Population dynamics of rice rats (a Hantavirus reservoir) in southern Chile: feedback structure and non-linear effects of climatic oscillations

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Abstract

We studied a fluctuating population of the long-tail rice rat (*Oligoryzomys longicaudatus*), the main Hantavirus vector in southern Chile, and spanning 19 years of monitoring. We determined that a first-order feedback structure and non-linear effects of Antarctic Oscillation Index (AAOI) and Southern Oscillation Index (SOI) explain 96% of the variation in annual per capita population growth rates. One important result of this study is that first-order feedback structure captures the essential features of population dynamics of long-tailed rice rats. This regulatory structure suggests that rice rats are limited by food, space or predators and regulated by intra-specific competition. The first-order dynamics observed in long-tailed rice rats strongly suggests that Hantavirus have no harmful effects on survival or reproductive processes. Besides the non-linear climatic signature in population dynamics, the periodic event of bamboo-flowering and mast seeding strongly influence rice rats population growth rates. Because of this, bamboo flowering may be used as a signal for forecasting long-tail rice rats outbreaks and for implementing information and health policies to avoid human-rodent contacts in specific areas. The observed effects of the two large-scale climatic indexes that influence climatic variability along southern Pacific Ocean, the AAOI and the SOI, emphasizes the role of considering non-linear feedback structures and climatic forces for understanding small rodent population dynamics. Because long-tailed rice rats represent the major Hantavirus reservoir in southern Chile and Argentina, we need to gain an in-depth understanding of the structure and functioning of these small rodent populations in face of the potential consequences of global change and climatic fluctuations.