

Since last meeting

Current projects

Brachiopods

Mammals

Timeline

Since last meeting

Current projects

Brachiopods

Mammals

Timeline

Since last meeting

- ▶ Evolution 2015 talk
- ▶ GSA 2015 talk
- ▶ Chapter 1 published (PNAS)
 - ▶ Effects of biotic traits on mammal species duration
- ▶ Chapter 2 submitted (Evolution)
 - ▶ Interplay between extinction intensity and selectivity in brachiopod extinction
 - ▶ Submitted early October, still in review?
- ▶ Did not submit DDIG

Review possible chapter 1

- ▶ Published in PNAS
- ▶ I took all of your comments very seriously and they really improved the paper.
 - ▶ Rick for forcing on the phylo (didn't do figure, but made me use it).
 - ▶ Ken and David for pushing about modern extinction risk.
 - ▶ Michael and Ken for helping me write it in english.
- ▶ Sorry i didn't send it to anyone except Michael and Ken.

Review possible chapter 2

- ▶ Submitted to Evolution
- ▶ What my patterns of extinction in Australia project eventually turned into.
 - ▶ Sorry about that.
 - ▶ Primarily drive by sample size issues.
- ▶ Sorry I didn't send it to anyone except michael and ken before submitting it.
 - ▶ This is actually a really good time to get all of your comments!

Since last meeting

Current projects

Brachiopods

Mammals

Timeline

Regional patterns in the diversification of Paleozoic brachiopods

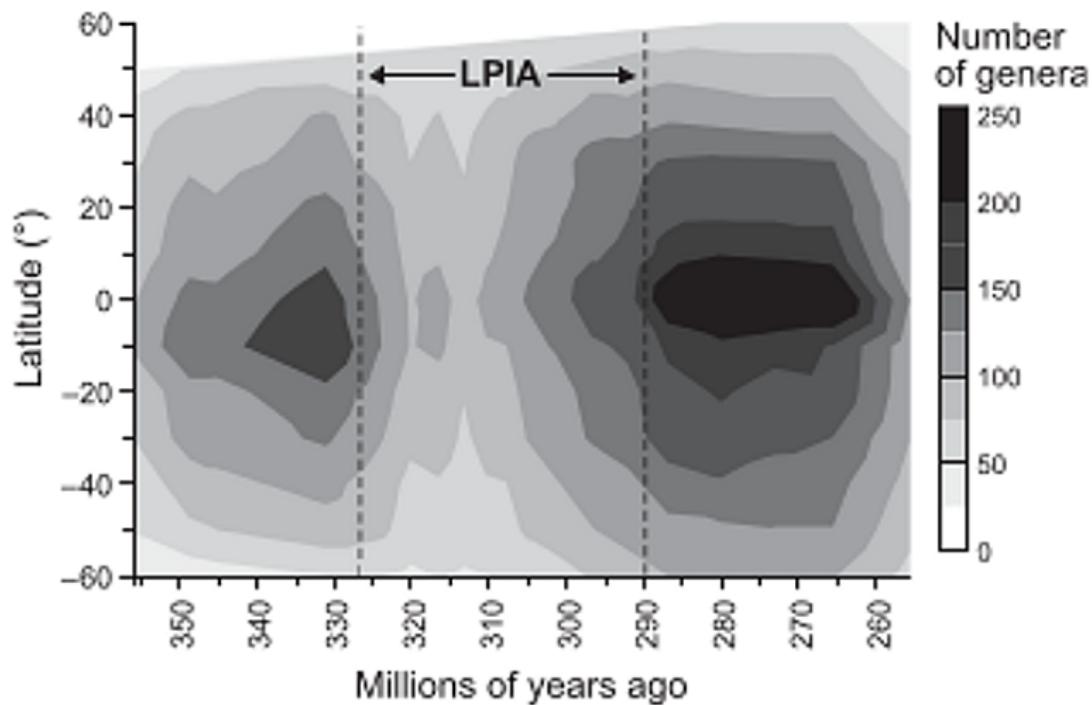
Question

How does differential taxonomic entrance and loss contribute to regional (e.g. latitudinal) diversity?

Motivation

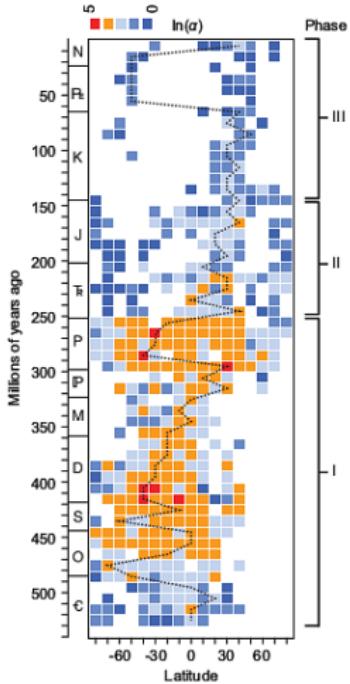
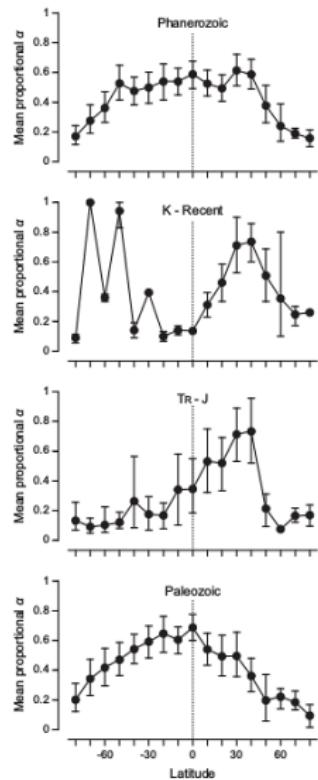
- ▶ latitudinal diversity gradients
 - ▶ through lense of a diversification process
- ▶ regional as opposed to global
 - ▶ variation within regions may not match global pattern
(more biologically relevant?)
 - ▶ partial follow up to brachiopod survival work

Brachiopod latitudinal diversity



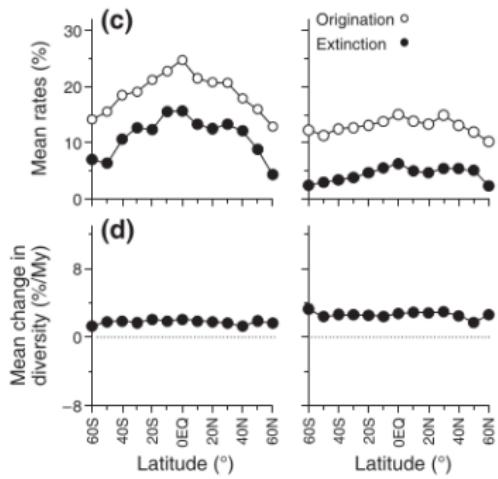
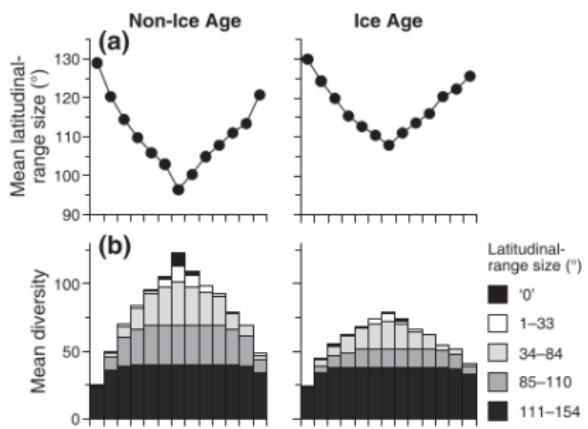
(Powell 2007 *G. Eco. Biogeo.*)

Variation in bioversity gradient



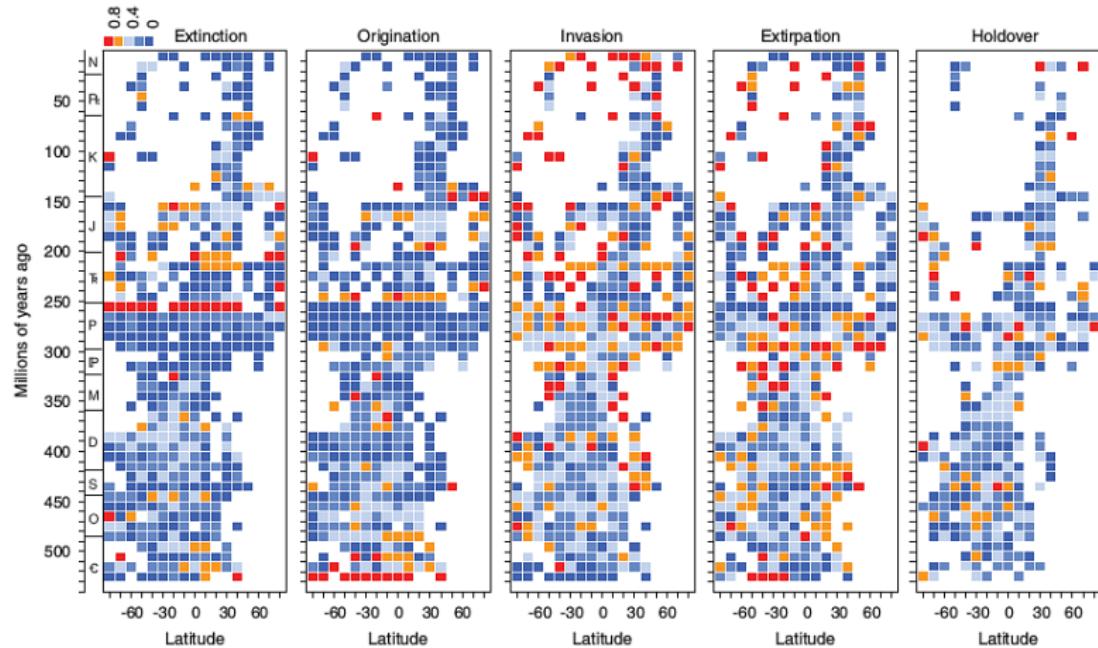
(Powell *et al* 2015 *Paleobio.*)

“Modes” of latitudinal diversity



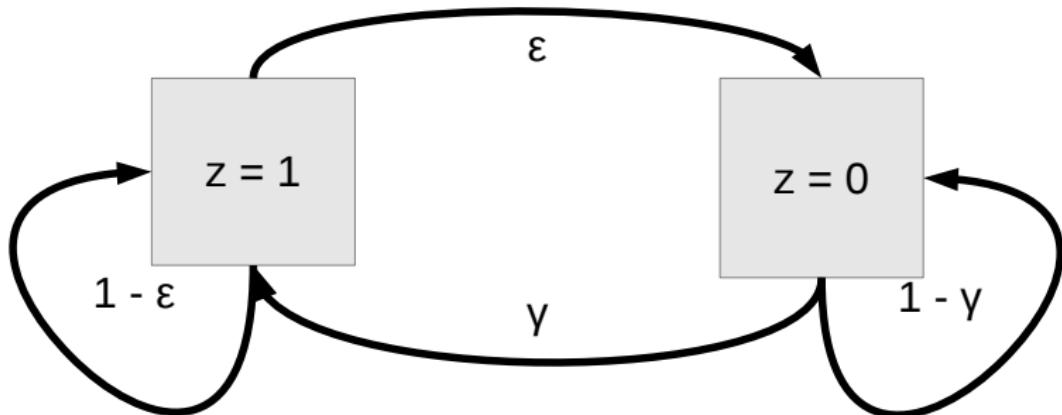
(Powell 2007 *G. Eco. Biogeo.*)

Change in evenness + diversity

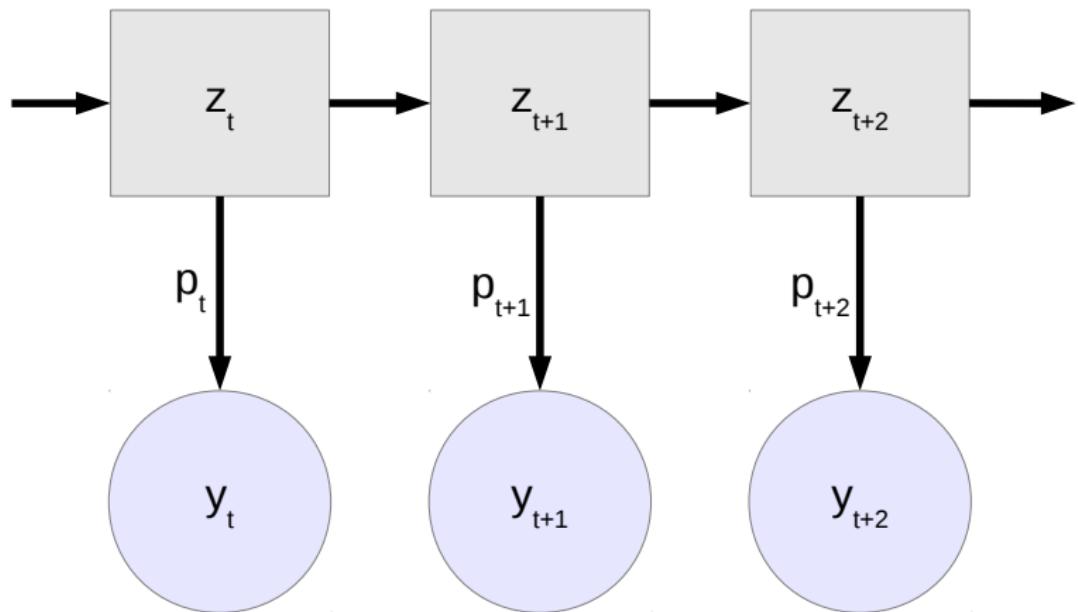


(Powell *et al* 2015 *Paleobio.*)

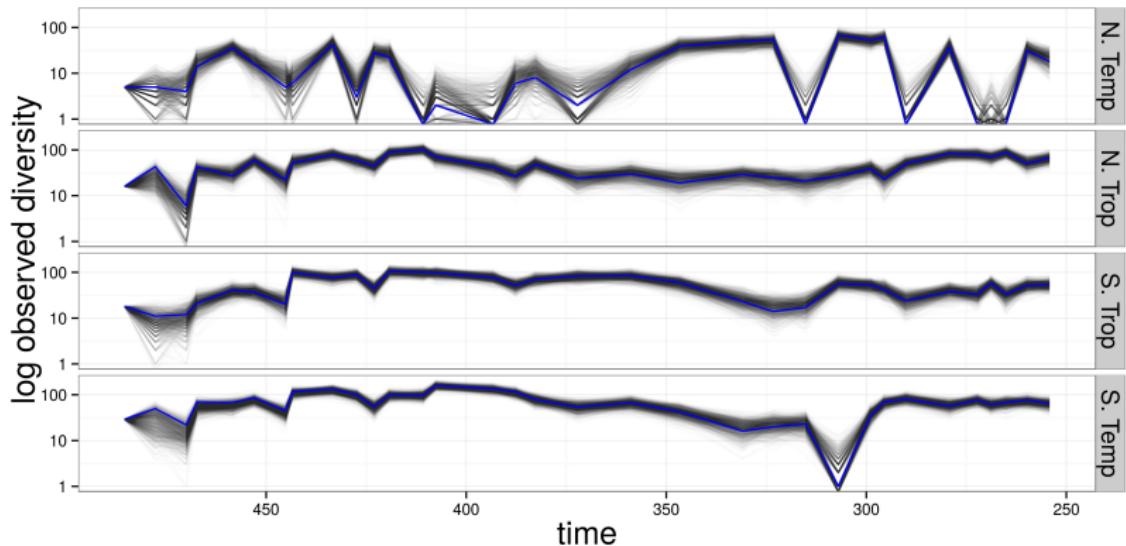
Model structure: Markov model



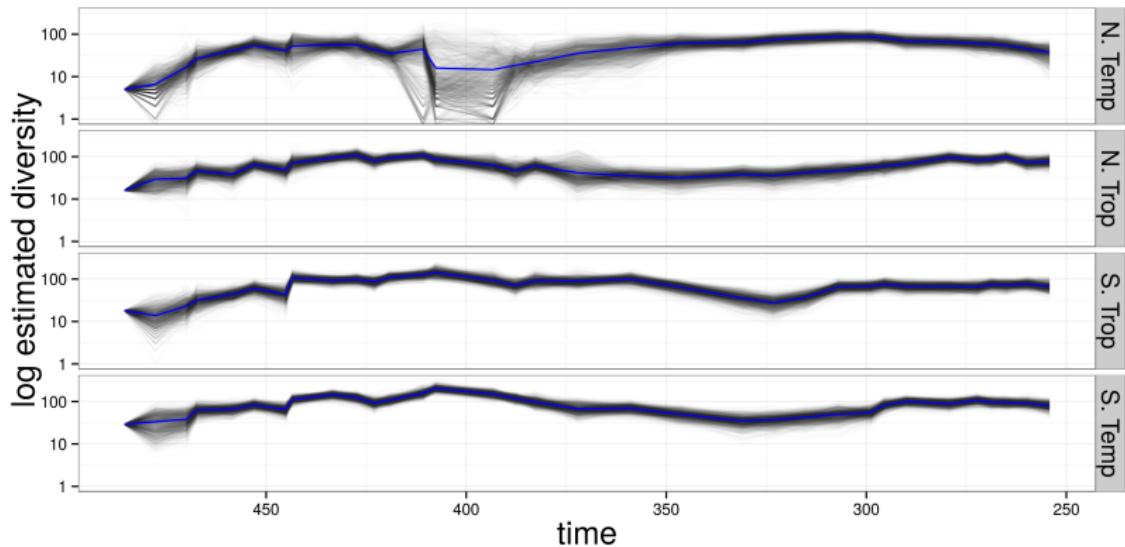
Model structure: hidden state



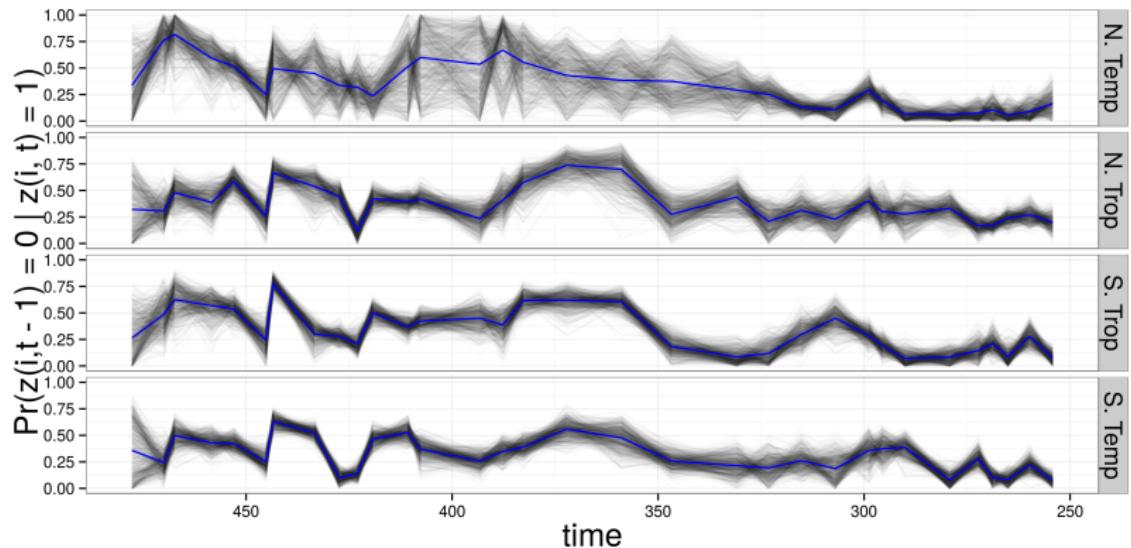
Observed diversity



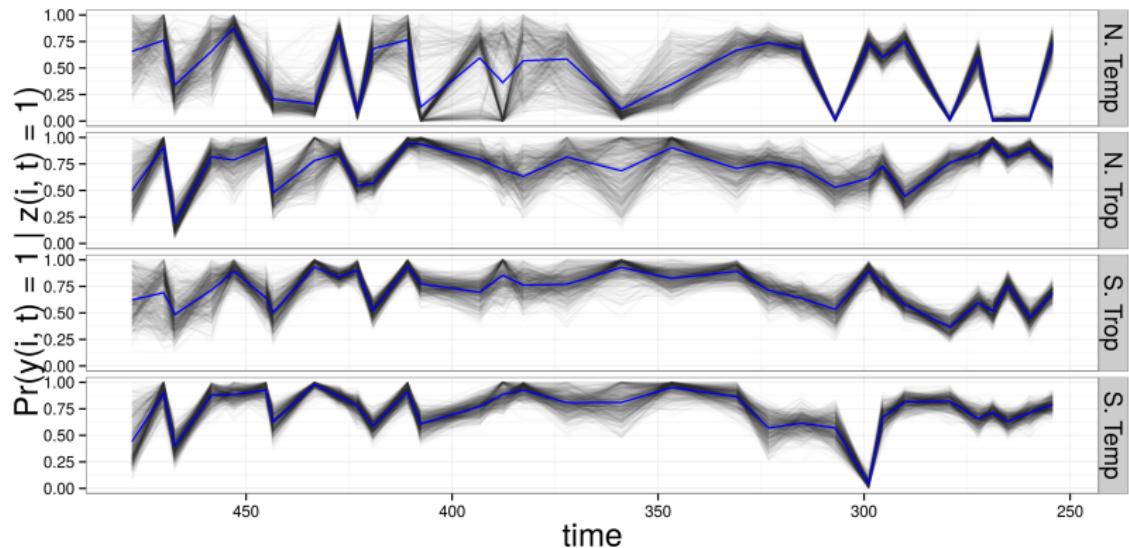
Estimated latent results



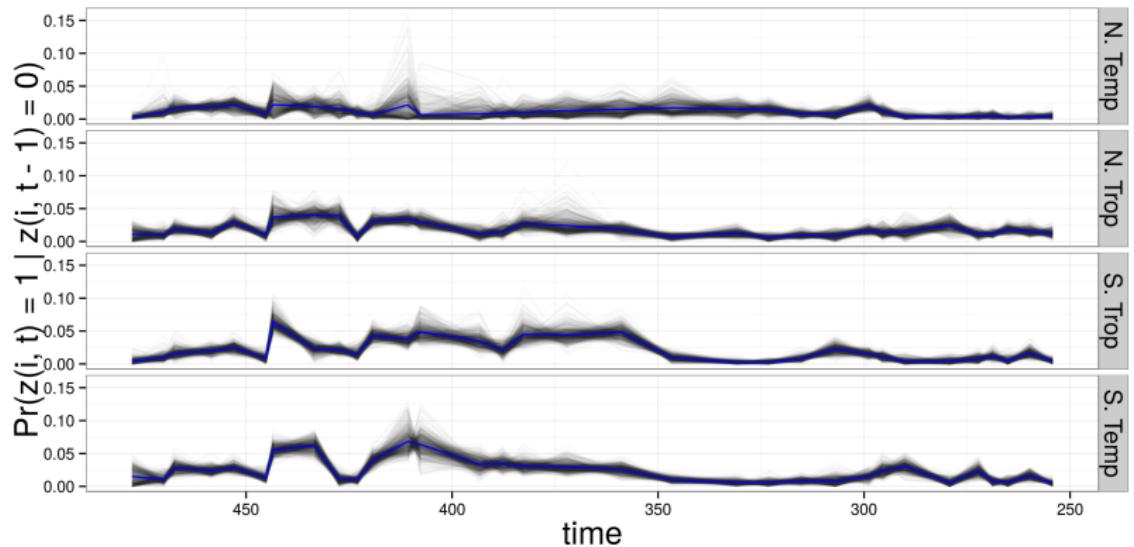
Turnover probability



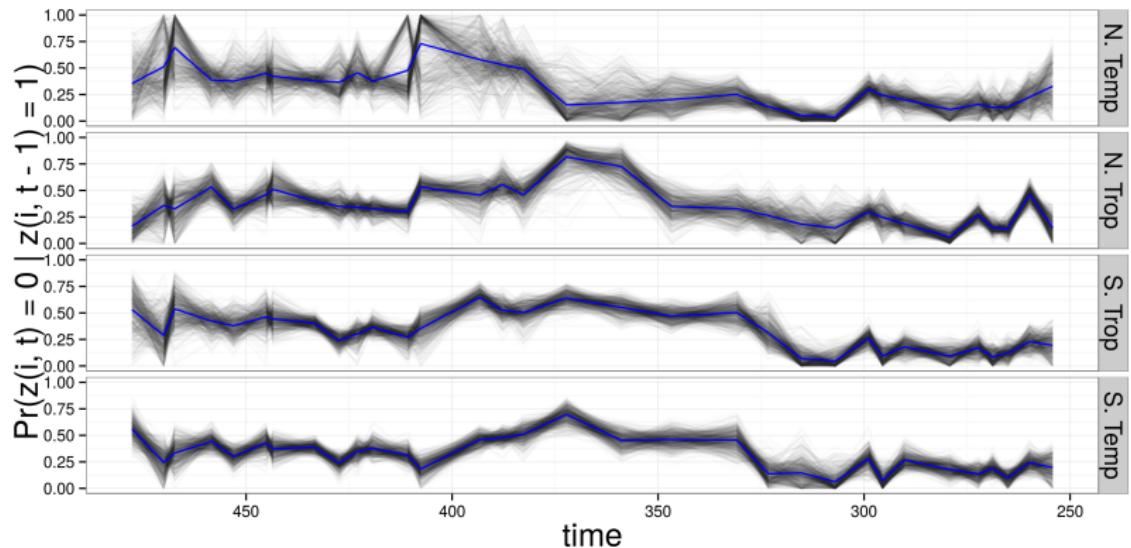
Observation probability



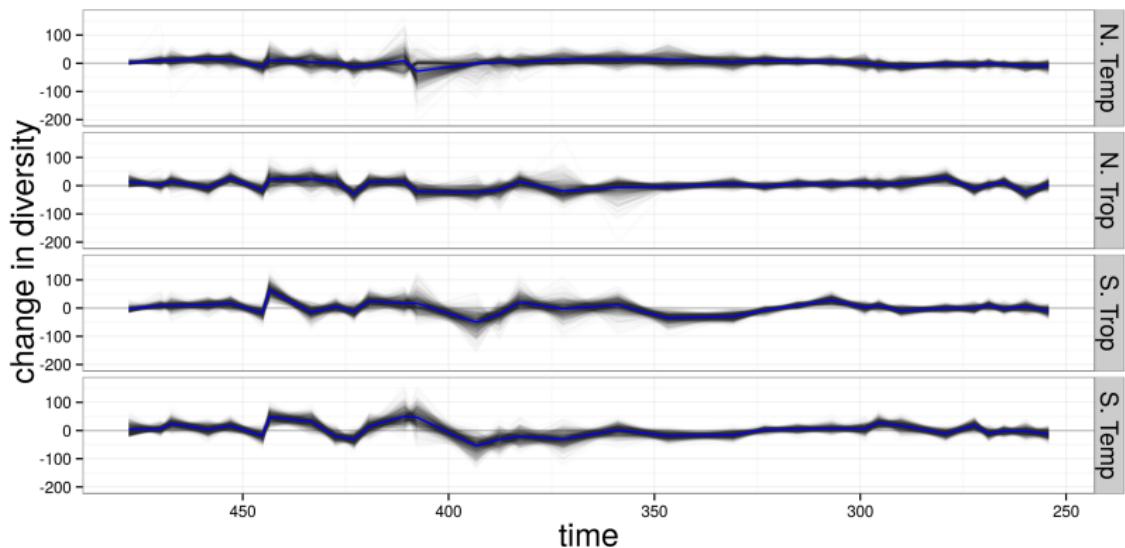
Gain probability



Loss probability



Change in diversity



Major assumptions

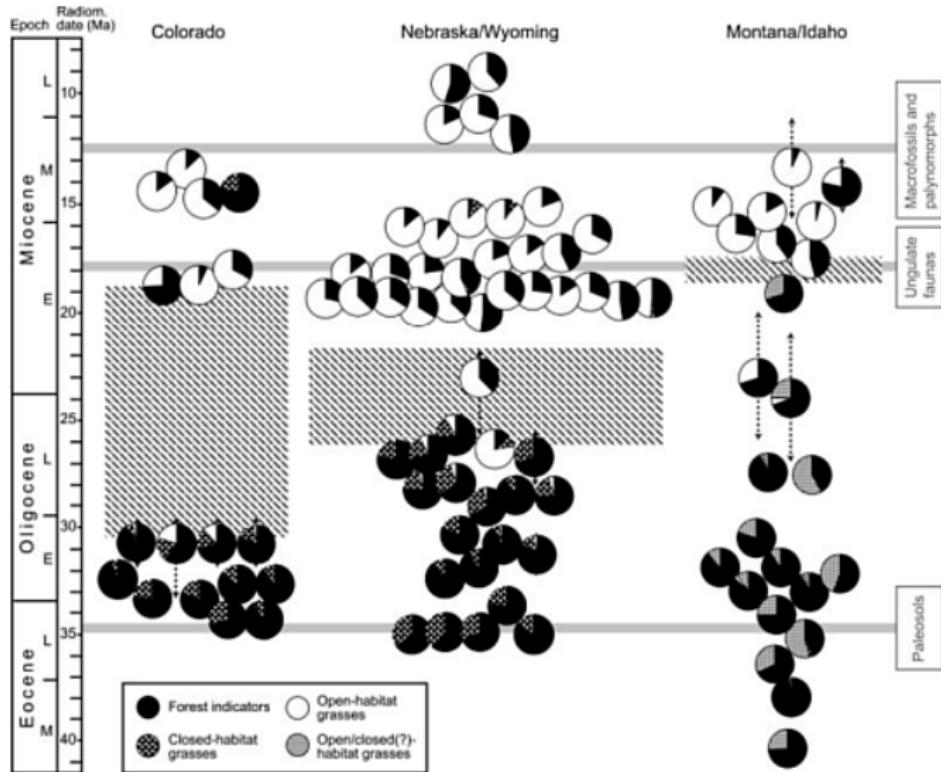
- ▶ model is only a first-order Markov process
 - ▶ can lead to some taxa existing longer than in actuality
- ▶ any taxon can occur in any geographic unit independent of other units
- ▶ both possibly controlled for by sampling parameter
 - ▶ further assumes all times and places can be considered similar
- ▶ Worth expanding time analyzed and/or to other taxonomic groups?

Changes in Cenozoic mammal ecotype composition

Question

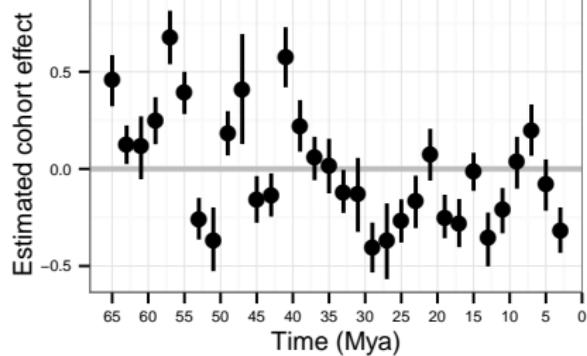
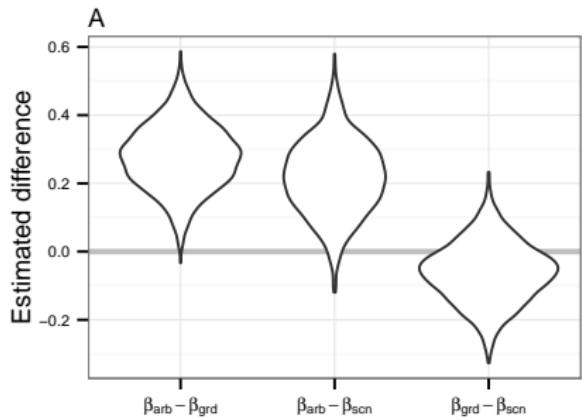
How do occurrence ratios of mammalian ecotypes change over time?

Environmental shift



(Stromberg 2005 PNAS)

Possible link?



(Smits 2015 *PNAS*)

Multi-logit regression

$$y_i \sim \text{Categorical}(K, \pi)$$

$$\pi_k = \frac{\exp(\beta_{k,j[i]} X_i)}{\sum_{k=1}^K \exp(\beta_{k,j[i]} X_i)}$$

$$\text{where } \beta_{K,j[i]} X_i = 0$$

$$\beta_{k,j} \sim \mathcal{N}(\beta'_k, \sigma_k)$$

$$\beta_{k,j}[1] \sim \mathcal{N}(\beta'_k[1] + \alpha_k U_k, \sigma_k)$$

Preliminary results

Further developments

- ▶ NOTE currently single flat mean; allow trend/multiple?
 - ▶ time order is not currently modeled
- ▶ NOTE no phylogenetic effect for $k = K$
 - ▶ every thing is relative to it
- ▶ climate as cohort-level predictor, integrating over uncertainty?
- ▶ observed taxa represent a proportional sample of reality
 - ▶ how can this be overcome in a model based framework?
- ▶ limits to complexity of model due to sample size

Since last meeting

Current projects

Brachiopods

Mammals

Timeline

Things to consider

- ▶ TAing this spring and next year
- ▶ Funding?
 - ▶ FMNH fellow (but I don't spend time at the museum).
- ▶ Estimates for time of completion?
- ▶ Post-doctoral opportunities?