

Transplantation of the Mediterranean seagrass *Posidonia oceanica* through naturalistic engineering techniques: value, weakness and further improvements

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Transplantation of seagrasses is considered a useful method to favour the recovery of degraded meadows. Hence, many projects have been carried out worldwide and a manifold of techniques have been applied. However, the choice of transplantation procedures remains a main problem to be assessed. In order to optimize efforts and to minimize risks of plants loss, the applied methodologies should take into account typology of hosting substratum, hydrodynamic conditions, depth and seagrass species.

Due to their fundamental ecological role in the Mediterranean coastal system, many restoration projects aiming to preserve *Posidonia oceanica* meadows took place in the last decades. Several transplantation techniques have produced different results. In fact the same transplanting methodology may originate diverse results under different environmental conditions.

Recently, naturalistic engineering techniques developed on land, have been used for transplantations of *P. oceanica*. Pilot projects concerning small surfaces were carried out between 2006 and 2010. More recently, a large-scale program (0.1 km²) was realized in 2012 at Civitavecchia (Roma, Tyrrhenian Sea). The applied technique consists basically of mattresses filled with sand coupled with a net covering able to hold steady in situ the plant rhizomes. These structures have been variously modified in time to be adapted to the different type of substratum and various hydrodynamic conditions of the transplanting sites.

Following the results of these transplantation experiences, we analyzed pros and cons of the techniques in order to improve the methodology. Firstly, these techniques may be considered suitable to large-scale projects allowing to minimize transplantation times. Secondly, the rhizomes may be successfully fixed to the structures; the majority of the transplanted shoots was not damaged showing a very good vegetative vitality with the production of new rhizomes, leaves and roots few months after transplanting. Finally, this procedure is flexible, as the basic technique can be modified and tailored to the various environmental conditions of the different receiving site. However, the results obtained in different areas are highly heterogeneous suggesting that a careful selection of the hosting site is a focal point. To this aim, a pilot study before the beginning of large-scale project seems mandatory, providing a fundamental support to guarantee successful results.