

# Sustainable methods for the ecological restoration of *Posidonia oceanica* in the Mediterranean Sea

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Seagrasses are essential components of coastal marine ecosystems. In the Mediterranean Sea, *Posidonia oceanica* meadows play a key role in nutrient cycling, carbon sequestration, primary production, controlling coastal geomorphology and providing habitat, shelter, and food for thousands of species.

Increasing anthropogenic pressure in coastal areas, mainly through direct human activities, such as fishing, anchoring, or dredging, is responsible for the regression of seagrass meadows globally. Particularly, in the Mediterranean Sea *P. oceanica* meadows have undergone a documented decline over the last century. Therefore, conservation and restoration efforts aimed at preserving *P. oceanica* seagrass meadows have intensified in recent decades, employing various techniques, both destructive and non-destructive. The most suitable restoration methodology should be selected according to the type of damage and/or cause of regression, always prioritising the most sustainable techniques. Non-destructive and sustainable approaches, including methods utilizing cuttings collected from drifting material on the seafloor and seedlings derived from floating or stranded fruits, have recently gained much attention, and are further developing. Seed-based strategies offer the advantage of providing more genetic diversity to the new plants, while vegetative fragments are more readily available and recoverable.

The aim of this study is to implement different sustainable techniques for restoring *P. oceanica* meadows in the Mediterranean Sea. To achieve this goal, we use both cuttings and fruits and test different cultivation and transplantation methodologies. The findings will allow us to identify the most suitable and sustainable approach for ecological restoration interventions for *P. oceanica* conservation.