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Langevin Formalism as the Basis for the Unification of Population Dynamics HAROLD P. DE VLADAR, Theoretical Biology, University of Groningen, The Netherlands — We are presenting a simple reformulation to population dynamics that generalizes many growth functions. The reformulation consists of two equations, one for population size, and one for the growth rate. The model shows that even when a population is density-dependent the dynamics of its growth rate does not depend explicitly neither on population size nor on the carrying capacity. Actually, the growth rate is uncoupled from the population size equation. The model has only two parameters: a Malthusian parameter ρ and an interaction coefficient θ. Distinct values of these parameters reproduce the family of θ-logistics, the van Bertalanffy, Gompertz and Potential Growth equations, among other possibilities. Stochastic perturbations to the Malthusian parameter leads to a Langevin form of stochastic differential equation consisting of a family of cubic potentials perturbed with multiplicative noise. Using these equtions, we derive the stationary Fokker Plank distribution which which shows that in the stationary dynamics, density dependent populations fluctuate around a mean size that is shifted from the carrying capacity proportionally to the noise intensity. We also study which kinds of populations are susceptible to noise induced transitions.

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