



POOR REPRODUCTIVE SUCCESS IN A SWEDISH ARCTIC CHARR BROODSTOCK - BIOLOGICAL OR ENVIRONMENTAL EFFECT?

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Introduction:

The Swedish Arctic charr (*Salvelinus alpinus*) breeding programme started in 1985, described in [1, 2]. A native strain of charr from Lake Hornavan in northern Sweden (66° 14' N, 17° 30' E) was selected to form the basis of this breeding programme. Since the start of the programme no individuals of other origin have been included and the strain has been kept at the Fisheries Board Research station in Kälärne, central Sweden. The result of 25 years of selective breeding is a fast-growing, late-maturing fish with high pigment retention in the fillet. However, the reproductive success is far from satisfactory. Gamete quality is generally low with high frequency of opaque eggs and watery sperm. The spawning period is often prolonged and poorly synchronised within and between sexes, leading to increased handling and hence stress of the fish as well as a more difficult stripping procedure. Fertilisation and hatching rates are erratic and on average very low compared to other salmonids in Scandinavian aquaculture, typically between 30 and 70 percent. The question is whether this problem derives from biological features of the strain itself or from suboptimal holding conditions. This was tested by rearing a split broodstock at two separate facilities and comparing reproductive success.

Methods:

Part of the 2005 generation Arctic charr from the Swedish breeding programme was divided into two replicates of equal family distribution. One group was kept at the Kälärne station, the other was sent to a commercial fish farm in Slussfors, 300 km further north. The two groups were reared until sexual maturation at age 3.5 and stripped at two locations. The Kälärne broodstock was stripped on the site while the Slussfors broodstock was transported to a hatchery 130 km further south three weeks before the first fish was stripped. After fertilisation the eggs from Slussfors were transported back to Kälärne and incubated under equal conditions as their resident relatives. Environmental conditions at the two facilities differ mainly in two aspects: temperature and light. Both are supplied with lake water of ambient temperature, but the location of

the Slussfors facility enables favourably lower summer temperatures not exceeding 16°C while temperatures may reach over 20°C in Kälärne. The fish are kept in indoor tanks with artificial lighting at natural photoperiod in Kälärne while Slussfors is an outdoor net pen facility with natural light.

Results:

Differences were found between the groups in synchronisation of spawning period and hatching rates. The Kälärne group exhibited a prolonged stripping procedure, 10 workdays extending just over a month at temperatures between 6-10°C, while the Slussfors stripping was completed in two sessions one week apart at 3-5°C. Spawning also occurred earlier in Slussfors than in Kälärne, October 9-15 and October 17 to November 19 respectively. Survival of the eggs differed significantly between the two groups, with hatching rates of 0.62 ± 0.22 and 0.38 ± 0.20 for Slussfors and Kälärne, respectively.

Conclusion:

There is a strong environmental factor to the low reproductive success of the studied Arctic charr broodstock. The high summer temperature in Kälärne together with the poor synchronization of the ovulation resulted in low egg quality. The hatching rates increased nearly two fold with more favourable temperature and light conditions in Slussfors, but were still below 70 percent which is considerably lower than other salmonids. Salmon and rainbow trout typically have a hatching rate of more than 90 percent under similar conditions. There are other factors such as the effect of handling stress and broodstock diets that need in-depth investigation regarding the critical environmental factors and holding conditions of the Arctic charr broodstock.

References:

- [1] ERIKSSON, L.-O., ALANÄRÄ, A., NILSSON, J. AND BRÄNNÄS, E. 2010. The Arctic charr story: development of subarctic freshwater fish farming in Sweden. *Hydrobiologia*, 650(1): 265-274.
- [2] NILSSON, J., BRÄNNÄS, E. AND ERIKSSON L.O. 2010 The Swedish Arctic charr breeding programme. *Hydrobiologia*, 650(1): 275-282.