Impact of Vaccination Temperature on Atlantic Salmon Resistance to Infectious Salmon Anemia Virus

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Aquaculture accounts for >50% of global aquatic animal protein production. Despite its growth, pathogen control remains a challenge to sustainability. Infectious salmon anemia virus (ISAv) significantly affects Atlantic salmon production, and commercial vaccines have limited efficacy. Vaccine efficacy for salmon—ectotherms with an optimal physiological temperature of 12-15°C—is affected by water temperature. As vaccination in aquaculture occurs across a wide thermal range, we hypothesize that vaccination at low temperatures compromises protection against ISAv. To assess this, we evaluated two market-available vaccines in salmon reared at 8°C, 12°C, and 15°C. Salmon were intraperitoneally injected with 100 µL of either vaccine 1 (V1) or vaccine 2 (V2). Half of each group received a booster after ~700 degree-days (dd). Approximately 1400 dd post-boost, fish were randomly placed in tanks until the pathogen challenge. In a separate room, unvaccinated donor fish were infected with ISAv-HPR4 (TCID50: $1x10^5$/mL), bled (100 µL) after 7 days, and then introduced to cohabitation tanks at a 7.5:1 ratio of cohabitants to donors. Survival was recorded, and tissues from survivors were collected to assess serum IgM and head kidney viral load. Our results show that salmon vaccinated at 15°C with either vaccine had higher survival than fish vaccinated at 8°C. Additionally, salmon vaccinated at 15°C with either vaccine had significantly higher ISAv-specific IgM levels compared to PBS controls. Among 110 survivors, ISAv was detected in the head kidney of eight individuals; notably, seven of these eight had been vaccinated at 8°C or 12°C. Our findings highlight the importance of temperature in optimizing vaccine efficacy and improving aquaculture sustainability.

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