Hierarchical modelling of population growth rate from individual capture-recapture data

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Abstract: Different approaches exist to estimate and model population growth and associated vital rates using capture-recapture data from open populations. Among them the temporal symmetry approach (Pradel 1996) has the unique characteristic of combining in the same likelihood the standard-time and the reverse-time approach, simultaneously incorporating survival and recruitment parameters and thus allowing inference on population growth rate. We present a Bayesian formulation of the Pradel's temporal symmetry method in which parameter estimates are derived by the posterior sampling of distributions generated by MCMC methods. The Bayesian formulation permits a hierarchical modelling of the biological and sampling processes, allowing the extension of the original fixed time effects structure to random time effects, an option which is still impractical in a frequentist framework. We illustrated the model by using individual capture histories of a long-lived seabird, the Scopoli's shearwater *Calonectris diomedea*, and assessed the influence of climatic variables on annual survival and population growth rate simultaneously.

References

Pradel, R. (1996) Utilization of capture-mark-recapture for the study of recruitment and population growth rate. *Biometrics*, 52: 703-709.