INFLUENCE OF MALE PARENTAL IDENTITY

ON THE GROWTH AND SURVIVAL OF OFFSPRING

IN ATLANTIC SALMON (*SALMO SALAR* L.)

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Introduction

Atlantic salmon show a great variability in size and age at which individuals reach sexual maturity. In males, two distinct classes are clearly defined: 1) anadromous males are large individuals which fight for access to females, 2) precocious parr are small sexually mature males which sneak fertilizations (reviewed in Fleming, 1996). It is hypothesized that these two phenotypes represent alternative tactics within the conditional strategy theoretical framework (see Gross, 1996). In this framework inheritance of growth rate is proposed to be an important factor contributing to the development of precocity. However, it is known that environmental and behavioral factors present immediately after emergence can influence growth of juvenile fish (Thorpe et al., 1983). Therefore, the main objective of this study was to determine if there is an influence of male reproductive phenotype on the development of offspring in Atlantic salmon. In order to isolate the influence of parental identity from exogenous factors, the growth and survival of Atlantic salmon offspring fathered by precocious and anadromous fish were recorded during the yolk-sac stage prior to emergence. We tested the hypothesis that there is a significant difference in growth rate and survival during the first early-life history stages between the two groups. We also aimed to determine if the relationship between fish and otolith size is the same between the two groups from hatching to emergence. Specifically, we established for each group: i) the age and size at hatching (from otolith measurements) and ii) the age and size at emergence. We then tested the hypothesis that alevins fathered by precocious males hatch earlier, grow faster, and emerge at larger sizes than do alevins fathered by anadromous males, thus increasing the probability of precocious maturity.

Methods

Fish from the Sainte-Marguerite River (48°20′N, 70°00′W), Québec, Canada, were used in this experiment. Eggs from a single anadromous female salmon were fertilized using sperm from both anadromous and precocious male phenotypes. Crosses were performed as follows: batch #1) sperm from two precocious parr and ¼ of female eggs (approximately 2000 eggs/batch), batch #2) replicate of #1 but with two different precocious males, batch #3) sperm from two anadromous males and ¼ of female eggs and batch #4) replicate of #3 with two different anadromous males. These eggs were then transferred to an egg incubator located on the river. At hatching, 90 eggs of each batch were transferred to individual cages in which they were filmed every two days (two batches - one of each parental identity - per day) until emergence in order to monitor the growth and survival rate of each family. Data from video monitoring were analysed with an image analyser which allowed us to determine length and daily growth rate of each alevin as described in Meekan et al. (1998). As we closely missed the hatching of eggs we used ototliths of these fish to establish their age at hatching. We also used microsatellites loci to discriminate the proportion of progeny fathered by each salmon in each batch. We then used a mixed-model analysis of variance (ANOVA) to detect differences in growth rate, age and size at hatching, age and size at emergence for each group. This test takes into account interdependency of samples since all fry shared the same mother.

Results and Conclusion

Analysis of these data are still in progress at this time. Preliminary results from the analysis of growth and development of precocious parr and anadromous offspring showed that precocious offspring from batch # 1 were significantly bigger than any other groups on the first day of observation. However there were no other significant statistical differences between the two groups as shown in figure 1. Total mortality from hatching to emergence was also higher in anadromous (32.2%) than in precocious (25.0%) alevins, even if this difference was not significant (P = 0.274). A more exhaustive analysis concerning the precise date of hatching for each fish will be required in order to clearly compare each "cohort" separately. Also, genetic data will allow us to compare the contribution of each father separately. This will be discussed in more detail during the oral presentation as will the implications of growth variation for our understanding of alternative reproductive tactics.

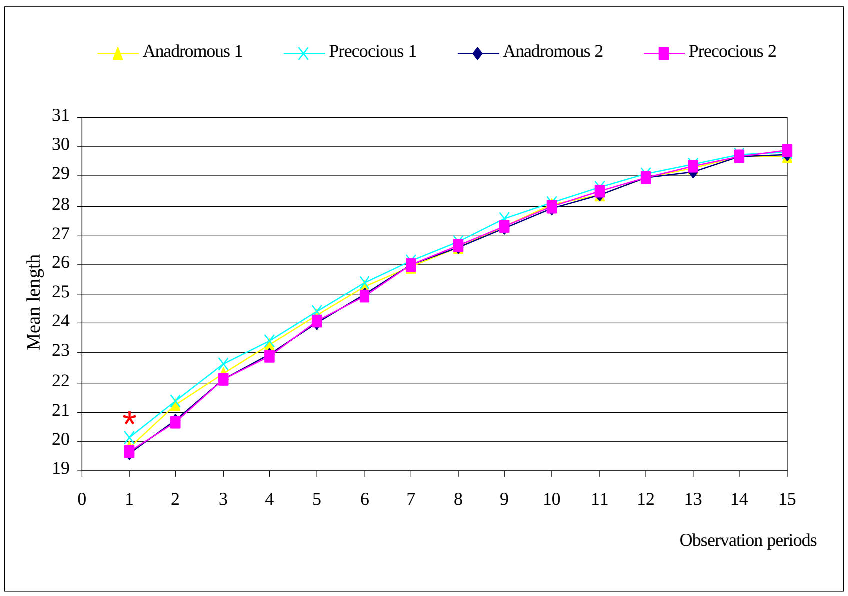

Figure 1. Mean length at each observation period for anadromous and precocious offspring

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