Population dynamics in the triplet annihilation model with a mutating reproduction rate

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I study a population model in which the reproduction rate λ is inherited with mutation, favoring fast reproducers in the short term, but conflicting with a process that eliminates agglomerations of individuals. The model is a variant of the *triplet annihilation model* introduced several decades ago [R. Dickman, Phys. Rev. B **40**, 7005 (1989)] in which organisms ("particles") reproduce and diffuse on a lattice, subject to annihilation when (and only when) occupying three consecutive sites. For diffusion rates below a certain value, the population possesses two "survival strategies": (i) rare reproduc- tion ($0 < \lambda < \lambda_{c,1}$), in which a low density of diffusing particles renders triplets exceedingly rare, and (ii) frequent reproduction ($\lambda > \lambda_{c,2}$). For λ between $\lambda_{c,1}$ and $\lambda_{c,2}$ there is no active steady state. In the rare-reproduction regime, a mutating λ leads to stochastic boom-and-bust cycles in which the reproduction rate fluctuates upward in certain regions, only to lead to ex- tinction as the local value of λ becomes excessive. The global population can nevertheless survive due to the presence of other regions, with reproduction rates that have yet to drift upward.