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Experimental observation of critical slowing down before population collapse LEI DAI, Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, USA., DAAN VORSELEN, Department of Physics and Astronomy, VU University, Amsterdam, The Netherlands., CARMEL DUDLEY, ONUR ORNEK, KIRILL KOROLEV, JEFF GORE, Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, USA. — Tipping points marking population collapse and other critical transitions in natural systems (*e.g.* ecosystems, the climate) can be described by a fold bifurcation in the dynamics of the system. Theory predicts that the approach of bifurcations will result in an increasingly slow recovery from small perturbations, a phenomenon called critical slowing down. Here we demonstrate the direct observation of critical slowing down before population collapse using replicate laboratory populations of the budding yeast *Saccharomyces cerevisiae*. We mapped the bifurcation diagram experimentally and found a significant increase in both the size and timescale of the fluctuations of population density near a fold bifurcation, in agreement with the theory. We further confirmed the utility of theoretically predicted warning signals by observing them in two different slowly deteriorating environments. To extend the application of warning signals to spatially extended populations, we proposed and identified several indicators based on the emergence of spatial patterns. Our results suggest that generic temporal and spatial indicators of critical slowing down can be useful in predicting tipping points in population dynamics.

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