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Report of the ICES/ICNAF Joint Working Party on North Atlantic Salmon

May 1969

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REPORT OF THE ICES/ICNAF JOINT WORKING PARTY ON NORTH ATLANTIC SALMON

20-21 MAY 1969

A. INTRODUCTION

The Working Party met at Charlottenlund Slot, Denmark, on 20th-21st May 1969. The meeting was attended by the following scientists:-

Canada	F.D,McCracken G.F.M.Smith W. Templeman
Denmark	O. Christensen P.M.Hansen Sv.Aa.Horsted P. Kanneworff E. Smidt
England and Wales	I.R.H.Allen
Ireland	Miss E. Twomey
Scotland	W.R.Munro B.B.Parrish /Chairman/ K.A.Pyefinch /Rapporteur/
Norway	L. Rosseland
Sweden	B. Carlin
USA	B. Kimsey B. Skud
Federal Republic of Germany	F. Thurow
ICES	J. Møller Christensen

In the time at its disposal, the Working Party confined its attention to /a/ further consideration of the developments in the fishery for salmon at West Greenland, and of the assessment of its effects on total and home-waters stocks and fishery yields of salmon; /b/ making a preliminary appraisal of the statistical and biological data available for the high seas fishery for salmon which has developed in recent years in the North-East Atlantic, particularly off the coast of Norway.

The results of these considerations are reported below under the headings West Greenland and North East Atlantic respectively.

B. WEST GREENLAND

1. Catch and Fishing Effort

Details of the catches made in the years 1960-1968, both at West Greenland and in home waters, are given in Table 1 and, as far as information is available, the catch per unit effort data are

summarized in Table 2.

The latest data show that the catch in the offshore drift-net fishery at West Greenland increased further from 305 tons in 1967 to 548 tons in 1968, but there was a decrease in the inshore catch from 1,283 tons to 579 tons, so that the total West Greenland catch in 1968 was some 400 tons less than in the previous two years. The available data on the number of fishing vessels operating in the offshore fishery /17 in 1968 compared with 11 in 1967/, indicate that the increase in the catch there in 1968 was due mainly to a further increase in fishing effort. /The average catch for vessel was also slightly higher than in 1967./ On the other hand, the decrease in the inshore fishery was due to a lower catch-per-unit effort /judged from research catches/, resulting from a decrease in the abundance of salmon on the inshore fishing grounds.

For those North American and European with substantial home waters salmon fisheries, the total catches /salmon plus grilse/ were lower in 1968 than in 1967 except in Ireland, where the catch increased slightly. This, however, appears to have been due to a substantial increase in the grilse catch in 1968, the salmon /i.e. fish which have spent two or more winters in the sea/ catch having decreased, as in Canada, England and Wales, Norway and Scotland. In England and Wales, and Scotland the grilse catch was also lower in 1968. It should be noted that the observed decreases in the catches in the different countries were well within the range of year to year variation observed in previous years.

2. Origin of Salmon at West Greenland

The Working Party considered further the information available on the composition and home waters origin of the salmon stock fished at West Greenland based on tag recapture data. It also examined the latest progress in the related studies of their biochemical characters and parasite fauna.

2.1 Recaptures of Tagged Salmon

The recaptures at West Greenland and in home waters of salmon tagged as smolts and kelts in home waters in the years 1963-1967 /Tables 3 and 5/ and the recaptures, both locally and in home waters of liberations in the West Greenland fishery in the years 1965-1968 /Table 6/ together with data on the liberations of tagged smolts in 1966-1968 /Table 4/ are given in Table 3-6. These tables include revisions of data presented in the corresponding tables in the Second Report of the Working Party /ICES, Coop. Res. Rep, No.12/.

The additional data for 1968 were in conformity with those for earlier years in showing that the salmon stock at West Greenland in 1968 consisted of fish which/surviving would return to home waters as salmon of two or more sea winters, and that it comprised a mixture of fish originating from North American /Canada and USA/ and European /UK, Sweden and Ireland/ river systems. They also pointed to salmon originating from rivers off the Norwegian west coast as constituting none, or a very small part of the stock exploited at West Greenland. It should be noted, however, that since very little smolt tagging has been conducted in recent years in Norwegian rivers flowing into the Skaggerak, it is not possible to determine from the tagging data whether salmon from those rivers contribute to the West Greenland stock.

The rates of recapture at West Greenland in 1968 of salmon tagged as smolts in 1967 was lower for all countries /except Ireland/ than those recaptured in 1967 from smolts tagged in 1966. This was due mainly to the reduction in the inshore catch in 1968. When adjustments are made to the total number of tags reported in the two years, to take account of this and to include estimates of the tags taken in the offshore fishery, the rates of return of tags, per ton of salmon caught at West Greenland were approximately the same in 1968 as in 1967 for the countries contributing the largest numbers of tagged fish in the West Greenland catch in the two years except for the USA, for which the rate decreased sharply from relatively high level in 1967.

The Working Party noted that the recaptures at West Greenland of fish tagged as smolts have varied widely for different river systems in some countries /e.g. Canada/ and between wild and hatchery reared smolts, especially in the UK. In the time available, it was not possible to assess fully the influence of these factors on estimates of the relative contributions of the salmon stocks in different countries to the West Greenland stock, but in view of the importance of these factors in the assessments, the Working Party decided that further consideration should be given to this problem at its next meeting in the light of the results of detailed analysis of the tag recapture data in relation to these factors, to be made within the countries concerned.

Only 47 salmon were liberated in the tagging experiment at West Greenland in 1968, compared with numbers ranging from 233-729 in the previous three years. This was due partly to the relative scarcity of salmon in the tagging areas compared with the earlier years (as reflected in the inshore fisher y as a whole) and the decision in 1968 to tag only the fish in good condition from the gill net catches. Four of these salmon were recaptured in the fishery off West Greenland, mostly within a few days after liberation, and to date (May 1969) none have so far been recaptured from home waters. As indicated in Section C, a further tagging experiment is planned to take place during the West Greenland fishing season in 1969.

2.2 Biochemistry and Parasite Studies

Although the investigations conducted so far on the biochemical characters and parasite fauna (as biological tags) in salmon in home waters and at West Greenland have not yet progressed far enough to provide reliable estimates of the home water origins of the salmon exploited at West Greenland, and their rates of mixing there, some promising, preliminary results have been obtained. Aspects of these investigations are summarised as follows:

a) Biochemical studies in Canada have shown that four protein systems show promise for stock identification, viz. the alpha-2 globulins, one transferrin zone in blood serum, liver esterases and the kidney esterases.

b) Investigations in Scotland have shown that liver esterases and, to a lesser extent serum proteins, represent the most promising biochemical approaches to identification of salmon of different origin at West Greenland. A preliminary analysis of more than 200 salmon has shown up 7 distinct patterns of liver esterases for which the distribution in Canada, West Greenland, Scotland, England and Sweden are demonstrated. Other work in Scotland on red cell antigens has produced a preliminary estimate of 20% "Scottish" type fish in a sample caught near Godthaab.

c) Recent biochemical studies in England have been confined to reassessing previous research on eye-lens proteins and work on these and blood serum proteins (both tissues which can be extracted from fish without affecting their market value) from salmon in UK and Ireland rivers and from West Greenland will be continued in 1969.

d) Canadian research on parasites in salmon indicates that parasites of fresh water origin are unlikely to be of use as biological tags in relation to the West Greenland salmon. However, of the marine parasites, the nematode Anisakis sp. and the cestode Eubothrium crassum show more promise and further studies on their occurrence and characteristics are in progress.

The Working Party noted that the applicability of the results of the biochemical methods as indices of the origin of salmon at West Greenland from different home waters stocks is governed by the maintenance of their genetic independence. Any deliberate mixing of genetically distinct stocks by, for example, the transfer of eggs or other early life history stages from one country to another, would complicate the interpretation of the results of these studies. It also noted that, that in view of the large number of possible characters and methods involved in the work, and the widely ranging and expensive nature of these investigations, there is a need for close collaboration between the workers engaged in biochemical and parasitic studies on salmon in the North Atlantic.

3. Assessment of Effects of West Greenland Fishery on Total and Home Waters Salmon Stocks and Yields

a) Total salmon yields

In its report presented to ICNAF last year, the Working Party concluded, on the basis of the available information on the growth of salmon between their occurrence in the exploited stock at West Greenland and their return to home waters, and the information available on the proportions of the fish present in this stock which would subsequently be caught in home waters, that the presence of a fishery at West Greenland, at the level of exploitation there during the period 1963-1967 had resulted in an increase in the total (home-waters plus West Greenland) catch of salmon from European rivers which visit West Greenland, but that the position with regard to salmon from North American rivers was less clear.

The new data available to the Working Party at this meeting provide no grounds for modifying this conclusion. It should be noted, however, that this assessment is based on the relative yields at West Greenland and in home waters of a given number of fish present in the stock at West Greenland. It is therefore based on the assumption that any reduction in the numbers of adult salmon returning to home waters is insufficient to significantly reduce smolt production. Although at present little is known of the relationship between adult stock size and smolt production for Atlantic salmon, the data available on the catches and catches-per-unit effort of both grilse and salmon in the home water fisheries on both sides of the North Atlantic during the years since the West Greenland fishery started (see Tables 1 and 2), suggest that home-water stock size has been relatively high compared with earlier years so that subsequent smolt production is unlikely to have decreased as a direct result of a decrease in spawning stock size.

The situation with regard to the total yield of salmon from North American rivers, visiting West Greenland, is still unclear due to uncertainties regarding the magnitude of the natural mortality rate they suffer on their return from West Greenland to home waters, and the rates of exploitation in each of the river systems to which they return. However, since losses in total yield would only occur at low rates of natural mortality (i.e. less than 20% during the 10-12 month period of return to home waters (i.e. more than about 90%), it seems likely

that also for salmon returning to North American rivers, taken as a whole, the presence of the West Greenland fishery has resulted in an increase in total yield. It is possible, however, that for the salmon returning to some individual river systems where the rate of exploitation is known to be high (e.g. the Miramichi), it may have resulted in no increase, and possibly a small loss in total yield.

b) Home-waters Salmon Stocks and Yields

As indicated in previous reports of the Working Party, precise estimates of the effects of the West Greenland fishery on home-waters salmon stocks and catches (i.e. of fish which have spent 2 or more winters in the sea) cannot be made due to the lack of accurate information on the natural mortality rates occurring between the time that the salmon leave West Greenland and their arrival in home waters and the rates of exploitation in the various river systems to which they return, only limiting estimates of the effects can, therefore, be attempted based on the range of estimates within which the values of these parameters seem likely to lie. In the First Report of the Working Party (ICES, Coop. Res.Rep.No.8, 1967), it was estimated that the natural mortality rate of Canadian salmon between West Greenland and home waters probably lies between 0.02 and 0.1 per month. If these two limits are taken to apply to both North American and European salmon, approximate upper and lower estimates can be obtained of the average annual loss in the weight of salmon reaching the river systems to the North Atlantic as a whole, in the years 1965-1968 (based on a mean catch of 1,340 tons at West Greenland in 1964-1967 and an average increase in weight of 50% between West Greenland and home waters), within which the actual loss probably lies. They are as follows:-

Upper estimate (M - 0.02 per month) = 1,667 tons approx.
Lower estimate (M - 0.10 per month) = 667 tons approx.

It is not possible, from the data currently available to assess the losses more accurately than this, but it should be noted that the value of the average increase in weight of 50% might be overestimated for the salmon returning to European rivers. If this is the case, the upper and lower estimates of the losses, given above, would be overestimated.

Estimates of the loss to the overall home-water catches, compared with what they would have been in the absence of a West Greenland fishery will be the loss to the stocks, times the average exploitation rate in home waters fisheries. As mentioned previously, information on the exploitation rates in home waters are available for very few of the river systems in the countries supplying salmon to West Greenland so that an overall average rate cannot be estimated accurately. It seems likely, however, that this rate does not exceed 0.6. If this value is used, the upper and lower estimates of the losses to the combined North Atlantic home-water catches would be as follows:-

Upper estimate (M - 0.02 per month) = 1,000 tons approx.
Lower estimate (M - 0.10 per month) = 400 tons approx.

In previous assessments, attempts have been made to estimate the losses to the home-water fisheries in the different countries known to supply salmon to the West Greenland stock, based on the relative proportions of fish in the West Greenland catch, originating from them, as indicated by the recaptures there in the years up to 1966 of salmon tagged as smolts. The data reported in the First and Second Reports of the Working Party (Coop.Res.Reps.Nos.8 and 12) indicated that the country contributing the largest proportion of the stock in

the West Greenland area was Canada and that the losses to its stock and fishery for salmon constituted over three quarters of the total loss to all countries combined, while each European country suffered an annual loss of less than 100 tons. The analysis of the longer series of data for the years 1964-1968 point, in fact, to quite large variations from year to year in the rates of recapture of tagged fish at West Greenland, originating from different countries and hence in their apparent contributions of salmon to the exploited stock there. This is evident from the following table, giving for the years 1964-1968, the numbers of recaptures at West Greenland per 1,000 smolts tagged in different countries per 1,000 tons of salmon caught at West Greenland and the ratios of the recaptures of tagged fish at West Greenland and as salmon in home waters (figures in brackets).

Year of recapture at W. Greenland	Canada	USA	England	Scotland	Ireland	Iceland	Sweden
1964	0.74(0.3)	-	0.62(0.3)	0.40(0.06)	-	-	-
1965	0.27(0.1)	-	0.78(0.1)	0.50(0.03)	-	-	-
1966	1.67(0.3)	-	1.60(0.2)	0.61(0.08)	-	-	-
1967	0.68(0.3)	0.31(0.2)	0.36(0.1)	0.79(0.2)	-	0.09(?)	0.40(0.06)
1968	0.62	-	0.38	0.95	0.18	-	0.32

While these figures confirm the earlier conclusions that the major part of the West Greenland stock throughout the period has been derived from rivers in Canada and the UK, it must be recognised that during this period changes have taken place in the types of tag and tagging methods used in the different countries (in 1967 and 1968 there has been greater uniformity in the type of tag used), in the distribution of tagging within each country's river systems (this applies particularly to Canada, where the smolt tagging effort has been extended to rivers not covered in the earlier years) and in the proportions of wild and hatchery reared smolts liberated. The results of the Canadian experiments show that the tag-recapture rate at West Greenland is much higher from some river systems than from others (the recaptures at West Greenland from liberations made in the Bay of Fundy area have been significantly lower than from rivers entering the Gulf of St. Lawrence). Also, the West Greenland recaptures from liberations in England and Scotland have been very much lower for hatchery reared than for wild smolts (this factor may account at least in part for the small number of recaptures of Irish salmon at West Greenland, all of the smolts tagged in 1966 and 1967 being hatchery reared). These factors, together with possible differences in the efficiency of recovery of different types of tag may introduce substantial errors in the estimates of the relative proportions of salmon at West Greenland, originating from different countries. The Working Party considers, therefore, that it is not possible, from the data currently available to estimate accurately the proportions of the total losses to home-water catches suffered by the fisheries of different countries. However, it seems clear that the largest proportion of the total losses have continued to be experienced by the fisheries for salmon in Canada and the UK.

A measure of the losses to the home-water stocks and catches of large salmon due to the West Greenland fishery, relative to what they would have been in the absence of that fishery, is given by the fishing mortality rate generated there (on the assumption that the growth and natural mortality rates do not change as a direct effect of that fishery). An estimate of the fishing mortality rate can be obtained from recaptures in the West Greenland fishery of salmon tagged during the fishing season there. However, accurate estimates can only be obtained from these data if the mortality due to tagging is negligible (or, if considerable, is known) and the efficiency of return of tags is high. Unfortunately, the tagging experiments conducted at West Greenland so far do not meet these

requirements especially with regard to the tagging mortality which has probably been very high (but its actual magnitude is unknown) so that reliable estimates of the effects cannot yet be obtained by this method. In the tagging experiments to be conducted at West Greenland in 1969, attempts will be made to improve the method of capture for tagging, by the use of longlines and observations will be made in captivity of the survival of fish after tagging, in relation to catches by gill nets.

It should be noted that the effects estimated by this method are based on the assumption that all of the large salmon returning to home waters are present within the exploited area off West Greenland and that the fishing mortality rate generated there applies to the stock as a whole. If this assumption is not fulfilled, as seems most likely, and an unknown part of the stock which will return to the rivers as large salmon is present in other areas, the effects on the home-water stocks and catches estimated in this way would provide an upper limit of the losses to them.

It is evident from the above results that at present the accuracy of the assessment of the magnitude of the effects of the West Greenland fishery on total and home-water salmon stocks and catches is limited by the lack of information on a number of aspects of the distribution and population dynamics of the salmon visiting West Greenland. Of major importance amongst these are:-

a) the rate of natural mortality occurring between the time the salmon leave West Greenland and their return to home waters;

b) the rates of exploitation in each country's home-water fisheries;

c) the rate of exploitation (fishing mortality rate) generated by the West Greenland fishery;

d) the identification of salmon at West Greenland originating from and, if surviving, returning to the river systems of different countries;

e) the relation between the size of the spawning stock and smolt production in home waters.

More detailed and accurate assessments will only be possible when further information on these processes becomes available from the research programs currently in progress, as outlined in a later section of this report.

C. NORTH-EAST ATLANTIC

In its report last year, the Working Party drew attention to the recent development of a high seas fishery for salmon by long-line in the North-east Atlantic off the West Coast of Norway and to a much smaller extent in the vicinity of the Faroes. Information on the catches taken in this fishery and on the composition and origin of the exploited stock is summarised below.

1. Norway

1.1 Catches and Fishing Effort.

Fishing for salmon in Norwegian coastal waters by drift-net has taken place from time to time since the seventeenth century. However, 1958 marked the beginning of a rapid growth in this coastal fishery which started in Finmask but rapidly spread southwards. While this fishing has remained mainly within the coastal waters, in some years 1968 it has extended to distances of 30-35 nautical miles off the coast. In the most recent years, however, it has taken place within 6-7 miles of the coast.

In 1965, a fishery by long-line was started by Danish fishermen in the sea outside Norwegian fishery limits. Catches in 1965 and 1966 were small, but the fishery grew rapidly in 1967 and 1968, with the participation of Danish, Norwegian, Swedish and Faroese vessels. Most of the long-line fishing takes place from about 30 to 150 nautical miles offshore, and it extends from Finmark southwards.

The available data on the catches taken in the Norwegian coastal drift-net fishery and the offshore long-line fishery, and the number of vessels engaged in the latter are given in Table 7. /The total salmon catches taken by Norway by all methods of fishing are given in Table 1.B./ Catch-per-unit-effort estimates for long-line fishery for different months in 1968 are given in Table 8. These data show that coastal drift-net fishery exceeded 300 tons in each of the years 1965-1967, but decreased sharply to 228 tons in 1968, while the long-line fishery increased sharply to over 300 tons in 1968.

1.2 Characteristics of the Offshore Norwegian Salmon Stock

Details of the length and age compositions of the catches taken in the long-line fishery in 1968 are given in Tables 9 and 10 respectively.

These data based on sampling in one year only suggest that the salmon stock exploited in the offshore fishery, like those at West Greenland, consist mainly of fish which, if sirviving, will return to home waters as salmon that have spent two or more winters in the sea /almost 90% of the fish sampled were in this category/. Only a small proportion /7%/ belonged to the grilse age-group. This indicates that any effects of this fishery on home-waters stocks is likely to be principally on their large salmon /with 2 or more sea-winters/ component.

One notable characteristic of the long-line catches seems to be the low condition factor of the fish caught. The average value of K for a sample of the fish caught in 1968 was 0.85, whereas the condition factor for fish caught in Norway in coastal waters lay between 1.0 and 1.2.

1.3 Origin and Distribution of the Offshore Norwegian Salmon Stock

Norway has maintained a salmon-smolt tagging programme, in which about 20,000 smolts are tagged each year, for many years. In 1967, 8 of these fish /representing 1.7% of the total recaptures/ were recaptured in the offshore fishery and, in 1968, 49 recaptures /10.5% of the total/ were recorded.

Recaptures have also been recorded, in this fishery, of smolts tagged in countries other than Norway. Out of a total of 1200 recaptures of tagged smolts from Sweden, five have been returned from this fishery and two out of the 4270 hatchery-reared smolts, liberated in Denmark in 1966, have also been taken in the offshore Norwegian fishery, one in 1968 and one in 1969.

The occurrence of hooks in the mouths and stomachs of salmon caught in rivers has been reported in 1967 and 1968 in Norway /182 reported occurrences/, the USSR /22 reported occurrences/ and in Scotland /4 reported occurrences/.

In addition to the tagging of smolts, salmon have been tagged from the off-shore long-line catches. Of 250 fish tagged up to the end of 1968, 4 have so far been recaptured, all on the Norwegian coast to the south of the tagging sites. Some 700 of the fish caught in the drift-net fishery have also been tagged and about 20% of these have been recaptured and the subsequent migrational pattern of these fish closely resembles that of fish tagged in the coastal bag-net fishery.

The information at present available suggests that the stock fished by the off-shore long-line fishery off the Norwegian coast /and by the drift-net fishery in coastal waters/ is composed mainly of salmon which if surviving will return to Norwegian rivers though, as the tag recaptures and hook observations suggest, fish from other countries' rivers are also present.

2. Faroe

In 1968 the Faroese research vessel "Jens Chr. Svabo" carried out an experimental long-lining cruise for salmon in the waters around Faroe. Between 8th and 23rd April lines were shot on 7 occasions and 182 salmon were caught, of which 7 were subsequently tagged and released. Most of the salmon caught were small /55-59 cm/, but a few were over 100 cm long and weighed more than 9 kg. A small sample of scales from the catch made by the "Jens Chr. Svabo" was examined. The results indicated that the small salmon which predominated in the catch were one-sea-winter fish, which were just beginning their second year's growth in the sea.

A few Danish and Faroese fishing vessels fished in this area in 1968 but the catch did not exceed 5 tons.

In April 1969, the "Jens Chr. Svabo" carried out a second cruise in the same area as in 1968. Lines were fished on 7 occasions and a total of 426 salmon were caught, of which 74 were tagged and released. The catch per unit effort was again very high averaging almost 80 salmon /1000 hooks during the cruise. The length-frequency distribution was very similar to that recorded in 1968; most of the fish were between 48 and 60 cm in length, suggesting that one-sea-winter fish again predominated in the catch.

To date, six salmon tagged in other areas, have been recaptured off Faroe, four from Norway and two from Scotland.

D. FUTURE RESEARCH PROGRAMME

The Working Party briefly reviewed the research programme proposed for 1969, at West Greenland. This will again be a cooperative programme between Canada, Denmark, and the UK and will consist of a further tagging programme and further work on methods of elucidating stock composition. The tagging programme will consist of /a/ a further investigation of the possibilities of pelagic long-lining, /b/ gill-net fishing, including impoundment of the fish caught /both tagged and untagged/, and /c/ drift-netting. The last investigation will be principally carried out by Canada, the former by Denmark, and the UK. Further investigations will be made in Canada and the UK, of the biochemical characteristics and parasites of salmon as a guide to stock composition.

Research in connection with the North-East Atlantic fishery will be conducted by Denmark, Norway and Sweden. Each country will collect statistics of catches and will collect data on the length, weight and age composition of the catches. In addition, Norway will undertake further tagging experiments and collect data from the commercial long-line vessels on the composition of the exploited stock. So far 675 salmon had been tagged from a commercial long-liner in 1969, and work will be started on a second vessel in the near future.

The programmes of smolt tagging will be continued as in previous years.

E. FUTURE MEETING

The Working Party recommends that it should meet for not less than two days prior to the ICNAF meeting in 1970.

Table 1. Catches at West Greenland and from the home waters of some countries, 1960-67, in metric tons and round fresh weight. (Revised to May 1969).

A. West Greenland Area

	Offshore						
	Norwegian	Faroese	Danish	Swedish	Total	Inshore	Total
1960	-	-	-	-	-	?	?
1961	-	-	-	-	-	127	127
1962	-	-	-	-	-	244	244
1963	-	-	-	-	-	466	466
1964	-	-	-	-	-	1,539	1,539
1965	+	36	-	-	36+	925	861
1966	32	87	-	-	119	1,251	1,370
1967	78	142	85	-	305	1,283	1,588
1968	138	134	272	4	548	579	1,127

+ Figures not available, but catch is known to be less than Faroes.

B. Home Waters (Salmon and grilse, except where shown separately)

	Ireland[a]	England and Wales[b]	Sweden[c]	Norway[d]
1960	514	281	30-50	1,659
1961	522	231	30-50	1,533
1962	1,180	318	30-50	1,935
1963	1,130	324	30-50	1,786
1964	1,188	305	30-50	2,157
1965	1,172	319	30-50	2,000
1966	1,090	379	30-50	1,863
1967	1,226	412	30-50	2,052
1968	1,250	275	30-50	1,616

	Scotland				
	Salmon	Grilse	Total	Canada[e]	USA
1960	945	468	1,413	1,635	less than 2
1961	807	370	1,177	1,581	less than 2
1962	999	713	1,712	1,718	less than 2
1963	1,266	406	1,672	1,855	less than 2
1964	1,197	687	1,884	2,126	less than 2
1965	1,048	542	1,590	2,162	less than 2
1966	1,049	546	1,595	2,311	less than 2
1967	1,223	868	2,091	2,916	less than 2
1968	1,061	460	1,521	2,143	less than 2

a) Grilse seem to be about 70-80% by weight or 80-90% by numbers in total Irish catches. Commercial catches only.

b) Salmon and grilse. Proportions of grilse in regional catches vary from 10% to 40% and average 22%.

c) Estimated 75% grilse. West coast catch only.

d) Includes not more than 5% sea-trout. Estimated 15% grilse based on (i) returns from fish merchants and (ii) tagging data.

e) Commercial catches only; angling catches (mostly grilse) are about 10% additional. Very few grilse taken in N.S. and N.B. but form significant part of Newfoundland catches.

Table 2. Estimates of catches per unit effort for some home water fisheries.

	Canada[a]	Ireland		Foyle Area[b]	Norway[e]	Scotland	
	(Drift Nets and Traps)	(Drift Nets)[c]	(Licences)[d]	(Drift Nets)	(Bag Nets)	(Fixed Engines)[f]	(Net and Coble)[g]
	(lbs)	(numbers)	(lbs)	(numbers)	(kg)	(numbers)	(numbers)
1960	169	325	950	104[h]	172	12.8	84.1
1961	159	224	1,030	-	158	12.3	60.9
1962	178	563	2,210	297	175	14.8	83.6
1963	193	456	1,940	334	177	19.9	109.3
1964	266	430	1,720	392	195	23.2	98.6
1965	262	520	1,700	361	172	17.8	84.0
1966	249	516	1,250	375	154	19.4	95.0
1967	248[M]	733	1,801[M]	524[M]	154	21.6	130.2
1968	186	552	1,744	459	129	17.3	97.9

a Miramichi area, salmon only. Average of mean monthly catch/unit effort for both types of gear throughout open seasons for each type. Units of effort taken as 1 trap net or 200 fathoms of drift net, as defined in FRB Tech. Rept. No. 29.

b Irish Republic and Northern Ireland.

c Salmon and grilse per drift net.

d Pounds salmon and grilse per licence.

e Salmon and grilse per bag net

f Salmon only, catch/net/month.

g Salmon only, catch/crew/month.

h ~~Not available~~.

Table 3. Number of smolts tagged in the years 1963-1967 and recovered in Greenland and home waters up to the end of 1968.

Country	Year of Tagging	No. Tagged	Recoveries			
			Greenland	Home waters		Total[a]
				Grilse	Salmon	
Canada	1963	13,182	15	201	48	264
	1964	63,643	18	304	155	477
	1965	65,313	139	549	401	1,089
	1966	87,584	90	358	377	785
	1967	130,352	47	379	-	426
Scotland	1963	17,748	10	307	188	505
	1964	12,180	6	299	233	538
	1965	13,239	9	160	132	301
	1966	23,406	29	478	118	625
	1967	25,444	15	210	-	226[c]
England & Wales	1963	9,485	9	16	32	57
	1964	17,129	10	33	99	142
	1965	5,974	12	35	59	106
	1966	12,999	5	28	38	71
	1967	22,740	6	22	-	28
Norway	1963	10,975	0	88	94	182
	1964	10,653	0	205	105	310
	1965	11,080	0	112	57	169
	1966	18,174	0	435	?	-
	1967	24,635	0	?	-	?
Iceland	1966	8,449	1	66	-	-
	1967	10,214	0	?	-	?
Ireland	1966	15,000	0	0	0	0
	1967	10,000	1	1	-	2
Sweden	1966	11,507	7	733[b]	123	863
	1967	4,999	1	364	-	365
USA	1966	82,000	36	24[b]	(160)	(220)
	1967	80,700	2	10[b]	-	12

a) All recoveries, Greenland and home waters

b) Includes recaptures from all places other than Greenland

c) Includes 1 recapture taken N. of Faroes 1968

Table 4. Numbers of smolts tagged, 1966, 1967 and 1968.

Country	1966			1967			1968		
	Hatchery	Wild	Total	Hatchery	Wild	Total	Hatchery	Wild	Total
Canada	78,976	8,608	87,584	114,689	15,663	130,352	136,670	41,942	178,612
Denmark	4,270	0	4,270	2,696	0	2,696	5,173	0	5,173
England and Wales	9,668	3,331	12,999	18,522	4,218	22,740	31,750	5,432	37,182
Iceland	8,367	82	8,449	10,061	153	10,214	?	?	?
Ireland	15,000	0	15,000	10,000	0	10,000	222	625	847
Norway	16,163	2,041	18,174	20,421	4,214	24,635	12,983	4,121	17,104
Scotland	8,000	15,406	23,406	4,451	20,993	25,444	5,338	15,695	21,033
Sweden	11,180	327[a]	11,507	4,999	564[a]	5,563	5,200	0	5,200
USA	82,000	0	82,000	80,700	0	80,700	76,000	0	76,600

a) Tagged as parr

Table 5. Recaptures of tagged kelts in Greenland and home waters up to the end of 1968.

Country	Year of Tagging	Number Tagged	Recaptures		
			Greenland	Home Waters	T o t a l
Canada	1963	1,519	0	677	677
	1964	1,995	1	627	628
	1965	4,396	0	1,693	1,693
	1966	5,026	1	1,169	1,170
	1967	3,611	-	809	809
	1968	2,650	-	439	439
England and Wales	1963	185	2	9	11
	1964	184	2	7	9
	1965	181	1	10	11
	1966	109	1	4	5
Ireland	1963	2,207	2	31	33
	1964	2,351	2	70	72
	1965	2,695	2	34	36
	1966	2,972	1	40	41
	1967	3,102	-	64	64
	1968	1,034	-	23	23
Scotland	1963	134	0	2	2
	1964	233	0	5	5
	1965	1,435	3	31	34
	1966	901	3	21	24
USA	1963	166	1	7	11[a]
	1964	225	0	16	23[a]
	1965	191	2	8	18[a]
	1966	647	4	14	30[a,b]

a These totals include tags returned from Canadian waters.

b Provisional total.

Table 6. Recaptures (to May 1969) of fish tagged in West Greenland.

Year Tagged	Number Tagged	Local Recaptures		Distant Recaptures	
		Number	Days Absence	Number	Location
1965	233	2	3, 26	1	Canada (1, S.W. Newfoundland)
1966	729	28	(1-8 days (24) (10-50 " (4)	4	Canada (1, Miramichi Estuary) Scotland (3, River Tweed (2), River Spey)
1967	375	5	1-21 days	1	Canada (1, Indian Head, Labrador) Ireland (2, River Slaney, River Barrow) Scotland (1, River Tay)
1968	17	4	1-3 days (3) < 1 month (1)	0	

Table 7. Catch by drift-net in the coastal fishery and by long-line in the offshore fishery off the Norwegian coast, 1965-1968.

/In metric tons, gutted, head on/

Year	Offshore Fishery by Longline										Inshore Fishery by Drift-net[a]
	Danish		Norwegian		Swedish		Faroese		Total		Norway
	Number of Ships	Catch	Number of Ships	Catch	Number of Ships	Catch	Number of Ships	Catch	Number of Ships	Catch	
1965	1-2	Not known	0	0	0	0	0	0	1-2	Not known	308
1966	10	Not known	0	0	Not known	Not known	0	0	10+	Not known	338
1967	22	66.5	Not known	Not known	6	Not known	0	0	28+	66.5+	359
1968	23	153.0	Not known	100[b]	16	105	2	3.5[c]	41+	361.5	228

Notes: a/ Including catches taken bz seine
b/ Estimated catch
c/ Out of the 1,080 fish caught, 721 were taken in the Faroese area.

Table 8. Catch per unit effort in Norwegian offshore long-line fishery.

Year	Month	Country	No. of Salmon Caught	No. caught per 1000 Hooks
1968	April	Denmark	1104	92
1968	May	Denmark	4435	100
1968	April-Aug.	Sweden	32751	42

Table 9. Length composition of catches taken in offshore fishing off Norway in 1968

Length-Group (cm)	April 1968		July 1968	
	Number	Percentage	Number	Percentage
50-59	-	-	3	1.2
60-69	29	11.6	146	58.1
70-79	119	47.6	38	15.3
80-89	94	37.6	55	21.8
90-99	6	2.4	7	2.8
100-109	2	0.8	2	0.8
No. in Sample	250		251	

Table 10. Age composition of catches taken in offshore fishery off Norway in 1968

Sea Winters	Number	%	Years in River	Number	%
1	68	7.4	1	-	
2	816	89.0	2	58	6.3
3	34	3.7	3	608	66.4
4	0		4	194	21.2
			5	49	5.4
			6	6	0.7