

# Following up Duvaucel's gecko (*Hoplodactylus duvaucelii*) on Mana Island

Post-translocation monitoring 11-14 years on

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& Martha the gecko

Sanctuaries of New Zealand  
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# First things first!

- I am profoundly deaf
- I have a “Deaf Accent”
- Some of you may struggle to understand me
- That’s OK

You should ignore me and look at the slides instead!

You can follow the text in the slideshow  
(following the text helps you follow me)

Ask questions afterwards, and Sarah will relay them to me!



\*We’ve put extra technical information for those who are interested at the bottom of some of the slides – look for the little photo of David Attenborough

# Herpetofaunal translocations in NZ

- 68% of our lizard fauna Threatened or At Risk
- Significant local extinctions and range contractions for many species
- Translocations undertaken for:
  - species conservation
  - ecosystem restoration
- 54 translocations of lizards undertaken in NZ by 2008<sup>1</sup>

<sup>1</sup>Miller K, Bell T & Germano J in prep.

# Translocation success: how do we know?

- Modelling and evidence indicates for some NZ lizards, it is not possible to claim translocation success for < 20 and up to 50 years using a traditional definition of success (due to extreme longevity)
- Traditional definition of a successful translocation<sup>1</sup>:
  - “new populations self-sustaining, comprising only of locally-born animals”
- Assessments compounded by nocturnal, crypticness, and low density of released lizards = data-poor, and low power!
- Little understanding of the factors in translocation success/failure
- Not ideal in ‘triage-crisis’ conservation management when answers are needed fast, and now!

<sup>1</sup>Towns & Ferreira 2001

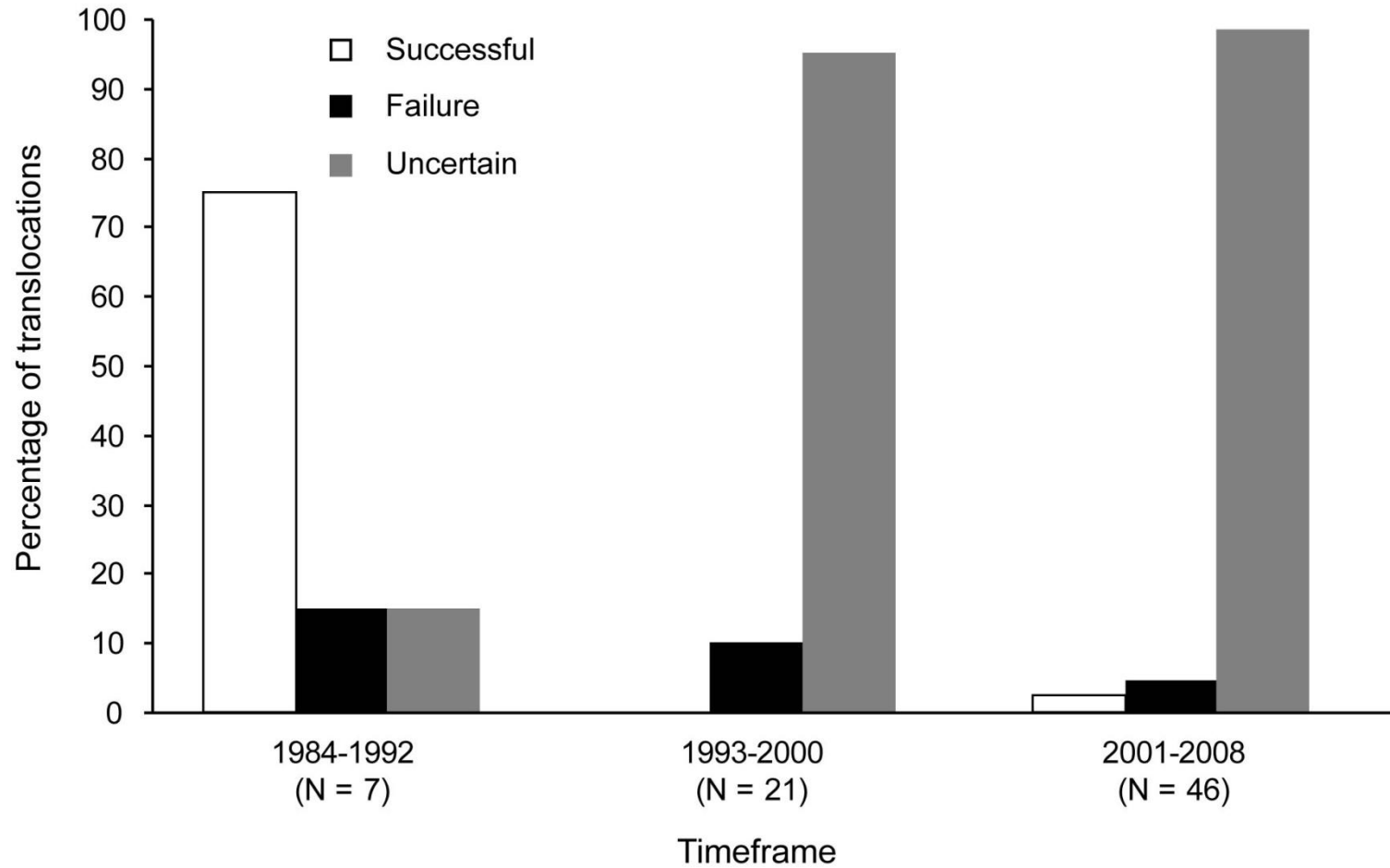
# Redefining translocation successes

- Miller et al. (in prep) have developed a new standardised definition of translocations, taking into account *a priori* information based on **life history traits, with time since release** of NZ species
  - Species longevity
  - Reproductive output
  - Age at maturity

# Four Stages of Success

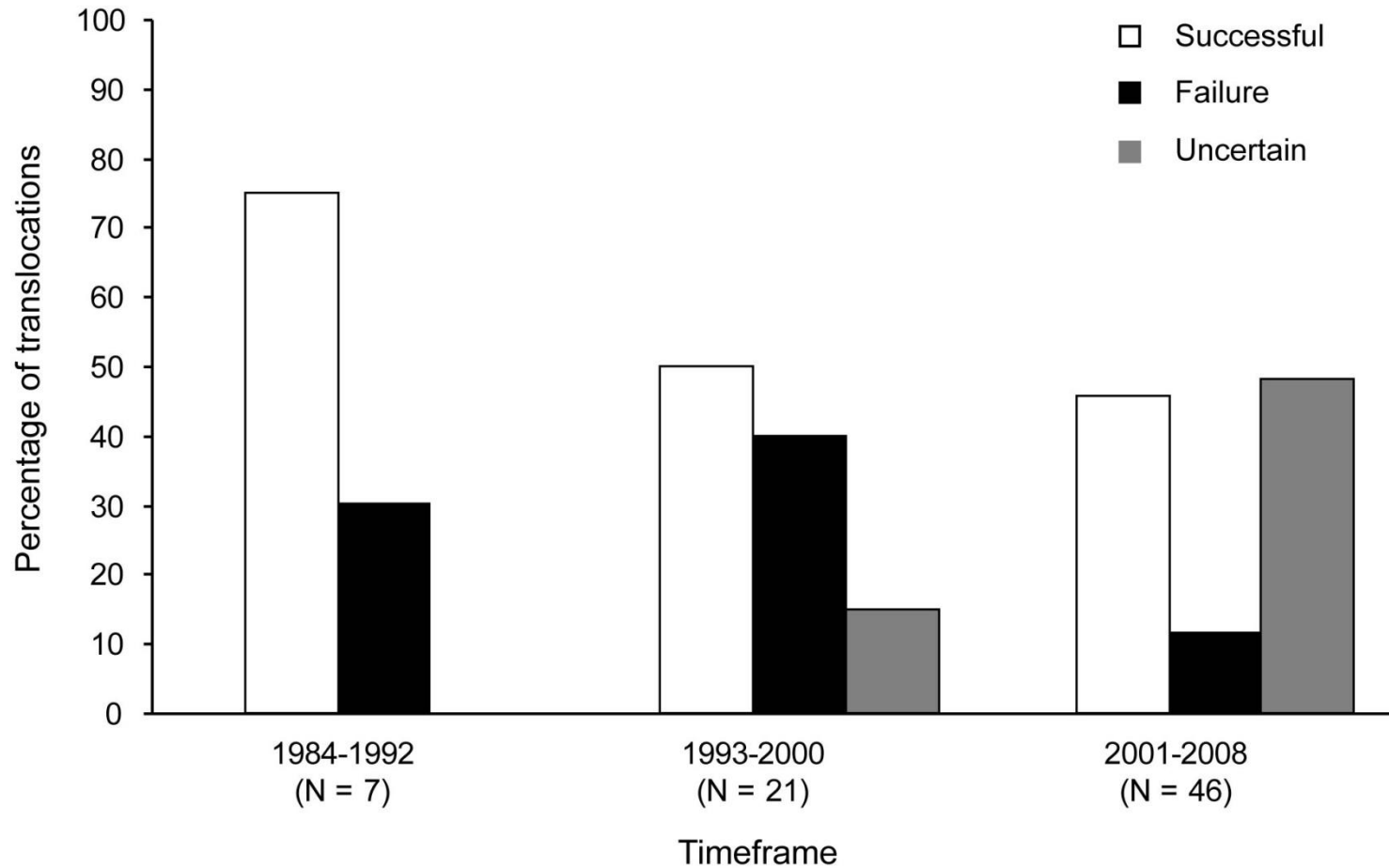
- **Stage 1: Survival, growth of founders**
  - Recapture of founders showing size, mass, condition increases; indicates suitable habitat
- **Stage 2: Evidence of reproduction**
  - Recruitment; indicates individual breeding condition reached, and finding mates
- **Stage 3: Population growth**
  - More caught than initially released
- **Stage 4: Self-sustaining population**
  - Consistently high number of individuals found during monitoring over time, including immature animals, decreasing proportion of founders; negligible probability of extinction

## Traditional Criteria for Success



New Zealand herpetofaunal translocations (n=74) assessed by traditional criteria

## Standardised Criteria for Success



New Zealand herpetofaunal translocations (n=74) re-evaluated using standardized criteria

- more successes appropriate for expected stage in accordance to life history/time
- less uncertainty



# **Q: What is the long-term response of a Duvaucel's gecko population to translocation?**

- Translocation of Duvaucel's gecko from North Brother Is. to Mana Is. occurred in 1998
- **Our study is the first to follow up translocation success of this species after an elongated (10+ yr) time period**
- It's a nice "real-world test" of Miller et al's success criteria
- To satisfy these criteria, we are examining for 2009-2013:
  - Founder animal survival
  - Population size and extinction probability
  - Demography
  - Individual condition (size, body condition, parasites)

# Duvaucel's gecko

- NZ's largest living extant gecko
  - 320 mm long, 118 g
- Extremely long-lived for a gecko
  - latest estimates at 50+ years<sup>1</sup>
- Abundant on predator-free offshore islands:
  - estimates up to 750 per hectare<sup>2</sup>

<sup>1</sup>Wilson 2010 (VUW thesis)

<sup>2</sup>Barwick 1982



# Intrinsic Vulnerability

- Strongly nocturnal
  - active at same time as rats!
- Large home ranges, uncertain but range from 30-2,000 m
  - risks increased exposure to predators
- Freeze when threatened if out in open
- Fat and obese species
  - escape options more limited than many lizards
- Extreme longevity (50 years or more)
- Late maturity (6-7 years to reach maturity<sup>1</sup>)
- Low reproductive output (1.12 young/female/yr<sup>2</sup>)
- At risk from all species of introduced predators

<sup>1</sup> Barwick 1982, Cree 1994

<sup>2</sup> Cree 1994

# Currently thought extinct on NZ's mainland

A 400 km straight-line gap between **living** northern and southern populations

**Subfossils** in Northland, Waikato, Hawke's Bay, Wellington, Nelson, Canterbury and Otago

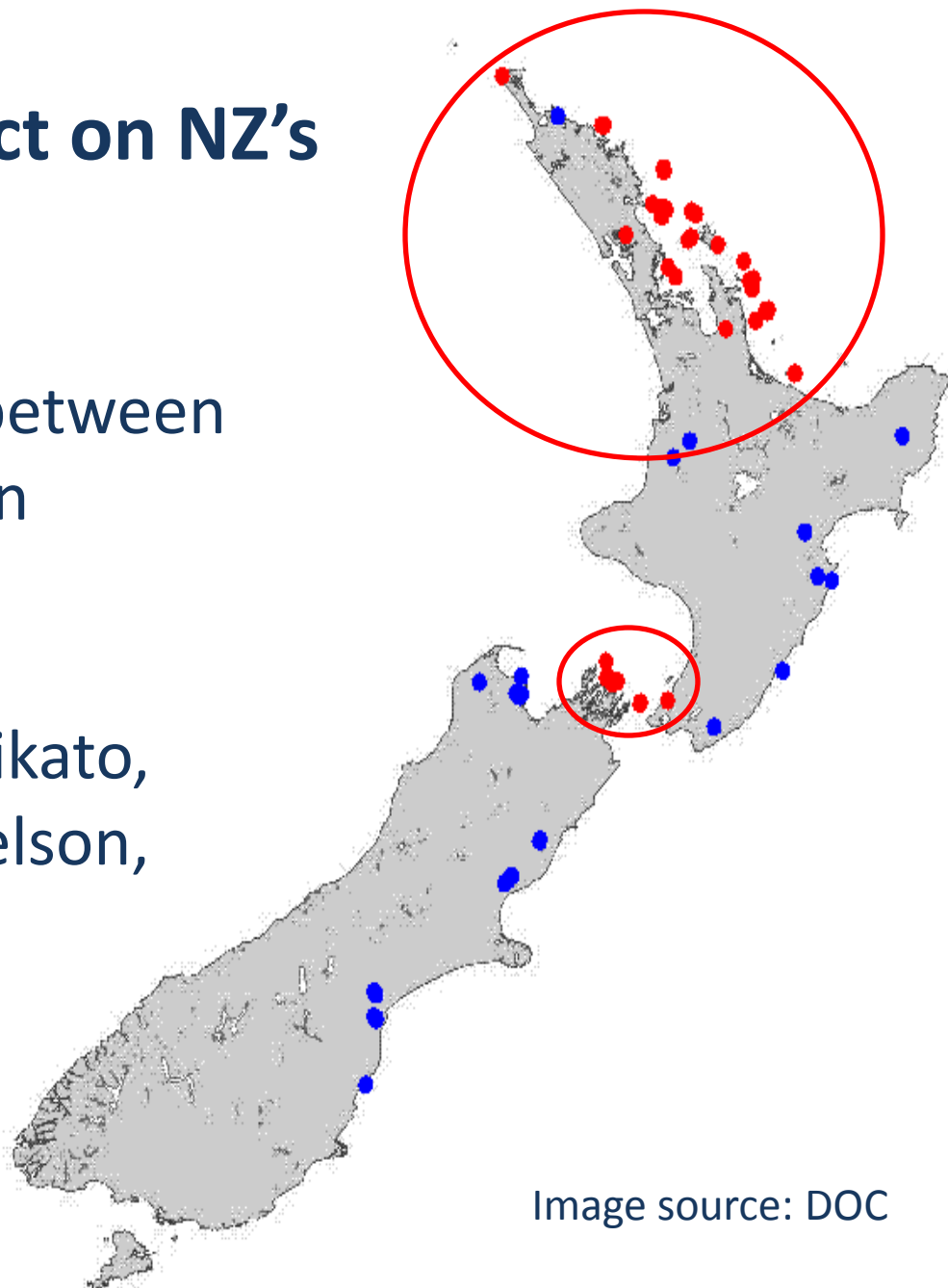


Image source: DOC

# **Not all bad news:**

## **Relictual and recovering populations**

- Still very abundant on mammal-free islands
  - 36 offshore islands
- Apparent population recoveries upon removal of mammals from islands
- Translocated to:
  - Mana Island (1998)
  - Motuora & Tiritiri Matangi Islands (both in 2006)
  - Long Island (2011)



# Release location: Mana Island

217 ha

Historical Maori  
occupation

150 years pastoral  
farming

Mice  
eradicated  
in 1990



Over 500,000  
trees and  
shrubs planted  
for ecological  
restoration  
since 1987

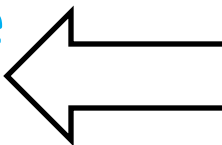
# Translocation to Mana

- 40 translocated from North Brother in 1998
- Toe clipped for individual ID
- 10 ♂ : 20 ♀ : 10 subadults (deliberate 1:2:1 ratio)
- Animals with excellent body condition selected for in harvest on NBI
- Founder females were gravid on release
- Release location provided geckos with choice of habitat (shore, coastal cliffs, forest)



# Capture methods

- 66 day and night sampling sessions
  - Feb 2009 to Feb 2012
- 8-night spotlight sessions
  - capture-mark-recapture along a transect
- Opportunistic captures (day / night)
- Onduline Artificial Retreats in shore scrub habitat and valley



Discontinued in  
Dec 2011, due to  
ACO disturbance







# How many geckos & how often?

By February 2012, we had...

- Total number of individuals caught: **115**
  - That is, 115 individuals from all sampling types (254 captures)
  - 285% increase since 1998
- 77 geckos by spotlight transect (170 captures)
  - 8% - 50% caught more than once during an 8-night spotlight session
  - 60% of geckos were caught more than once over the 5 capture sessions (total of 39 nights)

**Total number of individuals captured in  
cricket terms...**



**115 not out**

**(115 - 1 individuals, population not extinct)**

# Population size estimates (2009-2011 data)

- **Initial forays**
- **Caveats:** one more field season to go, testing and experimenting with various models and covariates, wide confidence intervals...
- Don't shoot us!
- Simple measures:
  - **133** = Manly-Parr est. (3x 8-night FV spot sessions treated as 'open')
- Huggins closed capture population estimates in MARK
  - Total N est. = **121.36**
  - 63 adults (95% CI: 29 – 322)
  - 58 juveniles (95% CI: 27 – 296)
- Likely underestimate since only animals moving through the valley are available for CMR – what is our effective trapping area?

# How many geckos were predicted?

- Results of population modelling in program VORTEX
- Deterministic and stochastic\* models run
- Estimated population sizes by 2011:
  - **125** individuals (stochastic estimate)
  - Compare with **121 – 133** individuals estimated by Manly-Parr and Huggins... uncanny!
- Population growth rate est. 5.12%
  - Towns (2002) suggests >2.6% is realistic
  - Other estimates ranged between 6-12%



\*In this model; age to first reproduction 8 years for both sexes; maximum breeding age 36 years; sex ratio 1:1 at birth; polygynous mating; 65% of males contributed to breeding pool; 56% females breeding/year, annual reproductive output 1.12 young/female/year. Two catastrophic events occurred. 1000 simulations run. This scenario is therefore stochastic.

# How many survived?

- Founder survival 2009-2012:
  - 10 founder animals recaptured, indicating minimum founder survival of 25%
  - Founders made up 8.7% of all individuals captured
- Estimated 95% survive & 5% die each year\*
  - Also, we're 95% certain that 77.5% to 99.0% of animals survive to see the next year
- One recorded death ☹️
  - Mana-born female gecko 2100 found dead
  - Reason for death unclear, but inflammation of parts of colon and cloaca & bacterial counts from gut – septicemia???



\* Estimated from Cormack-Jolly-Seber modelling of 2009 – 2011 data, best model = no age grouping, survival and p non-time specific



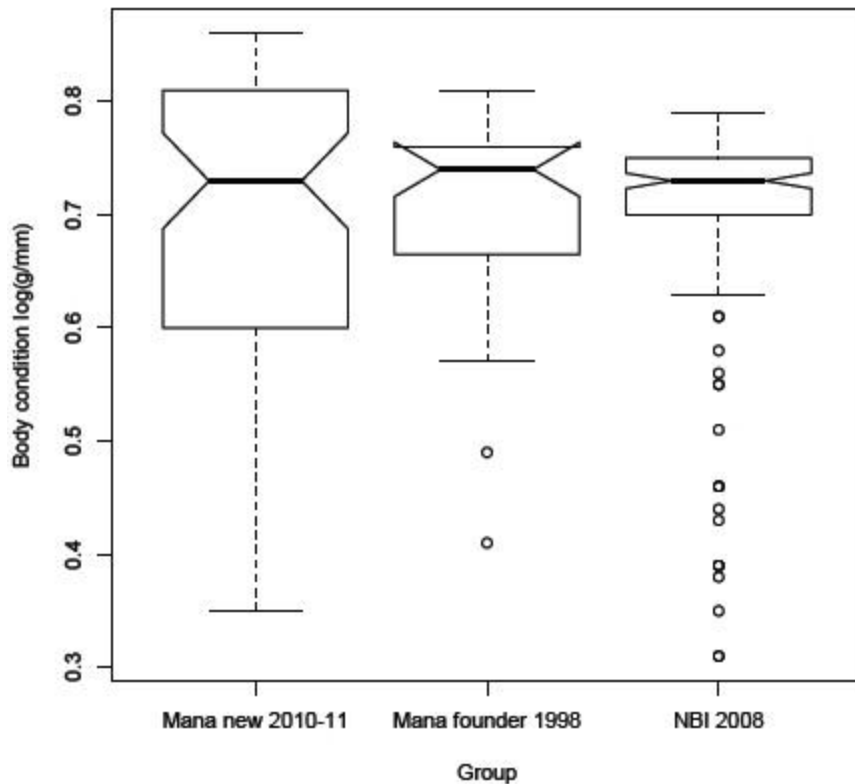
# Population demographics

Location	Population Status	Sex ratio F:M	% Adults	% Juveniles	Reference
Mana Island	Translocated	1:1.19	79 75 54	21 25 46	This study 2009-10 2010-11 2011-12
North Brother Island	Stable (with tuatara)	1:1.24	89*	11*	Wilson 2010
Green Island	Stable		86*	14*	Hoare et al. 2007
Korapuki Island	Recovering from rats (1993)		76	24	Hoare et al. 2007
Ohinau Island	Prior to rat eradication		96*	4*	Hoare et al. 2007

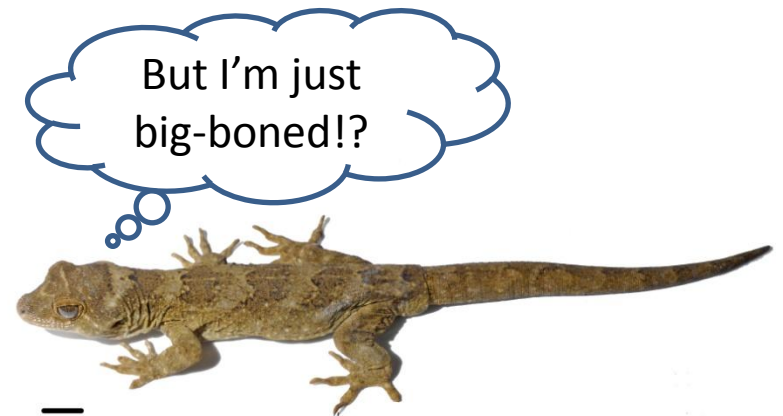
**Inflated % juveniles suggest population is still in recovery / growth phase. \* = sig. diff. from 2010-11 Mana Is. proportion**

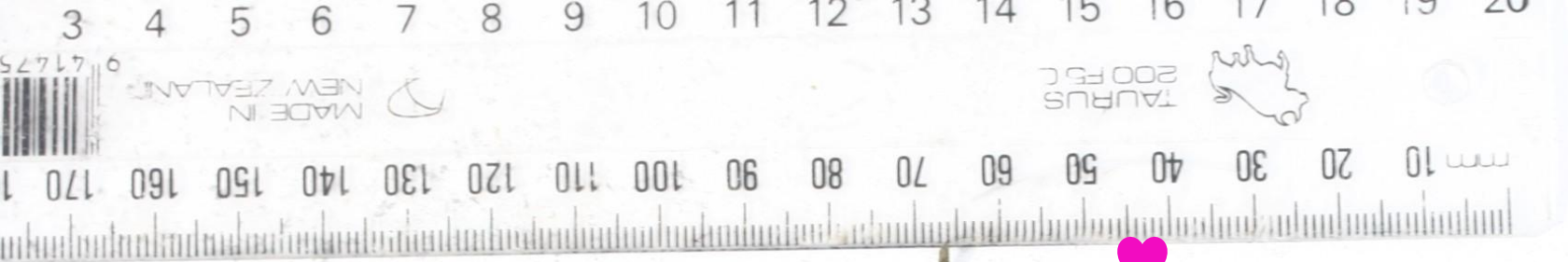


# Individual condition



Body condition not different from either group





Founder animal 0043

Captured from North Brother as a sub-adult in Nov 1997 (81mm SVL, probably 5 years old) & released on Mana in Feb 1998

Recaptured 6x during 2009 & 2012

She is now about 19 years old and 122 mm SVL

Gravid on 26 Feb 2009, 14 March 2010 & 24 Feb 2011 (suggests annual reproduction for some?)

Gave birth between 14 March 2010 & 30 March 2010 – was 66.5 g & dropped to 46 g (loss of 20.5 g!)



# Radio Telemetry: Habitat & Range Use

10 adults tracked over 16  
consecutive nights  
(6 ♂, 4 ♀)

2x daily (day, night)  
March-April 2011

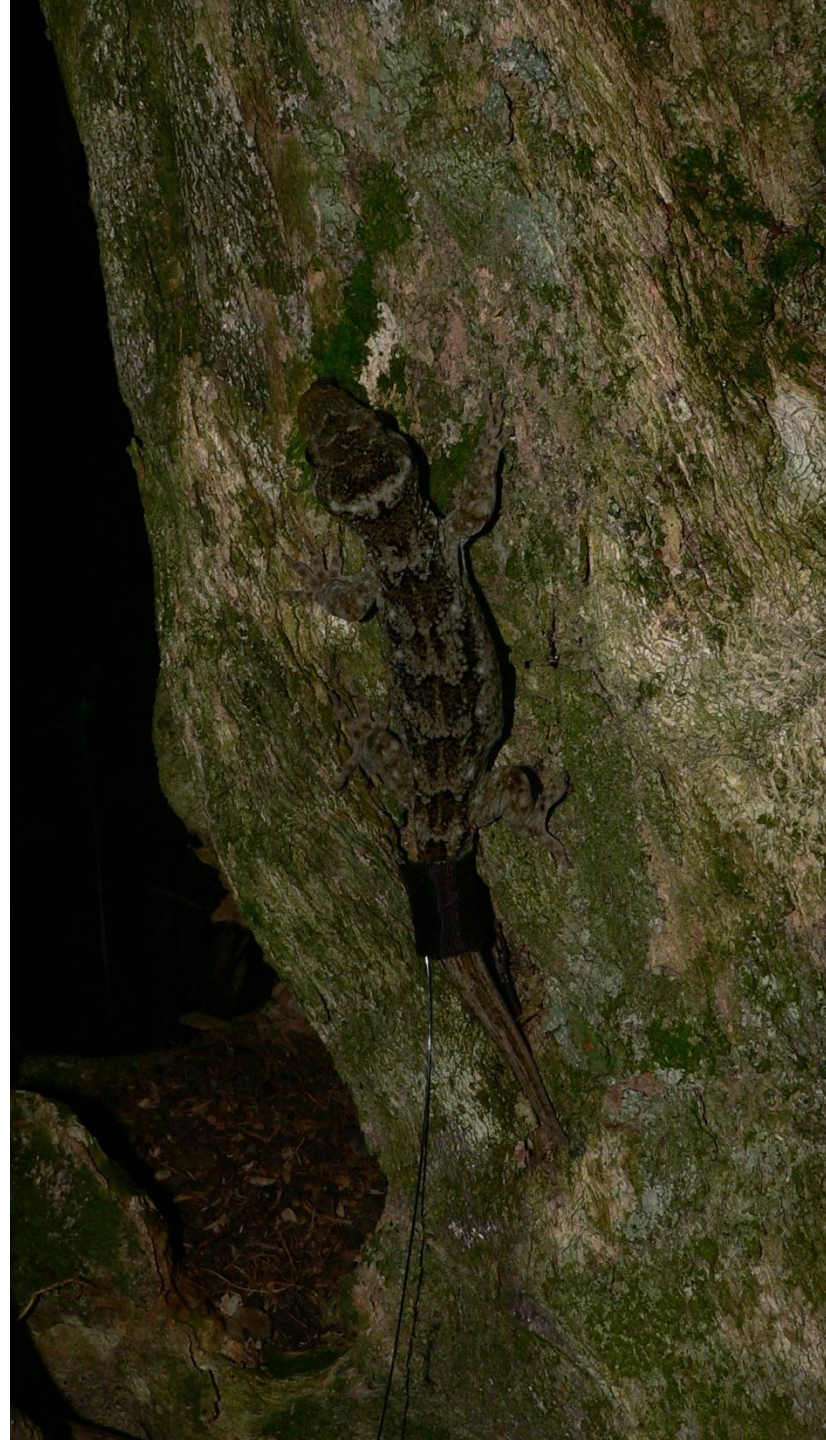
Still analysing the data...  
... but we can tell you  
this...





## Duvaucel's geckos on Mana Island:

- **7/10** of tracked adults visited the valley at least once over the 16 night tracking period
- Effective trapping area of spotlight transects not restricted to the valley, but other animals that never visit the valley will still be missed
- Large home ranges evident
- Use all habitat types from shoreline, coastal cliffs, scrub and inner forest
- Move between and across these habitats
- Sex and size classes overlap in range
- Have become arboreal as well as terrestrial











**Where did they go? Range area of tracked geckos**



# Translocation status achieved?

## ✓ Stage 1 (years 0-1)

- Founders larger, with higher body condition than released. New animals in better body condition than NBI populations and founder animals at release

## ✓ Stage 2 (years 1-5)

- In 2011, up to 25.4% of geckos captured were juveniles, and many unmarked adults present in the population suggesting recruitment

## ✓ Stage 3 (years 10+)

- More animals than 40 were identified in 2010-2012 (n=115 -1)
- Capture-mark-recapture based estimates coming soon!

## ? Stage 4 (year 50+) – pending...

- Come to my talk in 2048 (50 years post-release!)

# Conclusions

- **Results to date suggest that this translocation has reached an appropriate level of translocation success over a 10-15 yr timeframe for this species - ‘Stage 3’**
- Standardised spotlight transects of 8 nights are an effective sampling technique for capture-mark-recapture studies of this population, with ancillary captures from Onduline ARs
- CMR continues for 1 more summer to examine population sizes, growth and expansion from the release location



# Conclusions cont...

- DOC's translocation strategies appear to have worked well for this species
  - using PVA
  - biased founder selection (sex ratio, gravid females, body condition)
  - choice of release location
- Expanding population may have exploited favourable conditions hence initial PVA population size predictions too conservative?
  - lack of tuatara, more resources
  - ? earlier maturity and/or higher fecundity;
    - Recalculate PVA using earlier ages or higher reproductive output
- Next question: inbreeding depression/genetic drift due to Allee effects
  - DNA samples available from founders, and toe-clips of newborns
  - Who is keen to look into that – a possible Masters project?

# Acknowledgements

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# That's all, folks!



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