Population dynamics of three Neotropical small mammals: Time series models and the role of delayed density-dependence in population irruptions

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Abstract

It is widely believed that only precipitation levels (through increased primary production) determine irruptions of small mammals in semi-arid areas of western South America. Nevertheless, density-dependent factors may also drive population fluctuations. To test statistically these putative effects we analysed 11 years of population records on three sympatric species of small mammals at two different habitat types in north central Chile. We applied the classical diagnostic tools of time series analysis (the autocorrelation function: ACF) to the observed time series of three neotropical small mammals. We also used simple linear autoregressive time series models to reconstruct the endogenous dynamics of these populations. The analysis strongly suggests that population fluctuations of the three species have an important density-dependent component, with the most irruptive species (*Phyllotis darwini*, Waterhouse 1837) displaying stronger second order population feedbacks than the other two (*Akodon olivaceus*, Waterhouse 1837 and *Thylamys elegans*, Waterhouse 1839). The latter two species showed direct density-dependent feedbacks. We hypothesize that the frequent population outbreaks of *P. darwini* (and perhaps of other species) in semi-arid regions of western South America, may be the result of population-level (direct density- dependence) and community-level processes (delayed density-dependence), interacting with exogenous perturbations (rainfall and associated primary production).