PLASTIcity of seagrass Clones against AGEing (PLASTIC-AGE)

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Abstract

Seagrass meadows are essential and diverse habitats that significantly contribute to biodiversity, shape ecosystems, and offer valuable ecosystem services. Seagrasses store a significant amount of organic matter, effectively contributing to 'blue carbon' sequestration. Their reproductive strategies involve both sexual and clonal reproduction, influencing genetic composition and diversity within populations. Understanding the impact of climate change on seagrass ecosystems is imperative for developing effective conservation and restoration strategies, particularly given their potential as natural climate solutions. **This project aims to explore the plasticity and adaptive potential of long-lived seagrass clones, focusing on the Mediterranean endemic seagrass *Posidonia oceanica*.** The study addresses gaps in understanding the evolutionary mechanisms acting within long-lived seagrass clones, particularly the role of somatic mutations (SM) in introducing intra-clonal Somatic Genetic Diversity (SoGV) and challenging the perception of clonality as a static and less adaptive reproductive strategy. The objectives include estimating the accumulation rate of SM to use it as an index for ageing *P. oceanica* clones, assessing the effects of age on sexual reproductive patterns, clonal-specific responses, and intraclonal plasticity, and exploring multi-level selection under changing environments. The project will employ field sampling, geochronology, genomic analyses, and laboratory experiments to investigate these aspects. The project involves three work packages focused on each specific objective. The first (WP1) focuses on estimating the accumulation of SM in *P. oceanica* using innovative genomic approaches coupled with traditional techniques for yearly growth determination. The second (WP2) investigates the effects of ageing and senescence on the loss of sexual reproductive capacity through the clonal age estimation and lepidochronology analyses on the flowering record of the clones. The third (WP3) explores the clonal-specific responses, intraclonal plasticity and multi-level selection operating on clones of different ages through in-situ measurements and controlled experiments Altogether, the expected impact of this research is a significant contribution to understanding the persistence and resilience of long-lived seagrass clones and potentially influencing our perception of clonality in natural systems. Moreover, the project's outcomes may have broader implications for the evolutionary dynamics of natural selection against different reproductive strategies.