Monitoring at Otanewainuku

All result and outcome monitoring data and future recommendations

February 2014

Larissa Cherrie

Summary

This report has been prepared on behalf of the Otanewainuku Kiwi Trust with regard to monitoring within the Otanewainuku Conservation Area. This is to enable a quantitative understanding of the variety of different monitoring methods and statistics within this area. This information is of value to the Otanewainuku Kiwi Trust and the Department of Conservation in sustaining this rare remnant example of the highly underrepresented semi-coastal lowland forest.

Analysis of pest, predator and foliage data trends indicate that the present control strategies employed have halted the decline at Otanewainuku. Pest and predator numbers along with forest health seem to be stable. However, the health of the Otanewainuku forest outside the pest control block is declining at a concerning rate.

A 2014 survey of forest health within the control block must be completed to determine if the block is regenerating, or if further improvement of the forest as a habitat for native species will require a ramping up of control operation intensity and an extension of the area of operations.

Gaps in the data set have limited the scope of this report to a degree. Improving the management of data collection and storage will be critical to the success of future efforts to restore Otanewainuku to its former glory. Future control strategies must be designed on a scientific basis supported by a comprehensive, data based, understanding of the forest ecosystem.

Acknowledgements

I would like to thank the following people and organizations for their assistance in the development of this report.

- The New Zealand Royal Society and Bayer Boost for their very generous scholarship.
- The Department of Conservation Tauranga area office; especially Brad Angus for the access to historical records, with reference to the Otanewainuku Conservation Area, and also for his help in the field.
- Everyone at the Otanewainuku Kiwi Trust who helped me gather all the monitoring data, especially Nigel Veale, Phil Wells, Jenny Black and Dave Edwards.
- Forest and Bird and Des Heke for their data and enthusiasm.
- Gavin Cherrie for his guidance and statistical advice.

Table of Contents

1.0 Introduction

1.1 Purpose

This report has been formulated on the behalf of the Otanewainuku Kiwi Trust with regard to monitoring within the Otanewainuku Conservation Area. This is to enable a significant understanding of a variety of different monitoring methods and results within this area. This information is of value both to the Otanewainuku Kiwi Trust and the Department of Conservation in sustaining this rare example of a highly underrepresented semi-coastal lowland forest.

1.2 Scope

The scope of work to be carried out would encompass

- To compile a summary of systems and methods that are most effective for restoring biodiversity.
- Generate a comprehensive and concise report to present data and results in a manner that enables ease of future monitoring.

2.0 Pest and Predator Control Operations - Summary

2.1 Possum and Rodent control operations

As indicated in table 2.1, a diverse range of toxins have been used over the past twenty years of pest control operations. The Otanewainuku Kiwi Trust Operations group now reviews the strategy around use of toxins annually. Effectiveness of toxin operations are assessed by post trapping and monitoring bait take rates. While there are some gaps in the data set it is possible to gain an overview of the effectiveness of Possum control.

Table 2.1 Otanewainuku Conservation Area Pest Control History

Year	Organization	Method	Pre-control RTCI	Post-control RTCI
1994/ 1995	DoC	Trapping / Cyanide	36%	6%
1997	DoC	North Block: 1080 in bait stations	30.14%	6.73%
		South Block: Trapping / Cholecaliferol		
1999	DoC	North & South Block: Brodificum in bait stations	*30%**	21.41%
		Mountain Block: 1080 in bait stations		
2006	OKT	OKT control area: 1080 in 150x150m bait station network	*45%**	5.30%
2007	OKT	OKT control area: Cholecalciferol in 150x150m bait station network	15.60%	8.10%
2008	OKT	OKT control area: Cholecalciferol in bags at 25m spacing on 150m spaced control lines	9.90%	1.66%
2009	OKT	Otanewainuku Forest, including Otanewainuku mountain: Cholecalciferol in bags and Diphacinone in bait stations	No Information	No Information
2010	OKT	OKT control area: Cyanide and Pindone in bait stations	No Information	2.8%

2011	OKT	OKT control area: Cyanide (Feratox) encapsulated pellets and Pindone cereal pellets in bait stations	No Information	1.7%
2012	OKT	OKT control area: Pindone cereal pellets and Cyanide (Feratox) encapsulated pellets in bait stations	9.7%	0.7%
2013	OKT	OKT control area: Pindone cereal pellets and Cyanide (Feratox) encapsulated pellets in bait stations	No Information	4.4%
**Estimation based on experienced qualitative observation*				

2.2 Mustelid control operations

Historical predator controls are summarized in table 2.2

Following 2004 trials on the relative effectiveness of eggs and salted rabbit, both types of bait are now used in Stoat trapping operations.

Table 2.2 Otanewainuku Conservation Area Predator Control History

Year	Organization	Method
2002/2003	OKT	Stoat Trapping Tunnels with eggs
2004	OKT	Stoat Trapping Tunnels egg vs. salted rabbit trial
2005	OKT	Stoat Trapping Tunnels with alternate rabbit & egg
2006	OKT	Stoat Trapping Tunnels with alternate rabbit & egg
2007	OKT	Stoat Trapping Tunnels with alternate rabbit & egg
2008	OKT	Stoat Trapping Tunnels with alternate rabbit & egg
2009	OKT	Stoat Trapping Tunnels with alternate rabbit & egg
2010	OKT	Stoat Trapping Tunnels with alternate rabbit & egg

2011	OKT	Stoat Trapping Tunnels with alternate rabbit & egg
2012	OKT	Stoat Trapping Tunnels with alternate rabbit & egg
2013	OKT	Stoat Trapping Tunnels with alternate rabbit & egg

Table 2.3 Otanewainuku Trapping Data

Year	**Stoat**	**Ferret**	**Mustelid**	**Cat**	**Rat**	**H/hog**	**Possum**
2002/2003	37	4	41	5	112	5	4
2004	60	14	74	6	142	4	2
2005	78	11	89	20	217	11	8
2006	57	12	69	4	117	1	9
2007	80	3	83	3	224	5	12
2008	67	5	72	3	251	17	18
2009	69	6	75	7	176	11	9
2010	84	12	96	5	127	9	12
2011	64	11	75	3	65	13	9
2012	73	14	87	2	119	9	8
2013	51	10	61	2	123	6	7
Total	720	102	822	60	1673	91	98

3.0 Monitoring

3.1 Possum and control operation results

Trap-catch monitoring is used to record the possum population, refer table 2.1 and Figure 3.1.

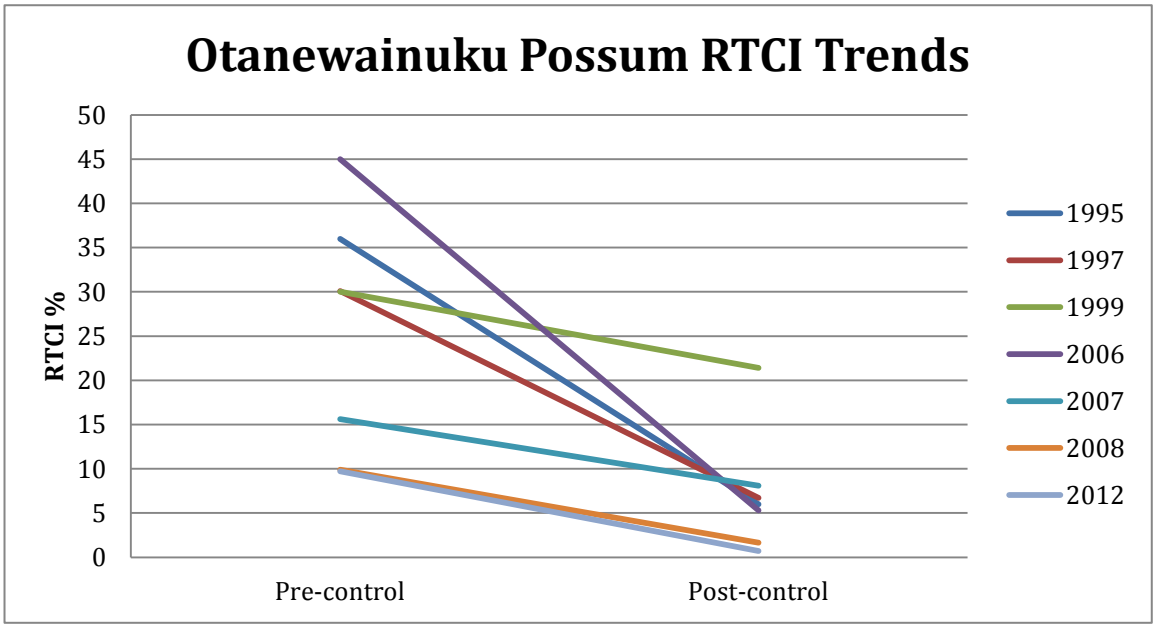
Unfortunately Trap-catch monitoring data sets from 2009 to 2011 and 2013 are incomplete or not available.

The 2013 Post toxin trap-catch result was reported by the contractor as being significantly higher than 2012 (4.4% compared with 0.7%). It is the opinion of the toxin contractor that the higher than usual trap-catch was due to the late start of toxin operations in 2013.

Data from 1995 through to 2008 show a generally improving trend in possum numbers.

Despite there being gaps in the data set there is enough evidence to support the view that the historical trend has been one of decreasing possum numbers in the part of the forest under pest control. The results from 2012 and 2008 are almost identical suggesting that possum numbers in the forest have now reached a plateau where reproduction and reinvasion rates are matched by the rate of animals killed by pest control and natural causes.

Figure 3.1 Otanewainuku Trap catch trends – Possums



3.2 Mustelid control operation results

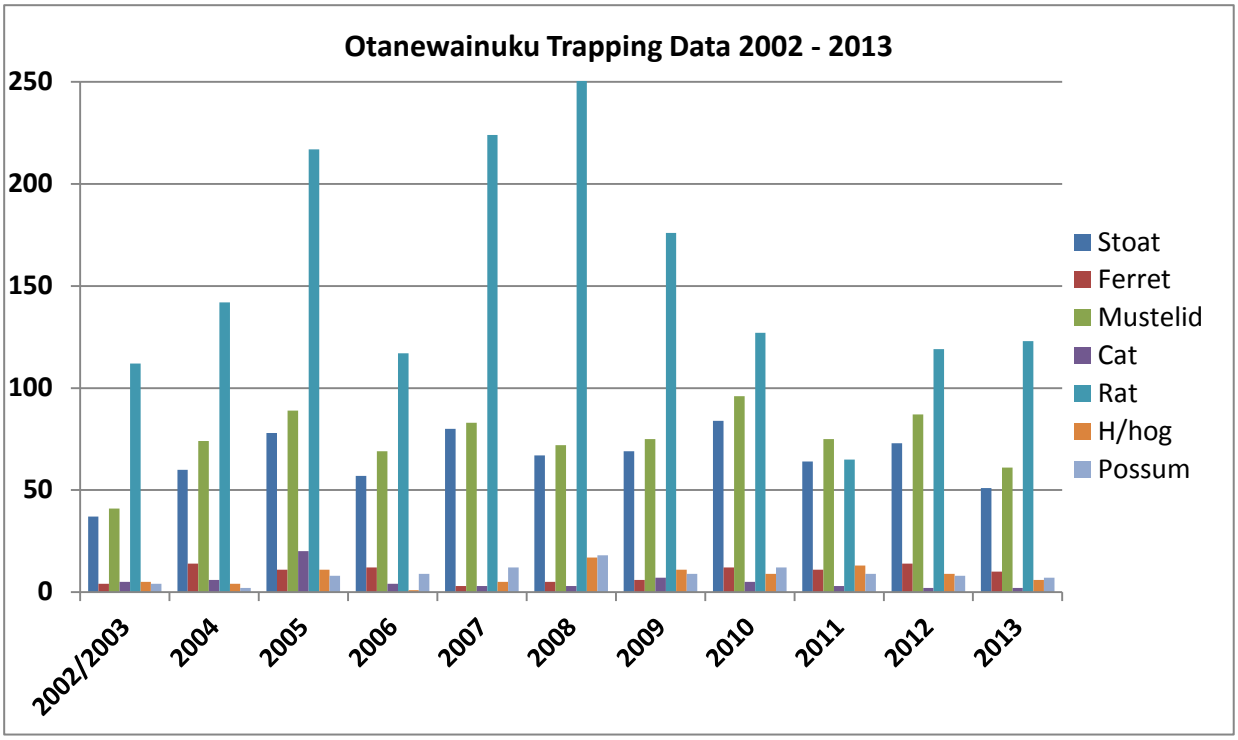
Refer to figure 3.2

Over the past ten years there is a trend of two to three times the rats caught compared to stoats.

Low numbers of ferrets, cats, hedgehogs and possums are caught.

Numbers of Mustelids trapped shows minor variation between years. There is no upward or downward trend in the number of animals trapped following the successful introduction of salted rabbit baits in 2004. The data indicates that an average of 78 Mustelids would be expected to be trapped each year.

Figure 3.2 Mustelid Trapping data



3.3 Kiwi monitoring

Historically Kiwi surveys have been conducted but this practice was discontinued when bird numbers fell to one breading pair. It is planed to introduce up to 10 birds a year for the next two years. The extensive use of radio transmitters will enable bird monitoring, data collection and analysis. Use of this data will need to be maintained to a very high standard to learn about the behaviour of the birds.

3.4 Kokako monitoring

A Kokako walk-through survey was conducted in Otanewainuku Forest during March of 2013 to obtain data on Kokako numbers in the forest, following two translocation releases of 18 birds in 2010 and 2011. For more information on the Kokako Survey please read *Otanewainuku Kiwi Trust – Kokako Survey* by Conor Quinn and Carmel Richardson.

3.5 Other bird monitoring

Forest and Bird completed a bird count survey every year in the Kaimai-Mamaku area, which includes Otanewainuku forest. The surveys are completed over a 17-day period in 2013. They were completed from the 12th October to the 1st November. Unfortunately the data collected from a variety of different sites in the Kaimai-Mamaku is compiled into one spreadsheet and it is not possible to reach any data based conclusions regarding bird life in the pest controlled block of Otanewainuku.

3.6 Invertebrate monitoring

The Otanewainuku area currently does not complete any invertebrate monitoring.

3.7 Bat monitoring

Between December 2009 and January 2010 Peter Cosnahan monitored three potential population sites at Te Kopia, Maungakakaramea and the Otanewainuku forest. Cosnahan hoped with the knowledge that bats were present in a particular area would enable a suitable management strategy to ensure the population is sustained. *Chalinolobus tuberculatus* (long tailed bat) was found at Manungakakaramea and Otanewainuku but no *Mystacina tuberculata* (lessor short tailed bat) were detected at any of the sites. Cosnahan recommends that further study work should be done to confirm the presence or absence of *Mystacina tuberculata* in these areas.

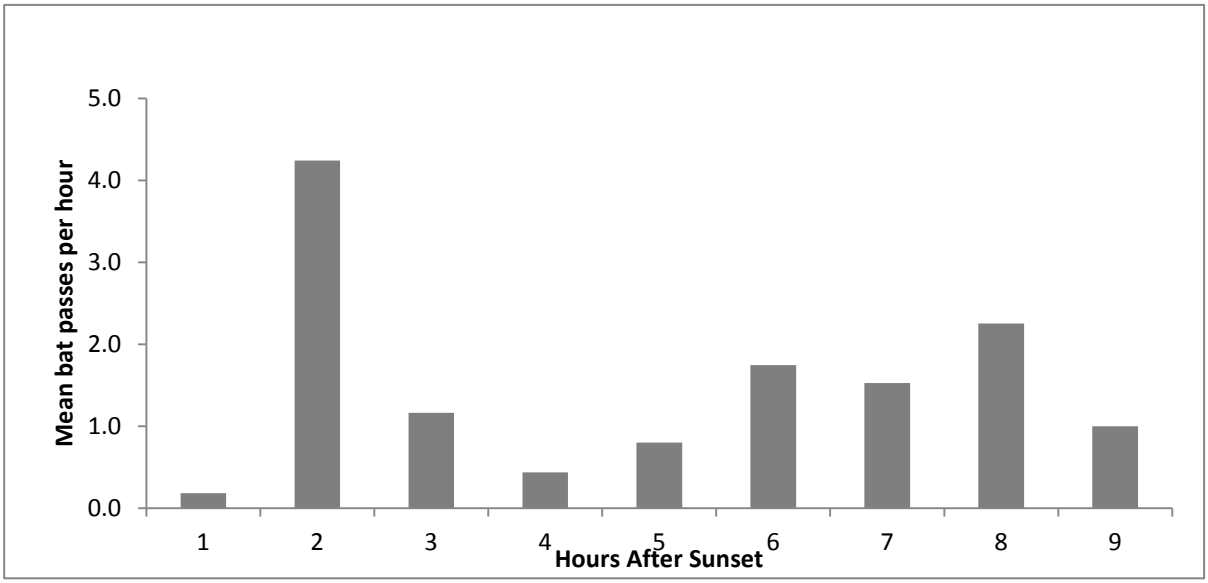
The Automated Bat Monitoring System (ABMS) were deployed for four nights at this site. There were no confirmed passes for *Mystacina tuberculata* (long tailed bat) during the survey. The activity for *Chalinolobus tuberculatus* (short tailed bat) shows a peak of 4.2 bph during the second hour after sunset followed by a period of decreasing activity to 0.4 bph during hour four. Activity then increased to a second smaller peak of 2.3 during hour eight, just before dawn.

Of the total 401 passes, 183 were detected at OTK4 and 160 at OTK9. Feeding buzzes were also detected exclusively at the two sites by an area of open water besides the water supply dams towards the east of the study area. There were a total of 12 feeding buzzes detected, 8 at OTK4, 4 at OTK9, giving an indication that these areas are being used for foraging.

No bat passes were detected at any of the deep forest sites that targeted *Mystacina tuberculata*

The ABMS used for this survey was the Digital Bat Recorders (versions D and E) designed and made by DoC. The ABMS is enclosed in a waterproof and shock resistant case. They have digital heterodyne monitors that process an ultrasound signal heard at one of frequencies 28 kHz and 40 kHz, and record an audible sound file to an SD storage card. The ABMS were chosen because they could be left in position over several nights unattended.

Figure 3.3 The mean number of bat passes per hour for *Chalinolobus tuberculatus* Otanewainuku.



Appendix A provides the GPS locations of the ABMS for Otanewainuku and Appendix B is a map of Otanewainuku Forest showing the locations of the ABMS.

3.8 Fish monitoring

The Otanewainuku area currently does not complete any fish monitoring.

3.9 Vegetation monitoring Results

3.9.1 FBI lines

The Foliar Browse Index method uses plant indicator species to assess the impact of possums on forest health and/or vegetation response to possum control. The method uses the assessment/re-assessment of permanently marked individuals to determine trends in the foliar cover and possum damage to leaves and stems.

Four suitable indicator species were identified as present within the Otanewainuku area, kohekohe (Dysoxylum spectabile), mahoe (Melicytus ramiflorus), pate (Schefflera digitata) and kamahi (Weinnmania racemosa).

A map showing the Otanewainuku Conservation Area and location of monitoring transects and plot locations for transects for 3-8 is given in Appendix C and a table with transects, plot locations and bearings is given in Appendix D.

Canopy Cover condition was monitored in 1994, with five FBI transects established, by Greg Corbett, a then Bay of Plenty Polytechnic Student. These transects were selected in a non-random fashion to attain adequate coverage of the area and vegetation types of forest (Corbett, 1994). Transects 1-5 were re-measured in 1996 by Paul Cashmore and Dale Williams and again in 1998 by Cashmore, Williams, Murray Thompson and Craig Summers. In August/September of 2000, three new transects (6-8) were placed with the intention to increase the sample size and improve statistical strength, these were placed randomly but with bearings which avoided existing lines, roads and boundaries. Lines 1-8 were measured in August of 2000 primarily by Summers, Nancy Williams, and Adrian Stoke with the help of Bruce Davidson. In 2003 transects 1, 3, 4, 6, 7 and 8 were measured at which time it was found that many of the tagged trees were inadequate and removed from the sample (Williams, 2000). Transects 3-8 were re-measured in 2009 by Martian Slimin and where possible additional indicator trees were added to the sample. Transects one and two were not re-measured on the grounds that they didn't lie within the area controlled for possums by the Otanewainuku Kiwi Trust (Slimin, 2009). Transects are marked with orange marker triangles with the start points and plots marked with red and white triangles overlaid in a star pattern.

In February 2014 Brad Angus (DOC) and Larissa Cherrie (OKT) re-measured transects 1 and 2 (outside pest control area). This (2014) data was compared with 2000 data for Stem Use, Brouse and Foliage Cover. A similar analysis was done for transects 3-5 (inside pest control area) comparing 2000 data with 2009 data. Refer to tables 3.1 & 3.2.

Table: 3.1 Otanewainuku Mean Transect scores

	Foliage Cover (%) Foliage Cover Scale			**Browse (0-4)** Proportion of Possum browsed leaves			**Stem Use (0-3)** Possum damage to lower 2m of trunk		
Transect	**2000**	**2009**	**2014**	**2000**	**2009**	**2014**	**2000**	**2009**	**2014**
T1 & T2 (Uncontrolled)	53.11	-	29.70	0.22	-	0.50	0.36	-	0.44
T3-T5 (Controlled)	58.18	55.00	-	0.07	0.10	-	0.35	0.12	-

Table: 3.2 Probabilities of samples having the same mean (2 tailed t-statistic for differences between means)

Comparators	**Foliage Cover (%)**	**Browse (0-4)**	**Stem Use (0-3)**
Uncontrolled 2000 vs. 2014	<0.01	<0.01	0.71
Uncontrolled 2000 vs. Controlled 2000	0.15	0.03	0.93
Controlled 2000 vs. 2009	0.25	0.35	0.01
Uncontrolled 2014 vs. Controlled 2009	<0.01	<0.01	<0.01

Findings Summary: From the information summarized above we can infer,

1. In the sample area with no pest control forest health is declining as measured by Foliage Cover and Browse index.
2. In the sample area with no pest control forest health is static or declining slowly as measured by the Stem Use index.
3. In the sample area with pest control forest health is static or declining very slowly as measured by Foliage Cover and Browse index.
4. In the sample area with pest control forest health is improving as measured by the Stem Use index.
5. As measured by all three indexes forest health is significantly better in the area with pest control than the area without pest controlled.

3.8.2 Exclosure plot

The Department of Conservation has one Exclosure Plot within the Otanewainuku area. It was established in 1981 and was re-measured in 1994 and 2000. This plot is in excellent condition, with an adjacent control. The Otanewainuku Exclosure Plot Location is attached – Appendix E.

3.8.3 20 x 20 plot

The Otanewainuku area currently does not have any 20 × 20 plots.

4.0 Gaps in the monitoring to date

There are gaps in the historic data collected to measure the effectiveness of pest and predator control in the Otanewainuku forest. Most importantly in the trap catch data pre and post toxin control. While this is frustrating the data available do provide an overview of the trends in Pest, Predator and Folia indexes.

A 2014 survey of transects 3 through 5 for Foliage Cover, Browse Index and Stem Use will be critical to determine if the forest is recovering as a result of the pest and predator control initiatives of the last 20 years.

5.0 General state of the forest given monitoring to date/Forest health data analysis

There is no question as to the benefit of the pest and predator control efforts in Otanewainuku. The health of the forest outside the pest control block is declining at a concerning rate.

Analysis of pest, predator and foliage data trends indicate that the present control strategies employed have at least “stopped the rot” at Otanewainuku. That is, while all indications are that the overall forest health has not declined in the last 12 years, neither has it improved.

The impact of pest control has been to massively reduce possum numbers to the point where residual trap catch numbers prior to the annual poisoning program sits at 10% and post poisoning sits at 1-2%. This is down from 30% and 20% respectively in the early years of the project.

Predator trapping has reached a stable equilibrium with a consistent average annual catch of 78 mustelids a year.

The most recent data (2009) shows Folia Coverage is stable in the 55 – 60% range; Browse Index is consistent at 0.1 while the Stem Use index has improved to 0.12.

It is possible, even likely, that there will be a time delay of several years in the recovery of these folia indexes following the reduction in pest numbers. Completion of folia index surveys of transects 3, 4 and 5 in 2014 should be a high priority as this could show signs of regeneration and provide some welcome “good news” to everyone associated with the project.

6.0 Recommendations for monitoring for the future

1. In order to gain a comprehensive understanding of forest biodiversity invertebrate, fish and bird count monitoring should be done on a regular basis, say, biannually

2. Increase the frequency of FBI monitoring to biannual re-measurements of Transects 1 – 5 only. This will give an additional measure of effectiveness of possum control operations and early detection of possible vegetation decline or improvement. Transects 3 – 5 should be monitored as early as possible in 2014 to compare with the 2014 data for transects 1 & 2.

3. Further study work should be done to confirm the presence or absence of *M. Tuberculata* (lessor short tailed bat) in Otanewainuku.

4. Extend the pest control management area as far north as budget and resources allow.

5. The Operations group should develop a formal process for capturing and assessing the appropriateness of new pest and predator control technologies for use in Otanewainuku.

6. Data analysis needs to be presented in a way to support the ongoing design of pest and predator control plans.

7.0 Readings

- Peter Cosnahan, October 2010, *Searching of New Zealand's Endemic Bats in the Bay of Plenty*, Bay of Plenty Polytechnic
- *Otanewainuku Kiwi Trust establishing a Kiwi population 2013-2018*
- Jess Scrimgeur, February 2013, *Establishing a Kiwi Population at Otanewainuku*, Department of Conservation
- Ryo Miyanami, November 2009, *An Assessment of ungulate impacts on plant regeneration on conservation land parcels in the Western Bay of Plenty*, Environmental Management, School of Applied Science, Bay of Plenty Polytechnic
- Wildlands Consultants Ltd for the Department of Conservation, Environment Bay of Plenty and Environment Waikato, February 2010, *State of the environment assessment for the catchments of the Kaimai Range and Northern Mamaku Plateau*, Report No. 2075
- Keith L. Owen, *Kiwi Management Plan: Bay of Plenty Conservancy 2005-2010*, Department of Conservation Rotorua
- Hugh A Robertson, *Kiwi (Apteryx spp.) recovery plan (threatened species recovery plan 50) 1996-2006*, Kiwi Recovery Group
- Nancy Williams, November 2000, *Possum Impacts and Indicator Species Condition, Otanewainuku Conservation Area*, Department of Conservation Tauranga
- Patrick Stewart, April 2003, *Forest Condition Survey at Otanewainuku*, Bay of Plenty Polytechnic
- M. Slimin, 22 April 2009, *Otanewainuku Conservation Area Forest Canopy Response to Historic Possum (Tricosurus vulpecula) 1994-2009*, Western Bay of Plenty District Council
- I.J. Payton, C.J. Pekelharing & C.M. Frampton, January 1997, *Foliar Browse Index: A Method for Monitoring Possum Damage to Forests and Rare or Endangered Plant Species,* Landcare Research New Zealand LTD
- Conor Quinn & Carmel Richardson, May 2013, *Otanewainuku Kiwi Trust – Kokako Survey,* Otanewainuku Kiwi Trust
- Karl McCarthy, *A comparison between Otawa and Otanewainuku Forests, using a Foliar Browse Index to evaluate the effects of possums on plant species*, School of Applied Science, Bay of Plenty Polytechnic
- September 2010, *Foliar Browse Monitoring in the Tauranga City Council Water Catchment – Oropi,* Naturally Native

8.0 References

People spoken with:

OKT – Dave Edwards, Nigel Veale, Phil Wells and Jenny Black

DOC – Local staff, Brad Angus

Oropi Water Catchment – Des Heke

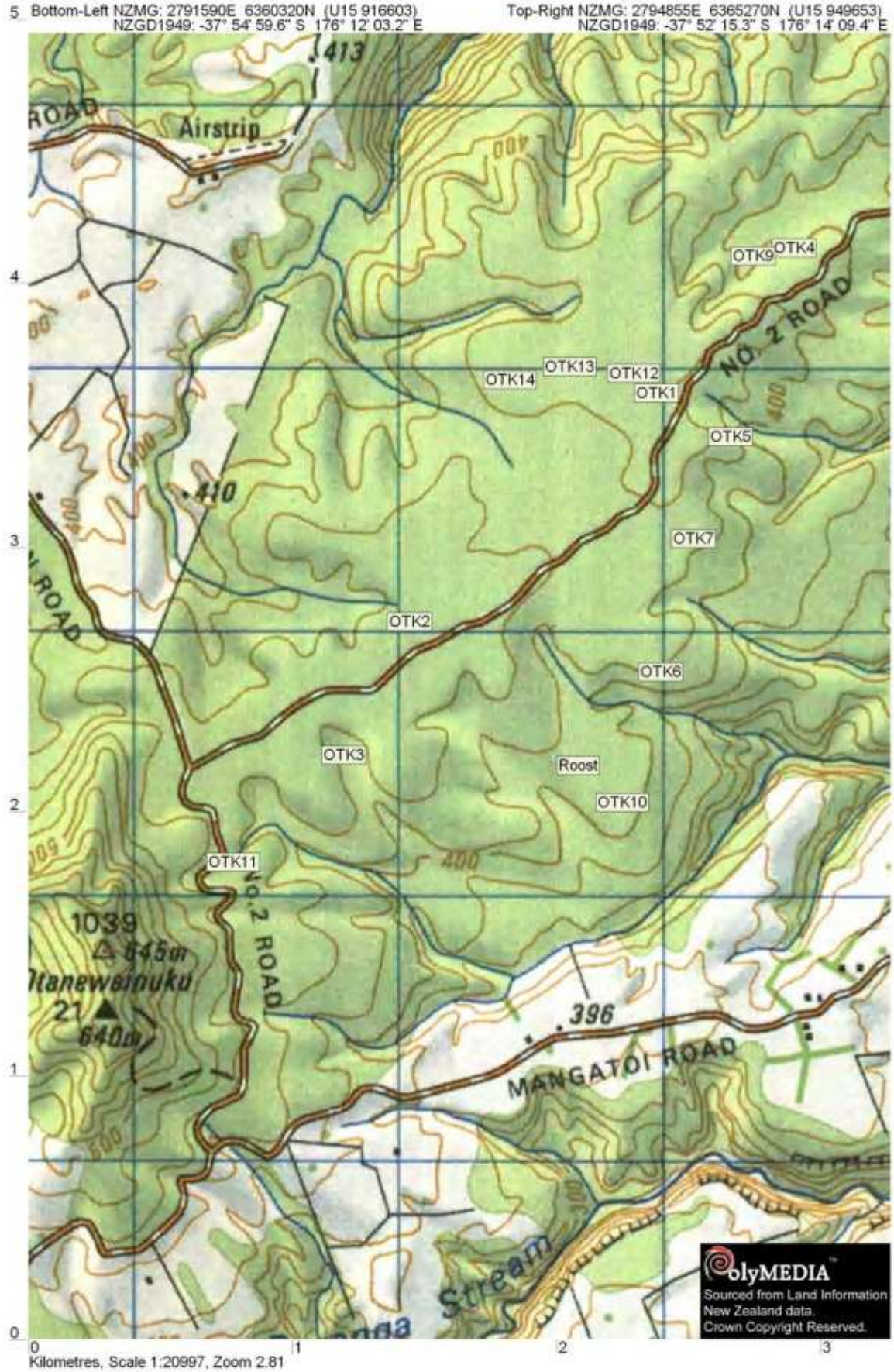
Possum Contractor – Phil Commins

9.0 Appendices

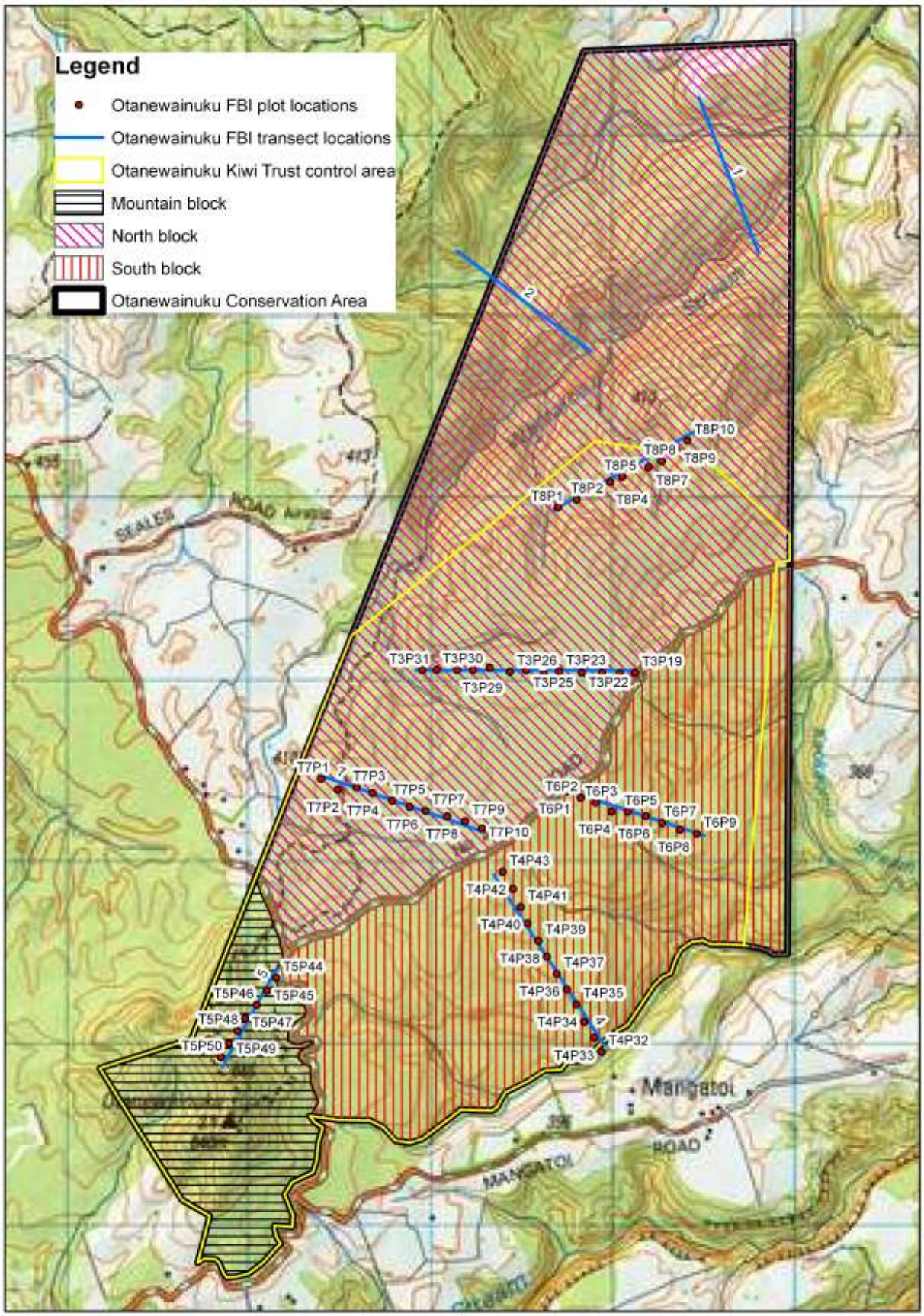
Appendix A: The GPS locations of the ABMS for Otanewainuku

ABMS Location	Easting	Northing	Description of the Location
OTK1	2793978	6361026	N17 BS3 Off the track to the west at the Ruru nest tree
OTK2	2793044	6363165	N8 Straight on to clearing past BS3 15m off track (track goes left)
OTK3	2792792	6362658	S20 BS2 on Right behind windfall
OTK4	2794498	6364581	Lower Dam behind pump
OTK5	2794258	6363862	S8 BS3, off to left by 4m stump 10m off track
OTK6	2793993	6362974	Rat line C meets S13, top of clearing S. down S13 a bit
OTK7	2794117	6363477	Rat line C meets S10, by C1
OTK9	2794342	6364548	Upper Dam on left side of dam
OTK10	2793849	6362478	Rat line C meets S16, on tunnel C20
OTK11	2792372	6362253	S24 BS3 in top of wheki
OTK12	2793892	6364103	On north side of where N17 meets the Totara Track.
OTK13	2793640	6364129	Where N16 meets the Totara Track in clearing
OTK14	2793426	6364081	Windfall Just past where the Totara track meets line N15

Appendix B: Map of Otanewainuku Forest showing the locations of the ABMS.



Appendix C: Otanewainuku Conservation Map



Appendix D: Foliar Browse Transect and Plot Locations

Otanewainuku Conservation Area Foliar Browse Index Transect and Plot Locations														
Transect	Start Point (NZMG)		Bearing (°mag)	Plot	Plot Location (NZMG)		Transect	Start Point (NZMG)		Bearing (°mag)	Plot	Plot Location (NZMG)	
	Eastings	Northings			Eastings	Northings		Eastings	Northings			Eastings	Northings
1	2794500	6367200	137°				5	2792168	6362341	186°	T5P44	2792168	6362341
2	2793900	6365800	285°								T5P45	2792117	6362269
3	2794148	6364025	247°	T3P19	2794148	6364025					T5P46	2792060	6362192
				T3P20	2794065	6364022					T5P47	2791997	6362119
				T3P21	2793967	6364024					T5P48	2791952	6362048
				T3P22	2793853	6364026					T5P49	2791908	6361978
				T3P23	2793730	6364031					T5P50	2791862	6361903
				T3P24	2793644	6364019	6	2793776	6363370	85°	T6P1	2793776	6363370
				T3P25	2793548	6364039					T6P2	2793848	6363334
				T3P26	2793457	6364030					T6P3	2793931	6363307
				T3P27	2793347	6364051					T6P4	2794019	6363258
				T3P28	2793254	6364040					T6P5	2794109	6363257
				T3P29	2793167	6364039					T6P6	2794208	6363234
				T3P30	2793053	6364041					T6P7	2794297	6363195
				T3P31	2792975	6364038					T6P8	2794397	6363159
4	2793963	6361932	304°	T4P32	2793963	6361932					T6P9	2794489	6363135
				T4P33	2793924	6362010	7	2792416	6363440	86°	T7P1	2792416	6363440
				T4P34	2793868	6362097					T7P2	2792508	6363379
				T4P35	2793824	6362195					T7P3	2792611	6363392
				T4P36	2793772	6362278					T7P4	2792700	6363359
				T4P37	2793718	6362363					T7P5	2792807	6363317
				T4P38	2793662	6362457					T7P6	2792905	6363283
				T4P39	2793615	6362544					T7P7	2792992	6363262
				T4P40	2793556	6362642					T7P8	2793112	6363232
				T4P41	2793517	6362732					T7P9	2793210	6363205
				T4P42	2793475	6362831					T7P10	2793303	6363165
				T4P43	2793418	6362925	8	2793723	6364937	38°	T8P1	2793723	6364937
											T8P2	2793827	6364980
											T8P4	2794011	6365078
											T8P5	2794078	6365106
											T8P7	2794223	6365159
											T8P8	2794296	6365192
											T8P9	2794376	6365257
											T8P10	2794438	6365305

Appendix E: Otanewainuku Exclosure Plot Locations

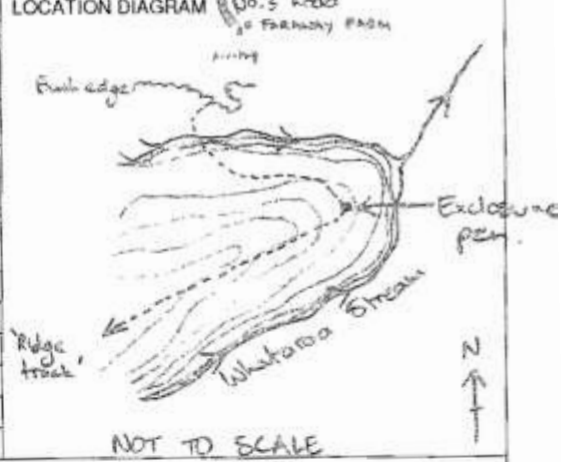
RECCE SHEET

Otanewainuku Exclosure pen.

SURVEY	Otanewainuku		MEASURED BY	Nancy Willems, Megan Willams	
CATCHMENT					
SUB/CATCHMENT			RECORDED BY	Nancy Willems.	
AREA	Rapanepahoe.				
MAP NO. (NZMS260)	Ngongotaha.	U15	MEAN TOP HEIGHT		8
DAY/MONTH/YEAR	6/9/2006		BASAL AREA		
ALTITUDE (metres)	200		CANOPY %		60
ASPECT (degrees)		30	SOIL DEPTH	A	
SLOPE		2°		B	
PHYSIOGRAPHY		Plateau		C	
PARENT MATERIAL				D	
DRAINAGE		Good		MID	
CULTURAL (logging, burning, etc)			SURFACE STABILITY		
GROUND COVER (%)	V	35	ROCK ON SURFACE	YES / NO	
	M	0	BEDROCK ON SURFACE	YES / NO	
	L	65	QUANTITY - BROKEN ROCK %	0	
	B	0	- SOIL %	0	
	R	0	SIZE OF LOOSE ROCK	N/A >30CM<	

APPROACH Through Charlie Stapleton's property (Farawayi Farm ph 573 5401) end of No. 3 Road, Te Puke. Off the end of the airstrip, through gate to next paddock east; up the hill, over the fence; follow bush edge around point then straight ahead to start of exclosure track. Start of track marked 3 horizontal orange permolats on rewirewi. Track is marked with white permolat and follows the drop-off on southern side of stream.

LOCATION DIAGRAM



NOTES

Cover M for control plot marked with white triangle.
Big treefall across plot.

Saplings - height ... Hwy care NOT Pull-up

BIRDS Pigeon, whitehead, grey warbler, fantail, harrier, hawk, kingfisher, rock etc, robin

BROWSE

Plant sp.	Low	Medium	Heavy	Animal
PEE arb		✓		possum
DYS eps			✓	" "