Rate of increase as a function of rainfall for house mouse *Mus domesticus* populations in a cereal-growing region in southern Australia

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Summary

1. Mouse plagues are a significant problem to agricultural areas of Australia, causing millions of dollars of damage. This study was conducted to determine if rainfall could explain the occurrence of mouse plagues.

2. On average, data on mouse abundance were collected every month, using mark-release-recapture techniques, from the Victorian Mallee cereal-growing region, from February 1983 to October 1994. No data were collected from December 1990 to September 1992. Three plagues of mice occurred during these 12 years. We examined the rate of increase of mouse populations as a function of antecedent rainfall.

3. The highest observed rate of increase per month was during 1986 (r=1.86). The highest observed rate of decrease per month was during 1984 (r=-2.85). The maximum rate of increase of mouse populations used in the numerical response function was 1.16 month^{-1}. The best estimate for the numerical response function was $r_{obs} = -6.79+7.95\ (1 - e^{-1.11V})$.

4. The numerical response of mouse populations to rainfall was examined against 6-month accumulated rainfall that was lagged by 0, 3 and 6 months. The best fit of the model was to lag rainfall by 3 months.

5. Two systems for the response of mouse populations to rainfall are described. The plague system occurred when mouse populations responded to rainfall: populations increased following high rainfall and decreased following low rainfall. The non-plague system occurred when the exponential rate of increase and rainfall were independent: populations crashed after a plague and were unable to respond to rainfall for at least 2 years thereafter.

6. The two systems suggest that there is `biological memory' that masks the effect of rainfall for a minimum period after a mouse plague. This memory appears to be associated with the time since the last plague, the population response by mice (including shifts in age structure) in the previous year, and the abundance of mice after the spring decline. If rainfall is used to predict mouse plagues to assist in their management, the biology of the system must be known.

Key-words: exponential rate of increase, house mice, numerical response, plague, rodent management.

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