Rats on Kapiti Island, New Zealand: Coexistence and diet of *Rattus norvegicus* Berkenhout and *Rattus exulans* Peale.

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ABSTRACT

Snap-trapping information and diet analysis were used to investigate the coexistence of Rattus norvegicus and Rattus exulans with one another and with indigenous avifauna on Kapiti Island (1,965ha, 40^{0} 51'S., 174^{0} 56'E.). The period of trapping was one year (May 1983 to April 1984) and a diversity of habitat types were involved. Areas were trapped for a three day period after three days of prebaiting and most areas were trapped three times during the year. Reproductive and morphometric parameters were also recorded for the rat populations and an alternative form of estimating density, nocturnal rat counts, was tested. Attempts were also made to measure the arboreal activity of rats using chalk dust tracking paper.

The density estimate for the combined populations (15.06 rats/100 trap-nights) is high when compared with mainland rat populations. Density varied with habitat and season, the highest density index being obtained in lowland grass, the lowest along a stony beach. A Standard Minimum estimate of 63 rats/ha was derived for the lowland grass area. Changes in density with season varied from area to area although there was a particular tendency for variations in spring. Species composition was different between habitats. Of eight areas trapped R. norvegicus was the predominant species in five. R. exulans was the predominant species in three areas and occurred in six. Seasonal fluctuations in species ratios were observed and in the three R. exulans areas a high negative correlation existed between the abundance of each species. Male R. exulans were heavier ($\bar{x}$=85.92g) than females ($\bar{x}$=78.98g) although the reverse situation occurred in R. norvegicus, (male $\bar{x}$=209.76g, female $\bar{x}$=222.07g). Reproduction in both species was seasonal with breeding activity peaking in summer and spring. Length of breeding season, average frequency of litter production and mean foetus number were greater in R. norvegicus. R.exulans showed greater fluctuations in age structure.

Of the three main food categories measured, invertebrates, vegetation and seeds, the invertebrate fraction was, in terms of mean percentage volume and frequency of occurrence, the most important for both species. R. exulans had a less varied diet and was more reliant on invertebrates. Lepidopteran larvae were the most frequently eaten invertebrates with Araneida, Coleoptera, Orthoptera, Dipteran larvae and Chilopoda also occurring. Invertebrates formed a greater part of the diet in summer months. Diet strongly reflected the habitat in which rats were trapped. Distinctly different diets were noted in animals inhabiting forest when compared with those from grassland. The proportion of exotic vegetation and seed was more pronounced in the grassland habitats. Although the overlap in diet was considerable, particularly with the invertebrate types eaten (52 types identified, 17 eaten by only one species) the differences in volumes eaten were substantial. Birds did not feature heavily in rat diet and no instances were recorded of kiore having eaten bird remains. Nocturnal rat counts appear an unreliable alternative to trapping as a density measure and kiore do not appear to forage arboreally.

The changes in species ratio, density and diet with area are discussed in terms of competition theory. It is hypothesised that

R. norvegicus is competitively superior and excludes R. exulans from mutually desirable habitats. The mechanisms of the competition are unclear although available evidence suggests that competition for food rather than competition for space is the more likely.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PLATES