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The Performance of Darkened Silver Tags on
Atlantic Salmon Smolts



by

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The tagging of salmon smolts at a counting fence situated near the upper limit of tidal influence on the River Axe, Devon, has provided information since 1960 on the percentage returns of different adult age classes: but due to escapement during periods of flooding, this information has rarely been complete. Moreover, each year a varying number of unmarked adults are captured at the trap and it has not yet been possible to show if these fish are produced from native smolts which had escaped tagging or if they were wanderers from other rivers or a combination of both. Therefore an analysis of the effect of tagging on either short or longer term viability of smolts is precluded and the returns here are only used to demonstrate the efficiency of a tag which has been used on juvenile salmon since 1911. Since 1961, the percentage of tag returns from a particular smolt run has varied from 1.1 to 2.4. Combined returns of both tagged fish and fish that had lost their tags but identified by fin clips varied between 1.65 and 3.06 per cent. Prior to 1963 smolts were tagged without the use of anaesthetic but there has been no significant increase in returns since MS 222 was used. The data discussed are based on returns of marked fish from the smolt runs of 1963 to 1967 for which years identical tagging procedure was combined with a simultaneous fin clip thus permitting the determination of the extent of tag loss in the different age classes.

Description of Tag

The tag consisted of a serially numbered diamond-shaped silver plate (0.33mm thick) with diagonals of 8mm and 7mm. Two holes (0.5mm diameter) were punched in each corner of the longer diagonal, through which was threaded the annealed silver wire (0.38mm diameter up to 1966 but 0.48mm diameter afterwards) by which the attachment was made. Before use the completed batches of tags on their wires were treated with potassium sulphide solution to darken the silver.

Method of Application

Each individual tag was attached by threading one end of the wire into a hypodermic needle (No.19 gauge) inserted through the flesh of an anaesthetised smolt (MS 222 at 50 ppm) just below the intercept of the first and second dorsal fin rays. On withdrawal of the needle the tag was lightly held in position across the front of the dorsal fin by twisting the wires together several times. The ends were then clipped short (to 3 or 4 twists) and turned backwards along the flank of the smolt. Finally, the adipose fin was clipped off and the fish placed in a recovery box with an open channel to the river.

It was found that an operator with little previous experience but with someone recording could measure, tag, fin clip and take scale samples from every tenth smolt at the rate of 100 per hour for sustained periods. Rates of 140 to 150 per hour have been achieved by skilled taggers.

Results

Examination of returning adults revealed that very little regeneration of the adipose fin occurs after a total clip. For the period under consideration there was no recapture at the trapping installation of a tagged adult salmon, which did not have an adipose fin clip. The tags were normally lying tight against the body of the fish as the result of growth and in a few cases the tag had become buried in the gristle at the front of the dorsal fin and could not be removed without leaving an open wound. In many cases a tag on an adult salmon could be easily overlooked by a casual observer and often its presence could only be detected by the presence of a swelling at the front of the dorsal fin. This, coupled with the lack of forwarding instructions on the tag means that except at the counting fence many may be overlooked or not returned.

TABLE I
Number of Adult Salmon Recaptures at the Counting Fence
Tabulated According to Marine Age Class and Year of Tagging

		YEAR OF TAGGING				
		1963	1964	1965	1966	1967
Number of Smolts Tagged		2854	2896	5873	3219	4118
Average size of smolts tagged	(cms)	15.4	15.4	15.8	16.2	16.3
Mark on Return	Age Class					
Tag and adipose fin clip	Grilse	8 (1)	14(1)	39(4)	28(1)	25(2)
	2 S-W	11(2)	37(4)	61(3)	33(1)	54(10) ^b
	3 S-W	6 (1)	7a(3)	2(1)	1	7(1)
Adipose fin clip only	Grilse	10	10a	9	11a	8
	2 S-W	6a	13	17b	11a	20
	3 S-W	3a	0	3	2a	3a

a. One fish included in each of these categories on basis of fork length alone.

b. Two fish in this category on basis of fork length alone.

() Number of ingrown tags included in category total.

The numbers of adults in the 3 sea winter age class shown in Table I are very few and have been pooled with the 2 year olds in that Table to produce Table II which shows the percentage of adult returns retaining tags.

TABLE II

Percentage of Adult Returns Retaining Tags

AGE CLASS	YEAR OF TAGGING				
	1963	1964	1965	1966	1967
Grilse	44.4	56.5	81.6	71.8	75.8
2 and 3	65.4	77.2	75.9	72.3	72.7

An analysis of Variance on the data shown in Table II indicated that the tagging efficiency varied from season to season but there was no significant difference when considering the age class of the returning adults.

TABLE III

Fork Length (cm) of Upstream Migrants Carrying Tags, those which Shed their Tags and those Unmarked

Year of tagging	Mark on recapture	Adult Age Class (Sea-Winters)								
		1			2			3		
		No.	mean	S.D.	No.	mean	S.D.	No.	Mean	S.D.
1963	Tagged	8	64.3	5.39	11	76.0	6.01	6	86.3	4.49
	Clipped only	10	59.5	5.56	5	72.1	8.31	2*	85.5	0.71
	Unmarked	33	63.6	5.01	74	75.9	4.29	20	85.2	8.53
1964	Tagged	14	63.1	4.45	37	75.5	4.29	6*	86.8	4.19
	Clipped only	9*	64.8	2.47	13	76.0	3.95	0	-	-
	Unmarked	59	64.7	3.98	95	76.1	3.87	22	85.0	4.06
1965	Tagged	38**	66.0	4.12	61	75.3	3.84	2	86.8	1.06
	Clipped only	9	62.3	2.32	15*	74.8	3.84	3	86.8	6.93
	Unmarked	50	64.3	4.08	91	74.8	4.01	13	87.5	3.60
1966	Tagged	28	65.4	4.66	33	76.2	3.07	1	91	-
	Clipped only	10*	66.0	4.36	10	74.4	5.38	1*	76.5	-
	Unmarked	102	65.4	3.28	77	77.1	3.82	8	84.5	3.32
1967	Tagged	25	62.3	4.23	49*	74.5	4.56	7	88.4	1.91
	Clipped only	8	62.4	3.41	21	75.8	4.39	2*	82.0	2.00
	Unmarked	13	62.5	4.39	23	74.5	4.62	2	80.3	3.25

* Figures do not coincide with Table I due to omission of fish whose fork length only is known.

** one unmeasured.

Table III shows the average size of adults on return. Clearly, there are no significant differences between the ultimate sizes of marked and unmarked upstream migrants. Since the origin of the unmarked fish is unknown it cannot be definitely stated that tagging with the darkened silver tag has no effect on growth.

Discussion

It is generally known that two basic requirements of a smolt tag are:-

1. That it should not affect the behaviour and survival of the smolt to which it is attached.
2. That it should be clearly visible on the adult. These two requirements are, unfortunately, virtually incompatible. However, with reference to the River Axe experiment Requirement (2) is not of prime importance since all the returning adults are anaesthetised and examined carefully for tags by experienced Ministry Staff. In this particular experiment, therefore it has been possible to utilise this small dark coloured tag which might not be so successful in other areas. From an Analysis of Variance on the data in Table II, it seems that in the earlier years, tagging was less efficient than in later years.

It is difficult to account for this since the tagging procedure has remained unaltered over the whole period and the change in wire thickness took place in 1966. The most likely explanation seems to be that in 1963 and 1964, unlike later years, a number of part-time workers were employed as taggers and it is thought that their efficiency of tag attachment may have been less than that of the permanent staff. However, a more important feature of the investigations is the fact that tag loss appears to be substantially the same irrespective of age class. Assuming that the behaviour of grilse and older fish in the sea is similar, it would appear that the majority of the tags were lost in the first few months at sea and that the additional year and additional 2 years spent in the sea by the 2 and 3 sea-winter fish, respectively, do not lead to any further significant tag loss beyond that incurred in the first year at sea. Furthermore, since the variance appears to be substantially no different from that expected from the binomial distribution, the tag loss, pooled for age classes, may be used to obtain a close estimate of the total number of marked fish recaptured in areas, other than the counting fence, from which only information concerning tagged fish has been received.

Summary

- (i) No comment can be made on the effect of tagging with the darkened silver tag on the immediate or long-term viability of salmon smolts in the sea.
- (ii) It cannot be shown that tagging has an effect on growth; but if it exists it is thought to be small.
- (iii) Tag loss is substantially identical for grilse and older fish suggesting that tags are chiefly shed during the first few months at sea.
- (iv) Tag loss may vary from tagging year to tagging year due to unknown factors.
- (v) The tag is not conspicuous on smolts.
- (vi) Returns from fishermen may be reduced by poor visual impact and the lack of instructions on the tag.