An investigation of the factors regulating house mouse (*Mus musculus*) and ship rat (*Rattus rattus*) population dynamics in forest ecosystems at Lake Waikaremoana, New Zealand.

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Sunset in Wairau Arm, Lake Waikaremoana, New Zealand.

Photo by Pete and Judy Morrin

For Derek

General abstract

Factors regulating the eruptive population dynamics of house mice, *Mus musculus*, and ship rats, *Rattus rattus*, were investigated over 29 months in mixed forest at Lake Waikaremoana, New Zealand. Mice and rats are generally present at low density, but erupt periodically following synchronous southern beech (*Nothofagus* spp.) seeding. A range of factors proposed as important in shaping the population dynamics of these species was investigated. These included rodent diet and habitat use, and the roles of food availability and predation pressure. Changes in rodent population dynamics were investigated using three relative density estimates: footprint tracking tunnels; and two kill trapping indices. Tracking tunnels gave reliable density estimates, but were influenced by sampling effort and habitat type. Rats had an opportunistic, omnivorous diet, and had no measurable detrimental effects of stomach parasite infection. Rats were generally more common in forest with the most food, but became equally abundant in all areas following widespread synchronous tree seeding. Rats were more numerous in areas with predators removed. Mice were found in all areas following *Nothofagus* seeding. Mice became scarce as food levels dropped, suggesting that the forest habitat does not contain enough food to support them in most years. The roles of food limitation and predation in shaping rodent population dynamics were investigated initially by computer modelling. The model showed that predators could not prevent a rodent population eruption, nor limit peak prey-population density. However, predation may be important during the decline and low phases of the eruption. The predictions of the model were tested in a large-scale field experiment. Predators were removed from a 750 ha peninsula in the study area. Rodent population dynamics during an eruption were compared in large areas with and without predators present. Predators did not prevent a prey eruption or limit peak population size as predicted by the computer model. There was evidence that predators limited prey populations during the post-eruption low phase, but the role of predation during the rodent decline remains unclear. Thus, the eruptive population dynamics of mice and rats in forest ecosystems in New Zealand are driven primarily by spatial and temporal variation in food supply, with predation by a single common predator potentially important during the crash and low phases following a population eruption.

Thesis Format

The chapters of this thesis are presented in a self-contained paper format. Each chapter consists of an Abstract, Introduction, Methods, Results, Discussion, and Reference section. Inevitably, this does lead to some repetition, especially in the reference lists, but allows each section to become more focused on a specific topic, and more easily followed.

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But hey, enough of my yacking.

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