Lizards & Ecosanctuaries: needs, priorities and mice

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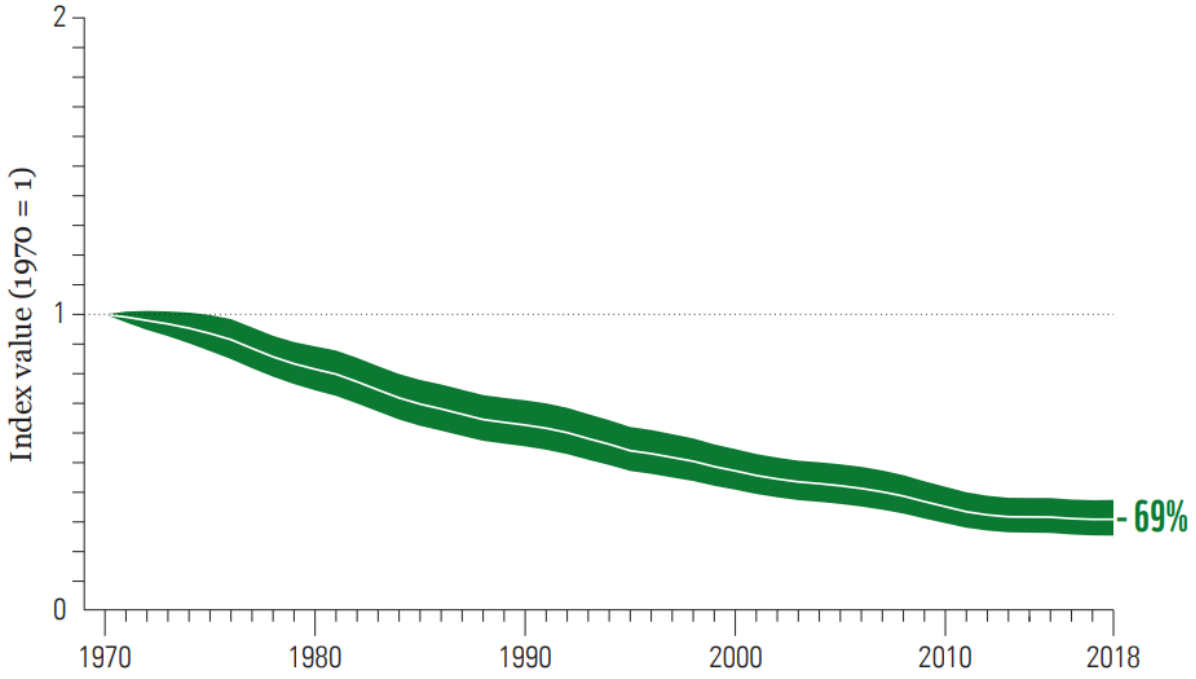
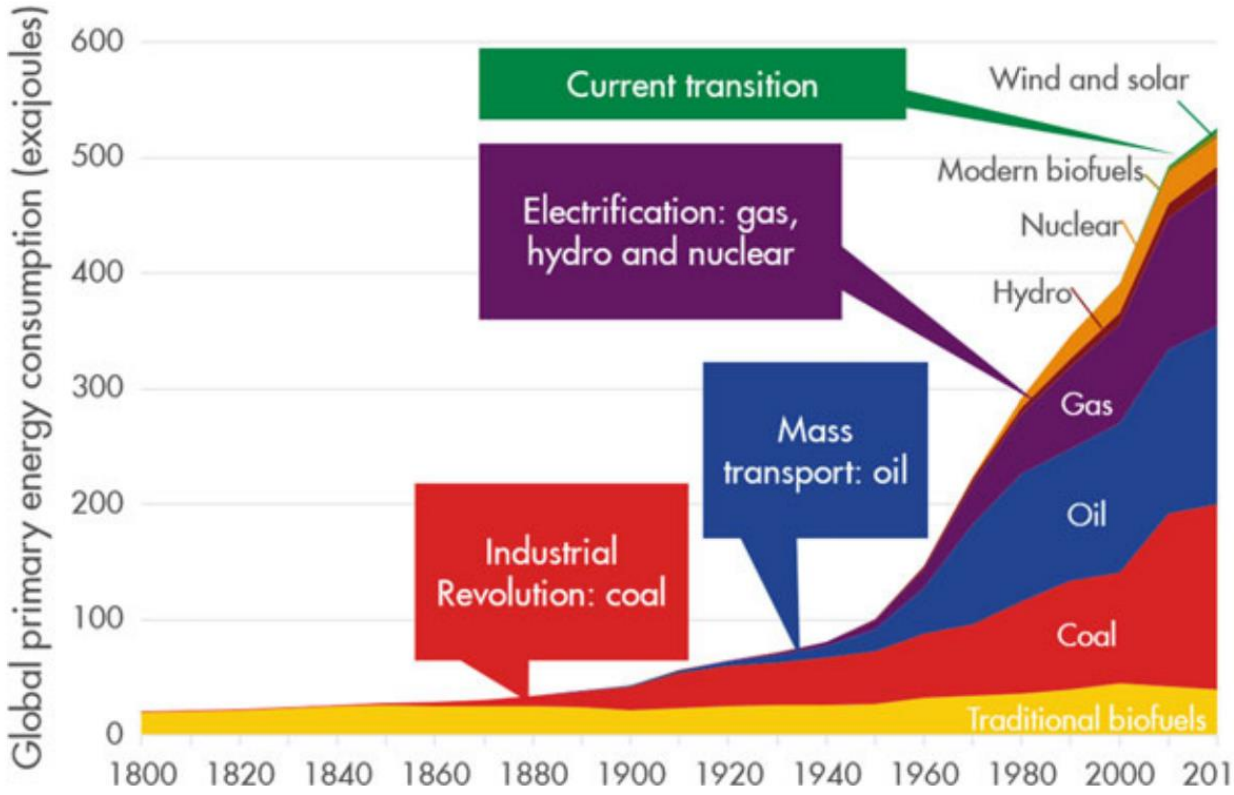
Mokopirirakau granulatus, forest gecko, West Coast. At Risk - Declining

Our efforts in context

- 38% spp. threatened of those assessed (IUCN)
- We're in ecological overshoot
- Growth desires a doubling in 20-30yrs.
- We fund conservation with the surplus economic growth

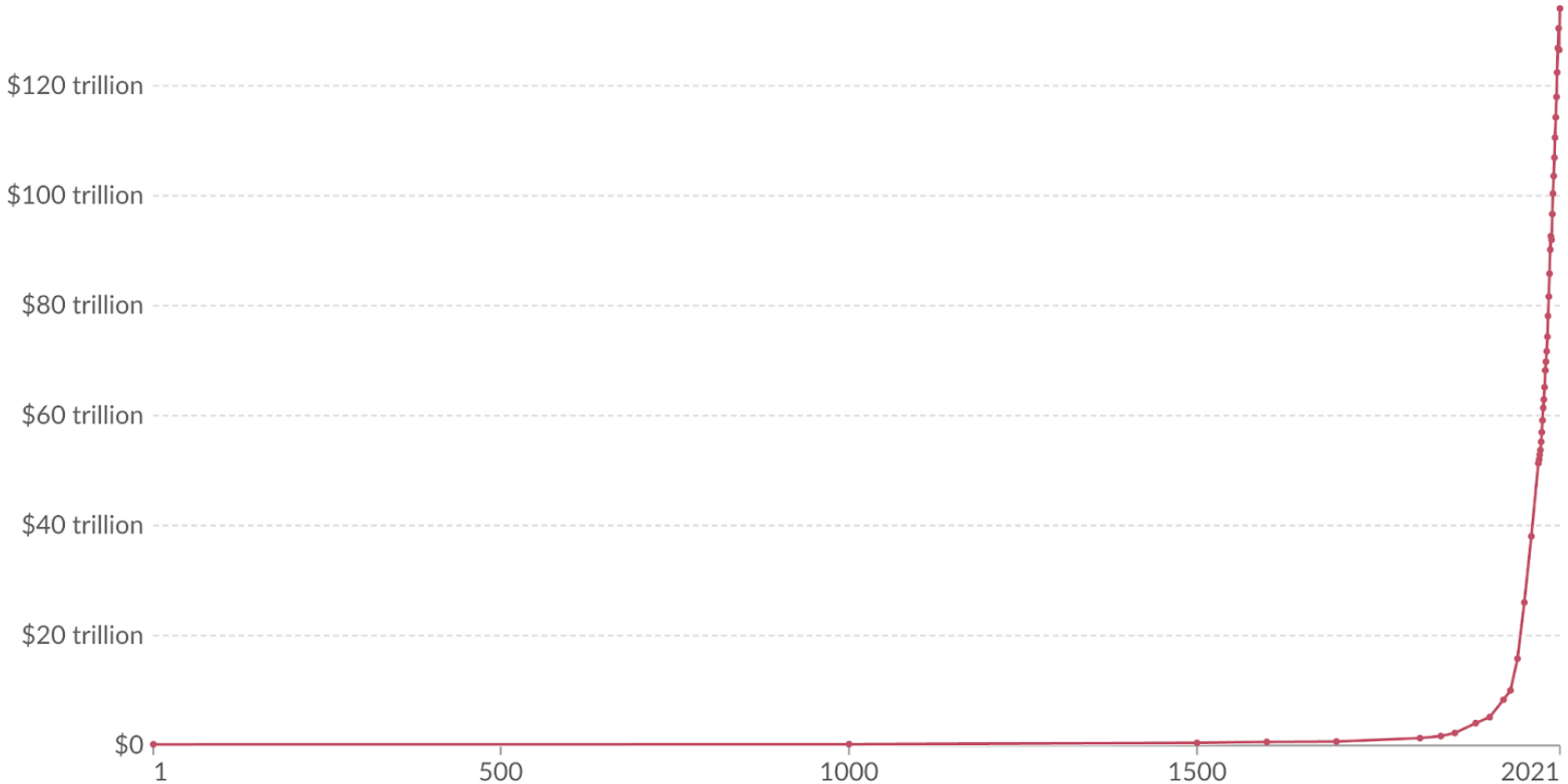




Global GDP over the long run

Total output of the world economy. These historical estimates of GDP are adjusted for inflation.

Our World in Data



Data source: World Bank (2023); Maddison Project Database 2020 (Bolt and van Zanden, 2020); Maddison Database 2010 (Maddison, 2009)

Note: This data is expressed in international-$[1] at 2017 prices.

OurWorldInData.org/economic-growth | CC BY

1. International dollars: International dollars are a hypothetical currency that is used to make meaningful comparisons of monetary indicators of living standards. Figures expressed in international dollars are adjusted for inflation within countries over time, and for differences in the cost of living between countries. The goal of such adjustments is to provide a unit whose purchasing power is held fixed over time and across countries, such that one international dollar can buy the same quantity and quality of goods and services no matter where or when it is spent. Read more in our article: What are Purchasing Power Parity adjustments and why do we need them?

Lizard Technical Advisory Group (TAG)

- Formed from the NI Skink Recovery Group and GAOS Recovery Group to cover all lizards.
  - Leiopelmid frogs and tuatara have their own recovery groups

- Internal and external members:
  - Rod Hitchmough – Independent herpetologist, encyclopaedia and taxonomist (retired)
  - Dylan van Winkel – Independent herpetologist
  - Ben Barr – Independent herpetologist
  - Marieke Lettink – Independent herpetologist
  - Jo Monks – Otago Uni herpetologist
  - Charlotte Crummack – DOC herper
  - James Reardon – DOC herper
  - Lynn Adams – **DOC chair**

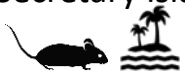
Lizard TAG

- Purpose:
  - Prioritise, plan & enable management for priority species
  - Raise awareness within DOC for herp values
  - Use processes & lobbying to secure resources & capacity *within* DOC for lizard conservation
  - Where possible, support external conservation endeavours that reflect our priorities (e.g. COET)

Lizards!

- 126 species (more coming)
- Nearly 30% ‘Threatened’ with extinction (NZTCS)
- Further 45% ‘At Risk’ of becoming threatened (NZTCS)
- Very vulnerable to predators and habitat loss
- Poorly factored into generic conservation management

Toropuku inexpectans, northern striped gecko, Coromandel pen. Threatened – Nationally vulnerable.

- Lizard TAG management achievements (**NC, NE**):
  - ***Oligosoma salmo***, Kapitea skink (NC)– Antje presenting details ☑ 
  - ***O. tekakahu***, Te Kakahu skink (NC) – improved security through translocation, now on three islands ☑ 
  - ***O.* aff. *infrapunctatum* "Cobble"** Cobble skink (NC) – rescued to captivity but looks like a second population found -Likely to drop to NE ☑ 
  - ***O. hoparatea*,** white-bellied skink (NC) –Existing tools management starting this year. ☑ 
  - ***O. lineoocellatum*,** Canterbury spotted skink (NV)– management using mouse proof exclosures at Orana park ☑ 
  - ***O. awakopaka***, Awakōpaka skink (NC) – mouse management before Dec. 2023, captive investigation ☑ 
  - ***O. pikitanga***, Sinbad skink (NE) – Surrogate translocation of *O. inconspicuum* 'mahogany' to Secretary Island, Clare presenting☑ 
  - ***O. albornense***, Alborn skink (NE)– not managed but good prospects. Charlotte presenting ☑ 
  - ***O. grande***, grand skink (NE)- predator control and mammal fences ☑
  - ***O. otagense***, Otago skink (NE) – predator control and mammal fences ☑

  O. kakerakau, kakerakau skink (NC) is under management of the Bream Head Conservation Trust (Ben Barr), translocation in iwi discussions.☑ 

- This leaves the following NC unmanaged:
- ***O. chloronoton***, southland green skink (NC) –not as threatened as thought but big bodied lowland skink, established existing tools would probably work. ☒ 
- ***O. kahurangi***, Kahurangi skink (NC) –Likely to drop to NE or NV at next review ☒ 
- ***O.* aff. *infrapunctatum* "Hokitika",** Hokitika skink (NC) – we haven't found a manageable or rescuable popn. ☒ 
- ***O.* aff. *infrapunctatum* "southern North Island"** Kupe skink (NC) – unmanaged, existing tools likely to be beneficial, MSc study will start 2024 ☒ 

- 4 unmanaged of 10 NC so 40% unmanaged

  ☑= managed ☑=some management ☒=unmanaged  =mouse risk  =climate risk  =wasp risk  = no secure island refuge

Naultinus rudis, rough gecko, Kaikōura
Threatened – Nationally Endangered.

Unmanaged Nationally Endangered

- Unmanaged **NE**:
  - ***Naultinus rudis***, rough gecko - - concerns about wasps ☒
  - ***Mokopirirakau galaxias***, Hura te ao gecko – existing tools possible ☒
  - ***Oligosoma auroraense***, Hawke's Bay skink –mouse-free fence within Cape Sanctuary. Also discovered on Portland Island and in Wahiawa ☑
  - ***O. burganae***, Burgan skink – more widespread than thought so will be delisted ☒
  - ***O. elium***, South Malborough spotted skink – existing tools worth trying ☒
  - ***O. judgei***, Barrier skink - options do exist on Cheviot faces existing tools, Awakopaka site benefits. More pops discovered, may be downlisted ☒
  - ***O. levidensum***, Slight skink – very worth trying existing tools, Mutuopao Island popn, but poorly known ☒
  - ***O. taumakae***, Taumaka skink – weka eradication ☒
  - ***M.* "Open Bay Islands"** Open Bay Islands gecko - weka erad. ☒
  - ***O. whitakeri***, Whitaker's skink - requires greater security, probably through translocation ☑
  - ***Tukutuku rakiurae***, harlequin gecko - lacking data on trend. Ground based or aerial rodent control and cat control very worth attempting ☒
  - ***O.* aff. *waimatense* "Marlborough"** Malborough scree skink – existing tools worth trying ☒
- 12 of 16 NE not adequately managed or managed at all (75% unmanaged)
- 16 species out of 26 high need species (NC/NE) unmanaged.
- A big concern is threatened species without island refuges

4 unmanaged of 10 NC so 40% unmanaged

☑= managed ☑=some management ☒=unmanaged =mouse risk =climate risk =wasp risk = no secure island refuge

- 7 NC/NE species remain unmanaged despite existing tools. Why?

1. Insufficient biodiversity management funds
2. Limited of operational management capacity in DOC
3. Limited of skills and capability esp to monitor responses
4. DOC unlikely to work on less threatened spp.

Oligosoma otagense, Otago skink, Macraes. Nationally Endangered

Sanctuaries to the rescue

- For species with no island refuges
- Provide secure populations of less threatened species
- Increase awareness of lizard values
- Collaborate to improve understanding of management responses

Sanctuary examples

- COET 14ha exclosure
  - Reintroduction of 4 threatened lizards
  - Vital habitat restoration
  - Mice suppressed to undetectable levels
  - Strong fauna recovery
- Mahakirau Forest estate
  - ~600ha private forest
  - Landowner driven
  - Exceptional pest suppression
  - 75m rodent grid – currently no mice or rats!

Mahakirau
forest estate

Mice

Impacts – this problem is old news

- Newman (1994) illustrated a strong response in skinks from the removal of mice from Mana Island in 1989, Pickard (1984) 20-25% of diet being lizards

- Mouse diet studies confirm omnivory and predation (in Bridgman 2012, Wedding thesis)

- Norbury et al. (2014) observed daylight predation on >25cm skinks and a decline in survival from 44%pa to 15%pa following a mouse incursion with density of >63 mice/ha

- Maungatautari study (Watts et al. 2022) showed invert biomass, diversity and body size halved by presence of mice

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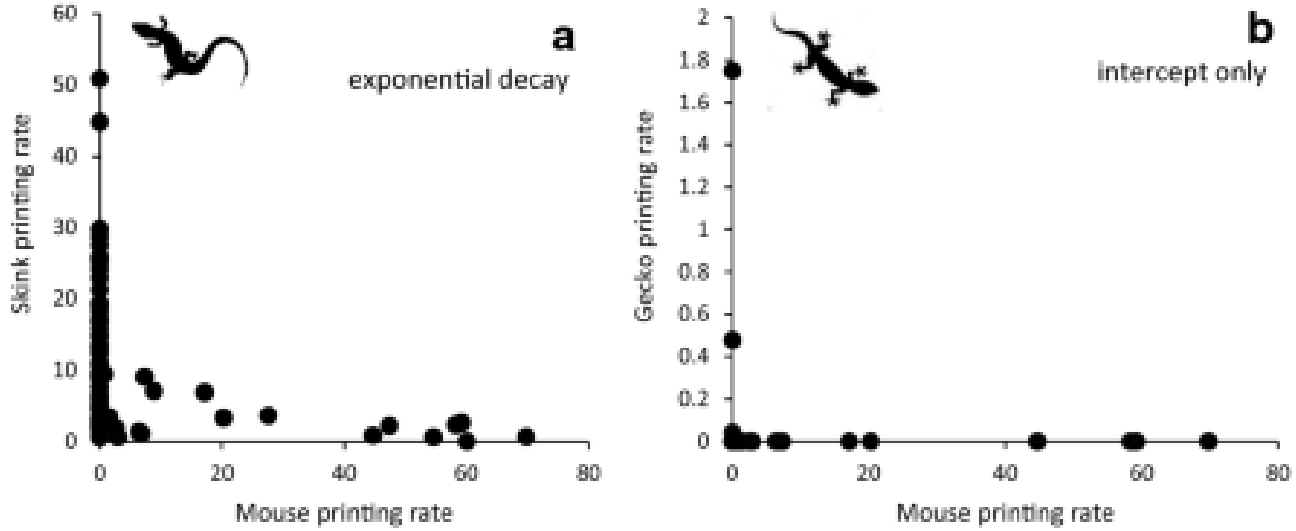
- Norbury et al. (2023) density impact function



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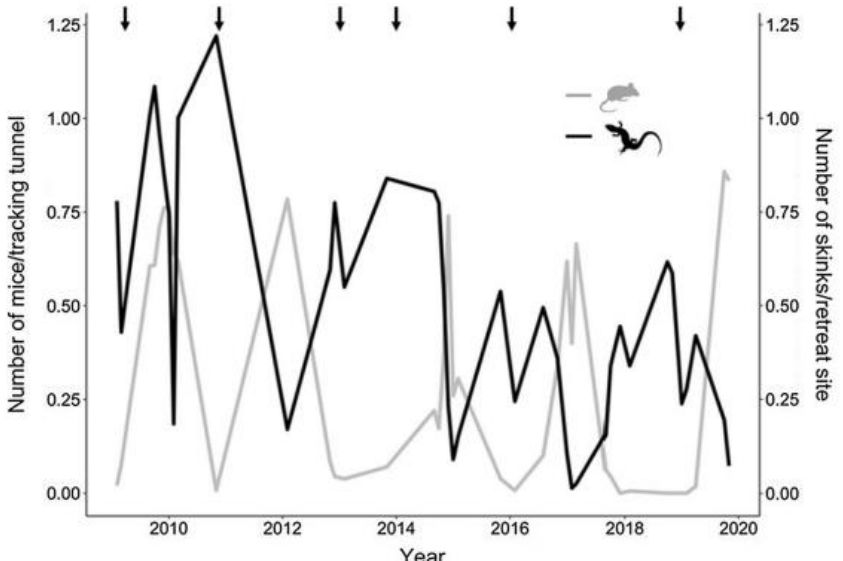
- Maungatautari study (Wilson et al. 2018) showed invert biomass, diversity and body size halved by presence of mice
- Norbury et al. (2023) density impact functions
- Monks et al. (2023) mesopredator release of mice
  - A problem common to fenced sanctuaries

Landscape scale control of selected mammalian predators fails to protect lizards

Fig. 2 Relative abundance of mice (grey line; number of tunnels on which mice were detected per tracking tunnel per line, averaged by month) and relative abundance of skinks (black line; number of skinks per artificial retreat, averaged by month) from 2009 to 2020 in the Eglinton Valley. The arrows represent mast years defined as years in which silver, mountain and red beech trees produced more than 500 seeds/m^2




Bushnell
M 26
© Te Korowai o Waiheke
57°F 13°C
06-28-2022 20:09:40

Oligosoma otagense, Otago skink, Macraes. Nationally Endangered

Antarctic Science page 1 of 11 *(2015)* © Antarctic Science Ltd 2015 doi:10.1017/S0954102015000279

Effects of mouse predation on burrowing petrel chicks at Gough Island

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[2]RSPB Centre for Conservation Science, Royal Society for the Protection of Birds, The Lodge, Sandy SG19 2DL, UK

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Tukutuku rakiurae, harlequin gecko, Rakiura. Nationally Endangered

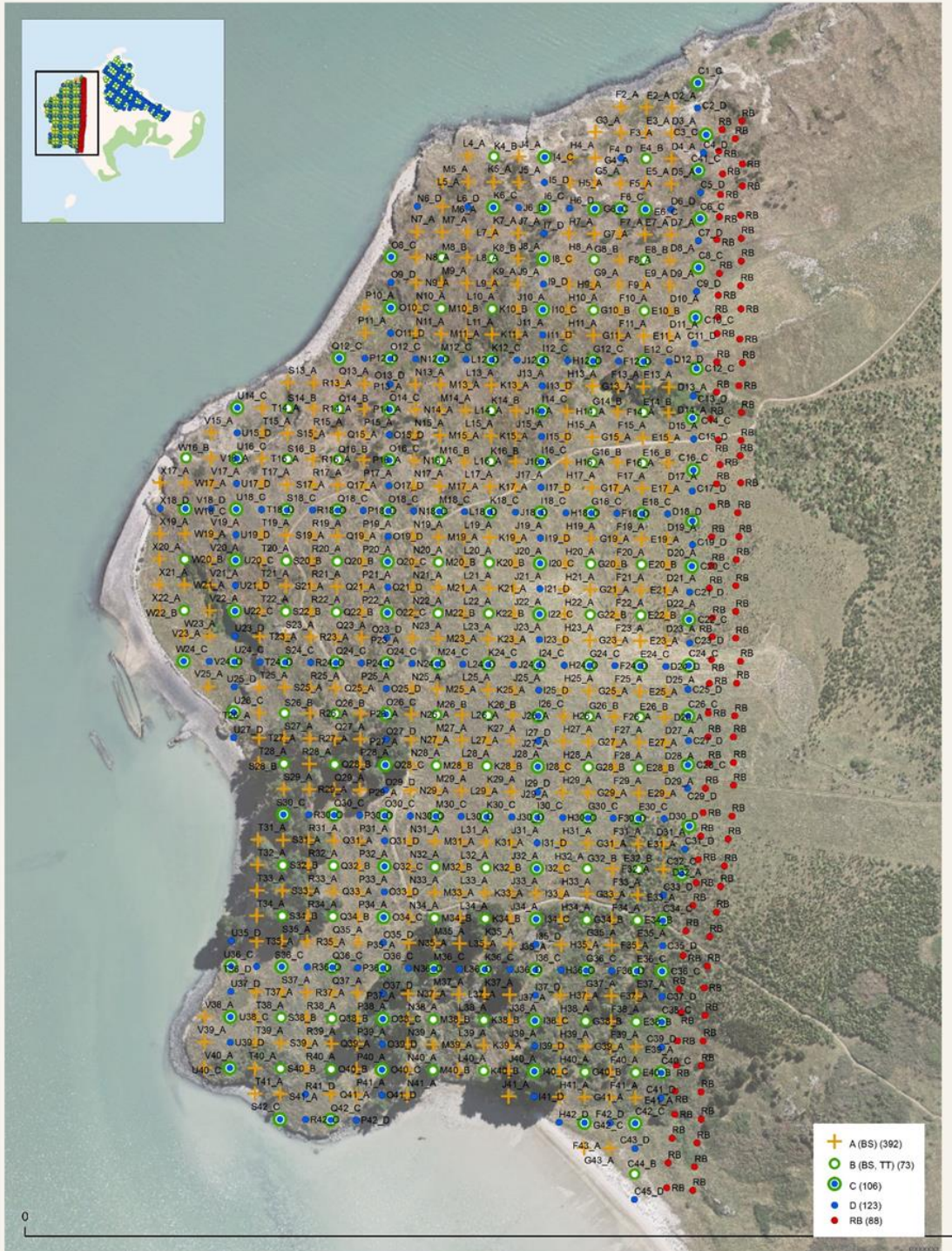
Otamahua study questions

1. Can feracol (cholecalciferol) sustainably suppress mice to below 5% tracking?

2. Is baiting regime sufficient in placement, volume and frequency?

3. What is the mouse density of 5% tracking?

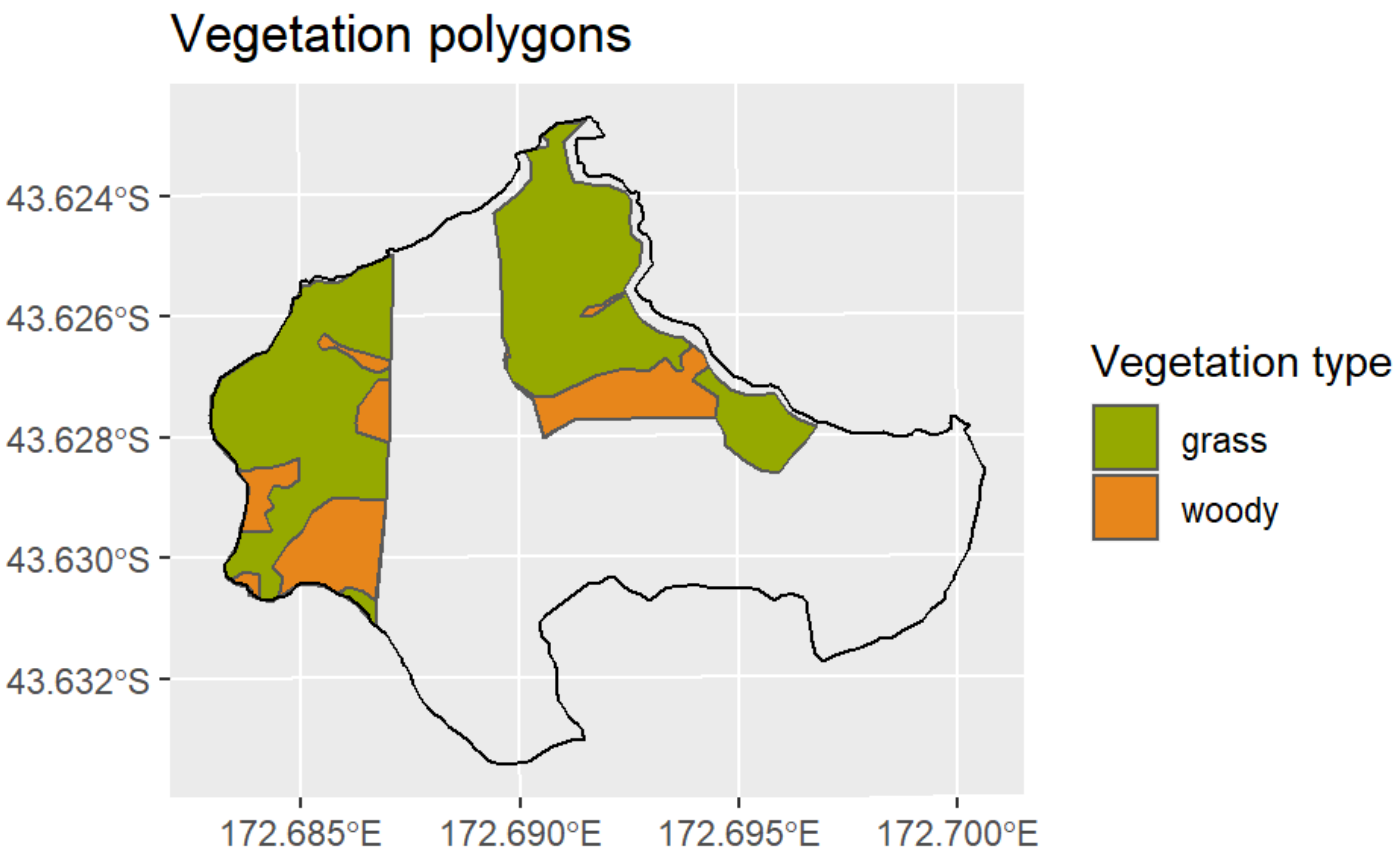
4. Are tracking tunnels a good index of mouse density?

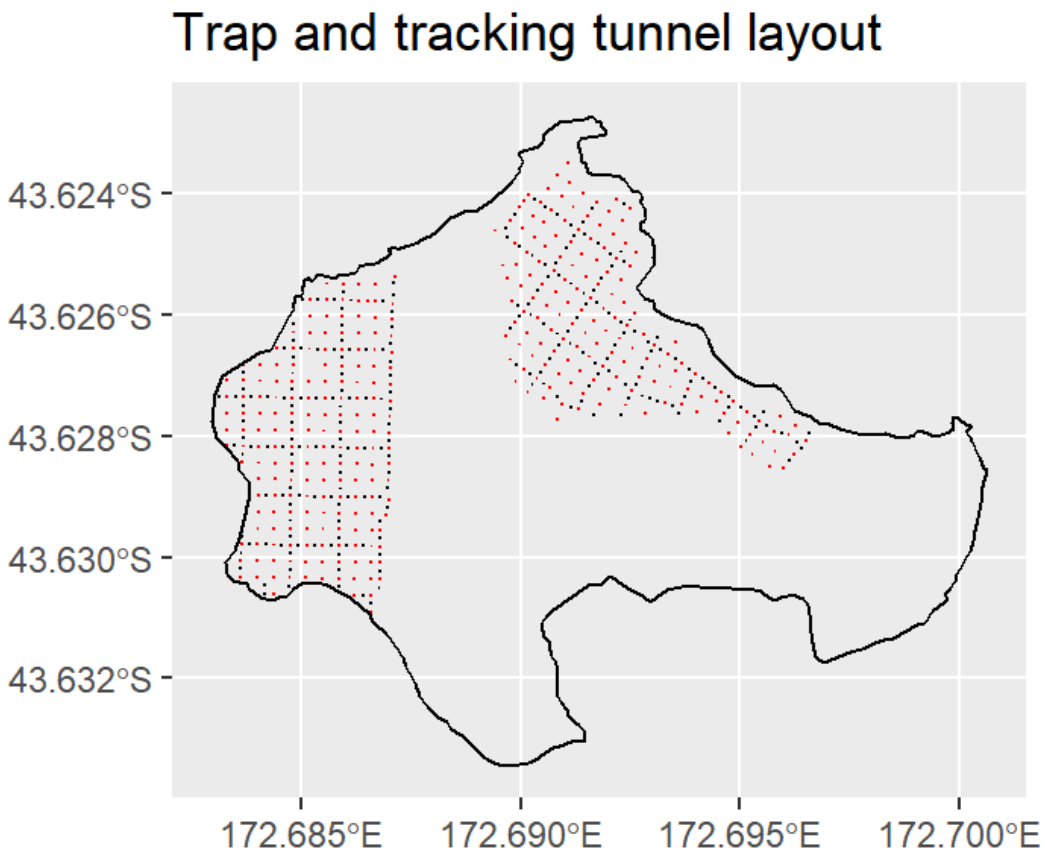

A (BS) (392)
B (BS, TT) (73)
C (106)
D (123)
RB (88)
0

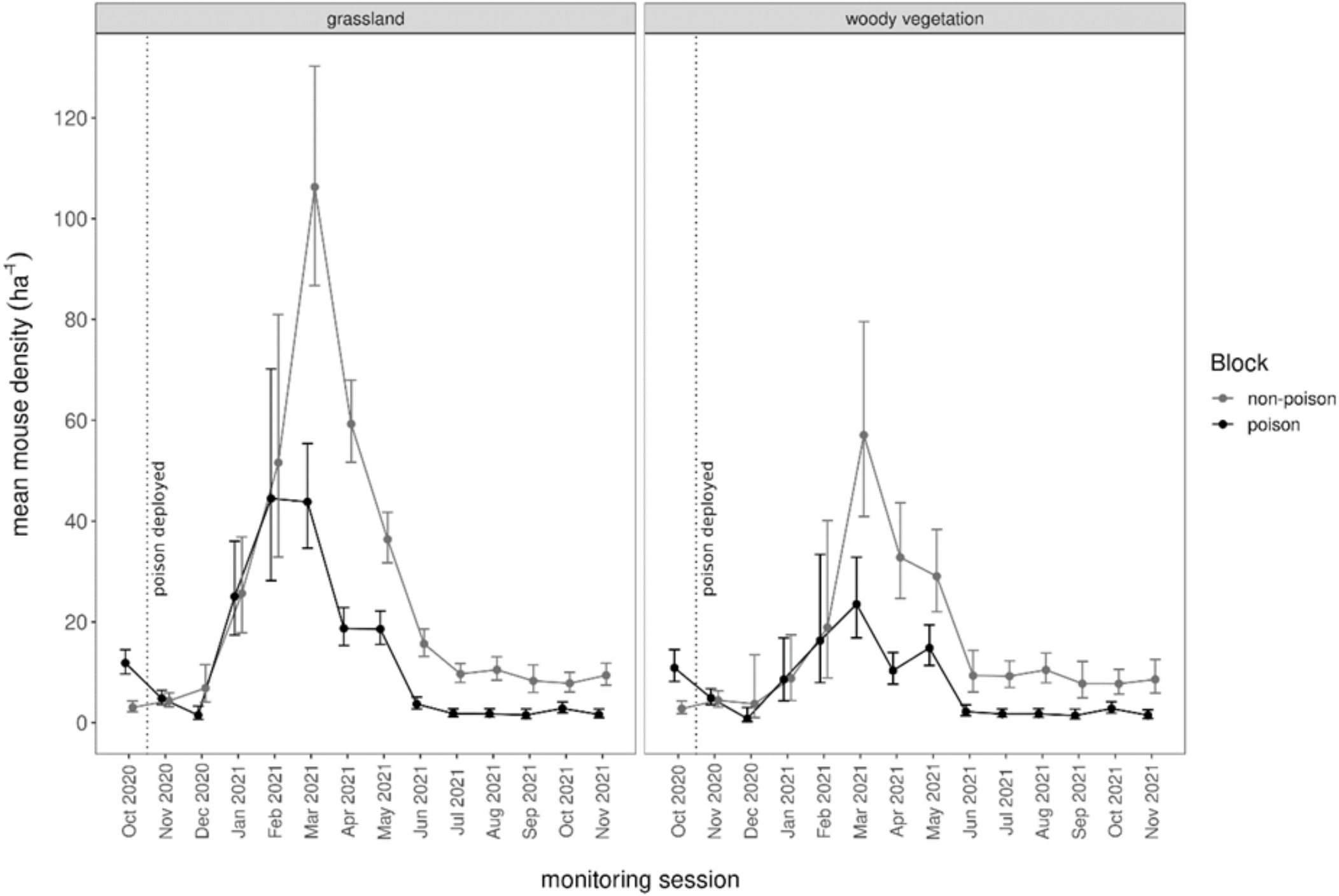

E (TT, LT) (61)
F (LT) (124)
G (TT) (71)
0

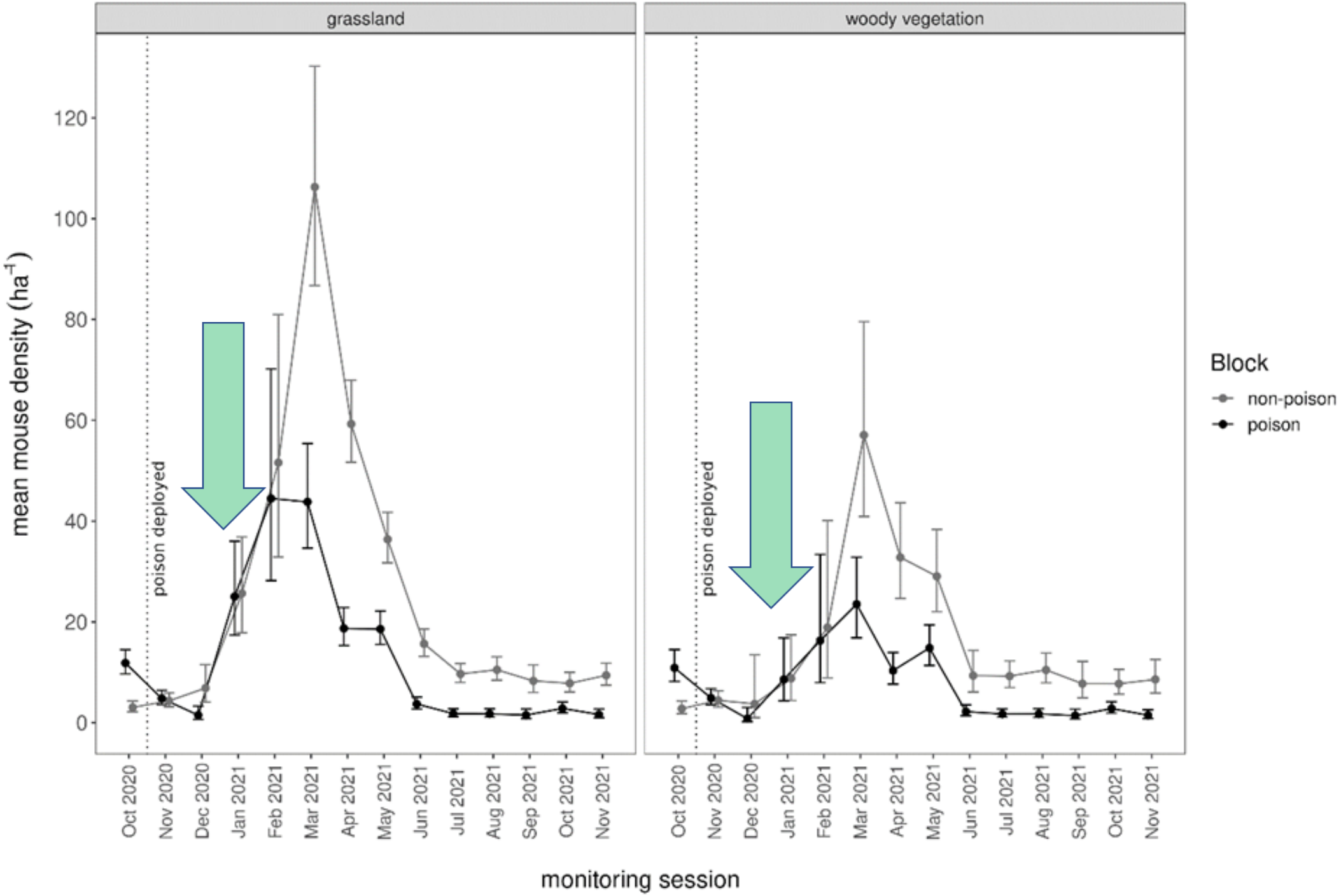

0035

Spatially explicit analysis

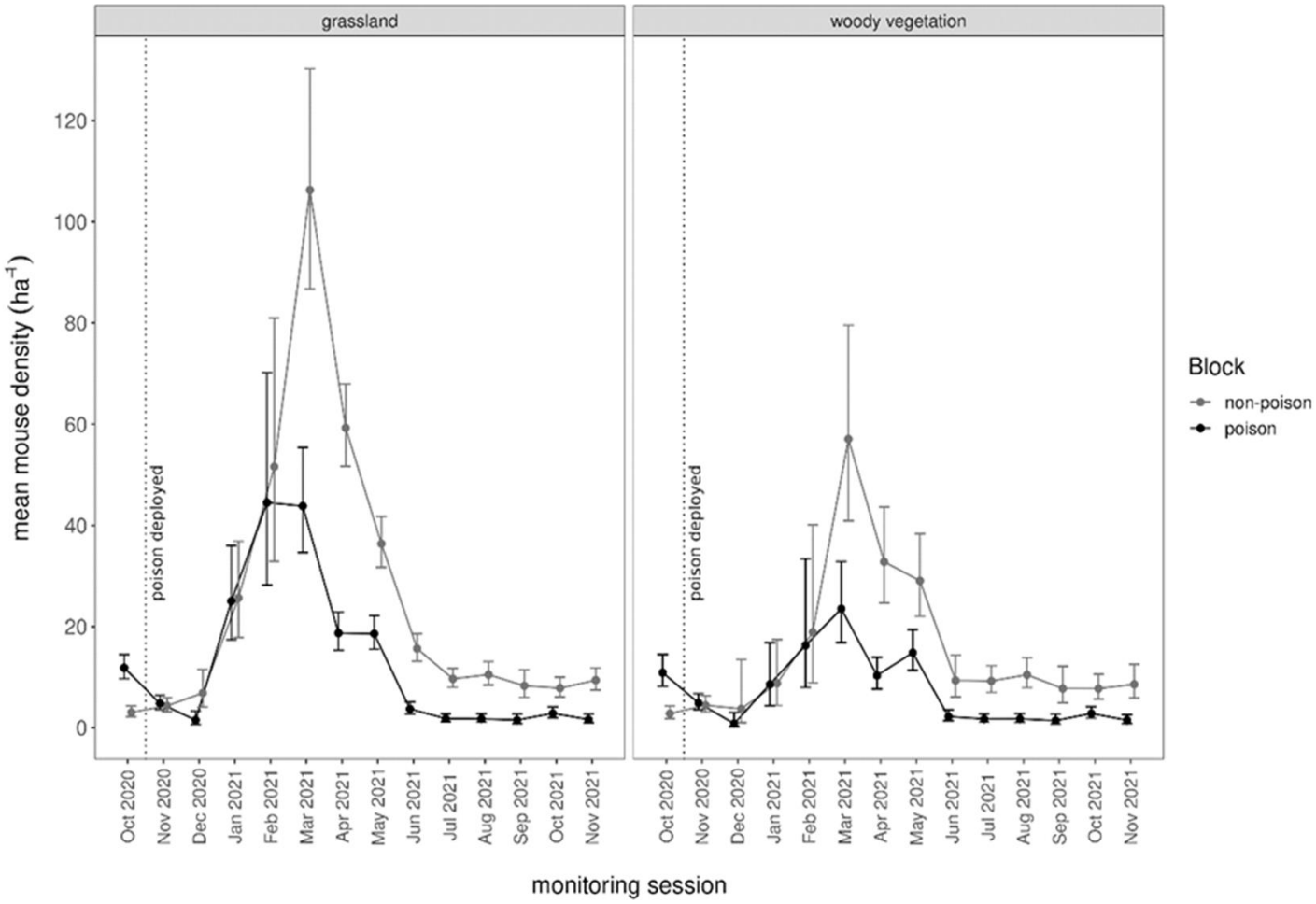


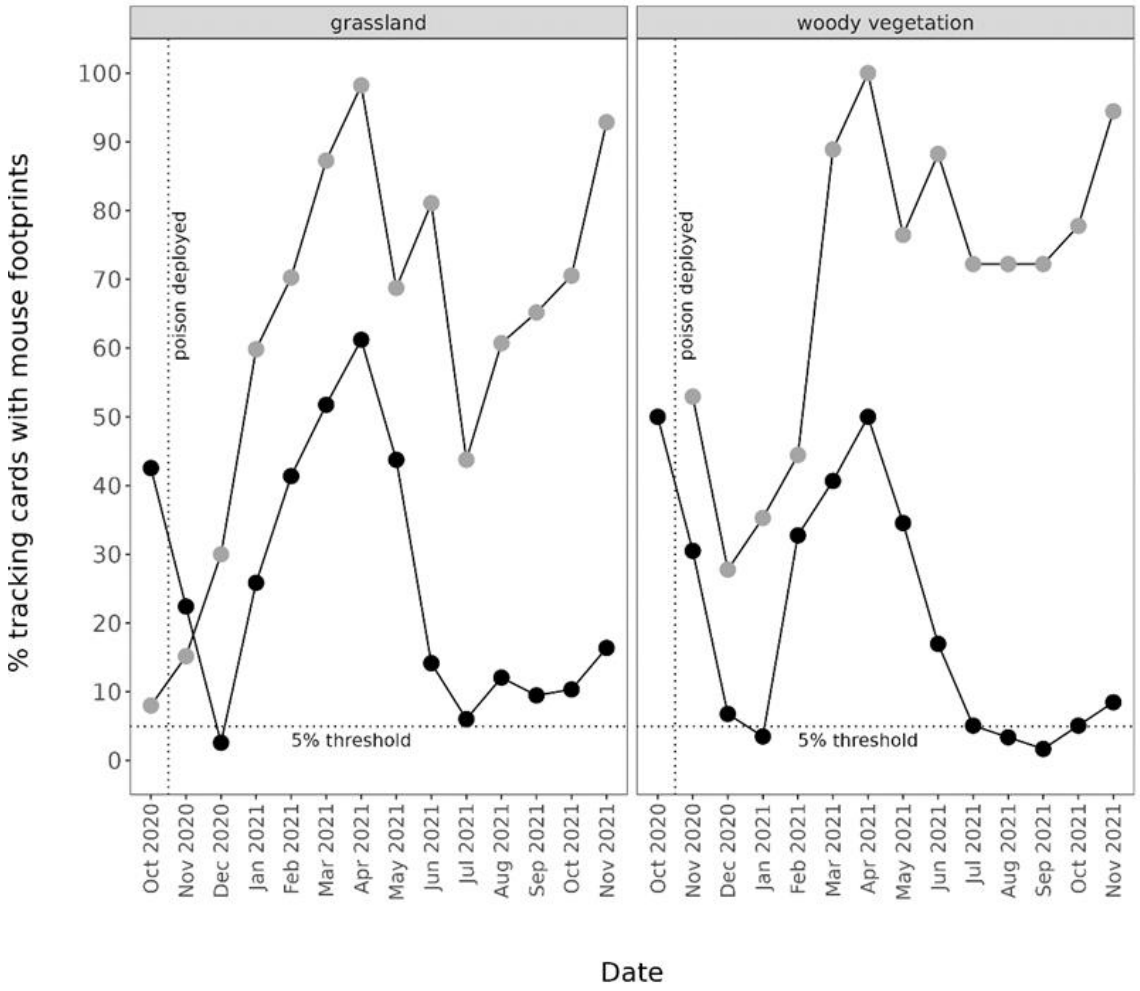


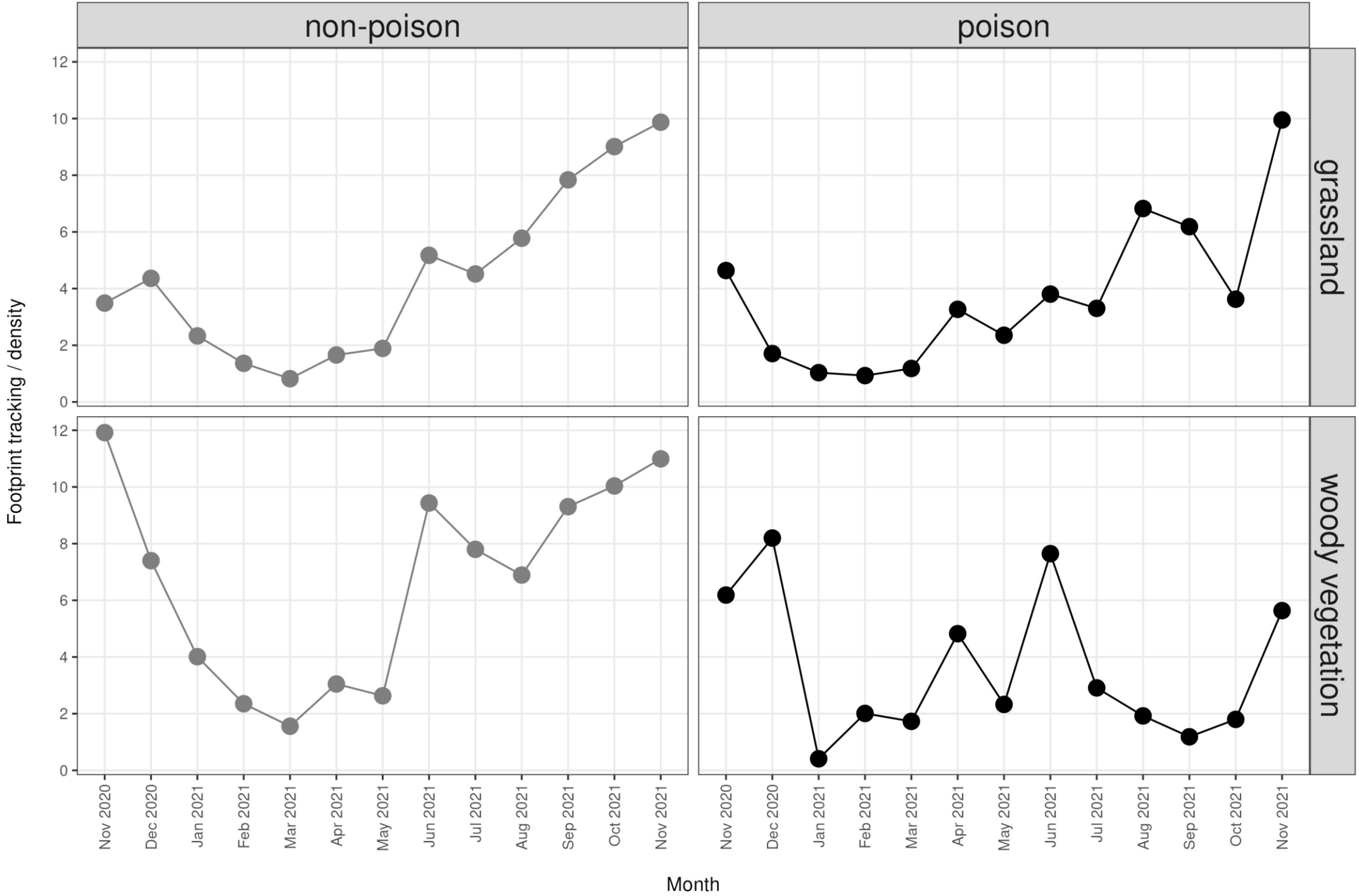

grassland
woody vegetation
poison deployed
poison deployed
mean mouse density (ha^{-1})
0
20
40
60
80
100
120
Oct 2020
Nov 2020
Dec 2020
Jan 2021
Feb 2021
Mar 2021
Apr 2021
May 2021
Jun 2021
Jul 2021
Aug 2021
Sep 2021
Oct 2021
Nov 2021
monitoring session
Block
non-poison
poison


grassland
woody vegetation
poison deployed
poison deployed
mean mouse density (ha^{-1})
0
20
40
60
80
100
120
Oct 2020
Nov 2020
Dec 2020
Jan 2021
Feb 2021
Mar 2021
Apr 2021
May 2021
Jun 2021
Jul 2021
Aug 2021
Sep 2021
Oct 2021
Nov 2021
monitoring session
Block
non-poison
poison

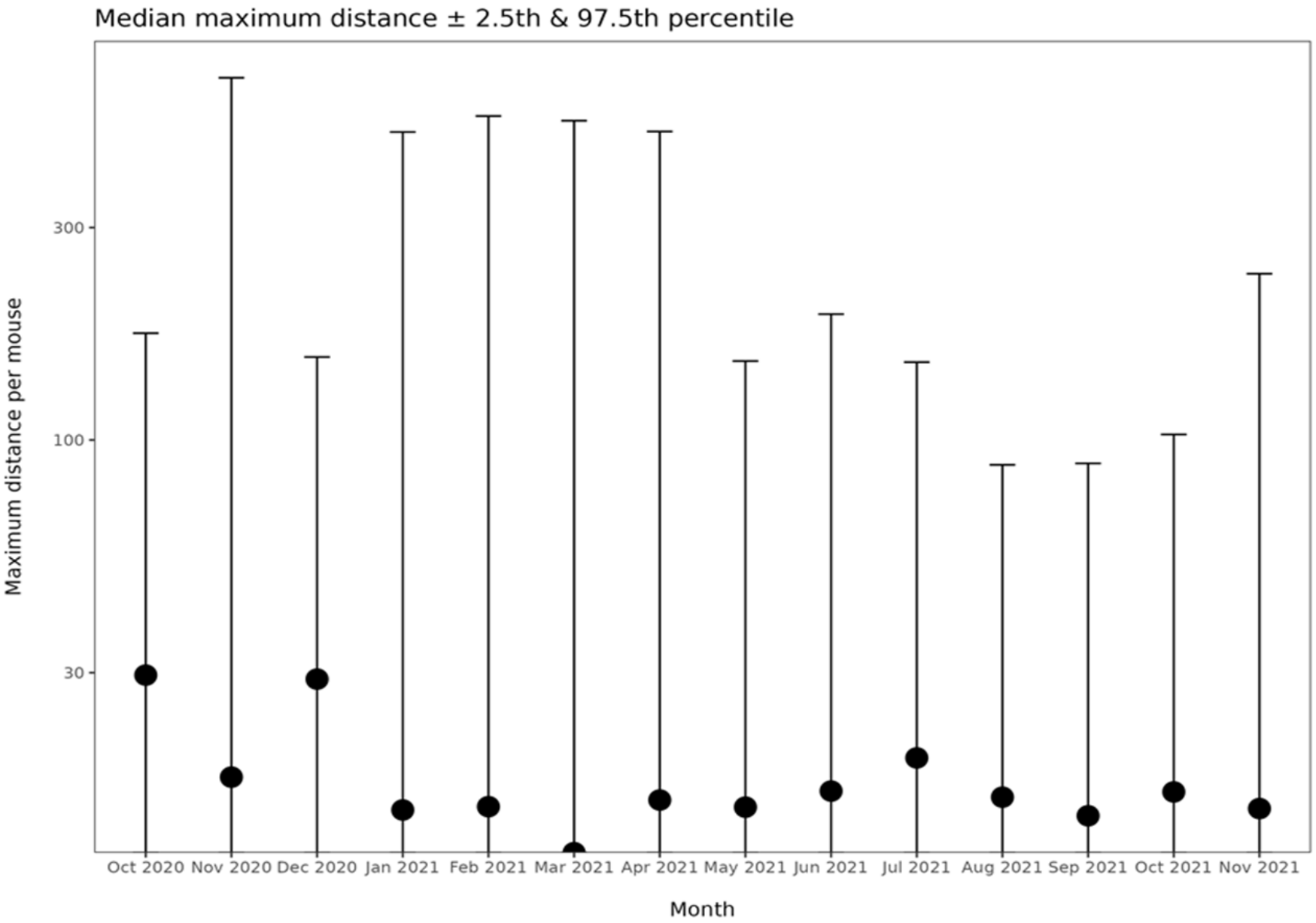
Density estimates vs tracking indices





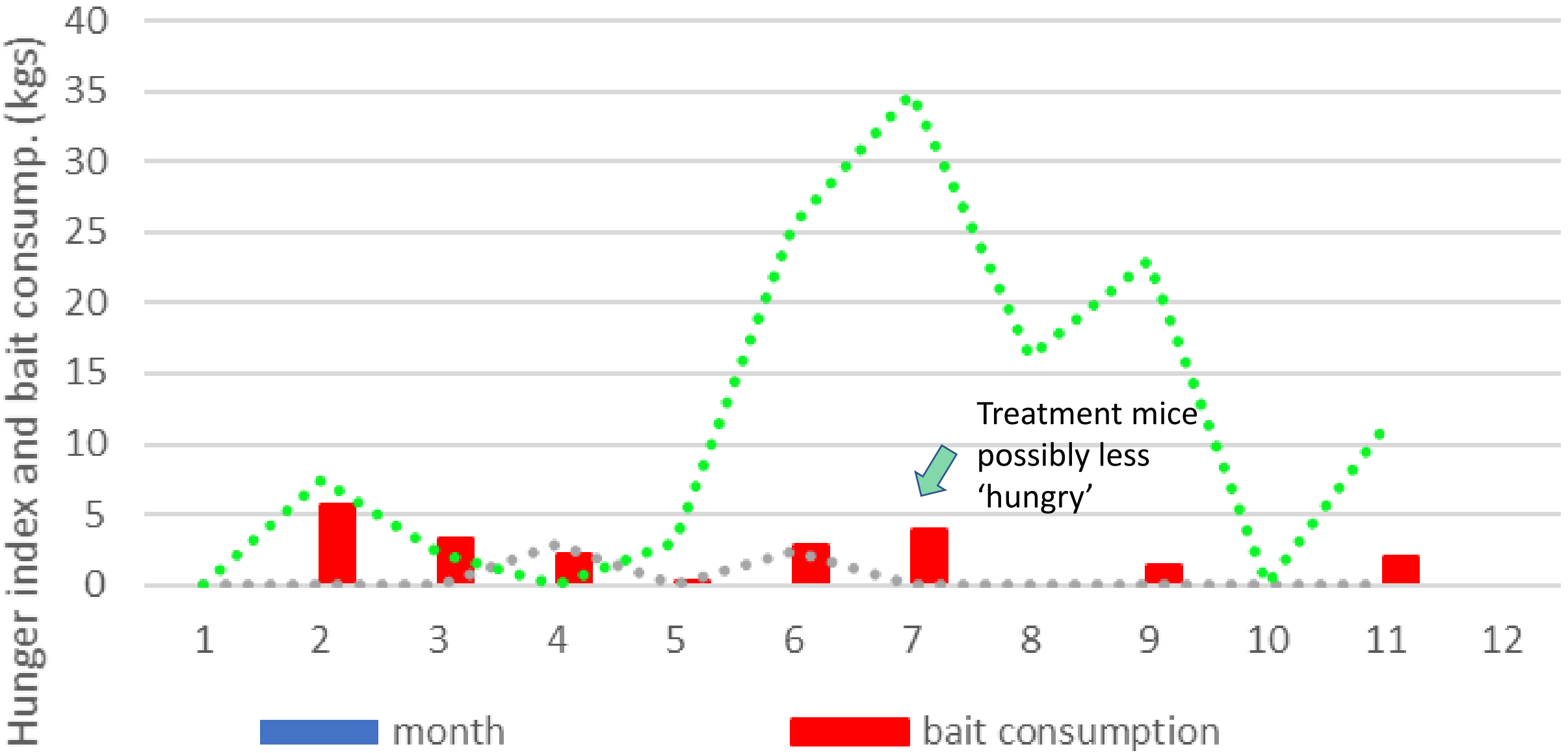

non-poison
poison
grassland
woody vegetation
Footprint tracking / density
0
2
4
6
8
10
12
Nov 2020
Dec 2020
Jan 2021
Feb 2021
Mar 2021
Apr 2021
May 2021
Jun 2021
Jul 2021
Aug 2021
Sep 2021
Oct 2021
Nov 2021
Month

Mouse movements



- Interpret with caution

Mouse resource limitation?



Questions

1. Can feracol sustainably suppress ice to below 5% tracking?
   - **No**
2. Is baiting regime sufficient in volume and frequency?
   - **Yes**
3. What is the mouse density of 5% tracking?
   - <2 mice per ha but tracking tunnels not linear
4. Are tracking tunnels a good index of mouse density?
   - Depends on what you need to know. OK for a 5% threshold.

New questions raised

1. Mouse impact ecology – function of abundance or prey switching?

2. Efficacy of persistent provisioning of brodifacoum

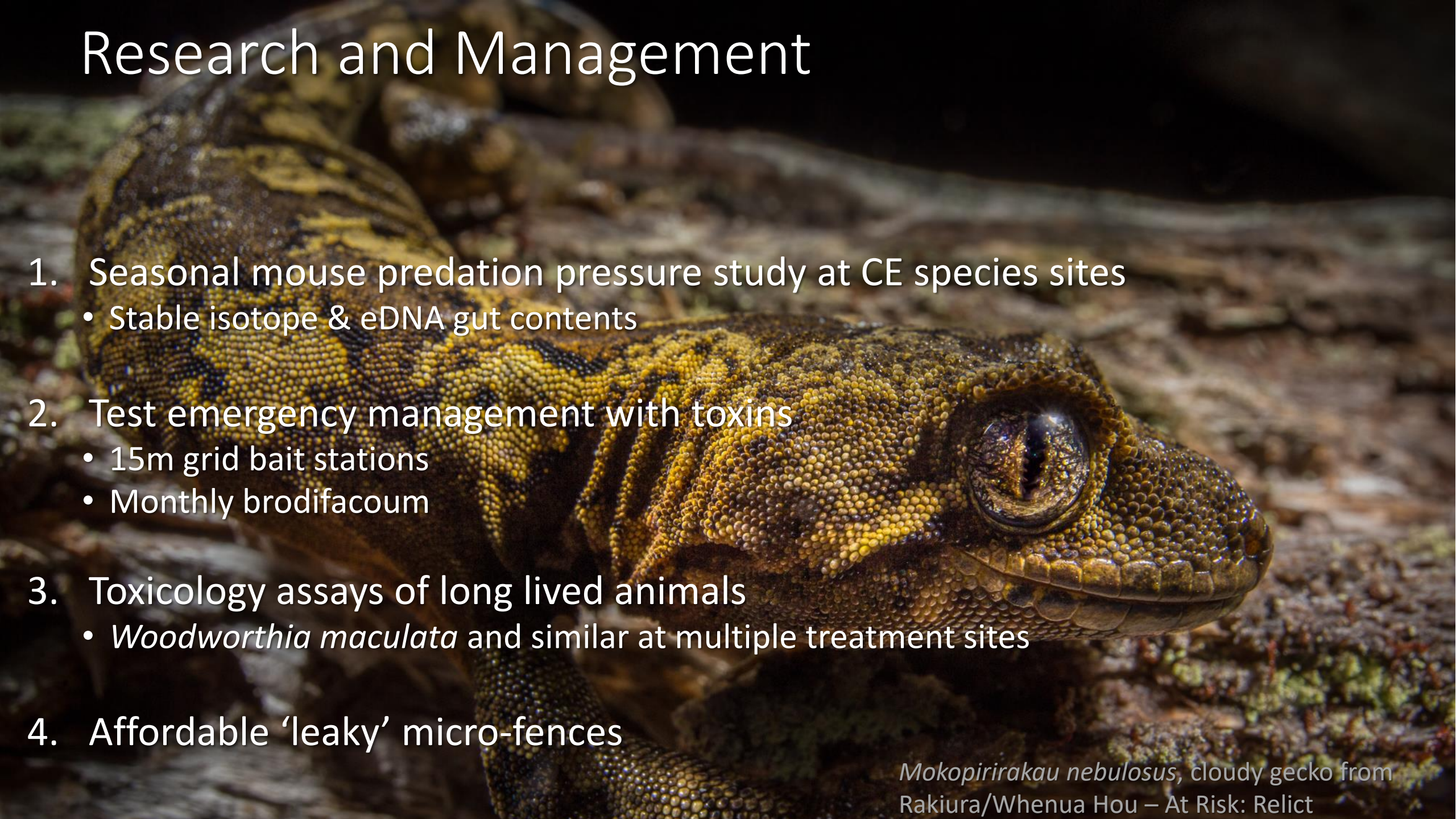
3. The bioaccumulation issue and best practice

4. Short-medium term mitigation of mice

Oligosoma inconspicuum 'mahogany', mahogany skink, Sinbad Gully. At Risk - Declining

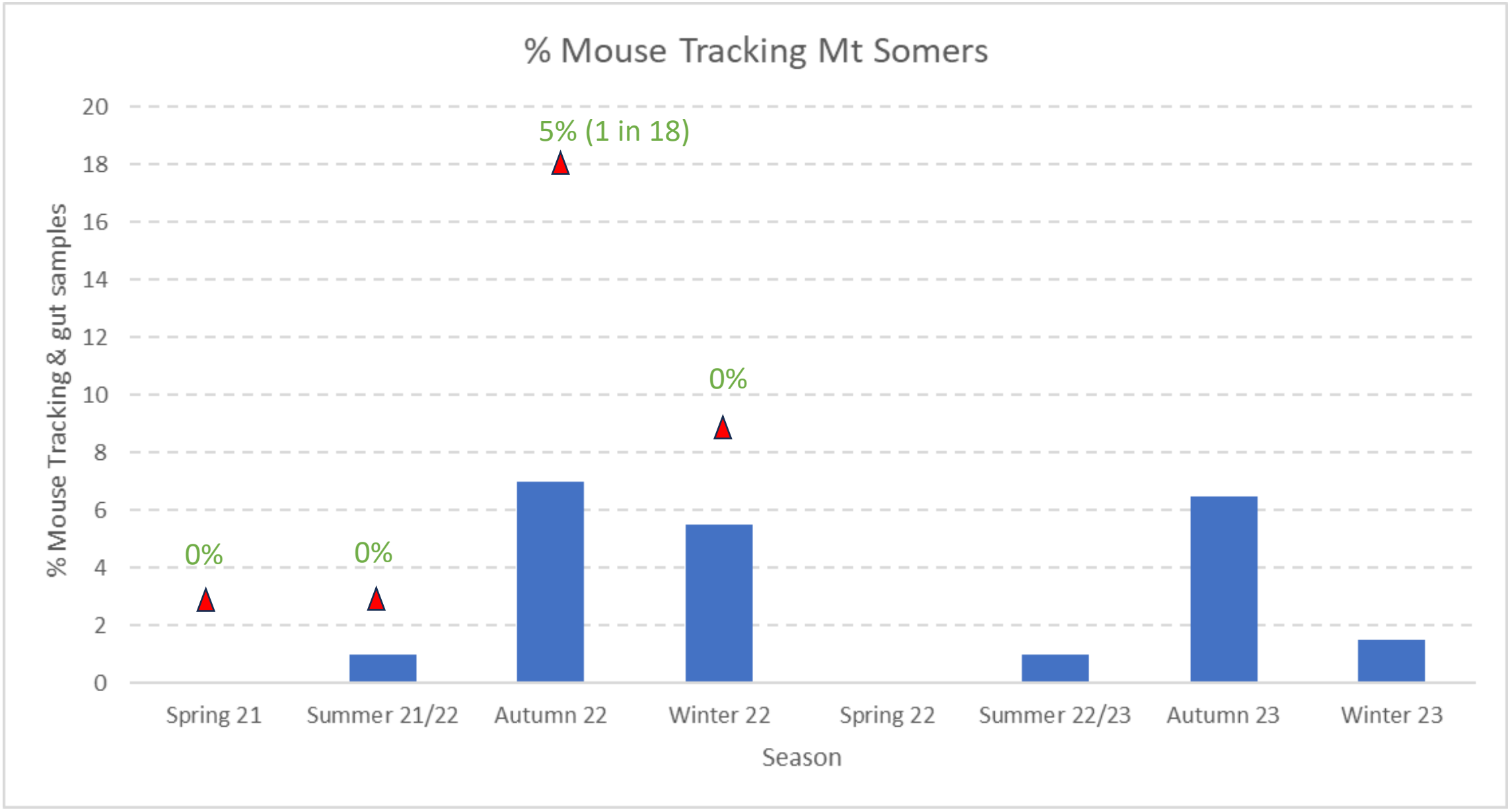
Research and Management

1. Seasonal mouse predation pressure study at CE species sites
   - Stable isotope & eDNA gut contents
2. Test emergency management with toxins
   - 15m grid bait stations
   - Monthly brodifacoum
3. Toxicology assays of long lived animals
   - *Woodworthia maculata* and similar at multiple treatment sites
4. Affordable ‘leaky’ micro-fences

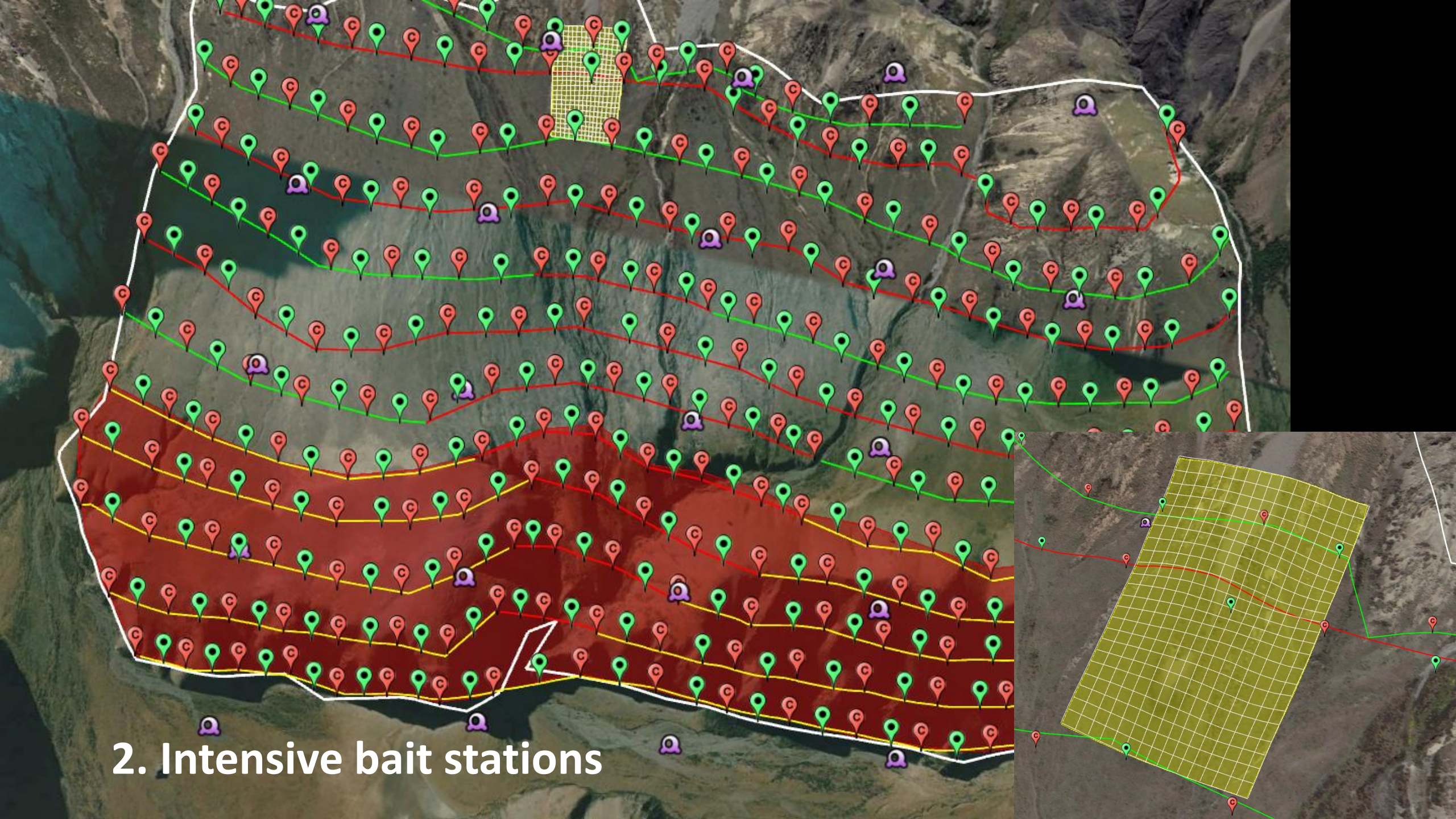


Mokopirirakau nebulosus, cloudy gecko from Rakiura/Whenua Hou – At Risk: Relict

Oligosoma hoparatea, white bellied skink, Mt. Somers Range. Nationally Critical



▲ = gut samples from 1600 trap nights per season, N% = percentage with lizards



2. Intensive bait stations

Lizard friendly snap trap

- >6,000 trap nights before killing skink
- Can reduce mice to undetectable levels when productivity low
- Needs NAWAC and comparison with timber IB standards

Learnings and management progress

- At Mt Somers, lizards not significant in diet when mice not abundant
- Mice may not be a threat when not eruptive in some ecosystems
- Elevated snap traps don’t kill lizards
- Mouse grids for white bellied skink and Awakopaka being deployed

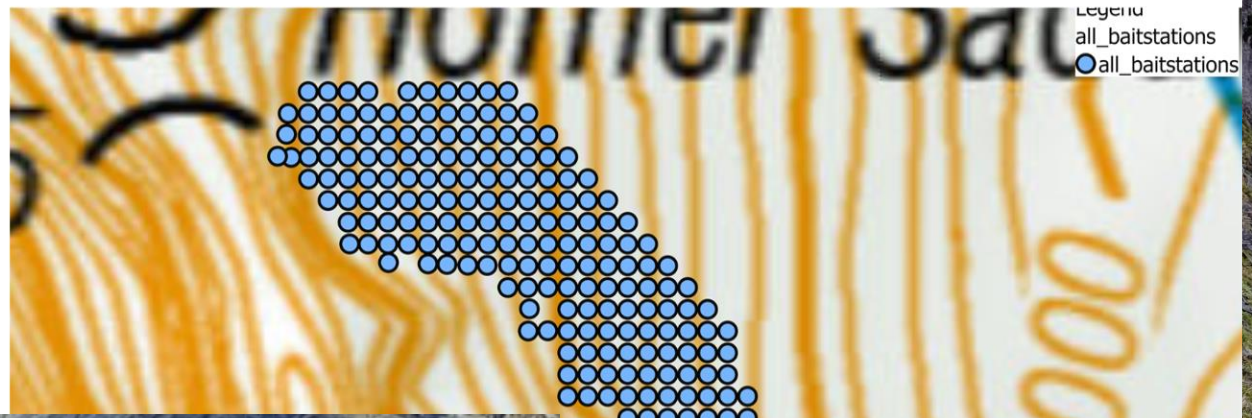
Awakopaka skink protection at Homer Cirque

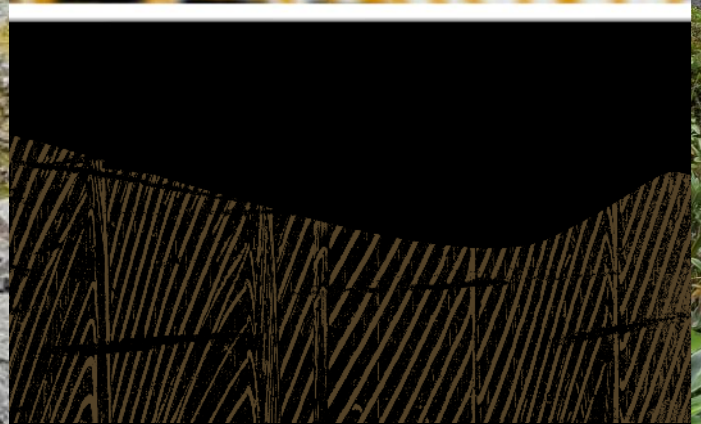
- SPECIES ON THE BRINK FUNDING

Oligosoma awakopaka,
Fiordland.
Nationally Critical


94
94
94
10 km

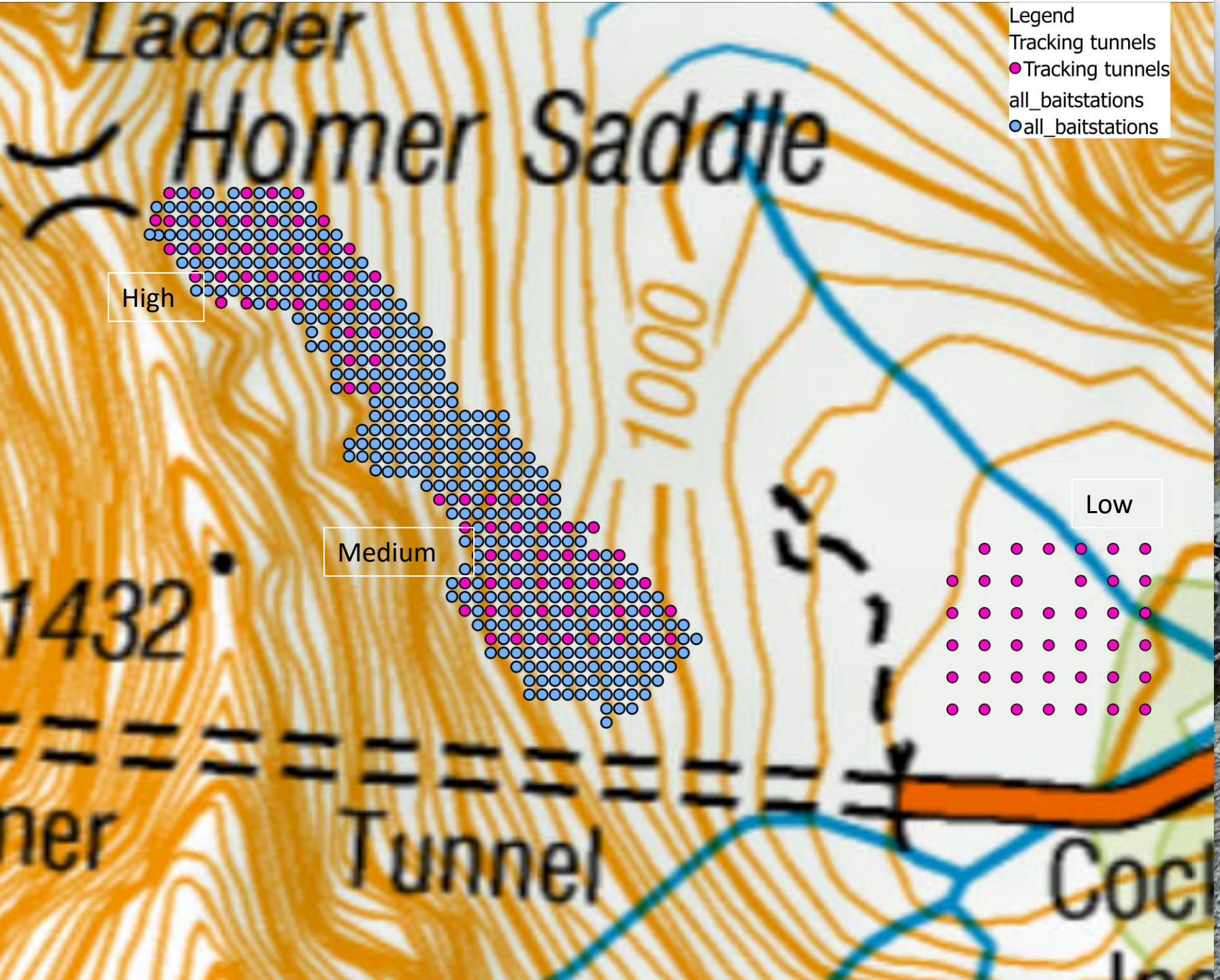
RTK GPS system





Tethered 44mm AL box channel

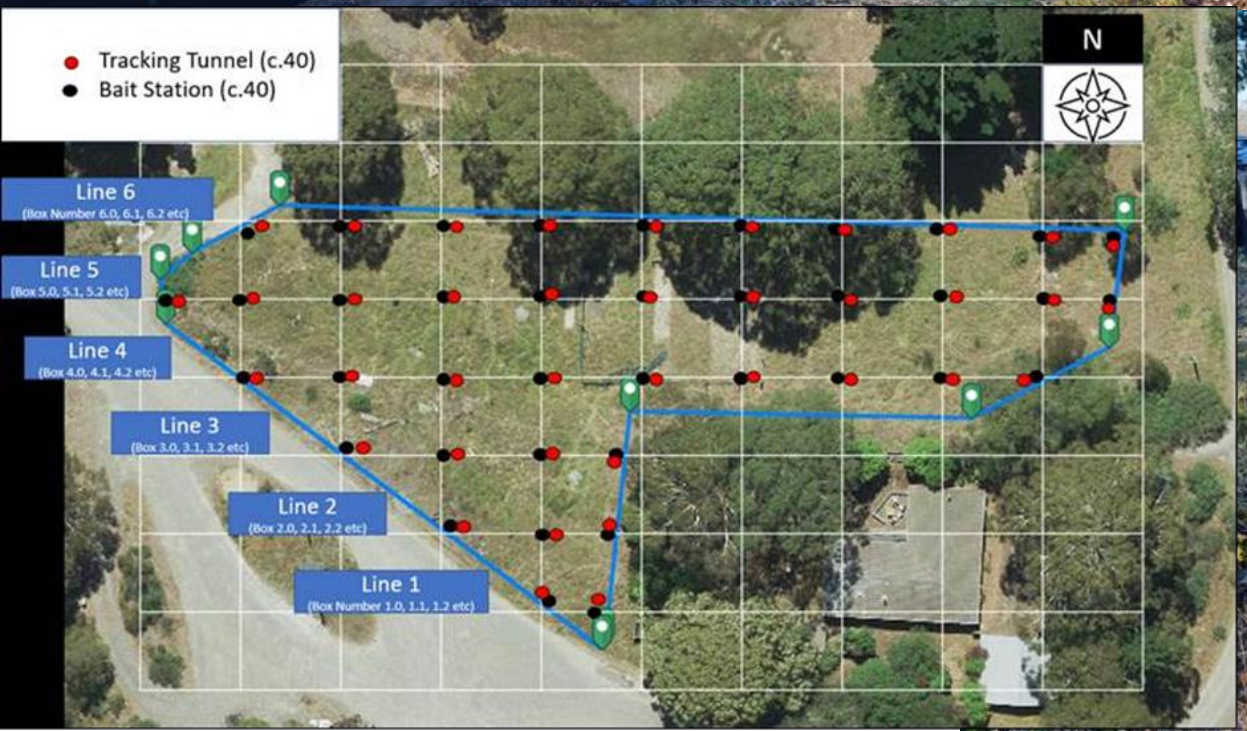

250


Ladder
Homer Saddle
Legend
Tracking tunnels
Tracking tunnels
all_baitstations
all_baitstations
High
Medium
Low
1000
1432
ner
Tunnel
Cocl

Oligosoma salmo, Kapitia skink, West Coast. Nationally Critical

Cheap mouse fences – emergency management

Oligosoma lineoocellatum, Canterbury spotted skink, Banks Peninsula. Nationally Critical


Tracking Tunnel (c.40)
Bait Station (c.40)
N
Line 6
(Box Number 6.0, 6.1, 6.2 etc)
Line 5
(Box 5.0, 5.1, 5.2 etc)
Line 4
(Box 4.0, 4.1, 4.2 etc)
Line 3
(Box 3.0, 3.1, 3.2 etc)
Line 2
(Box 2.0, 2.1, 2.2 etc)
Line 1
(Box Number 1.0, 1.1, 1.2 etc)

Mokopirirakau granulatus,
forest gecko, Whangārei.
At Risk - Declining