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## Population Dynamics – Session 2

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### Multi-scale density-dependent dispersal in spatially structured populations

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In spatially structured populations, dispersal is context-dependent and related both to local conditions (within patches) and to the metapopulation as a whole. Density-dependence experienced at different scales likely plays a role in initiating dispersal and determining dispersal success. This multi-scale density-dependence has hitherto received little attention despite its potential to produce spatiotemporally heterogeneous dispersal rates and fundamentally alter predictions about metapopulation dynamics and persistence. We developed a spatially explicit metapopulation model to quantify dual-scale density-dependence using data from a metapopulation of water voles *Arvicola amphibius* in Assynt North West Scotland where those rodents grow up to 300 g, live in small colonies and occupy 8% of the 860 km waterway network with slow flowing water and vegetated banks. Average dispersal was large scale with a colonization halving distance of 4.14 km. The per capita probability that a dispersal event resulted in successful establishment, or prevented extinction via the rescue effect, was higher for juveniles living in source patches with larger population sizes, i.e., consistent with positive local density-dependent emigration, and higher in years when the number of occupied sites in the metapopulation was lowest, i.e., consistent with negative regional density-dependence. In model simulations, multi-scale density-dependent dispersal induced increased variability in metapopulation dynamics and hence increased extinction risk. This was offset by increased dispersal success in low occupancy years. Thus, negative density dependent dispersal at the metapopulation scale partly counters the heavily destabilising impact of positive density dependence at the local scale. We suggest that metapopulations can only persist where those influences counter each other.

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Jens Jacob, Jana Eccard (Editors)

6<sup>th</sup> International Conference of Rodent  
Biology and Management  
and  
16<sup>th</sup> Rodens et Spatium

Potsdam, Germany, 3-7 September 2018

Book of Abstracts



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