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# Robust and fragile cycles in the chaotic *Tribolium castaneum* data series

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Because of the inherent discreteness of individuals, population dynamical models must be discrete variable systems. In case of strong nonlinearity, such systems interacting with noise can generate a great variety of patterns from nearly periodic behavior through complex combination of nearly periodic and chaotic patterns to noisy chaotic time series. The interaction of a population consisting of discrete individuals and demographic noise has been analyzed in laboratory population data [1, 2, 3]. We point out that some of the cycles are fragile, i.e. they are sensitive to the discretization algorithm and to small variation of the model parameters, while others remain "robust" against the perturbations. We introduce a statistical algorithm to detect disjoint, nearly-periodic patterns in data series. We show that only the robust cycles of the discrete variable models appear in the data series significantly. Our analysis identified the quasiperiodic 11-cycle (emerging in the continuous model) to be present significantly only in one of the three experimental data series [4]. Numerical simulations confirm that cycles can be detected only if noise is smaller than a certain critical level and population dynamics display the largest variety of nearly-periodic patterns if they are on the border of "grey" and "noisy" regions, defined in [5].

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