Eradicating the Last 5%: Catching the Uncatchable Rogue

Presented by Graham Hickling and Patrick Garvey

Manaaki Whenua – Landcare Research

The impacts of large populations of introduced mammalian predators in NZ and Australia are widely recognized

Abundant food

+

Lack of natural enemies and diseases

⇩

Focus has been on large-area control methods capable of removing most predators

However, some individual predators also have outsized impacts

North Head, Australia – 2015

- a single fox killed 26 little penguins in two weeks (nearly 20% of the local penguin population)

https://www.dailytelegraph.com.au/newslocal/northern-beaches/

Individual predators can have outsized impacts

Stephen's Island / Takapourewa, NZ – 1894

The Lighthouse keeper's cat ("possibly named Tibbles") and her offspring drove the endemic Stephens' Island wren to extinction

Galbreath and Brown, Notornis 2004

Individual predators can have outsized impacts

- A male cat killed 102 short-tailed bats at Rangataua Forest, Ruapehu

  Scrimgeour et al., NZ J. Zool. 2012

- A female German shepherd killed an estimated 500 kiwi in Waitangi forest

  Taborsky, Notornis 1988

- A single rat was suspected of killing >80% of NZ shore plover on Mana Island in 2007 and on Waikawa Island in 2012

  https://www.doc.govt.nz/nature/native-animals/birds/birds-a-z/shore-plover/

The individuals that cause the most damage can also be the most difficult to control

- Noises Islands 2004: a lone rat avoided detection for 18 weeks before being captured in a trap baited with penguin meat

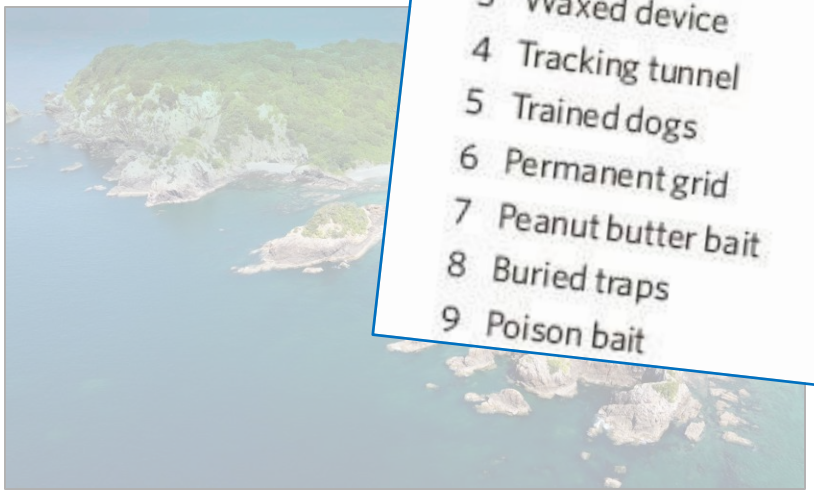
Russell et al. 2005, *Nature*

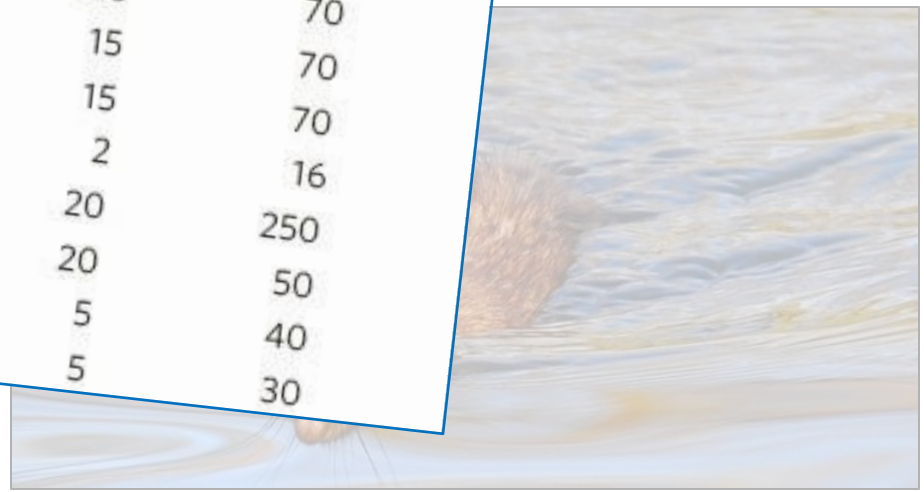
The individuals that cause the most damage can also be the most diffic

- Noises Islan 8 weeks
  months bef enguin meat

Table 1 | Attempts to detect and eliminate a rat

	Method	Number	Exposure (h)
1	Live trap	30	10
2	Snap trap	20	70
3	Waxed device	15	70
4	Tracking tunnel	15	70
5	Trained dogs	2	16
6	Permanent grid	20	250
7	Peanut butter bait	20	50
8	Buried traps	5	40
9	Poison bait	5	30





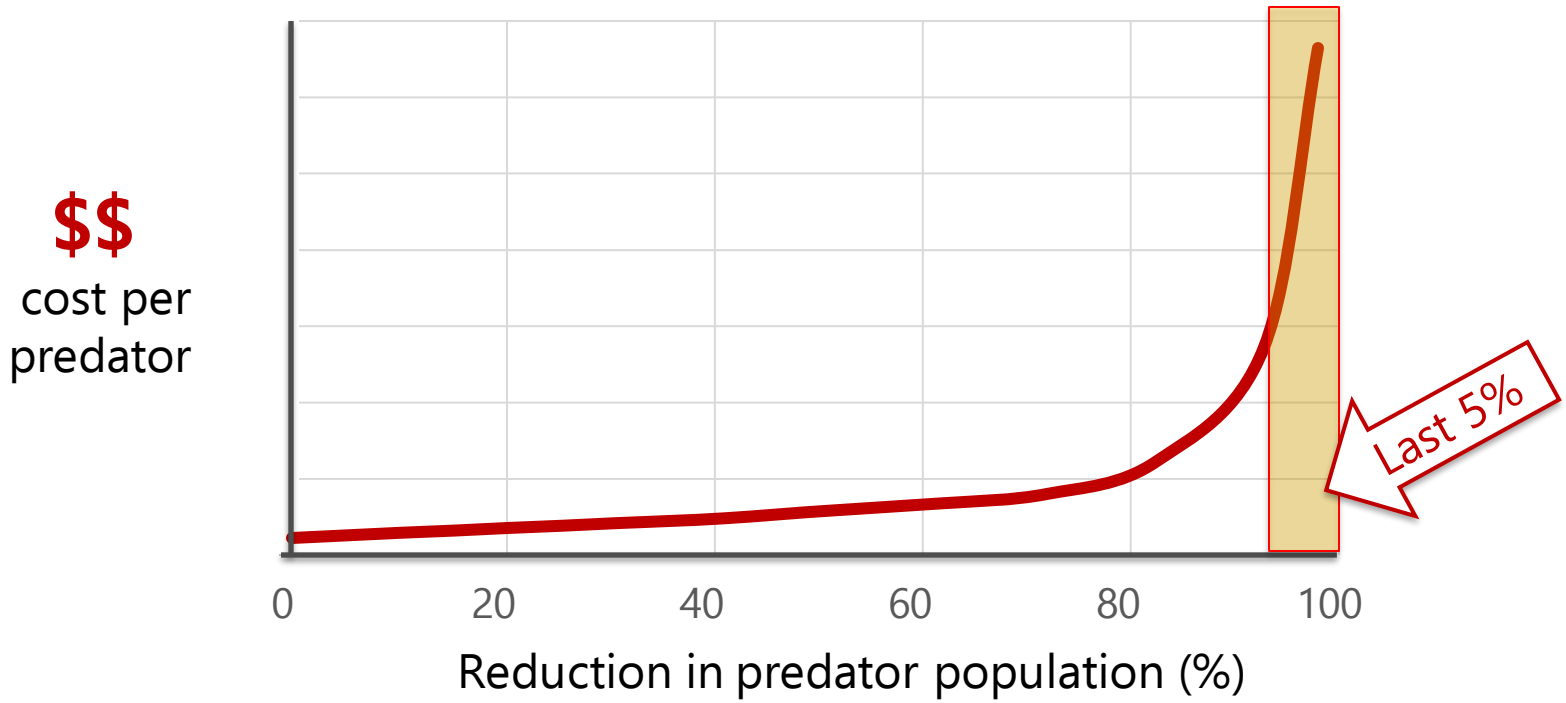
Russell et al. 2005, *Nature*

The individuals that cause the most damage can also be the most difficult to control

- In 2015, a stoat penetrated ‘mammal-proof’ Orokonui Ecosanctuary, Otago Peninsula
- Eliminated the local population of Saddlebacks
- 12 months of effort to capture that single stoat

https://www.odt.co.nz/news/dunedin/stoats-killed-orokonui-ecosanctuary

The individuals that cause the most damage can also be the most difficult to control



Amos et al. 2016, *R Soc open sci*

MWLR's Eradication Science (ES) Programme

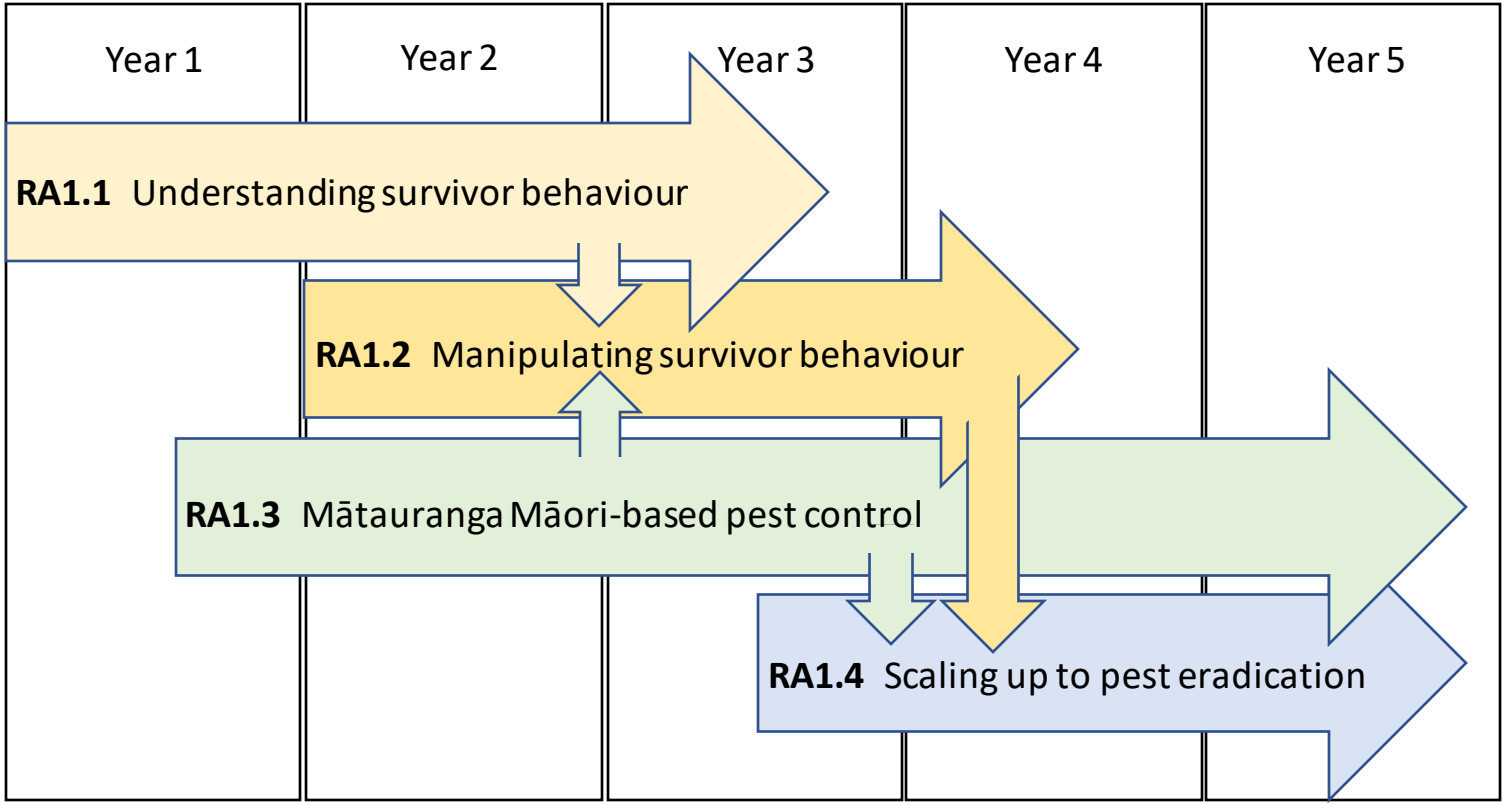
5-year MBIE-funded research effort, running from Oct 2019 through Sept 2024.

Key questions:

- What behavioural characteristics contribute to some individuals surviving control?
- How can we use novel combinations of cues to overcome these survival behaviours?

Three target species:

Research design: four interconnected Research Aims (RAs)



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Research Aim 1.1
Understanding survivor behaviour

RA 1.1 – Understanding survivor behaviour

Question – *What behavioural characteristics contribute to some individuals surviving control?*

Control methods – Trapping, Toxic baiting

Central Hypotheses: Individuals survive due to:

1. **Behavioural traits ('personalities')**
2. **Fear** of control tools e.g. avoids 'scary' trap
3. **Learned** e.g. sub-lethal

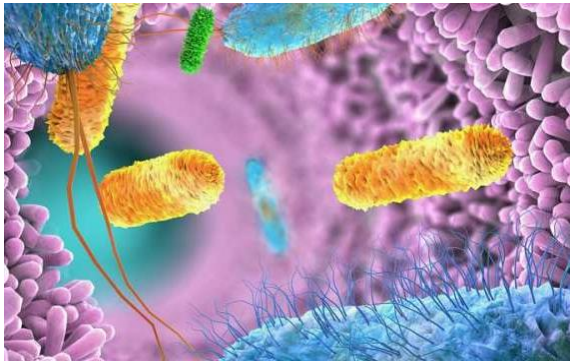
Additional hypotheses:

1. **Intrinsic differences** e.g. age, sex, condition, etc
2. **Dietary preference/ microbiome**
3. **Genetic** resistance to toxins (1080 control)
4. **Random subset** of a population (Null hypothesis)

Progress on RA1.1: Multiple factors could affect survivorship

Intrinsic

Diet/Microbiome



Genotype

Random subset

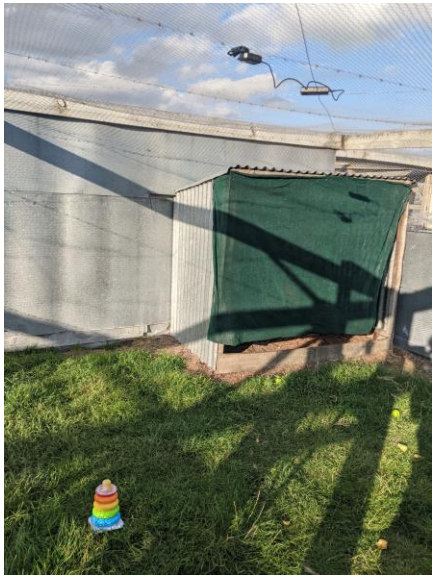
Personality - Measuring individual behaviour traits

- Exploration
- Activity

~trap/bait encounter

- Neophobia

~trap/bait interaction



- Boldness
- Docility

~trap/bait encounter

Survivors - Fear of baits and devices

Pests are under selection pressure to recognise and avoid devices

Innate

- Risk aversion
- Neophobia

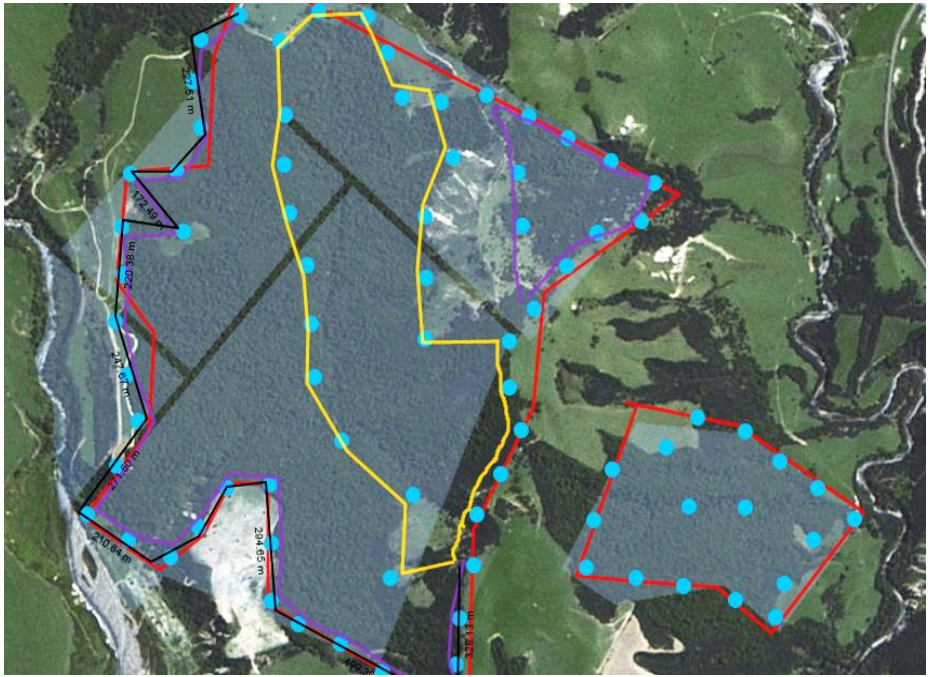
Learned

- Escape from trap
- Sub-lethal poisoning
- Social cues
- Human odour

Progress on RA1.1 Survivors of trapping operations

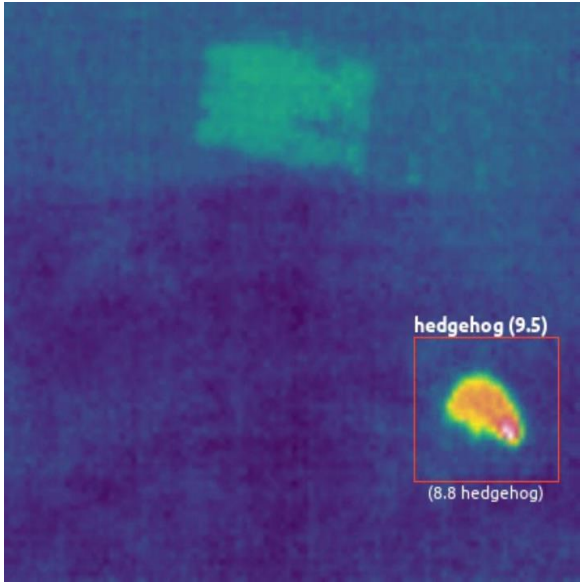
Field Experiment - Lottery Bush

Are certain possum personalities more likely to survive?



Progress on RA1.1 Survivors of trapping operations

- *How do pests respond to a novel trap?*
- *Will they get captured?*
- *What are the traits of recalcitrants?*



Progress on RA1.1 Survivors of toxic bait operations - **I**

Nelson Lakes 1080 trial - Compare the traits of 'average' possums vs. survivors

Two site:	Uncontrolled
	Nelson Lakes
Control measure:	1080 control operation
Trials:	Personality
	Neophobia (food)
	Diet/Microbiome

'Wriggle test' of a live-trapped possum


Bait trial
Number of individuals
14
12
10
8
6
4
2
0
Bait avoided
Bait eaten

Progress on RA1.1 Survivors of toxic bait operations - **II**

Franz Joseph 1080 trial - Compare the traits of 'average' possums vs. survivors

Study Design – Winter 2021:

1. Capture rats & possum prior to control operation
2. "False survivors" brought into captivity
3. Record individual measures: personality, diet, genetic, etc.
4. Radio/GPS collar
5. Capture survivors

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Research Aim 1.2
Manipulating survivor behaviour

RA1.2 – Manipulating survivor behaviour

How can we use sensory cues and alter risk perception to capture survivors?

Sensory cues – Sound, Sight, Scent

4Fs of animal behaviour

- Sensory cues to target pest motivations
- Sensory cues in combination

Change perception of devices

Fighting

Fleeing

Feeding

Fornication

Next steps

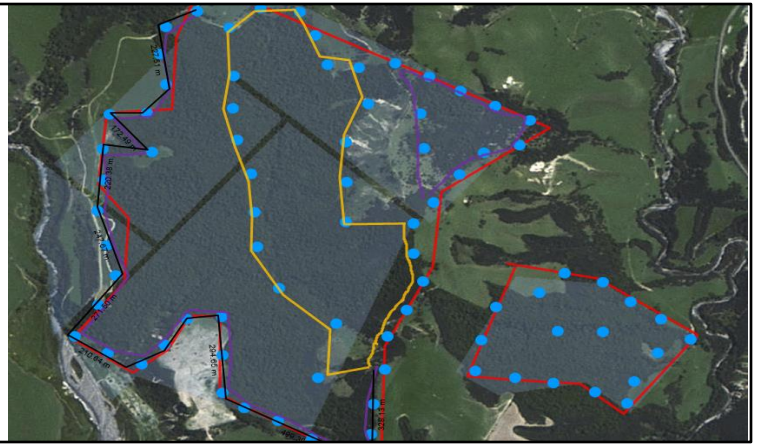
RA1.1

Personality and behaviour studies

- Survivors of 1080 control – possums
- Responses to devices – possums, rats, and stoats

Field trials

- Lottery Bush – May to August 2021
- 1080 field trial – September 2021



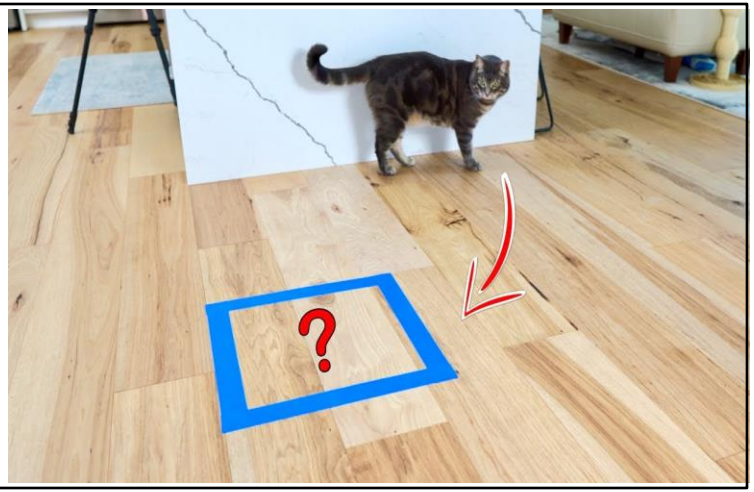
RA1.2

Sensory cues and devices

- Scent trials (the 4 Fs) – April to July 2021
- Auditory trials - January to September 2021
- Visual lure trials – September to December 2021

Lure combinations

Automated smart devices



Eradication Science - Collaboration

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MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Department of Conservation
Te Papa Atawhai

PREDATOR FREE 2050
kia uru ora, return to life

NEW ZEALAND'S BIOLOGICAL HERITAGE
Ngā Koiora Tuku Iho
National SCIENCE Challenges

ZIP

HAWKE'S BAY REGIONAL COUNCIL

Vision Mātauranga:

Hapū research partners

- Ngāti Porou,
- Tūhoe Tuawhenua
- Northern Taranaki iwi
- Moriori imi

Sensory research:

THE UNIVERSITY OF SYDNEY

UNIVERSITY OF CALIFORNIA SANTA CRUZ

THE Cacophony PROJECT

Personality research:

UCDAVIS UNIVERSITY OF CALIFORNIA

1495 UNIVERSITY OF ABERDEEN

UC UNIVERSITY OF CANTERBURY