

# Does environmental enrichment promote recovery from stress in rainbow trout?

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## INTRODUCTION

The EC Directive on animal experimentation suggests that animals should have enrichment to improve welfare yet relatively little research has been conducted on the impact of enrichment in fish. Studies on zebrafish have been contradictory and other fish species may require species specific enrichments. Salmonids are important experimental models given their relevance to aquaculture and natural ecosystems.

This study sought to establish how an enriched environment may promote better welfare in rainbow trout (*Oncorhynchus mykiss*) (Fig. 1) enhancing their recovery from invasive procedures.



Figure 1. The study species, Rainbow trout

## METHOD

Trout were held individually in either barren or enriched (gravel, plants and an area of cover) conditions and recovery rates after a potentially painful event and a standard stressor were investigated by recording parameters such as behaviour, opercular beat rate and plasma cortisol concentrations. Fish were randomly assigned to one of four treatment groups: Control, Sham, Stress and Pain. Video recordings were made prior to treatment then at 30 minute intervals afterwards.

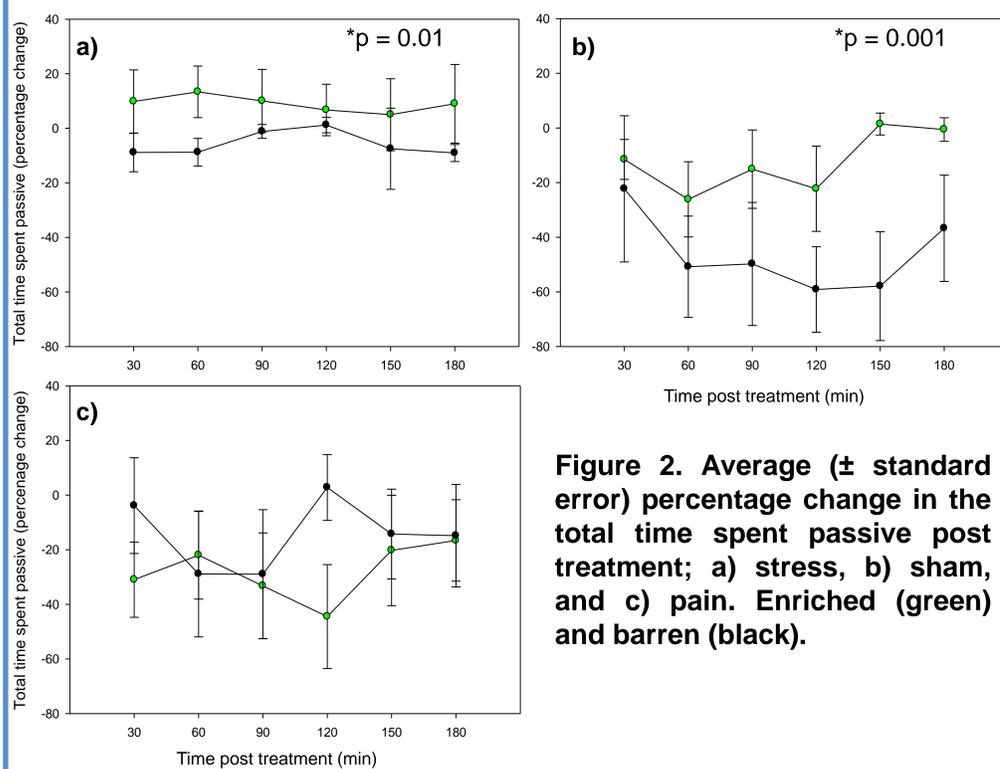


Figure 2. Average ( $\pm$  standard error) percentage change in the total time spent passive post treatment; a) stress, b) sham, and c) pain. Enriched (green) and barren (black).

## RESULTS

Following sham and stress treatments, fish exhibited a behavioural difference between the two environments, in that fish held in barren conditions exhibited an increase in activity compared to fish in enriched conditions (Fig. 2). However behavioural differences were not observed in fish after pain treatment. Recovery rates for the opercular beat rates were faster in sham and stress enriched treatment groups compared with barren (Fig. 3).

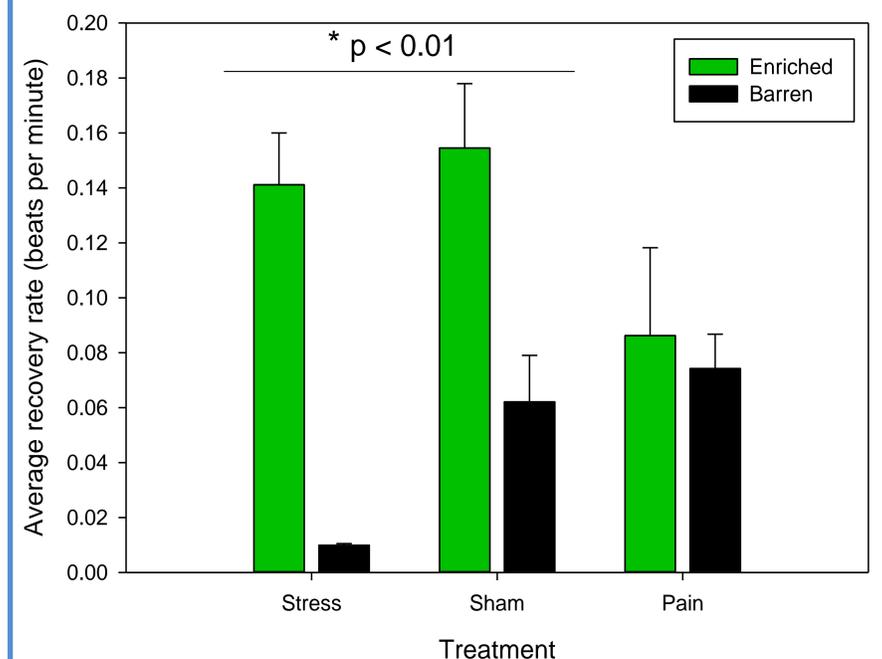


Figure 3. Average ( $\pm$  standard error) opercular beat recovery rate post treatment.

## DISCUSSION

These results suggest environmental enrichment for rainbow trout may not be an important factor when responding to a painful stimuli however it does appear to promote recovery and ameliorate adverse effects following stressors (sham and stress). Since physiological responses to stress and pain are processed in completely different ways, a painful stimuli may prevent the fish being able to benefit from enrichment. We also show fish held in barren conditions were perhaps more stressed as seen by an increase in activity (suggested non-invasive measure of stress). These results would have important implications for the husbandry and welfare of captive rainbow trout and may also affect the outcome of experimental studies depending on whether enrichment was adopted.

## ACKNOWLEDGEMENTS

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