Using movement modelling to Integrate transect and telemetry data

Michelot, Blackwell and Matthiopoulos (2019; Ecology, 100(1), e02452) describe a statistical modelling framework which incorporates both long-term resource selection and short-term step selection in a coherent and consistent way, with a single set of selection parameters. Our approach is based on exploiting a mathematical analogy between the way that an animal moves around its environment following some utilisation distribution, and the way that certain rejection-free Markov chain Monte Carlo algorithms explore a parameter space, defined in terms of a posterior probability distribution. This gives a way of constructing a wide range of movement processes, in discrete or continuous time, that are consistent with any given utilisation distribution. I will outline some extensions to the kinds of models with these properties.

Because this framework allows us to write down likelihoods for both telemetry, which reflects local step selection, and survey data, which reflects a long-term utilisation distribution, it has the additional benefit that it allows the integration of these different types of data in a natural way, which can be surprisingly straightforward to implement. One application of this form of data integration is to investigate the merits of different possible experimental designs using telemetry, surveys or both. I will describe some results from simulation experiments that explore the trade-offs and synergies between different kinds of data collection and the relationship between the accuracy of estimation of the selection parameters and some measures of effort and spatial coverage.