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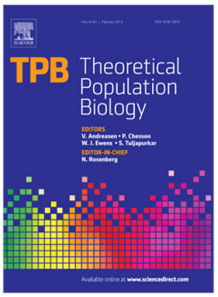

Selecting among three basic fitness landscape models: Additive, multiplicative and stickbreaking

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Selecting among three basic fitness landscape models: additive, multiplicative and stickbreaking

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Abstract

Fitness landscapes map genotypes to organismal fitness. Their topographies depend on how mutational effects interact—epistasis—and are important for understanding evolutionary processes such as speciation, the rate of adaptation, the advantage of recombination, and the predictability versus stochasticity of evolution. The growing amount of data has made it possible to better test landscape models empirically. We argue that this endeavor will benefit from the development and use of meaningful basic models against which to compare more complex models. Here we develop statistical and computational methods for fitting fitness data from mutation combinatorial networks to three simple models: additive, multiplicative and stickbreaking. We employ a Bayesian framework for doing model selection. Using simulations, we demonstrate that our methods work and we explore their statistical performance: bias, error, and the power to discriminate among models. We then illustrate our approach and its flexibility by analyzing several previously published datasets. An R-package that implements our methods is available in the CRAN repository under the name *Stickbreaker*.

Keywords: fitness landscape, epistasis, additive, multiplicative, stickbreaking

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