

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

FLT01: NORTHEAST ARCTIC SAITHE : EFFORT AND CATCH DATA, Norw Purse Seine

Year	Effort	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
1977	206	81152	8694	2144	133	9
1978	214	37652	8788	2126	456	88
1979	199	41942	6706	6575	1362	363
1980	215	23353	15280	3280	1683	681
1981	203	68716	57704	2219	154	36
1982	213	28360	43980	250	140	1
1983	161	12402	9775	12090	463	179
1984	124	21699	3842	2144	1363	21
1985	98	28815	2688	1096	340	95
1986	96	9869	593	181	108	51
1987	94	12364	32183	386	19	2
1988	103	3253	27063	13169	72	6
1989	131	5250	8521	18211	2880	24
1990	96	7207	3319	2582	1845	673
1991	105	42837	2054	463	162	92

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

FLT02: NORTHEAST ARCTIC SAITHE : EFFORT AND CATCH DATA, Norw Trawl

Year	Effort	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8
1976	36.8	11184	583	1080	1137	869	612
1977	52.7	4557	9047	3260	202	660	322
1978	51.3	488	3104	3440	1400	319	591
1979	42.7	7374	6538	2340	762	845	419
1980	57.4	10270	10301	1726	2891	1392	406
1981	71.0	5680	12137	10877	1901	1053	1351
1982	58.2	1719	10344	10006	5519	420	306
1983	57.7	3341	10024	14949	2189	1720	535
1984	85.5	14876	25819	7038	7161	656	744
1985	63.7	10070	6177	3844	3877	2446	441
1986	45.2	4388	8150	4078	3172	2044	779
1987	30.1	470	7862	2452	1169	1405	189
1988	50.4	1539	2241	14077	3031	1438	609
1989	59.8	3923	9038	9226	8659	1154	178
1990	60.4	8909	7960	3932	3722	3967	479
1991	52.3	24815	5121	2796	2210	1479	885

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

FLT03: NORTHEAST ARCTIC SAITHE : EFFORT AND CATCH DATA, Norw Survey

Year	Effort	Catch, age 3	Catch, age 4	Catch, age 5
1986	1	108.5	9.0	4.5
1987	1	54.0	118.5	4.4
1988	1	54.0	26.5	7.9
1989	1	68.6	37.0	21.6
1990	1	43.1	19.4	8.9
1991	1	219.4	10.8	8.1

Table 5.8

VPA Version 3.0 (MSDOS) - Jan 1991

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

with cpue data from file J:\IFAPWORK\WG_108\SAI_ARCT\FLEET.VT5

Disaggregated Qs

Log transformation

The final F is the (reciprocal variance-weighted) mean of the raised fleet F's.

No trend in Q (mean used)

Terminal Fs estimated using Laurec-Shepherd method

Regression weights

, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000

Oldest age F = .600*average of 5 younger ages.

Fishing mortalities

Age,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
2,	.215,	.217,	.194,	.205,	.058,	.079,	.146,	.115,	.124,	.009,	.018,	.045,	.070,	.160,	.027,	.045
3,	.891,	.760,	.608,	.435,	.507,	.410,	.400,	.213,	.749,	.766,	.117,	.128,	.127,	.247,	.506,	.251
4,	.666,	.661,	.495,	.666,	.500,	.563,	.650,	.528,	.808,	.502,	.466,	.415,	.406,	.514,	.464,	.476
5,	.591,	.485,	.539,	.509,	.610,	.625,	.800,	.823,	.565,	.402,	.517,	.281,	.534,	.804,	.463,	.359
6,	.401,	.297,	.418,	.369,	.456,	.517,	.519,	.465,	.765,	.521,	.477,	.553,	.535,	.675,	.553,	.504
7,	.411,	.356,	.357,	.519,	.504,	.332,	.277,	.364,	.295,	.634,	.585,	.851,	1.100,	.458,	.665,	.353
8,	.302,	.306,	.253,	.420,	.484,	.693,	.270,	.567,	.380,	.337,	.519,	.305,	.849,	.511,	.530,	.333
9,	.348,	.242,	.331,	.297,	.103,	.236,	.332,	.261,	.586,	.328,	.251,	.460,	.803,	.299,	.406,	.261
10,	.246,	.202,	.228,	.254,	.259,	.288,	.264,	.298,	.311,	.266,	.282,	.294,	.458,	.330,	.314,	.217

Log catchability residuals

Fleet 1

Age,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3,		-.75,	-.42,	-.03,	.06,	-.14,	-.07,	.41,	-.79,	-1.17,	.97,	.42,	1.07,	.58,	-.23,	.08
4,		.44,	.55,	.28,	.27,	-1.76,	-.49,	-.06,	.52,	.10,	1.74,	-.81,	-.85,	-.28,	.06,	.30
5,		.21,	.36,	-.66,	-.50,	.66,	2.14,	-1.12,	-.28,	-.02,	1.34,	.84,	-1.22,	-1.72,	-.81,	.78
6,		.86,	.12,	-.96,	-.93,	.71,	1.67,	-.63,	-1.22,	-.44,	.62,	1.82,	.99,	-1.28,	-1.66,	.34
7,		2.69,	-.64,	-1.82,	-2.25,	.83,	3.76,	-.94,	.18,	-1.14,	-.74,	2.32,	.65,	.20,	-2.44,	-.67

1, No data for this fleet at this age

Fleet 2

Age,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3,	-.94,	.24,	1.97,	-.36,	-.97,	.77,	.91,	.16,	-1.31,	-1.08,	.50,	2.02,	.57,	-.44,	-1.44,	-.60
4,	2.05,	-.21,	.91,	-.49,	.09,	-.50,	.41,	-.37,	-1.01,	-.42,	-.89,	.21,	1.67,	-.37,	-.53,	-.57
5,	.57,	.26,	.28,	.67,	.66,	-.14,	-1.01,	-.53,	.00,	.13,	-.69,	-.31,	-.16,	.01,	.14,	.12
6,	.96,	1.91,	.39,	.91,	.03,	-.03,	-.48,	-.38,	-.43,	-.48,	-.69,	-.61,	-.64,	-.34,	.00,	-.14
7,	.27,	1.28,	.90,	.05,	-.03,	.65,	.67,	.03,	.62,	-.56,	-.93,	-1.12,	-1.29,	-.21,	-.42,	.11
8,	.65,	.84,	.64,	-.36,	.15,	-.79,	.97,	-.40,	.47,	-.01,	-.76,	.16,	-1.04,	-.30,	-.22,	.00

Fleet 3

Age,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3,											.28,	.67,	-.11,	-.59,	-.32,	.07
4,											.55,	-.56,	.63,	-.53,	-.17,	.08
5,											-.10,	.20,	1.00,	-.43,	-.28,	-.40

3, No data for this fleet at this age

3, No data for this fleet at this age

3, No data for this fleet at this age

Table 5.8 continued

SUMMARY STATISTICS FOR AGE 3								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-6.55	.652	.1506	.2731	.000E+00	.000E+00	-6.547	.163
2	-7.08	1.113	.0441	.1381	.000E+00	.000E+00	-7.077	.270
3	-7.19	.482	.0008	.2681	.000E+00	.000E+00	-7.186	.182
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.251	.366		.147		.366		.162

SUMMARY STATISTICS FOR AGE 4								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-6.67	.820	.1331	.6403	.000E+00	.000E+00	-6.670	.205
2	-5.92	.900	.1402	.2705	.000E+00	.000E+00	-5.922	.218
3	-7.48	.557	.0006	.5154	.000E+00	.000E+00	-7.481	.210
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.476	.410		.214		.410		.273

SUMMARY STATISTICS FOR AGE 5								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-7.40	1.085	.0645	.7813	.000E+00	.000E+00	-7.396	.271
2	-5.56	.485	.2014	.4042	.000E+00	.000E+00	-5.559	.118
3	-7.96	.583	.0003	.2409	.000E+00	.000E+00	-7.964	.220
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.359	.353		.254		.353		.521

SUMMARY STATISTICS FOR AGE 6								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-8.42	1.141	.0231	.7079	.000E+00	.000E+00	-8.420	.285
2	-5.59	.740	.1948	.4367	.000E+00	.000E+00	-5.593	.180
3	No data for this fleet at this age							
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.504	.621		.221		.621		.126

SUMMARY STATISTICS FOR AGE 7								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-9.85	1.867	.0055	.1812	.000E+00	.000E+00	-9.849	.467
2	-5.60	.759	.1937	.3940	.000E+00	.000E+00	-5.598	.184
3	No data for this fleet at this age							
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.353	.703		.271		.703		.149

SUMMARY STATISTICS FOR AGE 8								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	No data for this fleet at this age							
2	-5.81	.622	.1561	.3328	.000E+00	.000E+00	-5.814	.151
3	No data for this fleet at this age							
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.333	.622		0.000		.622		0.000

Table 5.9

Title : Saithe in the North-East Arctic (Fishing Areas I and II) (ru

Separable analysis

from 1981 to 1991 on ages 2 to 10

with Terminal F of .391 on age 4 and Terminal S of .550

Initial sum of squared residuals was 60.581 and

final sum of squared residuals is 19.906 after 102 iterations

Matrix of Residuals

Years	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91		WTS
Ages												
2/ 3	-.078	1.117	-.020	-.300	-1.065	-.308	.875	.200	.513	-.934	.000	.236
3/ 4	.061	.205	-.686	.895	1.358	-.650	-.343	-1.099	-.220	.479	.000	.220
4/ 5	-.367	-.159	-.011	.523	.086	.635	.141	-.791	-.006	-.052	.000	.411
5/ 6	.040	.509	.341	-.222	-.169	.174	-.365	-.368	.429	-.370	.000	.484
6/ 7	.247	.051	.251	-.020	-.067	-.297	-.084	-.136	-.022	.077	.000	1.000
7/ 8	-.286	-1.080	-.282	-.762	.250	.723	.656	.816	-.382	.348	.000	.256
8/ 9	.469	-.484	-.084	-.468	.018	.186	-.661	.841	-.046	.227	.000	.363
9/10	-.524	-.227	-.390	.380	-.013	-.213	.365	.810	-.358	.169	.000	.395
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	-.001	
WTS	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		
Fishing Mortalities (F)												
F-values	1981											
	.6480											
F-values	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991		
	.5977	.5397	.5569	.3907	.3750	.4194	.6321	.5677	.5237	.3910		
Selection-at-age (S)												
S-values	2	3	4	5	6	7	8	9	10			
	.1153	.5721	1.0000	1.0370	1.0460	.9761	.8488	.6688	.5500			

Table 5.10

Run title : Saithe in the North-East Arctic (Fishing Areas I and II) (ru
Traditional vpa using file input for terminal F

Table 1	Catch numbers at age			Numbers*10**-3						
YEAR	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
AGE										
1	1	43	1	18596	1	1	281	110	1	497
2	1246	2815	20308	30430	7450	6952	5297	4090	25952	19842
3	37266	42050	9001	37115	22392	29664	25196	77333	43540	77019
4	11131	28925	59601	5001	54537	24836	18384	11949	62846	59280
5	4421	5888	13154	26300	13124	35956	5101	16939	13987	26961
6	8290	4650	2718	10142	12899	4125	8282	4747	16189	9556
7	2427	3861	3472	2861	4652	5616	787	4798	5122	9592
8	1024	1099	2655	2110	1374	2916	1913	1126	7950	2901
9	938	1075	1251	2733	933	1413	900	1711	2504	4352
10	451	697	1221	699	965	1397	577	675	3697	2195
+gp	1728	1777	3559	3593	2900	3493	1166	511	2799	5490
TOTALNUM	68923	92880	116941	139580	121227	116369	67884	123989	184587	217685
TONSLAND	122841	148036	198110	184548	201860	191191	107181	140379	260404	244732
SOPCOF %	125	120	117	104	110	100	113	98	96	80

Table 1	Catch numbers at age			Numbers*10**-3						
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
1	1	194	1	1	52	121	1711	907	486	127
2	11608	13829	21159	81601	54151	31662	45758	28334	18226	10467
3	65178	76296	36782	60832	125030	99049	48969	61963	40796	83954
4	52389	25206	44027	11691	30576	34317	27685	23328	36644	21822
5	29146	26911	15671	16366	7947	10140	12476	14122	9211	21528
6	10186	16031	20419	4436	8712	2062	4534	4400	6379	3619
7	5616	7114	12148	7808	3435	4332	1468	2901	3200	2550
8	3547	3935	4802	6789	3212	1456	1848	963	1338	2008
9	1865	2871	3258	2914	2679	1606	938	1356	147	369
10	2140	2610	2505	2350	1724	963	976	438	730	279
+gp	3149	3924	3821	4140	2880	1134	2150	1192	1629	629
TOTALNUM	184825	178921	164593	198928	240398	186842	148513	139904	118786	147352
TONSLAND	210508	215659	262301	233453	242486	182808	154465	164234	154379	175516
SOPCOF %	82	82	97	102	100	101	102	114	100	100

Table 1	Catch numbers at age			Numbers*10**-3						
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
1	137	484	24	0	0	65	0	412	603	32
2	17225	11638	14624	2216	3311	3867	5017	11157	11543	5948
3	34733	17244	41466	48917	22115	17869	8126	12378	21002	77663
4	65052	23768	33233	11974	12895	49829	35847	19915	13463	9879
5	13060	32700	12064	7189	6062	4339	32827	32643	8996	5611
6	8212	3226	11204	5279	4525	3118	4560	18751	9152	4954
7	1054	3008	1135	3740	2805	3490	2328	1939	7735	3008
8	1251	1177	1772	775	1399	755	1219	377	1126	1887
9	461	760	560	878	351	620	966	191	154	301
10	263	247	557	134	454	257	320	179	121	49
+gp	448	760	897	701	285	797	102	149	253	121
TOTALNUM	141896	95012	117536	81803	54202	85006	91312	98091	74148	109453
TONSLAND	170903	155405	158796	107147	70458	91679	114508	122664	95393	109221
SOPCOF %	100	100	100	99	99	102	99	100	100	100

Table 5.11

Run title : Saithe in the North-East Arctic (Fishing Areas I and II) (ru
Traditional vpa using file input for terminal F

At 1/09/1992

Table 2	Catch weights at age (kg)									
YEAR	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
AGE										
1	.2500	.2500	.2500	.2500	.2500	.2500	.2500	.2500	.2500	.2500
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	7.9240	7.8510	7.7810	7.9590	8.1060	7.9940	7.7160	7.4790	7.4040	7.0520
SOPCOFAC	1.2489	1.2025	1.1684	1.0439	1.0963	.9990	1.1330	.9754	.9575	.7950

Table 2	Catch weights at age (kg)									
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
1	.2500	.2500	.2500	.2500	.2500	.2500	.2500	.2500	.1800	.2900
2	.3400	.3400	.3400	.3400	.3400	.3400	.3400	.3400	.4500	.4300
3	.7100	.7100	.7100	.7100	.7100	.7100	.7100	.7100	.7900	.7300
4	1.1100	1.1100	1.1100	1.1100	1.1100	1.1100	1.1100	1.1100	1.2700	1.4000
5	1.6300	1.6300	1.6300	1.6300	1.6300	1.6300	1.6300	1.6300	2.0300	2.0500
6	2.3300	2.3300	2.3300	2.3300	2.3300	2.3300	2.3300	2.3300	2.5500	2.7600
7	3.1600	3.1600	3.1600	3.1600	3.1600	3.1600	3.1600	3.1600	3.2900	3.3000
8	4.0300	4.0300	4.0300	4.0300	4.0300	4.0300	4.0300	4.0300	4.3400	4.3800
9	4.8700	4.8700	4.8700	4.8700	4.8700	4.8700	4.8700	4.8700	5.1500	5.9500
10	5.6300	5.6300	5.6300	5.6300	5.6300	5.6300	5.6300	5.6300	5.7500	6.3900
+gp	7.4770	7.3850	7.2170	7.1270	7.3200	7.3940	7.5270	7.8090	6.9370	6.8410
SOPCOFAC	.8212	.8166	.9694	1.0155	1.0019	1.0059	1.0249	1.1370	.9985	.9973

Table 2	Catch weights at age (kg)									
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
1	.3600	.1800	.1800	.1800	.1800	.1800	.1800	.2500	.3400	.3100
2	.5100	.6000	.5300	.3800	.3200	.3400	.3300	.4500	.5400	.3900
3	.7700	1.0500	.7100	.7500	.5900	.5300	.6200	.7400	.7600	.7200
4	1.1200	1.3300	1.2600	1.3300	1.2200	.8400	.8700	.9700	1.0800	1.2300
5	2.0200	1.8600	2.0200	2.0700	1.9700	1.6600	1.3100	1.3900	1.5600	1.8200
6	2.6100	2.8000	2.7000	2.6300	2.3000	2.3200	2.4300	1.8100	2.1200	2.2700
7	3.2700	4.0000	3.8800	3.2800	2.8700	2.9700	3.8700	3.0200	2.4000	2.9500
8	3.9100	4.1800	4.4700	3.9600	3.7200	4.0000	5.3800	3.7600	3.6500	3.3900
9	4.6900	5.3300	5.3600	4.5400	4.3000	4.7200	5.8300	4.6400	3.6000	4.7300
10	5.6300	5.6800	6.0600	5.5500	4.6900	5.4400	5.3600	4.7500	6.3700	4.4000
+gp	7.5580	8.6650	7.1900	8.0120	6.5970	6.9040	7.4480	7.5000	4.7950	6.7310
SOPCOFAC	.9958	.9985	.9997	.9930	.9929	1.0152	.9902	.9969	.9980	.9967

Table 5.12

Run title : Saithe in the North-East Arctic (Fishing Areas I and II) (ru
Traditional vpa using file input for terminal F

At 1/09/1992

Table 8	Fishing mortality (F) at age									
YEAR	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
AGE										
1	.0000	.0001	.0000	.0644	.0000	.0000	.0007	.0003	.0000	.0016
2	.0038	.0267	.0593	.1799	.0331	.0409	.0161	.0130	.0786	.1054
3	.2355	.1713	.1116	.1464	.1949	.1782	.2039	.3383	.1864	.3499
4	.2170	.2896	.3890	.0835	.3315	.3436	.1598	.1405	.5083	.4147
5	.1125	.1704	.2068	.2966	.3259	.3802	.1090	.2167	.2426	.4271
6	.2080	.1658	.1108	.2437	.2320	.1605	.1400	.1402	.3313	.2601
7	.1866	.1412	.1797	.1631	.1682	.1497	.0415	.1125	.2207	.3344
8	.0472	.1206	.1363	.1580	.1098	.1511	.0697	.0769	.2748	.1874
9	.0483	.0639	.1960	.2025	.0971	.1575	.0636	.0821	.2440	.2378
10	.0370	.0460	.0960	.1600	.1020	.2060	.0890	.0620	.2550	.3500
+gp	.0370	.0460	.0960	.1600	.1020	.2060	.0890	.0620	.2550	.3500
FBAR 3- 6	.1932	.1993	.2045	.1926	.2711	.2656	.1532	.2089	.3171	.3629

Table 8	Fishing mortality (F) at age									
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
1	.0000	.0009	.0000	.0000	.0003	.0004	.0092	.0023	.0028	.0008
2	.0472	.1383	.1207	.2763	.2187	.2173	.1949	.2057	.0575	.0773
3	.5840	.4864	.6500	.5925	.8910	.7790	.6080	.4377	.5104	.4017
4	.4270	.4706	.5814	.4411	.6843	.6611	.5180	.6663	.5046	.5703
5	.3694	.4070	.6075	.4445	.6144	.5093	.5393	.5492	.6109	.6347
6	.2829	.3571	.6233	.3429	.4523	.3150	.4510	.3693	.5175	.5187
7	.2399	.3268	.5047	.5187	.4876	.4270	.3880	.5877	.5041	.4029
8	.1981	.2638	.3833	.5932	.4188	.3943	.3257	.4768	.5987	.6948
9	.1766	.2439	.3636	.4245	.4958	.3825	.4777	.4224	.1217	.3249
10	.1760	.3990	.3480	.4870	.4810	.3320	.4240	.4300	.4240	.3550
+gp	.1760	.3990	.3480	.4870	.4810	.3320	.4240	.4300	.4240	.3550
FBAR 3- 6	.4159	.4303	.6156	.4552	.6605	.5661	.5291	.5056	.5358	.5313

Table 8	Fishing mortality (F) at age									
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
1	.0010	.0032	.0001	.0000	.0000	.0008	.0000	.0010	.0037	.0002
2	.1436	.1139	.1243	.0090	.0184	.0464	.0754	.1194	.0344	.0451
3	.3917	.2090	.7336	.7660	.1171	.1303	.1298	.2681	.3431	.3374
4	.6277	.5107	.7812	.4835	.4659	.4156	.4145	.5312	.5222	.2685
5	.8203	.7657	.5328	.3782	.4852	.2806	.5341	.8379	.4894	.4302
6	.5339	.4871	.6584	.4724	.4355	.4979	.5346	.6761	.5993	.5521
7	.2781	.3805	.3153	.4796	.4971	.7170	.8791	.4581	.6672	.4014
8	.3532	.5713	.4049	.3694	.3311	.2390	.5944	.3301	.5303	.3344
9	.3327	.3771	.5936	.3600	.2844	.2393	.5443	.1702	.2175	.2606
10	.4060	.2990	.5260	.2720	.3200	.3480	.1870	.1800	.1550	.0994
+gp	.4060	.2990	.5260	.2720	.3200	.3480	.1870	.1800	.1550	.0994
FBAR 3- 6	.5934	.4931	.6765	.5250	.3759	.3311	.4032	.5783	.4885	.3971

Table 5.13

Run title : Saithe in the North-East Arctic (Fishing Areas I and II) (ru
Traditional vpa using screen input for terminal F

At 1/09/1992

Table 10	Stock number at age (start of year)					Numbers*10**-3				
YEAR	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
AGE										
1	143878	474778	248374	328754	233481	448122	425910	461987	266897	339587
2	360344	117796	388677	203350	252381	191157	366891	348451	378143	218516
3	195226	293899	93902	299895	139083	199906	150231	295601	281594	286185
4	62730	126305	202747	68764	212087	93710	136952	100315	172551	191340
5	45763	41340	77407	112502	51788	124648	54415	95564	71362	84978
6	48537	33481	28543	51534	68468	30609	69777	39952	62995	45842
7	15679	32276	23223	20918	33068	44450	21344	49665	28432	37032
8	24497	10651	22945	15886	14549	22883	31332	16765	36336	18668
9	21911	19132	7730	16393	11106	10673	16107	23926	12710	22600
10	13691	17092	14694	5202	10961	8251	7465	12376	18046	8153
+gp	52455	43577	42830	26740	32940	20631	15085	9369	13662	20393
TOTAL	984709	1210328	1151071	1149940	1059912	1195039	1295509	1453970	1342729	1273295

Table 10	Stock number at age (start of year)					Numbers*10**-3				
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
1	143908	250476	453363	370167	217737	347234	206517	440449	189896	173244
2	277581	117821	204897	371182	303066	178221	284182	167537	359790	155035
3	161013	216787	84000	148680	230523	199391	117417	191467	111660	278123
4	165138	73514	109122	35901	67312	77428	74911	52339	101192	54877
5	103474	88212	37596	49950	18910	27800	32729	36537	22009	50022
6	45391	58549	48076	16766	26220	8375	13678	15626	17272	9782
7	28938	28005	33540	21105	9742	13656	5004	7133	8843	8428
8	21702	18639	16537	16578	10286	4898	7295	2780	3245	4373
9	12672	14575	11721	9229	7500	5540	2704	4312	1413	1460
10	14588	8695	9350	6671	4942	3740	3094	1373	2314	1024
+gp	21466	13072	14262	11753	8256	4404	6816	3736	5165	2309
TOTAL	995870	888345	1022464	1057982	904495	870688	754347	923290	822798	738677

Table 10	Stock number at age (start of year)					Numbers*10**-3					
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
AGE											
1	145533	168778	331908	244729	114855	93069	133346	459884	182296	200000	0
2	141726	119029	137747	271722	200367	94035	76140	109175	376149	148707	163717
3	117489	100513	86959	99594	220466	161057	73499	57812	79326	297544	116382
4	152373	65019	66770	34188	37905	160564	115756	52851	36200	46083	173844
5	25402	66594	31944	25029	17261	19475	86755	62613	25438	17581	28845
6	21710	9157	25353	15351	14038	8700	12044	41636	22178	12766	9362
7	4768	10422	4607	10745	7837	7435	4329	3778	17338	9972	6018
8	4612	2956	5832	2752	5446	3903	2972	1471	2992	7284	5465
9	1787	2653	1367	3185	1557	3202	2516	1343	866	1441	4269
10	864	1049	1489	618	1819	959	2064	1195	927	570	909
+gp	1471	3229	2399	3233	1142	2975	658	995	1939	1409	1467
TOTAL	617735	549397	696374	711147	622693	555374	510078	794752	745650	743357	510278

Table 5.14

Run title : Saithe in the North-East Arctic (Fishing Areas I and II) (ru
Traditional vpa using screen input for terminal F

At 1/09/1992

Table 12	Stock biomass at age (start of year)					Tonnes				
YEAR	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
AGE										
1	35969	118695	62093	82189	58370	112031	106477	115497	66724	84897
2	122517	40051	132150	69139	85809	64993	124743	118473	128569	74295
3	138610	208668	66670	212925	98749	141933	106664	209877	199932	203191
4	69630	140199	225049	76329	235417	104018	152017	111350	191532	212388
5	74593	67385	126173	183378	84415	203176	88697	155769	116321	138514
6	113090	78011	66505	120073	159530	71320	162580	93088	146778	106813
7	49546	101991	73385	66101	104494	140461	67448	156940	89844	117021
8	98722	42925	92470	64022	58632	92218	126267	67563	146433	75232
9	106705	93173	37644	79835	54085	51976	78443	116520	61898	110064
10	77078	96229	82726	29288	61711	46454	42028	69674	101597	45904
+gp	415656	342120	333260	212827	267014	164922	116398	70069	101156	143809
TOTALBIO	1302117	1329445	1298126	1196107	1268226	1193501	1171763	1284820	1350784	1312128
EXPLTBIO	508990	617694	828950	918069	679314	720511	617644	688763	857584	848183

Table 12	Stock biomass at age (start of year)					Tonnes				
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
1	35977	62619	113341	92542	54434	86808	51629	110112	34181	50241
2	94378	40059	69665	126202	103043	60595	96622	56963	161905	66665
3	114319	153918	59640	105563	163671	141568	83366	135942	88211	203030
4	183303	81601	121125	39851	74717	85945	83151	58096	128513	76828
5	168662	143786	61281	81419	30823	45314	53348	59555	44678	102545
6	105761	136420	112017	39064	61094	19515	31869	36409	44044	26999
7	91443	88495	105988	66691	30786	43154	15814	22541	29094	27812
8	87460	75116	66643	66810	41453	19740	29400	11202	14083	19156
9	61711	70979	57083	44944	36525	26980	13167	21002	7275	8687
10	82130	48952	52640	37560	27824	21058	17421	7730	13308	6544
+gp	160502	96539	102927	83763	60433	32566	51306	29177	35826	15794
TOTALBIO	1185645	998485	922350	784408	684802	583243	527093	548728	601119	604299
EXPLTBIO	616399	613808	439564	504987	366420	321030	284867	285672	288541	331209

Table 12	Stock biomass at age (start of year)					Tonnes				
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
1	52392	30380	59744	44051	20674	16752	24002	114971	61981	62000
2	72280	71417	73006	103254	64118	31972	25126	49129	203120	57996
3	90466	105538	61741	74696	130075	85360	45569	42781	60288	214231
4	170657	86476	84130	46496	46245	134874	100707	51266	39096	56682
5	51311	123865	64526	52310	34003	32329	113649	87031	39684	31998
6	56663	25641	68453	40373	32288	20183	29266	75362	47017	28980
7	15590	41687	17874	35245	22491	22083	16754	17448	41612	29416
8	18033	12355	26071	10924	20259	15612	15989	5503	10921	24694
9	8383	14138	7325	14429	6695	15113	14670	6231	3118	6818
10	4863	5960	9026	3424	8533	5218	11061	5678	5907	2510
+gp	11121	27975	17246	26479	7535	20538	4899	7462	9298	9481
TOTALBIO	551760	545431	489141	451682	392916	400035	401694	462862	522042	524806
EXPLTBIO	289222	315603	234799	205524	188769	272735	286772	212756	195662	275986

Table 5.15

Run title : Saithe in the North-East Arctic (Fishing Areas I and II) (ru
Traditional vpa using file input for terminal F

At 1/09/1992

Table 13	Spawning stock biomass at age (spawning time)						Tonnes			
YEAR	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
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	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
6	113090	78011	66505	120073	159530	71320	162580	93088	146778	106813
7	49546	101991	73385	66101	104494	140461	67448	156940	89844	117021
8	98722	42925	92470	64022	58632	92218	126267	67563	146433	75232
9	106705	93173	37644	79835	54085	51976	78443	116520	61898	110064
10	77078	96229	82726	29288	61711	46454	42028	69674	101597	45904
+gp	415656	342120	333260	212827	267014	164922	116398	70069	101156	143809
TOTSPBIO	860797	754448	685991	572147	705466	567350	593165	573854	647706	598843

Table 13	Spawning stock biomass at age (spawning time)						Tonnes			
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
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	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
6	105761	136420	112017	39064	61094	19515	31869	36409	44044	26999
7	91443	88495	105988	66691	30786	43154	15814	22541	29094	27812
8	87460	75116	66643	66810	41453	19740	29400	11202	14083	19156
9	61711	70979	57083	44944	36525	26980	13167	21002	7275	8687
10	82130	48952	52640	37560	27824	21058	17421	7730	13308	6544
+gp	160502	96539	102927	83763	60433	32566	51306	29177	35826	15794
TOTSPBIO	589007	516502	497298	338832	258114	163013	158977	128060	143630	104991

Table 13	Spawning stock biomass at age (spawning time)						Tonnes			
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
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	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
6	56663	25641	68453	40373	32288	20183	29266	75362	47017	28980
7	15590	41687	17874	35245	22491	22083	16754	17448	41612	29416
8	18033	12355	26071	10924	20259	15612	15989	5503	10921	24694
9	8383	14138	7325	14429	6695	15113	14670	6231	3118	6818
10	4863	5960	9026	3424	8533	5218	11061	5678	5907	2510
+gp	11121	27975	17246	26479	7535	20538	4899	7462	9298	9481
TOTSPBIO	114653	127755	145995	130874	97802	98748	92639	117684	117872	101899

Table 5.16

Run title : Saithe in the North-East Arctic (Fishing Areas I and II) (ru

At 1/09/1992

Table 16 Summary (without SOP correction)
Traditional vpa using screen input for terminal F

	RECRUITS	TOTALBIO	EXPLTBIO	TOTSPBIO	LANDINGS	FBAR 3- 6
1962	143878	1302117	508990	860797	122841	.1932
1963	474778	1329445	617694	754448	148036	.1993
1964	248374	1298126	828950	685991	198110	.2045
1965	328754	1196107	918069	572147	184548	.1926
1966	233481	1268226	679314	705466	201860	.2711
1967	448122	1193501	720511	567350	191191	.2656
1968	425910	1171763	617644	593165	107181	.1532
1969	461987	1284820	688763	573854	140379	.2089
1970	266897	1350784	857584	647706	260404	.3171
1971	339587	1312128	848183	598843	244732	.3629
1972	143908	1185645	616399	589007	210508	.4159
1973	250476	998485	613808	516502	215659	.4303
1974	453363	922350	439564	497298	262301	.6156
1975	370167	784408	504987	338832	233453	.4552
1976	217737	684802	366420	258114	242486	.6605
1977	347234	583243	321030	163013	182808	.5661
1978	206517	527093	284867	158977	154465	.5291
1979	440449	548728	285672	128060	164234	.5056
1980	189896	601119	288541	143630	154379	.5358
1981	173244	604299	331209	104991	175516	.5313
1982	145533	551760	289222	114653	170903	.5934
1983	168778	545431	315603	127755	155405	.4931
1984	331908	489141	234799	145995	158796	.6765
1985	244729	451682	205524	130874	107147	.5250
1986	114855	392916	188769	97802	70458	.3759
1987	93069	400035	272735	98748	91679	.3311
1988	133346	401694	286772	92639	114508	.4032
1989	459884	462862	212756	117684	122664	.5783
1990	182296	522042	195662	117872	95393	.4885
1991	200000	524806	275986	101899	109221	.3971
Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)	(Tonnes)	

Table 5.17

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

Prediction run PRED-FIN-11

Initial stock size and Recruitment (Thousands)

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11
1992	200000	163746	116382*	173844	28845	9362	6018	5465	4269	909	1467
1993	200000	:	:	:	:	:	:	:	:	:	:
1994	200000	:	:	:	:	:	:	:	:	:	:

*Option 1; Option 2 = 191157, Option 3 = 265932

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
1992	0.33	0.47	0.74	1.16	1.69	2.20	2.68	3.52	4.17	5.39	6.50
1993	0.33	0.47	0.74	1.16	1.69	2.20	2.68	3.52	4.17	5.39	6.50
1994	0.33	0.47	0.74	1.16	1.69	2.20	2.68	3.52	4.17	5.39	6.50

Natural mortality

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11
1992	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1993	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1994	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Maturity ogive

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11
1992	0	0	0	0	0	1	1	1	1	1	1
1993	0	0	0	0	0	1	1	1	1	1	1
1994	0	0	0	0	0	1	1	1	1	1	1

Proportion of F before spawning

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11
1992	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0

Proportion of M before spawning

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11
1992	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0

Exploitation pattern

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11
1992	.002	0.05	0.249	0.434	0.451	0.454	0.424	0.369	0.291	0.239	0.239
1993	.002	0.05	0.249	0.434	0.451	0.454	0.424	0.369	0.291	0.239	0.239
1994	.002	0.05	0.249	0.434	0.451	0.454	0.424	0.369	0.291	0.239	0.239

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
1992	0.33	0.47	0.74	1.16	1.69	2.20	2.68	3.52	4.17	5.39	6.50
1993	0.33	0.47	0.74	1.16	1.69	2.20	2.68	3.52	4.17	5.39	6.50
1994	0.33	0.47	0.74	1.16	1.69	2.20	2.68	3.52	4.17	5.39	6.50

Table 5.18A

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

Effects of different levels of fishing mortality on catch,
stock biomass and spawning stock biomass

F factor 1992	Reference F 1992	Stock biomass 1992	Sp.stock biomass 1992	Catch weight 1992	F factor 1993	Reference F 1993	Stock biomass 1993	Sp.stock biomass 1993	Catch weight 1993	Stock biomass 1994	Sp.stock biomass 1994
0.9000	0.3573	567689	88198	115432	0.0000	0.0000	586963	98197	0	740082	270998
.	.	.	.	.	0.0500	0.0199	.	98197	7855	730424	265363
.	.	.	.	.	0.1000	0.0397	.	98197	15561	720954	259848
.	.	.	.	.	0.1500	0.0596	.	98197	23121	711668	254451
.	.	.	.	.	0.2000	0.0794	.	98197	30537	702563	249169
.	.	.	.	.	0.2500	0.0992	.	98197	37813	693634	243999
.	.	.	.	.	0.3000	0.1191	.	98197	44952	684878	238939
.	.	.	.	.	0.3500	0.1389	.	98197	51956	676291	233987
.	.	.	.	.	0.4000	0.1588	.	98197	58828	667870	229140
.	.	.	.	.	0.4500	0.1786	.	98197	65571	659611	224397
.	.	.	.	.	0.5000	0.1985	.	98197	72187	651512	219754
.	.	.	.	.	0.5500	0.2183	.	98197	78679	643568	215209
.	.	.	.	.	0.6000	0.2382	.	98197	85049	635777	210762
.	.	.	.	.	0.6500	0.2580	.	98197	91301	628136	206408
.	.	.	.	.	0.7000	0.2779	.	98197	97435	620641	202147
.	.	.	.	.	0.7500	0.2978	.	98197	103455	613289	197977
.	.	.	.	.	0.8000	0.3176	.	98197	109364	606079	193895
.	.	.	.	.	0.8500	0.3375	.	98197	115162	599005	189899
.	.	.	.	.	0.9000	0.3573	.	98197	120853	592067	185988
.	.	.	.	.	0.9500	0.3772	.	98197	126439	585260	182160
.	.	.	.	.	1.0000	0.3970	.	98197	131921	578583	178413
.	.	.	.	.	1.0500	0.4169	.	98197	137302	572033	174745
.	.	.	.	.	1.1000	0.4367	.	98197	142584	565607	171155
.	.	.	.	.	1.1500	0.4566	.	98197	147768	559303	167641
.	.	.	.	.	1.2000	0.4764	.	98197	152858	553117	164201
.	.	.	.	.	1.2500	0.4963	.	98197	157854	547049	160834
.	.	.	.	.	1.3000	0.5161	.	98197	162759	541095	157538
.	.	.	.	.	1.3500	0.5360	.	98197	167574	535252	154311
.	.	.	.	.	1.4000	0.5558	.	98197	172301	529520	151153
.	.	.	.	.	1.4500	0.5757	.	98197	176942	523895	148061
.	.	.	.	.	1.5000	0.5955	.	98197	181499	518376	145034
.	.	.	.	.	1.5500	0.6154	.	98197	185973	512960	142071
.	.	.	.	.	1.6000	0.6352	.	98197	190367	507645	139171
.	.	.	.	.	1.6500	0.6551	.	98197	194680	502429	136332
.	.	.	.	.	1.7000	0.6749	.	98197	198916	497310	133552
.	.	.	.	.	1.7500	0.6948	.	98197	203076	492286	130831
.	.	.	.	.	1.8000	0.7146	.	98197	207161	487356	128167
.	.	.	.	.	1.8500	0.7345	.	98197	211173	482517	125559
.	.	.	.	.	1.9000	0.7543	.	98197	215113	477767	123006
.	.	.	.	.	1.9500	0.7742	.	98197	218982	473105	120507
.	.	.	.	.	2.0000	0.7940	.	98197	222783	468529	118060

Run name : PRED-FIN-11
 Computation of ref. F: Unweighted mean of age 3 - 6
 Unit of measurement : Tonnes

Table 5.188

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

10:00 Monday, August 31, 1992 19

Prediction									
	Year	F factor	Reference F	Catch numbers	Catch weight	Stock size	Stock biomass	Sp.stock size 1. jan.	Sp.stock biomass 1. jan.
Flow	1992	0.9000	0.3573	95505	115432	710307	567689	27490	88198
	1993	0.4282	0.1700	46645	62647	695745	586963	31664	98197
	1994	0.4282	0.1700	51375	74116	727600	663192	86909	226452
FO.1	1992	0.9000	0.3573	95505	115432	710307	567689	27490	88198
	1993	0.4581	0.1819	49649	66651	695745	586963	31664	98197
	1994	0.4581	0.1819	54246	78062	724902	658288	85783	223638
Fmed	1992	0.9000	0.3573	95505	115432	710307	567689	27490	88198
	1993	0.7809	0.3100	80180	107120	695745	586963	31664	98197
	1994	0.7809	0.3100	80544	112710	697536	608817	74529	195444
Fmax	1992	0.9000	0.3573	95505	115432	710307	567689	27490	88198
	1993	0.8179	0.3247	83469	111452	695745	586963	31664	98197
	1994	0.8179	0.3247	83069	115861	694596	603531	73339	192454
F1992	1992	0.9000	0.3573	95505	115432	710307	567689	27490	88198
	1993	0.9000	0.3573	90620	120853	695745	586963	31664	98197
	1994	0.9000	0.3573	88356	122334	688207	592067	70765	185988
F1991	1992	0.9000	0.3573	95505	115432	710307	567689	27490	88198
	1993	1.0000	0.3970	99065	131921	695745	586963	31664	98197
	1994	1.0000	0.3970	94248	129315	680670	578583	67754	178413
Fhigh	1992	0.9000	0.3573	95505	115432	710307	567689	27490	88198
	1993	1.1587	0.4600	111898	148661	695745	586963	31664	98197
	1994	1.1587	0.4600	102482	138575	669239	558218	63239	167037

Run name : PRED-FIN-12
 Computation of ref. F: Unweighted mean of age 3 - 6
 Catch in numbers : Thousands
 Catch in weight : Tonnes
 Stock size : Thousands
 Biomass : Tonnes

Table 5.19A

10:13 Tuesday, September 1, 1992 1

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

Effects of different levels of fishing mortality on catch,
stock biomass and spawning stock biomass

F factor 1992	Reference F 1992	Stock biomass 1992	Sp.stock biomass 1992	Catch weight 1992	F factor 1993	Reference F 1993	Stock biomass 1993	Sp.stock biomass 1993	Catch weight 1993	Stock biomass 1994	Sp.stock biomass 1994
0.8100	0.3216	623022	88198	114747	0.0000	0.0000	657457	101719	0	822712	281437
.	.	.	.	.	0.0500	0.0199	.	101719	9220	811289	275581
.	.	.	.	.	0.1000	0.0397	.	101719	18262	800092	269850
.	.	.	.	.	0.1500	0.0596	.	101719	27131	789116	264242
.	.	.	.	.	0.2000	0.0794	.	101719	35829	778356	258753
.	.	.	.	.	0.2500	0.0992	.	101719	44360	767809	253381
.	.	.	.	.	0.3000	0.1191	.	101719	52728	757469	248123
.	.	.	.	.	0.3500	0.1389	.	101719	60935	747332	242977
.	.	.	.	.	0.4000	0.1588	.	101719	68986	737394	237941
.	.	.	.	.	0.4500	0.1786	.	101719	76883	727652	233011
.	.	.	.	.	0.5000	0.1985	.	101719	84630	718100	228187
.	.	.	.	.	0.5500	0.2183	.	101719	92229	708735	223465
.	.	.	.	.	0.6000	0.2382	.	101719	99684	699553	218843
.	.	.	.	.	0.6500	0.2580	.	101719	106998	690551	214320
.	.	.	.	.	0.7000	0.2779	.	101719	114173	681724	209893
.	.	.	.	.	0.7500	0.2978	.	101719	121212	673069	205559
.	.	.	.	.	0.8000	0.3176	.	101719	128118	664583	201318
.	.	.	.	.	0.8500	0.3375	.	101719	134893	656261	197166
.	.	.	.	.	0.9000	0.3573	.	101719	141541	648102	193103
.	.	.	.	.	0.9500	0.3772	.	101719	148064	640100	189125
.	.	.	.	.	1.0000	0.3970	.	101719	154465	632254	185232
.	.	.	.	.	1.0500	0.4169	.	101719	160745	624559	181421
.	.	.	.	.	1.1000	0.4367	.	101719	166908	617013	177691
.	.	.	.	.	1.1500	0.4566	.	101719	172955	609612	174040
.	.	.	.	.	1.2000	0.4764	.	101719	178890	602354	170466
.	.	.	.	.	1.2500	0.4963	.	101719	184714	595236	166968
.	.	.	.	.	1.3000	0.5161	.	101719	190429	588255	163543
.	.	.	.	.	1.3500	0.5360	.	101719	196038	581408	160191
.	.	.	.	.	1.4000	0.5558	.	101719	201544	574692	156910
.	.	.	.	.	1.4500	0.5757	.	101719	206947	568105	153698
.	.	.	.	.	1.5000	0.5955	.	101719	212250	561643	150553
.	.	.	.	.	1.5500	0.6154	.	101719	217456	555305	147475
.	.	.	.	.	1.6000	0.6352	.	101719	222565	549088	144462
.	.	.	.	.	1.6500	0.6551	.	101719	227581	542990	141513
.	.	.	.	.	1.7000	0.6749	.	101719	232504	537007	138625
.	.	.	.	.	1.7500	0.6948	.	101719	237337	531138	135798
.	.	.	.	.	1.8000	0.7146	.	101719	242081	525380	133031
.	.	.	.	.	1.8500	0.7345	.	101719	246739	519731	130322
.	.	.	.	.	1.9000	0.7543	.	101719	251312	514190	127670
.	.	.	.	.	1.9500	0.7742	.	101719	255802	508752	125074
.	.	.	.	.	2.0000	0.7940	.	101719	260210	503418	122532

Run name : PRED-FIN-21
 Computation of ref. F: Unweighted mean of age 3 - 6
 Unit of measurement : Tonnes

Table 5.19B

9:03 Tuesday, September 1, 1992 1

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

Prediction									
	Year	F factor	Reference F	Catch numbers	Catch weight	Stock size	Stock biomass	Sp.stock size 1. jan.	Sp.stock biomass 1. jan.
Flow	1992	0.8100	0.3216	99666	114747	785082	623022	27490	88198
	1993	0.4282	0.1700	55468	73459	753162	657457	32873	101719
	1994	0.4282	0.1700	57587	84975	766664	731876	90331	235148
FO.1	1992	0.8100	0.3216	99666	114747	785082	623022	27490	88198
	1993	0.4581	0.1819	59031	78149	753162	657457	32873	101719
	1994	0.4581	0.1819	60766	89458	763464	726091	89160	232223
Fmed	1992	0.8100	0.3216	99666	114747	785082	623022	27490	88198
	1993	0.7809	0.3100	95173	125495	753162	657457	32873	101719
	1994	0.7809	0.3100	89585	128516	731078	667805	77460	202927
F1992	1992	0.8100	0.3216	99666	114747	785082	623022	27490	88198
	1993	0.8100	0.3216	98232	129483	753162	657457	32873	101719
	1994	0.8100	0.3216	91743	131296	728343	662905	76485	200480
Fmax	1992	0.8100	0.3216	99666	114747	785082	623022	27490	88198
	1993	0.8179	0.3247	99058	130558	753162	657457	32873	101719
	1994	0.8179	0.3247	92317	132031	727606	661585	76222	199821
F1991	1992	0.8100	0.3216	99666	114747	785082	623022	27490	88198
	1993	1.0000	0.3970	117458	154465	753162	657457	32873	101719
	1994	1.0000	0.3970	104322	146930	711183	632254	70416	185232
Fhigh	1992	0.8100	0.3216	99666	114747	785082	623022	27490	88198
	1993	1.1587	0.4600	132568	173996	753162	657457	32873	101719
	1994	1.1587	0.4600	113042	157042	697731	608339	65722	173413

Run name : PRED-FIN-22
 Computation of ref. F: Unweighted mean of age 3 - 6
 Catch in numbers : Thousands
 Catch in weight : Tonnes
 Stock size : Thousands
 Biomass : Tonnes

Table 5.20A

10:13 Tuesday, September 1, 1992 3

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

Effects of different levels of fishing mortality on catch,
stock biomass and spawning stock biomass

F factor 1992	Reference F 1992	Stock biomass 1992	Sp.stock biomass 1992	Catch weight 1992	F factor 1993	Reference F 1993	Stock biomass 1993	Sp.stock biomass 1993	Catch weight 1993	Stock biomass 1994	Sp.stock biomass 1994
0.7400	0.2938	678356	88198	114575	0.0000	0.0000	727527	104550	0	905120	289837
.	.	.	.	.	0.0500	0.0199	.	104550	10578	891935	283804
.	.	.	.	.	0.1000	0.0397	.	104550	20950	879014	277899
.	.	.	.	.	0.1500	0.0596	.	104550	31121	866350	272120
.	.	.	.	.	0.2000	0.0794	.	104550	41094	853939	266465
.	.	.	.	.	0.2500	0.0992	.	104550	50874	841776	260930
.	.	.	.	.	0.3000	0.1191	.	104550	60465	829854	255513
.	.	.	.	.	0.3500	0.1389	.	104550	69871	818170	250211
.	.	.	.	.	0.4000	0.1588	.	104550	79095	806719	245022
.	.	.	.	.	0.4500	0.1786	.	104550	88141	795494	239943
.	.	.	.	.	0.5000	0.1985	.	104550	97012	784493	234973
.	.	.	.	.	0.5500	0.2183	.	104550	105713	773709	230108
.	.	.	.	.	0.6000	0.2382	.	104550	114247	763139	225346
.	.	.	.	.	0.6500	0.2580	.	104550	122618	752778	220686
.	.	.	.	.	0.7000	0.2779	.	104550	130827	742621	216125
.	.	.	.	.	0.7500	0.2978	.	104550	138880	732666	211660
.	.	.	.	.	0.8000	0.3176	.	104550	146779	722906	207290
.	.	.	.	.	0.8500	0.3375	.	104550	154527	713339	203013
.	.	.	.	.	0.9000	0.3573	.	104550	162127	703960	198827
.	.	.	.	.	0.9500	0.3772	.	104550	169583	694765	194729
.	.	.	.	.	1.0000	0.3970	.	104550	176897	685751	190718
.	.	.	.	.	1.0500	0.4169	.	104550	184072	676914	186793
.	.	.	.	.	1.1000	0.4367	.	104550	191111	668250	182950
.	.	.	.	.	1.1500	0.4566	.	104550	198017	659756	179189
.	.	.	.	.	1.2000	0.4764	.	104550	204792	651427	175507
.	.	.	.	.	1.2500	0.4963	.	104550	211440	643262	171903
.	.	.	.	.	1.3000	0.5161	.	104550	217962	635255	168375
.	.	.	.	.	1.3500	0.5360	.	104550	224361	627405	164922
.	.	.	.	.	1.4000	0.5558	.	104550	230640	619707	161542
.	.	.	.	.	1.4500	0.5757	.	104550	236802	612159	158233
.	.	.	.	.	1.5000	0.5955	.	104550	242847	604758	154994
.	.	.	.	.	1.5500	0.6154	.	104550	248780	597500	151823
.	.	.	.	.	1.6000	0.6352	.	104550	254602	590382	148719
.	.	.	.	.	1.6500	0.6551	.	104550	260316	583403	145681
.	.	.	.	.	1.7000	0.6749	.	104550	265923	576558	142706
.	.	.	.	.	1.7500	0.6948	.	104550	271426	569845	139794
.	.	.	.	.	1.8000	0.7146	.	104550	276826	563262	136944
.	.	.	.	.	1.8500	0.7345	.	104550	282127	556805	134153
.	.	.	.	.	1.9000	0.7543	.	104550	287329	550473	131422
.	.	.	.	.	1.9500	0.7742	.	104550	292436	544262	128747
.	.	.	.	.	2.0000	0.7940	.	104550	297448	538170	126129

Run name : PRED-FIN-31
 Computation of ref. F: Unweighted mean of age 3 - 6
 Unit of measurement : Tonnes

Table 5.20B

10:00 Monday, August 31, 1992 12

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

Prediction									
	Year	F factor	Reference F	Catch numbers	Catch weight	Stock size	Stock biomass	Sp.stock size 1. jan.	Sp.stock biomass 1. jan.
Flow	1992	0.7400	0.2938	103522	114575	859857	678356	27490	88198
	1993	0.4282	0.1700	64342	84218	810866	727527	33846	104550
	1994	0.4282	0.1700	63835	95823	805917	800360	93086	242144
F0.1	1992	0.7400	0.2938	103522	114575	859857	678356	27490	88198
	1993	0.4581	0.1819	68467	89590	810866	727527	33846	104550
	1994	0.4581	0.1819	67323	100843	802213	793697	91879	239131
F1992	1992	0.7400	0.2938	103522	114575	859857	678356	27490	88198
	1993	0.7400	0.2938	105225	137282	810866	727527	33846	104550
	1994	0.7400	0.2938	95282	139777	769272	734641	81254	212545
Fmed	1992	0.7400	0.2938	103522	114575	859857	678356	27490	88198
	1993	0.7809	0.3100	110252	143779	810866	727527	33846	104550
	1994	0.7809	0.3100	98676	144304	764777	726611	79819	208949
Fmax	1992	0.7400	0.2938	103522	114575	859857	678356	27490	88198
	1993	0.8179	0.3247	114737	149570	810866	727527	33846	104550
	1994	0.8179	0.3247	101617	148183	760769	719459	78543	205749
F1991	1992	0.7400	0.2938	103522	114575	859857	678356	27490	88198
	1993	1.0000	0.3970	135958	176897	810866	727527	33846	104550
	1994	1.0000	0.3970	114450	164523	741836	685751	72559	190718
Fhigh	1992	0.7400	0.2938	103522	114575	859857	678356	27490	88198
	1993	1.1587	0.4600	153357	199205	810866	727527	33846	104550
	1994	1.1587	0.4600	123657	175484	726351	658295	67721	178542

Run name : PRED-FIN-32
 Computation of ref. F: Unweighted mean of age 3 - 6
 Catch in numbers : Thousands
 Catch in weight : Tonnes
 Stock size : Thousands
 Biomass : Tonnes

Table 6.1 REDFISH in Sub-areas I and II. Nominal catch (t) by countries in Sub-areas I, Divisions IIa and IIb combined as officially reported to ICES.

Country	1982	1983	1984	1985	1986
Denmark	-	-	-	-	-
Faroe Islands	-	-	-	-	29
France	841	798	2,970	3,326	2,719
German Dem.Rep.	4,463	3,394	4,168	3,260	1,323
Germany, Fed.Rep.	3,182	3,395	3,289	3,306	3,561
Norway	10,045	11,083	18,650	20,456	23,255
Portugal	-	-	1,806	2,056	1,591
Spain	72	222	25	38	-
UK (Engl. & Wales)	336	182	716	167	129
UK (Scotland)	-	-	-	-	14
USSR	112,810	105,459	69,689	59,943	20,694
Total	131,749	124,533	101,313	92,552	53,315

Country	1987	1988	1989	1990	1991 ¹
Denmark	+	-	-	37 ³	23
Faroe Islands	450 ³	973	338	386	644 ²
France	1,611	3,369	344 ³	285 ³	245 ³
German Dem.Rep.	417	994	1,978	5,351	-
Germany, Fed.Rep.	5,412	1,361	2,267	1,390	1,053
Norway	18,051	24,662	25,295 ²	33,906 ²	44,166 ²
Portugal	1,175	500	340	830	166
Spain	25	26	5	-	1 ²
UK (Engl. & Wales)	230	468	259	332	317 ²
UK (Scotland)	9	2	13	1	13
USSR/Russia	7,215	9,139	14,344	18,918	14,898
Total	34,595	41,494	45,183	61,436	61,526

¹ Provisional figures.

² Working Group figure.

³ As reported to Norwegian authorities.

Table 6.2 REDFISH in Sub-areas I and II. Nominal catch (t) by countries in Sub-area I as officially reported to ICES.

Country	1982	1983	1984	1985	1986
Faroe Islands	-	-	-	-	-
Germany, Fed. Rep.	10	-	1	143	50
Norway	732	580	1,472	2,378	4,260
UK (England & Wales)	77	48	22	43	32
UK (Scotland)	-	-	-	-	3
USSR	1,750	4,023	532	368	1,066
Total	2,569	4,651	2,027	2,932	5,411

Country	1987	1988	1989	1990	1991 ¹
Faroe Islands	-	1	13	7	-
Germany, Fed. Rep.	10	6	+	-	-
Norway	2,331	2,232	1,823 ²	1,256 ²	2,565 ²
UK (England & Wales)	14	20	12	+	-
UK (Scotland)	-	-	2	-	-
USSR/Russia	769	199	594	114	255
Total	3,124	2,458	2,444	1,377	2,820

¹ Provisional figures.

² Working Group figure.

Table 6.3 REDFISH in Sub-areas I and II. Nominal catch (t) by countries in Division II as officially reported to ICES.

Country	1982	1983	1984	1985	1986
Faroe Islands	-	-	-	-	29
France	841	798	2,970	3,326	2,719
German Dem. Rep.	2,760	2,500	2,570	2,800	1,252
Germany, Fed. Rep.	3,172	3,395	3,288	2,972	3,319
Norway	9,140	10,500	17,111	18,062	18,693
Portugal	-	-	1,134	1,327	1,273
Spain	-	-	-	-	-
UK (England & Wales)	259	134	672	120	94
UK (Scotland)	-	-	-	-	11
USSR	63,125	82,836	63,342	59,047	19,099
Total	79,297	100,163	91,087	87,654	46,489

Country	1987	1988	1989	1990	1991 ¹
Faroe Islands	450 ²	970	315	371	639
France	1,611	3,349	316 ³	280 ³	232 ³
German Dem. Rep.	375	879	1,468	722	-
Germany, Fed. Rep.	3,562	1,320	2,144	1,338	735 ²
Norway	15,409	22,288	23,406 ²	31,117 ²	37,428 ²
Portugal	1,156	467	251	824	159
Spain	-	26	-	-	-
UK (England & Wales)	205	412	240	269	279 ³
UK (Scotland)	8	2	9	1	-
USSR/Russia	4,953	7,598	10,661	6,884	7,917
Total	27,729	37,311	38,810	41,806	47,389

¹ Provisional figures.

² Working Group figure.

³ As reported to Norwegian authorities.

Table 6.4 REDFISH in Sub-areas I and II. Nominal catch (t) by countries in Division IIb as officially reported to ICES.

Country	1982	1983	1984	1985	1986
Denmark	-	-	-	-	-
Faroe Islands	-	-	-	-	-
France	-	-	-	-	-
German Dem.Rep.	1,703	894	1,598	460	71
Germany,Fed.Rep.	-	-	-	190	192
Norway	173	3	67	16	302
Portugal	-	-	672	729	318
Spain	72	222	25	38	-
UK (England & Wales)	+	-	22	4	3
UK (Scotland)	-	-	-	-	+
USSR	47,935	18,600	5,815	528	529
Total	49,883	19,719	8,199	1,965	1,415

Country	1987	1988	1989	1990	1991 ¹
Denmark	+	-	-	37 ³	23
Faroe Islands	-	2	10	8	5 ³
France	-	20 ³	28 ³	5 ³	13 ³
German Dem.Rep.	42	115	510	4,629	-
Germany,Fed.Rep.	1,840	35	123	52	318 ²
Norway	311	142	66 ²	1,533 ²	4,173 ²
Portugal	19	33	89	6	7
Spain	25 ²	26 ²	5	-	1 ²
UK (England & Wales)	11	36	7	63	38
UK (Scotland)	1	-	2	-	13
USSR/Russia	1,493	1,342	3,089	11,920	6,726
Total	3,742	1,751	3,929	18,253	11,317

¹ Provisional figures.

² Working Group figure.

³ As reported to Norwegian authorities.

Table 6.5 REDFISH in Sub-areas I and II. Nominal catch (t) of *Sebastes marinus* and *Sebastes mentella* in Sub-area I and Divisions IIa and IIb combined.

Species	1982	1983	1984	1985	1986
<i>S. marinus</i>	16,366	19,260	28,379	29,484	30,203
<i>S. mentella</i>	115,383	105,273	72,934	63,068	23,112
Total	131,749	124,533	101,313	92,552	53,315

Species	1987	1988	1989	1990	1991 ¹
<i>S. marinus</i>	24,077	25,908	22,572	26,537	21,543
<i>S. mentella</i>	10,518	15,586	22,611	34,899	39,983
Total	34,595	41,494	45,183	61,436	61,526

¹ Provisional figures.

Table 6.6 REDFISH in sub-area IV (North Sea). Nominal catch (t) by countries as officially reported to ICES. Not included in the assessment.

Country	1985	1986	1987	1988	1989	1990	1991 ¹
Belgium	-	-	-	-	1	+	5
Denmark	6	24	16	32	23	41	29
Faroe Islands	24	-	3	90	13	25	144
France	690	578	833	915	n/a	n/a	n/a
Germany, Fed.Rep.	162	183	70	188	111	47	197 ²
Norway	1,204 ²	1,048	411	696	500 ²	483 ²	445 ²
UK (England & Wales)	8	35	16	125	134	369	16
UK (Scotland)	+	1	55	9	6	6	39
Total	2,094	1,869	1,404	2,055	788	971	875

¹ Provisional figures.

² Working Group figure.

n/a = not available.

Table 6.7 *Sebastes mentella* in Divisions IIa and IIb. Catch per unit effort and calculated total international effort.

Year	USSR		German Dem.Rep.		Total effort	
	catch/hour trawling (t/hr)		catch/day (t/day)		(USSR units)	
	RT ¹	PST ²	Freezer trawler	Factory trawler FVS IV (FAO code 090)	RT ¹	PST ²
1965	0.38	-	-	-	41,216	-
1966	0.39	-	-	-	26,008	-
1967	0.37	-	-	-	16,862	-
1968	0.45	-	-	-	12,029	-
1969	0.48	-	-	-	14,242	-
1970	0.46	-	-	-	49,817	-
1971	0.38	-	-	-	118,587	-
1972	0.38	-	-	-	75,953	-
1973	0.45	-	-	-	85,289	-
1974	0.69	-	-	-	100,539	-
1975	0.95	1.01	-	-	251,653	236.703
1976	0.99	1.26	-	-	271,653	213.442
1977	0.77	1.00	-	-	190,084	146.365
1978	0.63	0.86	-	-	147,002	107.688
1979	0.56	0.93	-	-	155,616	93.704
1980	0.70	0.91	-	-	113,363	87.202
1981	0.63	0.95	8.71	-	129,438	85,338
1982	0.63	1.05	9.58	-	183,148	109,889
1983	0.80	1.09	17.12	-	131,591	96,581
1984	0.70	1.30	13.62	-	104,191	56,103
1985	0.60	1.00	9.89	-	105,113	63,068
1986	0.43	0.68	7.90	-	53,749	33,988
1987	-	0.70	-	7.30	-	15,026
1988	-	0.70	-	11.78	-	22,266
1989	-	0.90	-	12.96	-	25,123
1990	-	1.00	-	14.77	-	34,899
1991 ³	-	0.80	-	-	-	49,979
1992 ³	-	0.60	-	-	-	33,300

¹ Side trawlers, 800-1000 HP.

² Stern trawlers. For 1975-1979, the PST data have been included from RT data.

³ Provisional figure.

Table 6.8 *Sebastes marinus*. Catch and catch per unit effort for Norwegian stern trawlers, and total international effort (Norwegian units).¹

Year	Catch (t)	% of total international catch	CPUE (t/hour)	Effort hours trawling
1981	1,315	6.3	0.32	65,081
1982	2,014	12.3	0.39	41,964
1983	1,590	8.3	0.46	41,869
1984	3,963	14.0	0.43	65,998
1985	3,080	10.5	0.35	84,240
1986	4,500	14.9	0.46	65,659
1987	2,168	9.0	0.37	65,072
1988	4,349	16.8	0.60	43,180
1989 ²	2,707	12.0	0.25	90,288
1990 ²	3,826	14.4	0.65	40,826
1991 ²	4,362	20.3	0.59	36,514

¹ Only including trips with more than 50% *S. marinus* in the catches.

² Provisional figures.

Table 6.9 REDFISH in Sub-areas I and II. Year-class strength.

Year class	International 0-group survey abundance indices	Russian Young fish surveys ¹
1961	-	poor
1962	-	poor
1963	-	strong
1964	-	strong
1965	159	strong
1966	236	strong
1967	44	average
1968	21	average
1969	295	very strong
1970	247	strong
1971	172	strong
1972	177	average
1973	385	below average
1974	468	poor
1975	315	poor
1976	447	poor
1977	472	poor
1978	460	poor
1979	980	poor
1980	651	poor
1981	861	close to poor
1982	694	strong
1983	851	average
1984	732	poor
1985	795	poor
1986	702	poor
1987	631	poor
1988	949	poor
1989	698	poor
1990	670	poor
1991	200	-

¹ On the basis of the abundance of age groups 1+ to 6+.

Table 6.10 *Sebastes mentella*. Average catch (no. of specimens) of different year classes per hour trawling in the USSR survey in the Barents and Norwegian Sea (1976-1983 published in "Annales Biologiques"). The + is added to the age to indicate that the survey partly has been carried out from the end of one year into the following year. These data are used as the only input in the recruitment program RCT3.

Year class	0	1	2	3	4	5	6	7	8	9	10	11
1965	-	-	-	-	-	-	-	-	-	-	-	0.4
1966	-	-	-	-	-	-	-	-	-	-	3.0	-
1967	-	-	-	-	-	-	-	-	-	11.7	-	0.3
1968	-	-	-	-	-	-	-	-	16.2	-	1.5	0.3
1969	-	-	-	-	-	-	-	43.4	-	8.7	12.2	3.1
1970	-	-	-	-	-	-	85.8	-	19.8	34.9	11.9	-
1971	-	-	-	-	-	22.7	-	19.5	51.9	18.0	5.7	-
1972	-	-	-	-	9.4	-	6.7	57.6	12.3	6.7	-	-
1973	-	-	-	0.6	-	4.3	37.3	8.6	5.6	-	-	-
1974	-	-	4.8	-	4.9	22.8	4.8	4.8	-	-	-	3.0
1975	-	7.4	-	1.7	6.4	2.4	3.5	5.0	-	-	4.0	-
1976	7.0	-	8.1	1.2	2.5	6.8	4.9	5.0	1.0	13.0	-	-
1977	-	0.2	0.2	0.2	0.9	5.1	3.7	1.0	19.0	2.0	-	-
1978	0.8	0.02	0.9	1.0	5.0	3.8	2.0	20.0	6.0	-	-	-
1979	-	1.9	1.4	3.6	2.3	9.0	11.0	16.0	1.0	-	-	0.1
1980	0.3	0.4	2.0	2.5	16.0	6.0	11.0	25.0	2.0	-	1.5	2.0
1981	-	2.2	3.9	20.0	6.0	12.0	47.0	18.0	6.3	1.6	0.5	-
1982	19.8	13.2	13.0	15.0	34.0	44.0	39.0	32.6	4.3	3.1	-	-
1983	12.5	3.0	5.0	6.0	31.0	34.0	32.3	13.3	4.0	-	-	-
1984	-	10.0	2.0	-	5.0	18.3	19.0	2.2	-	-	-	-
1985	107.0	7.0	-	1.0	5.2	16.2	1.7	-	-	-	-	-
1986	2.0	-	1.0	1.8	8.4	3.6	-	-	-	-	-	-
1987	-	3.0	37.9	1.3	8.0	-	-	-	-	-	-	-
1988	4.0	58.1	4.3	13.3	-	-	-	-	-	-	-	-
1989	8.7	9.0	17.0	-	-	-	-	-	-	-	-	-
1990	2.5	6.3	-	-	-	-	-	-	-	-	-	-
1991	0.3	-	-	-	-	-	-	-	-	-	-	-

Table 6.11 *Sebastes mentella*. Recruitment at age 6 (in millions). Results from the analysis using RCT3, and indices back-calculated from the Russian survey in March-April 1992.

Year class	C-regression	S.E.	RCT-3		S.E.	Russian index	Adopted ¹
			P-regression				
1976	219	.57	229		.53	117	190
1977	156	.52	172		.48	154	250
1978	131	.48	145		.38	136	221
1979	164	.43	157		.31	103	167
1980	186	.43	136		.21	81	131 ²
1981	238	.45	145		.23	79	128 ²
1982	314	.64	164		.28	124	201 ²
1983	267	.55	147		.25	76	123 ²
1984	235	.44	141		.22	50	81 ²
1985	145	.44	126		.23	41	67

¹ The Russian index raised to the P-regression level.

² Used as input to the assessment.

Table 6.12 *Sebastes mentella*. Maturity ogives from the USSR. Samples from research vessels. Sexes combined.

Age	Average		1986	1987	1988	1989	1990	1991
	1975-1983	1984-1985						
6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.046
9	0.101	0.013	0.006	0.083	0.000	0.000	0.012	0.139
10	0.195	0.140	0.017	0.182	0.028	0.074	0.131	0.174
11	0.300	0.304	0.132	0.278	0.125	0.178	0.300	0.138
12	0.540	0.528	0.377	0.616	0.297	0.473	0.688	0.358
13	0.702	0.739	0.822	0.821	0.562	0.684	0.714	0.470
14	0.862	0.896	0.795	0.926	0.760	0.716	0.824	0.637
15	0.966	0.938	0.862	0.938	0.855	0.794	0.848	0.762
16	0.994	0.975	0.875	1.000	1.000	1.000	1.000	1.000
17	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
18	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Table 6.13

:23 Thursday, September 3, 1992

Sebastes mentella in the Norwegian Sea, Spitsbergen and Bear Island

FLEET 1: SEBASTES MENTELLA : EFFORT AND CATCH DATA, USSR PST-TRAWLERS

Year	Effort	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10	Catch, age 11	Catch, age 12	Catch, age 13	Catch, age 14	Catch, age 15	Catch, age 16	Catch, age 17	Catch, age 18
1982	107438	835	4669	12274	46292	55860	45491	36890	15160	9280	5651	3293	2112
1983	93578	83	1925	4434	16176	30337	49510	46805	29041	16599	8087	5075	1991
1984	51171	1	35	1823	7253	20429	34813	43613	23884	11197	3898	1383	418
1985	56802	326	1360	3699	14997	28079	37598	30822	9769	3967	1826	617	318
1986	26976	1	1	587	2315	4522	8434	13164	5747	2010	522	309	52
1987	9093	1	64	637	1898	1618	2161	3751	2235	880	396	126	40
1988	11241	1	1	191	928	1773	2062	3513	3692	2031	990	496	166
1989	14533	162	1231	2827	3274	2899	2891	5310	4882	2041	1250	730	320
1990	17355	502	2709	4590	5031	4261	6224	8590	5580	1910	811	165	17
1991	17381	4641	6674	3790	3942	3591	3552	4812	4484	1974	704	173	146

Ages 9-17 used

Table 6.14

VPA Version 3.0 (MSDOS) - Jan 1991

Sebastes mentella in the Norwegian Sea, Spitzbergen and Bear
with cpue data from file J:\IFAPWORK\WG_108\SEBM_NOR\FLEET.163

Disaggregated Qs

Log transformation

No trend in Q (mean used)

Terminal Fs estimated using Laurec-Shepherd method

Regression weights

, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000

Oldest age F = 1.000*average of 5 younger ages.

Fishing mortalities

Age,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
6,	.000,	.000,	.000,	.001,	.000,	.000,	.000,	.000,	.000,	.000
7,	.010,	.001,	.000,	.007,	.002,	.000,	.000,	.001,	.002,	.003
8,	.042,	.026,	.007,	.022,	.003,	.002,	.000,	.015,	.013,	.016
9,	.082,	.046,	.031,	.079,	.013,	.015,	.006,	.050,	.064,	.014
10,	.280,	.134,	.095,	.335,	.058,	.045,	.030,	.081,	.129,	.061
11,	.342,	.270,	.235,	.573,	.165,	.059,	.059,	.080,	.171,	.166
12,	.407,	.515,	.513,	.792,	.344,	.128,	.108,	.089,	.291,	.346
13,	.551,	.852,	1.145,	1.093,	.718,	.305,	.347,	.235,	.490,	.949
14,	.479,	1.031,	1.512,	.757,	.630,	.316,	.622,	.484,	.696,	.980
15,	.595,	1.370,	1.585,	1.059,	.353,	.225,	.588,	.805,	.756,	.885
16,	.633,	1.537,	1.710,	1.223,	.427,	.132,	.468,	1.176,	1.209,	.851
17,	.748,	2.078,	1.295,	1.433,	.747,	.193,	.265,	1.474,	.778,	.705
18,	.601,	1.374,	1.450,	1.113,	.575,	.234,	.458,	.835,	.786,	.874

Log catchability residuals

Fleet 1

Age,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
9,	.03,	.48,	.38,	-.29,	1.03,	-.29,	1.02,	-1.19,	-1.17,	.00
10,	-.02,	.59,	.39,	-.72,	.44,	-.17,	.61,	-.53,	-.59,	.00
11,	.29,	.39,	-.02,	-.77,	-.12,	.06,	.45,	.07,	-.34,	.00
12,	.62,	.26,	-.32,	-.60,	-.38,	-.21,	.35,	.56,	-.29,	.00
13,	1.03,	.46,	-.39,	-.24,	-.45,	-.37,	-.11,	.10,	-.02,	.00
14,	1.34,	.44,	-.51,	.29,	-.14,	-.23,	-.52,	-.52,	-.14,	.00
15,	1.10,	.14,	-.58,	-.07,	.43,	.09,	-.49,	-.49,	-.13,	.00
16,	1.06,	.04,	-.59,	-.18,	.35,	.64,	-.23,	-.65,	-.44,	.00
17,	.89,	-.26,	-.34,	-.36,	-.28,	.26,	.33,	-.66,	.43,	.00

SUMMARY STATISTICS FOR AGE 9

Fleet,	Pred.	SE(q),	Partial,	Raised,	SLOPE	SE	INTRCPT,	SE
q			F	F		Slope		Intrcpt
1	-.14.08	.814	.0134	.0137	.000E+00	.000E+00	-.14.076	.245
Fbar		SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio			
	.014	.814	0.000	.814	0.000			

SUMMARY STATISTICS FOR AGE 10

Fleet,	Pred.	SE(q),	Partial,	Raised,	SLOPE	SE	INTRCPT,	SE
q			F	F		Slope		Intrcpt
1	-.12.90	.525	.0436	.0610	.000E+00	.000E+00	-.12.895	.158
Fbar		SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio			
	.061	.525	0.000	.525	0.000			

Table 6.14 Continued

SUMMARY STATISTICS FOR AGE 11									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	-12.39	.380	.0720	.1656	.000E+00	.000E+00	-12.395	.115	
Fbar		SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)		Variance ratio			
	.166	.380	0.000	.380		0.000			

SUMMARY STATISTICS FOR AGE 12									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	-11.88	.446	.1199	.3462	.000E+00	.000E+00	-11.884	.134	
Fbar		SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)		Variance ratio			
	.346	.446	0.000	.446		0.000			

SUMMARY STATISTICS FOR AGE 13									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	-11.18	.475	.2432	.9487	.000E+00	.000E+00	-11.177	.143	
Fbar		SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)		Variance ratio			
	.949	.475	0.000	.475		0.000			

SUMMARY STATISTICS FOR AGE 14									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	-11.01	.602	.2883	.9797	.000E+00	.000E+00	-11.007	.181	
Fbar		SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)		Variance ratio			
	.980	.602	0.000	.602		0.000			

SUMMARY STATISTICS FOR AGE 15									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	-11.03	.525	.2825	.8848	.000E+00	.000E+00	-11.027	.158	
Fbar		SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)		Variance ratio			
	.885	.525	0.000	.525		0.000			

SUMMARY STATISTICS FOR AGE 16									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	-11.00	.577	.2893	.8510	.000E+00	.000E+00	-11.003	.174	
Fbar		SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)		Variance ratio			
	.851	.577	0.000	.577		0.000			

SUMMARY STATISTICS FOR AGE 17									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	-11.01	.492	.2876	.7049	.000E+00	.000E+00	-11.009	.148	
Fbar		SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)		Variance ratio			
	.705	.492	0.000	.492		0.000			

Table 6.15

Title : *Sebastes mentella* in the Norwegian Sea, Spitzbergen and Bear

At 1/09/1992 15:52

Separable analysis

from 1982 to 1991 on ages 9 to 18

with Terminal F of .600 on age 13 and Terminal S of 1.000

Initial sum of squared residuals was 89.613 and

final sum of squared residuals is 23.652 after 61 iterations

Matrix of Residuals

Years	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91		WTS
Ages											
9/10	.960	.285	-1.246	.483	-1.048	.709	-1.192	.425	1.104	-.002	.303
10/11	.959	-.162	-1.255	.364	-.468	.508	-.240	-.005	.204	-.001	.452
11/12	.645	-.073	-.546	.392	-.048	.258	.373	-.460	-.125	-.001	.716
12/13	.532	.165	.168	.380	.228	.250	.306	-.634	-.151	.000	.837
13/14	-.050	-.245	.577	.039	.454	.128	.321	-.577	-.327	.000	.757
14/15	-.813	-.483	.347	-.606	.178	-.131	.332	-.160	-.218	.000	.700
15/16	-.562	-.006	.379	-.213	-.012	-.296	.072	.280	-.043	.000	1.000
16/17	-.779	.131	.253	-.644	-.380	-.623	-.544	.938	.610	.000	.464
17/18	-.247	.923	.045	-.007	.230	-.647	-.868	1.413	-.130	.000	.402
	.001	.000	.000	-.001	-.001	-.001	.000	.000	.000	.085	
WTS	.001	.001	.001	.001	1.000	1.000	1.000	1.000	1.000		

Fishing Mortalities (F)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
F-values	.6327	.9717	1.0100	1.0648	.4610	.1993	.2900	.4129	.5767	.6000

Selection-at-age (S)

	9	10	11	12	13	14	15	16	17	18
S-values	.0647	.1797	.2679	.4389	1.0000	1.3588	1.3677	1.4626	1.2327	1.0000

Table 6.16

Run title : Sebastes mentella in the Norwegian Sea, Spitzbergen and Bear
Traditional vpa using file input for terminal F

At 2/09/1992

Table 1	Catch numbers at age			Numbers*10**-3			
YEAR	1965	1966	1967	1968	1969	1970	1971
AGE							
6	48	0	0	7	31	0	0
7	285	0	0	0	94	0	0
8	1592	27	7	15	409	33	114
9	2163	279	15	89	524	131	284
10	1141	532	182	192	838	620	681
11	1545	465	285	355	933	2122	1590
12	1972	731	343	436	954	3428	4429
13	2471	1223	394	554	849	3983	4884
14	2804	1927	489	864	618	3526	5451
15	1996	2007	496	768	482	2808	4940
16	2067	1741	628	931	807	3983	7496
17	1592	1422	613	694	451	2743	4486
18	1473	944	540	665	849	3559	7382
+gp	2589	1980	3254	1802	2536	5714	14934
TOTALNUM	23738	13278	7246	7372	10375	32650	56671
TONSLAND	15662	10143	6239	5413	6836	22916	45063
SOPCOF %	104	102	100	94	95	94	98

Table 1	Catch numbers at age			Numbers*10**-3						
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
6	466	172	606	5834	18891	0	2905	3633	1065	932
7	792	1660	4847	19417	29815	2418	30158	20497	7412	3000
8	5728	4865	15451	42425	59395	17175	65162	43553	26296	8620
9	3586	9729	28781	82480	78241	33454	53391	46996	44131	26716
10	2049	4636	30144	108462	110712	52102	33569	37469	40441	48290
11	1770	2633	19843	119075	112524	49617	19909	26298	27089	39206
12	3865	3148	10603	57231	93144	53938	17242	20717	19950	33394
13	4564	5208	8634	29651	49550	33287	9270	16341	11172	21178
14	4704	5666	8634	20894	26134	19095	7410	6059	6400	11853
15	4098	4578	6514	16499	13881	12605	5456	3589	5607	6038
16	4704	5380	5908	13465	9839	5796	4134	3465	6801	2697
17	3632	3777	3332	13668	6300	4874	2134	2465	3441	2172
18	3167	2747	2878	12207	7233	5499	1545	1964	3001	1344
+gp	3447	3053	5300	22366	11439	13906	2917	6579	2546	1910
TOTALNUM	46572	57252	151475	563674	627098	303766	255202	239625	205352	207350
TONSLAND	28862	38380	69372	239070	269022	146365	92611	87145	79354	81546
SOPCOF %	101	118	99	91	98	95	101	100	97	95

Table 1	Catch numbers at age			Numbers*10**-3						
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
6	5	20	0	98	29	0	0	46	1	1435
7	854	86	34	571	117	0	0	457	746	4734
8	4775	1987	525	2009	215	109	0	1860	4023	6808
9	12554	4576	2106	4949	1049	1055	379	3823	6832	3866
10	47348	16695	7969	17096	3079	3145	1838	4265	8226	5513
11	57134	31310	22092	31564	5921	2679	3512	4141	7215	8262
12	46529	51099	36763	41511	10701	3580	4084	4492	11361	10257
13	37731	48307	47096	33190	15930	6213	6958	6797	16962	18771
14	15506	29973	25468	10519	7051	3702	7313	5840	11676	15238
15	9492	17132	12002	4243	2495	1459	4022	4246	4505	6183
16	5780	8347	4336	1971	704	656	1960	3159	2186	2071
17	3368	5238	1499	658	390	210	983	2309	687	424
18	2160	2055	517	343	81	66	328	1668	336	308
+gp	4184	673	472	52	67	0	106	2136	560	100
TOTALNUM	247420	217498	160879	148774	47829	22874	31483	45239	75316	83970
TONSLAND	115383	105273	72934	63068	23112	10518	15586	22611	34899	39983
SOPCOF %	100	99	104	101	100	100	100	99	100	100

Table 6.17

Run title : *Sebastes mentella* in the Norwegian Sea, Spitzbergen and Bear
Traditional vpa using file input for terminal F

At 2/09/1992

Table 2	Catch weights at age (kg)						
YEAR	1965	1966	1967	1968	1969	1970	1971
AGE							
6	.1680	.1680	.1680	.1680	.1680	.1680	.1680
7	.1830	.1830	.1830	.1830	.1830	.1830	.1830
8	.2250	.2250	.2250	.2250	.2250	.2250	.2250
9	.3110	.3110	.3110	.3110	.3110	.3110	.3110
10	.3670	.3670	.3670	.3670	.3670	.3670	.3670
11	.4320	.4320	.4320	.4320	.4320	.4320	.4320
12	.5080	.5080	.5080	.5080	.5080	.5080	.5080
13	.6110	.6110	.6110	.6110	.6110	.6110	.6110
14	.6790	.6790	.6790	.6790	.6790	.6790	.6790
15	.7530	.7530	.7530	.7530	.7530	.7530	.7530
16	.8210	.8210	.8210	.8210	.8210	.8210	.8210
17	.8720	.8720	.8720	.8720	.8720	.8720	.8720
18	.9100	.9100	.9100	.9100	.9100	.9100	.9100
+gp	.9990	.9930	1.0320	1.0100	1.0260	1.0000	1.0220
SOPCOFAC	1.0367	1.0223	1.0037	.9372	.9489	.9357	.9849

Table 2	Catch weights at age (kg)									
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
6	.1680	.1680	.1680	.1680	.1680	.1680	.1680	.1070	.1070	.1020
7	.1830	.1830	.1830	.1830	.1830	.1830	.1830	.1550	.1550	.1380
8	.2250	.2250	.2250	.2250	.2250	.2250	.2250	.2000	.2000	.1880
9	.3110	.3110	.3110	.3110	.3110	.3110	.3110	.2520	.2520	.2520
10	.3670	.3670	.3670	.3670	.3670	.3670	.3670	.3100	.3100	.3100
11	.4320	.4320	.4320	.4320	.4320	.4320	.4320	.3740	.3740	.3640
12	.5080	.5080	.5080	.5080	.5080	.5080	.5080	.4720	.4720	.4400
13	.6110	.6110	.6110	.6110	.6110	.6110	.6110	.5680	.5680	.5600
14	.6790	.6790	.6790	.6790	.6790	.6790	.6790	.7150	.7150	.6800
15	.7530	.7530	.7530	.7530	.7530	.7530	.7530	.8980	.8980	.8280
16	.8210	.8210	.8210	.8210	.8210	.8210	.8210	.9340	.9340	.9060
17	.8720	.8720	.8720	.8720	.8720	.8720	.8720	1.0240	1.0240	.9700
18	.9100	.9100	.9100	.9100	.9100	.9100	.9100	1.0500	1.0500	1.0500
+gp	.9770	.9800	1.0000	1.0070	1.0210	1.0320	1.0300	1.1300	1.1050	1.1180
SOPCOFAC	1.0143	1.1784	.9888	.9146	.9847	.9515	1.0130	.9966	.9734	.9503

Table 2	Catch weights at age (kg)									
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
6	.1020	.1020	.1020	.1020	.1020	.1440	.1440	.1980	.1400	.1360
7	.1380	.1380	.1050	.1350	.1200	.1800	.1800	.2020	.1400	.1800
8	.1880	.1880	.1650	.1670	.1370	.1950	.1950	.2420	.1510	.2140
9	.2520	.2520	.2120	.2150	.2180	.2190	.2090	.2820	.1990	.2460
10	.3100	.3100	.2830	.3030	.3010	.2880	.2800	.3310	.2820	.3030
11	.3640	.3200	.3380	.3520	.3530	.3300	.3330	.3780	.3610	.3880
12	.4400	.4000	.3830	.4200	.4480	.4390	.3970	.4560	.4760	.4670
13	.5600	.4660	.4380	.4810	.5100	.5110	.4680	.5140	.5510	.5730
14	.6800	.5630	.5020	.5640	.5810	.5640	.5370	.5680	.6140	.6140
15	.8280	.7300	.5660	.6730	.6480	.6360	.5850	.5890	.6600	.6850
16	.9060	.9920	.7110	.8090	.8450	.7720	.7470	.6720	.7510	.7830
17	.9700	1.1260	.8610	1.0140	.9480	.8090	.8080	.7080	.8650	.7970
18	1.0500	1.1490	.9660	1.0690	1.0560	.9540	.9010	.7740	.7830	.9910
+gp	1.1220	1.2280	1.2910	1.1600	1.2610	.0000	1.0470	.8380	.9230	1.0680
SOPCOFAC	1.0022	.9891	1.0415	1.0066	1.0023	.9976	1.0000	.9915	.9997	1.0036

Table 6.18

Run title : *Sebastes mentella* in the Norwegian Sea, Spitzbergen and Bear
Traditional vpa using file input for terminal F

At 2/09/1992

Table 8	Fishing mortality (F) at age						
YEAR	1965	1966	1967	1968	1969	1970	1971
AGE							
6	.0003	.0000	.0000	.0000	.0001	.0000	.0000
7	.0020	.0000	.0000	.0000	.0005	.0000	.0000
8	.0103	.0002	.0001	.0001	.0035	.0002	.0004
9	.0121	.0020	.0001	.0008	.0052	.0012	.0018
10	.0101	.0033	.0014	.0018	.0089	.0068	.0072
11	.0140	.0046	.0020	.0031	.0099	.0252	.0195
12	.0133	.0074	.0037	.0033	.0093	.0412	.0608
13	.0177	.0092	.0044	.0067	.0072	.0443	.0685
14	.0745	.0156	.0041	.0108	.0083	.0338	.0709
15	.0752	.0632	.0045	.0072	.0067	.0429	.0546
16	.1065	.0782	.0228	.0093	.0084	.0636	.1385
17	.0581	.0893	.0322	.0286	.0050	.0321	.0853
18	.0400	.0400	.0400	.0400	.0400	.0450	.1020
+gp	.0400	.0400	.0400	.0400	.0400	.0450	.1020
FBAR 10-15	.0341	.0172	.0034	.0055	.0084	.0324	.0469

Table 8	Fishing mortality (F) at age									
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
6	.0009	.0004	.0015	.0124	.0355	.0000	.0076	.0153	.0072	.0097
7	.0016	.0036	.0131	.0549	.0733	.0051	.0634	.0612	.0353	.0227
8	.0125	.0106	.0382	.1366	.2115	.0497	.1657	.1104	.0938	.0473
9	.0146	.0240	.0724	.2606	.3534	.1586	.1921	.1551	.1400	.1170
10	.0142	.0213	.0867	.3740	.5806	.3738	.2113	.1794	.1738	.2005
11	.0208	.0205	.1072	.5010	.7308	.4945	.2128	.2278	.1708	.2272
12	.0543	.0423	.0967	.4456	.8226	.8438	.2825	.3181	.2414	.2924
13	.0740	.0868	.1401	.3757	.7673	.7025	.2915	.4178	.2527	.3856
14	.0784	.1113	.1815	.5124	.5860	.6769	.2897	.2804	.2546	.4105
15	.0630	.0918	.1620	.5433	.6747	.5530	.3658	.1984	.4014	.3596
16	.0609	.0990	.1475	.5119	.6447	.5887	.3123	.3711	.6126	.3049
17	.0829	.0574	.0739	.5194	.4244	.6843	.3955	.2766	.6770	.3552
18	.0720	.0750	.0510	.3710	.5080	.7110	.4230	.6780	.5580	.5418
+gp	.0720	.0750	.0510	.3710	.5080	.7110	.4230	.6780	.5580	.5418
FBAR 10-15	.0508	.0623	.1290	.4586	.6937	.6074	.2756	.2703	.2491	.3126

Table 8	Fishing mortality (F) at age									
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
6	.0001	.0002	.0000	.0011	.0002	.0000	.0000	.0004	.0000	.0190
7	.0099	.0011	.0003	.0061	.0015	.0000	.0000	.0026	.0071	.0711
8	.0412	.0259	.0074	.0231	.0025	.0016	.0000	.0188	.0260	.0742
9	.0812	.0456	.0313	.0808	.0136	.0139	.0060	.0421	.0800	.0284
10	.2780	.1326	.0940	.3342	.0596	.0463	.0272	.0779	.1078	.0772
11	.3424	.2669	.2322	.5619	.1650	.0608	.0603	.0711	.1641	.1351
12	.4066	.5158	.5044	.7772	.3327	.1277	.1117	.0920	.2526	.3282
13	.5503	.8521	1.1522	1.0543	.6909	.2922	.3455	.2447	.5117	.7396
14	.4787	1.0266	1.5119	.7680	.5811	.2964	.5805	.4819	.7427	1.0799
15	.5952	1.3640	1.5591	1.0589	.3622	.1994	.5334	.7021	.7480	1.0305
16	.6106	1.5360	1.6745	1.1507	.4263	.1359	.3961	.9408	.8638	.8323
17	.6743	1.8025	1.2908	1.3064	.6431	.1931	.2755	.9934	.4730	.3501
18	.6304	1.0420	.8134	1.1011	.4602	.1856	.4571	.8961	.3215	.3566
+gp	.6304	1.0420	.8134	1.1011	.4602	.1856	.4571	.8961	.3215	.3566
FBAR 10-15	.4419	.6930	.8423	.7591	.3652	.1705	.2764	.2783	.4212	.5651

Table 6.19

Run title : *Sebastes mentella* in the Norwegian Sea, Spitzbergen and Bear
Traditional vpa using file input for terminal F

At 2/09/1992

Table 10	Stock number at age (start of year)					Numbers*10**-3	
YEAR	1965	1966	1967	1968	1969	1970	1971
AGE							
6	148956	144341	150484	228336	350547	589739	591203
7	149227	134736	130605	136163	206600	317159	533618
8	163554	134755	121914	118176	123206	186850	286977
9	189087	146476	121906	110306	106916	111092	169038
10	119668	169037	132272	110291	99724	96244	100396
11	116852	107195	152445	119512	99612	89437	86495
12	156864	104264	96552	137667	107801	89246	78909
13	147576	140061	93647	87038	124152	96635	77495
14	40997	131183	125570	84360	78229	111530	83654
15	28952	34431	116867	113155	75511	70197	97565
16	21490	24300	29247	105274	101657	67867	60847
17	29622	17482	20334	25867	94371	91216	57623
18	39463	25291	14467	17816	22745	84961	79928
+gp	69361	53046	87177	48277	67942	136406	161697
TOTAL	1421670	1366597	1393486	1442237	1659012	2138579	2465444

Table 10	Stock number at age (start of year)					Numbers*10**-3				
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
6	531164	431919	422425	495473	569645	569420	403576	251788	156331	101583
7	534943	480174	390653	381650	442776	497479	515233	362409	224374	140442
8	482838	483283	432901	348869	326877	372309	447838	437542	308442	195976
9	259559	431444	432667	377018	275377	239396	320555	343348	354531	254106
10	152681	231450	381138	364144	262885	174995	184847	239365	266047	278880
11	90194	136204	205017	316226	226682	133104	108955	135394	181013	202332
12	76753	79929	120739	166656	173382	98761	73453	79690	97552	138067
13	67191	65775	69330	99176	96581	68915	38431	50107	52460	69337
14	65479	56460	54568	54533	61633	40573	30890	25981	29855	36868
15	70513	54778	45704	41178	29561	31039	18657	20921	17761	20942
16	83585	59908	45216	35170	21642	13622	16154	11709	15523	10757
17	47938	71161	49096	35302	19074	10277	6842	10697	7310	7612
18	47877	39925	60799	41258	19003	11290	4690	4168	7340	3361
+gp	52110	44372	111965	75593	30053	28550	8856	13963	6227	4777
TOTAL	2562825	2666780	2822218	2832247	2555169	2289729	2178978	1987083	1724767	1465040

Table 10	Stock number at age (start of year)					Numbers*10**-3					
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
AGE											
6	91203	112964	109726	90086	131479	128323	201494	123025	80060	80109	0
7	91030	82519	102195	99284	81420	118939	116112	182320	111274	72441	71122
8	124225	81555	74584	92438	89293	73561	107621	105062	164535	99976	61049
9	169134	107865	71905	66988	81731	80591	66457	97379	93296	145053	83992
10	204547	141110	93251	63061	55910	72956	71919	59772	84479	77926	127574
11	206502	140166	111825	76805	40849	47664	63024	63328	50031	68625	65272
12	145869	132680	97123	80218	39624	31340	40582	53689	53366	38419	54247
13	93253	87896	71675	53071	33366	25706	24957	32840	44312	37508	25037
14	42667	48666	33920	20491	16732	15130	17367	15985	23266	24035	16199
15	22127	23921	15774	6767	8602	8468	10179	8794	8933	10017	7386
16	13225	11041	5533	3002	2124	5418	6277	5403	3943	3826	3234
17	7176	6498	2150	938	859	1255	4280	3822	1908	1504	1506
18	4829	3308	969	535	230	409	936	2940	1281	1076	959
+gp	9353	1083	885	81	190	0	302	3765	2135	349	903
TOTAL	1225139	981272	791515	653765	582410	609760	731506	758124	722819	660865	518480

Table 6.20

Run title : *Sebastes mentella* in the Norwegian Sea, Spitzbergen and Bear
Traditional vpa using file input for terminal F

At 2/09/1992

Table 12	Stock	biomass	at age (start of year)				Tonnes
YEAR	1965	1966	1967	1968	1969	1970	1971
AGE							
6	25025	24249	25281	38360	58892	99076	99322
7	27308	24657	23901	24918	37808	58040	97652
8	36800	30320	27431	26590	27721	42041	64570
9	58806	45554	37913	34305	33251	34550	52571
10	43918	62036	48544	40477	36599	35321	36845
11	50480	46308	65856	51629	43033	38637	37366
12	79687	52966	49049	69935	54763	45337	40086
13	90169	85577	57218	53180	75857	59044	47349
14	27837	89073	85262	57281	53117	75729	56801
15	21801	25926	88001	85206	56860	52858	73466
16	17644	19951	24012	86430	83460	55719	49956
17	25831	15244	17731	22556	82291	79540	50248
18	35911	23014	13165	16212	20698	77315	72735
+gp	69292	52675	89967	48760	69708	136406	165254
TOTALBIO	610508	597551	653329	655838	734058	889613	944220
EXPLTBIO	442616	576717	1850615	1050811	858018	756711	975403

Table 12	Stock	biomass	at age (start of year)				Tonnes			
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
6	89235	72562	70967	83239	95700	95663	67801	26941	16727	10361
7	97894	87872	71490	69842	81028	91039	94288	56173	34778	19381
8	108638	108739	97403	78496	73547	83769	100764	87508	61688	36844
9	80723	134179	134559	117253	85642	74452	99693	86524	89342	64035
10	56034	84942	139878	133641	96479	64223	67839	74203	82474	86453
11	38964	58840	88567	136610	97926	57501	47069	50637	67699	73649
12	38990	40604	61336	84661	88078	50171	37314	37614	46044	60749
13	41053	40189	42361	60596	59011	42107	23481	28461	29798	38829
14	44460	38336	37051	37028	41849	27549	20974	18576	21346	25070
15	53096	41248	34415	31007	22259	23372	14048	18787	15949	17340
16	68623	49185	37122	28874	17768	11184	13263	10936	14499	9746
17	41802	62052	42812	30783	16633	8961	5966	10953	7486	7384
18	43568	36332	55327	37544	17292	10274	4268	4377	7707	3529
+gp	50912	43485	111965	76123	30684	29463	9121	15778	6881	5340
TOTALBIO	853995	898564	1025253	1005698	823896	669728	605889	527470	502420	458710
EXPLTBIO	560117	522477	543675	569903	393834	253245	331721	323480	327240	274479

Table 12	Stock	biomass	at age (start of year)				Tonnes			
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
6	9303	11522	11192	9189	13411	18479	29015	24359	11208	10895
7	12562	11388	10730	13403	9770	21409	20900	36829	15578	13039
8	23354	15332	12306	15437	12233	14344	20986	25425	24845	21395
9	42622	27182	15244	14402	17817	17650	13889	27461	18566	35683
10	63410	43744	26390	19107	16829	21011	20137	19785	23823	23612
11	75167	44853	37797	27035	14420	15729	20987	23938	18061	26626
12	64183	53072	37198	33692	17751	13758	16111	24482	25402	17942
13	52222	40959	31393	25527	17017	13136	11680	16880	24416	21492
14	29013	27399	17028	11557	9721	8533	9326	9080	14285	14758
15	18321	17462	8928	4555	5574	5386	5955	5180	5896	6862
16	11982	10952	3934	2428	1795	4183	4689	3631	2961	2996
17	6960	7317	1851	951	815	1015	3458	2706	1651	1199
18	5070	3801	937	572	243	390	843	2275	1003	1066
+gp	10494	1330	1143	94	240	0	317	3155	1970	373
TOTALBIO	424663	316315	216071	177950	137636	155023	178293	225184	189666	197937
EXPLTBIO	260553	153581	83140	82539	63133	61850	56383	81952	82887	70503

Table 6.21

Run title : *Sebastes mentella* in the Norwegian Sea, Spitzbergen and Bear
Traditional vpa using file input for terminal F

At 2/09/1992

Table 13		Spawning stock biomass at age (spawning time)						Tonnes	
YEAR		1965	1966	1967	1968	1969	1970	1971	
AGE									
6		0	0	0	0	0	0	0	
7		0	0	0	0	0	0	0	
8		1104	910	823	798	832	1261	1937	
9		3528	2733	2275	2058	1995	2073	3154	
10		3513	4963	3884	3238	2928	2826	2948	
11		11106	10188	14488	11358	9467	8500	8221	
12		28687	19068	17657	25177	19715	16321	14431	
13		49593	47068	31470	29249	41721	32474	26042	
14		20042	64133	61389	41242	38244	54525	40897	
15		18531	22037	74801	72425	48331	44929	62446	
16		15526	17557	21130	76058	73445	49032	43961	
17		24539	14482	16844	21428	78177	75563	47735	
18		34834	22324	12770	15726	20077	74995	70553	
+gp		69292	52675	89967	48760	69708	136406	165254	
TOTSPBIO		280296	278136	347498	347518	404640	498907	487578	

Table 13		Spawning stock biomass at age (spawning time)						Tonnes			
YEAR		1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE											
6		0	0	0	0	0	0	0	0	0	0
7		0	0	0	0	729	819	849	506	313	174
8		3259	3262	2922	2355	1177	1340	1612	1400	987	589
9		4843	8051	8074	7035	8650	7520	10069	8739	9024	6468
10		4483	6795	11190	10691	18813	12524	13229	14470	16083	16858
11		8572	12945	19485	30054	29378	17250	14121	15191	20310	22095
12		14037	14617	22081	30478	47562	27092	20150	20311	24864	32805
13		22579	22104	23298	33328	41426	29559	16484	19980	20918	27258
14		32011	27602	26677	26660	36073	23747	18080	16013	18401	21610
15		45132	35061	29253	26356	21502	22577	13571	18149	15407	16750
16		60389	43283	32667	25409	17661	11117	13183	10871	14412	9688
17		39712	58949	40671	29244	16633	8961	5966	10953	7486	7384
18		42261	35242	53667	36418	17292	10274	4268	4377	7707	3529
+gp		50912	43485	111965	76123	30684	29463	9121	15778	6881	5340
TOTSPBIO		328190	311395	381951	334152	287581	202244	140702	156737	162791	170549

Table 13		Spawning stock biomass at age (spawning time)						Tonnes			
YEAR		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE											
6		0	0	0	0	0	0	0	0	0	0
7		113	102	54	0	0	0	0	0	0	0
8		374	245	98	0	0	0	0	0	1143	984
9		4305	2745	869	144	606	794	1153	110	1522	2712
10		12365	8530	4434	1509	1902	1597	1913	1543	3002	3613
11		22550	13456	11415	5894	3432	2800	4071	4812	3703	5831
12		34659	28659	19864	15262	9000	5916	7443	11898	12854	9384
13		36660	28754	22635	19937	13511	9655	8047	11023	15211	12723
14		25010	23618	14967	9777	8477	7057	7470	6964	10371	10788
15		17699	16869	8499	4099	5084	4766	5133	4309	4723	5524
16		11910	10887	3875	2246	1705	4007	4689	3631	2961	2996
17		6960	7317	1851	951	815	1015	3458	2706	1651	1199
18		5070	3801	937	572	243	390	843	2275	1003	1066
+gp		10494	1330	1143	94	240	0	317	3155	1970	373
TOTSPBIO		188167	146313	90640	60486	45013	37997	44538	52426	60113	57192

Table 6.22

Run title : *Sebastes mentella* in the Norwegian Sea, Spitzbergen and Bear

At 2/09/1992

Table 16 Summary (without SOP correction)
Traditional vpa using file input for terminal F

	RECRUITS	TOTALBIO	EXPLTBIO	TOTSPBIO	LANDINGS	FBAR 10-15
1965	148956	610508	442616	280296	15662	.0341
1966	144341	597551	576717	278136	10143	.0172
1967	150484	653329	1850615	347498	6239	.0034
1968	228336	655838	1050811	347518	5413	.0055
1969	350547	734058	858018	404640	6836	.0084
1970	589739	889613	756711	498907	22916	.0324
1971	591203	944220	975403	487578	45063	.0469
1972	531164	853995	560117	328190	28862	.0508
1973	431919	898564	522477	311395	38380	.0623
1974	422425	1025253	543675	381951	69372	.1290
1975	495473	1005698	569903	334152	239070	.4586
1976	569645	823896	393834	287581	269022	.6937
1977	569420	669728	253245	202244	146365	.6074
1978	403576	605889	331721	140702	92611	.2756
1979	251788	527470	323480	156737	87145	.2703
1980	156331	502420	327240	162791	79354	.2491
1981	101583	458710	274479	170549	81546	.3126
1982	91203	424663	260553	188167	115383	.4419
1983	112964	316315	153581	146313	105273	.6930
1984	109726	216071	83140	90640	72934	.8423
1985	90086	177950	82539	60486	63068	.7591
1986	131479	137636	63133	45013	23112	.3652
1987	128323	155023	61850	37997	10518	.1705
1988	201494	178293	56383	44538	15586	.2764
1989	123025	225184	81952	52426	22611	.2783
1990	80060	189666	82887	60113	34899	.4212
1991	80109	197937	70503	57192	39983	.5651
Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)	(Tonnes)	

Table 6.23

21:55 Wednesday, September 2, 1992 11

Sebastes mentella in the Norwegian Sea, Spitsbergen and Bear Island

Prediction run 'ROED': Initial stock size and Recruitment (Thousands)

Year	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15	Age 16	Age 17	Age 18	Age 19
1992	80000	71122	61049	83992	127574	65272	54247	25037	16199	7386	3234	1506	959	903
1993	80000	.	.	.	.	.	.	.	.	.	.	.	.	.
1994	80000	.	.	.	.	.	.	.	.	.	.	.	.	.

Weight in stock (Kilograms) = Weight in catch

Year	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15	Age 16	Age 17	Age 18	Age 19
1992	0.138	0.160	0.182	0.223	0.292	0.375	0.472	0.562	0.614	0.673	0.767	0.831	0.887	0.977
1993	0.138	0.160	0.182	0.223	0.292	0.375	0.472	0.562	0.614	0.673	0.767	0.831	0.887	0.977
1994	0.138	0.160	0.182	0.223	0.292	0.375	0.472	0.562	0.614	0.673	0.767	0.831	0.887	0.977

Natural mortality

Year	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15	Age 16	Age 17	Age 18	Age 19
1992	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1993	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1994	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Maturity ogive

Year	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15	Age 16	Age 17	Age 18	Age 19
1992	0.000	0.000	0.046	0.076	0.153	0.219	0.523	0.592	0.731	0.805	1.000	1.000	1.000	1.000
1993	0.000	0.000	0.046	0.076	0.153	0.219	0.523	0.592	0.731	0.805	1.000	1.000	1.000	1.000
1994	0.000	0.000	0.046	0.076	0.153	0.219	0.523	0.592	0.731	0.805	1.000	1.000	1.000	1.000

Exploitation pattern

Year	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15	Age 16	Age 17	Age 18	Age 19
1992	0.019	0.0711	0.0742	0.07	0.0772	0.1607	0.2633	0.6	0.8153	0.8206	0.8776	0.7396	0.6	0.6
1993	0.019	0.0711	0.0742	0.07	0.0772	0.1607	0.2633	0.6	0.8153	0.8206	0.8776	0.7396	0.6	0.6
1994	0.019	0.0711	0.0742	0.07	0.0772	0.1607	0.2633	0.6	0.8153	0.8206	0.8776	0.7396	0.6	0.6

Proportion of F before spawning: 0.0

Proportion of M before spawning: 0.0

Table 6.24

9:23 Thursday, September 3, 1992

Sebastes mentella in the Norwegian Sea, Spitsbergen and Bear Island

Effects of different levels of fishing mortality on catch,
stock biomass and spawning stock biomass

F factor 1992	Reference F 1992	Stock biomass 1992	Sp.stock biomass 1992	Catch weight 1992	F factor 1993	Reference F 1993	Stock biomass 1993	Sp.stock biomass 1993	Catch weight 1993	Stock biomass 1994	Sp.stock biomass 1994
0.5820	0.2655	174035	51436	20019	F-low	0.0228	179763	59697	2345	203293	85726
					F-0.1	0.0926			9159	195875	80669
					F-med	0.1825			17199	187114	74789
					F-max	0.2295			21105	182855	71969
					F-92	0.2655			23972	179725	69915
					F-high	0.3102			27385	175999	67489
					F-91	0.5657			44235	157559	55849

Run name : OEVREAAAS
Computation of ref. F: Unweighted mean of age 10 - 15
Unit of measurement : Tonnes

Table 6.25

Run title : *Sebastes marinus* in the Barents and Norwegian Seas (Fishing
Traditional vpa Terminal Fs estimated using Laurec-Shepherd method

At 3/09/1992

Table 1	Catch numbers at age			Numbers*10**3						
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
11	179	8	0	66	145	25	306	348	251	542
12	816	86	199	880	251	123	389	825	1405	744
13	814	249	101	1009	838	332	841	2552	1614	1565
14	1961	581	601	2697	3150	413	1458	1919	1751	2026
15	2364	1358	1623	5720	3697	1281	1304	3979	1627	1071
16	2636	2186	1425	5300	5264	1735	907	2873	1484	2215
17	1333	831	701	2275	2827	1141	1305	1223	1789	2832
18	1989	2241	4572	4421	7309	1409	2886	1650	1790	1384
19	1174	1314	1624	2632	3188	1570	3368	1171	1814	2180
20	1309	1109	2124	1818	1866	1635	2954	1284	1708	1285
21	2121	1803	4551	2242	3237	2810	2887	1755	1828	714
22	927	864	1475	1168	496	1372	1649	765	1232	445
23	715	643	2599	975	447	1678	2061	745	858	892
+gp	548	2839	3403	1329	282	3859	3869	2772	5994	5054
TOTALNUM	18886	16112	24998	32532	32997	19383	26184	23861	25145	22949
TONSLAND	16366	19260	28379	29484	30203	24077	25908	22572	26537	21543
SOPCOF %	100	99	101	100	100	99	100	103	100	100

Table 6.26

Sebastes marinus in the Barents and Norwegian Seas (Fishing Areas I and II)

Fleet 1 : SEBASTES MARINUS : EFFORT AND CATCH DATA, NORWEGIAN TRAWLERS

Year	Effort	Catch, age 12	Catch, age 13	Catch, age 14	Catch, age 15	Catch, age 16	Catch, age 17	Catch, age 18	Catch, age 19	Catch, age 20	Catch, age 21	Catch, age 22	Catch, age 23	Catch, age 24
1986	25173	34	241	1230	1427	2090	1096	2987	1302	763	1340	206	186	117
1987	18197	11	21	41	134	175	175	268	392	486	941	505	778	371
1988	21092	0	107	427	569	427	675	1493	1742	1528	1493	853	1066	782
1989	53478	454	1898	1478	3145	2204	857	1037	642	726	720	312	217	490
1990	26078	962	979	1050	911	832	1058	1047	1011	1004	1191	721	643	1104
1991	19537	528	889	1260	292	1200	1938	726	1455	602	247	147	447	261

Table 6.27

VPA Version 3.0 (MSDOS) - Jan 1991
 Sebastes marinus in the Barents and Norwegian Seas (Fishing
 with cpue data from file J:\IFAPWORK\WG_108\SEBI_NOR\FLEET.V51
 Disaggregated Qs
 Log transformation
 No trend in Q (mean used)

Terminal Fs estimated using Laurec-Shepherd method
 Regression weights
 , 1.000, 1.000, 1.000, 1.000, 1.000, 1.000
 Oldest age F = 1.000*average of 5 younger ages.

Fishing mortalities						
Age,	1986,	1987,	1988,	1989,	1990,	1991
11,	.001,	.001,	.001,	.001,	.000,	.005
12,	.002,	.001,	.011,	.004,	.004,	.000
13,	.024,	.003,	.009,	.080,	.008,	.004
14,	.063,	.013,	.013,	.024,	.066,	.012
15,	.146,	.030,	.048,	.041,	.023,	.046
16,	.325,	.085,	.024,	.126,	.018,	.035
17,	.163,	.097,	.077,	.037,	.097,	.038
18,	.310,	.102,	.334,	.118,	.062,	.091
19,	.229,	.090,	.335,	.196,	.166,	.090
20,	.148,	.158,	.219,	.183,	.428,	.151
21,	.260,	.309,	.405,	.175,	.380,	.282
22,	.039,	.150,	.267,	.158,	.160,	.132
23,	.197,	.162,	.312,	.166,	.239,	.150

Log catchability residuals

Fleet 1						
Age,	1986,	1987,	1988,	1989,	1990,	1991
12,	.37,	.88,	1.63,	-1.00,	-1.86,	-.02
13,	-.77,	2.59,	.81,	-2.18,	-.43,	-.01
14,	-.97,	1.63,	.69,	.07,	-1.41,	-.01
15,	-1.24,	1.34,	-.42,	.06,	.28,	-.01
16,	-1.66,	.73,	.61,	-.62,	.95,	-.01
17,	-.64,	.49,	-.35,	1.02,	-.51,	-.01
18,	-.72,	.82,	-1.21,	.56,	.56,	-.01
19,	-.19,	.91,	-.98,	.42,	-.14,	-.01
20,	.41,	.34,	-.39,	.63,	-.98,	-.01
21,	.15,	-.13,	-.69,	1.31,	-.64,	-.01
22,	1.24,	-.30,	-1.07,	.62,	-.48,	-.01

SUMMARY STATISTICS FOR AGE 12

Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-18.05	1.371	.0003	.0004	.000E+00	.000E+00	-18.046	.518
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.000	1.37		0.000		1.37		0.000

SUMMARY STATISTICS FOR AGE 13

Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-15.88	1.734	.0025	.0043	.000E+00	.000E+00	-15.885	.655
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.004	1.73		0.000		1.73		0.000

Table G.27 Continued

SUMMARY STATISTICS FOR AGE 14								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-14.81	1.190	.0072	.0116	.000E+00	.000E+00	-14.812	.450
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.012	1.19		0.000		1.19		0.000

SUMMARY STATISTICS FOR AGE 15								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-14.25	.914	.0127	.0464	.000E+00	.000E+00	-14.249	.346
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.046	.914		0.000		.914		0.000

SUMMARY STATISTICS FOR AGE 16								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-13.84	1.073	.0191	.0352	.000E+00	.000E+00	-13.839	.405
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.035	1.07		0.000		1.07		0.000

SUMMARY STATISTICS FOR AGE 17								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-13.53	.693	.0259	.0379	.000E+00	.000E+00	-13.533	.262
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.038	.693		0.000		.693		0.000

SUMMARY STATISTICS FOR AGE 18								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-12.92	.877	.0476	.0907	.000E+00	.000E+00	-12.925	.331
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.091	.877		0.000		.877		0.000

SUMMARY STATISTICS FOR AGE 19								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-12.70	.688	.0599	.0897	.000E+00	.000E+00	-12.696	.260
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.090	.688		0.000		.688		0.000

SUMMARY STATISTICS FOR AGE 20								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-12.53	.645	.0708	.1512	.000E+00	.000E+00	-12.528	.244
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.151	.645		0.000		.645		0.000

SUMMARY STATISTICS FOR AGE 21								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-12.21	.787	.0975	.2817	.000E+00	.000E+00	-12.208	.297
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.282	.787		0.000		.787		0.000

SUMMARY STATISTICS FOR AGE 22								
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	-13.01	.890	.0437	.1324	.000E+00	.000E+00	-13.009	.336
Fbar		SIGMA(int.)		SIGMA(ext.)		SIGMA(overall)		Variance ratio
	.132	.890		0.000		.890		0.000

Table 6.28

Run title : *Sebastes marinus* in the Barents and Norwegian Seas (Fishing
Traditional vpa Terminal fs estimated using Laurec-Shepherd method

At 3/09/1992

Table 8	Fishing mortality (F) at age									
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
11	.0040	.0001	.0000	.0004	.0013	.0006	.0013	.0008	.0001	.0050
12	.0218	.0021	.0031	.0220	.0019	.0012	.0105	.0038	.0035	.0004
13	.0213	.0075	.0028	.0174	.0237	.0027	.0093	.0797	.0083	.0043
14	.0407	.0171	.0202	.0858	.0626	.0132	.0133	.0237	.0650	.0116
15	.0704	.0323	.0547	.2413	.1458	.0295	.0474	.0411	.0227	.0464
16	.0836	.0774	.0389	.2264	.3249	.0850	.0237	.1256	.0175	.0352
17	.0465	.0308	.0290	.0725	.1623	.0967	.0766	.0364	.0966	.0379
18	.0729	.0926	.2110	.2287	.3097	.1022	.3329	.1179	.0618	.0907
19	.0930	.0568	.0809	.1619	.2292	.0903	.3336	.1952	.1648	.0897
20	.1121	.1072	.1102	.1101	.1482	.1579	.2185	.1828	.4258	.1512
21	.1372	.1989	.7151	.1460	.2598	.3086	.4051	.1749	.3785	.2817
22	.1220	.0685	.2219	.3525	.0392	.1498	.2673	.1585	.1605	.1324
23	.1074	.1048	.2685	.2003	.1972	.1618	.3118	.1662	.2392	.1500
+gp	.1074	.1048	.2685	.2003	.1972	.1618	.3118	.1662	.2392	.1500
FBAR 15-21	.0879	.0852	.1771	.1696	.2257	.1243	.2054	.1248	.1668	.1047

Table 6.29

Sebastes marinus W.G.1992 SHOT forecast spreadsheet version 3
Sub-area I and Divisions IIA and IIB September 1992

running recruitment weights

older .30 G-M = -.05
central .40 exp(d) .95
younger .30 exp(d/2) .98

Year	Land -ings	Recrt Index	W'td Index	Y/B Ratio	Hang -over	Act'l Prodn	Est'd Prodn	Est'd SQC.	Act'l Expl Biom	Est'd Expl Biom	Est'd Land -ings
1978	32	32		.09	.86				345		.1
1979	26	26	27	.09	.86	-17			280		.1
1980	22	22	23	.09	.86	-4			237		.1
1981	21	21	20	.09	.86	22			226		.1
1982	16	16	18	.08	.87	-27	0	18	191	195	.09
1983	19	19	21	.12	.84	47	-6	13	160	160	.13
1984	28	28	24	.20	.76	68	5	16	140	138	.23
1985	29	29	28	.23	.73	38	19	25	126	124	.27
1986	30	30	28	.27	.69	37	22	26	112	113	.32
1987	24	24	26	.24	.72	10	23	27	101	100	.28
1988	26	26	25	.28	.68	35	20	22	92	92	.34
1989	23	23	25	.27	.68	19	22	24	84	85	.33
1990	27	27	24	.34	.62	37	21	22	79	78	.43
1991	22	22	21	.32	.64	15	19	23	68	68	.4
1992	12	12	15	.22	.74		14	18		57	.25
1993		12	12	.22	.74		11	12		53	.25
1994		12	12	.22	.74		11	11		51	.25

Table 6.30

Sebastes marinus W.G.1992 SHOT forecast spreadsheet version 3
Sub-area I and Divisions Ila and Ilb September 1992

running recruitment weights

older .30 G-M = -.05
central .40 exp(d) .95
younger .30 exp(d/2) .98

Year	Land -ings	Recrt Index	W'td Index	Y/B Ratio	Hang -over	Act'l Prodn	Est'd Prodn	Est'd SQC.	Act'l Expl Biom	Est'd Expl Biom	Est'd Land -ings	
1978	32	32		.09	.86				345			.1
1979	26	26	27	.09	.86	-17			280			.1
1980	22	22	23	.09	.86	-4			237			.1
1981	21	21	20	.09	.86	22			226			.1
1982	16	16	18	.08	.87	-27	0	18	191	195	16	.09
1983	19	19	21	.12	.84	47	-6	13	160	160	19	.13
1984	28	28	24	.20	.76	68	5	16	140	138	28	.23
1985	29	29	28	.23	.73	38	19	25	126	124	29	.27
1986	30	30	28	.27	.69	37	22	26	112	113	30	.32
1987	24	24	26	.24	.72	10	23	27	101	100	24	.28
1988	26	26	25	.28	.68	35	20	22	92	92	26	.34
1989	23	23	25	.27	.68	19	22	24	84	85	23	.33
1990	27	27	24	.34	.62	37	21	22	79	78	27	.43
1991	22	22	24	.31	.65	14	22	24	71	71	22	.38
1992	12	22	22	.18	.78		20	20		66	12	.2
1993		22	22	.22	.74		20	13		72	16	.25
1994		22	22	.22	.74		20	16		74	16	.25

Table 7.1 GREENLAND HALIBUT in Sub areas I and II. Nominal catch (t) by countries (Sub-area I, Divisions IIa and IIb combined) as officially reported to ICES.

Country	1982	1983	1984	1985	1986
Denmark	-	-	-	-	-
Faroe Islands	-	-	-	-	42
France	8	67	138	239	13
German Dem.Rep.	1,153	1,913	2,089	3,807	2,659
Germany, Fed. Rep.	18	130	76	193	59
Norway	3,206	4,883	4,376	5,464	7,890
UK (Engl. & Wales)	10	2	23	5	10
UK (Scotland)	-	-	-	-	2
USSR	12,394	15,152	15,181	10,237	12,200
Spain	-	-	-	-	-
Total	16,789	22,147	21,883	19,945	22,875

Country	1987	1988	1989	1990 ¹	1991 ¹
Denmark	+	-	-	-	11
Faroe Islands	-	186	67	163	314
France	13	67	37 ³	39 ³	47 ³
German Dem.Rep.	1,855	712	589	909	-
Germany, Fed. Rep.	169	32	11	45	117
Norway	7,261	9,076	11,043 ²	16,825 ²	24,039 ²
UK (Engl. & Wales)	61	82	6	10	+
UK (Scotland)	20	2	-	-	2
USSR/Russia	9,733	9,430	8,812	4,764 ²	2,490 ²
Spain	-	-	-	-	132 ²
Total	19,112	19,587	20,408	22,755	27,152

¹ Provisional figures.

² Working Group figure.

³ As reported to Norwegian Authorities.

Table 7.2 GREENLAND HALIBUT in Sub-areas I and II. Nominal catch (t) by countries in Sub-area I as officially reported to ICES.

Country	1982	1983	1984	1985	1986
Faroe Islands	-	-	-	-	-
Germany, Fed. Rep.	-	-	-	-	1
Norway	505	490	593	602	557
UK (Engl. & Wales)	8	1	17	1	5
UK (Scotland)	-	-	-	-	1
USSR	200	196	81	615	615
Total	713	687	691	725	1,179

Country	1987	1988	1989	1990 ¹	1991 ¹
Faroe Islands	-	9	-	7	-
Germany, Fed. Rep.	2	4	-	-	-
Norway	984	978	335 ²	304 ²	1,923 ²
UK (Engl. & Wales)	10	7	+	-	-
UK (Scotland)	+	-	-	-	-
USSR/Russia	259	420	482	321 ²	522 ²
Total	1,255	1,418	817	632	2,445

¹ Provisional figures.

² Working Group figures.

Table 7.3 GREENLAND HALIBUT in Sub areas I and II. Nominal catch (t) by countries in Division IIa as officially reported to ICES.

Country	1982	1983	1984	1985	1986
Faroe Islands	-	-	-	-	6
France	8	67	138	239	13
German Dem.Rep.	73	14	189	82	55
Germany, Fed.Rep.	18	130	76	172	42
Norway	2,487	4,257	3,703	4,791	6,389
UK (Engl. & Wales)	2	1	1	2	5
UK (Scotland)	-	-	-	-	1
USSR	2,459	5,031	5,459	6,894	5,553
Total	5,047	9,500	9,566	12,180	12,064

Country	1987	1988	1989	1990 ¹	1991 ¹
Faroe Islands	-	177	67	133	314
France	13	67	37 ³	39 ³	47 ³
German Dem.Rep.	12	130	94	10	
Germany, Fed.Rep.	63	20	10	2	21
Norway	5,705	7,859	7,208 ²	8,025 ²	9,734 ²
UK (Engl. & Wales)	44	56	6	1	+
UK (Scotland)	10	2	-	-	1
USSR/Russia	4,739	4,002	4,964	1,246 ²	305 ²
Total	10,586	12,313	12,386	9,456	10,422

¹ Provisional figures.

² Working Group figure.

³ As reported to Norwegian Authorities.

Table 7.4 GREENLAND HALIBUT in Sub areas I and II. Nominal catch (t) by countries in Division IIb as officially reported to ICES.

Country	1982	1983	1984	1985	1986
Denmark	-	-	-	-	-
Faroe Islands	-	-	-	-	36
German Dem.Rep.	1,080	1,899	1,900	3,725	2,604
Germany, Fed.Rep.	-	-	-	21	16
Norway	214	136	80	71	944
UK (Engl. & Wales)	+	+	5	2	+
UK (Scotland)	-	-	-	-	-
USSR	9,735	9,925	9,641	3,221	6,032
Total	11,029	11,960	11,626	7,040	9,632

Country	1987	1988	1989	1990 ¹	1991 ¹
Denmark	+	-	-	-	11
Faroe Islands	-	-	-	23	-
German Dem.Rep.	1,843	582	495	899	-
Germany, Fed.Rep.	104	8	1	43	96
Norway	572	239	3,500 ²	8,496 ²	12,382 ²
UK (Engl. & Wales)	7	19	-	9	+
UK (Scotland)	10	+	-	-	1
USSR/Russia	4,735	5,008	3,366	3,197 ²	1,663 ²
Spain	-	-	-	-	132 ²
Total	7,278	6,054	7,308	12,667	14,285

¹ Provisional figures.

² Working Group figure.

Table 7.5 GREENLAND HALIBUT in Sub-areas I and II. Catch per unit effort and total effort.

Year	USSR catch/hour trawling (t)		Norway catch/hour trawling (t)	Average CPUE		Total effort (in '000 hrs trawling) ⁶	CPUE 7+ ⁷	GDR ⁸ (catch/day tonnage (kg))
	RT ²	PST ³		A ⁴	B ⁵			
1965	0.80	-	-	0.80	-	-	-	-
1966	0.77	-	-	0.77	-	-	-	-
1967	0.70	-	-	0.70	-	-	-	-
1968	0.65	-	-	0.65	-	-	-	-
1969	0.53	-	-	0.53	-	-	-	-
1970	0.53	-	-	0.53	-	169	0.50	-
1971	0.46	-	-	0.46	-	172	0.43	-
1972	0.37	-	-	0.37	-	116	0.33	-
1973	0.37	-	0.34	0.36	-	83	0.36	-
1974	0.40	-	0.36	0.38	-	100	0.36	-
1975	0.39	0.51	0.38	0.39	0.45	99	0.37	-
1976	0.40	0.56	0.33	0.37	0.45	100	0.34	-
1977	0.27	0.41	0.33	0.30	0.37	96	0.26	-
1978	0.21	0.32	0.21	0.21	0.27	123	0.17	-
1979	0.23	0.35	0.28	0.26	0.32	67	0.19	-
1980	0.24	0.33	0.32	0.28	0.33	47	0.25	-
1981	0.30	0.36	0.35	0.33	0.36	42	0.28	-
1982	0.26	0.45	0.40	0.33	0.43	39	0.37	-
1983	0.26	0.40	0.34	0.30	0.37	60	0.32	-
1984	0.27	0.41	0.36	0.29	0.36	61	0.30	-
1985	0.28	0.52	0.36	0.32	0.44	45	0.37	-
1986	0.23	0.42	0.34	0.30	0.39	58	0.32	-
1987	0.25	0.50	0.34	0.30	0.42	45	0.35	-
1988	0.20	0.30	0.31	0.26	0.31	63	0.26	4.26
1989	0.20	0.30	0.28	0.24	0.29	71	0.19	2.95
1990	-	0.20	0.27	-	0.24	95	0.16	1.66
1991 ¹	-	-	0.21	-	-	129	0.17	-

¹ Provisional.

² Side trawlers, 800-1000 hp. From 1983 onwards, side trawlers (SRTM), 1,000 hp.

³ Stern trawlers, up to 2,000 HP.

⁴ Arithmetic average of CPUE from USSR RT (or SRTM trawlers) and Norwegian trawlers.

⁵ Arithmetic average of CPUE from USSR PST and Norwegian trawlers.

⁶ For the years 1981-1990, based on average CPUE type B. For 1991, based on the Norwegian CPUE.

⁷ Total catch (t) of seven years and older fish divided by total effort.

⁸ For the years 1988-1989, frost-trawlers 995 BRT (FAO Code 095). For 1990, factory trawlers FVS IV, 1943 BRT (FAO Code 090).

Table 7.6 Greenland HALIBUT in Sub-areas I and II. Norwegian bottom-trawl survey indices (numbers in thousands) in the Svalbard area (Division IIb).

Year	Fish ² <20 cm	Age										Total
		1	2	3	4	5	6	7	8	9	10+	
1981	2.1											20,100
1982	0.7	No age data										26,000
1983	5.9											26,690
1984	3.2	550	3,042	2,924	8,573	6,847	5,657	4,345	2,796	1,709	187	36,630
1985	1.6	884	3,921	4,294	6,674	8,793	8,622	3,920	1,817	508	17	39,450
1986	0.1	49	1,005	1,967	7,314	4,671	1,754	2,301	372	11	26	19,470
1987	1.0	630	1,014	3,076	4,409	4,786	3,141	964	364	108	8	18,500
1988	2.5	818	4,298	6,191	6,696	12,289	2,396	6,015	338	257	20	39,300
1989 ¹	1.4	1,010	3,510	7,200	8,500	6,590	2,660	1,670	500	224	+	31,900
1990 ¹	0.4	115	336	5,050	7,130	7,730	4,490	2,330	918	544	+	28,700
1991 ¹	0.1	71	877	3,080	6,720	9,270	5,450	2,800	1,660	483	41	30,452

¹ New standard trawl equipment (rockhopper gear and 40 meter sweep length).

² In millions.

Table 7.7

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

FLEET 1 : GREENLAND HALIBUT : NORWEGIAN TRAWL EFFORT (hours trawling) AND CATCH-AT-AGE FROM TRAWL

Year	Effort	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10	Catch, age 11	Catch, age 12	Catch, age 13	Catch, age 14	Catch, age 15
1979	3542	1	4	1	26	123	66	53	32	64	55	24	6	1
1980	5029	1	1	1	14	95	90	55	25	107	64	39	63	7
1981	8936	1	1	1	89	263	148	103	110	183	109	128	39	18
1982	8077	7	81	172	192	252	206	129	142	122	100	83	23	13
1983	14476	1	1	59	30	154	336	295	333	129	60	95	157	26
1984	14116	1	1	11	70	193	219	268	241	128	193	91	112	37
1985	14768	1	1	1	40	169	239	438	379	269	199	90	70	40
1986	15774	1	11	32	202	308	265	244	361	223	202	149	202	159
1987	12333	1	25	234	446	821	375	117	188	92	46	92	1	1
1988	16526	1	38	461	794	1123	715	295	73	25	54	1	26	8
1989	29152	26	384	1520	1554	1359	586	276	57	88	57	69	105	23
1990	49622	61	544	1331	3160	2895	997	606	145	145	178	1	45	31
1991	77095	103	851	1796	2377	3064	1592	685	580	66	204	63	45	155

Ages 7-12 used

FLEET 2 : CATCH-AT-AGE FROM THE NORWEGIAN BOTTOM SURVEY AT SVALBARD

Year	Effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10
1984	1	550	3042	2924	8573	6847	5657	4345	2796	1709	187
1985	1	884	3921	4294	6674	8793	8622	3920	1817	508	17
1986	1	49	1005	1967	7314	4671	1754	2301	372	11	26
1987	1	630	1014	3076	4409	4786	3141	964	364	108	8
1988	1	818	4298	6191	6696	12289	2396	6015	338	257	20
1989	1	1010	3510	7200	8500	6590	2660	1670	500	224	1
1990	1	115	336	5050	7130	7730	4490	2330	918	544	1
1991	1	71	877	3080	6720	9270	5450	2800	1660	483	41

Ages 3-7 used

Table 7.8

VPA Version 3.0 (MSDOS) - Jan 1991

Greenland Halibut in the North-East Arctic (Fishing Areas I
with cpue data from file J:\IFAPWORK\WG_108\GHAL_NOR\FLEET.008

Disaggregated Qs

Log transformation

The final F is the (reciprocal variance-weighted) mean of the raised fleet F's.
No trend in Q (mean used)

Terminal fs estimated using Laurec-Shepherd method

Regression weights

, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000
Oldest age F = 1.000*average of 4 younger ages.

Fishing mortalities

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
3	.002	.014	.000	.004	.005	.002	.000	.006	.005	.013
4	.027	.063	.002	.021	.050	.018	.009	.030	.026	.056
5	.081	.094	.059	.076	.096	.076	.044	.097	.083	.101
6	.129	.150	.320	.249	.290	.232	.214	.300	.333	.153
7	.132	.222	.411	.361	.370	.541	.386	.513	.527	.429
8	.173	.346	.358	.319	.359	.408	.670	.344	.510	.532
9	.329	.315	.253	.289	.383	.283	.504	.560	.418	.760
10	.362	.465	.420	.394	.509	.506	.568	.232	.746	.852
11	.458	.338	.412	.375	.339	.329	.588	.273	.281	2.079
12	.445	.499	.253	.441	.466	.197	.496	.283	.664	1.507
13	.391	.387	.306	.172	.810	.351	.182	.341	.131	1.300
14	.414	.422	.348	.346	.531	.346	.459	.282	.456	1.434

Log catchability residuals

Fleet 1

Age, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991

1	No data for this fleet at this age									
1	No data for this fleet at this age									
1	No data for this fleet at this age									
1	No data for this fleet at this age									
7	.14	1.07	.79	.83	.33	-1.00	-.81	-.56	-.59	-.18
8	.26	.29	.50	.34	.18	-.41	-1.08	.13	-.21	.00
9	.38	.18	.13	-.54	-.02	.37	-.39	-.24	.12	.00
10	.10	-.44	-.07	-.56	-.74	-.51	.65	1.37	.19	.00
11	-.45	.22	-.16	-.74	-.54	-.25	1.05	.39	.48	.00
12	-.40	.55	-.32	-.80	-.63	.70	.35	.52	.03	.00

Fleet 2

Age, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991

3			.16	-.30	.70	.32	-.22	-.39	-.27	.00
4			-.45	-.09	-.27	.46	.12	.03	.19	.00
5			-.15	-.38	.34	.23	-.46	.22	.21	.00
6			-.55	-.97	.62	.14	.34	.47	-.05	.00
7			-.44	-.47	.09	.86	-.76	.39	.24	.10
2	No data for this fleet at this age									

2, No data for this fleet at this age

2, No data for this fleet at this age

2, No data for this fleet at this age

2, No data for this fleet at this age

SUMMARY STATISTICS FOR AGE 3

Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE
	q		F	F		Slope		Intrcpt
1	No data for this fleet at this age							
2	-1.99	.395	.1362	.0132	.000E+00	.000E+00	-1.994	.132
Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio				
.013	.395	0.000	.395	0.000				

Table 7.8 Continued

SUMMARY STATISTICS FOR AGE 4									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	No data for this fleet at this age								
2	-1.26	.297	.2842	.0560	.000E+00	.000E+00	-1.258	.099	
Fbar		SIGMA(int.)	SIGMA(ext.)		SIGMA(overall)		Variance ratio		
	.056	.297	0.000		.297		0.000		

SUMMARY STATISTICS FOR AGE 5									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	No data for this fleet at this age								
2	-.97	.320	.3772	.1005	.000E+00	.000E+00	-.975	.107	
Fbar		SIGMA(int.)	SIGMA(ext.)		SIGMA(overall)		Variance ratio		
	.101	.320	0.000		.320		0.000		

SUMMARY STATISTICS FOR AGE 6									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	No data for this fleet at this age								
2	-1.26	.564	.2827	.1528	.000E+00	.000E+00	-1.263	.188	
Fbar		SIGMA(int.)	SIGMA(ext.)		SIGMA(overall)		Variance ratio		
	.153	.564	0.000		.564		0.000		

SUMMARY STATISTICS FOR AGE 7									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	-12.51	.777	.2851	.3580	.000E+00	.000E+00	-12.508	.234	
2	-1.07	.562	.3437	.4723	.000E+00	.000E+00	-1.068	.187	
Fbar		SIGMA(int.)	SIGMA(ext.)		SIGMA(overall)		Variance ratio		
	.429	.456	.132		.456		.083		

SUMMARY STATISTICS FOR AGE 8									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	-12.27	.487	.3632	.5318	.000E+00	.000E+00	-12.266	.147	
2	No data for this fleet at this age								
Fbar		SIGMA(int.)	SIGMA(ext.)		SIGMA(overall)		Variance ratio		
	.532	.487	0.000		.487		0.000		

SUMMARY STATISTICS FOR AGE 9									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	-12.18	.321	.3976	.7604	.000E+00	.000E+00	-12.175	.097	
2	No data for this fleet at this age								
Fbar		SIGMA(int.)	SIGMA(ext.)		SIGMA(overall)		Variance ratio		
	.760	.321	0.000		.321		0.000		

SUMMARY STATISTICS FOR AGE 10									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	-12.09	.670	.4312	.8520	.000E+00	.000E+00	-12.094	.202	
2	No data for this fleet at this age								
Fbar		SIGMA(int.)	SIGMA(ext.)		SIGMA(overall)		Variance ratio		
	.852	.670	0.000		.670		0.000		

Table 7.8 Continued

SUMMARY STATISTICS FOR AGE 11									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	-12.15	.570	.4071	2.0787	.000E+00	.000E+00	-12.151	.172	
2	No data for this fleet at this age								
Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio					
2.079	.570	0.000	.570	0.000					

SUMMARY STATISTICS FOR AGE 12									
Fleet	Pred.	SE(q)	Partial	Raised	SLOPE	SE	INTRCPT	SE	
	q		F	F		Slope		Intrcpt	
1	-11.82	.553	.5662	1.5070	.000E+00	.000E+00	-11.822	.167	
2	No data for this fleet at this age								
Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio					
1.507	.553	0.000	.553	0.000					

Table 7.9

Title : Greenland Halibut in the North-East Arctic (Fishing Areas I

At 31/08/1992 18:48

Separable analysis

from 1982 to 1991 on ages 3 to 14

with Terminal F of .610 on age 8 and Terminal S of 1.000

Initial sum of squared residuals was 241.703 and

final sum of squared residuals is 76.337 after 87 iterations

Matrix of Residuals

Years	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91		WTS
Ages											
3/ 4	-.822	4.228	-4.518	.060	.875	.848	-3.168	1.013	.433	.000	.092
4/ 5	.141	1.108	-2.449	-.057	.552	.408	-1.380	.240	.182	.000	.215
5/ 6	.646	-.210	-.238	.035	.002	.212	-.967	-.016	.769	.000	.459
6/ 7	.052	-.666	.536	.334	-.266	.128	-.516	.082	.571	.000	.537
7/ 8	-.927	-.752	.326	.172	-.403	.092	-.156	.133	.335	.000	.504
8/ 9	-.525	.090	.273	.008	-.097	-.017	.203	-.165	.076	.000	1.000
9/10	.026	-.301	-.244	-.190	-.348	-.396	.704	.150	-.109	.000	.684
10/11	.109	-.110	.101	.223	.060	-.005	.425	-.428	-.053	.000	.997
11/12	.485	.331	.350	.300	.431	.003	.856	-.525	-.766	.000	.458
12/13	.186	.161	.122	-.363	-.166	-.188	-.003	.429	-.073	.000	.980
13/14	.593	.392	.370	-.512	1.253	.316	-.355	.195	-1.410	.000	.308
	.000	.000	.000	.000	.000	.000	.000	.000	.000	-1.125	
WTS	.001	.001	.001	.001	1.000	1.000	1.000	1.000	1.000		
Fishing Mortalities (F)											
	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	
F-values	.2841	.3477	.3008	.3334	.4382	.3576	.4301	.3730	.4083	.6100	
Selection-at-age (S)											
	3	4									
S-values	.0064	.0688									
	5	6	7	8	9	10	11	12	13	14	
S-values	.2209	.6590	1.0735	1.0000	.9391	1.0245	.8205	.9771	.7163	1.0000	

Table 7.10 Percentage of mature GREENLAND HALIBUT by age. Data from the USSR for the years 1983-1990.

Age years	1984 ¹	1985 ¹	1986 ²	1987 ²	1988 ¹	1989 ²	1990 ²	Average 1983-1987
3	-	-	-	-	-	-	-	-
4	-	-	0.04	0.06	-	0.01	0.09	0.05
5	0.28	0.18	0.23	1.20	0.04	0.10	0.29	0.23
6	0.68	0.43	0.49	0.46	0.40	0.66	0.52	0.49
7	0.70	0.64	0.52	0.70	0.57	0.74	0.66	0.66
8	0.76	0.77	0.62	0.74	0.63	0.68	0.75	0.78
9	0.80	0.92	0.80	0.91	0.67	0.81	0.71	0.89
10	0.89	0.97	0.88	0.96	0.89	0.92	0.77	0.95
11	0.96	0.99	1.00	1.00	1.00	0.94	0.93	0.99
12	0.96	1.00	1.00	1.00	1.00	1.00	1.00	0.99
13	0.96	1.00	1.00	1.00	1.00	1.00	1.00	0.99
14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

¹ The specimens analyzed were sampled through the whole year.² The specimens analyzed were sampled in August-February, only.

Table 7.11

Run title : Greenland Halibut in the North-East Arctic (Fishing Areas I
Traditional vpa using file input for terminal F

At 1/09/1992

Table 1	Catch numbers at age		Numbers*10**-3
YEAR	1970	1971	
AGE			
3	1	1	
4	34	1	
5	526	80	
6	2792	4486	
7	10464	12712	
8	18562	12283	
9	10034	6130	
10	6671	4339	
11	2517	2703	
12	1250	1660	
13	616	1044	
14	1104	300	
+gp	281	143	
TOTALNUM	54852	45882	
TONSLAND	89484	79034	
SOPCOF %	94	104	

Table 1	Catch numbers at age			Numbers*10**-3						
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
3	1	1	1	22	1	62	78	88	64	664
4	461	19	276	334	98	755	532	887	275	1146
5	1109	212	917	840	830	2037	1897	2218	731	1896
6	3521	1117	2519	2337	2982	3255	3589	3155	1138	1917
7	9605	3923	6204	6520	5824	4200	4118	2727	1665	1919
8	6438	3515	3838	4118	5002	2524	2365	1234	1341	933
9	2775	2551	1834	2265	3000	1610	1509	495	944	484
10	1734	1919	1942	1654	1350	1104	946	319	473	448
11	1368	1536	1622	1857	915	1062	934	296	511	482
12	1234	1127	1338	1536	1212	858	438	243	275	380
13	675	716	734	1122	698	595	349	103	242	384
14	200	251	531	600	526	384	147	45	145	150
+gp	80	126	216	368	358	180	112	51	78	62
TOTALNUM	29201	17013	21972	23573	22796	18626	17014	11861	7882	10865
TONSLAND	43055	29938	37763	38172	36074	28827	24617	17312	13284	15018
SOPCOF %	97	92	98	88	92	100	104	100	108	102

Table 1	Catch numbers at age			Numbers*10**-3						
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
3	48	314	0	88	141	50	5	216	152	299
4	551	1212	36	461	985	435	233	933	777	1324
5	1304	1543	915	1219	1672	1212	907	2101	2097	2471
6	1494	1864	3698	2874	3335	2972	2540	4498	5062	2946
7	1276	1851	3350	2561	2712	3572	3141	3692	4551	3848
8	1208	2287	1938	1548	1531	1746	2096	1674	1894	2331
9	1493	1491	1064	972	1128	752	1182	809	1197	1310
10	1258	1228	1191	1037	997	828	860	321	489	1146
11	838	713	602	614	530	362	481	230	259	337
12	502	488	340	363	434	202	313	127	308	543
13	324	247	171	161	314	186	133	121	41	206
14	108	201	132	120	305	63	140	141	94	195
+gp	46	64	71	63	239	7	47	28	43	311
TOTALNUM	10450	13503	13508	12081	14323	12387	12078	14891	16964	17267
TONSLAND	16789	22147	21883	19945	22875	19112	19587	20565	22755	27152
SOPCOF %	98	95	100	98	96	100	99	101	100	100

Table 7.12

Run title : Greenland Halibut in the North-East Arctic (Fishing Areas I
Traditional vpa using file input for terminal F

At 1/09/1992

Table 2 Catch weights at age (kg)		
YEAR	1970	1971
AGE		
3	.2000	.2000
4	.4410	.4410
5	.5670	.5670
6	.7370	.7370
7	1.0790	1.0790
8	1.4210	1.4210
9	1.8480	1.8480
10	2.2810	2.2810
11	2.8870	2.8870
12	3.2470	3.2470
13	4.3030	4.3030
14	4.9310	4.9310
+gp	5.7940	5.8410
SOPCOFAC	.9435	1.0434

Table 2 Catch weights at age (kg)										
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
3	.2000	.2000	.2000	.2000	.2000	.2000	.2000	.3000	.2000	.2000
4	.4410	.4410	.4410	.4410	.4410	.4410	.4410	.6000	.4820	.5000
5	.5670	.5670	.5670	.5670	.5670	.5670	.5670	.9000	.7020	.6600
6	.7370	.7370	.7370	.7370	.7370	.7370	.7370	1.2000	.8720	.8400
7	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.5000	1.1410	1.1500
8	1.4210	1.4210	1.4210	1.4210	1.4210	1.4210	1.4210	1.8000	1.4680	1.5600
9	1.8480	1.8480	1.8480	1.8480	1.8480	1.8480	1.8480	2.2000	1.7780	2.0400
10	2.2810	2.2810	2.2810	2.2810	2.2810	2.2810	2.2810	2.6000	2.3020	2.5700
11	2.8870	2.8870	2.8870	2.8870	2.8870	2.8870	2.8870	3.0000	2.6640	2.9800
12	3.2470	3.2470	3.2470	3.2470	3.2470	3.2470	3.2470	3.5000	3.0460	3.4300
13	4.3030	4.3030	4.3030	4.3030	4.3030	4.3030	4.3030	4.1000	3.3680	4.1300
14	4.9310	4.9310	4.9310	4.9310	4.9310	4.9310	4.9310	4.8000	4.2850	4.6800
+gp	6.0360	6.0060	5.9640	5.9100	5.9230	6.0270	5.9060	6.1760	5.3460	5.9990
SOPCOFAC	.9707	.9229	.9794	.8774	.9245	.9974	1.0375	1.0029	1.0766	1.0169

Table 2 Catch weights at age (kg)										
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
3	.2700	.3100	.3000	.3000	.3400	.3070	.4140	.3100	.2800	.2710
4	.6200	.4500	.4800	.3800	.4700	.5740	.5540	.6300	.5500	.5530
5	.6900	.7500	.6300	.6000	.6200	.7090	.7400	.7600	.7100	.7440
6	.8400	1.0400	.9600	.8900	.9200	1.0030	.9620	1.0300	1.0600	1.0250
7	1.0300	1.3400	1.1800	1.2000	1.2800	1.2660	1.2490	1.3200	1.2900	1.3570
8	1.3100	1.5700	1.5300	1.8500	1.9000	1.6830	1.6260	1.8000	1.7000	1.7190
9	1.7400	1.9700	2.3100	2.5900	2.4800	2.4820	2.1640	2.4200	2.1000	2.2820
10	2.2400	2.7300	2.8700	3.1800	3.1100	2.9820	2.8970	3.1300	2.6100	2.7140
11	2.7700	3.2900	3.4600	3.6200	3.3500	3.5470	3.4060	3.3700	2.8700	2.9950
12	3.3700	4.2200	3.7700	3.9500	3.7200	3.8000	3.6610	4.0500	3.4500	3.4570
13	4.3200	4.7100	3.9900	4.4800	4.0000	4.5600	4.2470	4.2900	3.7200	4.0300
14	5.3500	6.0800	4.3500	4.2500	4.1800	5.0020	4.1870	4.5000	4.0900	4.7140
+gp	5.8330	6.1220	4.5250	4.8250	4.5260	5.9530	4.4630	4.7200	4.5200	4.8550
SOPCOFAC	.9829	.9513	1.0001	.9760	.9572	.9976	.9907	1.0126	1.0006	1.0002

Table 7.13

Run title : Greenland Halibut in the North-East Arctic (Fishing Areas I
Traditional vpa using file input for terminal F

At 1/09/1992

Table 8 Fishing mortality (F) at age		
YEAR	1970	1971
AGE		
3	.0000	.0000
4	.0010	.0000
5	.0139	.0028
6	.0654	.1488
7	.2852	.4398
8	.6441	.5948
9	.5442	.4276
10	.5240	.4522
11	.4558	.3927
12	.4704	.5831
13	.6368	.8676
14	.6000	.7000
+gp	.6000	.7000
FBAR 6-10	.4126	.4126

Table 8 Fishing mortality (F) at age										
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
3	.0000	.0000	.0000	.0007	.0000	.0024	.0034	.0039	.0026	.0265
4	.0136	.0006	.0109	.0134	.0038	.0329	.0247	.0464	.0143	.0560
5	.0358	.0073	.0362	.0396	.0398	.0969	.1027	.1287	.0465	.1226
6	.1545	.0436	.1069	.1156	.1819	.2042	.2330	.2341	.0855	.1564
7	.5063	.2434	.3374	.4124	.4358	.3939	.4038	.2634	.1766	.1919
8	.3934	.3297	.3750	.3702	.6049	.3222	.3796	.1908	.1891	.1344
9	.2411	.2514	.2704	.3739	.4759	.3734	.3067	.1195	.2067	.0915
10	.1934	.2473	.2912	.3927	.3768	.3027	.3697	.0925	.1519	.1355
11	.2357	.2478	.3219	.4696	.3700	.5403	.4260	.1780	.1987	.2157
12	.2949	.2933	.3344	.5390	.6046	.6655	.4214	.1756	.2358	.2106
13	.4692	.2631	.2983	.4880	.4739	.6414	.5928	.1551	.2509	.5616
14	.3700	.3000	.3000	.4000	.4200	.4900	.3000	.1300	.3200	.2300
+gp	.3700	.3000	.3000	.4000	.4200	.4900	.3000	.1300	.3200	.2300
FBAR 6-10	.2977	.2231	.2762	.3330	.4151	.3193	.3386	.1801	.1619	.1420

Table 8		Fishing mortality (F) at age									
YEAR		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE											
3		.0020	.0129	.0000	.0035	.0050	.0018	.0003	.0087	.0061	.0120
4		.0262	.0608	.0017	.0209	.0472	.0180	.0099	.0561	.0371	.0636
5		.0792	.0903	.0565	.0704	.0929	.0716	.0450	.1104	.1630	.1503
6		.1272	.1471	.3044	.2380	.2632	.2241	.1989	.3070	.3940	.3401
7		.1404	.2169	.4001	.3372	.3484	.4680	.3681	.4626	.5467	.5546
8		.1681	.3754	.3484	.3071	.3265	.3735	.5219	.3225	.4319	.5671
9		.3105	.3040	.2830	.2785	.3626	.2492	.4398	.3680	.3797	.5680
10		.3401	.4269	.3994	.4615	.4808	.4656	.4699	.1922	.3745	.7167
11		.3776	.3104	.3618	.3485	.4282	.3025	.5108	.2070	.2213	.4516
12		.3436	.3716	.2255	.3643	.4187	.2707	.4374	.2297	.4412	.9123
13		.2640	.2674	.2029	.1500	.5809	.3001	.2716	.2836	.1020	.5627
14		.2838	.2457	.2113	.2026	.4383	.2039	.3651	.4834	.3505	.8866
+gp		.2838	.2457	.2113	.2026	.4383	.2039	.3651	.4834	.3505	.8866
FBAR	6-10	.2173	.2940	.3471	.3244	.3563	.3561	.3997	.3305	.4254	.5493

Table 7.14

Run title : Greenland Halibut in the North-East Arctic (Fishing Areas I
Traditional vpa using file input for terminal F

At 1/09/1992

Table 10	Stock number at age (start of year)		Numbers*10**-3
YEAR	1970	1971	
AGE			
3	45825	42801	
4	35821	39441	
5	41095	30800	
6	47458	34883	
7	45254	38262	
8	41758	29286	
9	25573	18873	
10	17500	12774	
11	7362	8919	
12	3566	4017	
13	1397	1918	
14	2615	636	
+gp	666	303	
TOTAL	315892	262914	

Table 10	Stock number at age (start of year)					Numbers*10**-3				
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
3	37471	31780	31307	32183	29152	27385	24568	24286	26374	27350
4	36838	32251	27352	26946	27680	25091	23513	21073	20821	22641
5	33946	31280	27741	23286	22883	23733	20896	19745	17316	17666
6	26436	28190	26726	23027	19265	18926	18542	16229	14942	14227
7	25874	19496	23229	20672	17657	13823	13281	12642	11053	11807
8	21214	13423	13155	14267	11780	9828	8024	7633	8362	7974
9	13906	12321	8309	7782	8481	5537	6129	4725	5429	5957
10	10593	9405	8248	5457	4609	4535	3281	3882	3608	3800
11	6995	7514	6321	5306	3172	2721	2884	1951	3046	2668
12	5184	4757	5048	3943	2855	1886	1364	1621	1406	2149
13	1930	3322	3053	3110	1980	1343	834	771	1171	956
14	693	1039	2198	1950	1643	1061	608	397	568	784
+gp	277	522	894	1196	1118	497	464	450	306	324
TOTAL	221357	195299	183582	169125	152273	136368	124388	115405	114401	118303

Table 10	Stock number at age (start of year)					Numbers*10**-3					
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
AGE											
3	25746	26411	27933	26814	30642	29518	21399	26895	27025	26989	0
4	22925	22115	22441	24042	22998	26243	25360	18413	22949	23120	22953
5	18426	19221	17912	19282	20266	18882	22185	21611	14984	19032	18673
6	13451	14652	15115	14570	15467	15895	15129	18254	16656	10958	14095
7	10472	10195	10886	9595	9884	10232	10934	10674	11559	9667	6712
8	8388	7833	7064	6280	5895	6005	5515	6513	5784	5759	4779
9	6000	6102	4632	4291	3976	3661	3557	2817	4061	3233	2811
10	4679	3785	3876	3004	2796	2381	2456	1972	1678	2391	1577
11	2856	2866	2126	2237	1630	1488	1287	1321	1401	993	1005
12	1851	1685	1809	1274	1359	914	946	664	925	966	544
13	1499	1130	1000	1243	762	770	600	526	455	512	334
14	469	991	744	703	921	367	491	394	341	353	251
+gp	200	315	400	369	721	41	165	78	156	563	325
TOTAL	116961	117302	115939	113705	117317	116396	110024	110134	107973	104537	74059

Table 7.15

Run title : Greenland Halibut in the North-East Arctic (Fishing Areas I
Traditional vpa using file input for terminal F

At 1/09/1992

Table 12	Stock biomass at age (start of year)		Tonnes
YEAR	1970	1971	
AGE			
3	9165	8560	
4	15797	17394	
5	23301	17464	
6	34977	25709	
7	48829	41285	
8	59338	41616	
9	47260	34878	
10	39918	29137	
11	21254	25750	
12	11580	13043	
13	6013	8252	
14	12897	3137	
+gp	3857	1771	
TOTALBIO	334185	267995	
EXPLTBIO	229889	183579	

Table 12	Stock biomass at age (start of year)					Tonnes				
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
3	7494	6356	6261	6437	5830	5477	4914	7286	5275	5470
4	16246	14223	12062	11883	12207	11065	10369	12644	10036	11320
5	19248	17735	15729	13203	12975	13457	11848	17771	12156	11660
6	19483	20776	19697	16971	14198	13949	13665	19475	13030	11951
7	27918	21036	25064	22305	19052	14916	14330	18963	12612	13578
8	30145	19074	18694	20274	16739	13966	11402	13740	12275	12439
9	25698	22770	15355	14382	15672	10233	11327	10394	9653	12152
10	24162	21452	18813	12448	10512	10344	7484	10094	8307	9766
11	20195	21693	18250	15317	9156	7856	8326	5853	8115	7951
12	16832	15444	16391	12804	9271	6122	4430	5674	4281	7372
13	8304	14296	13138	13382	8520	5777	3589	3159	3942	3947
14	3418	5123	10838	9616	8102	5232	3000	1905	2434	3669
+gp	1674	3133	5332	7069	6623	2998	2738	2778	1633	1944
TOTALBIO	220817	203111	195625	176090	148857	121392	107423	129735	103747	113219
EXPLTBIO	148971	145440	139612	130666	94011	90517	70082	95872	76190	104037

Table 12	Stock biomass at age (start of year)					Tonnes				
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
3	6951	8187	8380	8044	10418	9062	8859	8338	7567	7314
4	14214	9952	10772	9136	10809	15064	14049	11600	12622	12785
5	12714	14416	11285	11569	12565	13387	16417	16425	10639	14160
6	11299	15238	14511	12967	14230	15943	14554	18802	17656	11231
7	10786	13661	12846	11514	12652	12954	13657	14089	14910	13119
8	10988	12297	10807	11618	11201	10106	8968	11724	9833	9899
9	10439	12022	10699	11114	9861	9086	7698	6816	8527	7377
10	10481	10334	11123	9552	8695	7102	7115	6173	4379	6489
11	7912	9430	7356	8099	5460	5277	4383	4453	4020	2974
12	6238	7112	6819	5034	5056	3474	3464	2691	3190	3340
13	6474	5322	3991	5567	3048	3509	2549	2256	1691	2063
14	2509	6023	3238	2987	3848	1835	2054	1772	1394	1665
+gp	1165	1931	1812	1780	3265	243	735	369	705	2736
TOTALBIO	112171	125925	113638	108983	111106	107040	104502	105508	97135	95153
EXPLTBIO	78616	79177	63043	62984	67067	53803	49464	61457	53465	49418

Table 7.16

Run title : Greenland Halibut in the North-East Arctic (Fishing Areas I
Traditional vpa using file input for terminal F

At 1/09/1992

Table 13		Spawning stock biomass at age (spawning time)		Tonnes
YEAR	1970	1971		
AGE				
3	0	0		
4	790	870		
5	5359	4017		
6	17139	12597		
7	32227	27248		
8	46284	32460		
9	42061	31041		
10	37922	27680		
11	21042	25493		
12	11464	12912		
13	5953	8169		
14	12897	3137		
+gp	3857	1771		
TOTSPBIO	236994	187396		

Table 13			Spawning stock biomass at age (spawning time)					Tonnes		
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
3	0	0	0	0	0	0	0	0	0	0
4	812	711	603	594	610	553	518	632	502	566
5	4427	4079	3618	3037	2984	3095	2725	4087	2796	2682
6	9547	10180	9652	8316	6957	6835	6696	9543	6385	5856
7	18426	13884	16542	14721	12574	9844	9458	12516	8324	8962
8	23513	14878	14581	15813	13057	10893	8894	10717	9575	9702
9	22871	20265	13666	12800	13948	9108	10081	9251	8591	10816
10	22954	20379	17873	11826	9987	9827	7109	9589	7891	9278
11	19993	21476	18067	15164	9065	7778	8243	5795	8034	7872
12	16664	15290	16227	12676	9179	6061	4386	5617	4238	7298
13	8221	14153	13007	13248	8435	5720	3554	3128	3903	3907
14	3418	5123	10838	9616	8102	5232	3000	1905	2434	3669
+gp	1674	3133	5332	7069	6623	2998	2738	2778	1633	1944
TOTSPBIO	152520	143551	140006	124880	101520	77944	67402	75557	64304	72551

Table 13			Spawning stock biomass at age (spawning time)					Tonnes		
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
3	0	0	0	0	0	0	0	0	0	0
4	711	498	539	457	540	753	281	348	631	639
5	2924	3316	2595	2661	2890	3079	1806	2299	2128	2832
6	5536	7466	7110	6354	6973	7812	7423	9965	10417	6627
7	7119	9016	8478	7600	8350	8549	9150	9299	10437	9183
8	8571	9592	8430	9062	8736	7883	6098	8089	7080	7128
9	9291	10699	9522	9892	8776	8086	6159	4976	6481	5606
10	9957	9818	10567	9075	8260	6746	6545	5309	3722	5515
11	7832	9336	7282	8018	5405	5224	4295	4275	3779	2796
12	6176	7041	6751	4984	5005	3439	3464	2691	3190	3340
13	6409	5269	3951	5511	3017	3474	2549	2256	1691	2063
14	2509	6023	3238	2987	3848	1835	2054	1772	1394	1665
+gp	1165	1931	1812	1780	3265	243	735	369	705	2736
TOTSPBIO	68201	80003	70276	68380	65066	57124	50559	51649	51655	50130

Table 7.17

Run title : Greenland Halibut in the North-East Arctic (Fishing Areas I

At 1/09/1992

Table 16 Summary (without SOP correction)
Traditional vpa using file input for terminal F

	RECRUITS	TOTALBIO	EXPLTBIO	TOTSPBIO	LANDINGS	FBAR 6-10
1970	45825	334185	229889	236994	89484	.4126
1971	42801	267995	183579	187396	79034	.4126
1972	37471	220817	148971	152520	43055	.2977
1973	31780	203111	145440	143551	29938	.2231
1974	31307	195625	139612	140006	37763	.2762
1975	32183	176090	130666	124880	38172	.3330
1976	29152	148857	94011	101520	36074	.4151
1977	27385	121392	90517	77944	28827	.3193
1978	24568	107423	70082	67402	24617	.3386
1979	24286	129735	95872	75557	17312	.1801
1980	26374	103747	76190	64304	13284	.1619
1981	27350	113219	104037	72551	15018	.1420
1982	25746	112171	78616	68201	16789	.2173
1983	26411	125925	79177	80003	22147	.2940
1984	27933	113638	63043	70276	21883	.3471
1985	26814	108983	62984	68380	19945	.3244
1986	30642	111106	67067	65066	22875	.3563
1987	29518	107040	53803	57124	19112	.3561
1988	21399	104502	49464	50559	19587	.3997
1989	26895	105508	61457	51649	20565	.3305
1990	27025	97135	53465	51655	22755	.4254
1991	26989	95153	49418	50130	27152	.5493
Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)	(Tonnes)	

Table 7.18

12:25 Wednesday, September 2, 1992

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

Prediction run 'MANDAG': Initial stock size and Recruitment (Thousands)

Year	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
1992	25000	22953	18673	14095	6712	4779	2811	1577	1005	544	334	251	325
1993	25000	.	.	.	.	.	.	.	.	.	.	.	.
1994	25000	.	.	.	.	.	.	.	.	.	.	.	.

Weight in stock (Kilograms) = Weight in catch

Year	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
1992	0.276	0.552	0.727	1.042	1.324	1.709	2.191	2.662	2.933	3.454	3.875	4.402	4.687
1993	0.276	0.552	0.727	1.042	1.324	1.709	2.191	2.662	2.933	3.454	3.875	4.402	4.687
1994	0.276	0.552	0.727	1.042	1.324	1.709	2.191	2.662	2.933	3.454	3.875	4.402	4.687

Natural mortality

Year	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
1992	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
1993	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
1994	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15

Maturity ogive

Year	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
1992	0.00	0.05	0.20	0.59	0.70	0.72	0.76	0.85	0.94	1.00	1.00	1.00	1.00
1993	0.00	0.05	0.20	0.59	0.70	0.72	0.76	0.85	0.94	1.00	1.00	1.00	1.00
1994	0.00	0.05	0.20	0.59	0.70	0.72	0.76	0.85	0.94	1.00	1.00	1.00	1.00

Exploitation pattern

Year	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
1992	.0039	0.042	0.1347	0.402	0.6548	0.61	0.5729	0.6249	0.5005	0.596	0.4369	0.61	0.61
1993	.0039	0.042	0.1347	0.402	0.6548	0.61	0.5729	0.6249	0.5005	0.596	0.4369	0.61	0.61
1994	.0039	0.042	0.1347	0.402	0.6548	0.61	0.5729	0.6249	0.5005	0.596	0.4369	0.61	0.61

Table 7.19

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

18:18 Tuesday, September 1, 1992 13

Effects of different levels of fishing mortality on catch,
stock biomass and spawning stock biomass

F factor 1992	Reference F 1992	Stock biomass 1992	Sp.stock biomass 1992	Catch weight 1992	F factor 1993	Reference F 1993	Stock biomass 1993	Sp.stock biomass 1993	Catch weight 1993	Stock biomass 1994	Sp.stock biomass 1994
0.2690	0.1541	83974	40939	7004	0.0699	0.0699	95581	49938	4066	111282	62722
					F _{low}	0.1352			7638	107187	59542
					F _{0.1}	0.1541			8633	106047	58658
					F ₀₂	0.2292			12418	101713	55300
					F _{med}	0.2865			15140	98600	52894
					F _{max}	0.3208			16707	96809	51511
					F _{high}	0.5494			25991	86221	43368
					F ₀₁						

Recruitment: $25,000 \times 10^3$ at age 3.

Run name : DESEMBER
 Computation of ref. F: Unweighted mean of age 6 - 10
 Unit of measurement : Tonnes

Table 7.20

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

Effects of different levels of fishing mortality on catch,
stock biomass and spawning stock biomass

F factor 1992	Reference F 1992	Stock biomass 1992	Sp.stock biomass 1992	Catch weight 1992	F factor 1993	Reference F 1993	Stock biomass 1993	Sp.stock biomass 1993	Catch weight 1993	Stock biomass 1994	Sp.stock biomass 1994
0.2690	0.1541	79841	40939	7000		0.1352	84336	49583	7569	87950	57588
					$F_{0.1}$	0.1541			8555	86822	56706
					$F_{0.2}$	0.2292			12302	82536	53358
					F_{med}	0.2865			14995	79459	50958
					F_{max}	0.5494			25716	67243	41463
					F_{91}						

Recruitment: $10,000 \times 10^3$ at age 3.

Run name : DESEMBER
 Computation of ref. F: Unweighted mean of age 6 - 10
 Unit of measurement : Tonnes

Table 7.21

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

9:06 Wednesday, September 2, 1992 8

Recruitment: $25,000 \times 10^3$.

Prediction

	Year	F factor	Reference F	Catch numbers	Catch weight	Stock size	Stock biomass	Sp.stock size 1. jan.	Sp.stock biomass 1. jan.
$F_{0.1}$	1992	0.2690	0.1541	4815	7004	99059	83974	27213	40939
	1993	0.2360	0.1352	5152	7638	105805	95581	32562	49938
	1994	0.2360	0.1352	5918	9106	111298	107187	37302	59542
	1995	0.2360	0.1352	6437	10378	115318	117597	40685	68343
	1996	0.2360	0.1352	6792	11489	118298	126844	43339	76602
	1997	0.2360	0.1352	7034	12335	120534	134546	45501	83967
F_{92}	1992	0.2690	0.1541	4815	7004	99059	83974	27213	40939
	1993	0.2690	0.1541	5828	8633	105805	95581	32562	49938
	1994	0.2690	0.1541	6611	10138	110674	106047	36853	58658
	1995	0.2690	0.1541	7122	11408	114140	115218	39801	66439
	1996	0.2690	0.1541	7460	12492	116652	123199	42057	73591
	1997	0.2690	0.1541	7684	13293	118501	129690	43862	79827
F_{med}	1992	0.2690	0.1541	4815	7004	99059	83974	27213	40939
	1993	0.4000	0.2292	8410	12418	105805	95581	32562	49938
	1994	0.4000	0.2292	9087	13746	108291	101713	35142	55300
	1995	0.4000	0.2292	9439	14727	109806	106533	36557	59503
	1996	0.4000	0.2292	9626	15480	110783	110373	37512	63035
	1997	0.4000	0.2292	9731	15951	111453	113164	38232	65822
F_{max}	1992	0.2690	0.1541	4815	7004	99059	83974	27213	40939
	1993	0.5000	0.2865	10278	15140	105805	95581	32562	49938
	1994	0.5000	0.2865	10710	16031	106570	98600	33911	52894
	1995	0.5000	0.2865	10842	16572	106829	100643	34343	54815
	1996	0.5000	0.2865	10862	16930	106930	102118	34555	56282
	1997	0.5000	0.2865	10856	17082	106999	103015	34721	57300
F_{91}	1992	0.2690	0.1541	4815	7004	99059	83974	27213	40939
	1993	0.9590	0.5494	17840	25991	105805	95581	32562	49938
	1994	0.9590	0.5494	15911	22632	99624	86221	28986	43368
	1995	0.9590	0.5494	14613	20262	96082	80017	26468	38550
	1996	0.9590	0.5494	13861	18752	94228	76218	25024	35413
	1997	0.9590	0.5494	13490	17827	93324	73948	24278	33449

Run name : SATURN
 Computation of ref. F: Unweighted mean of age 6 - 10
 Catch in numbers : Thousands
 Catch in weight : Tonnes
 Stock size : Thousands
 Biomass : Tonnes

Table 7.22

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

Recruitment: $10,000 \times 10^3$ at age 3.

Prediction

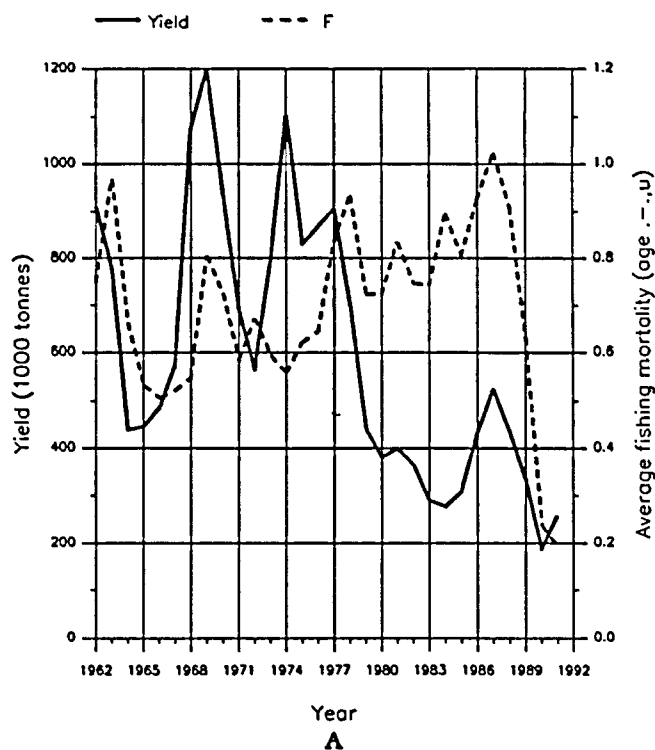
	Year	F factor	Reference F	Catch numbers	Catch weight	Stock size	Stock biomass	Sp.stock size 1. jan.	Sp.stock biomass 1. jan.
$F_{0.1}$	1992	0.2690	0.1541	4801	7000	84059	79841	27213	40939
	1993	0.2360	0.1352	5021	7569	77908	84336	31917	49583
	1994	0.2360	0.1352	5468	8805	72409	87950	34459	57588
	1995	0.2360	0.1352	5215	9273	67262	88805	32435	60752
	1996	0.2360	0.1352	4615	9119	63068	88557	30067	62365
	1997	0.2360	0.1352	4197	8837	60012	87213	28418	63217
$F_{0.2}$	1992	0.2690	0.1541	4801	7000	84059	79841	27213	40939
	1993	0.2690	0.1541	5679	8555	77908	84336	31917	49583
	1994	0.2690	0.1541	6099	9796	71801	86822	34013	56706
	1995	0.2690	0.1541	5742	10161	66156	86495	31585	58884
	1996	0.2690	0.1541	5022	9844	61630	85161	28915	59515
	1997	0.2690	0.1541	4530	9423	58399	82969	27063	59500
F_{med}	1992	0.2690	0.1541	4801	7000	84059	79841	27213	40939
	1993	0.4000	0.2292	8188	12302	77908	84336	31917	49583
	1994	0.4000	0.2292	8333	13244	69485	82536	32314	53358
	1995	0.4000	0.2292	7456	12942	62103	78079	28478	52086
	1996	0.4000	0.2292	6242	11842	56561	73289	24869	49576
	1997	0.4000	0.2292	5477	10824	52912	68697	22480	47047
F_{max}	1992	0.2690	0.1541	4801	7000	84059	79841	27213	40939
	1993	0.5000	0.2865	10001	14995	77908	84336	31917	49583
	1994	0.5000	0.2865	9776	15408	67814	79459	31092	50958
	1995	0.5000	0.2865	8426	14404	59337	72390	26367	47501
	1996	0.5000	0.2865	6844	12642	53289	65725	22272	43268
	1997	0.5000	0.2865	5904	11195	49543	60099	19692	39589
$F_{0.1}$	1992	0.2690	0.1541	4801	7000	84059	79841	27213	40939
	1993	0.9590	0.5494	17315	25716	77908	84336	31917	49583
	1994	0.9590	0.5494	14185	21484	61100	67243	26210	41463
	1995	0.9590	0.5494	10484	16606	49521	52652	18939	31688
	1996	0.9590	0.5494	7677	12376	42967	42628	14203	24191
	1997	0.9590	0.5494	6414	9923	39908	36668	11905	19569

Run name : SATURN
 Computation of ref. F: Unweighted mean of age 6 - 10
 Catch in numbers : Thousands
 Catch in weight : Tonnes
 Stock size : Thousands
 Biomass : Tonnes

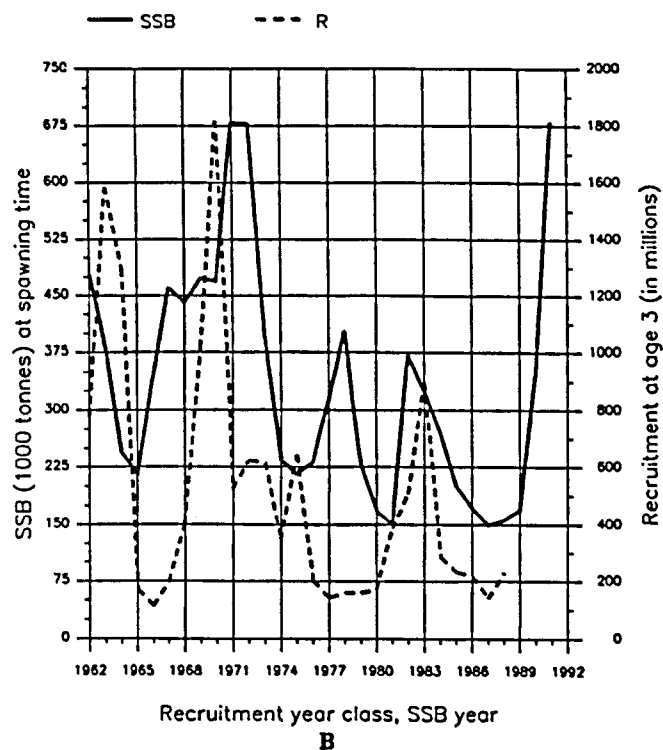
Figure 3.1

FISH STOCK SUMMARY
STOCK: Cod in the North-East Arctic (Fishing Areas I and II)
3-9-1992

Trends in yield and fishing mortality (F)

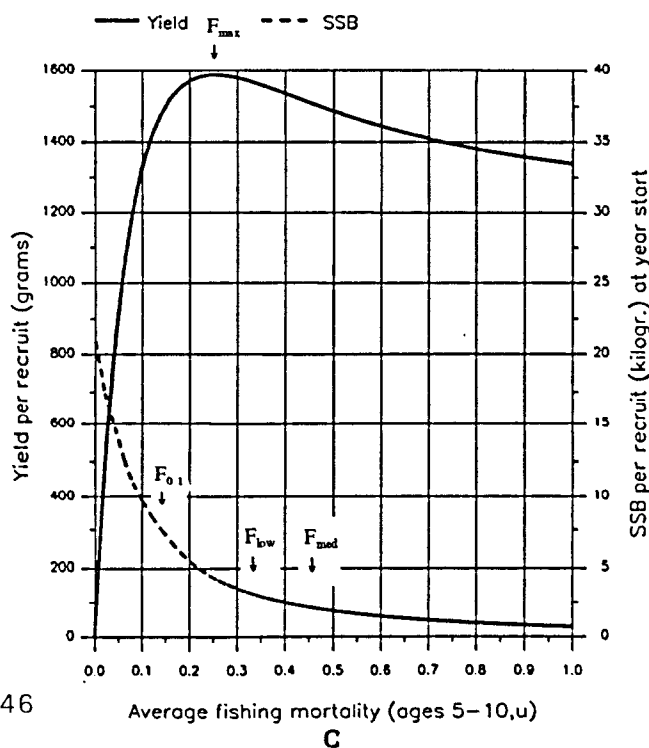


Trends in spawning stock biomass (SSB) and recruitment (R)

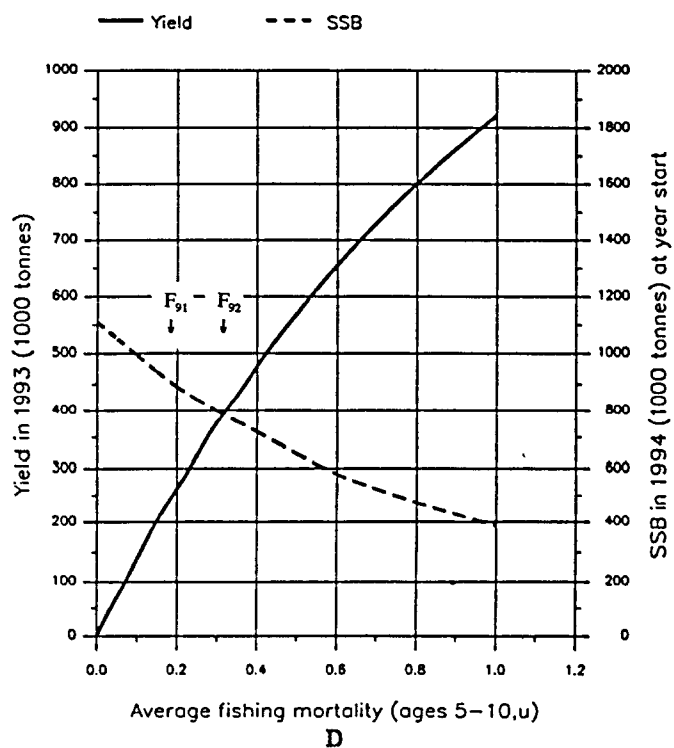


FISH STOCK SUMMARY
STOCK: Cod in the North-East Arctic (Fishing Areas I and II)
10-9-1992

Long term yield and spawning stock biomass



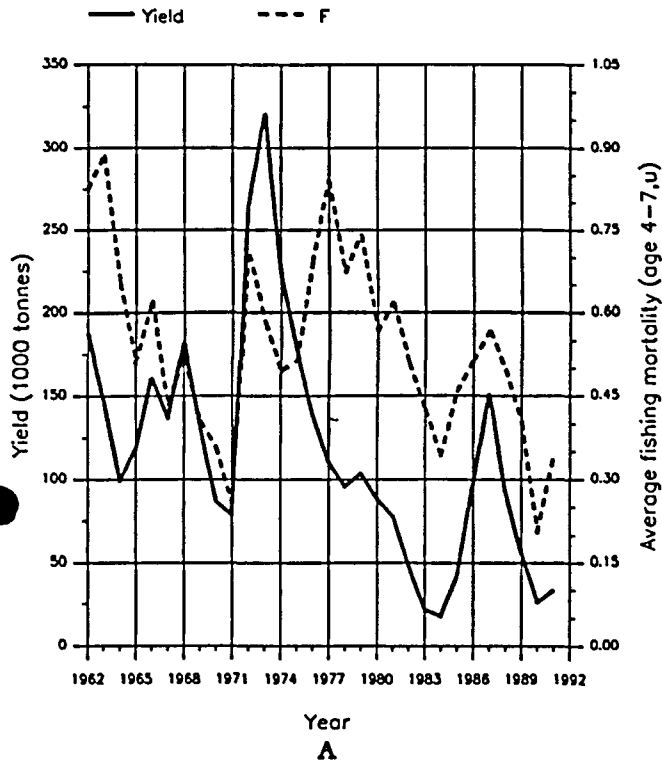
Short-term yield and spawning stock biomass



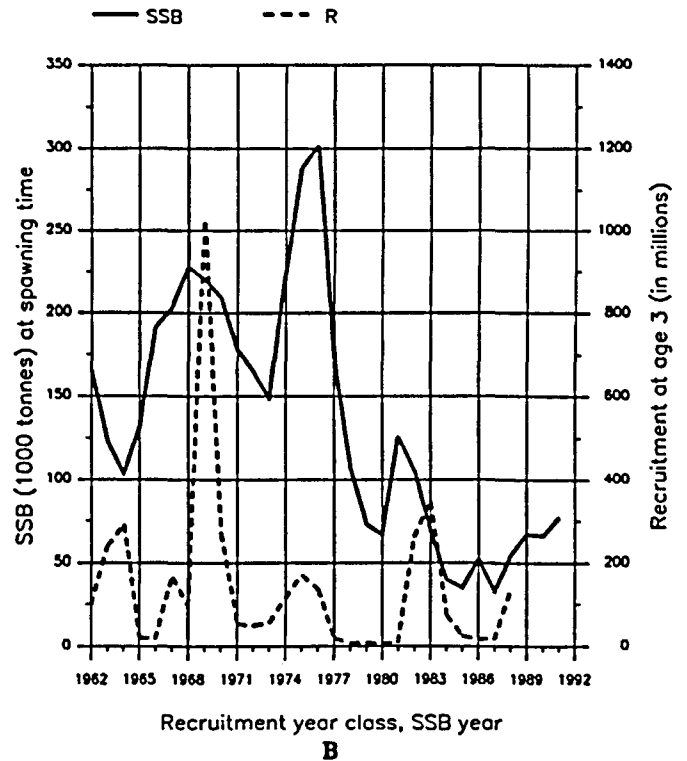
FISH STOCK SUMMARY

Figure 4.1 STOCK: Haddock in the North-East Arctic (Fishing Areas I and II)
31-8-1992

Trends in yield and fishing mortality (F)



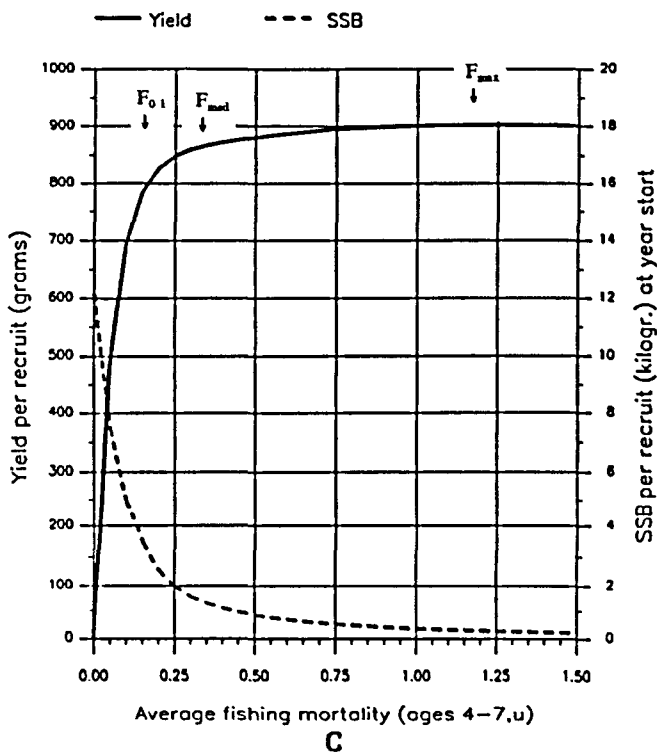
Trends in spawning stock biomass (SSB) and recruitment (R)



FISH STOCK SUMMARY

STOCK: Haddock in the North-East Arctic (Fishing Areas I and II)
3-9-1992

Long term yield and spawning stock biomass



Short-term yield and spawning stock biomass

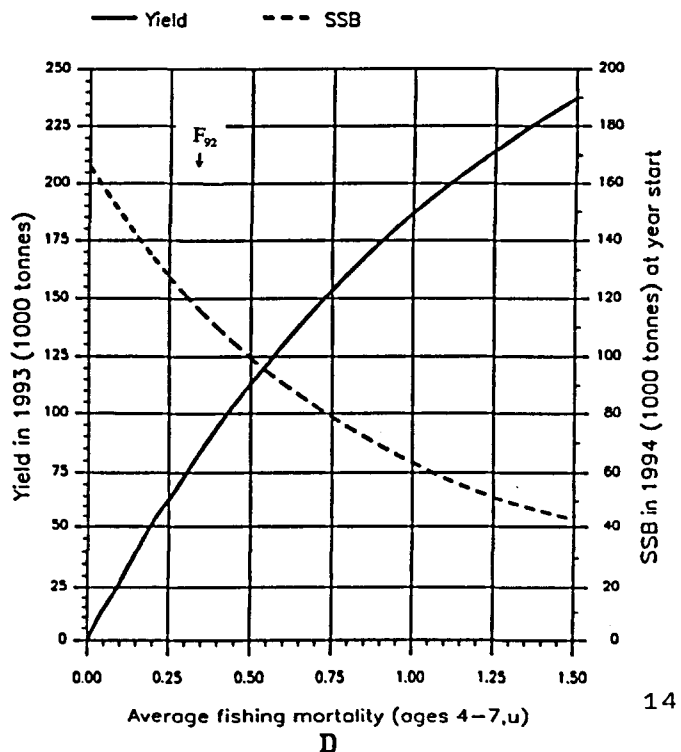
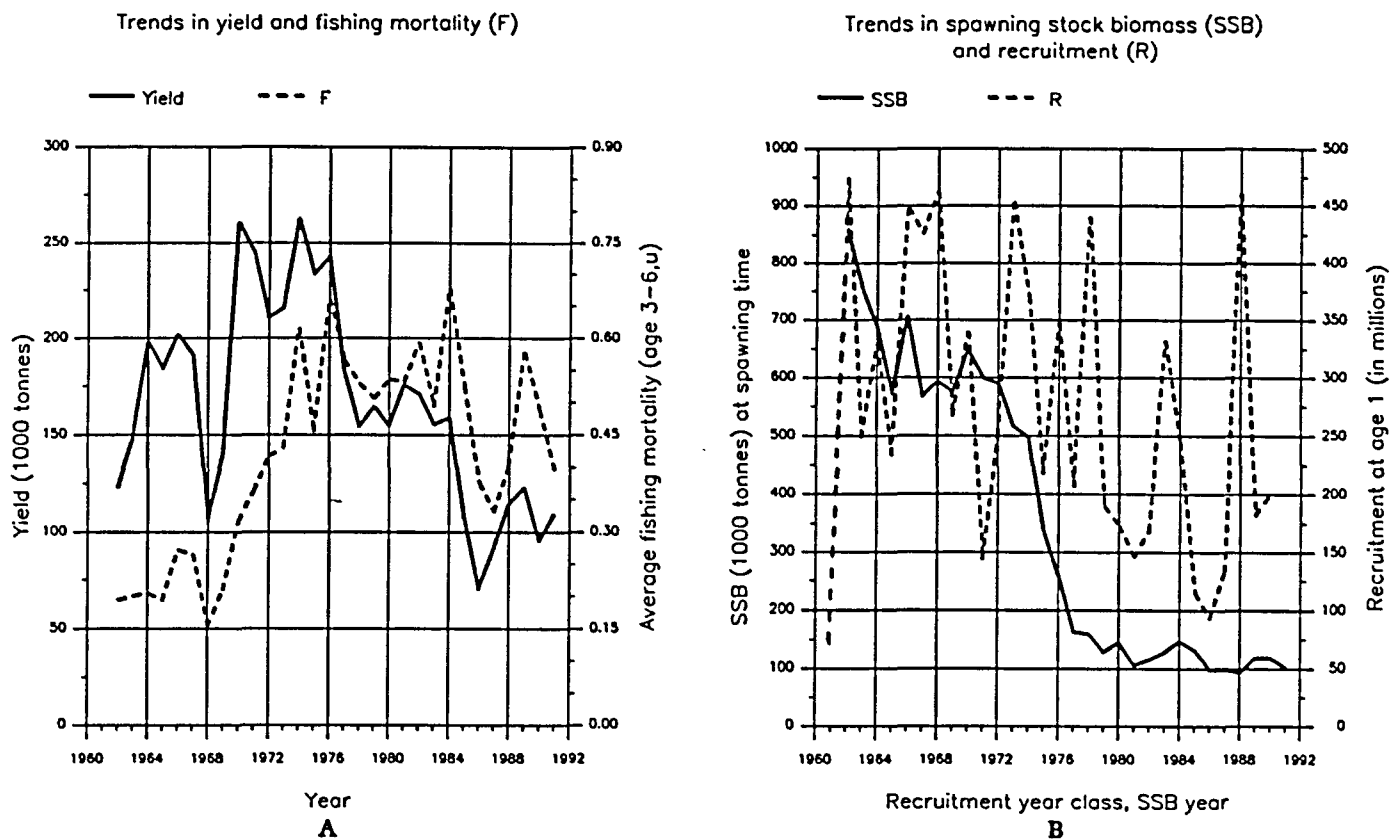
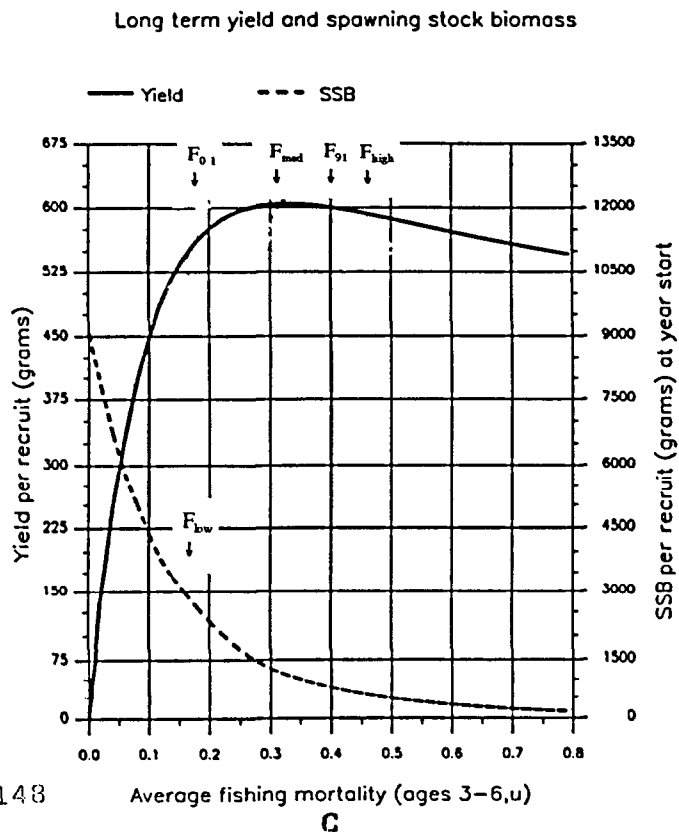


Figure 5.1

FISH STOCK SUMMARY
STOCK: Saithe in the North-East Arctic (Fishing Areas I and II)
1-9-1992



FISH STOCK SUMMARY
STOCK: Saithe in the North-East Arctic (Fishing Areas I and II)
28-8-1992



Year cl.	Regression type P	N_{t_6} , Abund. ind. age=6
1976	229	117
1977	172	154
1978	145	136
1979	157	103
1980	136	81
1981	145	79
1982	164	124
1983	147	76
1984	141	50
1985	126	41

$$N_{t_6} = N_{t_1} \exp\left(\sum_{t_1}^{t_6} M_t\right) + \sum_{t_1}^{t_6} C_t$$

$$M_t = \text{const} = 0,1$$

N_{t_1} - Abund. index from Russian survey 1992, mill.

C_t - Catch from year cl. at age t, mill.

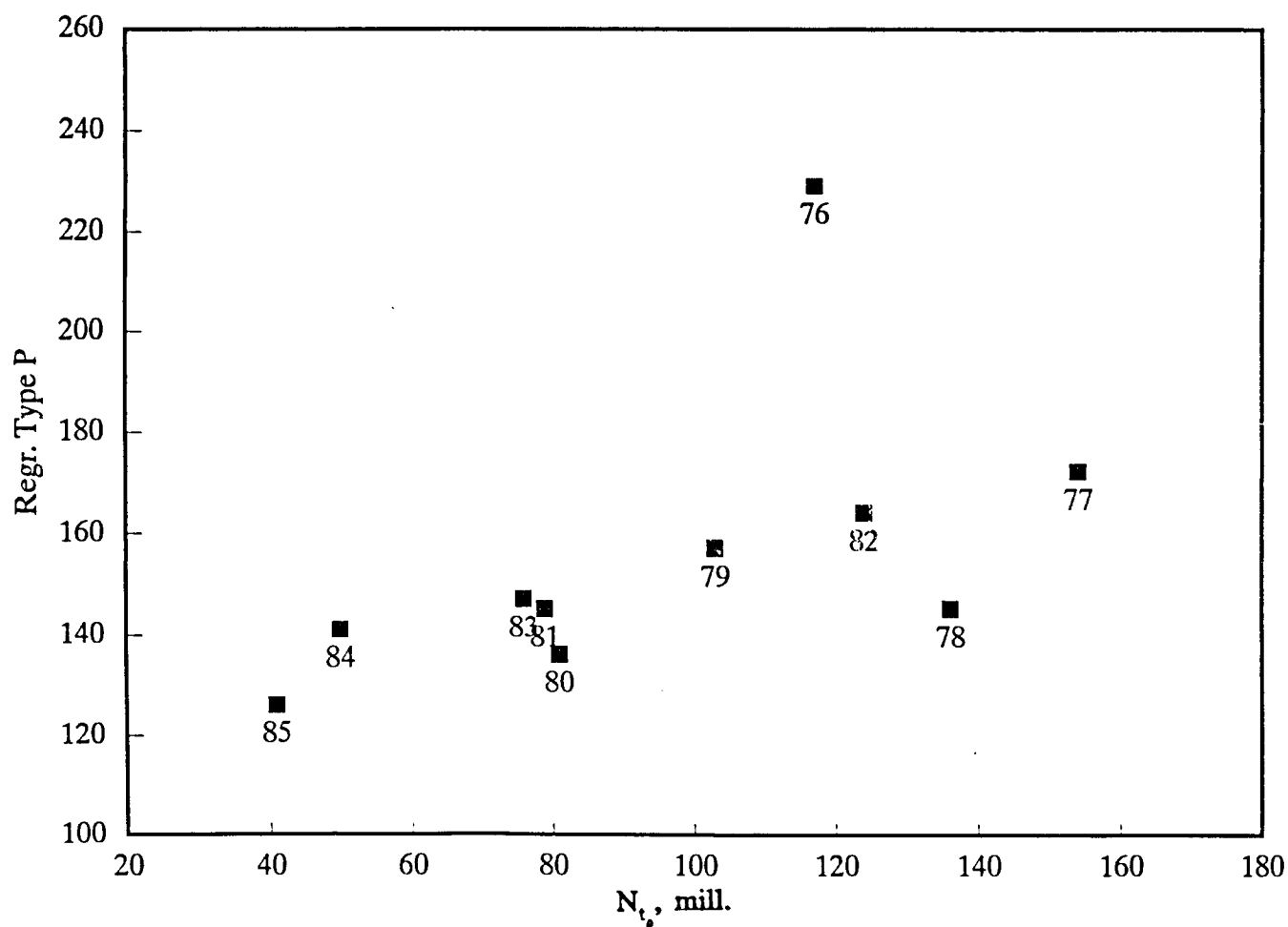


Figure 6.1 Plot of recruitment predicted by RCT3 for *Sebastes mentella* on year class abundance indices from the 1992 Russian survey back-calculated to age 6.

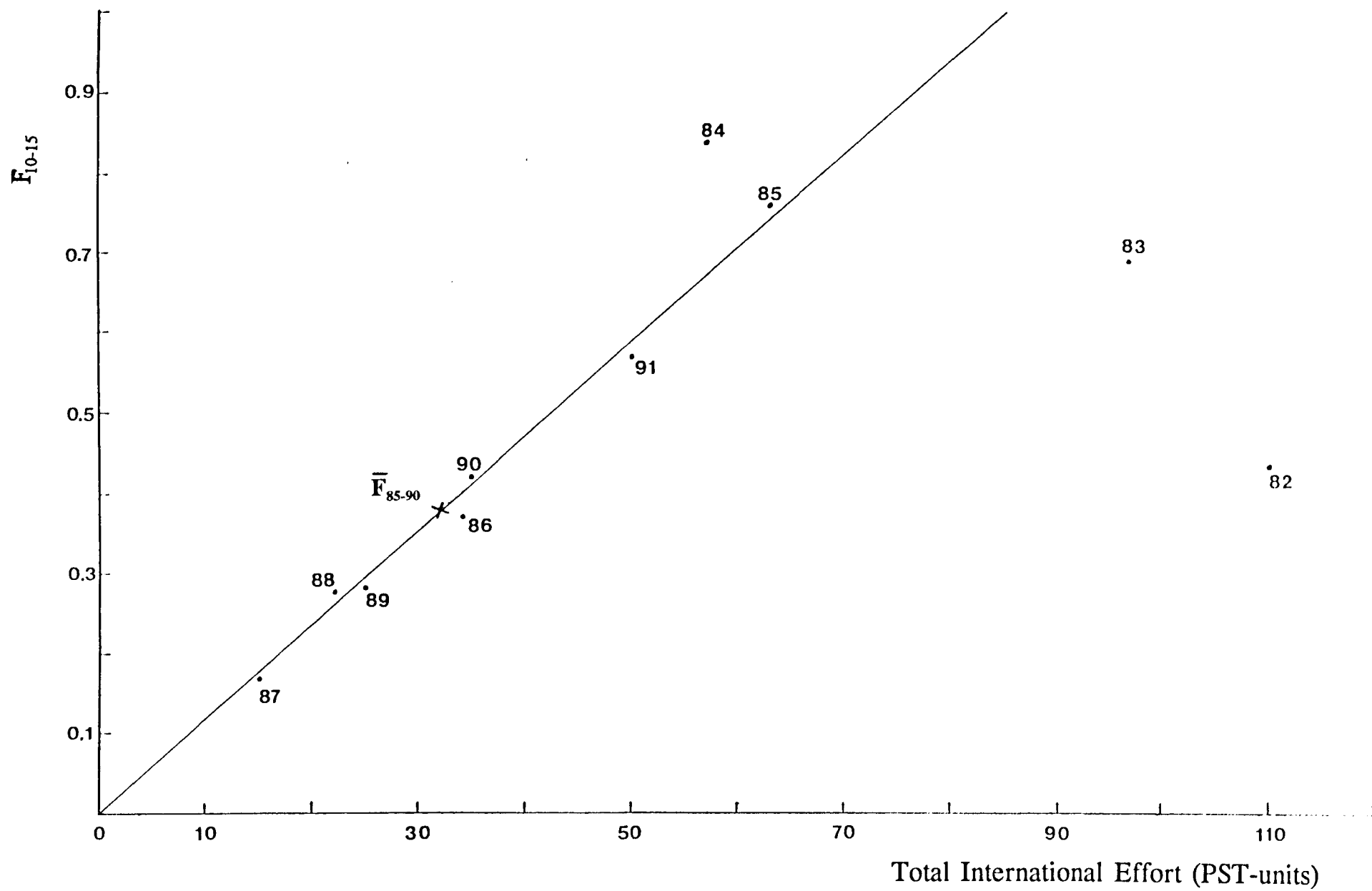
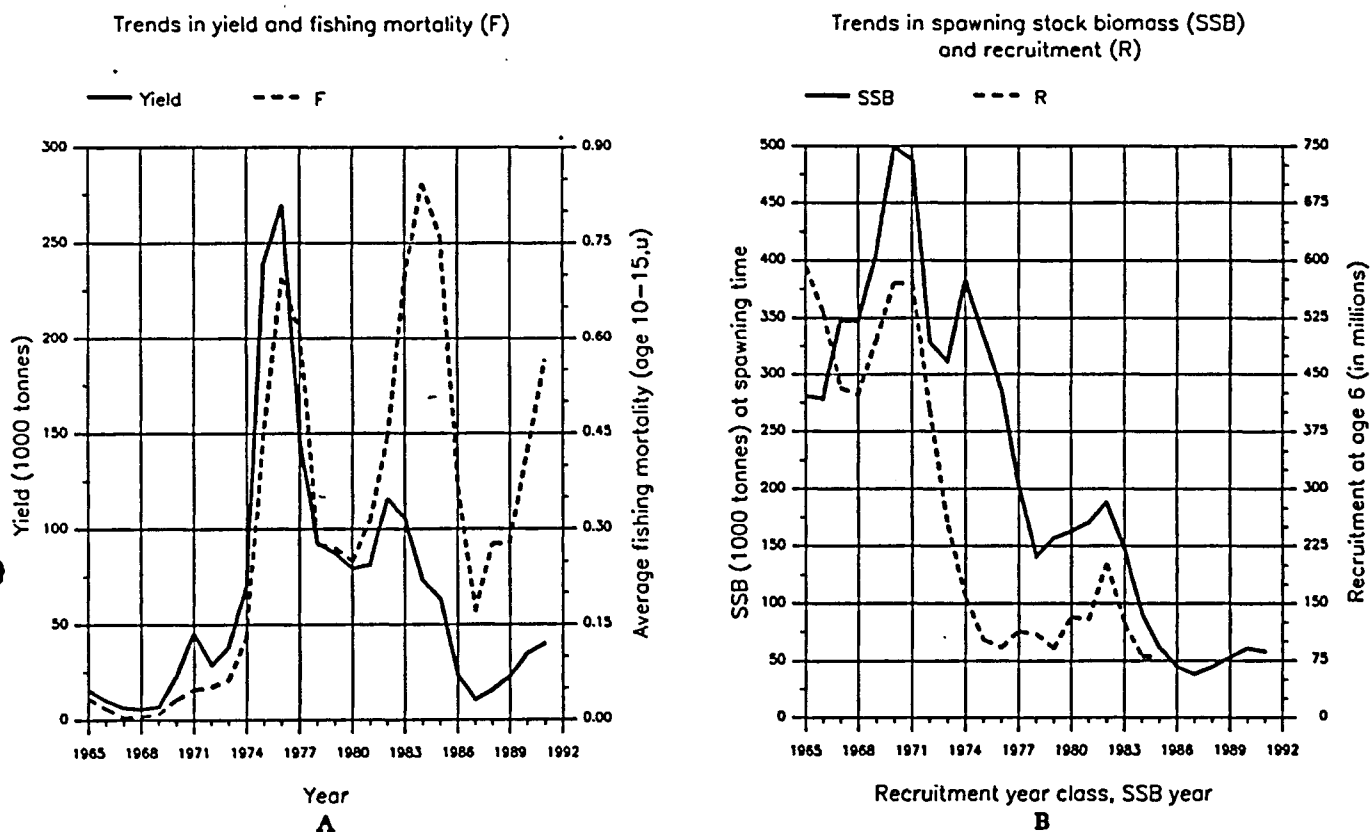


Figure 6.2 *Sebastes mentella*. Fishing mortality plotted against effort.

Figure 6.3

FISH STOCK SUMMARY **STOCK: *Sebastes mentella* in the Norwegian Sea, Spitzbergen and Bear Island** **27-8-1992**



FISH STOCK SUMMARY **STOCK: *Sebastes mentella* in the Norwegian Sea, Spitzbergen and Bear Island** **2-9-1992**

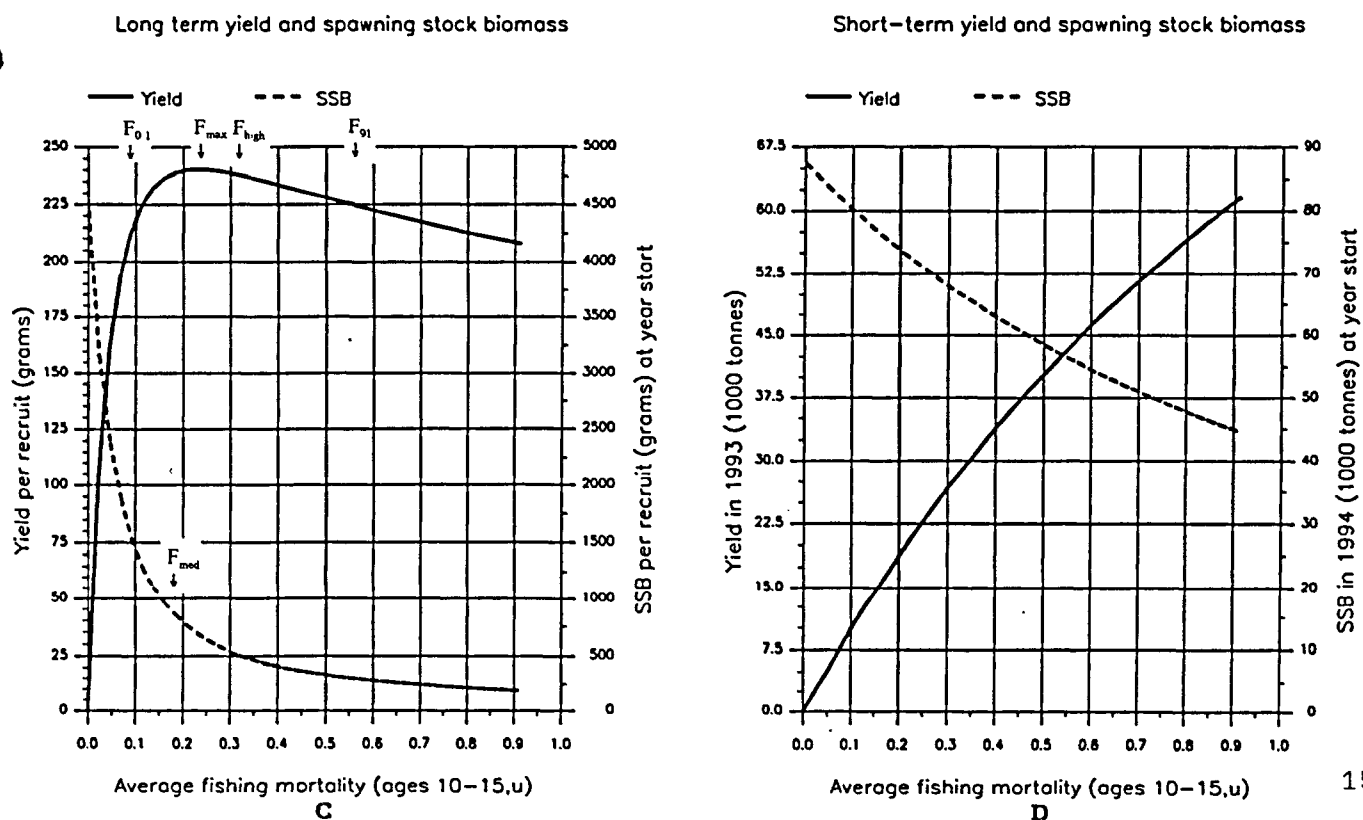


Figure 7.1 GREENLAND HALIBUT. F_{6-10} plotted against total international effort.

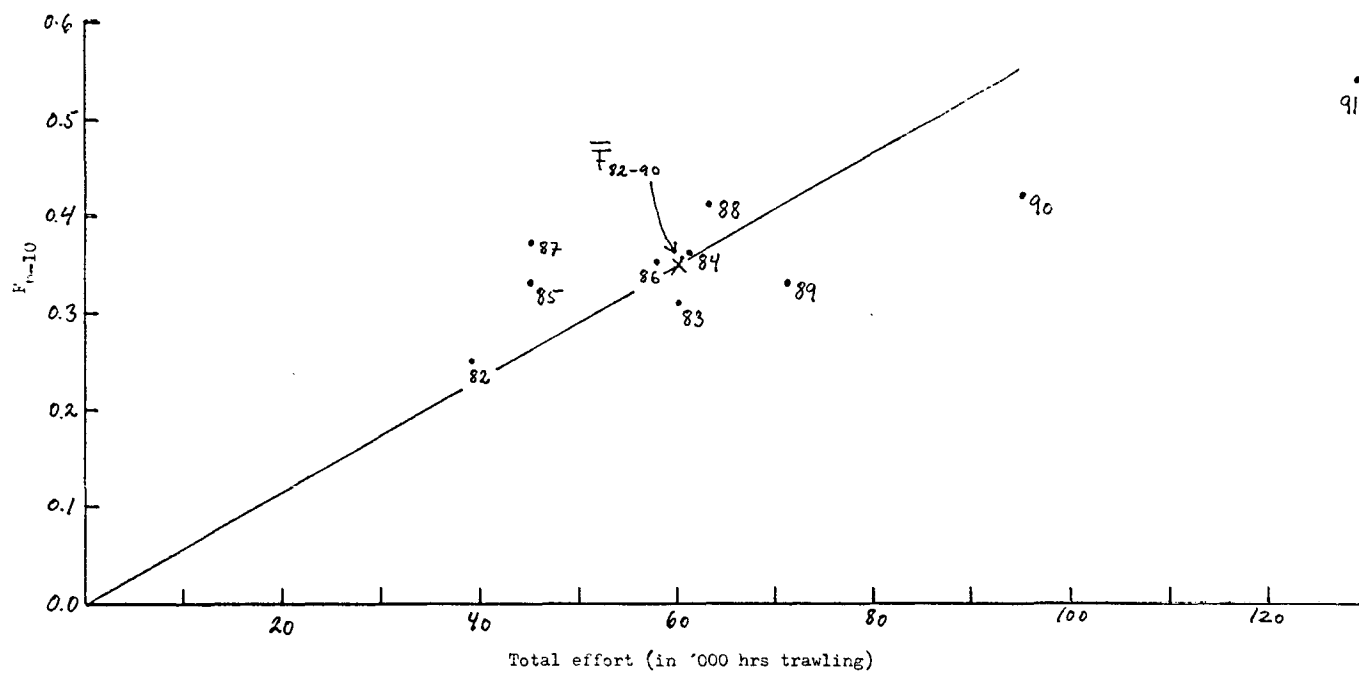


Figure 7.2 GREENLAND HALIBUT. Effort and F_{6-10} plotted against year.

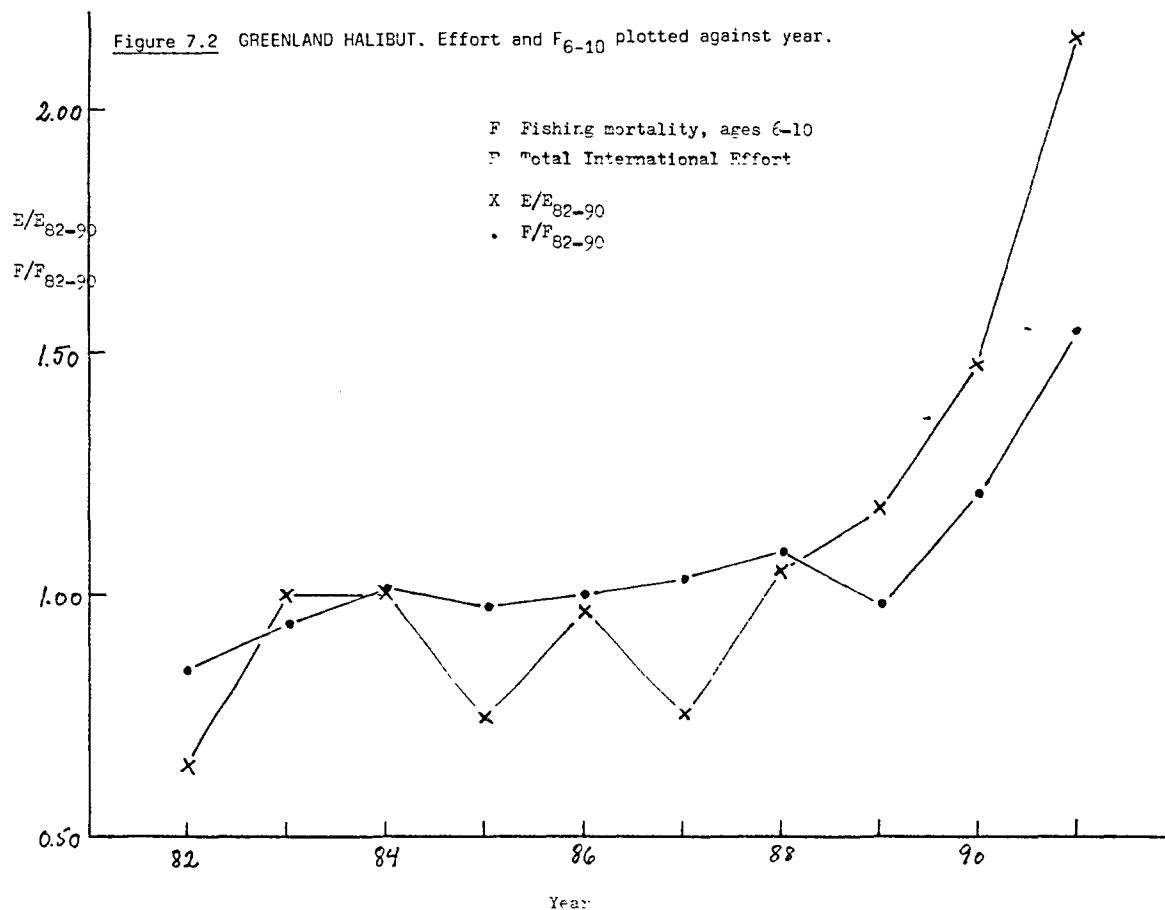
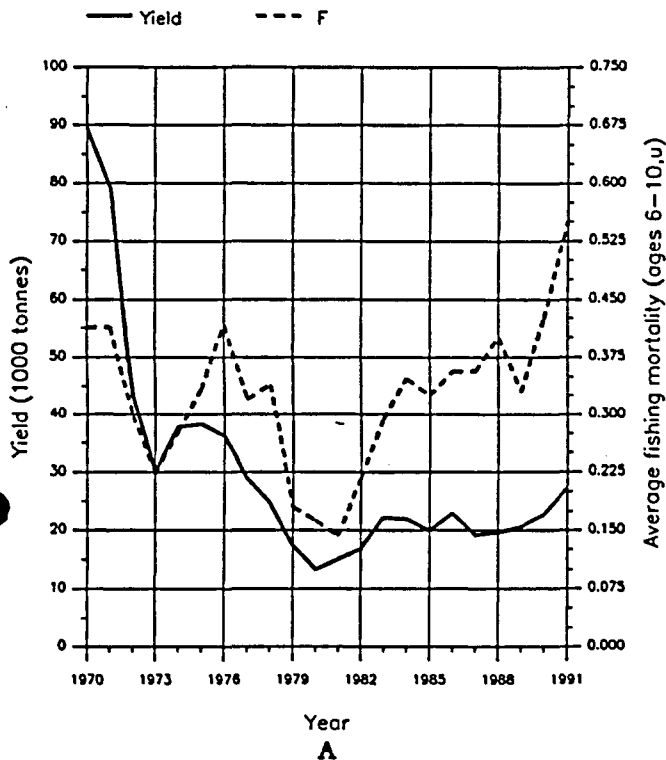


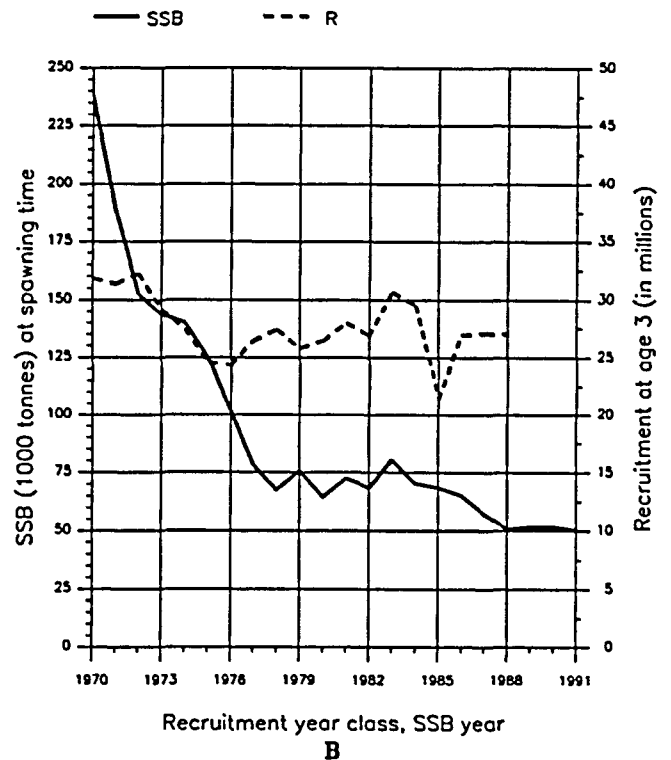
Figure 7.3

FISH STOCK SUMMARY
STOCK: Greenland Halibut in the North-East Arctic (Fishing Areas I and II)
1-9-1992

Trends in yield and fishing mortality (F)

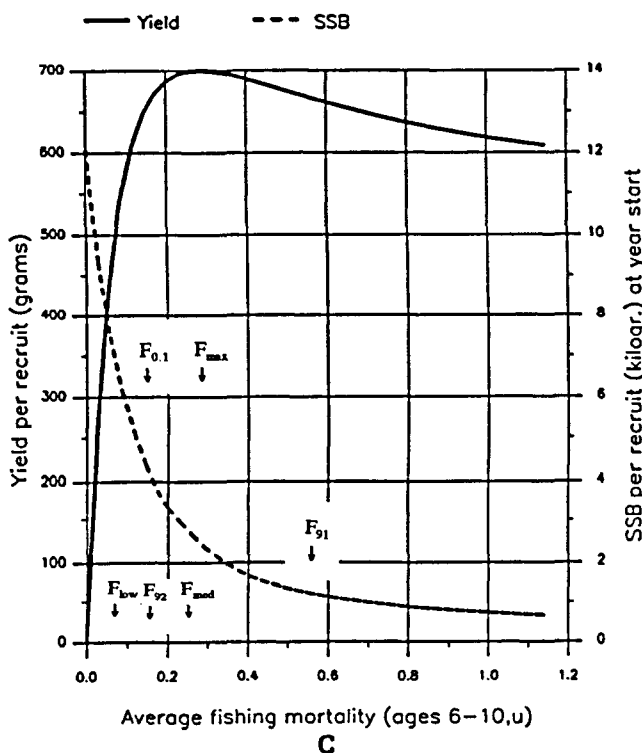


Trends in spawning stock biomass (SSB) and recruitment (R)

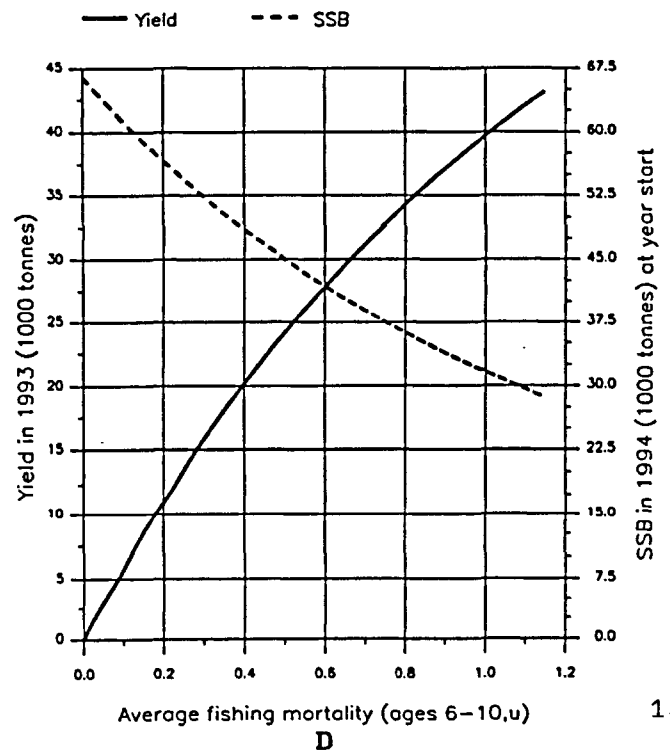


FISH STOCK SUMMARY
STOCK: Greenland Halibut in the North-East Arctic (Fishing Areas I and II)
2-9-1992

Long term yield and spawning stock biomass



Short-term yield and spawning stock biomass



APPENDIX 1

Plots of Survey Indices and VPA (Figures A.1 to A.15)

Time series of survey indices at age, used in the tuning analyses, were plotted along with the accepted VPA to determine how well the age-structured survey results reflected trends in actual stock abundance. This was completed for both cod and haddock. For comparison purposes each time series, for both VPA and survey indices, was scaled to its representative mean. The survey indices at age reflected the trends in stock abundance quite well, although some inconsistencies were apparent for some surveys. It was observed that strong year classes were most influential in determining relationships between survey indices and VPA for both species and at virtually all ages.

Time series of recruitment at ages 0, 1 and 2 for cod, were also plotted along with VPA results at age 3 (Figures A.12-A.15). The recruitment data plotted were not those used in the RCT3 program, but were derived from the same surveys used in the tuning. The new indices appear to more adequately reflect trends in year class strength as described by the VPA than the indices used in the RCT3 program. Results from the original analysis were used for catch predictions for this assessment. During the next assessment of the stock it will be decided if recruitment indices derived from the surveys used for tuning will be used to determine year class strength for predictions.

Figure A.1

NE Arctic Cod - Age 3 VPA & Survey indices

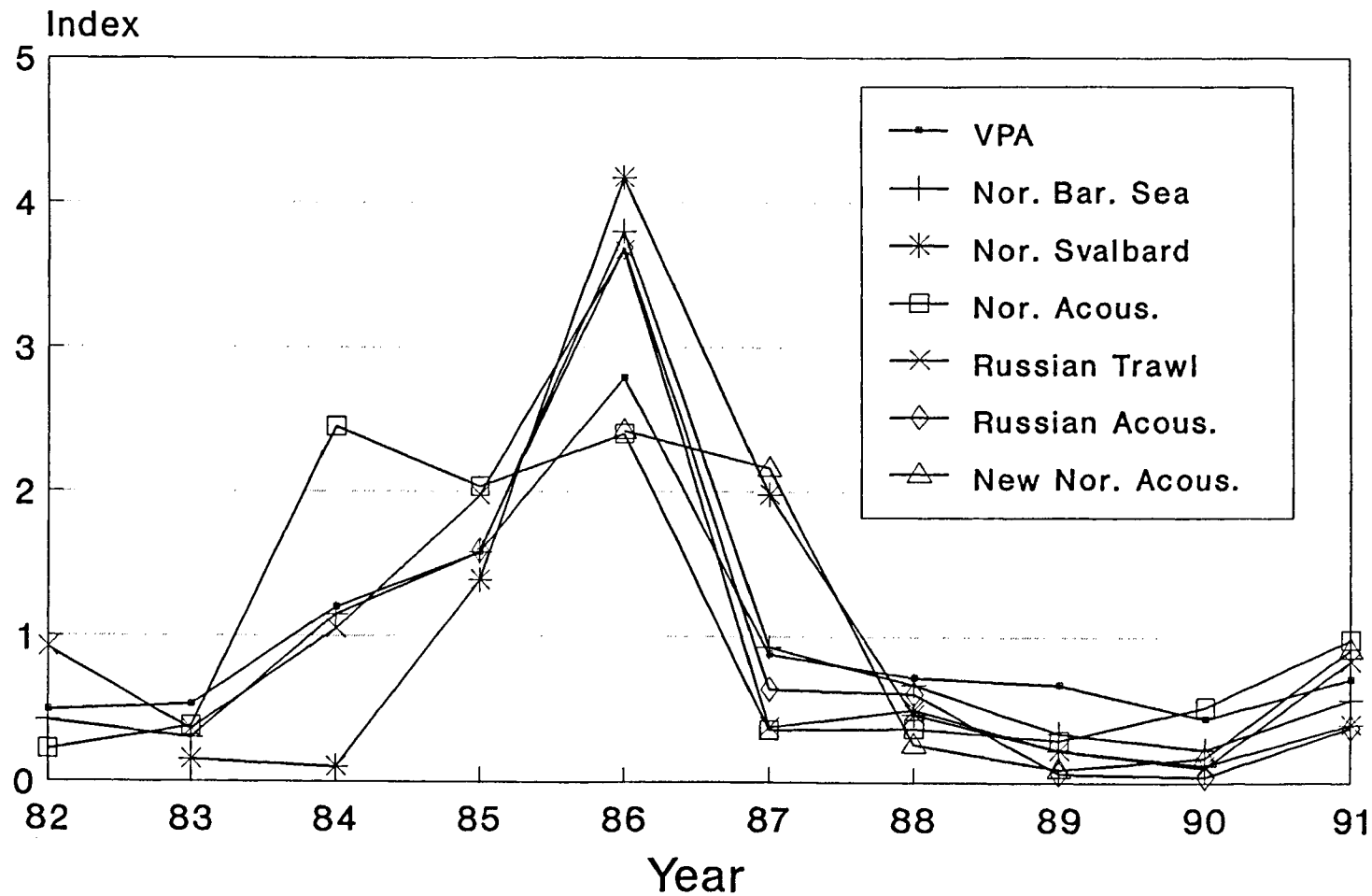


Figure A.2

NE Arctic Cod - Age 4 VPA & Survey indices

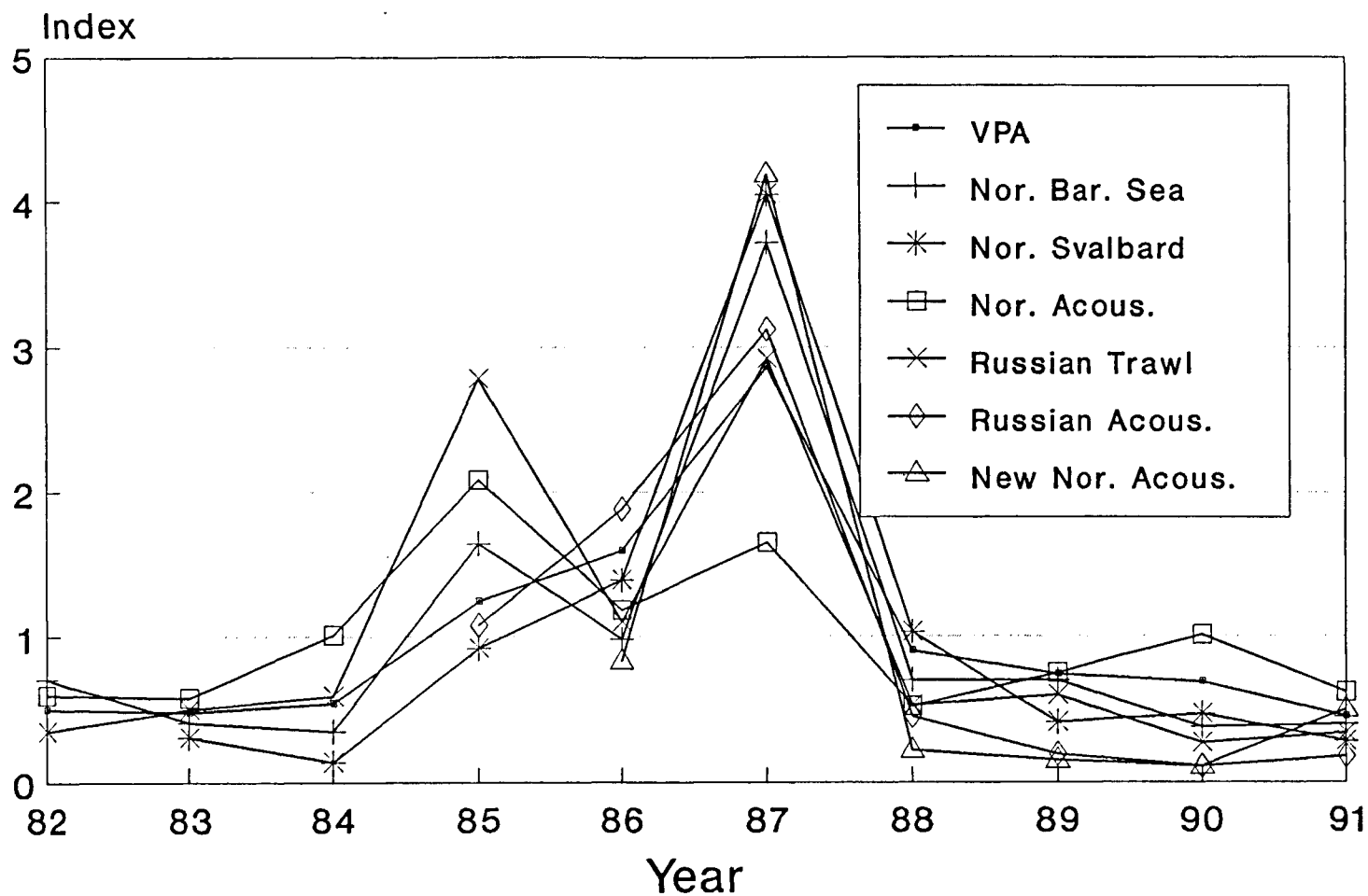


Figure A.3

NE Arctic Cod - Age 5 VPA & Survey indices

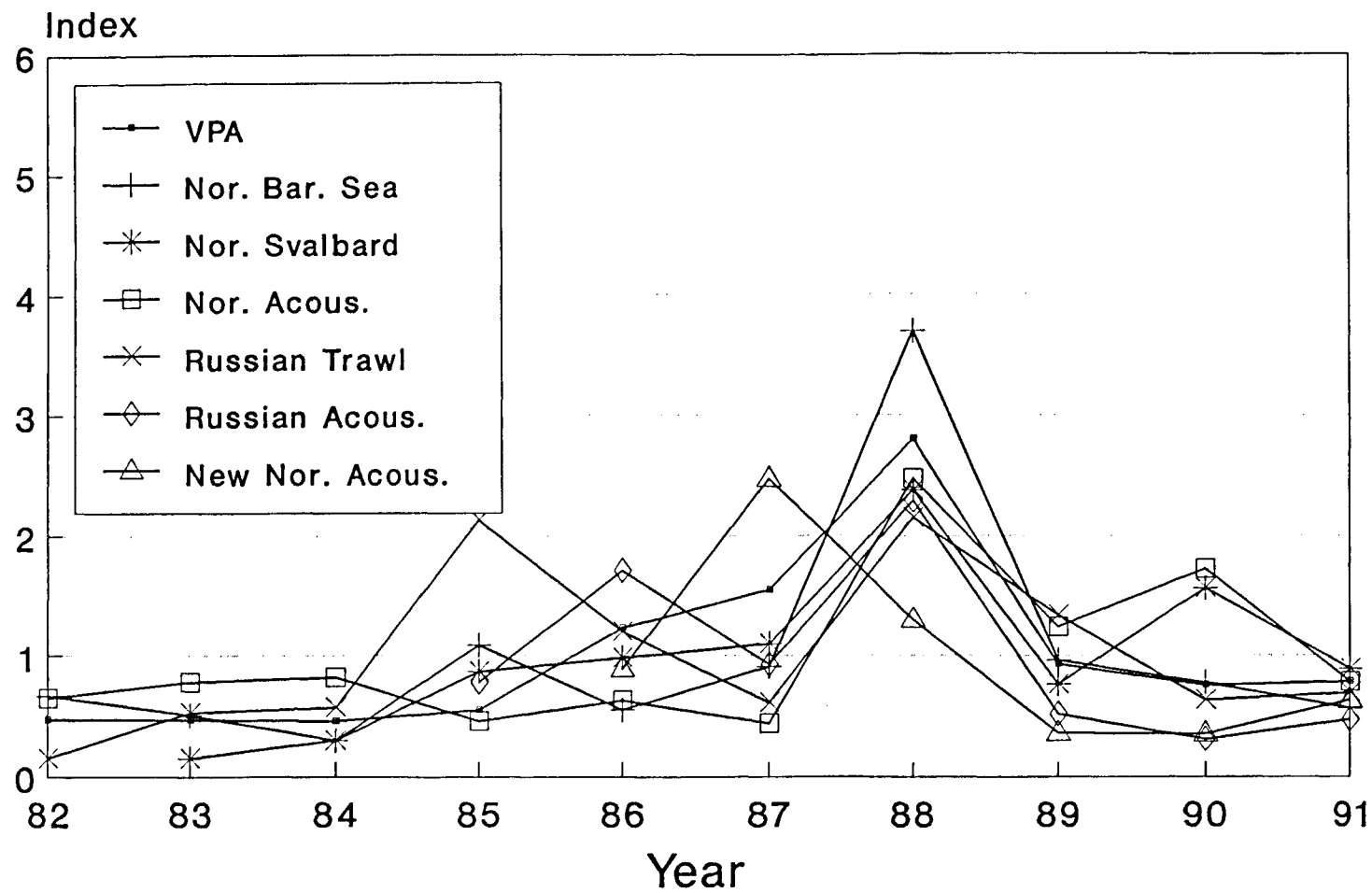


Figure A.4

NE Arctic Cod - Age 6 VPA & Survey indices

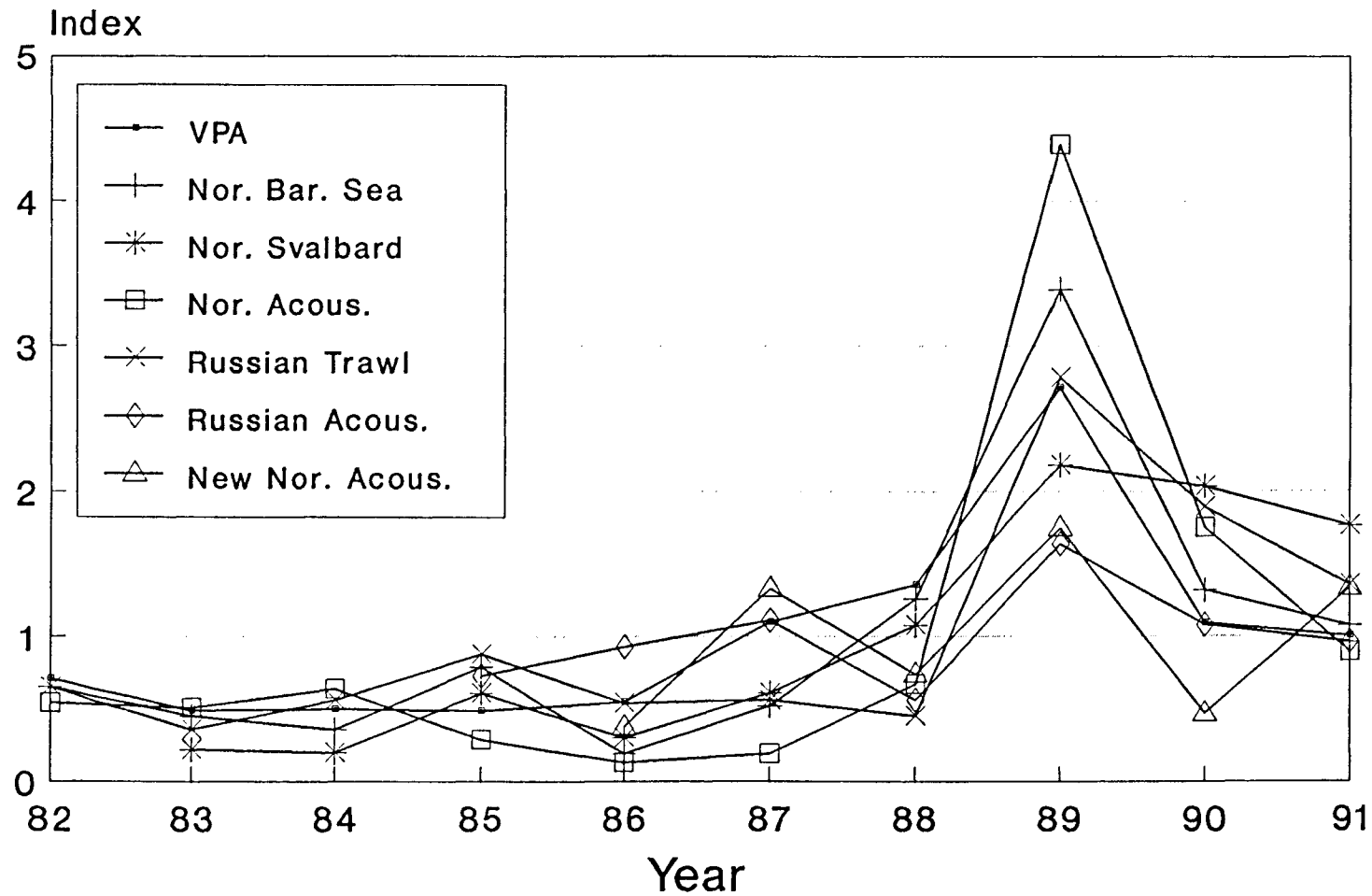


Figure A.5

NE Arctic Cod - Age 7 VPA & Survey indices

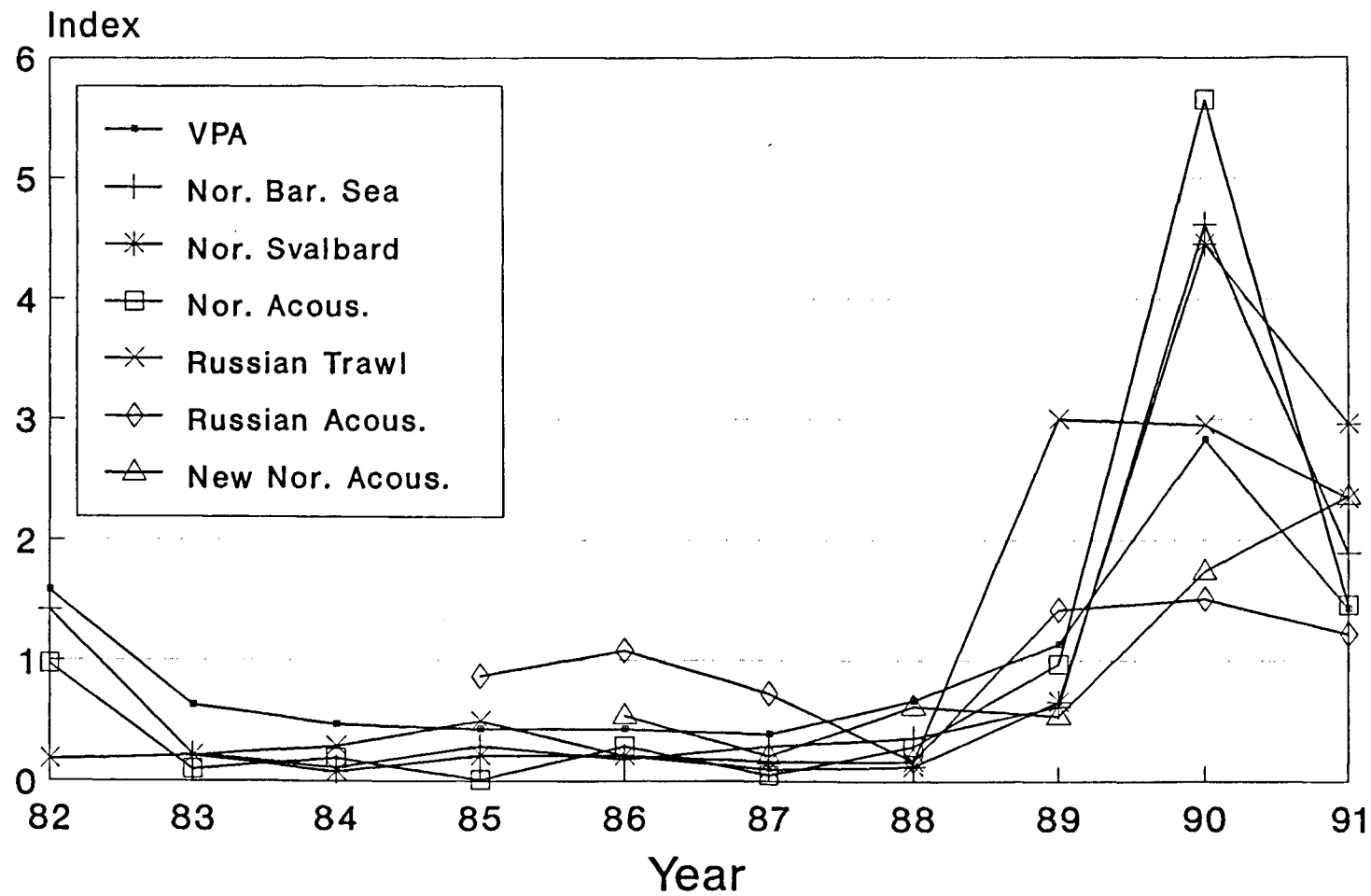


Figure A.6

NE Arctic Cod - Age 8 VPA & Survey indices

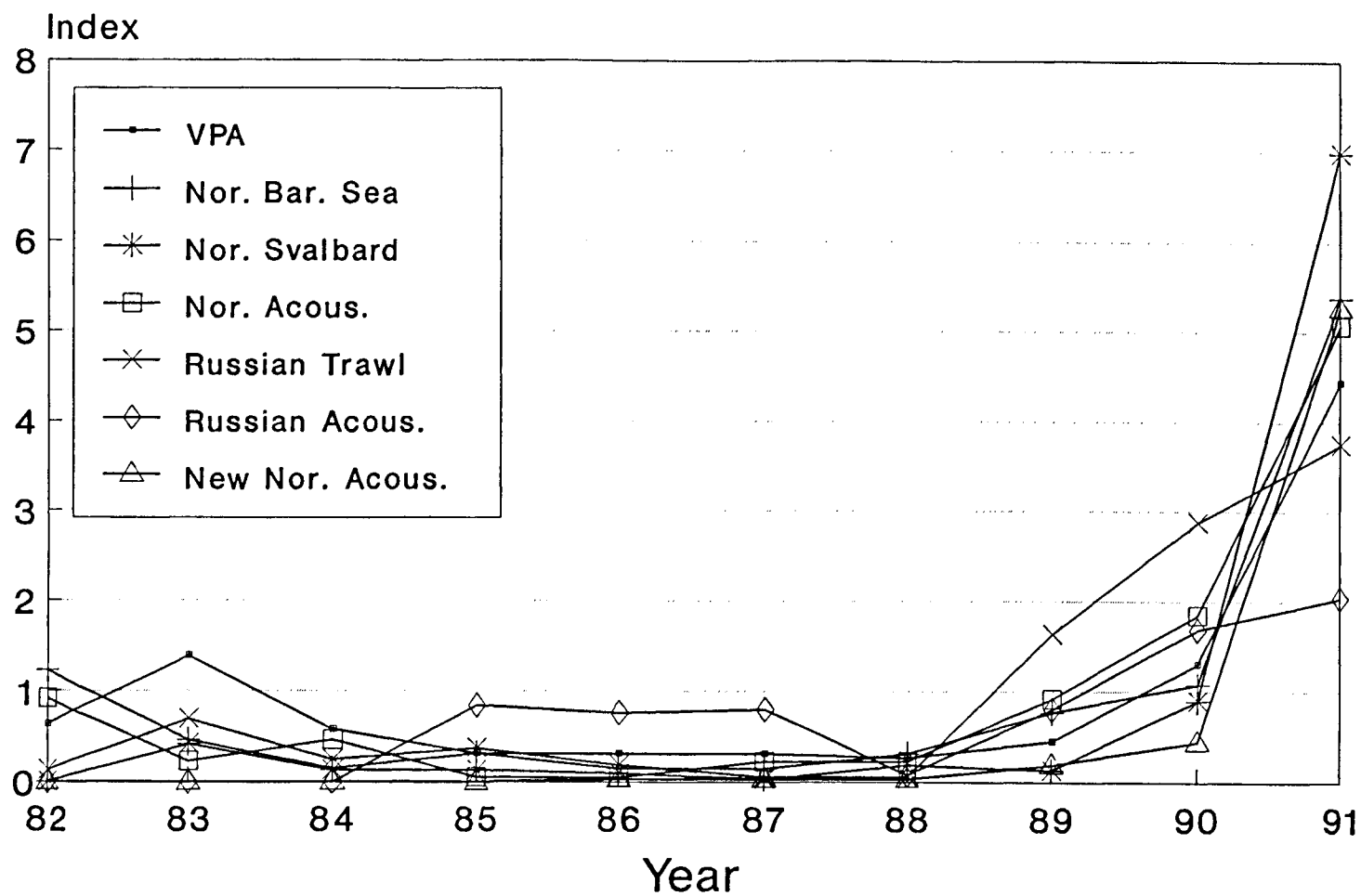


Figure A.7

NE Arctic Haddock age 3 VPA & survey indices

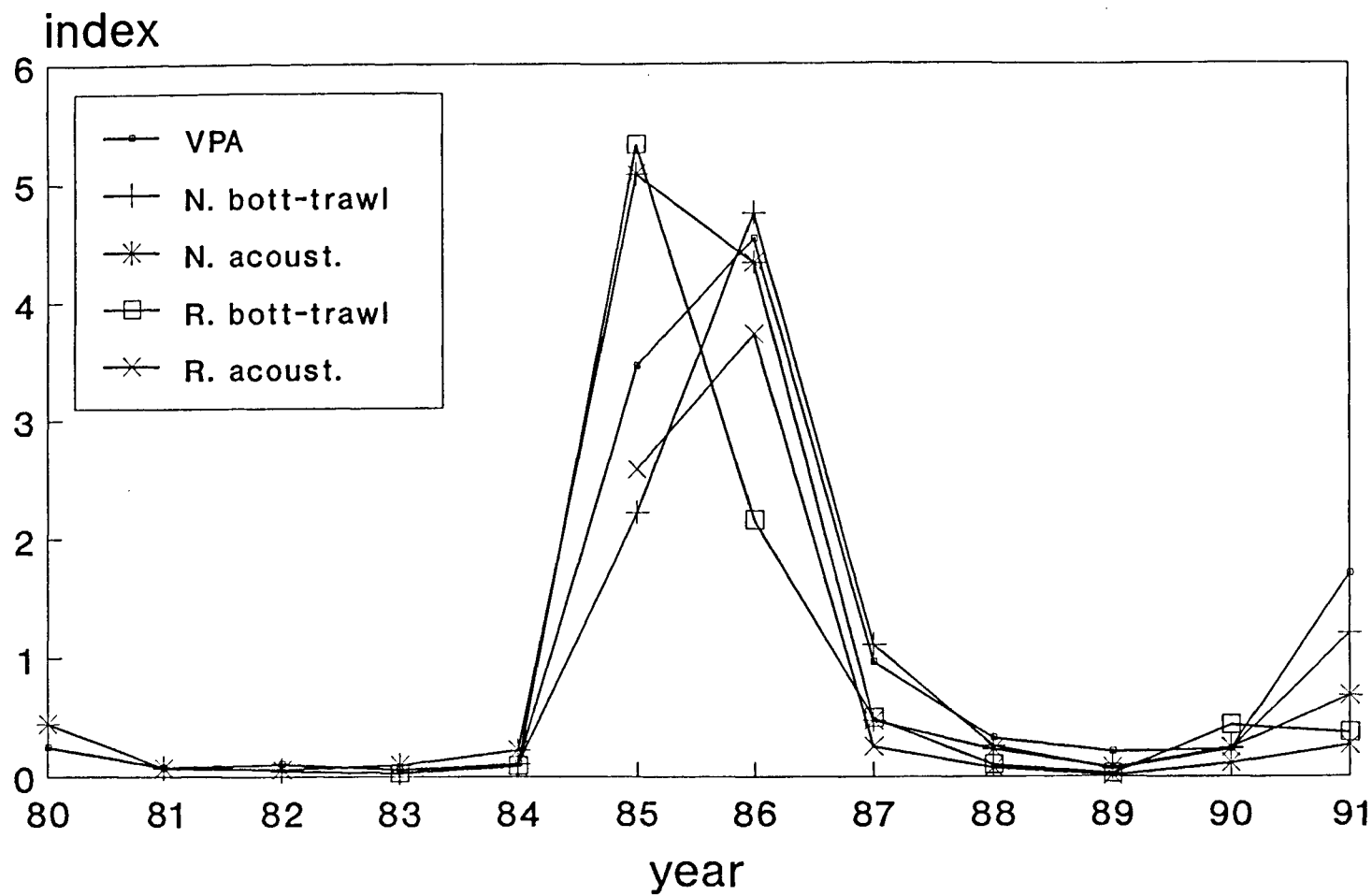


Figure A.8

NE Arctic Haddock age 4 VPA & survey indices

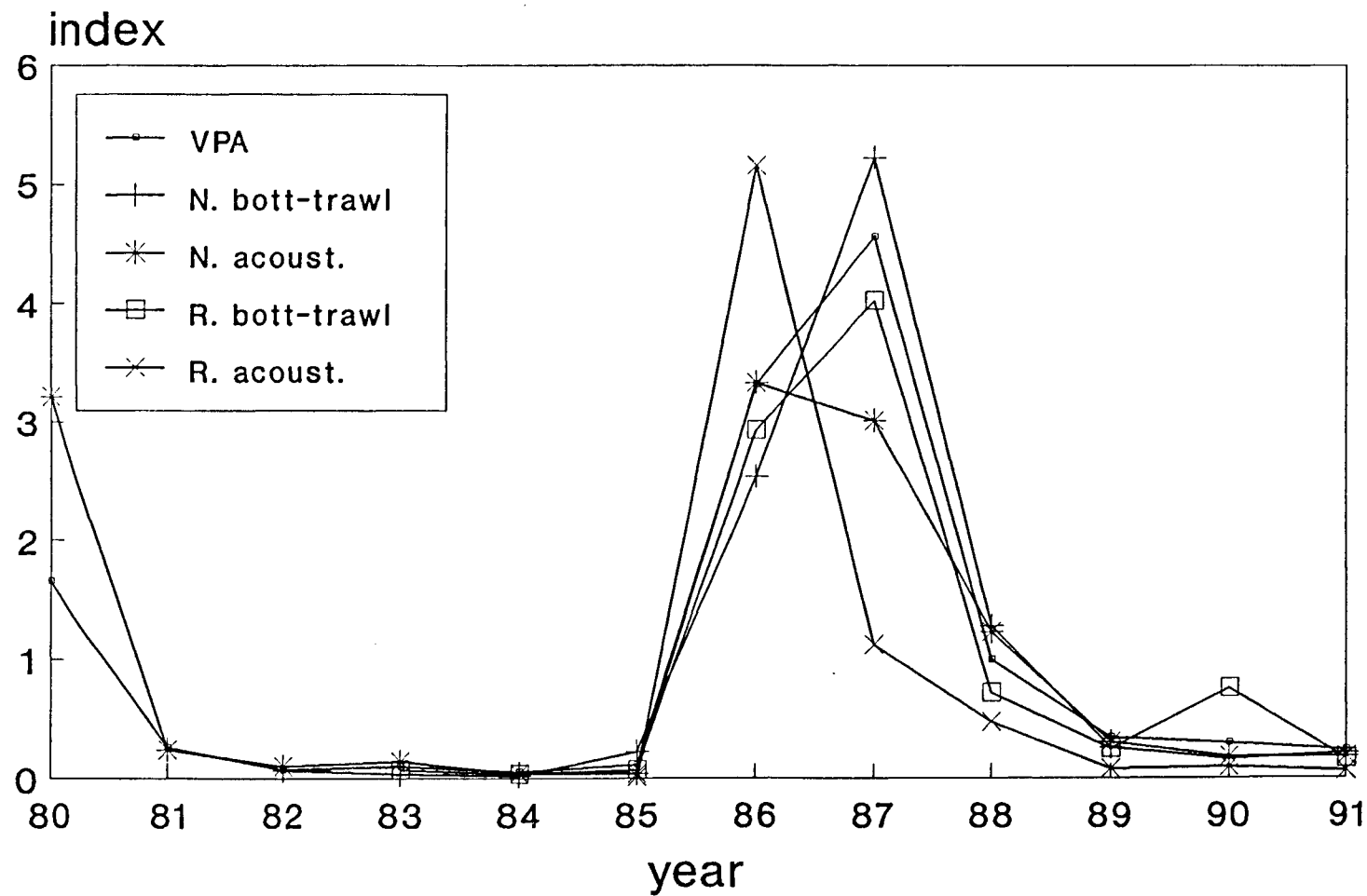


Figure A.9

NE Arctic Haddock age 5 VPA & survey indices

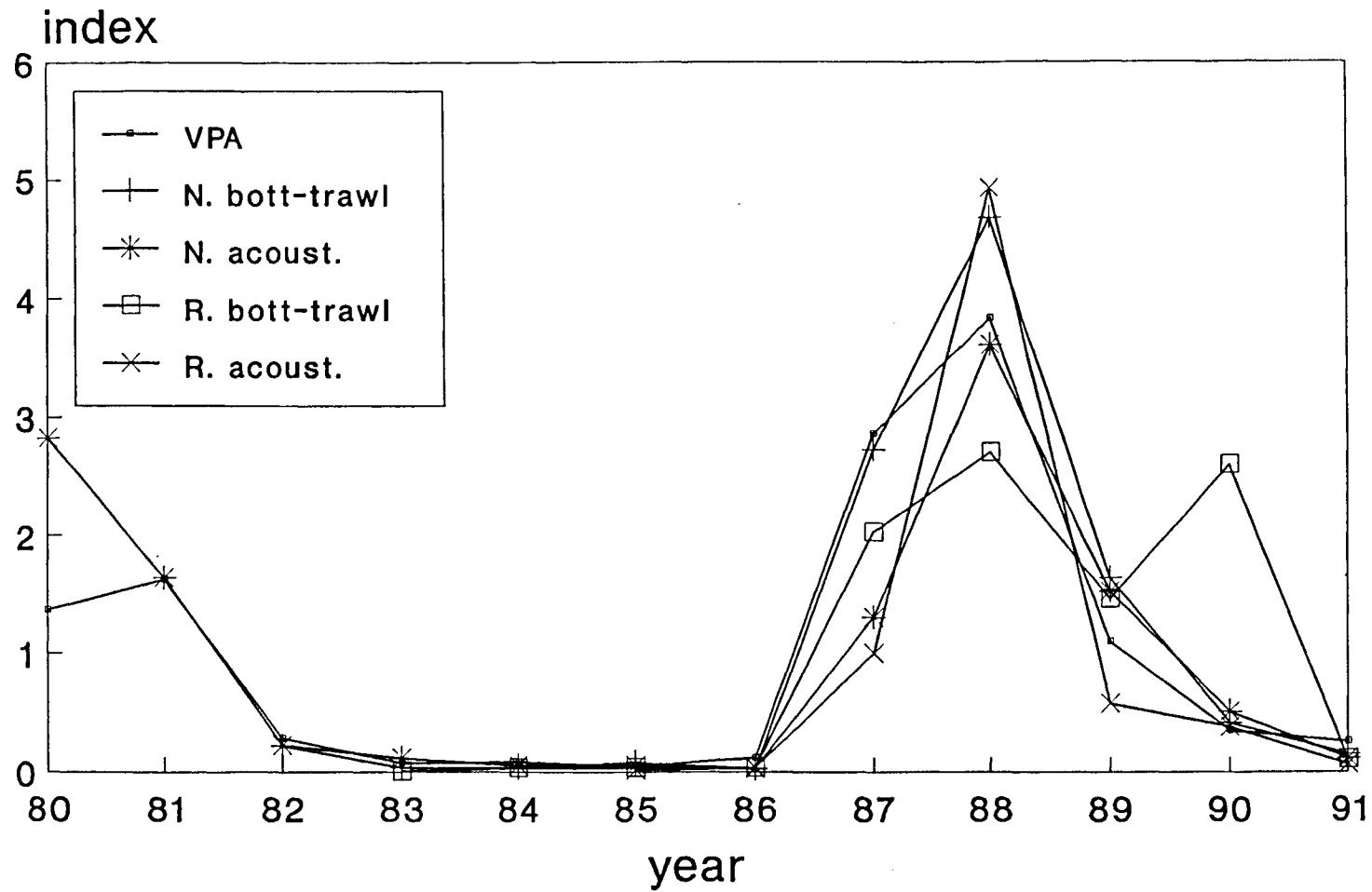


Figure A.10

NE Arctic Haddock age 6 VPA & survey indices

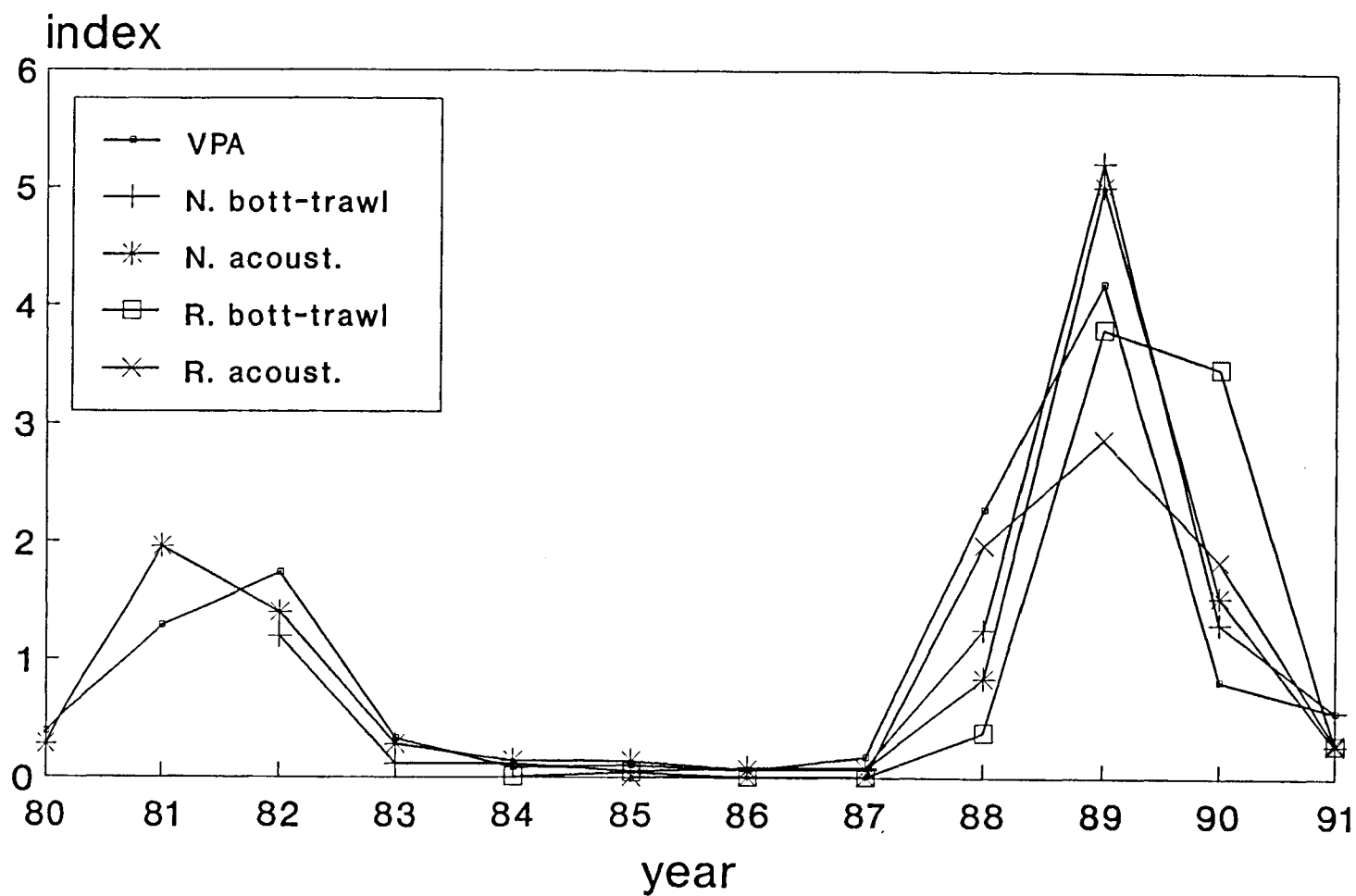


Figure A.11

NE Arctic Haddock age 7 VPA & survey indices

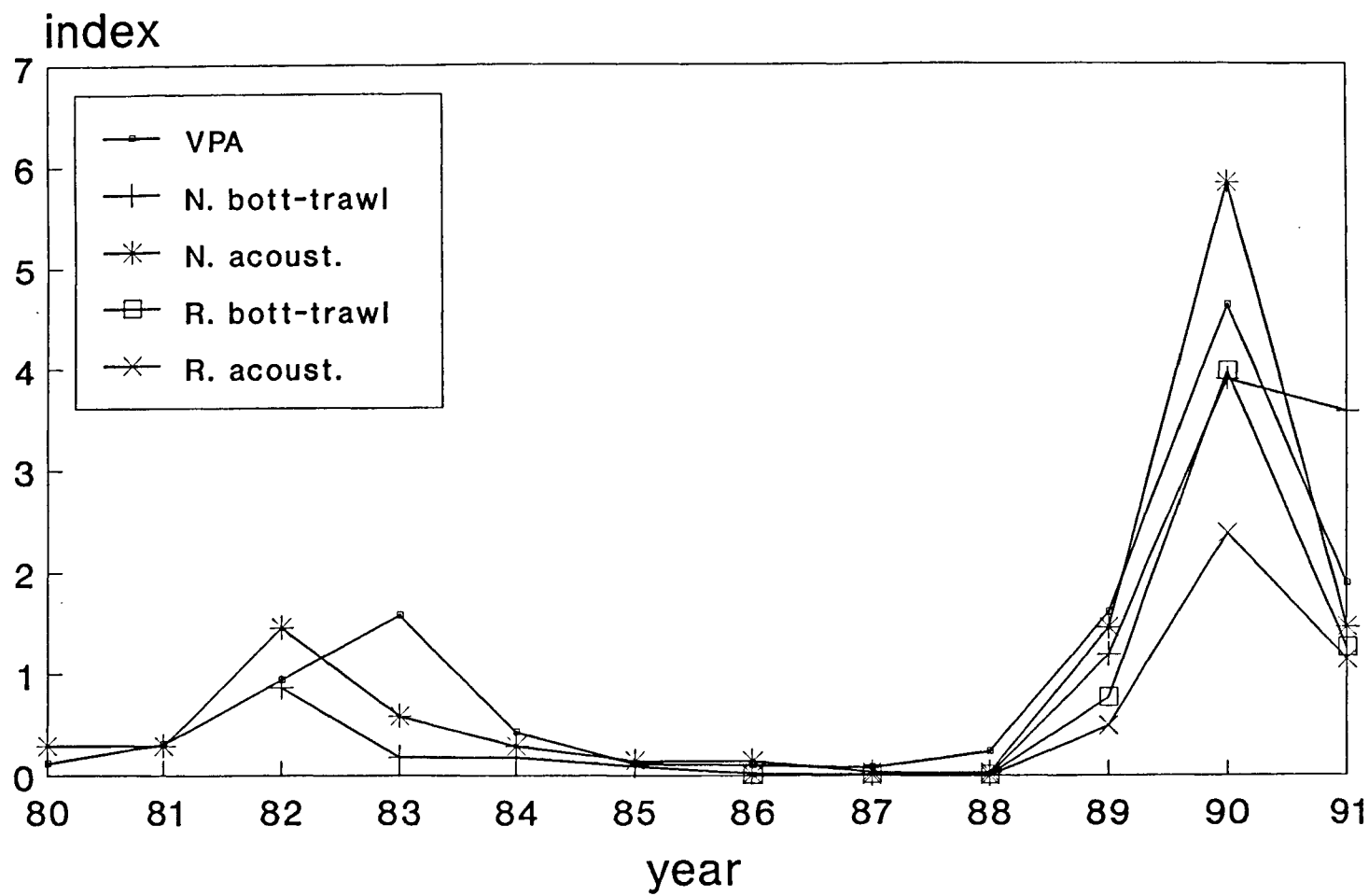


Figure A.12

ARCTIC COD RECRUITMENT INDEX FOR AGE 0

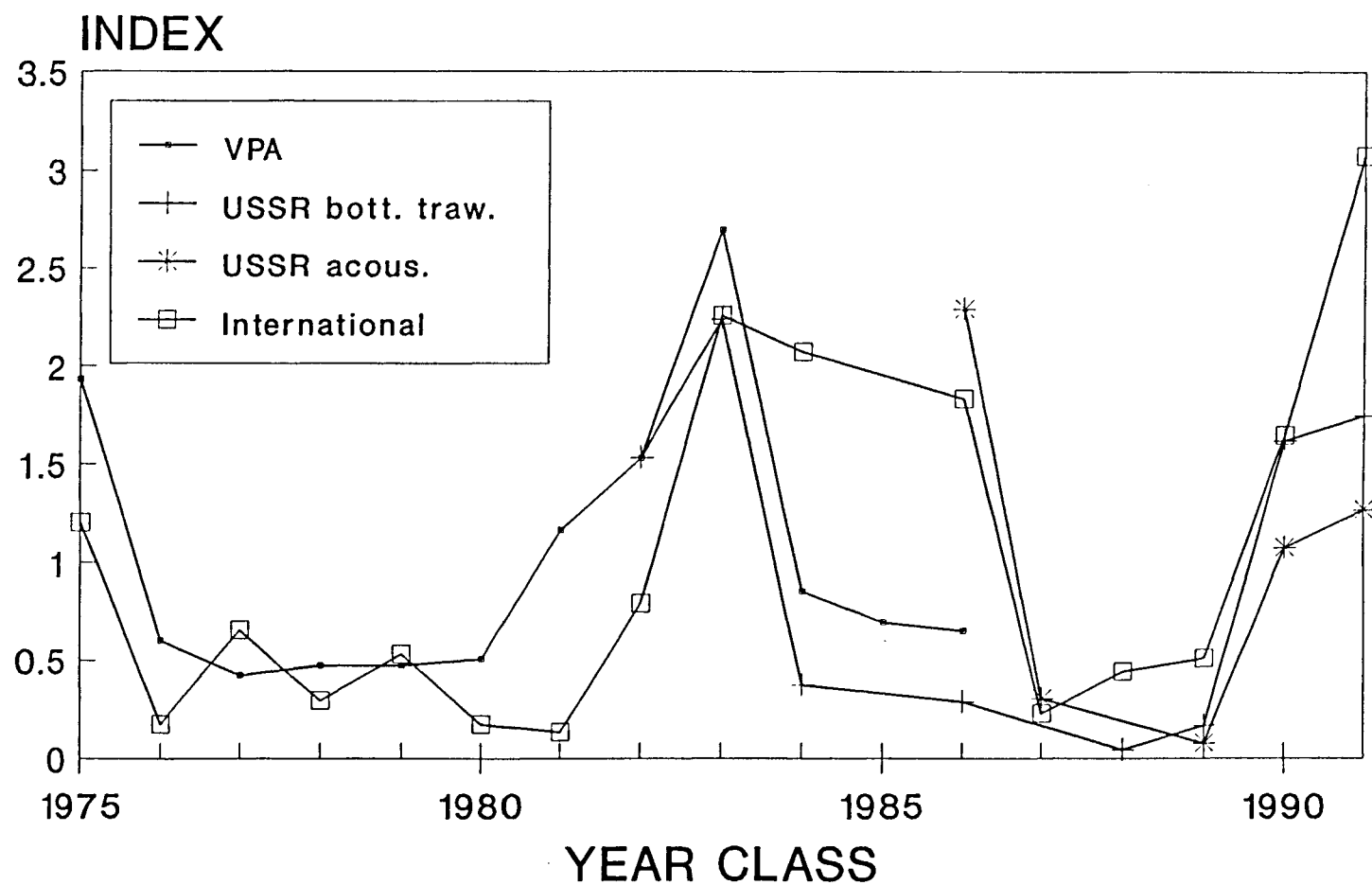


Figure A.13

ARCTIC COD RECRUITMENT INDEX FOR AGE 1

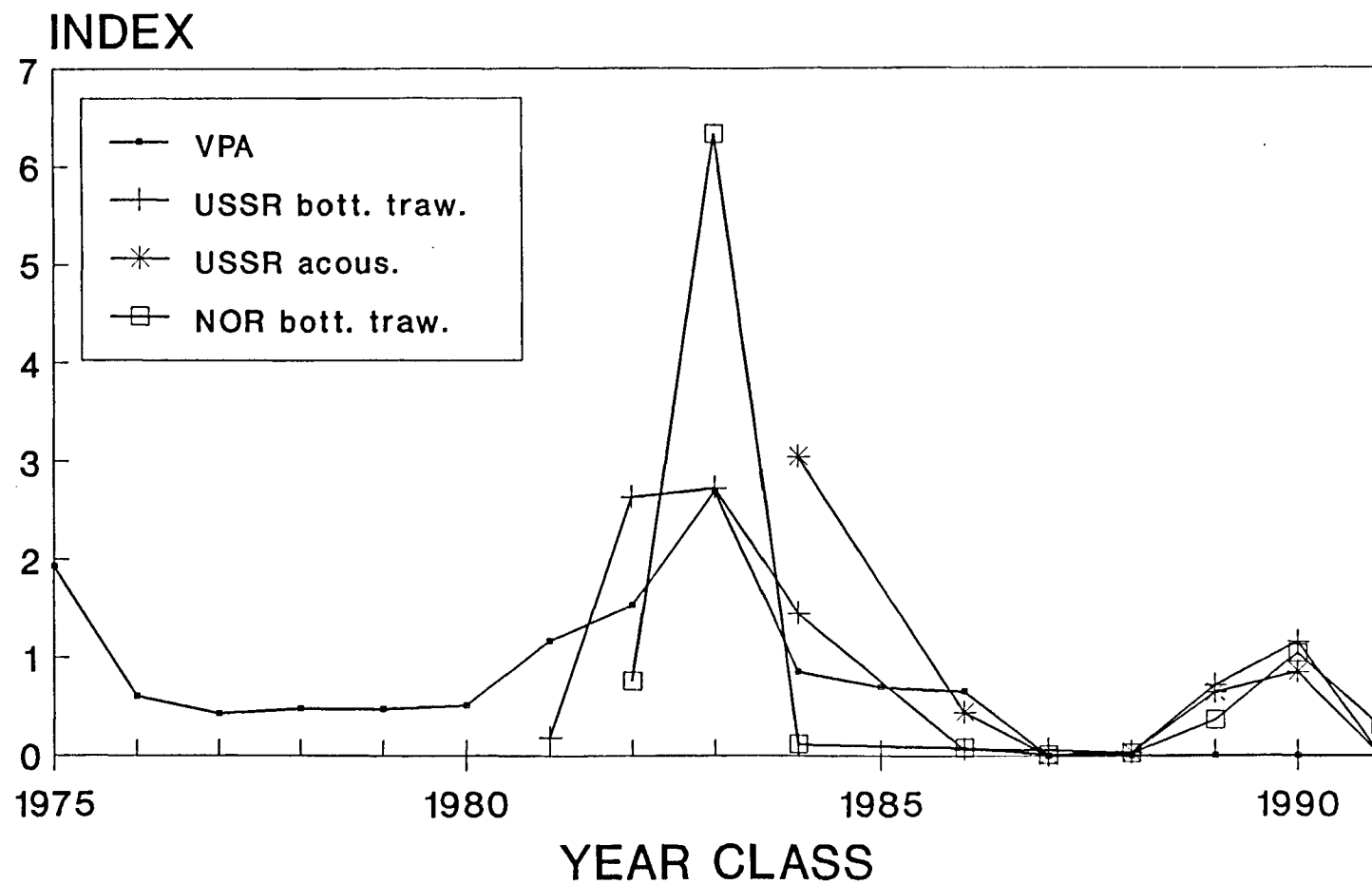


Figure A.14

ARCTIC COD RECRUITMENT INDEX FOR AGE 2

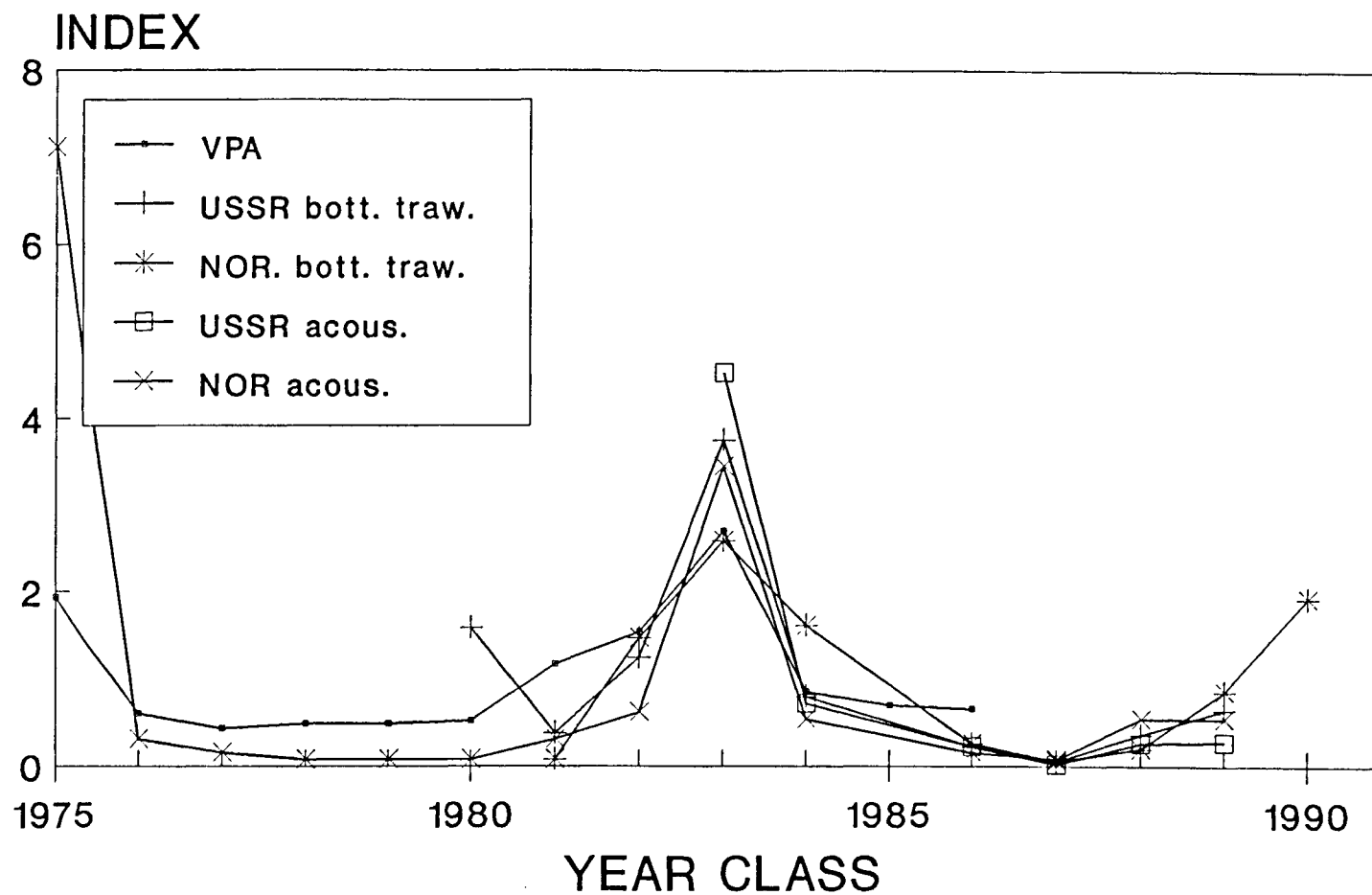


Figure A.15

ARCTIC COD RECRUITMENT INDEX FOR AGE 3

