Funding report: MASTS Aquatic Stressor Forum Travel Grant

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ASSG21: Oral presentation at ECSA 59 titled: Multiple stressor impacts on intertidal microphytobenthos

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Background

Work conducted during my PhD is focused on multiple stressor impacts in estuarine systems, with a particular focus on the microphytobenthos (MPB, an assemblage of intertidal, single-celled autotrophs). The major fieldwork was completed in the Autumn of 2021, but the findings had not been subject to major dissemination by 2022. Beyond publication as part of a thesis and potential future publications, the impact of the work would be enhanced by presentation and discussion at a conference, preferably of international importance and recognition. The conference deemed most suitable for maximising the impact of this work was ECSA (Estuarine and Coastal Sciences Association) 59 conference was held in San Sebastian, Spain, between the 5th and 8th September 2022 with the theme of "Using the best scientific knowledge for the sustainable management of estuaries and coastal seas". ECSA is also associated with the Estuarine, Coastal and Shelf Science journal, to which future manuscripts would strongly be considered for submission. An abstract (below) for the oral presentation of this work was accepted for presentation at the session: "Stress responses and resilience: From molecular to ecosystem level". MASTS travel grant was essential for the presentation of this work, due to the costs of travel and accommodation.

Abstract

The microphytobenthos (MPB) are an assemblage of microscopic autotrophs and mixotrophs which inhabit the surface few millimetres of sedimentary habitats and are the main primary producers in unvegetated intertidal flats. MPB are ecosystem engineers and, through the exudation of organic products and the formation of a biofilm, can hinder the erosion of sediment. Exposed not only to tidally driven changes in physical conditions, MPB communities may experience anthropogenic sources of stress originating in marine, terrestrial, and freshwater environments, including a range of pollutants. However, our understanding of the effects of many of these stressors on MPB communities and their associated ecological processes –individually and cumulatively – is still limited. Further, disentangling stressor effects from environmental context without minimising experimental realism is challenging. Experiments were carried out to investigate the response of MPB to multiple anthropogenic stressor exposure (herbicide and TiO_2 nanoparticles) in both laboratory mesocosms and the field (Eden Estuary, Scotland), and framed with statistical power analysis based on prior sampling of intertidal MPB in UK estuaries. Laboratory

experiments assessed stressor impacts on MPB in the absence of confounding factors such as initial macrofaunal and MPB communities. Field experiments using these stressors were carried out over a limited surface area in a series of patches and monitored non-invasively using pulse-amplitude modulation and field spectroscopy for a week before destructive sampling techniques were applied, to assess sediment stability, and chlorophyll and colloidal carbohydrate content. Results from both sets of experiments provided evidence for detrimental impacts of herbicide exposure at levels relevant to application dosages, with a neutral or mitigating effect of TiO_2 nanoparticles. Laboratory experiments were shown to have value in both assessing individual and combined stressor effects, and in determining field replication requirements in conjunction with power analysis.

Outcomes

The work was presented on the 5th of September and led to fruitful discussion and questions from the audience during the session and during networking breaks, with the potential benefit of enhancing future impact of published manuscripts during dissemination. Presentation at this conference served to meet the Aquatic Stressors Forum's aims to provide "…platform to promote the enhanced understanding of environmental stress, both natural and anthropogenic, on aquatic organisms." This grant also benefits the MASTS community by raising its profile at an international conference at which it was not directly represented.