The model

The model presented in the main paper focuses on a movement model that assumes that an animal's location is determined by a combination of environmental and demographic parameters. In many real systems, an animal's current location can be confounded by spatial-temporal autocorrelation, in which its current location is influenced by its previous locations. In this case, a model has to be designed to account for this lack of independence in locational data. For such cases, we designed a model that is analogous to the model discussed in the body of this paper, but accounting for spatial-temporal autocorrelation. In the below model, the demographic and environmental parameters are incorporated similarly to the primary model, however, the mu[i-1] term is included to account for the previous location at time t-1.

Autocorrelated Bayes Model

```
model_string1.0 <- "model{
  B0 ~ dnorm(0, 0.1)
  B1 ~ dnorm(0, 0.1)
  B2 ~ dnorm(0, 0.1)
  B3 ~ dnorm(0, 0.1)
  B4 ~ dnorm(0, 0.1)
  B5 ~ dnorm(0, 0.1)
  B6 ~ dnorm(0, 0.1)
  tau ~ dgamma(0.1, 0.01)
  s <- 1/sqrt(tau)
    for(j in 1:N){
      u[j] ~ dnorm(0, tau)
    #Set the first point to a zero then calculate mu for the first point
      mu[cumul_tracks[j]] <- B0 +
        (B1 * Spring[cumul_tracks[j]]) +
        (B2 * Summer[cumul_tracks[j]]) +
        (B3 * Winter[cumul_tracks[j]]) +
        (B4 * FL[cumul_tracks[j]]) +
        (B5 * Sex[cumul_tracks[j]]) +
        (B6 * NPGO[cumul_tracks[j]]) +
        u[j]

      for(i in (cumul_tracks[j]+1):(cumul_tracks[j+1]-1)) {
        mod.1[i] <- B0 +
                    (B1 * Spring[i]) +
                    (B2 * Summer[i]) +
                    (B3 * Winter[i]) +
                    (B4 * FL[i]) +
                    (B5 * Sex[i]) +
                    (B6 * NPGO[i]) +
                    u[j]

                     cov[i] ~ dnorm(mod.1[i], s)
                   logit(mu[i]) <- mu[i-1] + cov[i]

                  z[i] ~ dbern(mu[i])
      }
    }
}"
```

In the case of these data, the autocorrelated model provides qualitatively similar parameter estimates to the non-autocorrelated model without changing population level inferences. This indicates that autocorrelation is not a major issue for these data.

Autocorrelated vs non-autocorrelated parameter estimates

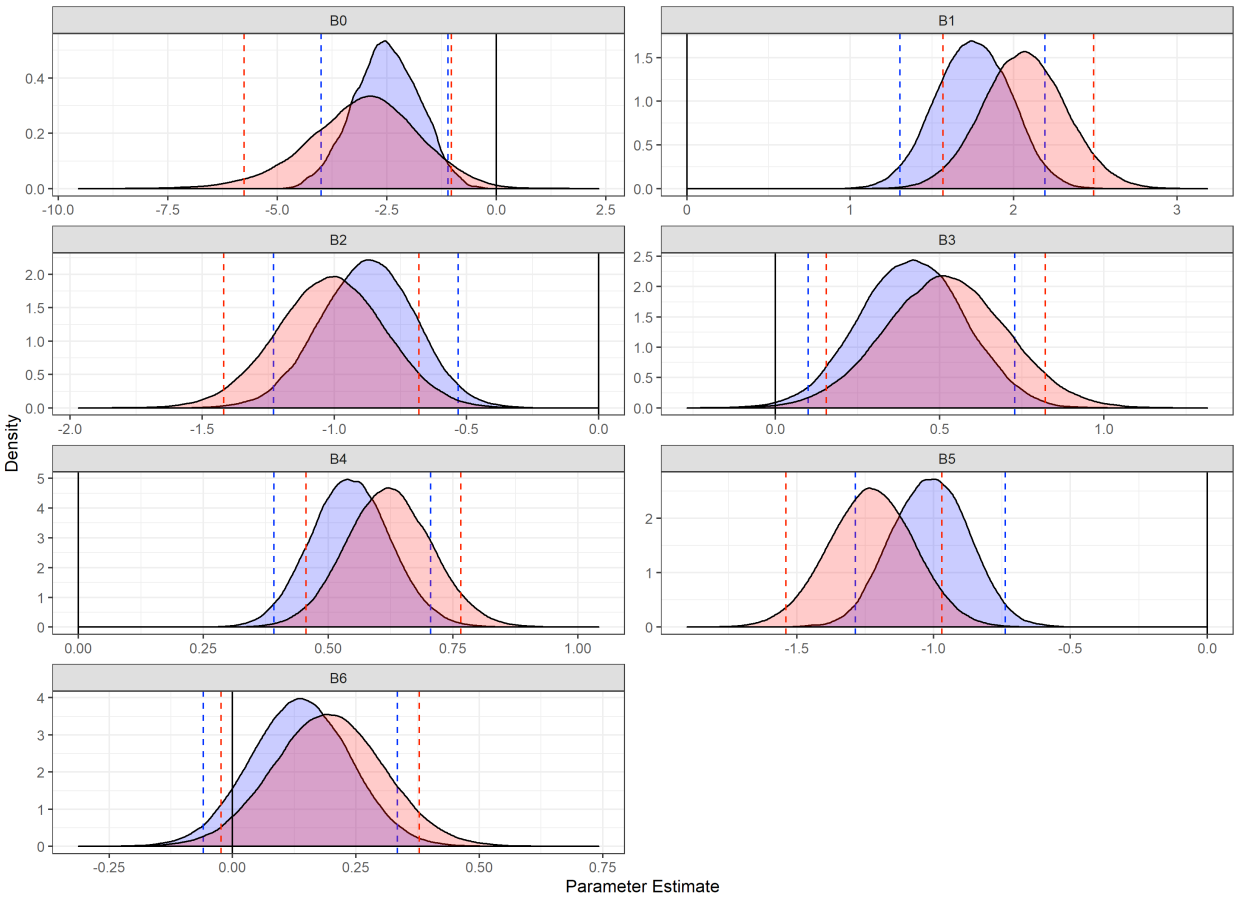

Fig. S1. This figure demonstrates that the parameter estimates for the non-autocorrelated model (in red) and the autocorrelated model (in blue) provide qualitatively similar results. All parameters 90% credibility intervals are shifted in the same direction across the two models and all posterior distributions overlap.

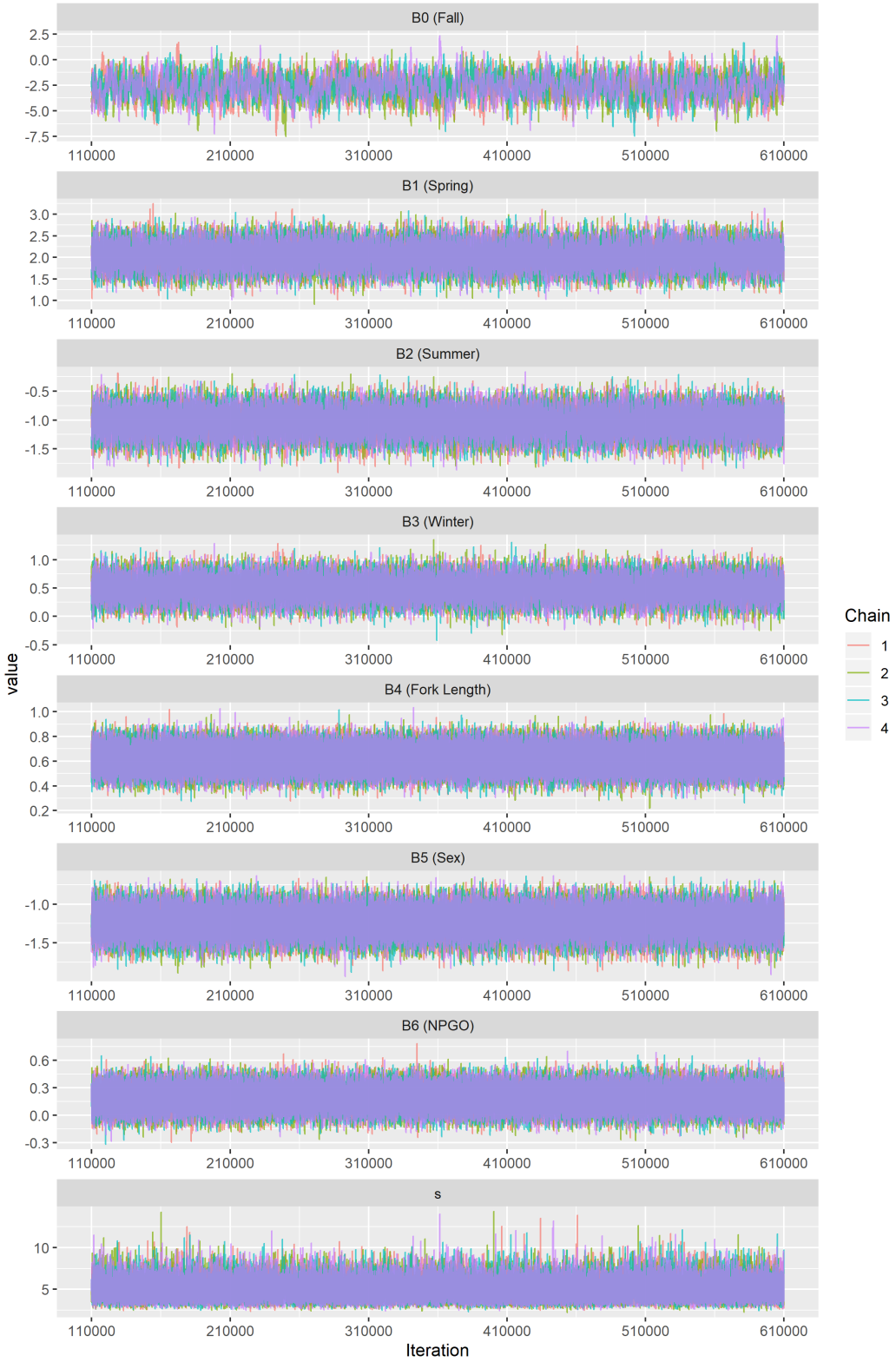

Fig. S2. Trace plots from the non-autocorrelated model, indicating model convergence and mixing among the four MCMC chains