Do Mice Matter?

The Impact of Mice on a New Zealand Ecosanctuary

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Fenced Ecosanctuaries

- The introduction of exotic mammals to NZ has devastated the native ecosystem
- Mammal-resistant fences have enabled the eradication of exotic mammals from ecosanctuaries in New Zealand
- Fenced sanctuaries aim to protect and restore the native ecosystem
- ***However…*** preventing the re-invasion of mice has proven challenging!

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The Mouse Problem

- Mice eat native animals and plants
- With limited competition and/or predators, they can become very abundant
- Mice are present in fenced ecosanctuaries where all other exotic mammals have been successfully eradicated
- What impact are mice having on the native biodiversity in fenced ecosanctuaries?

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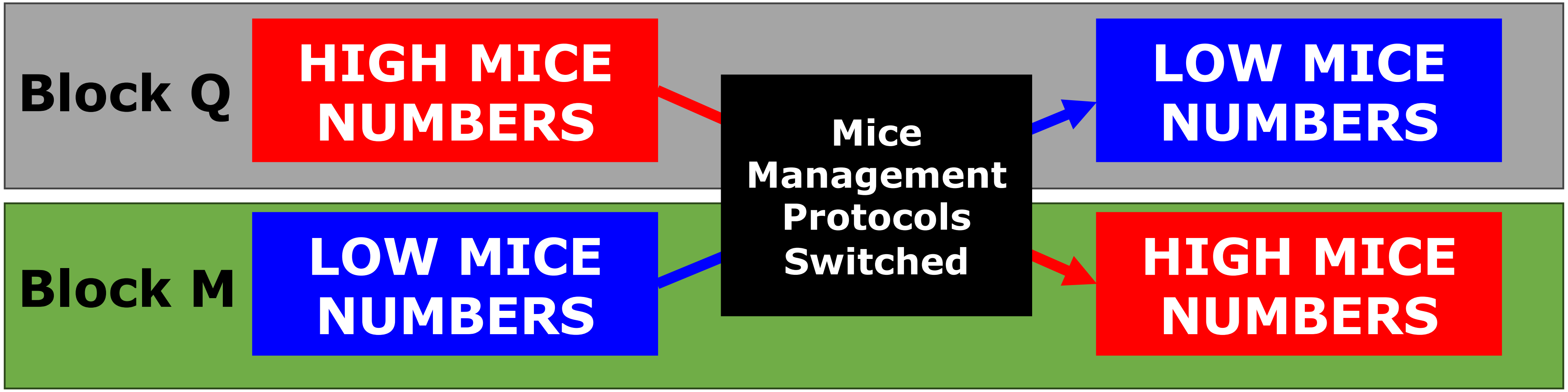
The Study

- Conducted by Manaaki Whenua – Landcare Research at Mountain Sanctuary Maungatautari
- Two fenced blocks (M and Q) within the sanctuary
- Cross-over trial



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Mice Eradication Protocol

- ***Initial eradication phase***
  - Aerial poison drops
- ***Maintenance phase***
  - Tracking tunnels (inspected weekly) to detect presence of mice
  - If detected, intensive trapping and poisoning effort in the surrounding area
- Very intensive and expensive – not sustainable long-term

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Data Collected

Table 1. Summary of methods used to sample invertebrates, seedlings and fungi in the study blocks M and Q at Sanctuary Mountain Maungatuatari between April 2011–February 2016.

Target Group	Sampling method	Number of traps/samples	Duration of sampling	Frequency of collection
Ground-dwelling invertebrate community	Pitfall trap	20 traps in each block (10 traps located 5 m apart along a 45 m transect × 2)	April 2011–2015 Summer 2011/12–2015/16	Annually (1 month in April; late Nov–late Feb, collected monthly)
Leaf-litter invertebrate community	Leaf-litter sample (33 cm diameter circular frame (0.086 m^2))	32 sampling points in each block	April 2011–2015	Annually
Land snails	Extracted via Tullgren funnel from leaf-litter samples	32 sampling points in each block	April 2011 and 2012	Twice
Wētā	Tracking tunnels	24 tracking tunnels in Q block; 36 tracking tunnels in M block	April 2011–February 2016	Every 3 months in Autumn (April/May), Winter (August), Spring (November) and Summer (February)
Earthworms	Searching leaf-litter and soil (depth of 10cm) from 50 × 50 cm quadrats (0.25 m^2)	20 sampling points in each block	November 2013 and 2015	Twice
Seedlings (cotyledonary, mixed-leaf and true-leaf seedlings)	Counted seedlings in circular 0.75 m^2 plots	36 sampling points in each block	April 2011, April 2013 and June 2016	Three times
Fungi	Offered mice six known edible and other mushrooms at cafeteria and filmed with cameras Fungal DNA from mouse faecal pellets	One 54 faecal pellets examined	48 hours in July 2011 August 2011 and February 2012	Once Once

Today's focus

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Paper: Watts et al. (2022) in *New Zealand Journal of Ecology*

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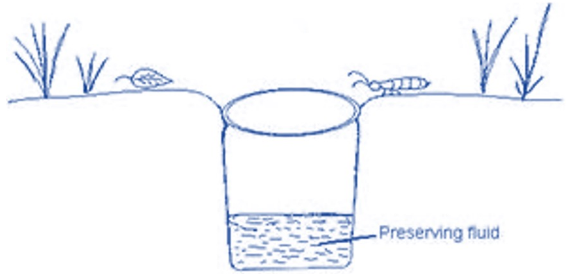
Sampling Ground-dwelling Invertebrates

- Sampled using pitfall traps placed along transect lines
- Transects randomly located within each block
- Traps set for 1 month at a time
- Sampled 4 months per year: November, December, February and April
- A total of 42,639 invertebrates were caught
- All were sorted (at least) to the Order level
- Rich data set!
- Key variable of interest: **Total number caught per trap**



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Statistical Analysis

- **Aim: Compare the temporal trends between the two study blocks**
- Fitted a linear mixed model with smoothing splines over time
- Fixed: Block + Time + Block.Time
- Random: Month + Transect + Transect.Time + Trap + Trap.Time

Correlated (Trap + Trap.Time)

Spline(Time) + Block. Spline(Time) + Transect. Spline(Time) + Trap. Spline(Time)

i.e., Trends over Time

	Constant	**Linear**	**Spline**
Overall	Fixed	Fixed	Random
Block	Fixed	Fixed	Random
Transect	Random	Random	Random
Trap	Random	Random	Random
Month	Random		

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83% Confidence Intervals

- Differences in the temporal trends examined using 83% C.I.s

Why not 95%?

For two independent Normally distributed samples, of equal size and common variance …

- just touching 83% C.I.s corresponds to a two-tailed t-test with a p-value of ≈ 0.05

whereas

- just touching 95% C.I.s corresponds to a two-tailed t-test with a p-value of ≈ 0.005

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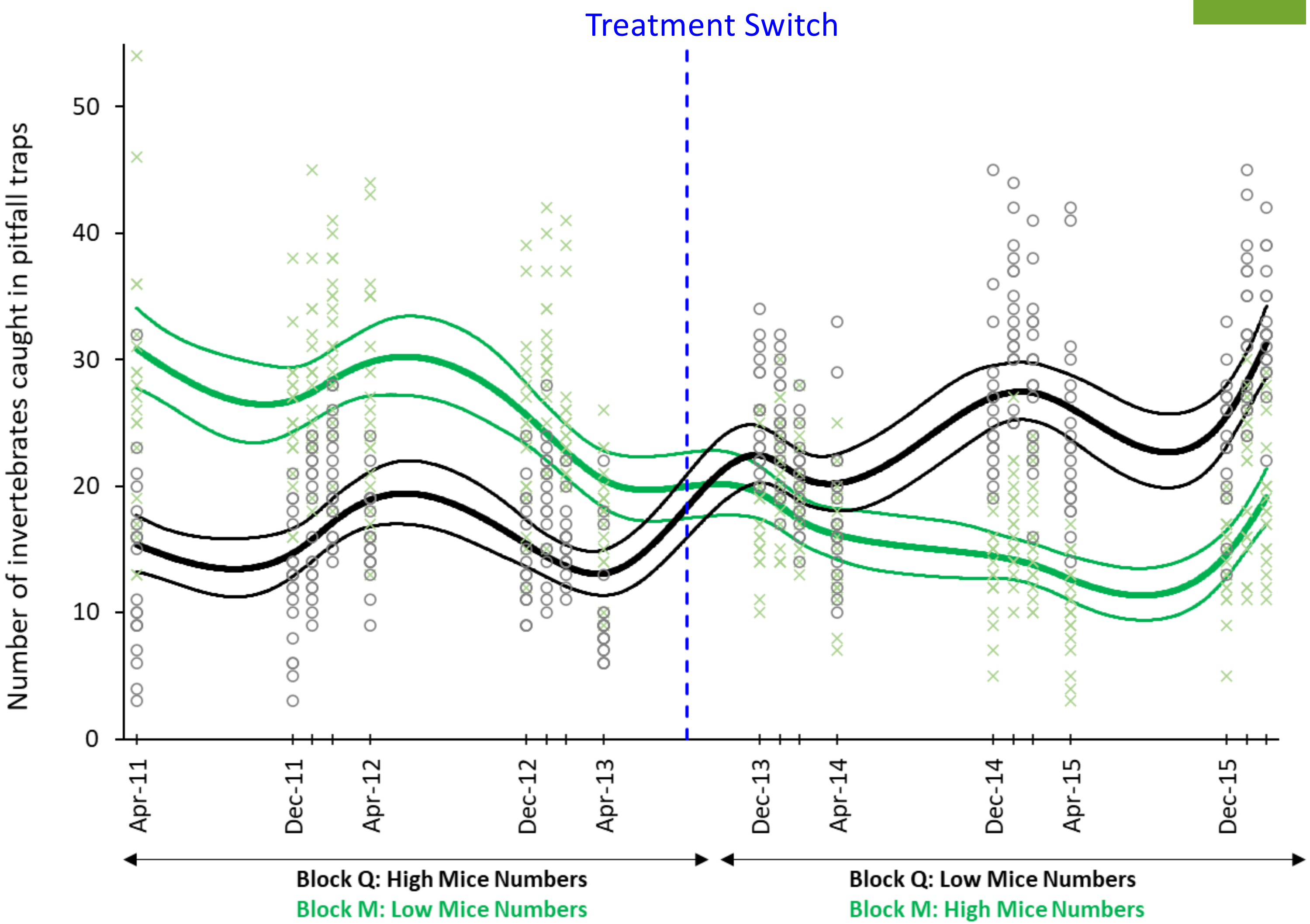
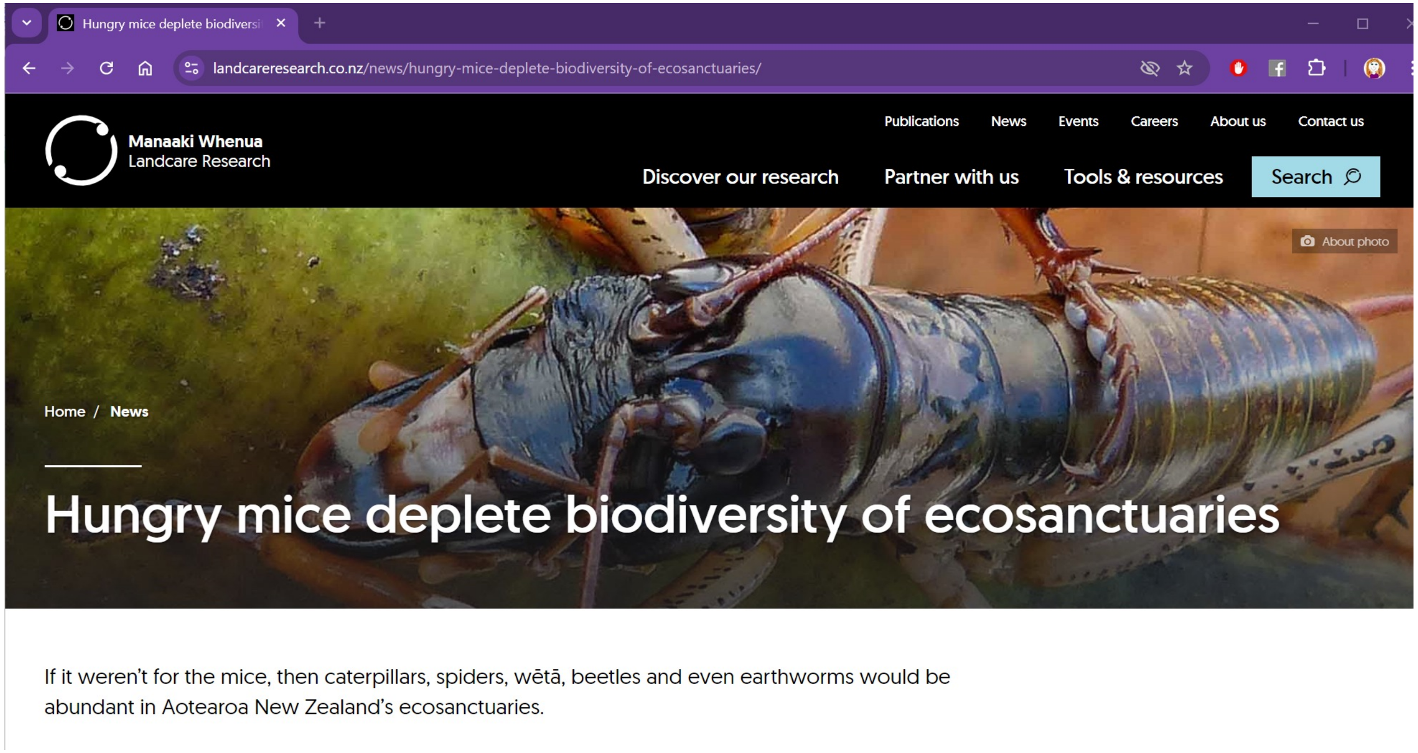
The Results



Treatment Switch
Number of invertebrates caught in pitfall traps
0
10
20
30
40
50
Apr-11
Dec-11
Apr-12
Dec-12
Apr-13
Dec-13
Apr-14
Dec-14
Apr-15
Dec-15
Block Q: High Mice Numbers
Block M: Low Mice Numbers
Block Q: Low Mice Numbers
Block M: High Mice Numbers

The Implications

- Mice may be catastrophic in ecosanctuaries that focus on the recovery of invertebrates (or their predators - lizards)
- Need more cost-effective methods for controlling mice in fenced ecosanctuaries



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Thank You

Paper

Watts et al. (2022)

New Zealand Journal of Ecology

https://newzealandecology.org/nzje/3472

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