



Mouse responses to predator removal and consequences for biodiversity



Questions

- Does top-order predator control lead to mouse outbreaks?
- Do mice negatively affect indigenous species?

Published work:

Mouse responses to top-predator removal (meso-predator release)

- Crooks & Soule (1999)
- Ritchie & Johnson (2009)
- Goldwater et al. (2012)

Mouse impacts on New Zealand indigenous fauna

- Newman (1994), Mana Island
- Lettink & Cree (2006), Kaitorete Spit
- Hoare et al. (2007), Pukerua Bay
- St Clair (2011)



Copper skink



Photo: Tony Whitaker

This talk focuses on three mouse and lizard studies in Otago

- a) Mouse and common lizard responses to predator removal, Macraes and Alexandra
- b) Mouse and common lizard spatial patterns, Macraes
- c) Otago skinks at Mokomoko Dryland Sanctuary, Alexandra



a) Mouse and common lizard responses to predator removal

Alexandra

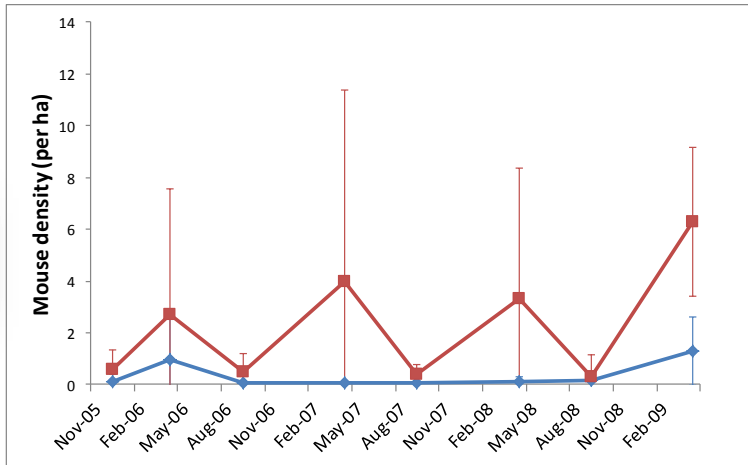


Macraes



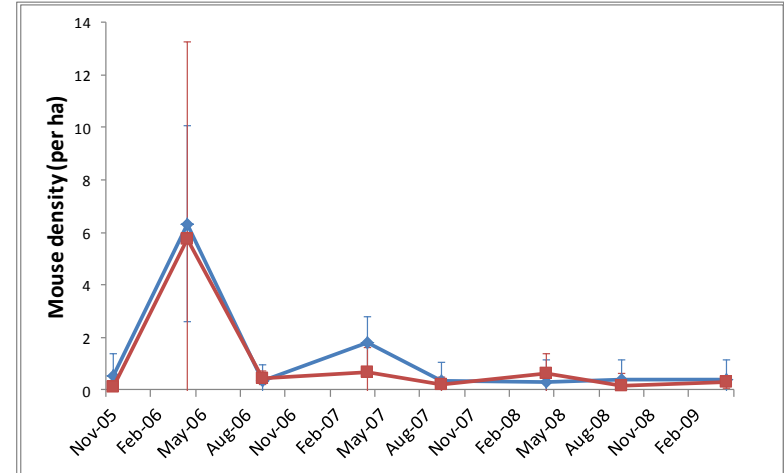
Alexandra

Mice

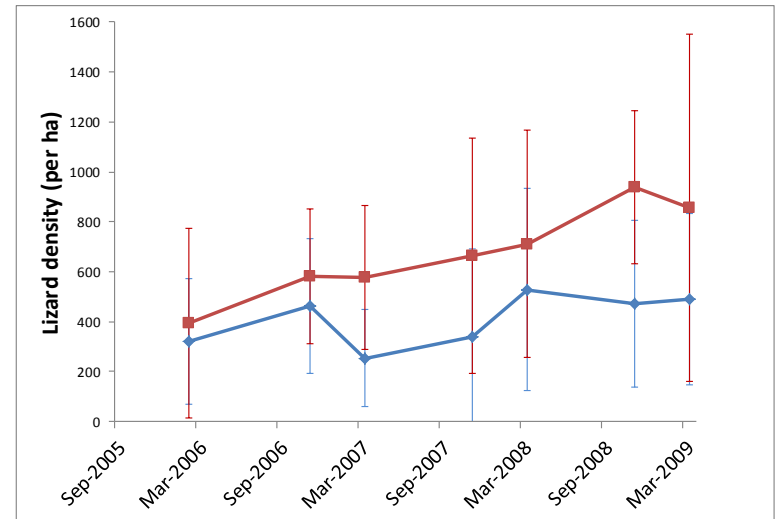
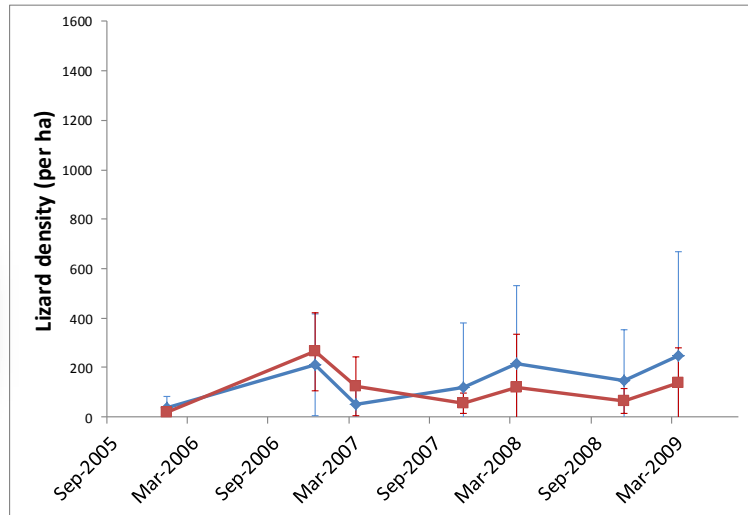


Macraes

+ Preds



Lizards



b) Mouse and common lizard spatial patterns, Macraes



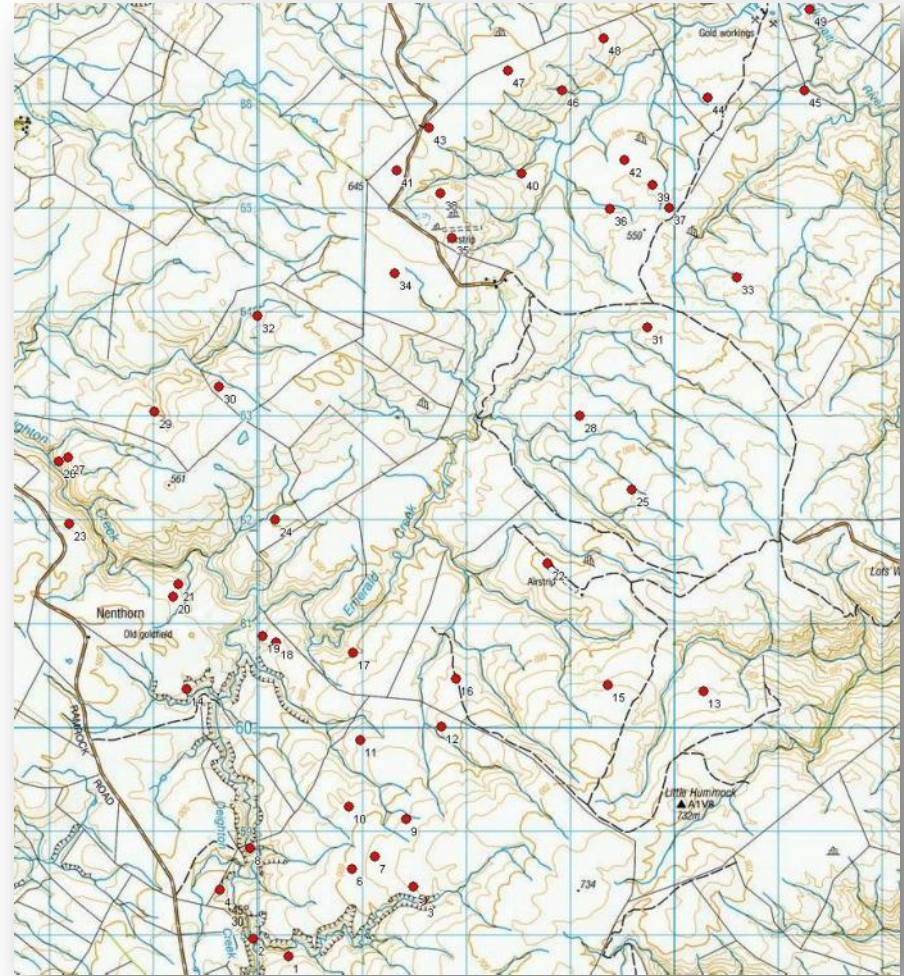
Pilot study – Sept 2010

Mouse, lizard, invert indexing devices

- Ink tunnels
- Artificial refuges

49 grids, random points

- Stratified by 3 habitats



Habitats

Degraded tussock



Tussock



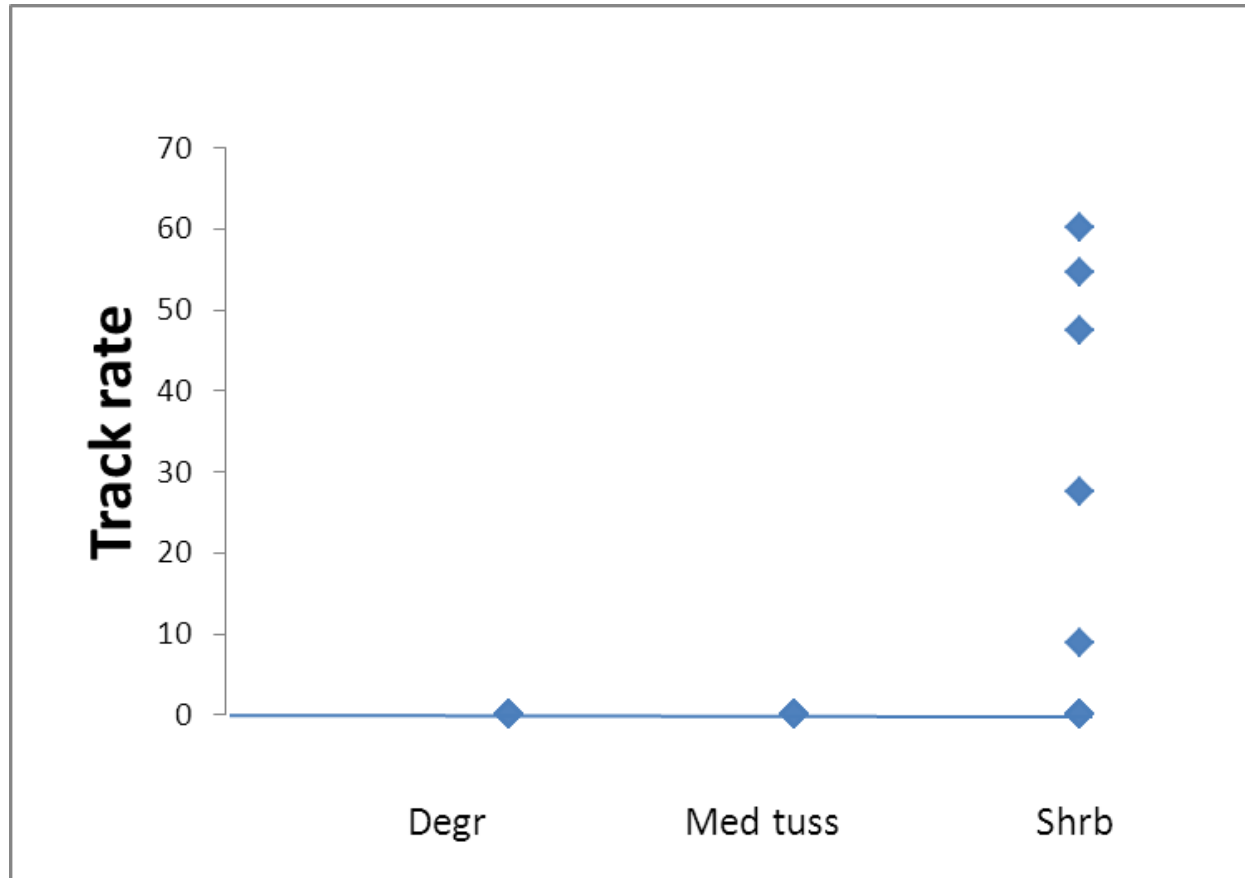
Shrub/tussock



Removal of grazing

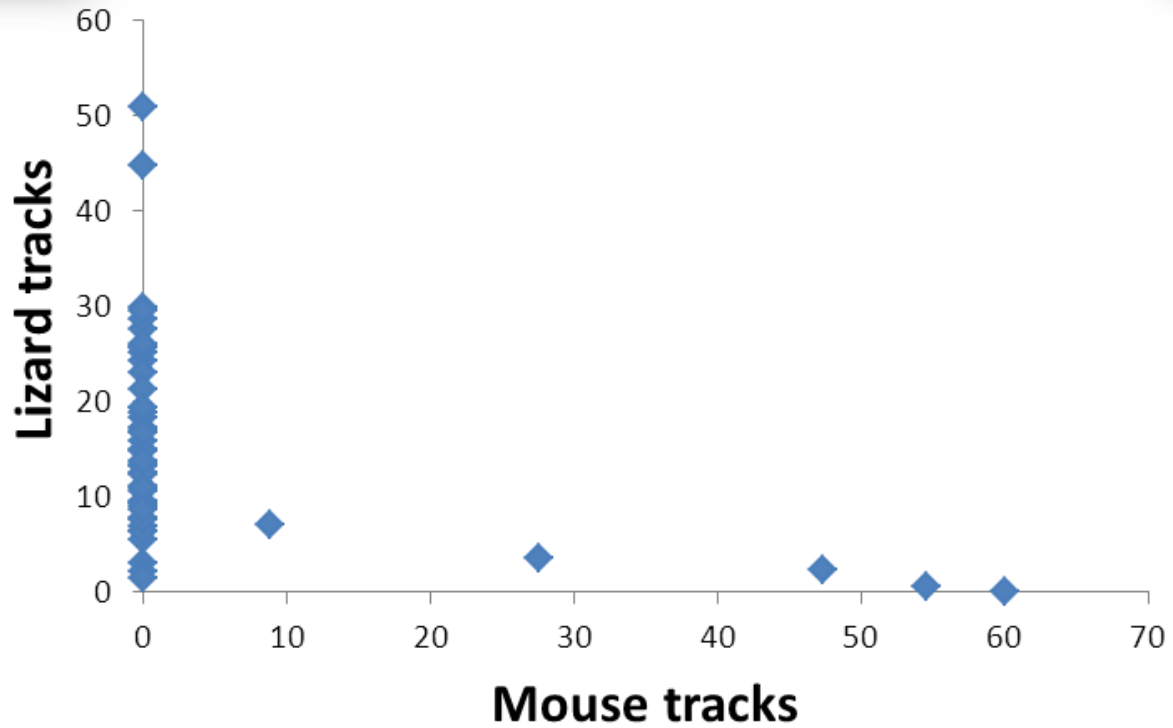


Mice and habitat



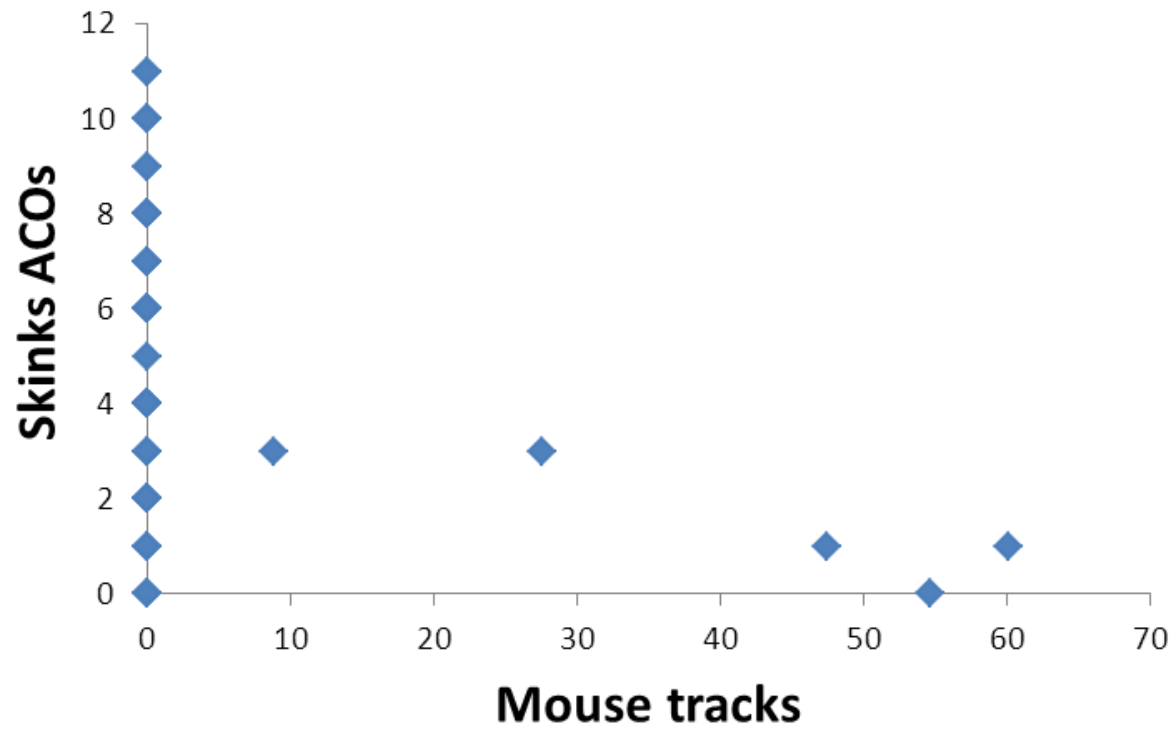


Lizards



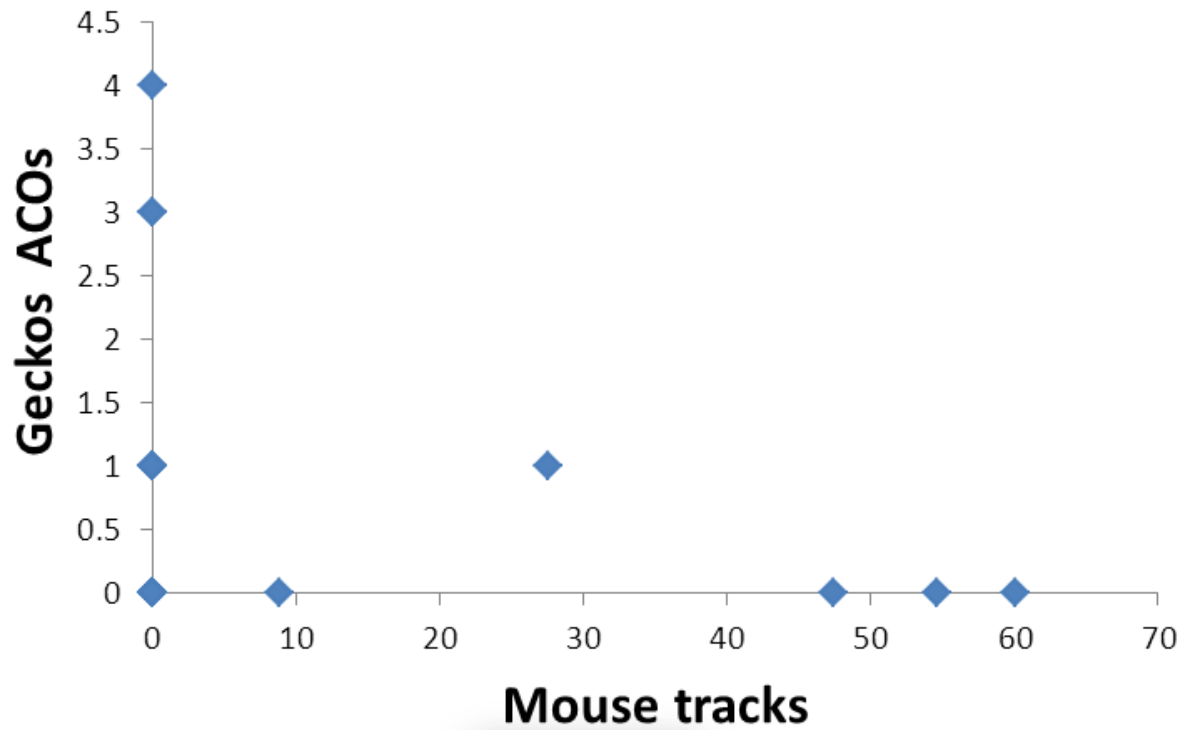


Lizards



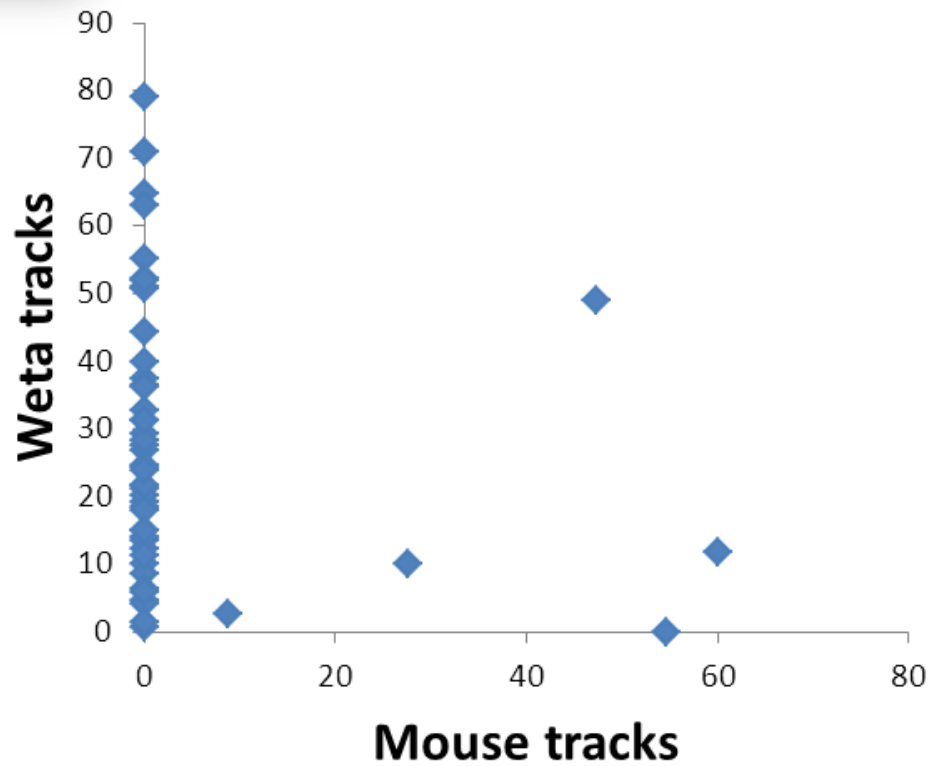


Lizards



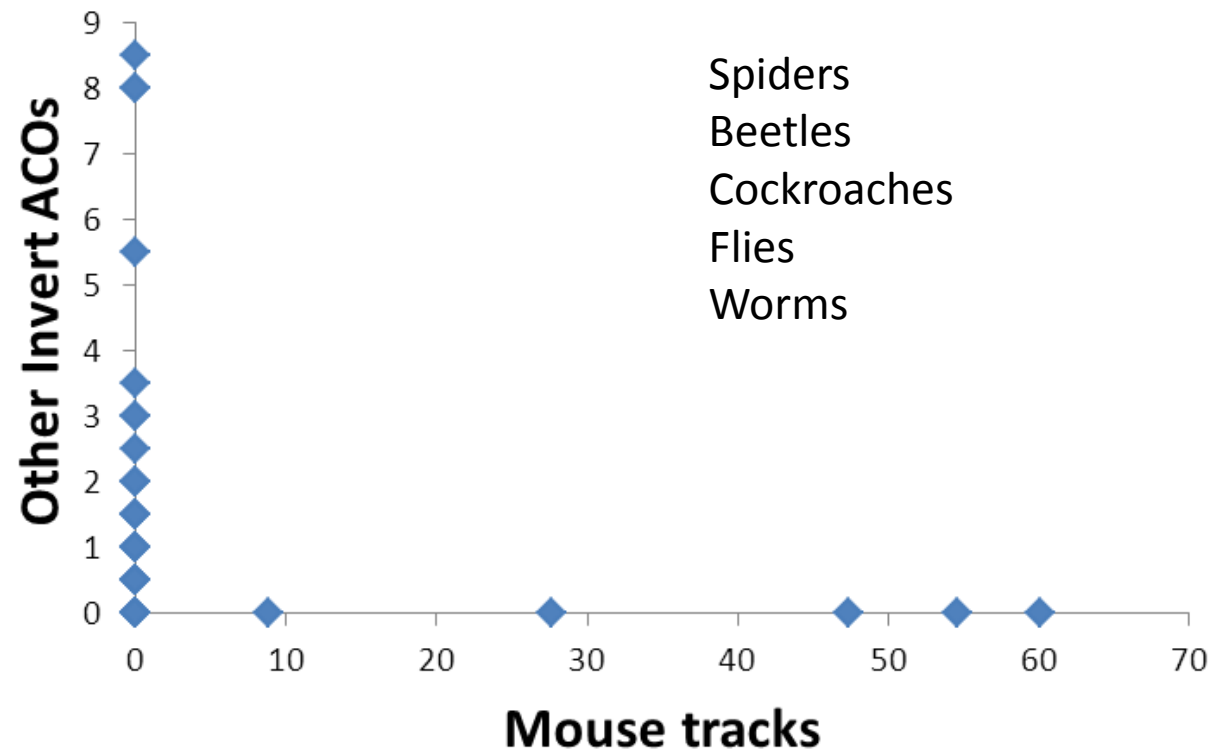


Inverts





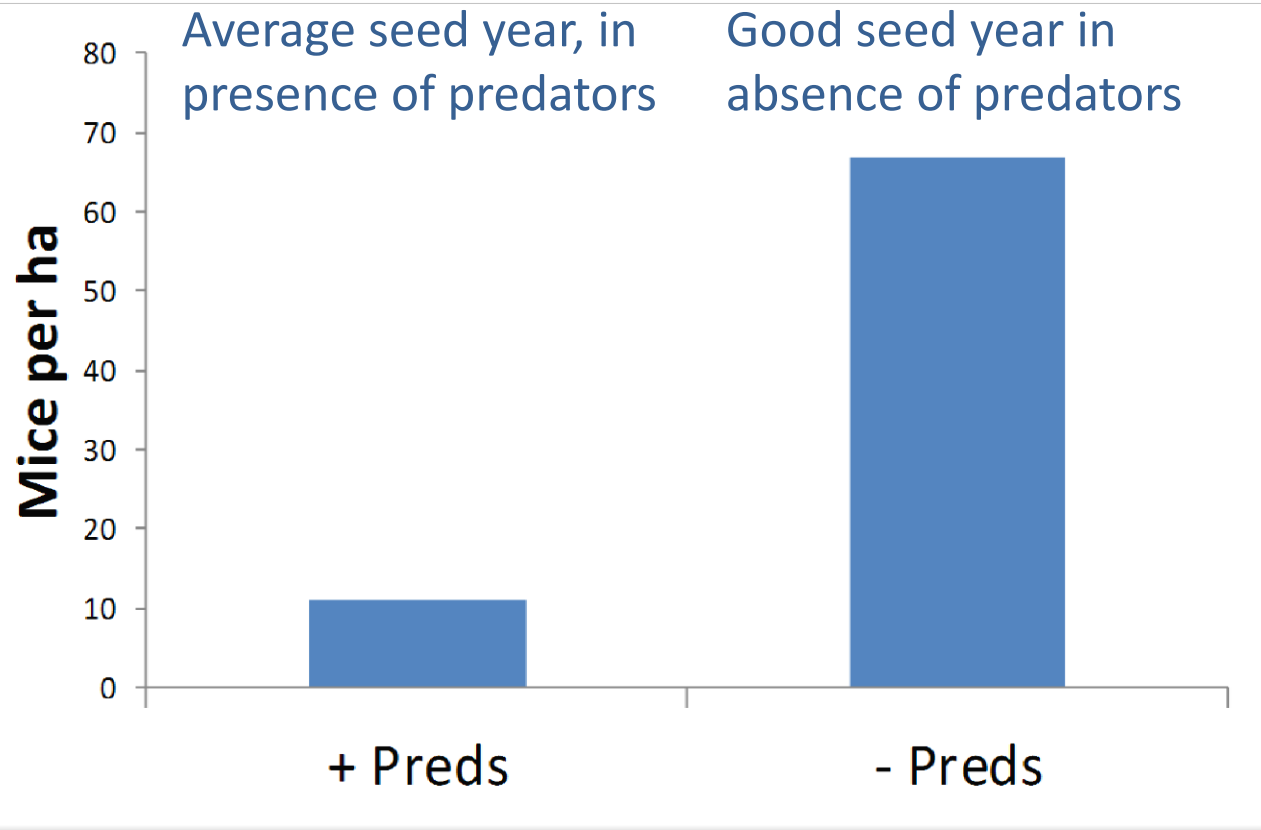
Inverts



c) Otago skinks at Mokomoko Dryland Sanctuary, Alexandra

2 years without mice.....
.....then whammo





Two observations of mice attacking adult skinks

Arthur et al. 2004



Skink survival

- Survival of first-release (in **absence** of mice) = 0.85 (0.60 – 0.95) per annum
 - Comparable to skinks at Macraes = 0.89 (0.50 – 1.00)
- Survival of second-release (in **presence** of mice) = 0.38 (0.05 – 0.73, note wide CI)
- Interestingly, survival of first-release skinks was largely unaffected by mice



What controls mouse dynamics?

Measured primary mouse food (seed and invertebrates)

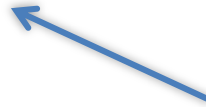


Mainly seed, but also invertebrates, were key predictors of mouse dynamics

What drives **mice** in grassland ecosystems?



Food (mainly **seed**, also invertebrates)

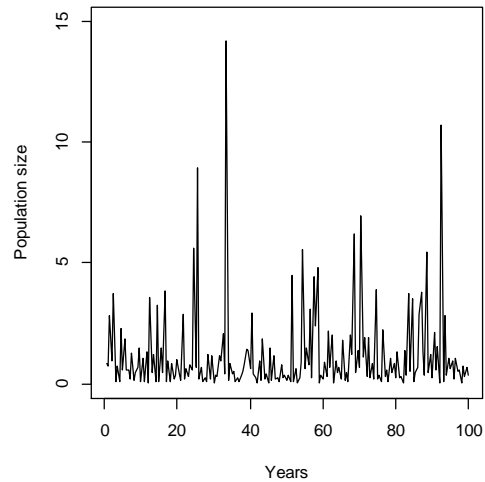


Predation

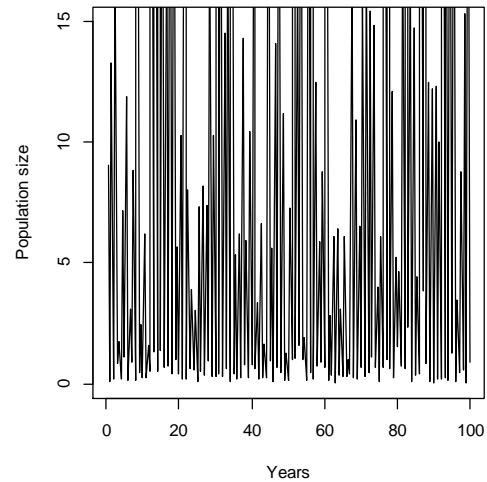


Populaton models for mice

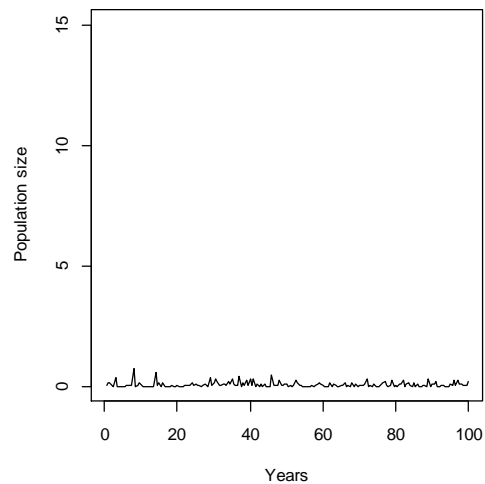
High Predator, High Seed



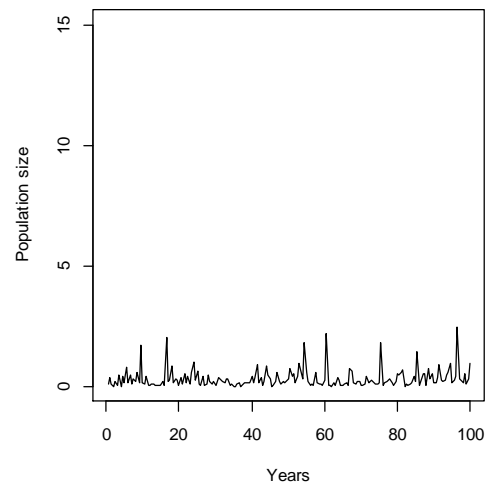
Low Predator, High Seed



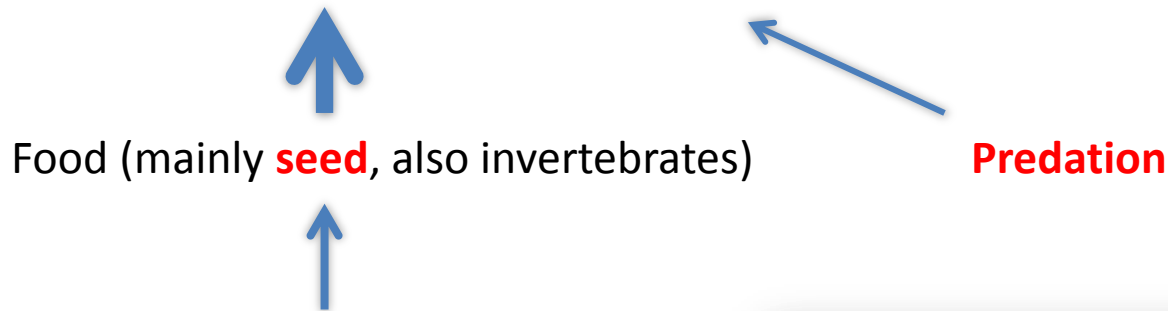
High Predator, Low Seed



Low Predator, Low Seed

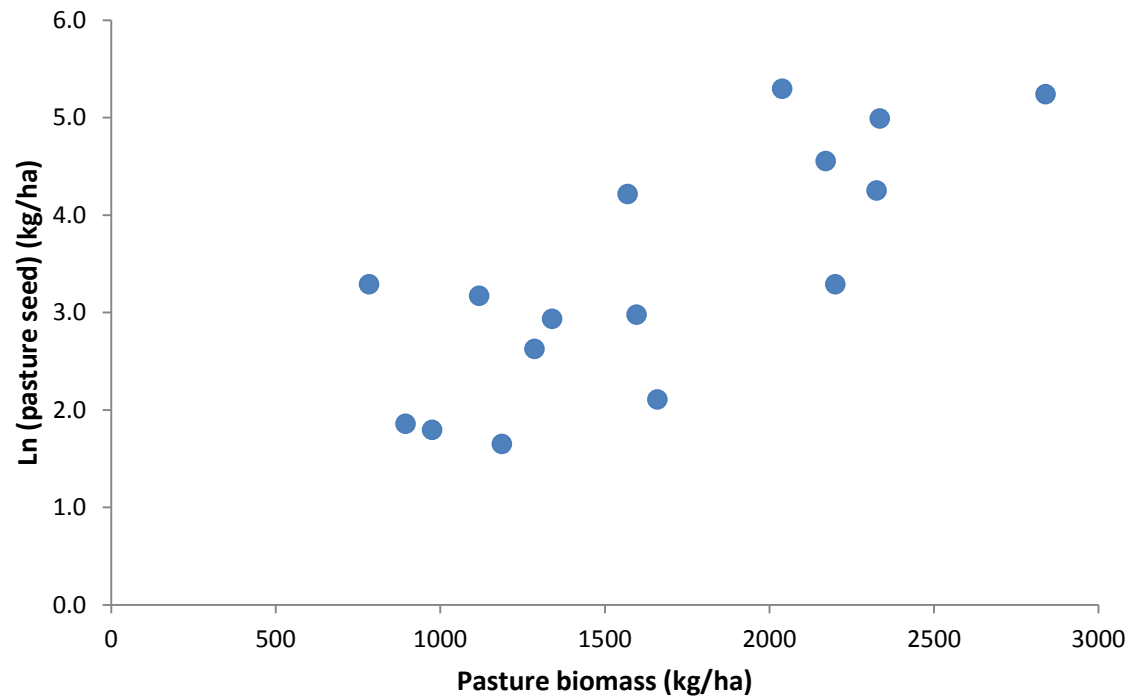


What drives **mice** in grassland ecosystems?

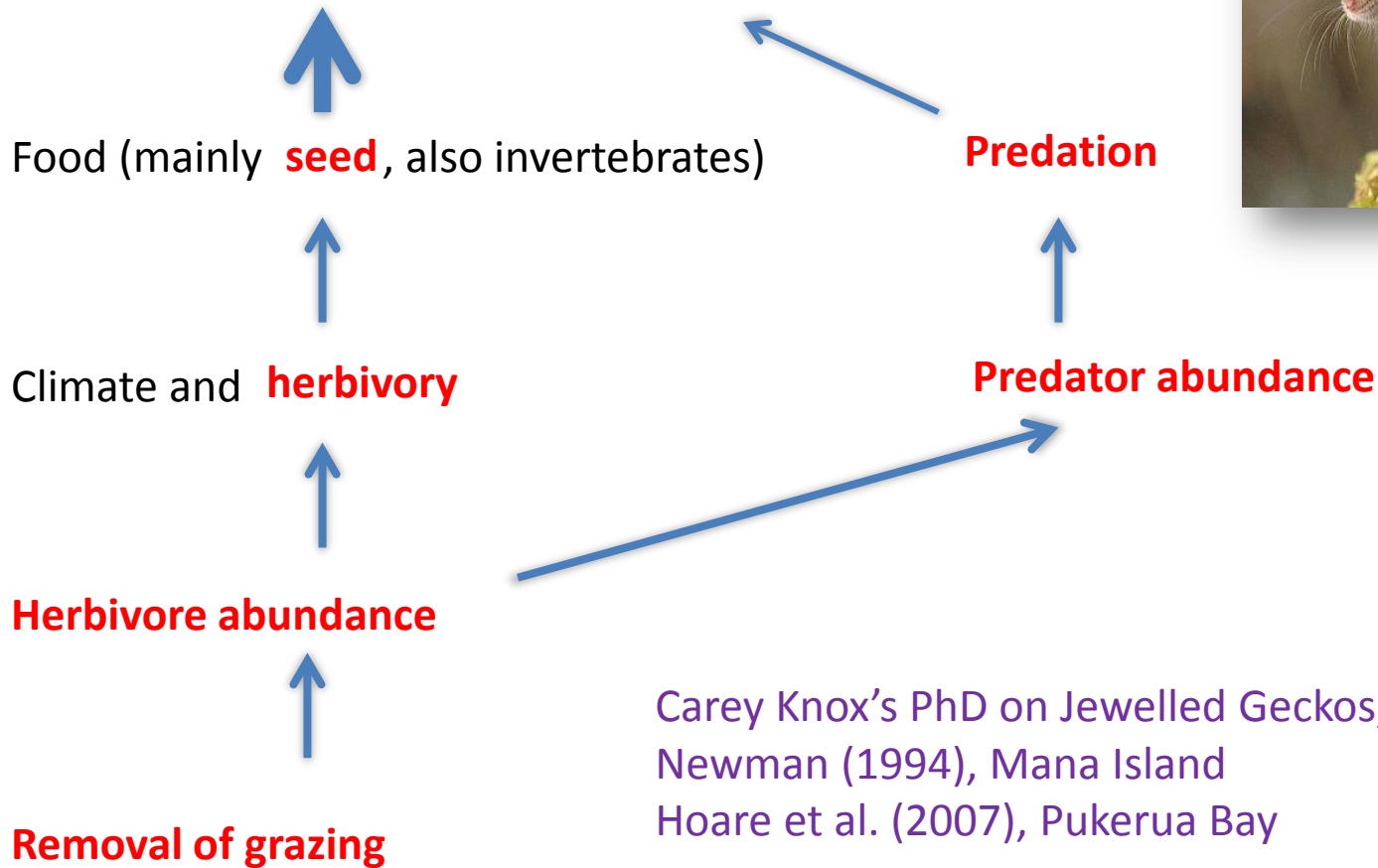


Seed productivity positively correlated with pasture biomass

($R^2 = 0.60$, $F_{15} = 21.05$, $p < 0.001$)



What drives **mice** in grassland ecosystems?



Carey Knox's PhD on Jewelled Geckos, Otago Pensinsula
Newman (1994), Mana Island
Hoare et al. (2007), Pukerua Bay

Conclusions

- Mice respond primarily to food but also to removal of top predators
- High mouse numbers appear to have detrimental effects on lizards and invertebrates
- Past studies have shown that both removal of predators and retiring land from grazing can benefit indigenous species
- However, the ensuing vegetation changes and complex interactions among invasive species can hamper recovery of indigenous fauna that are vulnerable to mice

Question

- While there is evidence that mice prey on indigenous lizards, we do not know whether they compete for shared food resources
- Future work will focus on mouse impacts on lizards and invertebrates, and the role of soil nutrients and soil biota

Thanks:

- Ministry of Science & Innovation
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