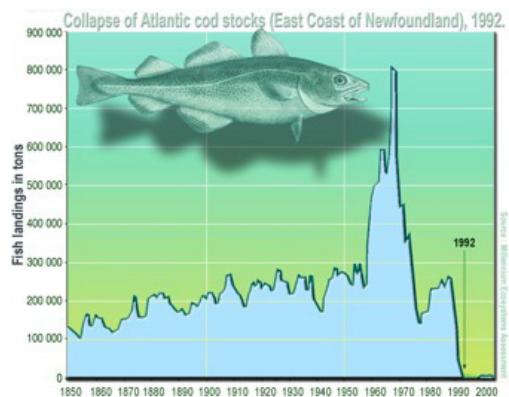


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Anticipating sudden transitions in biological populations Cooperation, cheating, and collapse

Department of Physics Colloquium

Natural populations can suffer catastrophic collapse in response to small changes in environmental conditions, and recovery after such a collapse can be exceedingly difficult. We have used laboratory microbial ecosystems to study early warning signals of impending population collapse. Yeast cooperatively breakdown the sugar sucrose, meaning that below a critical size the population cannot sustain itself. We have demonstrated experimentally that changes in the fluctuations of the population size can serve as an early warning signal that the population is close to collapse. The cooperative nature of yeast growth on sucrose suggests that the population may be susceptible to cheater cells, which do not contribute to the public good and instead merely take advantage of the cooperative cells. We confirm this possibility experimentally and explore how such social parasitism can lead to population extinction.