

Gambling with Australian brachiopods

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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.

Foundation

Question

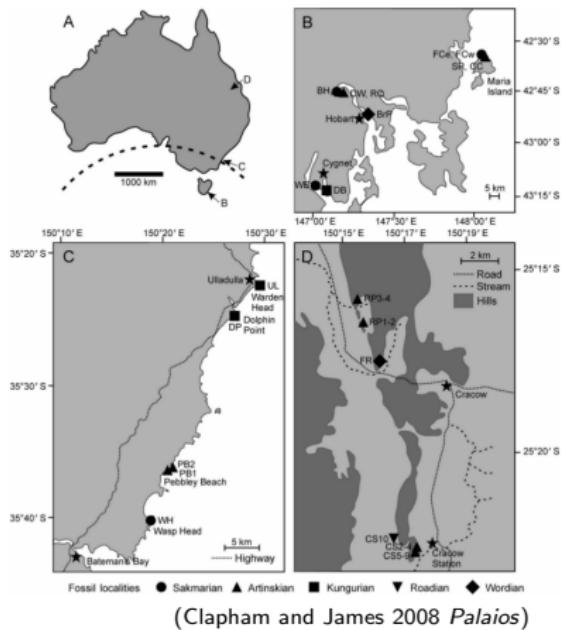
Why do taxa go extinct at **different rates**?

Enter brachiopods



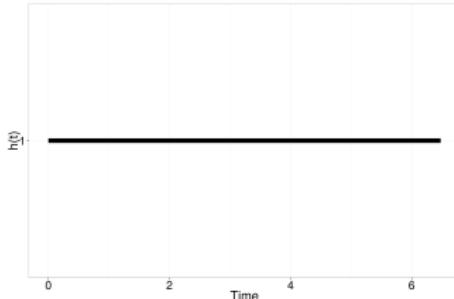
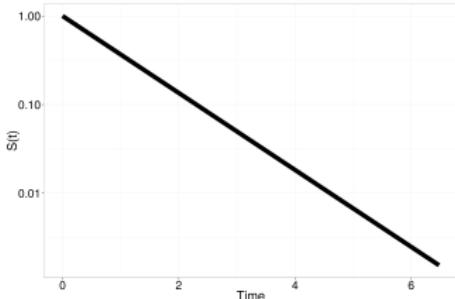
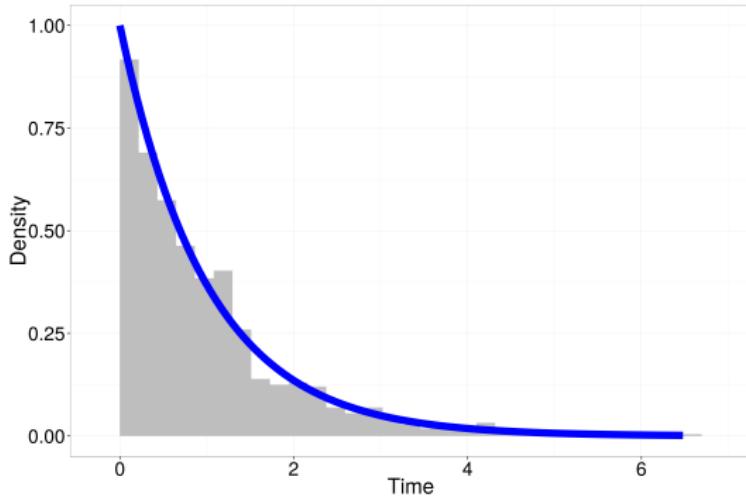
(Immersion Imagery, Shutterstock; Wikimedia)

System details

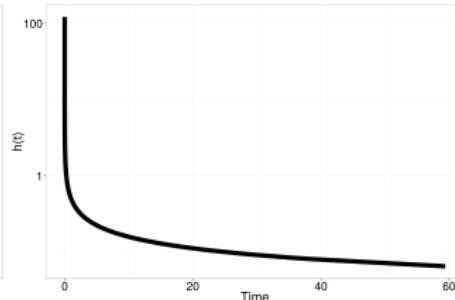
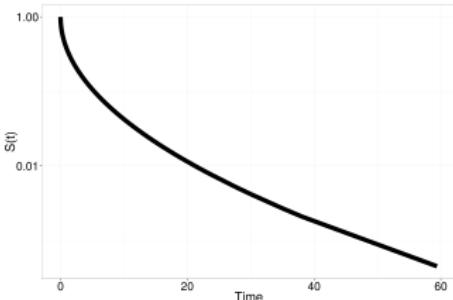
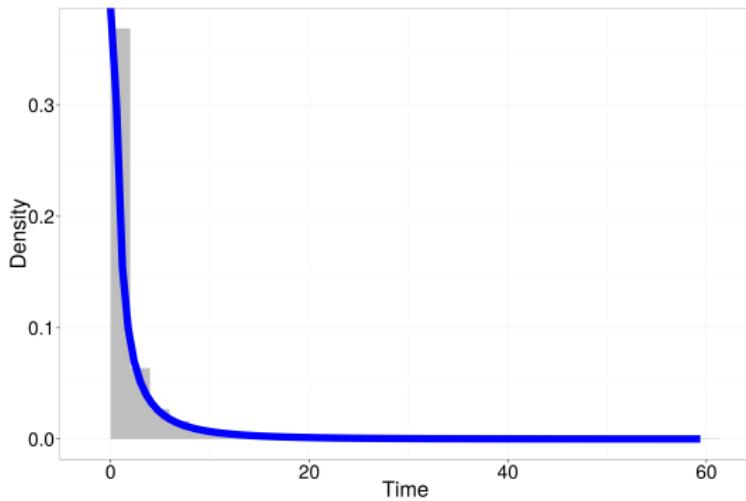


- ▶ Australian Permian
 - ▶ range in/out taxa right censored
- ▶ predictors
 - ▶ substrate probability
 - ▶ onshore/offshore probability
 - ▶ body size (Payne *et al.* 2014 *Proc. B*)
 - ▶ occupancy (see Vilhena *et al.* 2014 *Nature Com.*)

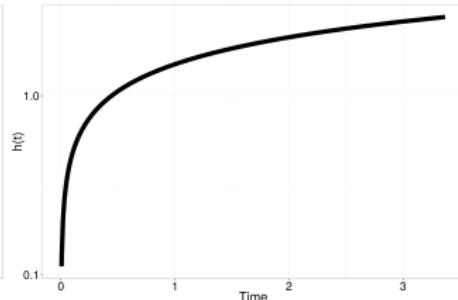
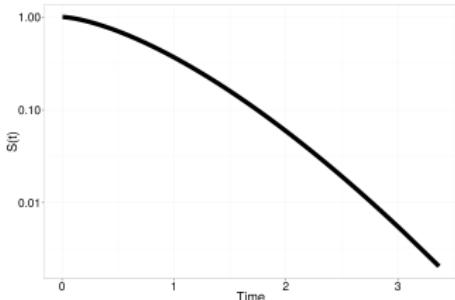
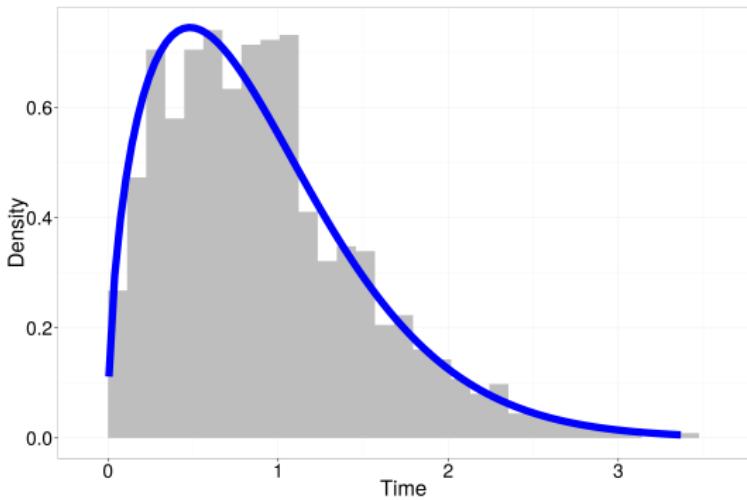
Survival analysis



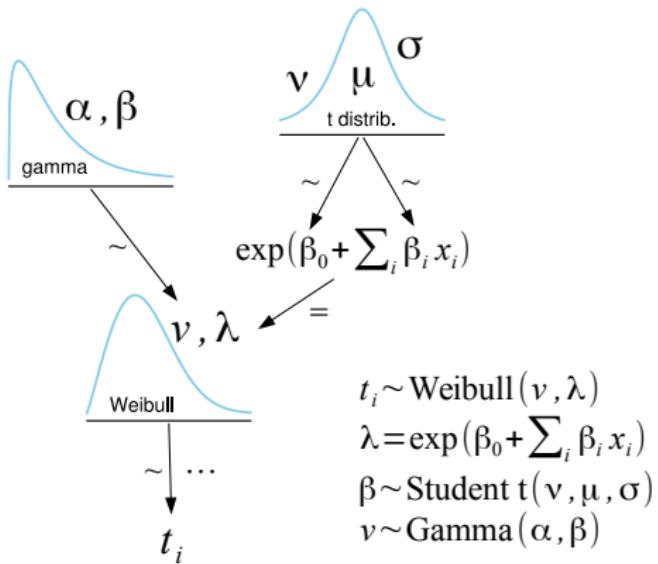
Survival analysis



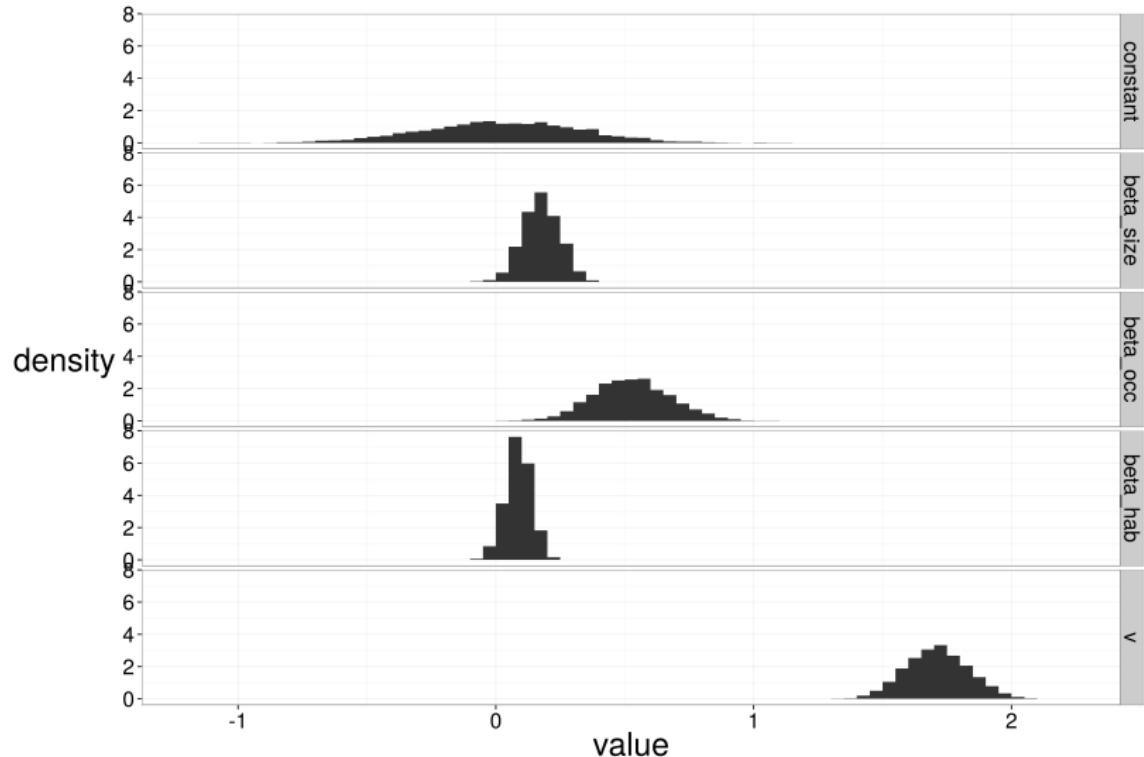
Survival analysis



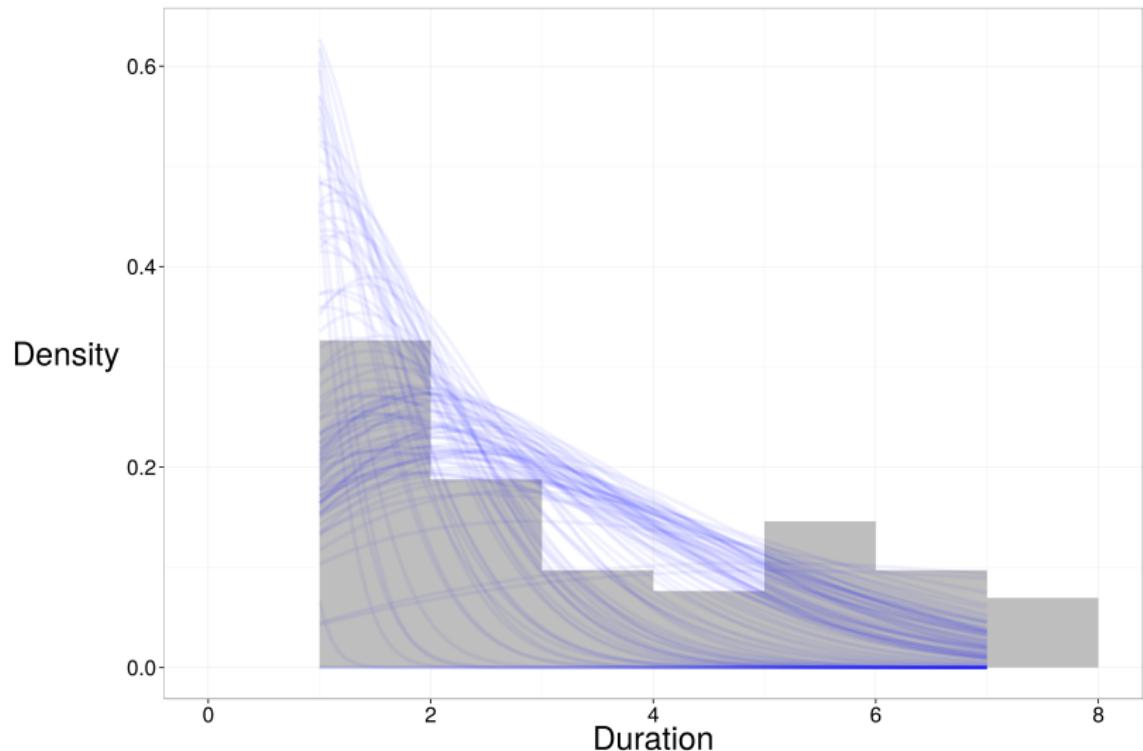
Bayesian model structure



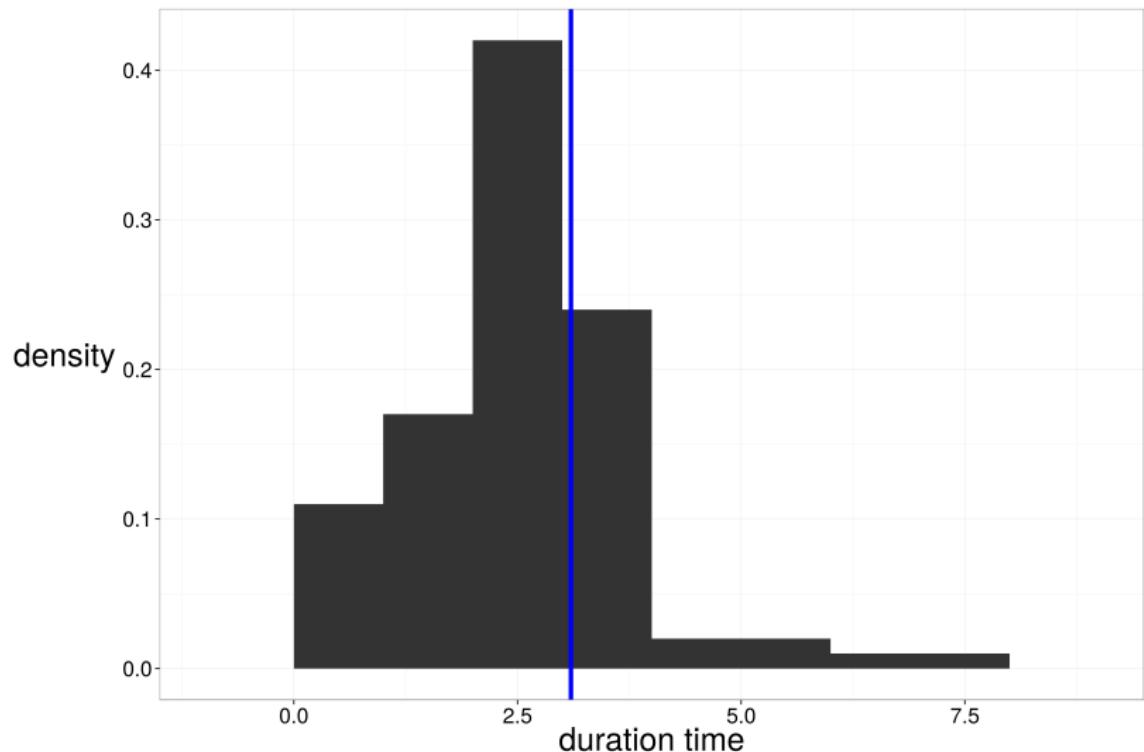
Parameter marginal posteriors



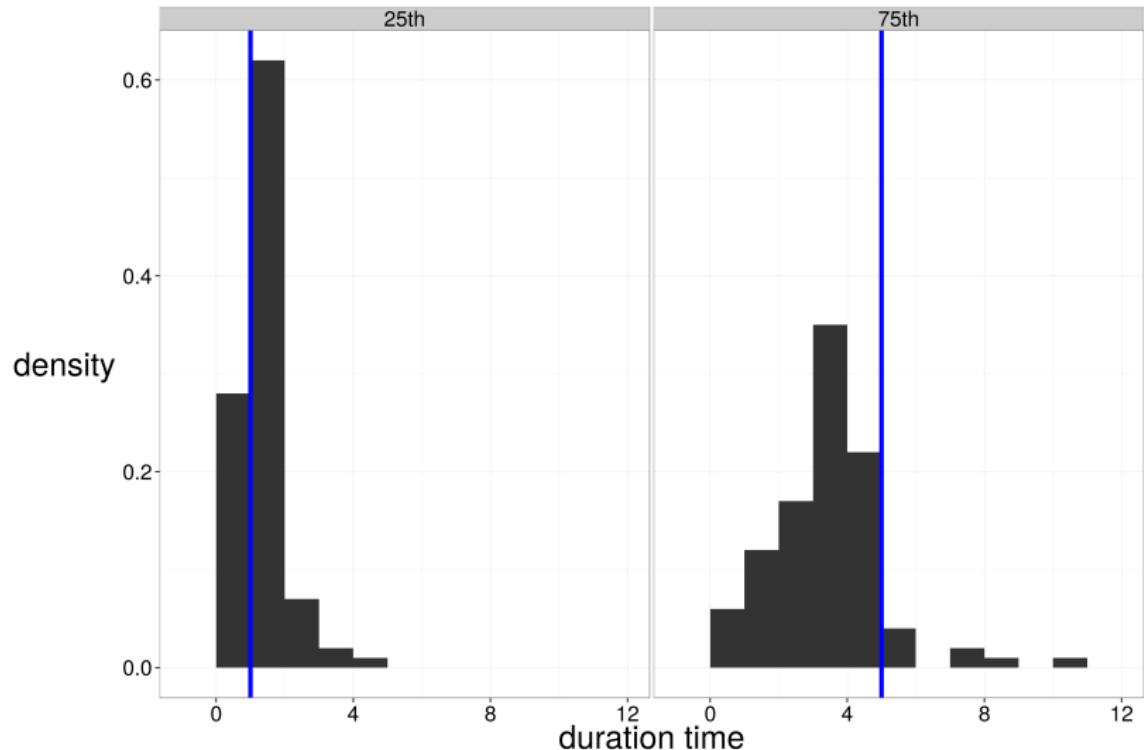
Estimated distribution



Posterior predictive check: mean duration



Posterior predictive check: quantiles



State of knowledge

Preliminary conclusions

Little evidence for single pattern of age-independence.

Occupancy has largest effect. Non-zero effect of other traits.

Modeling improvements

Major roadblock

HEAVY RIGHT TAIL

- ▶ sampling distribution
- ▶ different priors
- ▶ non-linear/heterogeneous variance
- ▶ fossil sampling effect

Remember...

Analysis is a narrative

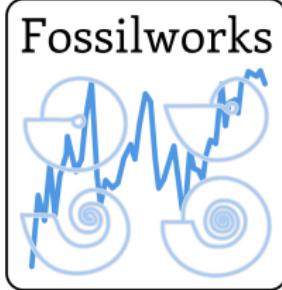
- ▶ fit model
- ▶ evaluate model
- ▶ improve model/include more information

Acknowledgements

- ▶ Advising
 - ▶ Kenneth D. Angielczyk,
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Garcia, Gene Hunt,
Darcy Ross, Liz
Sander



The Field
Museum



The Paleobiology Database
revealing the history of life



Identifiability and ridges

