Model structure

Competing Bayesian time-structured models fit iteratively 1000 times.

Each model uses the regression relationship of modeled abundance by removal differently.

The latent state vector ??t is the regression of removed by abundance state specification of seasonality

a trend μ_t , a seasonal pattern τ_t , and a regression component $\beta^t x_t$ from the modeled abundance by the observed removal of mongoose, and a linearized trend δ_t .

$y_t = \mu_t + \tau_t + \beta^t x_t + \epsilon_t$

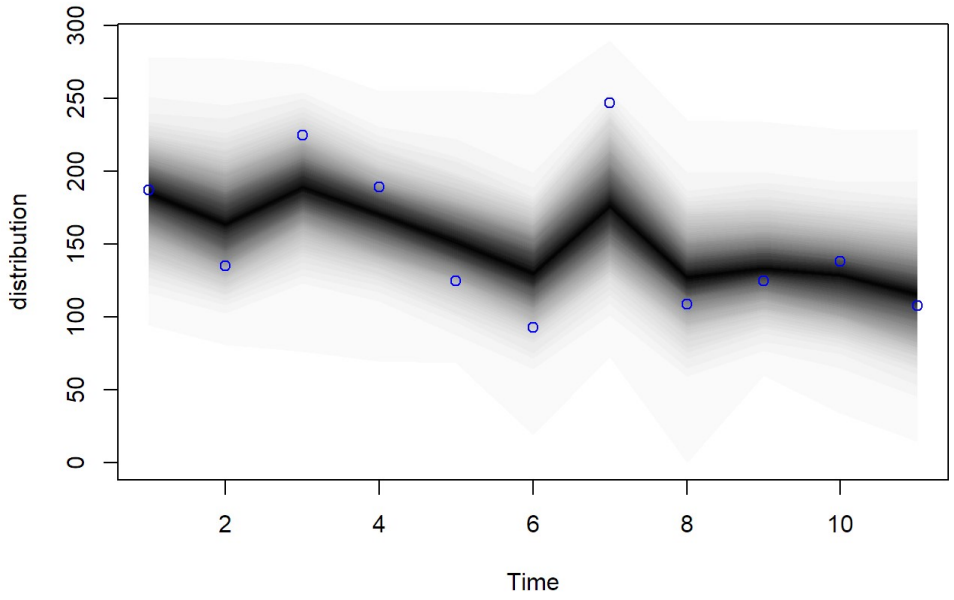
$\mu_{t+1} = \mu_t + \delta_t + n_t$

$\delta_{t+1} = \delta_t + n_{0t}$

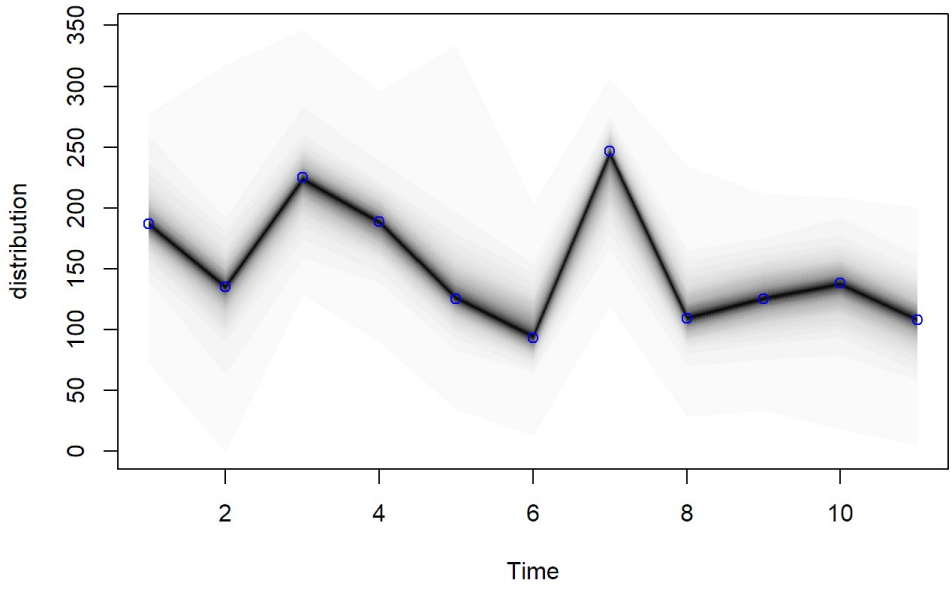
$\tau_{t+1} = -\sum_{s=1}^{S-1} \tau_t + n_{2t}$

Blue dots indicate datapoints. Each of 1000 trajectories shown by one line.

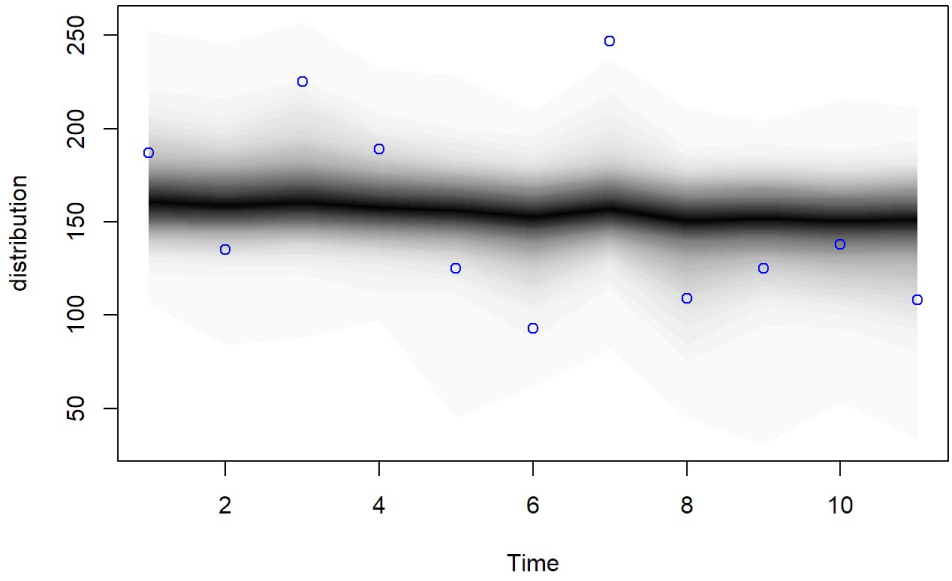
Model 1: Overall Poisson model, no seasons (uses ‘bsts’).



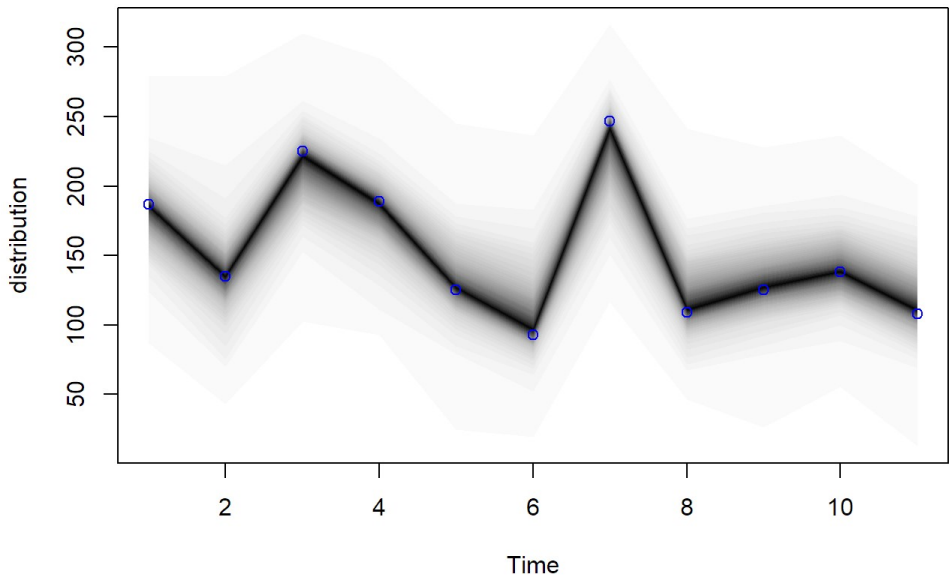
Model 2: Seasonal Poisson model (uses ‘bsts’)



Model 3: Overall Guassian model, no seasons (uses ‘bsts’)



Model 4: Seasonal Gaussian model (uses ‘bsts’)

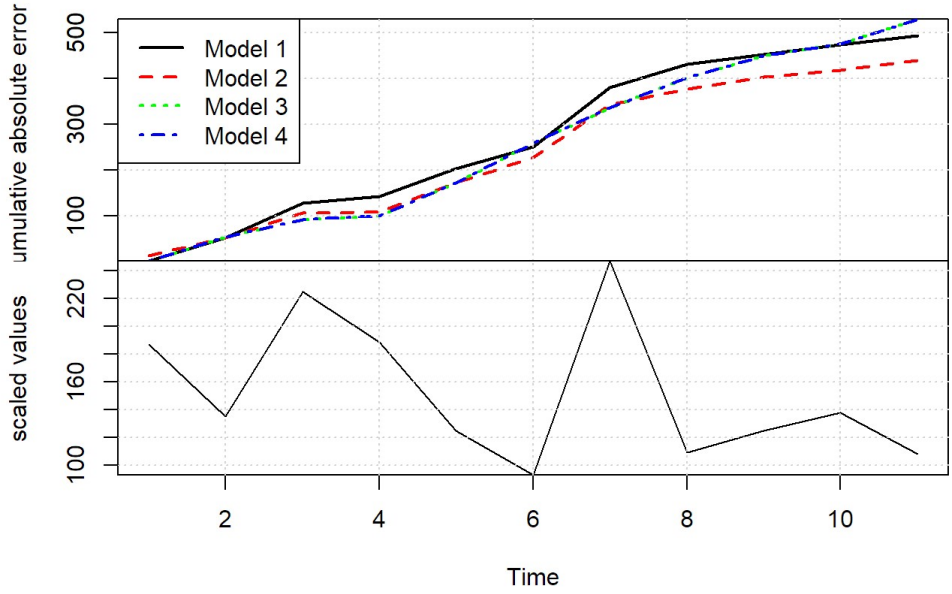


Here, the bottom panel shows the original data. The top panel shows how each model performed in predicting errors for each model.Model 1 is fit by a Poisson distribution The figure shows that the spikes in timesteps 3 and 7 are best explained by the models 1&2, which accumulated more errors at those times while the other two continued to collect the same number of error as they had as if the obseved data was constant. The overlap of the Poisson model Model 1 or the Gaussian model with seasonal levels in Model 3 explained the same error despite the fact that the prior was relaxed for seasonality in the latter through time step 9. Once timestep 9 occurs, which is one year after the mongoose control begins, the models acquire similar amounts of error.

The error at the MCMC convergence value θ is:

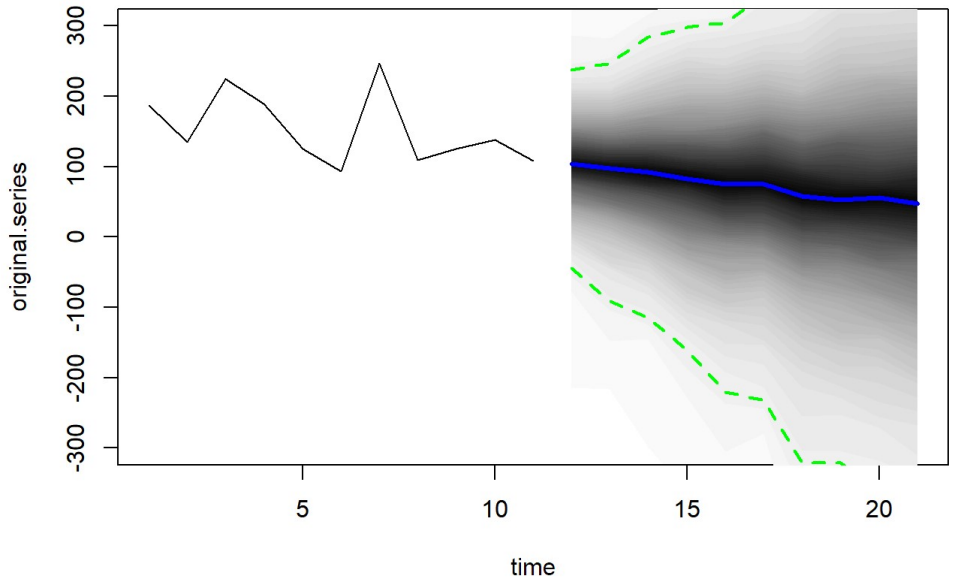
$y_t - E(y_t|Y_{t-1}, \theta)$

$Y_{t-1} = y_1, \ldots, y_t - 1$

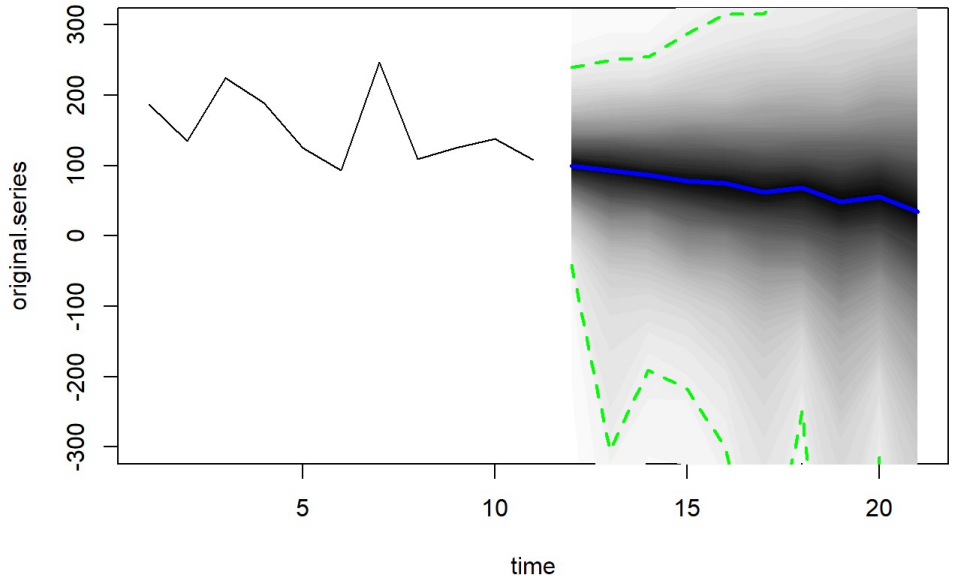


The posterior distirbution of the condition mean of the total model 1 passed to the ‘predict’ function for forecasting. First 200 trajectories burned in and 1000 iterations run.

Mangement Scenario 1: mongoose population trajectories based on current trapping.



Management Scenario 2: mongoose population trajectories if trapping at increased levels (~100 mongoose removed per year).



Management Scenario 3: mongoose population trajectories if trapping at current levels (100 mongoose removed per year) and excluded mongoose (no new immigration).