Multilevel assessment of seagrass response to main climatic and anthropogenic stressors: epigenetic changes and early warning indicators of mortality

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Project Summary

Seagrasses are strongly threatened by the effects of climatic changes and anthropogenic activities. Light and temperature changes are among the strongest stressors affecting seagrass health. Here we propose, to dissect the plasticity in the response to temperature increase and to identify early warning indicators to light limitation in species with different life styles (i.e. pioneer and late succession species). Congeneric species, or species representing comparable ecological stages in the Mediterranean climatic regions, both within the Mediterranean Sea and along the temperate coast of Australia, will be analyzed.

First, we will assess the role of epigenetic mutations in affecting plasticity response to temperature changes. Expected results include the assessment of plant plasticity and adaptive potential to warming, with particular reference to the importance of epigenetic mutations for the evolutionary success of species.

Plants will be cultivated in high temperature conditions and species plasticity will be assessed at morphological, physiological and molecular level, and correlated with the amount of epigenetic mutations. Second, we will identify early-warning indicators of light limitation. Genes involved in the response to light limitation will be searched in silica for the target species. Their expression will be evaluated during a long exposure of plants to light limitation in controlled conditions and related to the multilevel plant response (physiology, morphology, growth and mortality). Molecular probes specific to highly responsive genes (early warning indicators) will be designed and assembled into Nanostring chips to measure expression of many transcripts in multiplex fashion. Validation will be performed in field manipulative experiments through differential gene expression, profiled using a state-of-the-art Nanostring technology available within the laboratory of the external supervisor at UTS.

The project would provide the assessment of species plasticity against environmental stress, and the provision of a novel early warning tool for monitoring seagrass status before decline becomes visible. The comparison between species with different life styles and between Mediterranean and Australian species, will allow to assess if species-specific features have been acquired early in the evolutionary history of the species or if similar ecological role and life style influence at the same way the species response to stress.

Assessing the mechanisms activated by marine plants to withstand environmental changes, in an evolutionary and ecological context and devising early warning indicators of environmental stress will provide important tools for their management and conservation.