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Allee effects models in randomly varying environments

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ABSTRACT

One usually expects that the per capita growth rate of a population would decrease with increasing population size due to the reduction of available resources per individual. However, in natural population that may not be the case for low population sizes due to difficulties associated with low densities, for instance in finding mating partners or in collective defense against predators. These are called Allee effects. Deterministic specific dynamical models of population growth have been proposed to describe such effects. We propose, not a specific model but rather a general model, so that the qualitative behavior we derive will be robust w.r.t. model choice.

We also study the stochastic version of such general model, incorporating both Allee effects and the effect of environmental random fluctuations in the growth process. We study the model properties, existence and uniqueness of solution and the stationary behavior. We also obtain expressions for the first passage times, in particular, the mean and standard deviation of extinction times for the population.