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Experimental observation of critical slowing down as an early warning of population collapse DAAN VORSELEN, Department of Physics and Astronomy, VU University, Amsterdam, The Netherlands., LEI DAI, KIRILL KOROLEV, JEFF GORE, Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, USA — Near tipping points marking population collapse or other critical transitions in complex systems small changes in conditions can result in drastic shifts in the system state. In theoretical models it is known that early warning signals can be used to predict the approach of these tipping points (bifurcations), but little is known about how these signals can be detected in practice. Here we use the budding yeast Saccharomyces cerevisiae to study these early warning signals in controlled experimental populations. We grow yeast in the sugar sucrose, where cooperative feeding dynamics causes a fold bifurcation; falling below a critical population size results in sudden collapse. We demonstrate the experimental observation of an increase in both the size and timescale of the fluctuations of population density near this fold bifurcation. Furthermore, we test the utility of theoretically predicted warning signals by observing them in two different slowly deteriorating environments. These findings suggest that these generic indicators of critical slowing down can be useful in predicting catastrophic changes in population biology.

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