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Studies on the possible influence of early maturity on grilse  
frequency by means of tagging experiments in the river Lule

by

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During the last 25 years the grilse frequency in the Swedish east coast salmon rivers has been high after a marked increase in the first years of that period. The mean rate in the tagging experiments with hatchery-reared smolts of the Baltic stock is 45 % grilse of the total recaptures of spawning migrators (1954 - 1967, years of smolt release). That figures is too low as grilse are not caught as efficiently as salmon with some gears used in the rivers. The variation in grilse frequency is shown in figure 1. The high grilse-salmon ratio is mainly the effect of the heavy exploitation in the Baltic as the pre-grilse are too small to be caught in that fishery but occasionally. There are however some indications of wild smolts not producing as many grilse as to hatchery-reared ones. The possible effects of the hatchery-rearing in this regard are subject to investigations in Sweden. Three factors are studied: the heretage factor, which has been shown by Piggins (1974) to be of importance, the smolt size as indicative of growth rate (Eklund 1965; Ritter 1972) and pre-smolt maturity, which will be dealt with in this paper.

Grilse of the Baltic stock are predominantly males. Peterson (1967) found that 99,5 % of the grilse in river Indal were males. An increasing rate of maturity in two summer old male parr has been observed in the Swedish hatcheries for several years and it has been suggested that this fact might have some implication on the grilse frequency.

Smolt to be released in river Lule has since 1967 been tagged in late autumn as two summer old parr to make it possible to distinguish the mature males and release them as separate groups.

In table 1 the number of smolts released, number and % of mature males and tag return rates are summarized for four years. Early mature males are as an average 25,8 % of the total material and as the sex-ratio in hatchery reared two year old smolts is close to 50:50 (Eklund, 1965) that means 51,6 % of the total number of males compared to an estimate of 50 % found by Österdahl (1969) in a natural salmon stock.

Table 1. Number of smolts released in tagging experiments 1967 - 1970, number and percentage from group 1 and total recapture rates for group 1 and 2. Group 1: male smolts mature as parr. Group 2: smolts not mature as parr.

Year of release	Number of smolts released			Tag return rate %	
	Total	Group 1	%	Group 1	Group 2
1967	43800	13000	29,7	10,7	10,7
1968	17630	3700	21,0	5,6	8,0
1969	21000	5100	24,2	7,9	10,4
1970	21160	4936	23,3	9,1	9,3
Total and weighted means	103590	86736	25,8	8,9	9,6

The grilse frequency in river Lule is comparatively low so there are only 3,3 % grilse of the total number of recaptures. This makes it impossible to make any more detailed analyses and even from the whole smolt year-class 1968 the number of grilse is very small.

In table 2 is shown the proportion of males that were mature at tagging (assuming a sex-ratio of 50:50) and grilse recaptures. The average grilse percentage for the four years is 53,8. This figure is very close to the mean percentage of males being sexually mature as parr, 51,6 %.

Table 2. Percentage of the males mature at tagging and grilse recaptures.

Year of release	Percentage males mature at tagging	Grilse recaptures		
		Total number	Number from group 1	% from group 1
1967	58,2	176	108	61,4
1968	42,0	17	9	52,9
1969	48,4	75	32	42,7
1970	46,6	65	30	46,2
Total and weighted means	51,6	333	179	53,8

The grilse proportion figures are assuming no females from the group of not mature smolts. Unfortunately several recapture reports does not give information on sex and some sex determinations might be uncertain but no one grilse is reported as being a female in the tagging experiments in question. Applying the sex-ratio in grilse obtained in river Indal to this material one or two of the 333 grilse might have been females. With two females the grilse percentage should be changed from 53,8 to 54,1 %. Size distribution is equal for mature and not mature male smolts so that factor should not bias the results.

The mortality between smolt release and grilse age might be some what higher for the mature male parr. Recaptures during the first summer after release indicate that those males tend to stay in the river for a longer time than do the males that are not mature. Those staying in the river grow slowly and are subjected to heavy predation. This possible difference in mortality must however be of minor importance as the total recapture percentage are almost equal (Table 1). In the 1967 tagging experiments the total recapture percentages are identical and the distribution on different areas can be seen in table 3.

Table 3. Distribution of total recaptures in river and at coast (spawning migrators), Bothnian Sea and the Baltic proper from tagged smolt released 1967.

Group	Percent of total recaptures		
	in rivers and at coast	in Bothnian sea	Baltic
smolt not mature as parr	7,5	11,0	81,5
male smolt mature as parr	12,5	15,5	72,0

The higher percentage of spawning migrators from the male smolt mature as parr is entirely caused by the grilse proportion. The proportions of older spawners are then the same for both groups.

The so far obtained results are not very conclusive but indicate that parr maturity is a grilse producing factor of minor importance in comparison with heredity and invironment. The kind of tagging experiments are still going on and are now also including one river with a higher grilse frequency than river Lule so more information will soon be available.

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Figure 1. Percentage distribution of age of salmon spawning migrators according to tagging experiments in the Baltic. Gliding 5-years means.

