Full Bayesian comparative biogeography of Philippine geckos challenges predictions of climate-driven vicariant speciation

Evolution 2019

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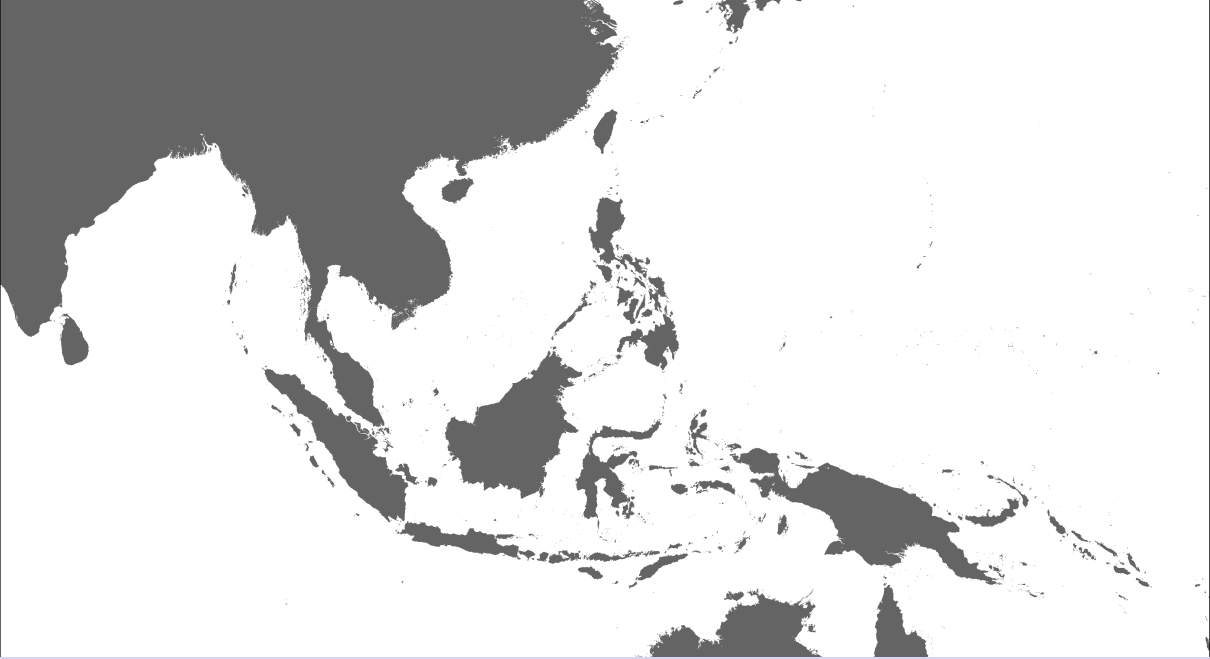
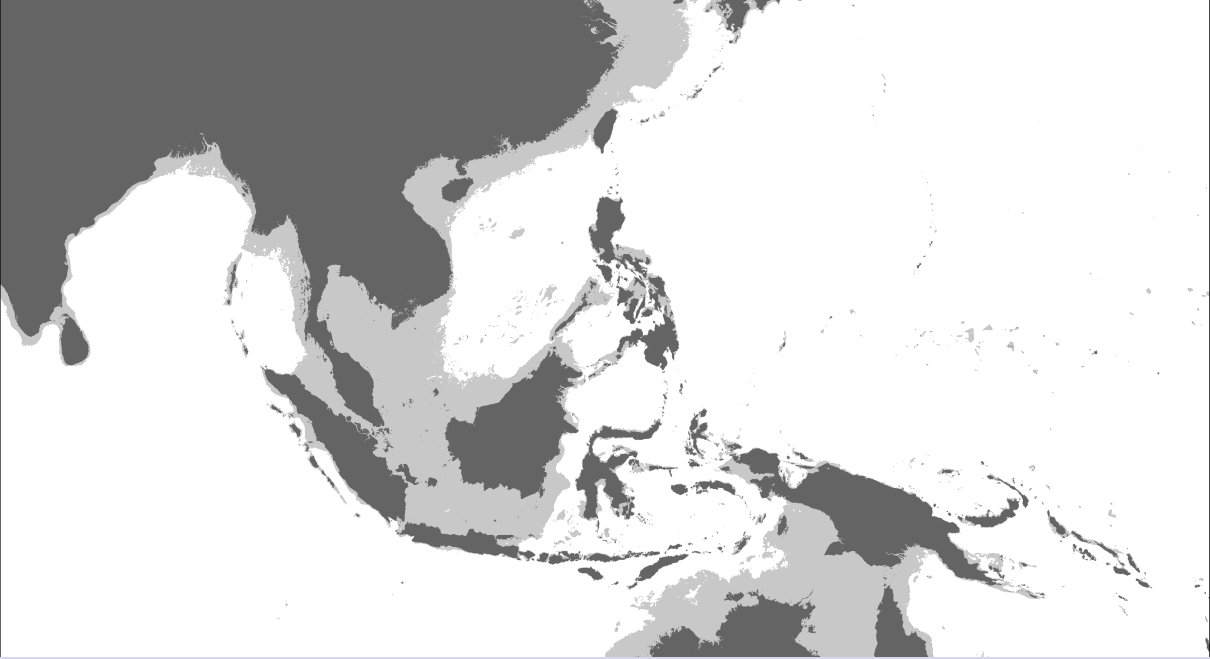
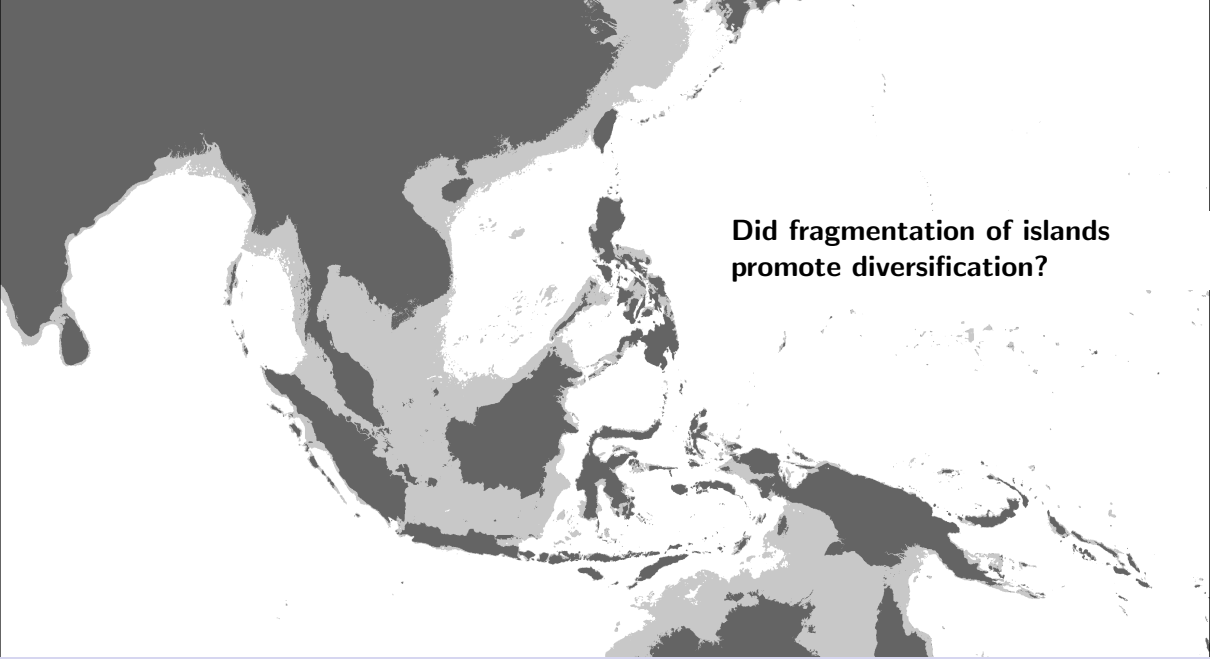
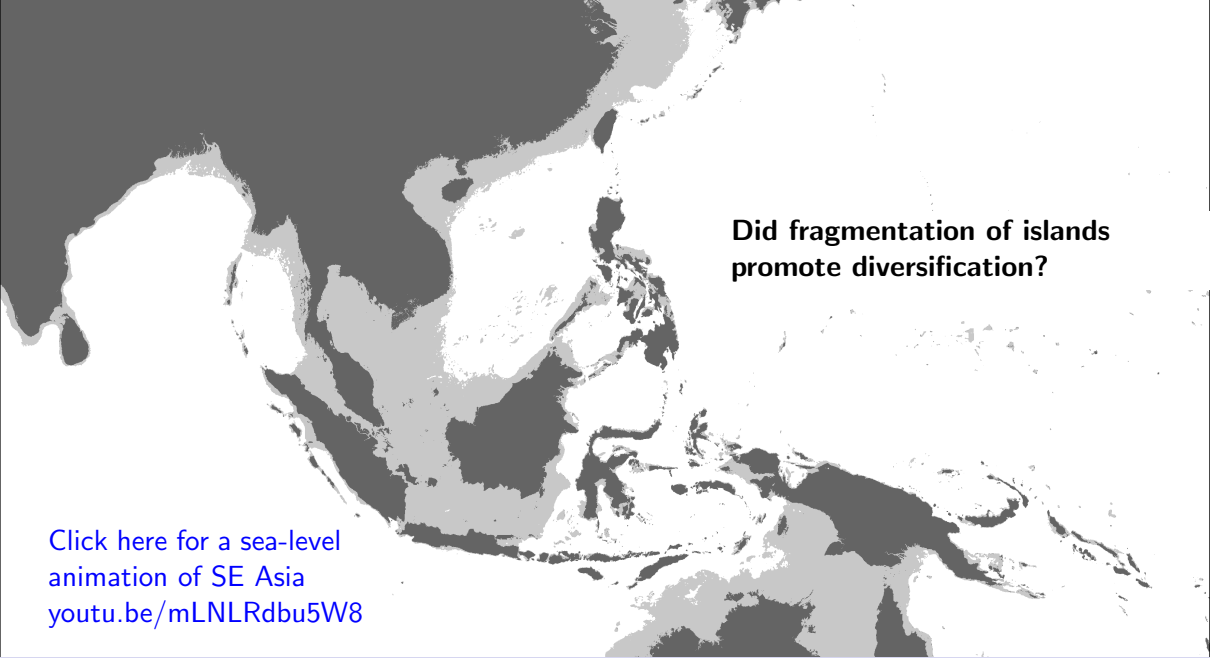
Thanks to ASN, SSE, SSB, and all organizers!



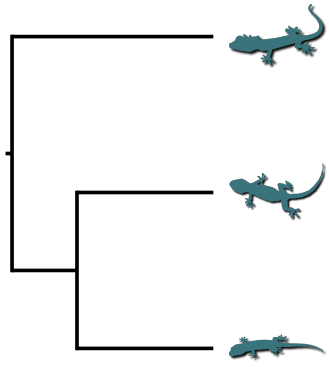


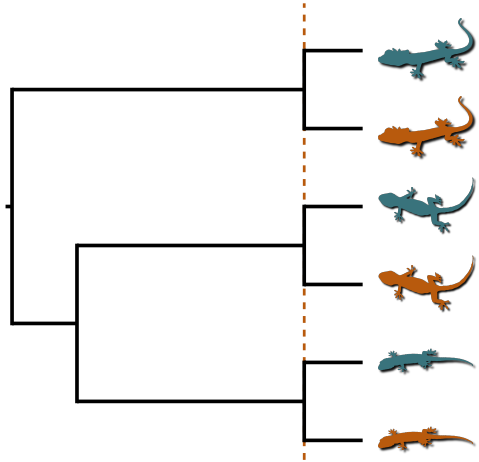

Did fragmentation of islands
promote diversification?

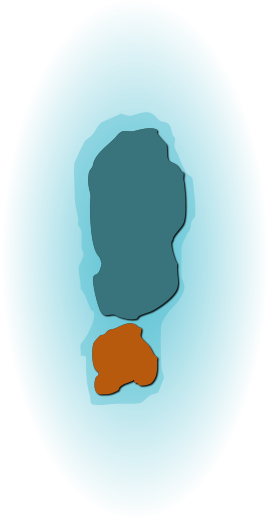


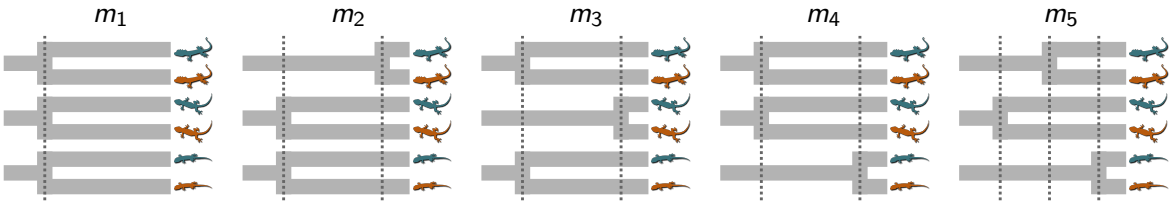
Did fragmentation of islands promote diversification?

Click here for a sea-level animation of SE Asia
youtu.be/mLNLRdbu5W8





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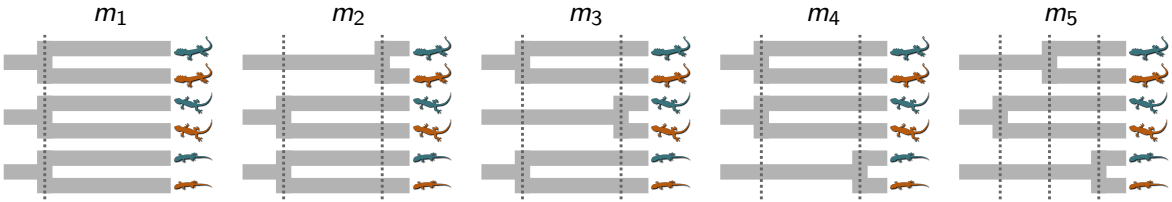
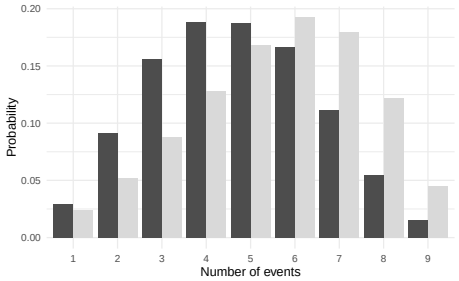
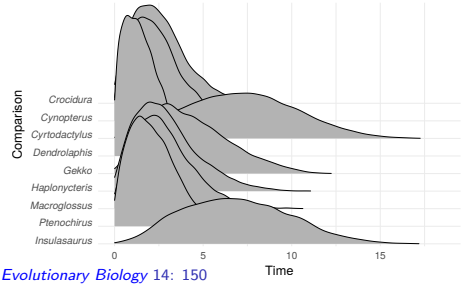


We want to infer the model and divergence times given genetic data

Previous tests of "species-pump"

- Our previous attempts using ABC left little information in summary statistics to inform divergence times [1,2]





[1] J. R. Oaks et al. (2013). *Evolution* 67: 991–1010. [2] J. R. Oaks (2014). *BMC Evolutionary Biology* 14: 150

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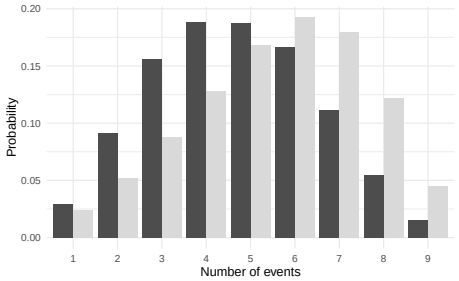

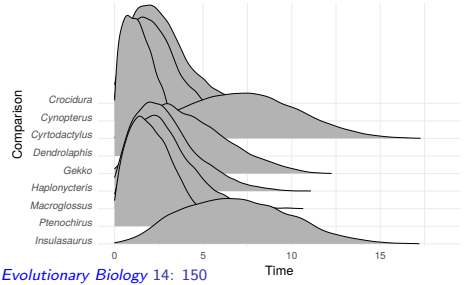

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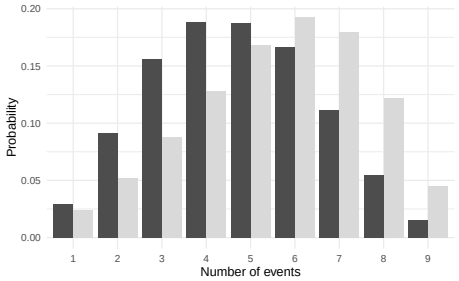

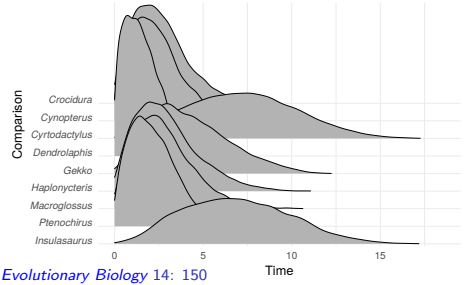

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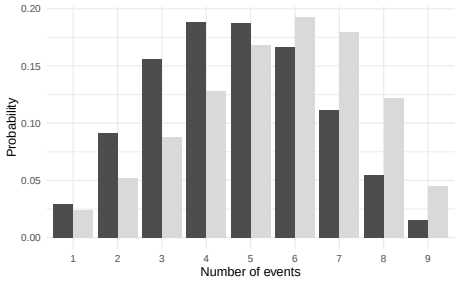
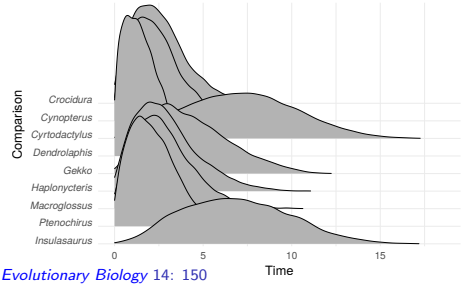
Our goal is to do both





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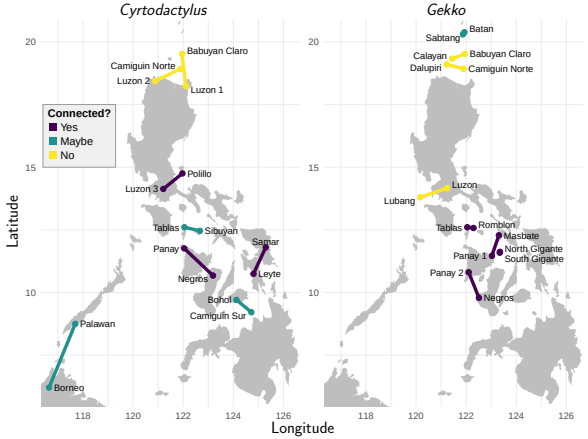

- Sampled 2–5 individuals from 8 pairs of populations for both *Cyrtodactylus* and *Gekko*
- Collected short DNA sequences (RADseq) from across genome of each individual

J. R. Oaks et al. (2019). *Evolution* 73: 1151–1167

Analyzed RADseq data with full-likelihood Bayesian comparative phylogeographic method[1]:

Ecoevolity: **E**stimating **evo**lutionary **coevality**

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- *Goal: Fast, full-likelihood Bayesian method to infer patterns of co-diversification from genome-scale data*
- Used simulations to assess how well `ecoevolity` works given the gekkonid RADseq data

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Want to learn more?

- Check out Kerry Cobb's poster (Saturday at 5:30pm ExHallBC_18)
- I'll be at the software bazaar (Sunday at 6:30pm)

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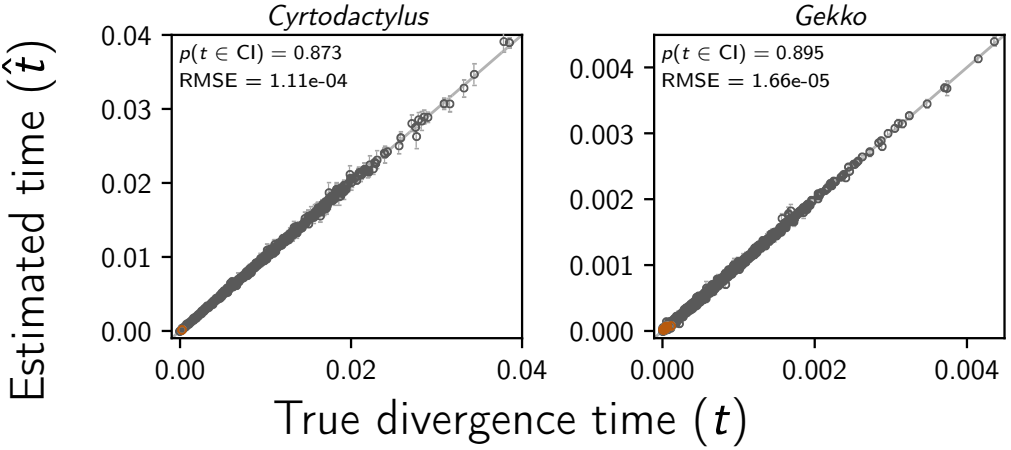
Results: Simulations



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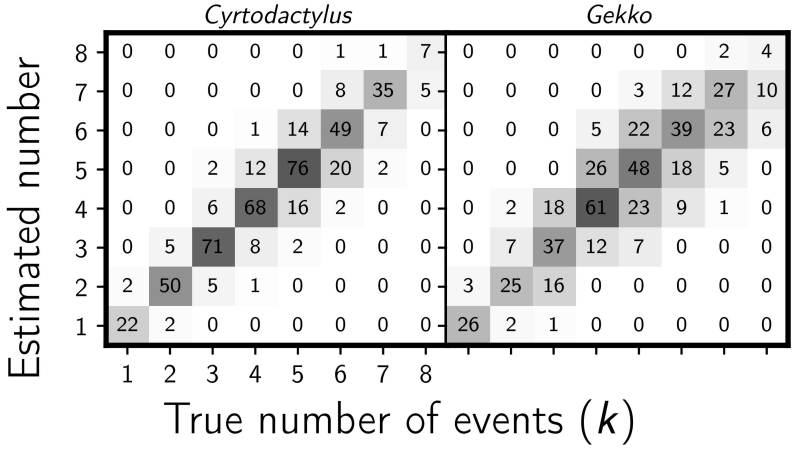

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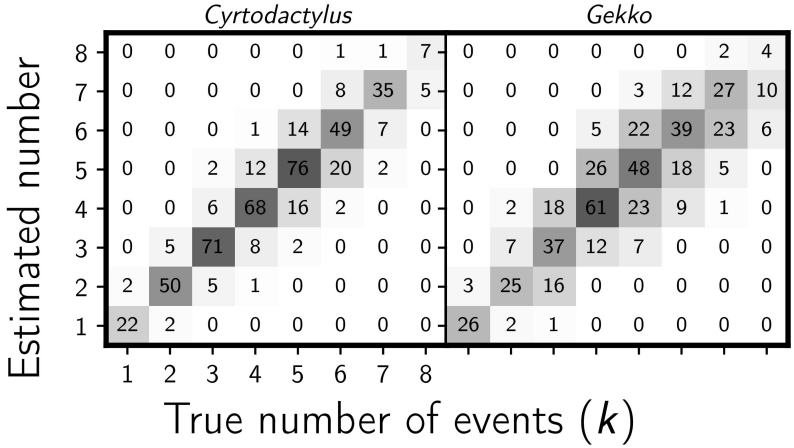
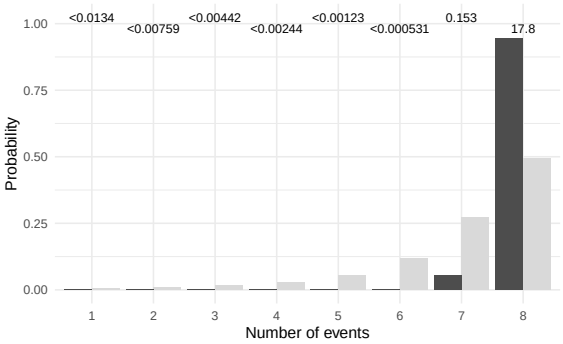


Method performs well on simulated data

J. R. Oaks et al. (2019). *Evolution* 73: 1151–1167

Results: *Cyrtodactylus*



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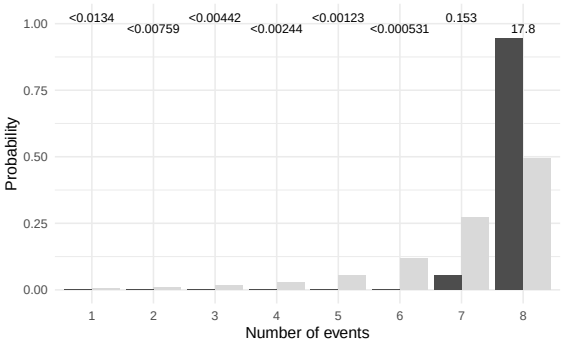

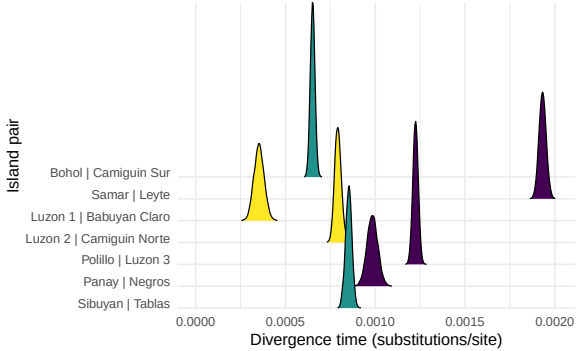

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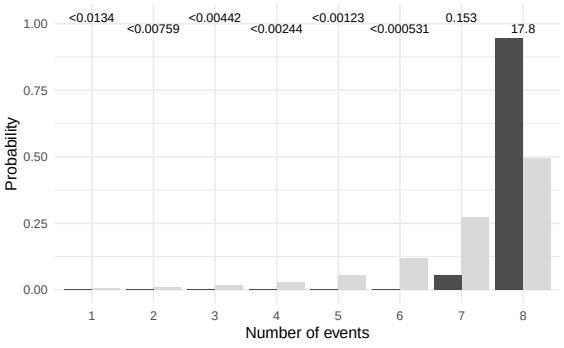
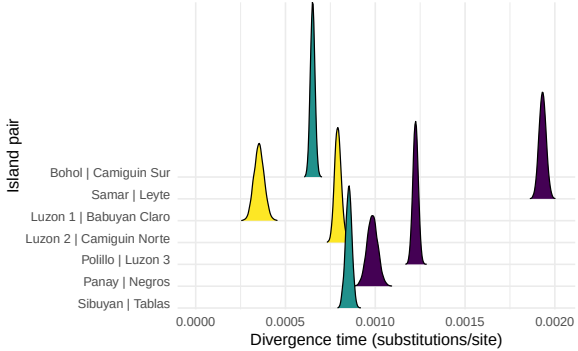
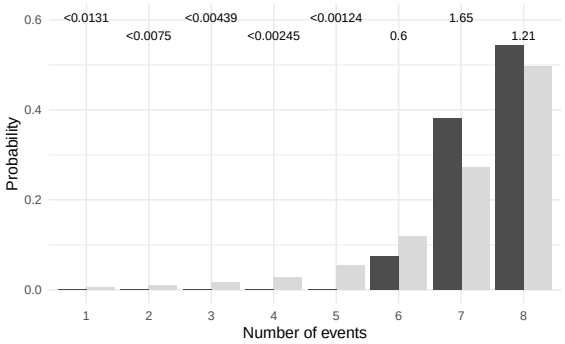




Strong support for independent divergences

J. R. Oaks et al. (2019). *Evolution* 73: 1151–1167

Results: *Gekko*



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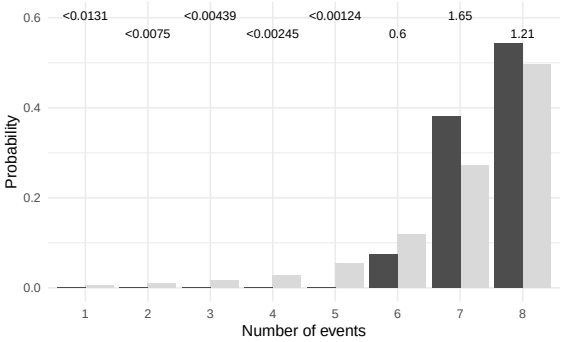
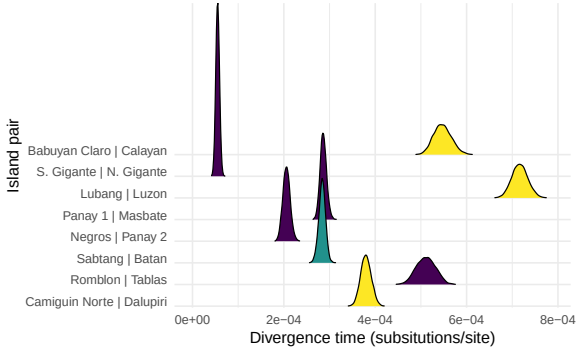
Results: *Gekko*





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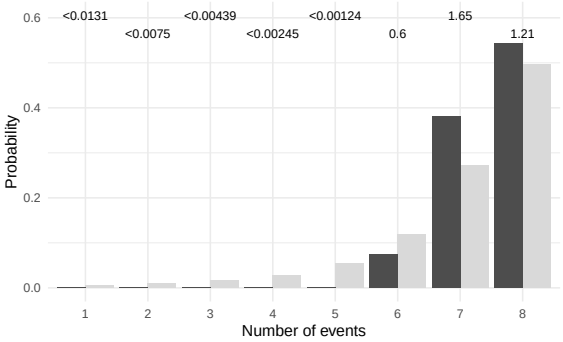

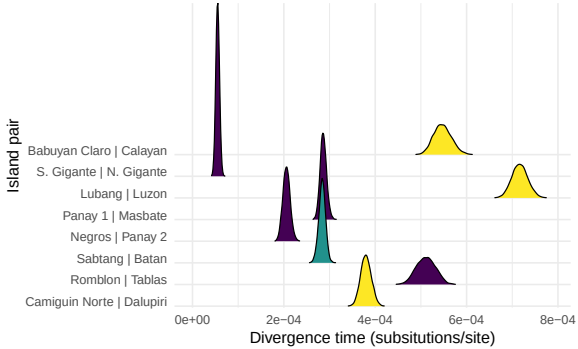

Weak support for independent divergences

J. R. Oaks et al. (2019). *Evolution* 73: 1151–1167

Take home points

- Support against the “species-pump” hypothesis

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- Habitat heterogeniety and rare over-water dispersal via rafting on vegetation are likely more important

Caveats

- Too few island pairs to rule out climate-driven vicariant speciation
- Variation in fragmentation times among island pairs
- Variation in mutation rates

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- Seems safe to conclude that the "species-pump" is not the rule for Philippine gekkonids

Everything is on GitHub...

Software:

- Ecoevolity: https://github.com/phyletica/ecoevolity

Open-Science Notebooks:

- Ecoevolity testing: https://github.com/phyletica/ecoevolity-experiments
- Gecko RADseq: https://github.com/phyletica/gekgo

Acknowledgments

Ideas and feedback:

- Phyletica Lab (the Phyleticians)
- David Bryant, Mark Holder, Adam Leaché, and Vladimir Minin; Editors Laura Kubatko, Mohamed Noor, and David Weisrock; and five anonymous

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Computation:

- Alabama Supercomputer Authority
- Auburn University Hopper Cluster

Funding:

DEB 1656004

Photo credits:

- Rafe Brown and Cam Siler
- PhyloPic!

Thanks to ASN, SSE, SSB, and all organizers of Evolution 2019!

Questions?

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