From integrated population models to integral projection models

R.S. McCrea[a] and **T. Coulson**[b]

[a]School of Mathematics, Statistics and Actuarial Science
University of Kent
Canterbury, UK
R.S.McCrea@kent.ac.uk

[b]Department of Zoology
University of Oxford
UK
timothy.coulson@zoo.ox.ac.uk

Keywords: continuous states; individual-based models; integrated population models; population dynamics.

Abstract: Multiple types of data have been collected on a single population and analysed separately as each type of data provide information on parameters of interest, for example productivity counts provide information on fecundity and recapture data provide information on survival. However, developments of integrated population models (Besbeas et al, 2002) broke this trend, when it was shown that multiple data sets with parameters in common could be coherently modelled in order to provide the best estimates for demographic parameters.

It has been shown that many capture-recapture models can be fitted using a state-space framework (Gimenez et al, 2007). State-space models require the assignment of individuals to a set of discrete states. For some applications this may be trivial, such as age-stage assignment, or classification by sex, however as more individual time-varying data is being collected it may be of use to consider a model which includes the potential to incorporate continuous states. Integral projection models, first proposed for ecological application in Easterling et al, (2000), provide the means to incorporate continuous states.

Currently, approaches are piecemeal in nature, and parameter estimates are obtained separately from component data sets; see for example Coulson et al, 2010. This talk will present current research on the simultaneous estimation of parameters of interest within the integral projection model.

References

Besbeas, Freeman, Morgan and Catchpole (2002) Integrating mark-recapture-recovery and census data to estimate animal abundance and demographic parameters. *Biometrics*, **58**:540-547.

Coulson, Tuljapurkar and Childs (2010) Using evolutionary demography to link life history theory, quantitative genetics and population ecology. *Journal of Animal Ecology*, **79**:1226-1240.

Easterling, Ellner and Dixon (2000) Size-specific sensitivity: Applying a new structured population model. *Ecology*, **81**:694-708.

Gimenez, Rossi, Choquet, Dehais, Doris, Varella, Vila and Pradel (2007) State-space modelling of data on marked individuals *Ecological Modelling*, **206**: 431-438.