

Gambling with Australian brachiopods

Peter D Smits

Committee on Evolutionary Biology, University of Chicago

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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**?

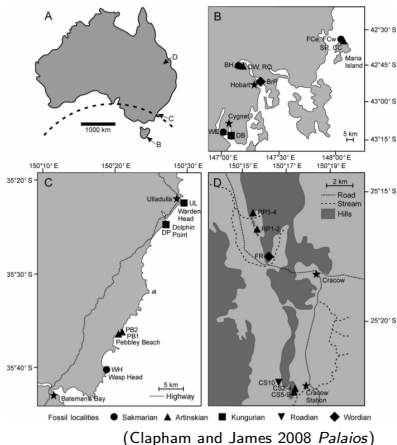
Enter brachiopods



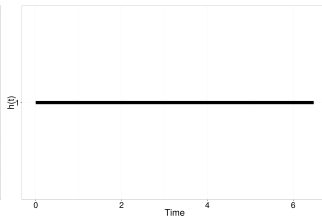
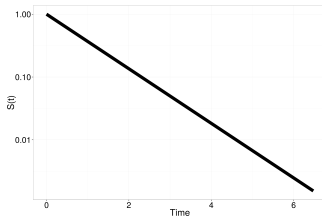
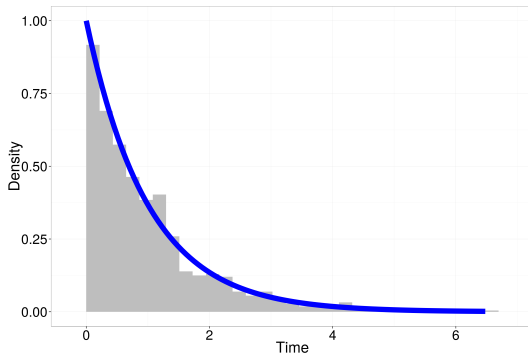
(Immersion Imagery, Shutterstock; Wikimedia)

System details

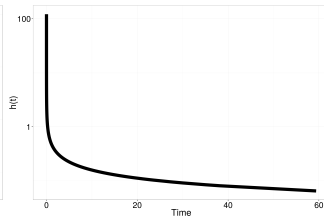
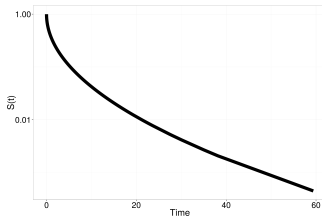
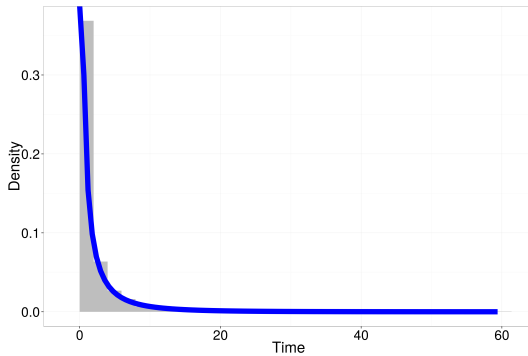
- ▶ Australian Permian
 - ▶ range in/out taxa right censored
- ▶ predictors
 - ▶ substrate probability (fully Bayesian approach)
 - ▶ onshore/offshore
 - ▶ body size (Payne *et al.* 2014 *Proc. B*)
 - ▶ occupancy (see Vilhena *et al.* 2014 *Nature Com.*)



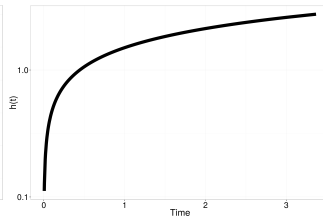
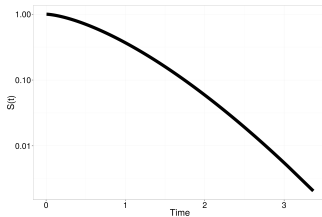
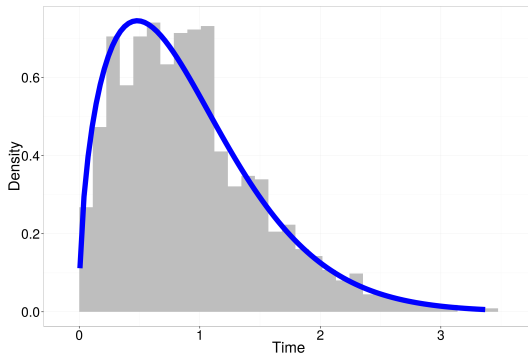
Survival analysis



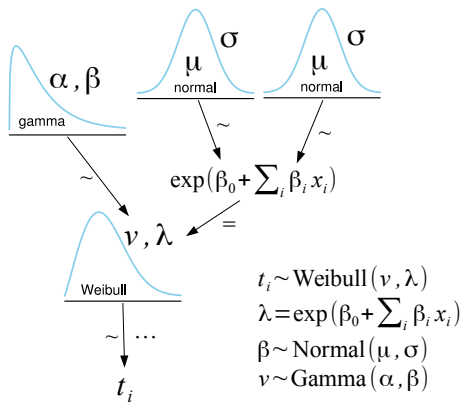
Survival analysis



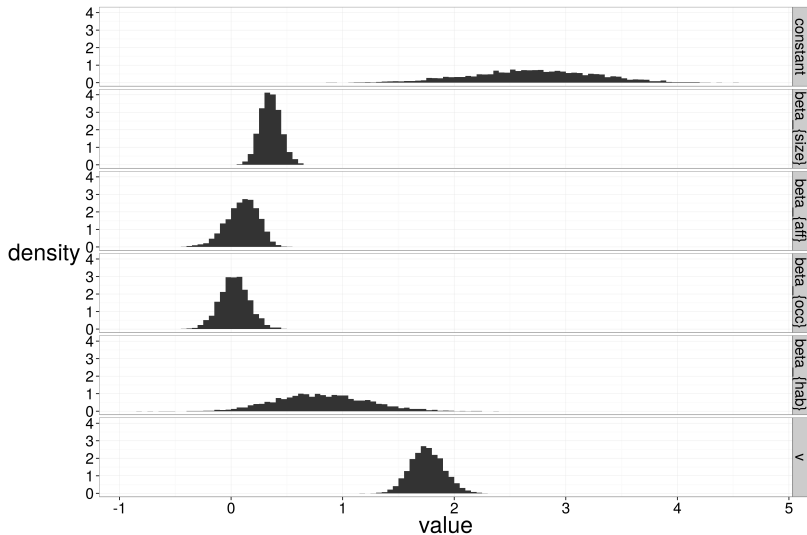
Survival analysis



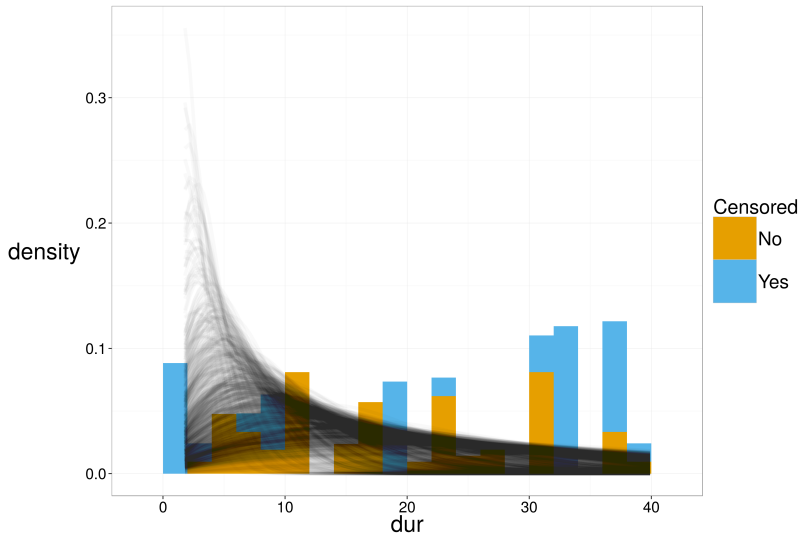
Bayesian model structure



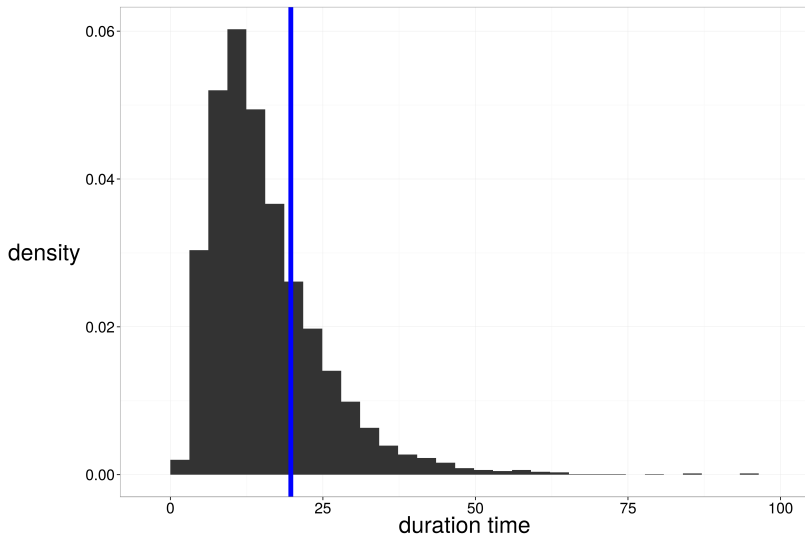
Parameter marginal posteriors



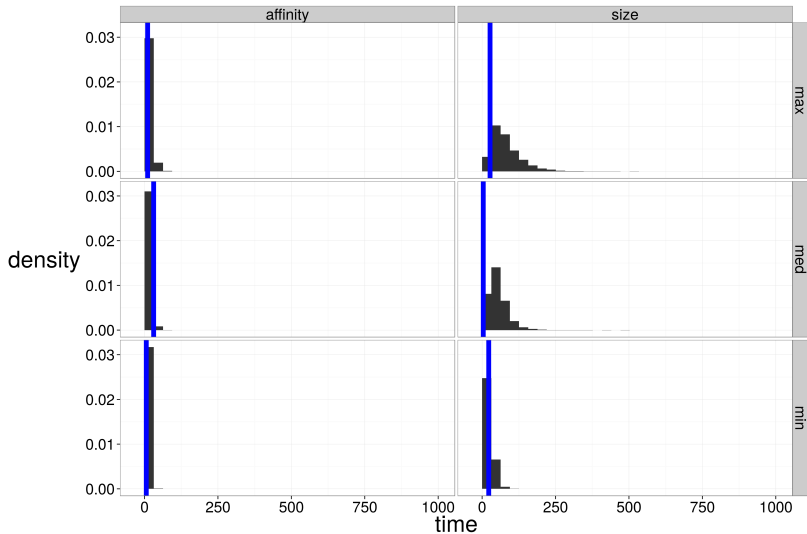
Durations



Posterior predictive check: mean duration



Posterior predictive checks: traits



Conclusions

Extinction is age-dependent ($v > 1$).

Body size and onshore/offshore have largest effects.

Model is not fully capturing variance.

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?
- ▶ effect of sampling

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