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PROBABILITIES AND TIMES TO FIXATION IN POPULATIONS WITH CHANGING SIZE

par
Diala Abu Awad
Postdoc UMR AGAP-GE²pop, Montpellier

The Wright-Fisher model and more specifically its diffusion by Kimura, has proven to be a powerful tool in population genetics for quantifying the consequences of genetic drift and selection.

However, this model is based on the assumption that populations do not change size. From this formulation, the notion of an effective population size was later introduced. Effective population size represents a stable genetic size of populations that can be considered independently from their demographic size.

Here we consider the diffusion limit of an individual-based model in which population size varies stochastically in order to determine the probabilities and times to fixation of neutral and non-neutral alleles at a single locus. We provide an expression for a fixed effective population size that allows us to calibrate our model with varying size to the Wright-Fisher diffusion. The conditions necessary for the predictions of the Wright-Fisher diffusion to remain accurate in populations with fluctuating size are examined. The consequences of neglecting the effects of demography on population genetics are discussed.