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The LIFE SEPOSSO proposal for the planning, implementation, and monitoring of *Posidonia* oceanica transplantations

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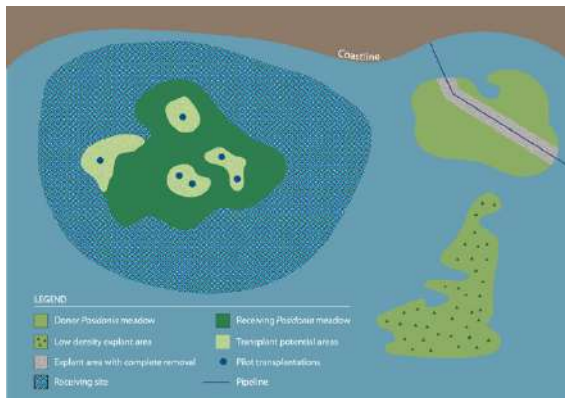
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ABSTRACT

Posidonia oceanica (L.) seagrass meadows are in regression in various areas of the Mediterranean basin, and it is estimated that their surface area has decreased by more than 30% over the last 50 years. Human activities and related forms of pollution are among the main threats to this habitat, causing loss or fragmentation of the meadows. The EU Strategy for Biodiversity for 2030, has formulated a plan for the restoration of terrestrial and marine ecosystems, mainly with a high potential for carbon capture and storage. The restoration of *Posidonia* meadows through sustainable and effective transplantation activities will not only contribute to the achievement of EU objectives for biodiversity and climate change but will also favour the maintenance and sustainability of fundamental activities for the coastal areas, such as fishing, tourism, and blue growth. Our work shows the specific procedural process for planning, implementation, and monitoring of *P. oceanica* transplantations providing detailed information and executive methods on the different phases of *P. oceanica* transplants. Each phase includes the main activities and their purposes for the acquisition of essential data to characterize and select the donor and receiving meadows and to select suitable areas for transplant. Specific parameters and sampling frequencies are explained to efficiently monitor the performance of transplantation over a long period (10 years). The procedures described refers to any transplant such as the restoration of degraded meadows, the reconnection of portions of damaged meadows, the compensation of sectors of *Posidonia* completely lost due to marine coastal works. The accuracy of the information provided is guaranteed by the analyses of 39 transplants carried out in Italy and 32 Environmental Impact Assessment decrees of marine infrastructural works affecting *P. oceanica* meadows, which allowed to select the best practices and the most efficient governance approaches for an effective *Posidonia* restoration.

Keywords: seagrass, habitat restoration, Mediterranean Sea, best practices, *Posidonia*.

Fig. 1 Example diagram of the different areas involved in the planning, implementation, and monitoring of *Posidonia oceanica* transplantation



Posidonia oceanica transplantation: insights and lessons from Italy

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ABSTRACT

Italy has invested more than other countries in research and experiments on *Posidonia oceanica* transplanting in the Mediterranean basin. Numerous experiments and extensive transplantations, some of which are in progress, have been carried out in Italy both to restore degraded meadows and to compensate for the damages caused by coastal works and infrastructures. Our study, implemented in the framework of the LIFE SEPOSSO project, takes into account the Italian case studies, with 39 transplantations carried out between 1994 and 2021. A number of anchoring modules, such as concrete frames with metal mesh, different types of metal grids and stakes are among the most frequently used techniques to fix *P. oceanica* cuttings to the substrate. Over time, additional anchoring methods, such as mats and mattresses of various types, bioplastic anchoring modules, and even the transfer of *P. oceanica* clods, have been developed and tested, with increasing focus on the environmental sustainability of the technique used. The transplantations carried out in Italy are very different from each other, in terms of technique, surface, receiving substrate (sand, *matte*, rocks), bathymetry and monitoring duration. Most of transplantations (89.7%) were carried out between 6 and 15 m depth and the most frequent transplanting substrate among case studies (53.9%) was dead *matte*. Only 20.6% of transplantations were carried out on a large spatial scale (> 500 m²), with a maximum area of 1 ha. 20.5% of transplantation had a medium-term (> 5 years) and 17.9% a long-term monitoring period (> 10 years). The performance of transplantation will be analyzed and discussed in order to better understand its effectiveness and its use in environmental decision-making and management.

Keywords: *Posidonia oceanica*, transplantation, seagrass, management, Italy