

Can populations live forever?

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Abstract

Both sampling variations in births and deaths (demographic stochasticity, modeled through branching processes or birth and death processes) and random fluctuations in environmental conditions (environmental stochasticity, modeled through stochastic differential equations - SDE) affect population growth.

We will compare the two sources of stochasticity w.r.t. population extinction, existence of stationary distributions and local behavior, using as benchmark Malthusian models (density-independent growth), namely the Galton-Watson process and the simple birth and death process for demographic stochasticity and the Malthusian SDE growth model (geometric Brownian motion) for environmental stochasticity. Under certain conditions, populations can live forever.

However, since resources are limited, growth of natural populations is density-dependent. Can populations, under this more natural setting, still live forever?

We review our main results on SDE density-dependent growth models. They are robust w.r.t. the shape of the density-dependence since we use general models instead of the commonly used specific models (like the logistic).

For the demographic stochasticity models, we review some results on specific models and speculate on potential results for general models.