



Landcare Research
Manaaki Whenua

Is Detection (and Mop-up) Feasible for Pest Eradication at Vast Scales?

Detection and surveillance research workshop
September 2013

Graham Nugent,
Andrew Gormley,
Mandy Barron
Landcare Research, Lincoln

*Research funded by MBIE:
Suppression Systems (Contract C09X1008)*



Eradication of Pests from Islands

Two main strategies

1. Fail-safe

- 100% knock-down/eradication
- No checking for survivors

2. Safe-fail

- Lower-cost knock down
- Detection and mop-up (DMU)



Fail-safe Rat Eradications

Ensures
every pest
at risk

- High sowing rate of palatable bait
- Repeat to mop-up survivors
- 100% 'guarantee'

Highly
successful

- 332 successful, 35 failed*
- Campbell Island (11,000 ha) is biggest area to date
- South Georgia (80,000ha) currently being attempted

How big can we go?



Predator Free Stewart Island?

Scale

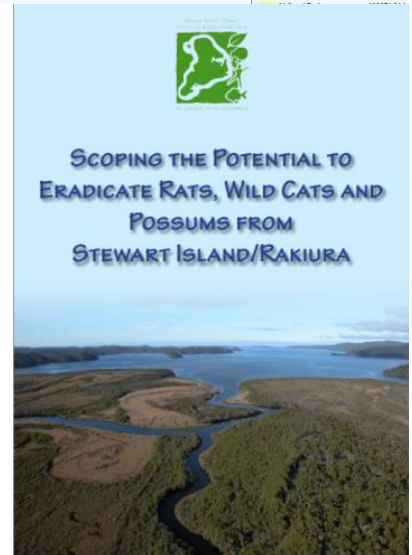
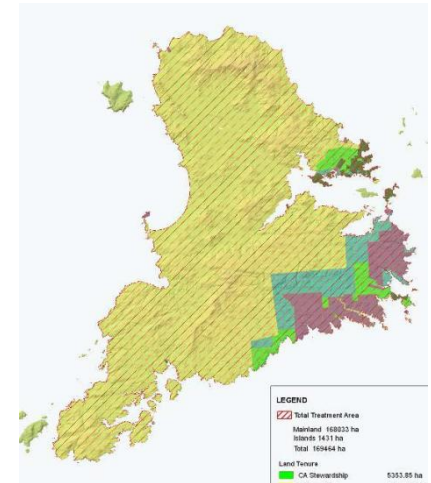
- 170,000ha, mostly National Park or conservation land

Species present

- Rats (3 spp) & possums
- Cats, Hedgehogs
- Red and White-tailed deer
- No mice, mustelids, rabbits, pigs, goats

Feasibility Study

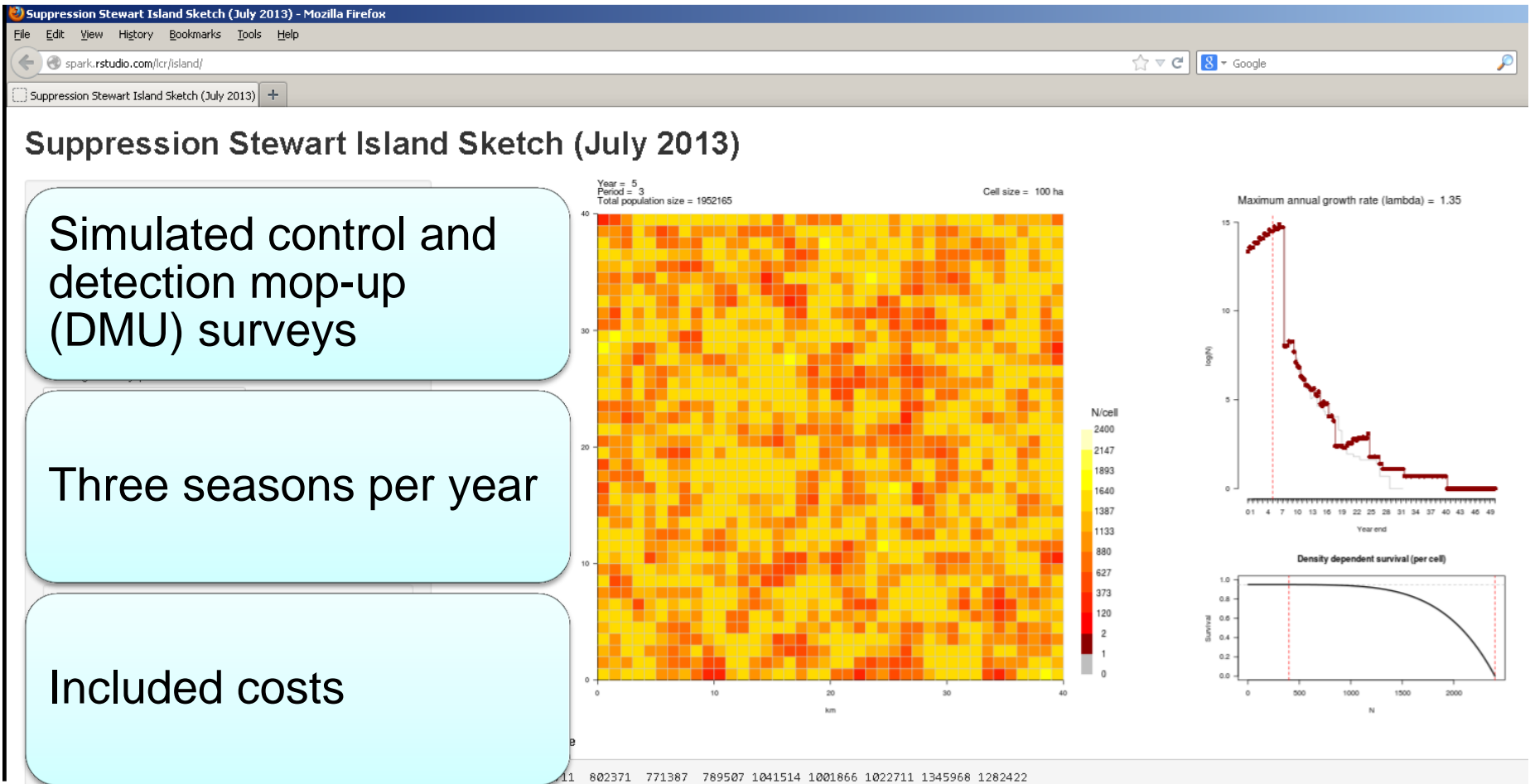
- Rats, wild cats and possums
- Aerial brodifacoum using 25kg/ha (2 x 12kg/ha sowings)
- \$35-55 million (\$200-350/ha)



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

Simulations

- Using R and package 'Shiny'
- <http://spark.rstudio.com/lcr/island/>



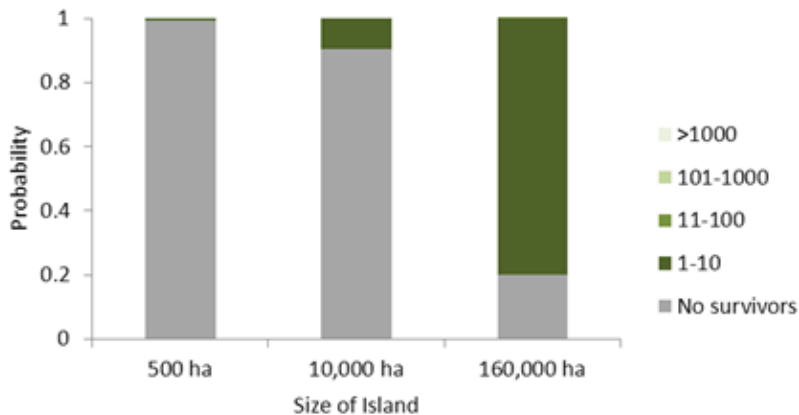
Fail-safe: Scale matters

Number of survivors increases with area

- Operational failure worse assuming heterogeneous survival

Highly dependent on mortality rate

- 1-10 survivors if 99.9999% mortality
-



99.9999% mortality
(survival is one in a million)

*Rat density of 10/ha

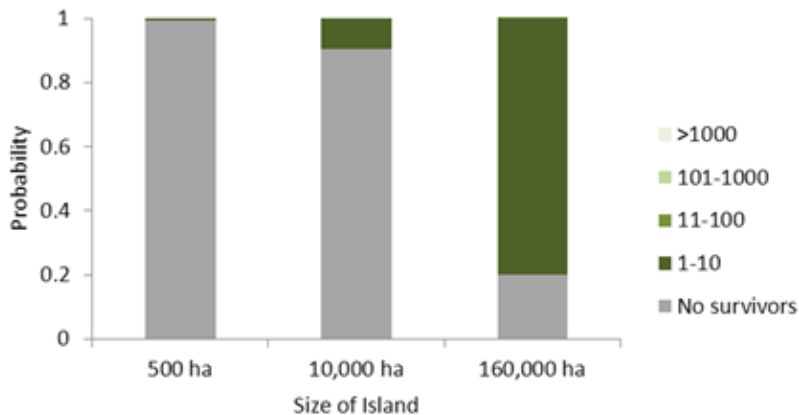
Fail-safe: Scale matters

Number of survivors increases with area

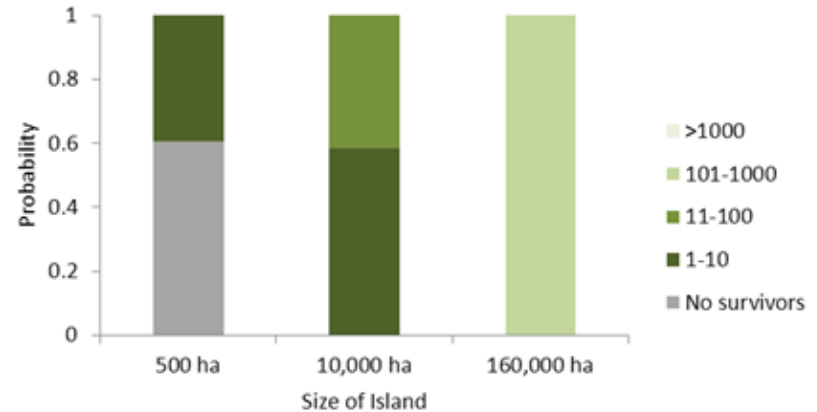
- Operational failure worse assuming heterogeneous survival

Highly dependent on mortality rate

- 1-10 survivors if 99.9999% mortality
- 100-1000 survivors if 99.99% mortality



99.9999% mortality
(survival = one in a million)



99.99% mortality
(survival = one in ten thousand)

Could a 'Safe-Fail' alternative work?

i.e. post knockdown detection and mop-up (DMU)

Spend less on knockdown,
and more on finding and
killing survivors

Need comprehensive
surveillance and effective
rapid response (mop-up)

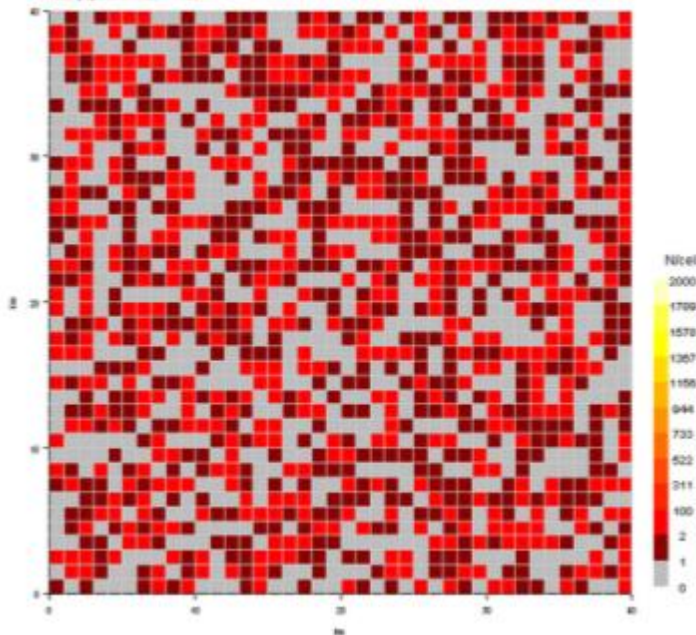


Safe-fail: Low cost knockdown

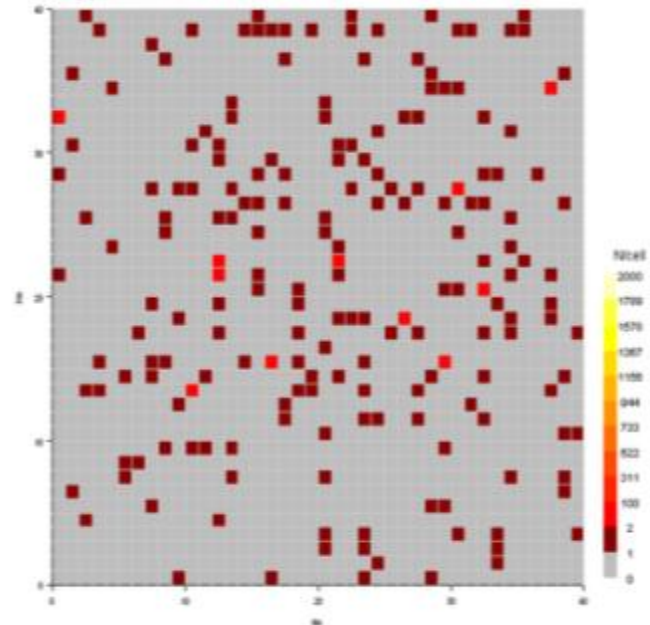
Single sowing with reduced bait density

- Need >99.99% kill for >80% reduction in occupancy

$P_{Surv} = 0.001 \rightarrow 99.9\% \text{ kill}$



$P_{Surv} = 0.0001 \rightarrow 99.99\% \text{ kill}$

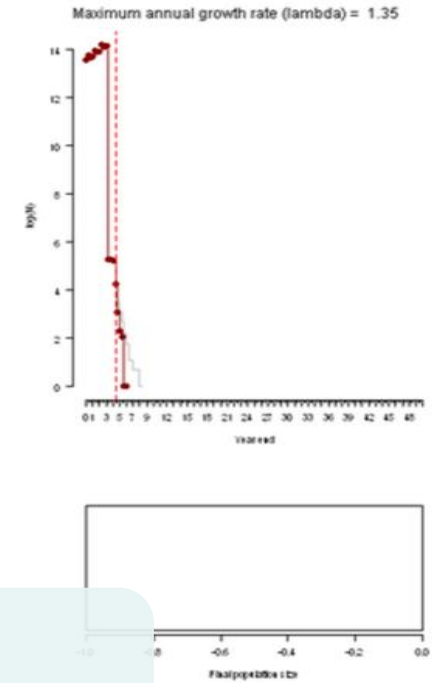
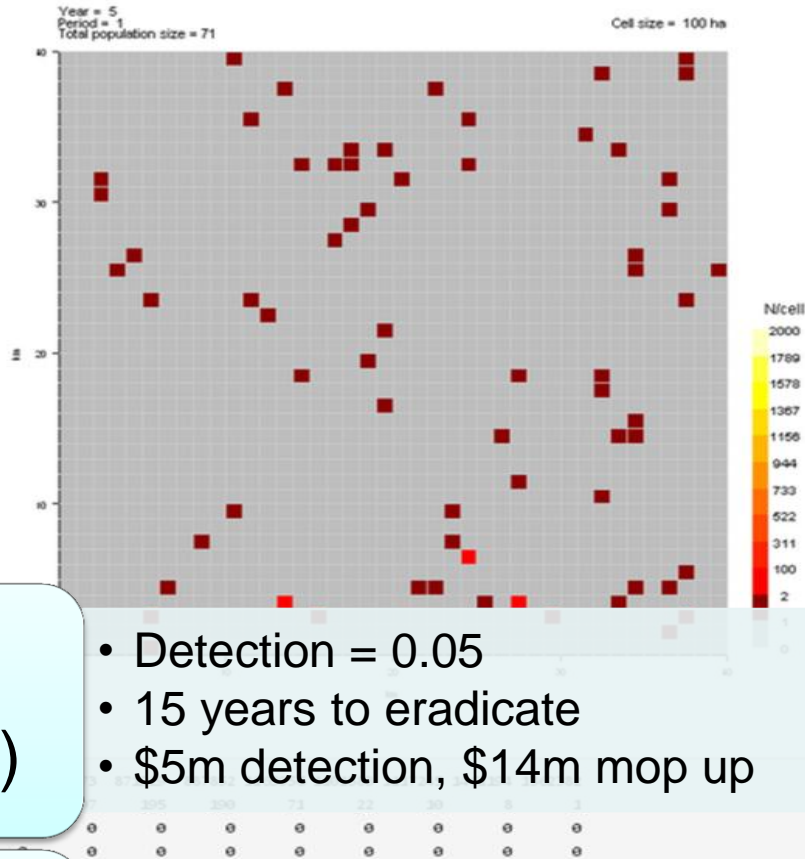


Safe-fail: Detection and Rapid Mop-up Protocol

Detection aimed at **clusters** of survivors
(not individuals)

Rapid large scale
aerial mop-up around
each detection





1km grid
(1600 cards)

- Detection = 0.05
- 15 years to eradicate
- \$5m detection, \$14m mop up

0.5 km grid
(6400 cards)

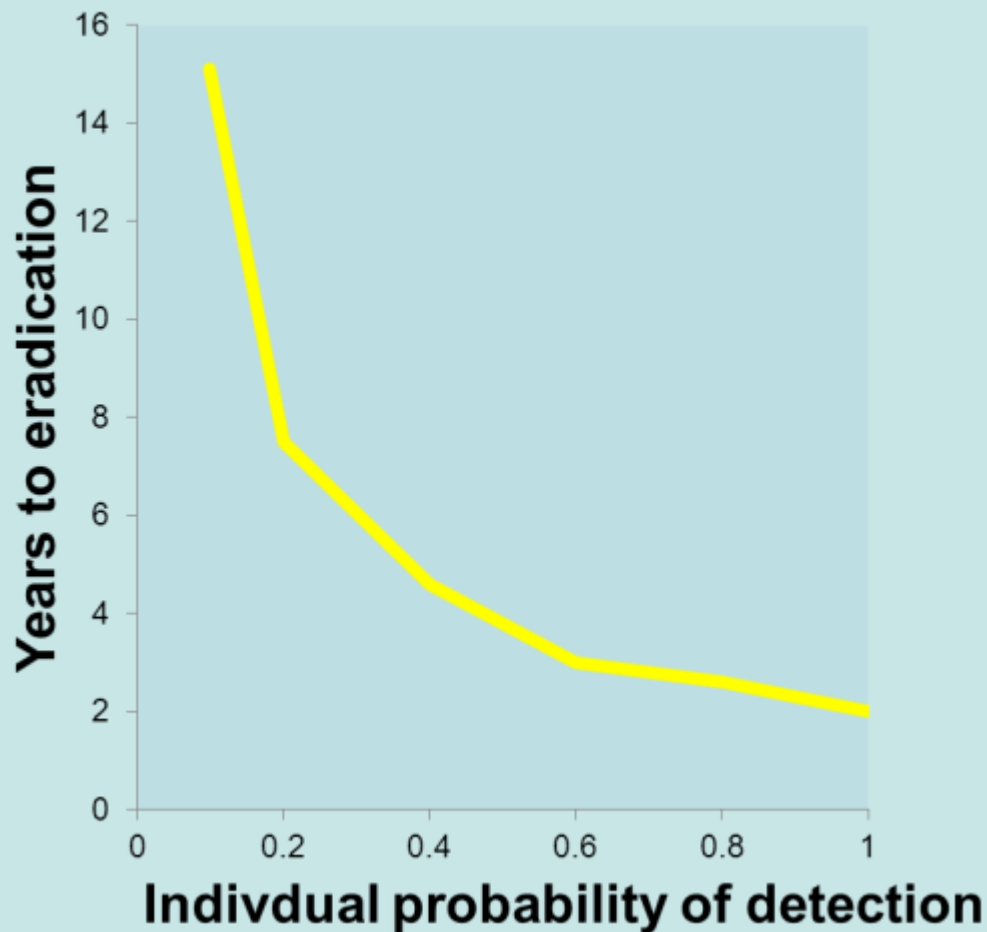
- Detection = 0.1
- 7-8 years to eradicate
- \$5m detection, \$10m mop up

0.25 km grid
(25,600 cards)

- Detection = 0.4
- 3 years to eradicate
- \$4m detection, \$8m mop up

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?
 - Sweetapple & Nugent (2008) calculated detection of 0.8 for chew card grid 250 x 50 m grid

Looking forward



Detection issues are crucial

- Early
- Cost effective

Current technology

- Safe-fail cost for Stewart Island may be higher than Fail-safe?

Increase cost-effectiveness

- High tech gizmos for real-time continuous surveillance

