

Feedback structures of northern small rodent populations

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Abstract

Regular oscillations of northern small rodents (lemmings, voles and mice) have fascinated ecologists for decades. In particular, cycles exhibited by Fennoscandian voles have inspired population ecologists to propose several hypotheses for their underlying causes. Although there is now some agreement that the interaction with specialist predators is involved, many aspects remain enigmatic, one being the precise ecological mechanism involved in the first-order feedback effect (i.e. direct density dependence). In this paper we evaluate the relative importance of first and second-order negative feedback on small rodent dynamics in 64 data sets, assess the evidence of non-linearity in the feedback structure, and look for similarities and/or differences between species and places. A clear feature of our analysis was the highly consistent pattern of first-order dynamics across species and locations, suggesting the importance of intra-specific interactions independent of local environmental conditions. Second-order feedback generally showed a large degree of variation and appears to be strongly dependent on environmental conditions and locality. There seems to be no consistent latitudinal pattern or non-linearity in the feedback responses. We conclude that northern small rodent populations are basically regulated by both highly consistent first-order feedback (e.g. intra-specific competition, functional responses of generalist predators) and less consistent, site-specific second-order effects (e.g. numerical responses of specialist predators or food plants).