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FACTEURS AFFECTANT L'ESTIMATION DE LA SURVIE DES SMOLTS FERRÉS  
DE L'ATLANTIQUE EN TANT QU'ADULTES RETOURNANTS

par

W.M. Shearer

Freshwater Fisheries Laboratory, Pitlochry, Ecosse.

Sommaire

On a procédé à un examen des prises de saumons et de griltes aux postes de prise au filet de Joseph Johnston and Sons Ltd pour les poissons ferrés et les poissons qui avaient perdu les fers des expériences portant sur l'étiquetage des saumons de 1 à 2 ans (smolts) dans la North Esk de 1968 à 1976. Les résultats ont montré que les changements affectant les membres de l'équipe de ferrage et l'endroit choisi pour la fixation du fer ont affecté le pourcentage de poissons ferrés revenant sans marqueur.

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FACTORS AFFECTING THE ESTIMATION OF THE SURVIVAL OF TAGGED ATLANTIC  
SALMON SMOLTS AS RETURNING ADULTS

by

W M Shearer

Freshwater Fisheries Laboratory, Pitlochry, Scotland

Summary

An examination was made of the catches of salmon and grilse at netting stations operated by Messrs Joseph Johnston and Sons Ltd for tagged fish, and fish which had lost tags from smolt tagging experiments in the River North Esk during the years 1968-1976. The results showed that changes in the members of the tagging team and the site of attachment of the tag affected the percentage of tagged fish which returned without tags.

Introduction

Details of the salmon smolt tagging experiments in the North Esk, near Montrose on the east coast of Scotland, including some of the results obtained for returning adults, have been given in an earlier report (CM 1975 M:13). This paper reports on the effects which changes in the composition of the tagging team, and slight alterations in the position of the tag, are believed to have had on the rate of recapture of Atlantic salmon tagged as wild smolts.

This work was only possible because most of the nets operated in the South Esk and on the coast between Aberdeen and Dundee, and all the nets fished in the North Esk, belong to Messrs Joseph Johnston and Sons Ltd., Montrose, and they have allowed their catch to be examined for tagged and untagged fish. This arrangement was particularly valuable since, in most years, between 85 and 95 per cent of all the tagged fish recovered were obtained from these fisheries.

Methods

Each spring from 1968 to 1976, wild smolts caught in traps situated just above the head of tide in the North Esk were tagged with the same type of tag before release.

The tag used was similar to the Canadian-type Carlin tag, and it was attached to the fish with polyethylene thread. In order to identify fish which had lost their tags, the adipose fin was removed from each fish before release. (This form of fin-clipping was not used elsewhere in Scotland). The results from earlier experiments involving the tagging and recapture of large numbers of smolts from the North Esk had shown that the adipose fin was naturally absent from less than 0.01 per cent of the fish tagged, and no regeneration of this fin was visible up to four years after its removal.

Before tagging commenced each fish was placed in a bucket containing a 40 ppm solution of MS 222 (Sandoz). When completely immobilised it was lifted out by the first member of the four-man tagging team, and placed horizontally in a 180 mm length of rubber tubing of 25 mm bore from which the top half had been cut away. This supported the fish and left both hands of the operator free to attach

the tag. The operator first pushed simultaneously two 25 x 1.1 mm syringe needles, set 10 mm apart in a holder, through the fish at precisely the desired place, and secondly supported the needles while the free ends of the threads attached to the tag were fed into them. The needles were then pulled back through the musculature of the fish, which was passed to the second member of the team, who secured the tag in position by tying the two pieces of thread together with a knot which would not slip. The third member of the team measured the fish, and if required removed a sample of scales, after removing any excess attaching thread and the adipose fin. All the data collected were recorded by the fourth member of the team, who also regulated the flow of fish between team members.

During the period between 1968 and 1974 the members of the tagging team were unchanged apart from the clerk. In 1975 and 1976 two temporary members of staff, with no prior experience of fish tagging, were drafted into the team. Since 1974, a fifth member was added to the tagging team, to anaesthetise and weigh each smolt.

The position of the tag, 10 mm below the middle of the dorsal fin, remained the same in 1968 and 1969 but, because of complaints from the netsmen about the damage the tag was causing to the fish, the site of attachment was raised some 5 mm in 1970, and this position remained unchanged until 1974. In that year the site of attachment of the tag was altered to the anterior end of the dorsal fin, one thread being inserted at the base of the dorsal fin, between the second and third fin rays, and the other through the musculature in front of the fin. This was an attempt to eliminate the small amount of tag damage which still occurred. In 1975 and 1976 the site of attachment reverted to that used from 1970 to 1973, ie 5 mm below the middle of the dorsal fin.

Each day during the fishing season the recaptures (with and without tags) which had been identified by the netsmen and the fish-house staff of Messrs Joseph Johnston and Sons Ltd., were examined, and a check made of the remaining fish in the fish-house for any tagged fish which might have passed through undetected. Details of the length, weight, sex and tag number (if a tag was present) were recorded for each fish which had been tagged as a smolt, together with a sample of scales and a description of the tag wound.

## Results

Table 1 summarises the total number for each year of recaptures caught in the nets operated by Messrs Joseph Johnston and Sons Ltd., and the proportions of grilse and salmon recaptured with and without tags, expressed as percentages of the respective totals of grilse and salmon recaptured.

Since no tags were returned by firms supplied with grilse or salmon by Messrs Joseph Johnston and Sons Ltd., it can be assumed that few if any tagged fish had passed unnoticed through the system of checks operated in the fish-house at Montrose.

The percentage of adult fish recovered from each smolt tagging experiment with the tag still intact ranged from 21 to 92 per cent, but within each group of experiments (1968-69 and 1970-73) when both the members of the tagging team and the site of attachment of the tag remained the same, the annual variation in the percentage tag loss was considerably less, varying from 29 to 30 per cent in the first group of experiments and 8 to 16 per cent in the second group.

Although the three changes in the site of attachment of the tag were all relatively minor they produced marked differences in the percentage of tagged fish caught without tags, even when these tags had been attached by the same tagging team. However the raising of the site of attachment of the tag eliminated most of the wounding.

The most significant change in the percentage of tagged fish caught without tags occurred when temporary staff with no prior experience of tagging were drafted into the tagging team. This change brought about an approximately eight-fold increase in the amount of tag loss (1975 tagging).

Although some tags were removed by the net when the fish were caught it appeared, from a detailed external examination of the area around the site where the tag had been inserted, that the greatest loss of tags occurred within a relatively short time of the smolts entering salt water. This result was deduced on the assumption that if a tag was lost soon after the fish had entered salt water the tag wound would have healed, merely leaving a scar in the interval between the time of loss and recapture, while if the loss occurred when the fish was captured the damage to the tissue would appear fresh and there would be no scar tissue. The fact that in most years the percentage tag loss between the grilse and salmon stages was smaller than the loss between the smolt and grilse stages tended to confirm that the greatest tag loss possibly occurred before the grilse stage was attained (18% compared with 26% in 1968 and 2% compared with 28% in 1969).

### Discussion

Since the comparison between annual results is an essential part of many smolt tagging experiments, the results obtained from experiments such as those described in this paper indicate the necessity for standardising not only the site of attachment of the smolt tag, but also the way each member of the tagging team undertakes his task. While the latter can best be achieved by keeping a team together for the duration of a particular experiment, the former is much more difficult to achieve when large numbers (10 000 or more) salmon smolts are being tagged during a three to four week period. It was found that the most satisfactory result, measured in terms of reproductibility, was obtained when the same person attached the tag to all the smolts.

In 1975 it appeared that much of the tag loss was the direct result of the tag having been attached to the smolt too tightly, so that when the fish began to grow rapidly in the sea the size of the loop of thread through the fish was too small to prevent it being torn out. Although the spacing which must be left between the two knots on either side of the fish can be shown to the operator it is only with experience that this spacing can be determined without the necessity to measure each one. Tagging smolts can be a monotonous task, especially for the person who has no interest in the final result of the tagging experiment, and this leads to a deterioration in performance. This means that although casual labour may be an attractive proposition when considering the staffing of a smolt tagging experiment the results obtained may be of little value.

Although it is not difficult to add a second means of identification when the smolt is being tagged, it is most unlikely that fishermen will have the time, interest or ability to search for and recognise, for example, a fin clip. Thus real differences in the measure of the survival of Atlantic salmon smolts in the sea based on the results from smolt tagging experiments can be completely masked by factors such as those caused by chances both in the efficiency of the individual members of the tagging team and in the positioning of the tag.

### Acknowledgements

Grateful acknowledgements must be expressed to Messrs Joseph Johnston and Sons Ltd., Montrose for permission to examine their catch and for their keen interest in the progress of this work.

TABLE 1

<u>Year Tagged</u>	<u>Total Number of Recaptures</u>	<u>Percentage of Recaptures</u>						<u>Tag Position</u>
		<u>With Tags</u>			<u>Without Tags</u>			
		<u>Grilse</u>	<u>Salmon</u>	<u>Total</u>	<u>Grilse</u>	<u>Salmon</u>	<u>Total</u>	
1968	127	74	56	70	26	44	30	10mm below dorsal fin
1969	35	72	70	71	28	30	29	10mm below dorsal fin
1970	252	92	87	90	8	13	10	5mm below dorsal fin
1971	467	94	87	92	6	13	8	5mm below dorsal fin
1972	499	94	85	92	6	15	8	5mm below dorsal fin
1973	862	85	82	84	15	18	16	5mm below dorsal fin
1974	601	52	54	52	48	46	48	Anterior end of dorsal fin
1975	166 <sup>a</sup>	23	15	21	77	85	79	5mm below dorsal fin
1976	168 <sup>a</sup>	64			36			

<sup>a</sup> up to and including 20 July 1977