ONE Planet
Doctoral Training Partnership

Natural Environment Research Council

Project title: Future Seas: Intraspecific differences in the ecological and transcriptional stress responses of intertidal ecosystem engineers

Ref: OP2414

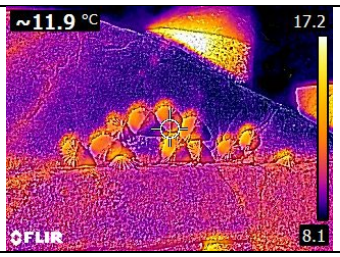
Keywords: Climate change, biodiversity, marine, biogeography,

One Planet Research Theme:

Climate & Climate Change ☒ | Earth System Processes ☐ | Anthropocene ☐ | Environmental Informatics ☐

Lead Supervisor: Dr Heather Sugden, Newcastle University

Key Research Gaps and Questions: This project will seek to determine 1. What are the thermal plasticity, thermal trajectories of local key ecosystem engineer species; 2. How does this vary over multiple generations; 3. How do environmental conditions influence the ecological sensitivity of these species?



Project Description: Multiple stressors such as ocean acidification, eutrophication, and climate change are listed as global research priority areas of biodiversity conservation, and are identified as 'grand challenges' for marine research. There is a need to better understand organism–environment linkages, identify the importance of the functional diversity of species, and understand how organisms respond to both natural and anthropogenically driven environmental change. The effects of climate change are already significantly altering the structure and functioning of coastal ecosystems. Rapid environmental changes in natural systems are variable and nonlinear, with biological responses difficult to interpret due to the complex, interacting influences exerted on organismal physiology. Species-specific impacts occur as the result of different functional traits, sensitivities, and adaptive and acclimatory capacities. Ecological stability is related to pathways of energy flow within organisms, with resultant implications for the resilience, resistance and persistence of populations. Shifts in the temporal dynamics of ecosystem engineers in response to environmental changes can modify interaction networks and change the vulnerability of entire communities to disturbance, although the degree of potential change is poorly understood. Biological impacts cause subsequent shifts in species distributions that are likely to result in novel ecological conditions in future climates that have no previous analog. Environmental change is rapidly increasing in rate and magnitude, and can alter survival, fitness, phenologies and interactions, affecting population viability and food web dynamics and the ecological stability of ecosystems.

Brief methodology: 1. Long-term mesocosm experiments will be used to investigate intrinsic metabolic and physiological mechanisms and the role in understanding how organisms respond to chronic changes in environmental conditions. 2. Mesocosm experiments will use future marine climate change, ocean acidification, and eutrophication scenarios for 2050 and 2100; 3. Biometric parameters and physiological performance of adults and reared juveniles will be measured throughout the experiments. 4. Extraction of total RNA from muscle and visceral tissue with high replicates will be conducted to identify differentially expressed genes (DEGs) and modulated pathways.

Prerequisites:

At least a 2i in marine biology or related scientific area. For more information, please contact Dr Heather Sugden (heather.sugden@ncl.ac.uk)

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