Joint inference of adaptive and demographic history from temporal population genomic data

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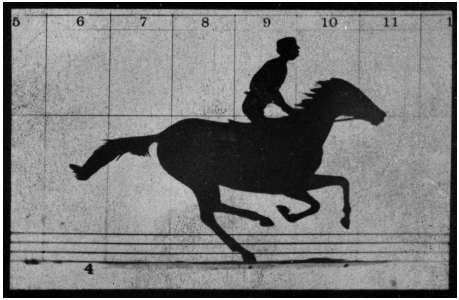
Temporal genetic data for the study of evolution



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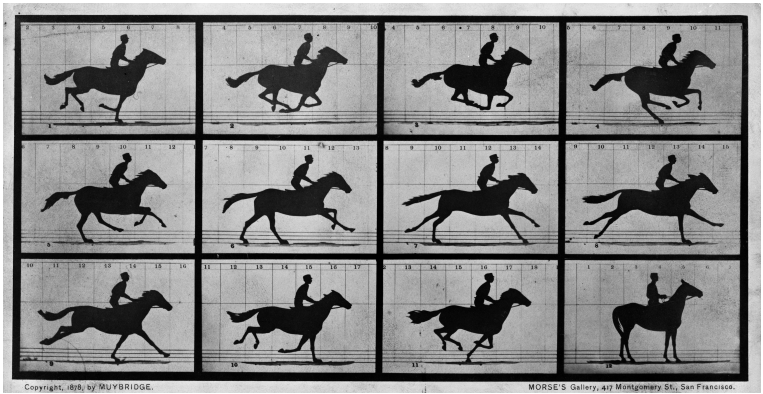

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Joint Inference of Demography and Selection

- Demographic inference assumes that effect of selection in genome-wide patterns of diversity can be ignored
- Selection inference focuses on detecting loci under selection (outliers)

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Model and approach

forward simulation + approximate Bayesian computation *via* random forest

equilibrium mutation-drift-selection

Haller & Messer (2019) doi:10.1093/molbev/msy228 (Software SLiM)

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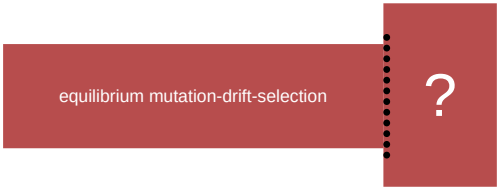

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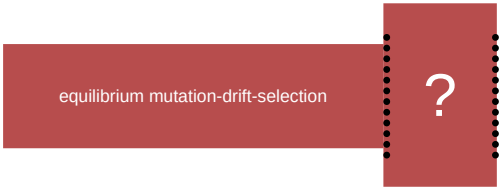

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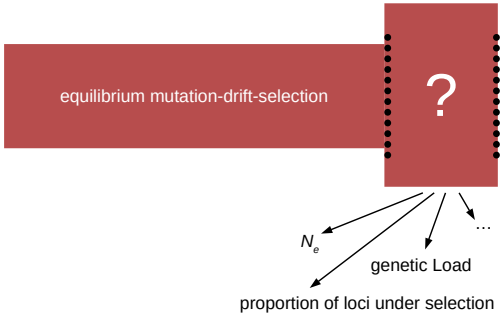

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Demography and Selection

Does joint inference work?

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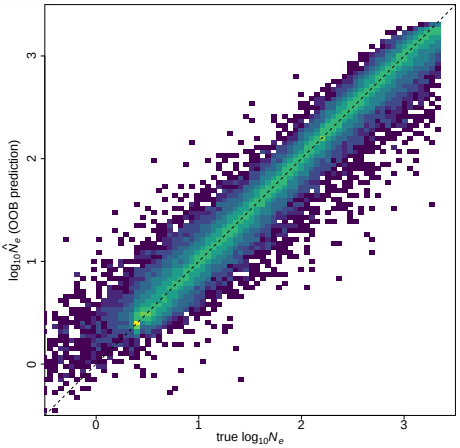

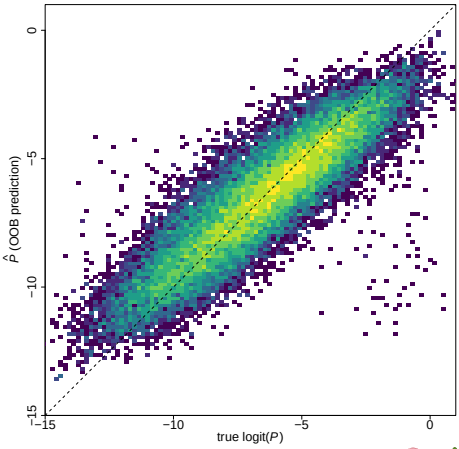

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Genetic Drift ("demography")

Does inference of "demography" account for the action of selection?

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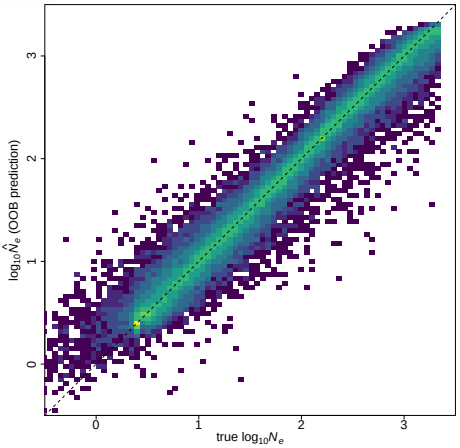

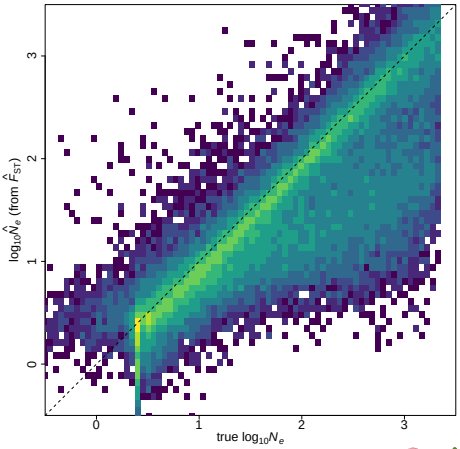

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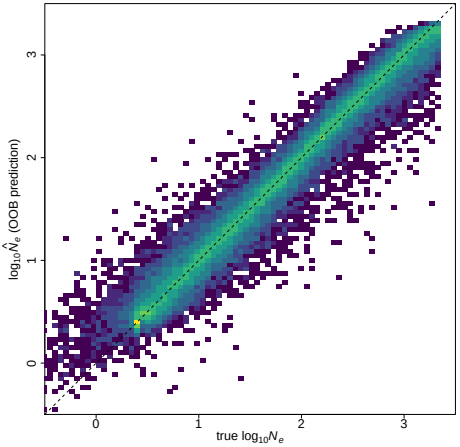

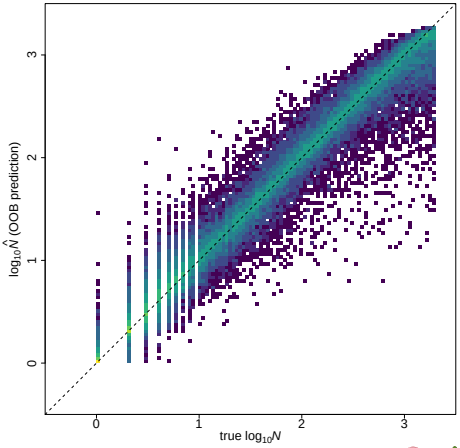

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Is there adaptive diversity? (Genetic Load)

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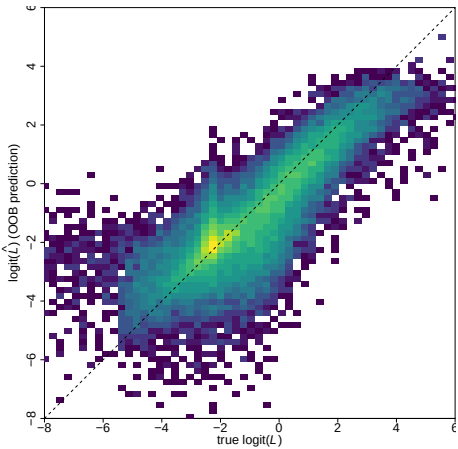

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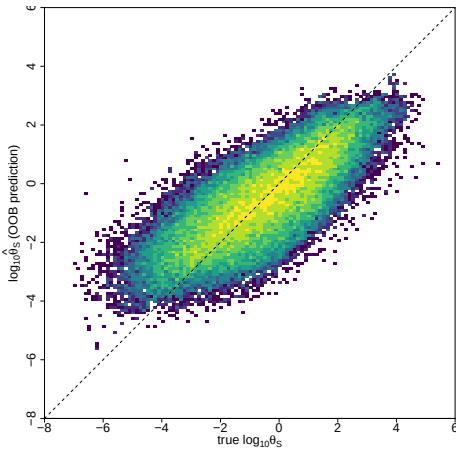

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Feral honey bee in California

Photo Andreas Trepte, photo-natur.net, CC-BY-SA

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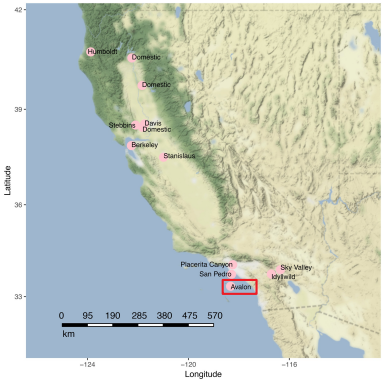

Cridland *et al.* (2018) GBE doi:10.1093/gbe/evy007

- Avalon, Catalina Island (Los Angeles)
- Samples from 1910 (2) & 2014 (5)
- Genome resequencing (236Mbp)
- 1 year = 1 generation

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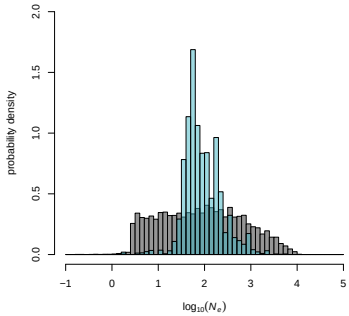
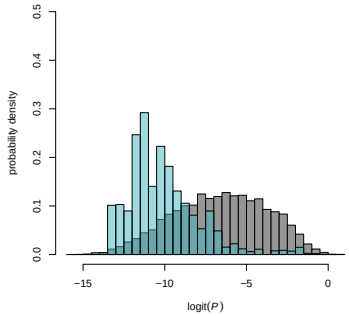
Results bees

$\hat{N}_e = 90$
95%CI(23–887)



$\hat{P} = 4 \times 10^{-5}$
95%CI(10^{-6}–10^{-2})



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Conclusions & Perspectives

- Estimation of demography in the presence of pervasive selection
- Estimation of adaptive potential of populations
- Practical limitations: improve computational efficiency
- Model limitations:
  - Background selection
  - Adaptation from standing variation
  - Complex demography (migration/structure)
  - Hard selection

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CeMEB

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