

Gambling with Australian brachiopods

Peter D Smits

Committee on Evolutionary Biology, University of Chicago

September 29, 2014

Gambler's Ruin

Definition

Given infinite time, all gambler's go bust.

Death of a taxon

Taxa as gamblers

All taxa, given infinite time, go extinct.

Question

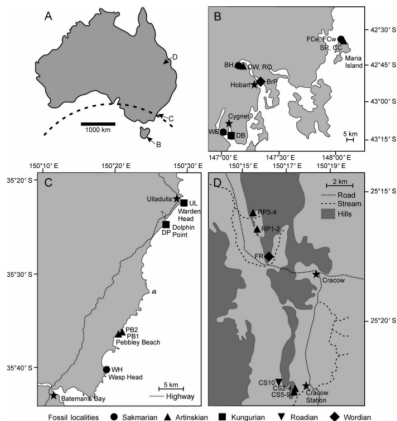
Why do taxa go extinct at **different rates**?

Enter brachiopods



(Immersion Imagery, Shutterstock; Wikimedia)

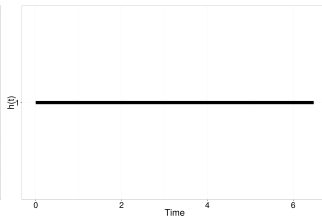
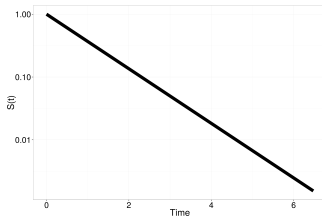
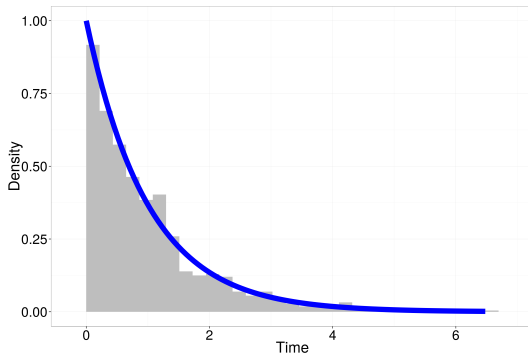
System details



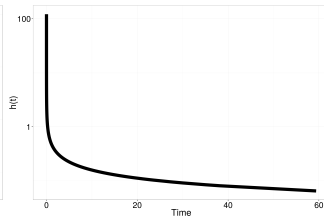
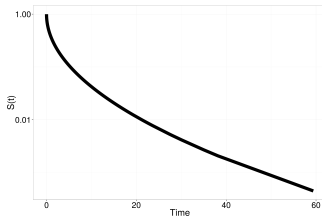
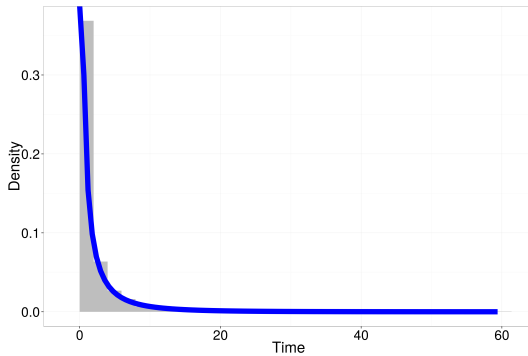
(Clapham and James 2008 *Palaeos*)

- ▶ Australian Permian
 - ▶ range in/out taxa right censored
- ▶ predictors
 - ▶ substrate probability (fully Bayesian approach)
 - ▶ onshore/offshore
 - ▶ body size (Payne *et al.* 2014 *Proc. B*)
 - ▶ occupancy (see Vilhena *et al.* 2014 *Nature Com.*)

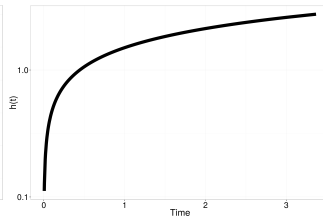
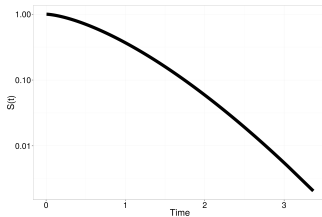
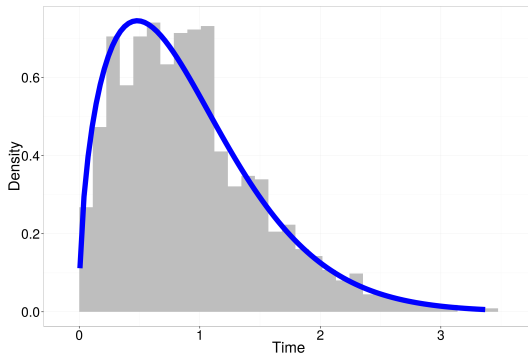
Survival analysis



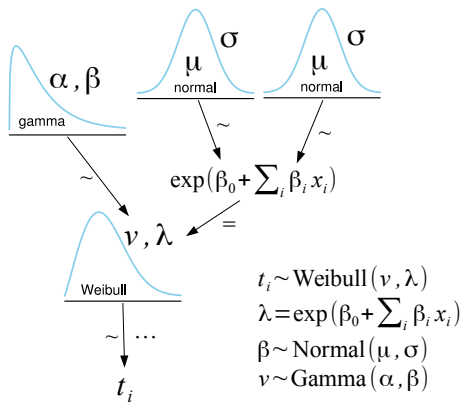
Survival analysis



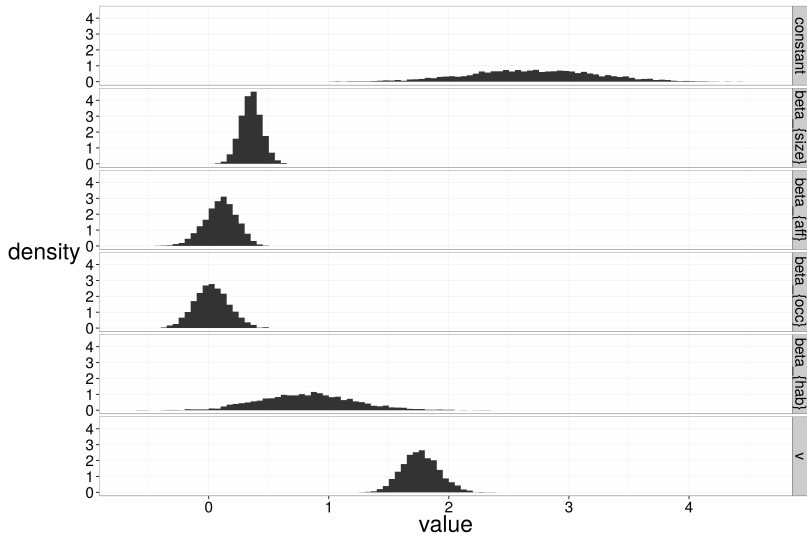
Survival analysis



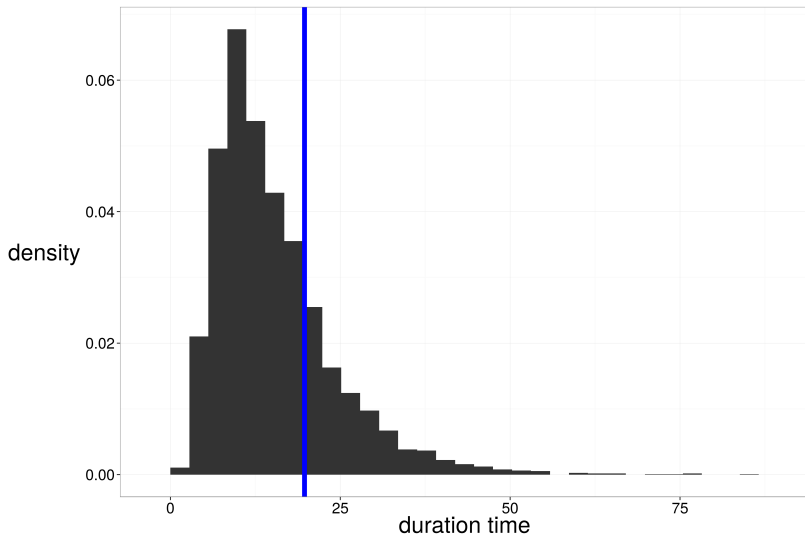
Bayesian model structure



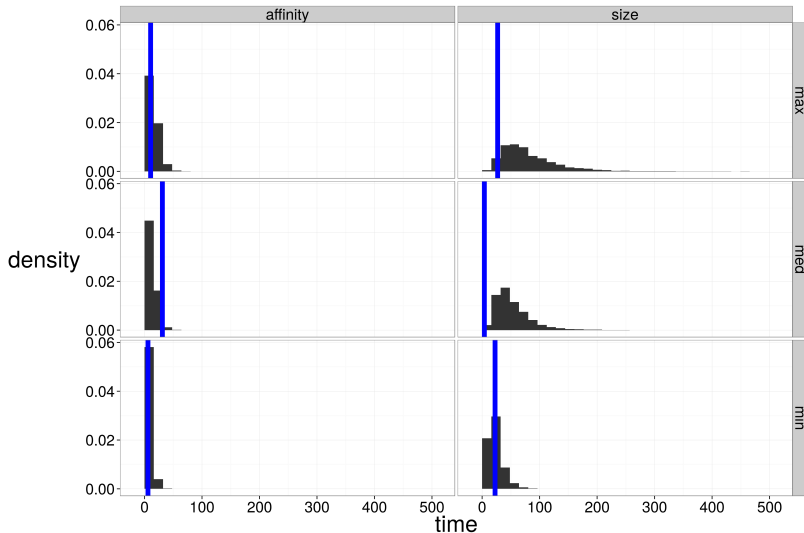
Parameter marginal posteriors



Posterior predictive check: mean duration



Posterior predictive check: affinity effect



Current conclusions

Improvements

- ▶ Data
 - ▶ New Zealand (FRED)
 - ▶ Improved paleoenvironment reconstructions
 - ▶ affixing strategy information
- ▶ Model
 - ▶ extended sensitivity analysis
 - ▶ robust priors (t -distribution)
 - ▶ substrate, habitat as distributions (fully hierarchical model) or just make categorical?
 - ▶ sampling rate as predictor

Acknowledgements

- ▶ Advising
 - ▶ Kenneth D. Angielczyk,
Michael J. Foote,
P. David Polly,
Richard H. Ree
- ▶ Discussion
 - ▶ David Bapst,
Megan Boatright,
Ben Frable,
Marites Villarosa
Garcia, Kathleen
Ritterbush, Darcy
Ross, Liz Sander,
Carl Simpson

