ENVIRONMENTAL ENRICHMENT IN RAINBOW TROUT: THE EFFECT OF RANDOMLY FIRED WATER INLETS

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Introduction

Experiments in mammals have shown that environmental enrichment in cages can help decrease fear and aggression responses (Reinhardt, 2004) and help to lower stress levels (Fox et al., 2006). Less is known about the effect of environmental enrichment in fish however. In most land-based aquaculture fish are raised in raceways or tanks that are rather barren and some efforts have been made to enrich the culture environment (e.g., Nordgreen et al., 2013). However, adding objects into the tanks may cause problems due to abrasions or the possible accumulation of waste or bacteria which are hard to clean regularly. For that reason, water inlets seem to be a good alternative since they are easy to apply and turn on and off automatically.

Materials and methods

The experiment was conducted using a total of 240 rainbow trout (average weight 373.6 g) that were randomly divided into 12 cages (1m x 1m x 1m) with 20 individuals each. Half of the cages had two water pumps (1082 EHEIM marine stream on + 5000) which were programmed to be fired randomly throughout the day (Figure 1), in an attempt to enrich the environment. The water temperature averaged 17.1°C. After one month, fish were anesthetized with clove oil and weighed to determine relative growth. Blood samples were taken from the caudal vein to measure plasma concentrations of cortisol, glucose, lactate, triglycerides, total proteins, albumin and creatine phosphokinase enzyme (CPK).

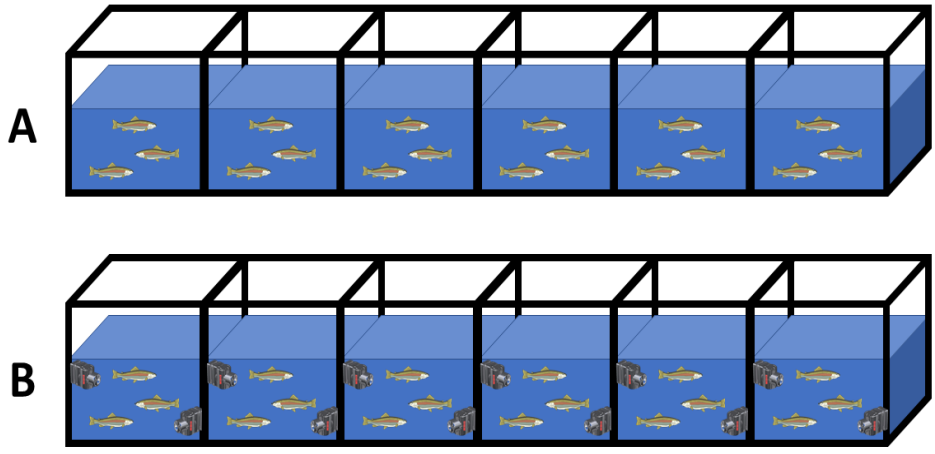

Figure 1. Experimental design. a) Control fish. b) Fish in enrichment cages with water pumps.

Results

Slaughter weight and relative growth presented were not significantly different between treatments. However the concentrations of plasma cortisol, triglycerides and CPK were lower in fish housed in enriched cages with randomly fired inlets. The remaining hematological parameters (glucose, lactate, total proteins, albumin, and CPK) were not significantly different among treatments.

Discussion and conclusions

Enriching trout tanks with randomly fired water inlets did not produce a significant increase in fish growth over a one month period, unlike other studies that have reported a positive effect (Brockmark et al., 2007). However, enriched fish had lower stress levels, which implies that inlets can help reduce stress due to a barren environment, probably by increasing environmental variability and unpredictability. Uncertainty provides a beneficial psychological challenge (Hyvarinen and Rodewald, 2013; Näslund and Johnsson, 2014) and the rainbow trout seemed to have reacted to that stimulus in a positive way.

Table I. Means of slaughter weight and hematologic parameters of rainbow trout with (control) or without pumps

	Control	**Pumps**	**p**
Slaughter weight (g)	370 ± 4.14	377 ± 3.45	0.17
Relative growth (%)	25.2 ± 1.28	26.3 ± 1.10	0.50
Cortisol (ng.ml.$^{-1}$)	21.5 ± 0.88	16.0 ± 1.40	0.003
Glucose (mg.dl.$^{-1}$)	110 ± 1.18	110 ± 2.25	0.95
Lactate (mmol.l.$^{-1}$)	3.11 ± 0.11	3.39 ± 0.18	0.11
Triglycerides (mg.dl.$^{-1}$)	286 ± 16.7	347 ± 24.2	0.04
Total proteins (g.dl.$^{-1}$)	3.89 ± 0.08	4.06 ± 0.08	0.13
Albumin (g.dl.$^{-1}$)	1.74 ± 0.05	1.83 ± 0.03	0.15
CPK (U.l.$^{-1}$)	1732 ± 231	1122 ± 156	0.04

Acknowledgments This project was financed by the ANIHWA ERA-NET project ERA58-WIN-FISH-UP.

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