Bayesian Mark-Recapture model adjusting capture probabilities for non-constant effort

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Through the annual standardised capture and ringing of birds, at a large number of sites, the British Trust for Ornithology's (BTO) Constant Effort Site (CES) scheme enables the estimation of adult survival. By design capture effort is constant between years, but may vary between sites, meaning that probability of capture p may do likewise. Survival ϕ is assumed to vary annually but to be universal over all sites. Thus a form of Cormack-Jolly-Seber model, $p(site), \theta(year)$, would appear appropriate. However, the protocol intends for each site to be visited 12 times per year during May to August. These visits are occasionally missed due to poor weather, net damage, ringer unavailability etc. A year with fewer than 12 visits is expected to have a lower capture rate than one where all 12 are made.

We present a Bayesian method for adjusting the site-specific capture probabilities for missed visits which negates the need for capture data to be analysed at the visit level. Capture rates are expected to vary in a predictable manner over the summer reflecting the times when birds are arriving at, and migrating from, the site. By fitting a parametric model to the seasonal change in capture probabilities an expression for the overall annual capture probability can be formed that adjusts for missed visits.

Fitting this model using Bayesian techniques requires the specification of priors in the parametric model. We discuss briefly the need to consider the resulting induced prior on the within year, and site-specific, capture probabilities.

Using simulated data, and Sedge Warbler *Acrocephalus schoenobaenus* CES data, we compare our new method to the usual CJS model in which the presence of missed visits is ignored.