

Sensitivity of Density Dependent Populations to Environmental Variability.

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Environmental variations (weather, toxin exposure, etc) alter demographic parameters of individuals. How do these perturbations feed through into effects on populations? Density dependence can reduce the effects of environmental stochasticity, but it is also possible for the two to interact in a way that amplifies the environmental noise, as in the case of Dungeness Crab (Higgins et al. 1997) and Soay Sheep (Coulson et al. 2001). However, we lack a general framework to predict how populations will respond to environmental noise. Here we perturb two and three stage class population models, including the LPA model of *Tribolium* (Dennis et al. 2001), with white noise, focussing on those parts of parameter space where the unperturbed population has a stable equilibrium. We assess responsiveness by measuring the variance of the input and output time series, and examine the ability of different elasticities to predict population responsiveness. The elasticity of density independent growth rate is effective as a general guide but for some forms of density dependence the one-step elasticity is better. Density dependence may reduce impacts, but this depends crucially on its form and which parts of the life history are impacted by the environmental shocks. Short-term population consequences are sometimes greater than would be inferred from conventional elasticities. The extent to which this occurs can be predicted by the magnitude of the stability determining eigenvalue.

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