Landcare Research
Manaaki Whenua

One-hit eradication of possums and rats: Is Blitzkrieg best?

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Graham Nugent, **Bruce Warburton**
Andrew Gormley, Mandy Barron
Landcare Research, Lincoln

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One-hit rat eradications from islands: **The 'Blitzkrieg' strategy**

- Aims at 100% 'guaranteed' initial knockdown, to avoid the need for mop-up, and for post-knockdown surveillance

- Typical approach: GPS guided aerial baiting w brodifacoum
  - double sown, v palatable bait, v high sowing rates
  - GPS guidance, overlapping bait swaths
  - Repeated twice to 'mop up' survivors (young still in the nest, gaps due to sowing errors, etc)

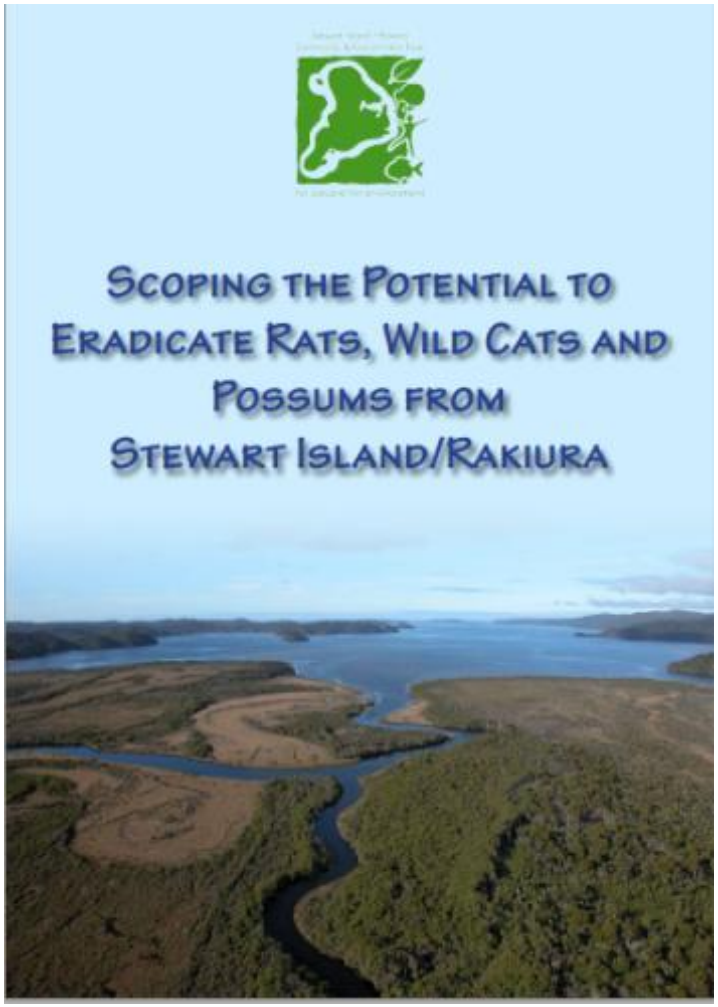
- 100% kill 'guaranteed', so no checking for survivors
  - no need for Plan B = 'Fail safe' approach

Fail-safe Blitzkrieg track record

- Highly successful
  - *Howald G, et al. 2007.. Conservation Biology 21(5): 1258-1268*
  - But the biggest island cleared so far is 11,000 ha Campbell Is

Our Q: Can it be scaled up to Stewart Island (160,000ha)?

Predator-Free Stewart Island



- Knockdown w aerial brodifacoum at ~25kg/ha (2 x 12kg/ha sowings) considered to be the **only feasible method**
  - Post knockdown surveillance deemed impractical

- Cost to eradicate rats, wild cats and possums estimated at:

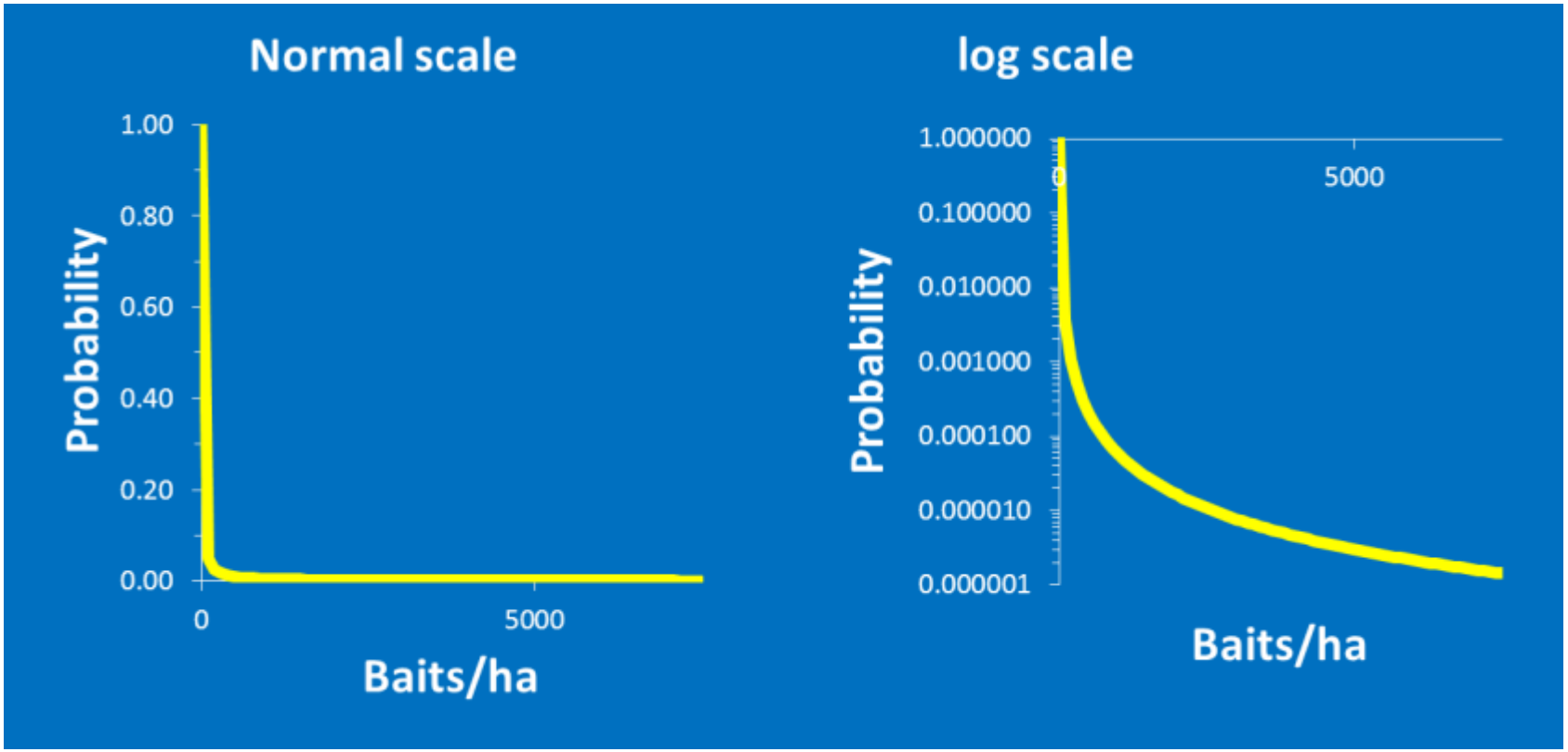
$35 -55 million

($200-350/ha)

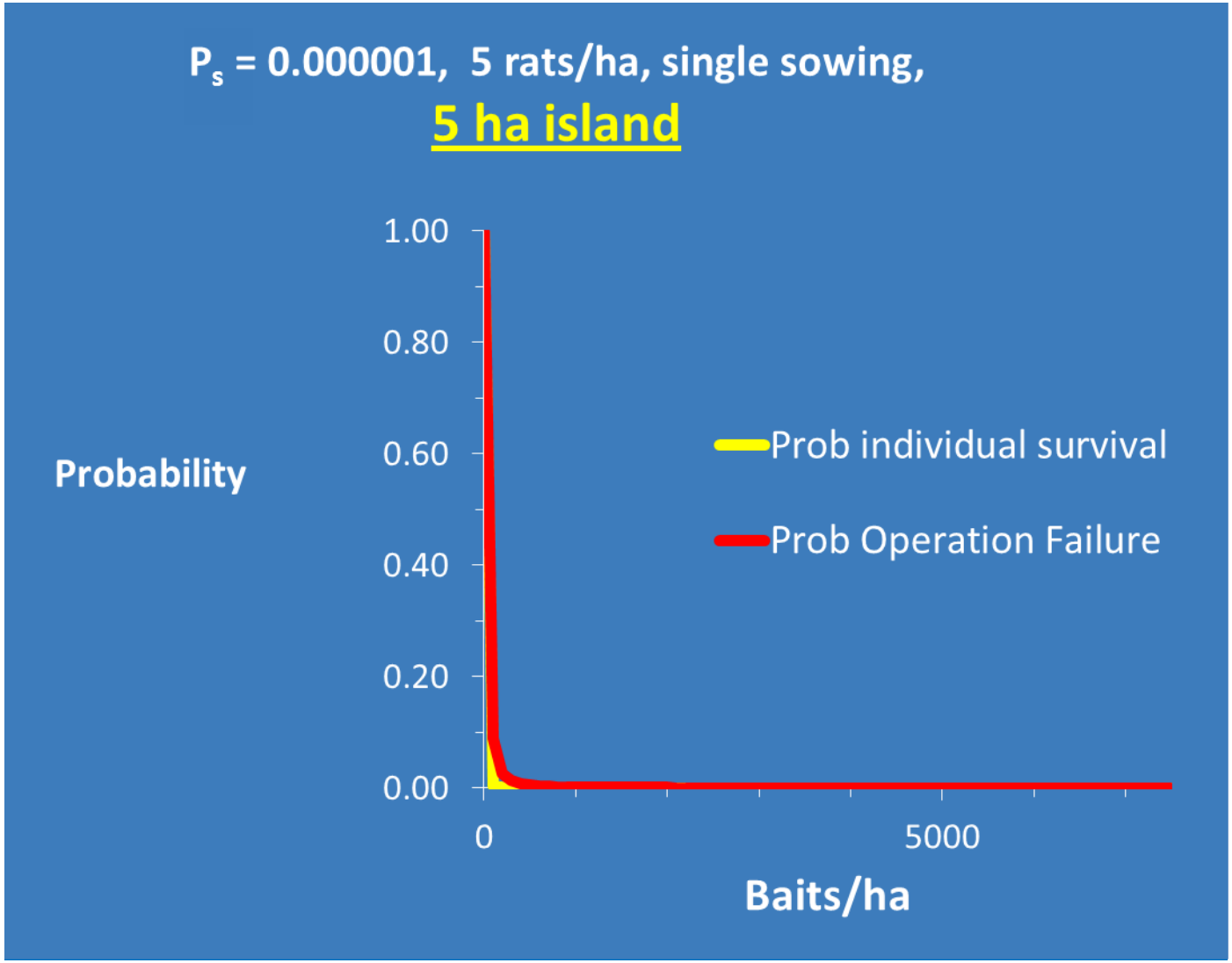
- *Compiled by Brent Beaven, DOC Invercargill*
  - *For Stewart Island/ Rakiura Community and Environment Trust*

Q1: Does scale matter?

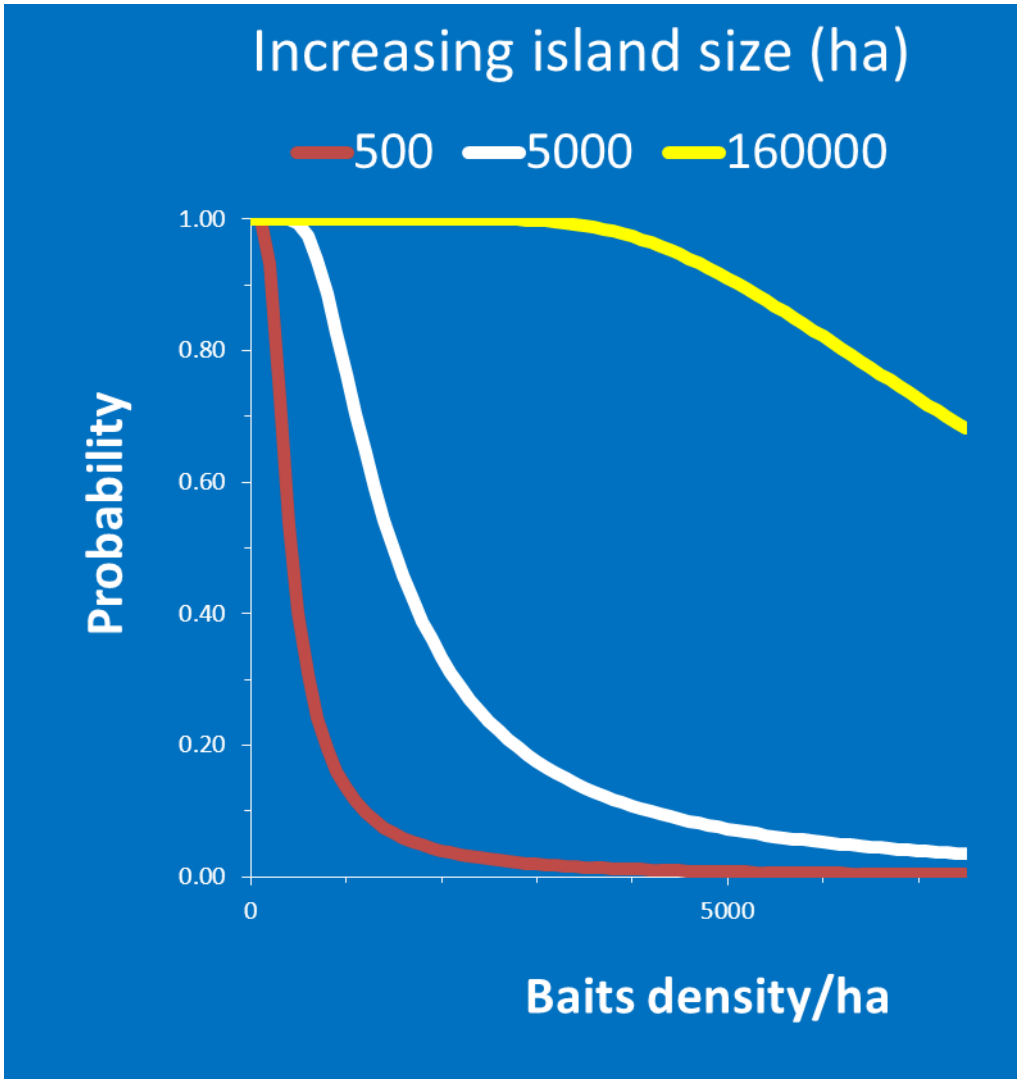
- Assume **probability of individual rat surviving** inversely related to **density of baits/ha** sown
  - *At 15kg/ha (7500 baits/ha) assume P_s = 0.000001 (a chance in a million)*



Does scale matter? (2)



Does scale matter? **Of course it does!**



- Probability of operational failure with increasing island size (P_s = 0.000001, 5 rats/ha, single sowing)

=> At Stewart Island scales, failure highly likely with single sowing

Q2: Could a ‘Safe-Fail’ alternative work?

Post knockdown detection and mop-up

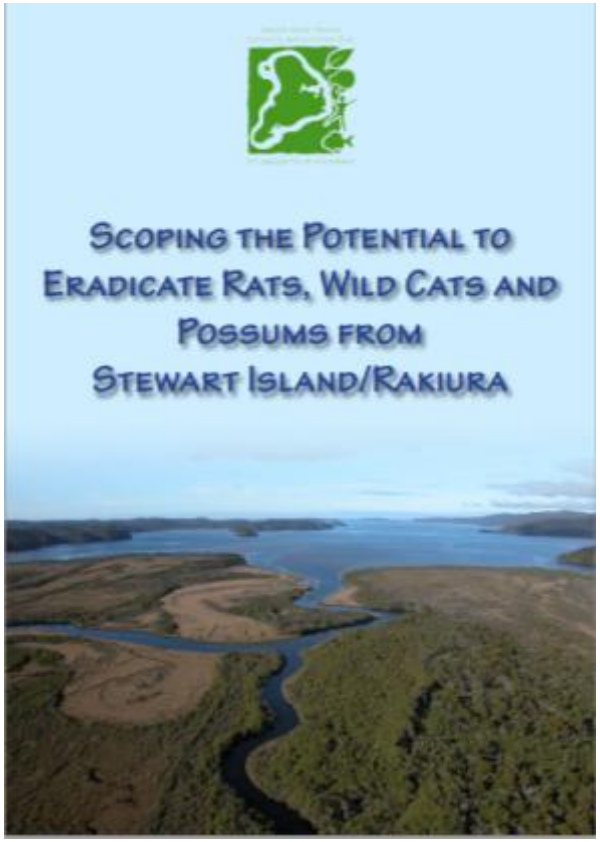
- At big scales, is it cheaper and safer to spend far less on knockdown, and more on finding and killing survivors?
- This would require comprehensive surveillance and effective rapid response (mop-up)

Stewart Island

- "*Detecting pests at low levels, over a large area will be difficult, if not exceedingly difficult, …. "*

- *"If a 50 x 100m grid was used, at least 400 000 bait stations [or monitoring devices] would be required to cover Stewart Island / Rakiura, with over 20 000km of track network to service them. "*

- ***"….it is not practicable to use bait stations** [or monitoring devices] **over the whole Island"***



Suppression Stewart Island Sketch (13 March)

Simulation of population growth and control & mop-up surveillance on Stewart Island (160,000 ha). Populations are simulated at the grid-cell level (you can vary size). Recalculates whenever any parameter is changed.

Grid & Simulation Parameters

Cell size (km):

1

Starting density per ha:

8

Maximum density per ha

24

Number of years:

50

Log population size

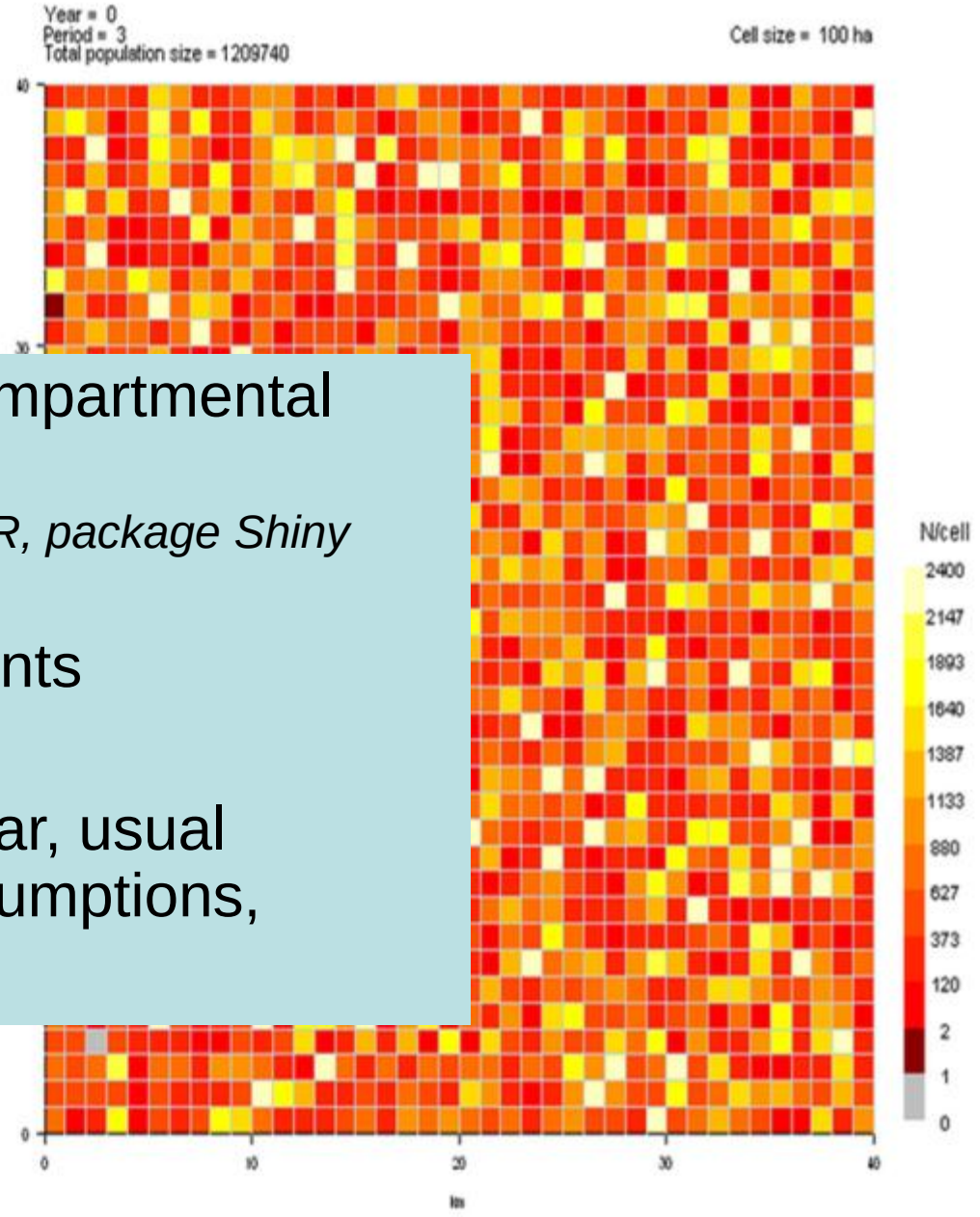
Turn off detection grid

Setup the parameters
multiple iterations. W

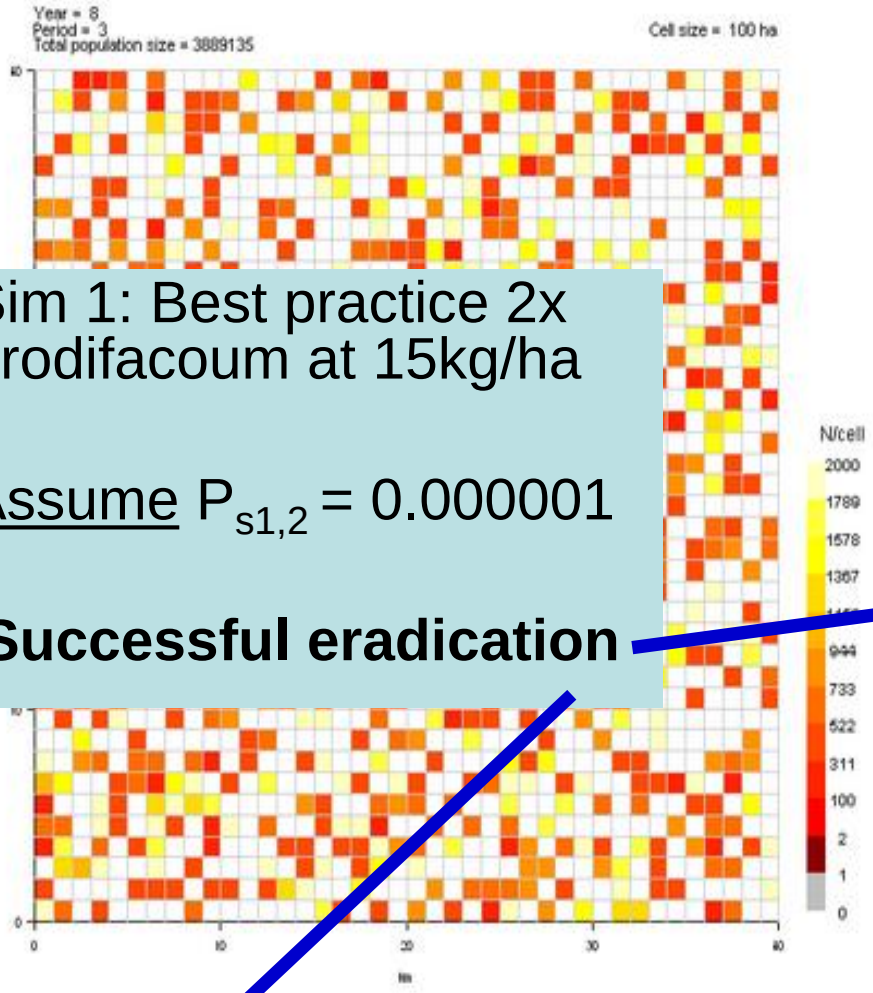
Iterations

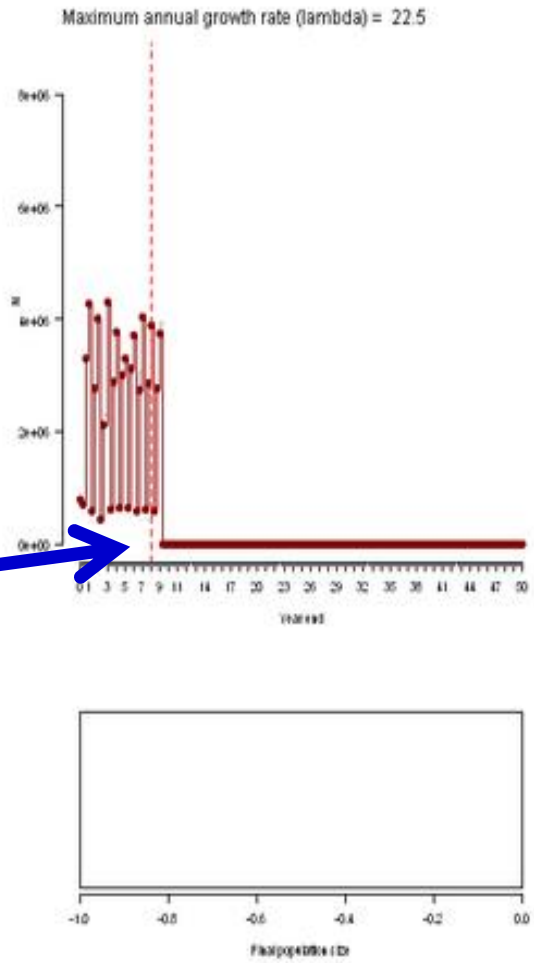
2

Time (1.33, 1.66 and 3 are 1st, 2nd and 3rd periods of year



- Constructed a compartmental spatial model
  - *Andrew Gormely , R, package Shiny*
- 1 km^2 compartments
- 3 seasons per year, usual demographic assumptions, possum and rats





- Sim 1: Best practice 2x brodifacoum at 15kg/ha
- <u>Assume</u> $P_{s1,2} = 0.000001$

=> Successful eradication

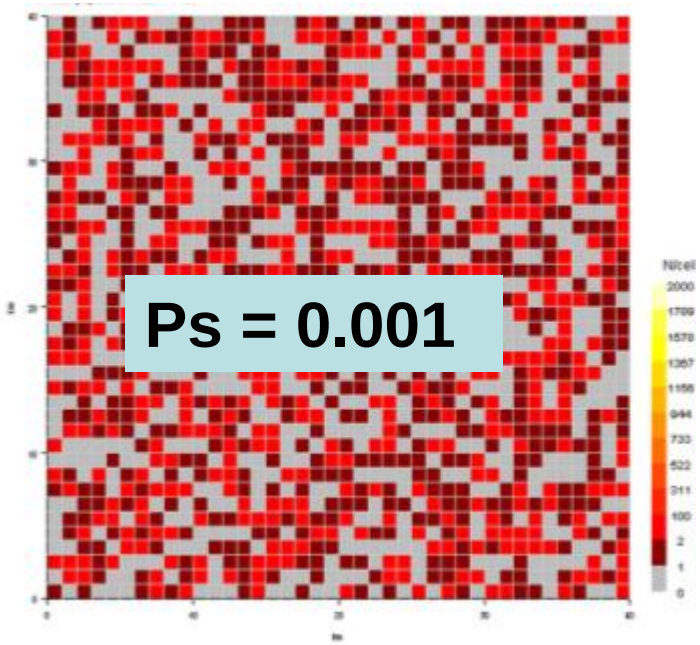
Population Size

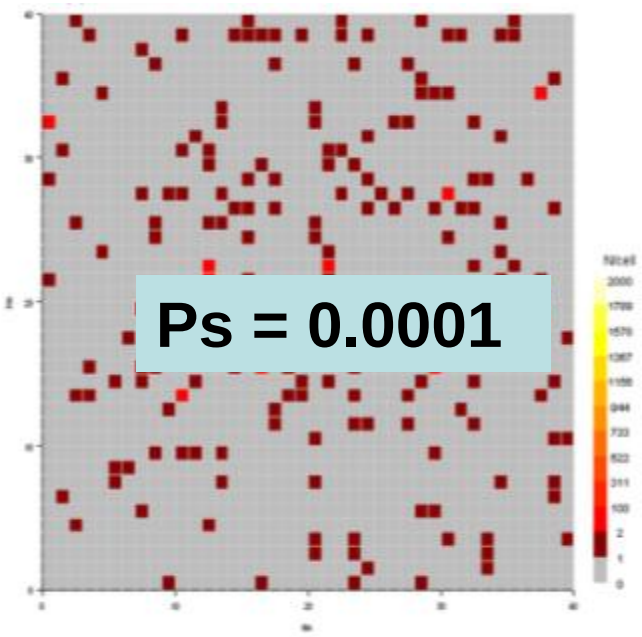
```
 [1]  780875  686621 3286882 1261776  580345 2779815 4018437  441927 2119533
[10] 4303420  607531 2861044 3776004  633411 3013522 3285848  655031 3117355
[19] 3710660  572330 2[illegible]12 4038959  601215 2861043 3889135  579865 2764003
[28] 3728106       0       0       0       0       0       0       0       0
[37]       0       0       0       0       0       0       0       0       0
[46]       0       0       0       0       0       0       0       0       0
[55]       0       0       0       0       0       0       0       0       0
[64]       0       0       0       0       0       0       0       0       0
[73]       0       0       0       0       0       0       0       0       0
[82]       0       0       0       0       0       0       0       0       0
```

Alternative: Low cost knockdown

Single sowing with reduced bait density => higher P_s

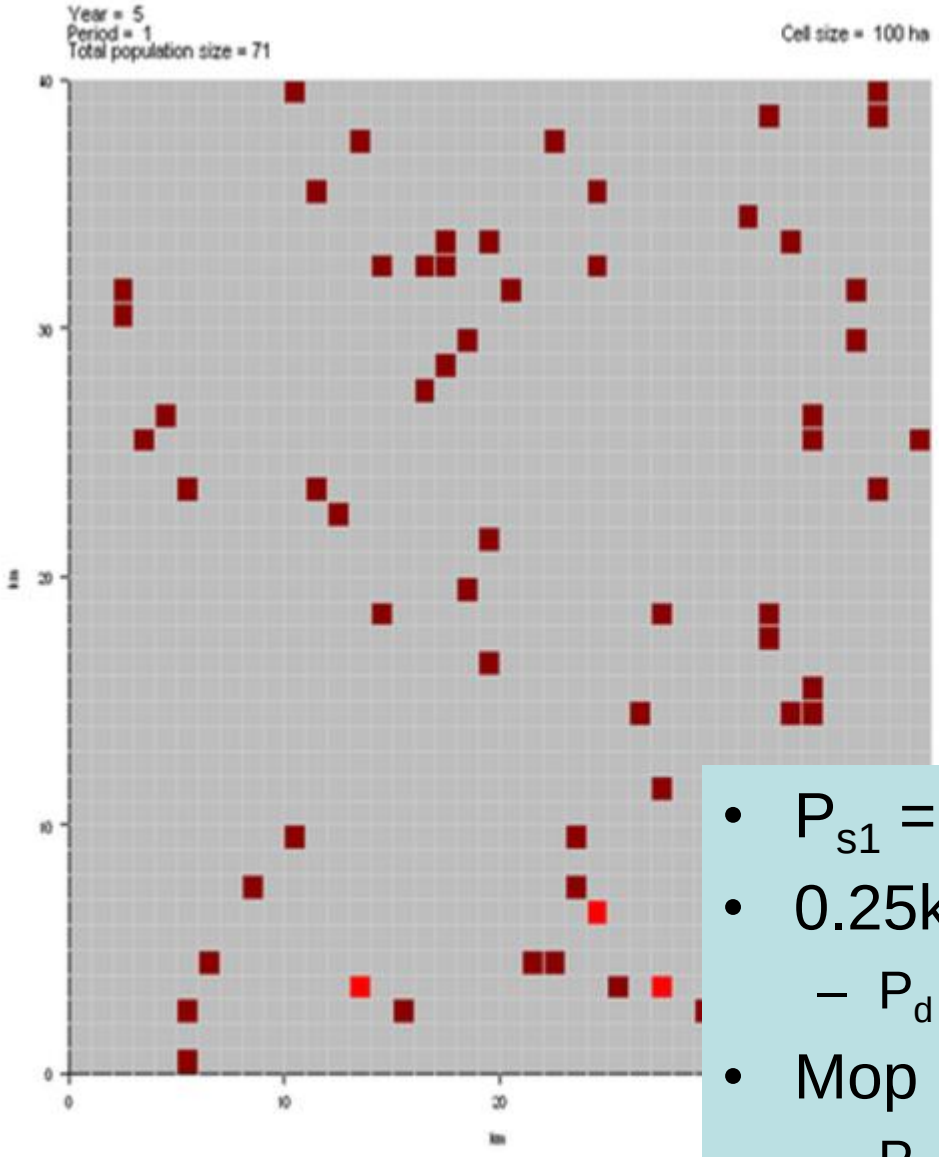
- First finding: Need P_s < 0.0001 for > 80% reduction in occupancy (at 1 km^2 scale)
  - Even with 99.9% kill, rats and possums still present in most areas.

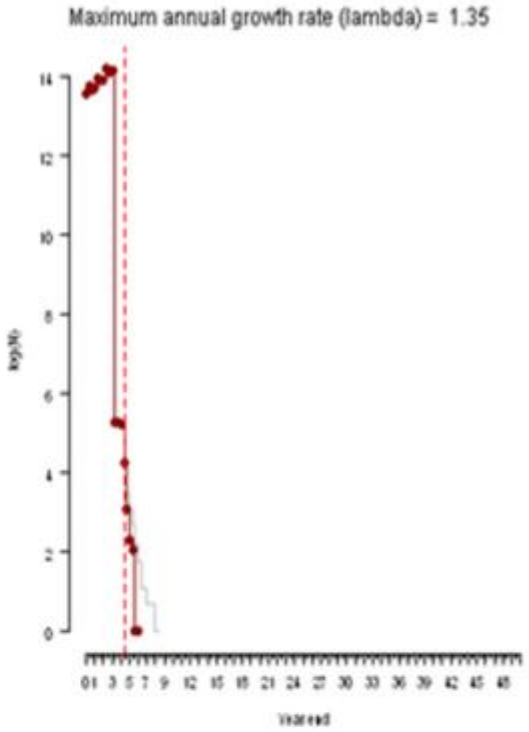




Simulated Detection and Rapid Mop-up Protocol

- **low-intensity** detection aimed at **clusters** of survivors (not individuals)
  - 1 chew card /1.0, 0.5, or 0.25km^2
  - 160, 640, 2560 CCs respectively
- Rapid large scale aerial mop-up
  - brodifacoum at 3kg/ha (Ps<0.001)
  - Control applied to either 400 or 1600 ha around each detection





- $P_{s1} = 0.0001$
- $0.25km^2$ detector grid
  - $P_d = 0.6$
- Mop up area 400 ha
  - $P_{smu} = 0.001$

⇒ **3 years to eradicate**

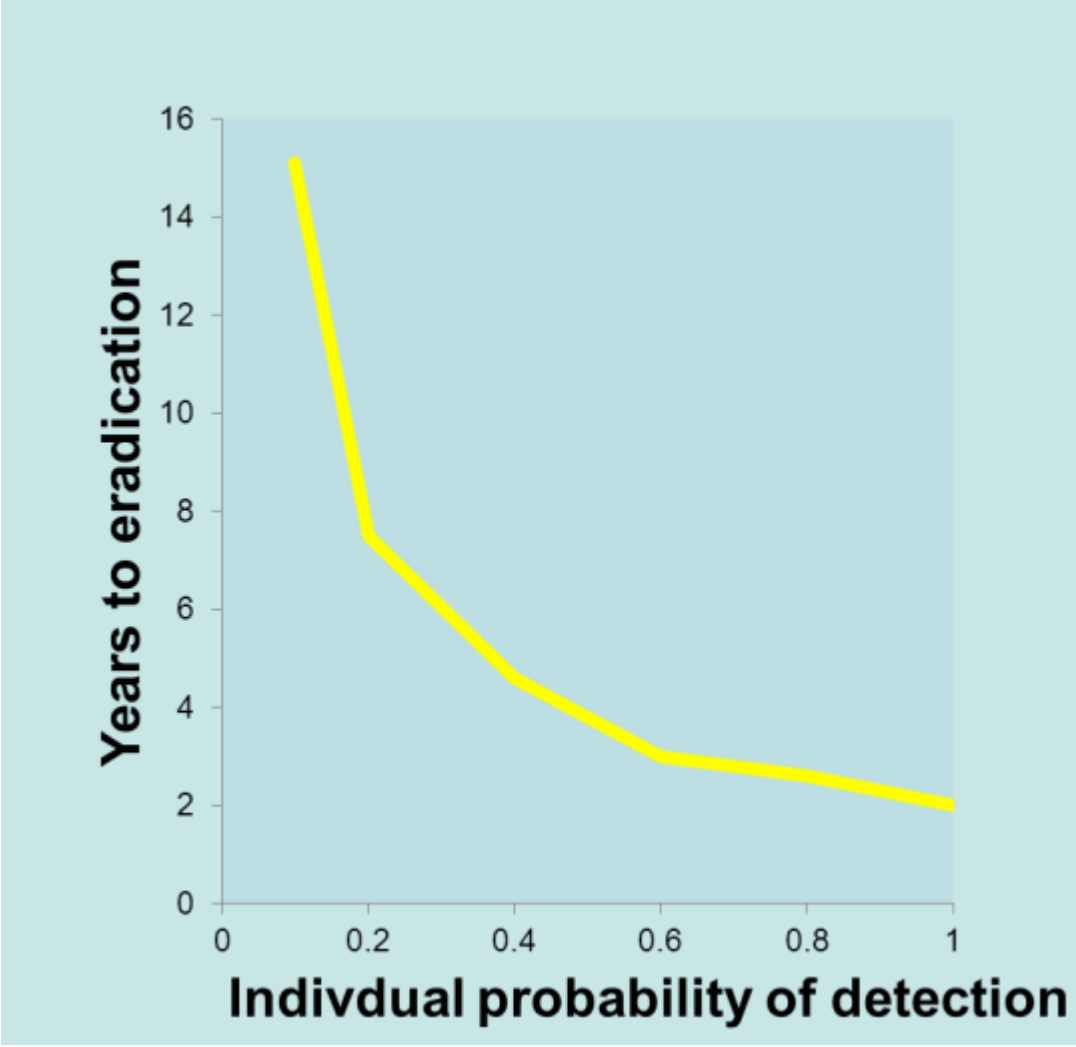
⇒ **$9m detection, $15m mop up**

Population Size

[1]	787178	931573	871929	887852	1165056	1101583	1117245	1461194	136
[10]	1374784	197	195	190	71	22	10	8	
[19]	1	0	0	0	0	0	0	0	
[28]	0	0	0	0	0	0	0	0	0

Detection probability is crucial

Main determinant of cost



- Needs to be greater than 0.5 for complete mop up within 3 yrs
- Is that realistic? Maybe….
  - Sweetapple & Nugent (2008) calculated P_d = 0.8 for chew card grid 250 x 50 m grid

Preliminary Conclusions (1)

- Scale does matter!! – and is likely to ultimately limit the success of the Fail-Safe strategy

- A Detection Mop Up safe-fail approach could overcome that, and provide a proven mechanism for future reinvasion detection and eradication
  - Also provides a mechanism for achieving zero density in unfenced mainland areas, or for progressive ‘roll back’ eradication

Looking forward

- But early detection is crucial!
- And cost of detection is crucial
- With current technology DMU cost for Stew Is probably **higher than** Blitzkreig?

- Need to increase cost-effectiveness of detection
    - High tech gizmos for real-time continuous surveillance