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Oceanic provinces and basin-scale connectivity derived from a hydrodynamical network help designing marine reserves in the Mediterranean Sea

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Larval dispersal and marine connectivity have been identified as crucial factors for structuring marine population and thus to design Marine Protected Areas (MPAs). Focusing on larval dispersal by ocean currents, we propose a new approach coupling Lagrangian modeling and network theory which characterizes marine connectivity in the whole Mediterranean basin. Larvae of different Pelagic Larval Duration are modeled as passive tracers advected in a simulated oceanic surface flow from which a network of connected areas can be constructed. Hydrodynamical 'coherent' provinces extracted from this network are delimited by frontiers which match mesoscale oceanographic features. By examining the repeated occurrence of such boundaries, we identify the relevant scales of larval dispersal across the entire seascape. We finally used these hydrodynamical units to define connectivity metrics for a few selected MPAs in the Mediterranean sea and we discuss our results for future allocations of MPA. The characterization of marine connectivity and its geographic structure at basin-scale has ecological and managerial implications, especially considering the growing interests for offshore MPAs.