

VEIÐIMÁLASTOFNUNIN



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The Result of Tagging Experiments
at the Kollafjörður Experimental Fish Farm
from 1970 through 1972

Fjölrit 9

Reykjavík

1973

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by

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Introduction.

The Kollafjörður Fish Farm has excellent facilities to study the absolute rate of returns of Atlantic salmon since the smolts are released from the Fish Farm and return as adults to a trap where every fish is handled and inspected for tags or finclips. All the pertinent background information on the Fish Farm is presented by Guðjónsson (1967, 1970 and 1972). The results of tagging experiments from 1965 through 1969 have been presented by Guðjónsson (1970 and 1972). The Carlin tag with a conventional steel wire has been almost entirely used in these experiments.

The 1970 Tagging Experiment.

In 1970 the total number of smolts released with the Carlin tag was 9219. These were one-year-old smolts reared indoors until their release. The average fork length of these fish was 13 - 14 cm. The total returns of these fish to date have been 2 fish or 0,02%. These results were disappointingly low but not quite unexpected after the clear cut results of the 1969 tagging experiment presented by Guðjónsson (1970). But these results proved once more that the rearing of one-year smolts under the present circumstances was not practical at all.

The 1971 Tagging Experiment.

1. The Groups Tagged

One of the primary purposes of this experiment was to try to improve the returns of one-year smolts to the Fish Farm. It was theorized that by putting the one-year smolts in outdoor ponds in February or March one could improve their returns. It was assumed that the spring photoperiod

would have some beneficial effects. A two-year-old control group was tagged. Some two-year-fish that were tagged were compared with respect to tagging time. One group was tagged before the end of March. The other was tagged after the 25th of April.

The ocean-going instinct of the various groups was examined in the outlet from the release ponds by electric fishing which commenced soon after the fish were supposed to have migrated out to sea.

In addition to tagging with Carlin tags there were some groups fin-clipped. The groups tagged and fin-clipped are shown in table 1.

The total number tagged by Carlin tags was 9608 whereof only 3775 were viable two-year-old migrants. The rest of the fish were experimental groups from the photoperiod experiment mentioned earlier.

2. The Electric Fishing

The electric fishing was performed several times during the summer of 1971 after the 25th of June. Previous years experience had shown that the one-year migrants if not properly smoltified did not want to leave the outlet creek. It was assumed that if the photoperiod treatment of the one-year-old smolts had been successful, they would migrate to sea to the same extent as the two-year-olds.

The results are shown in table 1. It is evident that group 1, 2 and 3 that are one-year-olds have remained to a great extent in the creek, since their return in the electric fishing is 13 - 15%. The control groups 4 and 5 that are two-year-olds were caught 10 - 12% of original release which shows that they also were reluctant to leave the creek. Groups 6 and 7, on the other hand, were hardly caught at all in the electric fishery which means that they migrated directly to sea soon after release.

3. The Adult Return

Since the one-year migrants did not seem to leave the station very promptly in 1971, it was not expected that they would return in great numbers in 1972. They, however, proved to be considerable improvement over earlier releases of one-year smolt at the Fish Farm (see 1970 experiment in this report).

The adult returns are shown in table 2. Groups 1 and 3 are the Carlin tagged one-year-old smolts. The combined returns from these groups

are 0,32%. These are low returns but 15 times better than the returns from one-year-olds tagged in 1970. These results thus indicated that we were on the right track.

As in the electric fishing the returns of the control two-year-olds were similar as for the one-year-olds amounting to 0,5%, which demonstrated further, that the age of the fish was not as important as the treatment of the fish, with respect to seaward migration and adult returns. No fish returned from a group of fin-clipped two-year-olds that were kept indoors until the day of their release.

Returns from group 2 were somewhat lower than the corresponding returns of Carlin tagged one-year-old smolts. This is to some extent due to the fact, that the returns of these fish in 1973 as two-year-old adults could not be considered valid. The reason for this was the great electric fishing of these fish in 1971 and their rerelease in 1972, which means that many of the adipose clipped fish returning in 1973 were only one-year-old adults.

The total returns from the release of two-year-smolts in 1971 is 4,5%. Of these about 87% returned in 1972 and 13% in 1973 after two years in the sea. This is in close agreement with previous findings at the Fish Farm. There did not seem to be appreciable difference between those tagged early and those tagged late.

The straying of salmon to other rivers amounting to 4,9% is not substantial compared to a 17% average for 1967 - 69 presented by Guðjónsson (1970).

The total return of salmon to the Fish Farm in 1972 was 681 fish. Of those 33 were kelts and ca. 600 returning as grilse. These fish are entirely the result of the release of ca. 8000 two-year-old smolts marked and unmarked. This indicates close to 7,5% total return of viable smolts, tagged and untagged, released in 1971.

4. The Length at Tagging versus Returns

The only data of real value for this are those from the release of tagged two-year smolts. The data are shown in table 3. These data show clearly the increase in rate of return with increase in length as presented by Carlin (1963, 1969) and Guðjónsson (1972). The rates of return per centimeter are, however, very much lower than those found by Guðjónsson

and Carlin's results are intermediate between the two. As an example we can see that the return-rate for a 15 centimeter fish according to the 1971 and '72 experiments is ca 4%. Carlin (1969) has a value of 7% for this length group but Guðjónsson (1972) ca 12%. These data are compared in graph 1. It has been taken into account that Carlin (1969) measured the total length of his smolts. It does not seem to make much difference for this purpose. The present data seem to indicate that a tagged smolt needs to be 18 cm. in average length before one can expect 10% return.

The 1972 Tagging Experiment.

1. The Groups Tagged

The groups tagged and the major experiments conducted are shown in table 4.

As in 1971 there was a great deal of tagging of two-year-old smolts to get better ideas of the year to year variation in returns from these releases on a production basis. One group of two-year-old smolts was tagged with a modified Carlin tag using locally made polyethylene thread.

In October of 1971 a group of one-summer-old salmon and a control group of one-year-olds were subjected to artificial lighting. The lights consisted of several 250 watt mercury light bulbs suspended ca. 1 meter above the water surface. The amount of light at the water surface was measured in lux, and was found to be on the average 13 - 1400 lux ranging from 200 lux to 2300 lux. The lights were turned on in the morning and off at night automatically using an electrical clock. The clock was set every 3 days to match sunrise and sunset according to the almanac. At the beginning of the experiment the one-summer-olds were only 10 cm long. It was therefore necessary to keep them in fairly warm water (9-10°C) until the beginning of December. They were then kept in cold water (2-3°C) until 1st of February 1972 when they were again kept in warmer water (9-10°C). As a result of the warming up they were up to 12,7 cm. average length by mid-March. When they were released they had been 28 weeks under artificial light.

The two-year-old control group (previously referred to as one-year-olds) was in natural temperatures all through the winter.

A group of relatively small two-year-old smolts was fin-clipped

with a left-ventral mark. This was done to get an idea of the possible returns of untagged two-year fish.

2. The Electric Fishing

During the first week of August the outlet creek from the Kollafjörður Fish Farm was fished with electricity to estimate the tendency of the smolts not to migrate to sea. In contrast to earlier years there were no marked or tagged fish in the outlet at all. This was not unexpected for the two-year-old smolts but very encouraging with respect to the one-year-olds. It seemed that all the fish in the photoperiod experiment had been ready to migrate to sea. The real validity of this assumption remained to be substantiated by the return-rate of these fish from the sea.

3. The Adult Returns

The returns of tagged fish to the Fish Farm are presented in table 5.

The returns of the various groups of two-year-old smolts vary from 3,6 - 8,6% averaging about 5,3%. This is somewhat higher than the return-rate for the 1971 tagging experiment but it must be considered that the released smolts were on the average larger in the 1972 experiment. Any real differences will be noted in the length/recapture rate analysis.

There does seem to be some difference in the return-rate of fish tagged with wire attachment (4,5) and those tagged with polyethylene attachment (4,0). This difference is probably primarily due to greater tag loss in those fish carrying the polyethylene thread. It must, however, be borne in mind that the thread used was not of the conventional type used for smolt-taggings in other countries, and was quite a bit less pliable.

The return rate of one-year-old smolts in the photoperiod experiment is fairly satisfactory compared to two-year-olds of the same average size when tagged. The returns for group 7 e.g. are half as good as for group 5. The control group (6) is superior to the one-year-olds but does not compare with a corresponding group from outdoor ponds. It is thus clear that the artificial environment has not been a satisfactory substitute for nature. Another interesting thing is that straying is greater in group 6 (7%) than in any other group. The amount of straying in all other groups combined was only 0,6%.

In spite of a small average size (14.0 cm.) the fin-clipped smolts showed a high return-rate of 6,8% almost twice as high as corresponding tagged smolts. This shows that the return-rate of untagged fish must be at least twice that of tagged fish, and possibly greater for fish in higher length groups since the return-rate of unmarked fish seems to be 3 - 4 times that of tagged fish in this experiment (see next paragraph).

The total return of salmon to the Fish Farm in 1973 was 1872 salmon until 1st of September. Of those 46 are kelts which is approximately 30% return from last years tagging. Of the remaining 1826 fish there are ca. 1600 returning as grilse. This is primarily the result of a release in 1972 of approximately 14.000 viable two-year-old smolts. This amounts to a total return of approximately 11%. Subtracting tagged fish from the total return of grilse gives ca. 1200 fish returning unmarked. This is the return from 6000 two-year-olds released amounting to approximately 20% return. A conservative estimate would be 17 - 20%.

4. The Length at Tagging versus Returns.

These data were set up like in the previous experiment using only returns of two-year old smolts and are shown in table 6.

The table shows that there is an increase in return-rates up to approximately 19 cm length. After that it tends to level off and even decline after a size of 21 cm. is reached. These findings are in good agreement with those shown by Carlin (1969) although his results levelled off at a much higher return-rate. These results further indicate that tagging with Carlin tags is not practical unless the fish are at least 14 cm. in average fork length.

A comparison of the results obtained by Carlin (1969), Guðjónsson (1972) and those from the present experiment is presented in graph 1. It is apparent that the results from 1971 and 1972 tagging experiments are quite a bit lower than Carlin's data and much lower than those of Guðjónsson. Since the 1971 and 1972 results are in fairly good agreement it is quite possible, that the returns from the 1969 tagging experiment presented by Guðjónsson are quite exceptional for Icelandic smolts.

The decrease of returns in smolts larger than 21 cm. is not easy to explain but it can be speculated that this is due to early sexual maturation

of the male smolt and a tendency to linger on in freshwater. This was indeed noticed at the Fish Farm in the fall of 1972.

References:

- Carlin Börje - 1963: "Laxforskningsinstitutet och dess Hittillsvarande Verksamhet, Laxforskningsinstitutets Laboratorium vid Älvkarleö", Svenska Vattenkraftsföreningens Publ. 502 (1963:10)
- Carlin Börje - 1969: "Salmon Tagging Experiments" Swedish Salmon Resurch Institute - Report, LFI Medd. 2-4/1969
- Guðjónsson Þór - 1967: "Salmon Culture in Iceland", ICES C.M. 1967/M:24
- Guðjónsson Þór - 1970: "The Releases and Returns of Tagged Salmon at Kollafjörður, Iceland", ICES C.M. 1970/M:6
- Guðjónsson Þór - 1972: "Smolt rearing Techniques, Stocking and Tagged adult salmon Recaptures in Iceland"
A paper presented at the International Atlantic Salmon Symposium in St. Andrews N.B. Canada.

Table 1. Groups Tagged in 1971 and Recaptures by Electric Fishing.

Group Number	Age of Smolt in Years	Number of Weeks in Outdoor Ponds	Number of Smolts Released	Number of Smolts Caught by Electric Fishing	% Caught by Electric Fishing
1	1	8	2261 (C)	299	13.2
2	1	10	6086 (F)	943	15.3
3	1	12	2989 (C)	440	14.7
4	2	0	448 (F)	55	12.3
5	2	10	583 (C)	58	9.9
6	2	35	2481 (C)	2	0.08
7	2	35	1294 (C)	2	0.15

C = Carlin Tag F = Finclipped

Table 2. Returns from 1971 Tagging Experiment

Group Number	Age of Smolt in Years	Number of Weeks in Outdoor Ponds	Number of Tagged Smolts Released	Mean Length of Tagged Smolts	R e t u r n s												
					1972 (after one Year)					1973 (after two Years)					Total Re- turns	%	Type of Tag
					K	O.P.	Total	K	O.P.	Total	K	O.P.	Total				
1	1	8	2261	14.8	3	1	4	3	0	3	0	0	7	0.31	Carlin Tag		
2	1	10	6086	13.2	13	0	13	Not Valid			13	0.21	Adipose clipped				
3	1	12	2989	14.5	9	0	9	1	0	1	0	0	10	0.33	Carlin Tag		
4	2	0	448	13.5	0	0	0	0	0	0	0	0	0	0.00	Fin-clipped		
5	2	10	583	13.5	2	0	2	1	0	1	0	3	0.51	Carlin Tag			
6	2	35	2481	15.0	91	7**	98	18	0	18	0	116	4.7	Carlin Tag			
7	2	35	1294	15.6	53	2	55	2	0	2	0	57	4.3	Carlin Tag			
Total 1+3 *	1	8-12	5250	-	12	1	13	4	0	4	0	17	0.32	Carlin Tag			
Total 6+7 *	2	35	3775	-	144	9	153	20	0	20	0	173	4.5	Carlin Tag			

* Carlin Tagged Only Excluding Experimental Controls and Fin-clipped.

** Two Recaptures off West-Greenland

Table 3. Recapture Rates for Various Length Groups of Two-year-old Smolts Tagged in 1971.

Fork length cm	Number Tagged	Number Recaptured	%
14.0(13,6-14,5)	1184	31	2,6
15,0(14,6-15,5)	1354	55	4,1
16,0(15,6-16,5)	681	27	4,0
17,0(16,6-17,5)	159	13	8,2
18,0(17,6-18,5)	58	6	10,3

Table 4. The Groups of Smolts Tagged in 1972.

Group Number	Age of Smolt in Years	Number of Smolts	Type of Tag	Type of Experi- ment
1	2	1998	Carlin Tag	Production Return-rate
2	2	1992	Carlin Tag	
3	2	629	Carlin Tag	
4	2	995	C. w/Wire	Type of Attachement
5	2	998	C. w/Polyethyl.	
6	2	1497	Carlin Tag	Photoperiod
7	1	970	Carlin Tag	
8	2	1000	Fin clipped left ventral	Finclip vs. Tag

Total 10.079

Table 5. Returns from 1972 Tagging Experiment

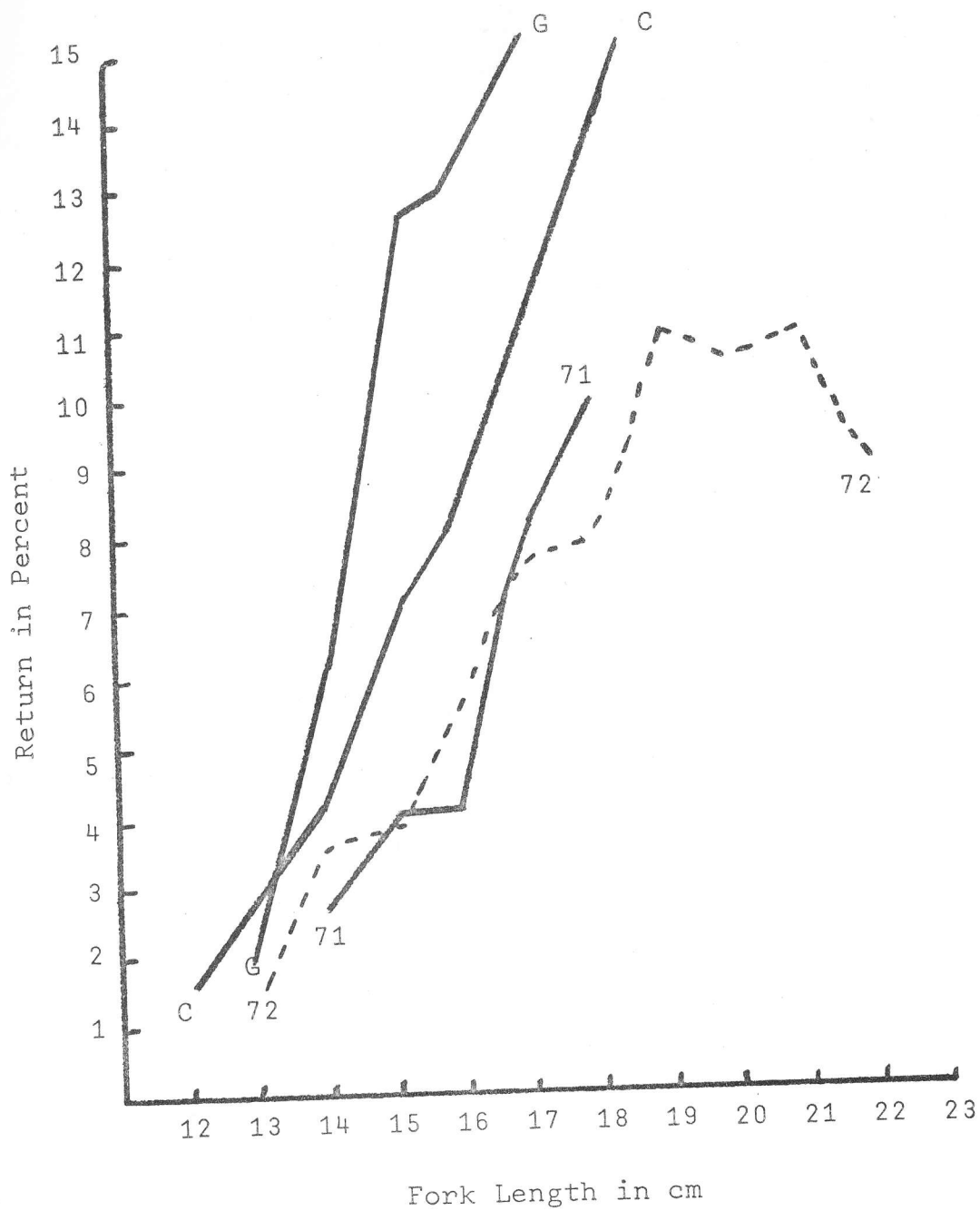
Group Number	Age of Smolt in Years	Number of Weeks in Outdoor Ponds	Number of Tagged Smolts Released	Mean Length of Tagged Smolts	R e t u r n s								Type of Experiment		
					1973 (after one Year)				1974 (after two Year)					Total Returns	
					K		O.P.		K		O.P.				Total ^{xxx}
					Total		Total		Total						
1	2	45	1998	14.2	72	1	73	-	-	-	73	3.6	Production Return-rate		
2	2	35	1992	16.8	137	0	137	-	-	-	137	6.8			
3	2	35	629	19.5	53	1	54	-	-	-	54	8.6			
4	2	35	995	14.6	45	0	45	-	-	-	45	4.5	Type of Attachment		
5	2	35	998	14.6	40	0	40	-	-	-	40	4.0			
6	2	0 ^x	1497	14.8	40	3	43	-	-	-	43	2.9	Photoperiod		
7	1	0 ^x	970	14.9	19	0	19	-	-	-	19	1.9			
8	2	35	1000	14.0	68	0	68	-	-	-	68	6.8	Fin clip Vs. Tag		
Tot. 1-5	2 ^{xx}		6612		347	2	349	-	-	-	349	5.3			

^x = Kept under Artificial Light for 35 Weeks
^{xx} = Excluding Fish in Photoperiod Experiment and Fin-clipped
^{xxx} = Data not available at the time of this report

Table 6. Recapture Rates for Various Length Groups of Two-year-old Smolts Tagged in 1972^x

Fork length cm	Number Tagged	Number Recaptured	%
13.0	643	9	1.4
14.0	2758	95	3.4
15.0	1832	69	3.8
16.0	890	51	5.7
17.0	760	55	7.2
18.0	593	47	7.9
19.0	300	33	11.0
20.0	162	17	10.5
21.0	92	10	10.9
22.0	45	4	8.9
23.0	21	3	14.3
24.0	6	0	0.0
25.0	3	0	0.0
Total	8105	393	4.8

^x = Including those in Photoperiod Experiment.



Graph 1. Comparison of Return-rates per Length Group from 4 Different Sources.

C = Carlin (1969)

G = Gudjonsson (1970)

71 = Tagging Experiment 1971

72 = Tagging Experiment 1972