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The classical deterministic Lotka-Volterra predator-prey model famously leads to closed curves in the predator-prey phase plane. A stochastic version of this model has been formulated as a simple birth-death process. The expected value of this process is governed by a system of differential equations that is almost, but not quite, identical in form to the deterministic system. The difference in rate functions is shown to be proportional to the time-dependent covariance of the populations of the two species. We explore the impact of this covariance term on the dynamical behavior of the predator-prey system. In particular, this difference creates expected value trajectories in the phase plane that are no longer closed. (Received July 24, 2017)