REPORT OF THE

FIRST ANNUAL MEETING

OF THE

NORTH-EAST

ATLANTIC COMMISSION

OF THE

NORTH ATLANTIC SALMON CONSERVATION ORGANIZATION

23 - 25 May 1984
Edinburgh

NORTH ATLANTIC SALMON CONSERVATION ORGANIZATION

ORGANISATION POUR LA CONSERVATION DU SAUMON DE L'ATLANTIQUE NORD

NORTH-EAST ATLANTIC COMMISSION

COMMISSION DE L'ATLANTIQUE NORD-EST

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REPORT OF THE FIRST ANNUAL MEETING
OF THE NORTH-EAST ATLANTIC COMMISSION
OF THE NORTH ATLANTIC SALMON CONSERVATION ORGANIZATION
23-25 MAY 1984, EDINBURGH, U.K.

1. OPENING OF THE MEETING

1.1 The meeting opened on 23 May 1984 under the Chairmanship of Mr Bjørn Smørgrav.

1.2 The Commission invited observers from the Soviet Union and Spain.

1.3 A list of participants is annexed, (Annex 2).

2. ADOPTION OF THE AGENDA

2.1 The Commission adopted the agenda contained in NEAC (84)1, (Annex 1).

3. NOMINATION OF A RAPPORTEUR

3.1 The Commission nominated Mr Thor Gudjonsson (Iceland) as rapporteur.

4. ACFM REPORT FROM ICES ON SALMON STOCKS, NASCO (84)4

4.1 Mr D Griffith, Chairman of the Advisory Committee on Fisheries Management of ICES, reviewed part of the ACFM report relating to salmon, NASCO (84)4, (Annex 13 to the report of the first annual meeting of the Council of NASCO).

4.2 The Chairman conveyed thanks to ICES for the ACFM report. It was pointed out that some of the figures on page 2 of the report were incorrect. The figures quoted for the Laerdalselv River should be 43% to 92%. The exploitation rate given for the River Eira, based on redd counts, should be 40% to 83%. The range of estimated total exploitation on the River Eira stock in Norwegian waters was 78% to 97% (see table 10 in the recent Working Group Report), (Annex 3). The figures will be corrected in the final version of the report.

.../...

5. REGULATORY MEASURES

5.1 The Chairman reviewed the statement of the ACFM on TAC in its report, NASCO (84)4.

5.2 The delegation of Iceland submitted a proposal, NEAC (84)5, (Annex 4).

5.3 The delegation of Norway made the proposal contained in NEAC (84)3, (Annex 5).

5.4 Following consideration of the matter the Commission agreed on the proposal for regulatory measures for fishing of salmon in the fisheries zone of the Faroe Islands 1984-85, as annexed to this report, NEAC (84)7, (Annex 6).

6. RECOMMENDATION TO THE COUNCIL ON SCIENTIFIC RESEARCH

6.1 The Commission endorsed the research priorities listed in the ACFM report, NASCO (84)4, section D, (pages 13-14). In addition, the Commission recommended to the Council priorities for data acquisition in 1985 as annexed to this report, NEAC (84)6, (Annex 7).

7. DATE AND PLACE OF NEXT MEETING

7.1 The Commission decided to hold its next meeting at the date and place of the next meeting of the Council.

8. CONSIDERATION OF THE REPORT OF THE MEETING

8.1 The Commission approved the report of its inaugural meeting (NASCO/NEAC I/5 Revised), (Annex 8).

8.2 It also considered and approved the report of the present meeting.

Edinburgh May, 1984

ANNEX 1

NEAC (84)1
NORTH ATLANTIC SALMON CONSERVATION ORGANIZATION
FIRST ANNUAL MEETING OF THE NORTH-EAST ATLANTIC COMMISSION
23-25 MAY 1984, AT THE GEORGE HOTEL, EDINBURGH, U.K.

AGENDA

1. Opening of the meeting

2. Adoption of the agenda

3. Nomination of a rapporteur

4. ACFM report from ICES on salmon stocks

5. Regulatory measures

6. Recommendation to the Council on scientific research .

7. Other business

8. Date and place of next meeting

9. Consideration of draft report of the meeting

Edinburgh, May 1984

ANNEX 2

NEAC (84)2
NORTH ATLANTIC SALMON CONSERVATION ORGANIZATION
FIRST ANNUAL MEETING OF THE NORTH-EAST ATLANTIC COMMISSION
23-25 MAY 1984, AT THE GEORGE HOTEL, EDINBURGH, U.K.

LIST OF PARTICIPANTS

PARTIES, MEMBERS OF THE COMMISSION:

Denmark in respect of the Faroe Islands	Mr A Olafsson
EEC	Mr H I Jakupsstovu
	Mr J Pearson
	Mr E J Spencer
Finland	Ms M Doran
	Mr P Niskanen
Iceland	Mr E Niemela
Norway	Mr T Gudjonsson
	Mr B Smørgrav
	Mr J Senneseth
Sweden	Dr K W Jensen
	Mr T Gustavsson

OBSERVERS - NON PARTIES:

Spain	
USSR	Mr J J Chao
ICES	Mr A A Volkov
	Mr D G Griffith

Edinburgh, May 1984

ANNEX 3

NORTH ATLANTIC SALMON CONSERVATION ORGANIZATION
NORTH-EAST ATLANTIC COMMISSION

ICES - REPORT OF MEETING OF THE WORKING GROUP ON NORTH ATLANTIC SALMON

International Council for the
Exploration of the Sea

CM 1984/Assess: 16

REPORT OF MEETING OF THE WORKING GROUP ON NORTH ATLANTIC SALMON

Aberdeen, 28 April - 4 May 1984

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REPORT OF MEETING OF WORKING GROUP ON NORTH ATLANTIC SALMON

0 INTRODUCTION

The Working Group on North Atlantic Salmon met at the Marine Laboratory, Aberdeen from 28 April-4 May, 1984. The following members participated:

E M Chadwick	Canada
W G Doubleday	Canada (Chairman)
T R Porter	Canada
D G Reddin	Canada
J Ritter	Canada
O Christensen	Denmark
J Møller Jensen	Denmark
Sv Aa Horsted	Denmark
H í Jákupsstovu	Faroes
R Mouritsen	Faroes
E Niemela	Finland
M Thibault	France
Th Gudjónsson	Iceland
J Browne	Ireland
L P Hansen	Norway
D Clarke	UK
D Dunkley	UK
G Kennedy	UK
E C E Potter	UK
W M Shearer	UK
R G J Shelton	UK
J Boreman	USA

1 MAIN TASKS

At its 1983 statutory meeting, ICES resolved that the Working Group should meet in 1984 to consider questions related to the fisheries in the Norwegian Sea and Faroes area and at West Greenland and to assess possible causes of the apparently low marine survival of salmon stocks contributing to many fisheries in 1983. The North Atlantic Salmon Conservation Organisation (NASCO) held its inangural meeting at Edinburgh in January 1984 and posed additional questions on Atlantic salmon to ICES. Consequently, the agenda of the Working Group meeting was amended as found in Appendix I. Specific questions are referred to in each section of the report.

Thirty-two documents were presented to the Working Group (Appendix II). Although a great deal of relevant information was presented to the Working Group, available data were found to be insufficient to permit the provision of complete answers to many of the questions posed. Section 6 of the report includes a suggested list of research programs which would provide information relevant to the perceived needs of NASCO.

2 NORTHEAST ATLANTIC

2.1 EFFECTS OF THE FISHERY IN THE NORWEGIAN SEA AND FAROES AREA ON HOME WATERS

The Working Group was requested by ICES to assess the effects of the fishery in the Norwegian Sea and Faroes area on home water fisheries and stocks, in particular to assess the implications of existing catch limits.

The Working Group has responded to the question by making an assessment of the impact of the fishery within the fisheries zone of the Faroes on home water stocks. No additional calculations were carried out for the fishery north of the Faroes zone for which no new data were available.

2.1.1 Description of the Faroes and Norwegian Sea Fisheries

Table 1 shows nominal catches taken in the northern Norwegian Sea between 1965 and 1983. Catches increased rapidly in the late 1960's to over 900 tonnes and then declined gradually throughout the 1970's to around 200 tonnes. In 1982 and 1983 catches increased again to about 600 and 400 tonnes respectively as a result of increased fishing by Faroese vessels. The data in Table 2 show that from a moderate catch in the Faroes area in the mid 1970's the fishery escalated substantially from 1979 to reach a yield of over 1000 tonnes in 1981. In 1982 and 1983 a quota of 625 tonnes was applied to this fishery.

In the seasons 1980/81 and 1981/82, no area restrictions were imposed on the salmon fishery in the Norwegian sea. In these years, only a few fish were caught in October and November and at this time of year the fishery was confined close to the Faroe plateau. The fishery in January is very dependent on weather conditions and there have been considerable differences between the catches in recent years. In January 1982 a relatively good fishery took place over a large area in the Norwegian sea. As the 1980/81 and 1981/82 seasons proceeded, the fishery extended as far as 71°N, but in the 1982/83 season the Faroese vessels were restricted to the Faroes fisheries zone. The fishery was good in February, March and April 1983, and a number of vessels had taken their quota by the end of April. However, some vessels which started late continued fishing into May and June.

2.1.2 Biological Characteristics of the Catches

Data on the biological characteristics of commercial catches in the Faroes fishery have been obtained from observers accompanying commercial fishing vessels since 1980/81. Since 1982/83 a market sampling program has operated alongside the observer program.

The following general conclusions have been drawn from an examination of the data:

(i) Daily observations of sex and sea age composition are often highly variable, even when samples are examined from a relatively small area and a short time period, as for example, within a cruise. The day to day variation in catch composition is greater than would be expected from a well mixed aggregation of salmon.

(ii) About 80% of the catch of virgin fish in each of the 1981/82 and 1982/83 seasons were two sea-winter fish. Sex ratios in the observer samples show that catches are heavily biased toward the female component in both years (84% in 1981/82 and 71% in 1982/83). Examination of the 1982/83 data suggests that this bias is of limited extent on one sea-winter fish (53% female) but increases in the two and three sea-winter groups (78% and 75% females respectively).

(iii) Catch rates and the proportion of female fish were generally higher in the more northern samples during the 1981/82 season. Although it is not possible to evaluate the 1982/83 sea-sampling data in a similar way, because of the limited area from which samples were taken, this result is consistent with catch data from log books for the 1982/83 season presented to the 1984 Study Group (Anon., 1984).

(iv) No clear evidence for growth during the period of the fishery was found in data from the 1981/82 sea-sampling. However the 1982/83 season shows reasonably clear evidence of an increase in both length and weight of two sea-winter fish as the season progresses (Fig. 1). The absence of a clear trend in 1981/82 may be explained by the wide area from which samples were taken in this season.

2.1.3 Assessment of the Effects of the Fishery at the Faroes

The Working Group adopted the following model to estimate the total losses (LF) to European home water stocks for each tonne landed in the Faroes fishery:

$$LF = 1/(1-N)\sum_{ij} (WRij \times PWi \times PNij \times Sij)$$

where suffix "i" refers to sea age classes (October 1 nominal birthday) of salmon taken in the Faroes fishery (discards are treated as a separate sea age class) and suffix "j" refers to the sea age classes of the same stocks on their return to home waters.

The parameters are defined as follows:

N = Non-catch fishing mortality expressed as a proportion of the total fishery induced mortality
WRij = Ratio of the weight of each sea age class in home waters to their mean weight in catches at the Faroes
PWi = Proportion by weight of each sea age class relative to the total nominal catch
PNij = Estimated proportion of the fish of each sea age class in the fishery returning in the same and subsequent years
Sij = Survival rates of different sea age classes between Faroes fishery and home waters.

This assessment equation is based on the model presented in the 1981 report of the North Atlantic Salmon Working Group (Anon., 1981).

2.1.3.1 Estimation of Assessment Parameters:

(a) Discards and non-catch fishing mortality (N)

During the sea-going observer cruises in 1982/83 5.5% of the total catches were discarded because the fish were less than 60 cm long and a further 1.5% were discarded because they were of poor quality. However there was evidence that the discard procedures on icing vessels differed from those on freezer boats on which the observations were made. For the period February to May, the freezer vessels retained only 49% of the fish under 2.5 kg (weight category 1) while they retained 57-63% (mean 59%) of the larger weight categories. It therefore appears that the difference in discard practices between freezer and icing vessels occurs only in weight category 1 which consists entirely of fish under 60 cm. Applying the value of 5.5% to the freezer landings and using the proportion of the catch of larger fish taken by icing vessels, the total number of fish under 2.5 kg taken by the icing boats can be estimated. This gives a discard rate of undersized fish by icing boats of 1.7% and thus a total discard rate of 3.2%. The overall discard rate for all vessels is then estimated to be 5.5%. This figure applies to the fishery in the 1982/83 season and might change in other years if the sea age composition of the exploited population were different.

Observations on the discard procedures suggest that about 40% of the discarded fish are released alive. However it was felt that capture and handling was likely to result in a high subsequent mortality, and a figure of 50% was suggested. The total discard mortality rate was therefore assumed to be 80%.

Although some fish are known to drop off the line and others escape with hooks embedded, there are no estimates of total non-catch fishing mortality rates. Consequently, the Working Group adopted a nominal value of 10% for the assessment (N = 0.1).

(b) The proportion, by weight, of each sea age class relativey to the nominal catch (PWi)

This parameter was estimated using the equation

$$PWi = PNi \times WFi/WF$$

where

PNi = proportion of landed catch, by numbers, of sea age class "i"
WFi = mean weight of fish of each sea age class landed in the Faroes
WF = mean weight of all fish landed in the Faroes

The age composition of the total Faroes catch was estimated by the Study Group to be 5.6%, 78.4% and 15.8% one, two and three sea-winter fish respectively. The mean weight of fish of each sea age class was estimated for the months February, March and April using the data collected during the sampling programs (Table 3). The data were used to estimate the mean weight of each age class in the total catch. The February weights were used for landings in November, December and February and the April weights for the April, May and June landings. The mean

weight of discards was estimated from measurements taken on the observer cruises to be about 1.5 kg. The calculation of PWi is shown in Table 4.

These estimates are based on extensive sampling in 1982/83 and are therefore thought to be reliable for that period, but may not apply to other years. Following a period of rapid expansion the pattern of the fishery has stabilized. However, application of these estimates to other years assumes that the annual pattern of exploitation by area and time will be similar to 1982/83.

(c) Proportion of fish returning to home waters in the same year (PNij)

In 1982 and 1983 blood serum samples collected from salmon caught at the Faroes were analysed for steroid hormones. Sample sizes were inadequate to provide separate estimates for each sea age class. It was estimated that the proportion of each sea age class that would mature in the same year was 78%. It was also assumed that all maturing fish would attempt to return to home waters in that year.

However, in view of the difficulty of distinguishing between elevated and basal hormone levels, it was thought that this was more likely to be an underestimate than an overestimate of the true values. It was also felt that a greater proportionof the older, rather than the younger, sea age classes might be expected to return in the same year. The results of tagging experiments carried out around the Faroes in the 1970's also suggested that about 90% of each sea age class return in the same year.

(d) Ratio of weights in home waters and in the Faroes fishery (WRij)

The 1981 Working Group report noted the sensitivity of the assessment to variation in estimates of the weight parameters. In particular, difficulty was found in estimating the mean weight of salmon of each sea age class returning to home waters because of the large differences between stocks. However, it was suggested that the ratio of the weight of fish returning to home waters to their weight at Faroes might be less variable; the fish that would be large on return to home waters are also likely to be in the upper end of the weight distribution of the catch at Faroes and vice versa.

Weight ratios were estimated from tag return data for a small number of wild and hatchery stocks from Norway, Scotland and Ireland (Table 5). Some of the ratios were derived from small numbers of tagged fish (less than 10). Unweighted averages of these values for the different sea age classes were used in the assessments. This approach was adopted because it gives a repeatable estimate of the weight parameters. However, it assumes that for each sea age class the weight ratios are approximately the same for all stocks in the fishery. If this assumption were incorrect then the limited amount of data would be likely to give biased weight ratio estimates and values in future years would be influenced by changes in the stock composition. In addition, the method assumes that growth rates of tagged and untagged fish and of hatchery and wild fish are the same for the period after they enter the Faroes fishery. Data for salmon from the River Imsa (Norway) give evidence of similar growth rates for hatchery and wild fish during this phase. The Working Group also noted that, although tagging had been observed to reduce the growth of smolts to adult salmon, differences in growth rates would be expected to be most marked at the post-smolt phase and a significant reduction in growth rates would be unlikely later in the life cycle.

(e) Survival rates between the Faroes area and home waters

Survival rates were estimated using the equation

$$Sij = e^{-MTij}$$

where

M = the instantaneous monthly relative rate of natural mortality, and
Tij = time in months between the mid dates of the fishery and the return of the stock to home waters.

No new data were available to improve on previous estimates of M = 0.01 and M = 0.005. Some doubts were expressed about the validity of mortality estimates previously used and the Working Group therefore agreed to apply an assumed value of M = 0.01 to all sea age classes in the assessment.

It was noted that the presence of seals in coastal waters of Norway, Ireland and UK is likely to be associated with increased natural mortality of salmon returning to their home river, due to predation. Several observations have been made of grey seals taking free swimming salmon in the open sea on the Scottish coast. In addition fish bearing marks consistent with recent attacks by seals have been caught in the experimental trap on the River North Esk (Scotland) outside the fishing season at a time when it is unlikely that the attacks were made on fish confined in fishing gear.

Using the estimated monthly landings by sea age class it was possible to estimate the mean date of capture of each sea age class at the Faroes. The mean date of capture of one sea-winter fish was mid April and of two and three sea-winter fish was the end of March. These dates are about two months later than those used in the 1981 assessment. As no new data were available for the times of return of fish to home waters, two months were subtracted from the previous estimates of T for each sea age class. The time between the mid date of the fishery and the return to home waters was therefore taken to be 3 months for fish of any sea age class returning in the same year and 13 months for fish returning in the following year.

2.1.3.2 Estimate of the Effects of the Faroes Fishery on Home Water Stocks:

The calculations and results for the assessment are shown in Table 6. These results suggest that for each tonne of salmon landed in the Faroes fishery about 1.6 tonnes are lost to stocks returning to European home waters. However the Working Group noted that there was considerable uncertainty about a number of the parameter values. The sensitivity of the assessment to errors in the values used was calculated as follows:

(a) Discards

The discarded fish contribute only 2% of the total loss estimate, and the discard rate is thought to be well estimated. Thus errors in this parameter are expected to have virtually no effect on the assessment. However any change in the discard rate is likely to be related to a change in the age composition of the catch, which would itself have a greater effect on the result.

(b) Non-catch fishing mortality (N)

This parameter has a proportional effect on the total assessment. Thus if N is assigned a value of 0.15 the estimate of total loss is increased by 6% of the estimated value and if N is assigned a value of 0.05 the estimate of total loss is decreased by 5%.

(c) Proportion by weight in each sea age class (PW_i)

The estimates of PW_i for the 1982/83 season are based on extensive sampling and are thought to be well estimated. Changes may occur in the age composition of the population in the fishery area in different years. However even a substantial change to a catch comprising 30%, 65% and 5% of one, two and three sea-winter fish gives only a 5% increase in the assessment result.

(d) Proportion returning in the same year (PNij)

It was suggested that the method used to estimate this parameter was more likely to underestimate than overestimate the true value. Using the value of 90% derived from the tagging experiments in the early 1970s reduces the estimated loss by 6%.

(e) Weight ratios (WRij)

There was considerable variation (up to $\pm$ 15%) in the values used to give the average weight ratios for each sea age class. In the unlikely event that all values are biased in one direction the final assessment will be increased or decreased by the same proportion. Errors in the weight parameters for the two sea-winter fish will have a disproportionate effect on the assessment.

(f) Survival (Sij)

The model used to estimate M is based on very limited data and may be inaccurate. If M is increased to 0.015 the estimated loss will be decreased by 3%. If M is decreased to 0.005 the estimated loss will be increased by 3%. Alternatively a 5% additional natural mortality on homing fish, caused by straying or predation in home waters, will decrease the assessment by 5%.

The approximate nature of some of the parameter values and the possibility of annual variation of all parameters should be noted. Therefore the value of 1.6 tonnes lost to home waters for each tonne of salmon caught in the Faroes fishery estimated above must be considered approximate.

2.1.4 Research Requirements

ICES has requested the Working Group to decide on specific research directions required for research programs orientated towards the improvement of future assessments in the Norwegian Sea and Faroes area.

2.1.4.1 Tagging:

It was agreed that feasibility studies should be carried out using the material now available from home waters to determine whether the stocks of salmon at the Faroes are likely to be separated using scale discrimination techniques before undertaking any large tagging experiment at the Faroes. Further scale samples

from home water stocks known to be contributing to the fishery at the Faroes should be supplied to the Scottish laboratory to provide a larger database on which to base future analyses.

Feasibility studies were called for on the use of smolt tagging to establish exploitation rates for monitored rivers and their use in obtaining material for discriminant analysis.

Results of any studies which would help in assessing the relative merits, including feasibility and costs, of smolt tagging programs and a program of tagging in the sea should be made available to the next meeting of the Working Group in Europe. Two members of the Working Group, Potter, UK and Browne, Ireland, were asked to address the question with reference to microtagging programs and Shearer (UK) with reference to a tagging program at sea off the Faroes.

2.1.4.2 Sampling Programs:

Because no parameters used in the current assessment model were brought forward which could not be studied by modifications to the shore-based sampling program, it was recommended that the observer program at sea be suspended. Tissue and blood sampling programs were both at a stage at which no further samples were required unless further research offered opportunities for improved discrimination between stocks and identification of maturity status, respectively.

The market sampling program at the Faroes should be expanded and means of financing this program should be sought. Scanning for micro and other tags should be continued for at least 5 years at the Faroes to permit recovery of tags from 1984 and 1985 smolts.

2.2 EXPLOITATION AND FISHING MORTALITY ON SALMON STOCKS IN THE NORTHEAST ATLANTIC COMMISSION AREA

NASCO requested ICES to assess the exploitation and the fishing mortality exerted upon the salmon stocks which migrate in the Northeast Atlantic Commission area, divided between the following fisheries:

(i) home water fisheries (as far as possible, divided between river fisheries and sea fisheries inside 12 miles),

(ii) sea fisheries outside 12 miles.

ICES was also requested to specify deficiencies in data required to answer these questions.

Two papers were presented to the Working Group describing the exploitation rates in Norwegian and Scottish home water fisheries. The Working Group also considered additional data for Norwegian home water fisheries derived from Jensen (1981) and data for Icelandic home water fisheries derived from Gudjónsson (1984). Unpublished data on exploitation rates in Ireland and of Swedish fish in Norway were reported verbally to the Working Group. Data relating to exploitation rates in sea fisheries outside 12 miles were available from only one study, and apply to the Norwegian Sea area, including the Faroese fishery. The exploitation rate U is defined as the number of fish caught in a fishery divided by the number of fish available to the fishery.

2.2.1 Norway

Tables 7 and 8 present the results from a Norwegian tagging experiment, involving the release of Carlin-tagged wild and hatchery-reared smolts at the mouth of the River Imsa (south-western Norway). The hatchery-reared fish were derived from nine parent stocks, including the stock native to the Imsa. On return to the River Imsa, all ascending adult fish were captured in a trap at the river mouth. Observations available to date refer to fish returning to home waters as one sea-winter fish in 1982 and as two sea-winter fish in 1983.

If it were assumed that all survivors from tagged fish escaping the home water fisheries return to the River Imsa, and the number of tagged fish recaptured in the trap were adjusted to allow for natural mortality occurring between the home water fisheries and the trap, then the number of fish of the returning sea age class escaping the home water fishery could be estimated.

The following additional assumptions were made:

(a) The monthly instantaneous natural mortality coefficient (M) has been taken to be 0.01 as assumed in the assessment model

(b) The mean dates of capture in the trap and in the home water fisheries were assumed to be 15 September and 15 July respectively

(c) Non-catch fishing mortality was assumed to be negligible

(d) Tagged and untagged fish were assumed to be equally vulnerable to the gear

(e) Exploitation rates for the home water fisheries were calculated for two assumed levels of tag reporting efficiency of 50% and 70% respectively.

The resulting estimates of exploitation rates in home waters are shown in Table 7. The Working Group noted that varying the natural mortality rate and time of return within reasonable limits had little effect on the final figures.

An analogous extension of this method, taking the estimated total number surviving to reach the home water fisheries, and adjusting this number to allow for natural mortality occurring beween the Norwegian Sea fisheries and return to home waters, allows the number of tagged fish escaping the Norwegian Sea fisheries to be estimated. The figures were again calculated for two levels of efficiency of tag reporting in home waters of 50% and 70%. To calculate the number of tags taken in the Norwegian sea area, the reported numbers have been adjusted using the estimate of efficiency of tag recovery of 75% calculated for the 1982/83 Faroese fishery by the Faroese Study Group (Anon., 1984). The Working Group noted that this figure has been applied to both the one sea-winter recaptures taken in 1981/82 and the two sea-winter fish. Efficiency of tag reporting was probably higher in 1982/83 than in 1981/82 because of increased effort by the Faroese laboratory in obtaining tags during the 1982/83 season. The estimated number of one sea-winter fish taken in the 1981/82 Norwegian sea fishery will therefore represent a minimum figure. In calculating these figures the following assumptions have been made, in addition to the assumptions required for the estimation of the number of fish returning to home waters:

(a) The monthly instantaneous mortality coefficient (M) has been assumed to be 0.01 for the period between fisheries in the Norwegian Sea and return to home waters

(b) The mean date of capture in the Norwegian sea has been taken as 15 March

(c) Non-catch fishing mortality on tagged fish in the Norwegian sea area has been neglected.

The resulting availability and exploitation rate estimates on the tagged fish in the Norwegian Sea area are shown in Table 8.

The Working Group also noted that data from this experiment show a significant correlation between the mean weight of grilse caught in the home water fishery and the exploitation rates in home waters (Fig. 2a). There was also a significant correlation between mean weight of two sea-winter fish taken in the Faroese fishery and the corresponding exploitation rates (Fig. 2b). Although other interpretations were possible, the most likely explanation of these results would seem to be size selection within sea age classes by the gear operating in these fisheries.

Further information relating to exploitation rates in Norway is given by Jensen (1981) who reports the exploitation rates on two rivers, the River Laerdalselv and the River Eira, both in west Norway. The River Laerdalselv study utilised direct counts of the number of spawning salmon obtained between 1960 and 1974 to estimate escapement. Counts were utilised from only the eight years in which the conditions allowed a complete count in all parts of the river. The River Eira study utilised redd counts obtained in all years from 1964-1974. Two estimates of escapement were used in exploitation rate calculations.

(a) Assuming escapement = redd count

(b) Assuming escapement = 2 x redd count

In both studies exploitation rates were calculated for the river fisheries using reported catch figures. The total exploitation rates were then calculated utilising the ratio of the reported catches in the local sea fisheries to the local river fisheries. Jensen states that a higher proportion of the river catch may have been reported, which would tend to result in an underestimate of the total exploitation rate. The results are presented in Tables 9 and 10.

2.2.2 Scotland

One paper presented to the Working Group describes the exploitation rates in Scottish fisheries. Data were derived from three sources:

(a) Between 1952 and 1955 and again between 1977 and 1983, salmon caught in coastal bag nets at sites on the west, northwest and east coasts of Scotland and in the Moray Firth were tagged and released and subsequent recaptures were recorded. Apart from the 1952 experiment which took place during the month of April, the tagging operations were carried out during the summer, when the commercial fishing effort was at its peak. The exploitation rates and 95% confidence limits were calculated by assuming that fish caught by coastal net fisheries (fixed engines) were unavailable to river sweep net fisheries, and that fish caught by both coastal net fisheries were unavailable to rod and line fisheries. In addition the following assumptions have been made:

(i) Tagging mortality is negligible
(ii) All tags recovered are reported
(iii) Natural mortality between tagging and recapture may be neglected because the fish pass through the fishery zones in a short period of time
(iv) Tagged and untagged fish are equally vulnerable to each fishing method
(v) Non-catch fishing mortality is negligible.

The results are presented for each of the major fishery regions in Scotland in Tables 11-13. The Working Group noted that the exploitation rates reported for coastal fisheries will be minimal estimates, because the fish may have been available for capture in these fisheries prior to tagging. Local exploitation rates within river systems which are heavily exploited will be underestimated by averaging with rivers which have lower exploitation rates. However the figures refer to exploitation rates within the fishing season, and the exploitation rate on the total stocks will be reduced by escapement during the closed season.

(b) Between 1976 and 1983 salmon caught in a trap in the lower reaches of the North Esk (East Scotland) were tagged and released into the stretch of river downstream from the principle sweep net fishery in the river. All fish in the river catch were inspected for tags by staff from the Scottish laboratory. Tag losses and natural mortality prior to passing through the main fishery were considered negligible. The population passing through the main fishery area during the netting season was estimated using a stratified mark recapture method (Schaeffer, 1951) incorporating a small adjustment for tags taken outside the river. This approach assumes that tagged and untagged fish are equally vulnerable to capture, and that non-catch fishing mortality is negligible. Escapement during the netting season was then calculated by subtracting the catch at the principal netting site, and the netting season exploitation rate is calculated from the escapement and total river catch figures. The results are shown in Table 14. Accurate data from the rod fishery are not available, though it is of limited extent on this river, and accounts for only about 5% of the total catch.

(c) In 1983, salmon caught in a jumper net operated by the Spey Research Trust at the mouth of the River Spey were tagged and released. Adjustments for emigration were made to the estimated number of marked fish available within the river prior to the calculation of exploitation rates by the river sweep net fishery, assuming that the probability of tagged fish being recaptured was equal for fish migrating within the river and outside the river. Exploitation rates by the rod fishery were calculated after further removal of the number of tagged fish captured by the sweep net fishery. The method requires similar assumptions to those described in (a). The following results were obtained:

Nets U = 0.11, 95% limits = $\pm$ 0.03
Rods U = 0.07, 95% limits = $\pm$ 0.03

2.2.3 Iceland

Data relating to Icelandic stocks have been presented for 4 Icelandic rivers by Gudjonsson (1984). In two of these rivers there is both a net and rod fishery and in one case, escapement has been estimated using a resistivity fish counter. In the other two rivers, rod fishing is the only method of capture and in one case, escapement has been estimated using a mechanical fish counter. The exploitation rate on the two rivers with fish counters has been calculated from the escapement and reported catches. Natural mortality during the period that fish are available to the fishery, and non-catch fishing mortality were considered negligible. Exploitation rates on the other two rivers were calculated from mark-recapture experiments, making similar assumptions to those previously described for Scottish coastal tagging experiments. The resulting figures ranged from approximately 0.2 (rod fishery) to 0.85 (rod and net fishery).

2.2.4 Republic of Ireland

Unpublished material for one Southern Irish river, the Burrishoole, was reported verbally to the Working Group. Smolts were microtagged and released at a site near the mouth of the river. All adults ascending the Burrishoole river on return to home waters were captured in a trap and the total number of adult returns taken in the home water net fisheries was estimated by multiplying the number of tags detected in a sample by the ratio of the reported catch to the sample size. It was assumed that tagged fish were randomly distributed throughout the catch. The method assumes negligible natural mortality after entry to the fishery, that all tags present are detected in the fishery samples, that all fish escaping the home water fishery return to the Burrishoole trap, that 100% of the catch is reported and that non-catch fishing mortality may be neglected. Data are presently available from a single year (1982) and suggest an exploitation rate on this stock greater than 80%.

2.2.5 Other Information

Data from a Swedish tagging study of hatchery reared smolts released on the west coast of Sweden showed a high exploitation rate by Norwegian home water fisheries on returning fish from the experiment. Quantitative data were not available to the Working Group.

2.2.6 Conclusions

The Working Group noted that the above estimates were directly applicable only to the years and areas from which they were calculated. It appears that a wide range of exploitation rates occur in home water fisheries in the Northeast Atlantic, ranging from a few percent to over 90%. The exploitation rates estimated for Scottish fisheries showed a wide range between areas, but were relatively stable between years at the same site. The estimated exploitation rates from both Norwegian studies were high, although the Working Group recognised that the exploitation rates on stocks in Norway other than those reported could be quite different. Data from studies of four Icelandic fisheries resulted in a range of exploitation rate estimates from 20-85%. The lowest figures were obtained for western Scotland, the highest for fish released in the River Imsa (south west Norway).

2.2.7 Data Deficiencies and Needed Research

Deficiencies in data in relation to the questions of this section were discussed. The Working Group recommends that estimates of exploitation rates for areas where they are not currently available should be obtained. The estimates should include figures for non-catch fishing mortality in home waters. Estimates should also include figures for illegal fisheries and non-reporting of legal catches. It would be preferable if these data could be collected from carefully chosen rivers.

2.3 OPTIONS FOR TOTAL CATCHES WITHIN SAFE LIMITS

NASCO requested that ICES consider options for total catches for salmon within the Northeast Atlantic Commission area for 1985 inside safe biological limits and advise on deficiencies of available data for this purpose and additional needed data in sampling programs. The problems of estimating a Total Allowable Catch (TAC) for salmon were examined in detail by the Working Group at its meeting in 1982 (Anon., 1982, section 4). The 1984 group re-examined the parameters which would be required for a TAC assessment and evaluated all new information available relating to these parameters.

2.3.1 Recruitment

Little new information was presented describing stock/recruitment relationships for Atlantic salmon stocks. In addition to the requirement for data relating to such relationships discussed in 1982, the Working Group recognised that TAC assessments would require estimates of recruitment into the exploited phase of the life cycle. Research is currently being undertaken by the Scottish laboratory with the aim of evaluating total annual Scottish smolt production. Although such an approach could provide a basis for the assessment of recruitment, it may not be possible to provide such estimates annually, and the possibility of significant fluctuations in post-smolt mortality should be noted. The calculation of a TAC within safe biological limits should therefore incorporate values for post-smolt mortality.

2.3.2 Growth

Some improvements have been made in the estimation of growth parameters for a limited number of stocks. However it was noted that the use of data based on tagged fish could distort growth curve estimates.

2.3.3 Migration

No new data were presented to the Working Group.

2.3.4 Natural mortality

No new data were available to the Working Group.

2.3.5 Stock composition

Information is required on the spatial and temporal distribution of stocks and biological characteristics of stocks. The ability to discriminate between salmon from different stocks in mixed fisheries is a necessary prerequisite to obtaining

such information. Data relating to wild fish of known origin taken in the Faroese fishery are inadequate to allow satisfactory reference standards to be defined for this fishery for the development of a discriminant function.

2.3.6 Catch statistics

The catch statistics currently reported by most countries are nominal catches. For assessment purposes these figures would need to be corrected for non-reporting of catches and non-catch fishing mortality. In addition, sex and sea age composition is required for all landings.

The Working Group concluded that the new information available was not adequate to vary the advice of the Working Group in 1982 that it would not be possible at the present time to estimate and advise on a single TAC which would maintain the home water stocks and safeguard spawning within safe biological limits. Regulation by a single TAC would not seem to be a practicable method to adequately ensure spawning escapement within safe biological limits for stocks which are, at least in part, harvested in mixed stock fisheries operating either on the high seas or in home waters.

2.4 DISTRIBUTION OF SALMON STOCKS

NASCO requested ICES to assess the distribution of salmon stocks throughout the Northeast Atlantic commission area and to identify deficiencies in pertinent data and needed sampling programs.

The Working Group assumed that this question related only to the distribution outside near shore areas of parties to the Northeast Atlantic Commission of NASCO.

The information available to the Working Group comes from three main sources:

I High seas fisheries
II Research vessel surveys
III Incidental observations and illegal fisheries

The observations are presented in Figure 3.

2.4.1 High Seas Fisheries

The Norwegian Sea and the Barents Sea are the only areas where high sea fisheries have taken place to any extent.

During the history of the high seas fisheries, the areas fished have varied widely. Compiling all areas fished, however it appears that viable salmon fisheries have taken place in almost the entire Norwegian Sea from the Shetland-Faroe-Iceland Ridge up to at least 74°N and extending into the Barents Sea as far as Novaya Zemlya.

From tagging data some information, however scarce, exist on the origin of stocks migrating to various parts of the Norwegian Sea. Of 1757 salmon (mostly one sea-winter fish) tagged at sea between 62°30' and 63°00'N and between 5°W and 7°W (ie just north of Faroes) 89 were recaptured in home water fisheries. The distribution of the recaptures indicated that the majority of the tagged fish migrated to Scotland, Norway and Ireland and to a lesser extent England, Northern Ireland, Sweden and USSR.

Recaptures of salmon tagged as smolts in the Faroese fisheries have confirmed that rivers in Norway, Scotland, Sweden, England and Ireland contribute to this fishery.

In Figure 4, recaptures of smolt tagged salmon in Faroese fisheries in the 1982/83 season from Sweden, Scotland and Norway are plotted by statistical rectangle in which they were caught. From this it appears that salmon originating from these countries are found well mixed within the Faroese fisheries zone. The proportion of number of tags recovered per 10 fish caught (Fig. 5) appears however to be higher towards the north and west. This would imply that the salmon stocks are not randomly mixed within the Faroese area. Using a X^2 test this tendency was found to be significant ($p<0.001$). Further north in the Norwegian Sea, recaptures of salmon tagged as smolts originating from all European countries have been reported at least as far north as 70°N. The proportions of tag returns originating from Norway and USSR in relation to other European countries, however, appear to increase with latitude.

2.4.2 Research Vessel Surveys

Outside the Barents Sea and the Norwegian Sea, experimental fishery has been conducted in the Irminger Sea (Jensen and Lear, 1980). In this experiment, salmon catches were widely distributed within this area. The catch per unit effort was less than that found in the West Greenland fishery. Based on scale characteristics 21% of the salmon caught were of North American origin and 79% European.

2.4.3 Incidental Observations and Illegal Fisheries

Salmon have been caught incidentally throughout the North Sea and the Irish Sea. Illegal fishing is known to have taken place as far as 50 nm of the North West Irish Coast.

2.4.4 Data Deficiencies and Needed Research

It was pointed out that a complete and general answer to the question of this section would require a costly research program. Answers could be given on some aspects with more modest programs if NASCO could elaborate on the kind of information required. As it is doubtful that a major program can be prepared in the near future, delay in feedback from NASCO on the kind and accuracy of the data required would not be serious.

2.5 SALMON BIOMASS IN THE FAROESE FISHING ZONE

NASCO requested that ICES assess the salmon biomass in the fisheries zone of the Faroe Islands and estimate the average weight gained and the feed consumed by salmon in this area. Furthermore ICES was requested to specify deficiences in data pertaining to this question and sampling programmes required in order to obtain such accuracy.

The Working Group was not able to carry out these assessments. No estimates of salmon biomass in the Faroese area were available, nor was there information on duration of stay in the Faroese zone or the food consumed there.

A model was presented to the Working Group (B. Hansen, in prep.) from which the total stock of salmon in the Faroese area might be estimated from catch in number per unit effort, if better knowledge becomes available on the behaviour of salmon during the feeding season. The model is based on the assumption that salmon under these conditions do not have systematic migratory movements, but move in a random manner associated with their search for prey. This leads to a "random walk" description, which is analogous to molecular diffusion. At the present stage there has been neither confirmation of the basic assumptions underlying the model, nor estimation of values for the critical parameters entering the model, but an experiment based mainly on acoustic tagging of salmon might provide the lacking knowledge and permit an absolute stock estimate.

2.5.1 Data Deficiencies and Needed Research

The deficiencies in data required to assess the salmon biomass in the fisheries zone of the Faroe Islands and to estimate the average weight gained and the food consumed by salmon in this area were discussed. It was concluded that it was a complex question but could be approached in two ways:

1 Estimate average biomass and average instantaneous growth rate at a number of times during the year with no relation to immigration and emigration of individual fish

2 Estimate biomass taking into account the duration of stay at the Faroes of individual fish, which would require apart from data on abundance, data on duration of stay, size at time of arrival and departure, specific growth rates by sea age class, stomach samples for feeding rate, food consumption and conversion rates. It would also be necessary to have estimates throughout the year and over the entire Faroe fisheries zone. These estimates would have to be ongoing to establish annual variation.

Estimates of salmon abundance could, in principle be provided by acoustic surveys, refinements of the catch rate model described above and by tagging. Tagging programs are discussed in section 2.1.

2.6 EFFECTS OF HARVESTING SALMON AT DIFFERENT STAGES OF THEIR MIGRATION ROUTES

NASCO requested ICES to assess the relative effects of harvesting salmon at different stages of their migration routes and to identify deficiencies in pertinent data and needed sampling programs.

Available information which could be used to describe the salmon migration routes is very scarce apart from in some inshore areas. The question could therefore only be answered in relation to the various fisheries. With regard to the Faroese fishery the relative effect on returns home waters is presented in Table 15 (see also section 2.1). From these it appears that the highest relative losses occur when harvesting young fish which would have matured one year later and the least when harvesting older fish which would have matured the same year.

Within the Commission area there are a number of interception fisheries inside national 12 mile limits in which salmon originating from other countries are caught. From tagging data it appears that most of these fish would have reached home water a few weeks after capture and the relative losses consequently not very great. However, significant numbers of these fisheries are conducted with drift nets (Table 16) which in addition to the reported landings also induce non-catch fishing mortality.

2.6.1 Data Deficiencies and Needed Research

The deficiencies in the data available from the Faroes and Norwegian Sea areas and home waters to assess the relative effects of harvesting salmon at different stages of their migration routes were outlined section 2.1: non-catch fishing mortality, ratio of the weight at each sea age class in home waters to the mean weight at Faroes, proportion by weight of each sea age class relative to the total nominal catch, estimated proportion of the fish of each sea age class in the fishery returning in the same and subsequent years and survival rates of different sea age classes between Faroes and home waters. Further deficiencies were identified as data needed to improve estimates of specific growth curves and a requirement for sex ratios in light of the information on the selectivity by sex due to the differences in timing of the fishing seasons in home waters.

The need for information on post smolt mortality which had been identified by many authors was highlighted. Information on this subject would help to clarify whether there is large scale straying of salmon which do not return to home waters.

3 WEST GREENLAND AND RELATED HOME WATER FISHERIES

3.1 THE WEST GREENLAND FISHERY 1982 AND 1983

NASCO requested that ICES describe events in the West Greenland fishery in 1982 and 1983 including regulations in effect, gear and vessels in use, temporal and geographical distribution of the fishery, and the quantity and composition of the catches by continent and, if possible, country of origin.

3.1.1 Statistics and Composition of the Fishery and the Regulations in Force

The reported nominal catches of salmon at West Greenland in the years 1960 to 1983 are given in Table 17.

The 1982 fishery took place in the period 25 August to 26 November resulting in a nominal catch of 1077 tonnes which was 176 tonnes or 14% below the quota of 1253 tonnes. As in previous years the total quota (TAC) was divided into two components: a "free component" (1021 tonnes) for which all licensed fishermen could fish, and a "small boat component" (232 tonnes) allocated to small vessels on a district basis. The free component was closed by 16 September, the catch at that date amounting to 993 tonnes. The "small boat component" was fished for thereafter, and as the catches between 17 September and 11 October were only 53 tonnes the regulatory scheme was revised so that the remaining part was opened to all licensed fishermen. However, only a few fishermen switched back to salmon fishing at that time, and from 12 October to 26 November only 31 tonnes were taken.

The 1983 fishery was opened on 10 August and the last landings of that year were made on 13 November, when the total nominal catch was 310 tonnes, ie 74% below the quota of 1190 tonnes. The "free component" of the quota was 958 tonnes and the "small boat component" 232 tonnes. After the first two weeks' fishing the catch was much below those made during the first two weeks of the 1981 and 1982 seasons. This tendency continued throughout the 1983 season. In the table below the total catches for the first week and the two first weeks for the years 1981-1983 are given:

	Nominal catch in tonnes	
Year	First Week	First two weeks
1981	465	735
1982	470	766
1983	105	192

The geographical distribution of the landings in the 1982 and 1983 fisheries (Table 18) was rather similar to those in 1976-81, ie the main part of the catch was from NAFO Divisions 1B and 1C (Fig. 6). The distribution of the fishery in terms of distance to the shore is not known, but the fishery took place between the shore and approximately 40 nautical miles from the baseline.

All the catch was taken by gill nets. Most of the catch was taken by drift nets, although some inshore set gill nets were still in use. The mesh size in force is 140 mm (stretched mesh). This is a target mesh size, not a minimum mesh size. The type of boats participating in the salmon fishery varies from small open boats to small cutters up to 60 GRT.

No measures of effort are available. Reports of reduced participation after the initial phase suggest that there was less fishing effort in 1983 than in previous years. The number of licences is not a reliable measure of fishing effort since many licencees do not participate in the fishery.

3.1.2 Origin of Salmon at West Greenland

In 1982, the Working Group recommended (Anon., 1982) that the possible inaccuracies in the discriminant function classifications of salmon of North American and European origin at West Greenland be investigated further. A new data base has been developed, based on scale samples from fisheries in 1980 in home waters in North America and Europe. The new database was established because of observed changes in the growth of European origin salmon in 1980. Country of origin was not considered as the database was thought to be insufficient for this type of analysis.

The best variables for discriminating between North American and European origin salmon were circuli counts in the winter and summer bands of the first sea year read at 45° from the longitudinal axis.

A test sample independent from the data base used for developing the discriminant function, showed a misclassification of only 2% with the new technique. Further test samples collected in the home water fisheries of Europe and North America in 1982 and 1983 indicated misclassifications of 6.6% and 4.6% respectively. Only a small bias was observed in favour of either group in both years.

The new discriminant function was used to identify the continent of origin of salmon in the West Greenland fishery in 1982 and 1983. The results indicated that the proportion of salmon of North American origin in samples from commercial catches at West Greenland in 1982 was 62% (95% CL 60-64) and in research vessel catches in 1982 it was 47% (95% CL 43-52). In samples from commercial catches in 1983 it was 40% (95% CL 41-38) (Table 19). These confidence limits assume sampled fish were taken at random throughout the catches. The sampling at West Greenland in 1982 was limited and the high value of 62% depends heavily on a single catch landed at Godthaab. This 1982 value derived by combining numbers of North American and European salmon sampled from landings at Holsteinsborg and Godthaab shows the largest discrepancy between research and commercial vessels in the time series (Table 19). Comparisons to investigate spatial and temporal trends showed no temporal trends but differences in North American proportion between NAFO Divisions and inshore and offshore areas were indicated. There is no trend in proportion of continent of origin of research and commercial catches at West Greenland but the observed value of 40% of North American origin in the 1983 commercial samples is considerably below those of the previous two years.

3.1.3 Biological Characteristics

Biological characteristics of salmon were recorded by sampling research vessel catches in 1982 and commercial catches in 1982 and 1983. The samples were analysed for fork length, whole weight, and age differences among fish identified to continent of origin. North American origin salmon were shorter and lighter than their European counterparts, similar to previous observations. The sea and smolt age compositions of samples collected at West Greenland in 1982-1983 are summarised in Tables 20 and 21 respectively. The sea age composition in 1982 of 6.0% multi sea-winter salmon and previous spawners is derived from a combination of samples of commercial landings in NAFO Divisions 1B and 1D. Samples from 1B had a higher percentage of multi sea-winter salmon and previous spawners (7.7%) than those from 1D (2.8%). The 1983 samples, although more numerous, were also taken in 1B and 1D but comparison of individual samples showed a uniform distribution of sea ages. The increase in the proportion of multi sea-winter salmon and previous spawners in 1982 and 1983 is consistent with fish plant records of the weight distribution of commercial landings landed in Division 1B.

In 1982, there was a small reduction in mean smolt age observed in samples from commercial and research vessel catches at West Greenland in comparison with that observed previously. In 1983, there was a substantial reduction in mean smolt age observed in samples from commercial catches in 1B and 1D and, correspondingly, a large increase in proportion of one year old smolts from Europe. This value of 35% is more than twice the 1982 value of 15% (Table 21).

3.1.4 Research Recommendations

The Working Group recommends the following projects to improve the information base on the West Greenland salmon fishery:

1. An attempt should be made to collect catch per unit effort data in the West Greenland fishery.
2. The annual commercial landings sampling program at West Greenland should be expanded to include a sampling location in southern Greenland so that the commercial landings can be more uniformly sampled.
3. The database for discriminant analysis used to identify continent of origin of salmon caught at Greenland should be tested every two years beginning in 1985. The test database should also be expanded to include scales from salmon from additional stocks known to contribute to the West Greenland fishery.
4. Discrimination should be attempted of country of origin of salmon in commercial catches.

3.2 POSSIBLE CAUSAL FACTORS FOR LOW 1983 CATCHES AT WEST GREENLAND AND IMPLICATIONS FOR 1984

NASCO asked ICES to explain the importance of various possible causal factors leading to the very low 1983 harvest of salmon at West Greenland and advise on the implications of the low harvest on returns of large salmon returning to home waters.

The water temperature off West Greenland has decreased considerably during the past 3-4 years as illustrated by the mean temperature of the water column (40 m) over the Fylla Bank (Fig. 7). The mean temperature of the water column in June 1983 was about 0.4°C, the lowest recorded since 1970. Surface water temperatures were also quite low, similar to those experienced in the early 1970's. This was most likely to be due to an abnormally strong 1982/83 winter cooling in the Davis Strait area, resulting in greater formation of ice which inhibited normal summer temperature increases.

Significant correlations (R^2 = 0.40 and 0.65, $p<0.05$) were obtained for catch per unit effort on sea surface temperature during experimental fishing in 1972 and 1982 but not within other years. Similar data for all years combined 1969-83 shows a weak correlation (R^2 = 0.11).

A review of the sea age composition of the 1983 catches at West Greenland suggests that one sea-winter salmon were not as abundant, relative to multi sea-winter salmon, as in previous years.

The low 1983 catch of one sea-winter and multi sea-winter salmon at West Greenland is coincident with low abundance of one sea-winter and multi sea-winter salmon in Canada (Table 22) and multi sea-winter salmon in USA. The total landings in eastern Canada in 1983 were the second lowest recorded in recent years. Since almost one half of the salmon normally harvested at West Greenland is of Canadian origin, a low abundance of Canadian salmon producing stocks would negatively impact on the catches at West Greenland.

Low returns of two sea-winter spring salmon to several rivers in Scotland, December 1983 - April 1984, also suggest low abundance of some stock components that would normally be expected to make a significant contribution to West Greenland catches in 1983. The Working Group has no evidence of reduced abundance of salmon originating from other countries which would have contributed to the West Greenland fishery in 1983.

Although hard data are not available, field observations suggest that low catch rates were experienced by Greenlandic fishing vessels in the initial phase of the fishery in 1983. This resulted in a subsequent reduction in the number of vessels fishing for salmon.

Low abundance of spawners occurred in 1978 and 1979 in many Canadian rivers, probably as a result of lower than normal marine survival of the 1977 smolt class. The subsequent reduced egg depositions in 1978-79 would affect the abundance of one sea-winter and two sea-winter salmon with total ages three and four in 1983. Thus the lower than normal abundance of one sea-winter salmon originating in rivers in Nova Scotia, New Brunswick, and parts of insular Newfoundland and Quebec and two sea-winter salmon in some Gulf of St Lawrence rivers may be at least partly attributed to low egg depositions in 1978 and 1979. This does not, however, totally explain the almost uniform low abundance of one sea-winter and two sea-winter salmon throughout the Canadian fisheries, particularly of salmon from spawning before 1978 and 1979.

There was no indication of reduced survival of eggs to smolts related to the 1982 smolt class.

Reduced marine survival of hatchery-reared smolts of Saint John River origin was noted for 1982 releases and to a lesser extent, for the 1981 releases (see section 4). One sea-winter and two sea-winter return rates for releases of hatchery-reared smolts 1974-82 were significantly correlated (R^2 = 0.45 and 0.56 respectively) with recorded Canadian catches and therefore can be considered to be an index of marine survival for Canadian salmon stocks. Thus, the reduced marine survival in the 1981 and 1982 smolt classes would appear to contribute partly to the low abundance of one sea-winter and two sea-winter salmon in Canada and at West Greenland.

The Working Group concluded that the low catch at West Greenland in 1983 was possibly caused by several factors:

1 low sea temperatures which may have affected the catch rates and/or availability of salmon,
2 reduced stock abundance in Canada, and reduced abundance of the spring-run component in Scotland, and
3 possible reduced fishing effort.

There was evidence for Canadian stocks that low abundance was influenced by low egg depositions and lower marine survival.

It was concluded above that the low abundance of some stock components which normally contribute to catches at West Greenland may have been partly responsible for the low 1983 catch there. Low abundance would suggest low returns of two sea-winter salmon to some rivers in 1984. It is however, likely that this will vary

between rivers and countries. The lower abundance of salmon of North American origin relative to those of European origin at West Greenland in 1983 seems to indicate that a relative lower return is more likely to occur in North America than in Europe. This is supported by the low abundance of one sea-winter salmon in Canada in 1983. No estimate of stock size for 1983 is available to quantify the extent of the expected low return of two sea-winter salmon in 1984.

Any decrease of fishing effort and/or decrease in catchability of salmon at West Greenland in 1983 would mean that the low catch at Greenland could exaggerate the apparent low stock abundance. In view of the Working Group's previous advice that catching of fish at West Greenland impacts on the catch of salmon in home waters, a reduction in fishing mortality at West Greenland will reduce the loss to home waters.

3.3 EFFECTS OF CATCHES AT WEST GREENLAND UPON HOME WATER STOCKS AND FISHERIES

NASCO requested ICES to advise on the effects of varying levels of harvest at Greenland on subsequent returns of large salmon to home waters.

The last assessment by the Working Group on the effects of the West Greenland fishery upon subsequent stocks and yields in home waters was made in 1980 (Anon., 1980). Assessments since that time have been concentrated on estimating TAC's corresponding to varying opening dates equivalent to a TAC of 1190 tons with the opening date of 10 August assuming a 140 mm mesh size. The Working Group has been guided in these analyses by the principle of ensuring the same proportion in the catch as in the mixture of stocks at West Greenland between the component originating from rivers in North America and that originating from Europe.

Although some of the parameters, for instance the proportional contribution by continent of origin, do fluctuate somewhat between years, the Working Group did not find sufficient changes in the parameters to warrant a new assessment on the direct effect of the West Greenland fishery on home water stocks and yield.

From its most recent assessment (Anon., 1980) the Working Group concluded that for each tonne of European origin salmon in the reported catch at West Greenland, from 1.29 to 1.75 tonnes would be lost, on average, to European home water stocks. Similarly, for each tonne of North American origin salmon in the reported catch at West Greenland, from 1.47 to 2.00 tonnes would be lost to North American stocks. Thus the combined loss to home waters per tonne of reported catch at West Greenland is likely to be from 1.37 to 1.85 tonnes.

The Working Group noted that the recapture rate at West Greenland of fish tagged as smolts in Scotland has decreased in most recent years. Since the overall reporting rate for recaptures in the Greenland fishery seems not to have decreased to the same extent, it appears that the contribution of Scottish rivers to salmon at West Greenland may have decreased in most recent years. The effect of the Greenland fishery upon Scottish stocks seems to be mainly on the spring run of salmon, and the abundance of this component of the Scottish stock has decreased in recent years.

3.4 EFFECTS OF HOME WATER CATCH LEVELS UPON SUBSEQUENT SPAWNING STOCK AND SMOLT PRODUCTION

NASCO requested ICES to examine the effects of home water catch levels upon spawning stock and subsequent smolt production.

Exploitation rates of salmon in home waters can vary over a very wide range of values, from less than 10% to over 90%. As in section 2.2, exploitation rate U is defined as the catch in number divided by the number of salmon available to the fishery concerned. The significance of the exploitation rate with respect to spawning stock and smolt production depends upon the capacity of the particular natal river to support egg deposition and rearing of fry, parr and smolts. When this capacity is reached or exceeded, the relationship between the escapement from the home water fishery and subsequent smolt production becomes less than proportional or, perhaps, inverse. Otherwise, the relationship between escapement and smolt production is direct, as is the case with most of the Canadian rivers examined. Assuming egg deposition and rearing capacities are not reached or exceeded, it is more advantageous to reduce exploitation rates that are high than rates that are relatively low. For example, if the exploitation rate is 90%, a 10% reduction would almost double spawning escapement; whereas, if the exploitation rate is 20%, a 50% reduction (to an exploitation rate of 10%) would only increase escapement by 12.5%. Growth and natural mortality between the period of the home water fishery and spawning are assumed to be negligible, so that the reduction in spawning stocks resulting from home water catches is approximately proportional (1:1).

3.5 EFFECT OF THE FAROESE FISHERY ON THE OCCURRENCE OF SALMON AT WEST GREENLAND

NASCO requested ICES to advise whether and to what extent the salmon fishery at the Faroes catches salmon which would otherwise subsequently be available to the West Greenland fishery.

Tagging of salmon at sea close to the Faroes between 1969 and 1975 produced evidence that the Faroese fishery harvested salmon that would otherwise be available to the West Greenland fishery. Three of the 91 recoveries from the 1751 fish tagged in Faroese waters were made at West Greenland. There has been no tagging at sea at the Faroes since 1975.

In recent years the fishery at the Faroes has moved north where it now harvests salmon which are roughly 80% maturing and more than 90% two sea-winter and older (see section 2.1). The West Greenland fishery harvests salmon which are non-maturing and more than 90% one sea-winter (Table 20). The age composition of the present catch at Faroes is older than that of both the catch in earlier years and the fish which were tagged. This change in age composition is attributed to the recent northward movement of the fishery. The age composition of the present Faroese catch resembles that reported for the 1971-73 Danish long-line fishery in the Norwegian Sea situated north of latitude 68°.

On the basis of the differences in maturity status and sea age composition of the catches in the Faroese and Greenland fisheries, the Working Group concluded that the Faroese fishery does not harvest significant numbers of salmon that would otherwise subsequently be available to the West Greenland fishery. It was noted however that the Faroese fishery may be harvesting salmon on their return migration from West Greenland to European rivers. Further, the Faroese fishery may be impacting on spawning stocks which contribute to both Faroese and Greenland fisheries.

On the basis of the two recent recaptures of tagged fish from Canada in the Faroese fishery, the Working Group noted that the fishery at Faroes harvests some salmon that might otherwise return to North American rivers. These fish might however be strays. Scale samples for discriminant scale analysis to establish the extent of North American fish in the Faroes catch should be made available.

4 MARINE SURVIVAL

ICES requested the Working Group to assess possible causes of the apparently poor marine survival of salmon stocks contributing to many fisheries in 1983.

Poor marine survival of the 1982 smolt class was not apparent for a number of Atlantic salmon stocks (Table 23). There was direct evidence for poor marine survival from one Canadian river, the Saint John (see section 3.2). There was also indirect evidence, based on low harvests and escapements, of poor marine survival for some salmon stocks in Labrador, the east coast of Newfoundland, and the north shore of Quebec. In the North Esk, Scotland, there was direct evidence that the marine survivals of the 1980-82 smolt classes were lower than values observed for smolt classes 1974-76. There is no information to identify possible causes. Observations in Sweden and Iceland suggest that marine survival of salmon can be adversely affected by cold temperatures at sea.

5 GEAR SELECTIVITY

The Chairman of ACFM requested the Working Group to report on mesh size regulations and selectivity of commercial fisheries for salmon in the North Atlantic.

Information on this subject is limited. There are no commercial fisheries for salmon in the USA and France, but some fish are caught in gear set to catch other species. For example, approximately 5 tonnes of salmon are taken at St Pierre and Miquelon. Information on commercial salmon fisheries in Sweden and the USSR was lacking at the time of writing this report. Information on the Faroese (including Denmark's fishery) and Greenland fisheries is presented elsewhere in the report. Additional information on commercial salmon fisheries can be found in the Working Group's Report for 1979 and 1980 (Anon., 1980). No information is available for commercial fisheries for salmon in Portugal and Spain. All measurements of mesh sizes refer to stretched mesh size.

5.1 CANADA

Three types of gear are used, viz., fixed gill nets, fixed trap nets and drift nets. All nets are made of multifilament synthetic material (single filaments of a size greater than 50g/9000m are banned). A total of 5689 licensed fishermen operate a total of 20,832 nets of which more than 90% are fixed gill nets. The minimum mesh size is generally 127mm although in some areas of Newfoundland it is 114mm and in New Brunswick and Prince Edward Island there is no minimum mesh size. No data on gear selectivity in Canadian salmon fisheries exist. Approximately 67% of salmon landed from these fisheries are two sea-winter or older. On three rivers, Miramichi, Restigouche and Saint John, commercial catches are controlled by quota. All salmon caught in Canadian waters outside the province of Newfoundland must be tagged to identify legally caught salmon. By-catches of Atlantic salmon are banned in all provinces.

5.2 ENGLAND AND WALES

In recent years about 75% of the commercial nominal catch of salmon for England and Wales has been taken by drift nets, the major fishery operating on the NE coast between June and August. A large part of the remaining catch is taken by seine and trap nets while small numbers of salmon are taken by a large variety of other methods. About 860 licences are issued annually for commercial fishing and, depending on the fishing method, the licence may be worked by an individual fisherman or a team of 2 to 5 men. In all fisheries the amount of gear that may be used is restricted and weekly closed periods exist.

Use of monofilament nets is prohibited in some areas but not in the major drift net fisheries. Minimum mesh regulations vary from area to area but are generally between 75 and 100mm. Most of the drift nets used have mesh sizes between 125 and 130mm and the most selected length of salmon taken by 127mm nets is estimated to be 64cm.

5.3 FINLAND

On the River Tana, salmon are caught by gill, seine and drift nets but in the River Neiden netting is limited to the use of gill nets. Although nets manufactured from monofilament twine are permissible in the River Neiden, nets made from this material are not allowed in the River Tana. In the main channel of both rivers the minimum mesh size of the salmon gill nets is 116mm but if used in tributaries the mesh size may be reduced to 80-90mm. The numbers of gill nets operated in the Rivers Tana and Neiden are 150-200 and 60-90 nets respectively. In 1983 there were 1017 net fishermen licensed to fish the River Tana. Commercial rod and line fisheries also operate in the River Tana. The minimum size of retained salmon is 25cm in both River Tana and River Neiden.

The fishing season in the River Tana extends from 1 May-31 August but melting ice usually delays the start of fishing until 31 May. Gill net fishing is only permitted three days per week between Monday and Thursday evenings. Each fisherman is allowed to fish only two gill nets at recognised sites. From 1984 it is planned to close the season on the 20 August in the River Neiden.

5.4 ICELAND

In Iceland, netting is mainly confined to three glacial rivers. The fishing is carried out at about 100 farms and this amounts to about 30% of the total catch. The gear used comprises gill nets manufactured from nylon and having a minimum mesh size of 90mm. The fishery tends to be selective for two sea-winter fish. Netting is limited to the period between 1000 hrs on Tuesday and 2200 hrs on Friday each week during the fishing season. The fishing season varies from river to river but is limited to three months within the period 20 May to 20 September.

5.5 IRELAND

Salmon fishing in Ireland is banned beyond twelve miles by an EEC directive. Generally the salmon fishing season extends from March until the end of July with a weekly closed time extending from 0600 hours on Saturday to 0600 hours the following Monday morning. Four types of nets are used (drift, draft, snap and loop nets) and traps are operated in a number of rivers. The nets are manufactured from multifilament synthetic twine (nylon, polypropylene) and the minimum mesh size is 89 mm. Eighty-three percent of the catch was taken by the drift net fishery in 1983. There is no information on the selectivity of the nets. A total of 1616 net licences is issued each year.

5.6 NORTHERN IRELAND

Within Northern Ireland waters, the closed season for commercial salmon fishing extends from 16 September to 17 March. In the area licenced by the Foyle Fisheries Commission (from which catches are allocated 50% to Northern Ireland and 50% to the Republic of Ireland), the closed season extends from 1 September to approximately mid-June (exact date variable). Weekend closed periods also operate in both areas. Multifilament nets (nylon and polypropylene) only are permissible in both areas, with minimum mesh size of 89 mm for drift nets and 64 mm for draft nets. A total of 125 drift net licences (114 of these in the Foyle area), 232 draft net (217 of these in the Foyle area) and 17 bag net licences (1 of these in the Foyle area) are issued. In addition, one licence is issued for a trap fishery in one river. There is no information on selectivity.

5.7 NORWAY

The great majority of commercial salmon fishing in Norway occurs at sea (within 12 miles of the coast). Four types of gear are used viz., drift nets, bag nets or pound nets, bend nets and stationed lift nets and of these, more than 75% of the nets in use are drift nets. The materials used include spun nylon for bag nets and lift nets and monofilament nylon (mostly) in bend nets. Drift nets may be constructed of monofilament, multimono and multitwine but approximately 80% are made of monofilament. The minimum mesh size permitted is 116 mm and most bag nets and lift nets are made in this mesh size. The mesh sizes used in bend nets are not known but must not be less than 116 mm. More than 70% of drift nets have mesh sizes of 130-140 mm although mesh sizes as small as 116 mm may be used. In 1982, at most 55% of the Norwegian commercial nominal salmon catch was taken by drift net. No details are available on gear selectivity.

Drift net and bend net fishing is permitted during the period 1 June to 5 August and bag nets and lift nets may operate from 15 May to 5 August. In all cases, there is a weekly closed time extending from 1800 hours on Friday to 1800 hours on Monday. The only licensed salmon fishery operated is the drift net fishery and in 1983 a total of 632 licences was issued. The number of drift nets that can be used in each licence is restricted.

5.8 SCOTLAND

The two main types of gear used to catch salmon on the Scottish coast are bag nets and stake nets. Within estuary limits, the only method of netting permitted is fishing by net and coble (drag, draught, seine or sweep-net). Nets are manufactured from synthetic twine (eg. courlene, ulstron). The minimum permissible mesh size of any net used to catch salmon is 89 mm. Netting intensity is very variable around the coast and in some rivers there are no net and coble fisheries. Fishermen in Scotland do not require a licence to fish for salmon, but must own or lease fishing rights. During the fishing season, generally between mid February and the end of August (exact dates vary in different districts although there is a statutory annual closed period of 168 days), netting is permitted between the hours of 0600 on Monday morning and noon on the following Saturday. No measure of the selectivity of these nets is available.

5.9 THE PHYSICAL PROPERTIES OF GILL NETS IN RELATION TO MESH REGULATIONS

In the context of home water fisheries the Working Group requests that additional information be provided on the evidence which led to the banning of monofilament nets in various areas. The Working Group also recommends further practical validation and documentation of the experimental conclusions found in Potter (1982).

6 FUTURE RESEARCH

6.1 RESEARCH PRIORITIES FOR NORTH ATLANTIC SALMON IN THE CONTEXT OF NASCO

It was agreed that a list of NASCO research priorities would be helpful to the Working Group. The following was proposed as an amended version of the statement considered by NASCO at its January 1984 meeting:

Effective conservation, restoration and enhancement of North Atlantic salmon stocks require the establishment and maintenance of a scientific information base and the better understanding of mechanisms whereby natural factors and human interventions affect salmon stocks. The Council recognises the vital role of coordination of research and compilation of data which could be played by ICES. The following programs of research are considered essential for NASCO to meet its objectives:

1 A systematic program should be undertaken to monitor all North Atlantic salmon fisheries. Biological samples of catches should be taken in addition to the compilation of statistics of catch, fishing effort, non-catch fishing mortality*, fishing gear and seasons.

2 A statistical database of catch, fishing effort, seasons and fishing gear, together with artificial smolt production, mark and recapture data and biological sampling information should be developed.

3 Research should continue on the identification of the location of origin of salmon. These studies should aim to improve scientific methodology, increase knowledge of salmon migration and provide estimates of total stock production.

4 Specific rivers, some of which should include multi sea-winter stock components, should be selected and monitored over a long period to provide information on annual smolt production, exploitation rates, geographical distributions of catches, adult returns and spawning escapement. Such monitoring should aim additionally to improve knowledge of factors influencing the salmon productivity of the freshwater habitat leading to improved estimates of optimal spawning levels and assessment of means to improve the productivity of salmon rivers.

5 A program should be developed to define and study factors influencing the natural mortality and age at maturity of salmon in the sea with special emphasis on determining the extent and causes of mortality in the months following the entry of smolts into the sea.

6 In addition it would be desirable to determine the geographical distribution of salmon throughout the marine phase.

7 OTHER BUSINESS

7.1 ABUNDANCE PROJECTION FOR CANADIAN SALMON STOCKS IN 1984

The poor returns of one sea-winter salmon abundance in Canada in 1983 indicate low returns of two sea-winter salmon in 1984. The low egg depositions in northern rivers in 1978 and 1979 are expected to result in low returns of one sea-winter salmon in 1984 and two sea-winter salmon in 1985. Most large salmon producing rivers in the Gulf of St Lawrence and the Saint John River have experience reduced egg depositions in recent years. Thus low abundance is expected for these stocks for several years. Since these stocks are known to make a significant contribution to the West Greenland fishery, the projected low abundance of Canadian stocks may reduce the catch rates in that fishery from historical average levels.

* Non-catch fishing mortality refers to fish mortalities generated directly or indirectly by fishing which are not included in recorded catches.

Appendix I

ICES Working Group on North Atlantic Salmon
(April 28 - May 4, 1984)

AGENDA

1. Call to order
2. Adoption of agenda
3. Distribution of meeting documents
4. Organisation of meeting
5. Northeast Atlantic

   A. Assess the effects of the fishery in the Norwegian Sea and Faroes area on home water fisheries and stocks, in particular assess the implications of existing catch limits;

   B. (a) Assess the exploitation and the fishing mortality exerted upon the salmon stocks which migrate in the Northeast Atlantic Commission area, divided between the following fisheries:

      (i) home water fisheries (as far as possible, divided between river fisheries and sea fisheries inside 12 miles)

      (ii) sea fisheries outside 12 miles

   (b) Consider options for total catches for the salmon inside safe biological limits for 1985.

   C. In order to enable the Commission to consider the factors referred to in Article 9 of the Convention when proposing regulatory measures, in particular subparagraphs (d) and (e), ICES is requested to:

   (a) assess the distribution of salmon stocks throughout the Northeast Atlantic Commission area,

   (b) assess the salmon biomass in the fisheries zone of the Faroe Islands and estimate the average weight gained and the feed consumed by salmon in this area,

   (c) assess the relative effects of harvesting salmon at different stages of their migration routes.

6. West Greenland and Related Home Water Fisheries

ICES is requested to describe, explain and interpret events in the West Greenland Atlantic salmon fishery in 1982 and 1983 so as to furnish a scientific basis for the consideration of management measures by the Commission. Specifically, ICES is requested to:

A. Describe events in the West Greenland fishery in 1982 and 1983 including regulations in effect, gear and vessels in use, temporal and geographical distribution of the fishery, and the quantity and composition of the catches by continent and, if possible, country of origin.

B. Explain the importance of various possible causal factors leading to the very low 1983 harvest of salmon at West Greenland and advise on the implications of this low harvest on returns of large salmon to home waters in 1984.

C. Advise on the effects of varying levels of harvest at Greenland on subsequent returns of large salmon to home waters.

D. Advise on the effects of varying levels of harvest in home waters on spawning stocks and subsequent smolt production.

E. ICES is also requested to advise whether and to what extent the salmon fishery at the Faroes catches salmon which would otherwise subsequently be available to the West Greenland fishery.

7. Marine Survival

The Working Group should meet to assess possible causes of the apparently poor marine survival of salmon stocks contributing to many fisheries in 1983.

8. Gear Selectivity

The chairman of ACFM has requested the Working Group to document mesh sizes of gear used in commercial salmon fisheries together with estimates of the most selected length for a given mesh size and material and any minimum landing size regulations.

9. Future research

A. Decide on specific research directions required for research programmes oriented towards the improvement of future assessments in the Norweigan Sea and Faroes area.

B. Specify deficiencies in data pertaining to question 5B and C and sampling programmes required in order to obtain the required accuracy.

C. Consider research priorities by North Atlantic Salmon in the context of NASCO.

10. Other business

11. Adoption of report

Appendix II

DOCUMENTS SUBMITTED TO THE WORKING GROUP

1 Environmental conditions in the West Greenland region during 1983. Mountain, D.G.

2 USA Status Report - 1983. Boreman, John.

3 Commercial fishing gear - Canada. Anon.

4 Causes and implications of low 1983 Atlantic salmon catch in Greenland. Reddin, D.G. and J.R. Keeley.

5 Possible causes of low abundance of Atlantic salmon in Canada - 1983. Porter, T.R. and J.A. Ritter.

6 The influence of spawning stock on production and yield of Atlantic salmon. Chadwick, E.M.P.

7 An update: The use of scale characters and multivariate analysis to discriminate between Atlantic salmon (Salmo salar L.) of North American and European origin caught at West Greenland. CM 1983/M:11 Reddin, D.G. and R.F. Burfitt.

8 Length, weight, sex and age characteristics of Atlantic salmon (Salmo salar L.) of North American and European origin caught at West Greenland in 1982-1983. Reddin, D.G. and P.B. Short.

9 Identification of North American and European Atlantic salmon (Salmo salar L.) caught off West Greenland in 1982-1983. Reddin, D.G., R.F. Burfitt, and P.B. Short.

10 Information on salmon fisheries in England and Wales. Potter, E.C.E.

11 Report of the meeting of the study group of the North Atlantic Salmon Working Group at Torshavn 27-30 March 1984. Anon.

12 The number, mean length (cm) and weight (kg) and age composition of net and coble catches taken in Rivers Tweed, Tay, North Esk, Dee and Spey - April 1980-1984. Shearer, W.M.

13 The seasonal distribution of the various age groups of salmon present in the North Esk net and coble catch 1981-1983. Shearer, W.M.

14 The exploitation of Atlantic salmon, Salmo salar L. in Scottish home water fisheries. Shearer, W.M.

15 A note describing the geographical distribution of the recapture sites on the Norwegian Sea of salmon tagged as smolts in Norway, Scotland and Sweden. Hansen, Lars P., Nils Johansson and W.M. Shearer.

16 Fluctuations on the mean lengths attained by North Esk salmon at the end of their first winter in the Sea, 1963-1983. Shearer, W.M.

17 A summary of the analysis of data from the salmon long line fishery, Faroes 1981-1982 and 1982-1983. Clarke, D.

18 The mean weight at recapture of Scottish wild salmon smolts tagged between 1979 and 1981. Shearer, W.M.

19 The length, weight and age composition of the salmon catches from the Rivers Spey and North Esk (Scotland) 1981-1983. Shearer, W.M.

20 The use of scale characteristics and multi-variate analysis to distinguish between fish of Scottish and Norwegian origin caught in the Faroes long-line fishery. Shearer, W.M.

21 The length and weight of one and two sea-winter salmon in Scottish commercial salmon fisheries, 1982-1983. Shearer, W.M.

22 On the temperature conditions along the west coast of Greenland in 1980 and 1983. Buch, Eric.

23 The physical properties of gill nets in relation to mesh regulations. ICES CM 1982/B:5. Potter, E.C.E.

24 A preliminary analysis of the exploitation pattern of Atlantic salmon tagged and released as smolts in River Imsa, S.W. Norway, 1981. Hansen, Lars P.

25 Tagging of Atlantic salmon smolts in Norway 1979, 1980 and 1981; numbers and mean weights of recaptures in the Norwegian Sea and in Norwegian home waters. Hansen, Lars P.

26 Data collected on board M/S Nordheim FP 795 22 February to 6 March 1984. Gudjonsson, Thor.

27 A preliminary report summarising the analysis of data from the salmon long-line fishery, Faroes 1981-1982. ICES CM 1983/M:22. Shearer, W.M. and D.R. Clarke.

28 The use of scale characteristics and multi-variate analysis to distinguish between stocks of fish. ICES CM 1983/M:21. Shearer, W.M.

29 Biological characteristics of Atlantic salmon caught by long-line in the Faroes fishery 1983. Shearer, W.M.

30 Models for salmon long-line catch. Hansen, Bogi.

31 Tana river young salmon densities. Niemela, E.

32 The assessment of potential maturity rates in salmon caught in Faroese waters, 1982 and 1983. Youngson, A.F.

Appendix III

REFERENCES

Anon. 1980. Report of the Working Group on North Atlantic Salmon 30 April - 3 May 1979 and 15-18 April 1980. ICES CM 1980/M:10.

Anon. 1981. Report of the meeting of North Atlantic Salmon Working Group. Copenhagen 1-6 April 1981. ICES CM 1981/M:10.

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Appendix IV

RESEARCH RECOMMENDATIONS IN ORDER OF OCCURENCE IN THE REPORT

1 Initiate a feasibility study for the use of tagging to establish exploitation rates for monitored rivers and their use in obtaining material for stock discriminant analysis Sect 2.1

2 The market sampling program at Faroes should be expanded Sect 2.1

3 Estimate exploitation rates and non-catch fishing mortality for areas where estimates are not available Sect 2.2

4 Initiate research programs to study post smolt mortality Sect 2.6

5 An attempt should be made to collect catch and effort data in the West in the West Greenland fishery Sect 3.1

6 The annual commercial landing sampling program at West Greenland should be expanded to include a sampling location in Southern Greenland so that the commercial landings can be more uniformly sampled Sect 3.1

7 The database of discriminant analysis used to identify continent of origin of salmon caught at Greenland should be tested every two years beginning in 1985. The test data base should also be expanded to include scales from salmon from additional stocks known to contribute to the West Greenland fishery Sect 3.1

8 Discrimination of country of origin of salmon in commercial catches should be attempted Sect 3.1

9 To initiate a study to determine the feasibility of scale determination techniques to identify stocks of salmon at West Greenland Sect 3.1

10 Conduct a discriminant analysis on scales collected at Faroes to determine the proportion of North American origin Sect 3.5

11 Provide scientific evidence for the supposed greater non-catch mortality of gill nets

Sect 5.9

12 A list of research priorities for North Atlantic salmon in the contect of NASCO

Sect 6.1

Table 1

Reported nominal catches in the northern Norwegian Sea long-line fishery north of latitude 67°N: 1965-1983 (tonnes round fresh weight)

Danish catches converted from gutted weight with a factor 1.16

Year	Denmark		Faroes		Germany Fed. Rep.		Norway		Sweden		Total Longline Catch
	No. of vessels	Catch	No. of vessels	Catch	No. of vessels	Catch	No. of vessels	Catch	No. of vessels	Catch	
1965	1-2	-[a]	0	0	0	0	0	0	0	0	-[a]
1966	10	-[a]	0	0	0	0	0	0	-	-[a]	-[a]
1967	22	77	0	0[b]	0	0	-	-[a]	6	-[a]	77+
1968	28	177	-	-[b]	0	0	-	100[c]	16	126	403[c]
1969	40	413	0	0[b]	5	24	-	450[c]	2	24	911[c]
1970	60	481	-	-[b]	4	21	-	420[c]	1	24	946[c]
1971	20	162	0	0	2	9	-	300[c]	1	17	488[c]
1972	20	182	0	0	2	4	-	300[c]	1	20	506[c]
1973	15	233	0	0	0	0	-	250[c]	2	50	533[c]
1974	10	148	0	0	0	0	-	200[c]	1	25	373[c]
1975	15	245	0	0	0	0	-	200[c]	1	30	475[c]
1976	20	264	0	0	0	0	0	0	1	25	289
1977	24	192	0	0	0	0	0	0	0	0	192
1978	13	124	0	0	0	0	0	0	0	0	124
1979	10	118	0	0	0	0	0	0	0	0	118
1980	7	127	?	28[b]	0	0	0	0	0	0	155
1981	8	213	-	-[b]	0	0	0	0	0	0	213
1982	7	334	?	259	0	0	0	0	0	0	593
1983	9	383	0	0	0	0	0	0	0	0	383

a Catch not known
b See note a for Table 2
c Estimated catch

Table 2

Reported nominal catches in the Faroese Area long-line fishery 1968-1983
(tonnes round fresh weight)

Converted from gutted weight with a factor 1.11

Year	Denmark		Faroes		Total Longline Catch
	No. of vessels	Catch	No. of vessels	Catch	
1968	0	0	2	5[a]	5
1969	0	0	4	7	7
1970	0	0	5	12[a]	12
1971	0	0	0	0	0
1972	0	0	2	9	9
1973	0	0	5	28	28
1974	0	0	5	20	20
1975	0	0	6	28	28
1976	0	0	9	40	40
1977	0	0	9	40	40
1978	2	14	8	37	51
1979	2	75	7	119	194
1980	6	150	22	568	718
1981	6	100	38	1025[a]	1.125
1982	6	74	31	606	680
1983[b]	6	62	25	678	740

[a] A small part of the catch taken more than 200 miles from the Faroese baseline

[b] Preliminary data

Table 3 Mean weights (kg) of salmon sampled in the Faroes fishery by sea age and month

Month	Sea age		
	1sw	2sw	3sw
February	1.60	3.50	8.22
March	2.69	3.97	8.22
April	2.01	4.04	7.84

Estimated mean weights of all landed salmon for whole season:

2.04 3.84 8.07

Mean weight of all salmon landed estimated from total landings = 4.3kg

Table 4 Calculation of the proportion, by weight, of the nominal catch in each sea age class

Smolt year class 'i'	Proportion of nominal catch by numbers (PNi)	Mean weight kg (WFi)	Proportion of nominal catch by weight (PWi)
Discard mortalities	0.055x0.8 = 0.044	1.5	0.015
Year class 1	0.056	2.04	0.026
Year class 2	0.784	3.84	0.700
Year class 3	0.158	8.07	0.302

Table 5. Estimates of WR_{ij} - the ratios for individual stocks of mean weights of fish returning to home waters to mean weights of fish caught at Faroes.

Age in Faroes fishery = i Age in home waters = j	1 1	1 2	2 2	2 3	3 3	3 4
Norway	1.65 1.6 1.57	2.85 3.27 3.45	1.15 1.50 1.42 1.26 1.24 1.27 1.25	2.41 2.20 2.56 2.06	1.33 1.03 1.04	-
Scotland	-	-	1.50 1.20	1.96	1.42	-
Ireland	1.72	-	-	-	-	-
Mean	1.64	3.19	1.30	2.24	1.20	(est. 1.50)

Table 6 Estimate of the losses to home water stocks for each tonne of nominal catch in the Faroes fishery area

i	j	WR_{ij}	PN_{ij}	PW_i	S_{ij}	1/1-N	LF_{ij}
Discards	1	1.64	0.78	0.015	0.97	1.11	0.021
Discards	2	3.19	0.22	0.015	0.88	1.11	0.010
1	1	1.64	0.78	0.026	0.97	1.11	0.036
1	2	3.19	0.22	0.026	0.88	1.11	0.018
2	2	1.30	0.78	0.700	0.97	1.11	0.764
2	3	2.24	0.22	0.700	0.88	1.11	0.337
3	3	1.20	0.78	0.302	0.97	1.11	0.304
3	4	1.50	0.22	0.302	0.88	1.11	0.097
							1.59

Estimate of total loss (LF) = 1.59

Table 7

Estimated exploitation rates in Norwegian home waters assuming 50% and 70% tag reporting rates

	1 SW fish		2 SW fish	
Stock	50%	70%	50%	70%
R Imsa wild	0.88	0.84	0.93	0.90
R Imsa	0.80	0.74	0.92	0.89
R Sandvik	0.89	0.85	0.95	0.93
R Figgjo	0.84	0.79	0.95	0.94
R Alta	0.97	0.95	0.97	0.95
R Eira	0.93	0.91	0.86	0.82
R Arøy	0.91	0.87	0.91	0.88
R Suldal	0.86	0.82	0.77	0.70
R Lone	0.57	0.49	0.83	0.78
R Figga	0.99	0.98	1.00	1.00

Table 8

Estimated exploitation rates in the Norwegian Sea assuming 50% and 70% tag reporting rates in Norwegian home waters

	1 SW fish		2 SW fish	
Stock	50%	70%	50%	70%
R Imsa wild	0.00	0.00	0.25	0.32
R Imsa	0.01	0.01	0.38	0.46
R Sandvik	0.00	0.00	0.50	0.58
R Figgjo	0.00	0.00	0.26	0.32
R Alta	0.02	0.03	0.55	0.64
R Eira	0.06	0.08	0.48	0.55
R Arøy	0.01	0.02	0.58	0.65
R Suldal	0.06	0.08	0.38	0.44
R Lone	0.00	0.00	0.00	0.00
R Figga	0.00	0.00	0.59	0.68

Table 9 Estimated rates of exploitation R Laerdalselv stock

Year	u_{River}	u_{Total}
1960	0.44	0.80
62	0.43	0.81
64	0.58	0.89
65	0.56	0.87
66	0.54	0.91
68	0.68	0.92
72	0.52	0.87
74	0.61	0.84

Table 10 Estimated rates of exploitation R. Eira stock

Year	u_{River}		u_{Total}
	Est = Redd Count	Est = 2 x Redd Count	
1964	0.57	0.40	0.92–0.86
1965	0.59	0.41	0.90–0.82
1966	0.63	0.46	0.93–0.87
1967	0.76	0.61	0.96–0.92
1968	0.82	0.70	0.96–0.92
1969	0.73	0.57	0.95–0.91
1970	0.83	0.70	0.97–0.93
1971	0.83	0.71	0.97–0.94
1972	0.76	0.62	0.97–0.95
1973	0.74	0.58	0.93–0.87
1974	0.62	0.45	0.88–0.78

TABLE 11 Exploitation rates on Scottish 1 sea-winter salmon tagged at coastal stations 1952-1983.

Area	Year	Number Tagged	Fixed Engine		Net and Coble		Rod
			U	CI*	U	CI*	U
West Coast	1981-83	255	0.04	0.02	0.03	-	0.05
Northwest Coast	1979-81	902	0.06	0.02	0.03	0.01	0.02
North Coast	1977-79	759	0.06	0.02	0.10	0.02	0.03
Moray Firth	1978-83	2149	0.11	0.01	0.09	0.01	0.05
East Coast	1954-55, 1977-78	786	0.29	0.03	0.26	0.04	0.01

TABLE 12 Exploitation rates on Scottish multi sea-winter salmon tagged at coastal netting stations 1952-1983.

Area	Year	Number Tagged	Fixed Engine		Net and Coble		Rod
			U	CI*	U	CI*	U
Moray Firth	1983	173	0.08	0.04	0.06	0.04	0.04
East Coast	1952-55, 1978	481	0.27	0.04	0.28	0.05	0.04

TABLE 13 Exploitation rates on all combined Scottish sea-winter salmon tagged at coastal netting stations 1952-1983.

Area	Year	Number Tagged	Fixed Engine		Net and Coble		Rod
			U	CI*	U	CI*	U
West Coast	1981-83	258	0.04	0.02	0.03	-	0.0
Northwest Coast	1979-81	916	0.06	0.02	0.03	0.01	0.0
North Coast	1977-79	776	0.06	0.02	0.10	0.02	0.0
Moray Firth	1978-83	2349	0.10	0.01	0.09	0.01	0.0
East Coast	1952-55, 1977-78	1280	0.28	0.02	0.27	0.03	0.0

* 95% Confidence Limits.

TABLE 14 Exploitation rates by North Esk net and coble fishery during the commercial netting season.

Year	One sea-winter	Multi sea-winter
1976	0.52	0.55
1977	0.51	0.43
1978	0.44	0.51
1979	0.42	0.45
1980	0.39	0.39
1981	0.50	0.57
1982	0.50	0.63
1983	0.53	0.39

Table 15 ASSESSMENT OF THE RELATIVE EFFECTS ON RETURNS TO HOME WATER OF HARVESTING SALMON AT DIFFERENT STAGES OF THEIR MIGRATION ROUTES

AGE AT CATCH	AGE AT HOME	WT AT HOME / WT IN FISHERIES	NON CATCH ADJUSTMENT (1/1-N)	SURVIVAL	RELATIVE LOSS
1	1	1.64	1.11	0.97	1.77
1	2	3.19	1.11	0.88	3.12
2	2	1.30	1.11	0.97	1.40
2	3	2.24	1.11	0.88	2.19
3	3	1.30	1.11	0.97	1.29
3	4	1.50	1.11	0.88	1.47

Table 16

Percentage of nominal catches taken by drift nets by country - 1982

	%
France	0
England & Wales	60
Scotland	0
Ireland	76
Northern Ireland	40
Norway	44
Sweden	?
USSR	?
Iceland	0

TABLE 17

Nominal Salmon Catches at West Greenland 1960-1983

(in Tonnes, Round Fresh Weight)

	Norway	Faroes	Sweden	Denmark	Gill-net and drift-net Greenland[d]	TOTAL	TA
1960	0	0	0	0	60	60	
1961	0	0	0	0	127	127	
1962	0	0	0	0	244	244	
1963	0	0	0	0	466	466	
1964	0	0	0	0	1539	1539	
1965	a)	36	0	0	825	861	
1966	32	87	0	0	1251	1370	
1967	76	155	0	65	1283	1601	
1968	138	134	4	272	579	1127	
1969	250	215	30	355	1360(385)[d]	2210	
1970	270	259	8	358	1244	2146[c]	
1971	340	255	0	645	1449	2689	
1972	158	144	0	401	1410	2113	
1973	200	171	0	385	1585	2341	
1974	140	110	0	505	1162	1917	
1975	217	260	0	382	1171	2030	
1976	0	0	0	0	1175	1175	11
1977	0	0	0	0	1420	1420	11
1978	0	0	0	0	984	984	11
1979	0	0	0	0	1395	1395	11
1980	0	0	0	0	1194	1194	11
1981	0	0	0	0	1264	1264	12
1982	0	0	0	0	1077	1077	12
1983	0	0	0	0	310	310[b]	11

a) Figures not available, but catch is known to be less than the Faroese catch.

b) Provisional

c) Including 7 metric tons caught on long-line by one of two Greenland vessels in the Labrador Sea early in 1970.

d) Up to 1968 gill-net only, after 1968 gill-net and drift-net. The figures in brack for the 1969 catch are an estimate of the minimum drift-net catch.

e) TAC corresponding to specific opening dates of the fishery.

Factor used for converting landed catch to round fresh weight in fishery by Greenland vessels = 1.11. Factor for Norwegian, Danish and Faroese drift-net vessels = 1.10.

Table 18. Distribution of nominal catches (tonnes) taken by Greenland vessels in 1973-83 by NAFO Divisions according to place where landed.

Division	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983[1]
1A	182	44	124	166	201	81	120	52	160	111	14
1B	194	116	168	302	393	349	343	275	347	330	77
1C	145	229	175	262	336	245	524	404	346	239	93
1D	385	290	204	225	207	186	213	231	202	136	41
1E	487	395	315	182	237	113	164	158	158	167	55
1F	192	88	185	38	46	10	31	74	31	76	30
Not known									20	18	
Total	1 585	1 162	1 171	1 175	1 420	984	1 395	1 194	1 264	1 077	310
E. Greenland	+	+	+	+	6	8	+	+	+	+	+
Total	1 585	1 162	1 171	1 175	1 426	992	1 395	1 194	1 264	1 077	310

1) Provisional figures

Table 19 Percentage (by number) of North American and European salmon in research vessel catches at West Greenland 1969-1983 and from commercial sample 1978-1983.

Year	Sample size	Percentage North American	95% confidence interval		Percentage European	95% confidence interval	
			Upper	Lower		Upper	Lower
			RESEARCH				
1969	212	51	57	44	49	56	43
1970	127	35	43	26	65	74	57
1971	247	34	40	28	66	72	50
1972	3488	36	37	34	64	66	63
1973	102	49	59	39	51	61	41
1974	834	43	46	39	57	61	54
1975	528	44	48	40	56	60	52
1976	420	43	48	38	57	62	52
1977	-	-	-	-	-	-	-
1978(a)	606	38	41	34	62	66	59
1978(b)	49	55	69	41	45	59	31
1979	328	47	52	41	53	59	48
1980	617	58	62	54	42	46	38
1981	-	-	-	-	-	-	-
1982	443	47	52	43	53	58	48
1983	-	-	-	-	-	-	-
			COMMERCIAL				
1978	392	52	57	47	48	53	43
1979	1653	50	52	48	50	52	48
1980	978	48	51	45	52	55	49
1981	4570	59	61	58	41	42	39
1982	1949	62	64	60	38	40	36
1983	4896	40	41	38	60	62	59

(a) during fishery

(b) research samples after fishery closed

Table 20 Sea age composition from research vessel and commercial catches of Atlantic salmon at West Greenland, 1969-83.

Year	Type	Sea Age Composition (%) 1SW	MSW	PS	Total number
1969	Research	93.8	4.9	1.3	226
1970	Research	93.8	4.1	2.1	145
1971	Research	99.2	0.4	0.4	251
1972	Research	94.1	5.6	0.3	877
1973	Research	93.8	4.4	1.8	113
1974	Research	97.7	1.7	0.6	836
1975	Research	97.6	2.0	0.4	535
1976	Research	95.7	2.6	1.7	422
1977	No Observations				
1978	Research	96.9	1.1	1.1	609
1979	Commercial	96.6	2.1	1.3	1655
	Research	96.7	1.8	1.5	340
1980	Commercial	97.5	2.2	0.3	980
	Research	98.4	1.1	0.5	617
1981	Commercial	97.0	2.5	0.6	4559
1982	Commercial	93.6	6.0	0.5	1922
	Research	95.3	2.4	2.2	491
1983	Commercial	90.5	8.1	1.4	4744

Table 21 River age distribution (%) of North American (wild and hatchery) a European salmon caught at West Greenland, 1968-82.

Year	1	2	3	4	5	6	7	N
				North American				
1968	0	19	41	21	16	2	0	386
1969	0	27	46	20	7	1	0	101
1970	0	60	23	13	3	3	0	40
1971	1	32	37	17	10	4	0	84
1972	1	32	51	10	4	1	0	470
1973	2	41	32	20	2	2	0	44
1974	1	36	38	11	11	3	0	336
1975	0	16	48	25	6	4	0	219
1976	1	44	30	14	11	0	0	258
1977	-	-	-	-	-	-	-	0
1978	3	33	44	12	6	2	1	423
1979	4	41	41	11	3	1	0	914
1980	6	36	33	16	8	1	0	1086
1981	4	31	38	19	7	2	0	1021
Total	3	34	39	15	7	1	0	5382
	(3,3)	(35,33)	(40,38)	(16,14)	(8,6)	(3,0)	-	
Mean	2	34	39	16	7	2	0	
	(7,0)	(41,28)	(43,34)	(19,13)	(10,5)	(3,1)	-	
1982	1	37	39	16	6	1	0	441
1983	3	47	33	12	3	1	0	765
				European				
1968	22	59	16	2	0	0	0	288
1969	0	84	16	0	0	0	0	99
1970	0	91	9	0	0	0	0	79
1971	9	66	20	3	1	0	0	161
1972	11	72	17	1	0	0	0	833
1973	27	59	12	2	0	0	0	49
1974	23	68	9	0	0	0	0	466
1975	26	53	18	2	0	0	0	274
1976	23	67	9	1	0	0	0	306
1977	-	-	-	-	-	-	-	0
1978	26	66	8	0	0	0	0	572
1979	24	64	10	1	0	0	0	957
1980	25	58	15	3	0	0	0	991
1981	15	68	15	1	0	0	0	771
Total	20	65	13	1	0	0	0	5846
	(21,19)	(66,64)	(14,12)	(1,0)	-	-	-	
Mean	18	67	13	1	0	0	0	
	(24,12)	(74,61)	(16,11)	(2,1)	-	-	-	
1982	15	56	24	4	1	0	0	403
1983	35	50	12	2	0	0	0	997
				North American & European				
1968-81	12	50	26	8	3	1	0	11228
	(13,11)	(51,49)	(27,25)	(9,8)	(3,3)	(1,1)	-	
1982	8	46	31	10	3	0	0	906
1983	21	49	21	7	2	0	0	1864

Nominal catches of salmon in home waters (in tonnes round fresh weight) 1900-1983

Table 22

Year	France	England & Wales	Scotland[a]			Ireland[b]			Northern Ireland[bc]	Norway[d]			Sweden (west coast)	Finland	USSR[e]	Iceland	Canada[f]			USA	Total[f] all Countries
	T	T	S	G	T	S	G	T	T	S	G	T	T	T	T	T	S	G	T	T	T
1900	50-100	283	927	509	1,436	-	-	743	130	-	-	1,000	40	-	1,100	101	-	-	1,[illegible]	<1	7,212
1901	50-100	272	772	474	1,246	-	-	707	132	-	-	1,531	37	-	790	127	-	-	1,[illegible]	<1	6,401
1902	50-100	318	808	932	1,740	-	-	1,459	366	-	-	1,906	45	-	710	125	2	-	1,[illegible]	<1	8,459
1903	50-100	325	1,168	530	1,698	-	-	1,458	306	-	-	1,786	23	-	490	145	-	-	1,[illegible]	<2	8,149
1904	50-100	307	913	1,001	1,914	-	-	1,617	377	-	-	2,147	36	-	900	135	-	-	1,[illegible]	<2	9,208
1905	50-100	320	805	728	1,563	-	-	1,457	281	-	-	2,000	40	-	900	130	-	-	2,[illegible]	<2	8,576
1906	50-100	307	788	836	1,624	-	-	1,238	287	-	-	1,791	36	-	570	106	-	-	2,[illegible]	<2	8,475
1907	50-100	420	857	1,276	2,133	-	-	1,483	449	-	-	1,900	25	-	893	146	-	-	2,[illegible]	<2	10,417
1908	50-100	282	783	780	1,563	-	-	1,413	312	-	-	1,514	20	-	827	162	-	-	2,[illegible]	<2	8,279
1909	50-100	377	539	1,408	1,947	-	-	1,710	267	801	502	1,303	22	-	390	130	-	-	2,[illegible]	<2	8,406
1910	50-100	527	503	826	1,329	-	-	1,787	297	815	356	1,171	20	-	448	195	1,562	761	2,323	<2	8,173
1911	50-100	426	496	923	1,419	-	-	1,639	234	771	436	1,207	18	-	417	204	1,482	510	1,992	<2	7,631
1912	34	442	598	1,105	1,703	200	1,004	1,804	210	1,054	514	1,568	18	32	462	210	1,201	568	1,769	<2	8,273
1913	12	450	661	1,303	1,964	244	1,686	1,900	182	1,220	506	1,726	23	50	772	256	1,681	783	2,434	2.7	9,802
1914	13	393	578	1,053	1,631	170	1,960	2,128	184	1,149	484	1,633	32	76	709	225	1,549	940	2,489	0.9	9,953
1915	25	447	669	892	1,561	274	1,942	2,216	164	1,088	449	1,537	26	76	811	266	1,573	912	2,485	1.7	9,614
1916	9	208	328	682	1,010	109	1,452	1,561	113	1,061	467	1,530	20	66	NA	225	1,721	776	2,506	0.8	7,108
1917	19	345	309	782	1,131	145	1,227	1,372	110	1,018	470	1,488	10	59	NA	230	1,893	692	2,585	2.4	7,311
1918	20	349	781	542	1,323	147	1,082	1,230	148	668	342	1,010	10	37	NA	291	1,275	370	1,645	4.1	6,007
1919	10	261	598	478	1,075	105	922	1,027	99	1,150	681	1,831	12	36	430	225	705	592	1,297	2.5	6,366
1920	30	360	651	483	1,134	202	745	947	122	1,352	478	1,830	17	34	631	249	1,763	917	2,680	5.5	8,040
1921	20	493	843	389	1,232	164	521	686	101	1,189	467	1,656	26	44	480	163	1,619	888	2,507	6.0	7,314
1922	20	296[h]	505[h]	496	1,002[h]	63	900	980	132	985	363	1,348	25	54	311	147	1,042	776	1,788	6.4	6,212
1923a	16	424	361	231	592	150	1,506	1,656	187	945	585	1,530	NA	57	NA	198	911	513	1,424	1.3	6,085

S = Salmon (two or more sea winter fish) G = Grilse (one sea winter fish) T = S + G

a = Provisional figures

b = Catch on River Foyle allocated 50% Ireland and 50% Northern Ireland

c = Not including angling catch (mainly grilse)

d = Before 1966 sea trout and sea char included (5% total)

e = USSR catch mainly salmon (2 or more sea winter fish)

f = French catch taken as 75 tonnes from 1900-1971 and USA catch as 1 tonne from 1900-1971

g = Salmon and grilse figures for 1902-1977 corrected for grilse error

h = The difference between provisional and final figures are likely to be larger than in previous years because of delays in processing the returns

i = Includes estimates of local sales and by-catch

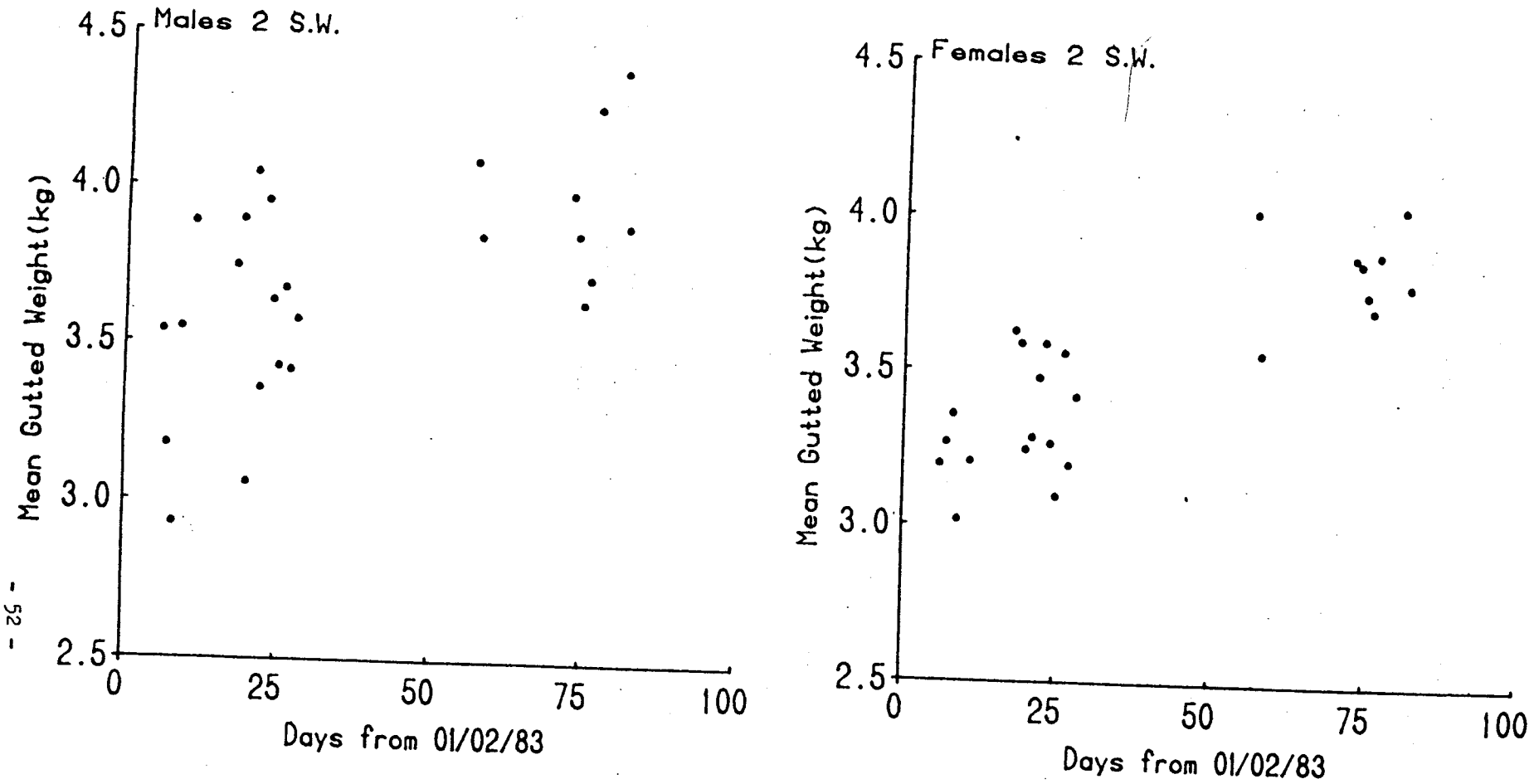
Table 23 Annual variation in survival of smolts originating from sample North American and European rivers

Country and Stock	Description of Data Set[1]	Sea-age of Return	Indices[2] of Survival from Smolt to Adult Stage for Smolt Year Class							
			1974	1975	1976	1977	1978	1979	1980	1981
Canada										
Saint John River	Hatchery, returns to home river	1	1.58	2.37	2.08	0.87	1.80	4.00	1.80	1.33
		2	0.48	0.64	0.66	0.30	1.17	0.82	0.36	0.24
Area N, Newfoundland	Wild, returns to sea fisheries and home river	1	10.53	12.76	15.66	5.76	19.76	13.75	9.19	12.00
Ireland										
Burrishoole River	Wild, returns to home river	1	9.21	6.04	4.14	6.17	9.41	7.82	2.87	5.06
		2	0.50	0.28	0.19	0.09	0.49	0.77	0.19	0.31
Corrib River	Wild, returns to fisheries and home river	1	-	-	-	-	-	-	6.1	6.8
Northern Ireland										
Bush River	Wild, returns to home river	1	-	-	6.21	6.46	5.77	10.68	5.63	-
		2	-	-	1.45	1.19	1.00	1.63	0.59	-
Scotland										
North Esk River	Wild, returns to sea fisheries and home river	1	36.00	11.36	23.78	-	-	-	8.36	11.00
		2	9.91	9.32	17.45	-	-	-	7.40	5.70
		3	0.35	0.20	0.46	-	-	-	0.31	-
Norway										
Orsta River	Wild, returns to sea fisheries and home river	1	-	-	-	-	-	1.52	0.72	1.49
		2	-	-	-	-	-	1.01	0.14	0.28
Mixed	Hatchery, returns to sea fisheries and home river	1	-	-	-	-	-	1.55	1.48	1.07
		2	-	-	-	-	-	1.17	0.99	0.94
Finland										
Neiden River	Wild, returns to sea fisheries and home river	1	-	-	0.97	0.75	0.35	-	-	-
		2	-	-	0.19	0.61	0.18	-	-	-
		3	-	-	0.29	0.68	0.18	-	-	-
Tana River	Wild, returns to sea fisheries and home river	1	-	0.34	1.26	2.67	0.51	0.91	-	-
		2	-	0.52	0.56	0.71	1.35	0.40	-	-
		3	-	0.31	0.31	0.39	0.34	0.40	-	-

1 Identifies origin of smolt groups as hatchery or wild and specifies the area of return or capture as adult fish.

2 Indices of survival expressed as the percentage of smolts captured in fisheries and/or returning to home waters as adults.

Figure 1. Mean Gutted Weight (kg) vs Date of Sampling 1983



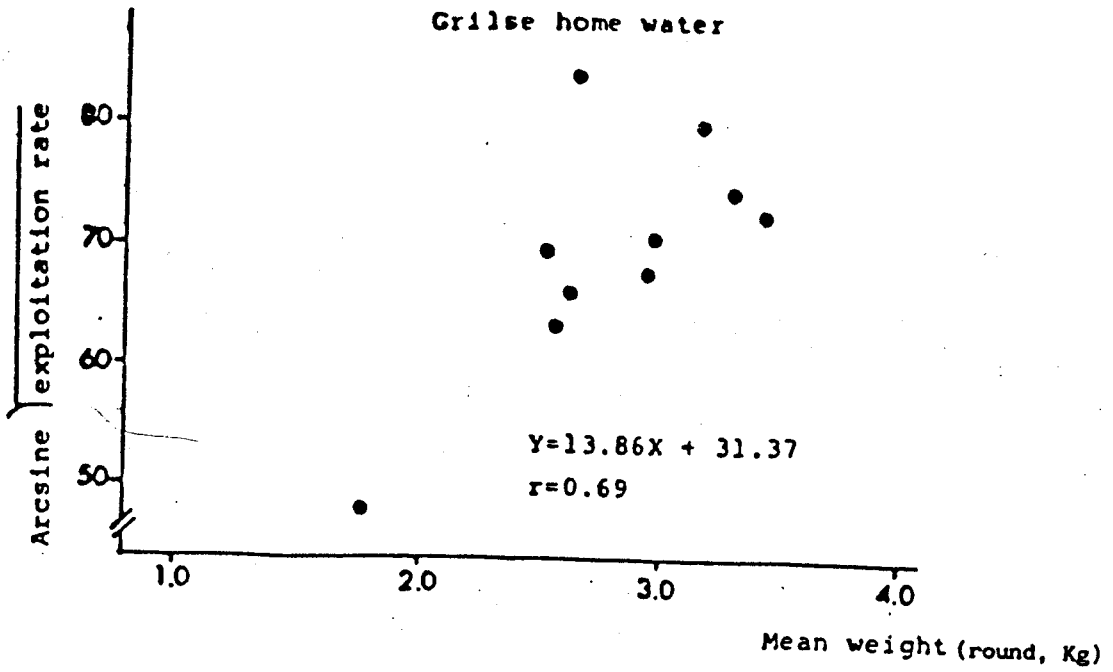


Fig. 2a Relationship between mean weight and exploitation rate for grilse in Norwegian home waters. The tag reporting rate in home water is assumed to be 50%.

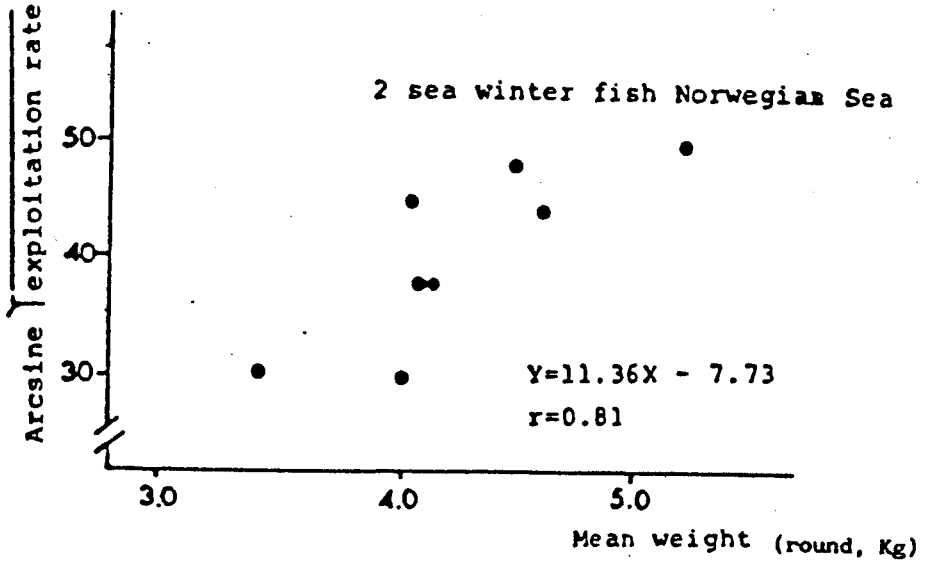


Fig. 2b Relationship between mean weight and exploitation rate for 2 sea-winter fish in the Norwegian Sea. The tag reporting rate in home water is assumed to be 50%.

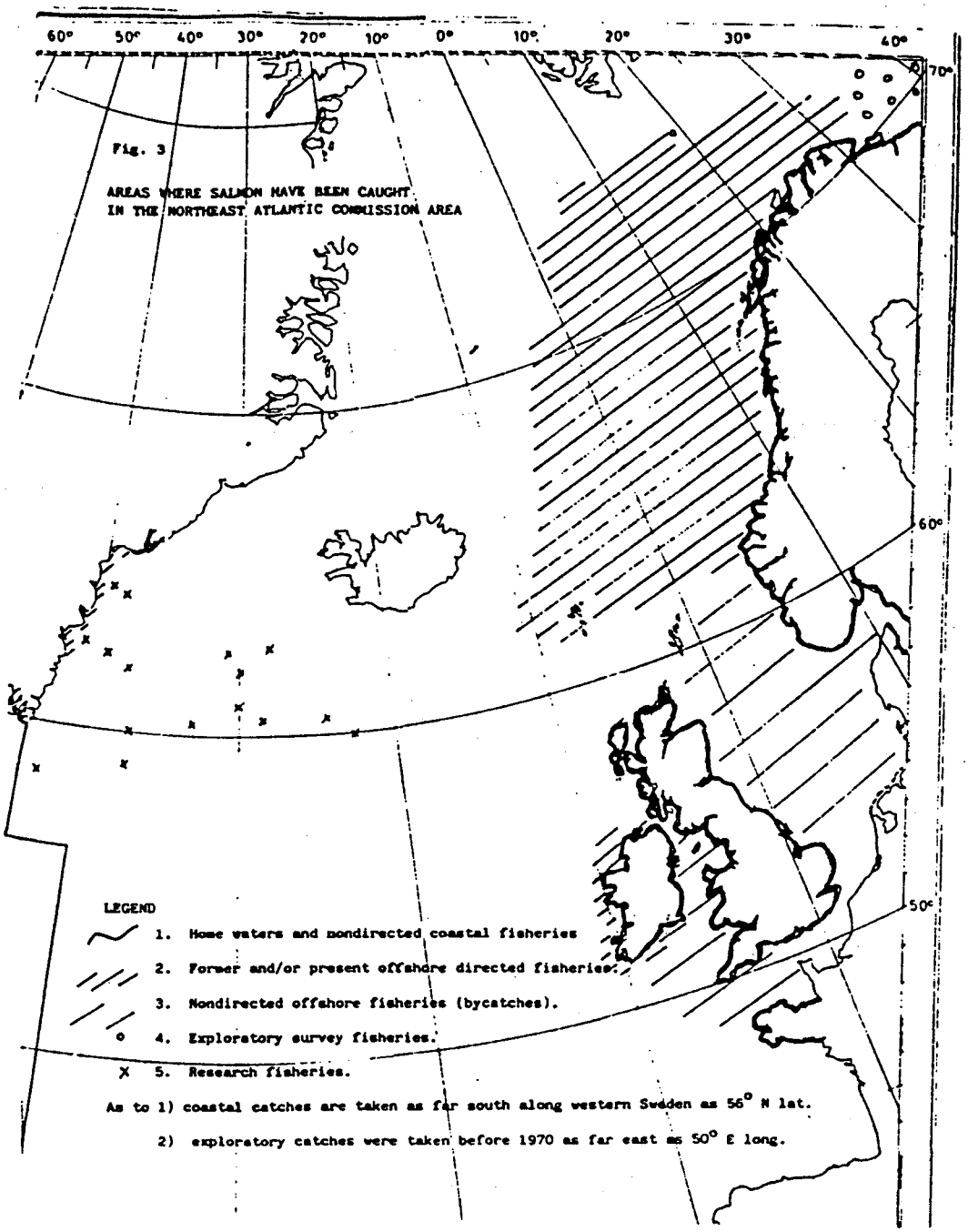


Fig. 3

AREAS WHERE SALMON HAVE BEEN CAUGHT IN THE NORTHEAST ATLANTIC COMMISSION AREA

Fig. 4 Tags recovered in the Faroese fisheries in the 1982-83 season by Norway, Scotland and Sweden

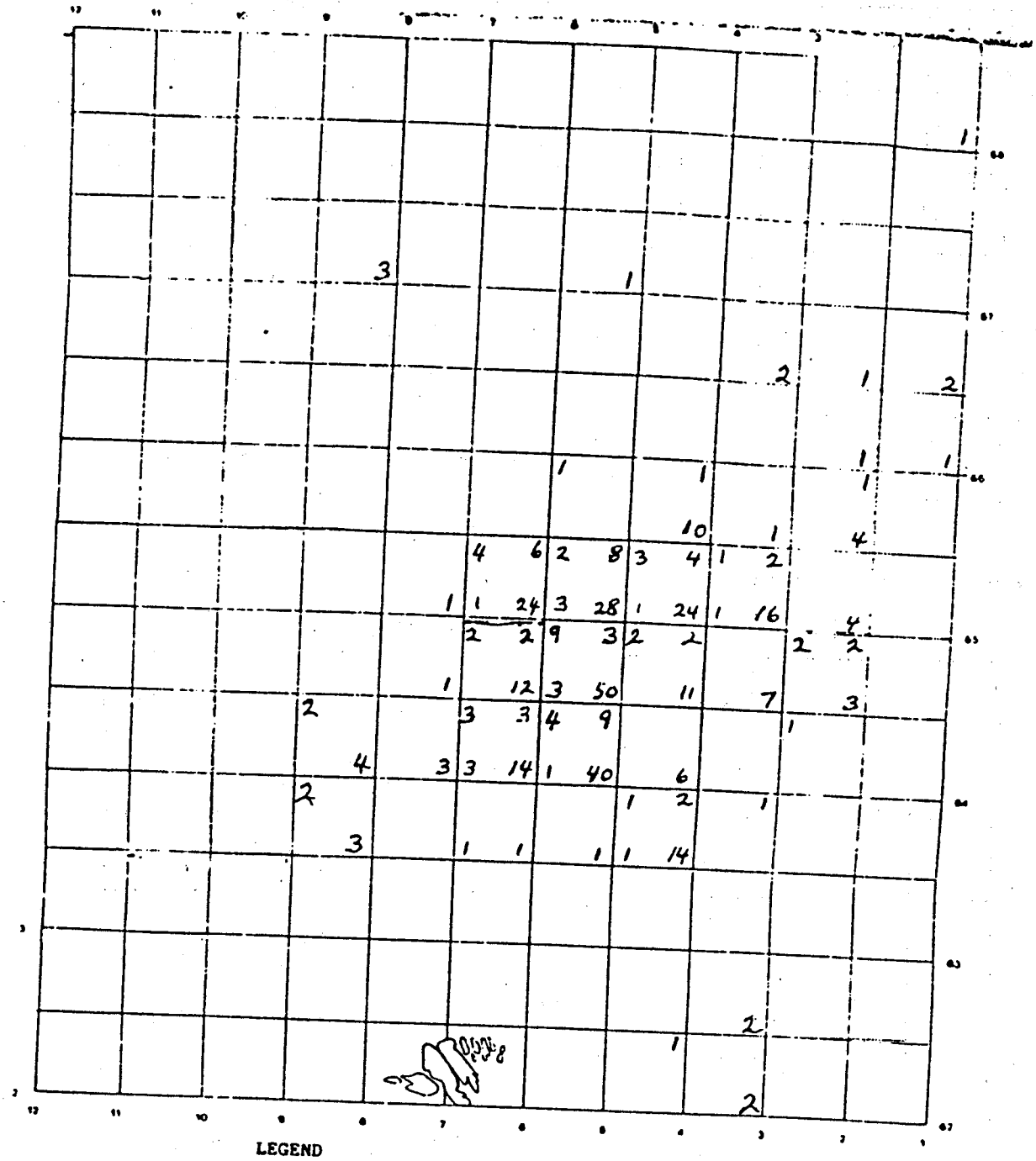
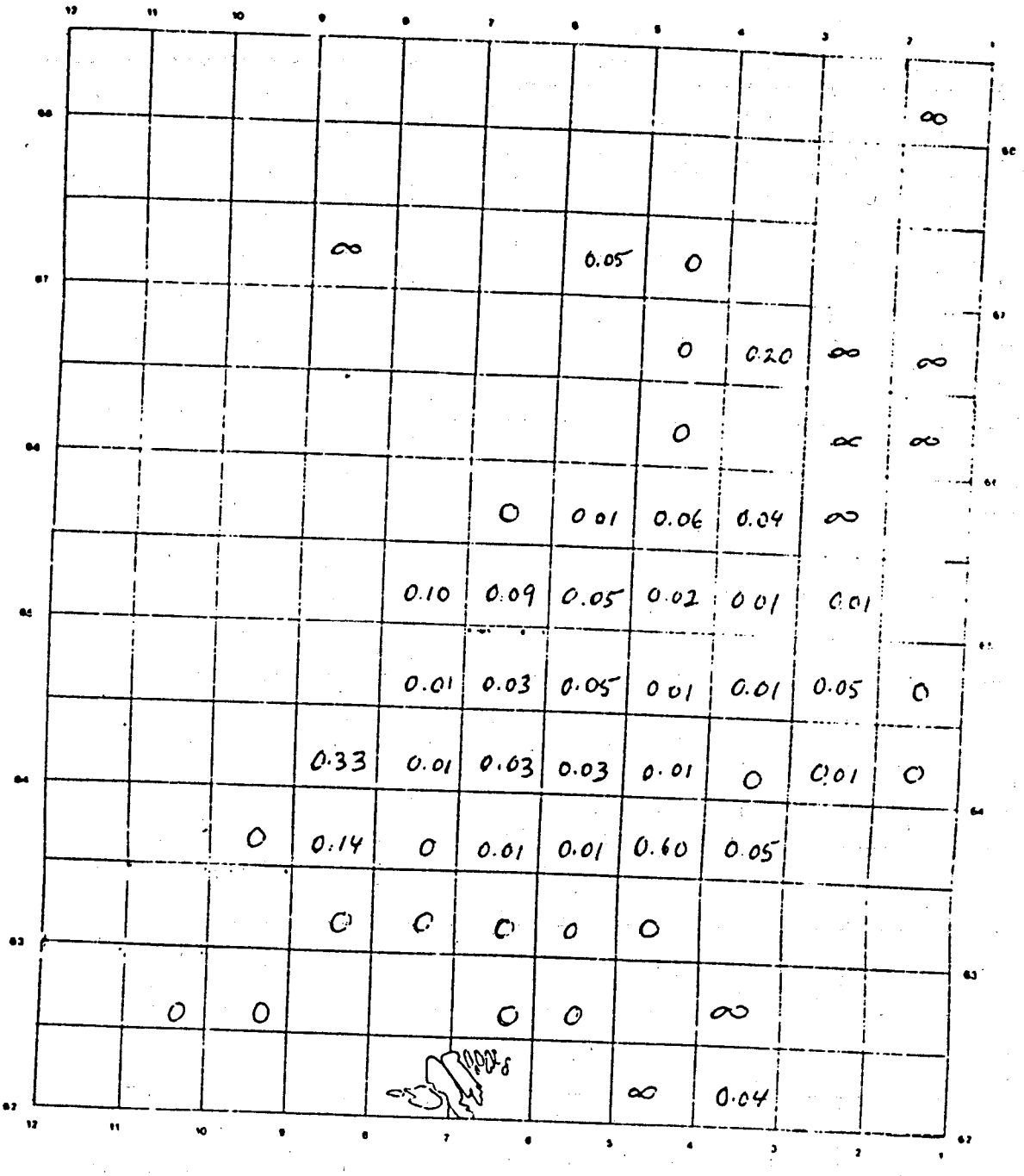


Fig. 5 Proportion % tags received per 10 fish caught at Faroes in the 1982–83 season



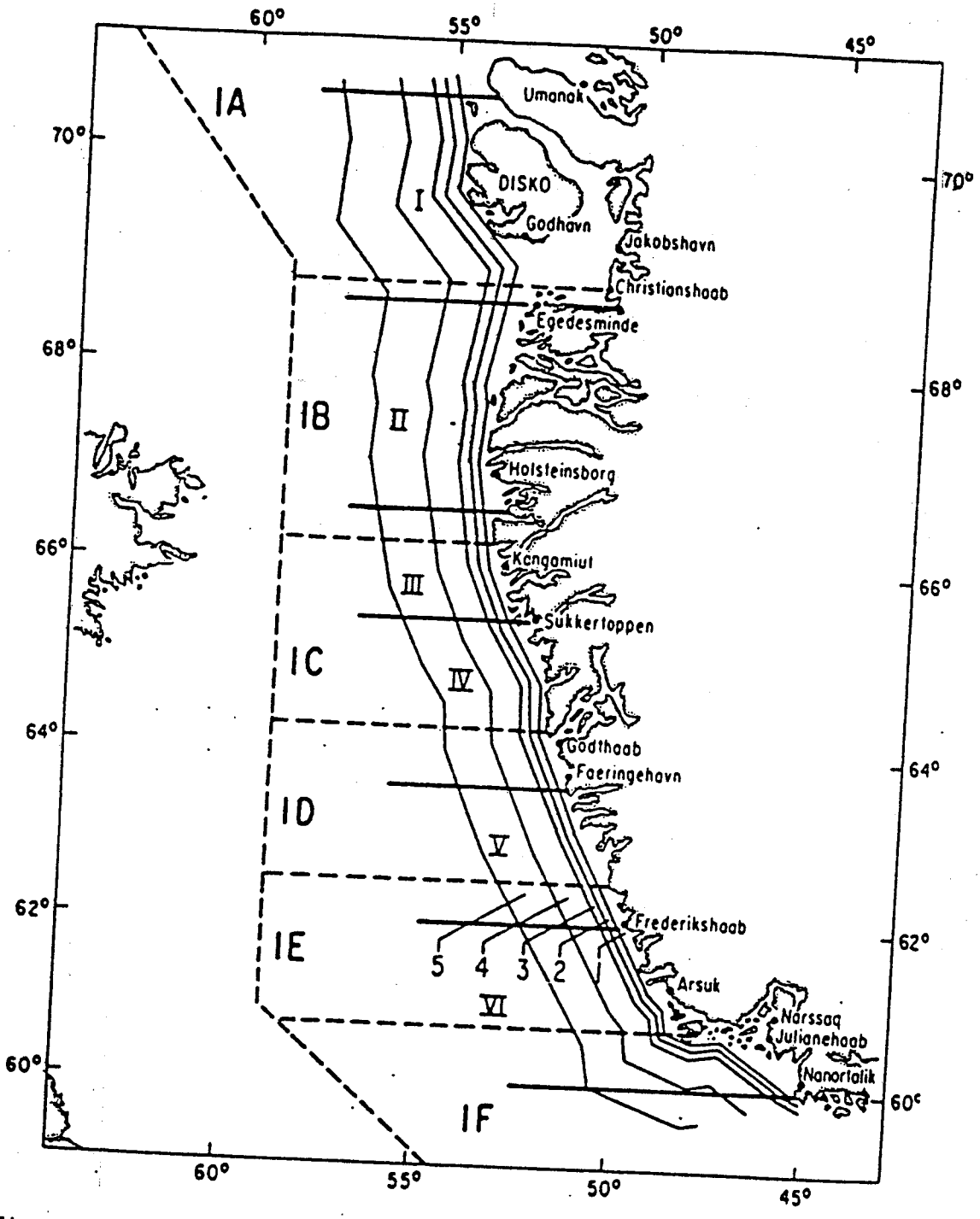


Fig. 6 Area map of West Greenland showing NAFO divisions, fishing areas (I-VI) and subareas (1-5).

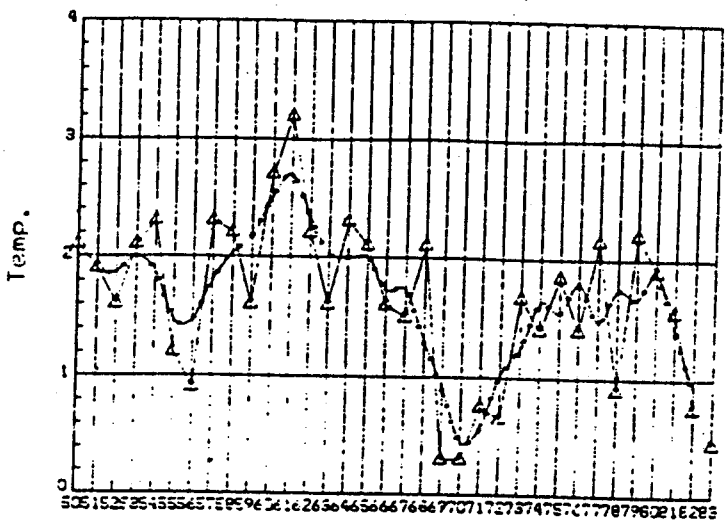


Figure 7. Mean temperature on top of Fylla Bank (40 m) by the middle of June. - actual observations, ---- 3 years running mean.

Edinburgh, May 1984

ANNEX 4

NEAC (84)5
NORTH ATLANTIC SALMON CONSERVATION ORGANIZATION
NORTH-EAST ATLANTIC COMMISSION

PROPOSALS TO THE NORTH-EAST ATLANTIC COMMISSION OF NASCO
FOR
REGULATORY MEASURES FROM THE DELEGATION OF ICELAND

1. To ban fishing for salmon stocks subject to the Convention beyond 12 nautical miles from baselines from which the breadth of the territorial sea is measured.

2. To prohibit the use of drift nets.

BACKGROUND PAPER ON DOCUMENT NEAC (84)5 FROM THE DELEGATION OF ICELAND

At the inaugural meeting of the Council and the North-East Atlantic Commission the views of the Icelandic authorities were made known. Reference was made to discussions on this question in the Althing. The Icelandic position was stated in a Resolution of the Althing of 14 March, 1983, which reads as follows:

"The Althing resolves to charge the Government with taking measures to stop Faroese fishing for Atlantic salmon in the ocean in accordance with Article 66 of the Law of the Sea Convention and co-operate in this connection with other countries of origin of the salmon stock, with the end in mind of prohibiting all sea fishing for salmon in the North Atlantic Ocean."

The ICES report now before the Commission presents two factors which are the greatest obstacles to effective conservation and management of the salmon stocks in this area, i.e. the Faroese fishing and the use of drift nets.

Accordingly in conformity with the position reflected in the Althing Resolution referred to the Icelandic Delegation has submitted proposals for regulatory measures for salmon fishing in the North-East Atlantic Commission found in document NEAC (84)5.

NEAC (84)3
NORTH ATLANTIC SALMON CONSERVATION ORGANIZATION
NORTH-EAST ATLANTIC COMMISSION

PROPOSAL BY THE DELEGATION OF NORWAY FOR REGULATORY MEASURES FOR FISHING OF SALMON IN THE FISHERIES ZONE OF THE FAROE ISLANDS

1. The total allowable catch of salmon in the fisheries zone of the Faroe Islands shall be set at 500 tonnes for the 1984/85 season.

2. The TAC shall include discards.

3. The fishing effort shall be distributed as evenly as possible throughout the entire fisheries zone of the Faroe Islands, and at least ¼ of the TAC shall be reserved for the southern part of the fisheries zone.

BACKGROUND

The salmon stocks originating in Norwegian rivers have been over-exploited for many years, and the present state of the stocks gives reason for concern. Catches in Norwegian home waters and rivers have over the years been reduced from around 2,000 tonnes in the middle of the 1960's to 1,550 tonnes in 1983 and even lower (1978 and 1982).

Interception fisheries in the Norwegian Sea, which at times have reached fairly high levels (960-1,340 tonnes), are one of the reasons for over-exploitation.

It could also be mentioned that the salmon parasite Gyrodactylus salaris has had the effect of considerably reducing the smolt production in more than 25 Norwegian rivers from the late 1970's. Great efforts are now being made to stop further spreading of the parasite and to rebuild the stocks. However, the rebuilding has not yet had any significant effect.

It is the view of the Norwegian Government that a reduction in interception fisheries in the Norwegian Sea is necessary to halt the over-exploitation of the stocks. The draft proposal for regulatory measures in the Faroese fisheries is designed to effect such a reduction and also to obtain more knowledge about the fishing possibilities in the entire fisheries zone of the Faroe Islands. It is also believed that the concentration of the fishing effort in the northern part of the Faroese fisheries zone has the effect of taking salmon of Norwegian origin to a greater extent than if fishing possibilities in other parts of the zone were better known and exploited.

The figure of 500 tonnes suggested as a TAC is not randomly chosen. It happens to represent a reasonable reduction of the present limitation established by bilateral agreement. The main reason for the suggestion is, however, that 500 tonnes represents the approximate average of reported catches

Continued....

in the Norwegian Sea in the 1970's (440 tonnes). It could, therefore, be considered a reasonable first step in the reduction of the interception fisheries in that area.

Norway would, for its part, be willing to make further sacrifices for the rebuilding of the stocks. Thus, the Norwegian Government will commit itself to:

(a) extend the prohibition zone for drift net fisheries, now in force east of Lindesnes, to Utsira further north on the west coast of Norway (approx. 59° 40' N) as from 1986;

(b) maintain on a permanent basis the prohibition zone for drift net fisheries in force from the Norwegian-Soviet border to North Cape;

(c) stop all salmon fisheries for a period of 10-14 days in the middle of June (which is the best fishing period) in Møre and Romsdal county (central Norway) during the 1984 and 1985 seasons.

Further regulations are and will be studied to reduce the drift net fisheries.

Edinburgh, May 1984

ANNEX 6

NEAC (84)7
NORTH ATLANTIC SALMON CONSERVATION ORGANIZATION
NORTH-EAST ATLANTIC COMMISSION

PROPOSAL FOR REGULATORY MEASURES FOR FISHING OF SALMON IN THE FISHERIES ZONE OF THE FAROE ISLANDS, 1984-85

1. The North-East Atlantic Commission takes note of the fact that the Faroese authorities, having decided in 1982 as a precautionary conservation measure to keep Faroese salmon catches within the 1065 tonnes attained in the 1980-81 season, have, as part of other arrangements, decided to fix the TAC for salmon in the Faroese fisheries zone for the 1984-85 season at 625 tonnes.

2. The fishing season shall be from 1 October to 31 May 1985.

3. The minimum size of salmon retained on board the fishing vessels shall be 60 cm.

4. The Faroese authorities shall see to it that efforts are made to increase the survival rate of discards. The Faroese delegation will at the next meeting of the Commission report to it as to what extent this aim has been achieved.

NEAC (84)6
NORTH ATLANTIC SALMON CONSERVATION ORGANIZATION
NORTH-EAST ATLANTIC COMMISSION

RECOMMENDATION FOR THE COUNCIL ON PRIORITIES FOR DATA ACQUISITION IN 1985

CATCH STATISTICS

These should included all removals from the stocks including recreational catches and estimates of illegal and non-reported catches. Monthly statistics on catch and effort by gear categories are also urgently required.

SAMPLING

All fisheries should be sampled to provide information on sea-age composition, weight, length, sex ratio and stage of maturity. Samples from mixed stock fisheries should in addition be used to determine country of origin of the salmon caught.

To enable assessments to be made of the salmon biomass in the fisheries zone of the Faroe Islands and estimates of the average weight gained and feed consumed in this area, data needs to be collected on abundance, duration of stay, size at time of arrival and departure, specific growth rates by sea-age class, feeding rates, food consumption and conversion rates throughout the Faroes fisheries zone and during the year.

RESEARCH PROJECTS

These are required to study post smolt mortality and its causes and to estimate recruitment to the exploited phase, non-catch fishing mortality in all fisheries, ratios of weight of each sea-age class in home waters to the mean weight at Faroes, proportions of each sea-age class returning in the same and

subsequent years and the survival rates of each sea-age class between Faroes and home waters. It is anticipated that on the last three items little information could be made available in the near future.

Edinburgh, May 1984

ANNEX 8

NORTH ATLANTIC SALMON CONSERVATION ORGANIZATION
NORTH-EAST ATLANTIC COMMISSION

NASCO/NEAC I/5 (Revised)

DRAFT REPORT OF THE MEETING OF THE NORTH-EAST ATLANTIC COMMISSION

NASCO-NEAC I/5 (Revised) Brussels, 7 February 1984

DRAFT REPORT OF THE MEETING OF THE NORTH-EAST ATLANTIC COMMISSION OF NASCO

1. Opening of the meeting

The meeting was opened on 18 January 1984 under the chairmanship of Mr. BORDES, representing the depositary, the Council of the European Communities.

2. Adoption of Rules of Procedure

The Commission adopted its Rules of Procedure which had been prepared during the three preparatory meetings (doc. NEAC I/2) (Annex I).

3. Election of Chairman and Vice-Chairman

The Commission elected Mr. B. SMØRGRAV (Norway) Chairman and Mr. A. OLAFSSON (Faroe Islands) Vice-Chairman.

From then on, the Chairman presided over the meeting.

4. Adoption of agenda

The Commission amended the draft agenda submitted by the EEC delegation (doc. NEAC I/1) by inserting the following items :

- Nomination of a rapporteur, and
- Date and place of next meeting

and then adopted the agenda (doc. NEAC I/3) (Annex II)

5. Nomination of a rapporteur

The Commission nominated Mr. T. Gudjonsson (Iceland) rapporteur for this meeting.

.../...

6. and 7. Regulatory measures, and
Recommendations to Council on scientific research

The observer of the ICES reviewed the work on Atlantic salmon which has been coordinated by ICES through the Working Group on North Atlantic Salmon for several years in cooperation with ICNAF and later by ICES alone, starting with the salmon fisheries of West Greenland and later took also to the salmon fisheries in the North-East Atlantic. Sampling systems have been developed for sea fisheries as well as home water fisheries, catch statistics collected and tagging programmes carried out. Data collected in individual countries have been used by the Working Group at annual meetings for assessing the effect of the sea fisheries on home water stocks. Most of the reports of the Working Group have been published and the remainder can be obtained from the ICES Secretariat. The next meeting of the Working Group will be held in late April or early May. A Special Study Group was established within the Working Group to plan and coordinate the collected biological samples of the Faroe salmon fishery. The Group will have a meeting (27-30 March) for evaluating the biological material which has been collected during the last two years.

Information on sampling programme concerning the Faroe salmon fishery was given by Mr. H. i Jakupsstovu (Faroe Islands).

.../...

The delegation of Iceland made a statement on regulatory measures.

The Commission considered its recommendations to the Council for scientific advice on the basis of the mandate of the Working Group on North Atlantic Salmon of the ICES (doc. NEAC I/4) and approved the recommendation annexed to this report (Annex III).

The delegation of the Faroe Islands introduced a draft proposal for request to ICES for advice with relevance to possible recommendations concerning fishing on salmon stocks subject to the North-East Atlantic Commission.

The observer of the ICES, Mr. B. Parrish, pointed out that the questions raised in the draft proposal were relevant to the main problems in salmon research. He felt that some of them were on the ambitious side, and he was not certain that ICES could come up with immediate answers to all of the questions referred to, but indicated that the Working Group on North Atlantic Salmon of ICES would do its best to provide the most complete information available.

The draft proposal of the delegation of the Faroe Islands was referred to a working group which recommended the proposal contained in doc. NEAC I/6. The Commission approved this proposal which is annexed to this Report (Annex IV).

8. Date and place of next meeting

The Commission decided to hold its next meeting at the same date and place as the next Council meeting.

9. Other business

None.

10. Consideration of draft Report of meeting

The Commission agreed that a copy of the Report of this meeting will be given to the heads of delegation for their consideration and will be given formal approval at the next meeting of the Commission.

TEXT OF REGULATORY MEASURE
(ISSUED BY TELEX ON 7 JUNE 1984)

"NASCO, c/o Scottish Office, Edinburgh, 7 June 1984.

The Secretary of NASCO has the honour to inform the members of the North-East Atlantic Commission that the Commission at its meeting, 23-25 May, 1984, under Article 8, sub-paragraph (b) of the Convention for the Conservation of Salmon in the North Atlantic Ocean, adopted a proposal for a regulatory measure for the fishing of salmon in the fisheries zone of the Faroe Islands 1984-85, the text of which is annexed to this notification.

The regulatory measure will, under Article 13 of the Convention, become binding on the members of the Commission 60 days from the date of this notification, i.e. on 6 August, 1984, unless the member in whose area of fisheries jurisdiction the regulatory measure will apply lodges an objection to it within the same period of 60 days.

ANNEX:

Proposal for regulatory measures for fishing of salmon in the fisheries zone of the Faroe Islands, 1984-85.

1. The North-East Atlantic Commission takes note of the fact that the Faroese authorities, having decided in 1982 as a precautionary conservation measure to keep Faroese salmon catches within the 1065 tonnes attained in the 1980-81 season, have, as part of other arrangements, decided to fix the TAC for salmon in the Faroese fisheries zone for the 1984-85 season at 625 tonnes.

2. The fishing season shall be from 1 October 1984 to 31 May 1985.

3. The minimum size of salmon retained on board the fishing vessels shall be 60 cm.

4. The Faroese authorities shall see to it that efforts are made to increase the survival rate of discards. The Faroese delegation will at the next meeting of the Commission report to it as to what extent this aim has been achieved.

This notification is dated 7 June 1984.

Malcolm Windsor
Secretary"