

**DOES ASSOCIATING WITH KIN AFFECT GROWTH
OF JUVENILE ATLANTIC SALMON IN THE WILD?**

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Introduction

The factors that determine growth of individual fish have been extensively studied, but the influence of social structure on growth is poorly understood. Laboratory experiments have shown that juvenile salmon use the water-borne chemical cues of conspecifics (hereafter termed ‘odours’) to recognise their relatives, and are less aggressive when they associate with kin. The implication of these results is that growth should be faster for individuals in groups where fish are closely related because kin use less energy for aggressive territory defence. Data collected in a recirculating laboratory stream tank confirmed this prediction (Brown & Brown 1993). However, rivers differ markedly in character from laboratory aquaria because there is little recirculation of water. Here we first test whether water recirculation influences kin-biased territorial interactions, and second, we describe a field study designed to test directly whether growth of wild fish in the wild is influenced by kinship.

Methodology

1. Does recirculation influence aggression?

We tested pairs of fish from two categories: those that were reared apart and were related to one another and those that were reared apart but were unrelated to one another. Each category of fish was tested under recirculating water-flow conditions, where fish were continuously exposed to water that had passed them many times before, and under through-flow conditions, where water ran to waste after having passed through the aquarium only once.

2. Does kinship affect growth of salmon in the wild?

Juvenile salmon were released in early summer into c. 50m² sections of a tributary of the River Conon in North Scotland, UK, either in single family groups (n = 8), or in mixed relatedness groups of eight families (n = 8). The fish were resampled four months later using quantitative electric-fishing techniques.

Results

1. Does recirculation influence aggression?

Levels of aggression were similar between pairs of kin and pairs of non-kin when there was negligible recirculation of water. However, when water was recirculated, pairs of nonkin were on average 1.56 times more aggressive than pairs of kin (Griffiths & Armstrong 2000, Fig. 1).

2. Does kinship affect growth of salmon in the wild?

Growth rates were similar between kin and mixed groups (Fig. 2).

Discussion

The results of the first experiment suggest that concentration of odours influences aggressive behaviour of juvenile Atlantic salmon. Differences in growth between groups of kin and mixed relatedness salmon observed in laboratory stream-tanks may therefore be much greater than expected for fish in

the wild. The results of the second experiment confirm this prediction. It seems that in natural riffle conditions where there is little recirculation of water, growth rates of juvenile Atlantic salmon do not differ between groups of mixed relatedness and full siblings (kin).

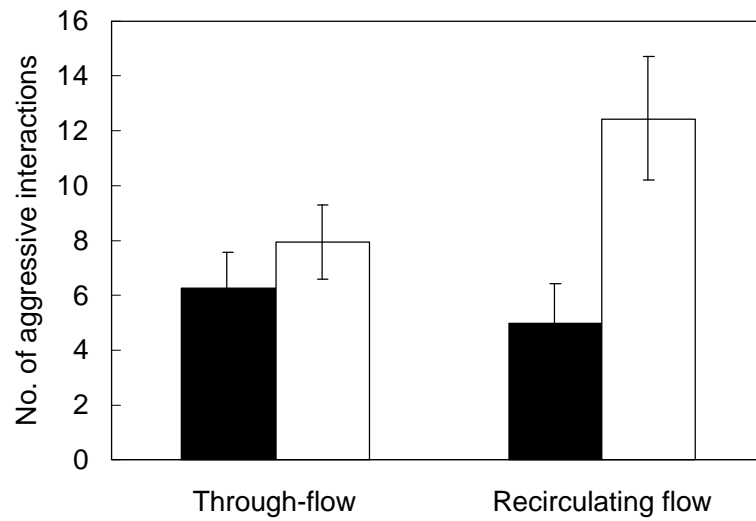


Figure 1. The total number of aggressive interactions of wild juvenile Atlantic salmon when paired with kin (■) or non kin (□) . Water flowed continuously either in a through-flow ($N=5$ kin, $N=6$ non kin) or in a recirculating flow ($N=5$ kin, $N=6$ non kin). In all cases means \pm S.E. per 10min are given.

Figure 2. The percent weight increase per day of groups of kin (■) and mixed relatedness (●) Atlantic salmon. In all cases means ($n=8$) \pm S.E. are given.

References

- Brown, G.E. and J.A. Brown. 1993. Do kin always make better neighbours?: the effects of territory quality. *Behav. Ecol. Sociobiol.* 33: 225-231.
- Griffiths, S.W. and J.D. Armstrong. 2000. Differential responses of kin and nonkin salmon to patterns of water flow: does recirculation influence aggression? *Anim. Behav.* 59: In Press.

