

# Understanding the Impact of Correlation within Pair-Bonds on Cormack-Jolly-Seber Models

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## Abstract

1. The Cormack-Jolly-Seber (CJS) model and its extensions have been widely applied to the study of animal survival rates in open populations. The model assumes that individuals within the population of interest have independent fates. It is, however, highly unlikely that a pair of animals which have formed a long-term pairing have dissociated fates. 2. We examine a model extension which allows animals who have formed a pair-bond to have correlated survival and recapture fates. Using the proposed extension to generate data, we conduct a simulation study exploring the impact that correlated fate data has on inference from the CJS model. We compute Monte Carlo estimates for the bias, range, and standard errors of the parameters of the CJS model for data with varying degrees of survival correlation between mates. Furthermore, we study the likelihood ratio test of gender effects within the CJS model by simulating densities of the deviance. Finally, we estimate the variance inflation factor for CJS models that incorporate sex-specific heterogeneity. 3. Our study shows that correlated fates between mated animals may result in underestimated standard errors for parsimonious models, significantly deflated likelihood ratio test statistics, and underestimated values of the variance inflation factor for models taking sex-specific effects into account. 4. Underestimated standard errors can result in lowered coverage of confidence intervals. Moreover, deflated test statistics will provide overly conservative test results. Finally, underestimated variance inflation factors can lead researchers to make incorrect conclusions about the level of extra-binomial variation present in their data.

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