The effects of introduced predators and the invasive weed *Tradescantia fluminensis* (Vell.) (Commelinaceae) on the land snail *Powelliphanta traversi traversi* (Powell) (Gastropoda: Pulmonata: Rhytididae).

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ERRATA

Abstract

p.ii, lines 3-4:

Rodent control was carried out continuously rather than using a single application of poison. Bait stations were topped up with Brodifacoum poison every 21-42 days over a period of 19 months.

p.ii, lines 12-13

Numbers of empty *Powelliphanta traversi traversi* shells found in each area decreased by approximately half when the interval between samples was reduced from 12 to 7 months (i.e. by approximately half). This suggested that the accumulation of shells in each area was related linearly to time rather than being strongly affected by any seasonal variation.

Chapter 3

p.23, lines 6-11

There were certain constraints in selecting suitable areas for this experiment, which lead to constraints in the experimental design. Poisoning had to be done over areas >200m across in order to successfully reduce rodent numbers and prevent re-invasion in the centres of the areas. Working on this assumption, only four large areas were available at Lake Papaitonga Scenic Reserve, and this resulted in only two replicates being possible.

p.25, lines 10-11

Permanent quadrats were used throughout the study, instead of a number of randomly chosen quadrats each time, to obtain mortality data by removing empty shells from these quadrats when they were searched. This was essential in determining the effect of reducing rat numbers in the areas that were poisoned. Consequently, a repeated measures design was used. The size of the quadrats ($100m^2$) ensured that sufficient numbers of snails and empty shells could be found, and were used as a compromise between a single larger quadrat and many smaller quadrats. It was also hoped that the quadrats established by this study would be used for further monitoring of *P. t. traversi*.

Chapter 4

p.51, lines 22-28

The main aim of the research was to determine what might happen to *P. t. traversi* in areas affected by *Tradescantia fluminensis* if this weed is removed. To answer this question, the use of *T. fluminensis* affected habitat by *P. t. traversi* was assessed, taking into account such factors as snail density in *T. fluminensis* affected habitat and native habitat, the size of the snails in each habitat type, and the effects of habitat type on snail movements. Ultimately, *T. fluminensis* removal experiments will need to be conducted to determine actual effects to *P. t. traversi*.

Chapter 5

p.82, lines 1-5

The effect of Grazon herbicide on *Cantareus aspersus* was tested further using a Chi-square test to compare mortality of the different treatments at 149 days after spraying. This confirmed a highly significant difference between treatments overall (χ^2 value = 76.48; df =2; $P<0.001$). It also showed a slightly non-significant interaction effect between treatment and age class (χ^2 value = 24.98; df =2; P=0.057).

Abstract

Powelliphanta traversi traversi (Powell) was studied at two forest remnants in the Horowhenua District. The effects of introduced predators, predator control, the invasive weed *Tradescantia fluminensis* (Vell.), and Grazon® herbicide on these snails were investigated. Brodifacoum poison was used in two areas of Lake Papaitonga Scenic Reserve to determine the effect of rodent control on *P. t. traversi*. Mouse abundance (inferred from tracking tunnel indices) was reduced in both poisoned areas below levels observed in two other areas that were not poisoned. Rat abundance was reduced below pre-poisoning levels but only to levels below one of the non-poison areas. In each poison and non-poison area, four 100m² quadrats were searched for *P. t. traversi* snails immediately before poisoning, and 12 and 19 months after poisoning commenced. After 19 months, only one poisoned area showed an overall increase in the number of snails, with significantly more live snails found (45) than at either of the two previous searches (22 before poisoning and 28 after 12 months of poisoning) ($P<0.05$). Numbers of empty *P. t. traversi* shells found in each area decreased at each search suggesting that shell accumulation is constant rather than seasonal. Rats were the greatest identified predator of *P. t. traversi* at Lake Papaitonga (17.87% of all empty shells), but the proportion of shells damaged by blackbirds and song thrushes was also high (11.91% of all empty shells) and increased from pre-poisoning numbers in three of the areas. Overall, there was no conclusive evidence to suggest that the numbers of live *P. t. traversi* increased as a result of rodent poisoning during the time period of this study. The effect of *T. fluminensis* on the movements of *P. t. traversi* at Prouse Bush was determined using harmonic radar. There was large variation in the movements and a highly significant difference between individual snails ($P<0.01$), with some snails regularly moving between areas of *T. fluminensis* and leaf litter. There was no significant difference in the mean daily displacement of movements by snails in leaf litter and *T. fluminensis*, but *T. fluminensis* did appear to affect home range size. Snails always found under *T. fluminensis* had significantly smaller mean 90% home range estimates (43.91 m²) than snails that were only ever found in leaf litter or those that moved between litter and *T. fluminensis* (171.35 m² and 610.14 m² respectively) ($P<0.05$). Snails in *T. fluminensis* had a significantly wider size-frequency distribution than those in leaf litter ($P<0.05$) and no live snails <35mm were found in leaf litter. There was no significant difference between the size-frequency distributions of empty shells found in both habitats, but their density was significantly greater in leaf litter ($P<0.05$). *Powelliphanta traversi traversi* regularly use *T. fluminensis* as a habitat and any control measures affecting this weed in native bush remnants need to be considered with regard to their possible effects on these snails. The toxicity of a 1.4% Grazon® solution (active ingredient triclopyr) to *P. t. traversi* was investigated by first using three life history stages of the brown garden snail (*Cantareus aspersus* Müller). After 149 days, there was significantly greater mean mortality of *C. aspersus* exposed to a direct spray and to a sprayed environment (82.34% and 78.40% respectively) than in a control treatment (36.95%) ($P<0.05$). *Cantareus aspersus* egg mortality (86.00%) was significantly greater than adult and juvenile snail mortality (66.86 and 62.20% respectively) ($P<0.05$). Five *P. t. traversi* snails were also exposed to a single environmental spray of a 1.4% Grazon solution but no mortality or detrimental effects were observed after 149 days. A 1.4% Grazon solution does not appear to be toxic to *P. t. traversi* snails when sprayed on leaf litter where the snails live so Grazon appears to be a suitable herbicide for controlling *T. fluminensis* in forest remnants containing *P. t. traversi*.

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