The impacts of larval experience on juvenile success: Linking environmental effects, molecular signalling and physiology during abalone metamorphosis.

Project ID: 3510

Supervisory team

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Host institutions: University of Exeter (Streatham)/University of Plymouth



Project description: The environmental conditions experienced during development can impact future survival, growth and recruitment in marine species. The European abalone (Haliotis tuberculata) is a commercially valuable and ecologically important marine snail whose populations are threatened by fishing pressure, disease outbreaks and environmental change. Successful recruitment of new individuals into adult populations depends on the ability of planktonic larvae to locate suitable habitat, settle onto the seabed and undergo metamorphosis into benthic juveniles. However, rising temperatures and increasing thermal variability are predicted to negatively impact settlement success, potentially affecting population resilience, aquaculture production and restoration efforts. Despite the importance of this life cycle transition, the molecular mechanisms regulating metamorphosis, and the extent to which larval environmental experience determines subsequent juvenile performance, remain poorly understood.This project will combine transcriptomics and ecophysiology to investigate how larval experience shapes metamorphosis and recruit quality in H. tuberculata. Using controlled laboratory experiments, larvae will be exposed to natural settlement cues to induce metamorphosis. A high-resolution RNA-sequencing time series spanning larval settlement, metamorphosis and early juvenile development will be used to identify candidate gene networks involved in environmental sensing, neuroendocrine signalling, tissue remodelling and shell formation. Candidate regulators will subsequently be localised using in situ hybridisation and immunolabelling approaches to generate a detailed spatial and temporal characterisation of metamorphic regulatory pathways in this species.The project will further determine how larval environmental history influences settlement success, metabolic performance, growth and survival, thereby affecting the quality of juvenile recruits. By integrating molecular mechanisms with physiological measures of developmental performance under environmentally relevant temperature regimes, the study will test the hypothesis that environmental conditions modify gene regulatory networks underlying larval development and metamorphosis, producing lasting carry-over effects on juvenile quality and recruitment potential. We will address the question: how does the larval environment shape juvenile success? Results will provide insight into developmental plasticity and resilience to environmental change in marine invertebrates while informing conservation, restoration and sustainable aquaculture of this species. Continued on next page……

This project provides a unique interdisciplinary training opportunity spanning developmental biology, molecular biology, marine ecology and ecophysiology. The student will develop expertise in transcriptomics, bioinformatics, spatial and quantitative gene expression, larval culture, experimental design, physiological measurements and

quantitative data analysis. By integrating molecular and organismal approaches, the student will gain the skills required to address fundamental questions in environmental developmental biology while generating knowledge relevant to marine conservation and aquaculture.

Our aim as the SWBio DTP is to support students from a range of backgrounds and circumstances. Where needed, we will work with you to take into consideration reasonable project adaptations (for example to support caring responsibilities, disabilities, other significant personal circumstances) as well as flexible working and part-time study requests, to enable greater access to a PhD. All our supervisors support us with this aim, so please feel comfortable in discussing further with the listed PhD project supervisor to see what is feasible.