THE EFFECT OF VACCINATION AND DIETARY P ON PERFORMANCE OF TRIPLOID AND DIPLOID ATLANTIC SALMON

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Introduction

Triploid Atlantic salmon are sterile. Hence, hybridization between escaped triploid farmed salmon and wild diploid salmon will not occur. In spite of this advantage, there has been some reluctance to adopt triploid salmon production in the salmon industry. This is based on a fear of reduced consumer acceptance, reports of higher early mortality, and a higher prevalence of skeletal deformities in the jaw and opercula in triploids. The occurrence of vertebral deformities, has, however, not been studied in triploid salmon.
Suboptimal dietary P during the early seawater phase (Fjelldal et al., 2009) and vaccination (Berg et al., 2006) are known risk-factors for vertebral deformities in farmed diploid salmon. The aim of the present study was to study the impact of vaccination and dietary P on the occurrence of skeletal deformities in diploid and triploid Atlantic salmon.

Material and Methods

In Dec 2007, three full-sibling families of Atlantic salmon were fertilized, and then subsequently each family were split in two; one batch subjected to hydrostatic pressure (triploid) and one batch as untreated control (diploid). The family ploidy groups were reared in separate tanks until vaccination (Sept 2008), when they were mixed and half of each ploidy group vaccinated. The fish were transferred to seawater (6 cages) as underyearling smolts in Oct 2008, with each ploidy – vaccine group present in each (individually marked fish) cage. During the first three months in seawater, triplicate cages were fed diets with 0.6 or 0.9% available P. Thereafter all cages were fed a commercial diet. The experiment was terminated in Dec 2009.

Results

The mortality was higher among triploids than diploids until the eye-egged stage, thereafter the mortality was low and equal between groups. Triploids grew faster than diploids and were significantly biggest both at sea transfer and harvest, and also had a significantly lower condition factor. Vaccination reduced growth in both diploids and triploids, resulting in significantly bigger unvaccinated than vaccinated fish in both ploidies. Dietary P did not affect growth.
Triploids had a significant higher prevalence of vertebral deformities both at sea transfer (x-ray) and harvest (palpation). The most common deformity was a shortening of the vertebral column beneath the dorsal fin, with vertebra number 24 as the most often affected vertebrae (Fig. 1 A,B). At sea transfer 7.6% of the triploids had a deformity in this particular vertebra. Vaccination and dietary P did not affect the prevalence of deformities in the present study. The occurrence of fish classified as spinally deformed during palpation at harvest (n = 3600; 450 per ploidy vaccine dietary group) varied between 6.2 and 8.4% among the triploid vaccine dietary groups, and between 0.4 and 1.2% among the diploid vaccine dietary groups. The occurrence of jaw (0 - 0.8%) and operculum (0.2 – 1.7%) deformities was low both in diploids and triploids, and not affected by the treatments.

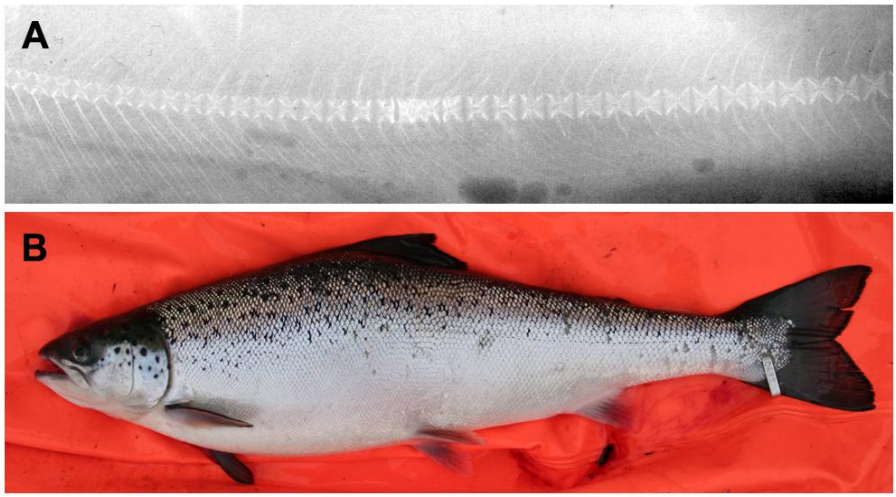

Fig. (A) X-ray of triploid smolt with a deformity beneath the dorsal fin. (B) Photography of triploid harvest size salmon with a shortening of the vertebral column beneath the dorsal fin.

Discussion

Dietary P during the early seawater phase did not affect the development of vertebral deformities in the present study. This is possibly related to the timing of sea transfer. We were not able to complete smoltification until mid October when the sea temperature and day-length is decreasing. The P level (0.6% available P) used in the present study is known to cause problems in underyearling smolts that are transferred to sea in mid August at higher temperature and day-length, and with much higher SGR (Fjelldal et al., 2009). It seems that the deformities that were present at harvest, that were mostly located beneath the dorsal fin, had started to develop before the experimental period in seawater. The fact that the morphogenesis of the chordacentrum starts during the late yolk-sac stage, and the first chordacentra develop beneath the dorsal fin (Grotmol et al., 2003), suggests that the deformities observed in triploids may have been initiated during the late yolk-sac stage or early start-feeding.

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