

COOPERATIVE RESEARCH REPORT

Series A, No. 24

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

December 1970

<https://doi.org/10.17895/ices.pub.8047>

ISBN 978-87-7482-728-3

ISSN 2707-7144

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May 1971

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A. INTRODUCTION

1. The first and second reports¹⁾ of the Working Party dealt with the growth of the fishery for salmon off West Greenland in the period up to May 1968, with the results of investigations during this time on the composition, origin and biological features of the salmon concentrations exploited there and with assessments of the effects of the fishery on total and home-waters salmon catches and stocks. This report deals with the further information obtained for this fishery and the assessments made of its effects in the period May 1968 to February 1970; in addition, information is presented on the development of a high seas salmon fishery in the Norwegian Sea, which developed during this period, and of preliminary assessments of its effects on total and home-waters catches and stocks.

2. In the period May 1968 - February 1970, three meetings of the Working Party were held, in May 1969, February 1970 and September 1970 respectively. The representation at these meetings was as follows:-

	<u>May 1969</u>	<u>February 1970</u>	<u>September 1970</u>
Canada	F. D. McCracken G. F. M. Smith W. Templeman	A. W. May	A. W. May
Denmark	O. Christensen P. M. Hansen S. A. Horsted P. Kannevorff E. Smidt	O. Christensen	O. Christensen S. A. Horsted J. Møller Jensen
England and Wales	I. R. H. Allan	I. R. H. Allan A. Swain	I. R. H. Allan
Federal Republic of Germany		F. Thurow	F. Thurow
France		R. Vibert	
Ireland	Miss E. Twomey	Miss E. Twomey	A. E. J. Went
Scotland	W. R. Munro B. B. Parrish (Chairman) K. A. Pyefinch (Rapporteur)	W. R. Munro B. B. Parrish (Chairman) K. A. Pyefinch (Rapporteur)	A. J. Aglen W. R. Munro B. B. Parrish (Chairman) K. A. Pyefinch (Rapporteur)
Norway	L. Rosseland	L. Rosseland	L. Rosseland

1) Report of the ICES/ICNAF Joint Working Party on North Atlantic Salmon, 1966. Int.Council Explor.Sea, Coop.Res.Rep., Series A, No.8, 27 pp., (1967).

Second Report of the ICES/ICNAF Joint Working Party on North Atlantic Salmon, May 1968. Ibid., Series A, No.12, 18 pp. (1969).

	<u>May 1969</u>	<u>February 1970</u>	<u>September 1970</u>
Sweden	B. Carlin	B. Carlin	B. Carlin
U.S.A.	J. B. Kimsey B. Skud	J. B. Kimsey W. Anthony	J. B. Kimsey
U.S.S.R.		A. Bogdanov Y. Riazantsev A. Volkov	G. V. Nikolsky
ICES	J. Møller Christensen		
ICNAF			L. R. Day

A. J. Aglen (Scotland) attended some of the sessions of the meeting in February 1970 and K. U. Vickers (Northern Ireland) attended on the first day of this meeting. Mr. S. Å. Horsted (Denmark) was unable to attend the meeting in February 1970 because of illness.

B. WEST GREENLAND FISHERY

1. Catch and Fishing Effort

3. The salmon catches taken at West Greenland in the years 1960-68, and provisional data for 1969 are given in Table 1. The catches in the inshore (set gill-net) and off-shore (drift-net) fisheries are given separately, but it should be noted that an accurate division of the catch into inshore and offshore components cannot be made for 1969 owing to some locally-registered vessels taking part in the drift-net fishery. Catches from these vessels were landed in Greenland and reported together with the set gill-net catches. The data for the two components in 1969 given in Table 1 are therefore only approximate.

4. These data indicate that there was a large increase in total salmon catch in 1969 to over 2 000 tonnes (1 tonne = 1 metric ton = 1 000 kg). Despite the uncertainty about the division of the total catch into its inshore and offshore components, it is clear that the drift-net fishery increased considerably and is now the larger component. In 1969 it exceeded 1 000 tonnes.

5. The available information on the size and age composition of the salmon stock exploited in both the inshore and offshore components of the fishery at West Greenland in 1969 suggests that as in previous

years the main part of the exploited stock consisted, as in former years, of fish which had spent one winter in the sea and which, if returning to home waters, would do so as two or more sea-winter fish.

6. The number of fishing vessels taking part in the drift-net fishery also increased substantially in 1969. The information available indicates that about 34 non-Greenland vessels (15 Danish, 6 Faroese, 11 Norwegian and 2 Swedish) took part in this fishery, as compared with totals of 17 in 1968 and 11 in 1967. In addition, some offshore drift-netting took place by about 30 Greenland-registered vessels, although they had much less fishing power per vessel than the non-Greenland vessels. Thus the number of drift-net vessels has increased steadily since 1966 in parallel with the increase in drift-net catch. Another significant change in 1969 is that a few of these vessels were using some monofilament nets and it seems likely that the use of these nets will increase. If this occurs, it would have a significant effect on fishing efficiency as recent observations in Greenland, both of monofilament nets fished from a commercial vessel and from a research vessel, have shown that these nets are at least twice as effective as the polyfilament nets used previously.

7. In contrast to the drift-net fishery, the fishing effort in the set gill-net fishery appears not to have increased significantly in 1969.

2. Distribution of Fishing

8. The distribution of the offshore drift-net fishery along the Greenland coast, based on information in 1969 and the main centres of the inshore set gill-net fishery are shown in Figure 1.

9. The inshore set gill-net fishery is carried out along a large part of the west coast of Greenland from Nanortalik (latitude 60°N) in the south to Disko Island (latitude approx. 70°N) in the north with some limited fishing extending to as far north as Upernavik (lat. 72°45'N). The main centres of fishing are in the vicinity of the larger towns (shown in Figure 1), the most important being the Arsuk-Frederikshaab area, Fiskenaesset, the area round Godthaab, the

Sukkertoppen district (including Sukkertoppen, Napassog and Kangamiut) and the Holsteinsborg area. The success of the fishery in the various districts varies from year to year, and in some years has failed completely in certain areas, especially in the south where drift ice often prevents nets being set.

10. Prior to 1969, the drift-net fishery, prosecuted almost entirely by European-registered vessels, was mainly confined to the area of the Store Hellefiske Bank, extending as far south as Kangamiut (lat. 66°N) in the early part of the season but tending to be concentrated on the Store Hellefiske Bank itself in the remainder of the season. In 1969, the fishery spread over a rather wider area than in previous years, extending from Sukkertoppen in the south to the Disko area in the north (hatched area in Figure 1). In addition, some Greenland-registered vessels fished with drift-nets in this general area. Therefore, the drift-net fishery has been mainly confined to an area between 65°N and 70°N and extending outwards to about 40 n.m. from the coast. However, exploratory fishing voyages have demonstrated that salmon are present over a wider area than this.

3. Origin and Destination of Salmon

3.1 Tag Recaptures at West Greenland

11. The recaptures, during 1964-1969, of salmon tagged in home waters as smolts (either natural or hatchery-reared) are shown in Tables 2, 3, and as adults in Table 4. These tables include revisions of data presented in earlier reports of the Working Party. In addition, information is presented, in Table 5, for parr tagged in home waters.

12. In 1969, as in previous years, the smolt tag returns show that the great majority of the fish recaptured at Greenland were derived from smolts which had entered the sea during the previous year and if surviving, would have returned to home waters as salmon of two or more sea-winters. Tags were again recorded at West Greenland from a number of North American (mostly Canadian) and European (mostly United Kingdom) river systems including, for the first time, recaptures of fish tagged as hatchery-reared smolts in Norway and Denmark respectively. Also, following tagging in 1968 of adults ascending a Newfoundland river, two of these fish were recaptured at Greenland in 1969.

13. Comparison of the recapture data in Tables 2 and 3 for tagged, natural and hatchery-reared smolts respectively indicates that survival in the sea is usually much less for the tagged, hatchery-reared fish. Therefore, the return rates from natural smolts are likely to be a better guide to the national contributions to the West Greenland stock. For those countries in which most or all of the smolts tagged were from hatcheries, it is possible that the return rates from Greenland underestimate their relative contributions to the exploited stock.

14. While separation of the smolt tagging data into hatchery-reared and natural components eliminates one source of variation in year-to-year recapture rates at West Greenland, it is evident that a good deal of variation still remains, both between countries and within countries. Thus, returns from West Greenland of hatchery-reared smolts tagged in the United States were relatively high for fish tagged in 1966, but were low for the 1967 and 1968 taggings. The return rate from West Greenland of Canadian tagged smolts was highest for the 1965 tagging (both hatchery-reared and natural) and declined substantially for smolts tagged in 1966, even though the Greenland catch increased slightly from 1966 to 1967. On the other hand, natural smolts tagged in 1966 gave the highest return rate at West Greenland from Scottish tagging, while for England and Wales the highest return rates were obtained from the 1967 and 1968 taggings. In addition, the rates of return from Greenland may vary for tagging in different home river systems and the relative numbers of smolts tagged is known to have varied between these rivers from year to year. It is therefore evident that more detailed evaluation of tag returns in the countries concerned is urgently needed, particularly with respect to possible bias in some years relative to the area of tagging, type of tag applied, etc.

15. In addition to the above sources of variation and error, the non-reporting of tags, especially from the drift-net fishery, poses a major problem. It is known that the reporting efficiency from this fishery is low so that, with the increase in its size relative to the set gill-net fishery, the magnitude of this source of error is likely to have increased progressively. Therefore, in view of the importance of tag recapture data in these studies, the Working Party

strongly recommended

that all possible steps be taken to increase the efficiency of reporting of tag recaptures from the drift-net fishery.

16. Despite the above factors, which preclude any accurate estimation of the relative contributions of salmon from different countries in the West Greenland stock, the recapture data over the whole period suggest that the major part of the exploited stock at West Greenland has been derived from rivers in Canada and the United Kingdom.

3.2 Biochemical and Parasite Studies

17. Investigations were continued in 1969 on biochemical characters and parasite fauna (as biological tags) in relation to the study of the origin and mixing of salmon at West Greenland. Although these investigations have not yet progressed far enough to provide reliable estimates of the origin and rate of mixing of the exploited stock in this area, recent Canadian investigations of blood serum proteins, in association with parasite studies, have provided very promising results. Analyses of a sample of 242 salmon caught by drift-net mainly in the Disko Bay area indicated, for example, that 43% of these fish were of North American origin. The Working Party considers that this and similar investigations in other countries should be continued as intensively as possible.

3.3 Tagging at West Greenland

18. From late August until the end of October 1968, Denmark and the United Kingdom collaborated in a further tagging experiment at West Greenland, in which the possibility of using T-nets as a means of catching salmon for tagging was thoroughly investigated and preliminary tests were made of the use of pelagic long-lines. The results were disappointing, in that the T-nets only caught 23 salmon (of which 13 were tagged) and only 11 salmon were caught on long lines, of which 5 were tagged. Most of the salmon tagged in 1968 (Table 6) were caught by set gill-net.

19. Further liberations of tagged fish were made at West Greenland in 1969 in the course of experiments by Canada, and by Denmark and the United Kingdom.

20. In the Canadian experiment, the salmon were captured by drift-net in day-light and tagging was conducted from a small boat patrolling the nets continuously throughout the fishing period so that the fish could be removed from the nets and tagged soon after capture. Between 6 September and 2 October, a total of 627 salmon, ranging in length between 55-88 cm (average 67 cm) was caught, of which 385 were tagged, 355 in Disko Bay and 30 off the coast further south; 134 of the fish liberated were graded as being in 'excellent' condition, 199 in 'good' condition and 52 in 'fair' condition on the basis of classifications made in earlier experiments conducted off the Newfoundland coast, when the same fishing, handling and tagging methods were used.

21. In the joint Danish-United Kingdom experiments, fishing was conducted by long line in a number of localities off the West Greenland coast between the Store Hellefiske Bank and Disko Bay during the period 11 October to 14 November 1969. A total of 65 salmon was caught during the experiment, of which 43 were tagged and liberated, all of the tagged fish being judged to be in very good condition. A notable feature of the salmon taken in this experiment, which may account for the small number caught, was their relatively large size (range 60-100 cm: average 76 cm) compared with those taken in drift-nets both in the commercial fishery and by research vessels. Another joint Danish-United Kingdom experiment was made to attempt to assess the viability of tagged and untagged fish caught by gill-net, but the numbers caught were too low to provide a reliable test. Fifteen tagged fish were, however, liberated.

22. The subsequent recaptures in the West Greenland fishery and in other areas of salmon tagged in these and earlier experiments are given in Table 6. These data show that, during the period 1965-69, a total of 1 818 salmon was tagged, of which 56 have been recaptured locally and, up to the end of 1970, 22 have been recaptured in home waters (10 in Canada, 5 in Scotland, 4 in Ireland and 3 in England and Wales). The overall recapture rate of 3.4% in the West Greenland fishery in 1969 was approximately the same as the average for the experiments in previous years. However, the recapture rate of the fish in the 'excellent' condition category in the Canadian experiment was substantially higher at 6.0%.

23. The accuracy with which tag recapture data from these experiments can be used in estimating the rate of exploitation of salmon in the West Greenland fishery is governed by (a) the magnitude of the mortality due to tagging and (b) the extent to which recaptured fish are recovered from the catch and reported. Unfortunately, insufficient information is available for the magnitude of these factors to be estimated accurately. As indicated in paragraph 15, it is known that the efficiency of tag recovery and/or reporting in the drift-net fishery is relatively very low. Since the proportion of the total catch taken by drift-net fishery has increased in recent years, and especially in 1968 and 1969, the magnitude of this source of error in the use of tag recapture data for estimating rate of exploitation has also increased. While an accurate adjustment of the recapture data for these experiments cannot be made in the absence of detailed information on the distribution of the catches taken by the gill-net and drift-net fisheries respectively, it seems likely that, from this and other sources of error (e.g. through no account being taken of tagging mortality), the estimated 6% recapture rate of the fish in the 'excellent' condition category in the Canadian experiment represents an underestimate of the rate of exploitation for that part of the total fishery within which tagged fish were present.

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

4.1 Total Salmon Yields

24. The results of previous assessments reported by the Working Party indicated that the development of the West Greenland fishery has resulted in an increase in the total catch (West Greenland plus home waters) of salmon of European origin in the West Greenland stock, and that, with the possible exception of fish originating from some river systems in Canada, where the rate of exploitation is known to be high, this probably also applies to the salmon originating from North American home waters.

25. The latest data available to the Working Party on the growth of salmon between their occurrence in the West Greenland stock and their return to home waters and on the rates of exploitation in home waters, provide no grounds for modifying these conclusions. It is emphasized, however, that they are based on the assumption that the exploitation at West Greenland has not reduced spawning stocks so much as to cause

a direct reduction in the number of smolts and subsequent recruitment of salmon. At present, too few data are available on the relationship between adult stock size and smolt production and between smolt production and the subsequent recruitment of grilse and older salmon for the validity of this assumption to be tested. The Working Party therefore stresses the need for such studies to be conducted within river systems in both Europe and North America, especially in the light of the salmon catch data for home-water fisheries in 1968 and 1969, which point to a reduction, in these years, in the quantities of two or more sea-winter salmon entering the river systems in both regions.

4.2 Home-waters Salmon Stocks and Yields

26. In its second report, the Working Party presented estimates of the possible magnitude of the losses in weight to the salmon stocks and catches in home waters resulting from the West Greenland fishery, based on (a) the average catch in that fishery in the years 1964-67, (b) data on the increase in weight of salmon between their appearance in the West Greenland fishery and their return to home waters, (c) limiting values of their natural mortality rate during this time and (d) an estimate of the overall average exploitation rate of salmon in the home-waters fisheries in countries to which salmon at West Greenland return. On the assumption that the salmon at West Greenland, if surviving, will return to home waters in the following year as two sea-winter salmon, the estimated losses to the home-waters stocks for an average catch of 1 340 tonnes for the years 1964-67 lay between 667 and 1 667 tonnes and to the home-waters catches between 400 and 1 000 tonnes (using an average rate of exploitation in all home-waters fisheries of 0.6).

27. It is evident from Table 1 that, with the exception of 1968, the total catch at West Greenland has tended to increase during the period since 1965 due to the steady growth of the drift-net fishery, to reach over 2 000 tonnes in 1969. Estimates of the losses to the home-waters stocks and catches were therefore made for the 1969 level of catch at West Greenland, using the same estimates of increase in weight (50%), upper and lower limits of natural mortality rate (0.02 and 0.1 per month) and home-waters exploitation rate (0.6), as

in the previous assessment. These estimates ranged between approximately 1 100 - 2 700 tonnes and 650 - 1 600 tonnes for the home-waters stocks and catches respectively.

28. Although no further information has become available since the previous assessment was made to justify any modification of the parameters used in the estimation of these losses, the Working Party noted the conclusions of the Baltic salmon experts that, after Baltic salmon reach exploitable size, the natural mortality rate is very low, i.e. about 10% per year ($M = 0.1$). This value is considerably less than the lower of the values used in the present assessment.

29. In the absence of accurate estimates of the proportions of salmon in the West Greenland catch which, if not caught and if surviving, would have returned to each country, it is not possible to estimate reliably the losses in individual countries. However, the latest data available provide no clear basis for modifying the previous tentative conclusion that the largest proportion of the losses have been experienced in Canada and the United Kingdom.

C. NORWEGIAN SEA FISHERY

30. In its second report, the Working Party drew attention to the long-line fishery for salmon which has developed, particularly from 1967 onwards, in the Norwegian Sea, off the Norwegian west coast. The latest information available to the Working Party on the growth of this fishery, its distribution, the composition, origin and subsequent destination of the exploited stock and assessments of its effects on total and home-waters salmon catches is summarized below.

1. Catch and Fishing Effort

31. Data on the catches taken and the number of vessels operating in the Norwegian Sea fishery in the years 1965-1968 and provisional statistics for 1969 are given in Table 7. These data show that this fishery has grown rapidly during the short period of its existence to reach, in 1969, a total catch in excess of 900 tonnes. This development has been due mainly to an increase in the number of Danish and

Norwegian vessels participating in the fishery, these together taking almost the whole of the catch in 1969. However, in 1969, a small number of German vessels participated in the fishery for the first time. The data on the number of vessels participating in the fishery indicate that the fishing effort increased at least ten-fold between 1966 and 1969.

32. Information on the catch-per-unit effort in this fishery in 1968 and 1969 is given in Table 8. These data indicate an average fishing rate in 1969 of about 40 salmon per 1 000 hooks for the Danish and German vessels during the main fishing months April-June; this would appear to be lower than the catch rates in 1968, as indicated by the limited data available for Danish vessels in that year. The March data for the Danish vessels also indicate that salmon were present in the fishing area and available for capture by long-line before the commencement of the main fishing season in April, and the Danish and German data point to a decrease in the abundance and/or availability of salmon in the fishing area in June, compared with the two preceding months.

2. Distribution of Fishing

33. The area within which long-line fishing took place in 1969 is shown in Figure 2. This shows that fishing took place off the Norwegian coast between latitudes 63°N and 72°30'N from the 12 miles fishery limit along the coast to as far as 200 miles offshore. The main fishery was concentrated in the region between latitudes 68°30'N and 72°N and 90-95% of the total catch of the Danish, Swedish, German and Faroese vessels was taken in this area. It was also one of the principal areas fished by Norwegian vessels, although their fishing was much more widely distributed along and closer to the coast than the vessels of the other countries.

34. Although a small number of Danish vessels started fishing in March 1969 and continued into July, as in previous years, more than 50% of the catch was taken in May. The available information on the distribution of catches provides no indication of any major changes in the distribution of fishing during the season.

35. In addition to the information on the distribution of salmon in the Norwegian Sea provided by the fishery itself, catches have

been made in the course of exploratory fishing surveys conducted during the same months in other parts of the Norwegian Sea, to the southwest of Bear Island, near Spitzbergen and east of the North Cape to as far as Novaya Zemlya. These indicate that salmon are available for capture by long-line over a much wider area than that in which the fishery has taken place so far. However, little is known of their abundance, composition and interrelations with the concentrations currently exploited.

36. It was also noted that a small commercial fishery, using long-lines, was conducted in the vicinity of the Faroe Islands in the spring of 1968 and 1969.

3. Composition of Stock

37. On the basis of age-readings of salmon taken from the Norwegian long-line fishery in 1968, it appeared that about 90% of the exploited stock in the Norwegian Sea had already spent two or more winters in the sea. Further age data collected between mid-March and mid-July 1969 from Norwegian and Danish catches confirmed these results for the salmon exploited during the main season (April to early June), but samples taken in mid-June and mid-July from Danish landings contained 11% and 60% of smaller, one sea-winter fish respectively. This points to a progressive recruitment of these younger fish to the exploited area during June and early July.

38. As in 1968, a notable feature of the two sea-winter salmon caught in the long-line fishery in 1969 was their widely varying but, on average, low condition factor (average = 0.79) compared with salmon of the same sea age caught at various localities in the Norwegian coastal fishery, the condition factors of which, in 1969, ranged from 0.96 to 1.04. In 1968 the condition factors of the salmon in the Norwegian Sea (average = 0.85) and in Norwegian home waters (average = 1.0-1.2) were somewhat higher than in 1969.

39. The age analysis of samples taken by a research vessel in the vicinity of the Faroes in April 1968 and 1969 showed that, in contrast to the Norwegian Sea fishery in April, one sea-winter salmon predominated in that area.

4. Origin and Destination of Salmon

40. Information on the recapture in the Norwegian Sea fishery in 1968 and 1969 of salmon tagged as smolts or parr in Norwegian, Swedish and Danish rivers are given in Tables 2, 3, and 5. These show that recaptures have been made in this fishery of fish tagged as smolts and parr in Norway and as smolts in Sweden and Denmark. No recaptures have so far been reported from this area of salmon tagged as smolts in the United Kingdom or Ireland (one recapture of a fish tagged as a smolt in Scotland has, however, been made at the Faroes). It is important to point out that smolt tagging experiments have not been conducted in U.S.S.R. rivers entering the Barents Sea in the years since this Norwegian Sea fishery commenced so that the possible contribution to the Norwegian Sea stock of salmon originating from them cannot be gauged from the smolt tagging data.

41. In addition to this evidence concerning the origin of salmon in the Norwegian Sea, information relating to their subsequent home-waters destination is available from the recaptures of salmon tagged in this area in 1968 and 1969. In May 1968, 238 salmon caught in the long-line fishery were tagged and 5 recaptures were reported from Norway later that year, 3 from the coastal and 2 from the river fishery. No further recaptures from these liberations were recorded during 1969. Between the end of March and mid-June 1969 (but mostly during April and May), a further 932 fish were tagged in the long-line fishery and 51 recaptures were reported in 1969, including 3 from the long-line fishery (though it is known that more than this were caught in it). All the remaining recaptures came from the Norwegian coastal and river fisheries. Most of the fish tagged had spent two winters in the sea.

42. Although in the absence of smolt tagging experiments in U.S.S.R. rivers and because of deficiencies in the reporting of tag recaptures from the long-line fishery it is not possible to determine, from the tag recaptures, the relative proportions of salmon originating from the rivers of different countries, the available data suggest that most of the exploited stock in the Norwegian Sea in 1968 and 1969 originated from Norwegian rivers. They also suggest that most of the returning salmon migrate to Norwegian home waters, mainly as two sea-winter salmon.

43. In addition to the evidence from tagging data, during 1968 reports were received from Norway, the U.S.S.R. and Scotland of fish in their

home-waters catches with hooks still attached which were the same as those used in the Norwegian Sea fishery. A considerable number of similar records were reported in Norway in 1969 but none from either the U.S.S.R, Scotland or elsewhere.

5. Assessment of Effects of Norwegian Sea Fishery on Total and Home-waters Salmon Stocks and Yields

44. As indicated in paragraph 37, the age composition data from samples taken during the main long-line fishing season (April-early June) in 1968 and 1969, showed that about 90% of the exploited stock in the Norwegian Sea consisted of fish which had spent two or more winters in the sea. Therefore, as with the West Greenland fishery, any effects which this fishery, as currently prosecuted, might have on total and home-waters stocks and yields will be mainly confined to adult salmon of two or more sea-winters.

5.1 Total Salmon Yields

45. The assessment of the effect of the Norwegian Sea fishery on total salmon yield (Norwegian Sea plus home waters) can be approached in the same general way as that adopted for the West Greenland fishery, using information on (a) the increase in weight of the fish between their appearance in the Norwegian Sea and home-waters fisheries respectively and, (b) the proportion of the fish present in the fished area which, if not caught there, would be subsequently caught in the home-waters fisheries.

46. Although accurate, direct measures of the increase in weight of salmon between their appearance in the Norwegian Sea and home-waters fisheries were not available for this assessment, data on the difference in condition factor between two sea-winter salmon in the Norwegian Sea, at the peak of the fishery in May and in Norwegian coastal waters one month later, in June, were used. On the assumption that these data were representative of the same population of salmon, exploited first in the Norwegian Sea and subsequently in Norwegian home waters, they indicate an average increase in weight of about 25% during this interval. On this basis it is estimated that, if more than 80% of the two sea-winter salmon in the exploited area in the Norwegian Sea are subsequently caught in home waters, the Norwegian Sea fishery will have resulted in a lower total

(Norwegian Sea plus home waters) weight of fish caught than would have been obtained in its absence, while if less than 80% are subsequently caught it will have resulted in a higher total catch (by weight).

47. Reliable measures of the rates of exploitation of two sea-winter salmon in home waters are not available for all of the home-waters areas in Norway and elsewhere to which two sea-winter salmon in the Norwegian Sea may return so that it is not possible to assess with any degree of certainty whether the Norwegian Sea fishery has increased or decreased the overall total catch (by weight). It is known, however, that the rate of exploitation of two sea-winter salmon in some Norwegian home-waters areas is high and probably in excess of 80%; also, in the absence of evidence of large concentrations of known predators in this area, it is probable that the natural mortality rate of these salmon between their appearance in the Norwegian Sea fishery and their return to home waters is small. Therefore it seems likely that, for the salmon returning to these areas, the Norwegian Sea fishery may have resulted in a lower catch than would have been obtained in its absence. On the other hand, for those salmon returning to other home-waters areas it has probably increased the total catch.

48. It should be noted that, because of the low average condition factor for the salmon exploited in the Norwegian Sea fishery, the overall average 'quality' of the total catch will be lower in the presence than in the absence of this fishery.

5.2 Home-waters Salmon Stocks and Yields

49. In order to estimate the effects of the Norwegian Sea fishery on the home-waters stocks and catches of all countries combined and of each country separately, measures are required of (a) the natural mortality occurring between the time the salmon are exploited in the Norwegian Sea and their arrival in home waters, (b) their increase in weight during this time, (c) the relative contributions to the Norwegian Sea catch of salmon which, if surviving, would return to the river systems in different countries and, (d) the exploitation rate in each country's home-waters fishing. Insufficient is yet known of the magnitude of these factors for the effects to be estimated reliably. However, as indicated in the previous section, the loss

in weight of catch due to natural mortality during the interval between the exploited phase in the Norwegian Sea and their return to home waters is likely to be small and probably no greater than the average increase in weight of the individual fish. On this basis, and on the assumption that all the salmon in the Norwegian sea stock, if not caught and if surviving would return to home waters in the same year, the loss (in weight) to the home-waters salmon stocks of all countries combined would be of roughly the same magnitude each year as the catch of salmon taken in the Norwegian Sea fishery, i.e. about 50 and 300 tonnes in 1967 and 1968 respectively, and, provisionally, not less than 800 tonnes in 1969.

50. The corresponding losses to the home-waters catches in these years again cannot be estimated accurately in the absence of full information on the exploitation rates in the home-waters fisheries of all the countries to which salmon in the exploited stock in the Norwegian Sea return. However, from the data which are available, it seems likely that the overall average rate for these fisheries is not less than 0.5. Using this value gives rough, provisional estimates of the losses to the catches of all countries combined of about 25, 150 and not less than 400 tonnes in 1967, 1968 and 1969 respectively.

51. In the absence of accurate measures of the relative proportions of the salmon in the exploited stock in the Norwegian Sea which return to the river systems of individual countries, it is not possible to apportion these estimated losses between countries but it seems clear that the biggest loss would be that to the stocks in Norwegian home waters.

52. The above rough estimates concern only the immediate direct effects of the Norwegian Sea fishery on total and home-water catches and take no account of its possible longer-term effects on smolt production and hence on future recruitment to the salmon stock as a result of a reduction in spawning stock. As indicated in relation to the effects of the West Greenland fishery, too little is known, at present, of the relation between adult stock size, smolt production and subsequent recruitment of Atlantic salmon and grilse for these effects to be estimated.

D. HOME-WATERS CATCHES

53. Catch statistics for the home-waters salmon and grilse fisheries in Canada, England and Wales, Ireland, Norway, Scotland, Sweden and U.S.A. are given in Table 9, together with catch data, for the first time, for France, Northern Ireland and the U.S.S.R. Whereas in the years up to 1968, statistics for salmon and grilse were presented separately only for Scotland, for 1969 they are also presented separately for England and Wales and Norway. Catch-per-unit-effort data are given in Table 10 for Canada, the Irish Republic, the Foyle area, Norway and Scotland. All these catch statistics have been revised and brought up-to-date as far as possible.

54. The statistics for 1969 indicate that, in the countries with substantial home-waters fisheries, the total catches (salmon plus grilse) were similar to those in 1968; they were slightly higher in England and Wales, Ireland and Scotland but slightly lower in Canada and Norway. Although complete statistics on the division of the total catch into grilse and salmon is not available for all countries, data presented from Canada, Scotland and the Irish Republic indicated that the salmon component of the catch in 1968 and 1969 was lower than the average of the previous five years. However, it should be noted that the salmon catches in 1968 and 1969 fell within the long-term range in years before the high seas fisheries developed. The grilse catch in 1968 and 1969 remained at a relatively high level.

55. Information presented to the Working Party on the seasonal breakdown of home-waters catches indicated that, in England and Wales, Scotland and Ireland catches have decreased in the spring fishery (to May), when the catch is composed almost exclusively of salmon, and have increased in the summer fishery (after May) when the main component is grilse. In Scotland the decline in catch in the spring fishery has taken place steadily from about 500 tonnes in the early 1950's to around 180 tonnes in 1967-1968, while in England and Wales and Ireland it has taken place more recently, mainly since 1965.

56. Scottish data for the summer fishery, on the other hand, indicate a marked increase in both salmon and grilse catches during the 1960's and the increase in the salmon catch in this season resulted in the maintenance of a relatively high salmon catch throughout the 1960's. These data point, in fact, to a change in the timing of the main salmon runs in

Scottish rivers during this period. The Working Party noted, however, that the division of the total catch into salmon and grilse in the Scottish fishery is usually made on a weight basis and it has always been recognized that, if the weight of grilse at capture increased, this method of dividing the catch would tend to overestimate the salmon and underestimate the grilse catch. The results of a comparison of the proportions of salmon and grilse in the catches in two Scottish rivers in 1969, estimated on the basis of weight and from direct readings of age from scale samples respectively did, in fact point to a substantial overestimation of the salmon catch taken in them in that year. However, such data as are available for previous years indicate that the extent of the overestimation in years prior to 1969 was relatively small.

E. RESEARCH PROGRAMMES

57. The Working Party considered the future research programmes to be conducted at West Greenland, in the Norwegian Sea and in home waters in relation to the problems of assessing the effects of the open sea fisheries on total and home-waters stocks and yields. The main features of these programmes are summarized below:-

1. West Greenland

- (a) Collection of catch statistics and sampling of the catches for length, weight and age in both the set gill-net (inshore) and drift-net (offshore) fishery will be continued throughout the fishing season.
- (b) An exploratory drift-net fishing survey to be made in the Davis Strait and Labrador Sea by Canada in 1970, to determine the distribution, abundance and composition of salmon in areas outside that currently fished by the drift-net fleets off the West Greenland coast; comparative tests also to be made (by Canada, Denmark and the United Kingdom) between the relative catching capacities of drift-nets and long-lines and of the condition of salmon caught by the two methods.

- (c) The continuation of biochemical and parasite studies of salmon at West Greenland and in home waters in North America and Europe in relation to determining the home-waters origin and rates of mixing of salmon in the exploited stock at West Greenland.
- (d) A further joint tagging programme between Denmark and the United Kingdom to be conducted in 1970 and 1971 in the course of the West Greenland fishery, using pelagic long-lines to catch salmon in good condition; further experiments to determine the viability of salmon caught by both long-lines and gill-nets also to be conducted.
- (e) In relation to determining the exploitation rate of salmon in the West Greenland fishery and obtaining more information on their home-waters destination, the Working Party considers that a larger scale tagging experiment than those conducted hitherto is necessary to ensure a wide distribution of a sufficiently large number of tags throughout the exploited stock. It also considers that an experiment organized in the same general way as that currently being undertaken on young herring in the North Sea would be very appropriate. At its meeting in September 1970, the Working Party discussed the arrangements for this experiment in some detail and, resulting from this discussion

recommended

- (a) that member countries of ICES and ICNAF be invited to provide the necessary funds for, and participation in, a large-scale salmon tagging experiment of three months' duration during the time of the West Greenland fishery in 1972, probably from mid-August to mid-November with the aim to liberate at least 3 000 tagged salmon as widely as possible within the area occupied by the exploited stock. Part of the tagging will be conducted aboard research vessels provided by countries participating in the experiment and part by scientific personnel aboard commercial fishing vessels. The scientific personnel would collect information on the recapture of tagged fish by the commercial vessels and

would also conduct tagging operations and sample the catch for associated biological observations. The cost of the experiment, apart from the research vessel and fishing gear costs and the scientist salaries is estimated to be about £ 20 000 (D.Kr. 350 000).

- (b) that a small group of experts, with Dr. A. W. May (Canada) as Convener meet for two days, at national expense, immediately preceding the next meeting of the Joint Working Party in March 1971 to prepare detailed plans for the experiment.

2. Norwegian Sea

- (a) Collection of catch statistics and routine sampling of the catches for length, weight and age to be continued throughout the fishing season by Norway, Denmark and Sweden.
- (b) If possible further tagging by Norway of salmon caught by long-line in the exploited area during the course of the season, to provide further information on the rate of exploitation and destination of the salmon in the exploited stock. In addition, tagging by Faroese and Scottish workers in the vicinity of the Faroes.
- (c) Biochemical and parasite studies, similar to those conducted in relation to the West Greenland fishery, to be conducted on salmon in the Norwegian Sea and home-waters stocks.

3. Home Waters

- (a) Collection of catch and fishing effort statistics and routine sampling of catches for length, weight and age to be continued.
- (b) Tagging of natural and/or hatchery-reared smolts (and, in some countries, parr) to be continued in North American and European rivers, including if possible, U.S.S.R. rivers entering into the Barents Sea.
- (c) Biochemical and parasite studies to be continued.
- (d) Studies of the relationship between spawning stock size, smolt production and subsequent recruitment of grilse and salmon to be continued in river systems in North America and Europe.

F. TABLES

Table 1. Catches at West Greenland 1960-1969, in metric tons and round fresh weight. (Based on data available on 28 February 1970).

Year	Drift-Net (Offshore)					Set Gill-Net (Inshore)	Total
	Norway	Faroës	Denmark	Sweden	Total		
1960	0	0	0	0	0	60	60
1961	0	0	0	0	0	127	127
1962	0	0	0	0	0	244	244
1963	0	0	0	0	0	466	466
1964	0	0	0	0	0	1 539	1 539
1965	a)	36	0	0	36+	825	861
1966	32	87	0	0	119	1 251	1 370
1967	78	155	85	0	318	1 283	1 601
1968	138	134	272	4	548	579	1 127
1969	250	215	740 ^{c)}	30 ^{b)}	1 235 ^{b)}	975 ^{c)}	2 210

a) - Figures not available, but catch is known to be less than Faroës.

b) - Provisional.

c) - Estimated. As the offshore catch includes some fish caught by residents of Greenland, a firm breakdown into offshore and inshore catches is no longer possible. The breakdown quoted is a minimum offshore fraction and a maximum inshore fraction.

Table 2. Number of natural (wild) smolts tagged in the years 1963-1969, and recaptured in Greenland and in other areas, including home-waters, up to the end of 1969. Figures in brackets are returns per thousand tagged.

Country	Year of Tagging	Number Tagged	Recaptures					Grand Total
			West Greenland	Norwegian Sea and Faroes	All Other Areas			
					Grilse	Salmon	Total	
Canada	1963	5 850	11 (1.9)	0	70	20 (3.4)	90	101
	1964	15 013	9 (0.6)	0	203	71 (4.7)	274	283
	1965	16 485	72 (4.4)	0	175	191 (11.6)	366	438
	1966	9 509	25 (2.6)	0	122	98 (10.3)	220	245
	1967	17 810	18 (1.0)	0	96	148 (8.3)	244	262
	1968	55 982	108 (1.9) ^{a)}	0	1 203	-	1 203	1 311
	1969	45 417	-	-	-	-	-	-
Scotland	1963	10 998	10 (0.9)	0	172	92 (8.4)	264	274
	1964	9 200	6 (0.7)	0	110	66 (7.2)	176	182
	1965	9 239	10 (1.1)	0	74	49 (5.3)	123	133
	1966	15 406	29 (1.9)	0	281	38 (2.5)	319	348
	1967	21 002	22 (1.0)	1	168	66 (3.1)	234	254
	1968	15 695	14 (0.9)	0	127	-	127	141
	1969	15 958	-	-	-	-	-	-
England and Wales	1963	9 485	8 (0.8)	0	15	38 (4.0)	53	61
	1964	17 129	10 (0.6)	0	30	97 (5.7)	127	137
	1965	5 873	12 (2.0)	0	35	57 (9.7)	92	104
	1966	3 219	5 (1.6)	0	28	37 (11.5)	65	70
	1967	4 118	10 (2.4)	0	23	49 (11.9)	72	82
	1968	5 790	19 (3.3)	0	43	-	43	62
	1969	8 611	-	-	-	-	-	-
Norway	1963	97	0	0	0	4 (41.2)	4	4
	1964	1 465	0	0	67	24 (16.4)	91	91
	1965	2 120	0	0	41	18 (8.5)	59	59
	1966	1 362	0	2	27	16 (11.7)	43	45
	1967	3 434	0	2	59	19 (5.5)	78	80
	1968	3 564	0	2	103	-	103	105
	1969	3 571	-	-	-	-	-	-
Iceland	1966	82	Recaptures included in Table 3					
	1967	153						
	1968	59						
	1969	15						
Ireland	1968	606	0	0	18	-	18	18
	1969	0	0	0	0	0	0	0
Sweden	1966	0	0	0	0	0	0	0
	1967	0	0	0	0	0	0	0
	1968	0	0	0	0	0	0	0
	1969	800	-	-	-	-	-	-
USSR	1969	500	-	-	-	-	-	-

^{a)} Provisional

Table 3. Number of hatchery-reared smolts tagged in the years 1963-1969 and recaptured in Greenland and in other areas, including home-waters, up to the end of 1969. Figures in brackets are returns per thousand tagged.

Country	Year of Tagging	Number Tagged	Recaptures					Grand Total
			West Greenland	Norwegian Sea and Faroes	All Other Areas			
					Grilse	Salmon	Total	
Canada	1963	7 332	4 (0.5)	0	132	29 (4.0)	161	165
	1964	46 659	9 (0.2)	0	101	83 (1.8)	184	193
	1965	45 988	67 (1.5)	0	378	214 (4.7)	592	659
	1966	70 881	70 (1.0)	0	239	293 (4.1)	532	602
	1967	112 317	63 (0.6)	0	276	190 (1.7)	466	529
	1968	113 992	140 (1.2) ^{a)}	0	289	-	289	429
	1969	128 280	-	-	-	-	-	-
Scotland	1963	6 750	0	0	3	3 (0.4)	6	6
	1964	3 000	0	0	7	7 (2.3)	14	14
	1965	3 000	0	0	19	0	19	19
	1966	8 000	1 (0.1)	0	13	4 (0.5)	17	18
	1967	4 451	0	0	1	0	1	1
	1968	5 335	0	0	3	-	3	3
	1969	3 694	-	-	-	-	-	-
England and Wales	1963	1 970	1 (0.5)	0	0	0	0	1
	1964	0	0	0	0	0	0	0
	1965	0	0	0	0	0	0	0
	1966	9 668	0	0	0	1 (0.1)	1	1
	1967	18 522	0	0	0	1 (0.1)	1	1
	1968	28 266	3 (0.1)	0	4	-	4	7
	1969	7 420	-	-	-	-	-	-
Norway	1963	10 999	0	1	88	95 (8.6)	183	184
	1964	9 182	0	1	135	87 (9.5)	222	223
	1965	8 072	0	12	71	20 (2.5)	91	103
	1966	13 812	0	33	411	149 (10.8)	560	593
	1967	18 393	2 (0.1)	47	240	53 (2.9)	293	342
	1968	12 983	0	22	173	-	173	195
	1969	16 967	-	-	-	-	-	-
Iceland	1966	8 367	2 (0.2)	0	66	14 (1.7)	80	82
	1967	10 061	0	0	24	6 (0.6)	30	30
	1968	9 985	0	0	45	-	45	45
	1969	7 586	-	-	-	-	-	-
Ireland	1966	15 000	0	0	0	0	0	0
	1967	5 000	1 (0.2)	0	1	0	1	2
	1968	222	0	0	0	-	0	0
	1969	7 194	-	-	-	-	-	-
Sweden	1966	11 181	7 (0.6)	1	690	137 (12.2)	827	835
	1967	4 000	1 (0.2)	4	364	47 (11.8)	410	414
	1968	4 298	1 (0.2)	1	586	-	586	588
	1969	6 381	-	-	-	-	-	-
USA	1966	82 251	37 (0.4)	0	69	168 (2.0)	237	274
	1967	80 717	0	0	12	10 (0.1)	22	22
	1968	73 730	7 (0.1)	0	9	-	16	16
	1969	73 418	-	-	-	-	-	-
Denmark	1965	1 880	0	0	1	2 (1.1)	3	3
	1966	4 270	0	4	18	44 (10.3)	62	66
	1967	2 696	0	2	13	7 (2.6)	20	22
	1968	5 173	1 (0.2)	1	36	-	36	38
	1969	3 837	-	-	-	-	-	-
USSR	1969	600	-	-	-	-	-	-

a) Provisional

Table 4. Number of kelts tagged in the winters 1962/63 - 1969/70 and recaptured in Greenland and in other areas, including home-waters, up to the end of 1969.

Country	Winter of Tagging	Number Tagged	Recaptures		
			Greenland	Other Areas	Total
Canada ^{a)}	1962-63	653	2	65	67
	1963-64	1 519	0	90	90
	1964-65	1 995	1	144	145
	1965-66	7 170	0	650	650
	1966-67	7 510	1	689	690
	1967-68	3 742	0	419	419
	1968-69	3 627	3	120	123
	1969-70	4 521	-	-	-
England and Wales (River Axe only)	1962-63	159	1	12	13
	1963-64	185	2	10	12
	1964-65	184	1	11	12
	1965-66	109 ^{b)}	1	7	8
	1966-67	178 ^{b)}	1	11	12
	1967-68	188	2	6	8
	1968-69	81	0	2	2
	1969-70	112	-	-	-
Ireland	1962-63	2 264	2	31	33
	1963-64	2 351	2	70	72
	1964-65	2 695	2	34	36
	1965-66	2 972	1	40	41
	1966-67	3 175	0	77	77
	1967-68	1 034	0	24	24
	1968-69	498	0	9	9
	1969-70	-	-	-	-
Scotland	1962-63	413	1	2	3
	1963-64	134	0	2	2
	1964-65	233	0	6	6
	1965-66	1 376	4	19	23
	1966-67	901	3	18	21
	1967-68	117	0	3	3
	1968-69	152	0	1	1
	1969-70	133	-	-	-
USA	1962-63	151	1	13	14
	1963-64	123	1	10	11
	1964-65	160	0	23	23
	1965-66	146	2	16	18
	1966-67	578	5	75	80
	1967-68	340	5	51	56
	1968-69	218	1	8	9
	1969-70	315	-	-	-
USSR	1968-69	566	0	10	10
	1969-70	1 147	-	-	-

a) Ascending adults tagged during any year are included in the totals tagged for the corresponding winter (i.e. those tagged in 1962 are included under 1962-63, those tagged in 1963 under 1963-64 etc.), but recaptures of these adults in the year of tagging have not been included.

b) In addition, 180 kelts were tagged by the Dee and Clwyd River Authority in 1965-66 and 291 kelts in 1966-67. No recaptures were reported from the first experiment and two (from 'Other Areas') from the second.

Table 5. Number of parr tagged in the years 1964-1969 and recaptured in Greenland and in other areas, including home-waters, up to the end of 1969. Figures in brackets are returns per thousand tagged.

Country	Number Tagged	Year of Tagging	Year of Assumed Migration	Recaptures					Grand Total
				West Greenland	Norwegian Sea & Faroes	All Other Areas			
						Grilse	Salmon	Total	
Canada	1 971 (H)	1964	1965	0	0	0	4 (2.0)	4	4
	0 (W)	1964		0	0	0	0	0	0
	1 882 (H)	1965	1966	0	0	0	0	0	0
	0 (W)	1965		0	0	0	0	0	0
	4 694 (H)	1966	1967	0	0	0	0	0	0
	15 (W)	1966	1967	0	0	0	0	0	0
	999 (H)	1967	1968	1	0	0	-	0	0
	58 (W)	1967	1968	0	0	0	-	0	0
	995 (H)	1968	1969	-	-	-	-	-	-
	385 (H&W)	1968	1969	-	-	-	-	-	-
	1 999 (H)	1969	1970	-	-	-	-	-	-
	147 (W)	1969	1970	-	-	-	-	-	-
Scotland	0 (H)	1966		0	0	0	0	0	0
	564 (W)	1966	1967	0	0	0	0	0	0
	0 (H)	1967		0	0	0	0	0	0
	4 046 (W)	1967	1968	0	0	6	-	6	6
	222 (H)	1968	1969	-	-	-	-	-	-
	5 130 (W)	1968	1969	1	-	3	-	3	4
	2 043 (H)	1969	1970	-	-	-	-	-	-
	4 505 (W)	1969	1970	-	-	-	-	-	-
England and Wales	4 939 (H)	1966	1967	0	0	0	0	0	0
	0 (W)	1966		0	0	0	0	0	0
	2 050 (H)	1967	1968	0	0	0	-	0	0
	0 (W)	1967		0	0	0	0	0	0
	2 121 (H)	1968	1969	-	-	-	-	-	-
	0 (W)	1968		-	-	-	-	-	-
	2 512 (H)	1969	1970	-	-	-	-	-	-
0 (W)	1969		-	-	-	-	-	-	
Norway	996 (H)	1965	1966	0	0	1	1 (1.0)	2	2
	0 (W)	1965		0	0	0	0	0	0
	2 000 (H)	1966	1967	0	3	3	0	3	6
	1 000 (W)	1966	1967	0	0	6	3 (3.0)	9	9
	1 995 (H)	1967	1968	0	4	7	-	7	11
	831 (W)	1967	1968	0	0	0	-	0	0
	1 000 (H)	1968	1969	-	-	-	-	-	-
	0 (W)	1968		0	0	0	0	0	0
	1 000 (H)	1969	1970	-	-	-	-	-	-
	0 (W)	1969		0	0	0	0	0	0
Ireland	0 (H)	1969		0	0	0	0	0	0
	821 (W)	1969	1970	-	-	-	-	-	-
Sweden	0 (H)	1965		0	0	0	0	0	0
	327 (W)	1965	1966	0	0	25	3 (9.2)	28	28
	0 (H)	1966		0	0	0	0	0	0
	591 (W)	1966	1967	0	0	57	5 (8.5)	62	62
	0 (H)	1967		0	0	0	0	0	0
	300 (W)	1967	1968	0	0	19	-	19	19
	500a) (H)	1968	1968	0	0	10	-	10	10
	0 (W)	1968		0	0	0	0	0	0
	0 (H)	1969		0	0	0	0	0	0
	0 (W)	1969		0	0	0	0	0	0
	0 (H)	1969		0	0	0	0	0	0

a) Tagged as 'one-year-old smolts', but recapture records suggest that they should be included in this table rather than in Table 4.

H - Hatchery-reared.

W - Natural (wild).

Table 6. Recaptures (to December 1970) of fish tagged at West Greenland.

Year Tagged	Number Tagged	Local Recaptures		Distant Recaptures	
		Number	Days Absence	Number	Location
1965	223	3	1, 3, 26	1	Canada (SW Newfoundland)
1966	729	28	1-8 (24) 10-50 (4)	4	Canada (Miramichi - 1) Scotland (River Tweed - 2) (River Spey - 1)
1967	375	6	1-2 (3) Not known (3)	4	Canada (Labrador - 1) Ireland (River Slaney - 1) (River Barrow - 1) Scotland (River Tay - 1)
1968	47	4	1-3 (3) < 1 month (1)	1	Canada (Labrador)
1969	444	15	4-35 days	12	Canada (Labrador - 1) (NE Newfoundland - 4 ^a) (Miramichi - 1) England (Torr & Torridge Estuary - 1) (River Wye - 1) Ireland (Waterville - 1) (River Slaney - 1) Scotland (near Montrose - 1) Wales (River Teify - 1)

a) One recapture in year of tagging.

Table 7. Catches in the Norwegian Sea long-line fishery and in the drift-net fishery within Norwegian fishery limits 1965-1969. Metric tons, round fresh weight.

	Norwegian Sea Long-Line Fishery												Drift-Net Fishery within Norwegian Fishery Limits
Year	Denmark		Faroes		Germany		Norway		Sweden		Total		
	Number of Ships	Catch	Number of Ships	Catch	Number of Ships	Catch	Number of Ships	Catch	Number of Ships	Catch	Number of Ships	Catch	
1965	1-2	_a)	0	0	0	0	0	0	0	0	1-2	_a)	283
1966	10	_a)	0	0	0	0	0	0	_a)	_a)	10+	_a)	312
1967	22	78	0	0	0	0	_a)	_a)	6	_a)	28+	78+	333
1968	28	184	2	5 ^{b)}	0	0	_a)	100 ^{d)}	16	126	46+	415	228
1969	40	427	4	7 ^{c)}	5	21	70+	450 ^{e)}	2	24	121+	929	234

a) Not known.

b) Roughly 70% of catch taken in vicinity of Faroes.

c) All taken in vicinity of Faroes.

d) Estimated catch.

e) Partly estimated.

Table 8. Estimates of catch-per-unit effort in the Norwegian Sea long-line fishery.

Year	Month	Country	No. of Salmon Sampled	No. of Salmon Caught per 1 000 hooks
1968	April	Denmark	1 104	92
1968	May	Denmark	4 435	100
1968	Apr.-Aug.	Sweden	32 751	42
1969	March	Denmark)	25 891	43
1969	April	Denmark)		57
1969	May	Denmark)		44
1969	May	Denmark)		13 ^{a)}
1969	June	Denmark)		29
1969	April	Germany)	5 459	50
1969	May	Germany)		46
1969	June	Germany)		23

a) This catch, which comprised only 196 fish, was taken a short distance south of the area mainly fished by Danish vessels in 1969.

Table 9. Catches in home-waters, 1960-1969 (salmon plus grilse except where shown separately)
in metric tons, round fresh weight.

Year	England and Wales			France	Iceland	Irish ^{b)} Republic	Northern ^{b)} Ireland	Norway			Scotland			Sweden ^{c)}	USSR	Canada	USA
	Salmon	Grilse	Total					Salmon	Grilse	Total	Salmon	Grilse	Total				
1960	-	-	283	50-100	200	743	139	-	-	1 659	960	476	1 436	40	1 100	1 635	< 2
1961	-	-	232	50-100	200	707	132	-	-	1 533	820	376	1 196	27	790	1 580	< 2
1962	-	-	318	50-100	100	1 459	356	-	-	1 935	1 015	725	1 740	15	710	1 717	< 2
1963	-	-	325	50-100	200	1 458	306	-	-	1 786	1 286	412	1 698	16	480	1 848	< 2
1964	-	-	307	50-100	200	1 617	377	-	-	2 147	1 216	698	1 914	16	590	2 066	< 2
1965	-	-	320	50-100	?	1 457	281	-	-	2 000	1 042	560	1 602	17	590	2 113	< 2
1966	-	-	387	50-100	120	1 238	287	-	-	1 863	1 069	555	1 624	17	570	2 356	< 2
1967	-	-	420	50-100	120	1 463	449	-	-	2 052	1 245	888	2 133	23	883	2 859	< 2
1968	-	-	282	50-100	171	1 413	312	-	-	1 593	1 020	543	1 563	?	827	2 104	< 2
1969	264	113	377	50-100	147	1 730	267	801	582	1 383	987	954	1 941	?	360	1 957 ^{a)}	< 2
Angling Catch Inc. Inc. Inc. Inc. Inc. Inc. Inc. Inc. Inc. Not Inc. Inc. Not Inc. ^{d)} Inc.																	
Percentage Grilse 10-40 (by no.) - ^{e)} 53 (in 1969) 80-90 (by no.) 70-80 (by wt.) 90 (by no.) 80+ (by wt.) 15 (by wt.) 75 (by no.) - ^{e)} ?																	

a) Provisional.

b) Catch in River Foyle allocated on basis of 50% Irish Republic and 50% Northern Ireland.

c) West coast catch only.

d) Angling catches (mainly grilse) about 10% additional (by weight).

e) Mainly salmon.

Table 10. Estimates of catches per unit effort for some home-water fisheries.

Year	Canada ^{a)}		Irish Republic		Foyle Area ^{b)}	Norway ^{e)}	Scotland	
	(Drift-Nets and Traps) (lbs)		(Drift-Nets) ^{c)} (numbers)	(Licences) ^{d)} (lbs)	(Drift-Nets) (numbers)	(Bag Nets) (kg)	(Fixed Engines ^{f)} (numbers)	(Net and Coble) ^{g)} (numbers)
	Old Series	New Series						
1960	169	-	325	950	104	172	12.8	84.1
1961	159	-	224	1 030	- h)	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	300	733	1 650	524	154	21.6	130.2
1968	186	183	552	1 650	482	129	17.3	97.9
1969	-	159	491	2 077	455	137	15.9	123.4

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. New estimating procedure adopted in 1967.

b) Irish Republic and Northern Ireland; drift-nets in the open sea only.

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

G. APPENDIX

Working Papers 1969-1970

ICES/ICNAF
Salmon
Document

- 69/1 Biochemical studies on Atlantic salmon (Salmo salar L.) and some of its parasites. By L. Nyman .(also ICNAF Res.Doc.69/37)
- 69/2 The length, weight and age composition of the commercial catches from the River Tay and River Tweed in 1968. By W.R. Munro and I.J.R. Hynd (also ICNAF Res.Doc.69/40).
- 69/3 Note on the salmon landed by M.F.V. Faro Bank, May 1968. By W.M. Shearer and I.J.R. Hynd. (also ICNAF Res.Doc.69/41).
- 69/4 Results of the examination of scale samples from salmon taken off Faroe, 1968. By W.R. Munro and I.J.R. Hynd. (also ICNAF Res.Doc.69/42).
- 69/5 Scottish salmon tagging data, 1965-1967. By Department of Agriculture and Fisheries for Scotland, Pitlochry. (also ICNAF Res.Doc.69/43).
- 69/6 US salmon research in the State of Maine. By E.T. Baum and A.L. Meister. (also ICNAF Res.Doc.69/49).
- 69/7 Studies on the parasites of Atlantic salmon (Salmo salar) in 1968. By J.H.C. Pippy. (also ICNAF Res.Doc.69/50).
- 69/8 Distribution of Atlantic salmon recaptures in Greenland waters and the recaptures in North America and Europe of the Greenland tagged salmon as reported to 18.4.1969. By S. Å. Horsted and P. Karneworff. (also ICNAF Res.Doc.69/61).
- 69/9 Scottish research programme for Greenland and high seas salmon investigations, 1969. By Department of Agriculture and Fisheries for Scotland, Pitlochry and Aberdeen. (also ICNAF Res.Doc.69/64).
- 69/10 Canadian tagging data for Atlantic salmon to 28 February 1969. By P.F. Elson. (also ICNAF Res.Doc.69/67).
- 69/11 Scottish salmon catch statistics. By W.R. Munro. (also ICNAF Res.Doc.69/69).

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- 69/12 Salmon work in Greenland, 1968. By W.R. Munro. (also ICNAF Res.Doc.69/70).
- 69/13 Salmon fishery in the North Atlantic by Swedish fishing vessels in 1968. By B. Carlin. (also ICNAF Res.Doc.69/71).
- 69/14 Utilization of three stocks of Atlantic salmon tagged and liberated as smolts in the Northwest Miramichi River from 1964 to 1967. By P.F. Elson. (also ICNAF Res.Doc.69/72).
- 69/15 Research programme for Greenland and in home waters for England and Wales, 1969. By Ministry of Agriculture, Fisheries and Food, London. (also ICNAF Res.Doc.69/78).
- 69/16 Salmon catches for major salmon rivers in five areas of England and Wales, 1965-1968. (also ICNAF Res.Doc.69/79).
- 69/17 The proportional occurrence of salmon tagged in the UK and in Canada in some offshore drift net catches made in the West Greenland area, 1B, in 1968. By I.R.H. Allan. (also ICNAF Res.Doc.69/80).
- 69/18 The proportions of grilse in England and Wales catches. By I.R.H. Allan and A. Swain. (also ICNAF Res.Doc.69/81).
- 69/19 Serological and biochemical studies on Atlantic salmon. Progress Report. By N.P. Wilkins. (also ICNAF Res.Doc.69/6).
- 70/1 Drift net tagging of Atlantic salmon. By A.W. May. (also ICNAF Res.Doc. 70/2).
- 70/2 Size and age of salmon from West Greenland, 1968 and 1969. By A.W. May. (also ICNAF Res.Doc.70/3).
- 70/3 Canadian salmon statistics. By A.W. May. (also ICNAF Res. Doc.70/4).
- 70/4 Origin of salmon at West Greenland. By L. Nyman. (also ICNAF Res.Doc.70/5).
- 70/5 Use of fluorescence to find parasitic nematodes. By J.H.C. Pippy. (also ICNAF Res.Doc.70/6).

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- 70/6 Studies on the nematode parasites of Atlantic salmon and related species from other hosts. By O.L. Nyman and J.H.C. Pippy. (also ICNAF Res.Doc.70/7).
- 70/7 Summary of salmon parasite investigations, 1969. By J.H.C. Pippy. (also ICNAF Res.Doc.70/8).
- 70/8 Relative catching efficiency of salmon drift nets and relative viability of salmon caught. By A.W. May. (also ICNAF Res.Doc.70/9).
- 70/9 Canadian tagging and recapture data for Atlantic salmon, updated to 31 December 1969. By P.F. Elson. (also ICNAF Res.Doc.70/1).
- 70/10 Irish salmon. Homewater stocks and exploitation. By E. Twomey. (also ICNAF Res.Doc.70/32).
- 70/11 Parasitic investigations in juvenile and adult salmon in 1968 and 1969 in selected Irish waters. By M.B. Kane. (also ICNAF Res.Doc.70/33).
- 70/12 Notes on the salmon long-lining cruises by the RV 'Jens Chr. Svabo' off Faroe, April 1969. By W.R. Munro. (also ICNAF Res.Doc.70/40).
- 70/13 Recent trends in Scottish salmon and grilse catches. By W.R. Munro (also ICNAF Res.Doc.70/41).
- 70/14 Length and age distribution of Atlantic salmon from West Greenland, 1969. By P. Kanneworff. (also ICNAF Res.Doc. 70/42).
- 70/15 Notes on spawning and recruitment in a tributary of a Scottish river system. By K.A. Pyefinch. (also ICNAF Res.Doc.70/43).
- 70/16 Greenland salmon research programme, 1969. Pelagic long-lining cruises by R/V 'Adolf Jensen'. By W.R. Munro. (also ICNAF Res.Doc.70/44).

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- 70/17 Scottish juvenile salmon tagging data, 1965-1969.
By DAFS, Pitlochry. (also ICNAF Res.Doc.70/45).
- 70/18 Polymorphism of serum transferrin in Atlantic salmon.
By Dag Møller. (also ICNAF Res.Doc.70/56).
- 70/19 Catch statistics and age/length distribution of
Atlantic salmon from the southern part of the Davis
Strait. By P. Kanneworff. (also ICNAF Res.Doc.70/65).

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FIG. 1 DISTRIBUTION OF WEST GREENLAND SALMON FISHERY, 1969

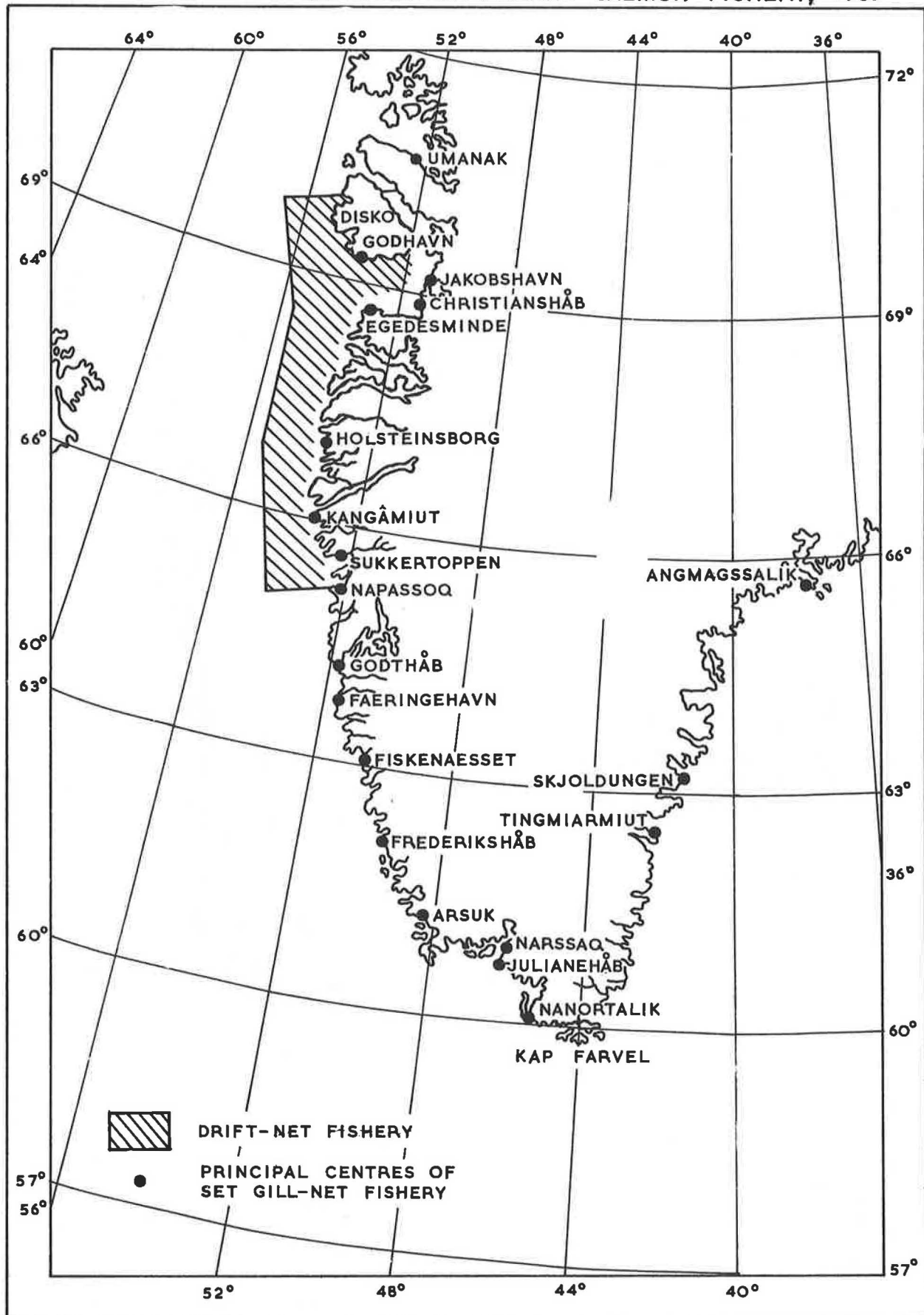


FIG. 2 DISTRIBUTION OF NORWEGIAN SEA SALMON FISHERY, 1969

