

Bayesian statistics with R

9. Conclusions

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Remember the objectives

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- Try and demystify Bayesian statistics, and what we call MCMC.
- Make the difference between Bayesian and Frequentist analyses.
- Understand the Methods section of ecological papers doing Bayesian stuff.
- Run Bayesian analyses, safely hopefully.

What was on our plate?

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1. An introduction to Bayesian inference
2. The likelihood
3. Bayesian analyses by hand
4. A detour to explore priors
5. Markov chains Monte Carlo methods (MCMC)
6. Bayesian analyses in R with the Jags software
7. Contrast scientific hypotheses with model selection
8. Heterogeneity and multilevel models (aka mixed models)
9. Conclusions

Free the modeler in you (M. Kéry)

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- Uses probability to quantify uncertainty for everything (propagation of uncertainty).
- Allows use of prior information ('better' estimates: avoid boundary param estimates, acknowledge existing knowledge).
- Can fit complex (hierarchical) models with same MCMC algorithms.
- Credible intervals make more sense than confidence intervals

**With great tools come great
responsibilities**

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- Checking convergence is painful.
- Specifying priors might be tricky.
- Model adequacy should be checked (posterior predictive checks - not covered).
- Computational burden can be high (see function `R2jags::jags.parallel()` and package `'jagsUI'`).

Tips and tricks

<https://hal.science/CEFE/haI-04731240v2>

The screenshot shows the PLOS Computational Biology website interface. At the top left is the PLOS logo and the text 'PLOS Computational Biology'. To the right are navigation links for 'Browse', 'Publish', and 'About', along with a search bar containing the text 'Search' and a link to 'advanced search'. Below the header, there are two tabs: 'OPEN ACCESS' and 'EDUCATION'. The main title of the article is 'Ten quick tips to get you started with Bayesian statistics', followed by the authors 'Olivier Gimenez, Andy Royle, Marc Kéry, Chloé R. Nater' and the publication date 'Published: April 10, 2025' with a DOI link. A horizontal menu below the title includes 'Article', 'Authors', 'Metrics', 'Comments', and 'Media Coverage'. On the right side, there are statistics: '44 Save', '1 Citation', '5,271 View', and '1 Share'. Below these are buttons for 'Download PDF', 'Print', and 'Share', and a 'Check for updates' button. A section titled 'Introduction' is visible on the left, with a 'Figures' section below it. The 'Figures' section contains three thumbnails: a circular diagram, a list of text, and a plot with two bell curves. At the bottom, a citation box contains the text: 'Citation: Gimenez O, Royle A, Kéry M, Nater CR (2025) Ten quick tips to get you started with Bayesian statistics. PLoS Comput Biol 21(4): e1012898. <https://doi.org/10.1371/journal.pcbi.1012898>'.

So what?

So what?

- Make an informed and pragmatic choice.
- Are you after complexity, speed, uncertainties, etc?
- Talk to colleagues.