Investigating the Behavioural and Physiological Response of Endangered Freshwater Pearl Mussels (*Margaritifera margaritifera*) to Stress Exposure

NERC iCASE studentship

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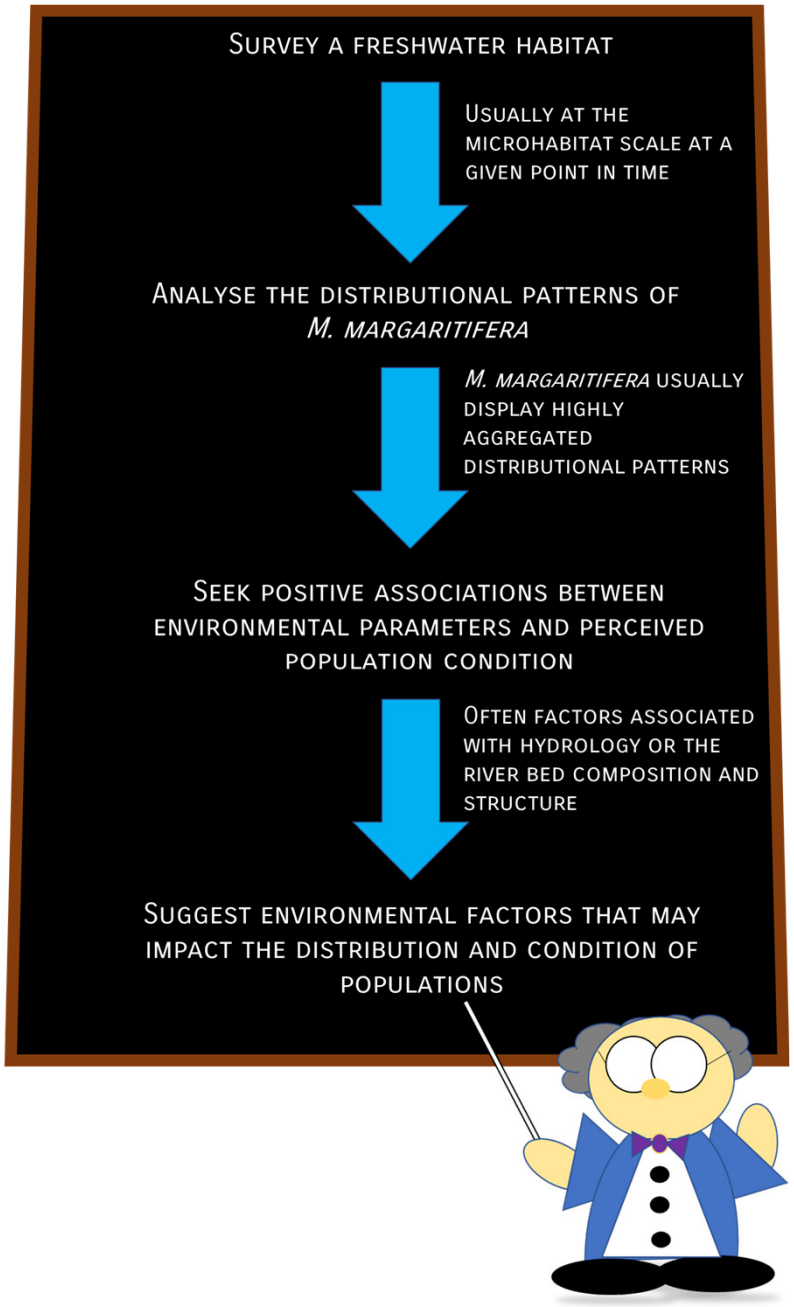
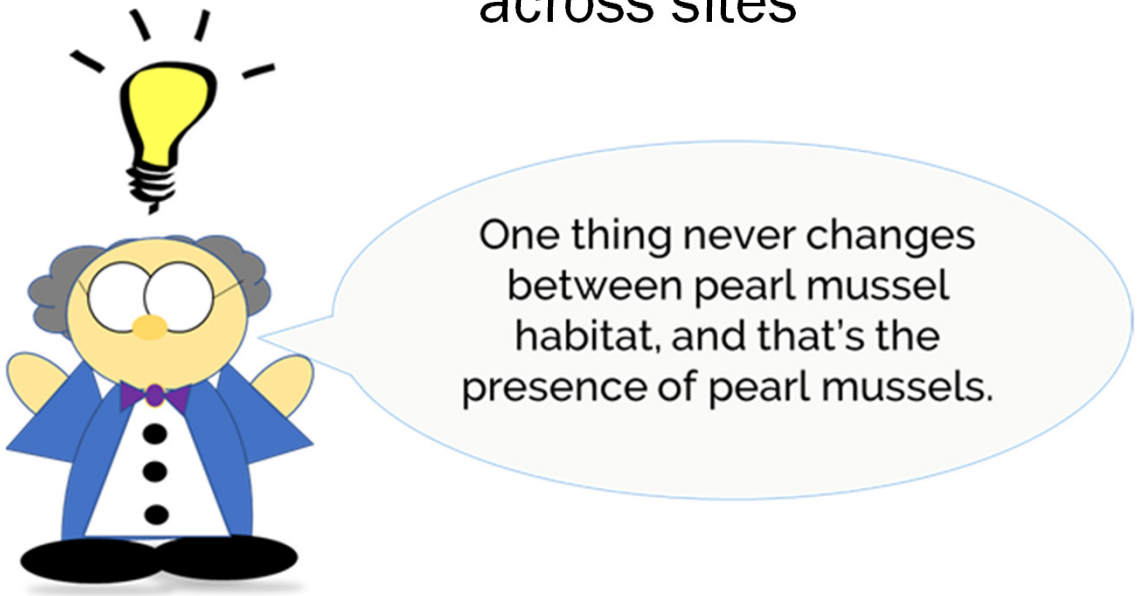
University of Glasgow SSE NERC SCIENCE OF THE ENVIRONMENT SAGES Scottish Alliance for Geoscience, Environment and Society SCENE Loch Lomond

DEFINING PREFERABLE HABITAT



IMPORTANCE OF LIFE HISTORY TRAITS

Environmental predictors lose efficacy when employed across sites



or close their shells in response to unfavourable water chemistry

OBJECTIVE

To establish a non-invasive method of quantifying acute mussel stress; using behavioural response indicators, coupled with measures of physiological condition

STRESS STUDIES

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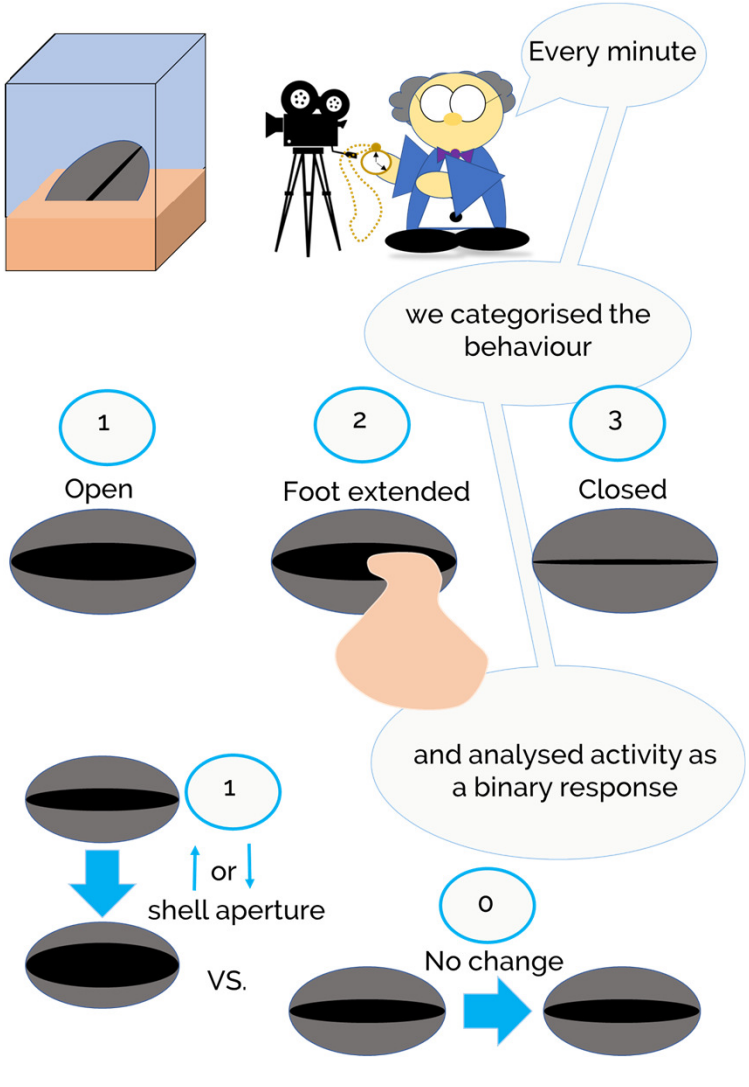
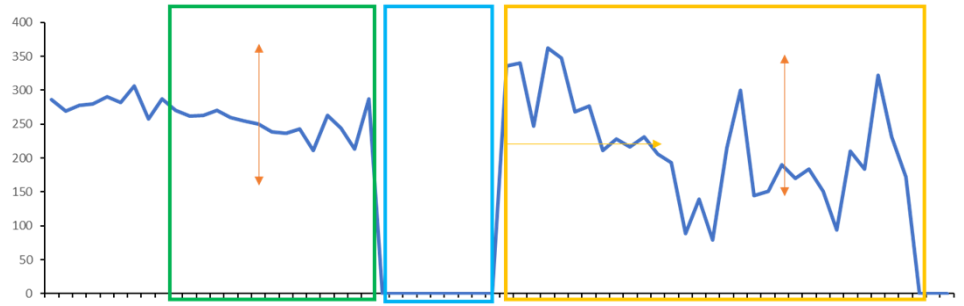
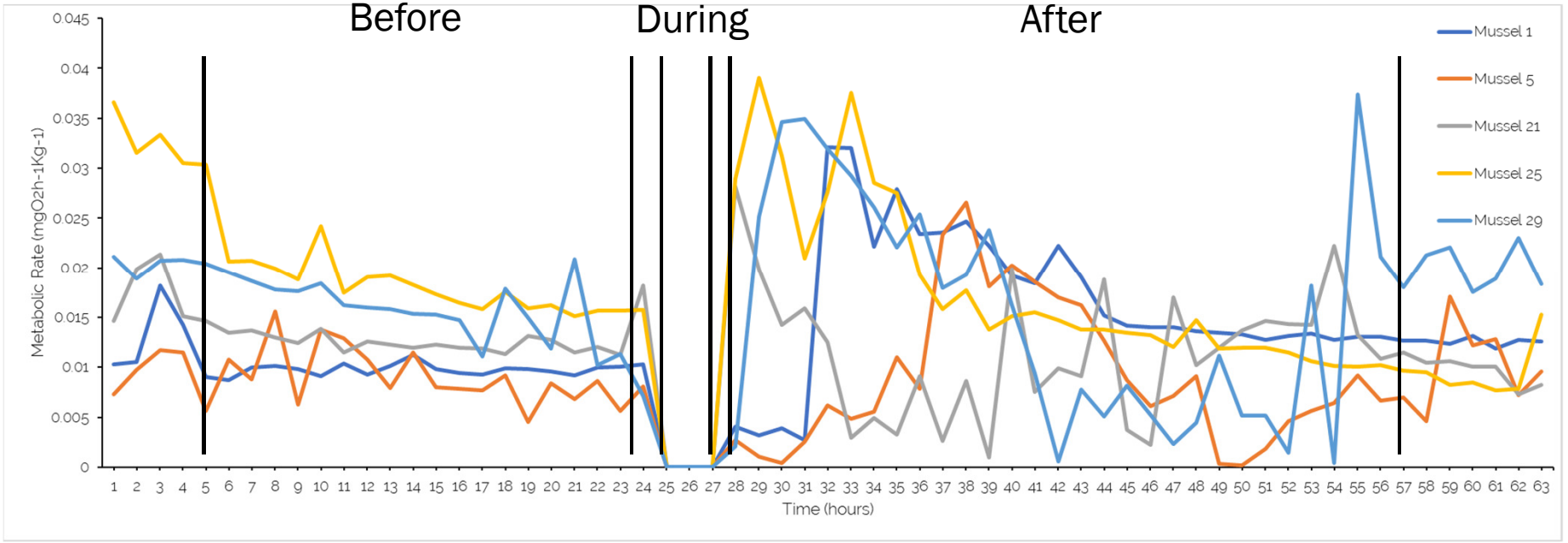
Time lapse footage + Intermittent respirometry



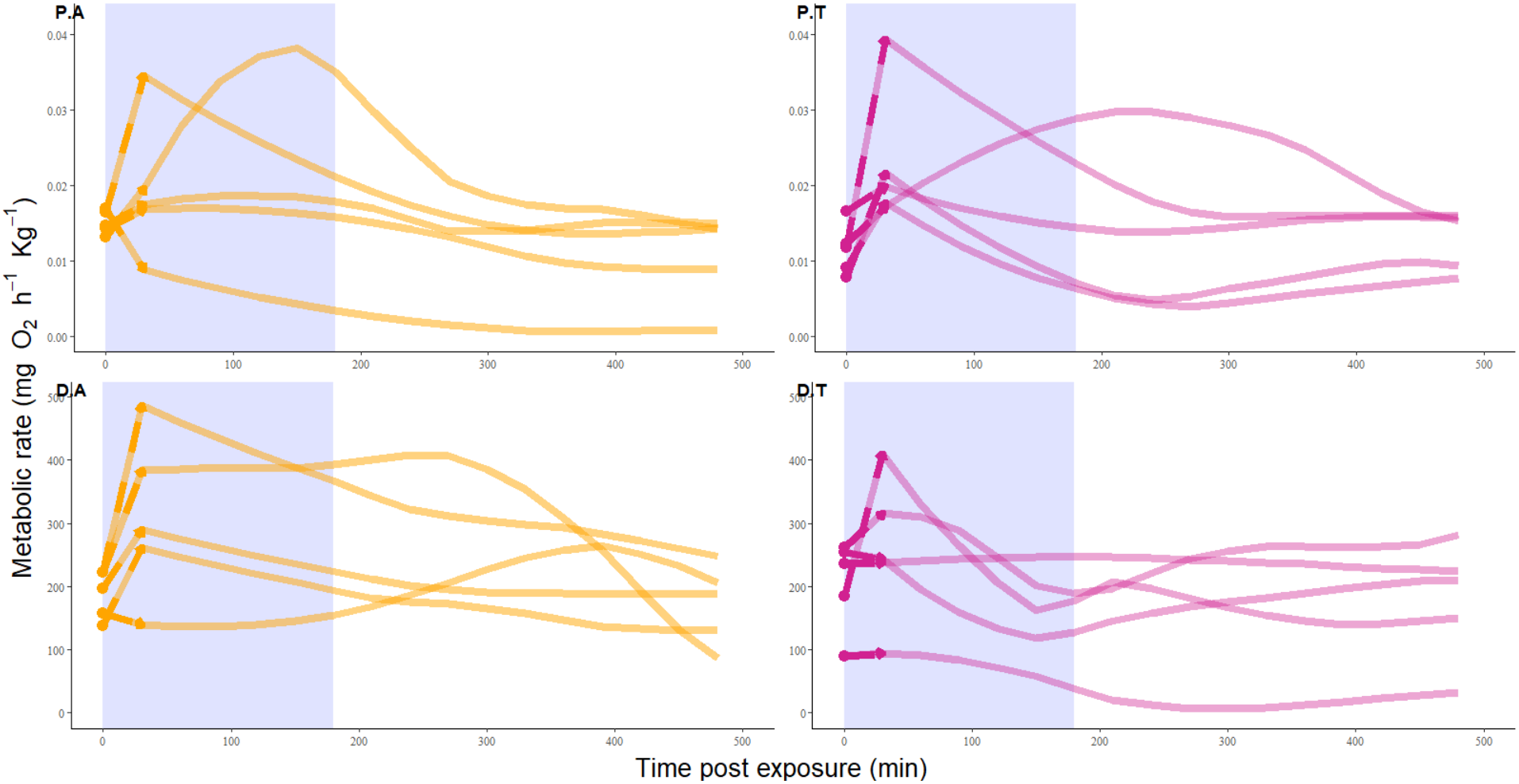


Measuring changes in metabolic rate at 30 minute intervals - throughout an experimental run - provided an indication of physiological response to stress.

MUSSEL RESPONSE



PHYSIOLOGICAL RESPONSE



METABOLIC DIFFERENTIAL

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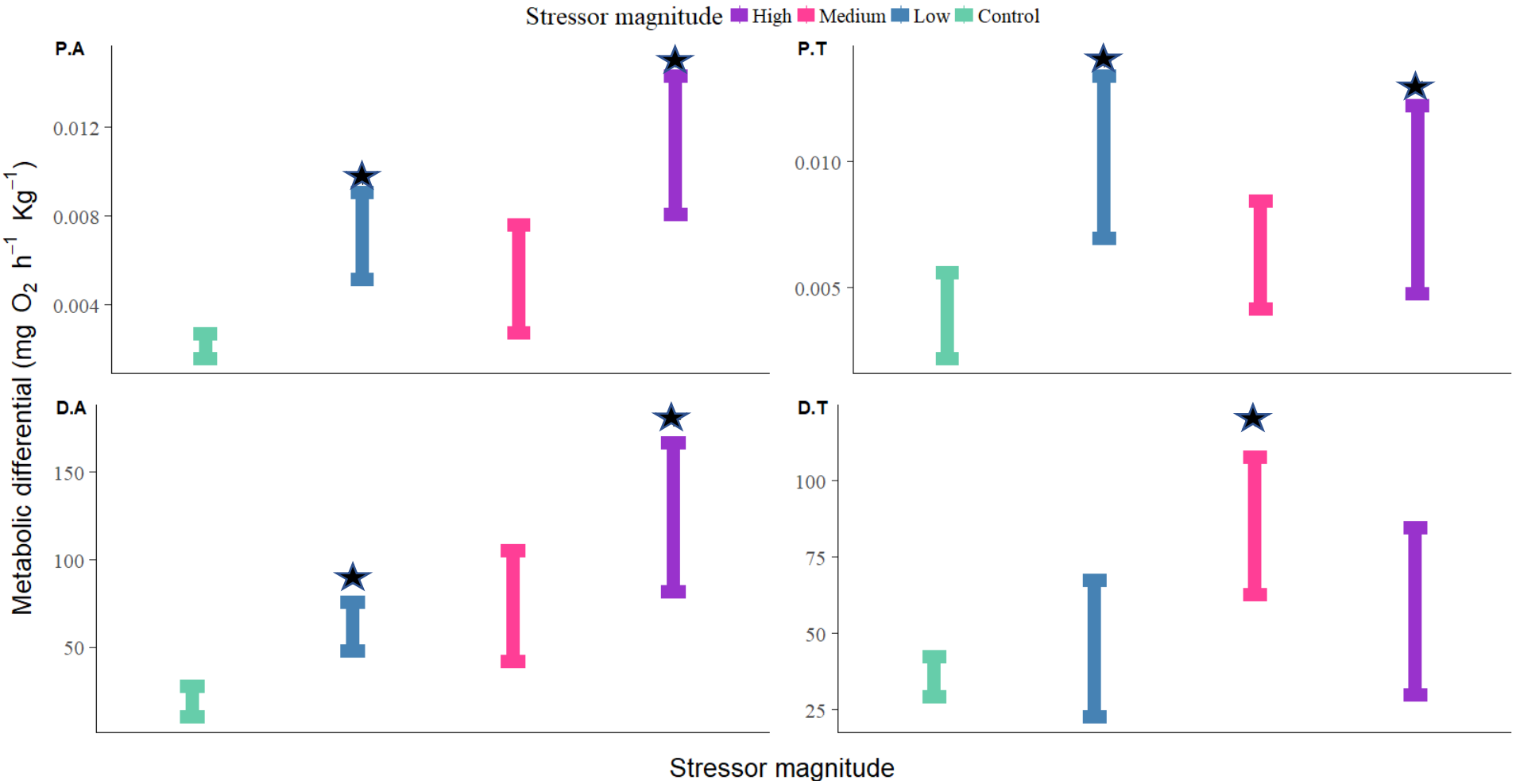
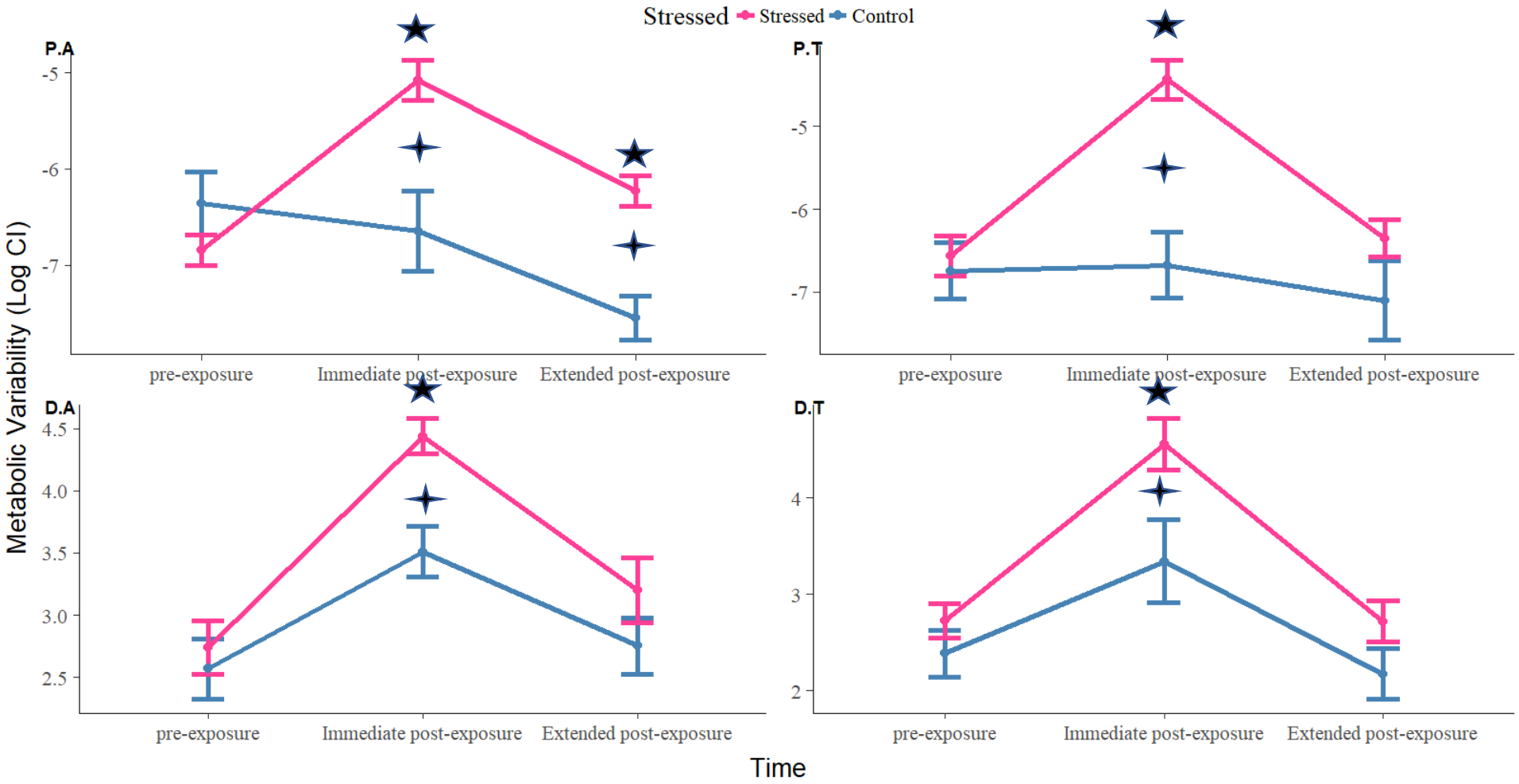
Difference between standard metabolic rate (SMR) and the average metabolic rate from immediate post-exposure period



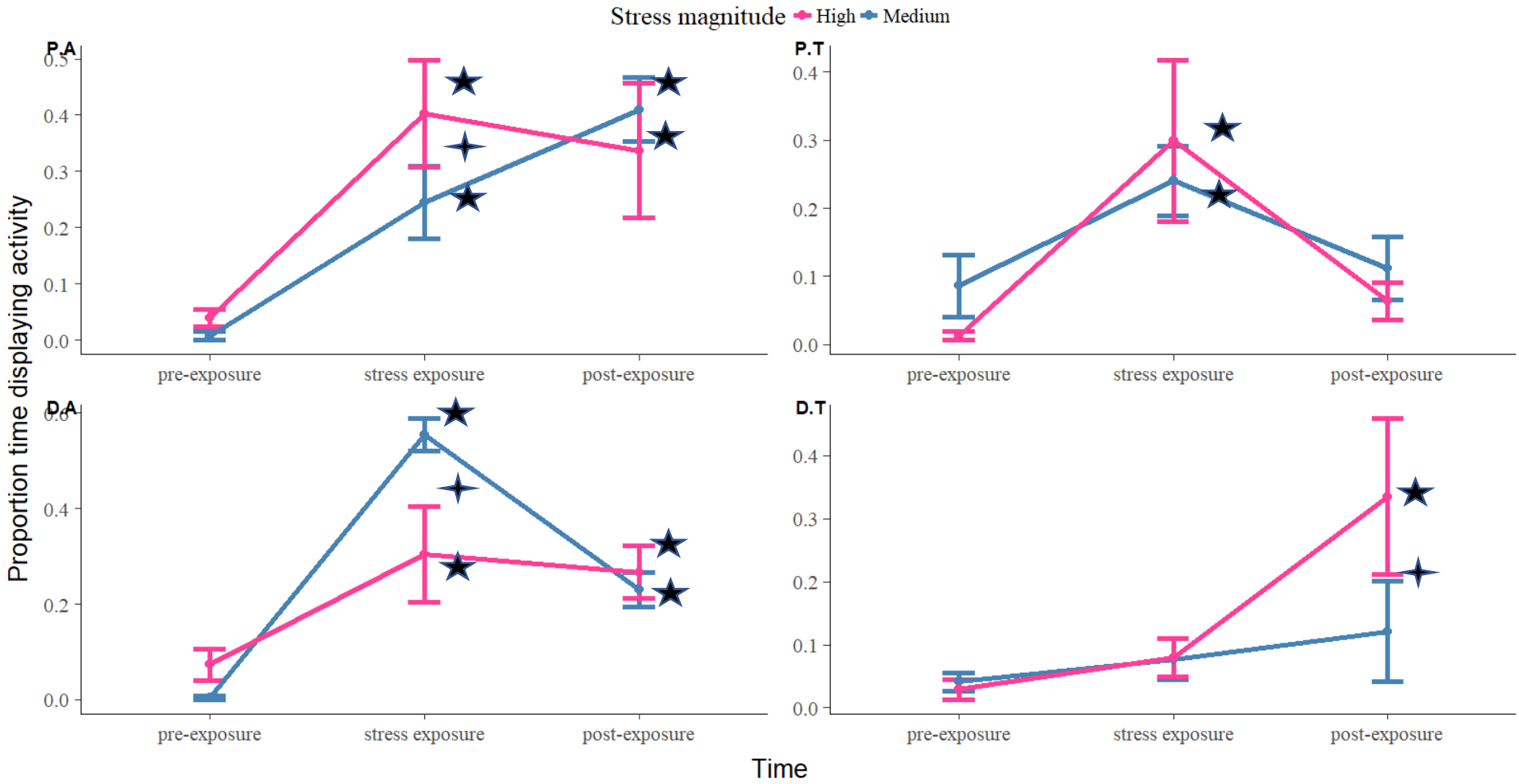
METABOLIC VARIABILITY

Measured as confidence intervals



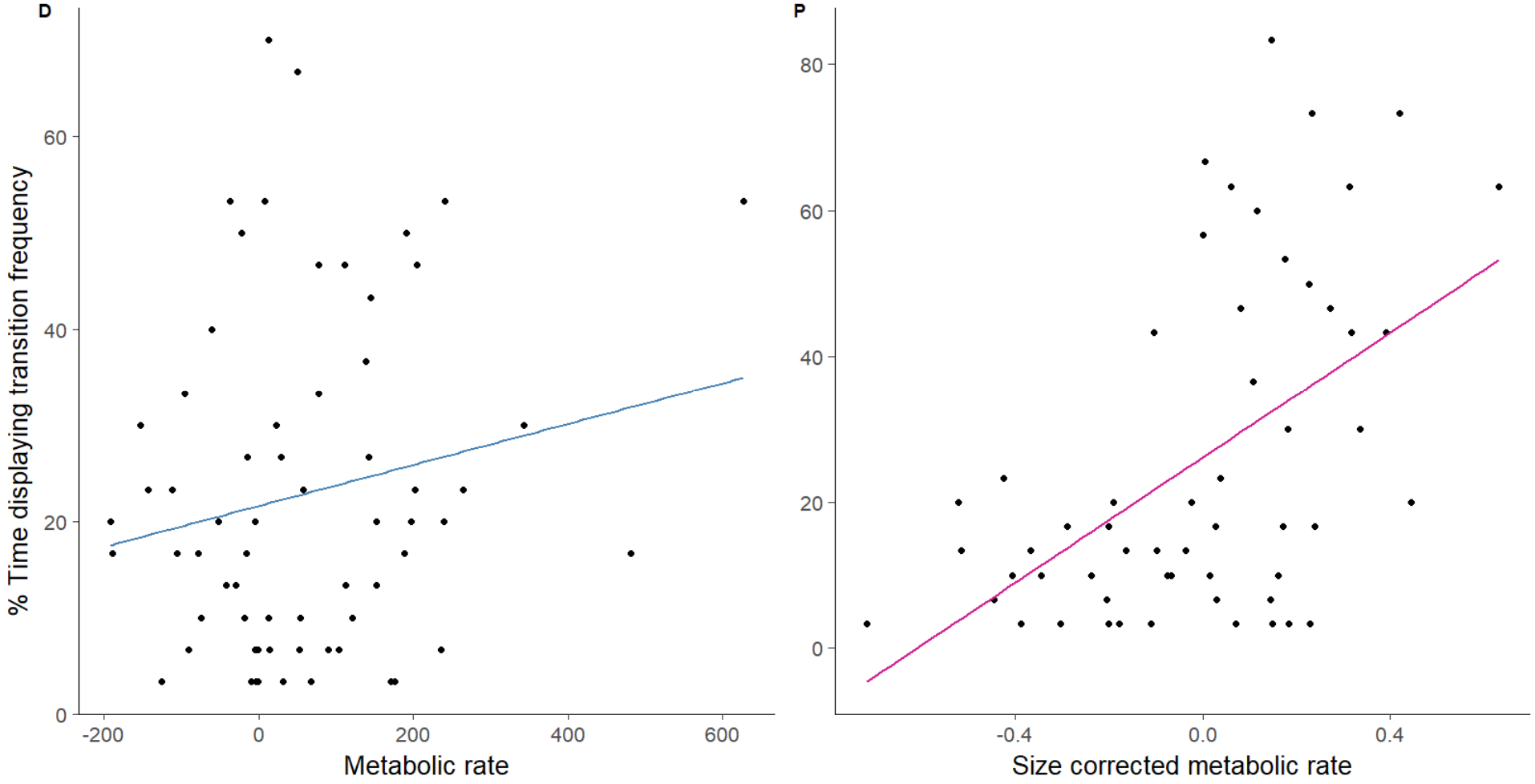
TRANSITION FREQUENCY

Analysing the activity of the valve. Examined as the proportion of time an individual would spend displaying this behaviour.



THE LINK

Strong positive association between metabolic rate and percentage of time spent displaying transition frequency



SUMMARY

Evidence of behavioural responses to stress exposure, linked to significant changes in the physiological functioning of corresponding *A. anatina* and *M. margaritifera* mussels.

Variation in the reaction norms across individuals and species: different sensitivities to the stress exposures; accentuated by the perceived alterations in behavioural and physiological traits.

THOUGHTS

Both stressors would likely evoke oxygen deprivation and the subsequent adoption of anaerobic metabolic pathways.

Variation between individual metabolic response – reflect personality traits

Variation between metabolic response of species - reflect variation in physiological functioning and habitat

Transition frequency dampens affect of stressor and may assist fast recovery

Variation in transition frequency between stressors: a trade-off between stress damage and metabolic requirements or a difference in magnitude of stress caused

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IMPLICATIONS FOR BEHAVIOR AS A BIOMARKER

- Direct observation of behaviour using high resolution camera technology: a useful method of unrestricted categorisation of behavioural traits, but requires extensive image analysis - limiting sample sizes.
- Animal-attached remote sensing technologies (e.g. Hall sensors) circumvent these issues, but haven't been tested in a field setting
- Bio-monitoring studies recording 'species-environment' data for extended periods of time should garner sufficient data to understand individual response mechanisms
- If perfected, these methods would enable researchers to explore factors influencing mussel condition across populations and freshwater systems - aiding restoration and reintroduction schemes

THANKS FOR LISTENING

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