# 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

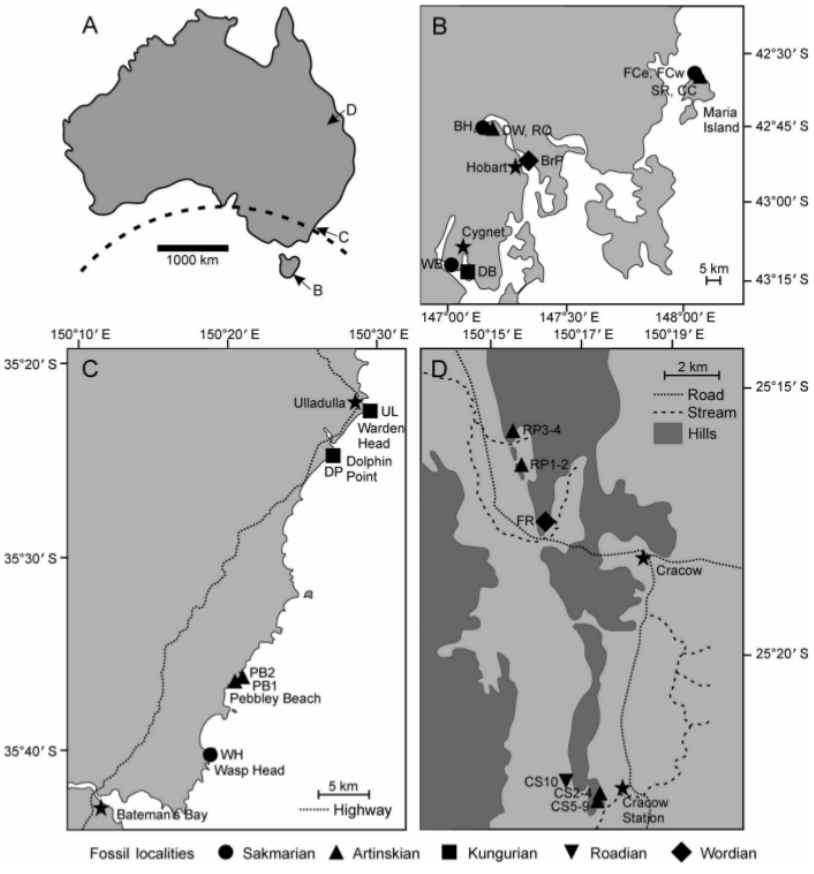
**Question**

Why do taxa go extinct at different rates?

# Enter brachiopods

(Immersion Imagery, Shutterstock; Wikimedia)

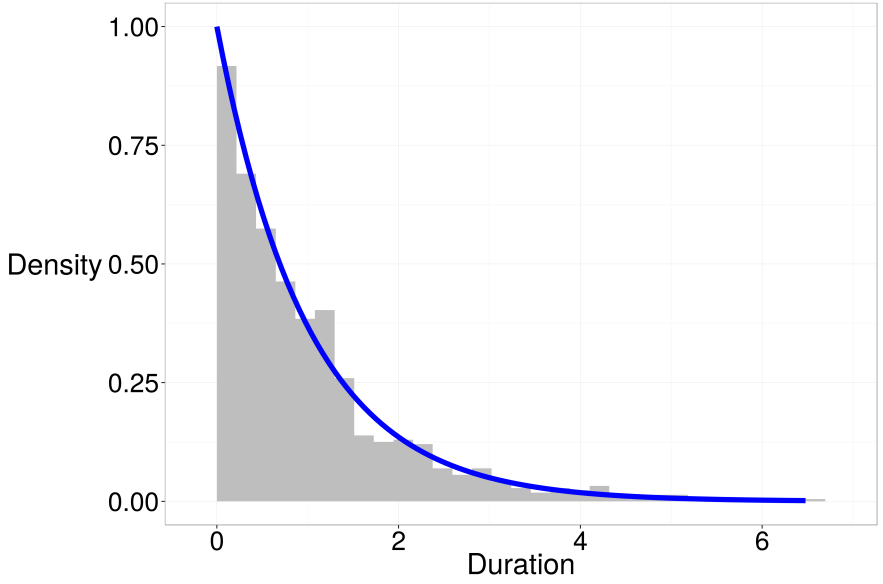
# System details

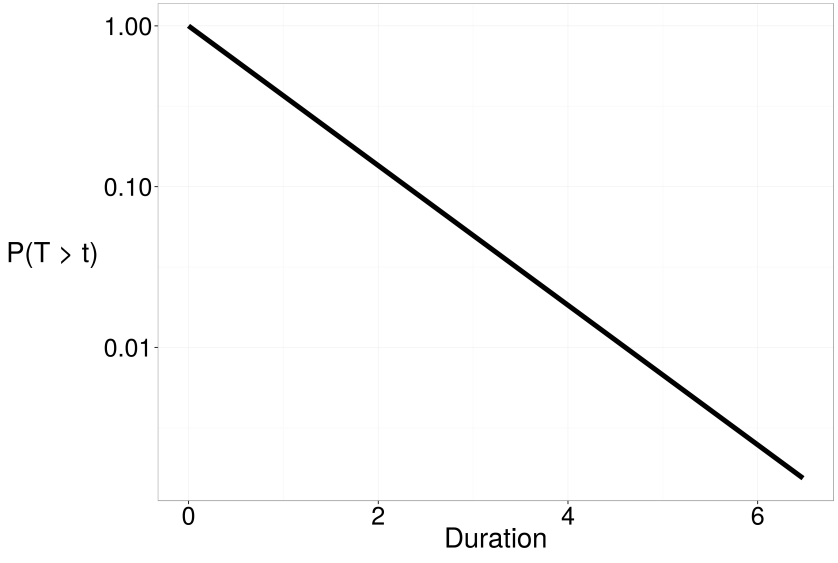


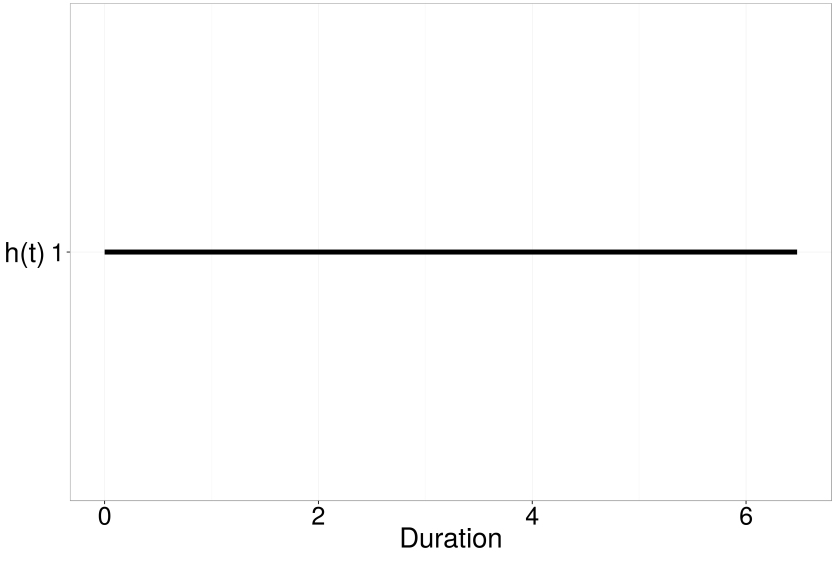

(Clapham and James 2008 *Palaios*)

- 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.*)

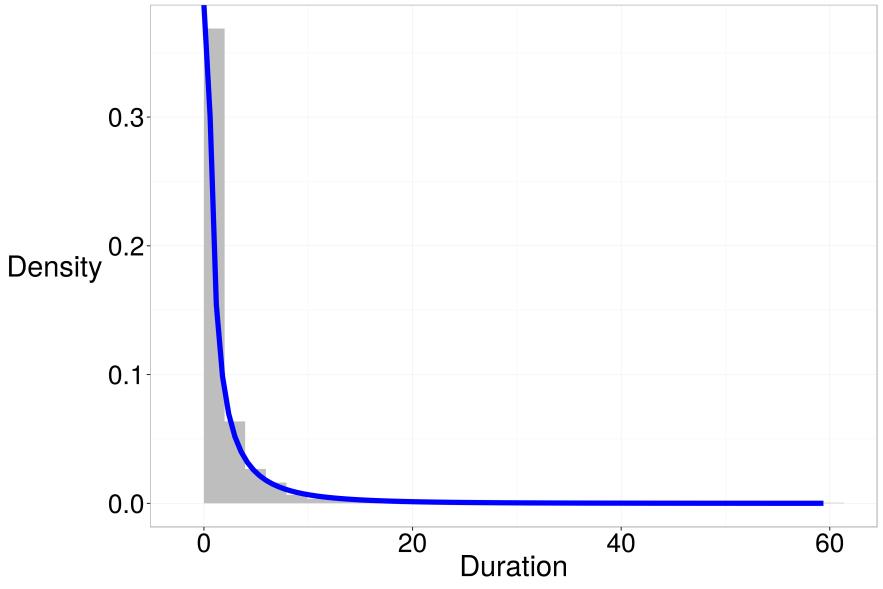
# Survival analysis: constant extinction

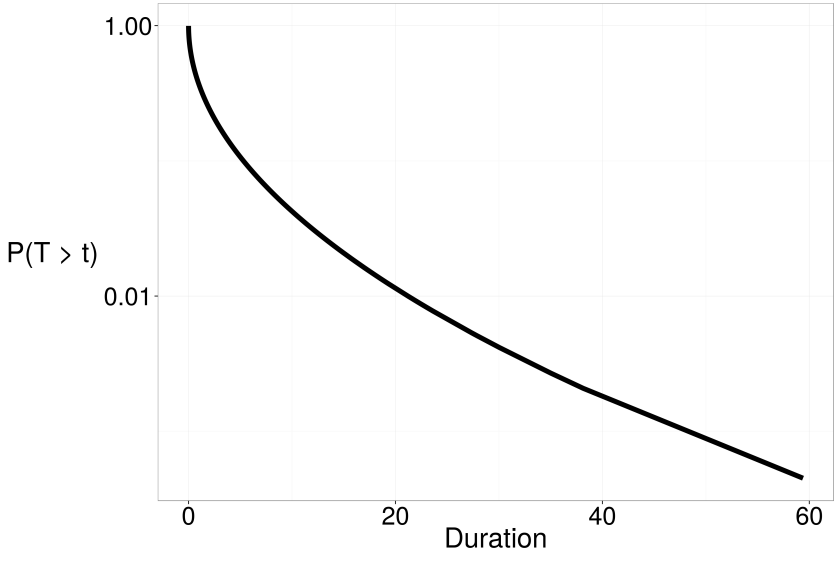


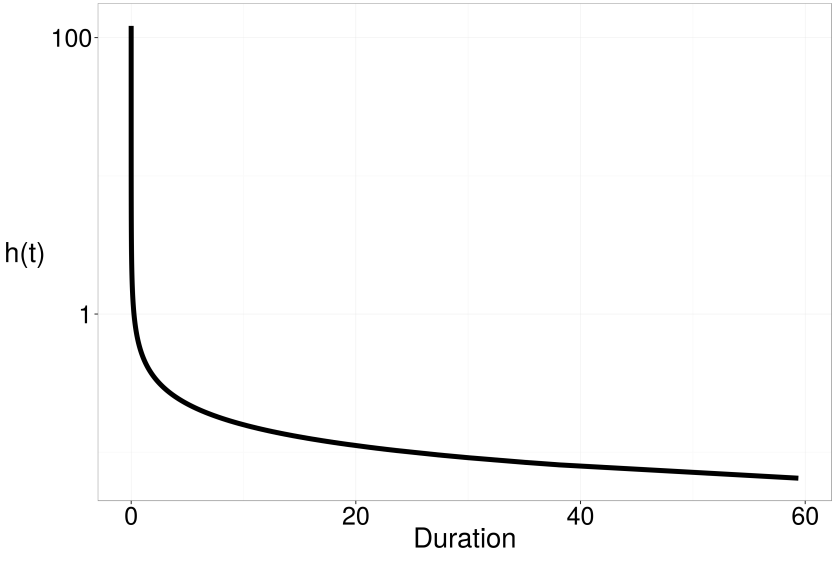



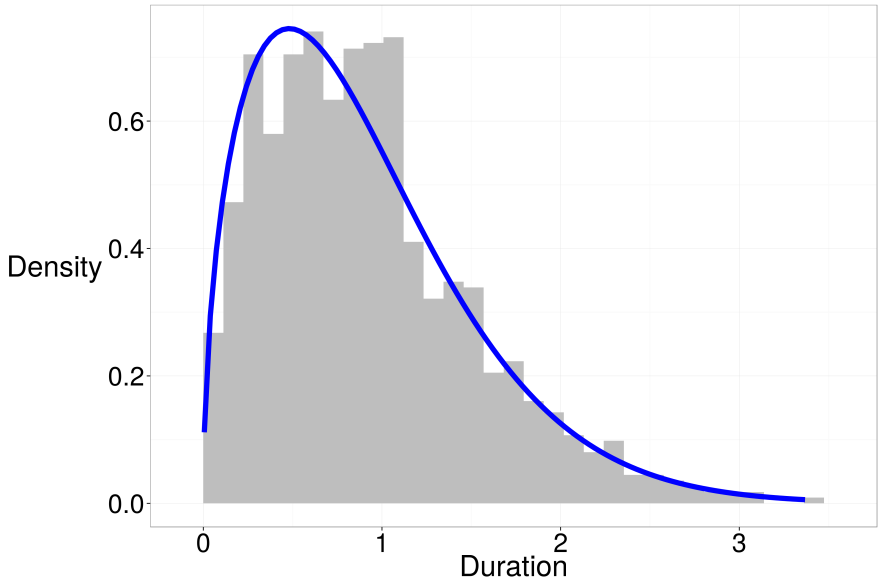
# Survival analysis: decelerating ($k < 1$)

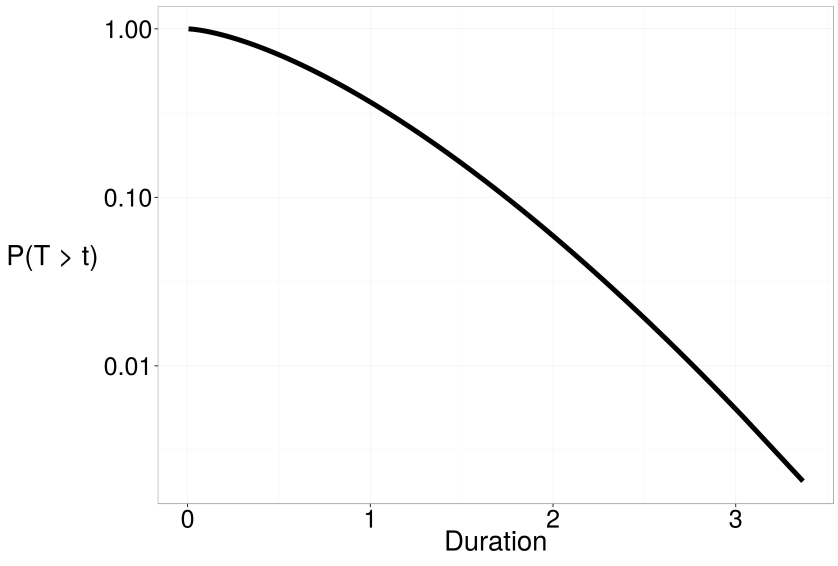


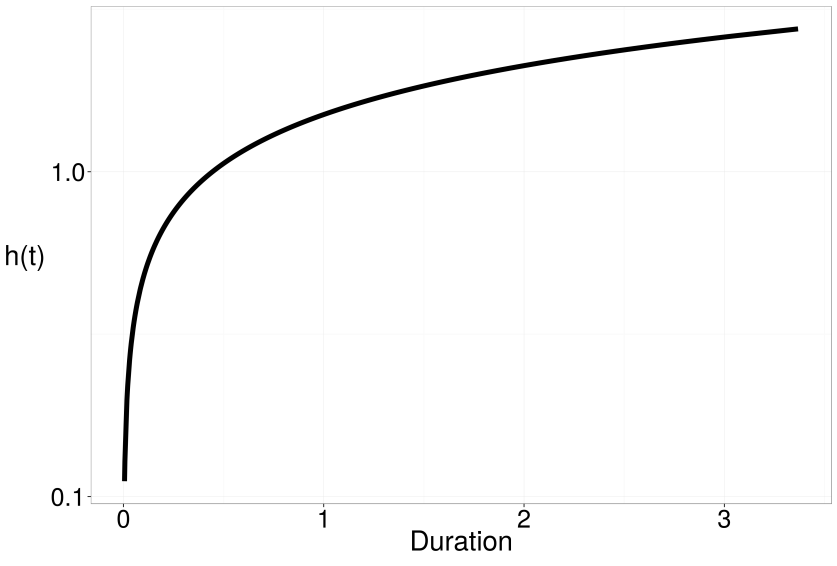



# Survival analysis: accelerating (k > 1)

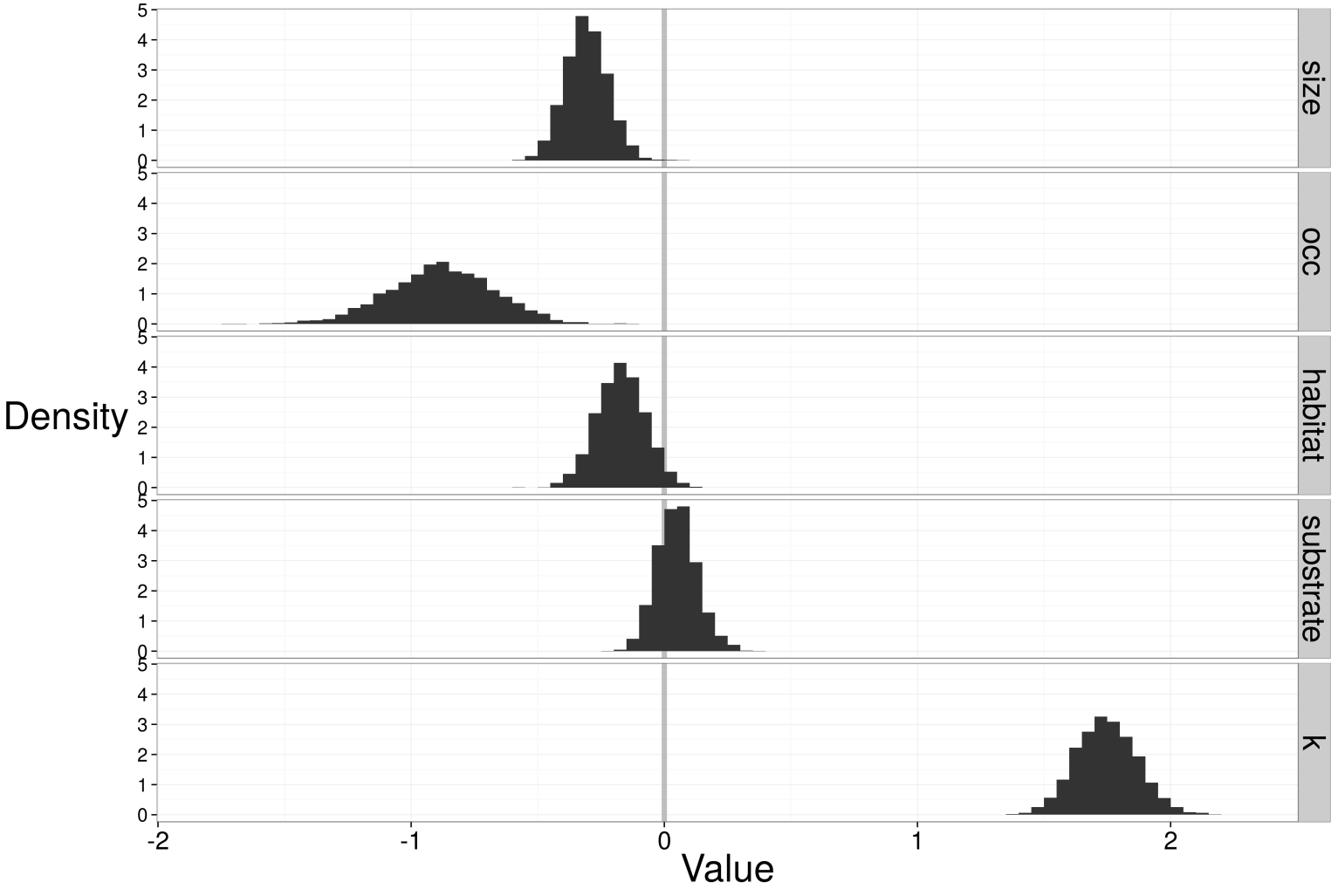


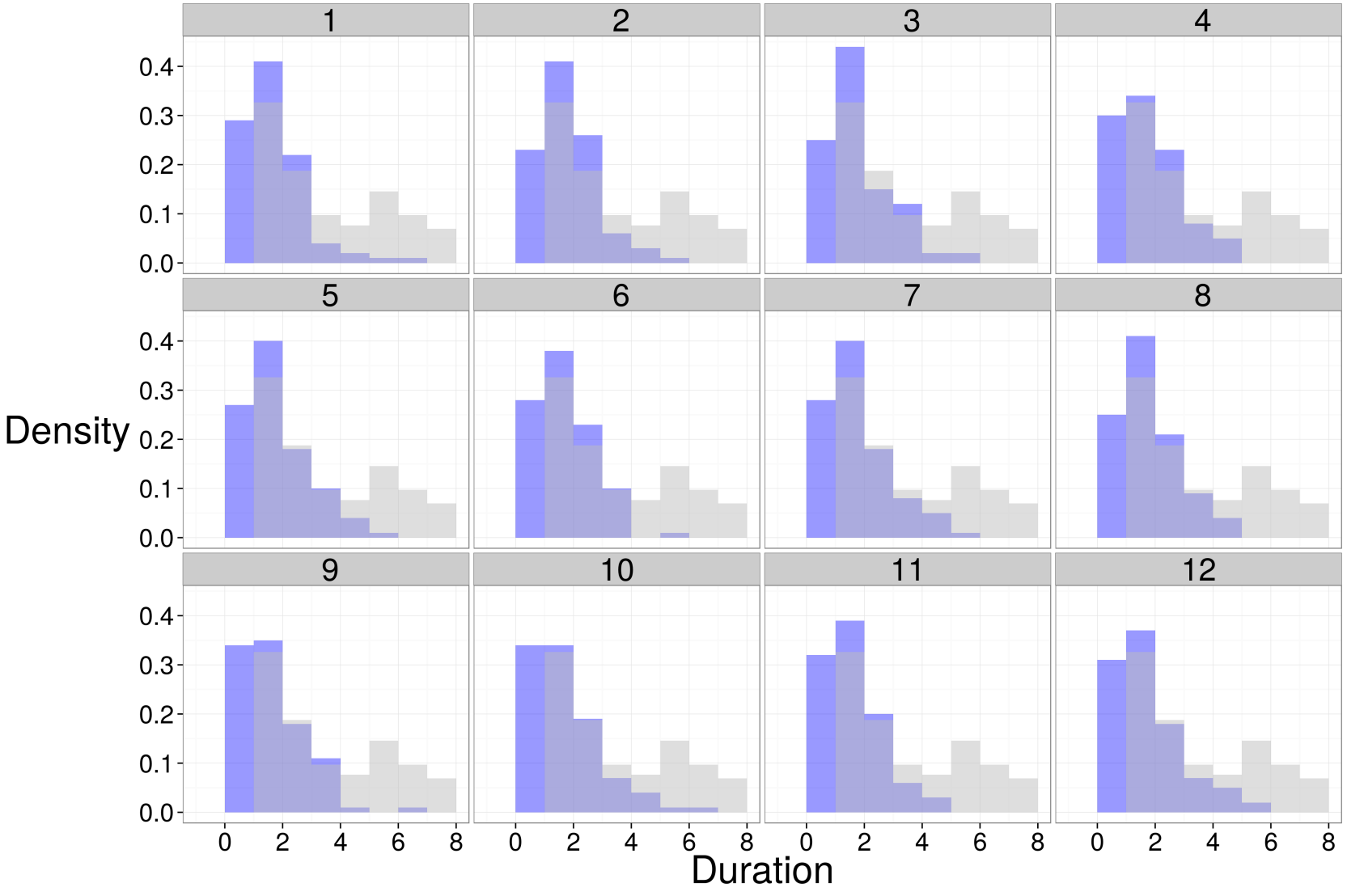



# Parameter marginal posteriors

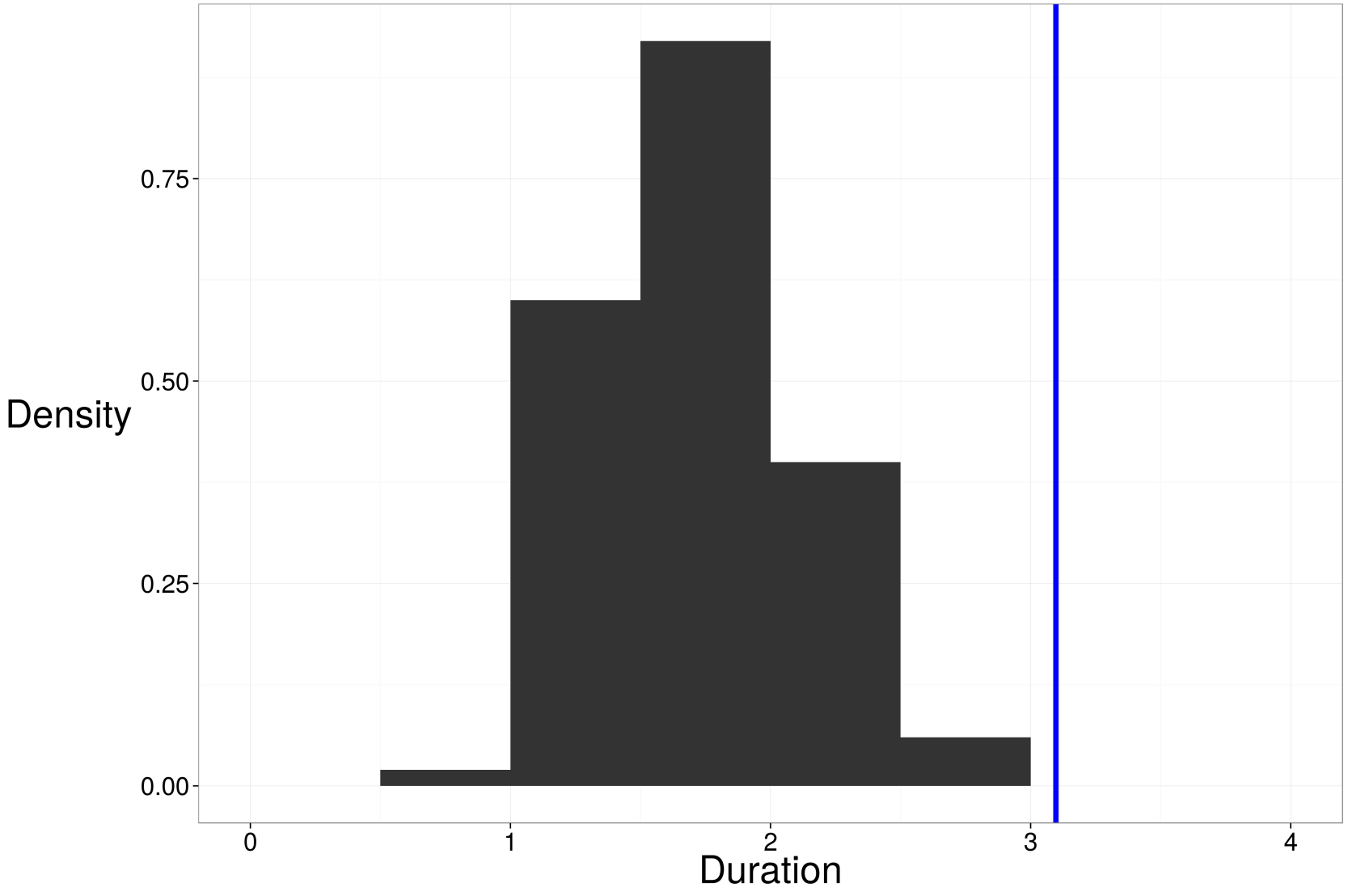
For all but $k$, if farther to left then $\uparrow$ trait $\propto \uparrow$ duration.



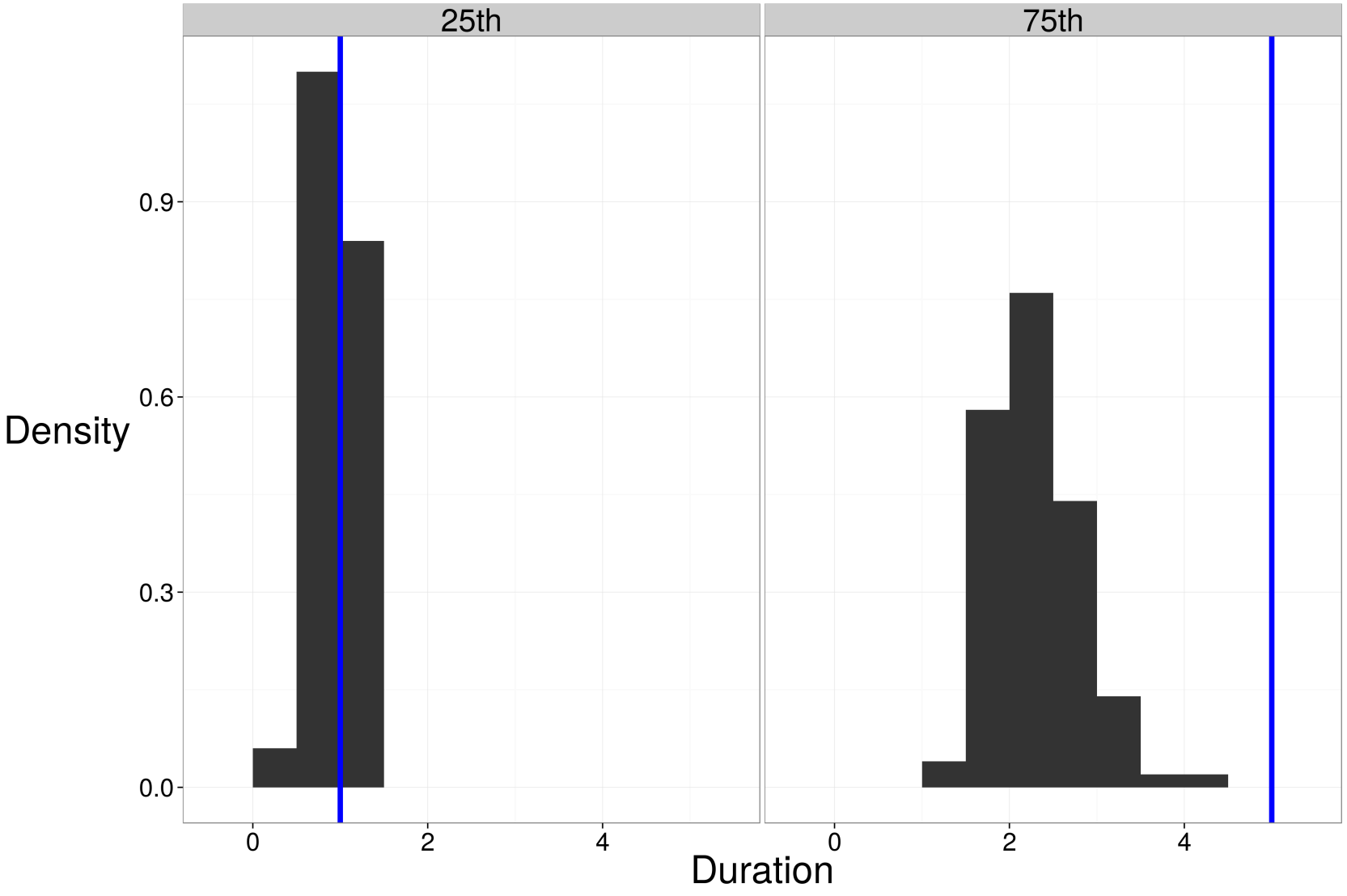
# Estimated versus observed: distribution



# Estimated versus observed: mean duration



# Estimated versus observed: quantiles



# State of knowledge

## Preliminary conclusions

Little evidence for single, age-independent pattern.

Occupancy has largest effect.

Substrate affinity $\approx$ no effect.

# Modeling improvements

## Major roadblock

HEAVY RIGHT TAIL: model missing long-lived genera

- sampling distribution
- different priors
- larger dataset, more traits
- sampling effect?

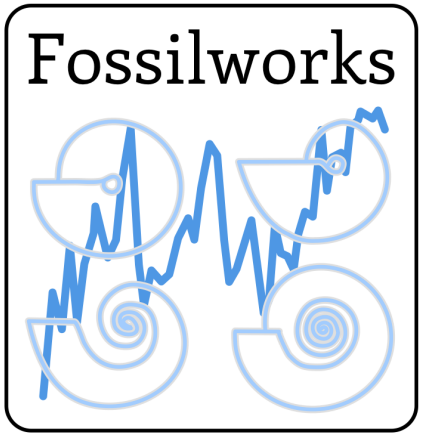
# Remember. . .

Analysis is a narrative

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

# Acknowledgements


- Advising
  - Kenneth D. Angielczyk, Michael J. Foote, P. David Polly, Richard H. Ree
- Discussion
  - David Bapst, Marites Villarosa Garcia, Gene Hunt, Nadia Pierrehumbert



The Paleobiology Database
revealing the history of life