Population dynamics of a South American rodent: seasonal structure interacting with climate, density dependence and predator effects

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Abstract

Understanding the role of interactions between intrinsic feedback loops and external climatic forces is one of the central challenges within the field of population ecology. For rodent dynamics, the seasonal structure of the environment necessitates changes between two stages: reproductive and non–reproductive. Nevertheless, the interactions between seasonality, climate, density dependence and predators have been generally ignored. We demonstrate that direct climate effects, the nonlinear effect of predators and the nonlinear first–order feedback embedded in a seasonal structure are key elements underlying the large and irregular fluctuations in population numbers exhibited by a small rodent in a semi–arid region of central Chile. We found that factors influencing population growth rates clearly differ between breeding and non–breeding seasons. In addition, we detected nonlinear density dependencies as well as nonlinear and differential effects of generalist and specialist predators. Recent climatic changes may account for dramatic perturbations of the rodent's population dynamics. Changes in the predator guild induced by climate are likely to result, through the food web, in a large impact on small rodent demography and population dynamics. Assuming such interactions to be typical of ecological systems, we conclude that appropriate predictions of the ecological consequences of climate change will depend on having an in–depth understanding of the community–weather system.