Phylogenetic tree shape, non random extinctions and the expected loss of Phylogenetic Diversity

Odile Maliet, Fanny Gascuel, Amaury Lambert

MCEB
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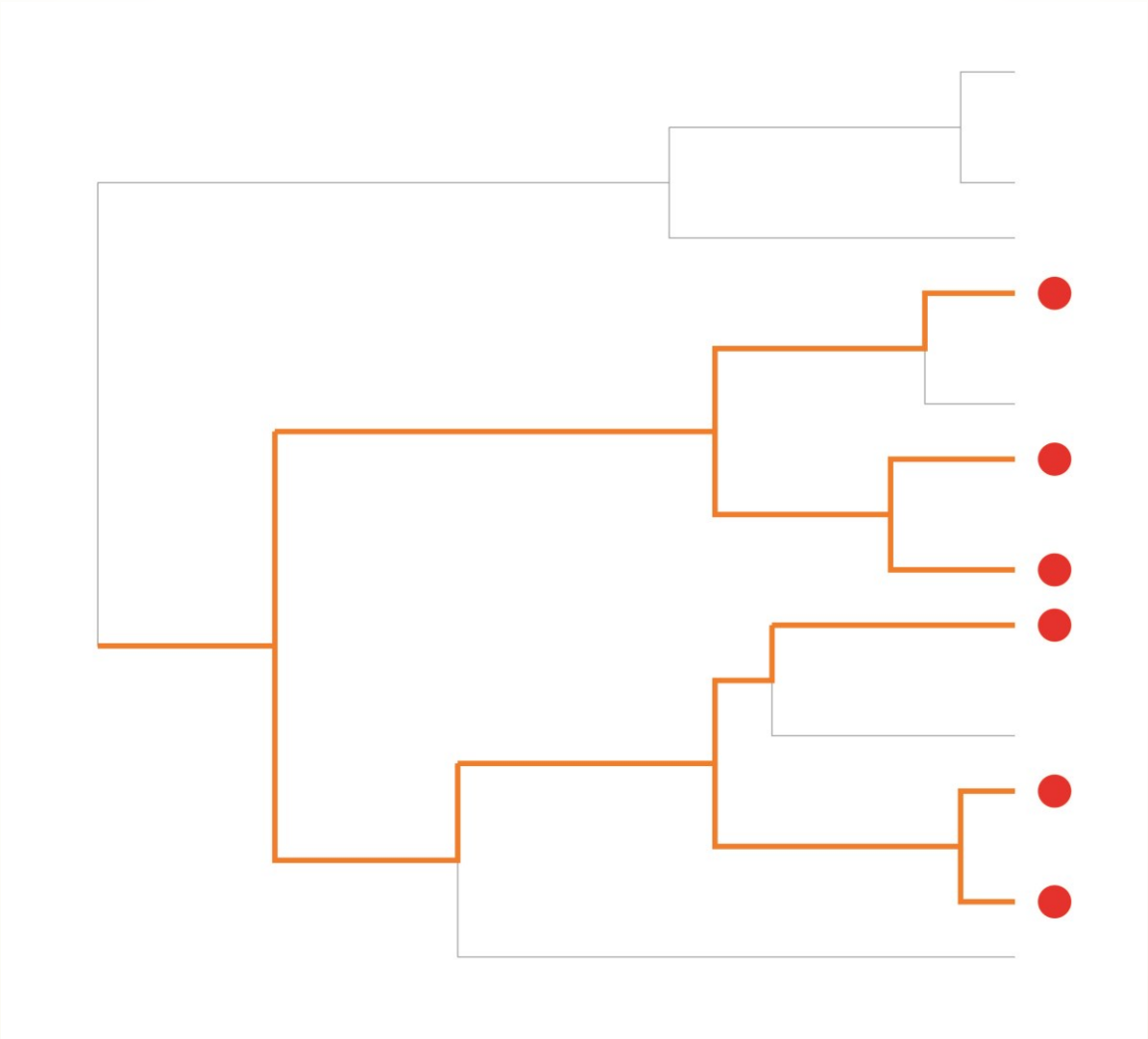
Phylogenetic diversity



Faith 1992

Phylogenetic diversity loss during a mass extinction event

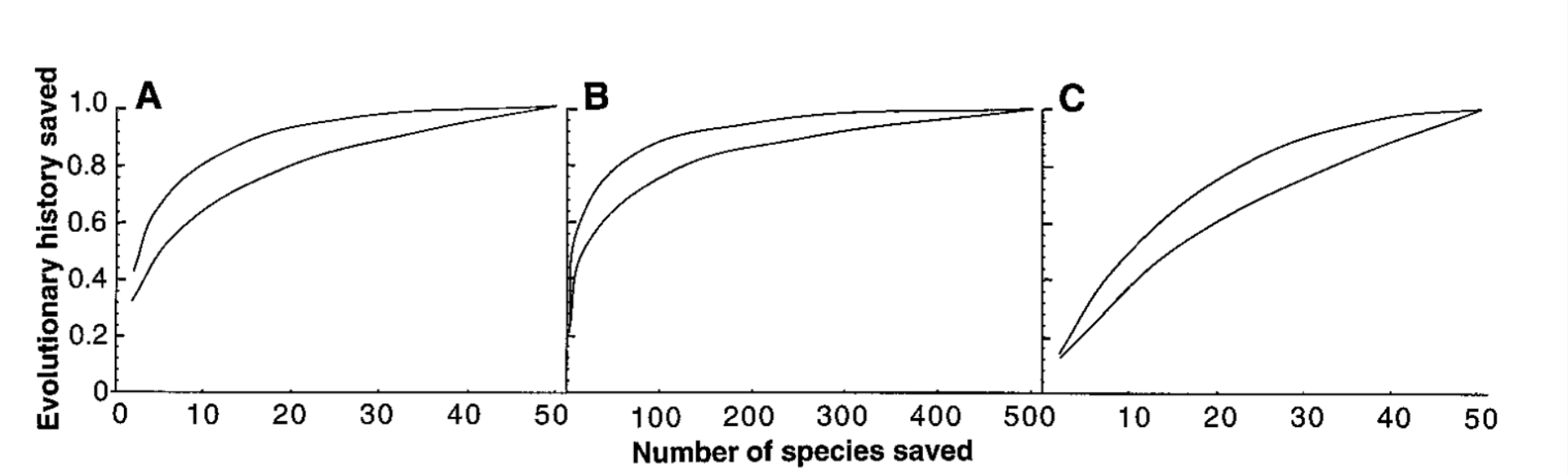
Extinction and the Loss of Evolutionary History

Sean Nee* and Robert M. May

Extinction episodes, such as the anthropogenic one currently under way, result in a pruned tree of life. But what fraction of the underlying evolutionary history survives when *k* of *n* species in a taxon are lost? This is relevant both to how species loss has translated into a loss of evolutionary history and to assigning conservation priorities. Here it is shown that approximately 80 percent of the underlying tree of life can survive even when approximately 95 percent of species are lost, and that algorithms that maximize the amount of evolutionary history preserved are not much better than choosing the survivors at random. Given the political, economic, and social realities constraining conservation biology, these findings may be helpful.

Nee and May (1997)

What can affect the relation between species loss and PD loss ?



A, B : Kingman's coalescent
C : Yule

Nee and May (1997)

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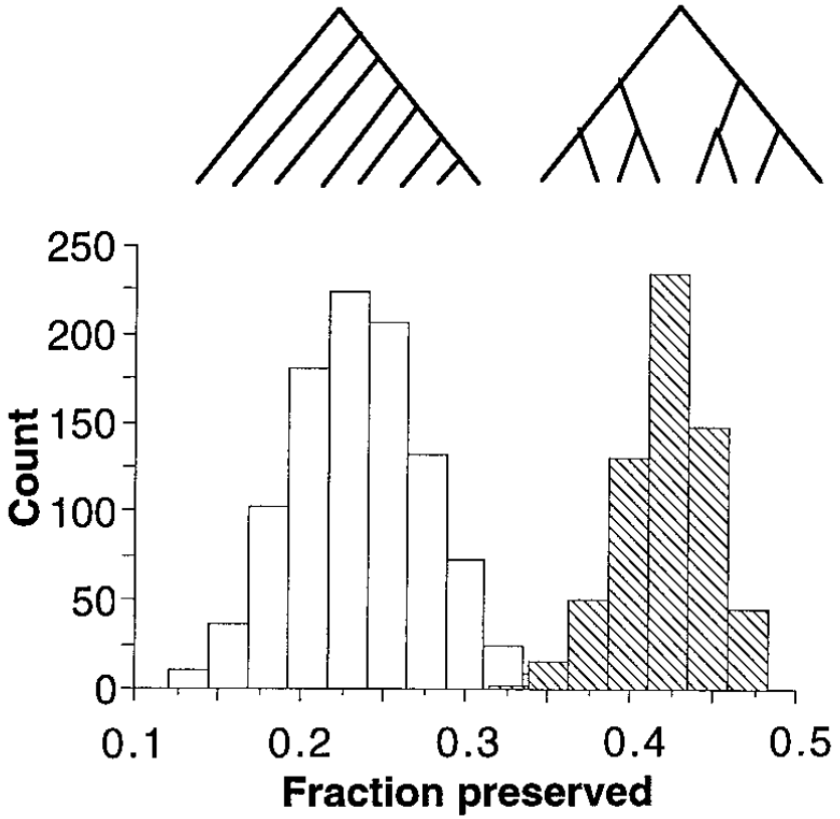


Nee and May (1997)

What can affect the relation between species loss and PD loss ?

Evolutionary biology

Revisiting the impacts of non-random extinction on the tree-of-life

T. Jonathan Davies[1] and Kowiyou Yessoufou[2]

[1]Department of Biology, McGill University, Montreal, Quebec, Canada
[2]African Centre for DNA Barcoding, University of Johannesburg, Johannesburg, Gauteng, South Africa

Davies and Yessoufou (2013)

What other tree shape properties may impact PD loss ?

What is the combined effect of tree shape and phylogeny dependant extinction risks ?

Model presentation

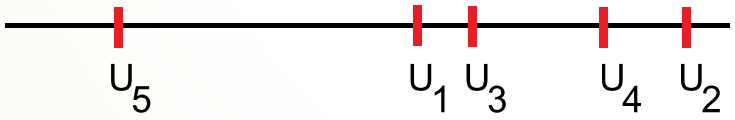
- Statistical way to produce labeled histories with extinction risks

- 3 parameters model
  - β : tree balance
  - α : clade size / clade age correlation
  - η : distribution of extinction risk

Repartition of node depths

β : tree balance

α : clade size / clade age correlation



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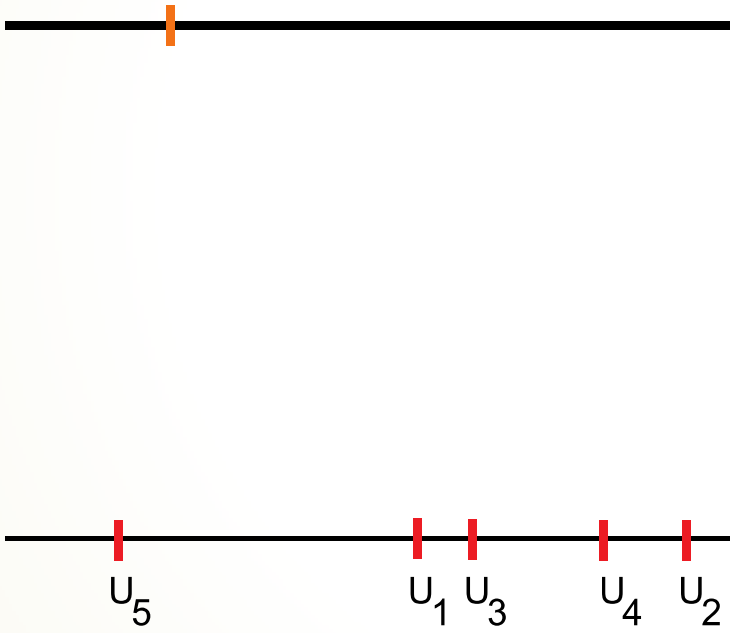

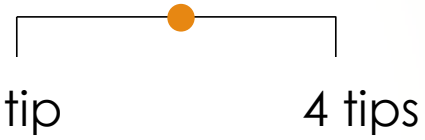

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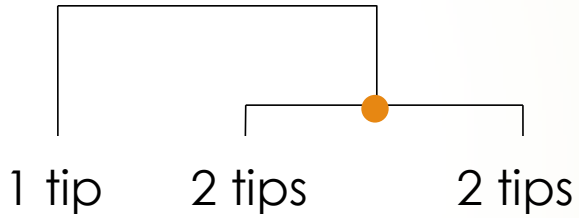

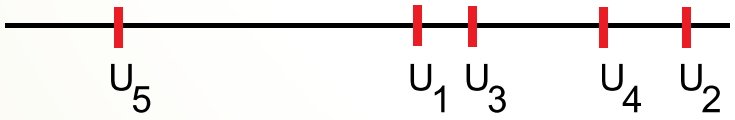

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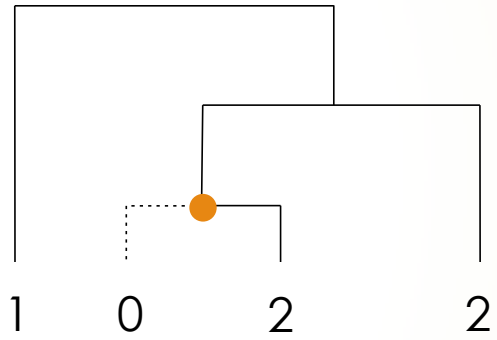

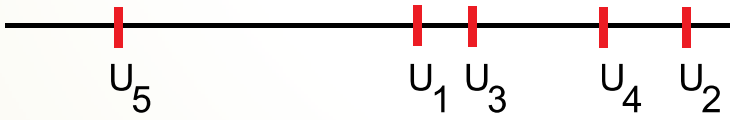

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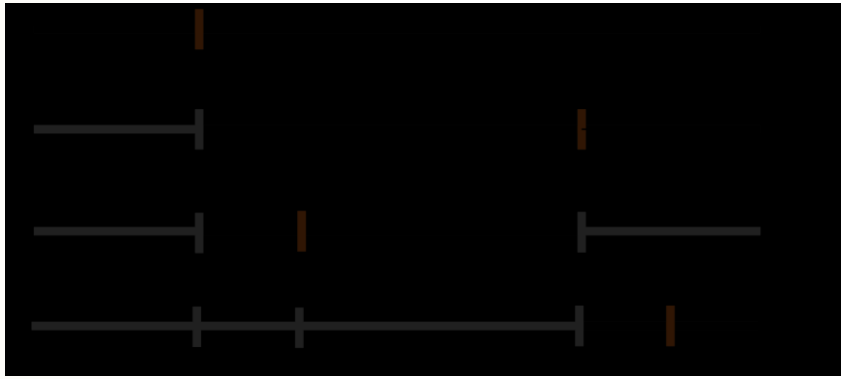

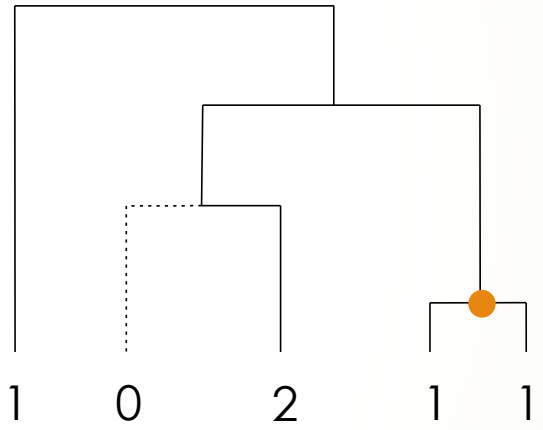

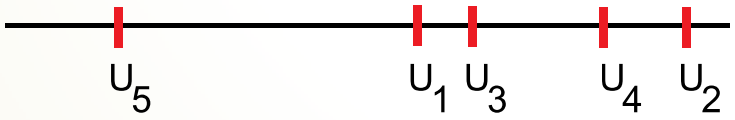

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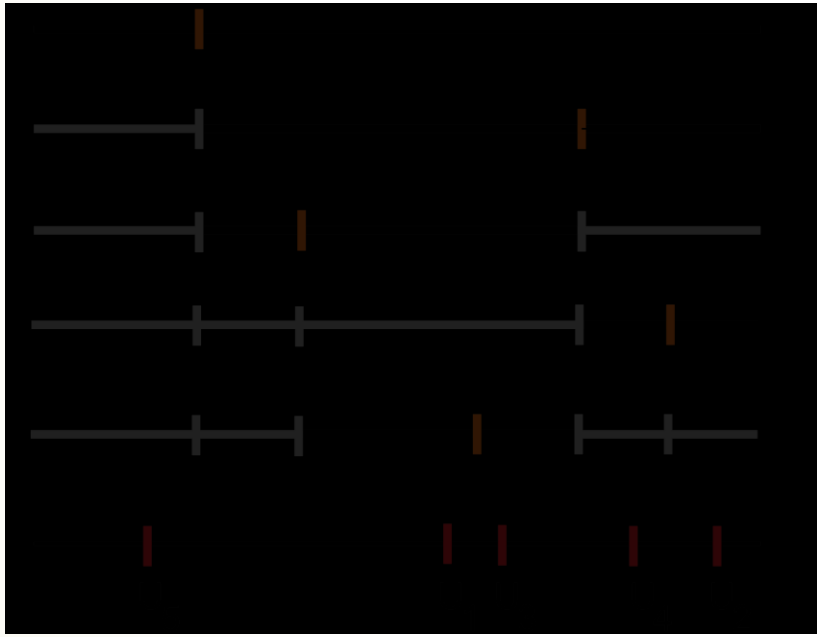

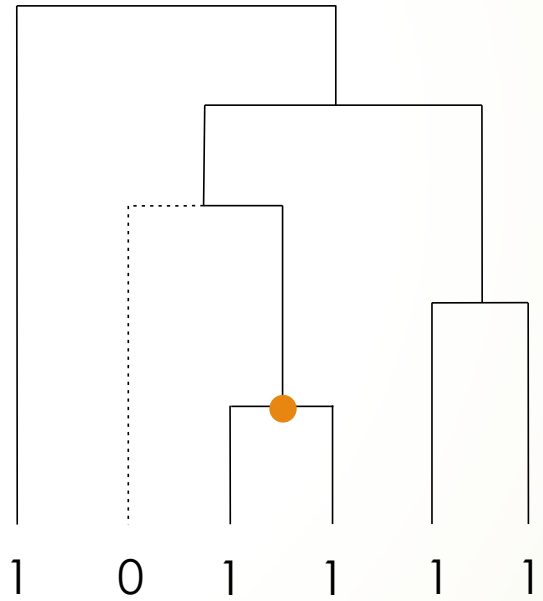

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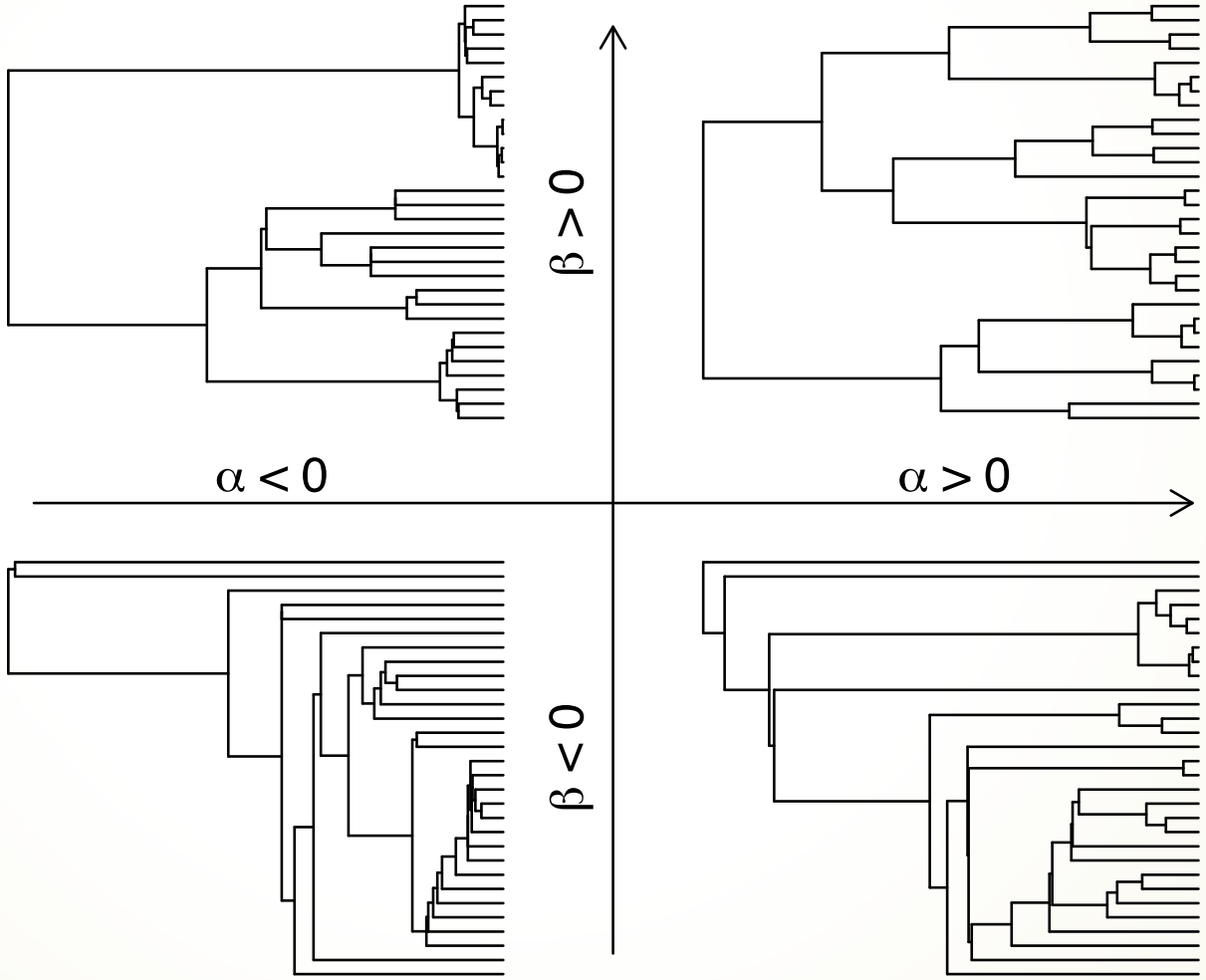
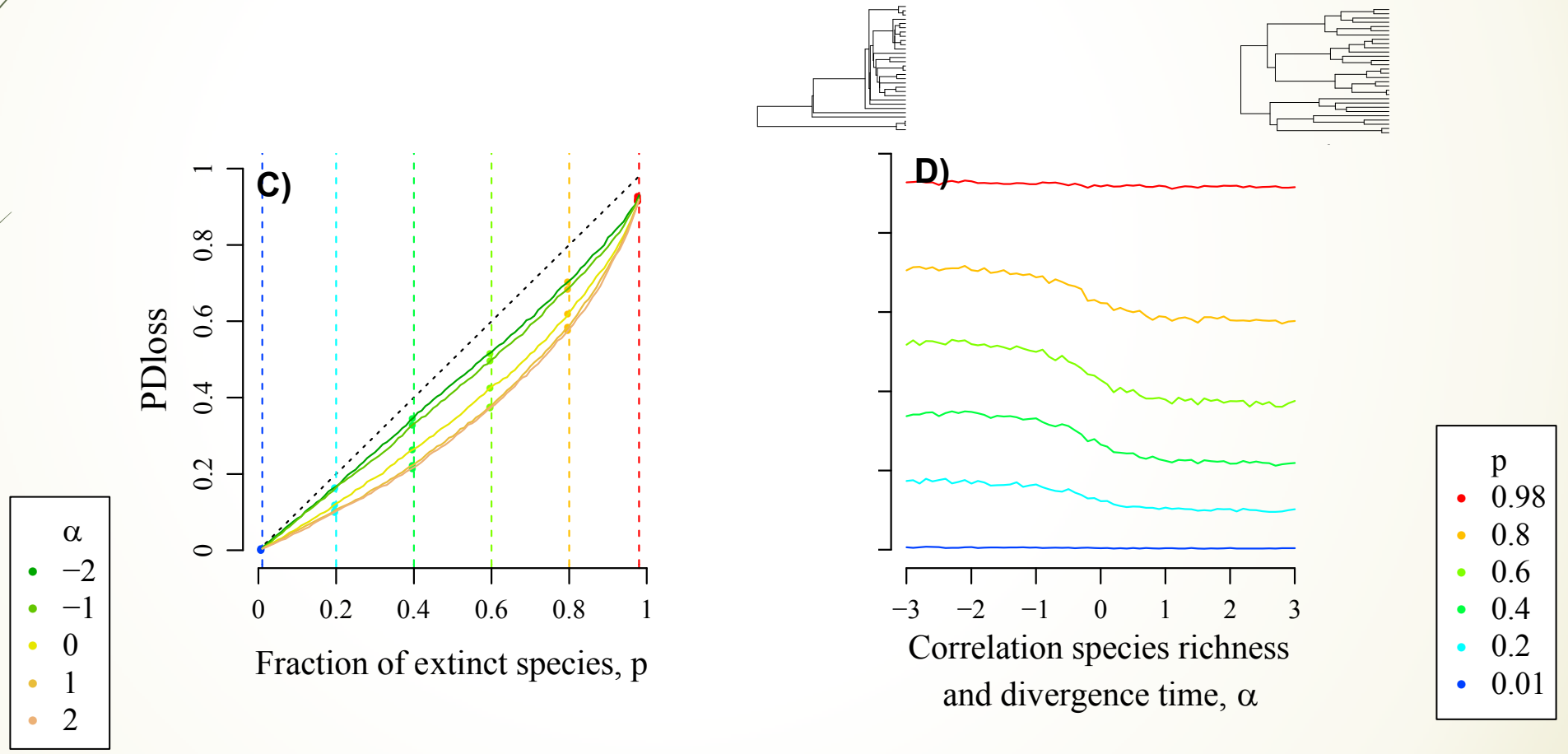


Clade size clade age correlation

$(\beta = 0)$



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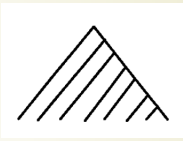
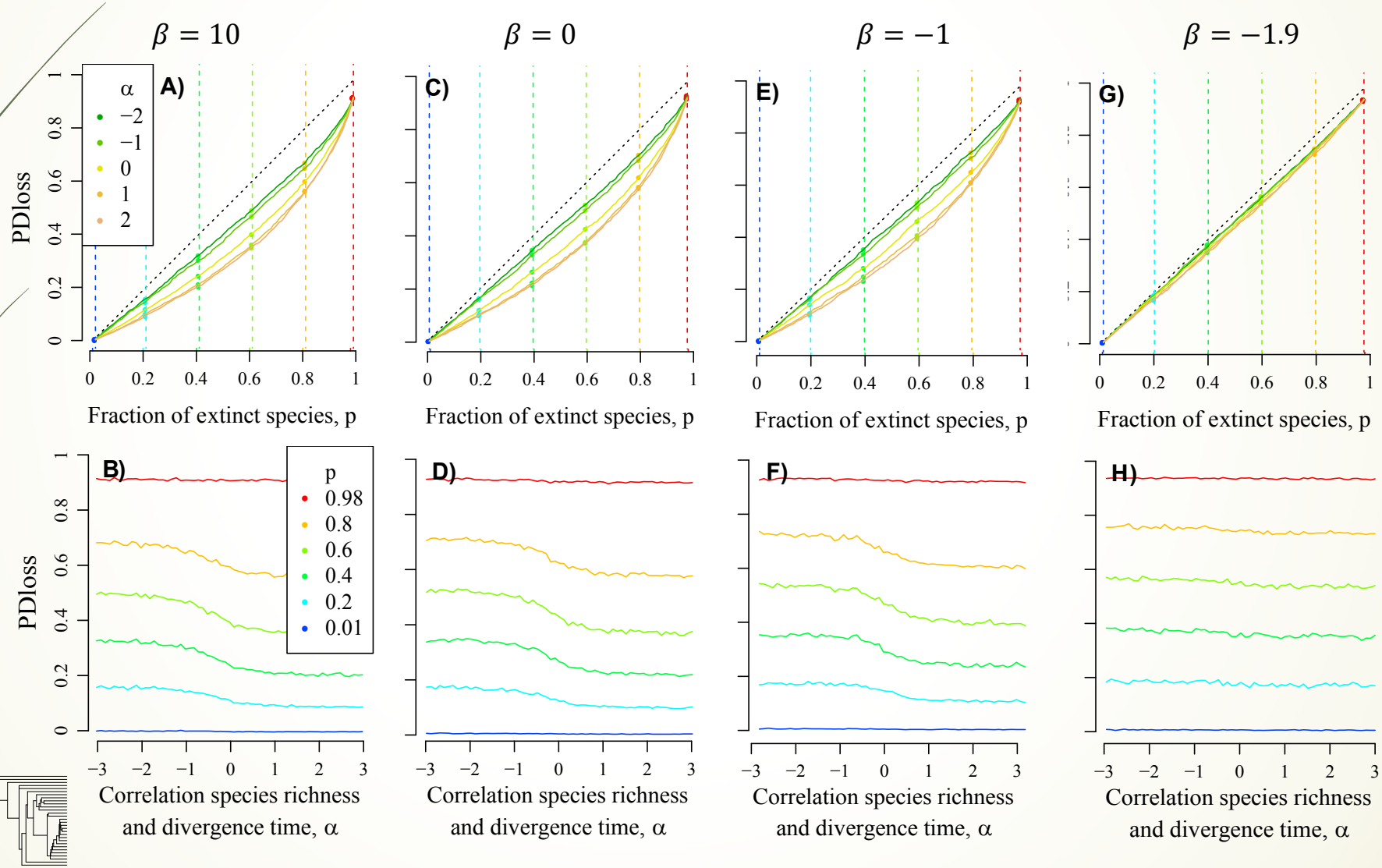
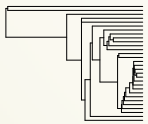
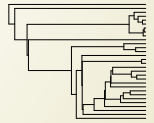




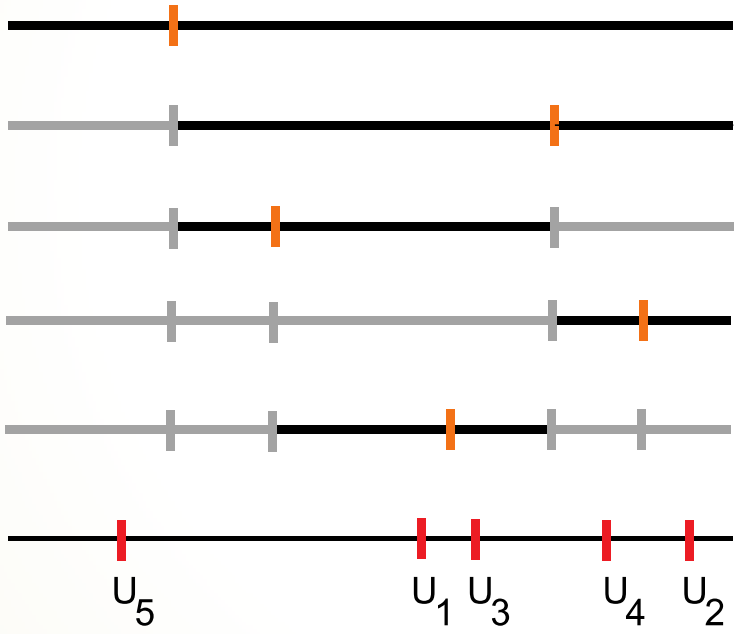


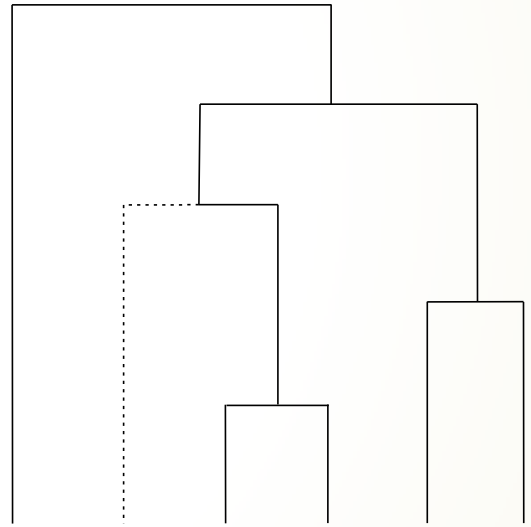


Abundances

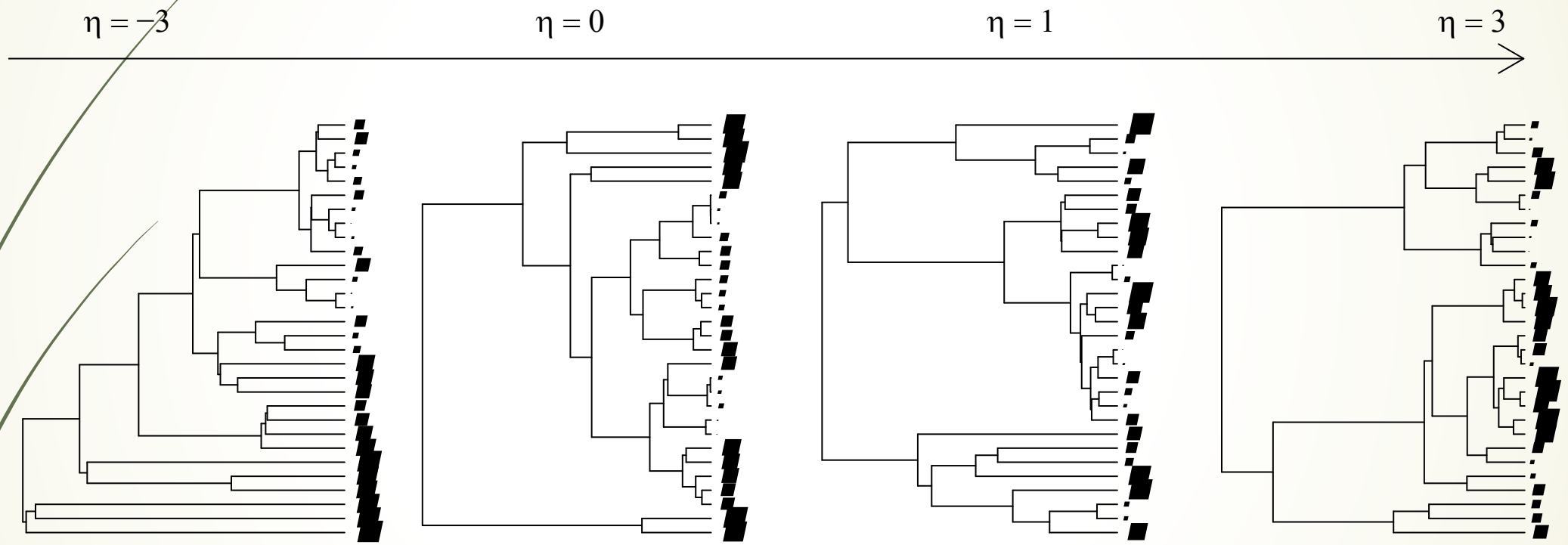
β : tree balance

η : distribution of extinction risk



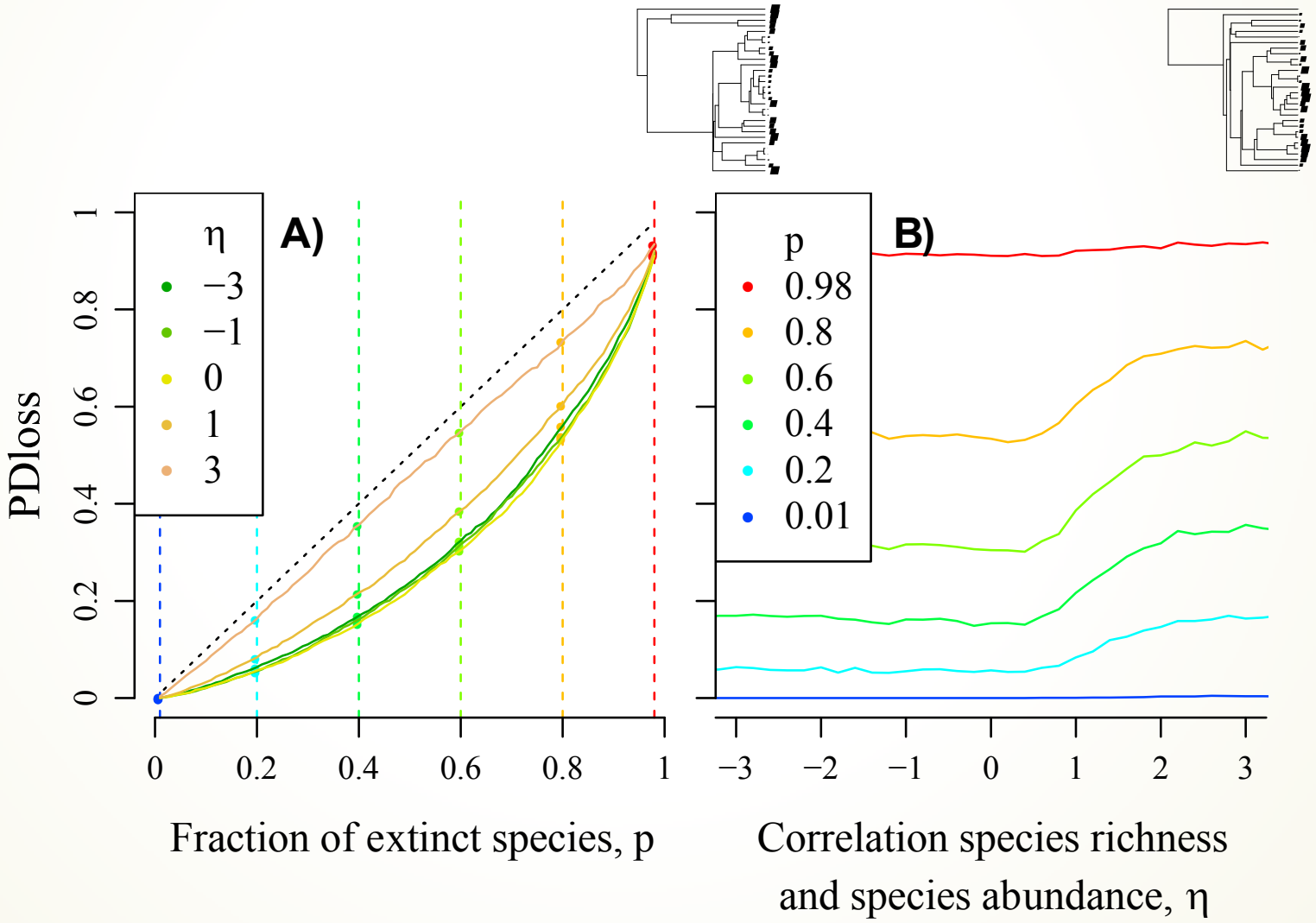


Abundance



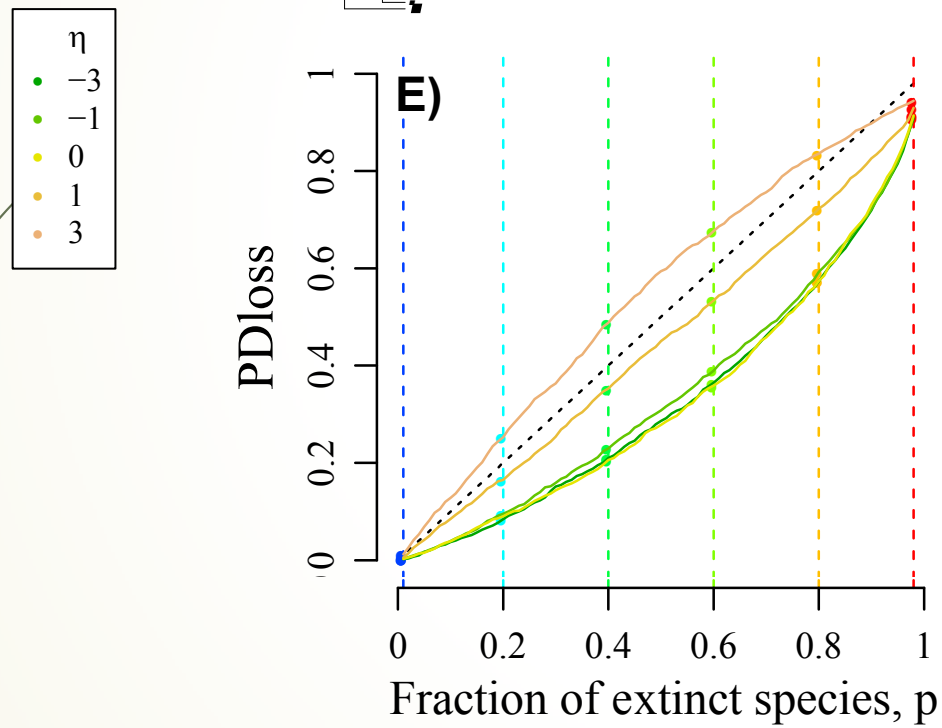
Abundances : proxy for extinction risks

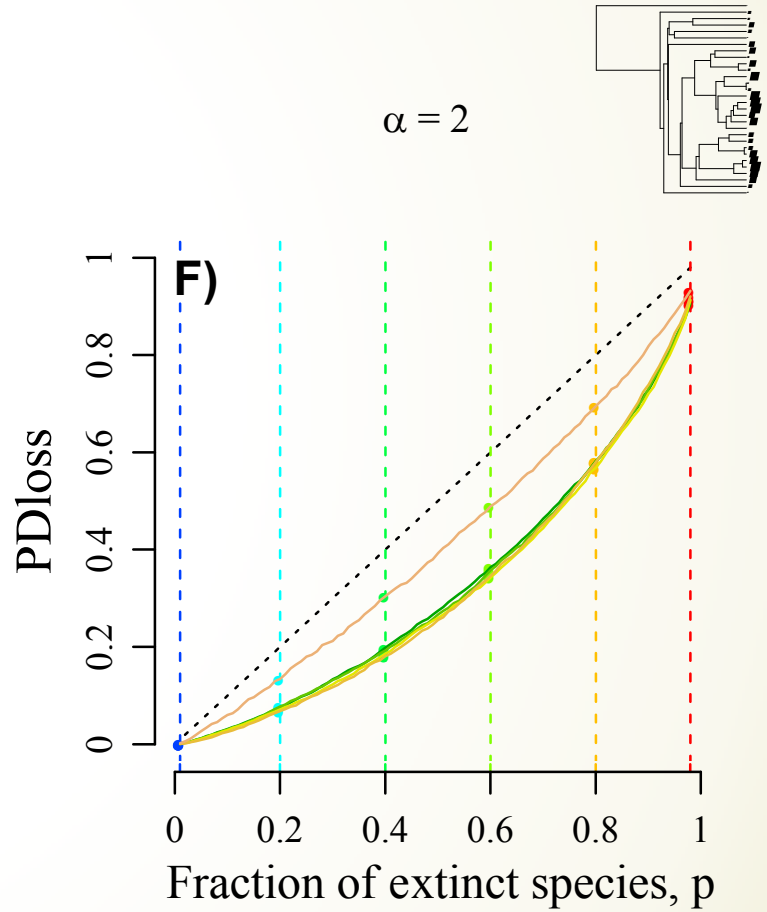
The effect of extinction risk clustering



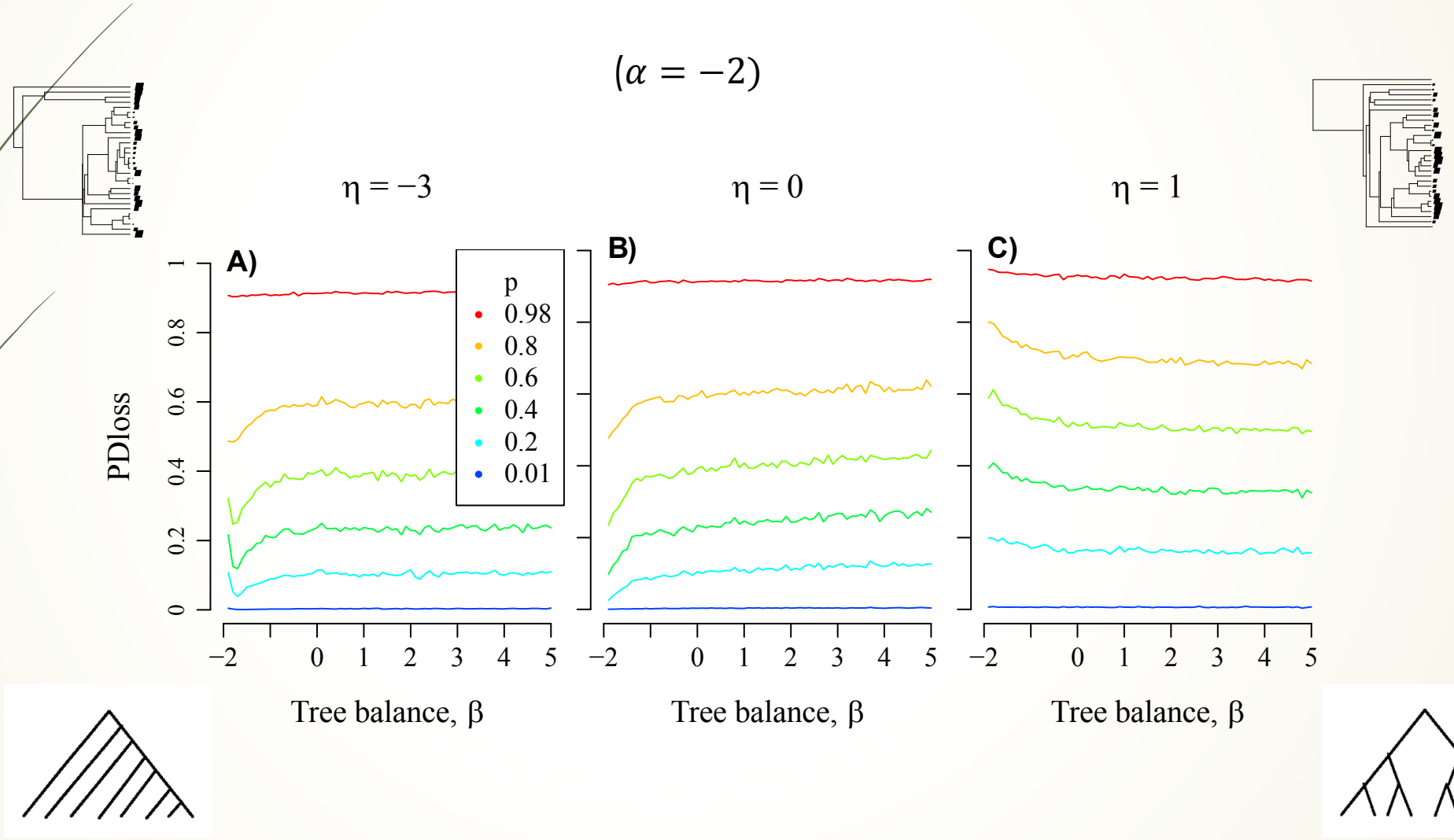
Combined effect of α and η

$(\beta = -1)$





Tree imbalance



Summary

- Statistical way to produce labeled histories with extinction risks at the tips
- May reverse two well known patterns
  - Higher PD loss than species loss when small clades are old and their species are extinction prone
  - Imbalanced tree lose less PD than balanced trees when species in small clades are more extinction prone