



How much are wild vertebrate populations evolving right now?

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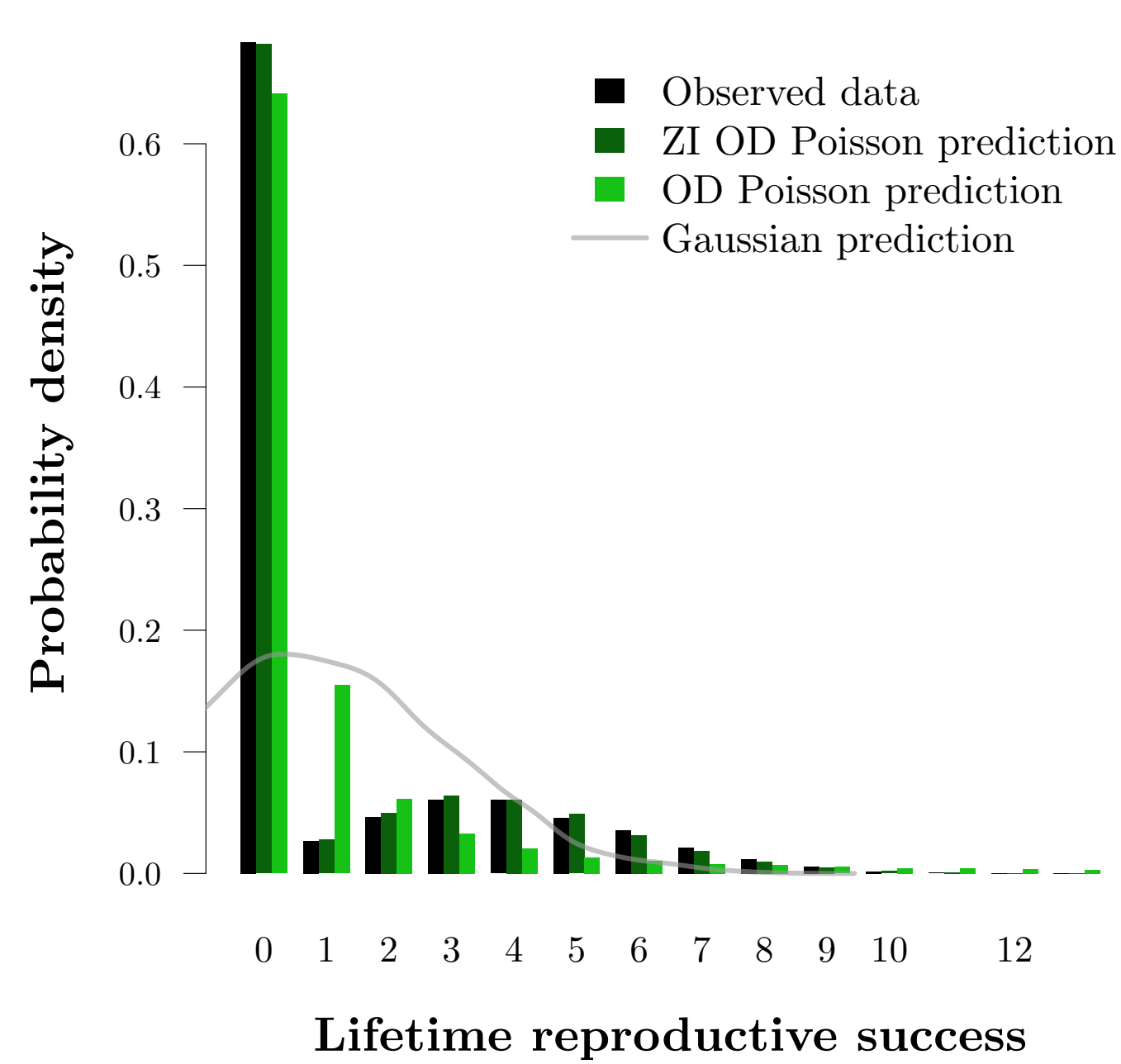


THE BIG PROBLEM: We do not know how much wild organisms are currently evolving!

Fisher's fundamental theorem of natural selection states that **additive genetic variation in fitness measures evolution across all traits and all the genome**. That is just what we need*! Yet, there are few estimates in free-ranging populations, and most may be unreliable. Indeed, it is difficult to measure fitness, difficult to estimate genetic variance, statistical models tend not to fit the data, and it is unclear how to interpret estimates from generalized linear models. A dozen long-term monitored populations have high quality fitness and relatedness measurements. How to make the most of these data? Are birds and mammals currently evolving? How fast?

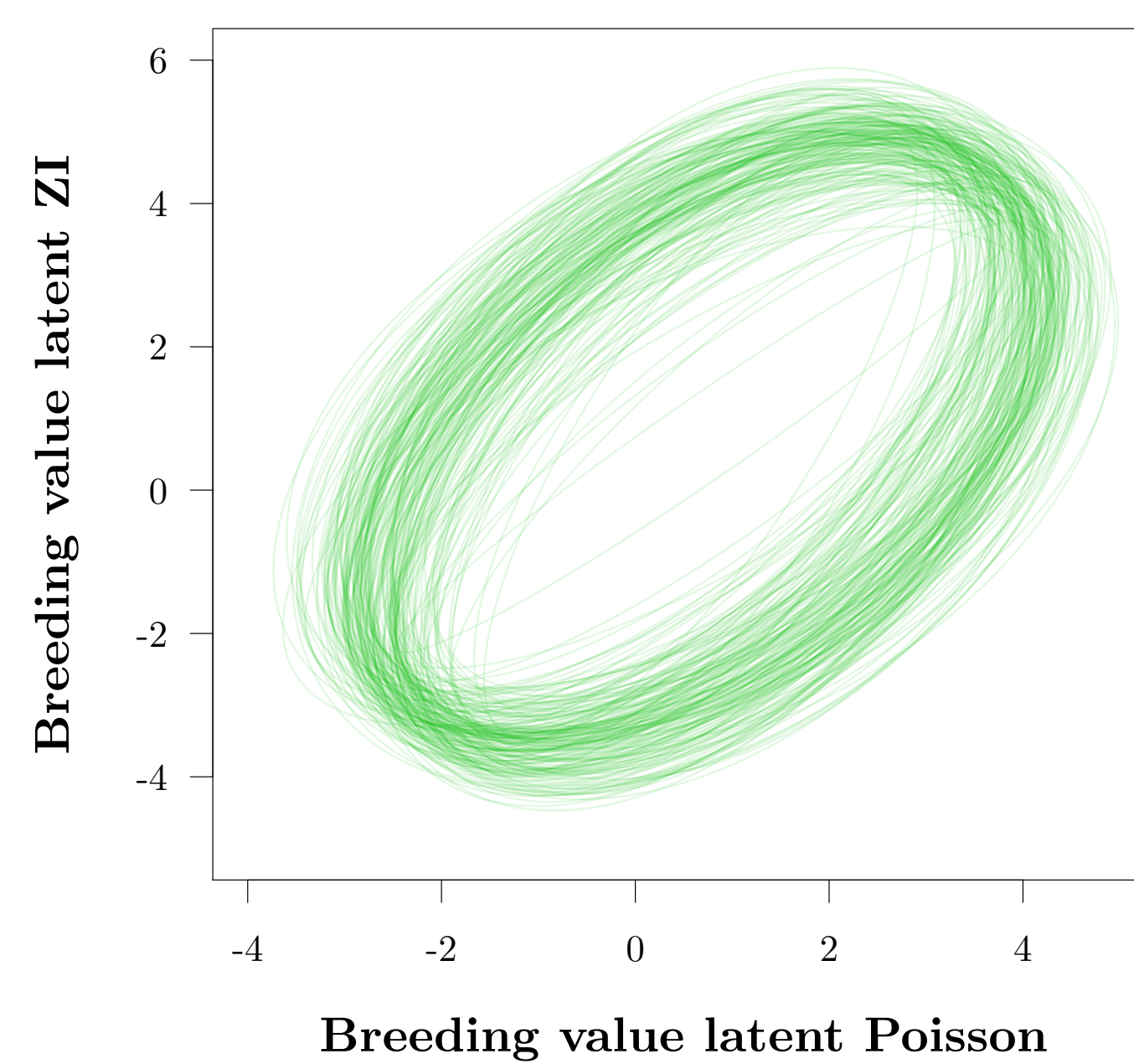
THEORY: How to estimate additive genetic variance in relative fitness ($V_A(\omega)$) ?

MODEL DISTRIBUTIONS FOR FITNESS



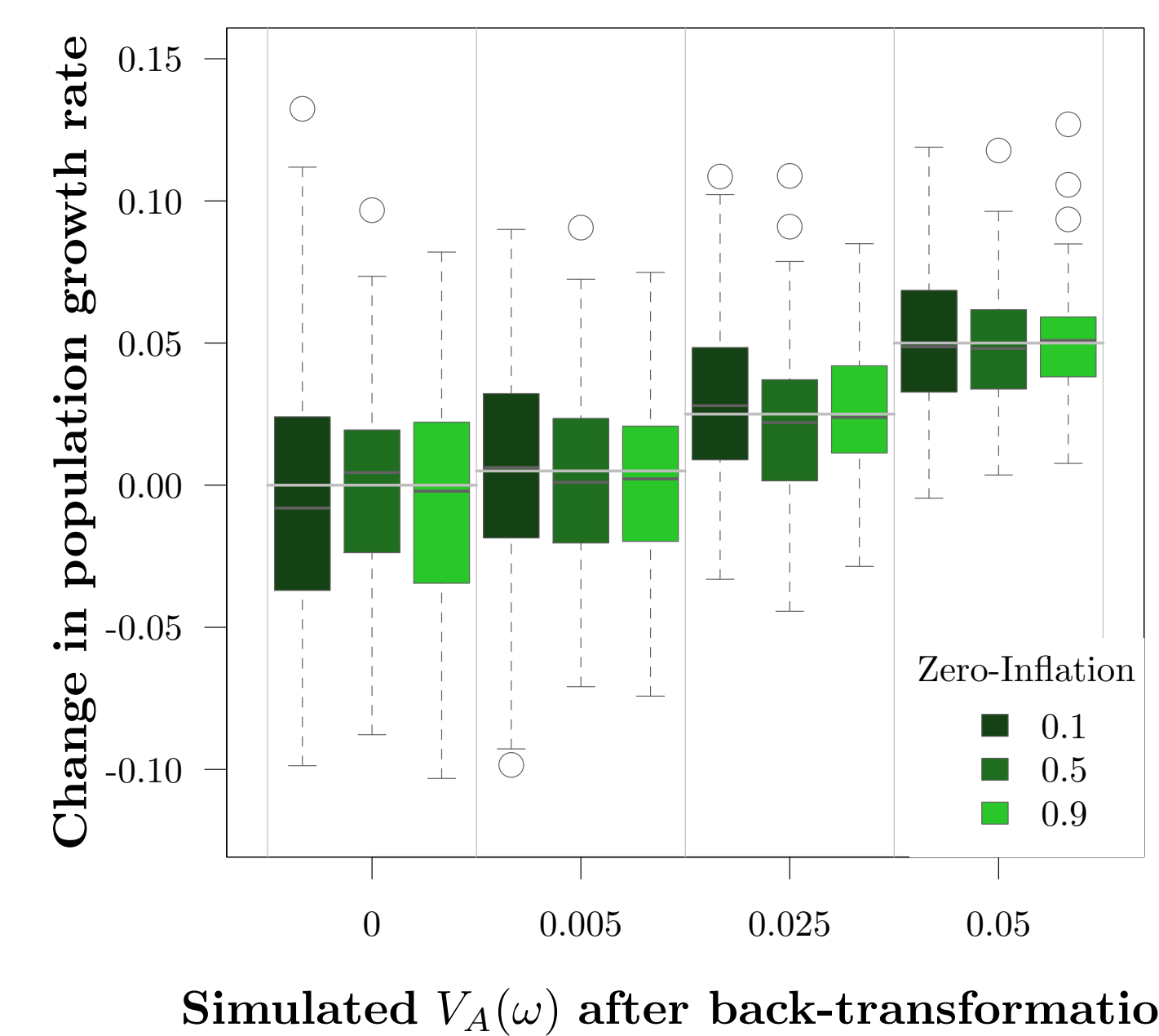
Zero-Inflated Over-Dispersed Poisson models tend to fit well lifetime fitness data. Quantitative genetic estimates may be more precise than with Gaussian or Poisson models.

ESTIMATE LATENT GENETIC VARIATION



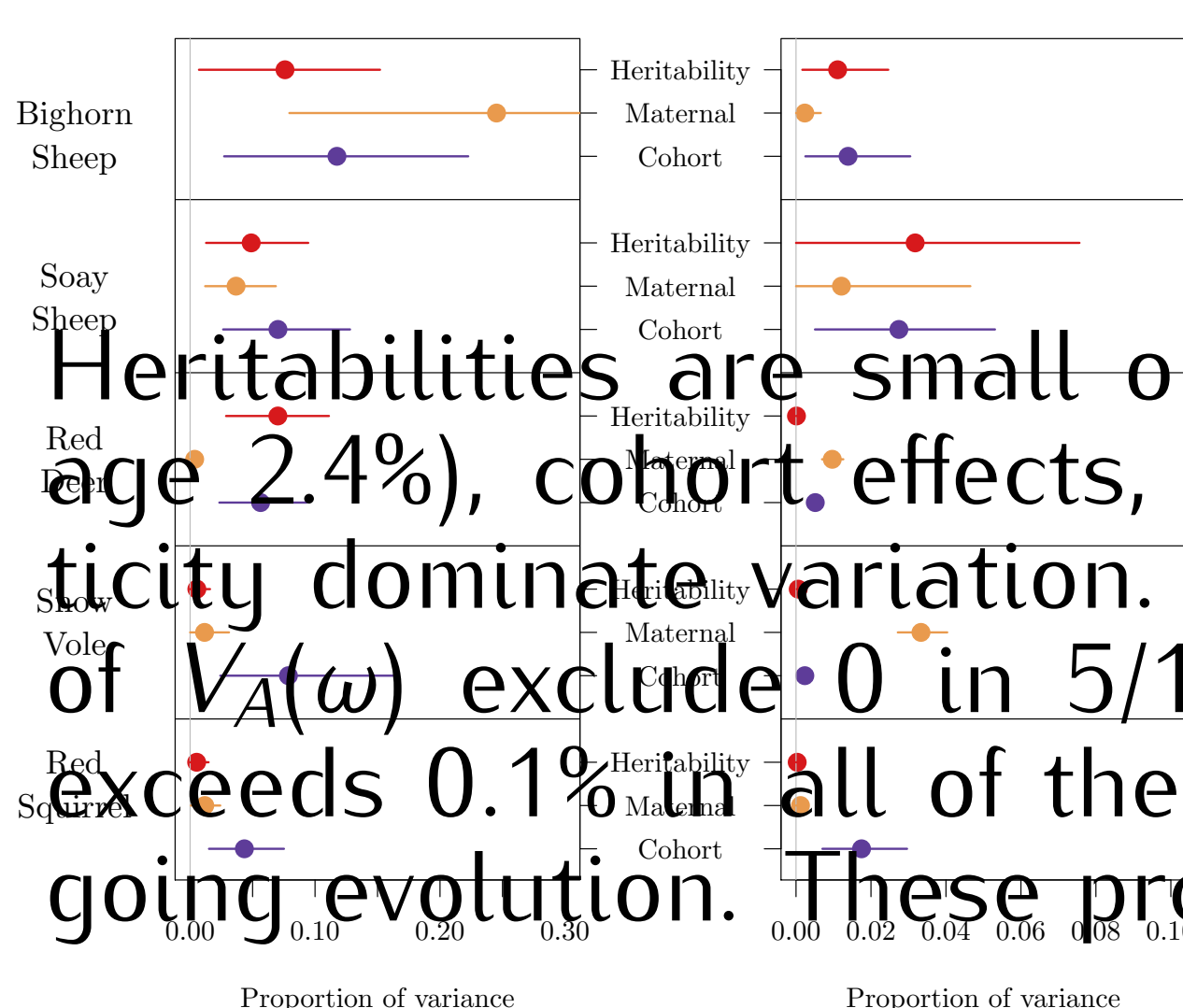
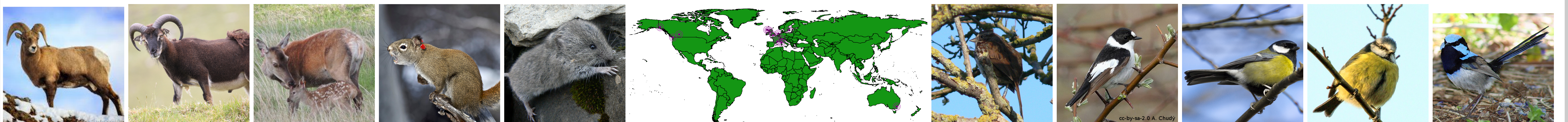
Quantitative genetic ANIMAL MODELS use relatedness matrix to estimate G-matrix for the zero-inflation and the over-dispersed Poisson processes on two latent scales (log and logit).

CONVERT LATENT PARAMETERS TO $V_A(\omega)$

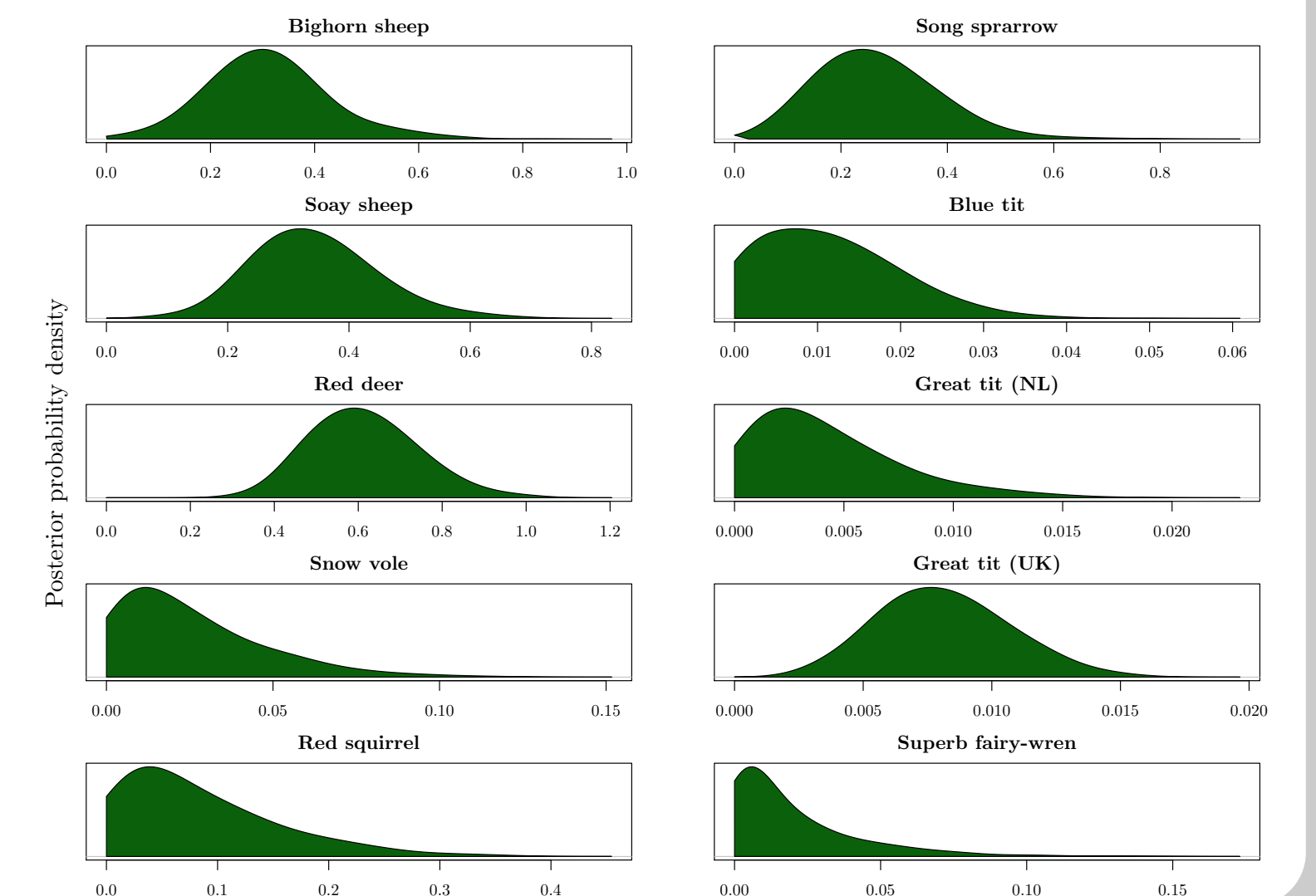


Monte-Carlo integration of latent breeding values to the scale of data. Back-transformation works: with simulations $V_A(\omega)$ equals the increase in population growth rate.

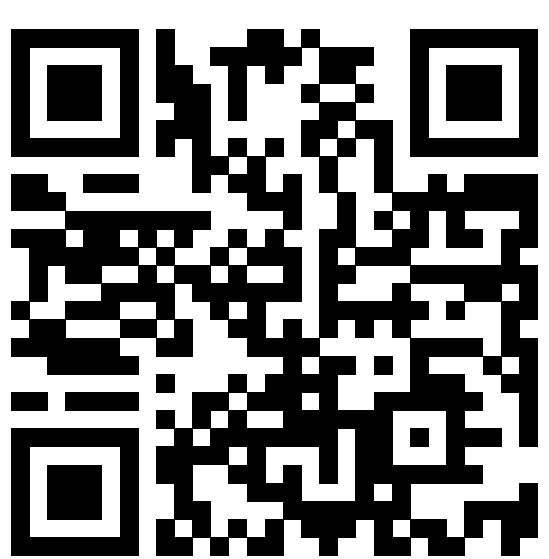
EMPERICAL RESULTS: Additive genetic variation in fitness detectable in most populations



Heritabilities are small on the scale of the data (average 2.4%), cohort effects, maternal effects and stochasticity dominate variation. However, credibility intervals of $V_A(\omega)$ exclude 0 in 5/10 populations, and the mode exceeds 0.1% in all of them, suggesting widespread ongoing evolution. These preliminary results suggest



Website



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* Fisher's theorem relies on stringent assumptions, or alternatively on a specific meaning of evolution. In the absence of competition and gene-by-environment interactions, $V_A(\omega)$ is the increase in expected population growth rate. This clean link between evolution and demography probably doesn't apply (for long) in nature.

R and L^AT_EXcode



github.com/timotheenivalis/VAWisWOW