

Multispecies approach to the restoration of degraded Mediterranean reefs

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The current rate of biodiversity loss and habitat degradation calls for innovative approaches to ecosystem restoration. Despite increasing efforts in marine restoration, multispecies approaches, when species are transplanted in degraded sites based on their natural co-occurrence, remain largely underexplored, particularly in applied management. This study was carried out in the Porto Cesareo Marine Protected Area (Italy), within a fully protected zone (Zone A), where the illegal harvesting of endolithic date mussels (*Lithophaga lithophaga*) led to the destruction of shallow rocky bottoms and the formation of extensive barren grounds. This study aims to evaluate whether incorporating positive species interactions can enhance restoration success and provide more effective management solutions. We transplanted fragments of two species that naturally co-occur, often being closely associated, in the same habitat: the reef-building coral *Cladocora caespitosa* and the massive sponge *Aplysina aerophoba*. We established three experimental treatments: coral fragments transplanted alongside sponge fragments (multispecies), coral fragments transplanted in pairs (monospecies), and sponge fragments transplanted in pairs (monospecies). We tested the hypothesis that multispecies transplantation can improve restoration performance compared to monospecific approaches. The experiment started in April 2023, and transplant performance (survival and growth) was assessed after 15 months of monitoring. Survival did not differ significantly between multispecies and monospecific treatments for either species. However, overall survival differed between species, being higher in *A. aerophoba* (~92%) than in *C. caespitosa* (~67%). Linear mixed models, including site as a random factor and treatment as a fixed factor, revealed that growth was significantly higher in multispecies treatments than in monospecies treatments for both species ($p \leq 0.05$). Overall, our findings highlight that multispecies assemblages enhance growth performance without affecting survival, supporting the integration of species interactions into evidence-based management. These results suggest that multispecies restoration can represent a practical and scalable strategy for the recovery of degraded habitats.