RESTRICTED

INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

Serial No. 3231
(B.g.14)

ICNAF Res.Doc. 74/45

ANNUAL MEETING - JUNE 1974

Report on recaptures from the International Salmon Tagging Experiment at West Greenland, 1972
Analysis of smolt tagged in home waters and recaptured at West Greenland, 1972[1]

by

J. Møller Jensen
Grønlands Fiskeriundersøgelser
Charlottenlund, Denmark

CONTENTS:

A. Material and Methods.

The International Salmon Tagging Experiment took place at West Greenland in August-October, 1972. 13 vessels took part in the experiment (8 commercial and 5 research vessels).

Tags used were made of yellow laminated plastic, measuring 15x5x0.8 mm. and bore on one side a serial number preceded by the letter X, and in English the instruction, "state where, when and how caught". The other side carried a message "Return to ICES, 2920 CHL, Denmark, Reward". The attachment of tags were a 2-part modified Carlin type, using annealed stainless steel wire of 0.4 mm diameter.

[1] Presented to the ICES/ICNAF Joint Working Party on North Atlantic Salmon, ICES, Charlottenlund, March 1974.

A.1. Tagging.

The total number of salmon tagged in the experiment is 2364. Table 1 shows for each vessel the number of salmon tagged by categories (G=good, F=fair, P=poor) Criteria for rating the condition were as follows:

Good - minor scale loss (generally 10% or less but up to 20% if fish is very lively), fish lively and hard to handle, swims away quickly after tagging.

Fair - moderate scale loss (generally 10% to 20% but to a maximum 30%), fish swims slowly in tagging tank and on release.

Poor - moderate to large scale loss (generally 10% to 30%), fish has difficulty maintaining its position in tagging tank; operculum or fins may be injured; if released, fish swims away sluggishly and erratically.

Table 2 gives the number of salmon tagged per week in each area. As shown in Table 2 the total number of salmon tagged at West Greenland was 2334 (G 1673, F 622, P 37), whereas 30 were tagged in the Labrador Sea (G 14, F 15, P 1).

Table 2 also shows that 60% of the total number tagged were obtained during the first four weeks of the experiment, and that Area III was the area with the highest activity accounting for 25% of the total number tagged.

A.2. Recaptures from the experiment (ICES-tags).

The total number of recaptures by 15th February, 1974 was 204 or 8.6% of salmon tagged. Table 3 shows the number of recaptures by country of recapture, and by categories in numbers as well as percentage.

Table 4 shows the number of recaptures of salmon tagged by various vessels given by categories and according to main areas of recaptures. The percentages of recaptures for the tagging vessels are very uniform, with a mean of $7.8 \pm 2.9\%$.

A.2.a. Recaptures at West Greenland, 1972.

Table 5 shows the number of recaptures tagged by commercial- and research vessels given by categories (number as well as percentage) and according to time span between release and recapture. 30 salmon tagged in the Labrador Sea are included in the calculation in spite of there have been no recaptures of these in Greenland. Table 5 also gives the actual number of recaptures as well as the number estimated when the reporting rate is taken into account (see Section B.4.a.). The break-down in time span between release and recapture is made in order to get figures which are not biased by the phenomenon that many fish were released close to nets in the sea and such fish may have entered nets shortly after release. In fact 26% of the Greenland recaptures were reported in the first 2 days after release.

Only 38 salmon af category "poor" were tagged and only one of these were recaptured (on the same day as released of a Norwegian vessel).

There is a difference between salmon tagged by commercial vessels and those tagged by research vessels; the percentage of recaptures (corrected

for reporting rate) being higher for the commercial vessels than for the research vessels. The reason for this seems to be that the commercial vessels unlike the research vessels often worked as a fleet and therefore the chance for recapture shortly after the release would be bigger. This seems clearly demonstrated in Table 5, under "2 days or less in sea", which shows corrected percentage of recaptures for these fish of 2.7 and o.1% for commercial and research vessels respectively.

A.2.b. Recaptures at West Greenland, 1973.

The number of recaptures at Greenland in 1973 is shown in Table 4. The total number was 3 (2 tagged as "good", 1 as "fair"), all tagged by commercial vessels. From the 1969-tagging of 444 salmon in Greenland water 3 were recaptured in 1970. This demonstrates occurring of salmon at Greenland one year and wintering in the sea probably near Greenland.

A.2.c. Recaptures in home-waters.

The number of recaptures in home-waters is given in Table 3 for each country. Table 4 shows for the two main areas North America (Canada) and Europe the number of recaptures of salmon tagged by various vessels. The total number of recaptures is 48, 11 from Canada and 37 from Europe (23% and 77%). The proportion between recaptures from North America and Europe is very close to the proportion found by R.H.Payne for the salmon stock at West Greenland 1972, based on serum transferrin polymorphism (ICES C.M. 1973/M8). Payne in his samples found 20% from North America and 80% from Europe.

Looking at the tagging categories of the recaptures from home-waters Table 4 shows for the commercially tagged salmon 23"good" and 2 "fair", in percentage of number tagged 1.8 and 0.7% respectively, whereas the figures from the research vessels are 15 "good" and 8 "fair", 3.5 and 2.2% respectively. The difference in percentage of recaptures in home-waters between these four groups (commercial "good" and "fair", and research "good" and "fair") could be due to the difference in tagging mortality between the groups.

It should be noted that the two commercially "fair" recaptures in home-waters arise from the Norwegian tagging teams.

The time spent in sea between release and recapture is for recaptures from North America 309 $\pm$ 32 days and for Europe 266 $\pm$ 58 days.

Included in the number of recaptures in home-waters are two tagged in the Labrador Sea by A.T.CAMERON and CRYOS in the weeks 33 and 35. One of these was recaptured in Scotland and one in Canada. The tagging position for both was close to 56°46'N.50°30'W. The distance migrated for both is nearly the same, 275 nautical miles.

A.3. Tagging categories.

The instruction given to the observers was to tag only salmon of the category "good", whereas research vessels should tag "good" as well as "fair". The two observer vessels have complied with this instruction, BAKUR and LEIKUR (Table 1), while ELDORADO and ULLA tagged 83% salmon of the category "fair". The Norwegian observers have seen really good salmon in the Norwegian long-line fishery, and probably tended to have another judgment of the fish than other observers. The other commercial vessels are between these two groups.

Table 6 shows the percentage of recaptures inside the tagging categories "good" and "fair", for the two groups of tagging vessels, commercial - and research vessels respectively. The difference in percentage of recaptures between the two groups of vessels inside the same tagging category must be due to difference both in tagging mortality and fishing intensity on the released fish.

Recaptures of salmon in 1973 show a remarkable difference in percentage of recaptures inside each tagging category. Salmon belonging to the group "good" tagged by the research vessels have 50% better recapture rate than salmon tagged by the commercial vessels. "Fair" tagged salmon show a much bigger difference in percentage of recaptures from 1973. There are only few recaptures of "fair" tagged salmon from the commercial vessels, and these salmon were all tagged by the two Norwegian vessels. It should also be noted that the single 1973-recapture belonging to the category "poor" is tagged by the Norwegian vessel ULLA. Maybe all the Norwegian tagged salmon should be lifted one category up.

B. Results.

In the following sections the results from the analyses of the tagging experiment itself are given. Also the results from the analyses of smolt tagged in home-waters and recaptured at West Greenland, 1972, in relation to the distribution in the fishery are given.

B.1. Growth during the fishing season.

From the tagging experiment itself it is impossible to estimate the growth of salmon, partly because the span of time between release and recapture was very limited, but mainly because of the inaccuracy in measurements of length of fish in many cases. Table 7 gives the average growth in centimeters against time in sea. According to these figures, the growth in terms of increment in length should be nothing or even negative during the season, and since this seems incredible the data are not used in analyses of growth rate.

B.2. Movements within the fishing area.

Table 9 shows all recaptures broken down by days in sea and distances migrated in nautical miles, north- and southwards. Generally, more salmon have been taken south than north of the tagging site. Table 8 shows the same as Table 9; in this table recaptures are set up in tagging area against recapture area. 77 salmon or 50% of recaptures were taken in the tagging

area, 40 salmon or 26% were taken in areas south of the tagging area, 18 salmon or 12% were taken north of the tagging area, and 18 salmon or 12% were without any information about recapture areas. Tables 10-15 show recaptures from each tagging area respectively. In the tables the number tagged by two weeks are given in figures, whereas recaptures in same period are given by a symbol each, the symbol indicating time spent in sea. The reason to set it up in this way is to try to visualize the migration along the coast in time. Looking at tagging Areas II-V (Tables 11-14) tagged salmon only from these areas have a chance to go either south or north and still be in the fishing area. The tables show that most recaptures taken north of the tagging areas belong to the tagging period Weeks 32-33, but already from the first tagging weeks the migration towards south started.

It is very difficult to get an idea about the migration between offshore and inshore areas, because information about recapture locality is in many cases insufficient. However, the fishing gear used and the nationality of fisherman may give some ideas (Table 16).

This table shows that most recaptures were taken offshore by Danish, Faroese and Norwegian drifters. Generally, it seems as if migration between offshore and inshore waters has been very small. It should be noted, however that salmon must have migrated to coastal areas, because the fishery in these areas is rather significant. It is difficult from the information of recaptures to separate the stock in an offshore and an inshore stock, when many drifters, especially the Greenlanders and in many cases the Danish and Faroese, are fishing very close to the inshore area, in some cases (Greenlanders) even inshore.

It is also pointed out that judgment about migration from recaptures only can be made when additional information about fishing intensity in each area is taken into account, and when bias due to possible difference in reporting rate between fleets can be overcome.

B.3. Tagging mortality.

The survival experiments with tagged salmon were very limited both in 1972 and in 1973. For the present analyses these experiments have, therefore, been combined with experiments from 1969 and 1970. The experiments were carried out in the following way: After tagging the salmon were held in a keep net (8x8x4 meters depth) for 24 hours or more before inspection. The number of salmon survived and dead were counted and the survivors released. The results of these experiments are given in Table 17.

In some cases it was possible to split up the salmon in the experiments in tagging categories (see Table 18).

These experiments give an idea about short-term tagging mortality; but from recaptures both in Greenland and in home-waters it has proved from the percentage of recaptures from the four tagging groups (comm."good", comm."fair", res."good", and res."fair") that each of these groups has different tagging mortalities, over short time as well as over long time (see Section B.5.).

B.4. Estimation of total smolt tags recaptured at West Greenland, 1972, and their distribution in the fishery.

Table 19 shows the total number of recaptures of tags other than ICES-tags. The total amount of recaptures is given by tagging nation, tagged as smolts and adults, and number recaptured by the ISTE tagging vessels.

B.4.a. Estimation of reporting rate.

The reason for using smolt tags rather than the ICES-tags for estimation of reporting rate, is the greater number of recaptures and a likely random distribution of these tags in the stock of salmon at West Greenland. In the estimation of the reporting rate it is assumed that the reporting rate of the tagging vessels is 100% due to the observers on board.

An estimation based on the very few adult salmon tagged gives a reporting rate of same order as for smolt , viz. 0.89

B.4.b. Distribution of smolt tags in relation to the fishery.

Table 22 gives the distribution of recaptures of smolt tags in 5 week periods and in areas compared with the number of salmon caught. The reporting rate of 0.83 has been used to correct all figures for recaptures. and when the locality of recapture is unknown (25%) , the recaptures are allocated to areas in same proportion as the recaptures for which area is known. The average number of recaptures per 1000 salmon caught remains, of course, 1.17 (see Section 4.B.a.) and the standard deviation for the weighted mean is $\pm$0.77 (weighted by number of salmon in each period/area) Number of recaptures per 1000 salmon caught fluctuates from 0 to 5.6. One of the reasons for this fluctuation could be the large proportion of tags which has been allocated to areas, but which may originate from certain parts of the fishery.

Making the same exercise as above for recaptures from the commercial tagging vessels gives figures found in Table 23. Here the average number of recaptures per 1000 salmon caught is smaller 1.16, because the research vessels (with 4 recaptures in a catch of 2629 salmon) are not included. The standard deviation for the commercial tagging vessels is $\pm$ 0.67 or nearly the same as the standard deviation for the fishery as a whole. Therefore, both sets of figures indicated that tagged fish are not completely mixed (or caught) in the exploited stock.

The reason for this non even distribution of tags in the stock could be, that the tagged salmon in the stock are found in small "shoals"; but it can also be a statistical phenomenon, because earlier investigations did not show "shoals of salmon of different nationality".

B.5. Estimation of fishing mortality and tagging mortality for fish tagged at West Greenland, 1972.

The original model for these estimations is taken from W.E.Ricker (Handbook of computations for biological statistics of fish populations. Fish.Res.Bd. Canada, Bull.119, 1958). The reason using this model was that the model operates with continuous taggings and recaptures throughout the period analysed. The model has here been modified by Mr.K.P.Andersen, Danish Institute for Marine Research. K.P.Andersen also undertook the

computer runs of the model.

The objectives have been to find such values for fishing mortality coefficient (F) and tagging mortality coefficient (X), that the number of recaptures at Greenland arrived at in the model corresponds with the actual number observed (corrected figures), and the proportion between number of recaptures in home-waters and estimated number of tagged salmon which arrive to home-waters varies as little as possible between different groups of tags.

The model operates with 7 periods, each of 6 weeks (unit of time = 6 weeks). The first three periods (weeks 32-37, 38-43, 44-49) cover the fishing season at West Greenland, and the last period (7th) is taken as the period in which salmon arrive to home-waters. The time spent in sea between tagging in Greenland and arrival to home-waters in the model is thus between 24 and 42 weeks and corresponds closely to the observed time between release and recapture (see Section A.2.c.).

Only salmon which belong to the tagging category "good" are used, and because there is a difference between "good" salmon from the commercial tagging vessels and those from the research vessels, the model operates with two main groups of "good" tagged salmon (commercial "good" and research "good"). The difference between the two groups of "good" salmon lies in difference in tagging mortality between them, and to the difference in fishing mortality in their first period after release.

Each of the two main groups of "good" salmon is further split up in two tagging periods, weeks 32-37, weeks 38-43 respectively. Recaptures from the first tagging period (t = 1) were caught in periods t = 1, 2, 3, and 7 (home-waters) recaptures from the second tagging period (t = 2) were caught in periods t = 2, 3, and 7 (home waters).

In the following all equations used in the model are given for each of the four groups tagged fish (constants will be explained later in the section). The following abbreviations are used:

F_1 = coefficient of fishing mortality in period t = 1
F_2 = " " " " t = 2
F_3 = " " " " t = 3
E = coefficient of emigration (kept constant in the model)
X_{res} = coefficient of tagging mortality for the research vessels excluding mortality immediately after tagging.
X_{com} = coefficient of tagging mortality for the commercial vessels, excl. mortality immediately after tagging.
A = tagging mortality immediately following release
$R_{t't''}$ = (t' = 1 or 2 and t'' = 1, 2, 3,.. or 7) denotes recaptures of fish tagged in period t' and recaptures in period t''.
N = number of tagged fish in Greenland
N_E = number of tagged fish on route to home-waters
T = number of salmon tagged, T_{res_1}, T_{res_2}, T_{com_1}, T_{com_2}

1. Equations for salmon tagged by research vessels in the first tagging period.

$$\frac{dN}{dt} = AT_{res_1} - \left(\frac{F_1}{2} + E + X_{res}\frac{(7-t)^2}{36}\right)N \quad \text{for } t = 1$$

$$\frac{dN}{dt} = -\left(F_t + E + X_{res}\frac{(7-t)^2}{36}\right)N \quad \text{for } t = 2 \text{ or } 3$$

$$\frac{dN_E}{dt} = - X_{res} \frac{(7-t)^2}{36} N_E + EN$$

2. Equation for salmon tagged by research vessels in the second tagging period.

$$\frac{dN}{dt} = AT_{res_2} - (F_2 + E + X_{res} \frac{(7-t)^2}{36})N \quad \text{for } t = 2$$

$$\frac{dN}{dt} = - (F_3 + E + X_{res} \frac{(7-t)^2}{36})N \quad \text{for } t = 3$$

$$\frac{dN_E}{dt} = - X_{res} \frac{(7-t)^2}{36} N_E + EN$$

3. Equations for salmon tagged by commercial vessels in the first tagging period.

$$\frac{dN}{dt} = AT_{com_1} - (F_1 + E + X_{com} \frac{(7-t)^5}{7776})N \quad \text{for } t = 1$$

$$\frac{dN}{dt} = - (F_t + E + X_{com} \frac{(7-t)^5}{7776})N \quad \text{for } t = 2 \text{ or } 3$$

$$\frac{dN_E}{dt} = - X_{com} \frac{(7-t)^5}{7776} N_E + EN$$

4. Equations for salmon tagged by commercial vessels in the second tagging period.

$$\frac{dN}{dt} = AT_{com_2} - (F_2 + E + X_{com} \frac{(7-t)^5}{7776})N \quad \text{for } t = 2$$

$$\frac{dN}{dt} = - (F_3 + E + X_{com} \frac{(7-t)^5}{7776})N \quad \text{for } t = 3$$

$$\frac{dN_E}{dt} = - X_{com} \frac{(7-t)^5}{7776} N_E + EN$$

From the equations the following assumptions are made:

1) There is no immigration to West Greenland fishing area during the fishing season.
2) The emigration rate during the period t=1 to t=7 is constant.
3) There is no natural mortality in Greenland and between Greenland and home-waters

In all four sets of equations the following figures apply:

T_{res_1} = 327 with R_{11}=9.9, R_{12}=16.6

T_{res_2} = 99 with R_{22}= 2.2

T_{com_1} =1005 with R_{11}=48.0, R_{12}=28.0

T_{com_2} = 256 with R_{22}= 9.8

The following values of other parameters in the four sets of equations are those which most closely fulfil the objective that number of recaptures from the run should correspond with actual number observed.
F_1=0.3, F_2=0.25, F_3=0.05, E=0.35, X_{res}=0.35 and X_{com}=1.1.

The comparison between resulting figures and observed figures is given in Table 24.

The number of observed recaptures given in Table 24 has been corrected by the reporting rate factor, and recaptures taken during the first two days after release are deducted except for those that would have been taken under "normal circumstances" (their number is taken as average number of recaptures in two days for all recaptures).

Comments on F_1, F_2, and F_3

Another objective was to arrive at values of F_1, F_2, and F_3 which did not differ significantly between fish tagged by commercial vessels and those tagged by research vessels.

The number of observed recaptures in the first period shows a difference between research and commercial tagged salmon. Knowing that the research vessels in many cases tagged salmon in distance from fishing places, it was assumed that F_1 for the research vessel to be very low immediately after tagging, but during the first period (t=1) the F_1 approaches the same level as that for the commercial vessel salmon. Instead of having a gradually increasing (and therefore, complicated) F_1 for the research vessel salmon in the first period in model, an average value was put in. The value to fit the objectives should be $\frac{F_1}{2}$.

F_2 for the two groups of vessels was from the beginning of computations nearly the same.

F_3 is a guessed figure knowing from the fishing activities itself that it should be very small compared to F_1 and F_2.

Comments on A, X, and E.

It showed necessary to assume that some of the tagged salmon died immediately after tagging. Trying various runs on the computer it was found that 50% reduction fitted the objectives. A therefore = 0.5.

About E and X, the solutions which gave the values for F_1 and F_2 given above lead to the following values for (E+X)

From the research vessels $E+X_{res} = 0.67$
From the commercial vessels $E+X_{com} = 1.47$

Assuming for the research vessel value of (E+X), that half the indicated "mortality" arrises from the emigration and the other half from long term tagging mortality, and assuming that commercial vessel salmon have the same coefficient of emigration (E) as the research vessel salmon, the following values for E and X resulted

$E = 0.35$ $X_{res} = 0.35$ $X_{com} = 1.10$

Now a set of values for F_1, F_2, F_3, E, X_{res} and X_{com} which fits the objectives has been found. However, these values directly in model leads to fewer tagged salmon reaching home-waters, than the actual number of recaptures in home-waters.

It was, therefore, necessary to find a mathematical formular, which would give a high tagging mortality at the beginning of the experiment and a negligible at the end of the 7th periods. Also it had to be higher at the beginning for the commercial vessel salmon than for the research vessel salmon whereas at the end of the experiment it should be on the same level for both tagging groups.

The following correction factors in connection with X_{res} and X_{com}, will give nearly the same proportion for each tagging group between recaptures in home-waters and the number of tagged salmon arrived there, and also figures for recaptures at West Greenland close to the actual number observed (corrected figures)

$\frac{(7-t)^2}{36}$ for X_{res}, when $X_{res} = 0.35$

$\frac{(7-t)^5}{7776}$ for X_{com}, when $X_{com} = 1.10$

These factors give in the first period $X_{res} = 0.35$ and $X_{com} = 1.1$ respectively. In the 4th period values for X_{res} and X_{com} become nearly equal and thereafter the effect of tagging mortality becomes negligible.

Discussion of the assumptions in the model.

If the first assumption that there is no immigration to West Greenland fishing area during the fishing season does not hold, then there is an immigration, and the model then overestimates F and underestimates stock size exploited.

If the assumption is correct, then there must be some stocks of salmon without connection during the fishing season with the stock at West Greenland, for example in the Labrador Sea and in the Irminger Sea. There are no recaptures at Greenland from the small tagging experiment in the Labrador Sea, but recaptures from the experiment occur in home-waters, most of them in Canada but a single in Scotland. It looks as if some areas outside West Greenland supply some additional fish to the catches in home-waters. This being so the catches in home-waters on salmon from West Greenland, will only be a part of the total catches of salmon in home-waters.

The second assumption, that the emigration rate during the period t=1 to t=7 is constant, is probably incorret, and an increasing rate of emigration during the period could be more proper. It would not influence the values for F, but the tagging mortality rate change reversible to the rate of emigration.

The third assumption, that there is no natural mortality in Greenland and between Greenland and home-waters could be discussed. If there in Greenland is a natural mortality even a small one, then the exploitation rate will be higher. In the model (the tagged population) the natural mortality will act together with E+X, which means that either the E or the X or both will be smaller.

A natural mortality between Greenland and home-waters will reduce the number arriving to home-waters from Greenland, both in the tagged and in the untagged population. If the natural mortality shall be used in a model, it seems reasonable to have a smaller one, when the salmon are feeding (Greenland) and a bigger one under spawning migration, when some of the salmon can be lost and when great physiological changes take place as the fish mature.

B.6. Exploitation rate at West Greenland estimated from the tagging experiment.

Assuming that the values for F_1, F_2, F_3, and E as found for the tagged population apply also to the untagged population, a run of the model for an initial stock of 100,000 salmon is given in Table 25.

This indicates that 4.7% of the initial stock will be wintering at Greenland or somewhere else in the sea. 33% were caught at Greenland and 62% arrived to home-waters.

The proportion between the catches from Period 1 and those from Period 2 in the table, is very close to the proportion between the actual 1972 catches from the same periods, viz. 2.25 and 2.37 respectively.

B.7. Size of the exploited stock at West Greenland, estimated from the tagging experiment.

Given an exploitation of 33% and the total number of salmon caught at West Greenland, 1972, the size of the exploited stock can be readily estimated. The total number of salmon caught at West Greenland in 1972 was about 584 500. The initial stock size is, therefore, estimated to be about 1.77×10^6 salmon. The actual number of individuals occurring in the fishing area throughout or during part of the fishing season could, however, be higher, since it is assumed that no immigration to fishing area takes place during the season. The percentage caught would then be correspondingly lower.

B.8. Natural mortality rate between West Greenland and home-waters.

Two sets of figures from the runs can be used in a discussion about the natural mortality between Greenland and home-waters.

The first arise from Table 25 viz. that 62% of salmon occurring at West Greenland in the autumn enter home-waters next year. If the salmon catches in Greenland and in home-waters are 2000 and 3000 metric tons respectively, and the increment in weight between Greenland and home-waters is 50%, then the overall exploitation rate in home-waters is 0.53. Assuming that all the salmon in the catches of home-waters has been in Greenland in the autumn before. This still assuming no natural mortality between Greenland and home-waters. If the actual overall exploitation rate in home-waters is higher than 0.53, then a natural mortality occur, which can be estimated from the figures.

The other set of figures arise from the number of tagged salmon which enter home-waters and the actual number of recaptures. If estimates of reporting rate in home-waters can be given together with the overall

exploitation rate in home-waters, then the natural mortality could again be obtained as the mortality necessary to eliminate the difference between number of tagged fish entering home-waters in the model and the number obtained from actual recaptures, reporting rate and exploitation rate.

Table 1. Number of salmon tagged per vessel and by tagging categories.

	Nos. tagged			Relation between categories (%)			TOTAL
Commercial vessels	G	F	P	G	F	P	Nos.
POLARLAKS (Den.)	145	96	8	58.0	38.4	3.2	250+
SILPHA "	92	9	-	91.1	8.9	-	101
SUSI-ANN "	179	35	-	83.6	16.4	-	215+
BAKUR (Far.)	286	1	1	99.3	0.3	0.3	288
HVÍTANES "	121	20	-	85.8	14.2	-	141
LEIKUR "	422	-	-	100.0	-	-	422
ELDORADO (Nor.)	7	26	-	21.2	78.8	-	33
ULLA "	9	87	7	8.7	84.5	6.8	103
TOTAL	1261	274	16	81.2	17.6	1.0	1553++
Research vessels	G	F	P	G	F	P	TOTAL
A.T.CAMERON (Can.)	120	94	5	54.8	42.9	2.3	219
ADOLF JENSEN(Den.)	141	182	10	42.3	54.7	3.0	333
CRYOS (France)	98	30	-	76.6	23.4	-	128
SCOTIA(Scotl.)	64	56	7	50.4	44.1	5.5	127
TORNAQ (Dn.)	3	1	-	75.0	25.0	-	4
TOTAL	426	363	22	52.5	44.8	2.7	811
GRAND TOTAL	1687	637	38	71.4	26.9	1.6	2364

+ Including 1 not given by tagging category.
++ " 2 " " " "

Table 2. Salmon tagged by area per week.

AREA		North of 68°40'N.			68°40'N. 66°35'N.			66°35'N. 65°25'N.			65°25'N. 63°35'N.			63°35'N. 62°00'N.			62°00'N. 60°00'N.			South of 60°00'N.			TOTAL			GRAND TOTAL	Accumulated
		I			II			III			IV			V			VI			Labrador Sea							
Week No.	Date	G	F	P	G	F	P	G	F	P	G	F	P	G	F	P	G	F	P	G	F	P	G	F	P		%
32	30.7.-5.8.				16	5	1	88	32	2	26	8	0	17	0	0	3	0	0				150	45	3	199 +	8.4
33	6. -12.8.	2	0	1	106	38	1	109	5	1	31	26	0	70	29	4	21	15	2	8	8	1	347	121	10	478	28.6
34	13. -19.8.	0	1	0	7	2	0	167	31	0	40	37	2	108	50	4	16	9	0				338	130	6	474	48.7
35	20. -26.8.				4	5	0	23	16	3	85	60	6	51	22	0	5	18	5	6	7	0	174	128	14	316	62.1
36	27.8.-2.9.	98	32	2	30	22	0	9	5	0	14	12	0	1	0	0	19	9	0				171	80	2	254 ++	72.8
37	3. -9.9.	106	11	0	32	20	1	0	0	0	2	6	0	2	1	0	10	1	0				152	39	1	192	80.9
38	10. -16.9.	4	4	0	82	12	0	49	12	0	30	8	0	2	0	0							167	36	0	203	89.5
39	17. -23.9.	3	3	0	10	5	0	31	6	0	12	24	1	34	3	0							90	41	1	132	95.1
40	24. -30.9.	0	1	1	3	0	0	6	2	0				1	3	0							10	6	1	17	95.8
41	1. -7.10.	0	3	0	4	0	0	7	0	0				49	0	0	1	4	0				61	7	0	68	98.0
42	8.-14.10.										5	0	0	16	1	0							21	1	0	22	99.6
43	15.-21.10.										1	3	0	5	0	0							6	3	0	9	100.0
TOTAL		213	55	4	294	109	3	489	109	6	246	184	9	356	109	8	75	56	7	14	15	1	1687	637	38	2364 +++	100.0

\+ Including 1 not given by category, Area III
++ " 1 " " " " IV
+++ " 2 " " " Areas III and IV

Table. 3. Recaptures from the tagging experiment 1972, by area (country) and by tagging category (see Section A.1.). Recaptures outside Greenland are from 1973.

AREA	NUMBER				%			
	G	F	P	Total	G	F	P	Total
Greenland, 1972	129	23	1	153	76.3	67.6	100.0	75.0
Greenland, 1973	2	1	0	3	1.2	2.9	0	1.5
Canada	5	6	0	11	3.0	17.6	0	5.4
Scotland	17	2	0	19	10.0	5.9	0	9.3
England	6	2	0	8	3.6	5.9	0	3.9
Ireland	7	0	0	7	4.1	0	0	3.4
France	2	0	0	2	1.2	0	0	1.0
Spain	1	0	0	1	0.6	0	0	0.5
Total	169	34	1	204	100.0	99.9	100.0	100.0

Table 4. Number of recaptures from the 1972 Tagging Experiment given by categories and according to area of recapture. Figures in brackets are number caught by tagging vessels.

Tagging vessel	Nos. tagged				Main area of recapture: Greenland, 1972				Grl., 1973			N.America			Europe			Total				
	G	F	P	Total	G	F	P	Total	G	F	Tot.	G	F	Tot.	G	F	Tot.	G	F	P	Tot.	%
POLARLAKS	145	96	8	250	18(8)	4(3)	0	22(11)	0	0	0	1	0	1	2	0	2	21	4	0	25	10.0
SILPHA	92	9	-	101	5(1)	1(0)	-	6(1)	0	0	0	0	0	0	1	0	1	6	1	-	7	6.9
SUSI-ANN	179	35	-	215	13(4)	2(0)	-	15(4)	1	0	1	0	0	0	3	0	3	17	2	-	19	8.8
BAKUR	286	1	1	288	27(9)	0	0	27(9)	1	0	1	1	0	1	5	0	5	34	0	0	34	11.8
HVITANES	121	20	-	141	8(3)	0	-	8(3)	0	0	0	1	0	1	3	0	3	12	0	-	12	8.5
LEIKUR	422	-	-	422	30(16)	-	-	30(16)	0	-	0	1	-	1	5	-	5	36	-	-	36	8.5
ELDORADO	7	26	-	33	0	2(0)	-	2(0)	0	0	0	0	1	1	0	0	0	0	3	-	3	9.1
ULLA	9	87	7	103	2(1)	4(3)	1(1)	7(5)	0	1	1	0	0	0	0	1	0	2	6	1	9	8.7
Commercial v.	1261	274	16	1553	103(42)	13(6)	1(1)	117(49)	2	1	3	4	1	5	19	1	20	128	16	1	145	9.3
A.T.CAMERON	120	94	5	219	5(1)	1(0)	0	6(1)	0	0	0	0	1	1	1	2	3	6	4	0	10	4.6
ADOLF JENSEN	141	182	10	333	14(4)	8(2)	0	22(6)	0	0	0	0	2	2	5	1	6	19	11	0	30	9.0
CRYOS	98	30	-	128	2(0)	0	-	2(0)	0	0	0	1	0	1	6	0	6	9	0	-	9	7.0
SCOTIA	64	56	7	127	5(2)	1(0)	0	6(2)	0	0	0	0	2	2	2	0	2	7	3	0	10	7.9
TORNAQ	3	1	-	4	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research v.	426	363	22	811	26(7)	10(2)	0	36(9)	0	0	0	1	5	6	14	3	17	41	18	1	59	7.3
GRAND TOTAL	1687	637	38	2364	129(49)	23(8)	1(1)	153(58)	2	1	3	5	6	11	33	4	37	169	34	1	204	8.6

Table 5. Recaptures of ICES-tags at Greenland 1972 in number and percentage of numbers tagged inside each category, given with and without correction for the reporting rate. Figures in brackets are numbers caught by tagging vessels.

	Tagging vessels	Total number of recaptures: Nos. G	F	P	Total	% G	F	P	Tot.	2 days or less in sea after tagging: Nos. G	F	P	Tot.	% G	F	P	Tot.	More than 2 days in sea after tagging: Nos. G	F	Tot.	% G	F	Tot.	Time in sea not known: Nos. G	F	% G	F
Uncorrected figures	Comm. vessels	103 (42)	13 (6)	1 (1)	117 (49)	8.2	4.7	6.3	7.5	32 (21)	6 (4)	1 (1)	39 (26)	2.5	2.2	6.3	2.5	62 (21)	4 (1)	66 (22)	4.9	1.5	4.2	9 (0)	3 (1)	0.7	1.1
	Res. vessels	26 (7)	10 (2)	0	36 (9)	6.1	2.8	0	4.4	1 (1)	0	0	1 (1)	0.2	0	0	0.1	22 (6)	8 (2)	30 (8)	5.1	2.2	3.7	3 (0)	2 (0)	0.7	0.6
Corr.for report. rate	Comm. vessels	115.5	14.4	1.0	130.9	9.2	5.3	6.3	8.4	37.3	6.4	1.0	41.7	2.7	2.3	6.3	2.7	70.4	4.6	75.0	5.6	1.7	4.8	10.8	3.4	0.9	1.2
	Res. vessels	29.9	11.6	0	41.5	7.0	3.2	0	5.1	1.0	0	0	1.0	0.2	0	0	0.1	25.3	9.2	34.5	5.9	2.5	4.3	3.6	2.4	0.8	0.7
Uncorr.	Total	129 (49)	23 (8)	1 (1)	153 (58)	7.6	3.6	2.6	6.5	33 (22)	6 (4)	1 (1)	40 (27)	2.0	0.9	2.6	1.7	84 (27)	12 (3)	96 (30)	5.0	1.9	4.1	12 (0)	5 (1)	0.7	0.8
Corr.	Total	145.4	26	1	172.4	8.6	4.1	2.6	7.3	35.3	6.4	1.0	42.7	2.1	1.0	2.6	1.8	95.7	13.8	109.5	5.7	2.2	4.6	14.4	5.8	0.9	0.9

Table 6. Percentage of recaptures inside the tagging categories "good" and "fair" for the two groups of tagging vessels respectively, after correction for reporting rate.

Tagging vessel	Recaptures at Greenland 1972								Recap. at Grl. 1973		Recap. in Home-waters		Grand total		No. tagged	
	≤2 days in sea		>2 days in sea		time not known		total									
	G	F	G	F	G	F	G	F	G	F	G	F	G	F	G	F
Commercial	2.72	2.34	5.58	1.68	0.86	1.24	9.16	5.26	0.19	0.44	2.20	0.88	11.54	6.59	1261	274
Research	0.23	0	5.94	2.53	0.85	0.66	7.02	3.20	0	0	4.24	2.66	11.26	5.86	426	363
Total	2.09	1.00	5.67	2.17	0.85	0.91	8.62	4.08	0.13	0.19	2.71	1.89	11.47	6.17	1687	637

Table 7. The average growth in cm for tagged salmon "good" and "fair" respectively, broken down by time in sea.

Days in sea	"GOOD"				"FAIR"			
	Rec. on tagging vessels		Total recapt		Rec. on tagging vessels		Total recapt	
	No.	Growth	no.	Growth	No.	Growth	No.	Growth
0-10	29	0.38 ± 2.00	44	-0.14 ± 2.62	5	-1.20 ± 1.10	8	-1.75 ± 1.75
11-20	10	-1.10 ± 1.52	19	-0.68 ± 1.86	1	0 ± 0	1	0 ± 0
21-30	3	1.33 ± 3.51	5	1.60 ± 2.61	1	2.00 ± 0	1	2.00 ± 0
31-40	2	0.50 ± 2.12	9	-1.00 ± 2.64			1	-2.00 ± 0
41-50	1	1.00 ± 0	11	-0.27 ± 3.95	1	1.00 ± 0		
51-60			2	-1.50 ± 6.36			3	-2.33 ± 2.52
61-70								
71-80			2	2.50 ± 2.12				
>80								
NK.			5	-1.40 ± 2.51			2	-5.50 ± 4.95

Table 8. Number of recaptures of ICES-tags set up in area of tagging against area of recapture. Figures in brackets are recaptures taken by all the tagging vessels.

Area of recapt.	Area of tagging						
	I	II	III	IV	V	VI	Total
I	15 (6)	2 (0)	2 (2)				19
II	1 (1)	9 (5)	3 (0)				13
III	2 (2)	11 (6)	20 (5)	5 (3)	1 (0)		39
IV	1 (0)	1 (0)	16 (8)	9 (1)	3 (0)		30
V		5 (3)		3 (1)	19 (14)	2	29
VI						5 (1)	5
NK.	1 (0)	5 (0)	5	2	5	0	18
Total	20 (9)	33 (14)	46 (15)	19 (5)	28 (14)	7 (1)	153 (58)

Table 9. Recaptures of ICES-tags by days in sea, and by distance migrated (nautical miles).

days in sea	Southward						Northward						NK.
	⟨10	11 30	31 50	51 100	101 300	⟩301	⟨10	11 30	31 50	51 100	101 300	⟩301	
0- 2	3	3	4	1			3	6	2				18
3-10	4	2	5	6			2	3	2		1		3
11-20		4	1	5	3	1	3			3	1		2
21-30	1	2		1	5		1	2			1		3
31-40		1	1		1	3	1	4	2		1		
41-50		1		2		3			1				
⟩51				2	2	1					3		
NK.							1	2	1				13
Total	8	13	11	17	11	8	11	17	8	3	7	0	39

Table 10. Recaptures of tagged salmon released in Area I.

Week No.	32-33	34-35	36-37	38-39	40-41	42-43
Nos. tagged	3	1	249	14	5	0
Area of recapture						
I			○○○○ ○○○○ ○○○○ ○○			
II			○			
III				◔◔		
IV				◔		
V						
IV						

○ 0-13 days in sea ◕ 42-55 days in sea
◔ 14-27 " " ● 56-69 " "
◑ 28-41 " " X > 70 " "

Table 11. Recaptures of tagged salmon released in Area II.

Week No.	32-33	34-35	36-37	38-39	40-41	42-43
Nos. tagged	167	18	105	109	7	0
Area of recapture						
I		◔		◕		
II	○○		○	◔○○○		
III	○○	◔		◕◑◔◔ ○○○○	●	
IV						X
V			◑	◕◑○	●	
VI						

Table 12. Recaptures of tagged salmon released in Area III.

Week No.	32-33	34-35	36-37	38-39	40-41	42-43
Nos. tagged	237	240	14	98	15	0
Area of recapture						
I			◑◑			
II		◔				X
III	○○○○ ○○	○○○○ ○○○	◔	◑○○	◕◕◕	
IV	○○	◔◔○○ ○○○	◔◔	◑◑◑	●	●
V						
VI						

○ 0-13 days in sea ◕ 42-55 days in sea
◔ 14-27 " " ● 56-69 " "
◑ 28-41 " " X >70 " "

Table 13. Recaptures of tagged salmon released in Area IV.

Week No.	32-33	34-35	36-37	38-39	40-41	42-43
Nos. tagged	91	230	34	75	0	
Area of recapture						
I						
II						
III	○○	○		○		X
IV	○	○○○		◕◑◑○		○
V			◔	◑		●
VI						

Table 14. Recaptures of tagged salmon released in Area V.

Week No.	32-33	34-35	36-37	38-39	40-41	42-43
Nos. tagged	120	235	4	39	53	22
Area of recapture						
I						
II						
III						
IV		○		◕	◕	
V	○○○	○○○○ ○○○	◑◔◔	◕◔○○	◔◔	○
VI						

○ 0-13 days in sea ◕ 42-55 days in sea
◔ 14-27 " " ● 56-69 " "
◑ 28-41 " " X >70 " "

Table 15. Recaptures of tagged salmon released in Area VI.

Week No.	32-33	34-35	36-37	38-39	40-41	42-43
Nos. tagged	41	53	39	0	5	0
Area of recapture						
I						
II						
III						
IV						
V	○	◔				
VI	○		◑○	◑◑		

Table 16. Recaptures given by fishing gear used and by countries or vessels.

Countries or vessels	Gear drift net	gill net	NK
Research vessels	1		
Danish comm. tagg. vessels	25		
Faroese " " vessels	22		
Norwegian " " vessels	10		
Danish drifters	23		
Faroese "	18+		
Norwegian "	7		
Greenlanders	21	7	19
Total	127+	7	19

+ Including 10 reported from the Faroese without information of gear used.

Table 17. Survival of tagged salmon in keep net.

Year	No.examined	No.released	No.dead	Survival rate
1969	20	11	9	0.55
1970	41	29	12	0.71
1972	33	23	10	0.70
1973	24	17	7	0.71
Total	118	80	38	0.68

Table 18. Survival of tagged salmon in keep net by tagging categories.

Tagging categories	No.examined 1972	1973	No.released 1972	1973	Survival rate 1972	1973	1972+1973
"good"	3	12	3	10	1.00	0.83	0.87
"fair"	9	12	4	7	0.44	0.58	0.52
"poor"	4	-	3	-	0.75	-	0.75
Total	40		27				0.68

Table 19. Recaptures of tags other than ICES-tags at West Greenland, 1972.

Tagging nation	Total no.of recaptures Tagged as: Smolt	Adult	Taken by ISTE tagg.vess. Tagged as: Smolt	Adult
Canada	273	11	46	2
USA	102	0	16	0
North America	375	11	62	2
Scotland	156	0	31	0
England	33	0	8	0
Ireland	1	0	0	0
Sweden	4	0	0	0
Norway	5	0	1	0
Iceland	2	0	1	0
France	12	0	1	0
Faroese	0	1	0	0
Europe	213	1	42	0
Grand total	588	12	104	2

Table 20. Number of salmon caught in 1972, and tags reported in number as well as per 1000 salmon caught.

Vessel	No.of salmon caught	No.of tags reported	Tags per 1000 salmon caught
Tagging	88,830	104	1.17
Other	495,667	484	0.98
Total	584,497	588	1.01

Table 21. Number of tags estimated and reporting rate.

Vessels	No.of tags estimated	Reporting rate
Tagging	104	1.00
Other	580	0.83
Total	684	0.86

Table 22. Smolt tags distributed in the fishery, number of recaptures per 1000 salmon caught.

week no.	area	I	II	III	IV	V	VI
30-34	No. of recaptures	1.78	19.85	31.50	21.63	44.19	23.20
	no. of salmon caught	444	13404	49319	3865	94957	8260
	Rec. per 1000 salmon caught	4.01	1.48	0.64	5.60	0.47	2.81
35-39	No. of recaptures	63.64	31.53	29.79	128.09	44.72	76.75
	No. of salmon caught	58715	20095	13889	92961	89970	40726
	Rec. per 1000 salmon caught	1.08	1.56	2.14	1.38	0.50	1.88
40-44	No. of recaptures	16.06	14.27	11.71	57.14	26.97	35.69
	No. of salmon caught	17639	4592	2545	35456	21125	11120
	Rec. per 1000 salmon caught	0.91	3.11	4.60	1.61	1.28	3.21
45-49	No. of recaptures	1.78	0	0	5.36	0	0
	No. of salmon caught	1144	212	5	3667	175	355
	Rec. per 1000 salmon caught	1.56	0	0	1.46	0	0
Total	No. of recaptures	83.26	65.65	73.00	212.22	115.88	135.64
	No. of salmon caught	77942	38303	65758	135949	206227	60461
	Rec. per 1000 salmon caught	1.07 $\pm$0.24	1.71 $\pm$0.54	1.11 $\pm$0.94	1.56 $\pm$0.70	0.56 $\pm$0.24	2.24 $\pm$0.58

Total weighted mean 1.17 $\pm$ 0.77 (number of tags per 1000 salmon caught by number of salmon for each period/area).

Table 23. Smolt tags distributed in the fishery, number of recaptures per 1,000 salmon caught, figures for the commercial tagging vessel.

weeks	areas	I	II	III	IV	V	VI
30-34	No. of recaptures	0	2	12	2	21	0
	Salmon caught	73	3165	19797	2371	20030	356
	Rec. per 1000 salmon	0	0.63	0.61	0.84	1.05	0
35-39	No. of recaptures	19	10	10	12	9	0
	Salmon caught	16701	4358	5268	3515	5656	333
	Rec. per 1000 salmon	1.14	2.30	1.90	3.41	1.59	0
40-44	No. of recaptures	0	0	1	0	2	0
	Salmon caught	1062	660	670	0	2061	125
	Rec. per 1000 salmon	0	0	1.49	0	0.97	0
45-49	No. of recaptures	0	0	0	0	0	0
	Salmon caught	0	0	0	0	0	0
	Rec. per 1000 salmon	0	0	0	0	0	0
30-49	No. of recaptures	19	12	23	14	32	0
	Salmon caught	17836	8183	25735	5886	27747	814
	Rec. per 1000 salmon	1.07 ±0.28	1.47 ±0.97	0.89 ±0.54	2.38 ±1.38	1.15 ±0.23	0 0

Total weighted mean 1.16 ± 0.67 (number of tags per 1000 salmon weighted by number of salmon for each period/area).

Table 24. The resulting figures and the observed figures (in brackets), of recaptures at West Greenland, from research and commercial "good" tagged salmon. Period 7 gives the number of tagged salmon which arrives to home-waters , in brackets the number of recaptures

Tagging vessels:	Research vessels		Commercial vessels	
Recapture period	Tagging period			
	1	2	1	2
1	9.3(9.9)		39.8(48.0)	
2	17.8(16.6)	2.4(2.2)	28.1(28.0)	8.6(9.8)
3	1.7(0)	1.2(0)	2.0(1.0)	1.6(0)
7	47.2(11)	16.2(4)	59.8(16)	17.0(7)

Table 25. A run to show catches at West Greenland for each 100,000 salmon present, and number of salmon arriving to home-waters (F_1=0.30, F_2=0.25, F_3=0.05, E=0.35).

Period	No.in Greenl. at beginning of each period	Catches in no. at W.Greenland	No.on route to home-waters
1	100 000	22 059	25 736
2	52 204	9 814	39 476
3	28 650	1 181	47 740
4	19 205	-	62 209
7	4 736	-	62 209
	4 736	33 054	62 209