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Potential and realized connectivity of the seagrass *Posidonia oceanica* and their implication for conservation

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Abstract

Aim: Connectivity assessments are crucial to large-scale conservation planning, in particular for establishing and monitoring connected networks of marine protected areas (MPAs). Using biophysical modelling and genetic analyses, we assessed potential and realized connectivity among MPA populations of a benthic foundation species, the Mediterranean endemic seagrass *Posidonia oceanica*.

Location: Adriatic and Ionian seas (central Mediterranean).

Methods: We assessed potential and realized connectivity among eight *P. oceanica* meadows, mostly located in MPAs. Potential connectivity was assessed over a time horizon of 10 years via an individual-based biophysical model whose physical component relies on fine-scale spatio-temporal ocean circulation fields. Genetic assessments of realized connectivity were carried out by means of a set of 14 neutral microsatellite loci, as well as a larger dataset of 19 loci including outlier loci that did not conform to expectations under neutrality.

Results: Our findings point out a relatively high potential connectivity through long-range dispersal of floating fruits. Genetic connectivity analyses show a complex scenario with an apparent lower realized connectivity. The *P. oceanica* meadow within Torre Guaceto MPA (TOG), a well-enforced MPA within our study area, showed one of the highest levels of genotypic richness, indicative of high levels of sexual reproduction and/or recruitment of foreign genotypes. Both biophysical modelling and population genetics indicate that TOG is important to ensure the viability of the species at the local scale, and does likely play a key role as a source of propagules for the whole Adriatic area.

Main conclusions: Our results show that realized dispersal does not necessarily match with the potential for dispersal. Still, both genetic and physical connectivity analyses show good agreement in identifying hotspots of connectivity. Such information can guide management of networks of MPAs and advance conservation of marine biodiversity.

KEYWORDS
dispersal, genetic connectivity, Lagrangian, marine protected areas, propagules, seagrass

