# FAMILY-PLOIDY INTERACTIONS DURING FRESHWATER GROW OUT AND SMOLTIFICATION IN ATLANTIC SALMON

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## Introduction

The use of sterile triploid Atlantic salmon (*Salmo salar*) in aquaculture has been considered as a possible strategy to reduce genetic interaction between escaped farmed and wild salmon. However, previous studies have indicated that triploid salmon show varying survival, growth performance and deformity prevalence compared to diploids. In this respect, studies recommend the need for selection programs for successful triploid production in salmonids, particularly since triploids often show greater performance variability both within and between families. The aim of the study was therefore to examine the effect of family on production performance in diploid and triploid Atlantic salmon during freshwater grow out and determine suitable genotypes for triploid production.

## Material and Methods

In Dec 2008, eight full-sib families of Atlantic salmon were created from newly fertilised eggs, with one half of each batch subjected to hydrostatic pressure shock (triploid) and the other left untreated (diploid). Family-ploidy groups were incubated separately and reared until mid-Aug. On 17$^{th}$ Aug 2009 eight x 2m$^3$ tanks were stocked with 60 fish / family / ploidy, producing a quadruplicate design (4 tanks/ploidy, n=480/tank). All fish were individually PIT tagged, with 30 individuals / family / tank adipose fin clipped for growth monitoring. The remaining 30 adipose intact individuals / family were retained to be culled periodically for tissue sampling. Fish were exposed to constant light (LL) until 7$^{th}$ Sept where they were then subjected to LD 10:14 for 8 weeks then returned to LL until smolting (mid-Jan 2010). Fish were sampled before the start of LD 10:14, end of LD 10:14, mid-point of LL (~200°days) and a final sample prior to seawater transfer (~400°days, SWT). On each sampling date the 30 adipose fin-clipped fish / family were measured for weight-length, smolt index and visible deformity. Within the culled fish, 5 individuals were culled per tank / family for collection of blood (GH-IGF-I), gill biopsy ($Na^+K^+$-ATPase), and tissues (liver and gill). Prior to seawater transfer (SWT), 20 individuals / family were x-ray radio-graphed for examination of vertebral deformity.

## Results

Mean survival to hatch was not significantly different between ploidy (77.3±6.0%), but did differ significantly between families. Egg quality was identified as a significant contributer to incubation mortality. Subsequent mortality during grow out until SWT was 1.1±0.2% and 1.3±0.3% for diploid and triploid respectively. Results also showed that visible deformity prevalence was generally low in both ploidy during freshwater grow out but did differ according to family.

Weight was not significantly affected by ploidy, but there was a significant interaction ($p<0.0001$) with family (Fig A). Triploids did consistently exhibit a significantly lower condition factor than diploids. Although weight did not differ between ploidy within a given family, smoltification was significantly affected by ploidy. Triploids smolted

significantly earlier than diploids, as indicated by smolt index and ATPase levels. Examination of the family by ploidy interaction on growth showed that family performance did not rank consistently between the diploid and triploid states.

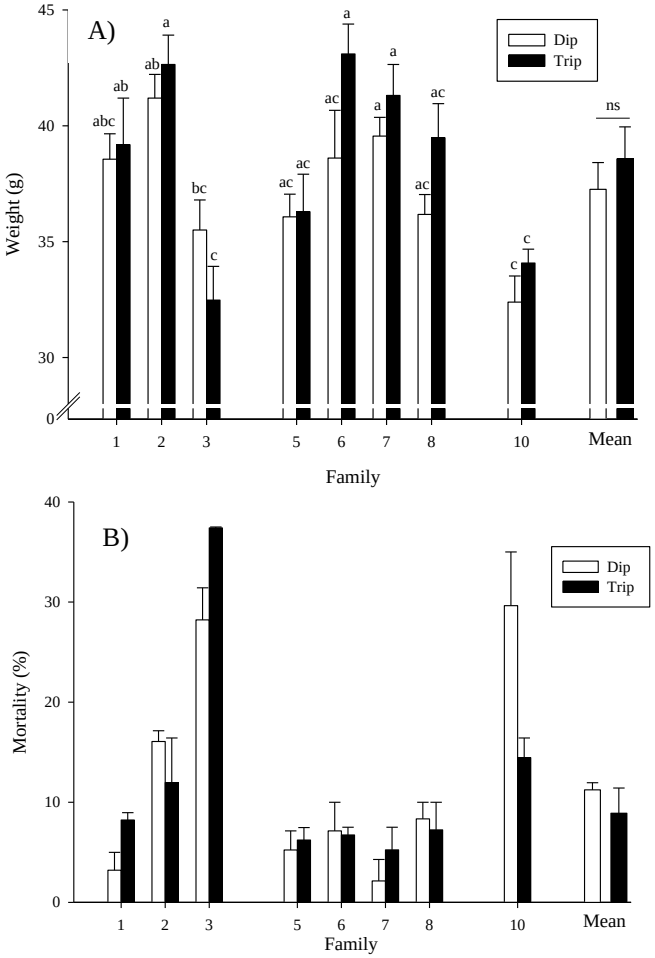


Fig. **A**) Family by ploidy differences in weight at time of SWT in diploid and triploid smolts. **B**) Percentage contribution of families to post-SWT mortality.

Total mortality on SWT was 11.2% and 8.9% for diploid and triploid respectively. However, family significantly affected SWT mortality, with two families in both ploidy accounting for the greatest percentage of the total mortality (Fig B). SWT mortality correlated strongly with smolt index.

**Discussion**

Results are promising for the salmon industry as triploids generally grew faster, had comparable survival, equivalent deformity rates and faster smoltification rate than diploids, although this was affected by family. As family performance did not rank consistently between the diploid and triploid states this indicates that differential selection criteria may be required in order to optimize parental selection for triploid production. Further, differential smolting rates between ploidy also indicate the existence of ploidy specific thresholds for smoltification. Overall, with correct culture conditions and correct choice of parentage the full growth potential of triploids may be maximised

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