



# UNDERSTANDING THE CONTRIBUTION OF INDIVIDUAL VARIATION IN STRESS-RESPONSE FOR IMPROVING FISH WELFARE IN AQUACULTURE: A CASE STUDY IN A DIURNAL AND NOCTURNAL SPECIES

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## Background & Aim

*Micropterus salmoides*  
(diurnal species)



Within-population, individuals show high variation in their adapted response to the environment<sup>1,2</sup>. However, farming conditions are generally constant for practical reasons, meaning only individuals who can rapidly adapt to these new conditions can survive<sup>3</sup>. Therefore, aquaculture research should deal with this future challenger by predicting the animal response to the new environment<sup>4</sup>.

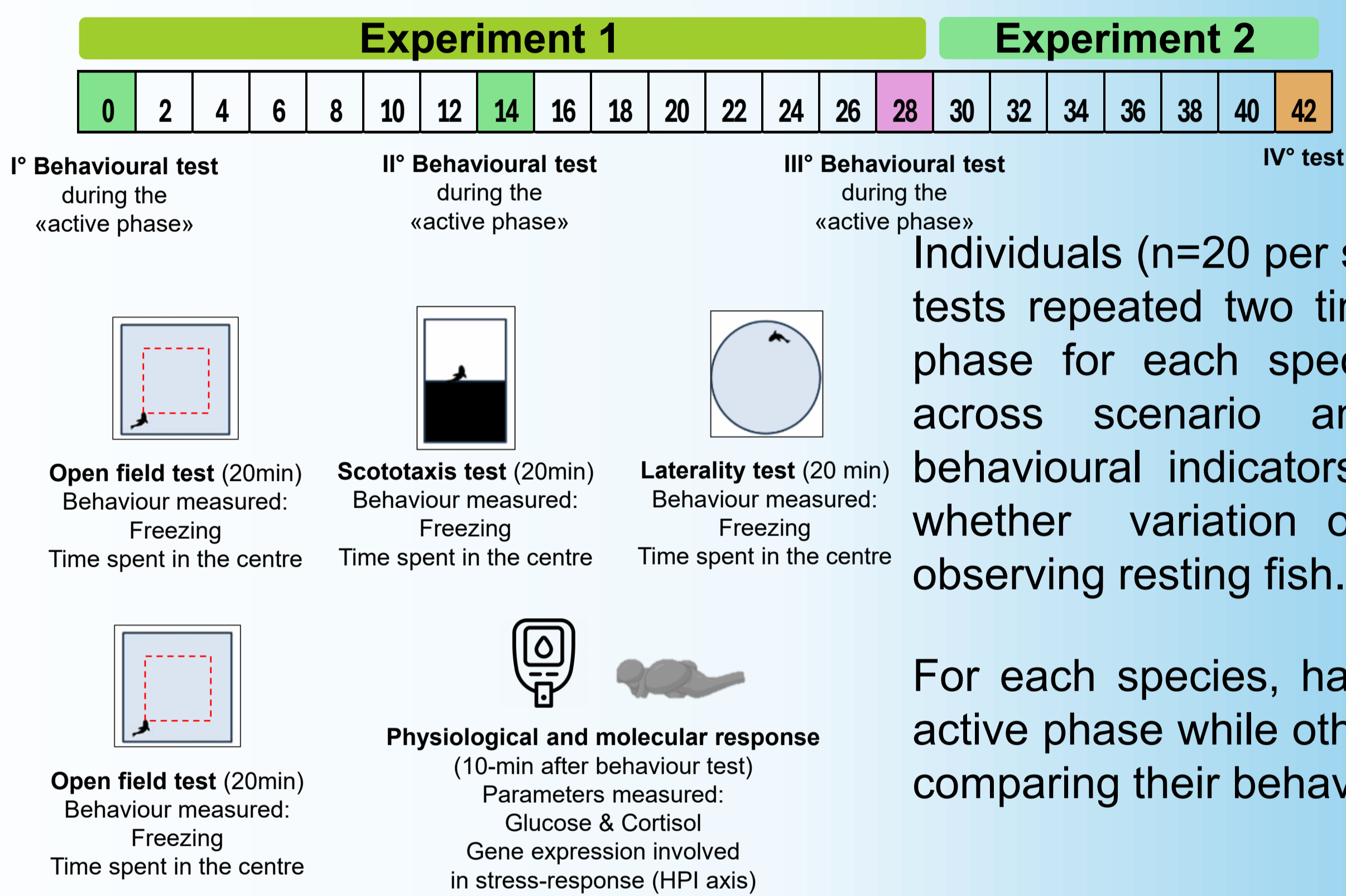
*Ameiurus melas*  
(nocturnal species)



Here, we characterize individual consistency in behavioural and physiological responses to new situation during the day in two commercial interest species with different activity patterns.

## Experimental design

Scheme of the experimental design (lasted 42 days).



### Experiment 1

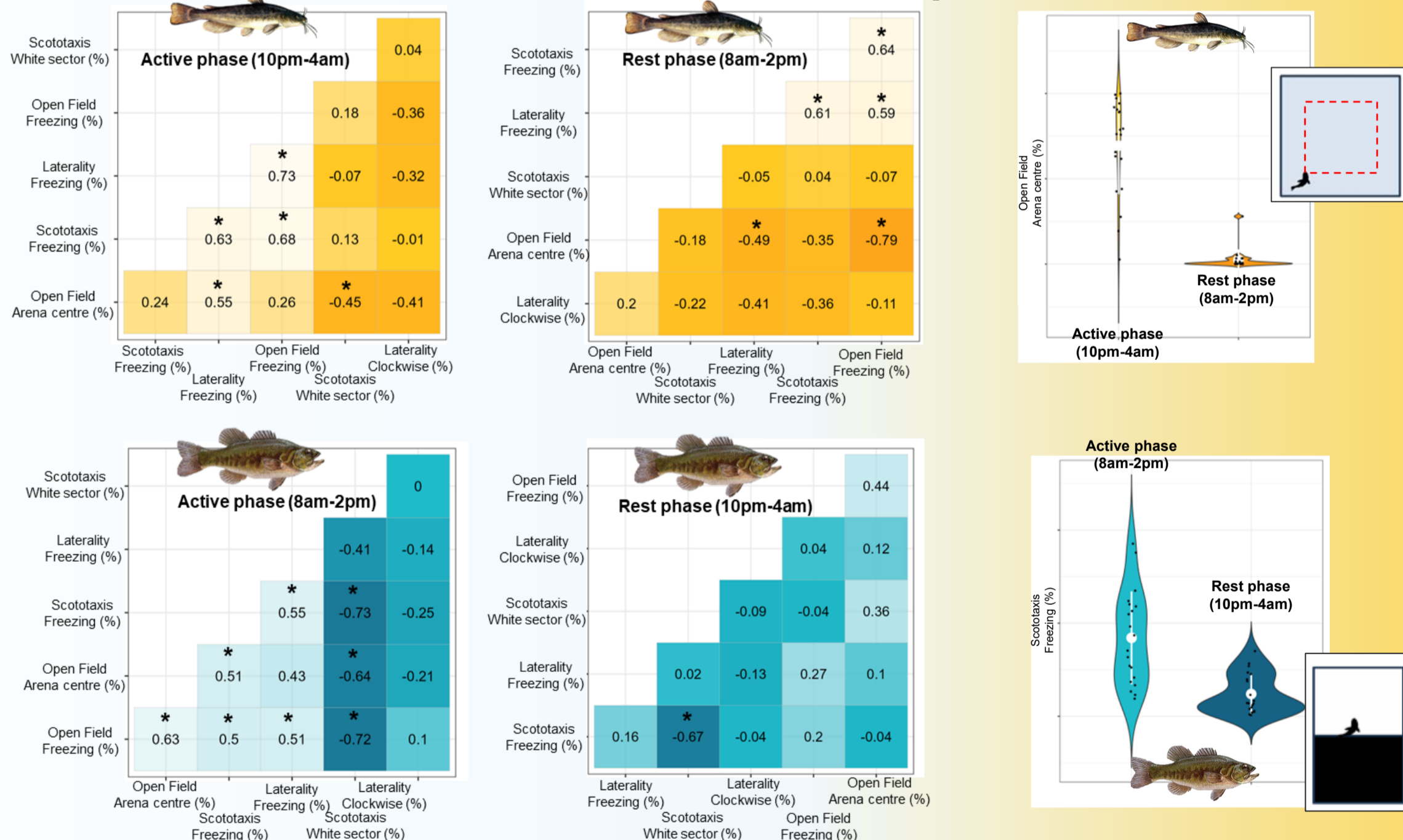
Individuals (n=20 per species) underwent to a set of behavioural tests repeated two times (2-weeks delayed) during the active phase for each species. Consistency of individual variation across scenario and time were assessed considering behavioural indicators of welfare state<sup>5</sup>. Then, we examined whether variation of individuals' responses changed when observing resting fish.

### Experiment 2

For each species, half of the animals was tested during their active phase while others during their rest phase with the aim of comparing their behavioural and physiological responses.

## Results

### Experiment 1: within-individual variation depends on time sampling



Covariation among behavioural traits differed whether animals were tested during their active or resting phase.

*M. salmoides* showed less individual variation of behavioural traits during their resting phase (night) compared to their active phase (day; Fig 2c,d). Less markable, *A. melas* showed a similar pattern.

### Experiment 2: behavioural indicators did not predict physiological response

*M. salmoides* exposed to the behavioural test showed higher glucose level compared to control group, especially during the active phase. Glucose level did not differ between treated and controlled group of *A. melas*.

Individual variation of behavioural response did not predict glucose level in the two species (Gene expression: working in progress, see for the next Aqua2025).

## Conclusion

Consistency of individual variation demands more efforts for aquaculture research on providing the most suitable conditions to improve fish welfare.

Robust Behavioural Welfare Indicators are necessary for predicting fish physiological state in captive conditions.

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