**Do you need all the moves?**

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**Abstract:** The latent-multinomial model of Link et al. (2010) provides a general framework for modeling mark-recapture data with identification errors. Assuming that the vector counts for the observed histories is a linear transformation of the latent vector of counts for the true histories, given by $\boldsymbol{f} = \boldsymbol{A}\boldsymbol{x}$, Link et al. (2010) proposes a Bayesian approach using MCMC to sample from the joint posterior distribution of the model parameters and the latent counts. In particular, use a Metropolis-Hastings algorithm to updates the vector latent counts on each MCMC iteration generating proposals by adding or subtracting elements from a basis for the kernel of $\boldsymbol{A}$ one at a time. This mechanism ensures that the proposals satisfy the linear constraints, but the resulting Markov chain may not be irreducible. As Schofield and Bonner (2013) discuss, an irreducible chain can be constructed by augmenting the basis to produce a Markov basis. However, the algorithms for computing Markov bases are computationally intensive and fail for relatively small problems (e.g, 5 or more capture occasions). We discuss conditions on $\boldsymbol{A}$ which ensure that the chains produced by the original method of Link et al. (2010) are irreducible, negating the need to compute the Markov basis, and provide examples of models which do and do not satisfy these conditions. We also discuss alternative methods to avoid computation of the full Markov basis using tailored bases for particular $\boldsymbol{f}$ (called sub-Markov bases) or adjustments to the underlying MCMC algorithms.

# References

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