

Ecological Applications Appendix S1
Simulation study accompanying the paper:
*Monitoring partially-marked populations using
camera and telemetry data*

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October 4, 2021

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Introduction and Methods

We conducted a small simulation study to compare the performance of the joint generalized spatial mark-resight (gSMR) model with the two-stage gSMR model. One hundred datasets were simulated from the model with parameters chosen to resemble the deer study described in the manuscript. Specifically, parameters were $\beta_0 = 1$, $\beta_1 = -0.02$, $\alpha = 0.5$, $\sigma_\epsilon = 0.1$, $\lambda_0 = 0.07$, and $\sigma = 400$. For the joint model, we assumed a uniform marking process with $p^{\text{cap}} = 0.2$. The design involved 60 cameras with the same spatial arrangement as the cameras at our AL study site. We modeled the population over 20 primary sampling periods, each corresponding to a 14-day period. We simulated one telemetry location per day. Code to reproduce the simulation study can be found at <https://github.com/rbchan/monitor-cam-telem>.

Results and Discussion

Average population size in the simulation study declined from 73 to 45 during the 20 year period (Figure S1). The number of marked individuals ranged from 1 to 27 and was approximately 20% of the total population size over the 20 primary sampling periods (Figure S1).

Parameter estimates (posterior means) were similar for the encounter rate parameters (Figure S2), the density trend parameters (Figure S3), and for the realized values of abundance (Figure S4).

Obtaining 10,000 MCMC draws (after discarding 2000 burn-in) took approximately 15 hours for the two-stage model and 17 hours for the joint model. Unlike the two-stage model, run time for the joint model will increase with the complexity of the marking process.

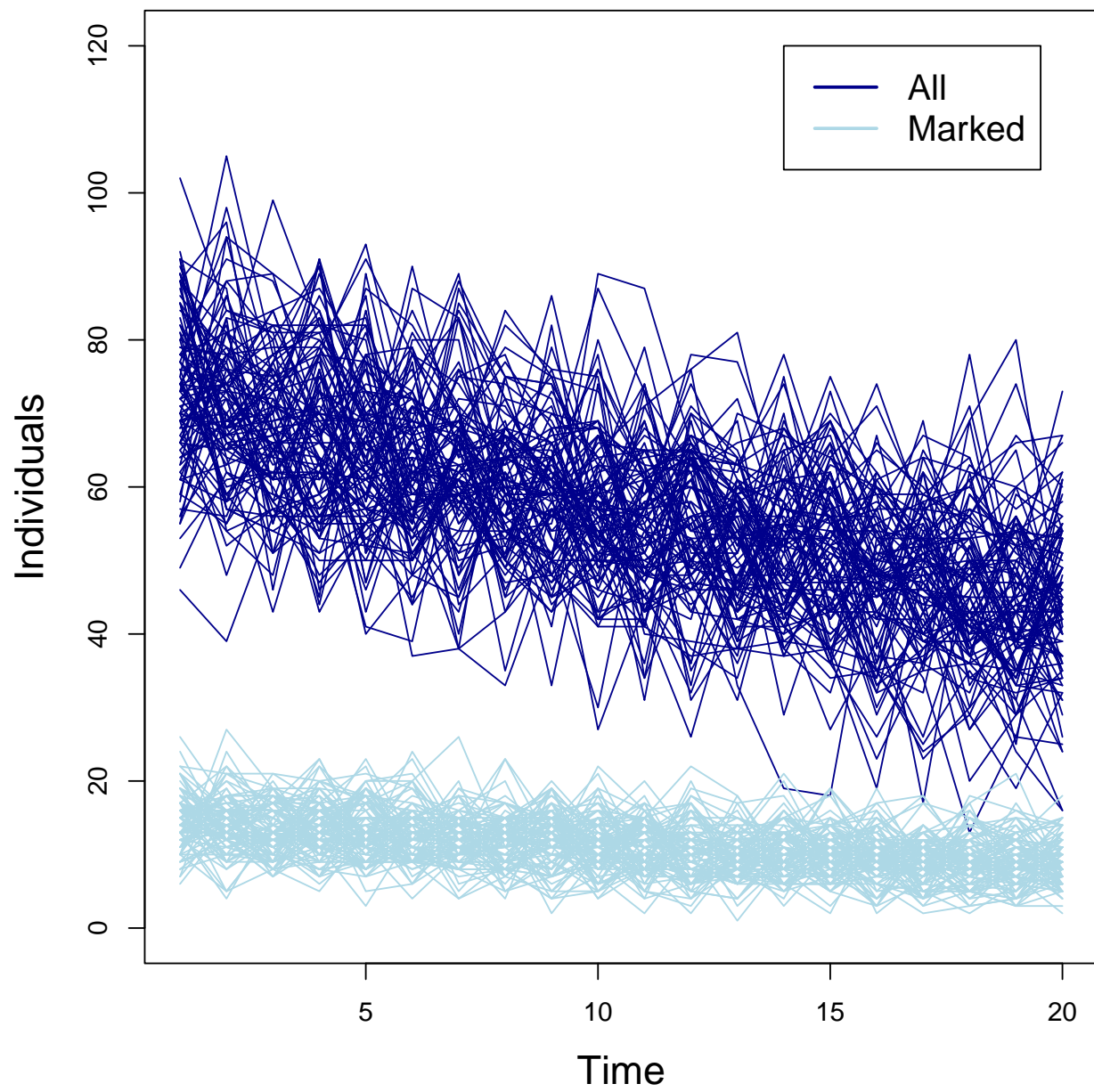


Figure S1. Population size (N) and the number of marked individuals over time.

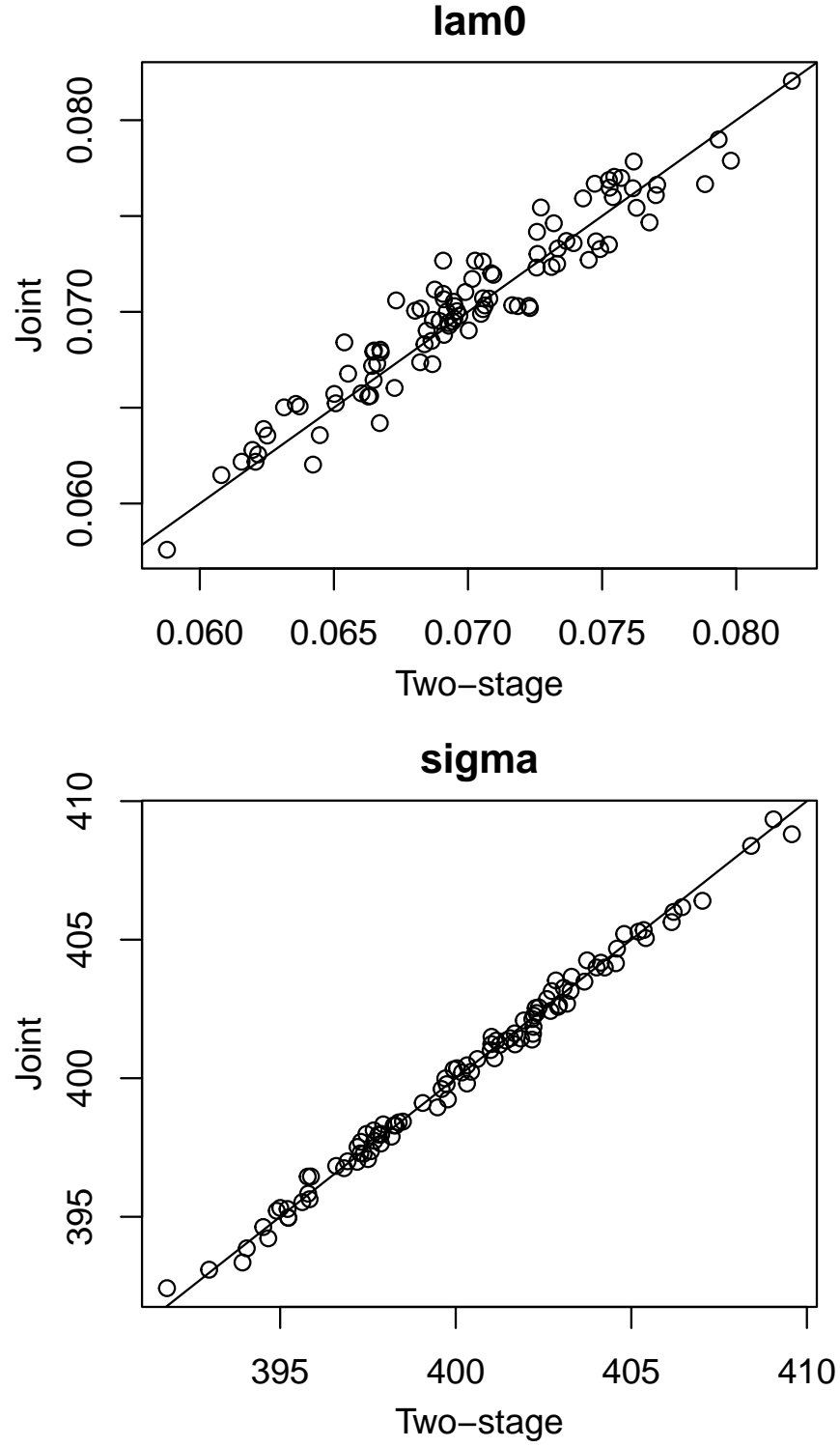


Figure S2. Results from the 100 simulated datasets used to compare posterior means for the encounter rate parameters (λ_0 and σ) for the joint model and the two-stage model.

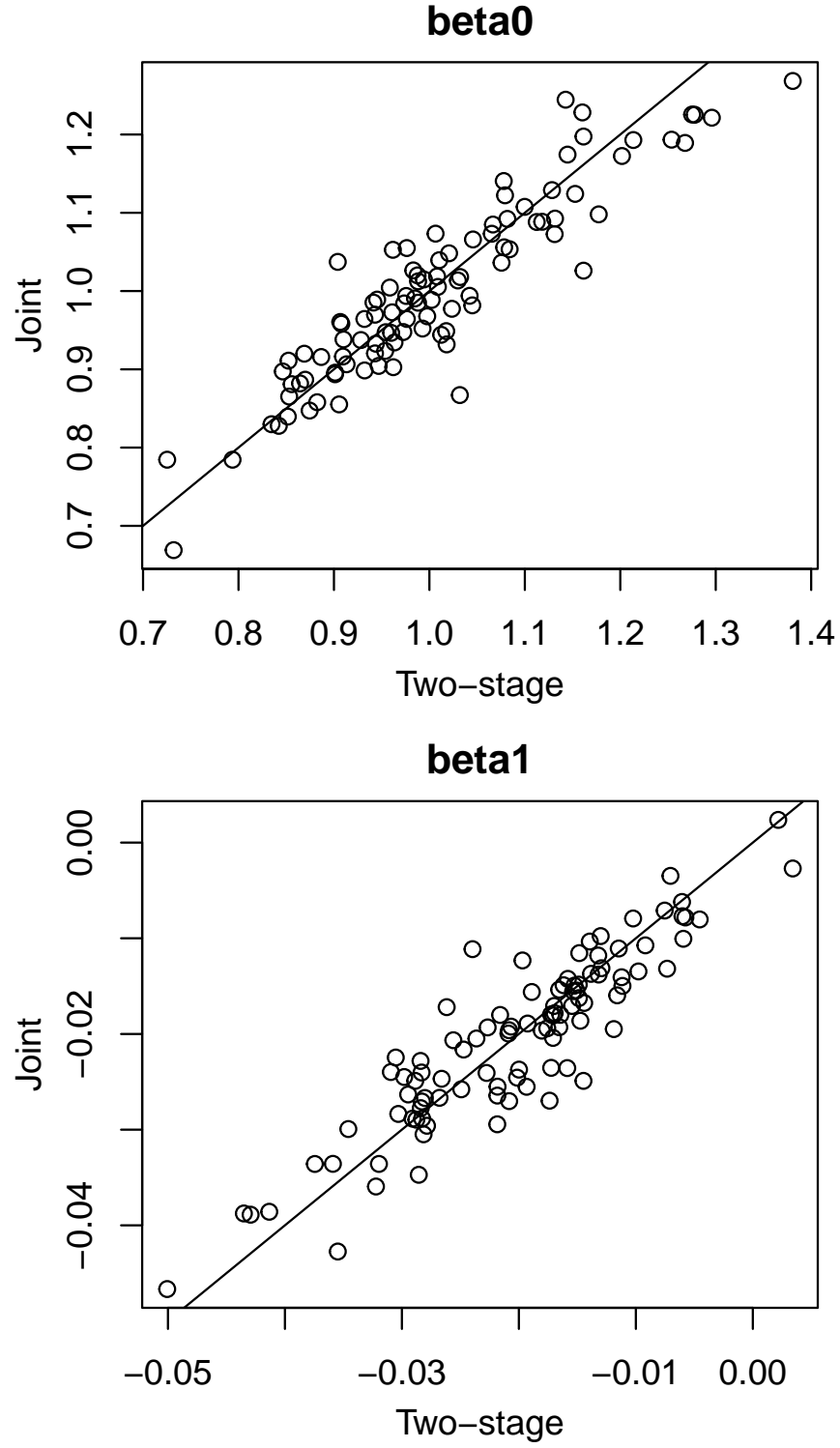


Figure S3. Results from the 100 simulated datasets used to compare posterior means for the density trend parameters (β_0 and β_1) for the joint model and the two-stage model.

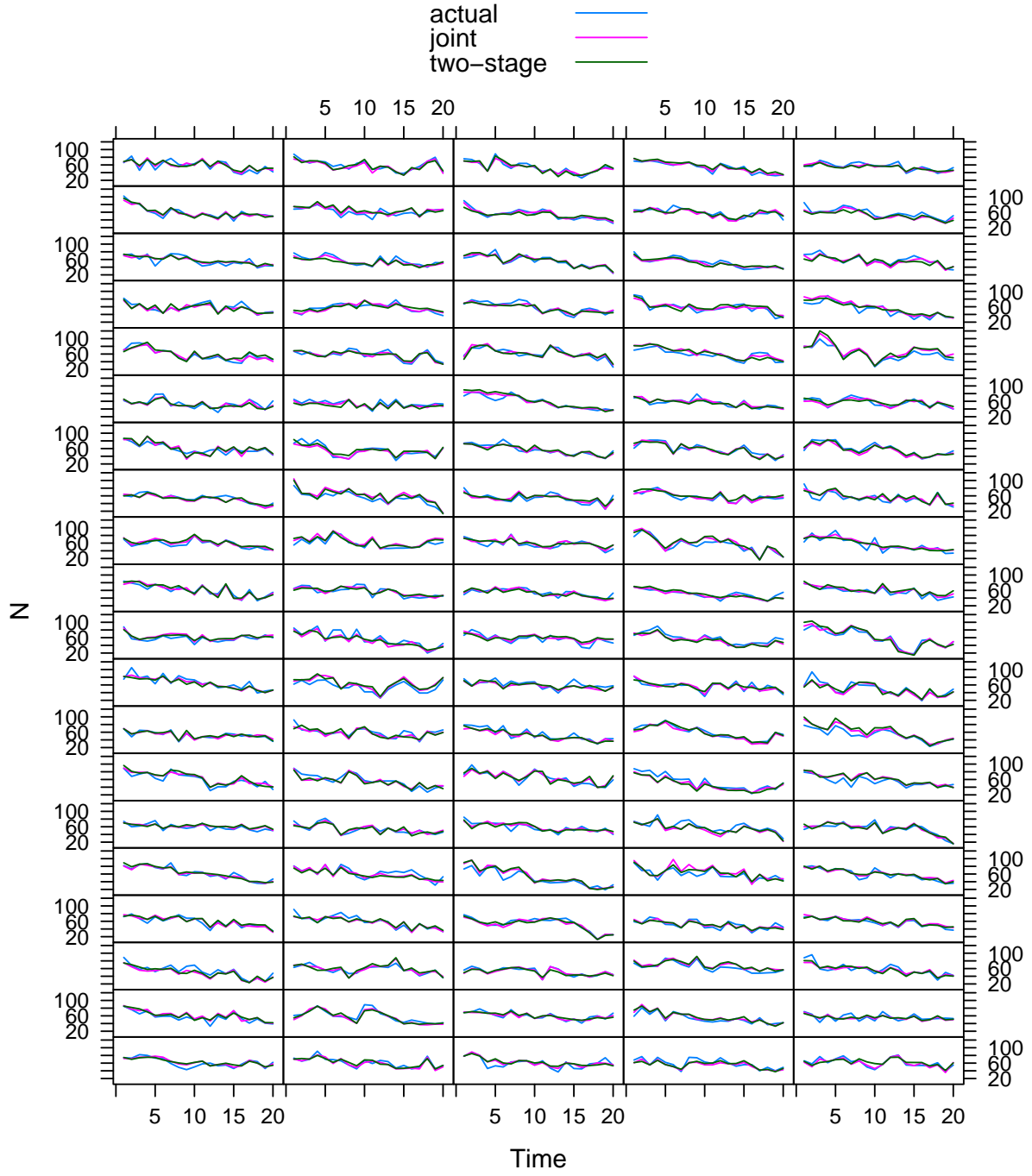


Figure S4. Results from the 100 simulated datasets used to compare posterior means for abundance over time (N_t) for the joint model and the two-stage model.