Relevant spatial scales when upscaling larval transport into a connectivity matrix to forecast marine population density distribution: the Eunicella singularis study case in the Gulf of Lion (NW Mediterranean)

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Abstract

In the marine environment, connectivity among populations arise from dispersal during the larval stage for most sedentary species and particularly 70 % of benthic invertebrates. Offspring released into the water column are transported and dispersed almost passively by the flow due to limited motility ability compared to horizontal flow speed. As a consequence, the spatio-temporal variability of hydrodynamic primarily shapes larval transport that is the integration of larval dispersal over the pelagic larval duration. Ocean modelling works well for hindcasting realistic coastal circulation, and can provide a comprehensive description of flow variability at high spatial and temporal resolution, which improves description of larval transport. Yet, such refinement might be ruined by a coarse upscaling procedure that is when larval transport is summarized into larval connectivity matrices by integration of larval transport for the duration of a spawning event between spawning and settlement grounds. In particular, the upscaling of larval transport into a connectivity matrix questions the relevant spatial scales at which spawning and settlement grounds should be agreggated. In this study, we point out how a priori choices of spatial scales in the upscaling procedure of larval dispersal simulations into larval connectivity matrices deeply alter spatial distribution of population density forecasted by a spatially explicit metapopulation model. Comparison between modelled and observed spatial distribution of the population density of the white gorgonian, *Eunicella singularis,* in the Gulf of Lion demonstrates the importance of taking into account small spatial scales of transport structuration when upscaling larval transport into larval connectivity matrices.

Keywords: larval transport, connectivity, meta, population, marine invertebrates, spatial distribution, population density

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