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Early Warnings of Regime Shifts: A Whole-Ecosystem Experiment

S. R. Carpenter,^{1*} J. J. Cole,² M. L. Pace,³ R. Batt,¹ W. A. Brock,⁴ T. Cline,¹ J. Coloso,³
J. R. Hodgson,⁵ J. F. Kitchell,¹ D. A. Seekell,³ L. Smith,¹ B. Weidel¹

Catastrophic ecological regime shifts may be announced in advance by statistical early warning signals such as slowing return rates from perturbation and rising variance. The theoretical background for these indicators is rich, but real-world tests are rare, especially for whole ecosystems. We tested the hypothesis that these statistics would be early warning signals for an experimentally induced regime shift in an aquatic food web. We gradually added top predators to a lake over 3 years to destabilize its food web. An adjacent lake was monitored simultaneously as a reference ecosystem. Warning signals of a regime shift were evident in the manipulated lake during reorganization of the food web more than a year before the food web transition was complete, corroborating theory for leading indicators of ecological regime shifts.