

Posterior SBC on the Lotka-Volterra model

Teemu Säilynoja

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In this notebook, we show the results of calibration assessment on the [Lotka-Volterra model](#) using posterior SBC. We begin by conditioning the model on the 21 years of observations shown below in Figure 1.

For collected results of all our experiments, see the notebook named [lotka-volterra-sbc](#).

1 The Model

We receive no warnings of divergent transitions, or high R hat values, but see strong correlation between many of the parameter posteriors.

2 Data conditioned simulation-based calibration

Nex, we run posterior SBC, by augmenting the data with posterior predictive draws and refitting the model to these two datasets.

SBC diagnostic messages

```
SBC_results with 500 total fits.  
- 6 (1%) fits resulted in an error.  
- No fits gave warnings.  
- 154 (31%) fits had at least one Rhat > 1.01. Largest Rhat was NA.  
- 149 (30%) fits had tail ESS undefined or less than half of the maximum  
rank, potentially skewing  
the rank statistics. The lowest tail ESS was NA.  
If the fits look good otherwise, increasing `thin_ranks` (via  
recompute_SBC_statistics)  
or number of posterior draws (by refitting) might help.
```

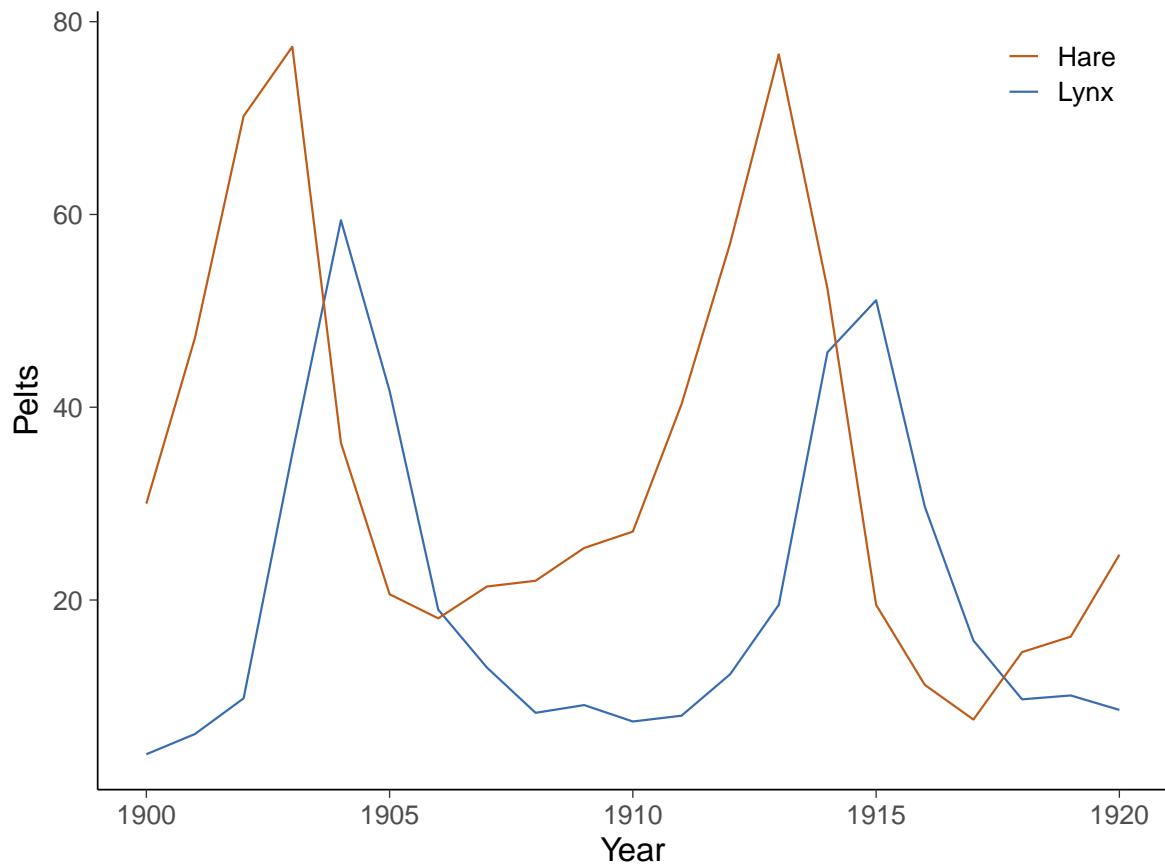


Figure 1: Historical data of pelts collected by Hudson Bay company.

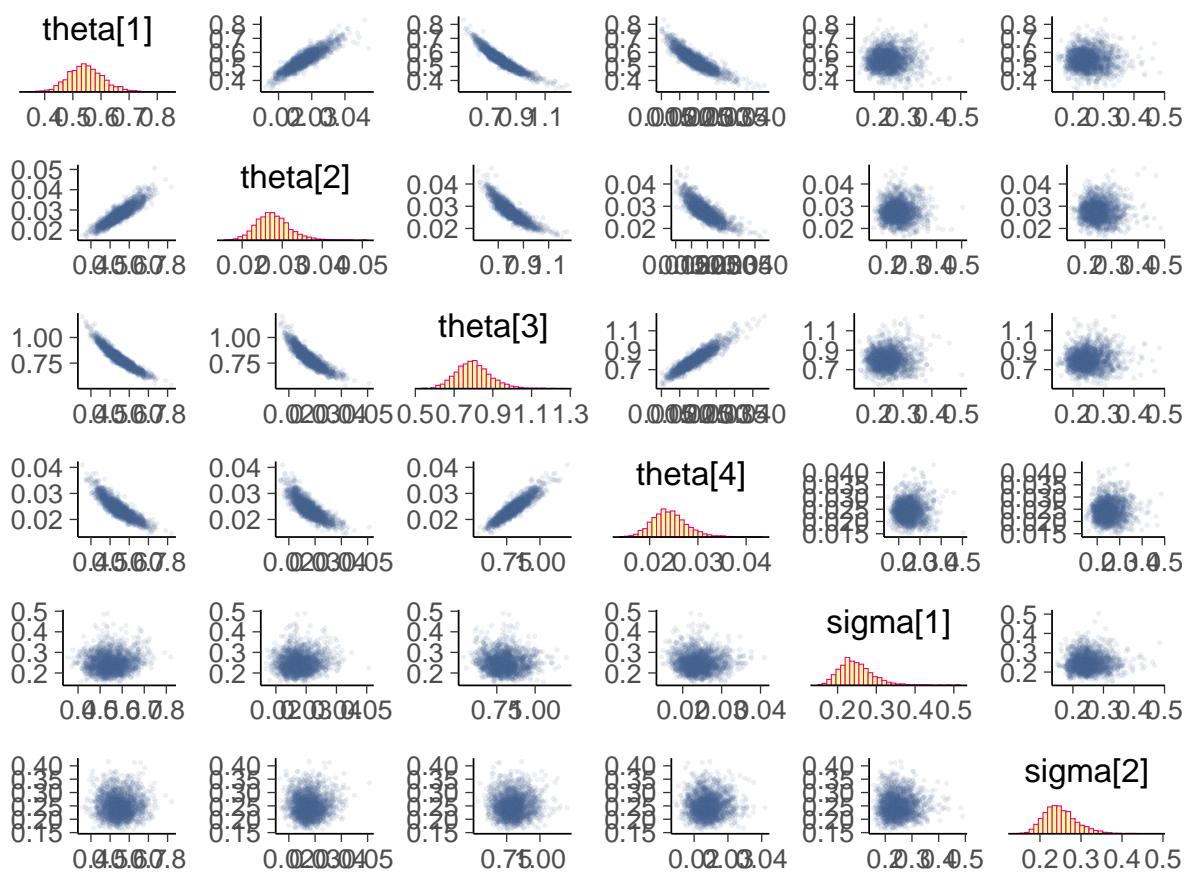


Figure 2

- The lowest bulk ESS was NA
- 23 (5%) fits had some failed chains.
- 79 (16%) fits had divergent transitions. Maximum number of divergences was 998.
- 14 (3%) fits had iterations that saturated max treedepth. Maximum number of max treedepth was 1000.
- 494 (100%) fits had some steps rejected. Maximum number of rejections was 2026.
- Maximum time per chain was NA sec.

We receive warnings of iterations with high R hat values and one or more divergent transitions. In the calibration assessment in Figure 3 we see some apparent calibration issues. This is perhaps not as clear from the parameter recovery plots in Figure 4, but there too we see some outliers and in general large uncertainty. This is likely due to the often occurring multi-modal posteriors, one of which is later shown in Figure 6.

3 A closer look at one augmented posterior

Next, we look at the augmented posterior of the SBC iteration where the worst R hat values were encountered.

Below, in Figure 5, we show the parameter values used in generating the posterior predictive draw.

Next, we look at the pairs plot of the parameter posteriors. Below, in Figure 6, we see strong multi-modality as well as correlation between parameter values.

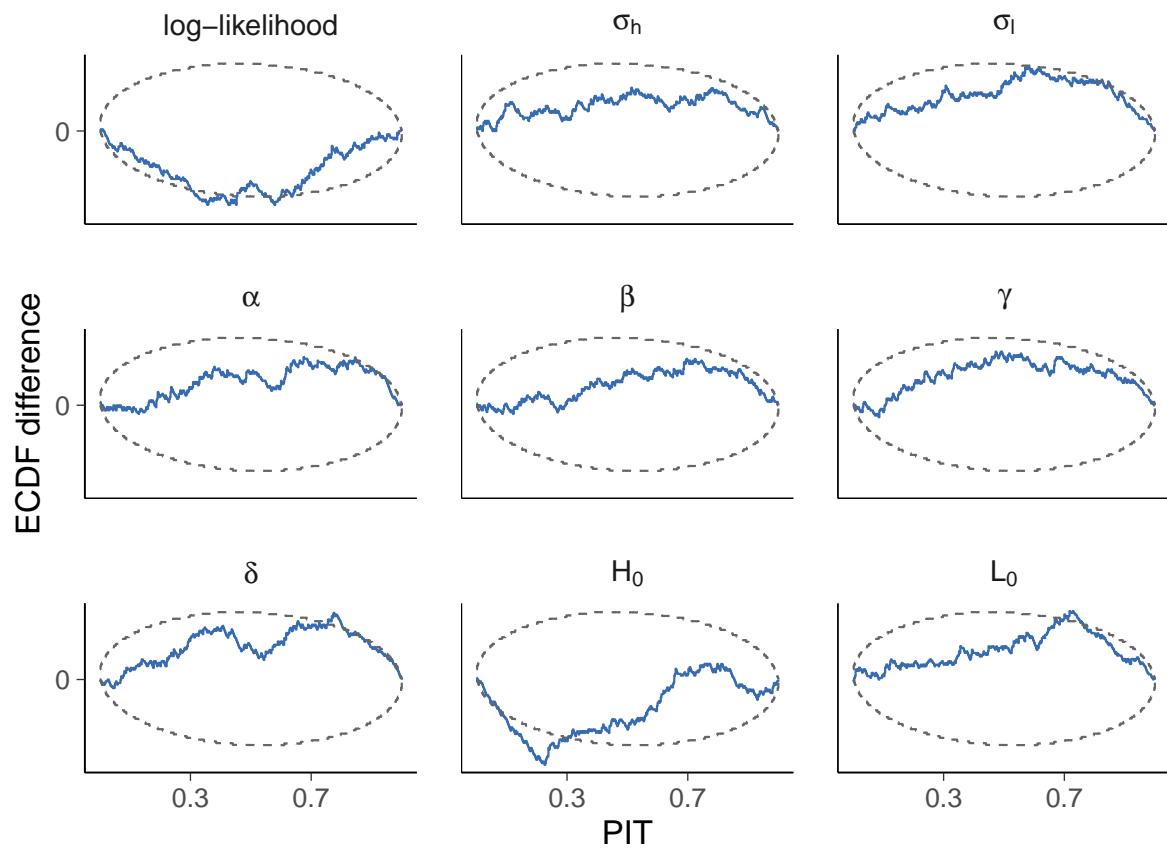


Figure 3

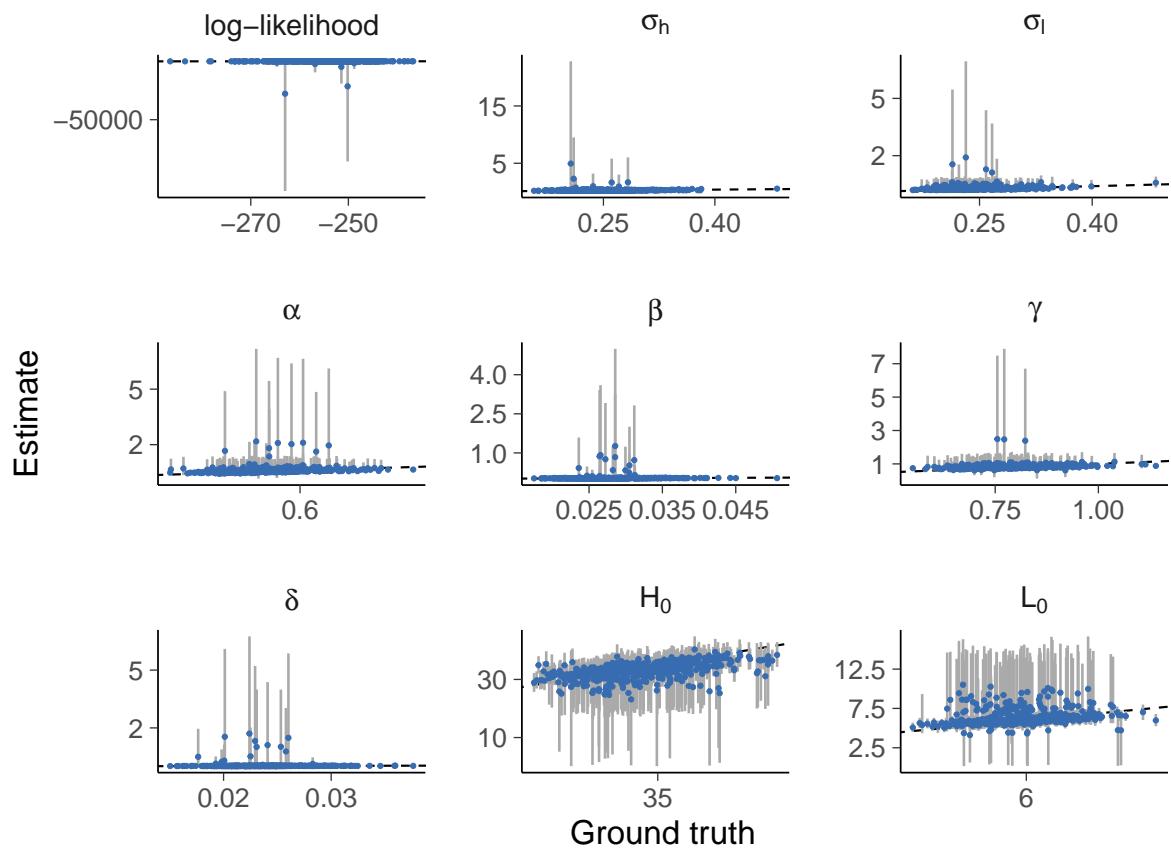


Figure 4

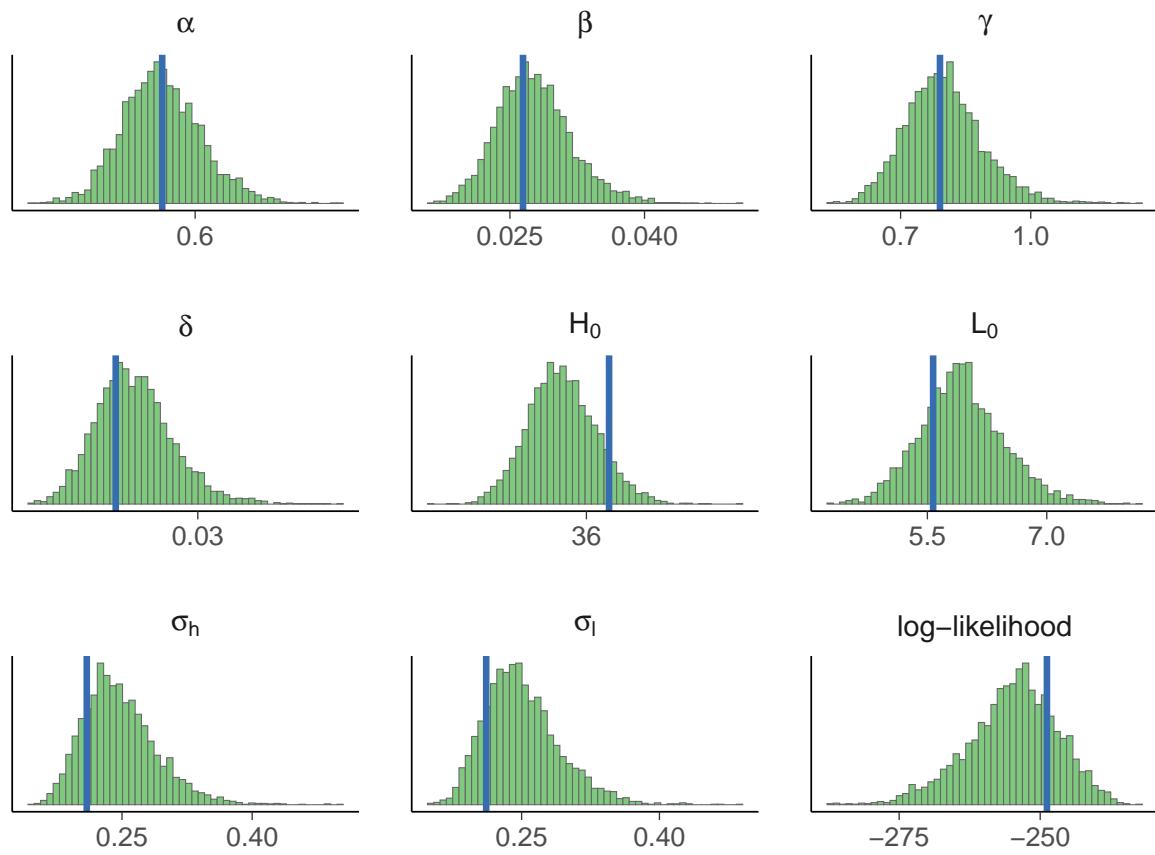


Figure 5

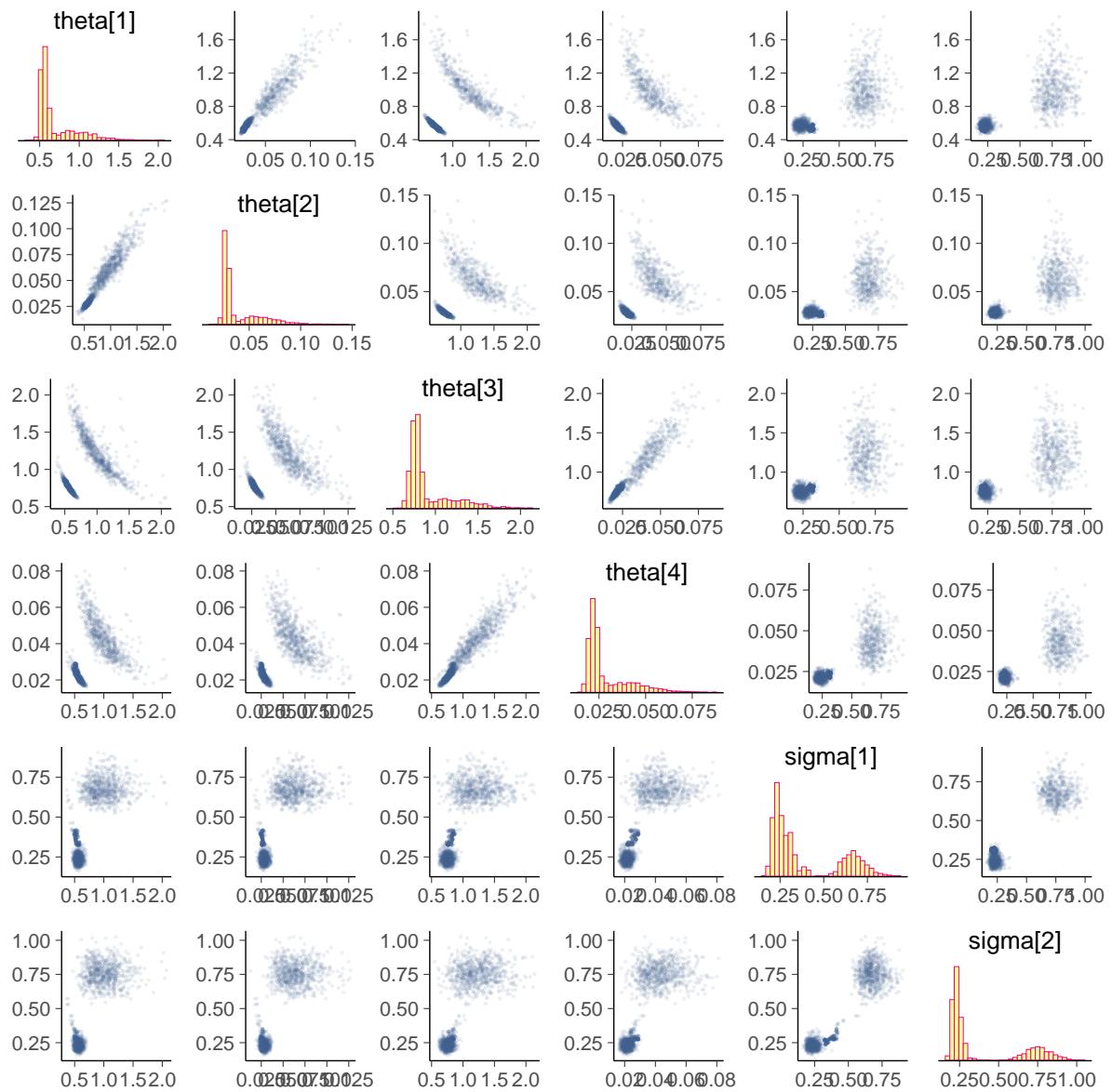


Figure 6

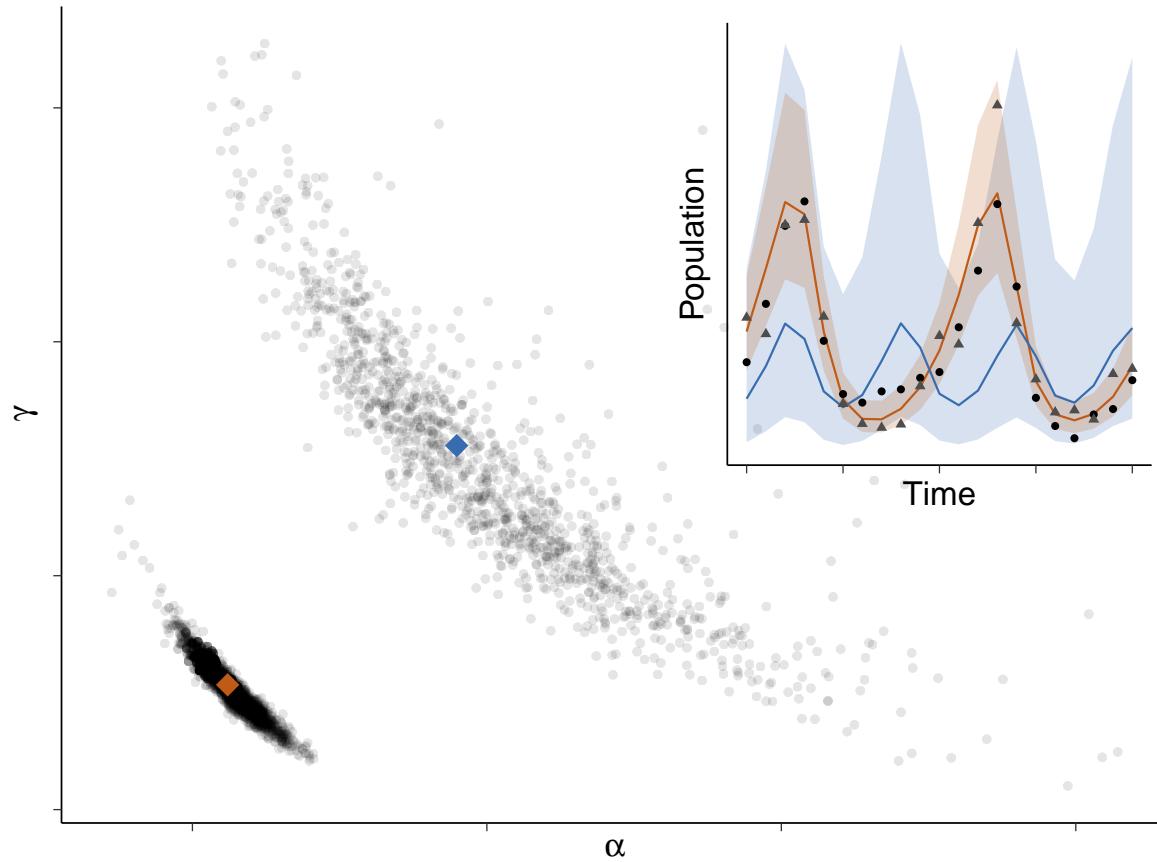


Figure 7: Predictive mean and 95% predictive interval for parameter values from the two modes.

Lastly, we show the resulting marginal posteriors in relation to the true parameter values.

