Fol. 41 Assess

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

International Council for the Exploration of the Sea

C.M.1986/Assess:17

REPORT OF THE WORKING GROUP ON NORTH ATLANTIC SALMON

Copenhagen, 17-26 March 1986

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

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

TABLE OF CONTENTS

0 INTRODUCTION

The Working Group on North Atlantic Salmon met at ICES headquarters from March 17-26, 1986. The following members participated:

J. Browne	Ireland
W.G. Doubleday (Chairman)	Canada
C.P. Goodyear	USA
Th. Gudjónsson	Iceland
L.P. Hansen	Norway
M. Holm	Norway
Sv.Aa. Horsted	Denmark
H.í. Jákupsstovu	Faroe Islands
J. Møller Jensen	Denmark
G.J.A. Kennedy	UK (N. Ireland)
T.L. Marshall	Canada
D.J. Meerburg	Canada
A.L. Meister	USA
E.G. Niemelä	Finland
T.R. Porter	Canada
E.C.E. Potter	UK (England)
P.J. Rago	USA
D.G. Reddin	Canada
W.M. Shearer	UK (Scotland)
M.M. Thibault	France

1 MAIN TASKS

At its 1985 Statutory Meeting, ICES resolved that the Working Group should meet at ICES Headquarters in 1986 to consider questions posed to ICES by the North Atlantic Salmon Conservation Organisation (NASCO), to provide estimates of catch in numbers by sea-age and to determine the impact of non-tagged, adipose fin-clipped salmon on the detection of coded wire tags. These questions correspond to items 5 to 9 of the agenda as found in Appendix 1. In addition, the Chairman of ACFM requested all Assessment Working Groups to consider the issues of "Safe Biological Limits" for exploitation of fish stocks and description of the long term potential of fish stocks. These issues were addressed under Agenda Item 10.

Nineteen documents were presented to the Working Group (Appendix 2). Although many new and relevant data were presented to the Working Group, available data remain insufficient to permit the provision of complete answers to many of the questions posed. Section 8 of the report considers additional research needed to provide more complete answers to the questions posed by NASCO and ICES.

1.1 Nominal Catches of Salmon in Home Waters

Nominal catches of salmon in home water fisheries for 1960-85 are given in Table 1. Figures for 1985 are incomplete. The 1985 total is slightly higher than that of 1984, but generally lower than in earlier years. Rough estimates of unreported catch in several countries are added to Table 1 for 1985 for the first time. No attempt was made to estimate such catches for earlier years.

1.2 Catch in Numbers by Sea Age and Weight for Recent Years

ICES requested the Working Group to estimate catch in numbers by sea age for the most recent years, wherever possible.

National salmon catches from several countries are given in Table 2. Figures for 1985 are provisional. Previous spawners have most often been included in figures for 1SW (one sea winter) and MSW (multi sea winter) fish. The following comments were made concerning numbers and weight of salmon given in Table 2.

France

Ages were determined from scale reading of samples of rod catches from Brittany, lower Normandy and the Allier and Gaves Rivers and from commercial samples from the Gaves estuary.

Scotland

From late June onwards when 1SW and MSW fish occur together in the fishery, the majority of fishermen divide their catches between 1SW and MSW fish on the basis of weight. Fish less than 3.5 kg are normally recorded as 1SW fish. This means that in those years when 1SW fish are heavier than normal the number of fish classified as MSW could contain a proportion of 1SW fish. Thus the breakdown between 1SW and MSW could be inaccurate and the magnitude of the error could vary between years.

Ireland

The figures relating to numbers of 1SW and 2SW fish were obtained using the total weight and average weights for each sea age class.

Norway

1SW fish are taken to be fish less than 3 kg. MSW fish are equal to or larger than 3 kg. The estimates are based on total weight of the two categories and the average weight of salmon in these categories for the different counties. For two counties, there were no average weights available. The estimates for these counties are based on the average weights for the total country.

Iceland

1SW and MSW fish are separated at 65 cm in length.

Canada

The weight of 1SW and MSW salmon landed each year 1982-85 by Canada was obtained from official nominal catches submitted to ICES. Each of these categories contains some previous spawners, usually less than 10%. The numbers of 1SW and MSW salmon are calculated using a mean weight of 2.0 kg for 1SW salmon and 4.5 kg for MSW salmon.

United States

The USA catch includes both wild and hatchery origin salmon for the period 1982-85. The 1985 sample for sea age was for the Penobscot River only. This sample was applied to the total Maine catch.

Faroes

The total catch in number in the Faroese fishery was derived from the catch in numbers in seven weight categories reported for individual landings. Based on monthly biological samples, these were divided into catch in numbers by sea age. In some instances, samples from neighbouring months were applied, particularly in the beginning and end of the season.

West Greenland

The numbers at age are available for the West Greenland fishery from 1982 to 1985. The numbers were derived as the product of the total number of salmon caught and the proportion of each sea age class taken in samples of commercial catches at Greenland. The total number of salmon was calculated individually for each NAFO division by dividing the catch weight by the mean weight of fish in the samples.

2 QUESTIONS OF INTEREST TO THE NORTH AMERICAN COMMISSION OF NAFO

2.1 Historical Catches of Salmon Originating in Rivers or Artificial Production Facilities of Another Country

Estimates of numbers of Maine origin 1SW fish caught in Newfoundland-Labrador fisheries were made using the model described in Anon.(1986a, p. 3-7). The Working Group extended the analysis to include tag recoveries in Newfoundland-Labrador in 1984 and total run size in Maine rivers for 1985. Estimated tag returns of 1SW fish from Newfoundland-Labrador fisheries in 1984 are given in Table 3, adjusted as in Anon.(1986a). Following the meeting of the Working Group in Woods Hole (Anon., 1986a), several transcription errors were noted in run size and harvest data for Maine rivers. It was also noted that the parameter Ua should be redefined as the numbers of untagged salmon angled below fish counting traps where they exist. Revised data, along with data for 1985, are given in Appendix 4. Updated harvest estimates by month and statistical area are presented in Tables 4 and 5 for tag retention rates (L) of 0.90 and 0.99, respectively. The resulting estimates increased by an average of 1% for both L = 0.90 and L = 0.99. Estimates of the ratio of tags recovered in home waters to run size in Maine rivers are presented in Table 6.

Estimates of harvest of 1SW Maine origin salmon in Newfoundland-Labrador in 1984 were slightly below the average of the period 1971 to 1983, while the 1985 run size of 2SW salmon in Maine was almost 80% above the average for 1972 to 1984. No account was taken of possible yearly changes in several input parameters which influence harvest estimates. Members of the Working Group noted that the proportion of tags recovered by anglers to untagged fish (T'a/Ua) was approximately equal to the proportion of tagged/untagged fish in the traps (T't/Ut) in all years except 1984 (Appendix 4). Possible causes of this apparent anomaly should be investigated.

2.2 Description of Fisheries Catching Salmon Originating in Another Country's Rivers or Artificial Production Facilities

Historically, salmon of USA origin have been taken in Newfoundland and Labrador, Nova Scotia, New Brunswick and, to some extent, in Quebec.

The preliminary landings of Atlantic salmon by statistical area in the Newfoundland, Labrador and Quebec commercial landings are given in Table 7. In Newfoundland and Labrador, there were about 3,600 licensed salmon fishermen and about 14,300 licensed gear units (1 unit = 50 fathoms of gill net) for salmon in 1985. In Newfoundland and Labrador, the commercial fishing season was as described in Anon.,(1985a, Table 22). The commercial fishing season was closed in New Brunswick, Nova Scotia and along the south shore and parts of the north shore of the Gulf of St. Lawrence in Quebec. Gear types used in the Canadian fisheries are described on p.25 Anon.,(1984a).

2.3 By-Catches and Poaching of Atlantic Salmon

Tag reporting from by-catches is necessary for calculating the number of USA origin salmon intercepted in Canadian waters. By-catch is the incidental capture of salmon in gears, set to catch other species. It is not known what proportion of the by-catch is killed. Poaching is the illegal harvest of salmon with gears purposely used to catch this species.

Estimates provided by USA state and federal biologists suggest that by-catch is small, i.e., in the order of 2% of Atlantic salmon returning to USA waters (Anon., 1986a).

By-catches in Canadian waters have been included in landing statistics through 1984. Since 1984, Canadian commercial fishermen have been required to release all Atlantic salmon taken as by-catches. However, the extent this has reduced mortality due to by-catch is unknown.

No new information was presented.

2.4 Tag Recovery Procedures and Tag Return Data

Tags of USA origin are returned to the USA either directly by the fishermen or by officials of the Government of Canada. Since many of the length and weight estimates applied by fishermen were in round numbers, this cannot be taken as precise. The Working Group recommended that any future studies which rely on these biological parameters should distinguish tags recorded by fishermen. No new information on tag recovery procedures was presented.

2.5 Salmon Tags Captured but not Reported

In past calculations of the number of USA origin salmon taken in Canadian fisheries, the Working Group employed an assumed tag reporting rate of 0.7 to 0.9 (Anon., 1986a). In areas, such as the Penobscot River, Maine, and near Nain, Labrador, where there is a high degree of contact between fishermen and agency representatives, the reporting rate is believed to be near 100%. The Working Group also suspected that the reporting rate may be declining in areas where new regulations have been imposed to reduce the catches. The Working Group assumed a tag reporting rate of 0.9 for Labrador and Maine waters, and 0.7 for insular Newfoundland. No new material was presented.

2.6 Expected Impact of Management Measures taken by Canada in 1984 and 1985 in Reducing the Harvest of USA-Origin Salmon

Canadian salmon fishery regulations have changed substantially in 1984 and 1985 (see Section 3.3) with closures of some fisheries and season or licensed effort reduction in others. No new information was presented at this meeting relating licensed fishing effort and fishing mortality. Licensed effort in the Newfoundland-Labrador fishery has been reduced due to new regulations by about 31% between the historical average (1971-83) and 1985 (Table 8), and reported catch declined by 50% from an average of 1,655 tonnes to 832 tonnes. However, the decline in catch was also influenced by reduced abundance of salmon. For example, about 1/4 of the reduction in effort occurred between 1984 and 1985, at a time that reported landings increased from 821.4 to 832.4 tonnes. The reduction in total catch and in the harvest of USA origin salmon attributed to reduced licensed fishing effort was expected to be less than 31% and could not be quantified (Anon., 1986a). At that time, the Working Group noted that 2% of the 11% estimated reduction of Canadian harvest of USA-origin salmon due to season changes and closures occurred at Newfoundland. Closures of some Newfoundland fisheries, but not season changes, are implicitly included in the reduction of licensed fishing effort there. Thus, the impacts of the two measures are not directly additive.

As another means of evaluation, the Working Group also reviewed recent harvest estimates of USA-origin fish at Newfoundland and compared these to run size estimates in Maine the following year from Table 6. A tag retention rate of 0.99 was assumed for distant fisheries. The estimated harvest of Maine-origin salmon in Newfoundland decreased by about 600 fish between 1983 and 1984 (a decrease of 32%). Run size of 2SW salmon of the same smolt class rose by about 1,500 fish (an increase of 52%) from the previous year. Although the harvest of Maine-origin fish in Newfoundland decreased from 1983 to 1984 to about 1,300 fish, it was only slightly below the 1971-83 mean of 1,400 fish. When the Newfoundland harvest of Maine-origin 1SW salmon was compared to Maine 2SW salmon run size the following year, this ratio also decreased from the 1983 to 1984 Newfoundland harvests (by about 55%) although this value was not significantly different (P>0.05) from the mean. The declines in proportions between the 1983 and 1984 Newfoundland harvests of Maine-origin salmon are consistent with the management measures adopted by Canada, but the Working Group could not conclude that the reductions were caused by the management measures as there have been wide fluctuations in previous years.

2.7 Data Deficiencies and Research Needs

This item is dealt with in Section 8 of the report.

3 QUESTIONS OF INTEREST TO THE WEST GREENLAND COMMISSION OF NASCO

3.1 The West Greenland Fishery in 1985

NASCO requested that ICES describe events in the West Greenland fishery in 1985, including regulations in effect, gear and vessels in use, temporal and geographical distribution of the fishery, and the quantity and composition of catches by continent and, if possible, country of origin.

3.1.1 Description of the fishery in 1985

The nominal catches in NAFO Subarea 1 (Figure 1) in the years 1960-85 are given in Table 9.

The fishery started officially on 1 August and ended on 2 November. The total landings at West Greenland in 1985 were 851 tonnes, 1 tonne less than the TAC of 852.3 tonnes set by the Greenland authorities. These landings do not include unreported catch.

The TAC of 852.3 tonnes was calculated to provide a reduction from 1,190 tonnes equivalent to the expected reduction (by Canadian authorities) in Canadian catches for 1984 of MSW salmon, relative to the average for 1978-83, adjusted for an opening date of August 1.

The geographical distribution of landings is given in Table 10. The distribution differs from that of previous years, where the main part was taken in NAFO Divisions 1B and 1C, whereas in 1985 the main part was taken in Divisions 1C and 1D.

No effort data are available, but a comparison between the first week's catches for the period 1976 to 1985 could give some indication of the availability of salmon to the fishery.

Nominal catches in tonnes		
Year	First week	Two first weeks
1976	147	360 (10-23 Aug)
1977	-	500 (10-23 Aug)
1978	not available	
1979	-	509 (1-14 Aug)
1980	260	711 (1-14 Aug)
1981	465	735 (25 Aug-7 Sep)
1982	470	766 (25 Aug-7 Sep)
1983	105	192 (10-24 Aug)
1984	17	58 (10-24 Aug)
1985	204	361 (1-14 Aug)

The landings during the first week and the two first weeks of 1985 were higher than the landings in 1976, 1983 and 1984, but less than in the other years. This suggests increased abundance of salmon and/or effort in 1985 relative to 1983 and 1984.

The total catch was taken by gill nets, mostly drift nets. The mesh size in force is 140 mm (stretched mesh). This is a target mesh size, not a minimum mesh size. The type of vessels participating in the fishery varied from small open boats to small cutters up to 60 tonnes.

3.1.2 Origin of salmon in the landings at West Greenland

The discriminant analysis data base discussed in last year's report (Anon., 1985b), consisting of 345 North American and 401 salmon of European origin, was used to identify the continent of origin of salmon in the West Greenland fishery in 1985. The results indicate that the proportion of salmon of North American and European origin was 50% (95% C.L. 53-46) and 50% (95% C.L. 54-47), respectively (Table 11). The estimates make no adjustment for catch by division. These confidence intervals were calculated by a technique that corrects the estimate of proportions of stock mixtures for the misclassification rate and includes sampling variation.

Temporal trends in the proportion of continent of origin were not detected. The North American proportion in NAFO Division 1B is not significantly different from that in Division 1D, but both proportions are significantly higher than those proportions observed in Divisions 1C and 1E. Similarly, the North American proportion in Division 1C is not significantly different from that in Division 1E (Working Paper 17).

Two test samples were collected in 1985, the first one derived from 41 salmon tagged outside Greenland and recaptured at Greenland; the second one was collected in homewaters and comprised 152 and 148 salmon from North America and Europe, respectively. Using the techniques outlined by Reddin and Burfitt (1983) and Reddin and Short (1985), the first sample showed a misclassification of 15%. This could indicate an increase of the misclassification rate in 1985 compared to a rate of 6% in the original data base, but the sample size was too small to justify firm conclusions. Using the same technique in the second test sample, the analysis resulted in a misclassification rate of 25%. A greater proportion of North American salmon than of European were misclassified. Because the test sample includes the same smolt year class as the fishery at Greenland in 1984, the result could perhaps indicate that the proportion of North American salmon in the 1984 Greenland fishery was underestimated.

Table 11 shows the result of the analyses of scale characteristics. There is no trend in the proportion observed in commercial samples from 1967 to 1985. The composition of continental origin is influenced by different mesh sizes, sampling sites and sample sizes from year to year.

The test samples collected from North American rivers in 1985 indicated many fish with scale patterns inconsistent with those previously observed for North American salmon at West Greenland. This may have been a result of a change in distribution of salmon in 1984 that may have occurred because of the colder-than-normal environmental conditions in the Northwest Atlantic. The Working Group, therefore, questioned whether these fish were representative of the salmon at Greenland in 1984.

An alternative estimate of the overall proportion of North American and European origin salmon for the years 1982-85 was derived, the proportion found in each division was weighted by the catch number in that division. In division(s) without samples, the overall proportions and mean estimated from all samples were used. The table below gives the new proportion compared to that found earlier.

In order to assess the alternative method, it is necessary to sample in all divisions and throughout the whole fishing season.

A comparison between the two methods to obtain the proportion of North American and European catches at West Greenland is given below:

Year	Proportion weighted by catch in number		Proportion all samples combined	
	NA	EU	NA	EU
1982	57	43	62	38
1983	40	60	40	60
1984	54	46	50	50
1985	47	53	50	50

In 1985, a proportion of 50% North American origin corresponds to a catch of 409 tonnes or 150,000 fish from North America and 442 tonnes or 150,000 fish from Europe.

The Working Group noted that nearly all salmon from 1-year smolts of North American origin are produced in hatcheries and nearly all of the USA-origin salmon are of hatchery origin. Thus, it is possible to estimate the harvest of USA-origin salmon at Greenland from observations on the number of North American salmon in the Greenland fishery and the relative proportions of 1-year smolts from USA and Canadian hatcheries among them. Specifically, the harvest (H) of USA-origin salmon of all smolt ages in the nominal catch can be estimated as:

$$H = N \times C/P$$

where

N = number of North American origin salmon from 1-year smolts in the Greenland catch,

C = fraction of the North American 1-year smolts in the fishery at Greenland that are of USA origin, and

P = fraction of the USA salmon at Greenland that were released as 1-year smolts.

The number N of North American-origin salmon harvested at Greenland that were derived from 1-year smolts was estimated from the product of the proportion of the salmon from North America (0.5), the frequencies of NA 1-year smolts observed in samples of the Greenland fishery for the years 1984 (0.049) and 1985 (0.051) and the estimated number of salmon taken in the fishery in these two years (90,000 and 300,500, respectively). This procedure produces estimates of N for 1984 and 1985 of 2,205 and 7,690, respectively.

The fraction C of the USA contribution to the North American salmon in Greenland that originated as 1-year smolts was estimated for 1984 and 1985 from the ratio of previous-year releases of 1-year hatchery smolts in Maine to the sum of the North American releases of 1-year hatchery smolts thought to contribute significantly to the harvest of such salmon in Greenland. In 1984 and 1985, the value of C was estimated to be 0.806 (368,000 of 456,500 1-year smolts released in 1983) and 0.873 (658,000 of 753,900 1-year smolts released in 1984), respectively.

The proportions P of the USA hatchery-origin salmon that were stocked as 1-year smolts in Maine and available at Greenland in 1984 and 1985 were 0.68 and 0.83, respectively. Thus, the catch of USA-origin salmon in the West Greenland fishery is estimated as about 2,600 fish in 1984 and 8,090 fish in 1985. The 1984 estimate is about 0.5% of the Maine smolt release in 1983, and the 1985 estimate is about 1% of the Maine releases in 1984.

These estimates could be improved by appropriate weightings of the various USA and Canadian hatchery releases for their relative survival and production of MSW salmon, and by including the contributions of 1-year smolts from southern New England. Additional analyses should be performed to account for the harvest of MSW salmon and repeat spawners of USA origin at Greenland. However, their inclusion would not be expected to significantly increase the harvest estimates, because of the diminished numbers of individuals of these age categories in USA populations.

In addition to these refinements, the accuracy of the classification of salmon from Greenland as North American 1-year smolts should be assessed. The Working Group identified this variable as one which might be subject to a large amount of error, because of the low relative frequency of this category in the samples from the Greenland fishery. The Working Group discussed possible misclassification errors and concluded that misclassifications of 1-year smolts as 2-year smolts is more likely than the reverse. This would tend to bias the estimated harvest of USA-origin salmon at Greenland downward. However, the combined effects of possible misclassification errors could significantly compromise the adequacy of this method to estimate the harvest of USA-origin salmon at Greenland. Consequently, the estimates derived above should be considered provisional until the robustness of the classification procedures is confirmed.

The Working Group also assessed the applicability of the tag return model employed to estimate the Canadian catch of USA-origin salmon for developing analogous estimates of the Greenland harvest of USA-origin salmon. It was determined that the model could be used to derive such estimates. However, it was discovered that at least for some years there was a considerable discrepancy between the number of tags returned from Greenland to Maine and the number of salmon tags known to have been captured in the Greenland fishery. As a consequence, it was decided by the Working Group that this model would not be applied until the appropriate tag recovery information can be resolved.

3.1.3 Biological characteristics

Biological characteristics were recorded from samples from commercial catches (NAFO Divisions 1B-1E) in 1985, using the results of discriminant analyses to divide catches into North American and European components. The compositions of fish length, weight and ages between these two groups of fish of continental origin were then compared.

As previously observed, the North American 1SW salmon were significantly shorter and lighter than their European counterparts (Working Paper 17).

The sea and smolt age compositions of samples collected are summarised in Tables 12 and 13, respectively.

The mean smolt age of 2.74 years observed in the samples from salmon of North American origin taken in 1985 is higher than observed in 1983 and 1984, i.e., 2.68 and 2.60 years, respectively, but lower than the average mean smolt age observed during the period 1968-81, which was 3.12 years. There are no corresponding changes in the mean smolt age of European origin salmon.

The sea age composition in 1985 (Table 12) of 93.8%, 5.9% and 0.3% of 1SW, 2SW salmon and previous spawners, respectively, differs from those founded in 1983 and 1984. In those two years, the 2SW components were 8.1% and 11.6%, respectively.

Based on a proportion of 50% North American origin in the 1985 West Greenland salmon catches, the catch at age by continental origin is as follows:

Sea age	NA	EU
1	139,000	142,400
2	10,500	7,000
PS	500	600
Total	150,000	150,000

The nominal catches at West Greenland from 1976 to 1985 were broken down into three weight categories based on information from the Royal Greenland Trade Department. The three weight categories are: Cat.1: 1.1 - 3.3 kg; Cat.2: 3.3 - 5.5 kg and Cat.3: more than 5.5 kg (given in round fresh weight). This breakdown into weight categories is summarised in Tables 14 and 15. The proportion of "category 3 salmon" - which only contained MSW salmon and previous spawners - increased during 1983 and 1984 compared to previous years and decreased again in 1985, which is in accordance with information obtained from the sea age compositions. If the proportion of weight-category-3 salmon in the catches can be used as an indicator of the distribution of MSW salmon in Greenland waters, the proportion of MSW salmon increased during the fishing season (Table 14). With respect to the geographical distribution, it seems that MSW salmon are more abundant in NAFO Divisions 1A, 1B and 1F than in Divisions 1C-1E (Table 15).

3.1.4 <u>Changes in the environmental conditions from 1983-84 to 1985 at West Greenland</u>

To illustrate the climatic changes in the West Greenland area in the 1980's, Figure 2 shows the anomaly of the monthly mean air temperatures at Godthåb from January 1980 to January 1986. During 1980 and 1981, the air temperature fluctuated around the normal conditions (30-year monthly mean). The period from February 1982 to November 1984 was characterised by negative temperature anomalies for each month, and particularly the winter months in 1983 and in 1984, which were extremely cold. The reason for the cold conditions was the displacement of an Arctic-Canadian cold air mass to the Davis Strait area with the centre situated near Egedesminde, where the temperature anomalies during the winters 1983 and 1984 were -12^{0}C and -14^{0}C, respectively. In 1985, the temperature returned to almost normal conditions, except for the winter months 1984-85 and 1985-86 where high positive anomalies were observed.

There are reasons to believe that negative air temperature anomalies from February 1982 to November 1984 have affected the sea surface temperature, because the mean temperature in June on Fylla Bank (the upper 40 m) is generally well correlated with the mean air temperature in the same month.

Another factor than the air temperature that can affect the surface temperature is the horizontal and vertical circulation of the water mass itself. The inflow of the relatively warm Irminger Current water into the deeper layer of the West Greenland waters is the most important long-term factor for the environmental conditions along the coast of West Greenland, but the annual variations in strength of the Irminger Current do not seem to have the same immediate effect on the temperature of the surface layer.

Therefore, the lower abundance of salmon in 1983 and 1984, followed by a somewhat higher abundance in 1985, could be partly explained by low temperatures during the winters 1982/83 and 1983/84, followed by relatively warm temperatures during the winter 1984/85.

3.1.5 The occurrence of salmon in the coastal water of East Greenland

Atlantic salmon occur in the Irminger Sea and have been caught at several stations spread over the Irminger Sea by the Danish research vessel during the summers of 1966 and 1973-75, and in 1985 by an Icelandic research vessel in the coastal area.

The proportions of salmon of North American and European origin caught in 1973-75, estimated by discriminant functions based on scale characters, were 21% and 79%, respectively (Møller Jensen and Lear, 1980). The recapture at East Greenland of adult salmon tagged as smolts in North American and European rivers has also indicated a mixed population in the area.

The salmon fishery in the coastal area of East Greenland is generally restricted and, in some years, completely prevented by drifting polar ice. The variability of catch of salmon in the coastal area seems to be reflected in the distribution of years with tag recaptures as shown below:

Recaptures taken in the coastal area of East Greenland from 1965-85.

Tagging country	Year of recapture						Total
	1965	1966	1971	1974	1977	1985	
France	-	-	-	1	-	-	1
Iceland	-	-	-	-	-	1	1
Ireland	-	-	-	-	-	2	2
Norway	-	-	-	-	2	1	3
Scotland	-	1	-	-	1	-	2
Sweden	1	-	-	1	1	-	3
Canada	-	-	1	1	3	-	5
USA	-	-	7	4	-	7	18
Total	1	1	8	7	7	11	35

The reported landings from East Greenland are, except for the years 1971, 1977 and 1978, below 1 tonne; no information from 1985 was at present available.

3.2 Effects of Varying Levels of Harvest at Greenland on Subsequent Returns of Large Salmon to Home Waters

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 1,190 tonnes with the opening date of 10 August and 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 parameter values used to calculate the loss to home waters for each tonne of salmon harvested at West Greenland are subject to fluctuations between years, the Working Group did not find sufficient changes in the parameters to warrant a new assessment. The Working Group noted that the continental proportion of salmon caught at West Greenland used in the previous assessment (Anon., 1980) was 0.41 North American and 0.59 European, based on estimates made for 1969-78. However, in recent years (1980-84), the mean North American proportion, by number, was about 0.50. Thus, the new value was used in calculations of total impact of landings at West Greenland on home waters.

From its 1980 assessment (Anon., 1980), the Working Group concluded that, for each tonne of European-origin salmon in the reported catch at West Greenland, 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, 1.47 to 2.00 tonnes would be lost to North American stocks. Hence, in 1985, 600 to 817 tonnes were lost to North American stocks and 571 to 774 tonnes were lost to European stocks.

3.3 Impact of Management Measures Taken and Proposed by States of Origin on Home Water Catches and Spawning Escapements of Salmon

Salmon occurring in the West Greenland Commission Area originate from Canada, Denmark, England and Wales, Finland, France, Iceland, Ireland, Greenland, Northern Ireland, Norway, Scotland, Spain, Sweden and United States. The major contributors to the West Greenland fishery are Canada and Scotland. The Working Group described the salmon fisheries in most countries in Anon. (1980; 1984a).

3.3.1 Changes in management measures

The Working Group noted changes in the following home water fisheries fisheries compared to previous descriptions:

Canada

The commercial fisheries in Nova Scotia, New Brunswick, the south shore and a portion of the north shore of the Gulf of St. Lawrence in Quebec (Districts 1-13), and Statistical Sections 38 and 39 on the south coast of Newfoundland (see Anon., 1985a) were closed in 1985. Many of these fisheries were also closed in 1984. Remaining commercial fisheries in Quebec were subject to a TAC of 60 tonnes for 1984 and 1985.

The opening date for the remaining commercial salmon fishery in Newfoundland was delayed from 18 May to 5 June in 1984 and 1985. There was also a reduction (29%) in the number of licensed commercial salmon fishermen in Newfoundland and Labrador from 5,100 in 1983 to 3,600 in 1985. This resulted in a reduction (27%) in licensed gear from about 19,600 gear units (1 unit = 50 fathoms of gill net) to about 14,300 units.

In 1984 and 1985, the incidental catch of salmon in commercial gear for other species had to be returned to the water.

In the recreational fisheries in 1984 and 1985, all salmon captured greater than 63 cm in length had to be released for all rivers except those in Quebec and Labrador. The angling season in all provinces except Quebec were extended by up to 2 weeks in 1985.

United States

There was no legal fishery in the Connecticut and Merrimack Rivers in 1985. Beginning in 1985, recreational fishermen were allowed to retain only 1 MSW salmon on the Penobscot River and a total of 5 salmon on all Maine rivers annually. The season opening date for the recreational fishery was changed from 1 April prior to 1982 to 1 May from 1982 onwards.

Ireland

There has been only one regulatory change in 1985 compared to the previous description in Anon. (1984a). In 1985, specific regulations dealing with the prohibition of monofilament nets were replaced by more general regulations prohibiting the use of monofilament gill nets for salmon fishing. No assessment has yet been made if this has caused any change in exploitation.

Northern Ireland

The amount of licensed gear in 1985 has changed from that described in Anon. (1984a). The changes in 1985 are as follows: a decrease of 3 drift net licenses to 122, a decrease of 74 draft net licenses to 158, and an increase of 12 fixed engine licenses to 29.

Norway

There have been only minor regulatory changes in recent years; however, more substantive changes to decrease exploitation are being considered.

Other countries

There have been only minor changes in management measures in most other countries in recent years.

3.3.2 Impact of management measures

Canada

In 1981-83, an average of 270 tonnes of MSW salmon (Table 16). were caught in commercial fisheries which were closed in 1985 or in recreational fisheries where retention of MSW salmon was prohibited in 1985. It is presumed that these fish would have survived to spawn had the 1985 regulations been in place in 1981-83. This weight is 22% of the average total landings of MSW salmon in 1981-83 for all of Atlantic Canada. Thus, it was anticipated that the landings of MSW salmon in 1985 were reduced by 22% (or 148 tonnes) due to area closures and reductions in exploitation in the recreational fisheries. Similarly, 3% of 1SW salmon would not have been caught in the commercial fisheries if area closures had been in effect in 1981-83 (Table 16). Of these, only 70% (16 tonnes) would have been expected to spawn due to angling exploitation. Thus, it can be expected that the closure of some commercial fisheries in Canada in 1985 would result in a 2% (12 tonnes) decrease in landings of 1SW salmon.

The average salmon catch, 1981-83, prior to 5 June in Newfoundland commercial fishing areas affected by a delayed opening in 1985, was 84 tonnes of MSW salmon and 7 tonnes of 1SW salmon (Table 17). These values are 11% and 1% , respectively, of the average total commercial landings in those areas in 1981-83. Thus, in 1985, many of these percentages, approximately 48 tonnes of MSW salmon and 5 tonnes of 1SW salmon, would have been affected by the delayed opening of the commercial fisheries. Some of these salmon would be subjected to fishing mortality when the season was opened, but this was not quantified.

Past assessments of the salmon stocks of the Miramichi and Restigouche Rivers included a forecast of homewater returns of MSW salmon for 1983 to 1985. Also, total returns to homewaters and spawning escapements were estimated for each river (Table 18). In 1983 and 1984, the estimated returns to both rivers were less than or approximated the predicted value. In 1985, the estimated returns, while within the 95% C.L., were 20% higher than the predicted value for the Restigouche River and 32% higher than predicted returns for the Miramichi River.

An indication of the impact of management changes in homewaters (near river estuary or in river) can be obtained by comparing the ratio of the number of MSW spawners to total homewater MSW returns (Table 18). The proportion of MSW spawners to total MSW returns has increased from 0.11 in 1983 to 0.70 in 1985 for the Restigouche River and 0.10 in 1983 to 0.93 in 1985 for the Miramichi River.

The impact of Canada's management measures in 1984 and 1985 was also evaluated by comparing mean harvests of 1SW and MSW salmon in 1984-85 to mean harvests for previous years (Table 19). While there was no significant difference in the mean of the harvests of 1SW salmon for 1984-85 compared to previous years, the mean of the harvests for 1984-85 of MSW salmon (586 tonnes) was significantly lower ($P<0.01$) than the mean harvest for 1970-83 of 1,426 tonnes. Also, the mean ratio of MSW salmon to 1SW salmon harvests of the same smolt class for the years 1984-85 (1.175) was significantly ($P<0.05$) lower than the mean ratio for the years 1971-83 (2.052). This indicates that Canada is now catching fewer MSW salmon compared to previously, relative to 1SW salmon catches of the same smolt class. This is consistent with expectations as most of Canada's management measures were directed at reductions in fisheries which harvested high proportions of MSW salmon relative to 1SW salmon in the past.

To evaluate the impact of reductions in fisheries distant from rivers of origin on returns to rivers for spawning, the mean returns to the Miramichi River for 1984-85 were compared to previous years (Table 20). The mean grilse and MSW returns for 1984-85 were not different from previous years ($P>0.05$). However, the mean ratio of MSW salmon to grilse returns of the same smolt class (assuming all MSW salmon are 2SW) for 1984-85 (0.774) was significantly greater ($P<0.01$) than the mean for 1971-83 (0.558).

Closure of the commercial fisheries in selected areas and mandatory release of MSW salmon in the recreational fishery were estimated to have reduced the harvest of MSW salmon by 22%. Increase in spawning escapement due to delayed season opening to 5 June and a 27% reduction in licensed fishing effort in Newfoundland could not be quantified.

Conclusion

The Working Group concluded that management measures taken by Canada in 1984 and 1985 reduced the harvest of salmon in Canadian fisheries, particularly the MSW salmon.

United States

On the Penobscot River, the exploitation rate by the recreational fishery decreased from 22-27% in prior years to about 10% in 1985, presumed due to changes in regulations.

Other countries

The impact of management changes in Ireland, Northern Ireland and Norway was not quantified. The Working Group was unable to evaluate the impact of existing management measures when no changes had taken place.

3.4 Tag Recovery at West Greenland

NASCO asked the Working Group to evaluate the tag recovery and return procedure at West Greenland, including an assessment of the accuracy and completeness of information accompanying tag returns, and indicate methods for improving the tag recovery and return procedures.

The Working Group considered these questions for microtags and for external tags separately. Following a recommendation from the Working Group at its March 1985 meeting, scanning of landings for fin clips and microtags was implemented on a trial basis in the West Greenland salmon fishery during the 1985 season. The Working Group confirms that the recovery, handling, and reporting procedure recommended is as set out in Appendix 5. All coded wire tags recovered at West Greenland are sent to the Fisheries Laboratory, Lowestoft (UK) for decoding.

A total of 14,319 salmon (5% of the catch) were examined for microtags at West Greenland in 1985. Among these were found 223 adipose fin-clipped fish of which 36 were carrying microtags. Two of these tags were lost in the recovery process, probably because cores had to be cut to fit into the sample bottles. Provision of somewhat wider sample bottles should prevent such losses in the future. No other technical problems were encountered in the scanning programme. Additional information (date, locality, length of fish, etc. and scales) was supplied for each tagged fish.

The trial scanning programme covered only 5% of the landings in 1985. It was felt that with the same manpower as available in 1985 the number of fish scanned could be doubled. It was also felt that it might be possible to have plant employees store fin-clipped fish separately so that these could be scanned at a later occasion. The Working Group <u>recommends</u>:

i) that, as far as practical, future sampling of West Greenland salmon landings for microtags be uniformaly spread in accordance with the temporal and spatial distribution of landings, and

ii) that all microtagged fish should, in the future, be adipose fin-clipped.

The Working Group also examined an analysis of external tag reporting rates in the Greenland fishery. Additional tag recoveries not constituted in the analysis were reported at the meeting. There was a consensus that tag reporting rates at Greenland have likely declined from the value of 0.84 reported from the 1972 experiment.

Tags are given by fishermen to local officials of the Greenland Trade Department, and a reward is paid. These officials send the tags to the Greenland Fisheries and Environment Research Institute. The tags are then forwarded to institutes in countries of origin. However, the Working Group noted discrepancies between the number of USA-origin tags reported sent in recent years by Danish authorities and those received by USA authorities. The Working Group recommends that procedures be adopted to prevent a recurrence of this situation in the future.

Fish plants normally have supplies of tag return envelopes. The same envelopes are used for all species of fish. The envelopes have fields for recording additional information regarding the tagged fish. In some instances, the return of tags has been delayed by one year or more. Information was also reported on the proportion of tags accompanied with complete information which were returned to Canada from West Greenland, 1974 to 1985. In the best years, 1974-78, about 50% of all tags were accompanied with complete information. This value declined to about 7% in 1982-83 and has since increased to about 30% in 1984-85.

An information program will be implemented in 1986 to increase awareness of fishermen with respect to tag return procedures and tag rewards, which may be increased to 100 D.Kr. The Working Group was unable to recommend means of improving information provided with tags.

3.5 Spawning Escapements and Target Spawning Biomass for Salmon Stocks Occurring in the West Greenland Commission Area

Canada

For Canadian salmon stocks contributing to the salmon population in the Commission Area, there is no target spawning biomass. However, there is a target minimum egg deposition of 2.4 eggs/m^2 area of parr rearing habitat, exclusive of lacustrine habitat, from which the spawning requirements can be calculated.

The number of salmon spawning and target escapements were available for three rivers in Canada:

River	Target deposition			1985 spawning escapement	
		Fish			
	Eggs x 10^6	MSW	1SW	MSW	1SW
Miramichi	132	23,600	22,600	22,700	24,500
Restigouche	71.4	12,200	2,600	10,200	2,800
Saint John	67.7	10,100	7,600	9,000	7,000

The 1985 spawning escapements were calculated utilising samples to determine sex ratios and fecundity and subtracting an estimate of removals upstream from the total returns to the river. The number of spawners required to achieve the target egg deposition is based entirely on the eggs from MSW spawners. Total returns were estimated from a mark-recapture experiment for the Miramichi River in 1985, for the Restigouche River from a spawner-to-angled fish ratio of 0.86 (1970-82), and for the Saint John River from counts at the Mactaqauac dam plus returns to downstream tributaries and using an exploitation of 0.33 for the angling fishery in the river.

United States

For USA salmon stocks contributing to the salmon population in the Commission Area, optimal egg density was assumed to be 2.4 per m^2. The number of spawners and spawning requirements are estimated for three rivers in USA. Spawning escapement was counted at fishway traps.

River	Target spawning escapement	1985 spawning escapement
	MSW females	MSW females
Penobscot	3,000	1,400
Merrimack	1,537	106
Connecticut	4,076	152

Norway

There is no target spawning biomass for any Norwegian river contributing to the salmon population in the Commission Area. The river exploitation rates have been estimated from fishway counts and a mark-recapture study for the River Drammen from which a spawning escapement can be estimated. The spawning escapement in 1985 was 1,988 salmon.

Other countries

Target spawning biomasses were unavailable for rivers in Iceland, Ireland, Northern Ireland, France, Scotland, England and Wales and Norway. Spawning escapements in 1985 were available for the River Blanda in Iceland (320 females), the Burrishoole River in Ireland (529), the River Bush in Northern Ireland (1,390), the River Dir in France (280), the North Esk in Scotland (9,072), and the River Drammen in Norway (1,988). Therefore, since little is known about target spawning biomass and spawning escapements for the rivers that contribute to the salmon population of the Commission Area, it is recommended that more information be obtained.

4 QUESTIONS OF INTEREST TO THE NORTH-EAST ATLANTIC COMMISSION AREA

4.1 Description of Salmon Fisheries in the North-East Atlantic Commission Area

NASCO requested ICES to assess the exploitation rates and fishing mortality exerted upon the salmon stocks which migrate in the North-East Atlantic Commission area divided between:

i) homewater fisheries, divided into freshwater and marine components, and

ii) sea fisheries beyond 12 miles.

The Working Group noted that the only high seas fishery still operating in this area was the Faroese fishery. Nominal catches are given in Table 21. Details of the catch in numbers for area, catch per unit effort and the sampling and survey programmes undertaken in 1985 are outlined in the report of the Special Study Group on the Norwegian Sea and Faroese Salmon Fishery (Anon., 1986b).

Estimates of fishing mortality in the Faroese fishery are based on Carlin tag returns from two rivers - the River Imsa in Norway (wild and hatchery-reared smolts) and the North Esk in Scotland (wild smolts). Microtag returns from the River Burrishoole in Ireland were also made available to the Working Group.

Norway - tagging study

In the 1985 Working Group report (Anon., 1985b), estimates of exploitation rates in the Faroese fisheries and in Norwegian home waters were presented for salmon tagged as smolts in the River Imsa, SW Norway. Tables 22 and 23 give updated figures for these wild and hatchery-reared fish.

Exploitation rates were estimated as described in Anon. (1985b), and the following assumptions and approximations were made:

1) Tagged fish escaping home-water fisheries return to River Imsa.

2) The monthly instantaneous natural mortality rate was taken to be 0.01.

3) Tagged and untagged fish were equally vulnerable to the gear.

4) Non-catch fishing mortality was taken to be negligible.

5) The mean dates of capture in the Faroese area, Norwegian home waters and River Imsa trap were taken to be 15 March, 15 July and 15 September, respectively.

6) Tag-reporting efficiency was assumed to range between 50% and 70% in Norwegian home waters, and was estimated at 75% in the Norwegian Sea.

Adjusting for non-reported tags and for natural mortality between the Faroese area, Norwegian home waters and River Imsa, it was possible to produce estimates of the number of salmon of the different year classes available both to the Norwegian Sea and Norwegian home water fisheries. Tables 22 and 23 give estimates of 1SW and 2SW salmon of the River Imsa stock available to the different fisheries and estimated exploitation rates in these fisheries for two levels of tag reporting in the Norwegian home water fishery. In all groups, exploitation in the Norwegian Sea of salmon in their first sea winter is zero for wild salmon and salmon released as 1+ smolts. Exploitation of 1SW salmon released as 2+ smolts is low. This may be because 2+ reared smolts are bigger than wild and 1+ reared smolts during their first sea winter are thus more vulnerable to the longlines.

Home water exploitation is very high both for grilse and 2SW salmon. The exploitation rate for 2SW fish in the Faroese fishery is lower than in home waters. However, the absolute catch of 2SW fish in the Faroese fishery can be as high as in home waters because a greater number of fish is available.

In 1985, the overall rod catch in the River Drammen was recorded and the total freshwater salmon stock was calculated using a mark-recapture technique. There is no commercial fishing for salmon in the area. The rod exploitation rate of the freshwater stock was found to be 0.33. It was noted that this exploitation rate was smaller than the mean figure of 0.51 reported for rod catches in the River Lærdal in Norway during the period 1960-77

(Rosseland, 1979). No information was presented on the marine fishery mortality of River Drammen salmon, including Norwegian coastal fisheries.

Scotland

Based on tagging experiments with wild smolts in the North Esk, Scotland, it was possible to estimate exploitation rates in the different fisheries using the same method as has been used for the River Imsa. The trap in the North Esk does not catch the total adult run, but estimates of exploitation rates based on the total run during the fishing season have been presented to the Working Group in the past (Anon., 1985b). Furthermore, counts of upstream migrants have demonstrated that 20% of the total stock migrates into the river after the fishing season has closed. It is thus possible to estimate the total annual run of tagged fish as follows:

$$\hat{N} = \frac{a}{b \quad c}$$

where

N = estimated total annual run of tagged fish from a particular smolt year class;

a = number of tagged fish caught in the North Esk;

b = estimated exploitation rate in the North Esk; and

c = proportion of migrants into the river during fishing season of the total annual run.

The following additional assumptions and approximations have been used:

1) Tagged fish escaping home water fisheries return to the North Esk.

2) The monthly instantaneous natural mortality was 0.01.

3) Tagged and untagged fish were equally vulnerable to the gear.

4) Non-catch fishing mortality was taken to be negligible.

5) The mean dates of capture in the Norwegian Sea, Scottish home waters and River North Esk were taken to be 15 March, 15 June and 15 July, respectively.

6) Tag-reporting efficiency was assumed to be 100% in the North Esk and Montrose Bay, 75% in Scottish home waters and 50% for returns from all other fisheries excluding the Faroese. From the Faroese, the estimated tag-reporting efficiency of 75% was used.

The estimated number of tagged 2SW salmon available to the fisheries at the Faroes, North Esk and all other fisheries combined and the estimated exploitation rates are presented in Table 24.

Ireland

The River Burrishoole in western Ireland has a facility for full upstream and downstream counting of adult salmon and smolts. Reared smolts were microtagged and released at a site near the mouth of the river. Details of the definition and methodology used in the calculation of exploitation rates are the same as those outlined in the 1985 Working Group Report (Anon., 1985b). Recapture details and values calculated for homewater exploitation rates for the smolt release for the years 1980-84 are presented in Table 25.

Conclusions

The results presented to the Working Group in 1986 are an update of the exploitation rates outlined in previous reports. As concluded by Anon.(1985b), it appears that a wide range of exploitation rates occurs in home water fisheries in the North-east Atlantic varying from a few percent to over 90%. Very little information relating to freshwater exploitation rates was made available to the Working Group, and no conclusions could be drawn on the extent of variation in this aspect or its possible impact on stocks in the North-East Atlantic Commission area.

4.2 Composition of Catches in The Faroese Salmon Fishery in the 1985/86 Fishery Season

The estimated catch in numbers by age group for the 1984/85 season is presented in Table 26. From a special sampling scheme in which some vessels were asked to keep illegal-sized fish, the number discarded was estimated at 13.5% of the total. This is the highest recorded since it was first monitored in 1982/83.

Tables 27 and 28 show that the higest recovery rates of tagged fish are from the smolt releases at the Swedish west coast and western Norway. The recapture rates of salmon tagged in Scotland, Ireland and England are similar and are at the low end of the range. The recapture rate from Iceland appears to be even lower.

The number of recoveries where the fishing position has been given by statistical rectangles are plotted by country of origin in Figures 3-6. An analysis of the recovery locations of all tags in the fishery showed that they were taken in the rectangles associated with the highest catches, and it is also evident that salmon from all countries are found well mixed in the same areas.

During an experimental fishery program for salmon off the Faroes in the period 1969-76, 1,949 salmon were tagged and released at sea. Of these, 93 were subsequently recovered in a number of different geographical areas (see for instance Anon., 1981). The highest numbers of recoveries were in Norway (31), Scotland (33) and Ireland (15). From this experiment, it has sometimes been wrongly concluded that these countries are contributing smolts to the Faroese fishery today in approximately the same proportions. The number of salmon tagged by statistical rectangle during the

1969-76 experimental fishery is presented in Figure 7. Comparing this figure with the distribution of the recent fishery, it is evident that the tagging took place at the very fringe of the area fished today. Any conclusion on the origin of the salmon caught now cannot, therefore, be based on the tagging programme in the period 1969-76.

The number of recoveries of Norwegian tags relative to the number released (Table 27), on the other hand, strongly indicates that Norway is by far the largest contributor to the Faroese fishery, especially taking into account the number of smolts produced by each country. This is, furthermore, substantiated by the high proportion of salmon of river age 3 or greater caught in the Faroese fishery.

4.3 Catches of Salmon in the North-East Atlantic Commission Area

NASCO asked ICES to present the catch statistics of the North-East Atlantic Commission salmon fisheries on an annual basis, and on a seasonal basis where the season overlaps the end of the year, distinguishing between freshwater and marine components.

Catches of salmon taken at the Faroes from 1982 to 1985 are shown by calendar year and by fishing season in Table 21. The Faroese salmon fishery is the only one in the North-East Atlantic Commission area with a season extending over 1 January. Catches of other fisheries in the area are shown in Table 1. These catches for 1983-85 are sub-divided, where possible, into riverine, estuarine and marine components in Table 29.

In some countries, catch statistics are not collected in a way which easily distinguishes riverine, estuarine and marine catches. For Ireland, all drift net catches were called marine, draft net estuarine and rod and trap catches were called riverine. Divisions between zones in England and Wales involve some approximations. For Scotland, the rod fishery was considered riverine, the net and coble fishery estuarine, and the bag and stake net fishery marine.

In the absence of a suitable definition to split the brackish water, estuarine zone into freshwater and marine components, the Working Group was unable to report estuarine catches in the categories requested by NASCO.

4.4 Contribution of Hatchery-Reared Salmon and Fish Farm Escapees to the Faroese Salmon Fishery

NASCO asked ICES to estimate the contribution of hatchery-reared fish and fish farm escapees to the Faroese fishery.

Many countries are presently augmenting natural production by releasing into their rivers, in total, many millions of juvenile salmon at or before the smolt stage. Furthermore, farming Atlantic salmon in countries bordering the North-east Atlantic has increased dramatically in recent years and the present annual rate of increase is likely to continue in the foreseeable future. In 1985, the total production of farmed salmon was 35,000 tonnes of which 29,000 tonnes were produced by Norway.

For some years, it has been known that hatchery-reared smolts, tagged and released in rivers of the salmon-producing countries, are recaptured in the Faroese fishery and there is now direct evidence from Norway that salmon known to have escaped from sea-cages have also been caught in this fishery in addition to Norwegian home-water fisheries. Thus, there is an urgent need to provide a method whereby fish which have escaped from farms (escapees) can be identified in the Faroese catch and at the same time to have the ability to distinguish them from fish which had originally been released, at or before the smolt stage, to enhance home water stocks.

Three methods have presently been explored:

1) direct observation of catches at sea,

2) discriminant analysis, and

3) scale reading.

1) <u>Direct observation of catches at sea</u>

Experienced observers have determined the proportion of fish in the catch with eroded fins taken during research cruises. In 1985, the value reported was some 7% of the catch. However, this value was probably an overestimate of the number of fish farm escapees because the observers could have included some fish which had originally been released at or before the smolt stage to enhance home-water stocks. Such fish could also have eroded fins and, therefore, be indistinguishable from escapees. Conversely, this method would exclude any escapees which lacked fin erosion.

2) <u>Discriminant analysis</u>

Discriminating between fish farmed at two units in Norway and wild Norwegian salmon has been investigated using right and left pectoral and upper and lower tail fin measurements. The results of this analysis showed that 94.4% and 91.4% of the wild and farmed salmon examined could be correctly classified. However, before this method is adopted for general use, material from a much wider range of farms and wild stocks should be tested. In addition, it would be necessary to include material in these tests from fish known to have been released at or before the smolt stage in home rivers and subsequently caught as adults in the Faroese fishery.

3) <u>Scale reading</u>

The Atlantic Salmon Scale Reading Workshop (Anon., 1984b) concluded that there could be considerable difficulty in ageing the river zone of reared salmon using standard procedures. All the fish judged by an experienced scale reader to have abnormal freshwater growth patterns were considered reared fish. Using this method, 4.2% of the fish sampled in the 1984/85 fishing season were classified as reared fish.

Although this group could have included fish released at or before the smolt stage for river enhancement, it might not include fish reared to the smolt stage in cages in lochs and subsequently escaping from sea cages because the river growth pattern on their scales could have been normal. Nevertheless, there was a good measure of agreement using this method to identify reared fish and the results obtained by the experienced observer examining catches at sea.

On the basis of the data available to the Working Group, it concluded that reared fish contributed between 4% and 7% to the Faroese salmon catch in the 1984/85 fishing season.

Because of the possible dramatic increase in the number of escapees likely to be caught in the Faroese area in future years, there is an urgent need to devise methods to distinguish between wild fish and escapees and to separate from the latter group any hatchery-reared fish which have been released in home rivers at or before the smolt stage to enhance home water stocks.

Therefore, the Working Group recommends that investigations to develop methods to identify fish belonging to these groups should continue and the use of alternative methods should be explored and endorses the recommendations of the Special Study Group on the Norwegian Sea and Faroese Salmon Fishery.

4.5 Natural Mortality of Salmon in the Marine Phase

The estimation of natural mortality of salmon during its marine life is of great importance to stock management programmes and in attempts to assess the impact of high seas fisheries on home water stocks and catches.

It is reasonable to assume that the natural mortality of salmon does not remain constant throughout the marine phase of its life history. If natural marine mortality is mainly due to predation, the larger the fish, the fewer potential predators it has. It is thus reasonable to suggest that the natural mortality rate decreases with fish size (Doubleday *et al*.,1979). Previous estimates of natural mortality of Atlantic salmon have been presented in the context of assessing the survival of salmon subsequent to their exposure to the West Greenland fishery. Doubleday *et al*. (1979) used the inverse weight model to obtain estimates of the natural mortality of salmon from the Sandhill River, Labrador and the River Bush, Northern Ireland over the period 14 to 24 months (after leaving the river as a smolt). In addition, further estimates were calculated for the River Bush assuming no growth from 1SW onwards. This model has also been used to estimate natural mortality at sea for salmon originating from North Esk River, Scotland (Shearer, 1984). The results of these studies are shown in Table 30.

Due to the lack of data describing the abundance of salmon between smolt descent and their return to home water, the inverse weight hypothesis has not been proven.

Data available to the Working Group from River Imsa, Norway and the Burrishoole River System in Ireland suggest that the natural mortality of wild salmon from the time smolts leave their home river until they become available in the Faroese longline fishery ranges between 0.50 and 0.80. This covers a period of 6-8 months. For both rivers, there is great variation between years, and the figure of 0.50 obtained for the Burrishoole salmon in 1985 is considerably lower than previous estimates. It should be noted that the figures are based on the same assumptions and approximations as were used in the present exploitation models of the two rivers. It should also be noted that the assumed monthly natural mortality rate used subsequent to the salmon becoming available to the fisheries was 0.01.

4.6 Plan and Coordinate a Programme of Research to Examine Data for Salmon Originating in Selected Rivers as a Basis for Advising Whether Rates and Patterns of Exploitation are Within Safe Biological Limits

The concept of safe biological limits for exploitation of Atlantic salmon is discussed in Section 6 of this report in terms of spawning stock biomass.

The Working Group reviewed a number of approaches in the literature, notably Symons (1979) and Chadwick (1982), to the problem of estimating the spawning escapement given optimum production. An experimental design to approach this problem in two rivers in Newfoundland was described.

There were three basic approaches:

1) determine optimum parr densities for habitats of different productivity and estimate the egg production required to produce these densities;

2) monitor a river and determine the number of smolts arising from a known parent egg deposition; and

3) manipulate the stocks of adult salmon in one or more rivers to produce known and varied egg depositions and monitor the resultant smolt production.

It was felt that, in all these approaches, a target escapement or egg deposition should be established as a baseline for reviewing rates and patterns of exploitation. There were difficulties with the three approaches, and it would be difficult to plan general programmes of research for a wide variety of local problems.

The parameters and guidelines presented in the literature should be treated with caution as limited data were available to the authors or the data describe only very specific situations.

It was pointed out that it was complicated to interpret data from juvenile studies. The numbers and age groups were related to the habitat types. Many parameters, including discharge, proportion of rearing areas available and the age structure of the population, could act as limiting factors, and this would determine the egg production necessary in any particular case.

Egg deposition would have to vary a great deal to provide the data points necessary for a recruitment curve. It was important, also with this approach, to know the smolt age composition and the sex ratio in the adult population.

The approach of varying the egg deposition by manipulation seemed likely to give information over a shorter period, but the limitations outlined above apply here also.

The Working Group noted that more data in different ecological zones with different smolt ages and habitat types were required. This work should be encouraged on a range of rivers on both sides of the Atlantic.

A number of rivers were identified where programmes of research on rates and patterns of exploitation could be planned. These rivers were: River Imsa, Norway; North Esk, Scotland; River Bush, Northern Ireland; and River Burrishoole, Ireland.

There was no obvious need for coordination of these studies because of their diverse natures other than the recovery of tags internationally as is carried out at present.

4.7 Feasibility of Regulating the Faroes Salmon Fishery by Limitations of Fishing Effort

In general, the problems of regulation of the fisheries by limitation of fishing effort are the same as for the TAC-approach since natural mortality and the fishing mortality rate at the Faroes are largely unknown.

However, exploitation rates have been estimated for salmon from one river in each of Norway, Ireland, Northern Ireland and Scotland, respectively. The information available suggests that fishing mortality varies between the stocks and between years.

According to homewaters nominal catches (Table 1), the abundance of MSW salmon varied over the period 1980-84 by a factor of 1.4 for Norway, 1.7 for Scotland, and 3.2 for Ireland.

The catch rate data at the Faroes expressed as catch per 1,000 hooks/month (Table 31) show a variation of a factor of 3-4 within the season, which often is more than between seasons.

Based on experience elsewhere with limitations on a dimension of fishing effort which led to expansions in other dimensions (i.e., the Canadian Pacific salmon fishery), an evaluation of possible effects of effort limitations was made as follows:

a) Number of lines/boat - Most boats already operate at their maximum capacity; therefore, no significant expansion on this dimension could be expected.

b) Bait - The fishermen are reported to be very particular about bait type and quality already, thus no additional effectiveness by changing bait types could be achieved.

c) Boats - Data on individual performance of different classes of boats taking part in the salmon fishery would have to be analysed in greater detail to allow for definite conclusions. Considering the greater catch rates during that part of the season when the weather mostly is rough (Table 31), larger boats may have an advantage in efficiency over small boats.

d) Prolongation of line fishing time - The lines are shot just once per day and there is, therefore, no room for gaining efficiency by expanding the duration of sets.

e) Cooperative fishing operations - Under quota regulations, there has been little cooperation between vessels to find fish. Effort regulation, on the other hand, may in theory lead to the fishermen enhancing efficiency by cooperative fishing.

f) Quotas - An individual boat effort quota would give less motive to catch large fish than an individual boat catch quota.

Conclusions

It is technically feasible to regulate the number of hooks used. The number and size of vessels taking part in the fishery could also be limited. It is, therefore, feasible to regulate fishing effort. Both abundance and catchability appear to vary substantially between years and, most likely, within seasons.

The Working Group could not determine whether a fixed TAC or a fixed fishing effort level would lead to a more constant fishing mortality. There appears, however, to be some potential for increased efficiencies.

5 IMPACT OF NON-TAGGED, ADIPOSE-FIN-CLIPPED SALMON ON THE DETECTION OF CODED WIRE TAGS

Difficulties have been encountered in detecting which tags in Atlantic salmon return to USA waters. There is a concern that if the frequency of microtags in fish examined for detection is low, insufficient effort will be exerted on average, and some microtags will go undetected.

The ICES Anadromous and Catadromous Fish Committee (ANACAT), at the 1985 Statutory Meeting, considered a suggestion by Dr. P. Goodyear (USA), that adipose fin clipping should be limited to use as an external mark for tagged Atlantic salmon. It was proposed that this practice would both minimise the number of salmon that must be purchased or otherwise handled to retrieve microtags and thereby improve the detection rate of microtags in tagged salmon. This suggestion was referred to the Working Group.

At the present time, only relatively small numbers of adipose-fin-clipped salmon require examination from microtags. Therefore, there would seem to be no significant saving in cost or sampling effort in reducing this number. The Working Group had no information relating the frequency of microtagged salmon among adipose-fin-clipped salmon to the possibility of detecting microtags.

It was noted by the Working Group that if the frequency of microtags among fin-clipped salmon was very high and the latter were few, some fishermen might withhold adipose-fin-clipped fish from the sampled catch. Based on the data provided in the 1985 ANACAT Activities Report, about 8.5% of fish with adipose clips released in 1984 were also marked with microtags. In contrast, about 16% of the adipose-fin-clipped fish at West Greenland were found to possess tags. This observation suggests that the frequency of tagged salmon with adipose fin clips in the stock was higher than the ANACAT Report indicated. Members of the Working Group pointed out that Canada was the only country which reported to ANACAT fin clips on non-microtagged fish. Many other adipose-fin-clipped salmon are known to have been released than are reflected in the ANACAT Report. Consequently, the expected frequency of marked, adipose-fin-clipped salmon could not be ascertained.

The adipose fin clip is used for many other purposes than the identification of salmon marked with some other tag. It is used as a mark to distinguish hatchery from wild salmon in returns to river systems augmented by hatchery releases. It is widely used in small-scale experiments to estimate parr densities, movement and other factors within natal streams. In some nations, many of the fish released with adipose fin clips have been reared and released by private institutions to quantify their contribution to the runs. In most cases, government agencies have little or no regulatory control over such activities. Reduction of the use of adipose fin clips to tagged salmon would represent a major change from past practices.

Existing evidence does not indicate a need to restrict adipose fin clips to fish also marked with other tags. However, it is apparent that fish with microtags should also be fin-clipped, otherwise it is likely that the probability of detection in fisheries will be greatly diminished. The Working Group also suggested that all fish marked with coded wire tags be checked for tag retention prior to release and that a specific experiment be conducted to determine the fraction of tags not detected at current frequencies of tags in the sampled population.

6 PROVISION OF ADVICE FOR MANAGEMENT OF STOCKS "WITHIN SAFE BIOLOGICAL LIMITS"

The Working Group was asked to address the concept of safe biological limits for the exploitation of Atlantic salmon in the North Atlantic. Using the approach of the Irish Sea and Bristol Channel Working Group as a model, the primary lines of evidence which would lead to an assessment that safe biological limits had been exceeded are:

1) declines in recruitment,

2) declines in spawning stock,

3) historically low values of spawning stock or recruitment in the past two years, and

4) projections that recruitment would reach historically low levels in the next two years.

The Working Group emphasised that determination of a safe biological limit for Atlantic salmon which is anadromous was fundamentally different from similar assessments for other marine species. First, the premise of forming regulations on the basis of individual stocks is now firmly established. Yet Atlantic salmon are comprised of several thousand stocks, most of which are inadequately studied and are fished in mixed-stock fisheries.

Moreover, within a major river system, there may be several stocks of differing production and trend of abundance. Second, rivers which have been thoroughly studied are often small and perhaps not representative of major rivers. Third, Atlantic salmon rivers span a wide range of latitudes, temperatures and productivity levels. Thus, generalisations based on one or two isolated systems may be misleading. Fourth, there is extensive artificial enhancement of Atlantic salmon.

General approaches

Several generalisations were proposed to define safe biological limits in terms relevant to Atlantic salmon. The criteria suggested that safe biological limits were exceeded if:

a) egg deposition for a stock was less than required to maintain that stock,

b) hatchery supplementation was required to maintain a stock,

c) consistent declines in catches occur in the North Atlantic, and

d) insufficient genetic diversity for spawners occurred in a river.

Density-dependent processes within the freshwater and marine stages can act to buffer the populations from decreases in numbers of spawners. The ability of such mechanisms to compensate for decreased egg deposition is obviously limited, but the upper extreme is difficult to define.

Hatchery supplementation of natural stocks may be counter-productive for a number of reasons such as increased density of adults attracting additional fishing effort.

Limited data are available to assess stock-recruitment relations in Atlantic salmon. Two papers which focus on the determination of optimal escapement levels are by Elson (1975) and Symons (1979). Elson (1975) argued that maximum smolt production should occur at some intermediate level of egg deposition. Symons' (1979) synthesis suggests that a stream will reach maximum smolt production when egg deposition equals or exceeds 3.4 eggs/m^2. Recent publications of Chadwick (1982) and Buck and Hay (1984) support Symons' assertions.

The optimum egg deposition levels specified by either the Elson or Symons models should be viewed as threshold levels necessary to attain maximum smolt output for the areas sounded. Abiotic events, in particular cold temperatures, can result in severe density-independent reductions in smolt density. For example, Chadwick's single observation of very low smolt output in a year of high spawning density was related to a long severe winter.

No papers were presented addressing the issue of historically low levels of spawners, but members indicated that in at least two rivers, the Burrishoole in Ireland, and River Imsa in Norway, numbers of spawners were reduced. Representatives from other countries reported either steady or fluctuating levels of spawners, although some of the series were very short. Such trends are easily confounded due to increased rates of smolt stocking (e.g., in USA) or variations in sea survival. Moreover, it was noted that reliance on short-term trends could be highly misleading for Atlantic salmon stocks.

The only examples known to the Working Group of a hatchery being required to maintain stocks were for rivers such as the Clyde in Novia Scotia where acid precipitation or other freshwater habitat loss had reduced salmon productivity.

Total catches reported to ICES have varied from 6,530 tonnes in 1961 to 11,948 tonnes in 1973. These figures, while subject to numerous biases, should be consistent with actual total catches unless there have been concomitant trends in the relative amount of non-reported catch. Some rivers have spawning populations of only a few salmon. The loss of one or more components of a spawning run may reduce the genetic variability of that run. No analyses were presented to the Working Group to substantiate this possibility.

7 WORKING GROUP DATA BASE

At its meeting in March 1985 (Anon., 1985b), the Working Group recommended the collection of river index data from specified rivers and suitable biological sampling data into a single data base. Data were provided from Canada, Ireland, Northern Ireland, Norway, Scotland and USA. However, some members reported that agencies had expressed reservations about supplying data without having a better idea of the use to which it would be put and also having some assurance that use of the data by the Working Group would not prejudice their own publications of research results.

It was agreed that the data would only be used to answer questions put to the Working Group. In addition, the following restrictions to the use of the data were agreed:

a) Access to the data should be limited to Working Group members.

b) The data should only by used by members during the course of Working Group meetings.

c) Data from particular countries should not be used if representatives of that country were not present at a meeting.

d) Raw data should not be used in the report and any synthesis presented should not permit inference of the raw data.

e) Sections of the report using the data should include reminders that permission has to be sought to cite the report. In addition, references to the source of the data could be included as personal communications if this were requested.

The Working Group agreed that descriptions of the fisheries and sampling schemes involved in the data base would be desirable.

8 FUTURE RESEARCH

The Working Group reviewed research needs identified at both the March 1985 meeting in Copenhagen (Anon., 1985b) and the September 1985 meeting in Woods Hole (Anon., 1986a). The progress made on each item is summarised in Table 32.

The Working Group reiterated the need for more information on the items of Table 32 for which there is a need for further research:

28) Unreported catches have not been reported for some countries and fisheries. This information is needed to fully document North Atlantic salmon catches.

29) Catch-at-age data were preliminary and incomplete; more complete reporting is required.

30) The Working Group discussed the salmon research programmes at Greenland and around the Faroe Islands. It was noted that the sampling programmes supply data on stock composition (continent of origin and river and sea age of salmon) and on biological characters (growth, sex, etc.), and that the recent programme at Greenland also serves the purpose of ensuring that microtags are found. It was noted that continent-of-origin data and data on biological characteristics have shown relatively little variation between years, and it was discussed whether, for this reason, the sampling could be made on a smaller routine scale. In the present programmes, salmon catches are sampled much more intensively than catches of any other fish in the Greenland and Faroese fisheries. Opinions were, however, expressed that as long as NASCO requests annual advice on status of stocks and of effects of varying levels of harvest in specific fisheries on other specific fisheries, it seems necessary to maintain the high level of sampling. Also, with the present intensification of smolt-tagging programmes with microtags, it was felt necessary to inspect a relatively high proportion of the landings in search of recaptures, at least until results of analysis of recent large-scale tagging experiments have been presented and the experiments evaluated. The Working Group <u>recommends</u>:

i) that future sampling of West Greenland salmon landings for microtags, in so far as practical, be uniformly spread in accordance with the temporal and spatial distribution of landings;

ii) that the possibility of having landings in places and/or in periods not covered by sampling teams sampled by plant employees with respect to adipose-fin-clipped fish should be investigated; and

iii) that means be investigated to improve the cost of effectiveness of sampled salmon catches at West Greenland.

31) The accuracy of estimates of the age composition of catches of North American hatchery-origin salmon at Greenland should be examined, including needed sample sizes.

9 OTHER BUSINESS

As recommended by Anon.(1985b, p.11), Table 33 shows the distribution of tags of salmon captured outside home waters and tagged as wild smolts or hatchery-reared smolts released in their home river. No data were available for western Sweden and the USSR.

Table 1 Nominal catch of SALMON in home waters (in tonnes round fresh weight) 1960-85.

Year	France	Engl.+ Wales	Scotland[2]			Ireland[3]			Northern Ireland[3]/[4]	Norway[5]		
	T	T	S	G	T	S	G	T	T	S	G	T
1960	50-100	283	927	509	1,436	-	-	743	139	-	-	1,659
1961	50-100	232	772	424	1,196	-	-	707	132	-	-	1,533
1962	50-100	318	808	932	1,740	-	-	1,459	356	-	-	1,935
1963	50-100	325	1,168	530	1,698	-	-	1,458	306	-	-	1,786
1964	50-100	307	913	1,001	1,914	-	-	1,617	377	-	-	2,147
1965	50-100	320	835	728	1,563	-	-	1,457	281	-	-	2,000
1966	50-100	387	788	836	1,624	-	-	1,238	287	-	-	1,791
1967	50-100	420	857	1,276	2,133	-	-	1,463	449	-	-	1,980
1968	50-100	282	783	780	1,563	-	-	1,413	312	-	-	1,514
1969	50-100	377	539	1,408	1,947	-	-	1,730	267	801	582	1,383
1970	50-100	527	503	826	1,329	-	-	1,787	297	815	356	1,171
1971	50-100	426	496	923	1,419	-	-	1,639	234	771	436	1,207
1972	34	442	588	1,105	1,693	200	1,604	1,804	210	1,064	514	1,568
1973	12	450	661	1,303	1,964	244	1,686	1,930	182	1,220	506	1,726
1974	13	383	578	1,063	1,631	170	1,958	2,128	184	1,149	484	1,633
1975	25	447	669	892	1,561	274	1,942	2,216	164	1,038	499	1,537
1976	9	208	328	682	1,010	109	1,452	1,561	113	1,063	467	1,530
1977	19	345	369	762	1,131	145	1,227	1,372	110	1,018	470	1,488
1978	20	349	781	542	1,323	147	1,082	1,230	148	668	382	1,050
1979	10	261	598	478	1,075	105	922	1,097	99	1,150	681	1,831
1980	30	360	851	283	1,134	202	745	947	122	1,352	478	1,830
1981	20	493	843	389	1,233	164	521	685	101	1,189	467	1,656
1982	20	286	596	496	1,092	63	930	993	132	985	363	1,348
1983	16	432	672	549	1,221	150	1,506	1,656	187	957	593	1,550
1984	25	345	504	509	1,013	101	728	829	78	995	628	1,623
1985[1]	22	362	495	379	874	100	1,495	1,595	98	892	630	1,522

(cont'd)

Table 1 (cont'd)

Year	Sweden (west coast)	Finland	USSR[6]	Iceland	Canada[7]			USA	Total all[8] countries	Unrep. catch	Total incl. unrep. catch
	T	T	T	T	S	G	T	T	T		
1960	40	-	1,100	100	-	-	1,636	<2	7,212		
1961	27	-	790	127	-	-	1,583	<2	6,403		
1962	45	-	710	125	-	-	1,719	<2	8,483		
1963	23	-	480	145	-	-	1,861	<2	8,148		
1964	36	-	590	135	-	-	2,069	<2	9,268		
1965	40	-	590	133	-	-	2,116	<2	8,576		
1966	36	-	570	106	-	-	2,369	<2	8,475		
1967	25	-	883	146	-	-	2,863	<2	10,417		
1968	20	-	827	162	-	-	2,111	<2	8,279		
1969	22	-	360	133	-	-	2,202	<2	8,496		
1970	20	-	448	195	1,562	761	2,323	<2	8,173		
1971	18	-	417	204	1,482	510	1,992	<2	7,631		
1972	18	32	462	250	1,201	558	1,759	<2	8,273		
1973	23	50	772	256	1,651	783	2,434	2.7	9,802		
1974	32	76	709	225	1,589	950	2,539	0.9	9,554		
1975	26	76	811	266	1,573	912	2,485	1.7	9,616		
1976	20	66	NA	225	1,721	785	2,506	0.8	7,249		
1977	10	59	NA	230	1,883	662	2,545	2.4	7,311		
1978	10	37	NA	291	1,225	320	1,545	4.1	6,007		
1979	12	26	430	225	705	582	1,287	2.5	6,356		
1980	17	34	631	249	1,763	917	2,680	5.5	8,040		
1981	26	44	450	163	1,619	818	2,437	6.0	7,314		
1982	25	54	311	147	1,082	716	1,798	6.4	6,212		
1983	28	57	436	198	903	530	1,434	1.3	7,216		
1984	40	44	354	159	645	467	1,112	2.0	5,624		
1985[1]	42	49	-	198	526	574	1,100	2.1	5,864	3,070[9]	8,934

S = Salmon (two or more sea winter fish).

G = Grilse (one sea winter fish).

T = S + G.

[1]Provisional figures.

[2]Salmon & grilse figures for 1962-77 corrected for grilse error.

[3]Catch on River Foyle allocated 50% Ireland and 50% N. Ireland.

[4]Not including angling catch (mainly grilse).

[5]Before 1966, sea trout and sea char included (5% total).

[6]USSR catch mainly salmon (2 or more sea winter fish).

[7]Includes estimates of some local sales and by-catch, some fish in "G" column are non-maturing.

[8]French catch taken as 75 tonnes from 1960-71 and USA catch as 1 tonne from 1960-71.

[9]No estimate provided for some countries.

Table 2 Catch of salmon in numbers and weight in tonnes (round fresh weight).

Country	Year	1SW		2SW		3SW		4SW		5SW		MSW		PS		Total	
		No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
France	1985	1,074	-	-	-	-	-	-	-	-	-	3,278	-	-	-	4,352	22
Scotland	1982	208,061	416	-	-	-	-	-	-	-	-	128,242	596	-	-	336,303	1,092
	1983	209,617	549	-	-	-	-	-	-	-	-	145,961	672	-	-	320,578	1,221
	1984	213,079	509	-	-	-	-	-	-	-	-	107,213	504	-	-	230,292	1,013
	1985[1]	147,864	379	-	-	-	-	-	-	-	-	111,083	495	-	-	258,947	874
Ireland	1980	248,333	745	-	-	-	-	-	-	-	-	39,608	202	-	-	287,941	947
	1981	173,667	521	-	-	-	-	-	-	-	-	32,159	164	-	-	205,824	685
	1982	310,000	930	-	-	-	-	-	-	-	-	12,353	63	-	-	322,353	993
	1983	502,000	1,506	-	-	-	-	-	-	-	-	29,411	150	-	-	560,822	1,656
	1984	242,666	728	-	-	-	-	-	-	-	-	19,804	101	-	-	262,470	829
	1985	498,333	1,495	-	-	-	-	-	-	-	-	19,608	100	-	-	517,941	1,595
Norway	1984	292,555	628	-	-	-	-	-	-	-	-	174,683	995	-	-	467,238	1,623
Iceland	1982	23,026	58	-	-	-	-	-	-	-	-	18,119	89	-	-	41,145	147
	1983	33,769	85	-	-	-	-	-	-	-	-	24,454	113	-	-	58,223	198
	1984	18,901	47	-	-	-	-	-	-	-	-	22,188	112	-	-	41,089	159
	1985[1]	49,735	124	-	-	-	-	-	-	-	-	16,578	74	-	-	66,313	198
Canada	1982	358,000	716	-	-	-	-	-	-	-	-	240,000	1082	-	-	598,000	1,798
	1983	265,000	530	-	-	-	-	-	-	-	-	201,000	903	-	-	466,000	1,434
	1984	234,000	467	-	-	-	-	-	-	-	-	143,000	645	-	-	377,000	1,112
	1985	287,000	574	-	-	-	-	-	-	-	-	117,000	526	-	-	404,000	1,100
USA	1982	33	-	123	-	5	-	-	-	-	-	-	-	21	-	1,182	-
	1983	34	-	330	-	2	-	-	-	-	-	-	-	5	-	371	-
	1984	56	-	575	-	2	-	-	-	-	-	-	-	12	-	645	-
	1985	24	-	546	-	7	-	-	-	-	-	-	-	7	-	584	-
Faroe Isl.	1982/83	10,000	-	112,000	-	24,000	-	500	-	+	-	-	-	-	-	147,000	-
	1983/84	5,000	-	129,000	-	15,000	-	+	-	-	-	-	-	-	-	149,000	-
	1984/85	400	-	136,000[2]	-	10,000	-	-	-	-	-	-	-	2,000	-	150,000	-
West Greenland	1982	315,532	-	17,810	-	-	-	-	-	-	-	-	-	2,688	-	336,030	-
	1983	90,500	-	8,100	-	-	-	-	-	-	-	-	-	1,400	-	100,000	-
	1984	78,942	-	10,442	-	-	-	-	-	-	-	-	-	630	-	90,014	-
	1985	292,181	-	18,378	-	-	-	-	-	-	-	-	-	934	-	311,493	-

[1] Partial catch.

[2] 5,000 reared salmon is included.

Table 3. Estimated tag returns from 1SW salmon of Maine origin in Newfoundland-Labrador fisheries by Statistical Area and month for 1984. Other = Statistical Areas E to N.

MON	A	B	C	D	O	OTHER
MAY	0	0	0	0	0	0
JUN	0	0	0	0.88	0	0.88
JUL	0.95	0.95	1.90	0.95	1.90	1.90
AUG	1.94	0	0.97	0	9.70	0
SEP	0	0	0	0	1.95	0
OCT	0.94	0.94	0	0	0	0
NOV	1.93	3.86	0.96	0	0	0
DEC	0	0.97	0	0	0	0

Table 4. Number of 1SW salmon of Maine origin harvested in Newfoundland-Labrador by Statistical Areas and months from 1971 to 1984, assuming a tag retention rate of 0.90.

1971

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	0	0	0	0	0
JUN	0	6	6	17	0	22	50
JUL	24	30	6	0	23	12	96
AUG	0	6	0	0	14	6	27
SEP	0	0	0	0	29	0	29
OCT	0	6	0	0	0	6	12
NOV	6	61	37	0	0	0	104
DEC	0	12	12	0	0	0	24
	30	121	60	17	67	46	341

1972

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	0	0	0	11	11
JUN	0	0	0	9	0	28	38
JUL	0	0	0	0	0	31	31
AUG	0	0	10	0	8	31	50
SEP	0	0	0	0	49	0	49
OCT	0	0	0	0	0	0	0
NOV	0	0	31	0	0	0	31
DEC	0	0	0	0	0	0	0
	0	0	42	9	57	102	210

1973

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	0	0	0	0	0
JUN	8	15	8	8	6	46	90
JUL	25	0	0	0	6	25	56
AUG	0	0	0	0	26	0	26
SEP	0	0	0	0	13	0	13
OCT	0	0	0	0	0	0	0
NOV	8	17	0	0	0	0	25
DEC	0	0	0	0	0	0	0
	41	32	8	8	52	71	212

ctd.

Table 4 (ctd)

1974

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	8	4	0	4	16
JUN	0	0	7	42	0	84	133
JUL	99	38	30	38	24	68	297
AUG	0	8	8	0	6	0	21
SEP	0	0	8	0	6	0	14
OCT	8	8	15	0	0	0	30
NOV	31	146	15	0	0	0	192
DEC	0	69	39	0	0	0	108
	137	269	130	84	36	156	811

1975

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	5	0	0	0	5
JUN	0	38	28	19	0	28	113
JUL	123	103	21	21	40	62	368
AUG	10	10	0	21	65	0	107
SEP	0	0	0	0	41	0	41
OCT	0	51	10	0	0	0	61
NOV	42	166	42	0	0	0	249
DEC	0	0	21	0	0	0	21
	175	368	127	60	146	90	965

1976

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	16	0	0	0	16
JUN	138	111	55	0	0	111	415
JUL	633	90	121	60	211	90	1206
AUG	61	123	0	61	286	31	563
SEP	0	0	0	0	48	0	48
OCT	0	0	0	0	0	0	0
NOV	31	122	0	0	0	0	153
DEC	0	0	0	0	0	0	0
	864	446	192	122	546	232	2401

ctd.

Table 4 (ctd)

1977

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	0	0	0	0	0
JUN	102	51	0	0	0	102	255
JUL	277	111	0	0	43	0	431
AUG	0	0	0	0	44	0	44
SEP	0	0	0	0	44	0	44
OCT	0	0	0	0	0	0	0
NOV	0	0	0	0	0	0	0
DEC	0	0	0	0	0	0	0
	379	162	0	0	131	102	774

1978

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	0	0	0	0	0
JUN	0	0	0	0	0	0	0
JUL	65	0	0	0	50	0	115
AUG	0	0	0	0	102	0	102
SEP	0	0	0	0	103	0	103
OCT	0	0	0	0	0	0	0
NOV	0	0	0	0	0	0	0
DEC	0	0	0	0	0	0	0
	65	0	0	0	256	0	320

1980

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	0	8	0	0	8
JUN	462	202	29	29	34	115	871
JUL	1115	456	110	31	477	251	2440
AUG	48	32	80	0	460	0	620
SEP	0	16	0	0	63	0	79
OCT	62	31	0	16	0	0	109
NOV	32	254	48	0	0	0	334
DEC	0	112	64	0	0	0	176
	1719	1103	330	84	1033	367	4637

ctd.

Table 4 (ctd.)

1981

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	0	15	0	15	30
JUN	52	26	26	26	0	78	208
JUL	0	85	0	57	44	57	242
AUG	0	0	0	0	269	0	269
SEP	0	0	0	0	23	0	23
OCT	0	28	28	0	22	0	78
NOV	0	172	143	29	0	0	344
DEC	29	0	0	0	0	0	29
	81	311	197	126	358	150	1223

1982

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	0	0	0	0	0
JUN	112	37	37	75	0	56	317
JUL	183	223	61	41	79	183	770
AUG	21	0	21	0	257	0	299
SEP	0	0	0	0	16	0	16
OCT	40	60	0	0	0	0	100
NOV	41	62	21	0	0	0	123
DEC	0	0	0	0	0	0	0
	397	383	139	115	352	239	1625

ctd.

Table 4 (ctd.)

1983

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	0	0	0	0	0
JUN	127	127	0	0	0	64	318
JUL	346	69	0	0	54	0	470
AUG	0	0	0	0	329	0	329
SEP	0	0	0	0	0	0	0
OCT	137	0	0	0	53	0	190
NOV	140	281	0	0	0	0	421
DEC	0	0	0	0	0	0	0
	751	477	0	0	436	64	1728

1984

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	0	0	0	0	0
JUN	0	0	0	33	0	33	66
JUL	36	36	72	36	56	72	307
AUG	73	0	37	0	284	0	393
SEP	0	0	0	0	57	0	57
OCT	35	35	0	0	0	0	71
NOV	73	145	36	0	0	0	254
DEC	0	36	0	0	0	0	36
	217	253	145	69	397	105	1185

Table 5. Number of 1SW salmon of Maine origin harvested in Newfoundland-Labrador by Statistical Areas and months from 1971 to 1984, assuming a tag retention rate of 0.99.

1971

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	0	0	0	0	0
JUN	0	6	6	18	0	24	55
JUL	27	33	7	0	26	13	105
AUG	0	7	0	0	16	7	29
SEP	0	0	0	0	32	0	32
OCT	0	7	0	0	0	7	13
NOV	7	67	40	0	0	0	114
DEC	0	13	13	0	0	0	27
	33	133	66	18	73	51	375

1972

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	0	0	0	12	12
JUN	0	0	0	10	0	31	42
JUL	0	0	0	0	0	34	34
AUG	0	0	12	0	9	35	55
SEP	0	0	0	0	54	0	54
OCT	0	0	0	0	0	0	0
NOV	0	0	34	0	0	0	34
DEC	0	0	0	0	0	0	0
	0	0	46	10	63	112	231

1973

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	0	0	0	0	0
JUN	8	17	8	8	7	51	99
JUL	27	0	0	0	7	27	62
AUG	0	0	0	0	29	0	29
SEP	0	0	0	0	15	0	15
OCT	0	0	0	0	0	0	0
NOV	9	19	0	0	0	0	28
DEC	0	0	0	0	0	0	0
	45	35	8	8	57	78	233

ctd.

Table 5 (ctd.)

1974

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	9	4	0	4	18
JUN	0	0	8	46	0	92	146
JUL	109	42	33	42	26	75	327
AUG	0	9	9	0	7	0	24
SEP	0	0	9	0	7	0	15
OCT	8	8	17	0	0	0	33
NOV	34	161	17	0	0	0	211
DEC	0	76	42	0	0	0	119
	151	295	143	92	39	172	892

1975

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	6	0	0	0	6
JUN	0	41	31	21	0	31	124
JUL	135	113	23	23	44	68	405
AUG	11	11	0	23	71	0	117
SEP	0	0	0	0	45	0	45
OCT	0	56	11	0	0	0	67
NOV	46	183	46	0	0	0	274
DEC	0	0	23	0	0	0	23
	193	404	139	66	160	99	1062

1976

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	17	0	0	0	17
JUN	152	122	61	0	0	122	457
JUL	696	99	133	66	232	99	1327
AUG	68	135	0	68	315	34	619
SEP	0	0	0	0	53	0	53
OCT	0	0	0	0	0	0	0
NOV	34	134	0	0	0	0	168
DEC	0	0	0	0	0	0	0
	950	491	211	134	600	255	2641

ctd.

Table 5 (ctd.)

1977

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	0	0	0	0	0
JUN	112	56	0	0	0	112	280
JUL	305	122	0	0	47	0	474
AUG	0	0	0	0	48	0	48
SEP	0	0	0	0	49	0	49
OCT	0	0	0	0	0	0	0
NOV	0	0	0	0	0	0	0
DEC	0	0	0	0	0	0	0
	417	178	0	0	144	112	852

1978

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	0	0	0	0	0
JUN	0	0	0	0	0	0	0
JUL	71	0	0	0	55	0	126
AUG	0	0	0	0	113	0	113
SEP	0	0	0	0	113	0	113
OCT	0	0	0	0	0	0	0
NOV	0	0	0	0	0	0	0
DEC	0	0	0	0	0	0	0
	71	0	0	0	281	0	353

1980

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	0	9	0	0	9
JUN	508	222	32	32	37	127	958
JUL	1227	501	121	35	524	277	2684
AUG	53	35	88	0	506	0	682
SEP	0	18	0	0	69	0	87
OCT	68	34	0	17	0	0	120
NOV	35	280	52	0	0	0	367
DEC	0	123	70	0	0	0	193
	1891	1213	363	92	1136	404	5101

ctd.

Table 5 (ctd.)

1981

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	0	16	0	16	33
JUN	57	29	29	29	0	86	229
JUL	0	93	0	62	48	62	267
AUG	0	0	0	0	296	0	296
SEP	0	0	0	0	25	0	25
OCT	0	31	31	0	24	0	86
NOV	0	189	158	32	0	0	378
DEC	32	0	0	0	0	0	32
	89	342	217	139	393	165	1345

1982

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	0	0	0	0	0
JUN	123	41	41	82	0	62	349
JUL	201	246	67	45	87	201	846
AUG	23	0	23	0	283	0	328
SEP	0	0	0	0	18	0	18
OCT	44	66	0	0	0	0	111
NOV	45	68	23	0	0	0	136
DEC	0	0	0	0	0	0	0
	436	421	153	127	388	263	1788

ctd.

Table 5 (ctd.)

1983

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	0	0	0	0	0
JUN	140	140	0	0	0	70	350
JUL	381	76	0	0	59	0	517
AUG	0	0	0	0	362	0	362
SEP	0	0	0	0	0	0	0
OCT	151	0	0	0	59	0	209
NOV	154	309	0	0	0	0	463
DEC	0	0	0	0	0	0	0
	826	525	0	0	480	70	1901

1984

MON	A	B	C	D	O	OTHER	SUM
MAY	0	0	0	0	0	0	0
JUN	0	0	0	36	0	36	72
JUL	39	39	79	39	61	79	337
AUG	80	0	40	0	312	0	433
SEP	0	0	0	0	63	0	63
OCT	39	39	0	0	0	0	78
NOV	80	160	40	0	0	0	279
DEC	0	40	0	0	0	0	40
	239	278	159	76	437	115	1303

Table 6. Estimated total number of 1SW Maine-origin salmon harvested in Newfoundland-Labrador commercial fisheries (year i) using a tag retention rate (L) = 0.90 and 0.99 for years 1971-1984. Ratio = tags to run size in Maine waters. Run size for 1980 not given because no tags released in 1978.

	Newfoundland Harvest in year i		Maine (i+1)	
Year i	L=0.99	L=0.9	Run Size	Ratio
1971	375	341	1277	.2258
1972	231	210	1318	.1322
1973	233	212	1295	.1633
1974	892	811	2169	.1792
1975	1062	965	1213	.1326
1976	2641	2401	1882	.0451
1977	852	774	3586	.0245
1978	353	320	1529	.0210
1979	-	-	-	-
1980	5101	4637	4653	.0860
1981	1345	1223	5399	.0480
1982	1788	1625	1821	.0670
1983	1901	1728	2848	.0196
1984	1303	1185	4320	.0379

Table 7. Catches in kg of Atlantic salmon of all ages for statistical areas of Newfoundland-Labrador and Quebec N. shore commercial fisheries in 1985. Figures are preliminary.

Area	Catch
Newfoundland and Labrador	
A	94,713
B	109,234
C	70,950
D	64,713
E-N	256,575
O	236,250
Quebec N.shore	69,800

Table 8 Catch (tonnes) and licensed effort (gear units) for Newfoundland and Labrador commercial salmon fishery 1971-85.

Year	Effort (units)	Catch (tonnes)
1971	17,320	1,577
1972	13,595	1,394
1973	16,376	2,011
1974	19,642	2,010
1975	25,181	2,043
1976	23,749	2,013
1977	21,775	1,938
1978	22,284	1,180
1979	21,169	987
1980	21,918	2,103
1981	21,032	1,910
1982	18,634	1,321
1983	19,565	1,029
1984	15,243	521
1985	14,300	832

One unit of gear is equivalent to 50 fathoms of net.

Table 9 Nominal catches at West Greenland 1960-85 (in tonnes, round fish weight).

Year	Norway	Faroes	Sweden	Denmark	Greenland[4]	Total	Quota
1960	-	-	-	-	60	60	-
1961	-	-	-	-	127	127	-
1962	-	-	-	-	244	244	-
1963	-	-	-	-	466	466	-
1964	-	-	-	-	1,539	1,539	-
1965	-[1]	36	-	-	825	861	-
1966	32	87	-	-	1,251	1,370	-
1967	78	155	-	85	1,283	1,601	-
1968	138	134	4	272	579	1,127	-
1969	250	215	30	355	1,360	2,210	-
1970	270	259	8	358	1,244	2,146[3]	-
1971	340	255	-	645	1,449	2,689	-
1972	158	144	-	401	1,410	2,113	-
1973	200	171	-	385	1,585	2,341	-
1974	140	110	-	505	1,162	1,917	-
1975	217	260	-	382	1,171	2,030	-
1976	-	-	-	-	1,175	1,175	1,190
1977	-	-	-	-	1,420	1,420	1,190
1978	-	-	-	-	984	984	1,190
1979	-	-	-	-	1,395	1,395	1,190
1980	-	-	-	-	1,194	1,194	1,190
1981	-	-	-	-	1,264	1,264	1,265[5]
1982	-	-	-	-	1,077	1,077	1,253[5]
1983	-	-	-	-	310	310	1,190
1984	-	-	-	-	297	297	870
1985	-	-	-	-	851	851[2]	852

[1] Figures not available, but catch is known to be less than the Faroese catch.

[2] Provisional

[3] Including 7 tonnes caught on long-line by one of two Greenland vessels in the Labrador Sea early in 1970.

[4] For Greenlandic vessels: all catches up to 1968 were taken with set gill-nets only, after 1968 the catches were taken with set gill-nets and drift nets. All non-Greenlandic catches from 1969-1984 were taken with drift-nets.

[5] Quota 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 10 Distribution of nominal catches (tonnes) taken by Greenland vessels in 1975-85 by NAFO divisions according to place where landed.

Div.	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985[1]
1A	124	171	201	81	120	52	105	111	14	33	84
1B	168	299	393	349	343	275	403	330	77	116	122
1C	175	262	336	245	524	404	348	239	93	64	195
1D	204	218	207	186	213	231	203	136	41	4	204
1E	315	182	237	113	164	158	153	167	55	43	145
1F	185	43	46	10	31	74	32	76	30	32	101
INK	-	-	-	-	-	-	20	18	-	5	-
Total	1,171	1,175	1,420	984	1,395	1,194	1,264	1,077	310	297	851
East Greenl.	+	+	6	8	+	+	+	+	+	+	7
Total	1,171	1,175	1,426	992	1,395	1,194	1,264	1,077	310	297	858

[1] Provisional figures.

Table 11.

Percentage (by number) of North American and European salmon in research vessel catches at West Greenland 1969-82 and from commercial samples 1978-85.

		Sample Size		Continent of Origin (%)			
Source	Year	Length	Scales	N.A.	(95% C.L.)	E	(95%) C.L.)
Research	1969	212	212	51	(57,44)	49	(56,43)
	1970	127	127	35	(43,26)	65	(74,57)
	1971	247	247	34	(40,28)	66	(72,50)
	1972	3,488	3,488	36	(37,34)	64	(66,63)
	1973	102	102	49	(59,39)	51	(61,41)
	1974	834	834	43	(46,39)	57	(61,54)
	1975	528	528	44	(48,40)	56	(60,52)
	1976	420	420	43	(48,38)	57	(62,52)
	1977	-	-	-	(-)	-	(-)
	1978*	606	606	38	(41,34)	62	(66,59)
	1978**	49	49	55	(69,41)	45	(59,31)
	1979	328	328	47	(52,41)	53	(59,48)
	1980	617	617	58	(62,54)	42	(46,38)
	1981	-	-	-	(-)	-	(-)
	1982	443	443	47	(52,43)	53	(58,48)
Commercial	1978	392	392	52	(57,47)	48	(53,43)
	1979	1,653	1,653	50	(52,48)	50	(52,48)
	1980	978	978	48	(51,45)	52	(55,49)
	1981	4,570	1,930	59	(61,58)	41	(42,39)
	1982	1,949	414	62	(64,60)	38	(40,36)
	1983	4,896	1,815	40	(41,38)	60	(62,59)
	1984	7,282	2,720	50	(53,47)	50	(53,47)
	1985	13,272	2,917	50	(53,46)	50	(54,47)

*During fishery
**Research samples after fishery closed

Table 12 Sea age composition (%) from research vessel and commercial catches of ATLANTIC SALMON at West Greenland, 1969-85.

Year	Type	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	1,655
	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	4,559
1982	Commercial	93.6	6.0	0.5	1,922
	Research	95.3	2.4	2.2	491
1983	Commercial	90.5	8.1	1.4	4,744
1984	Commercial	87.6	11.6	0.7	7,298
1985	Commercial	93.8	5.9	0.3	13,272

Table 13 River age distribution (%) of North American (wild and hatchery) and SALMON caught at West Greenland 1968-85.

Year	1	2	3	4	5	6	7	N
			North American					
1968	-	19	41	21	16	2	-	386
1969	-	27	46	20	7	1	-	101
1970	-	60	23	13	3	3	-	40
1971	1	32	37	17	10	4	-	84
1972	1	32	51	10	4	1	-	470
1973	2	41	32	20	2	2	-	44
1974	1	36	38	11	11	3	-	336
1975	-	16	48	25	6	4	-	219
1976	1	44	30	14	11	-	-	258
1977	-	-	-	-	-	-	-	-
1978	3	33	44	12	6	2	1	423
1979	4	41	41	11	3	1	-	914
1980	6	36	33	16	8	1	-	1,086
1981	4	31	38	19	7	2	-	1,021
1982	1	37	39	16	6	1	-	441
1983	3	47	33	12	3	1	-	765
1984	5	52	29	9	5	1	-	1,342
1985	5	41	36	12	5	1	-	1,410
Mean	2	36	39	15	7	2	-	
	(3.1)	(42.29)	(43.34)	(17.13)	(9.5)	(3.1)	-	
			European					
1968	22	59	16	2	-	-	-	288
1969	-	84	16	-	-	-	-	99
1970	-	91	9	-	-	-	-	79
1971	9	66	20	3	1	-	-	161
1972	11	72	17	1	-	-	-	833
1973	27	59	12	2	-	-	-	49
1974	23	68	9	-	-	-	-	466
1975	26	53	18	2	-	-	-	274
1976	23	67	9	1	-	-	-	306
1977	-	-	-	-	-	-	-	-
1978	26	66	8	-	-	-	-	572
1979	24	64	10	1	-	-	-	957
1980	25	58	15	3	-	-	-	991
1981	15	68	15	1	-	-	-	771
1982	15	56	24	4	1	-	-	403
1983	35	50	12	2	-	-	-	997
1984	23	57	15	4	1	-	-	1,289
1985	20	62	15	3	1	-	-	1,422
Mean	17	67	14	1	-	-	-	
	(23.12)	(73.60)	(17.11)	(2.1)	-	-	-	

Table 14 SALMON at West Greenland. The mean landings per month in tonnes for the period 1976-85, and the size composition by weight categories are given as percentages of the mean landing.

	Month			
	Aug	Sep	Oct	Nov
Mean landing in tonnes	655	420	61	9
Cat 1 in %	62	46	25	11
Cat 2 in %	33	47	59	67
Cat 3 in %	5	7	16	22
No. of years involved	10	9	8	5

Table 15 SALMON at West Greenland. The mean landings (tonnes) for August and September given for different combinations of years and for each NAFO division. The composition by weight categories is expressed as percentage of the mean landings.

Division		1976-85	1976-82	1983-84	1985
1A	Landings	91	112	23	77
	Cat.1 in %	43	42	48	49
	Cat.2 in %	47	49	35	36
	Cat.3 in %	10	9	17	15
1B	Landings	249	314	87	115
	Cat.1 in %	53	50	63	83
	Cat.2 in %	40	43	25	15
	Cat.3 in %	7	7	11	2
1C	Landings	258	321	72	195
	Cat.1 in %	60	58	64	79
	Cat.2 in %	36	38	22	17
	Cat.3 in %	4	4	14	4
1D and 1E	Landings	298	354	77	349
	Cat.1 in %	62	60	60	74
	Cat.2 in %	34	36	28	23
	Cat.3 in %	4	4	12	3
1F	Landings	45	41	30	101
	Cat.1 in %	62	61	70	66
	Cat.2 in %	31	32	23	28
	Cat.3 in %	7	7	7	7
SA1	Landings	944	1,149	279	837
	Cat.1 in %	57	55	59	74
	Cat.2 in %	37	40	28	22
	Cat.3 in %	6	5	13	4

Table 16 Landings (tonnes) of MSW and 1SW salmon in the recreational and commercial fisheries in 1981 to 1983 for areas which were closed to fishing in 1985; and total landings in Canada 1981 to 1983. Number in parenthesis is percentage of total landings of MSW salmon and 1SW salmon.

Year	Landings (tonnes) for all fisheries		Landings (tonnes) for fisheries closed in 1985	
	MSW	1SW	MSW	1SW
1981	1,619	818	301	22
1982	1,082	716	278	23
1983	903	530	232	25
Mean	1,201	688	270 (22%)	23 (3%)
SD	373	146	35	2

Table 17 Weight (tonnes) of salmon in commercial salmon fishery 1981-83, prior to 5 June in areas of Canada affected by delayed opening in 1985.

Year	Weight (in tonnes)	
	MSW	1SW
1981	196	12
1982	26	2
1983	30	3
Mean	84	7
SD	97	6

Table 18 Predicted and estimated returns of MSW salmon to the Restigouche and Miramichi Rivers and estimated resulting spawning escapement, 1982-85.

Year	Returns (R) Predicted	Returns (R) Estimated	Spawners(S)	S/R
		Restigouche River		
1982	-	13,500	1,900	0.14
1983	13,500	11,000	1,200	0.11
1984	11,300	9,900	5,100	0.52
1985	12,200	14,600	10,200	0.70
		Miramichi River		
1982	-	24,500	6,200	0.25
1983	43,000	24,300	2,400	0.10
1984	10,000	9,800	8,300	0.85
1985	18,400	24,300	22,700	0.93

Table 19 Harvest by weight (tonnes) of 1SW (Year N) and MSW Atlantic salmon (Year N+1) by Canada for the years 1970-85.

Year N	1SW salmon (Year N)	MSW salmon (Year N+1)	Ratio MSW salmon (Year N+1) / 1SW salmon (Year N)
1969	-	1,562	-
1970	761	1,482	1.95
1971	510	1,201	2.36
1972	558	1,651	2.96
1973	783	1,589	2.03
1974	950	1,573	1.66
1975	912	1,712	1.88
1976	785	1,883	2.40
1977	662	1,225	1.85
1978	320	705	2.20
1979	582	1,763	3.03
1980	917	1,619	1.77
1981	818	1,082	1.32
1982	716	903	1.26
1983	530	645	1.22
1984	467	526	1.13
1985	574	-	-

Table 20 Return in numbers (thousands) of Grilse (Year N) and MSW salmon (Year N+1) to the Miramichi River Zone, New Brunswick.

Year N	Grilse (Year N)	MSW salmon return (Year N+1)	Ratio MSW salmon (Year N+1) / Grilse (Year N)
1971	44.6	36.3	0.813
1972	57.8	34.2	0.592
1973	55.7	53.6	0.962
1974	91.8	36.3	0.395
1975	81.0	28.6	0.353
1976	114.1	63.7	0.558
1977	34.6	28.8	0.832
1978	30.1	11.0	0.365
1979	62.3	43.0	0.690
1980	51.3	13.7	0.267
1981	51.0	24.5	0.480
1982	62.9	24.3	0.386
1983	20.0	9.8	0.490
1984	23.0	24.3	1.057
1985	46.4	-	-

Table 21 Nominal catches of Atlantic salmon by Faroese vessels 1982-85 and the season 1981/82 to 1984/85.

Year	Catch (tonnes)	Season	Catch (tonnes)
1982	960	1981/82	884
1983	753	1982/83	694
1984	697	1983/84	786
1985	672	1984/85	664

Table 22. Estimated number of 1-sw and 2-sw salmon of the River Imsa stock available to the Norwegian Sea fishery and Norwegian home water fishery, and estimated exploitation rates. The number of salmon caught in the trap in River Imsa is considered to be the total river escapement. The estimates are based on 75% and 50% tag reporting rate in Norwegian Sea and Norwegian home waters respectively.

			1-SW					2-SW				
			Norw. Sea		Norw. home waters			Norw. Sea		Norw. home waters		
	Smolt type	No. tagged	No. of fish available	Expl. rate	No. of fish available	Expl. rate	No. in trap	No. of fish available	Expl. rate	No. of fish available	Expl. rate	No. in trap
Released	R. Imsa wild	3214	776	0.00	555	0.88	66	177	0.25	127	0.93	9
1981	R. Imsa 2+	5819	757	0.01	586	0.80	114	125	0.38	74	0.92	6
Released	R. Imsa wild	736	61	0.00	39	0.87	5	18	0.50	9	0.89	1
1982	R. Imsa 1+	5581	130	0.00	73	0.99	1	48	0.33	31	0.97	1
	R. Imsa 2+	8501	712	0.03	524	0.95	25	129	0.57	54	0.93	4
Released	R. Imsa wild	1287	211	0.00	174	0.82	31	27	0.33	17	0.94	1
1983	R. Imsa 1+	5861	27	0.00	23	0.96	1	3	0.31	2	1.00	0
	R. Imsa 2+	6052	205	0.02	172	0.93	12	19	0.47	10	1.00	0
Released	R. Imsa wild	936	118	0.00	113	0.73	30					
1984	R. Imsa 1+	1863	22	0.00	21	0.76	5					
	R. Imsa 2+	7445	353	0.05	323	0.85	48					

Table 23. Estimated number of 1-sw and 2-sw salmon of the River Imsa stock available to the Norwegian Sea fishery and Norwegian home water fishery, and estimated exploitation rates. The number of salmon caught in the trap in River Imsa is considered to be the total river escapement. The estimates are based on 75% and 70% tag reporting rate in Norwegian Sea and Norwegian home waters respectively.

			1-SW					2-SW				
			Norw. Sea		Norw. home waters			Norw. Sea		Norw. home waters		
	Smolt type	No. tagged	No. of fish available	Expl. rate	No. of fish available	Expl. rate	No. in trap	No. of fish available	Expl. rate	No. of fish available	Expl. rate	No. in trap
Released	R. Imsa wild	3214	592	0.00	416	0.84	66	142	0.32	93	0.90	9
1981	R. Imsa 2+	5819	596	0.01	452	0.74	114	105	0.46	55	0.89	6
Released	R. Imsa wild	736	48	0.00	29	0.83	5	16	0.56	7	0.86	1
1982	R. Imsa 1+	5581	98	0.00	52	0.98	1	39	0.41	22	0.95	1
	R. Imsa 2+	8501	549	0.04	382	0.93	25	115	0.63	40	0.90	4
Released	R. Imsa wild	1287	163	0.00	133	0.76	31	22	0.41	12	0.92	1
1983	R. Imsa 1+	5861	20	0.00	17	0.94	1	2	0.50	1	1.00	0
	R. Imsa 2+	6052	154	0.03	126	0.90	12	16	0.56	7	1.00	0
Released	R. Imsa wild	936	94	0.00	90	0.66	30					
1984	R. Imsa 1+	1863	17	0.00	16	0.69	5					
	R. Imsa 2+	7445	272	0.06	245	0.80	48					

Table 24 Estimated number of tagged 2SW salmon of the River North Esk stock available to the Faroes fishery, Scottish home water fishery and the North Esk fishery, and estimated exploitation rates.

Year	Faroes fishery		North Esk		All other fisheries[1]	
	No. of fish available	Expl. rate	No. of fish available	Expl. rate	No. of fish available	Expl. rate
1983	188	0.13	48	0.31	158	0.70
1984	277	0.14	111	0.35	231	0.52

[1] Mostly in Scottish home waters.

Table 25 Microtag recoveries and calculated home-water exploitation rates from hatchery-reared smolts released from the River Burrishoole in Ireland 1980-84.

Year of smolt rel.	Smolt age	Nos. tagged	Estimated numbers recovered			Exploitation rate in home waters	
			Faroes(A)	Home waters(A)	River trap	(A)	(B)
1980	1	2,258	-	32	33	0.49	0.75
	2	2,095	-	19	48	0.28	0.52
1981	1	2,367	-	150	35	0.81	0.88
	2	3,400	-	177	42	0.81	0.88
1982	1	1,923	-	99	32	0.76	0.84
1983	1	7,157	-	109	30	0.78	0.86
	2	7,507	-	156	49	0.76	0.84
1984	1	22,197	6	2,523	750	0.77	0.86
	2(C)	7,600	6	-	216	0.44	0.60

A) Expanded by fishery.

B) Expanded by fishery and non-catch fishing mortality.

C) All fish released up to 1983 were from a grilse stock. Those released in 1984 were from 2-sea-winter wild parent stock, the 2-sea-winter component of which will return in 1986.

Table 26 Estimated monthly catch by sea age of wild maiden fish together with catches of previous spawners and hatchery-reared fish in the Faroes salmon fishery 1984-85.

Year	Month	Sea age (yrs) 1	2	3	Previous spawners	Hatchery-reared[3]	Total number
1984	November	-	6,238	-	-	267	6,505
	December[1]	90	19,843	971	474	1,197	22,575
1985	January	80	13,604	961	465	914	16,024
	February	-	21,348	4,151	485	970	26,954
	March	-	25,128	2,389	288	979	28,784
	April[2]	84	25,402	1,633	141	901	28,161
	May	106	19,697	654	-	654	21,111
	Whole season	360 (0.2)	131,260 (87.4)	10,759 (7.2)	1,853 (1.2)	5,882 (3.9)	150,114

()Percentages.

[1]No scale sample - Nov/Jan data used.

[2]Scale sample <50 fish - Mar/May data used.

[3]Based on scale samples.

Table 27 Summary of the total numbers of tagged salmon released by country since 1978 and the number of recoveries from the same releases in the Faroes salmon fishery.

Country	No. released	No. recaptured	Recaptured/Released x 10^{-3}
Norway	306,500	979	3.19
Sweden	60,200	302	5.02
Scotland	68,800	69	1.00
England	12,200	14	1.15

Table 28 The number of microtagged fish found during the screening of Faroes in the 1984/85 season.

Country	No. tags	Age	Raising factor	Estimated tags in fishery	Number tagged
1) Port Sampling					
Iceland	1	1 SW		4	151,144
Ireland	3	2 SW	3.7	11	141,608
	1	1 SW		4	260,816
2) Discards					
Scotland	3	1 SW		63	30,040[1]
Iceland	1	1 SW	21	21	151,144
Ireland	14	1 SW		297	260,816

Country	No. released	Estimated No. in fishery	Rec/Rel x 10^{-3}
Iceland	151,144	25	0.17
Ireland	260,816	301	1.15

[1] This number includes special experimental groups.

Table 29 Nominal catches (tonnes) of SALMON by zones, 1983-85.

	1983			1984			1985[1]		
	River	Estuary	Marine	River	Estuary	Marine	River	Estuary	Marine
Engl.+ Wales	64	81	284	47	80	218	96	67	209[1]
Iceland	137	54	6	118	37	4	127	83	6
Ireland[2]	89	172	1,254	94	130	625	95	138	1,301
Finland	57	-	21[3]	44	-	29[3]	49	-	-
France	-	-	-	-	-	-	16	6	-
Norway	306	-	1,244	299	-	1,323	313	-	1,209
Scotland	263	466	492	222	333	458	285	241	347[2]

[1] Provisional.

[2] Incomplete data.

[3] Taken in Norwegian Sea.

Table 30 Natural mortality at sea estimates from 14-24 months for Atlantic salmon from the Sandhill River, Canada; River Bush, Ireland; and North Esk, Scotland.

River	Method	Estimated percentage mortality 14-24 months	Authors
		Range	
Sandhill	Inverse weight model	10-14%	Doubleday et al.(1979)
Bush	Inverse weight model	2.3-3.4%	" " "
Bush	Inverse weight with constant M from one sea winter	5.9-8.6%	" " "
North Esk	Inverse weight model	6.1-13.6%	Shearer (1984)
North Esk	Inverse weight with constant M from one sea winter	1.6-3.7%	"

Table 31 Catch in number per unit effort (1,000 hooks) by month in the Faroese longline fishery for SALMON in the seasons 1982/83 - 1984/85.

Season	Nov	Dec	Jan	Feb	Mar	Apr	May	Whole season
1982/83	83.9	133.7	73.2	48.5	46.0	39.1	34.1	46.9
1983/84	75.1	81.0	78.6	52.5	38.9	23.1	31.5	51.3
1984/85	41.7	34.6	30.7	35.0	37.4	41.5	37.0	35.8

Table 32 Research needs identified in Anon.(1985b) and Anon.(1986), and action taken.

Research Needs	Action
1) Description of sport fisheries for Atlantic salmon in Maine, USA.	Information expected at next meeting.
2) Catch and effort statistics for these sport fisheries by river system and by sea age.	Information expected at next meeting.
3) Newfoundland catch data by month from 1970-73.	Information expected at next meeting.
4) Revised estimates of catches of Maine-origin salmon to be compared with reported catches in the fall fishery.	Additional information on accuracy of fall fishery catches expected at next meeting.
5) The effectiveness of the tag recovery network to be reassessed. (Canada)	Nothing additional reported.
6) Non-catch fishing mortality used for Newfoundland fisheries should be re-evaluated.	Nothing additional reported.
7) The extent of by-catches of Atlantic salmon in the fisheries of other species and poaching should be evaluated, particularly the effect of making illegal the retention of salmon caught in other gear. Means should be considered to estimate any continuing by-catch.	Nothing additional reported.
8) A breakdown of the USA tag recovery information from Newfoundland and Labrador should be tabled by sea age, month, year and statistical area.	Information expected at next meeting.
9) There is a continuing need for additional study of the relationship between licensed fishing effort and fishing mortality. (Canada)	Work in progress, but not expected for next meeting.
10) Scale samples taken in the Newfoundland-Labrador commercial fisheries should be examined to determine the proportion of fish of hatchery origin (age 1 smolts or other criteria). Available data should be examined to determine the representativeness of existing samples and to determine sampling requirements to obtain estimates for the entire provincial fishery.	Nothing additional reported.

11)	Carlin-tagged smolts may have a higher mortality than untagged smolts. Available data should be compiled to assess the relative rates of mortality of tagged and untagged smolts.	Some data examined at present meeting. More information expected at next meeting. Also further suggestion for investigation of differential fishing mortality as opposed to total mortality.
12)	In the revised estimates of numbers of USA-origin salmon in the Newfoundland-Labrador fisheries, the Working Group noted from a sensitivity analysis that exploitation rates in the Maine sport fisheries and reporting rates of USA tags from Canadian fisheries were critical to the results. The Working Group recommended that estimates of these parameters be improved.	Nothing additional reported.
13)	The Working Group identified data deficiencies and recommended the development of a data base to be maintained at ICES headquarters and accessible only to the Working Group. This was to include national catches of salmon and river index data from the North Esk (Scotland), Burrishoole (Ireland), Bush (Northern Ireland), Ims (Norway), Lagan (Sweden), Blanda (Iceland), Western Arm Brook, Saint John and Miramichi (Canada) and Penobscot and Merimack (USA). It was recommended that these data should be included as for Appendix V of Anon. (1985b) from samples of a minimum of 100 fish.	Some information provided to the present meeting, but the data base is still incomplete. Additional non-trap information is particularly required.
14)	Additional wild smolts should be tagged in monitored rivers of the North-East Atlantic Commission Area to establish exploitation rates for salmon, especially in the Norwegian Sea and Faroese area, and to provide material for stock-discriminant analysis.	Additional microtagging of wild smolts planned for England, Wales, Ireland and Northern Ireland.
15)	Exploitation rates and non-catch fishing mortality should be estimated for areas in the Northeast and Northwest Atlantic, particularly where they are not currently available.	Additional information provided for the Drammen River in Northeast area. Nothing provided for Northwest. More information required.
16)	Research programmes to study post-smolt mortality should be continued and reported upon.	Some estimates provided, but these depended on assumed rates of natural mortality. Information on bird predation from USA and on cod predation from Norway expected at next meeting.
17)	Collection of catch and effort data in the West Greenland fishery should be initiated.	Catch data available but no effort data provided. Effort information still required.

18)	The data base of the discriminant analysis used to identify continent of origin of salmon caught at West Greenland should be tested in 1985 and every two years thereafter. Also, the data base should be extended to include scales from salmon of additional stocks known to contribute to the West Greenland fishery.	This was done in 1985 and the Working Group recommended that it should be repeated each year. It was also recommended that, as an additional test of the discriminant function, tissue samples should be taken at West Greenland to provide immediate calibration.
19)	An attempt should be made to discriminate country of origin of salmon in both the West Greenland and Faroes commercial catches. Studies should be initiated to determine the feasibility of the scale discrimination technique to separate stocks of salmon at West Greenland and in the Faroes.	Some information presented. More work is required but none is in progress.
20)	Scientific evidence related to the supposed greater non-catch mortality of monofilament gill nets relative to multi-filament nets should be compiled and examined.	No additional data available. The Working Group requests that further information be provided for the next meeting.
21)	A programme to scan the West Greenland commercial catch for microtags and external tags should be initiated.	This has been initiated.
22)	Provide a brief description and conclusions from home-water fisheries and catches.	Has been described and reported in more in more detail. More information needed for some countries.
23)	It is recommended that tables showing the distribution of recaptured salmon outside home-water zones should be provided by countries which have tagged smolts in these native rivers.	Table provided.
24)	It is recommended that research be conducted to obtain information to be used on the catch rate model of Hansen (1984)	Progress made but work not yet completed. Paper submitted to ICES Statutory Meeting 1985.
25)	A technique of classifying hatchery-reared salmon and those escaped from fish farms should be developed and tested.	Progress made and paper submitted to the Working Group. Further testing required. Recommended special task for Study Group on Faroes Fishery.
26)	Non-catch fishing mortality should be further investigated. (NE-Atlantic)	Progress made but more information required.
27)	It is recommended that estimates of exploitation rates should be obtained for areas where they are not currently available.	Progress made but more information rerequired.

Table 33 Distribution of recaptured salmon outside home water zones.

Recapture area	(List in Anon. 1985b)	France	England + Wales	Scotland	Ireland	Northern Ireland	Norway	W.Sweden	Finland	USSR	Iceland	Canada	USA	
		Country of origin												
W.Sweden	1	-	1	-	p	-	2	-	-	-	-	-	-	
Denmark	2	-	1	-	p	-	1	-	-	-	-	-	-	
	3	-	-	-	-	-	-	-	-	-	-	-	-	
	4	-	-	-	-	-	-	-	-	-	-	-	-	
N.France	5	x	-	-	-	-	-	-	-	-	-	-	-	
England + Wales	6	-	-	3	p	-	1	-	-	-	-	-	-	
Ireland	7	-	2	2	x	3	-	-	-	-	-	-	-	
N.Ireland	8	-	1	1	p	x	-	-	-	-	-	-	-	
Scotland	9	-	3	x	p	2	1	-	-	-	-	-	-	
S.Norway	10	-	-	-	p	-	x	-	1	-	1	-	-	
N.Norway	11	-	2	2	-	-	x	-	3	-	-	1	-	
Barents Sea	12	-	-	-	-	-	1	-	1	x	-	-	-	
N.Norwegian Sea	13	-	-	-	p	-	3	-	1	-	-	-	-	
N.E.Greenland	14	-	-	-	-	-	-	-	-	-	-	-	-	
S.E.Greenland	15	-	1	-	p	-	1	-	-	-	1	1	1	(18)
Iceland	16	-	-	1	-	-	-	-	-	-	x	-	-	
Faroes	17	-	3	3	p	1	3	-	1	-	2	-	-	
Central Atlantic	18	-	-	-	-	-	-	-	-	-	-	-	-	
W.France	19	x	-	-	-	-	-	-	-	-	-	-	-	
Spain	20	-	-	-	-	-	-	-	-	-	-	-	-	
W.Greenland		1	3	3	p	2	1	-	1	-	2	3	3	(1,500)
Labrador		-	1	1	-	-	-	-	-	-	-	x	2	(270)
Newfoundland		-	-	1	-	-	-	-	-	-	-	x	3	(1,105)
Quebec		-	-	-	-	-	-	-	-	-	-	x	1	(5)
New Brunswick		-	-	-	-	-	-	-	-	-	-	x	1	(41)
Nova Scotia		-	-	-	-	-	-	-	-	-	-	x	2	(89)
USA		-	-	-	-	-	-	-	-	-	-	1(1)	x	

- = zero.
1 = infrequent.
2 = frequent.
3 = highly frequent.
x = home waters.
p = present.

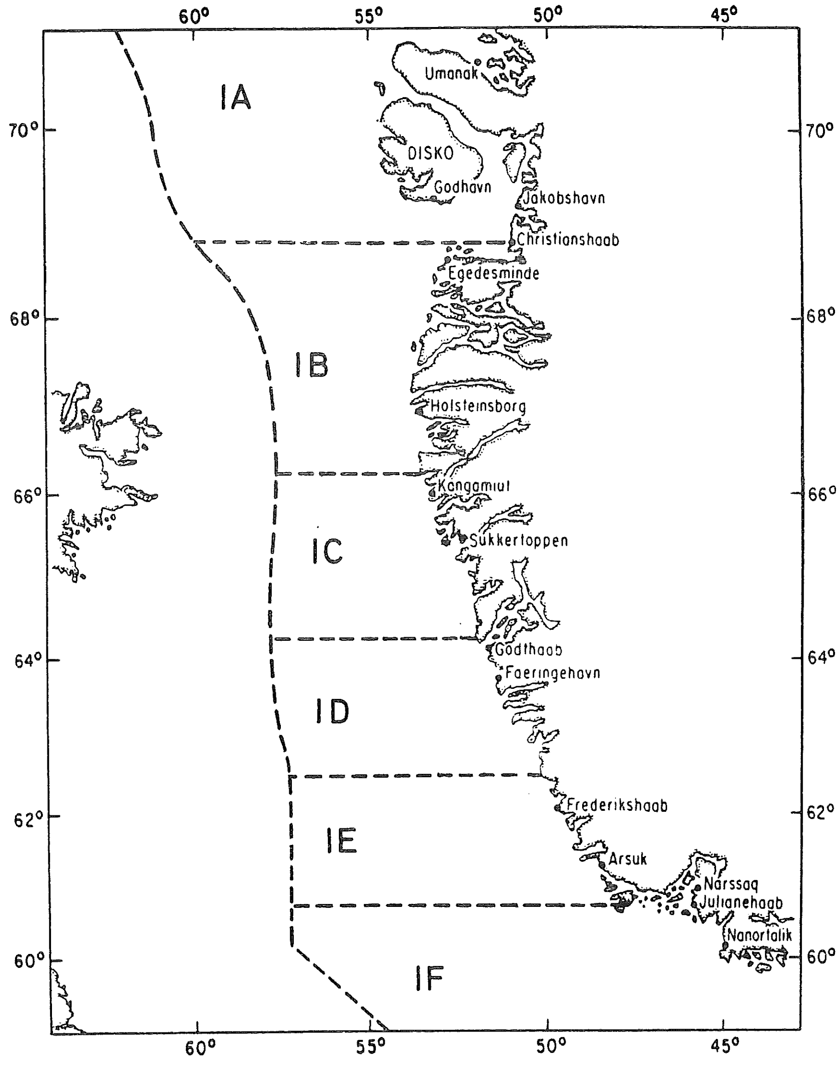


Figure 1. Map of West Greenland showing NAFO Divisions 1A-1F.

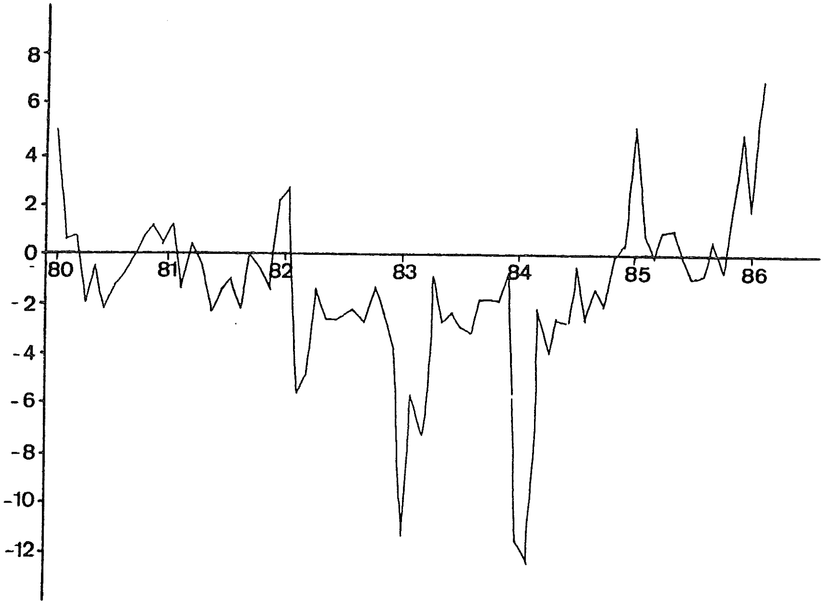


Figure 2. Air temperature anomalies at the Godthåb Station in the period 1980-86.

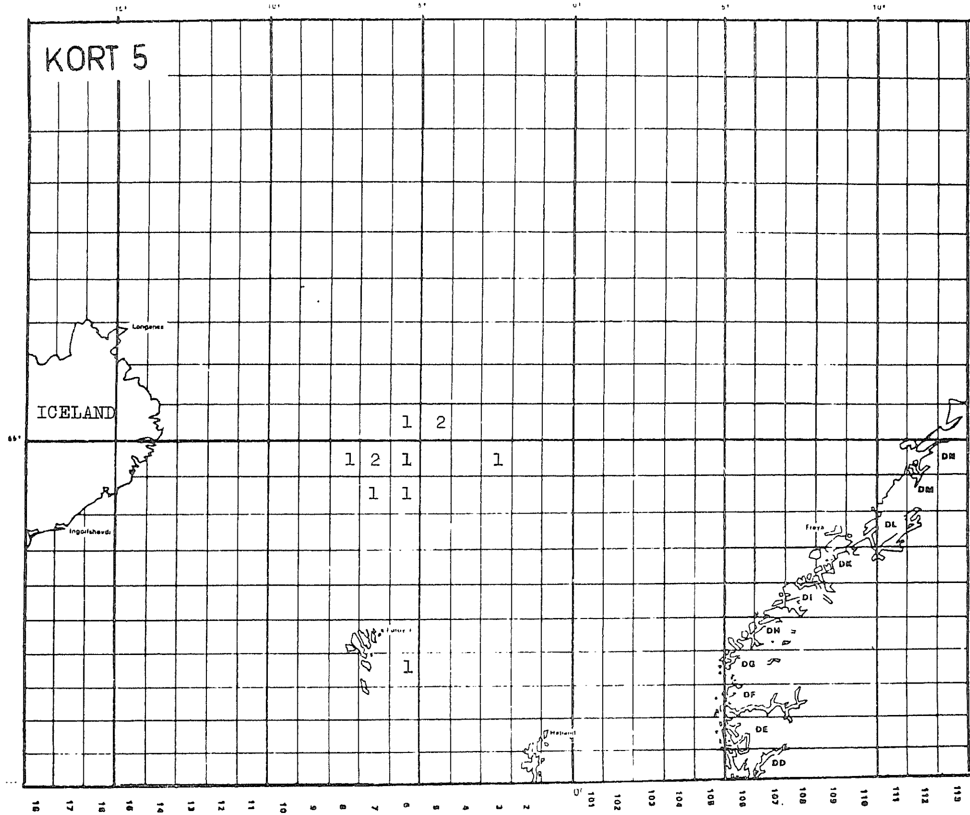


Figure 3. Number of recaptures of salmon by statistical rectangle tagged in England since 1978.

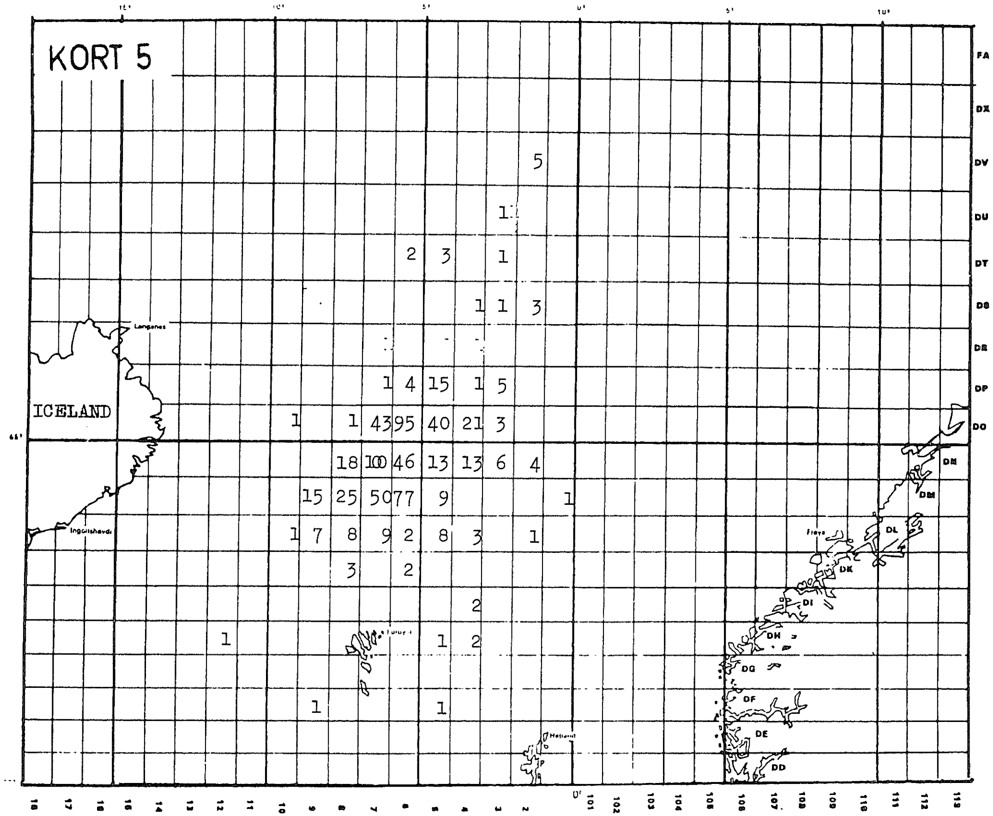


Figure 4. Number of recaptures of salmon by statistical rectangle tagged in Norway since 1978.

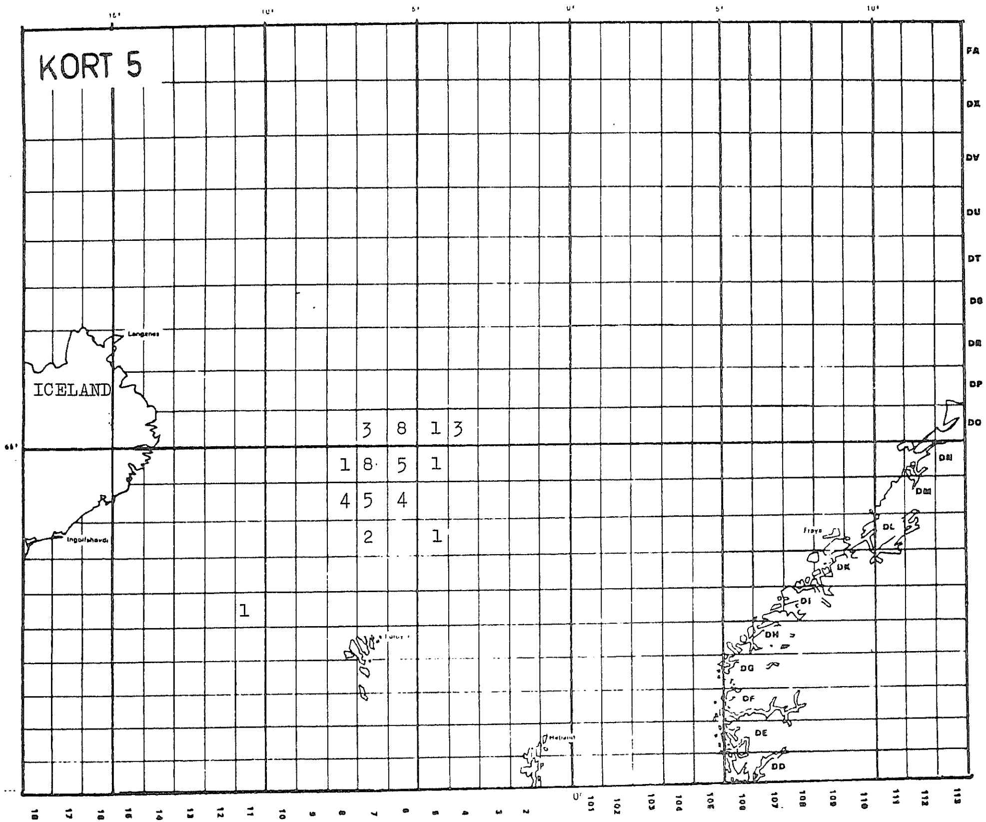


Figure 5. Number of recaptures of salmon by statistical rectangle tagged in Scotland since 1978.

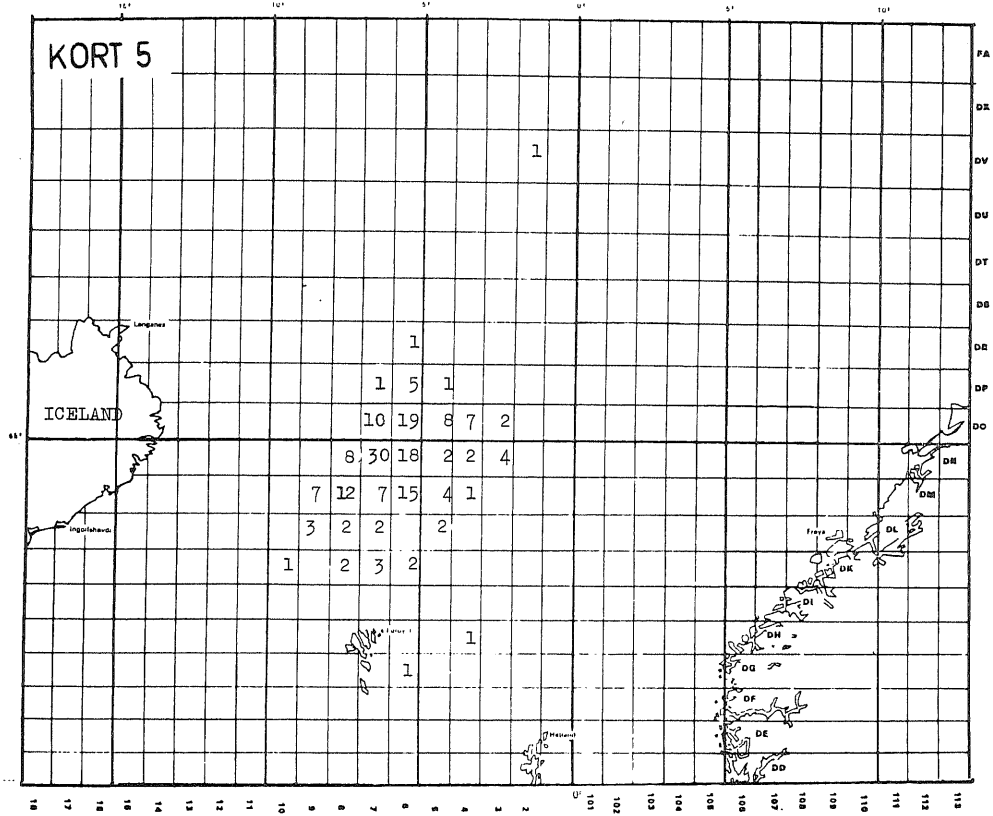
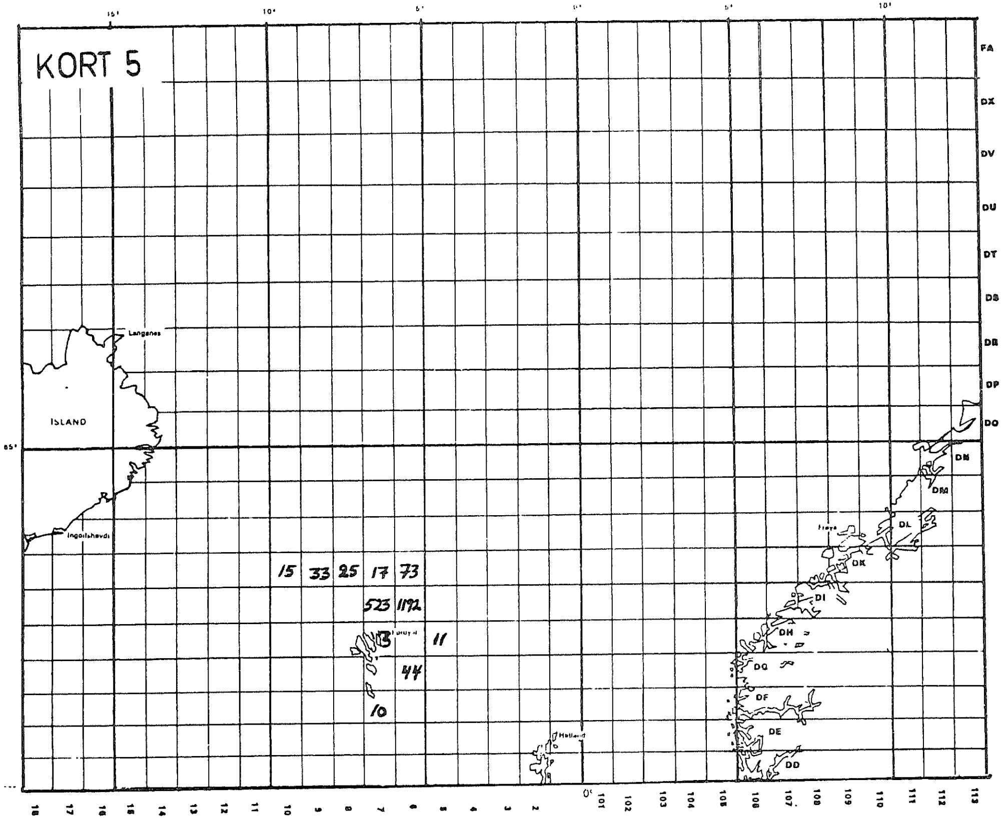


Figure 6. Number of recaptures of salmon by statistical rectangle tagged in Sweden since 1978.



<u>Figure 7.</u> Number of salmon tagged by statistical rectangle in the period 1969-76. (From Struthers, 1981.)

Appendix 1

ICES Working Group on North Atlantic Salmon
(March 17 - March 26, 1986)

AGENDA

1. Call to order

2. Adoption of Agenda

3. Distribution of meeting documents

4. Organisation of meeting

5. North American Commission Area

   a) provide estimates of the number, weight, age composition and river of origin of historical catches from 1967-84 of salmon originating in rivers or artificial production facilities of another country. These estimates should be broken down by season, locality and gear type. The estimates should also take into consideration available information on the release and recovery of tagged salmon and catches and exploitation rates for salmon in areas where such catches occur;

   b) provide a description of fisheries catching salmon originating in another country's river or artificial production facility. The description should include catch, effort, exploitation rate, gear type, season, and age composition of historical catches of salmon by year;

   c) assess the extent of by-catches of Atlantic salmon in fisheries for other species and poaching of Atlantic salmon;

   d) evaluate the tag recovery procedure, including an assessment of the accuracy and completeness of information accompanying tag returns;

   e) assess the proportion of salmon tags captured but not reported;

   f) specify data deficiencies and necessary research programs to address those deficiencies;

   g) estimate the expected impact of management measures taken by Canada in 1984 and 1985 in reducing the harvest in Canadian fisheries of salmon originating in the USA.

6. West Greenland Area

   a) describe the events in the West Greenland fishery in 1985, including regulations in effect, gears and vessels in use, temporal and geographical distribution of the fishery, and the quantity and composition of catches by continent and, if possible, country of origin.

b) advise on the effects of varying levels of harvest at Greenland on subsequent returns of large salmon to home waters;

c) estimate the impact of management measures taken and proposed by States of origin of salmon occurring in the Commission area on home water catches and, where possible, on spawning escapements;

d) evaluate the tag recovery and return procedure at West Greenland, including an assessment of the accuracy and completeness of information accompanying tag returns,and indicate methods for improving the tag recovery and return procedure.

e) consider estimates of spawning escapements and target spawning biomass for salmon stocks occurring in the Commission Area.

7. North-East Atlantic Commission Area

a) describe the fisheries for salmon in the North-East Atlantic Commission area, to assess the total exploitation exerted upon the stocks and to estimate the fishing mortality so generated:

   (i) for homewater fisheries divided into freshwater and marine components,
   (ii) for sea fisheries beyond 12 miles;

b) estimate the quantity, age composition and homewater origin of the landings and discards of salmon taken in the Faroes in the 1985/86 fishing season;

c) present the catch statistics of the North-East Atlantic Commission salmon fisheries on an annual basis, and on a seasonal basis where the season overlaps the end of the year, distinguishing between freshwater and marine components;

d) estimate the contribution of hatchery-reared fish and fish farm escapees to the Faroese fishery;

e) assess natural mortality of salmon in the marine phase;

f) plan and coordinate a program of research to examine data for salmon originating in selected rivers as a basis for advising whether rates and patterns of exploitation are within safe biological limits;

g) assess the feasibility of regulating the Faroese salmon fishery by limitation of fishing effort so as to achieve the same rate of fishing mortality as would result on average from a given catch level in tonnes. To assess the relative effectiveness of this approach as opposed to annually adjusting a total allowable catch in achieving the same fishing mortality.

8. Estimate catch in numbers by sea age for the most recent years, wherever possible.

9. Determine the impact of non-tagged, adipose fin-clipped salmon on the detection of coded wire tags and subsequently on corresponding assessments of homewater contributions to sampled fish.

10. Provision of advice for management of stocks "within safe biological limits"

11. Working Group Database (see C.M.1985/Assess:11 p.26)

12. Review of progress on research recommendations

13. Future Research

14. Other business

15. Adoption of Report

Appendix 2

Documents Submitted to the Working Group

1. Browne, J. and D.J.Piggins. The Burrishoole as an index river.

2. Buch, E. On the climate in the West Greenland area in the period 1980-85.

3. Gudjónsson, T. Recapture of Tagged Salmon Outside Iceland in 1984 and 1985.

4. Hansen, L.P. Estimates of exploitation rates and post-smolt mortality of Atlantic salmon released as smolts in River Imsa, SW Norway 1981-84.

5. Hansen, L.P., T.B. Næsje, and E. Garnås. A note on the exploitation of Atlantic salmon in River Drammen, southern Norway 1985.

6. Hansen, L.P., T.F. Næsje, and I. Nordhuus. Fin size as a possible factor to discriminate between wild and farmed Atlantic salmon; a pilot study.

7. Hoydal, K. The feasibility of regulating the Faroese salmon fishery by limitation of fishing effort.

8. Jakupsstovu, H.i. The Faroese longline fishery for Atlantic salmon in the 1984/85 fishery season.

9. Møller Jensen, J. The Salmon Fishery at West Greenland 1985.

10. Møller Jensen, J. The size composition of salmon landed at West Greenland from 1976 to 1985.

11. Lund, R.A. and L.P.Hansen. Biological characteristics of Atlantic salmon from a coastal fishery at Kvaløya, western Norway.

12. Marshall, T.L. Recapture of Canadian-Tagged Atlantic Salmon Outside Homewaters, 1980-85.

13. Meister, A.L. Atlantic Salmon of USA Origin Recovered in East Greenland and ICES Area XIV Waters.

14. Potter, E.C.E. and D. G. Reddin. Recoveries of coded wire microtags from salmon caught by commercial vessels at West Greenland in 1985.

15. Reddin, D.G. Stock Discrimination.

16. Reddin, D.G. and P.B.Short. Indentification of North American and European Atlantic Salmon (Salmo salar L.) Caught at West Greenland in 1985.

17. Reddin, D.G. and P.B.Short. Length, Weight, Sex and Age Characteristics of Atlantic salmon (Salmo salar L.) of North American and European Origin Caught at West Greenland in 1985.

18. Ritter, J.A., T.L. Marshall, and A. L. Meister. Estimation of Reporting Rates for Tagged Atlantic Salmon Recaptured in the Greenland Fishery.

19. Verspoor, E. Genetic Discrimination of European and North American Atlantic Salmon Using Multiple Polymorphic Protein Loci: Potential for Stock Separation in the West Greenland Fishery.

Appendix 3

REFERENCES

Anon. 1980. Report of the Working Group on North Atlantic Salmon. ICES, Doc. C.M.1980/M:10.

Anon. 1981. Report of Meeting of North Atlantic Salmon Working Group, Copenhagen, 1-6 April 1981. ICES, Doc. C.M.1981/M:10.

Anon. 1984a. Report of Meeting of the Working Group on North Atlantic Salmon, Aberdeen, 28 April-4 May 1984. ICES, Doc. C.M.1984/Assess:16.

Anon. 1984b. Report of the Atlantic Salmon Scale-Reading Workshop, Aberdeen, Scotland, 23-28 April 1984. ICES, Doc. C.M.1984/M:25.

Anon. 1985a. Report of Meeting of the Working Group on North Atlantic Salmon, St. Andrews, New Brunswick, Canada, 18-20 September 1984. ICES, Doc. C.M.1985/Assess:5.

Anon. 1985b. Report of Meeting of Working Group on North Atlantic Salmon, Copenhagen, 18-26 March 1985. ICES, Doc. C.M.1985/Assess:11.

Anon. 1986a. Report of Meeting of the Working Group on North Atlantic Salmon, Woods Hole, Massachusetts, USA, 16-20 September 1985. ICES, Doc. C.M.1986/Assess:8.

Anon. 1986b. Report of the Meeting of the Special Study Group on Norwegian Sea and Faroes Salmon Fishery. ICES, Doc. C.M. 1986/M:8.

Buck, R.J.G. and Hay, D.W. 1984. The relation between stock size and progeny of Atlantic salmon, <u>Salmo salar</u> L., in a Scottish stream. J. Fish. Biol., 23:1-11.

Chadwick, E.M.P. 1982. Stock-recruitment relationship for Atlantic salmon (<u>Salmo salar</u>) in Newfoundland rivers. Can. J. Fish. Aquat. Sci. 39:1496-1501.

Doubleday, W.G., Ritter, J.R. and Vickers, K.U. 1979. Natural mortality rate estimates for North Atlantic salmon in the sea. ICES, Doc. C.M.1979/M:26.

Elson, P.F. 1975. Atlantic salmon rivers, smolt production and optimal spawning: an overview of natural productions. Int. Atl. Salmon Found. Spec.Pub. Ser. 6:96-119.

Hansen, B. 1984. Assessment of a salmon stock based on long-line catch data. ICES, Doc. C.M.1984/M:6.

Møller Jensen, J. and Lear, W.H. 1980. Atlantic salmon caught in the Irminger Sea and at East Greenland. J. Northw. Atl. Fish. Sci., 1:55-64.

Reddin, D.G. and Burfitt, R.F. 1983. 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. ICES, Doc. C.M.1983/M:11.

Reddin, D.G. and Short, P.B. 1985. Identification of North American and European Atlantic salmon (Salmo salar L.) caught at West Greenland in 1984. Canadian Atlantic Fisheries Scientific Advisory Committee Working Paper 85/59 (mimeo.).

Rosseland, L. 1979. Littom bestand og beskatning av laksen i Lærdalselva. In: Gunnerød, T.B. and P. Mellqvist (eds.): Vassdragsreguleringers biologiske virkninger i magasiner og lakseelver. Norges Vassdrags- og Elektrisitetsvesen, Direktoratet for Vilt og Ferskvannsfisk, p.174-186.

Shearer, W.M. 1984. The natural mortality at sea for North Esk salmon. ICES, Doc. C.M.1984/M:23.

Struthers, G. 1981. Observations on Atlantic salmon stocks in the sea off the Faroe Islands 1969-79. Working Paper for the North Atlantic Salmon Working Group, 1981.

Symons, P.E.K. 1979. Estimated escapement of Atlantic salmon (Salmo salar) for maximum smolt production in rivers of different productivity. J. Fish. Res. Board Can., 36: 132-140.

Appendix 4

List of input parameters by river and year (i+1) used to estimate run size and tag returns of 2SW salmon to Maine rivers. Symbols are defined at end of table.

1972

River	T'_a	U_a	T'_t	U_t
Penobscot	1	3	199	118
Union	0	0	0	0
Narraguagus	10	117	25	146
Pleasant	0	1	0	0
Machias	12	49	36	150
East Machias	0	4	0	0
Dennys	0	55	0	0
Kennebec	0	0	0	0
Sheepscot	0	18	0	0
St. Croix	0	0	0	0
Androscoggin	0	0	0	0

1973

River	T'_a	U_a	T'_t	U_t
Penobscot	1	14	158	120
Union	0	72	0	0
Narraguagus	0	70	0	88
Pleasant	0	2	0	0
Machias	0	32	0	0
East Machias	0	5	0	0
Dennys	0	37	0	0
Kennebec	0	0	15	13
Sheepscot	0	18	0	0
St. Croix	0	0	0	0
Androscoggin	0	0	0	0

1974

River	T'_a	U_a	T'_t	U_t
Penobscot	4	19	201	295
Union	0	2	0	11
Narraguagus	0	49	0	91
Pleasant	0	27	0	0
Machias	1	31	0	0
East Machias	0	2	0	0
Dennys	0	44	0	0
Kennebec	0	0	0	0
Sheepscot	0	18	0	0
St. Croix	0	0	0	0
Androscoggin	0	0	0	0

ctd.

Appendix 4 (ctd)

1975

River	T'a	Ua	T't	Ut
Penobscot	20	47	353	510
Union	0	8	0	48
Narraguagus	0	106	0	0
Pleasant	0	7	0	0
Machias	0	46	0	0
East Machias	0	27	0	0
Dennys	0	37	0	0
Kennebec	2	0	0	0
Sheepscot	0	10	0	0
St. Croix	0	0	0	0
Androscoggin	0	0	0	0

1976

River	T'a	Ua	T't	Ut
Penobscot	12	29	146	400
Union	0	20	0	139
Narraguagus	0	31	0	0
Pleasant	0	1	0	0
Machias	0	18	0	0
East Machias	0	17	0	0
Dennys	0	16	0	0
Kennebec	0	0	0	0
Sheepscot	0	9	0	0
St. Croix	0	0	0	0
Androscoggin	0	0	0	0

1977

River	T'a	Ua	T't	Ut
Penobscot	21	155	59	349
Union	0	48	0	175
Narraguagus	0	117	0	0
Pleasant	0	3	0	0
Machias	0	20	0	0
East Machias	0	25	0	0
Dennys	0	23	0	0
Kennebec	0	0	0	0
Sheepscot	0	22	0	0
St. Croix	0	0	0	0
Androscoggin	0	0	0	0

ctd.

Appendix 4 (ctd.)

1978

River	T'a	Ua	T't	Ut
Penobscot	17	314	67	1257
Union	0	10	0	138
Narraguagus	0	126	0	0
Pleasant	0	15	0	0
Machias	0	54	0	0
East Machias	0	54	0	0
Dennys	0	68	0	0
Kennebec	0	0	0	0
Sheepscot	0	32	0	0
St. Croix	0	0	0	0
Androscoggin	0	0	0	0

1979

River	T'a	Ua	T't	Ut
Penobscot	5	129	26	525
Union	0	9	0	29
Narraguagus	0	55	0	0
Pleasant	0	7	0	0
Machias	0	24	0	0
East Machias	0	24	0	0
Dennys	0	35	0	0
Kennebec	0	6	0	0
Sheepscot	0	7	0	0
St. Croix	0	0	0	0
Androscoggin	0	0	0	0

1980

River	T'a	Ua	T't	Ut
Penobscot	0	758	0	1860
Union	0	25	0	173
Narraguagus	0	114	0	0
Pleasant	0	5	0	0
Machias	0	69	0	0
East Machias	0	57	0	0
Dennys	0	206	0	0
Kennebec	0	3	0	0
Sheepscot	0	27	0	0
St. Croix	0	0	0	0
Androscoggin	0	0	0	0

ctd.

Appendix 4 (ctd.)

1981

River	Tá	Ua	Tt́	Ut
Penobscot	56	546	166	1706
Union	3	25	153	104
Narraguagus	0	72	0	0
Pleasant	0	21	0	0
Machias	1	47	0	0
East Machias	1	76	0	0
Dennys	0	117	0	0
Kennebec	0	13	0	0
Sheepscot	0	14	0	0
St. Croix	0	0	0	14
Androscoggin	0	0	0	0

1982

River	Tá	Ua	Tt́	Ut
Penobscot	48	829	188	2869
Union	0	8	0	111
Narraguagus	0	74	0	0
Pleasant	0	15	0	0
Machias	0	53	0	0
East Machias	0	35	0	0
Dennys	0	35	0	0
Kennebec	2	20	0	0
Sheepscot	0	14	0	0
St. Croix	0	0	1	7
Androscoggin	0	0	0	0

1983

River	Tá	Ua	Tt́	Ut
Penobscot	18	123	92	523
Union	0	5	0	114
Narraguagus	0	86	0	0
Pleasant	0	0	0	36
Machias	0	16	0	0
East Machias	0	8	0	0
Dennys	0	26	0	0
Kennebec	1	15	0	0
Sheepscot	0	14	0	0
St. Croix	0	0	0	45
Androscoggin	1	0	1	17

ctd.

Appendix 4 (ctd.)

1984

River	Ta	Ua	Tt	Ut
Penobscot	4	333	51	1123
Union	0	0	0	37
Narraguagus	0	67	0	0
Pleasant	0	0	0	15
Machias	0	34	0	0
East Machias	0	42	0	0
Dennys	0	62	0	0
Kennebec	0	1	0	0
Sheepscot	0	20	0	0
St. Croix	0	0	0	32
Androscoggin	0	0	0	86

1985

River	Ta	Ua	Tt	Ut
Penobscot	21	278	138	2629
Union	0	1	0	81
Narraguagus	0	61	0	0
Pleasant	0	0	0	31
Machias	0	30	0	0
East Machias	0	31	0	0
Dennys	0	20	0	0
Kennebec	0	0	0	0
Sheepscot	0	5	0	0
St. Croix	0	8	0	342
Androscoggin	0	0	0	22

Ta = number of tagged 2SW salmon angled below the fish counting trap where they exist.

Tt = number of tagged 2SW samon counted at the fish counting trap.

Ua = number of untagged salmon angled below the fish counting trap, where they exist.

Ut = number of untagged salmon counted at the fish counting trap.

Appendix 5

Recommendations for
Recovery and Reporting Procedures for Microtags

Microtags are most easily recovered by scanning landed catches at markets or fish plants.

However, as each fishery will have a particular set of sampling problems, detailed sampling procedures should be worked out in advance by the sampling teams.

1. Information to be collected for each sample examined must include:

   a. Number of salmon examined.
   b. Number of adipose clips found.
   c. Number of tags located.

Where samples have been pre-selected into weight groups, the total number of fish landed, the number of fish examined in each weight group and the numbers and weight landed in each weight group should be recorded.

2. Information to be collected for each recovery should include where possible:

   a. Location of capture/preferably latitude and longitude or port of landing.

   b. Date of capture.

   c. Name of boat.

   d. Method of capture.

   e. Scale sample.

   f. Length (cm). Total length (fork length?) to be specified to nearest cm below.

   g. Weight (kg) specifying whether gutted or whole to nearest 1/10 kg below.

3. Handling of cores. The cores should be preserved in alcohol or sent to the appropriate cleaning laboratory. The tags when removed should be read by two independent readers:

   a. A reader in the cleaning laboratory.
   b. A reader in the country of origin of the tag.

   For high seas fisheries only:

   Where the cleaning laboratory is in the country of origin, the tag should be sent to a country using microtags for a second reading.

Reporting

Responsibility for reporting initial details of recoveries from the high seas rests with the cleaning laboratory.

A data base on all tags should be kept by the cleaning laboratory. A reference number should be incorporated for each record and this should be used in all communications and reports.

A data base on tags returned to the country of origin is the responsibility of that country. This should include:

a. Number tagged, date of tagging and date of release.

b. River of origin, location of release and year of migration.

c. Wild or hatchery.

d. Mean length (cm) at release.

e. Mean weight (g) at release.

f. Number caught in home waters (1SW fish).

g. Number caught in home waters (2SW fish).

A data base should be established at ICES to encompass all high seas fishery's returns. The responsibility for updating this data base should rest with the country of origin of the tag.

- - - - - - -