Explore the use of assisted evolution approaches for improving seagrass restoration and for enhancing the resilience of restored populations (AEvol-Sea)

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Project Summary

Seagrasses create critical coastal habitats worldwide and provide numerous ecological functions and socio-economical services, rendering them as one of the most valuable ecosystems on earth. Seagrasses are exposed to different types of human-induced disturbances, which frequently leads to habitat loss and eventually local/regional extirpation. Given their ecological and socio-economic importance, seagrass conservation and restoration is a global primary priority recognized by the UN (www.decadeonrestoration.org). **The goal of this project is to explore and develop assisted evolution approaches in *P. oceanica* seeds/seedlings with potential for enhancing their stress-tolerance and overall resilience.** First, the project will assess the effectiveness and stability of seedling priming approaches (thermal and chemical priming) on the acquisition of a stress memory (Priming). Second, it will investigate the effects of seedling priming approaches (thermal and chemical priming) on cross-stress tolerance and third, it will identify and select stress-resistant genotypes for improving *P. oceanica* restoration and for promoting the resilience of restored populations to environmental stress. Experiments will be performed on beach-cast *P. oceanica* seeds collected along the southern coast of Sicily and left to germinate in aquaria. Priming experiments will be performed under controlled conditions at the mesocosms facilities made available from the three supervisors. Priming processes will be activated by exposing seedlings to heat stress (33ºC) for a few days and by soaking seedlings with H2O2 (<10 µM) for 12 hours; while the identification of stress-resistant genotypes will be done through phenotypes screening experiments. Effectiveness of priming and resistant-genotypes selection will be evaluated by exposing primed and selected seedlings to climate change-related stress factors. The effectiveness and stability of selected priming methods and the effectiveness of stress-resistant genotypes selection will be evaluated and compared by analyzing their fitness (e.g., size, necrotic marks), growth and survival, global enzymatic and non-enzymatic antioxidant responses (TEAC and ORAC) and oxidative stress damage (MDA). Effectiveness of both assisted evolution strategies will also be evaluated by transplanting primed/not primed and tolerant/sensitive seedlings in the field, taking advantage from the existing transplanting units present in the SIC of Bagnoli and installed within the project Abbaco. Better performing genotypes in mesocosm conditions will also be compared and their genetic makeup will be analyzed to find correlations between genetic and fitness traits. Overall, the results of this project will provide important information potentially fostering transplantation projects in *P. oceanica* and seagrasses in general.