Prior choice and data requirements of Bayesian multivariate mixed effects models fit to tag-recovery data: the need for power analyses

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Abstract

1. Recent empirical studies have quantified correlation between survival and recovery by estimating these parameters as correlated random effects with Bayesian multivariate mixed effects models fit to tag-recovery data. In these applications, increasingly negative correlation between survival and recovery indicates increasingly additive harvest mortality. The power of mixed effects models to detect non-zero correlations has rarely been evaluated and these few studies have not focused on a common data type in the form of tag recoveries. 2. We assessed the power of multivariate mixed effects models to estimate negative correlation between annual survival and recovery. Using three priors for multivariate normal distributions, we fit mixed effects models to a mallard (Anas platyrhychos) tag-recovery dataset and to simulated data with sample sizes corresponding to different levels of monitoring intensity. We also demonstrate a method of calculating effective sample size for capture-recapture data. 3) Different priors lead to different inference about additive harvest when we fit our models to the mallard data. Our power analysis of simulated data indicated most prior distribution and sample size combinations resulted in correlation estimates with substantial bias and imprecision. Many correlation estimates spanned the available parameter space (–1,1) and were biased towards zero. Only one prior combined with our most intensive monitoring scenario allowed our models to consistently recover negative correlation without bias. Underestimating the magnitude of correlation coincided with overestimating the variability of annual survival, but not annual recovery. 4) The inadequacy of prior distributions and sample size combinations typically assumed adequate for robust inference represents a concern in the application of Bayesian mixed effects models for the purpose of informing harvest management. Our analysis approach provides a means for examining prior influence and sample size on mixed-effects models fit to capture-recapture data while emphasizing transferability of results between empirical and simulation studies.

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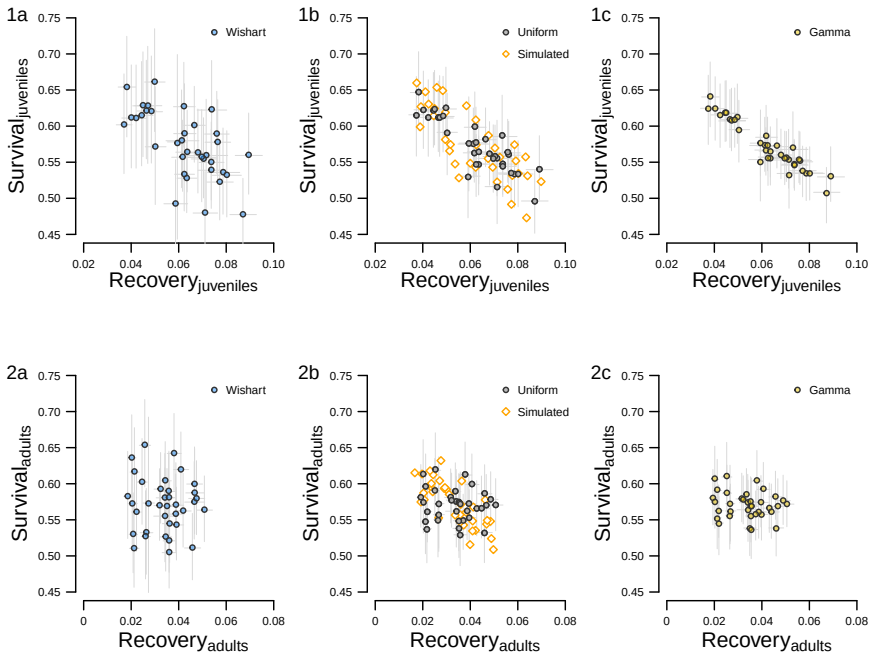

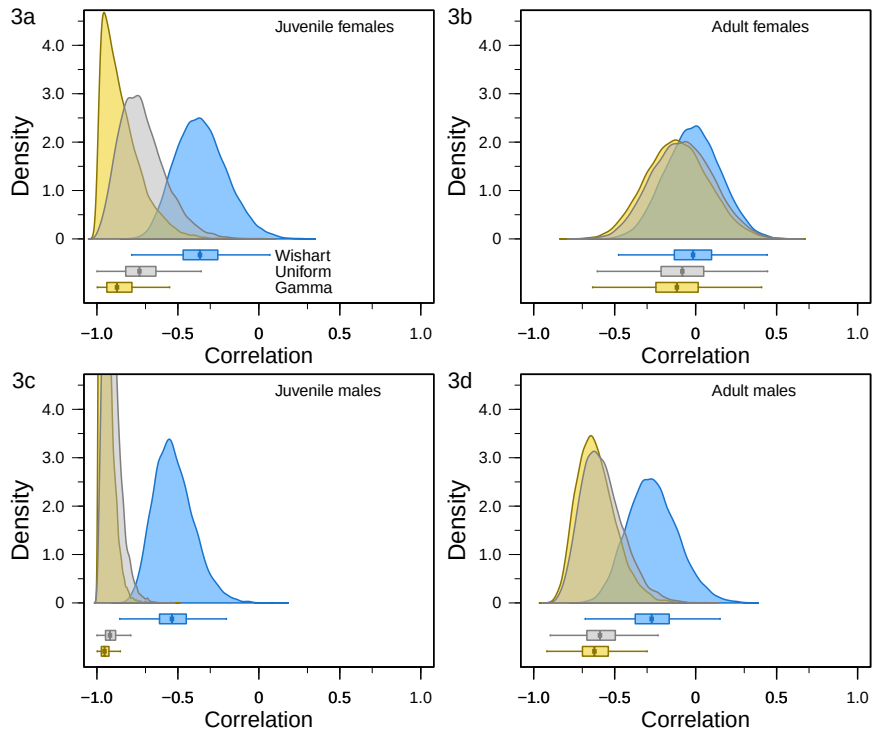

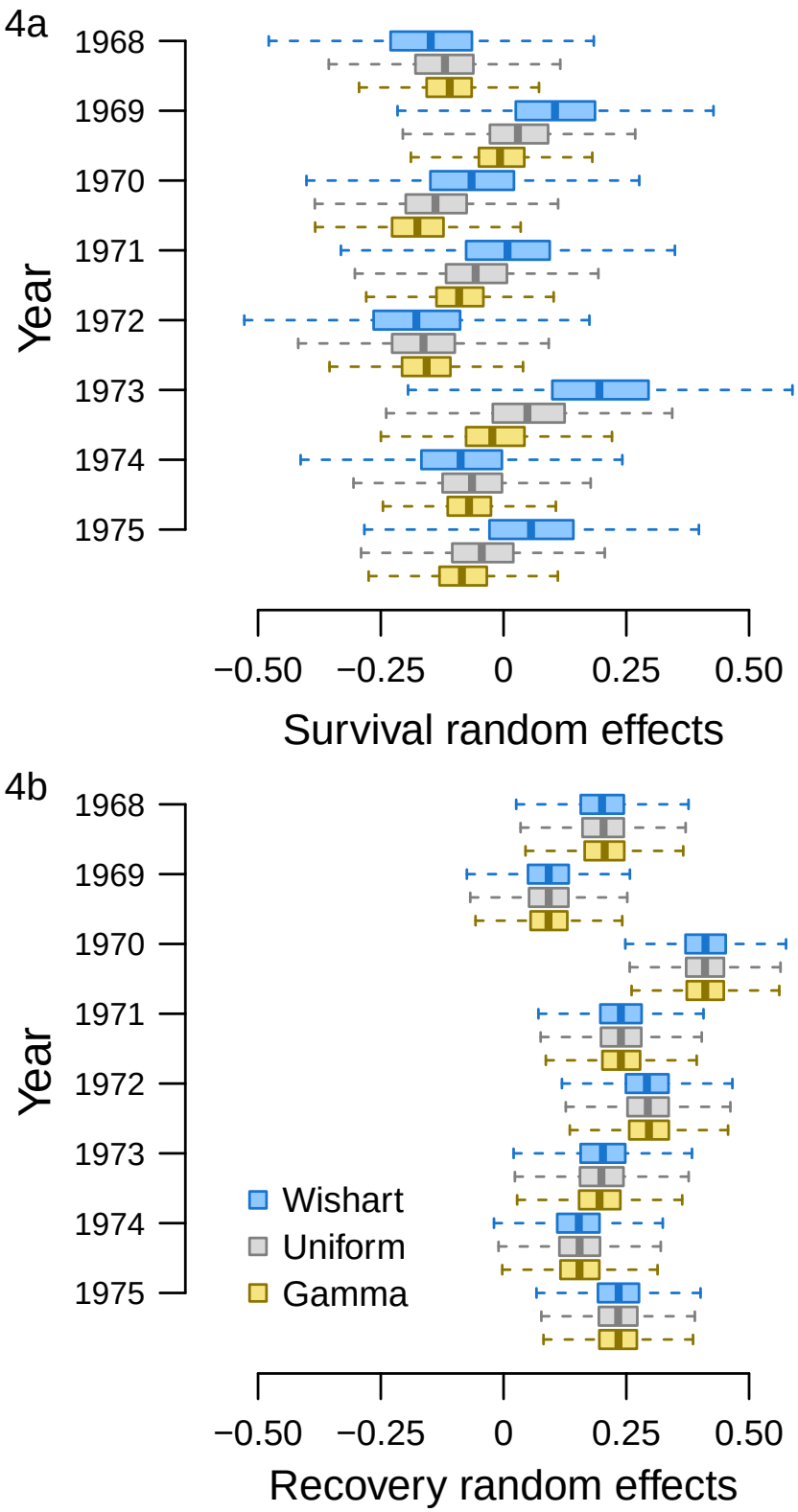

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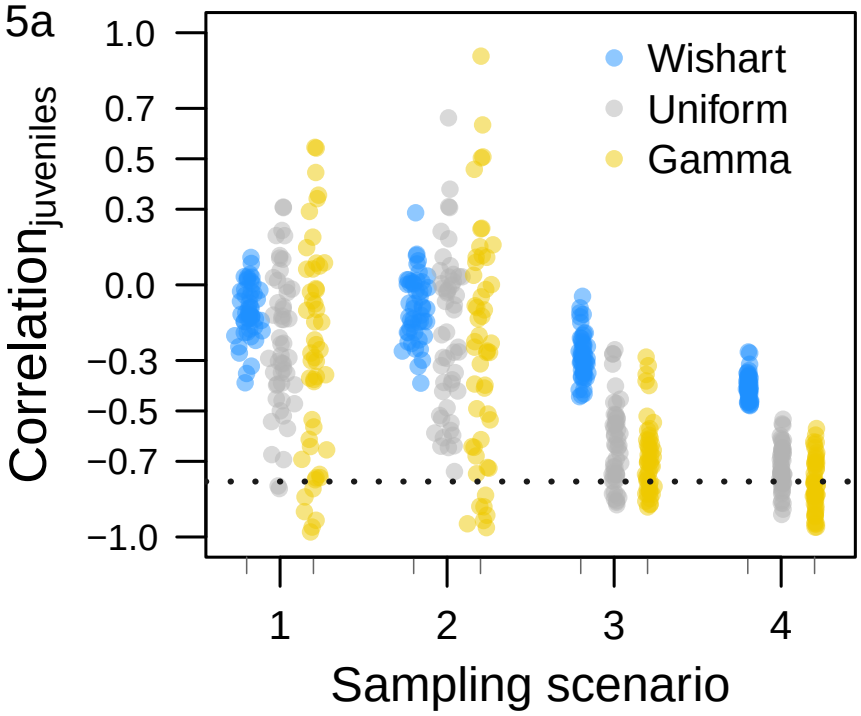

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