MASTS Small Grant Scheme

SG508 Funding Report: Understanding the mechanistic interaction between noise and heavy metal co-exposure in *Nephrops norvegicus* larvae.

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Project overview

One of the largest hindrances to the interpretation of multi-stressor studies is a relative lack of mechanistic understanding. Although it is accepted that establishment of phenomenological studies – those that seek only to identify effects – are often a necessary precursor to mechanistic studies, phenomenological studies alone rarely provide sufficient data to help inform risk assessment, mitigation, or policy decisions.

My previous experiment "*Effects of pile driving noise and cadmium co-exposure on the early-life-stage development of the Norway Lobster, Nephrops norvegicus"* (supported by MASTS SG452) evidenced a wide range of context-dependent effects on larvae of a commercially important species, and it was hypothesised that these effects were partly driven by oxidative stress responses. In a follow-up experiment, a new cohort of *Nephrops norvegicus* larvae were exposed to a comparable combination of cadmium and pile-driving playbacks, and their tissues sampled to allow quantification of oxidative stress biomarkers.

Summary of the work funded by the grant

The grant directly contributed £500 towards the consumable costs for quantification of catalase (CAT), glutathione peroxidase (GPx), and superoxide dismutase (SOD), with the remaining costs being covered by Edinburgh Napier University (Table 1).

Table 1: Summary of costs for biomarker analysis

Consumables	Attributed Cost
CAT determination kit	£300
GPx determination kit	£300
SOD determination kit	£150
Purchased consumable costs: £750	

Additional 'in-kind' contributions for the quantification of thiobarbituric acid reactive substances (TBARS), glutathione (GSH) and total protein were provided by Heriot-Watt University.

Results

The funds provided enabled a more comprehensive suite of oxidative stress biomarkers to be assessed than would have otherwise been possible. Likewise, the financial support enabled analysis of seven independent samples per assay (each run in triplicate) for each of the eight experimental treatments. Although the data are yet to be fully scrutinised and put into full context, some trends and patterns consistent with observations from the earlier experiment appear to be present, which may ultimately help to determine the validity of the hypothesis that oxidative stress responses regulates observed context-dependent shifts the cadmium-noise interactions.

Benefit to the MASTS community

The research contributes towards the "Marine Biodiversity, Function and Services" research theme by addressing the resilience of a commercially valuable species to two ubiquitous stressors.

The data produced also adds complementary context to existing results which contribute directly to the MASTS Marine Stressors Forum research objective to *"…provide an integrated platform to promote the enhanced understanding of environmental stress, both natural and anthropogenic, on marine organisms."*

Similarly, the context provided by these data may allow more generalised extrapolation of potential risks and impacts posed by both aquatic noise and chemical pollutants. This in turn could be used to better inform and direct environmental risks assessments, contributing to more effective mitigation and management measures in future.

Expected outputs

The data produced will contribute directly to a chapter in my PhD thesis, "*Effects of noise on early-life-stage aquatic invertebrates in a multi-stressor context*".

The value added by this data should allow publication in a journal with a high impact factor of good reputation such as Science of the Total Environment.