

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

**Translocation and post-release monitoring
techniques of Auckland green gecko (*Naultinus
elegans elegans*) using a penned release**

A thesis in partial fulfilment of the requirements for the degree of

Master of Science in

Conservation Biology,

Massey University, Auckland, New Zealand

Sarah Naomi Scott

2016



Juvenile green gecko “Jade”, posing for a photo, Hunua Ranges, New Zealand.
Photograph by Harry Scott.

Abstract

A translocation of Auckland green gecko (*Naultinus elegans elegans*) using penned and hard releases is conducted during an emergency salvage in the Hunua Ranges, Auckland. The value of limiting individuals' movement post-translocation is discussed. Radio-telemetry as a resourceful long-term monitoring technique is also discussed including limitations.. The population of 52 individuals were salvaged prior to deforestation of habitat as part of the mitigation process in human-wildlife conflict. Translocations are a major part of New Zealand's conservation strategies, and this event proved a unique opportunity to study post-release movements of Auckland green gecko (*Naultinus elegans elegans*).

To test whether penned releases have an effect on post-release movements, salvaged geckos were divided into two groups. One group of individuals was released as a penned release and one group as a non-penned (hard) release. Using radio-telemetry, information was collected on movement behaviours post-release. 100% minimum convex polygons and 95% kernel estimates were used to establish areas for each individual and compared between the two release groups. Due to the small sample sizes, statistical power was low and no statistically significant differences were found between penned and non-penned release groups in terms of movement post-release. However, exploratory data analysis shows some differences in range particularly in relation to distance from release (m). It seems that penned released geckos tend to stay within the area of their release site compared with non-penned released geckos. This could be an early indication of territory and home range establishment from founder individuals.

Multiple methods of monitoring post-translocation of green geckos as well as trapping and monitoring of mammalian predators within the area were carried out throughout the duration of the radio-telemetry aspect of the study. The benefits and limitations are discussed for each. Rat trapping in the release site area showed a trend with very low numbers caught ($n=2$) and high levels of mice prints throughout the general shrubland area. The presence of rat poison in the digestive tract of one rat caught during trapping leans towards successful pest control to date which is keeping numbers of rats at relatively low densities.

Using penned release methods during wildlife translocations can prove to be an expensive and long-term endeavour. The practical use of penning Auckland green gecko post-release is still yet to be accurately defined in this study. Using radio tracking techniques to monitor the translocated individuals' movement behaviours up to 4 weeks after release was successful. Using specific materials and harness designs that are the right 'fit' for the species is imperative as was shown with the unsuccessful use of the first design in this study. Transmitters allowed for the collection of detailed information of movement behaviours horizontal and vertical to be collected with ease. For cryptic, arboreal geckos this information would otherwise be difficult to attain if relying only on regular searching techniques such as spotlighting. Future translocations of gecko should consider using radio-telemetry to collect invaluable information for future translocation management decisions.

Permits and Authorisations

MUAEC Protocol 13/71

“Dispersal of Green Geckos Following Translocation”

Approved Thu 22/05/2014 3:25 p.m.

National Doc Permit number 37031-FAU, File number NHS-12-03

This National permit is for use by trained Tonkin and Taylor staff and covers capture, handling, and relocation of NZ lizards across the Auckland Region, including Hunua Quarry.

Acknowledgements

First and foremost, I would like to thank my supervisors Dianne Brunton and Manu Barry for their time and guidance over the past two years. Thank you Manu for your extensive herpetofauna knowledge and experience that has been invaluable to this study. As well as always having plenty of help in terms of theses and papers that could point me in the right directions. Thanks to Winstone Aggregates for providing the funding and means for this project, in particular Keith Barber, for your extensive help out in the field. Big thanks to all of the team at Tonkin & Taylor, Graham Ussher, Matt Baber, Duncan Law, Keiran Miller, Caleb Sjardin, and Megan Young for their support and extensive help not just with spotlighting but also sharing of knowledge, experience and enthusiasm during the early hours of the morning. Thank you to Carey Knox and Jo Monks for their correspondence with gecko harness design, their studies greatly influenced the process of this one. Thanks to Aaron Palmer for all your help in the field as well as technical help with field gear, help in the lab and with statistics using R. Thanks to Adam Smith for his extensive help with R and giving me the tools to progress my own knowledge. Thank you to all my volunteers- Esther, Bailey, Harry, Liam, Jill, Liz, Wesley, Kelsey, Anja, Mark, Mum and my two biggest helpers Dad and Carl who came out on multiple trips day, night, and weekends to help me get the work done at the quarry. Thanks to my amazing friends and colleagues from Massey, Monika, Natasha, Eli, Michael, Faline, Serena and Ewan for the weekly lunch dates, as well as their support through some, if not all of this journey. Special thanks to Faline for generously helping me with R in her spare time. Biggest thanks to my family for being such a great support during my time studying as it hasn't been easy. Last but not least, thank you to Carl, my partner,

number one volunteer, and biggest cheerleader and support particularly the last two and a half years of study. I don't know what I would have done without you.

Contents

ABSTRACT.....	3
PERMITS AND AUTHORISATIONS.....	5
ACKNOWLEDGEMENTS.....	6
CONTENTS.....	8
LIST OF FIGURES.....	11
LIST OF PLATES.....	12
LIST OF TABLES.....	13
LIST OF APPENDICES.....	14
CHAPTER ONE.....	15
1.1 INTRODUCTION.....	16
1.1.1 <i>New Zealand Herpetofauna</i>	16
1.1.2 <i>Distribution- Past and Present</i>	16
1.1.3 <i>Threats</i>	17
1.1.4 <i>Translocation</i>	18
1.1.5 <i>Green gecko ecology</i>	20
1.2 AIMS.....	22
1.3 THESIS STRUCTURE.....	23
CHAPTER TWO.....	24
1.4 STUDY SITE.....	25
1.4.1 <i>Hunua Ranges</i>	25
1.5 METHODOLOGY.....	26
1.5.1 <i>Establishment of study site</i>	26
1.5.2 <i>Spotlighting and Translocation</i>	28
1.5.3 <i>Handling and measuring procedures</i>	29
1.5.4 <i>Transmitter attachment and release</i>	30
1.5.5 <i>Tracking</i>	32
1.5.6 <i>Subsequent Search Efforts</i>	33
1.5.7 <i>Pest Control</i>	35
1.5.8 <i>Relevant permits and authorisations</i>	37
1.5.9 <i>Statistical Analysis</i>	38
CHAPTER THREE.....	39

1.6	INTRODUCTION.....	40
1.7	METHODOLOGY.....	42
1.7.1	<i>Statistical analysis</i>	43
1.8	RESULTS.....	44
1.8.1	<i>Translocated population</i>	44
1.8.2	<i>Search effort</i>	44
1.8.3	<i>Gecko morphometrics</i>	46
1.9	DISCUSSION.....	50
1.9.1	<i>Search effort, methodology and constraints</i>	50
1.9.2	<i>Habitat preference</i>	51
1.9.3	<i>Morphometrics</i>	51
1.9.4	<i>Measures of a successful translocation</i>	52
1.9.5	<i>Population data</i>	53
1.10	SUMMARY AND CONCLUSION.....	54
CHAPTER FOUR.....		55
1.11	INTRODUCTION.....	56
1.11.1	<i>Translocation and dispersal</i>	56
1.11.2	<i>Monitoring methods</i>	56
1.11.3	<i>Minimum convex polygons and kernel density estimates</i>	57
1.12	METHODOLOGY.....	58
1.12.1	<i>Harness design</i>	58
1.12.2	<i>Release and tracking</i>	58
1.12.3	<i>Statistical analysis</i>	59
1.13	RESULTS.....	60
1.13.1	<i>Average daily movements</i>	61
	61
1.13.2	<i>Movement in relation to release point</i>	62
1.13.3	<i>Habitat use</i>	63
1.13.4	<i>Calculation of areas occupied</i>	64
1.14	DISCUSSION.....	68
1.14.1	<i>Harness design and transmitter attachment</i>	68
1.14.2	<i>Habitat use</i>	69
1.14.3	<i>Penned vs. Non-penned</i>	70
1.14.4	<i>Movement patterns after release</i>	71
1.14.5	<i>Minimum convex polygons and kernel estimates</i>	72
1.15	SUMMARY AND CONCLUSION.....	74
CHAPTER FIVE.....		75

1.16	INTRODUCTION	76
1.16.1	<i>Recapture methods</i>	78
1.16.2	<i>Short term monitoring techniques</i>	78
1.17	METHODOLOGY	79
1.17.1	<i>Recapture effort</i>	79
1.17.2	<i>Tracking tunnels and trapping</i>	79
1.18	RESULTS	81
1.18.1	<i>Gecko recapture</i>	81
1.18.2	<i>Recapture methods</i>	81
1.18.3	<i>Trapping</i>	82
1.18.4	<i>Tracking tunnels</i>	85
1.19	DISCUSSION	88
1.19.1	<i>Recapture</i>	88
1.19.2	<i>Tracking methods</i>	89
1.19.3	<i>Tracking tunnels in trees</i>	89
1.19.4	<i>Attempted captures using funnel traps</i>	90
1.19.5	<i>Trapping and tracking tunnels on the ground</i>	90
1.19.6	<i>Caught rodent results</i>	91
1.20	SUMMARY AND CONCLUSION	93
CHAPTER SIX.....		95
1.21	OVERVIEW	96
1.21.1	<i>Penning prior to release</i>	97
1.21.2	<i>Transmitter use</i>	98
1.21.3	<i>Post-release monitoring</i>	98
1.21.4	<i>Pest Control</i>	98
1.21.5	<i>Moving forward</i>	99

List of figures

FIGURE 1. SATELLITE VIEW OF THE HUNUA RANGES SOUTH EAST OF AUCKLAND IN RELATION TO AUCKLAND SUBURBS AND THE FIRTH OF THAMES.	26
FIGURE 2. AERIAL MAP OF WINSTONE AGGREGATE QUARRY. WHITE OUTLINE INDICATES THE PROPOSED QUARRY PIT; GECKO SEARCH AREA IS INDICATED BY ORANGE; SECOND STAGE GECKO SEARCH AREA INDICATED BY BLUE; PURPLE OUTLINE INDICATES THE RELEASE SITE ALSO KNOWN AS HAYPADDOCK.	27
FIGURE 3. MALE AND FEMALE WEIGHT (G) OF AUCKLAND GREEN GECKOS (<i>NALTINUS ELEGANS ELEGANS</i>) SHOWN COMPARATIVELY AS BOXPLOTS DISPLAYING MEDIANS AND RANGE.	46
FIGURE 4. MALE AND FEMALE SNOUT-VENT-LENGTHS (MM) OF AUCKLAND GREEN GECKOS (<i>NAULTINUS ELEGANS ELEGANS</i>) EXPRESSED AS BOXPLOTS DISPLAYING MEDIANS AND RANGE.	47
FIGURE 5. THE CORRELATION BETWEEN WEIGHT (G) AND SNOUT-VENT-LENGTH (MM). ALL GRAVID FEMALES WERE EXCLUDED FROM THIS ANALYSIS DUE TO THEIR WEIGHT BEING LARGER THAN NORMAL. ANIMALS WITH NO TAIL OR A REGENERATED TAIL WERE ALSO EXCLUDED DUE TO THE IMPACT IT WOULD HAVE ON WEIGHT.	48
FIGURE 6. COMPARATIVE BOXPLOTS OF AUCKLAND GREEN GECKO (<i>NAULTINUS ELEGANS ELEGANS</i>) NON-PENNED AND PENNED RELEASE GROUPS AVERAGE WEEKLY MOVEMENTS (M).....	61
FIGURE 7. GRAPH OF THE TWO DIFFERENT RELEASE TYPES FOR SIDE BY SIDE COMPARISON OF AVERAGE DAILY DISTANCE PER WEEK OVER FOR EVERY WEEK FOR FIVE WEEKS' POST-RELEASE.....	62
FIGURE 8. BOXPLOT OF NON-PENNED AND PENNED RELEASE GROUPS FINAL DISTANCE FROM RELEASE POINT (M).....	63
FIGURE 9. COMPARATIVE GRAPH OF PENNED AND NON-PENNED RELEASE GROUPS' AVERAGE MAXIMUM DISTANCES FROM RELEASE (M) SHOWN IN WEEKS' POST-RELEASE.....	64
FIGURE 10. 100% MCP (A) PENNED GECKOS, (B) NON-PENNED GECKOS. SEX IS DISTINGUISHED BY COLOUR: MALES IN BLUE, FEMALES IN RED. RELEASE POINTS SHOWN WITH AN X WITHIN EACH POLYGON.	66
FIGURE 11. 95% KERNEL ESTIMATES OF (A) PENNED AND (B) NON-PENNED RELEASE GROUPS. DIFFERENTIATED BY SEX; MALES IN BLUE, FEMALES IN RED. RELEASE POINTS SHOWN USING X.....	68
FIGURE 12. DIAGRAM OF APPROXIMATE POSITIONING OF RELEASE SITE. THE PENNED AREA (BLACK OVAL), TRAPS SET (BLUE RECTANGLES), TRACKING TUNNELS (GREEN TRIANGLES), VEHICLE ACCESS WAY (DOUBLE ORANGE LINES), FORESTED AREA (ABOVE BLUE LINES).....	81

List of plates

PLATE 1. THE 0.5M FENCE USED TO SURROUND THE PENNED RELEASE AREA AS A BARRIER. MADE FROM BLACK PLASTIC AND POSITIONED AROUND THE ENTIRE SOFT RELEASE AREA. ALL VEGETATION ON BOTH SIDES CUT AWAY TO PREVENT ESCAPE OVER THE FENCE.	28
PLATE 2. AUCKLAND GREEN GECKO BEING WEIGHED USING A PLASTIC CUP AND ELECTRONIC WEIGHTS DURING PROCESSING.	29
PLATE 3. AUCKLAND GREEN GECKO WEARING THE ORIGINAL HARNESS DESIGN USING NON-ADHESIVE GREEN BANDAGE MATERIAL.	31
PLATE 4. MALE AUCKLAND GREEN GECKO WEARING THE SECOND HARNESS DESIGN MADE USING SELF-ADHESIVE HYPO-ALLERGENIC SPORTS TAPE COLOURED GREEN WITH XYLENE FREE MARKER.....	32
PLATE 5. RADIO TRACKING OF TRANSMITTER RELEASED AUCKLAND GREEN GECKOS (<i>NAULTINUS ELEGANS ELEGANS</i>). .	33
PLATE 6. COMPARISON OF INTESTINAL COLOURATION BETWEEN TWO RATS. LEFT HAS INGESTED BAIT WITH ABNORMAL COLOUR, RIGHT IS NORMAL COLOUR OF TRACT.....	37
PLATE 7. OPEN CONTENTS OF MALE RATS' (<i>RATTUS RATTUS</i>) STOMACH CONTENTS SHOWING LARGE AMOUNTS OF RECENTLY EATEN POISONOUS BAIT.	82
PLATE 8. (A) PICTURE DORSAL SURFACE OF MALE SHIP RAT (<i>RATTUS RATTUS</i>) COLOUR MORPH 'RATTUS', (B) DORSAL SURFACE OF FEMALE RAT (<i>RATTUS RATTUS</i>) COLOUR MORPH 'FRUGIVOROUS'	84
PLATE 9. (A) VENTRAL SURFACE OF MALE SHIP RAT (<i>RATTUS RATTUS</i>) COLOUR MORPH 'RATTUS', (B) VENTRAL SURFACE OF FEMALE SHIP RAT (<i>RATTUS RATTUS</i>), COLOUR MORPH 'FRUGIVOROUS'	86
PLATE 10. TRACKING CARD COVERED WITH MICE PRINTS (<i>MUS MUSCULUS</i>) LESS THAN 10MM WITH THE CHARACTERISTIC THREE DOTS FROM THE FRONT OF THE FOOT AND 2-3 FROM THE BACK OF THE FOOT.....	87
PLATE 11. TRACKING CARD WITH POSSUM (<i>TRICHOSURUS VULPECULA</i>) PRINT SURROUNDED BY MICE PRINTS (<i>MUS MUSCULUS</i>). POSSUM PRINT SHOWS THE MAIN PADS OF THE FOOT AND TOE PADS. MICE PRINTS SHOW THE 3 FRONT TOES AND TWO BACK MARKS FROM FOOT PADS.....	88

List of tables

TABLE 1. SEARCH EFFORT FROM EVERY NIGHT SEARCHED INCLUDING SEARCH AREAS AND NUMBER OF GECKOS CAUGHT EACH NIGHT.....	45
TABLE 2. MEAN MEASUREMENTS AND STANDARD ERRORS FOR ALL SEX/REPRODUCTIVE STATUS CATEGORIES.....	48
TABLE 3. MEDIANS (M^2) + RANGE (MIN-MAX) FOR MCP 75%, MCP 95%, MCP 100% AND 95% KERNELS FOR PENNED AND NON-PENNED GROUPS AND NUMBER OF INDIVIDUALS IN EACH GROUP.....	64
TABLE 4. EACH INDIVIDUAL GECKO TRACKED IN BOTH RELEASE GROUPS WITH SVL (MM), WEIGHT (G) AND BOTH 100% MCP AND 95% KERNEL ESTIMATES (M^2).	66
TABLE 5. RESULTS OF TRACKING CARDS COLLECTED OVER A SIX-WEEK PERIOD SIMULTANEOUSLY WITH RAT TRAPPING.	86

List of Appendices

APPENDIX I. TABLE OF NUMBER OF FIXES, FINAL DISTANCE FROM RELEASE (M), AVERAGE WEEKLY MOVEMENT (M), TOTAL DISTANCE TRAVELLED (M) AND AVERAGE PERCH HEIGHT (M) FOR ALL GECKOS TRACKED FOR LONGER THAN A WEEK.	108
APPENDIX II. PATHOLOGY REPORT FROM MASSEY UNIVERSITY FOR DECEASED GECKO M30.....	109
APPENDIX III. TABLE OF RAW DATA, ALL COLLECTED MEASUREMENTS FOR EVERY GECKO CAUGHT DURING SPOTLIGHTING EFFORTS IN 2014. GECKO I.DS' AND MORPHOMETRICS ALONG WITH ANY DISTINCT MARKINGS OR SCARS.	110