Appendix 1: Nest survival model posterior and joint distributions

We used the statistical notation of Hobbs and Hooten (2015) to write a model statement for the posterior and joint distributions of the random effects specification of daily nest survival. Bold symbols (e.g., $\boldsymbol{\beta}$ and $\boldsymbol{\alpha}$) represent matrices (uppercase) or vector (lowercase) data, and non-bolded lowercase letters can represent either a matrix (i.e., y_{it}) or vector (i.e., α_s) if subscripted, or a scaler (i.e., μ) if not subscripted. Subscripts refer to nest (*i*), day (*t*), covariate (*k*), and site (*s*). Vector f_i is the first day a nest was under observation, and vector l_i is the last day determining nest fate (the hatch date or mid-point date between last active and last checked for successful nests, or the date of last check for failed nests).

$$\psi_{it} = \frac{\exp\left(\alpha_{s(i)} + \sum_{k=1}^{7} \beta_k \, \mathrm{X}_{k(it)}\right)}{1 + \exp\left(\alpha_{s(i)} + \sum_{k=1}^{7} \beta_k \, \mathrm{X}_{k(it)}\right)}$$

$$\begin{aligned}
[\boldsymbol{\beta}, \boldsymbol{\alpha}, \mu, \sigma^2_{site} | \mathbf{Y}] \quad & \propto \prod_{i=1}^{198} \prod_{t=\mathrm{f}_i}^{T=\mathrm{l}_i} \mathrm{Bernoulli}(\mathrm{y}_{it} | \psi_{it}) \\
& \times \prod_{k}^{7} \mathrm{normal}(\beta_k | 0, 1.5) \\
& \times \prod_{s=1}^{6} \mathrm{normal}(\alpha_s | \mu, \sigma^2_{site}) \\
& \times \mathrm{normal}(\mu | 0, 1.5) \\
& \times \text{inverse gamma}(\sigma^2_{site} | 0.001, 0.001)
\end{aligned}$$

References

Hobbs, N. T., and M. B. Hooten. 2015. Bayesian models. Bayesian Models. Princeton University Press.