

Assessing the contribution of outlier individuals to landscape connectivity with spatial capture-recapture models and finite mixtures

With increasing fragmentation and habitat loss, maintaining connectivity is a challenge to ensure the persistence of wide-ranging animal populations. However, this key process remains difficult to measure. Recently spatial capture-recapture (SCR) models have been developed using ecological distance to allow the simultaneous estimation of density and connectivity. Like in any capture-recapture model, a challenge is to deal with individual heterogeneity, e.g. to consider individual variation in home-range size. When the source of heterogeneity is known, it is easy to account for individual heterogeneity in SCR models by using specific parameters, for males and females for example. Still, some residual heterogeneity that cannot be defined by a priori ecological knowledge is challenging to accommodate. Indeed, some outlier individuals can display relatively long intra-annual movement compared to most of the surveyed population. The inclusion of these individuals in the analysis can lead to an overestimation of home-range size, and cause problems for inferences on density. However, when it comes to connectivity, individuals with a larger home-range are key to make links between distant patches. We propose to use finite mixtures into SCR models to evaluate the contribution of long-distance movements in maintaining landscape connectivity. Home-range size is related to a scale parameter, which controls the shape of the detection probability. Our model allows estimating different scale parameters when the source of heterogeneity is unknown. The population is divided into several hidden classes to which individuals are assigned based on data. We carry out a simulation study to assess the performances of our proposal. Also, as a case study, we focused on the endangered Pyrenean brown bear population. We show that a few males moving across the Pyrenees ensure connectivity between two core areas.