



Te Urewera Mainland Island

Annual Report

JULY 2005 - JUNE 2006



Department of Conservation
Te Papa Atawhai

Te Urewera Mainland Island

Annual Report: July 2005 - June 2006

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EAST COAST BAY OF PLENTY CONSERVANCY

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OUR VISION:

To acknowledge and nurture the mauri of the northern
Te Urewera ecosystem



Mike Butcher assessing a seeding pellet plot for damage.



Wendy Croft (volunteer) undertaking a rat capture trial.



Natalie Curnow (ranger trainee) undertaking a rat capture trial.



Djaek Solger (volunteer from New Caledonia) learning ecosystem restoration techniques.



James Lang (Community Advocate Contractor) talking to Waimana School.



Sonny Biddle (local Kaumatua) at a kiwi release.



Jinx Te Pou (DOC contractor) checking possum kill traps in Otamatuna Core Area.

Summary

This report focuses on the management actions and outcomes for the tenth season of Te Urewera Mainland Island (TUMI) (*Note: This project was previously referred to as the Northern Te Urewera Ecosystem Restoration Project (NTUERP)*).

THE PROJECT

Te Urewera Mainland Island is set in the northern part of Te Urewera National Park and is focused on learning about restoring and maintaining ecosystem processes within a large, forested landscape: our vision is *to acknowledge and nurture the mauri of the northern Te Urewera ecosystem*. Restoration is currently being attempted through the ongoing control of animal pests (principally possums, rats, stoats and deer) and the monitoring the outcomes of pest control on native flora and fauna. Learning is achieved through structured manipulation of management techniques. The project is administered by the Department of Conservation (DOC) and is one of six official 'Mainland Islands'.

The management approach for the project is to carry out possum control over a large *Background Area* to allow for broad gains in ecosystem restoration, while more intensive management is done within smaller, distinct *Core Areas*. The operational area for the project is approximately 50 000 ha comprising of 42 800 ha of Background Area where possum control is done on a rotational basis (approximately one-third of the area is treated each year) and five Core Areas encompassing approximately 7200 ha. A key aspect of the management strategy is testing a range of methods to improve capability for conservation managers.

ACHIEVEMENTS

Pest control was undertaken for brush-tailed possums, ship rats, stoats, red deer, cats and dogs. We monitored the outcome of pest control work on kokako, whio, kiwi, mistletoe species, canopy condition and abundance of palatable seedlings and baseline population information was gathered during a survey for long-tailed bats.

Using ground-based techniques (i.e. trapping and laying of cyanide), 16 578 ha were treated for possums: 9 366 ha in the Background Area and 7 212 ha in Core Areas. An average residual trap-catch index (RTC) of 2.93% was achieved across the Background Area (target = 5% RTC) and contractors reported a total of 12,126 possums killed. Possum control was undertaken in all Core Areas.

Rat control was undertaken over approximately 1550 ha in five Inner Core Areas. In total, 6785 rats were trapped; however management objectives were not consistently achieved in any of the Core Areas: 47% of indices recorded during target periods in the five Inner Core Areas were above target levels. Five trials investigating aspects of rat control were in operation this season; three trials compared catch rates of traps under different tunnel types (wooden or coreflute) and two trials compared catch rates of new traps ('Thomas' or 'Ka Mate', and DOC200) against the best practice trap (Victor Professional).

Trapping for stoats was undertaken over 7215 hectares. The total number of stoats trapped throughout TUMI was 435 including 19 caught in rat traps (a decrease of 13% from the previous year); as in previous seasons most captures were in the summer months.

A total of 64 deer and 12 pigs were killed in the Otamatuna Deer Control Area compared to 49 deer and six pigs killed in 2004/05. However, the measurement of seedling/pellet transects showed that the trend of increasing deer densities has continued, probably largely due to the lack of commercial recovery. Palatable seedling densities increased slightly. The number of tawa seedlings present in plots was analysed and densities do not appear to have changed over the past eight years.

We continued to use the survival of young kiwi as the measure of effectiveness for our stoat-trapping regime; however, no young kiwi were banded this season. The area to the north and east of Otamatuna and Mangaone Core Areas was surveyed to gather baseline data for future monitoring where it is expected kiwi numbers in this area will increase as a result of the protection of kiwi in the Core Areas.

The second year of baseline monitoring for long-tailed bats in the Waimana Valley was completed. Further monitoring will increase the baseline sample size and give a more accurate indication of bat abundance in the Waimana Valley.

A range of methods were used to both promote the project and exchange knowledge: a presentation was made to the East Coast Hawke's Bay Conservation Board; informal talks were held with other DOC staff; and staff attended hui at Waimana and Ruatoki. International presentations were made to projects in Norfolk Island and New Caledonia. Staff gave talks to students from Opotiki College and Ashbrook Primary and articles were submitted to local papers, particularly in regard to the threat of kiwi from dogs. In addition, a DVD outlining the project was produced as a resource to promote the project.

Kokako monitoring continued to focus on nesting success in Core Areas with 'A-Line' regimes (Waikokopu, Pakoakoa and Onepu) where there are small populations. Overall, pair numbers at Waikokopu and Pakoakoa Core Areas have remained static and these populations remain vulnerable to extinction. An increase of 36% in the number of pairs in the Mangaone Core Area (now 23) is encouraging and likely reflects the influence from the adjacent Otamatuna Core Area as well as the ongoing possum, stoat and rat control at Mangaone.

KEY LEARNINGS

- Results indicate that the trapping/toxin (cholecalciferol in the form of Feracol® (Connovation Ltd)) combination employed this season is probably more effective at controlling rats than a trapping-only regime.
- Seedling-pellet data suggests that current level of deer control in the Otamatuna Core Area is inadequate for palatable seedling recruitment and that deer control should be increased to cater for this
- Current results from the Fenn/DOC200 trial continue to indicate that DOC200 traps are more effective at catching stoats than single set Fenns in wooden tunnels.
- Whio adult losses inside the treated area and their replacement by unbanded birds remain a concern for ensuring a self-sustaining population.
- Monitoring this year showed that possums have had a considerable impact on mistletoe abundance at Okehu indicating that the four-year possum control rotation is not adequate for maintaining beech-hosted mistletoe.
- Kill trapping as a form of wide spread possum control under performance-based contracts appears to be viable.
- Maintaining low possum numbers within Core Areas while undertaking wide-scale, rotational possum control using leg-hold trapping in the Background Area is becoming more difficult due to elements such as rising costs.
- There has been no obvious change in the overall good condition of the kamahi canopy.

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1.0 Introduction

1.1 PURPOSE AND SCOPE OF REPORT

The purpose of this report is to communicate the management actions and outcomes associated with the Te Urewera Mainland Island for the year 1 July 2005 to 30 June 2006.

The report is divided into six main sections:

1. Introduction: Information on the project and the site, the policy framework, and the vision and objectives for the project;
2. Management Approach: An overview of management concepts and terminology, as well as other relevant information;
3. Management & Research: This section highlights what we have learnt from the project this year. It also gives an overview of the current management structure and details any areas of investigations and research;
4. Pest Control: Individual reports on animal pest control, including possum, rat, stoat, deer, cat and dog control;
5. Conservation Monitoring: Individual reports on the outcomes on the ecosystem of our animal pest control. This section includes reports on the monitoring of kokako, kiwi, whio, mistletoe, canopy condition, deer impacts and long-tail bat abundance;
6. Community Awareness & Participation: This section gives an overview of advocacy and involvement of the public in the Mainland Island.

1.2 PROJECT OVERVIEW

The focus of the Te Urewera Mainland Island (TUMI) is to learn about restoring ecosystem processes within a large, podocarp/tawa forest environment. This restoration is achieved principally by controlling animal pests, and monitoring the impacts of the animal pest control on the ecosystem.

TUMI is one of six Department of Conservation (DOC) sites labelled as 'Mainland Islands': 'islands' of protected areas within a 'sea' of unprotected area. The Mainland Island concept was launched in 1995 and TUMI was initiated in 1996. Prior to the establishment of the project, surveys in the late 1980s and early 1990s indicated that the forests of northern Te Urewera housed the largest known population of kokako (*Callaeas cinerea wilsoni*), but populations were found to be declining at an alarming rate. Protection of nesting kokako in the form of possum (*Trichosurus vulpecula*) trapping was instigated by DOC staff and this work served as the precursor for the establishment of TUMI. A strategic plan for the project was produced by Wildland Consultants (Shaw et al. 1996) and this served as the foundation management document.

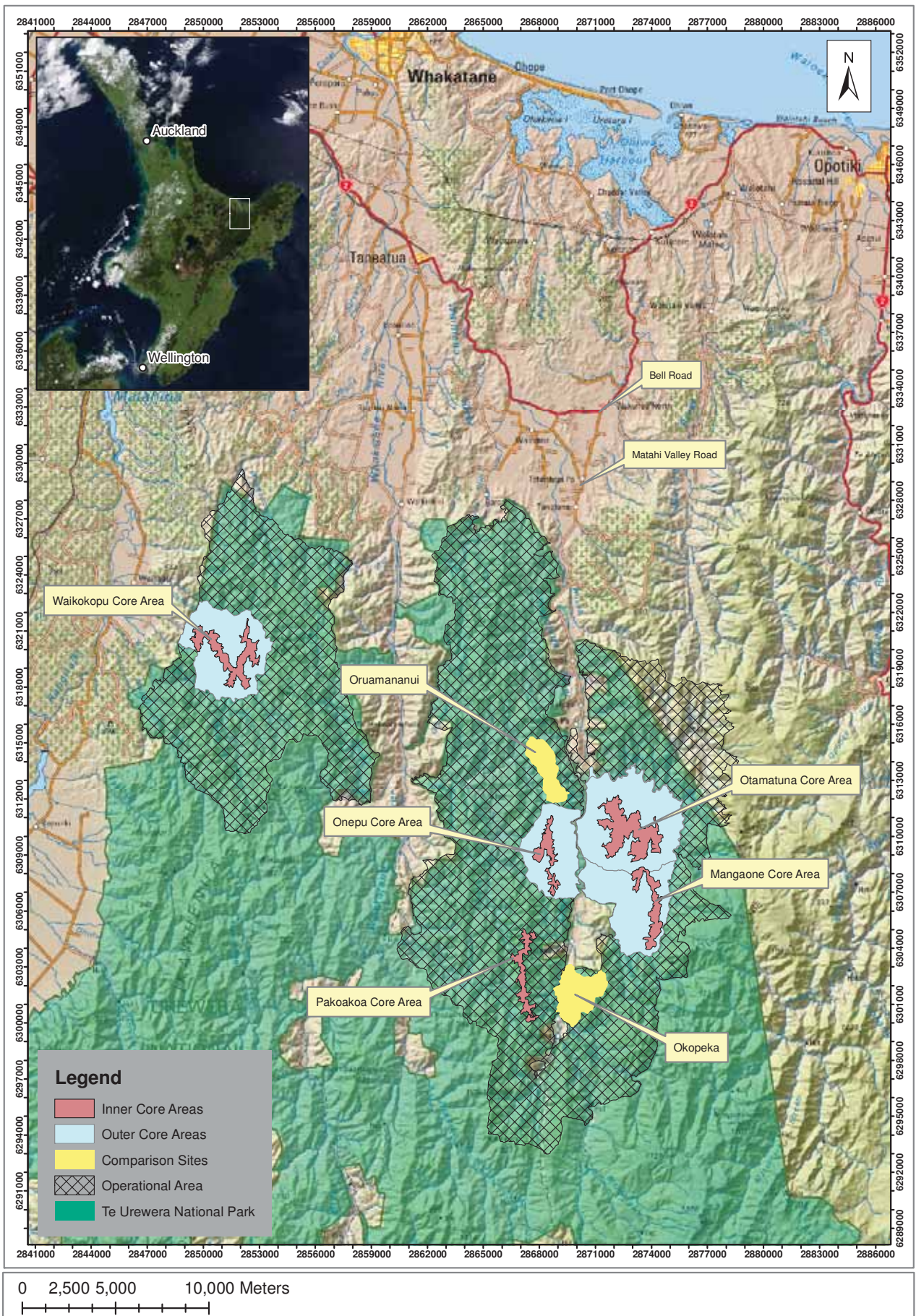


Figure 1.1 Location and overview of Te Urewera Mainland, 2005/06.

1.3 SITE DESCRIPTION

TUMI is located within the northern section of Te Urewera National Park and lies c. 30km south of Whakatane and c. 30km SSW of Opotiki. The administrative and management base for the project is the Opotiki Area Office (Department of Conservation); the office and project are situated within the East Coast Hawke's Bay Conservancy and further support is provided by staff in the Conservancy Office in Gisborne, and the Research, Development and Improvement Division in the DOC Head Office in Wellington. The principal road access for the project is via Bells and Matahi Valley Roads off State Highway 2, east of Taneatua. Figure 1.1 shows the location of TUMI and the main management areas in the project.

Te Urewera National Park (212 673 ha) is part of the largest extant forest tract in the North Island and the region encompasses the Huiarau Range which divides the Hawke's Bay, Poverty Bay and the Bay of Plenty. The boundaries of TUMI are more or less the National Park's eastern, northern and western boundaries and the Waikare River to the south. The forests to the south-west and east of the National Park boundary are part of the same forest tract and are largely under DOC management (Whirinaki Forest Park, Waioeka Conservation Area, Waioeka Gorge Scenic Reserve, Urutawa Conservation Area and Raukumara Conservation Park).

Physically, the land is characterised by ridge after ridge of bush-clad ranges, rising from valley floors of significant rivers to over 900 m above sea level. The vegetation is characterised as semi-coastal lowland forest, being relatively homogeneous in nature and largely comprised of beech forest to the south and rimu/tawa forest to the north. Partly as a result of its size and management history, northern Te Urewera contains an assemblage of flora and fauna as complete as any in the North Island. This assemblage includes a number of rare and threatened species, such as mistletoe, tusked weta, kereru, karearea (falcon), kokako, kaka, kiwi, whio, long-tail bats and short-jawed kokopu. Most of these species require some form of active management to prevent their numbers diminishing.

Ngai Tuhoe are tangata whenua and are intricately connected with the land and its values. A significant proportion of the land adjoining Te Urewera National Park is owned by Tuhoe hapu; this includes several large blocks wholly surrounded by National Park.

1.4 PROJECT FRAMEWORK

Strategic direction for the project is set by various documents and acts of parliament. The most relevant acts of parliament are the Conservation Act 1987 and the National Parks Act 1980, as well as the Wildlife Act 1953. Relevant policies and plans set by the Department of Conservation are contained in publications including: *Conservation General Policy*, *Department of Conservation Strategic Business Plan: Restoring the Dawn Chorus*, *Statement of Intent*, and *General Policy for National Parks 2005*, as well as the *New Zealand Biodiversity Strategy*.

Regional conservation management is guided by the *East Coast/Hawke's Bay Conservation Management Strategy*. Further, strategic direction for Mainland Islands is guided by eight principles incorporating learning, communication, restoration, sustainability, and community participation. The specific guiding document for the project is the *Northern Te Urewera Ecosystem Restoration Strategy* (Shaw et al. 1996).

1.5 PROJECT VISION AND MANAGEMENT OBJECTIVES

The vision for the Te Urewera Mainland Island is:

To acknowledge and nurture the mauri of the northern Te Urewera ecosystem

The term *mauri* can be translated to mean health and life-force and the challenge before managers of the project is that in order to nurture the mauri of northern Te Urewera, the restoration of the ecosystem must be as complete as possible (Shaw et al. 1996).

The four main management objectives for the project are listed below (Shaw et al. 1996, pp. 14-15):

1. To ensure the long-term sustainability of the northern Te Urewera ecosystem, by undertaking management activities for the purpose of protecting the health and natural functioning of key components and processes in the northern Te Urewera ecosystem;
2. To maintain and restore threatened species populations;
3. To give effect to the Treaty partnership between the Department and tangata whenua throughout the planning and implementation of the ecosystem restoration programme;
4. To gain the support and co-operation of the wide community of interest (including the local residents, recreation, business, political, scientific, and education) in the ecosystem restoration programme; and to positively contribute to the wide community of interest in the immediate term and over the timeframe of the project.

The above objectives, which generally have a multi-year focus, are supported by annual objectives that are reported on in this document.

2.0 Management Approach

2.1 INTRODUCTION

The initial TUMI Strategic Plan (Shaw et al. 1996) outlined an understanding that achieving restoration across the wider forest tract of 50 000-70 000 ha would require incremental effort. The stated intention was 'to start small, with one area of c.1300 ha (Otamatuna), get the techniques right, develop a cost-effective approach, and then to expand the intensive management programme systematically across the wider northern Te Urewera' (Shaw et al. 1996, p. 8).

The project's emphasis is on undertaking management trials designed to answer questions that are relevant to the continued and improved success of active ecosystem restoration in northern Te Urewera. These management trials entail the development or testing of intensive and multi-pest control regimes within small defined study areas (e.g., Otamatuna), while carrying out possum control across the remainder of the 50 000 ha area for the purpose of enhancing forest/habitat condition while attempting to 'hold the line' on biodiversity loss.

The establishment of the Otamatuna study area was the obvious starting point for the project, building on the annual possum control which had begun there in 1993, and kokako monitoring undertaken since 1991. Okopeka was established as the principal non-treatment study area for reference or comparative purposes. Other smaller-scale study areas now referred to as Core Areas (see below) have been selected in successive years.

2.2 MANAGEMENT CONCEPTS AND TERMINOLOGY

Two key terms are used to describe the broader management approach to ecosystem management within TUMI; 'Background Area' and 'Core Area'.

As generally described above, the *Background Area* is a large, defined area (currently c.42 800 ha) encompassing (but not limited to) the northern part of Te Urewera National Park where management allows some enhancement of forest/habitat condition; currently, this is achieved by possum control only (Fig 1.1).

Core Areas are small- to medium-sized, defined management areas surrounded by the Background Area, where the goal is to sustainably control to low levels, a range of animal pests to allow for ecosystem recovery and the dispersal of target species. As management techniques develop, the long-term intention is to have a matrix of Core Areas across the northern Te Urewera landscape allowing the conservation of both individual species and the ecosystem as a whole. Current Core Areas are shown in Figure 1.1.

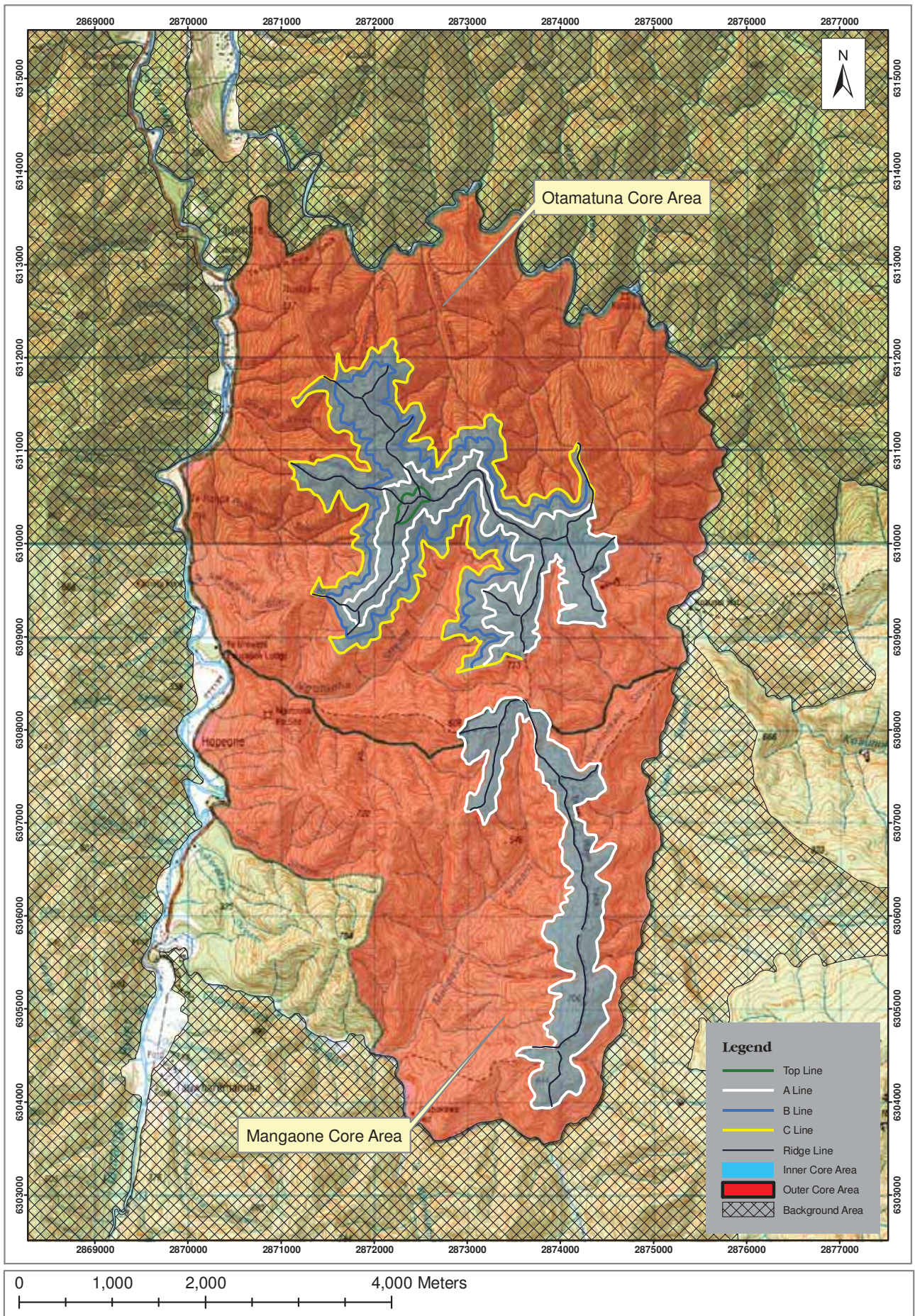


Figure 2.1 Overview of the Otamatuna and Mangaone Core Areas (Te Urewera Mainland Island) showing Inner and Outer Cores, Ridge, A-, B-, and C-Lines, and Background Area, 2005/06.

To help gauge the effects of management on pest animals and native species, two comparison areas have been used within TUMI. Okopeka (c.300 ha) was established in 1996 at the start of the project and is located on the eastern side of the Tauranga River and the northern side of the Otane Stream (Fig 1.1); no animal pest control is undertaken here. Orouamananui has an undefined boundary but is an area of ridge crest approximately three kilometres long north of the Onepu Core Area. It falls within the Background Area and possum control is undertaken periodically. Orouamananui was established in 2000/01 as a comparison site for kokako nesting success monitoring and was used as a Core Area comparison site for rat monitoring and for distance-sampling bird counts. The area containing the rat monitoring lines is indicated in Figure 1.1.

Core Areas are further divided into the *Inner Core* and *Outer Core* where the Inner Core is the area where rat control is undertaken and the Outer Core is the remainder of the Core Area.

Topographically, the current Inner Core Areas are situated around major ridge systems, including adjacent side-spurs (rather than valley and stream floors). Most intensive pest control work is undertaken on marked tracks that run along the main ridges and spurs and along side or contour lines. These side lines generally run parallel to other trap lines. The first side line below the ridge and spur tracks is termed the *A-Line*; the second (below the A-Line) is called the *B-Line* and so on. Currently, the most developed Core Area, Otamatuna, has a C-Line configuration, i.e. three side lines below the ridge and spur lines. Figure 2.1 illustrates the Core Area, Inner Core, Outer Core, and A-, B-Line (etc.) concepts.

Currently, there are five Core Areas located within TUMI and these are referred to by the following names (either in conjunction with the words Core Area, or by the name alone): Otamatuna, Mangaone, Pakoakoa, Onepu and Waikokopu. Table 2.1 details the characteristics of management areas, including the types of pest control and monitoring undertaken this season.

Table 2.1 Management practices, and characteristics of management areas within Te Urewera Mainland Island, 2005/06

	Management Area							
	Otamatuna	Mangaone	Onepu	Waikokopu	Pakoakoa	Okopeka	Orouamananui	Background Area
Management Regime	Core Area	Core Area	Core Area	Core Area	Core Area	Non-treatment	Background reference	Background area
Total Area (ha)	2530	1503	1232	1782	185	300	-	42 800
Inner Core (ha)	577	232	179	377	185	-	-	-
Outer Core (ha)	1953	1271	1053	1405	-	-	-	-
Year initiated	1996	1998	1997	1999	2003	1996	2000	1996
Rat Control Configuration	A-B-C Line	A-Line	A-Line	A(B)-Line	A-Line	-	-	-
Animal Pest Control								
Possums	✓	✓	✓	✓	✓		✓	✓
Rats	✓	✓	✓	✓	✓			
Stoats	✓	✓	✓	✓	✓			
Deer & Pigs	✓							
Cats	✓	✓						
Dogs	✓	✓						
Animal Pest Monitoring								
Possums	✓			✓	✓	✓		✓
Rats	✓	✓	✓	✓	✓		✓	
Deer	✓		✓					✓
Outcome Monitoring								
Kokako	✓	✓	✓	✓	✓			
Kiwi	✓	✓						
Whio	✓	✓	✓					✓
Mistletoe	✓					✓		✓
Canopy condition	✓					✓		✓
Understorey	✓		✓					
Long-tailed Bats								✓

2.3 MANAGEMENT TECHNIQUES

Within TUMI, there is a strong emphasis on developing sustainable management techniques; by sustainable we mean that there will be no effects generated from current management that will adversely affect future management or the physical and socio-political environments. In particular, significant effort is put into improving the effectiveness of animal pest control.

Currently, the principal means of controlling animal pests is the use of traps, and hunting (including using specialised dogs). Trapping is supplemented by the low-level use of acute toxins such as cyanide-based products and cholecalciferol. No anticoagulant toxins have been used in the project since 2000/01, and no 1080 is used. Specific animal pest monitoring is currently undertaken for rats, deer and possums. Conservation monitoring is focused on vulnerable flora and fauna as an indication of the effectiveness of animal pest management. The labour used is a mix of DOC permanent and temporary staff members, and contract employment.

Helicopters are frequently used and are considered an essential management tool as they provide an efficient means of moving people and supplies into remote locations.

2.4 INFRASTRUCTURE

On-site project infrastructure includes access tracks, management huts and campsites, animal traps, bait stations, permanent markers, and information panels.

The access tracks include some public walkway tracks, and are generally formed tracks that are kept free of obstacles (vegetation and windfalls), involve benching in some instances, and are mainly marked with permanent markers, usually plastic triangles. The quality of the tracks varies considerably depending on their purpose (e.g. public track, bait station sidle line).

Tracks, kill-trap sites and bait station sites as well as monitoring lines and points are marked with plastic triangles. These are colour-coded for their various purposes and often have information written on them (e.g. trap numbers, line names, and track junctions). The main colours and their corresponding uses found within TUMI are:

Orange:	Public track markers
Yellow:	Stoat trap, rat trap and bait station lines
Pink:	Kill-trap and bait station sites; mistletoe sites
Blue:	Rat monitoring lines

Backcountry huts, purpose-built solely for the use of DOC staff and contractors, are located in each of the core areas (Otamatuna has two huts). The huts are supplied with gas for cooking, a wood fire for heating, a water supply and toilet. The two huts within Otamatuna also feature a 12-volt battery / solar power system from which internal lighting, VHF radios and other devices can be run. Adjacent to the huts are sheds of various nature in which materials such as tools, poisons and traps are stored. Helicopter access is handy to all huts. A number of campsites with various materials (e.g. tent flies, storage drums) also provide support for field workers. Public huts managed by the Department of Conservation are also used from time to time for operation purposes.

3.0 Project Management and Research

3.1 ANNUAL REVIEW

With the establishment of the Core Area supervisor position, the pest control focus in the five Core Areas has been tightened. While rat tracking indices results from this season did not meet target objectives increased attention to the detail of pest control in Core Areas will build towards good results in future seasons. Contractor management, control regimes, co-ordination of resources and quality control through auditing have been improved and will likely be improved further. Further, the use of cholecalciferol (currently used for possum control) for quickly reducing rat populations has strong potential when used in conjunction with a trapping regime.

Possum control in Core Areas has had a renewed focus setting the tone for seasons to come. Increased possum control will complement the gains made from rat control (whether seasonal or year-round) and stoat control achieving the synergies needed for ecosystem recovery. Possums are one of the most significant of pest animals and their control in the high-(biodiversity) value Core Areas needs to occur on an annual basis. However, establishing effective control while likely take several as different control methods are trialed and then implemented. In particular, the use of kill traps has excellent potential for more effective longer term control compared to using leg-hold traps.

Changing patterns in commercial as well as recreational hunting for red deer has highlighted the benefits these activities were previously having on the abundance of palatable seedlings. With the decline in non-Departmental hunting the abundance of palatable seedlings has decreased highlighting the need to set clear operational targets for the number of deer to be removed and allocating sufficient resources to ensure these targets can be met.

There are still issues associated with increasing the number of kiwi with transmitters. Following on from the losses from dog kills (see Moorcroft et al. 2007) and then a staff vacancy, the programme is still in a rebuilding phase. The information gained from kiwi monitoring though is still seen as central to the Core Area / Background Area model for protecting a self-sustaining population of kiwi in northern Te Urewera.

Kokako monitoring has highlighted that the small populations at Waikokopu and Pakoakoa are both vulnerable to extinction and also problematic for providing small sample sizes from which to base management decisions on. There is still some doubt as to the impact that stoats may be having on kokako breeding success at Pakoakoa (stoat control at Waikokopu was installed in November 2004), and the A-Line style regime for rat control does not encompass all parts of the current kokako territories.

These two sites will still be the focus for intensive monitoring in the upcoming years, while censusing will continue at Mangaone and Onepu (both A-Line regimes) as well as at Otamatuna where a method will need to be developed to count the large number of pairs present.

Monitoring of whio has continued to build on the excellent data set already gained. Recovery of whio in the Te Waiiti Stream has been strong but insights into the effects of localised floods on breeding success have indicated the vulnerability of this species to natural events as well as ongoing predator pressure. The key recommendations coming from this year is that more information needs to be gathered on population dynamics and the agents of decline both in managed and unmanaged sites.

Overall, there has been a tightening in pest control objectives and subsequent implementation and perhaps in many aspects of the project. Team morale is high and current staff have the energy and motivation to continue to enhance the outcomes.

3.2 ADMINISTRATION

Key personnel involved in the projected are listed below.

Table 3.2.1 Key Department of Conservation staff involved in the Te Urewera Mainland Island, 2005/06

Key DOC staff

Opotiki Area Office	
Kevin Cannell	Area Manager
Trish Edwards	Programme Manager, Business Services
Karen Kaukau	Ranger, Business Services (part)
Louise Withers	Ranger, Business Services (part)
Andrew Glaser	Programme Manager, Biodiversity Assets
Hemi Barsdell	Ranger, Biodiversity Assets
Jane Haxton	Ranger, Biodiversity Assets
Cody Thyne	Ranger, Biodiversity Assets (part)
Greg Moorcroft	Ranger, Biodiversity Assets (part)
Lindsay Wilson	Programme Manager, Biodiversity Threats
Daniel Baigent	Ranger, Biodiversity Threats
Shane Gebert	Ranger, Biodiversity Threats
Pete Livingstone	Ranger, Biodiversity Threats
Rebecca Gibson	Ranger, Biodiversity Threats (part)
Anastacia Kirk	Ranger, Biodiversity Threats (part)
Graeme Shaw	Programme Manager, Visitor Assets & Community Relations
Lisa Loughlin	Ranger, Community Relations & Visitor Assets (part)
Dennis Rutter	Ranger, Visitor Assets (part)
East Coast Hawke's Bay Conservancy Office, Gisborne	
Chris Ward	Conservancy Advisory Scientist
John Lucas	Technical Support Officer, Threats
Rhys Burns	Technical Support Officer, Fauna
Don McLean	Technical Support Officer, Flora
Research, Development & Improvement Division	
Craig Gillies	Scientific Officer
Darren Peters	National Predator Officer
Elaine Wright	Terrestrial Sites Manager

Table 3.2.2 Contractors and temporary staff employed by the Department of Conservation for the Te Urewera Mainland Island, 2005/06

Name	Key task
Wayne Looney	Contracted deer hunter
Perrin Brown	Contracted deer hunter
Jason Healy	Contracted deer hunter
Mike Dowden	Contracted deer hunter
Keith Beale	Core area pest control
Arthur Sandom	Core area pest control
Gaye Payze	Core area pest control
Joe Rurehe	Core area pest control
Kevin Marsden	Possum control contractor
Andy Marsden	Possum control contractor
Hepa Rako	Possum control contractor
Lyn Thyne	Possum control contractor
Gary Thyne	Possum control contractor
Gary Peratiaki	Possum control contractor
Colin Cartwright	Possum control contractor
Walter Kilgour	Possum control contractor
Michael Thrupp	Possum control contractor
John Williams	Possum control contractor
Malcolm McFarlane	Possum monitoring contractor
Glen Ballinger	Possum monitoring contractor
Nic Gorman	Temporary worker (kokako)
Tim Allerby	Temporary worker (whio)

A hui focusing on key aspects of the Mainland Island was held on 6 – 7 June 2006 at the Lions Education Lodge, Waimana Valley. It was well attended by local tangata whenua as well as representatives from the Opotiki Area Office, East Coast Hawke’s Bay Conservancy Office and the Research, Development and Improvement Division. A brief overview of the year’s work and achievements was presented and then key issues were discussed.

Five staff attended the Mainland Island hui held at Saint Arnaud 11 – 13 October 2005. Presentations were made by Jane Haxton (‘Highlights and Hiccups’) and Hemi Barsdell (possum kill trap trial at Waikokopu).

3.3 RESEARCH

This section is a summary of research projects undertaken within TUMI that have run for part or all of the financial year being reported on. In general, the purpose of the research is to enhance management capability through improving knowledge and/or practices. Research includes 'field trials', which are investigations that have gone through a particular review process, and also investigations that were undertaken in conjunction with other agencies (where the level of Departmental involvement varies). Some projects have a multi-year focus and may not yet be completed, while others bridge reporting periods. More detail may be included in later sections in this report or in other documents referenced here.

Comparison of catch rates between raised set versus ground set possum traps in Te Urewera Mainland Island (Onepu Core Area)

Researcher DOC
Study Period December 2005 to May 2006

Summary

A 1500ha site in the Onepu Core Area in the Northern Te Urewera National Park was chosen to undertake the trial. Two treatments were used: 1. Victor No.1 leg hold traps set at 35cm from the ground using nail brackets; 2. Victor No.1 leg hold traps set at ground level. Traps were laid out in continuous lines with each trap spaced 25m apart, alternating between ground and raised sets. Line location was not randomised or independent. The traps were checked each following day they were set and results were recorded as per the NPCA protocol. There were a total of 36 trap line checks over the period 14 December 2005 and 19 May 2006.

Results and comparisons for different catch periods are below.

Table 3.3.1

Trap Type	Possums caught	Rats caught	Other spp caught	Sprung	Sprung with fur	Total trap nights
Ground	560	86	3	91	30	5738
Raised	299	77	1	65	13	5738
Total	859	163	4	156	43	11476

Table 3.3.2

Catch period	Ratio raised/ground	Confidence interval
First 3 nights	0.57	0.15
First 5 nights	0.55	0.10
Last few nights	0.51	0.20
Overall	0.54	0.09

Report Section(s) Section 4.2
Reference Documents & Files DOCDM-56524 – Raised set trial NTUERP [Field Trial Report] (Unfinished)

Optimising the maintenance control of possums through adaptive management: III Study sites and experimental design

Researcher Landcare Research Manaaki whenua: (John Parkes, David Choquenot, David Forsyth)

Study Period 2001 onwards

Summary

An adaptive experimental management project for maintenance control of possums where treatment (possum control) at seven sites is based on monitoring cues. The cues chosen were frequency (2, 4 or 7 years), density indices (10% and 25% trap catch) and resource condition.

Report Section(s) Section 4.2

Reference Documents & Files Landcare Research Report: LC9900/74
Investigation number: 2398

Comparison of possum kill-trap types in Waikokopu Core Area

Researcher DOC (Lindsay Wilson, Hemi Barsdell)

Study Period August 2003 – September 2005

Summary

Three types of possum kill traps were trialed in the Waikokopu Core Area to compare catch rates. In total, 415 traps were used: 199 'Warrior', 118 'Connibear' (or 'Steve Allen') and 98 Sentinel. Generally, the traps were set out in a sequence of Connibear-Warrior-Sentinel-Warrior-Connibear, etc. Catch rates were higher for Connibear traps but these traps also had the highest spring-off rates; the most effective trap was the Sentinel.

Report Section(s) Methods are detailed in section 4.2

Reference Documents & Files OLDDM-960034 Waikok Kill Trap Presentation for Mainland...

An investigation into the ability of rat control measures in the Onepu Core Area to extend an influence on rat population densities beyond the margins of the control area (Onepu Core Area)

Researcher Pete Fergusson

Study Period April 2005 – December 2005

Summary

The study was conducted as part of a 2005 Royal Society Maths, Science and Technology Fellowship. The influence of rat control methods beyond the A-Line perimeter of the Onepu Core Area was measured using tracking tunnels where tracking tunnel lines were set at 50m inside the A-Line and also 50m, 150m, 250m and 350m outside the A-Line. Tracking rates were measured at six-weekly intervals from April to December 2005.

The main conclusion was that the rat control regime produced a gradient in rat abundance, with indices increasing from the ridge top trap line to 250m below the perimeter trap line at which point the management regime had no influence on rat abundance.

Report Section(s) Reported on in 2004/05 (see Annual Report)
Reference Documents & Files Unpublished report with title as above: DOCDM-87196

Efficacy of DOC 200 versus Mk 6 Fenn traps at catching stoats (Onepu Core Area)

Researcher DOC (Field trial)
Lindsay Wilson, Craig Gillies, Darren Peters

Study Period 1 September 2004 – 30 April 2007

Summary

The relative efficacy of single set DOC200 traps (in wooden tunnels) to that of single set Fenn traps (in wooden tunnels) at catching stoats (*Mustela erminea*) was tested. 173 of each trap type were set alternately every 100m along trap lines at Onepu Core Area in the Northern Te Urewera Mainland Island. 146 stoats were caught in the DOC200 traps and 90 in the Fenn traps between September 2004 and April 2007. The proportion of DOC200 traps that caught a stoat, or stoats, was significantly greater than the proportion of Fenn traps that caught a stoat, or stoats. It was recommended that practitioners should consider the DOC200 as an effective alternative to the Fenn Mk 6 trap.

Report Section(s) 4.4
Reference Documents & Files OLDDM-767156 DOC 200 vs Mk 6 Fenn Trap at Te Urewera
OLDDM-147264 Northern Te Urewera Trap Trial (data)
DOCDM-239920-OPOWAC Onepu DOC200vFennMk6 trial FINAL report [Report Title: Animal Pest Field Trial Report for the efficacy of single set DOC200 traps versus single set Fenn Mk 6 traps set in wooden tunnels in the Te Urewera Mainland Island]

Efficacy of DOC 200 versus Victor Professional Rat traps at catching rats (alternate sets) (Mangaone Core Area)

Researcher DOC (Field trial)
Darren Peters, Craig Gillies, Lindsay Wilson

Study Period 1 November 2004 – 30 June 2006

Summary

The objective of this study was to compare the trapping effectiveness of Victor Professional rat traps set in current best practice coreflute trap tunnels, with DOC200 traps set in a single set wooden trap tunnel.

A comparison was made between each trap for catchability (determined by the number of rats caught), trap ability (age and gender differences of those rats which are killed), escapability (measured by the number of escapes), and interference (incidence of disturbance of the trap by non-target species, such as possums and pigs). Seventy-one DOC200 traps in single set wooden trap tunnels were placed every 50 metres along the A-Line in the Mangaone Core Area. Similarly, 71 single set Victor Professional rat traps in current best practice coreflute tunnels were placed every 50 metres along the same section of trap line, alternately with a DOC200 trap. In effect, every 25 metres along the line, either a DOC200 or a Victor Professional kill traps was encountered. The DOC200 performed well in terms of 'catchability' with a proportionally higher catch rate than the Victor Professional. This would indicate that improved rat kill trapping results can be achieved with DOC200s in single set wooden tunnels, in comparison to Victor Professional rat traps in coreflute tunnels.

Report Section(s)	Section 4.3
Reference Documents & Files	OLDDM-767157 [Field Trial Template] DOCDM-84148 [Data] DOCDM-71806-OPOWACRAT DOC200 v Victor [Report] Report Title: Animal Pest Field Trial Report for Efficacy of DOC 200 versus Victor Professional Rat traps at catching rats in the Mangaone Core Area of the Te Urewera Mainland Island.

Efficacy of catching rats with Victor Professional traps in Coreflute tunnels versus wooden tunnels (alternate sets) (Otamatuna & Onepu Core Areas)

Researcher	DOC (Field trial) Dan Baigent, Darren Peters, Craig Gillies, Lindsay Wilson
Study Period	May 2005 – February 2006

Summary

Wooden tunnels and corflute tunnels (without wooden bases) (see Appendix 9.1) each enclosing one Victor Professional rat trap were placed alternately along selected rat control lines in the Otamatuna and Onepu Core Areas. Altogether 101 of each trap type were set: 51 were placed every 50m in Otamatuna (23 on 'Topline' and 28 on Tawai Ridge); and 50 were placed every 25m along the main ridge in the Onepu Core Area. Where necessary, the existing coreflute tunnels at both sites were removed and replaced with wooden tunnels. Trap checks at Otamatuna were done from May 2005 to January 2006, and at Onepu from August 2005 to February 2006. 19 checks were undertaken on the Tawai ridge tunnels, 17 on the Topline tunnels and 16 on the tunnels within the Onepu Core Area. Traps were baited with either a combination of peanut butter and white chocolate, or Ferafeed (Connovation Ltd) pre-feed.

A total of 217 rats and 90 mice were trapped during this trial, with 128 rats and 74 mice caught in wooden tunnels and 89 rats and 16 mice caught in coreflute tunnels. 240 traps were sprung with no capture: 45 in wooden tunnels and 196 in coreflute tunnels.

Report Section(s) 4.3
Reference Documents & Files DOCDM-200674 [Animal pests field trial]

Efficacy of catching rats with Thomas (or Ka Mate) trap v. Victor Professional trap (Onepu Core Area)

Researcher DOC / Bruce Thomas
Study Period November 2005 – ongoing

Summary

Thomas' (brand-named 'Ka Mate') rat traps are a new product about which its developers wished to gain evidence of operational effectiveness. In 2005/06 it was used in existing DOC pest control operations including this project, and data from trapping results was used in an analysis done under contract by Landcare Research (Note: only data from 3/1/06 to 23/2/06 from Waimana (TUMI) was used in this analysis). Within TUMI a comparative trial that extended beyond the dates covered in the Landcare analysis was undertaken. The trial consisted of three stages, all with the same regime except that bait types were changed. Stage one of the trial was conducted during 2005/06 and is reported on here, while stages two and three were conducted in the 2006/07 financial year. Starting from a randomly selected trap, 200 wooden tunnels were placed alternately between existing coreflute tunnels (spaced at 25m) along the 'Boulders' perimeter line (A-Line) within the Onepu Inner Core Area during November 2005. The coreflute tunnels were shut down for the duration of the trial leaving the wooden tunnels spaced at 25m apart. Within the wooden tunnels, Victor Professional rat traps and Thomas rat traps were placed alternately as single sets. Thomas rat traps were baited with cooked peanut butter in a wire coil and Victor Professional rat traps were baited with peanut butter. 10 checks were made from November 2005 to May 2006. During stage one, 173 rats were caught: 111 in Victor traps and 62 in Thomas traps. Spring-off rates were essentially equal from 147 occurrences. 18 mice and 1 stoat were caught in the Thomas traps and 13 mice (0 stoats) were caught in Victor traps.

Report Section(s) 4.3
Reference Documents & Files Morriss, G., Warburton, B., Forrester, G.: 2007. Efficacy of the Ka Mate Rat Trap. Landcare Research contract report: LC0607/094. DOCDM-123380 OPOWAC Thomas trial Onepu [Data]

Rat trapping efficacy of Victor Professional rat traps housed in either a corflute tunnel with wooden base or a corflute tunnel with no base (alternate set) (Onepu Core Area)

Researcher DOC (Field trial)
Dan Baigent, Darren Peters, Craig Gillies,
Lindsay Wilson

Study Period December 2005 – ongoing

Summary

30 coreflute tunnels with wooden bases were placed alternately at 25m spacings between existing coreflute tunnels with no wooden base along a perimeter line within the Onepu Inner Core Area. This created trap spacing between both trap types of approximately 12.5m. Single-set Victor Professional rat traps were placed within both tunnel types. Traps were baited with a combination of peanut butter and white chocolate, or Ferafeed prefeed (Connovation Ltd). Bait types were changed every subsequent round. 8 checks were made from December 2005 to March 2006. In total, 69 rats, 17 mice and 161 sprung traps were recorded. In tunnels without bases 35 rats (51%), 9 mice (53%) and 131 sprung traps (81%) were recorded. This trial will be continued through the 2006/07 trapping season.

Report Section(s) 4.2

Reference Documents & Files OLDDM-972647 [Data]

Efficacy of catching rats with Victor Professional traps in Coreflute tunnels versus wooden tunnels (paired sets) (Otamatuna)

Researcher DOC

Study Period June 2005 – March 2006

Summary

This investigation tested the performance of Victor professional rat traps housed in two types of coreflute covers against the performance of Victor professional rat trap housed in wooden tunnels. In the first part of the trial, 50 wooden tunnels and 50 coreflute tunnels each enclosing one Victor Professional snap trap were placed side by side every 50m along the Tawai C (perimeter) rat control line within the Otamatuna Core Area. The 50 wooden tunnels were added to the 50 coreflute tunnels already on site and were placed at every alternate existing coreflute tunnel site, i.e. a single coreflute cover housing a Victor Professional rat trap was set between the paired sets. The coreflute tunnels had no base, i.e. traps were set on directly on the ground. 14 checks were made between 4 July 2005 and 26 March 2006. 63 rats, 15 mice and 30 sprung traps were recorded from the 'wooden' sets; 27 rats, 8 mice and 79 sprung traps were recorded from the 'coreflute' sets.

The second part of the investigation will compare capture rates of coreflute tunnels with wooden bases versus the same wooden tunnels using the same paired configuration described above. This trial will be reported on in the 2006/07 annual report.

Report Section(s) 4.3

Reference Documents & Files DOCDM-79162 [Data]

Quantify gains in natural character from 'extensive' possum control

Researcher Landcare Research (Caroline Thompson)

Study Period 2004 – 2010

Summary

Study compares condition (tree mortality and growth rates) of conservation assets (forest trees) that have been subject to infrequent (4 – 7 years) or no possum control. In May 2006, 13 lines (108 plots) were established in Te Kaharoa region where possum control is undertaken, and 16 lines (101 plots) were established in the Waiotahi Valley (no possum control). Tawa, kamahi (possum palatable) and rewarewa (non-palatable) were marked and scored within these plots. Trees will be re-measured after a four-year period.

Report Section(s) 4.2

Reference Documents & Files Landcare Investigation number 3670

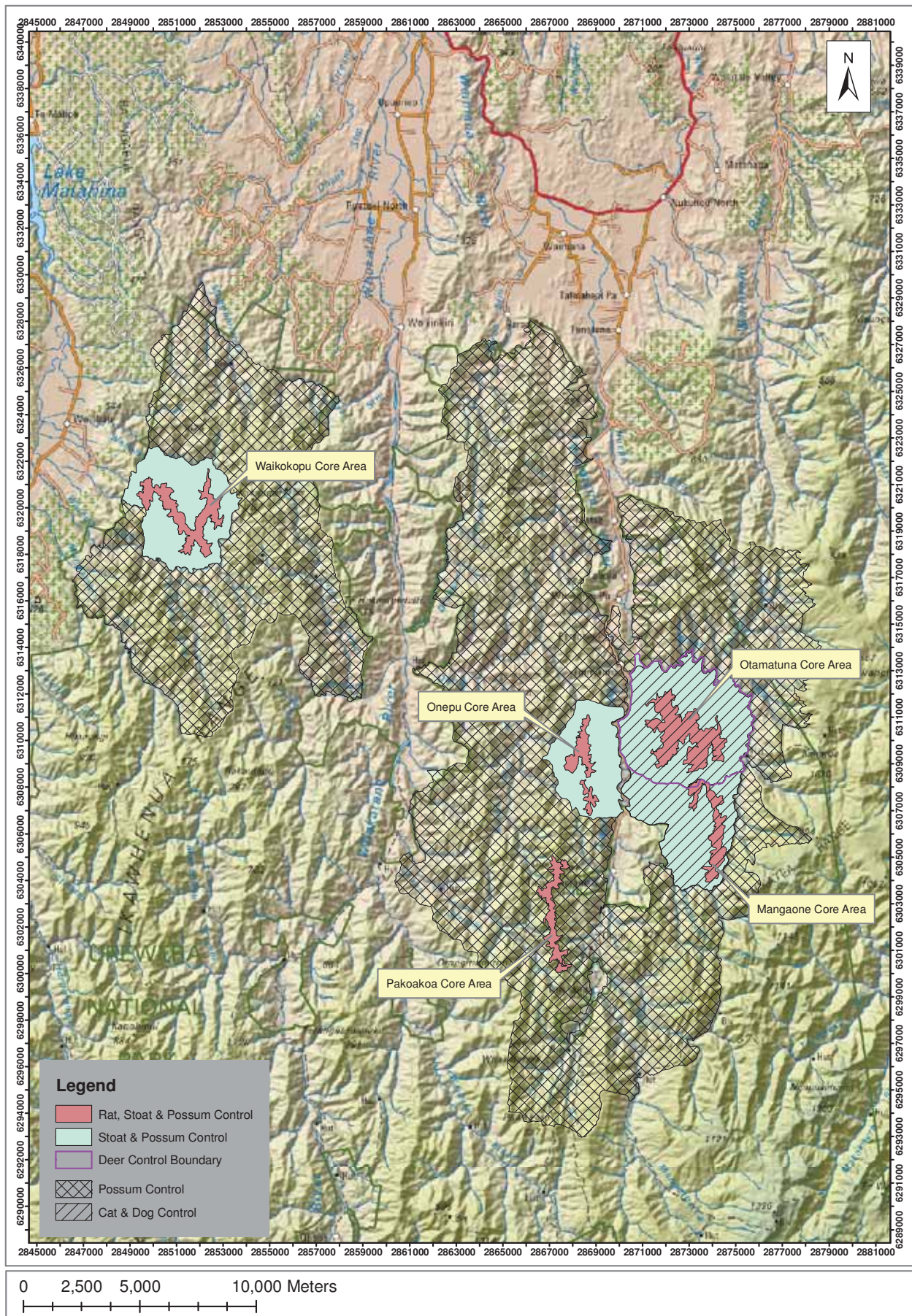


Figure 4.1.1 Overview of pest control within the Te Urewera Mainland Island showing areas of possum, rat, stoat and deer control, Core Areas and management comparison sites, 2005/06.

4.0 Pest Control

4.1 INTRODUCTION

The control of animal pests is the principal means of achieving ecosystem restoration within Te Urewera Mainland Island. The animals targeted are possums, rats, stoats, deer, cats and dogs. More information on individual species is given in the following sections.

The approach for pest control within northern Te Urewera is to manage animal pests at different scales according to their impacts, behaviour and available methodologies. Possums, which can have a devastating impact on natural ecosystems as browsers, competitors and predators are targeted on a large scale, c. 50 000 ha. In contrast, rats are managed on much smaller scales, c.200 – 600 ha in areas within high-value biodiversity sites. Deer and stoats are managed on intermediate scales (c. 1200 ha – c. 4000 ha). However, animal pest control for different species is not performed in isolation; a range of animal pests are controlled at individual sites to enhance ecosystem functioning and achieve synergistic effects.

Within TUMI, the area in which large-scale possum control alone is undertaken is termed the Background Area. The sites of more intensive effort are termed Core Areas, the boundaries of which are determined by the limits of some pest control. Rat control is undertaken within centralised areas termed Inner Core Areas that are currently based around higher-altitude areas, i.e. main ridgelines and associated spurs. Outer Core Areas are usually bounded by the limit of stoat control. These boundaries are defined by topographical features, particularly waterways, or tracks (including roads). For further information on the terms used, see Section 2.2. Currently, Core Areas cover c. 7230 ha.

The areas in which different pest animals are targeted are shown in Figure 4.1.1. Possum control is done over the entire project area (c.50 000 ha) although not all this area is treated every year. Stoat control is undertaken in all Core Areas (7230 ha) although there is no broad-scale stoat control (i.e. no Outer Core) for the Pakoakoa Core Area. Rat control work is undertaken in all the Core Areas and encompasses c.1500 ha. Deer control is done only within the Otamatuna Core Area (2530 ha). Lower-intensity control for cats and dogs occurs in the adjacent Otamatuna and Mangaone Core Areas; however this work will be reported on in future annual reports.

4.2 POSSUMS (LINDSAY WILSON)

4.2.1 Abstract

Possum control is an integral part of the TUMI strategy with around 50 000 ha treated on an approximate 3-yearly rotational basis to improve ecosystem condition. This season, 16578 ha were treated for possums: 9,366 ha in the Background Area and 7,212 ha in Core Areas. Possum control was achieved using ground-based techniques i.e. trapping and laying of cyanide. All control work was undertaken by contractors. An average residual trap-catch index (RTC) of 2.93% was achieved across the Background Area this season; this is below the target of 5% RTC. Contractors reported a total of 12,126 possums killed within the Background Area. Possum control was undertaken in all Core Areas. The Pakoakoa Core Area (2244ha) was controlled using a network of 'Sentinel' kill traps as the primary control technique. Post-control monitoring of Otamatuna Inner Core showed an RTC of 2.7%, and at Waikokopu Inner Core an RTC of 3%. The use of a skilled group of contractors continues to achieve good results. The methods of control used are target-specific, low risk and can be expected to be sustainable technically and politically with a high level of community support.

4.2.2 Introduction

The Te Urewera Mainland Island (TUMI) project commenced in 1996 and encompasses approximately 50 000 ha of the northern part of Te Urewera National Park. Possum (*Trichosurus vulpecula*) control has been undertaken by the Department of Conservation (DOC) in part of this area since 1992 with control initially focused on protecting vulnerable canopy species such as tawhero (kamahi; *Weinmannia racemosa*). However, in more recent years the impacts of possums on a variety of flora and fauna has been recognised and the conservation objectives have broadened towards ecosystem restoration. It is recognised that vulnerable species can tolerate only low possum densities (<5% RTC) and the current control strategy within TUMI is to maintain possums at low to moderate densities by undertaking control within small blocks on a rotational basis.

One aerial 1080 operation was carried out in 1997 as an initial knockdown in the Southern Ikawhenua area. The control frequency within the Background Area is between two and four yearly where the frequency is determined by temporal and possum density triggers as part of the Landcare Research project 'Optimising the maintenance control of possums through adaptive management' (Section 3.2). Core Areas have previously been managed with a variety of toxins placed in bait stations, such as brodifacoum, Pindone, cholecalciferol and cyanide. Since 2000/01, the only toxins applied have been cyanide and cholecalciferol. At present, the primary control method is leghold trapping. However, along the main ridges and spurs within the Waikokopu and Pakoakoa Core Areas a combination of different kill traps has been established.

Conservation outcomes of the possum control programme are assessed using the Foliar Browse Index method (Payton et al. 1997) to measure canopy condition (Section 5.7), and by monitoring the condition of two mistletoe species, *Peraxilla tetrapetala* and *Alepis flavida* (Section 5.7). Kokako (*Callaeas cinerea wilsoni*) nest monitoring and kokako population census have also been undertaken within the Core Areas in order to gauge the effectiveness of combined possum, rat (*Rattus rattus*) and stoat (*Mustela erminea*) control (Section 5.2).

4.2.3 Objectives

The annual objectives for possum control within TUMI are:

- To reduce possum densities within part of the Background Area to < 5% Residual Trap Catch during each treatment year.
- To maintain possums in Core Areas at < 3% Residual Trap Catch within the Inner Cores and < 5% Residual Trap Catch in the Outer Cores.

4.2.4 Methods

Within TUMI, possum control is managed on two scales: 1) large-scale 'Background Area', 2) small-scale, more intensively controlled 'Core Areas' (Section 2.0). For management purposes, the Background Area is split into six *management areas*: Northern Ikawhenua, Central Ikawhenua, Northern Whakatane, Southern Whakatane, Northern Waimana, and Southern Waimana. Each management area is further divided into 5-10 *clusters* and then subdivided further into **monitoring blocks** each approximately 300 ha in size. The number of blocks within each cluster can range from two to six. The boundaries of monitoring blocks are mainly based on topographical features such as ridgelines and waterways. In total, the Background Area covers c.42 800 ha with 148 blocks in 41 clusters. Monitoring blocks were kept small (approximately 300 ha) and contractors were allocated clusters containing three to four adjoining blocks.

Contractors were selected by competitive tender (for further details refer to 'East Coast Hawke's Bay Animal Pest Management Tendering Procedure Manual for Animal Pest Contracts' DOC DM-213908). Contractors were employed on a performance-based contract using a combination of control methods: Victor No. 1 leghold traps, cyanide and cholecalciferol. Performance levels were met when target trap catch index of <5% RTC was achieved. A condition of the contract was that up to half of the contract value could be paid as a progress payment during the course of the contractor's work on a block, and the remaining balance paid upon achievement of the target trap catch index.

Figure 4.2.1 indicates where possum control was undertaken during the 2005/06 season. The main control method was trapping using Victor No. 1 leg-hold traps set against the base of a tree. Within the Otamatuna and Mangaone Core Areas, traps were set 350mm above ground level to minimise any adverse impact on kiwi (*Apteryx mantelli*).

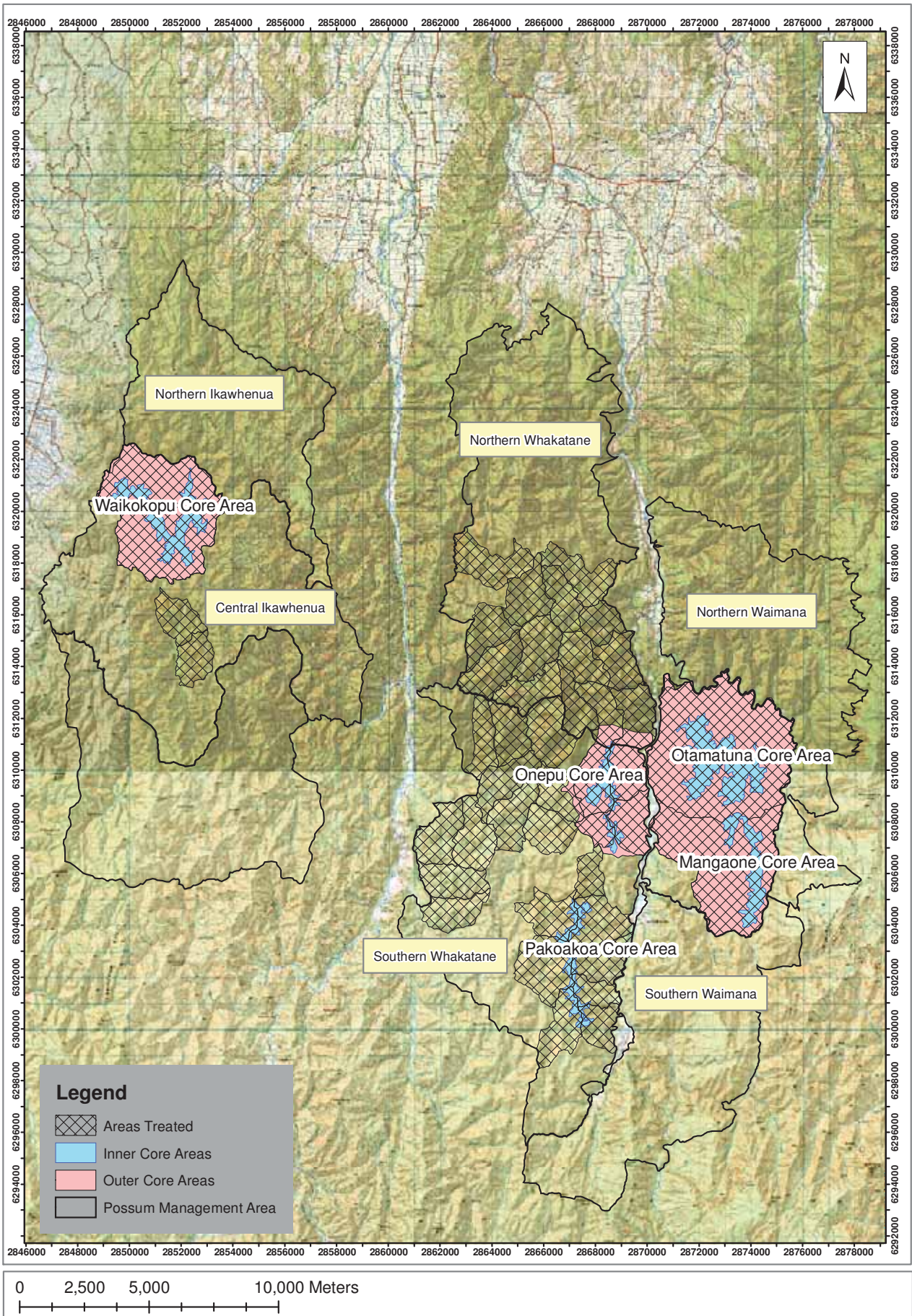


Figure 4.2.1 Areas treated for possum control, Te Urewera Mainland Island, 2005/06.

Trapping was supplemented with cyanide poisoning, in the form of a paste (60% sodium cyanide) and/or Feratox (80% potassium cyanide, encapsulated and coated with cereal) either set in a bait station or laid on the ground. Where a kiwi population was known to exist, baits were placed either in a container, or at 700 mm above ground. Cyanide was applied by those operators who held an Approved Handler (Pesticides) licence. Pre-feeding with non-toxic bait (flour, cereal pellets or kibbled maize) occasionally preceded toxin application.

As part of the tendering process contractors submitted a proposed timetable for controlling possums in each block. Contractors notified the Department when they considered possum densities had been reduced to below the target trap catch index (<5% RTC), and provided a date when post-control monitoring could commence. Monitoring was undertaken within 10 days of the commencement date by independent monitoring contractors. If post-control monitoring revealed that the RTC target was not met, further control work was deemed necessary by the contractor on the failed block. The block was re-monitored following notification by the contractor that possum densities had been sufficiently reduced to meet the target index. A proportion of the cost to re-monitor the block was recovered from the control contractor. As soon as the target index was met, the contractor was paid. Both the control contractors and monitoring contractors were regularly audited by DOC staff.

In addition to the Background Area, possums were controlled within the more intensively managed multi-pest control Core Areas: Otamatuna, Mangaone, Onepu, Pakoakoa, and Waikokopu. Possum control within four of the Core Areas was undertaken by contractors on prescriptive contracts. Here, contractors were paid a fixed amount for possum control undertaken in a prescribed manner. All necessary equipment was supplied by the Department. Maintenance control was carried out within Otamatuna, Onepu and Mangaone Core Areas using Feratox in bait stations and in bags stapled to trees. Feratox was also put out within the Inner Core Areas when possum interference occurred on the rat lines. Feracol® (Connovation Ltd) paste was put out at Otamatuna, Mangaone, and Pakoakoa Core areas to reduce possum numbers with rat control being seen as a useful by-kill. For details of the methodology used refer to the Mangaone Cholecalciferol Trial Report (DOCDM-235003) and the Otamatuna Cholecalciferol Trial Report (DOCDM-79897). Within the Otamatuna and Onepu Core Areas, leg-hold trapping as well as Feratox was used to control possums. The intensive trapping regime in the Waikokopu Core Area was maintained with a series of kill traps set along main ridges and prominent spurs. Sentinel, Connibear and Warrior kill traps were set in a sequence of Connibear – Warrior – Sentinel – Warrior – Connibear etc. In total there were 389 kill traps used: 116 Connibear, 177 Warrior and 96 Sentinel traps (Section 3.2). This year the Pakoakoa Core Area was controlled by a performance based contractor using a network of 'Sentinel' kill traps set out in a network at 50 metre intervals along all significant ridges and spurs, traps were set at 1.2m above ground level and baited with a prefeed paste ('Smooth in a tube', Connovation Ltd).

The traps were supplied by the Department of Conservation and the contractor set the traps out in prescribed locations then operated them at a frequency they felt necessary to achieve the control target. A limited amount of leghold trapping and some poisoning with cyanide paste and Feratox pellets was also undertaken by the contractor. The Pakoakoa Core Area consisted of seven monitoring blocks totalling 2244 hectares.

A comparative trial was undertaken within the Onepu Core area to assess the relative efficacy of leghold traps set on the ground compared with leghold traps raised 350mm above ground level. Traps were spaced at 25-metre intervals along major ridges and spurs and were alternately set on the ground or raised. Raised traps were secured by nailing two 90mm jolt head nails to the tree and then sliding the trap springs through these nails. For detail on this trial refer to Section 3.3.

The National Possum Control Agencies (NPCA) residual trap catch (RTC) protocol (2005) was used for all monitoring. The NPCA trap catch protocol is however, applicable to large operational areas – not small blocks less than 500 ha in size (as is the case in TUMI), therefore minor variations to the protocol were implemented. Five lines of 10 traps were used to monitor each block (average size approximately 300ha). This is less than the recommended NPCA protocol minimum of 10 lines per block, but the subsequent total number of lines in each operational area is greater than the recommended minimum, therefore providing good precision when each contract block is considered as a stratum. The appropriate number of lines recommended by the protocol was used in pre-control and trend monitoring.

4.2.5 Results

This season, possums were controlled over 16,578 ha. Of this, 9366 ha were in the Background Area and 7212 ha were in Core Areas. The Background Areas treated were: Central Ikawhenua (463 ha), Southern Whakatane (5287 ha) and Northern Whakatane (3616 ha). Central Ikawhenua consisted of two blocks carried over from the 2004/05 financial year, as the contractor had not been able to complete these due to ill health. The Core Areas treated were: Otamatuna Inner Core (557 ha), Otamatuna Outer Core (1953 ha), Mangaone Inner Core (232 ha), Onepu Inner Core (179 ha), Onepu Outer Core (1053ha), Pakoakoa Core (185), and Waikokopu Inner Core (377 ha) and Waikokopu Outer Core (1405 ha).

An average RTC of 2.93% was achieved over the Background Area this season (Table 4.2.1). This is below the target of 5% RTC. A total of 11,863 possums were reported killed by contractors within the Background Area.

Post-control monitor results at Otamatuna were 2.7% RTC in the Inner Core and 9.5% RTC in the Outer Core. The Pakoakoa Core is contained within eight adjoining blocks of the Southern Whakatane management area. The average RTC of these combined blocks was 2.66% RTC. In the Onepu Outer Core a 14.9% RTC was recorded prior to control. A subsequent post-control monitor recorded a 8.2% RTC.

In the Onepu Inner Core a pre-control monitor of 7.4% RTC was recorded, but no post-control monitoring was carried out. At Mangaone Inner Core only a pre-control monitor was undertaken and recorded as 12.9% RTC. A 31.2% RTC was recorded at Okopeka, the non-control site for the Mainland Island.

The kill-trapping regime within the Waikokopu Core Area (Inner and Outer Cores) continued with 1450 possums killed. In the preceding year, 741 possums had been killed. At Waikokopu 3.01% RTC was recorded in the Inner Core, and 17.87% RTC in the Outer Core. Possum RTC indices in Core Areas from 2000/01 to 2005/06 are shown in Table 4.2.1.

Possum RTC results per block are recorded on DOCDM-239618, covering the years 1998/99 – 2005/06.

T a b l e
4.2.1 Pre- and post-control residual trap catch index results for possums in management areas within the Background Area, Te Urewera Mainland Island, 2000/01 to 2005/06

Management Area	2001/02		2002/03		2003/04		2004/05		2005/06	
	Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-
Northern Ikawhenua			19.6	3.4				4.4		16.8
Central Ikawhenua					21.2	3.8		3.5		
Northern Whakatane		2.8				3.1				
Southern Whakatane	14.5	3.6		3.1				3.8		8.5
Northern Waimana	32.7			3.9				4.2		
Southern Waimana		3.9								

Table 4.2.2 Trend (pre-control) and post-control residual trap catch index results (%) for possums in Core Areas, Te Urewera Mainland Island, 2000/01 to 2005/06

Management Area	2001/02		2002/03		2003/04		2004/05		2005/06	
	Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-
Otamatuna Inner Core				5.7				4.5		
Otamatuna Outer Core				5.7				10.4		
Mangaone Inner Core			✓							12.9
Mangaone Outer Core										
Onepu Inner Core										7.4
Onepu Outer Core										14.9 8.2
Waikokopu Inner Core							8.1	3.4		
Waikokopu Outer Core							22.9	13.5		
Pakoakoa Inner Core					20.2		25.5			

✓ Core area worked and monitored as part of the enclosing background area.

Results for outcome monitoring of kokako (Section 5.2) mistletoe (Section 5.5) and canopy condition (Section 5.7) are elsewhere in this report.

4.2.6 Discussion

Sustained, intensive possum control is an essential element of the TUMI project and it is vital that possums continue to be maintained at low densities if the objectives of ecosystem restoration are to be attained.

Good results were achieved this year with trap catch index targets being met in the Background Control Area.

Tendered performance-based contracts and ground control techniques continue to be effective, although this year 14 blocks required re-monitors. The high number of failed blocks on first monitor was a cause for concern and discussions were held with the contractors to get some feedback. The lowered target (from 5.3% to 4.7%) was seen by some as a contributing factor to reducing morale and making target harder to achieve. There was also a view that the tendering process allowed contractors with insufficient experience and equipment to secure contracts. This may require a change in the threshold at which applicants are placed on the preferred contractors list and permitted to tender and/or a change in the weighting of contractor attributes and price.

From looking at previous data from when the target was 5.3% it was observed that within clusters and management areas the post control RTC consistently averaged around the 3% level, well within the desired target of 5%. It is felt that the practice of numerous small monitoring blocks and therefore high total numbers of monitoring lines within a management unit is possibly making the contractor's task overly difficult. With the desired outcome being less than 5% within the management area a proposal was developed for next year's work that would see the contractor being able to have individual monitoring blocks be as high as 6.7% provided that the overall contract area had an overall average of less than 5%. This would mean that contractors who achieved very low post control results on one or more of their blocks would be able to use this as a credit in a subsequent monitoring block within the same contract. Details are yet to be formalised but this may be a way to increase contractor morale and performance, reduce the risk of failing monitoring blocks and reduce control and monitoring costs without compromising outcomes.

Despite the difficulties contractors incurred, the average RTC of 2.83% was an overall improvement on RTC averages during 2002/03, 2003/04 and 2004/05 financial years.

Of the proposed possum control work scheduled for 2005/06 all work was completed with the exception of a 280ha block in Southern Ikawhenua; this work was being carried through into 2006/07. The block was not completed due to a contractor having health problems falling behind in the completion of other contracted blocks.

Not all Core Areas were treated intensively this year and resource priorities precluded monitoring at all sites. Core Areas will need to have ongoing intensive multi-pest management to achieve the desired conservation outcomes. The kill-trap possum control regime being trialed at Waikokopu continues to produce a reduction in the possum density. The possum density in the Waikokopu Outer Core has remained above the target level of 5% RTC; the downward trend provides cautious optimism that this approach may ultimately prove effective. A priority for next year should be to ensure all Core Areas receive intensive possum control and are monitored post-treatment.

4.2.7 Recommendations

- In 2006/07, all Core Areas should receive intensive possum control and be monitored pre- and post-control;
- Core Area maintenance control contracts should be introduced, and be of a minimum of two years duration;
- A kill trap regime will be introduced into other Core Areas, and extended at Pakoakoa; and
- The performance based RTC index target will be reviewed, and may be increased marginally to allow managers to give contractors an increased margin. Consideration should be given to a credit system whereby contractors are given credit for achieving better than target densities within an individual monitoring block of their contracted area. The desired outcome being that post control the total contract area averages less than 5% trap catch and no one monitoring block exceeds 7% trap catch.

4.2.8 Acknowledgements

Thanks to all the ground-based possum hunters: Gary Peratiaki, Lyn Thyne, Marina Geary, John Yearbury, Gary Thyne, KLM Holdings, Trap 'n' Track, Joseph Rako, and Walter Kilgour; contractors undertaking pre- and post-control RTC monitoring; M & M Contractors, Colin Cartwright; helicopter support: Waimana Helicopters and Central Helicopters. Also thanks to Shane Gebert, Pete Livingstone, Anastacia Kirk and Daniel Baigent at DOC Opotiki for contract and data management, and enthusiastic support.

4.3 RATS - DAN BAIGENT

4.3.1 Abstract

Rat control within Te Urewera Mainland Island during 2005/06 was undertaken over approximately 1550 ha in five Inner Core Areas. The management objective was to control rats to below a 5% tracking index: year-round in the Otamatuna Inner Core Area; and from 1 November to 28 February in Onepu, Mangaone, Pakoakoa and Waikokopu Core Areas (seasonal). In total, 7014 single-set trap sets were used with 97% being Victor Professional rat traps set in coreflute tunnels, and the remainder being DOC 200 traps set in wooden boxes (n=70), and Thomas traps set in wooden boxes (n=100). Traps were generally placed as single sets, mostly at 25m apart on lines approximately 150m apart. The number of trap check rounds varied between sites and ranged from eight to 19. These trap check rounds were used in conjunction with unofficial cholecalciferol (in the form of Feracol®, Connovation Ltd) toxin baiting trials in all areas except Onepu. Relative abundance monitoring was undertaken in all five Core Areas. In total, 6785 rats were trapped. Management objectives were not consistently achieved in any of the Core Areas; 47% of indices recorded during target periods in the five Inner Core Areas were above target levels. Results indicate that the trapping/toxin combination employed this season is probably more effective at controlling rats than a trapping only regime. Trapping success rates may be improved by continued attention to trap set maintenance, reduction of interference, and improving bait type and longevity. Five trials investigating aspects of rat control were in operation this season; three trials compared catch rates of traps under different tunnel types (wooden or coreflute) and two trials compared catch rates of new traps ('Thomas' or 'Ka Mate', and DOC200) against the best practice trap (Victor Professional).

4.3.2 Introduction

The ship rat (*Rattus rattus*) (rat) is the most uniformly distributed of the three rat species present on the New Zealand mainland (Innes 2005). They are the only species to have been trapped within Te Urewera Mainland Island (TUMI) and therefore the target species for rat control. Ship rats have been clearly identified as significant predators and competitors of native fauna (Brown 1994) and as such are a major threat to the northern Te Urewera ecosystem.

Rat control within TUMI commenced in 1996 and was focused in the Otamatuna Core Area where control was primarily intended to protect birds during their breeding seasons. The effect of rat control (in conjunction with possum (*Trichosurus vulpecula*) and stoat (*Mustela erminea*) control) was measured by monitoring kokako (*Callaeas cinerea wilsoni*) and robin (*Petroica australis longipes*) breeding success with ongoing pest control and pest monitoring. Since 1996/97, the area treated for rat control has increased as Core Areas (Section 2.1) have been developed. Previously, poisons such as brodifacoum, pindone and cholecalciferol have been utilised in rodent control at specific times of year.

However, in recent years, control methods have evolved in response to social and ecological sensitivity (especially in regards to the use of toxins) as well as past results, to the point where trapping is considered the principal control mechanism. Current control is beginning to investigate the efficacy of a trapping/toxin combination (using cholecalciferol in the form of Feracol® (Connovation Ltd) by way of collecting by-kill data associated with possum control operations.

The decision to develop trapping methodologies has created an environment of innovation and adaptation where different trapping techniques and management regimes have been, and continue to be, investigated. Because of the scale of the project, the nature of trialing different control methods and the limitations of resources, at any one time there is a range of trap-set types both within and between Core Areas.

Within this section of the report, control methods and results for rat control in each Core Area are presented, as well as summaries of current trials.

4.3.3 Objectives

- To maintain rat tracking indices at under 5% year-round in the Otamatuna Inner Core Area.
- To maintain rat tracking indices at under 5% during the period 1 November to 28 February (kokako breeding season) in the Onepu, Mangaone, Pakoakoa and Waikokopu Inner Core Areas.
- To assess the effectiveness of rat control techniques.

4.3.4 Methods

Best practice rat trapping currently consists of using a Victor® Professional (Victor, USA) rat trap covered by a tunnel to guide target animals and help exclude non-target species. Within TUMI, design has evolved from a folded coreflute tunnel with one entrance but no base (i.e. the trap sits on the ground) to a coreflute tunnel with a wooden base and a trap access at one end so the cover does not have to be lifted. Current trials are examining the performance of wooden box tunnels that wholly enclose the trap. Best practice information for rat control can be accessed through local DOC offices:

- Kill trapping for rats (DOCDM-29390)
- Trap layout and tunnel construction for Victor Professional rat trap housed in either a wooden or coreflute tunnel: (DOCDM-103712)

For the purpose of this report, the following terms are defined:

- *Initial knockdown*: The first rat control undertaken during a season following an extended period with no control (usually in reference to those areas managed under seasonal control)
- *Knockdown*: The first *period* of control during which rat abundance indices are significantly reduced

During the 2005/06 season, rat control was undertaken in the five Inner Core Areas (Otamatuna, Mangaone, Onepu, Waikokopu and Pakoakoa) along ridge, spur and A-, B- and C- lines where applicable (Section 2.2). In total, approximately 1550 ha were enclosed by rat control lines (Figs 4.3.1 and 4.3.2). Various trap and trap cover types were used as detailed below.

Distances between trap sets varied (see below), however, the vast majority of traps were set 25m apart along control lines, with a maximum of 50m spacings along a small number of internal (non-perimeter) lines and a minimum of 12.5m spacings along a small section of one perimeter line. Control lines were designed to be approximately 150m apart, although in practice, due to vegetation and general topography, distances between some lines may have been greater than 150m. Traps were generally placed as 'single sets', that is, one trap within a cover per site.

Trap checks were completed by either contractors or DOC staff. As well as checking and re-baiting traps, distributing poison and replacing broken or lost traps, contractors were also required to maintain the infrastructure including parts of the track network to certain standards. Emphasis was placed on quality of work and audits were completed throughout the year checking aspects such as trap set-off weight, trap condition, bait condition and track maintenance standards.

Relative abundance monitoring for rats was undertaken in each of the five Core Areas as well as the Oruamananui non-treatment site (Fig 4.1.1). Methods generally followed the DOC best practice (Gillies and Williams (2002); OLDDM-118330) where tracking tunnels using food colouring on a sponge and baited with peanut butter were set 50m apart on marked lines. All core areas had 50 tracking tunnels; Otamatuna had five lines of 10 tunnels, however due to the narrow shape and size of the other four Core Areas, the tunnels were laid out on 10 lines of five tunnels each.

Otamatuna

The Otamatuna Inner Core Area is set up on a C-Line system although a small section of the area has a B-Line configuration and a further small section has an A-Line configuration (both due to topography) (Section 2.2) (Fig 4.3.1). Approximately 557 ha are encompassed by the perimeter of the Inner Core boundaries. A total of 2362 'Victor Professional' rat trap sets were used (1087 on perimeter lines, 1275 on internal lines), of which all except 100 were set in plastic coreflute tunnels. The remaining 100 traps were set in wooden boxes. Of these 100 traps, 50 were part of an trial comparing tunnel types (set alternate with coreflute tunnels) and 50 were part of a trial also comparing tunnel types (wooden v. coreflute) but where the tunnels were paired (i.e. placed side by side) (see below) (Appendix 4.3.1).

Traps were baited with either a combination of peanut butter and white chocolate, or Ferafeed® (Connovation Ltd) pre-feed. This baiting occurred in an alternate fashion (alternate by full area trap clearance), where all baits were changed during every clearance. This baiting information was also used as an auditing tool.

The distances between trap sites remained the same as previous years, with the traps on the ridges and A-Line having 50m spacings and the traps on the B- and C- lines having 25m spacings. Large Philproof bait-stations are placed every 100m along all control lines. During the 2005/06, season 15 rounds of trap checking were completed commencing early July 2005 and finishing late May 2006. To monitor rat abundance, rat tracking was undertaken six times during the year: July, September, November and December 2005, and January and May 2006.

Mangaone

The Mangaone Inner Core Area is set up with an A-Line configuration (Fig 4.3.1) (Section 2.2). A total of 1101 rat traps are located within this Core Area; 1032 'Victor Professional' rat traps set in coreflute tunnels placed at 25m intervals, and 69 single- set DOC200s in wooden tunnels placed alongside every alternate coreflute tunnel on a section of these A-lines as part of a trial. For the duration of this trial, 69 Victor Professional rat traps in coreflute tunnels were closed down. Of the total number of rat traps, 782 were placed on the A-Line (perimeter), while 319 were situated internally, along the ridges and spurs.

Traps were baited with either a combination of peanut butter and white chocolate or Ferafeed® (Connovation Ltd) pre-feed. This baiting occurred in an alternate fashion (alternate by full area trap clearance), where all baits were changed during every clearance. This baiting information was also used as an auditing tool. The trial comparing DOC 200 and Victor Professional traps was continued this season (see below). Philproof bait-stations are located every 50m along all control lines, alternating between large and small stations. During the 2005/06 season, 13 rounds of trap checking were undertaken commencing 10 September and finishing early March 2006. Rat tracking indices were measured seven times: in July, September, October, November and December 2005, and Feb and March 2006.

Onepu

Rats in the Onepu Inner Core Area were controlled using an A-Line configuration (Section 2.2) encompassing approximately 179 ha (Fig 4.3.1). In total, 1259 'Victor Professional' rat traps were set in coreflute tunnels, 150 'Victor Professional' rat traps were set in wooden tunnels and 100 'Thomas' traps were set in wooden tunnels. Two trials for rat control were initiated this season at Onepu: one compared Victor Professional and Thomas traps, and the other compared coreflute and wooden tunnels (see below). In total, 1116 traps are placed on the A-Line (perimeter), and the remaining 393 on internal or ridgelines. The traps were predominantly spaced at 25 m (n=849), with the remainder (n=660) spaced at 12.5m. For the duration of the trial involving the 'Victor Professional' and 'Thomas' traps, 200 of the 660 traps spaced at 12.5m were shut down as they sat along the same control line. Subsequently, for operational purposes, 916 traps were open along the A-Line and 393 were open along internal lines. Philproof bait-stations (large) are placed every 100m along all control lines.

In 2005/06, 19 rounds or trap checks were completed by contractors commencing on 13 July 2005. Fourteen of these rounds were undertaken as was planned at the beginning of the financial year with an extra five rounds added over the duration of the trapping season. The last round was done in March. Traps were baited with either a combination of peanut butter and white chocolate or Ferafeed® (Connovation Ltd). Rat monitoring was undertaken in August, September, November and December 2005, and January and March 2006.

Waikokopu

Waikokopu Inner Core Area has a full A-Line with a partial B-Line set up (Section 2.2) encompassing approximately 377 ha (Fig 4.3.2). In total, 1715 'Victor Professional' rat traps were used, spaced at 25m and housed within coreflute tunnels. From modifications made during the previous year, several varieties of coreflute tunnels were used (see Moorcroft et al. 2007).

The 2005/06 control season consisted of nine trapping rounds and two toxin pulses using Feracol® (Connovation Ltd) commencing September 2005 and finishing late-February 2006. Rounds undertaken during the kokako breeding season (1 November to 28 February) were set at 2-weekly intervals. Traps were baited with either white chocolate, or a combination of peanut butter and white chocolate. During this season, rat abundance monitoring was undertaken in August, October, November and December 2005, and January 2006.

Pakoakoa

Pakoakoa rat control is based on an A-Line system (Section 2.0) encompassing 185 ha; 970 'Victor Professional' rat traps were in place at the start of the season. All traps were housed in coreflute tunnels with wooden bases. Traps were set 25m apart on control lines with 737 traps set on the perimeter and 233 on internal lines (Fig 4.3.1).

The 2005/06 management regime consisted of eight rounds of trap clearances commencing in October 2005 and ending in March 2006. Traps were baited with either Ferafeed (Connovation Ltd) or a combination of white chocolate and peanut butter. Rat tracking indices were undertaken in August, September, November and December 2005, and March 2006.

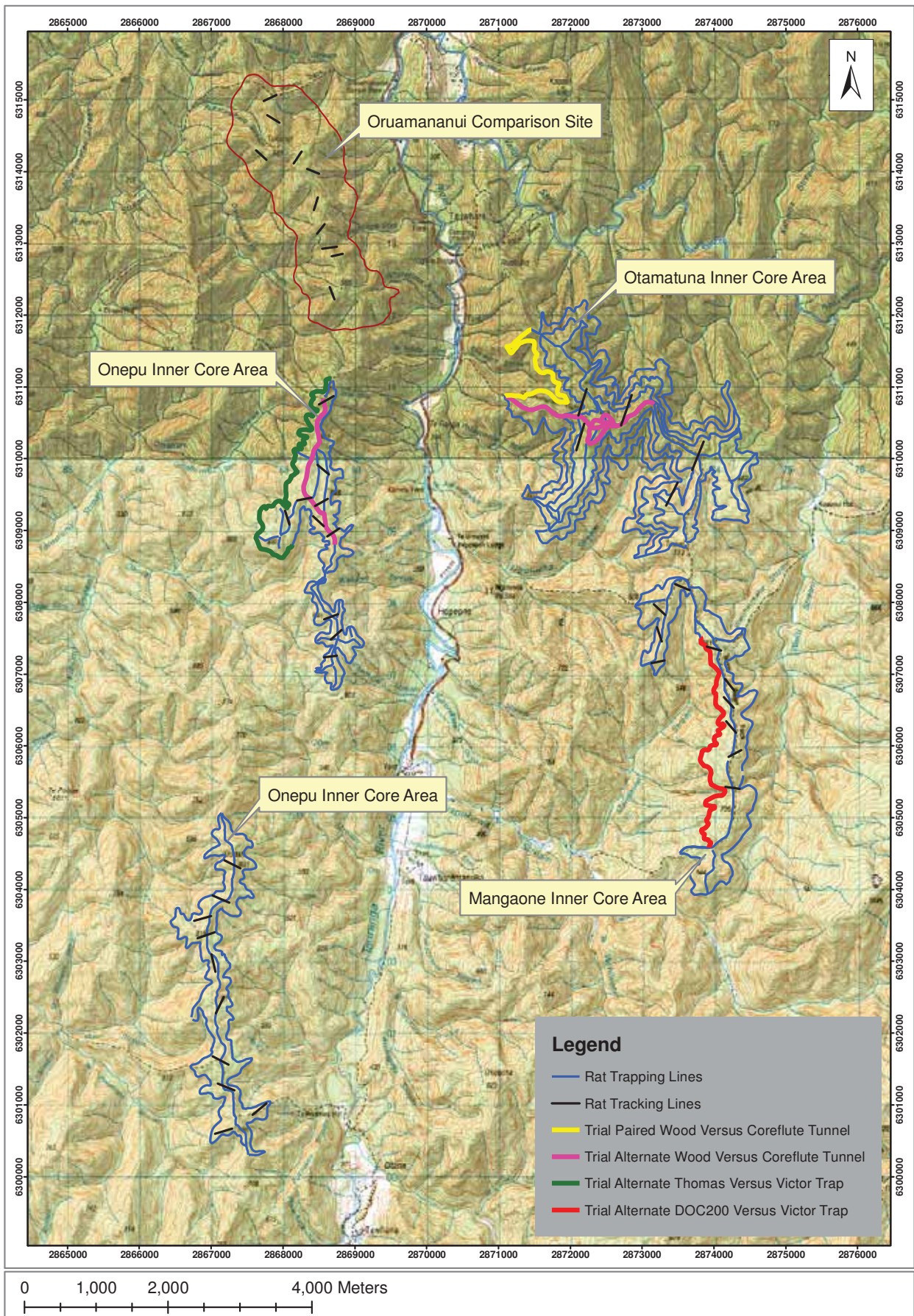


Figure 4.3.1 Location of rat control lines including trial sites, in the Otamatuna, Mangaone, Onepu and Pakoakoa Core Areas, Te Urewera Mainland Island, 2005/06.

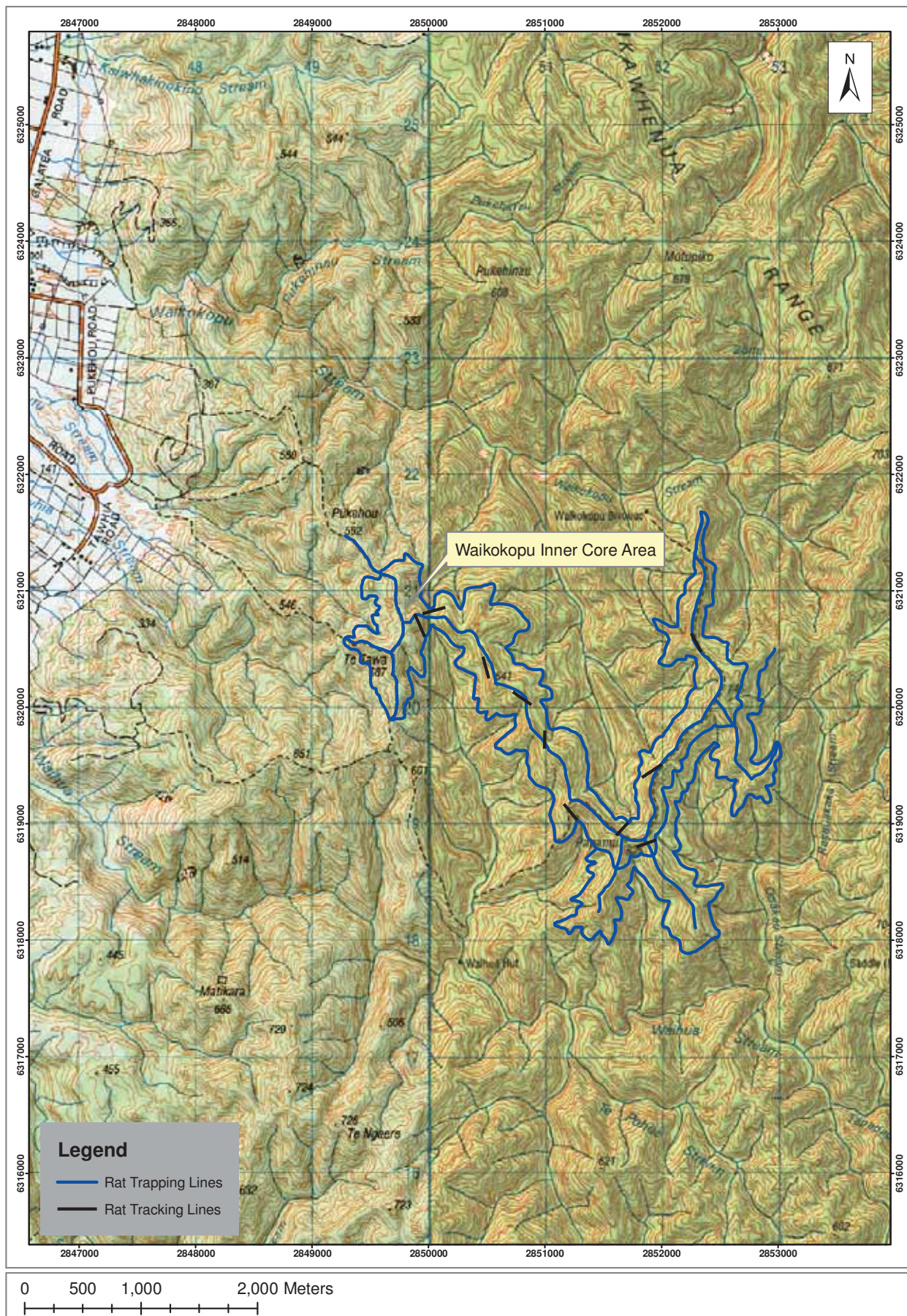


Figure 4.3.2 Location of rat control lines including trial sites, in the Waikokopu Core Area, Te Urewera Mainland Island, 2005/06.

4.3.5 Results

At Otamatuna, the tracking index was maintained to less than 5% from November 2005 to May 2006. The objective of maintaining rat abundance to below 5% tracking index between the months of November and February was not achieved in any of the remaining Core Areas.

In total, 5979 rats were recorded trapped over the year within the five Core Areas (1550 ha); this was a decrease of 43% from the previous season. Fewer rats were trapped in all Core Areas except for the Onepu Core Area, with the Otamatuna Core Area showing the greatest decline in the number of rats trapped (<50% of the previous year's total). A total of c.101250 trap checks were made (a decrease of 2% from the 2004/05 season). Additional data for all areas can be obtained from the Opotiki Area Office.

Rat tracking indices for Otamatuna and Oruamananui are shown in Figure 4.3.3, and those for Mangaone, Onepu, Pakoakoa and Waikokopu in Figure 4.3.4. Rat captures by month for each Core Area are shown in Table 4.3.1.

Figure 4.3.3

Rat tracking indices at Otamatuna Core Area and Oruamananui non-treatment area, Te Urewera Mainland Island, 2005/06

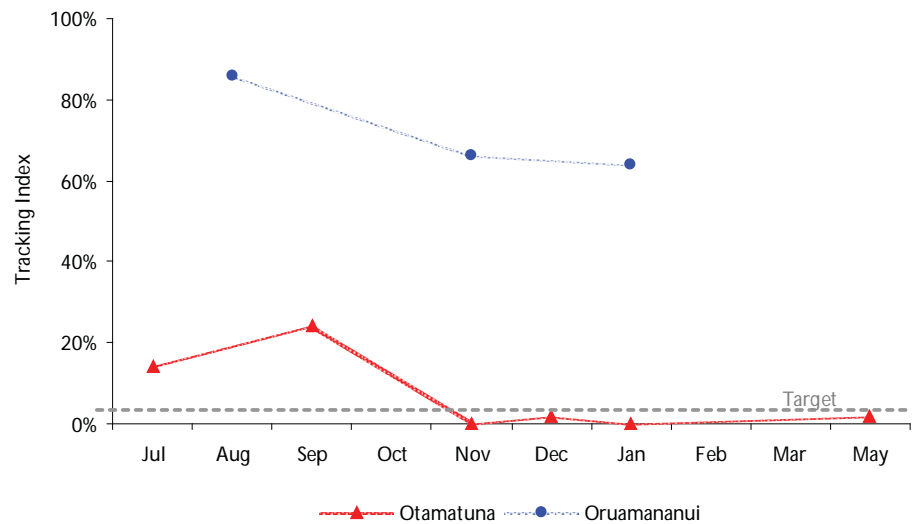


Figure 4.3.4

Rat tracking indices at Mangaone, Onepu, Waikokopu and Pakoakoa Core Areas, Te Urewera Mainland Island, 2005/06. The dashed horizontal line indicates the index target for the control period (indicated by the shaded area)

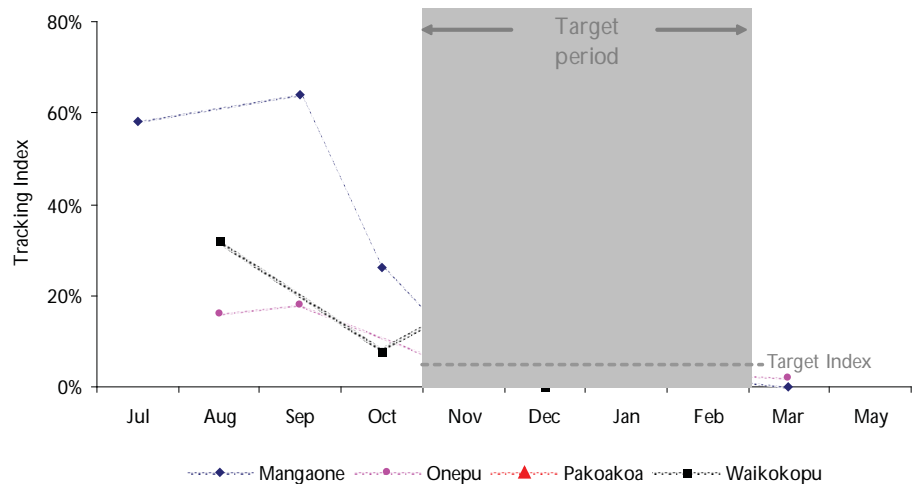


Table 4.3.1 Rat captures at Otamatuna, Mangaone, Onepu, Waikokopu and Pakoakoa Core Areas, Te Urewera Mainland Island, 2005/06

Rat captures - all Core Areas

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
Mangaone			112	532	223	207	114	106					1294
Onepu	99	183	246	74	52	154	169	86	51				1114
Otamatuna	402	157	145	210	310	187	203	117	143		265		2139
Pakoakoa				300	126		265	97	46				834
Waikokopu					385	62	80	71					598
Total	501	340	503	1116	1096	610	831	477	240		265		5979

Otamatuna

In total, 2179 rats were trapped at Otamatuna during the 2005/06 season. This compares to 5219 rats trapped last season. Non-target captures included 522 mice (*Mus musculus*), five stoats and 42 birds: 27 robins (*Petroica australis*), one long-tailed cuckoo (*Eudynamis taitensis*), two chaffinches (*Fringilla coelebs*), nine blackbirds (*Turdus merula*), one tomtit (*Petroica macrocephala*) and two unidentified individuals. Rat tracking indices show target levels of <5% were maintained once they had been achieved.

Mangaone

In total, 1294 rats were trapped at Mangaone during the 2005/06 season compared to 1385 trapped last season. Non-target captures included 66 mice, five stoats and eight birds: one robin and seven blackbirds. The highest index during the targeted period was 10% recorded in December with the lowest being achieved during the latter stages of the control period (February).

Onepu

The lowest index for the target period was recorded at its culmination in March (2%) and the highest (6%) was recorded in December. In total, 1114 Rats were trapped at Onepu during the 2005/06 season compared to 866 trapped in the 2004/05 season. Non-target captures included 164 mice, five stoats and three birds: two robins and one blackbird.

Waikokopu

In total, 598 rats were trapped at Waikokopu during the 2005/06 season whereas 2218 rats were trapped in 2004/05, a decrease of 73%. Non-target captures included 179 mice and 2 stoats. The lowest index in the Waikokopu Core Area (0%) was recorded in December.

Pakoakoa

In total, 834 Rats were trapped at Pakoakoa during the 2005/06 season that compares to 1192 rats trapped during 2004/05. Non-target captures included 10 mice, 2 stoats and 1 bird (unknown species). Tracking indices taken in the Pakoakoa Core Area showed that rats were not controlled to low levels (<5% tracking index).

Oruamananui

Oruamananui continued to be the comparison site for rats. Biennial possum control is undertaken in this block with the most recent treatment occurring during 2003/04. Rats continue to be present in high numbers.

4.3.6 Trials

Five trials investigating aspects of rat control were undertaken at three Core Areas this season. Three trials focused on comparing different tunnel types using Victor Professional rat traps and two trials compared different trap types (DOC200 and 'Thomas' or 'Ka Mate') against the Victor Professional rat trap. Further references can be found in Section 3.

1. Alternate wooden tunnel v. corflute tunnel (Otamatuna and Onepu)

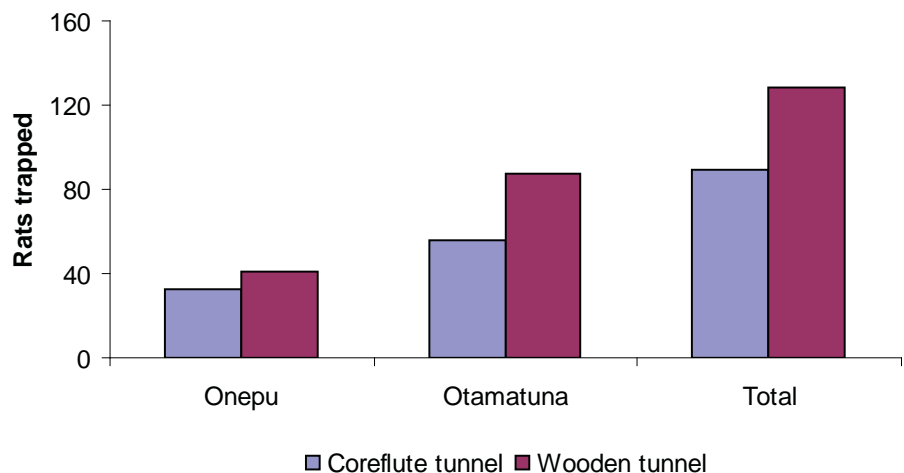
Trial period: June 2005 – January 2006

Methods: A total of 102 wooden or corflute tunnels each enclosing one Victor Professional rat trap (see Appendix 9.1) were placed alternately every 50m along selected rat control lines in Otamatuna (Topline (46 tunnels), Tawai Ridge (56) tunnels) and Onepu (92 tunnels every 25m along the main ridge). Existing coreflute tunnels at both sites were removed and replaced with wooden tunnels. Traps were baited with either a combination of peanut butter and white chocolate or Ferafeed (Connovation Ltd) prefeed. This baiting occurred in an alternate fashion (alternate by full area trap clearance), where all baits were changed during every clearance. Nineteen checks were undertaken on the Tawai ridge tunnels, 17 on the Topline tunnels and 16 on the tunnels within the Onepu Core area. The trial was set up from May-July 2005.

Results: A total of 217 rats and 90 mice were trapped during this trial, with 214 traps being sprung with no capture.

Figure 4.3.5

Number of rats trapped in a trial comparing coreflute and wooden tunnels set alternately, Onepu and Otamatuna Core Areas, Te Urewera Mainland Island, 2005/06)



In this trial, the Victor Professional rat traps in wooden tunnels caught 44% more rats than Victor Professional rat traps in coreflute tunnels.

Conclusions and Recommendations:

Victor Professional rat traps housed in wooden tunnels performed better than those housed in coreflute tunnels.

2. Paired wooden tunnel v. coreflute tunnel (Otamatuna)

Trial period: June 2005 – March 2006

Methods: A total of 100 wooden tunnels and coreflute tunnels (without a wooden base) each enclosing one Victor Professional snap trap were placed side by side every 50m along the Tawai C-Line within the Otamatuna Core Area. The 50 wooden tunnels were added to 50 coreflute tunnels already on site and were placed at every alternate existing coreflute tunnel site. The trial was set up in June 2005. Traps were checked as part of the planned regime where 15 checks were undertaken from July 2005 to May 2006.

Results: Ninety rats were trapped as part of this trial with 63 rats trapped within wooden tunnels and 27 rats trapped within coreflute. Fifteen mice were trapped within the wooden tunnels and eight within the coreflute tunnels. Thirty traps were sprung with no capture within the wooden tunnels and 79 sprung with no capture within the coreflute tunnels.

Conclusions and Recommendations:

To date, the Victor Professional rat traps in wooden tunnels have performed better than the Victor professional rat traps housed in coreflute tunnels. Victors in wooden tunnels had a superior rat-catch ratio, mouse-catch ratio and spring-off ratio; although at this stage the conclusions are derived from a small sample size. With the continuation of similar tunnel trials, a decision will be made to either continue this trial to establish an adequate sample size, or to discontinue and modify the coreflute tunnels.

3. DOC200 v. Victor in wooden tunnel (Mangaone)

Trial period: September 2004 – June 2006

Overview: The objective of this study was to compare the trapping effectiveness of Victor Professional rat traps set in current best practice coreflute trap tunnels, with DOC200 traps set in a single set wooden trap tunnel. A comparison was made between each trap for catchability (determined by the number of rats caught), trap ability (age and gender differences of those rats which are killed), escapability (measured by the number of escapes), and interference (incidence of disturbance of the trap by non-target species, such as possums and pigs).

Methods: Seventy-one DOC200 traps in single set wooden trap tunnels were placed every 50 metres along the A-Line in the Mangaone Core Area. Similarly, 71 single set Victor Professional rat traps in current best practice coreflute tunnels were placed every 50 metres along the same section of trap line, alternately with a DOC200 trap.

In effect, every 25 metres along the line, either a DOC200 or a Victor Professional kill traps was encountered.

Results: The DOC200 performed well in terms of 'catchability' with a proportionally higher catch rate than the Victor Professional: The Victor trap caught 172 rats over the trial period (mean 2.42 ± 0.18 SE rats per trap). The DOC200 trap caught 218 rats over the same period (mean 3.07 ± 0.17 SE rats per trap). The proportion of DOC200 traps that caught a rat(s) was significantly higher than the proportion of Victor traps that caught a rat(s); Pearson $\chi^2=3.873$ df=1, Exact p=0.048 (1 tailed).

Conclusions and Recommendations:

Results indicate that improved rat kill trapping results can be achieved with DOC200s in single set wooden tunnels, in comparison to Victor Professional rat traps in coreflute tunnels

4. Thomas trap v. Victor Professional trap (Onepu)

Trial period: November 2005 – ongoing

Overview: The trial was set up to gain an indication whether the prototype 'Thomas' or 'Ka Mate' trap was similarly effective at trapping rats compared to the Victor Professional rat trap. This trial was conducted in three stages with the first stage occurring during this reporting period.

Methods: From a randomly selected starting trap on the Onepu A-Line 200 wooden tunnels were placed alternately between existing coreflute tunnels during November 2005. The coreflute tunnels were shut down for the duration of the creating a trial trap spacing of 25m between the wooden tunnels. Victor Professional rat traps and Thomas rat traps were set alternately as single sets within the wooden tunnels,. During this stage, Thomas traps were baited with cooked peanut butter packed in a wire coil and Victor Professional rat traps were baited with peanut butter.

Results: 173 rats, 31 mice and 1 stoat were trapped within this trial during the 2005/06 season. Of these, the Victor Professional trap caught 111 rats and 13 mice, while the Thomas trap caught 62 rats, 18 mice and 1 stoat. The occurrence of traps being sprung with no capture was similar for both traps though the overall bait presence per checks for the Thomas trap was superior with 90% presence as opposed to 68% for the Victor Professional.

Conclusions and Recommendations:

Results from this stage of the trial indicate that the Victor trap baited with Ferafeed is more effective at trapping rats than the Thomas trap baited with cooked peanut butter in a coil. Bait type is an important factor. Limitations to this include the baits for the Thomas trap being cooked, which were requested to be used and provided by the inventor of the trap. Further, the wire coils themselves may have created a difference in interaction between the target species and the traps.

Lastly the design of the Thomas traps being used in the trial (hand made prototypes) and the placement of the coils underneath the trigger (as standard in the baiting of the trap) left a possibility for less than perfect trap set off occurrences. This includes the fine setting of the coil baits as well as the ability for the target species to remove the coil bait as required for the triggering of the trap.

Further trials involving the two traps are required and further data will need to be collected using different baits that may have an influence on the interaction of target species to the traps as well as general palatability.

5. Corflute tunnel with wooden base v. corflute tunnel with no base (Onepu)

Trial period: December 2005 – ongoing

Methods: Approx 230 coreflute tunnels with wooden bases were placed alternately at 25m spacings between already existing coreflute tunnels with no wooden base along a perimeter line within the Onepu Inner Core Area. This created an approximate trap spacing of 12.5m. Within both varieties of tunnels were housed single set Victor Professional rat traps. All traps were baited alternately between rounds with either a combination of white chocolate and peanut butter or Connovation Ltd's Ferafeed.

Results: Over 8 checks from December 2005 until March 2006, initial results showed an even rat capture ratio over a small sample of 69 rats. The mouse capture ratio was also similar. The main difference in performance was noticed with the spring off rates (no capture), with the coreflute tunnels without a wooden base recording 130 while the coreflute tunnel with the wooden base recorded 31, an overall ratio of 4.2:1.

Conclusions and Recommendations: Results to date do not provide sufficient information to draw any firm conclusions on the efficacy of coreflute tunnels with wooden bases versus coreflute tunnels without wooden bases. This trial will be continued through the 2006-2007 trapping season.

4.3.6 Discussion

Continued attention has been given to the operational demands of an intensive trapping system. In particular, effort was made to focus trapper attention on the finer points of trapping which can easily be neglected or temporarily overlooked (e.g. the maintenance and timely replacement of traps and ensuring all trapping units are in place and operating). In general, during this season we have seen a marked improvement in the overall attention paid to these factors by contractors.

The overall decrease in the number of rats trapped this season compared to last season is most likely due to a by-kill factor from Feracol in possum control (Section 4.2). These operations have been carefully followed to gather data that may provide an insight into the efficacy of Feracol for rat control.

The by-kill of rats in possum control operations using Feracol appears to have had a significant effect in reducing rat abundances. In Core Areas where control is seasonal, initial knockdown results appeared to be improved compared to previous years and at Otamatuna where year-round control is undertaken target indices were reached more consistently than in previous seasons. Considering the time period over which the Feracol was distributed and the similarities between results in the Core Areas, it appears that appropriate use of Feracol can significantly reduce rat populations both more quickly and with less person hours than by a trapping-only operation. Once rat abundance levels have been lowered results indicate that a trapping-only regime can be sufficient to maintain low abundances. Further investigation into this approach may be required to ascertain the most effective combination of trapping and toxins.

Due to previously-experienced anomalies in the Waikokopu Core Area (where high trapping but low tracking rates in Waikokopu did not correlate with low tracking and low trapping rates in other Core Areas), a similar regime (as used in other Core Areas) of toxin (Feracol) 'knock down' followed by 'maintenance trapping' was used (even though tracking indices were low), in an effort to ensure that rat abundances 'on-the-ground' were in fact lowered.

The introduction of wide scale stoat control within the Waikokopu Core Area (November 2005) may also have had an effect on the rat indices (as rats comprise a major proportion of stoat diet in this forest type (King 2005)) although it is unclear what impact the trapping regime would have had this season.

Another factor, which appears to have improved the efficacy of the trapping system, is the use of pre-feed along control lines. The pre-feed appears to attract rats increasing the opportunities for capture in traps along those lines: during the pre-season pre-feed round at Mangaone where more than 100 traps (either unbaited or baited with old and mouldy bait), caught rats.

The introduction of Ferafeed (Connovation Ltd) as a baiting option proved to be successful. There is little to suggest the bait itself is either superior or inferior to other currently used or previously used baits. The nature of the bait itself in being singular (2 baits not being required together), its apparent extended life on the trap (bait was present on average longer than the white chocolate/peanut butter combination), its usability (contractors found the product in general easier and quicker to use) and its similar catch rate compared to the white chocolate/peanut butter alternative means it was a suitable alternate bait. Having two effective baits also allowed for effective auditing; trappers had a contractual obligation to change the bait type each subsequent round meaning a simple visual check determined whether the trap had been re-baited in any particular round. The continued auditing of contractors remains a major aspect in maintaining the ongoing effectiveness of rat control. Along with the benefits of alternate baiting, attention continued to be given to ensuring contractors replaced all traps no longer capable of catching efficiently, and in particular identifying less obvious faults often associated with deteriorating traps.

By-kill of birds was an escalating problem within the Otamatuna Core Area. A factor in this increase may be attributed to increasing bird numbers as opposed captures due to changes in management techniques. A small number of tunnels in one area were prone to interference by pigs and the disturbance of coreflute tunnels could have added to the risk to birds. Efforts will be made to reduce this interference, whether by adding contracted pig control or by other means. An increased trap check frequency may be required in the short term to combat this problem until a permanent solution is found, as pigs are often unlikely to stay in the same general area for extended periods.

4.3.7 Conclusions and Recommendations

Results indicate that the trapping/Feracol regime is effective for reducing rat abundances significantly. In order to meet operational objectives, further investigations on the timing of the regime, particularly the toxin application, need to be done.

Interference with rat trap sets by either pigs or possums continued to be a significant issue even with intensive possum control. Increased pig control and continued possum control is needed to improve trapping success.

4.3.8 Acknowledgements

Thanks to this season's rat trappers: Keith Beale, Arthur Sandom, Gaye Payze, Joe Ruruhe, Scott Lloyd, Leonard Sparks, Pete Fergusson and Grant Jones; and also all the volunteers who put time and effort into the project. Also, thanks to: Environment BOP for funding for Pakoakoa; all DOC Opotiki staff for continued efforts with the Core Areas in contractor and data management and field work; ECHB Conservancy staff for their continued contributions; Darren Peters and Craig Gillies for their efforts and support with trials in the area. Also thanks to Doug Perkins and crew for their Core Area track cutting efforts.

4.4 STOATS - DAN BAIGENT AND GREG MOORCROFT

4.4.1 Abstract

Within Te Urewera Mainland Island (TUMI) there are currently 1495 trap sets for stoat control encompassing 7215 hectares. The majority of trap sets (58%) are double-set Fenn traps set in a wire cage tunnel. A trial comparing single-set Fenn traps in wooden tunnels and single DOC200 traps in wooden tunnels continued to be run over 1232 ha in the Onepu Core Area. Two hundred and thirty four DOC200 single sets in wooden boxes were placed within the Waikokopu core area at 100m trap spacings within the Inner Core and at 200m trap spacings within the Outer Core. Bead blasting and waxing of the stoat traps at Otamatuna and Mangaone during the previous year was sufficient to allow for continued high levels of trap performance. The total number of stoats trapped throughout TUMI was 435, (a decrease of 13% from the previous year), including 19 caught in rat traps; most captures were in the summer months. Captures in the Otamatuna/Mangaone Core Areas decreased by 11% compared to the previous year. Current results from the Fenn/DOC200 trial continue to indicate that DOC200 traps are more effective at catching stoats than single set Fenns in wooden tunnels. Outcome monitoring for kiwi was once again undertaken following the filling of a staff vacancy in August although no chicks were located this season.

4.4.2 Introduction

Three members of the mustelid family (Mustelidae) are established in New Zealand: the stoat (*Mustela erminea*), the ferret (*M. furo*) and the weasel (*M. nivalis vulgaris*). The threat of mustelids, particularly stoats, to extant fauna is now well-recognised, with mustelids being responsible for the widespread decline and, in some cases, possible extinction, of a number of native bird species (King 1984; Elliot and O'Donnell 1988; Beggs and Wilson 1991; O'Donnell 1996). Mustelids, then, pose a significant threat to natural ecosystem processes.

Trapping results within TUMI indicate that stoats are by far the most common of the three mustelid species present in the area and management of mustelids within TUMI is therefore focused on this species. As such, this work is generally referred to as stoat control although other mustelid species may be caught.

Control for stoats within TUMI began with the project's inception in 1996/97. Work was initially concentrated at Otamatuna Core Area where 1100 ha was managed with a trapping and toxin regime (it was assumed stoats would be secondarily-poisoned by preying on poisoned rodents) (Beavan et al. 1999). As the project developed, stoat control was initiated in other Core Areas and the principal means of control was rationalised to trapping. Trap lines within TUMI were established according to a 'best guess' approach on what might be adequate for controlling stoats; stoats roam widely for prey so traps need to be set over large areas at regular-enough spacings so stoats have a reasonable chance of encountering a trap in any particular period.

Placement of traps was limited by management and practical constraints such as funding for trap purchase and servicing of traps, and topography within management areas.

Trap set design has evolved in regard to both trap and cover type with current research being undertaken on the efficacy of the recently-introduced DOC200 (Appendix 9.1). Current trial data suggests the DOC200 has joined the Fenn as a viable option for wide-scale stoat control, although its performance in comparison to the Fenn is yet to be fully determined. Within this project, Fenn traps are usually placed in double sets under a wire mesh cover (see Appendix 9.1).

Within the adjacent Otamatuna and Mangaone Core Areas there are three 'sub-areas' within one contiguous block: Otamatuna, Mangaone and EBOP (for Environment Bay of Plenty) (see Moorcroft et al. 2007:48). The three sub-areas are currently managed under separate contracts and under different regimes (see below).

Within TUMI different trapping techniques and management regimes for stoat control have been, and continue to be, investigated (e.g. see Beavan et al. 1999). Some investigations (or trials) follow a particular process and are called Field Trials, while other trials are less formal. Because of the scale of the project, the nature of trialing different control methods and the limitations of resources, it is not possible to have best practice control methods in place at every site. Rather, it is usual that a particular area or number of traps at a site may be part of an investigation or not yet upgraded, and so at any one time there will be a range of trap set types both within and between the Core Areas.

Within this section of the report, control methods and results for stoat control are detailed, and these may include details of investigations. Further details of investigations are contained in Section 3.2 or as a separate report that is referenced.

4.4.3 Objectives

The aim for annual stoat control is to protect native species from depredation. The current indicator species for stoat control is kiwi (Section 5.3).

The annual objectives for stoat control within TUMI are:

- To enable at least 50% of monitored kiwi chicks and juveniles to reach 1000g in weight; and
- To assess the effectiveness of stoat control techniques used in investigations.

4.4.4 Methods

Stoat control was undertaken by setting kill traps on tracks (or lines). These control lines were generally set on prominent topographical features such as ridges, spurs, rivers and streams. Pink triangles with the trap name inscribed were used to mark trap sites.

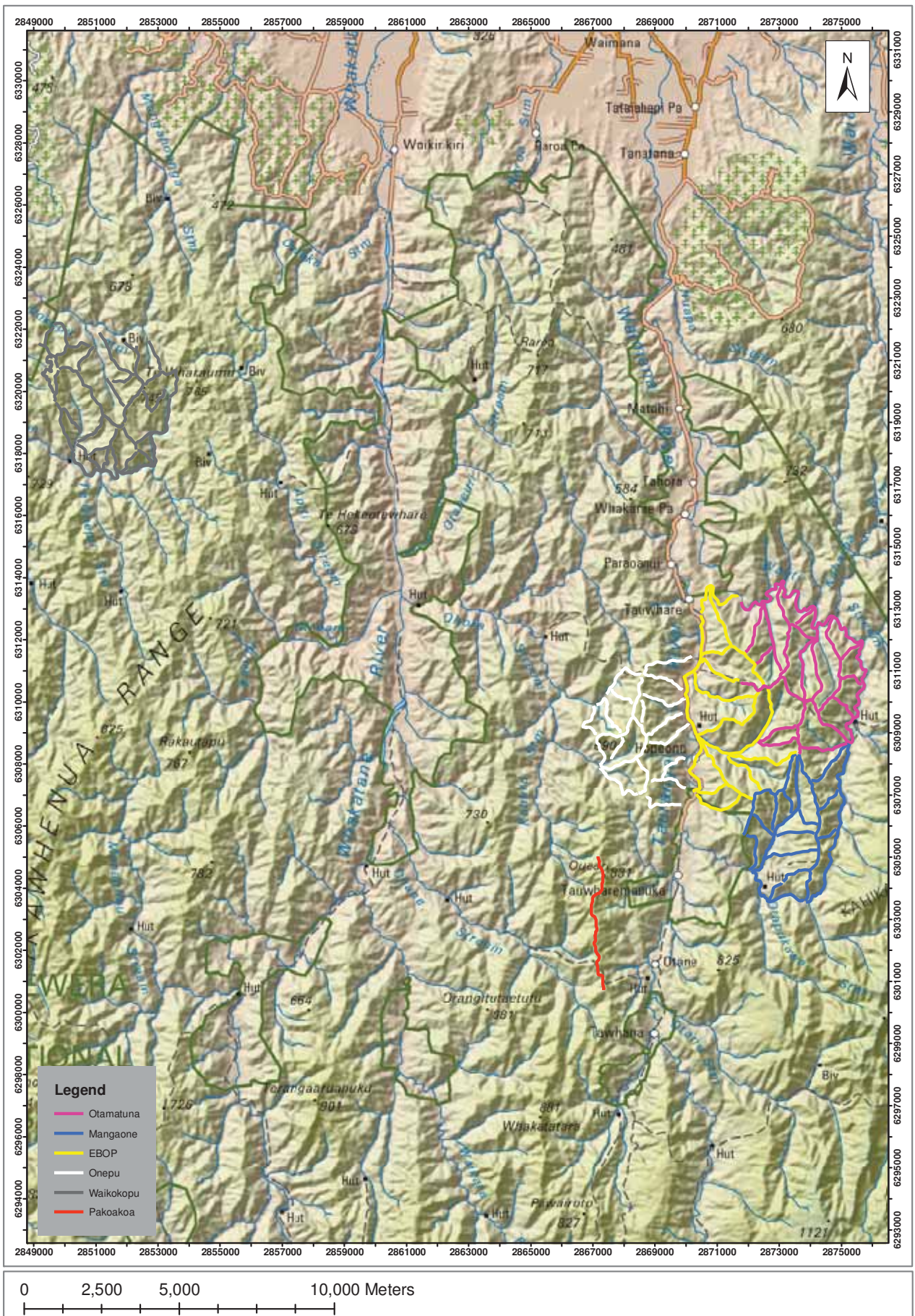


Figure 4.4.1 Stoa trapping lines in Core Areas, Te Urewera Mainland Island, 2005/06.

As of November 2005, a total of 7215 ha was encompassed by stoat control lines, with control in place in four blocks: Otamatuna/Mangaone/EBOP (4013 ha), Pakoakoa (Inner Core only – 185 ha), Onepu (1232 ha) and Waikokopu (1782 ha) (Figure 4.4.1).

The most commonly used trap set is shown in Appendix 9.2, and generally consists of two Mark 6 Fenn traps (Fenn & Co., UK) set under a wire-mesh tunnel with a clear plastic sheet cover, and baited with a hen egg placed between the traps. Fenn trap sets are contractually maintained where nine out of ten must have a spring-off weight below 150gm with five of these springing off below 100gm.

In total, 1495 trap sites were used for stoat control within TUMI in 2005/06. Fenn traps were used at 1088 sites, where 915 were double-set Fenns and 173 were single Fenns set in wooden boxes. DOC200 traps (Curtis Springs and DOC) were the other trap type used (407 sites) (Table 4.4.1). Hen's eggs were used to bait all traps: eggs were purchased by the contractor to ensure freshness, and contractors were subsequently reimbursed by the Department. Eggs were replaced every six weeks during warmer months and every eight weeks during cooler months.

As part of the auditing process for stoat contractors, audit tags in the form of numbered ear tags were placed within selected control tunnels. These were required to be returned with data sheets after the completion of each trapping clearance as evidence of control lines walked. On-site audits were undertaken early in the season to ascertain the general quality of control being provided by the contractor and to assess any need for improvements.

This season, the total trapping area within TUMI was significantly expanded with the addition of 234 single-set DOC200 stoat traps placed within the Waikokopu Core Area, extending stoat control here from 377 ha to 1782 ha. All DOC200 traps were placed at 200m apart and placement followed major topographical features including ridges, spurs and streams, and a selection of possum kill-trap control lines established previously. The existing stoat control (double-set Fenn traps at 150m spacing) was set out along ridges 1, 2 and 8. As part of the expansion, DOC200 traps were placed along these ridges at 200m spacing and six Fenn trap sets were removed and the other sets re-located so that eventually alternate sets of Fenn and DOC200 traps were set along the three ridges every 100m (Figure 4.4.1).

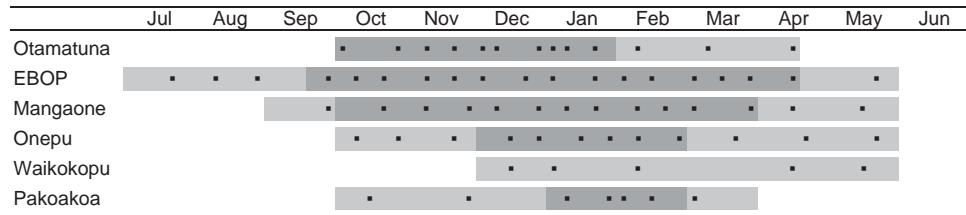
Table 4.4.1 Number and type of trap sets for stoat control in Core Areas, Te Urewera Mainland Island, 2005/06

Core Area	Number of sites	Trap density (ha/trap)	Trap spacings (m)	Types and numbers of trap sets (trap type, traps/set, cover type)
Otamatuna/Mangaone				
Otamatuna 304				
EBOP 256	817	4.9	150	817 Fenn double set wire mesh
Mangaone 257				
Onepu	346	3.6	100	173 Fenn, single set, wooden box 173 DOC200, single set, wooden box
Pakoakoa	50	3.7	100	50 Fenn, double set, wire mesh
Waikokopu	276	6.5	100 200	42 Fenn, double set, wire mesh 234 DOC200, single set, wooden box
Total	1495	4.8		915 Fenn, double set, wire mesh 173 Fenn, single set, wooden box 407 DOC200, single set, wooden box

Distances between control lines varied according to topography (Fig 4.4.1). The distances between trap sets ranges from 100m to 200m, with the majority (61%) set at 150m (Table 4.4.1).

Traps within the EBOP area were removed for bead blasting and waxing during July-August as a continuation of the same process undertaken at the Otamatuna-Mangaone sites the previous year and this concluded the bead-blasting/waxing for all traps within these three named areas. Trap checks were undertaken by contractors on a pre-set schedule. The frequency of checks varied at each site (Figure 4.4.2) although specific periods when stoats are traditionally trapped in larger numbers (summer) were targeted for all areas to have similar trapping regimes (two weekly).

Figure 4.4.2
Trap check frequencies in Core Areas, Te Urewera Mainland Island, 2005/06. Clear areas indicate no checks undertaken, light shading indicates 3- or 4-weekly checks and dark shading indicates 2-weekly checks.



Trapping at Waikokopu began in November 2005 when the expansion of the trap network into the Outer Core was completed. Post-summer trap checks were conducted on approximately monthly intervals until May in all areas except Waikokopu and Pakoakoa where stoat trapping is run in conjunction with rat trapping and therefore concluded late February/early March. Pakoakoa was checked in combination with the rat trapping rounds with two checks being undertaken from October to December and five checks undertaken at approximately two week intervals thereafter until the completion of the rat trapping schedule.

4.4.5 Results

In total, 435 stoats were trapped in the five Core Areas within TUMI (Table 4.4.2). This total includes 19 stoats trapped in Victor Professional traps set for rats (Section 4.3). Captures within dedicated stoat traps have decreased by 15% from the 2004/05 season with a comparable number of trap checks being undertaken.

A predictable spike in capture numbers (as observed in previous years) occurred during the summer months (specifically, late December and throughout January) in all control areas. Where there was a sizeable winter layoff between trap checks (>2 months), a one-off spike in the first subsequent clearance occurred.

Table 4.4.2 Number of stoats trapped in 'stoat traps' within Core Areas, Te Urewera Mainland Island, 2005/2006

Core Area	Sub-Area	Sub Total	Stoats in 'stoat' traps	Stoats in 'rat' traps	Total
Otamatuna/Mangaone	Otamatuna	84		5	
	EBOP	102	266		276
	Mangaone	80		5	
Onepu			78	5	85
Pakoakoa			42	2	44
Waikokopu			30	2	32
TOTALS			416	19	435

Results after approximately two years from the trial comparing Fenn traps and DOC200 traps continue to indicate that single set DOC200 traps in wooden tunnels are more effective than single-set Fenn traps in wooden tunnels (Table 4.4.3). Full results of this trial can be found at DOCDM-239920 (Section 3.3).

Table 4.4.3 Trapping results for trial comparing Fenn trap and DOC 200 catch rates in Onepu Core Area, Te Urewera Mainland Island, September 2004 to June 2006

Trap type	Stoats trapped	Rats trapped	Other animals trapped	Trap set at check	Trap sprung, no catch
Fenn	54	142	1	3387	44
DOC 200	103	211	2	3273	43
Total	157	353	3	6660	87

4.4.6 Discussion

The addition of 1405 ha of trapping in the Waikokopu core area has been the major change to the current stoat control project within in the 2005/06 season.

The effectiveness of bead blasting and waxing of Fenn traps and its impact on overall stoat captures remains difficult to determine, though such factors as ease of use and trap life were certainly improved. The average trap set-off weight decreased and those traps previously significantly outside the target set-off weight were now able to be sprung within target weights. Non bead-blasted/waxed Fenn traps within the EBOP control area realised similar trap catch increases as those areas where traps had been bead-blasted/waxed indicating that the increase in stoat trapping in this could not necessarily be attributed solely to the bead blasting and waxing. Similar trap catch results were seen with rats as a by-kill. One to two years after having been bead-blasted and waxed the Fenn traps remain effective and in similar condition to when they were first waxed. Following waxing, there was an issue with the wax on some triggers where a proportion of the traps were difficult to set and not able to be sprung within target weights. This occurrence was reduced significantly within a short space of time, although some units required excess wax to be removed before becoming settable. Comments from the contractors using the re-waxed traps in Otamatuna and Mangaone are very positive; the ability to set the trap more easily and finer is apparent. The input required to achieve this standard of trap is relatively high however and efforts are required to continue searching for methods which would not require trapping units to be brought off the hill. Whether the re-waxing has played a part in the increase in stoat captures from the previous year cannot be determined from this year's data alone. Catch rates are also influenced by management factors (such as trap condition, number and spacing of traps, and frequency of trap checks), and seasonal and yearly fluctuations in stoat abundance principally caused by variations in abundances of their prey, and trapping history at a site.

Captures from areas that were checked less frequently during late autumn and winter showed that stoats continued to be caught within this period of the year. In those areas where fewer checks are undertaken through late autumn and winter, subsequent initial clearances show one-off peaks in capture rates followed by reduced capture rates. These results show indications of continued efficiency (although somewhat reduced) in periods where no or fewer clearances are scheduled. Future consideration therefore needs to be given to the frequency of checks undertaken in any given year and the potential risks and rewards of reducing this.

The DOC200 v. Fenn single-set trial within the Onepu Core Area will continue into the 2006/07 season. There appears to be numerous advantages from the use of the DOC200 trap including being easier to set and generally easier to maintain. The position of the DOC200 within the wooden tunnel does mean it is slightly harder to fully remove animal remains from, which, without a stainless steel trigger plate (as those used within the trial), may become an issue over time as traps rust and generally deteriorate through the reaction between the decaying carcasses and the trap metal.

4.4.7 Recommendations

- Maintain a regular maintenance programme of Fenn and DOC200 traps; and
- Continue monitoring kiwi as a measure of the effectiveness of the stoat trapping regime.

4.4.8 Acknowledgements

A big thank-you to Keith Beale, Joe Rurehe (sole contractors), Arthur Sandom and Gaye Payze (Waimana Pest Control) who undertook stoat contracts for the Opotiki Area Office and for their dedication to trapping stoats this season. Thanks also to John Tohia, Raymond Heta and Te Waiiti Takao for their assistance with the stoat control extension at Waikokopu. A huge thanks to Scott Lloyd in his temp staff role for his assistance and input with all matters relating to pest control within the Core Areas. Thanks also to Darren Peters (RD&I, Wellington) and Craig Gillies (RD&I, Hamilton) and the East Coast Hawke's Bay Conservancy staff for their assistance in the project in general.

4.5 DEER - GREG MOORCROFT AND SHANE GEBERT

4.5.1 Abstract

This was the tenth season of deer control within the 2530 ha Otamatuna Deer Control Area. The objective was to control deer to low enough levels to allow the regeneration of palatable seedlings. A total of 64 deer and 12 pigs were killed during the year: 59 by ground-based contract hunters using indicator dogs; and five deer and one pig by DOC staff. Monitoring of the number of palatable seedlings in the treatment and non-treatment blocks showed that the number of palatable seedlings has increased slightly, although counts of faecal pellets on monitoring lines also indicated that deer numbers were still increasing. Key recommendations are: to maintain the same operational target (at least 60 deer removed) for at least three further seasons; to ensure the programme is adequately resourced to reasonably attain the operational target; to continue to monitor deer abundance in a non-treatment (comparison) area; and to continue to use hand-held GPS units for auditing purposes.

4.5.2 Introduction

Forest structure in the Te Urewera National Park has been modified by introduced mammals including red deer (*Cervus elaphus scoticus*) and pigs (*Sus scrofa*) which are common throughout (Allen et al. 1984); ungulates have caused major changes in the shrub and small tree tier (Bockett 1999) and therefore are a major threat to ecosystem restoration within northern Te Urewera.

Government-funded deer control in the Waimana, Waikare and lower Whakatane catchments commenced in 1966, however by 1980 decreasing effectiveness of paid hunters and the increase in commercial recovery of wild deer led to a significant decrease in government funding for control programs (Whiting et al. 1980). Commercial efforts were having a measureable impact on wild deer populations however, recovery fluctuated depending on markets. By the mid-2000s however, commercial recovery had, to all intensive purposes, ceased.

Red deer (deer) were first controlled within TUMI (at Otamatuna) in 1997/98 and management has continued every year to present. Rusa (*Cervus timorensis*) are locally common within northern Te Urewera but not known to be present within the current management area (L. Wilson, Department of Conservation, pers. comm. 2005). The Otamatuna Core Area (2530 ha) is bounded by the Te Waiiti Stream in the north and east, the Tauranga River on the west, and the Ngutuoha Stream, the Wall Track and the Koanui Track on the south. The area in which deer are controlled (Otamatuna Deer Control Area) has the same boundaries as above except part of the southern boundary runs down the Waiohinekaha stoat line instead of the Koanui Track (Fig 4.5.1).

The impacts of deer are quantified using a technique that measures the number of palatable seedlings (in various height classes) within permanent plots. Also, deer abundance is measured using a relative index of the number of deer faecal pellets in permanent plots.

These methods and the outcomes of the monitoring are examined in another section within this report (Section 5.6) while this section discusses the issues associated with controlling deer.

4.5.3 Objectives

The management objective for deer control this season was:

- To kill at least 60 deer within the Otamatuna Deer Control Area.

4.5.4 Methods

Deer within the 2530 ha Otamatuna Deer Control Area (Fig 4.5.1) were primarily controlled by ground hunting undertaken by contractors using indicator dogs, with some incidental shooting by DOC staff encountering animals (not using dogs). All dogs used by contractors had passed DOC training qualifications and were also trained for ground-bird (kiwi (*Apteryx mantelli*)) aversion. Animals were stalked and shot using high-powered rifles. Pigs were also hunted if incidentally encountered. The Otamatuna Deer Control Area is closed to all other hunting, and all kills by DOC staff or other contractors are recorded and included in the results presented here.

Contractors generally hunted in 5- or 10-day units, and were required to focus hunting effort at certain times of the year (spring and during the autumn 'roar') when deer are more conspicuous. Hunters were contracted on a basis of completing either a certain number of deer kills or a number of hunting hours. During this season, no more than 50 hours of contractor's hunting effort could be spent within 300m of the Te Waiiti Stream and no more than six of the deer shot within 300m of the Te Waiiti Stream would count towards the contractor's target.

Contractors were required to carry a Global Positioning Satellite receiver (GPS) (Garmin *Etrex*) which was usually supplied by the Department. Instructions on the setup and use of GPS were given to all hunters (see DOCDM-118025 and DOCDM-107451) including keeping the GPS face-up in a place that allows the best possible contact with satellites. The GPS was kept on continuously during hunting to record tracking data, and kill locations were recorded as waypoints. An accurate record was kept of the number of hours spent hunting and the number of animal kills. The number of encounters was also recorded. While hunting, as well as using the GPS, hunters recorded details of their work in a waterproof notebook. These details were entered onto a datasheet daily, including a map of where the hunter had worked. Data from GPS units was downloaded at the Opotiki Area Office after each unit of hunting time. The right-hand jawbone of any animals killed was required to be removed from the animal and brought in to the Opotiki DOC office; this enabled kills to be verified and data on population structure to be collected. Contractors were also obliged to remove from pigs shot a 200g sample of the liver and place in a plastic bag which was labelled with tag number, sex, location shot, date shot and estimated weight. These were to be frozen as soon as possible and delivered to the supervisor at the end of the month.

Three contract hunters were employed this season: Wayne Looney (640 hours), Jason Healy (250 hours) and Mike Dowden (24 hours).

4.5.5 Results

A total of 64 deer and 12 pigs were killed in the Otamatuna Deer Control Area this season. DOC staff accounted for 8% (n=5) of the deer kills; all of these were shot in the Te Waiiti Stream while two staff were conducting surveys for whio (*Hymenolaimus malacorhynchos*). The three contract hunters spent 914 hours hunting to achieve the 58 deer and 11 pig kills. Of the 64 deer killed, 35 were male and 29 were sexed as females. Most of the deer were killed in the centre of the control area or in Te Waiiti Stream. Most GPS tracking points are concentrated on the main ridgelines; the location of deer and pig kills and GPS tracking points are shown in Fig 4.5.1. Table 4.5.1 shows the hunting effort and results for the Otamatuna Core Area from 1997/98 to 2005/06.

Table 4.5.1 Hunting effort and the number of deer and pigs killed in the Otamatuna Deer Control Area, Te Urewera Mainland Island, 1996/97 – 2005/06

	Contractor hunting hours	Animals killed by contract hunters		Animals killed by DOC staff		Total no. of animals killed		Contractor deer kills per 100 hours
		Deer	Pigs	Deer	Pigs	Deer	Pigs	
1996/97	Not applicable	-	-	28	0	28	0	-
1997/98	Not available	29	0	12	1	41	1	-
1998/99	665	66	8	2	0	68	8	9.9
1999/00	1241.5	87	29	6	6	93	35	7
2000/01	1072	74	6	0	0	74	6	6.9
2001/02	847	44	10	0	0	44	10	5.2
2002/03	693	24	21	3	3	27	24	3.5
2003/04	740	43	4	0	0	43	4	5.8
2004/05	482	37	6	12	0	49	6	7.7
2005/06	914	58	11	5	1	64	12	6.3
Total	6654.5	462	95	68	11	531	106	6.5

4.5.6 Discussion

There was a substantial increase in hunting effort by contract hunters this season and this was matched by an increase in the number of deer killed. The increase in resources allowing this increased effort followed reprioritisation after recommendations made in the previous year (see Moorcroft et al. 2007). The decrease in the number of deer killed (by contract hunters) per hour hunted this season compared to last season can be attributed to the increased effort needed to locate the increasingly sparsely-located deer as culling progressed through the season.

While hunters are in the field, they are most-often based at centrally located huts in the Otamatuna Core Area. As hunters need to access both the huts and the wider block, main ridge systems are often walked. The hunter effort (as indicated by GPS tracking points) reflects this situation and further, many deer kills locations reflect encounters as hunters walk from huts to access other areas in the block.

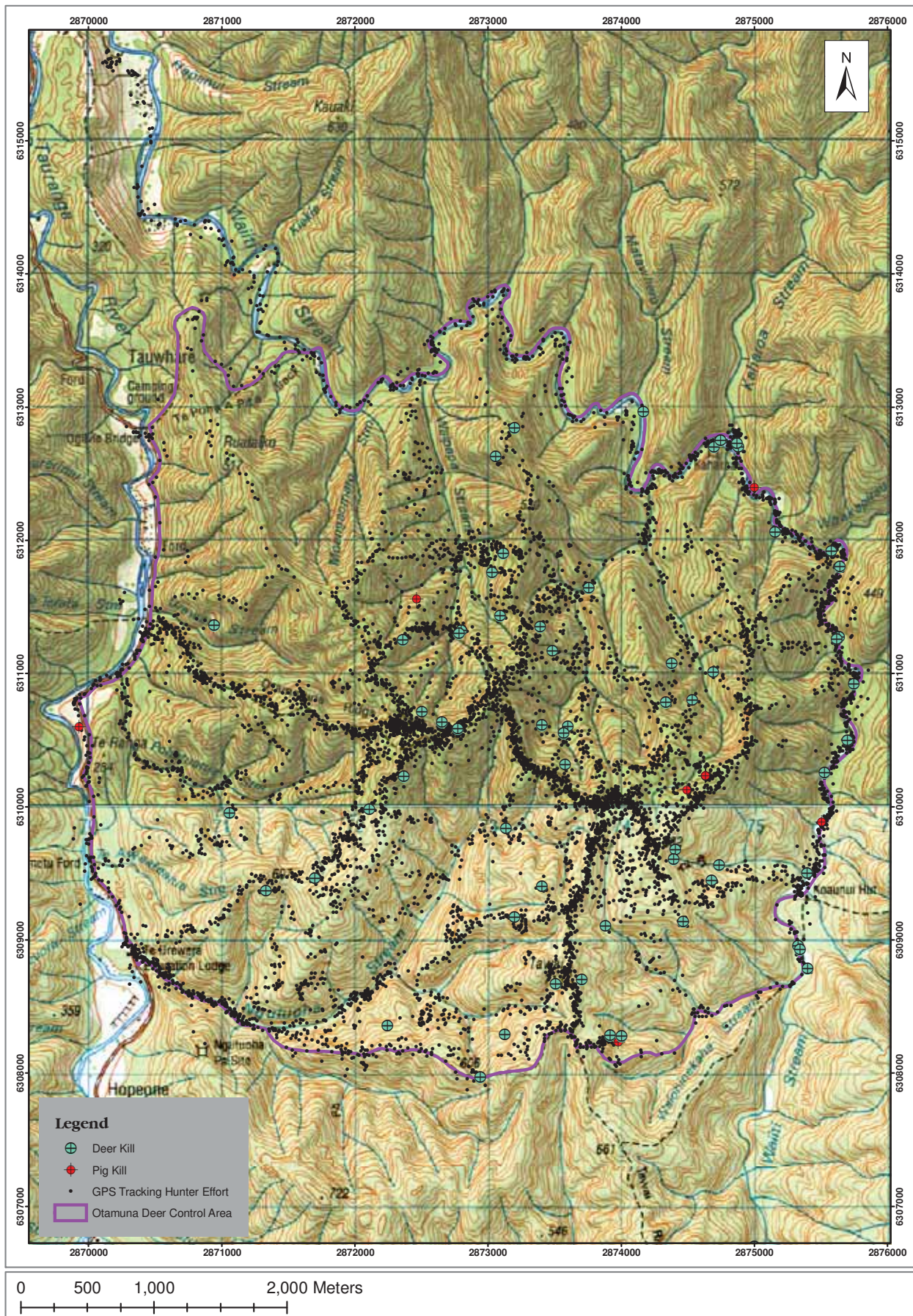


Figure 4.5.1 Location of management huts, deer and pig kills and GPS tracking fixes from contractor hunters, in the Otamatuna Deer Control Area, Te Urewera Mainland Island, 2005/06.

Restrictions in the number of culled deer in Te Waiti Stream that count towards contractual obligations reflect the intention of managers to emphasise deer control towards the centre of the control area. Here, complementary rat, stoat and possum control means ecosystem restoration gains are higher if these pests are reduced to very low levels.

The use of hand-held GPS units for auditing contractors continues to be an invaluable tool and their use is highly recommended in other programmes where feasible. Any improvements in unit capability (e.g. signal reception under canopy) will only increase the effectiveness of this method.

Programmes such as this one require skilled hunters using dogs trained to a high standard. Further, hunter effectiveness increases as individual hunters become more familiar with the hunting area. As such, there is a certain amount of vulnerability associated with this kind of programme as there is a relatively small pool of suitable contractors to draw from. It is certainly advantageous to retain, where possible, well-performing contractors.

The establishment of an operational target for deer removal should prove beneficial in improving our understanding of the relationships between the number of deer killed, the number of pellets on pellet lines and the recovery of palatable understorey species. Ultimately this should enable us to protect and restore this component of the ecosystem, however, future control needs to be adequately resourced and supported. Deer control in the immediate subsequent seasons should continue to work to the same operational target. As our understanding improves, it may be appropriate to revise the operational target; however, several years of data is likely needed before this would happen.

The impacts of deer in the control area are affected by deer abundances in the wider area as well as the control effort inside the control area. Deer abundances in the wider region are usually beyond the influence of managers of this project, but continued monitoring in a non-treatment area will provide a valuable comparison to population trends in the absence of control.

4.5.7 Recommendations

- Maintain the same operational target (at least 60 deer removed) for at least three further seasons;
- Ensure the programme is adequately resourced to reasonably attain the operational target;
- Continue to monitor deer abundance in a non-treatment (comparison) area; and
- Continue to use hand-held GPS units for auditing purposes.

4.5.8 Acknowledgements

DOC staff would like to acknowledge the efforts of the contract hunters employed this season.

5.0 Conservation Monitoring

5.1 INTRODUCTION

Conservation or outcome monitoring measures the effects of management on selected ecosystem components. Particular animals or plants were selected for monitoring because they have significant conservation value (i.e. they may be threatened or at risk), or they have particular characteristics that inform about the success or failure of management. The monitoring methods used are usually well established and follow best practices, but in some cases have been adapted to fit local circumstances.

Table 5.1.1 identifies what components of the ecosystem were monitored during 2005/06, methodology and monitoring rationale (assessment of management action).

Table 5.1.1 Conservation monitoring overview for Te Urewera Mainland Island, 2005/06

Ecosystem component	Monitoring method	Assessment target (management action)
Kokako	Survey, census, breeding success	Rat and possum control; A-Line management regime
Whio	Survey	Stoat control
Kiwi	Call-rate survey; chick survival (transmitters)	Stoat control, dog control
Mistletoe	Mistletoe and host condition; mistletoe abundance	Possum control
Forest understorey (palatable seedlings)	Counts of seedlings in plots	Deer control
Forest canopy	Foliar Browse Index (canopy condition)	Possum control
Long-tail Bats	Transect survey	Rat and stoat control

Kokako monitoring was done in the Otamatuna, Onepu, Pakoako and Waikokopu Core Areas; Whio monitoring was done in two sites with pest management (Te Waiiti Stream and lower Tauranga River) and a non-treatment site (upper Tauranga River); Kiwi monitoring was done in the Otamatuna/Mangaone Core Areas; Mistletoe monitoring was undertaken in the Otamatuna Core Area and the Okopeka non-treatment area; Palatable seedlings were counted in both the deer control area (Otamatuna) and a comparison area (Onepu); Forest canopy condition was done throughout the Background Area as well as in the Okopeka non treatment area;

Previous outcome monitoring includes measuring northern rata condition, five-minute bird counts, and North Island robin survival and breeding success.

5.2 KOKAKO - JANE HAXTON & NIC GORMAN

5.2.1 Abstract

This season, nest monitoring was conducted at Waikokopu, Pakoakoa and Onepu Core Areas, population census results were obtained for the Mangaone Inner Core Area, and the Otamatuna Outer Core Distribution Survey was undertaken. In the Pakoakoa Core Area, two fledglings were produced from the five pairs monitored giving a nesting success rate of 33%. Three pairs were monitored in the Waikokopu Core Area, however, no nesting was observed from these pairs. Of the 11 known pairs at the Onepu Core Area, six pairs were monitored for nesting success. Two pairs produced three nests out of which four chicks fledged. Two pairs accompanied by one fledging each were located during post-season monitoring. The Mangaone census revealed 23 pairs and seven singles, an increase of 36% since 2003/04. During the Otamatuna Outer Core Distribution Survey, 17 pairs and 10 singles were detected. Pair numbers at Waikokopu and Pakoakoa Core Areas have remained static and these populations remain vulnerable to extinction. Key recommendations are to: continue annual nest monitoring at Waikokopu and Pakoakoa Core Areas; complete a biennial census at both Waikokopu and Pakoakoa Core Area prior to the breeding season; develop a new population census method for Otamatuna; investigate how kokako protection in Pakoakoa Core Area can be improved; and ensure pest control target indices are met, particularly in Core Areas where kokako populations are vulnerable.

5.2.2 Introduction

The North Island kokako (*Callaeas cinerea wilsoni*) (kokako) is ranked as nationally endangered (Hitchmough et al. 2005) and currently has a scattered distribution through northern and central North Island. In 1992/93 the ranges of the northern Te Urewera were surveyed to assess the distribution and density of the kokako. A total of 625 kokako were located, making this the largest known kokako population; however, more recent surveys within northern Te Urewera indicated that in areas without intensive pest control, kokako populations were in decline (Jones et al. 1999). Kokako are vulnerable to predation by introduced pests, especially at nest sites where eggs and chicks are taken by rats, possums and mustelids. Within Te Urewera Mainland Island (TUMI) kokako are used as an indicator species to measure the effectiveness of pest control programs.

From data gathered at Otamatuna Core Area in 1996/97, it was found that 75% of successful kokako nests were located above the A-Line (Section 2.2). Using this information a potentially more cost-effective management approach (compared to Otamatuna) for kokako protection population was initiated. From 1997, four further Core Areas (Onepu, Mangaone, Waikokopu and Pakoakoa; Table 2.1) were established based on the A-Line format (Section 2.2), principally to protect kokako. Pest control regimes within all Core Areas have evolved in response to both the restriction in the use of brodifacoum and also changes in social sensitivities (i.e. favouring the use of traps over toxins) where currently most pest control is achieved by using traps (see Section 4.0).

Research in the northern Te Urewera has national implications for other large forest tracts, where it is important to preserve existing populations of kokako and other passerine species, to maintain behavioural characteristics (e.g. song dialects) and genetic diversity, in a cost-effective manner. Northern Te Urewera kokako recovery will continue to be a major contribution towards the long-term national goal of recovering kokako to 1000 pairs by the year 2020.

5.2.3 Objectives

The annual objectives for kokako management during 2005/06 were:

- To undertake nest monitoring in the Pakoakoa and Waikokopu Core Areas;
- To undertake a census in Mangaone Core Areas; and
- To undertake the Outer Core Distribution survey in Otamatuna Core Area.

5.2.4 Methods

Nest Monitoring

Nest monitoring was undertaken in three Core Areas: Pakoakoa, Waikokopu and Onepu. Monitoring methods followed Flux (2001) where all known pairs were frequently followed and observed for nesting behaviour. Once a nest was located, weekly observations were done to determine the nest outcome. If a nest was deemed to have failed, examination of the ground in the vicinity was done to record any sign indicating the cause of failure.

Census

A population census was undertaken in Mangaone Core Area from 2 May – 9 June 2006. The census was undertaken in the Inner Core Area using established trap lines (Fig 5.2.4). Census methods were used as described by Flux and Innes (2001). Local kokako dialect was recorded using a directional microphone and broadcasted through amplified mini disc players to attract or locate kokako throughout the census period. GPS positions were taken for all adult kokako located and the status of all birds was recorded (i.e. pair, single, banded or un-banded). All juveniles encountered were also recorded.

Survey

The Otamatuna Outer Core Distribution Survey was conducted for the second consecutive season. The walk-through survey technique (Flux and Innes 2001) was used to survey the Inner Core perimeter (the outermost line of rat control) where the entire perimeter and significant spurs and ridges (to approximately 200m below the perimeter) were surveyed and all birds encountered were recorded (Fig 5.2.5). The survey was conducted from 10 – 30 June 2006.

5.2.5 Results

Nest Monitoring

Five pairs of kokako were located within the Pakoakoa Core Area in late October/early November 2005. Of the five pairs monitored, two pairs made three confirmed nesting attempts (Table 5.2.1). All nesting attempts occurred 50-60m outside the Inner Core Area (A-line) boundary (Fig 5.2.1). Of the three attempts, one was successful, producing 2 chicks. One pair bond was discovered broken by the end of the season. All nest failures occurred in the early stages of development (incubation or early brooding). All pairs were observed in moult and the breeding season was concluded as of 31 March 2005. On 30 March, it was observed that a single kokako, located near the Pakoakoa hut, was accompanied by a juvenile; this pair bond being a recent development. No juveniles were seen with any of the non-breeding pairs.

Three of four known kokako pairs in the Waikokopu core area were monitored throughout the breeding season until mid-January, by which stage all birds were observed in moult. Some monitoring was undertaken on the fourth pair but not intensively enough to ensure any nesting attempts were observed. No nesting attempts were observed from any of the monitored pairs, however, a previously- unknown fifth pair was found late in the season with a dependent fledgling (Table 5.2.1).

Eleven pairs of kokako were located within the Onepu Core Area in late October/early November 2005. Six pairs of the eleven were monitored for nesting success. A total of three nesting attempts were observed from two of the six pairs (Table 5.2.1). One nest was found during incubation while the other two were found at advanced stages of brooding. All three nest attempts were successful, with a total of four chicks fledged. None of the other monitored pairs showed signs of nesting at any stage during the season. Two pairs that were not monitored were each found with a single dependent fledgling during March 2006.

Table 5.2.1 Monitoring effort and observed nesting success at Onepu, Pakoakoa and Waikokopu Core Areas, Te Urewera Mainland Island, 2005/06

Core Area	Total Pairs	Monitored pairs	Nesting pairs	Known nesting attempts	Known successful nests	Chicks fledged from monitored nests	Nesting success rate	Fledglings per nesting attempt
Pakoakoa	5	5	2	3	1	2	33%	0.67
Waikokopu	5	3	0	0	0	0	-	0
Onepu	11	6	2	3	3	4	100%	1.33
Total	21	14	4	6	4	6	67%	1

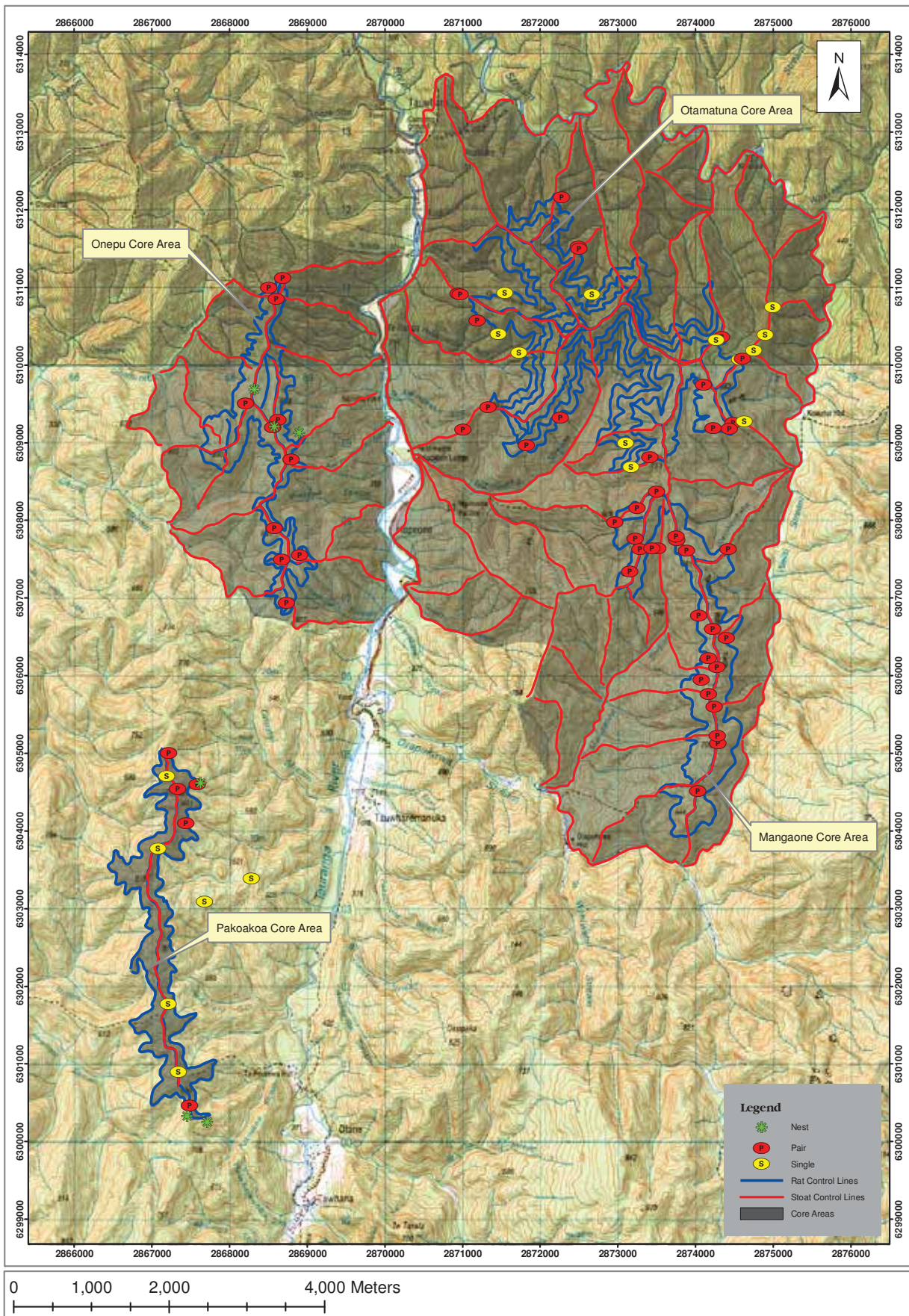


Figure 5.2.1 Locations of kokako and monitored kokako nests in the Oteamatauna (Outer Core distribution survey – see text), Oteakoako (pairs only), Otepu (pairs and nests only) and Oteakoako Core Areas, Te Urewera Mainland Island, 2005/06.

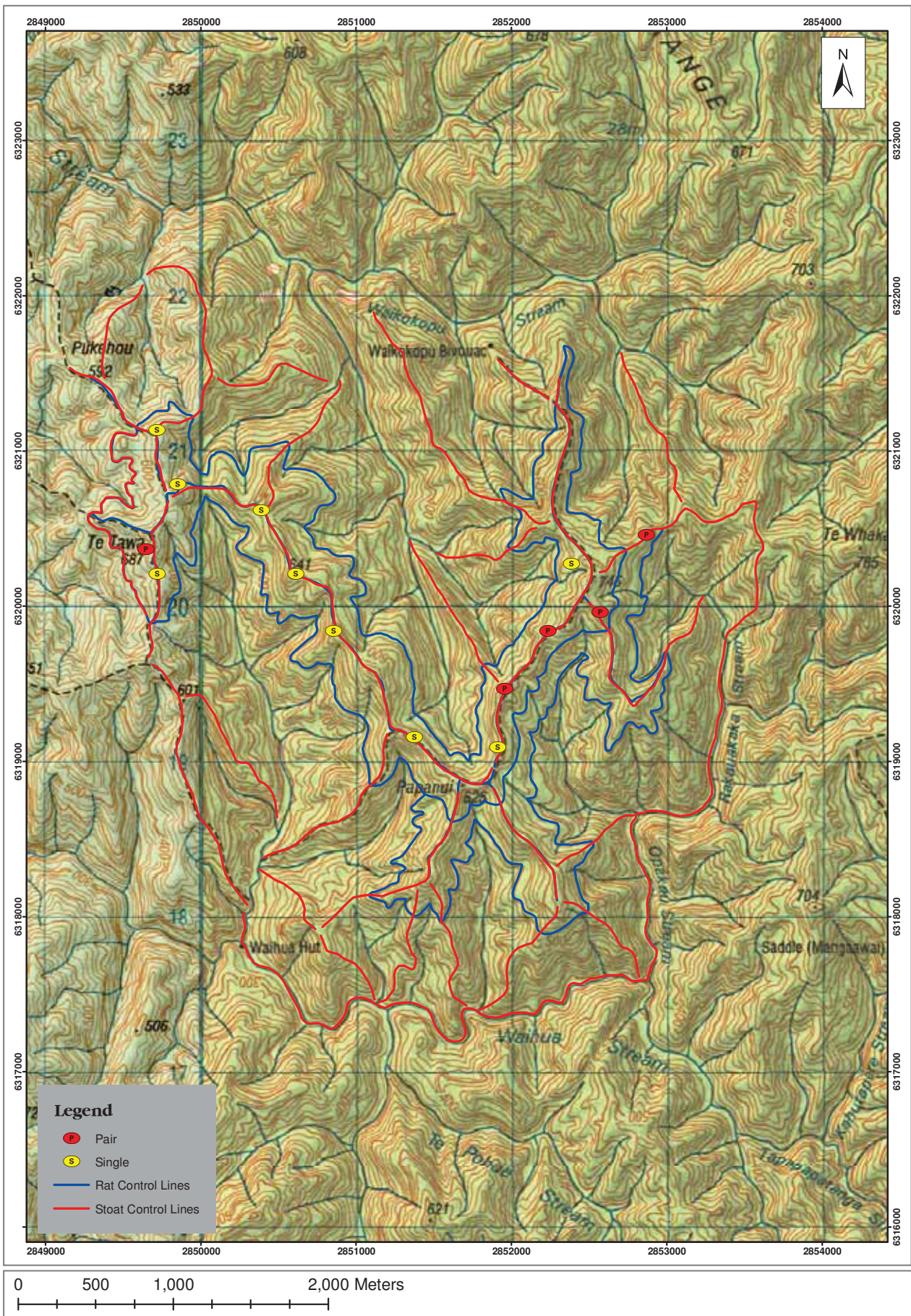
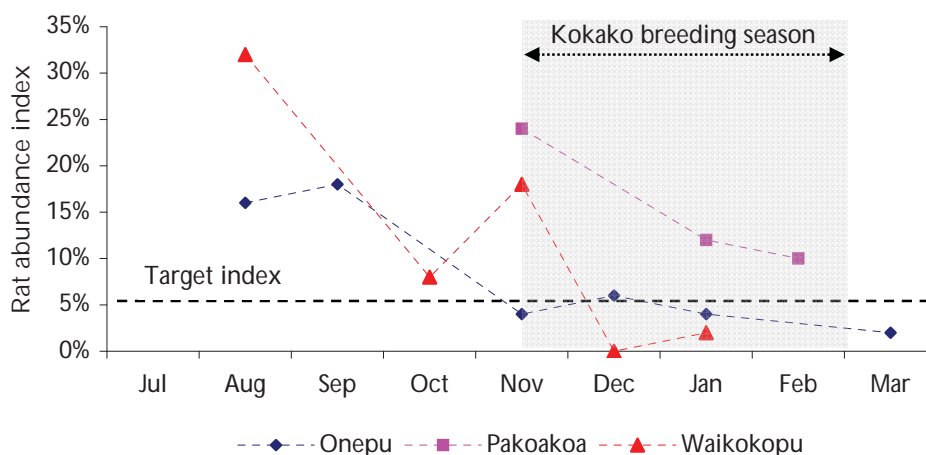


Figure 5.2.2 Location of territorial kokoko in the Waikokopu Core Area, Te Urewera Mainland Island, 2005/06.

Pest Control

Rat monitoring indices for the three Core Areas where nesting success was monitored are presented in Figure 5.2.6. The objective for rat control was to achieve less than 5% tracking from the start of November to the end of February (Section 4.3). This was generally achieved at Onepu (the highest index was 6% during this period), and low rat abundances were recorded at Waikokopu for part of the period. Rat abundances in Pakoakoa decreased as the season progressed; however, they were not reduced to below the target level at any point.

Figure 5.2.6
Rat monitoring indices
at Onepu, Pakoakoa and
Waikokopu Core Areas, Te
Urewera Mainland Island,
2005/2006



Possum abundance measures were only taken in the Onepu Core Area where a 7.4% Residual Trap Catch Index (RTC) was achieved in the Inner Core and 8.2% RTC was achieved in the Outer Core Area (Section 4.2). These were above the target RTC of 5%.

Kokako protection at Waikokopu Core Area was enhanced by an extensive extension to the stoat trapping regime. The number of trap sets was increased from 48 to 250, mostly DOC200 traps in wooden boxes encompassing nearly 1800 hectares (Section 4.4).

Census

At Mangaone Core Area, 23 pairs were located within or immediately outside the Inner Core Area, although two of these pairs consisted of sub-adult birds that may not yet have established pair bonds or territories. In addition, seven single adult/sub-adult kokako were located (Figure 5.2.4). The number of pairs recorded at Mangaone since 1991/92 is presented in Figure 5.2.7.

Survey

Survey results from the Otamatuna Outer Core Distribution Survey are presented in Table 5.2.2. Survey routes and kokako locations are shown in Figure 5.2.5

Table 5.2.2 Number of kokako encountered in the Otamatuna Outer Core Distribution Survey, Te Urewera Mainland Island, 2004/05 – 2005/06

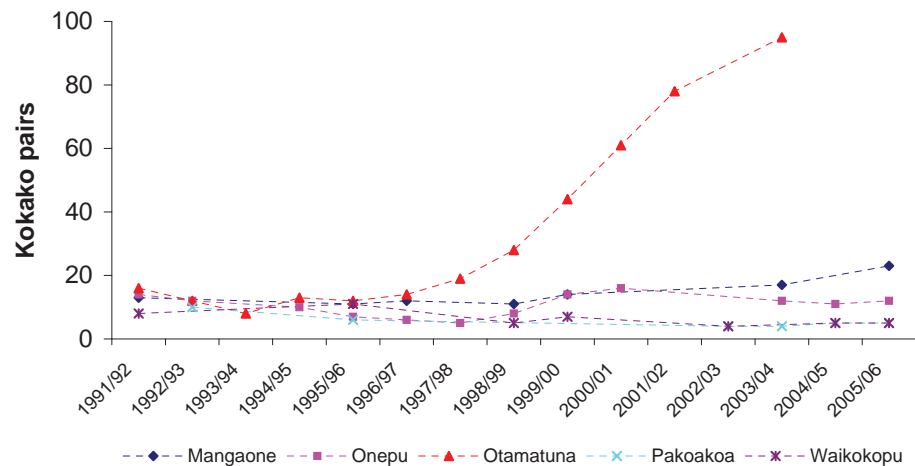
Season	Number of pairs	Number of singles	Total kokako
2004/05	30	8	68
2005/06	17	10	44

Population Recovery

Results for the number of pairs in four Core Areas were obtained this season. The number of pairs at Mangaone has again increased over the two-year period since the last census was completed. The total number of adult and single kokako has increased by 36% from the previous survey and by 77% since 1998/99. The number of pairs at both Waikokopu and Pakoakoa Core Areas remained the same as the previous season. In the Onepu Core Area, one additional pair was observed compared to 2004/05.

Figure 5.2.7

Number of kokako pairs in Core Areas, Te Urewera Mainland Island, 1991-2006



5.2.6 Discussion

The kokako population at Pakoakoa remains in a vulnerable position with pair numbers remaining low. Observed breeding effort was relatively low this season, however, as there was great difficulty in locating birds and maintaining follows, it is possible that other nest attempts went unobserved.

Under the current A-Line pest control regime kokako recovery at Pakoakoa Core Area is not being achieved. The majority of nesting attempts from the past two seasons were outside the Core Area boundary (A-line). A recent research project undertaken in the Onepu Core Area showed that the influence of trapping on rat abundance beyond the perimeter trap line does not extend as far as anticipated; rat tracking was significantly higher 50m outside the A-line than inside (Fergusson 2006). It is likely that kokako at Pakoakoa will continue to nest in these unprotected areas. This information suggests that the A-line regime is not adequate for the recovery of the kokako population at this site. The concept of using an A-line regime for kokako recovery this requires further discussion.

Of the five pairs present in Waikokopu Core Area, breeding efforts have been only been recorded from two of these. The remaining pairs may be male/male or old birds with low fertility, both indications of a declining population. Alternatively, the lack of breeding activity this season may be symptomatic of a poor breeding season in general. If the Waikokopu population was monitored in a season where nesting effort was as high as in other Te Urewera kokako populations, a different outcome may be observed. As the reason for non-breeding is unknown, ongoing nest monitoring should assist in answering this question.

There are eight territorial singles at Waikokopu and these birds represent potential for the population to increase. The extension to the stoat-trapping regime should impact positively on the kokako recovery in the Core Area.

The increase in the number of kokako at Mangaone is encouraging. With the presence of a number of territorial single birds within or immediately outside the Inner Core Area, there is potential for further pair increases. Not all 11 pairs within the Onepu Core Area were monitored due to other Core Area priorities. Although it has been under a similar predator control regime (A-line) to Mangaone Core Area, the number of kokako at Onepu has not increased to same extent. The most significant difference between these two Core Areas is their proximity to Otamatuna and it is quite likely that the Mangaone population is being augmented by dispersal from Otamatuna. This is perhaps demonstrated by distribution pattern of kokako at Mangaone where more birds are clustered in the northern end than the southern end. However, the situation is typically more complex as observations made in Onepu suggest that the decrease in the number of kokako pairs may be partly attributable to the loss of older birds.

Though the results from the Otamatuna Outer Core distribution survey showed a slight increase compared to the previous season, the method used has limitations. A new method for looking at population expansion into the Outer Core will be developed in conjunction with the Kokako Recovery Group.

5.2.7 Conclusion and Recommendations

Pakoakoa and Waikokopu Core Areas both remain in a highly vulnerable state and a concerted effort for pest control needs to continue to ensure that these populations are given the best opportunity to recover under the present regimes. Nest monitoring will continue in the 2006/07 season to measure the performance of pest control and to help answer whether the A-line regime is effective in protecting and enhancing kokako populations. Due to the observations made about preferred nesting areas, at Pakoakoa Core Area, changes to the A-line regime should be investigated to ensure that nest areas are protected. As the population within the Mangaone Inner Core approaches capacity, Mangaone itself may become a significant source of dispersing young birds within the wider Urewera landscape.

After analysing this season's results it has been decided that the Outer Core Distribution survey will not be continued.

A new census method is to be developed in conjunction with the Kokako Recovery Group to count birds in high-density areas and to measure dispersal patterns in large blocks.

It is recommended to:

- Continue annual nest monitoring at Waikokopu and Pakoakoa Core Areas;
- Complete a biennial census at both Waikokopu and Pakoakoa Core Area prior to the breeding season;
- Develop a new population census method for Otamatuna;
- Investigate how kokako protection in Pakoakoa Core Area can be improved; and
- Ensure pest control target indices are met, particularly in Core Areas where kokako populations are vulnerable.

5.3 NORTH ISLAND BROWN KIWI - GREG MOORCROFT

5.3.1 Abstract

Kiwi continued to be monitored as an outcome measure for stoat control and to gain information on population dynamics including sub-adult dispersal. Adult and young kiwi were fitted with radio transmitters and monitored regularly. Additionally, population monitoring was conducted through the standardised Kiwi Call Survey method. This season, sites 2 – 5 km from stoat control areas were monitored to gather baseline data in an area where it is expected that kiwi dispersing from protected areas will populate in the medium term. In total, 15 birds were monitored using transmitters: six kiwi with transmitters were alive on 1 July and nine birds were captured during the period. Two birds died and three birds were lost from the sample so at 30 June 2006, 10 kiwi with transmitters were alive. One paired adult female was found dead after having been entangled by her transmitter; and one sub-adult kiwi was killed during capture. One adult male kiwi caught in a possum trap outside of the study area was released having had the lower part of its left amputated. This bird dispersed a straight-line distance of 1.5 km and established a territory. No kiwi chicks were monitored this season. One male showed signs of breeding; one nest was visited and although evidence of breeding found, no chicks were located. Call rates to the north and east of Otamatuna and Mangaone (1.37/hr) were lower than those recorded in the Otamatuna and Mangaone Core Areas (mean 3.15/hr from four years). The number of breeding males with transmitters needs to be increased to improve sample sizes for chick survival data. Feral dogs remain a threat to kiwi although no monitored kiwi were killed by dogs this season. Measures to manage the threat by feral dogs should be continued and improved where possible.

5.3.2 Introduction

North Island brown kiwi (*Apteryx mantelli*) (kiwi), the only kiwi species currently extant in northern Te Urewera, has a “Seriously Declining” conservation rating (Hitchmough, 2002). At unmanaged sites on the mainland, they are declining at an average rate of 5.8% per year (approximately halving every decade) with as few as 6% of young kiwi reaching adulthood (McLennan et al. 1996). The principal cause of decline is intense predation of kiwi in their first six months of life by stoats (*Mustela erminea*) and cats (*Felis catus*); 50% of mortalities are caused by predators, chiefly stoats (McLennan et al. 1996). By approximately six months of age, kiwi have generally reached sufficient size (c.1000g) to ward off attacks by stoats. In addition to the threats to young kiwi, predation of adult kiwi by dogs (*Canis familiaris*) and ferrets (*Mustela furo*) can cause catastrophic declines in local populations (e.g. Taborsky 1988, Pierce & Sporle 1997).

Kiwi have been monitored within Te Urewera Mainland Island (TUMI) since the project's inception in 1996 where the survival of young kiwi has been used as an indicator of the effectiveness of the stoat control regime. The stoat trapping area in which kiwi are monitored, has increased from 1300 ha in 1996 (Otamatuna Core Area) to 4013 ha in 2005 within the combined Otamatuna (2510 ha) and Mangaone (1503 ha) Core Areas (Figure 5.3.1). A further 1232 ha of stoat control within the Onepu Core Area adjacent to the Otamatuna / Mangaone block, effectively gives 5245 ha of contiguous area with management for stoats. Stoats are also controlled in the Pakoakoa (185 ha) and Waikokopu (1782 ha) Core Areas (Section 4.4).

From December 2002, a series of deaths of monitored kiwi as well as evidence from field sign showed that significant numbers of kiwi within northern Te Urewera (in particular Otamatuna and Mangaone) were being killed by feral dogs. From a sample of 17 kiwi with transmitters attached, 13 had died or had likely been killed over an eleven month period. Six of these deaths have been confirmed as dog predations and a further three were highly likely to have been dog predations. In contrast, over the previous six years, one monitored adult kiwi had been found dead. A series of measures including hunting and live trapping as well as dog aversion training and advocacy has currently reduced the threat to kiwi from dogs in the northern Te Urewera.

5.3.3 Objectives

The objectives of kiwi management within TUMI for the 2005/06 season were:

- To monitor the fate of young kiwi until birds reach 1000g in weight;
- To monitor the survivorship of territorial kiwi;
- To track the fate of non-territorial sub-adult kiwi; and
- To monitor a population of kiwi adjacent to protected areas.

5.3.4 Methods

All processing of kiwi follows practices outlined in the Kiwi Best Practice Manual (Robertson & Colbourne 2003).

Any kiwi handled within the management area is given a label prefixed by NTU which is followed by a consecutive number (e.g. NTU-1, NTU-2, etc.). A separate file is maintained on each bird with appropriate data recorded. Some birds may be monitored for several years, while other birds may only be caught once then released without further tracking.

Adult kiwi were captured with the use of specialised dogs during the day or at night, or using playback of kiwi calls to lure kiwi to a site for hand capture. An *adult* transmitter (Sirtrack Ltd or Kiwitrack Ltd) was attached to one leg allowing kiwi to be monitored remotely for up to one year.

Adult kiwi were generally only handled once annually to minimise stress levels and in order to monitor natural breeding rates. Signals from territorial birds with transmitters were checked at least once per month throughout the year, more often during breeding months.

From late June, the positions of individual male kiwi were checked regularly using telemetry from regular locations. A compass bearing and signal strength were recorded. Consistency in the direction of bearings from the regular monitoring points indicated that the male had started to incubate eggs. A 'close fix' of the nest location was gained by tracking the kiwi to within a few metres although the distance varied according to access and likelihood of disturbance to the bird. A close-fix allowed the nest site to be inspected if the site was abandoned by the male. The nest site and an access trail were marked using flagging tape and pegs with reflective tape.

Nests were checked after approximately 85 days of incubation by visiting them at night after the male had left the area. Any chicks found were fitted with a *chick* transmitter attached to one leg. Chicks were re-located every two weeks to monitor their progress and change their transmitter band to accommodate the increasing girth of their leg. At about six months of age when birds weighed 1000g, an adult transmitter was attached.

If a kiwi was of sufficient size a permanent metal band containing a unique identifying number was attached. Most monitored kiwi in TUMI have an 'R'-sized band attached, but some females have legs that are too large for these bands; in these cases an 'RA'-sized band was fitted.

Transponders (Allflex Ltd.) have been used since 2002. These are small (11.1 x 2.1 mm) units consisting of a microchip contained within an inert coating. A unique 14-digit code is ascribed to each unit and these codes are read at close-quarters by a dedicated scanner. Transponders, where used, were inserted subcutaneously, posterior to the left wing, by a trained operator.

After sub-adult kiwi were fitted with adult transmitters, they were tracked down every three to six months for band or transmitter replacement, until evidence of breeding was found. Aerial support, using helicopters or fixed-wing aircraft fitted with the appropriate radio-telemetry equipment, was used when necessary.

Kiwi call counts were undertaken north and east of Otamatuna and Mangaone Core Areas during May 2007 where count sites were 2 – 5 km from the edge of the stoat trapping area (see Figure 5.3.1 for call count site locations). It is expected that call rates will increase in this area over the medium term as sub-adult kiwi disperse from the area of stoat control and establish territories. The Kiwi Call Survey method as described in Robertson & Colbourne (2003) was used. Kiwi calls were counted from six sites with good listening coverage, during the first two hours of darkness, for four nights each site. Particular environmental conditions were scored, and any kiwi heard were recorded by sex, bearing and distance; other animals heard were also noted.

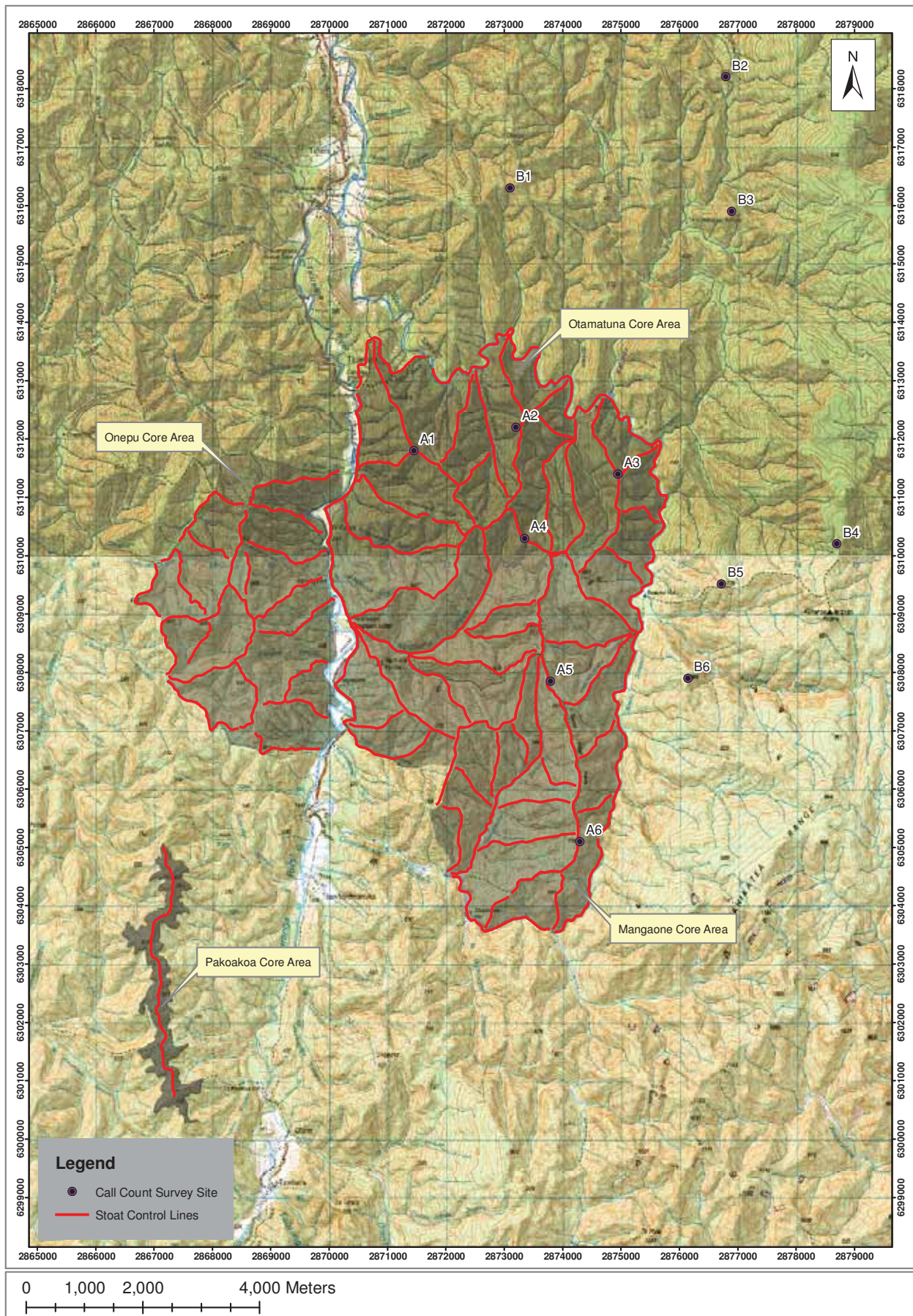


Figure 5.3.1 Location of kiwi listening sites and kiwi monitoring area including stoat control, Te Urewera Mainland Island, 2005/06.

5.3.5 Results

Details of kiwi monitored this season can be found in Appendix 9.3.

Kiwi chick survival

No kiwi chicks were monitored this season. After its capture in October 2005, positional fixes from one adult male (NTU-107) indicated that it was incubating eggs. The nest position was fixed on 7/1/06 and visited at night on 13/2/06 after the male had come off. Eggshell fragments and membrane as well as droppings were found inside the nest but no chick was present. The male had abandoned the nest by the following morning and further examination of the site failed to reveal any further evidence. The nest burrow was deep and had to be excavated out at the entrance. However, access was still difficult and not all the nest was able to be examined carefully.

Adult survival

In total, 15 birds were monitored this season; six kiwi with transmitters attached were alive at 1 July 2005 (NTU-69, -74, -102, -103, -104, -105) and nine birds were captured during the period (NTU-107 to -115). By 30 June 2006, 10 kiwi with transmitters were alive; two birds had died and three birds were lost from the sample. Of the birds that were lost or died: the signal was lost from one adult male (NTU-69), likely a failed transmitter; an adult male (NTU-74) dropped its transmitter; a paired adult female (NTU-103) was found dead after having been entangled by her transmitter; and one sub-adult kiwi (NTU-115) was killed during capture (Table 5.3.1). One adult male kiwi (NTU-114) caught in a possum trap outside of the study area was released having had the lower part of its left amputated. This kiwi had moved a straight line distance from the release site near the Lions Education Lodge to the Pohatuatua catchment where it appeared to be territorial. The transmitter attached to this bird was subsequently found dropped, however a chance sighting of what was very likely this bird in the same area indicates that it has remained and is territorial.

Table 5.3.1 Number and fate of kiwi caught, Te Urewera Mainland Island, 1996/97 to 2005/06

	Start Season	Caught	Dead	Lost	Tx dropped	Tx removed	End Season
1996/97	0	10		3			7
1997/98	7	12	3	1	1	2	12
1998/99	12	22	1	8	5		20
1999/00	20	14	1	11	4	7	11
2000/01	11	15	3	7	4	2	10
2001/02	10	11	3	4			14
2002/03	14	14	8	4	2	1	13
2003/04	13	7	6	7	2		5
2004/05	5	1					6
2005/06	6	9	2	1	2		10
Total		115	27	46	20	12	

Sub-adult monitoring

Five sub-adult kiwi were monitored this season, including three birds that were caught during the season (Table 5.3.2). Dispersal distances of previously monitored sub-adult kiwi are shown in Table 5.3.2. A sixth sub-adult kiwi was killed during capture.

Table 5.3.2 Dispersal distances of sub-adult kiwi, Te Urewera Mainland Island, 1996/97 to 2006/07.

Kiwi	Start Dispersal	End Dispersal	Gross Dispersal (km) #	Net Dispersal (km) ##
21	1997/98	2002/03		1.8
44	1998/99	1999/00		5
51	1999/00	2000/01	2.5	
54	1999/00	2003/04		6.5
78	2001/02	2003/04	2.4	
105	2003/04	Ongoing		
106	2004/05	Ongoing		
108	2005/06	Ongoing		
110	2005/06	Ongoing		
113	2005/06	Ongoing		
Mean distance			2.4	4.3

Distance moved in a straight line from point of capture to established territory by sub-adult kiwi not caught in natal territory

Distance moved in a straight line from point of capture to established territory by sub-adult kiwi caught in natal territory

Population monitoring

Call counts rates from the six listening sites were combined to give a mean call rate (Table 5.3.3).

Table 5.3.3 Number of calls heard and call rates of North Island brown kiwi in locations 2 – 5 km from stoat trapping areas, Te Urewera Mainland Island, 2005/06

Year	Female calls	Male calls	Total calls	Call rate (calls /hour)
May 2006	16	47	63	1.37

These call rates are lower than those recorded in the Otamatuna / Mangaone Core Areas (mean rate: 3.15 calls per hour) between 2001/02 and 2004/05 (Moorcroft et al. 2007).

5.3.6 Discussion

Lack of breeding effort from some territorial males and late capture of further males has hindered increasing the sample of young kiwi. Capturing kiwi is problematic and resource demanding; results from this season emphasise the need to have a suitably large sample to ensure enough breeding males are monitored to get a suitable sample of chicks.

It is encouraging that there were five territorial males with transmitters at the end of the season.

Tracking dispersing kiwi in the rugged terrain of northern Te Urewera needs to incorporate aerial surveys using a fixed-wing plane or a helicopter. There are several opportunities throughout the year where other work within the project allows for this to happen, however, these opportunities are not always convenient. Therefore, budgets should include allowance for some aerial surveys as determining the extent of sub-adult dispersal is still an important factor for the long-term management of kiwi.

It is encouraging to note that no further dog kills were recorded during this season, whether of monitored birds or otherwise indicated by field sign. However, the threat to kiwi from feral dogs remains present and support for research into methods that reduces this threat should be encouraged. Further, continued advocacy and enforcement is essential in protecting kiwi, particularly in areas where significant effort is put in to recovering populations.

The survival and establishment of a territory by the released kiwi NTU-114 further supports other anecdotal evidence that kiwi with amputations can survive in the wild. It is unfortunate that the transmitter was dropped before evidence of breeding (if any) had been found.

5.3.7 Recommendations

- Continue to monitor kiwi within TUMI as a measure of the effectiveness of stoat control;
- Increase the sample size of kiwi with transmitters to include at least 5 breeding males;
- Ensure provision of funds to undertake occasional aerial surveys;
- Maintain advocacy and other techniques to reduce the threat of predation by feral dogs; and
- Support research for alternative methods for controlling feral dogs.

5.3.8 Acknowledgements

Rhys Burns continued to provide valuable advice, and expertise in the field. Andrew Glaser, Cody Thyne, Hemi Barsdell, Rhys Burns, Jane Haxton and Greg Moorcroft listened for kiwi this season.

5.4 WHIO - ANDREW GLASER

5.4.1 Abstract

Whio (or blue duck) (*Hymenolaimus malacorhynchos*) were monitored to determine population dynamics and trends as an outcome measure to assess the effectiveness of the stoat trapping regime within Te Urewera Mainland Island. Monitoring was undertaken at two sites; one where predator control was undertaken (Te Waiiti) and the other that served as a non-treatment (upper Tauranga). Nineteen pairs in the Te Waiiti produced 31 ducklings of which 32% fledged (0.53 juveniles per pair). The eight pairs in the upper Tauranga produced nine ducklings of which seven fledged (0.88 juveniles per pair). As in the previous two seasons a significant localised flood event in the lower Waimana catchment affected breeding success in Te Waiiti. One new adult was banded and five juveniles were marked. All metal bands were removed to minimise the risks caused through wear and transponders were used as a safe alternative. One dispersed juvenile was encountered this season. There has been a total recruitment of 23% of the 80 juveniles marked. One of these juveniles had not been seen for four years since first banded. There has been a 58% turnover of adult birds over the past five years of banding, causing concern with regard to this population's long term viability and the ability of the current predator control regime to protect whio. Further research through close order monitoring will assist in determining what may be causing this decline. Other factors that need defining are the impact of flood events and juvenile survival and recruitment into this population.

5.4.2 Introduction

Whio or blue duck (*Hymenolaimus malacorhynchos*) are a 'nationally endangered' (Hitchmough 2002) ancient species of waterfowl that have adapted to live year round in New Zealand's forested rivers and streams. Habitat of whio includes lowland forest rivers and streams in intact riparian forests, which are usually of high quality with good to moderate stability, moderate gradients and low transport of fine sediments (Collier 1993). Whio occupy an ecological niche in the upper trophic level within New Zealand riverine ecosystems and serve as an indicator of riverine ecosystem health and completeness (Adams et al. 1997).

Threats to the remaining whio populations are perceived to be habitat loss/disturbance, direct human impact, competition, predation and population fragmentation. More recently, predation of whio by stoats (*Mustela erminea*) has been shown to be the main contributing factor in their decline (Adams 2000; Holmes 2000; Willans et al. 2001).

The Te Urewera Mainland Island (TUMI) is a large-scale restoration project set in the northern part of Te Urewera National Park. Te Waiiti Stream is within the boundaries of TUMI and represents an unmodified North Island riverine system where intensive mustelid control is being undertaken. It is one of six areas nationally that are currently undertaking research by management into the effects of predators on whio populations.

These projects may collectively assist in defining the requirements of who conservation and meet key objectives of the Blue Duck Recovery Plan (Adams et al. 1997).

Te Waiiti Stream forms the northern and eastern boundaries of the Otamatuna Core Area (2530 ha) which was the initial study area within TUMI. Intensive mustelid control has been conducted in Otamatuna for ten consecutive years from August 1996. The initial treatment area of 1100 ha (1996) was increased to 4000 ha by August 2001 where 18km of the Te Waiiti Stream was protected (Fig 5.4.1) (see Section 4.4 for further details on stoat control).

Who monitoring within Te Waiiti Stream has been conducted for five consecutive years following the gathering of baseline data in January 1999. Who monitoring in Te Waiiti Stream primarily focuses on adult survival, pair productivity and survivorship of juveniles to fledging, which may provide a measure of the effectiveness of stoat trapping within the riverine system. Juvenile recruitment, dispersal and population dynamics are also studied through the ongoing banding of this population.

The upper Tauranga River (Fig 5.4.1) was surveyed intensively this season to determine population status, productivity and juvenile recruitment. The upper Tauranga River was surveyed for fourth consecutive year for comparative purposes as the non-treatment area. The upper Tauranga has also been surveyed four times previously (1996, 2000, 2001, and 2002) as 'one-off' walk-through surveys of another catchment within the Opotiki Area. The Tauranga River is also unmodified with similar terrain and vegetation cover to the Te Waiiti Stream. There is no control for stoats in the immediate vicinity of the upper Tauranga, and as such this site serves as a comparison or non-treatment site for the Te Waiiti Stream.

As well as the survey work undertaken by DOC staff, who sighting and reports received from staff, contractors and the general public year have also been recorded.

5.4.3 Objectives

- Monitor who population dynamics, survival and productivity in the Te Waiiti Stream as a measure of the effectiveness of pest control within riverine systems;
- Develop management techniques for protecting and enhancing who populations;
- Determine the nature and extent of juvenile dispersal and settlement; and
- Monitor the upper Tauranga River who population including juvenile productivity/survival and recruitment as a comparative non-treatment site to the Te Waiiti Stream.

5.4.4 Methods

Survey

The following methods are standard techniques and tools as described in the best practice manual 'Managing Blue Duck, A Manual of Field Techniques and Practices' produced by the Blue Duck (Whio) Recovery Group (2004). The 'walk-through survey' method was used to determine the number of whio present on all waterways surveyed this season. Whio are most active in early morning and late evening when feeding on the main water flows, so emphasis was placed on surveying the river at these times. Surveys were conducted 2-3 hours after dawn until no later than 10 am, and evening surveys from 4 pm until an hour before dark. The preferred time to survey is between December and late January when adults with young are likely to be found together on main rivers. The results also give an indication of the number of juveniles available for recruitment into the adult population. The locations of survey sites are shown in Figure 5.4.1.

Te Waiiti Stream

The Te Waiiti stream study area consists of the main stream from the junction of the Tauranga-Waimana River (grid reference E2870200 N6315800) to the 'upper forks' (grid reference E2874900 N6306000). Walk-through surveys were conducted throughout the breeding season on a fortnightly basis to assess productivity and juvenile survivorship until the juveniles fledged. The first surveys were conducted on 7 September 2005 and the last on 22 December 2005. The entire 18 km of stream system of the Te Waiiti valley was surveyed on 18 -22 December 2005. Each section of stream was surveyed at least twice at different times to verify the result. A German short-haired pointer (GSP) dog was used for the walk-through survey so that most birds within the river system were found. The dog also helped verify the result and was invaluable during specific banding expeditions to locate birds in hiding. Whio were banded (see below) as they were encountered during the January survey.

Kaharoa

Surveys were not conducted in the Kaharoa Stream (a tributary of the Te Waiiti Stream) as they have been during previous years due to the limited number of staff.

Tauranga River

One section of the Tauranga River (= Waimana River above the Te Waiiti Stream junction) was used as study site for monitoring whio this season. The upper Tauranga study site runs from the junction of the Tauranga River and the Tawhana Stream (grid reference E2868800 N6399250) up the main stem of the river to the junction with the Mangatoatoa Stream (grid reference E2870600 N6392100).

The upper Tauranga River has been surveyed to act as a non-treatment area for comparison with the Te Waiiti Stream. Walk-through surveys were conducted throughout the breeding season on a fortnightly basis to assess productivity and juvenile survivorship until the juveniles fledged.

The first surveys were done on 9 September 2005 and the last on 20 December 2005. The whio indicator dog was not used during the surveys and no banding was undertaken at this site.

Juvenile Dispersal

No juvenile dispersal surveys were undertaken this season due to the limited number of juveniles produced. Only incidental encounters of dispersed banded juveniles were recorded during other monitoring surveys. Band combinations were recorded as well as the location and social status (i.e. pair, territory holding); often information received was limited as some attributes could only be ascertained by multiple encounters.

Whio Capture and Banding/Marking

For the sixth consecutive season, banding of the Te Waiiti Stream population was undertaken just prior to juveniles fledging during a week-long survey in December. Whio were captured by stretching a double drop of butterfly net across a waterway and then herding the whio downstream into the net. All territory holding birds were banded with a colour band combination and metal bands were removed replacing them with a transponder (microchip) as part of a field trial for this marking technique. Pairs were given a mirroring band combination (if possible), with the same colours placed on the opposite legs. Juveniles in the Te Waiiti system were marked only by the insertion of transponders under their skin in the nape (back of the neck).

When a bird was captured, the standard measurements that were taken included; head/bill length, upper bill length, tarsus length, wing length, and weight.

Sexing and Age Classification

Adult birds encountered were sexed by the type of calls they produced or by the size variation between the birds of a pair. Males 'whistle' when approached and are generally larger, while females emit a 'rattley growl' and generally have a smaller body size. Juvenile birds do not generally call in the company of their parents but just 'peep', although during capture they may call sometimes. If captured birds were unable to be sexed by the above methods, then a cloacal examination was usually undertaken. Distinguishing adult from juvenile birds was ascertained through a variety of characteristics, e.g. the colour of the bird's iris, colour of the bill, plumage, or obvious size difference. Juveniles have a dark brown iris while an adult's iris is yellow. The adults have a pale yellow pinkish bill, while juveniles have a pale blue/grey colour. Adult birds also have their entire chest daubed with chestnut plumage that may be more extensive and heavier in colour in the male, while the juvenile is very pale blue/grey with small flecks of chestnut. There presently is no way of aging adults in the field other than by categorising 'old birds' as those having bare wing spurs.

Reported Sightings

Sightings of who were reported at various times of the year during the course of unrelated work by staff or by the public. These chance encounters when walking waterways were recorded on a spreadsheet in the Opotiki Area Office. In most cases these recorded sightings are one-off encounters with who in short sections of river.

5.4.5 Results

Surveys

Te Waiiti Stream

During this season's monitoring in the 18 km of the Te Waiiti Stream a total of 19 territorial pairs and 31 ducklings were found. Of these, 32% (n=10) of juveniles were known to have fledged (Table 5.4.1, Appendix 9.5.1). The total number of independent who seen by the end of the season was 49; 19 pairs, one single and 10 fledged juveniles. Four of the 10 pairs that hatched ducklings had fledged their young (Appendix 4.3.3 and 4.3.5). Mean juvenile production was 0.53 per pair (Table 5.4.1). The number of known fledglings was low compared to previous years due to the impacts of a significant flood event in October when class I-III juveniles were present on the river.

Adult numbers have decreased by 15% (three less territorial pairs) compared to last season. There has been a 200% increase in pair numbers on Te Waiiti stream since January 1999 with a mean annual increase of 24% (Table 5.4.1). This season, the mean territory length was 1000m of stream per pair; pair density was 1 pair per kilometre compared to 0.3 in January 1999. The Te Waiiti pair density for this season is almost double that of the mean pair density from the nationally monitored waterways (Godfrey et. al. 2003).

Table 5.4.1 Monitoring data for who in the Te Waiiti Stream, Te Urewera Mainland Island, 1999/00 - 2005/06

	Survey distance	Pairs	Singles	Pairs producing juveniles	Juveniles produced	Juveniles fledged
1999/00	18km	6	4	-	-	18
2000/01	18km	11	0	-	-	20
2001/02	18km	13	1	12	51	47
2002/03	18km	15	1	12	48	46
2003/04	18km	20	7	1	6	1
2004/05	18km	21	0	13	52	12
2005/06	18km	19	1	10	31	10
Total	-	-	-	-	188	154

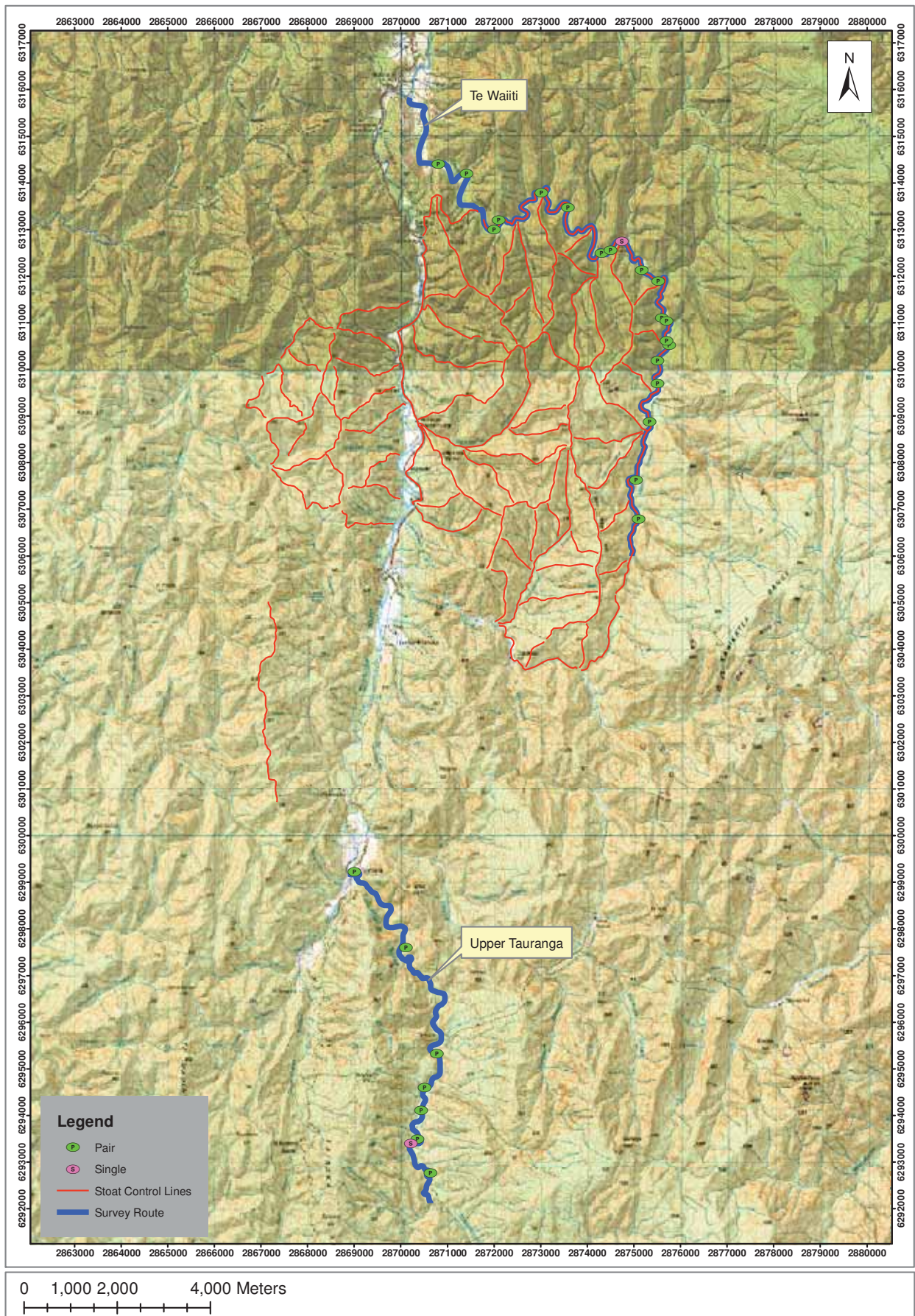


Figure 5.4.1 Whio survey areas, whio pair and single territory locations, and stoat trapping lines, Te Urewera Mainland Island, 2005/06.

Upper Tauranga

During this season's monitoring in the upper Tauranga a total of eight pairs of whio and one single male were found. Two of the eight pairs produced nine juveniles of which 78% (n=7) fledged (Table 5.4.2). The mean territory length was 1250m per pair giving a pair density of 0.8 pairs per kilometre. Mean juvenile production for the total number of pairs present was 1.1 juveniles per pair, and a mean of 0.88 fledglings per pair (Appendix 9.5.2).

Pair numbers appear to have increased four to eight since 1996. There was significantly more survey work undertaken over the past three seasons at this site and one more kilometre surveyed so results between earlier less-intensive surveys are not directly comparable with the later surveys. However, one off walk-through surveys has shown that 64% of a known population can be found; therefore recent results probably still indicate an increase in the population over this time.

Table 5.4.2 Monitoring data for whio in the upper Tauranga River, Te Urewera Mainland Island, 1996 - 2005/06

	Survey Distance	Pairs	Singles	Pairs producing juveniles	Juveniles Produced	Juveniles Fledged
Mar-1996	9km	4	0	-	-	1
Mar-2000	9km	4	2	-	-	2
May-2001	9km	3	0	-	-	0
Apr-2002	9km	5	1	-	-	0
2002/03	10km	6	2	4	19	18
2003/04	10km	5	1	2	5	2
2004/05	10km	8	2	5	19	9
2005/06	10km	8	1	2	9	7
Total	-	-	-	-	52	39

Banding and Population Dynamics

Banding

Banding has now been undertaken for the sixth consecutive year. Resighting of banded individuals has helped to determine the population dynamics of the Te Waiiti river system. A total of 136 individuals have been marked: 125 individual whio have been banded (48 adults, 75 juveniles and two sub adults) and a total of 48 whio have had a transponder inserted (26 adults, 1 sub-adult and 21 juveniles) (Tables 5.4.3, 5.4.4). During this season six new birds were marked; one adult was banded and five juveniles had transponders inserted. Metal bands were removed from all the adults caught.

The number of new territorial pairs that have been banded has decreased as the number of resident pairs has increased (Table 5.4.5). This season, the male from one new pair was banded (the female was already banded) however there were two other unbanded paired birds and one unbanded single that were not banded.

Table 5.4.3 Number of adult whoio banded in Te Waiiti Stream, Te Urewera Mainland Island, 2000/01 – 2005/06

	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	Total
Males	6	7	5	5	0	1	24
Females	6	7	4	6	1	0	25
Total	12	14	9	11	1	1	49

Table 5.4.4 Number of juvenile whoio marked using bands or transponders, Te Waiiti Stream, Te Urewera Mainland Island, 2000/01 – 2005/06

	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	Total
Males	7	6	19	1	4	4	41
Females	7	14	20	0	3	1	45
Total	14	20	39	1	7	5	86

Table 5.4.5 Number of territorial pairs banded in Te Waiiti Stream, Te Urewera Mainland Island 2000/01 – 2005/06

	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	Total
New territorial pairs	7 ^a	6	2	2	0	0.5	17.5

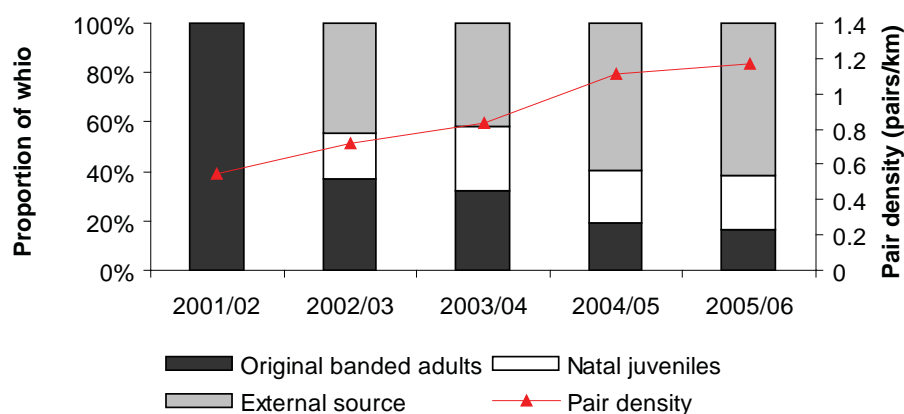
^a total includes two sub-adult birds holding a territory

Population Dynamics

The banding data indicates that the total adult population has had a turnover or territorial abandonment for known marked birds of 58% over the past five years. Adult female turnover (64%) is higher than that of males (52%). Of the 14 territorial whoio banded in 2000/01 (the first year of banding), 14% (n=2) were present during this season. The adult population has increased considerably since 2000/01 with the majority of adults coming from outside the Te Waiiti as unbanded birds; 10 completely new pairs have formed and 18 individuals formed pairs with previously territorial birds. The population this season consisted of: 64% of known banded adults (n=25, comprising of 15% of the 2000/01, 35% of the 2001/02, 15% of 2002/03, and 35% of 2003/04 banded birds); 26% recruited natal juveniles; and 10% from birds sourced outside of the Te Waiiti (external source) (see Figure 5.4.2).

Figure 5.4.2

Pair density, and the origin of banded territorial whoio in Te Waiiti Stream, Te Urewera Mainland Island, 2000/01 – 2005/06



During this season, 10 natal juveniles were found in the Te Waiiti (Table 5.4.6). All 10 were paired, of which 60% had bred however only 20% successfully produced juveniles. Of these, four were 2000/01 juveniles, three were 2001/02 juveniles and three were 2002/03 season juveniles. One of the 2000/01 juveniles (female) had not been seen for four years since she was first banded as a juvenile. Two of the 2002/03 juveniles (1 male and 1 female) returned after a two-year absence. A total of 23% (n=18; 11 females, 7 males) of the 80 banded juveniles have been recruited back into their natal system over the past four seasons.

Table 5.4.6 Recruitment, pairing and breeding success of juvenile whio¹ in the Te Waiiti Stream, Te Urewera Mainland Island, 2001/02 - 2005/06

	2001/02	2002/03	2003/04	2004/05	2005/06
Natal juveniles recruited ² (%)	35	23	14	12	8
Natal juveniles paired (%)	21	12	8	12	8
Natal juveniles that bred (%)	21	9	0	8	20

¹Banded birds only. All juvenile whio were banded or marked in Te Waiiti Stream

²Number of juvenile whio that are present in Te Waiiti territories in any one year divided by the total number of whio marked as juveniles. Not all birds have stable territories; some birds move in and out of the study population and may be present in one year but not necessarily in another year.

There was one sibling-sibling pairing encountered over the past year.

Te Waiiti Stream Juvenile Dispersal

No juvenile dispersal surveys were conducted this season due to the limited number of fledglings produced within the Te Waiiti. However one banded juvenile was encountered outside its natal origin during other survey work (see Appendix 9.6). The one juvenile was found in the Te U Stream, a tributary of the Te Waiiti in the Waimana catchment. The band combination of this bird was unable to be positively identified so the cohort and its precise territorial origin on Te Waiiti Stream are not known.

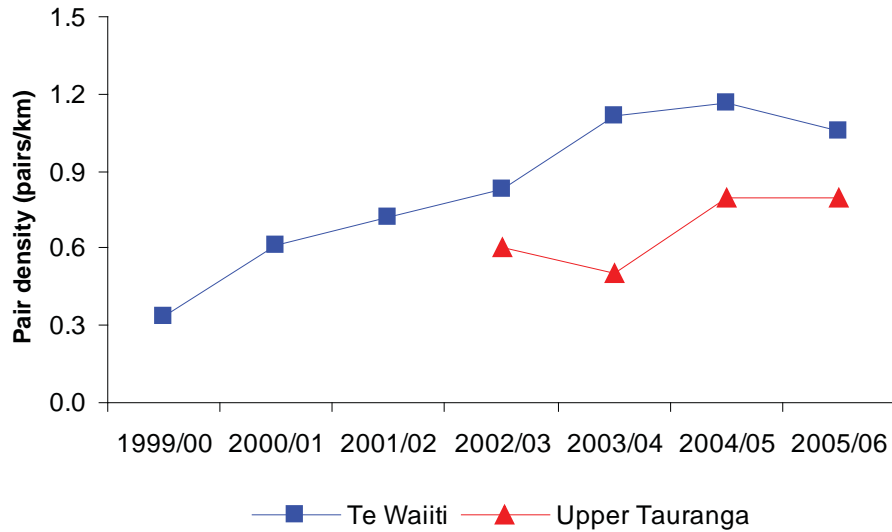
The most distal banded juvenile observed is 20.5 km to date for this population. A total of 26 banded juveniles have been found outside their natal origin (31% of the total number banded; 14 females, 7 males, 5 unknown); 12 of these are known to have paired and seven known to have fledged chicks.

Treatment versus Non-Treatment

Pair density in the Te Waiiti has increased every year since monitoring began in the 1999/2000 season apart from this season. In years where comparable monitoring was undertaken, pair densities in the upper Tauranga have remained relatively constant (Fig 5.4.3).

Figure 5.4.3

Pair density of whio in the Te Waiiti and Upper Tauranga Streams, Te Urewera Mainland Island, 1999/00 – 2005/06



Productivity of whio in the northern Te Urewera for the 2005/06 season is shown in Table 5.4.7. Pair density (number of pairs per kilometre) in Te Waiiti is higher than the upper Tauranga. A greater proportion of pairs in the Te Waiiti produced young, however, a greater proportion of pairs fledged young and a greater proportion of young fledged in the upper Tauranga.

Table 5.4.7 Productivity of whio in the Te Waiiti, upper Tauranga and lower Tauranga, Te Urewera Mainland Island, 2005/2006

Study site	Survey distance (km)	Territorial pairs	Pair density (per km)	Pairs producing ducklings (%)	Pairs fledging young (%)	Number of known ducklings produced	Number known fledged young	Proportion young fledged (%)	Fledglings per total number pairs
Te Waiiti	18	19	1.1	55	22	31	10	32	0.53
Upper Tauranga	10	8	0.8	25	25	9	7	77	0.88

A comparative analysis of the Te Waiiti and the upper Tauranga River since 2001 is shown in Table 5.4.8. The mean pair density is higher in Te Waiiti Stream although both pair densities are higher than the mean national pair density of monitored whio populations (0.59 pairs per km; Godfrey et al. (2003)). A greater proportion of pairs in the Te Waiiti breed, although mean juvenile production per pair and the mean number of fledglings per pair are similar for both sites. A greater number of fledglings have been produced in the Te Waiiti although the mean proportion of young fledged is similar.

Table 5.4.8 Comparative analysis of selected population parameters for whio in Te Waiiti (2000/01 - 2005/06) and the upper Tauranga River (2002/03 - 2005/06), Te Urewera Mainland Island

Study site	Survey distance	Mean territorial pairs	Mean pair density (per km)	Mean pairs breeding (%)	Mean juveniles produced per pair	Mean fledglings per pair	Mean known chicks produced	Mean known fledged young	Mean young fledged (%)
Te Waiiti	18 km	15	0.83	581	2.3	1.8	37.6	22	56
Upper Tauranga	10 km	6.8	0.54	49	1.9	1.4	14	9	65

¹ In 2003/04 river levels were too high to count pairs that bred (only one known) therefore the data has been excluded from this analysis

5.4.6 Discussion

The 2005/06 breeding season commenced two weeks earlier compared to previous seasons. The first clutches started to appear on the river on 7 September, when in previous seasons the majority of broods were present near the end of September. The productivity of whio in the Te Waiiti was once again impaired by a flood event on 22 October that saw the river level rise 1.9m higher than its normal flow in a 12-hour period at the Waimana rain gauge. Ducklings can be extremely vulnerable to flood events at the first three weeks of their life. No pairs re-nested once they had lost their brood; pairs went into moult indicating the breeding season had finished. The flood events are thought to not only impact directly on juvenile whio, causing fragmentation of broods and hypothermia, but also indirectly by severely limiting their food source, which would normally be flourishing at this time of year. This flood event was very localised to the lower reach of the Waimana catchment (similar to the flood event of the previous season). This season the upper Tauranga rose approximately 500 millimetres (A. Glaser, pers. obs.) during the same period. Where it was expected that productivity would be higher in Te Waiiti where there is pest management, results indicate that productivity for the Te Waiiti was lower than the upper Tauranga most likely as a direct result of the flood event. Limited juvenile survival will affect the adult replacement and this has the potential to have a significant impact on the long-term viability of whio. If the frequency of these environmental stochastic events increases (as predicted through global warming), there may be an acceleration in whio decline, particularly in sites where predators are not managed. Localised as well as regional flood events will continue to occur from time to time and as a result it emphasises the importance of pest management in recovering whio.

This season, there was a decrease in the number of pairs in Te Waiiti compared to the previous two years. Poor productivity and adult turnover may be affecting the densities so we may not be able to truly determine the Te Waiiti's carrying capacity. There were limited additional external sourced birds found from the surrounding area. There has been a total of 35 new territorial birds banded (excluding the originals banded in 2000/01). While this indicates a diverse gene pool it emphasises the reliance of the Te Waiiti population on the greater whio population for recruitment.

If the surrounding population undergoes a greater turnover than that of the Te Waiiti, it is not likely this population will be sustainable in the longer term. Monitoring of pair densities over the medium term will provide further indication of both the sustainability of this population and the carrying capacity of this waterway.

Recruitment of juveniles into their natal population in Te Waiiti could be limited by above average pair densities in the Te Waiiti, the natural disposition of juveniles to disperse, the availability of territories in the surrounding area and poor survival. If the majority of the territories in the Te Waiiti are occupied by adults this may not allow younger birds to establish. The proportion of banded juveniles recruited has decreased as pair density has increased. Whether the dispersal is natural or increased due to the high pair density the confounding issue is the same, juveniles taking up residency in untreated areas where there is potential for increased mortality.

Despite the current relatively high pair density, adult turnover and losses in this protected population remains a cause for concern. Adult who have an expected life span of at least eight years in the wild, and as territorial birds it is expected that adults would remain relatively loyal to their territories. However, in the Te Waiiti, we have observed a higher than expected turnover of adults. Williams (2005) suggests that in order for the population to remain viable annual adult loss should not exceed 20%, whereas in Te Waiiti annual adult loss is 25% and average longevity is 3.9 years (Graeme Elliot, Department of Conservation, 2006, pers. comm.). Currently, annual adult loss is being offset by recruitment of birds from outside the Te Waiiti, and, to some degree, juveniles fledged within this population. As above, this indicates the reliance on the greater who population. Not enough information is available to accurately determine the fate of missing adult birds, in particular, whether the losses are due to predation that could be prevented by more effective management.

Losses of adult females are higher than that of males; female who are more susceptible to predation due to a lighter body weight (than that of males) and that females are the sole nest incubators. Predation may still be a factor affecting adult survivorship within the population. The current pest control regime was not installed to specifically protect who and while there has been some benefit to the population (as indicated by increasing pair densities and productivity) losses of adults and replacement of these losses by external birds underlies the vulnerability of this population. Determining the fate of missing adult birds is exacerbated by the transient nature of some birds; a small proportion of territorial adults have disappeared then reappeared after two years absence. Similarly, some juveniles that have been recruited into the population have disappeared then reappeared after a one or two year absence. An investigation into adult mortality through close-order monitoring and population dynamics would enable an understanding of what the significant impacts are for this life stage. However the ability to conduct such a study is limited by several factors: the current transmitters used for who monitoring are prone to failing and would not warrant the expense to determine fate; observer-effects on birds can influence their conspicuousness; and limited resources mean the number of areas that need to be surveyed is restricted.

Banding of whio for the purpose of identifying individual birds to determine population dynamics within the Te Waiiti system is essential. Identification of the unique numbers on the metal band and loss of colour bands through the significant wear caused from both metal and plastic colour bands coming into contact with rocks has been documented in this river system. This wear renders them ineffective at providing identifying information after a two-year period. In the worst cases bands become so worn that they developed sharp knife-like edges that can potentially cause lacerations, amputation and even death to whio. Bands need to be maintained as a minimum bi-annually to ensure that they still can be useful for identification. This requires catching and handling which puts birds through a significant amount of stress which in turn can alter their behaviour and make them extremely wary about humans, and also affect monitoring observations. For these reasons we have trialed and developed a new method for marking whio using transponders (or microchips) and have removed metal bands from birds. Also, juvenile birds may disperse and never be encountered again, making it unlikely that bands will ever be removed or changed. Juveniles will at least be identified if they return to Te Waiiti natal origin and are able to be caught and then scanned. The use of transponders provides a safe and long-term alternative for identifying whio, although currently birds need to be caught to be re-scanned which compounds the issues mentioned above. An ability to scan birds for the presence of a transponder without having to catch them would greatly enhance this method.

Population modelling has indicated that although the Te Waiiti system has high productivity and high pair density, it still remains vulnerable to extinction within 100 years. This site is reliant on outside-sourced birds for replacement. External recruitment of unbanded adult birds is the main source for the population increase in the Te Waiiti. However, if this external source is susceptible to higher rates of decline and is a sink population, then it is unlikely that protection of small areas will be sufficient to maintain whio populations. Adult survival in unprotected habitats would be expected to be considerably less than that in the protected area and that would imply that the over the long-term, the population in unprotected areas would be insufficient to continue to provide source birds to support the Te Waiiti population. Fledged juvenile survival in unprotected environments has been documented as low as 30% (Holmes 2000; Adams 2002; Peet et al. 2003). Unless we produce sufficient numbers of fledged juveniles and a high percentage of these recruit into a protected area that is large enough to encompass their demographic requirements and replace adult losses, then the greater Te Urewera population remains as a sink population.

The high productivity and dispersal patterns seen in the Te Waiiti provide the surrounding area with a pulse of new stock. However, of the mean annual production of 24 fledglings, currently only 23% have returned to their protected natal area. If fledgling deaths are as high as 70%, as indicated by Holmes & Caskey (2000) and Peet & Caskey (2004), then as few as 9% of fledged juveniles may survive outside the protected area.

5.4.7 Conclusion and Recommendations

Whio adult turnover inside the treated area remains a concern for ensuring a self-sustaining population and its long-term viability.

Results indicate that the current protection of 4100 ha including 18 km of river in Te Waiiti (on one side of the river) is insufficient to meet targets of adult survival and replacement to equal the losses within this sub-population. The reliance on externally-sourced adults to support the losses would also indicate that it currently is not a self-sustaining population. The data highlights the necessity of a minimum base population of at least 50 protected pairs to provide resilience over time, spread risk across a large habitat and for the production of a high number of juveniles to offset losses in unprotected habitats to maintain population viability. Sightings of dispersed juveniles indicate the extent of a whio population, their interaction and the necessity to manage large-scale systems in order to protect dispersing juveniles as well as breeding adults. Tracking juvenile survivorship to territorial occupation remains a key component for understanding population dynamics, to define management needed and the scale of the management required.

The monitoring data gathered to date from the Te Waiiti and Tauranga populations indicates the complexity of whio management and highlights the need for further monitoring and research to define the long-term trends and to establish the necessities to provide security for whio.

It is recommended that:

- We increase our understanding of whio population dynamics, particularly adult survival, and juvenile dispersal and survival through close order monitoring;
- Management effort is increased to secure 50 territorial pairs; and
- More data is collected on local weather events that may affect whio.

5.4.8 Acknowledgements

I would like to thank the following people for their support of the whio monitoring programme in the Opotiki Area: Paki Te Pou, Sonny Biddle, Leigh Glaser, Hemi Barsdell, Greg Moorcroft, Brenda Baillie, Murray Williams, Nic Etheridge, Lyn Thyne, Keith Beale, Pete Fergusson and Tim Allerby.

5.5 MISTLETOE MONITORING - HEMI BARSDELL

5.5.1 Abstract

This season, quintinia-hosted pirirangi (*Peraxilla tetrapetala*) was monitored at Okopeka (non-treatment), Okehu (Background Area) and Otamatuna Core Area, and beech-hosted *Alepis flavida* (alepis) was monitored at Okehu and Ogilvies (Otamatuna Core Area). Monitoring this year showed that possums have had a considerable impact on mistletoe abundance at Okehu. The reduction of beech hosted mistletoe abundance at Okehu is most likely due to the peaks in possum densities between periods of control. This indicates that the four-year possum control rotation is not adequate for maintaining beech-hosted mistletoe. Possums also had considerable impact over the last year on Okopeka pirirangi, this is reflected by the significant reduction in foliar density and the increase in dieback scores at this site. At Ogilvies, the low to medium possum numbers have impacted severely on a small number of mistletoe there, but overall the mistletoe at Ogilvies remains in a reasonable state of health. Precautionary measures with increased possum control at Ogilvies should be implemented to avoid further losses to this population however. Monitoring at Otamatuna this year showed pirirangi there remain in a healthy state in the presence of continual low possum densities.

5.5.2 Introduction

Within the context of the Te Urewera Mainland Island (TUMI) mistletoe species are monitored to identify what level of management is required for maintaining and enhancing mistletoe populations throughout the northern Te Urewera. Mistletoe species are also used as an indicator of forest health as they are highly susceptible to possum (*Trichosurus vulpecula*) browse (Ogle, 1995). It is expected that with the reduction of possums to low levels, mistletoe abundance will increase and individual mistletoe will be healthy, thus indicating a healthy forest and a healthy ecosystem.

Red mistletoe, or pirirangi (*Peraxilla tetrapetala*) and alepis (*Alepis flavida*) (yellow-flowering mistletoe) are the two mistletoe species that are monitored within TUMI. Pirirangi is hosted primarily upon *Quintinia serrata* (quintinia) but is also present on red beech (*Nothofagus fusca*) and hard beech (*Nothofagus truncata*). Alepis is also hosted on red and hard beech.

Pirirangi (hosted on quintinia) was first monitored at Otamatuna in 1995/1996 and annual monitoring up to and including 1999/2000 provided a baseline from which subsequent monitoring could measure changes in abundance. Baseline establishment is done over at least two consecutive seasons as pirirangi have been known to not flower each year. Possum control at Otamatuna began in 1992, particularly for protection of kokako. Since the establishment of TUMI in 1996, the Otamatuna Core Area has had a history of intensive multi-pest control, where possums have been kept at low abundance levels.

Okopeka is the non-treatment control block where possum densities have remained at around 25-30% residual trap catch. Pirirangi monitoring at Okopeka began in 1999/2000 and by the end of the 2000/01 season, a population baseline had been established. In the past, monitoring at Okopeka and Otamatuna has focused primarily on measuring changes in pirirangi abundance whereas monitoring at these two sites over the past two seasons has also focused on measuring pirirangi and host tree health.

Mistletoe hosted on beech species were first comprehensively surveyed for in the summer of 2000/2001. These surveys resulted in the discovery of a few scattered pockets of beech mistletoes throughout the northern Te Urewera. The Ogilvies and Okehu areas were found to contain the densest numbers of mistletoe, combined they contain over half (30 out of 48) of the known beech hosted mistletoe in the northern Te Urewera. The Ogilvies ridge area is part of the Otamatuna Outer Core Area. The Okehu area is situated roughly 3 kilometres east of the Whakarae Marae in the Waimana Valley.

This year was the second year that monitoring occurred at these two sites, with the first year of monitoring being conducted in 2000/01 following the discovery of *Alepis flavida* in 1999/00. Monitoring at Okehu aimed to measure the effect of the four-year background possum control regime in place there on mistletoe abundance. Foliar Browse Index (FBI) monitoring was also conducted at both sites with the aim of gauging the effect of different possum abundances on mistletoe health.

5.5.3 Objectives

Management objectives for the 2005/06 year were:

- To expand mistletoe monitoring in the background possum control area to attempt to increase our knowledge of the efficacy of this regime at protecting and enhancing mistletoe populations; and
- To monitor mistletoe health at Otamatuna, Okopeka, Ogilvies and Okehu to measure the effects of possum browse and to gauge the effect of the different possum densities on the mistletoe at these sites.

5.5.4 Methods

This season, monitoring was conducted at three sites and focused on either quintinia-hosted pirirangi or beech-hosted alepis (Table 5.5.1)

Table 5.5.1 Mistletoe monitoring details, Te Urewera Mainland Island, 2005/06

Date	Site	Host	Mistletoe species
13/02/2006	Ogilvies (Otamatuna)	Beech	<i>Alepis flavida</i>
16/02/2006	Okehu	Beech	<i>Alepis flavida</i>
16/02/2006	Okehu	Quintinia	<i>Peraxilla tetrapetala</i>
9/03/2006	Okopeka	Quintinia	<i>Peraxilla tetrapetala</i>
23/03/2006	Otamatuna	Quintinia	<i>Peraxilla tetrapetala</i>

Host and mistletoe health monitoring (see below) was conducted at all sites for both species. Abundance monitoring (see below) was conducted at Okehu for both beech-hosted *Alepis* and quintinia-hosted pirirangi.

Abundance Monitoring

During the establishment of the population baseline, host trees were searched in areas where mistletoe was known. Individual trees that were searched, whether or not mistletoe was present, were marked with a metal tag. Tagged trees that were found to host mistletoe were classified as *known hosts*, and tagged trees that were searched but did not host mistletoe were classified as *potential hosts*.

As well as a metal tag, known hosts were also marked with pink plastic triangles that were marked with the labels of the mistletoe hosted in that tree. Mistletoes were numbered sequentially with an 'M' prefix, for example M37, M38. If a host tree contains more than one mistletoe then each mistletoe is labelled with the same number but given an alphabetical suffix to further distinguish them, for example M37a, M37b. Locations of mistletoe on the host tree were identified using photographs with sufficient detail to indicate where mistletoe are on the tree itself and to distinguish between individual mistletoe on the same tree.

During abundance monitoring, known and potential hosts were searched for mistletoe by ground searching for flower remnants and leaves, and using binoculars for thorough visual searches of the host tree canopy. Only host trees with metal numerical tags were searched. Searching occurred at the height of mistletoe flowering season from mid-December to late February when mistletoes are most conspicuous.

Mistletoe and Host Tree Health Monitoring

Monitoring of mistletoe and host tree health was done using an adaptation of the DOC best practice for monitoring Loranthaceous mistletoes (Knightbridge 2002). Only plants that were clearly visible from the ground were scored. Mistletoe were scored from a designated viewing point (Mistletoe View Point or MVP) which were often marked using pink triangles labelled with 'MVP' and the corresponding mistletoe label. Some leeway in movement away from the MVP (c.5m) was allowed in order to obtain the most representative measurements. The location details of the MVP in relation to the base of the host tree were listed below the photo of each plant. Binoculars (10x50) were used to view plants during scoring.

The date, species, tag number and diameter at breast height (DBH) of the host tree were recorded and then the tree was scored on dieback, foliar density and the presence of borer.

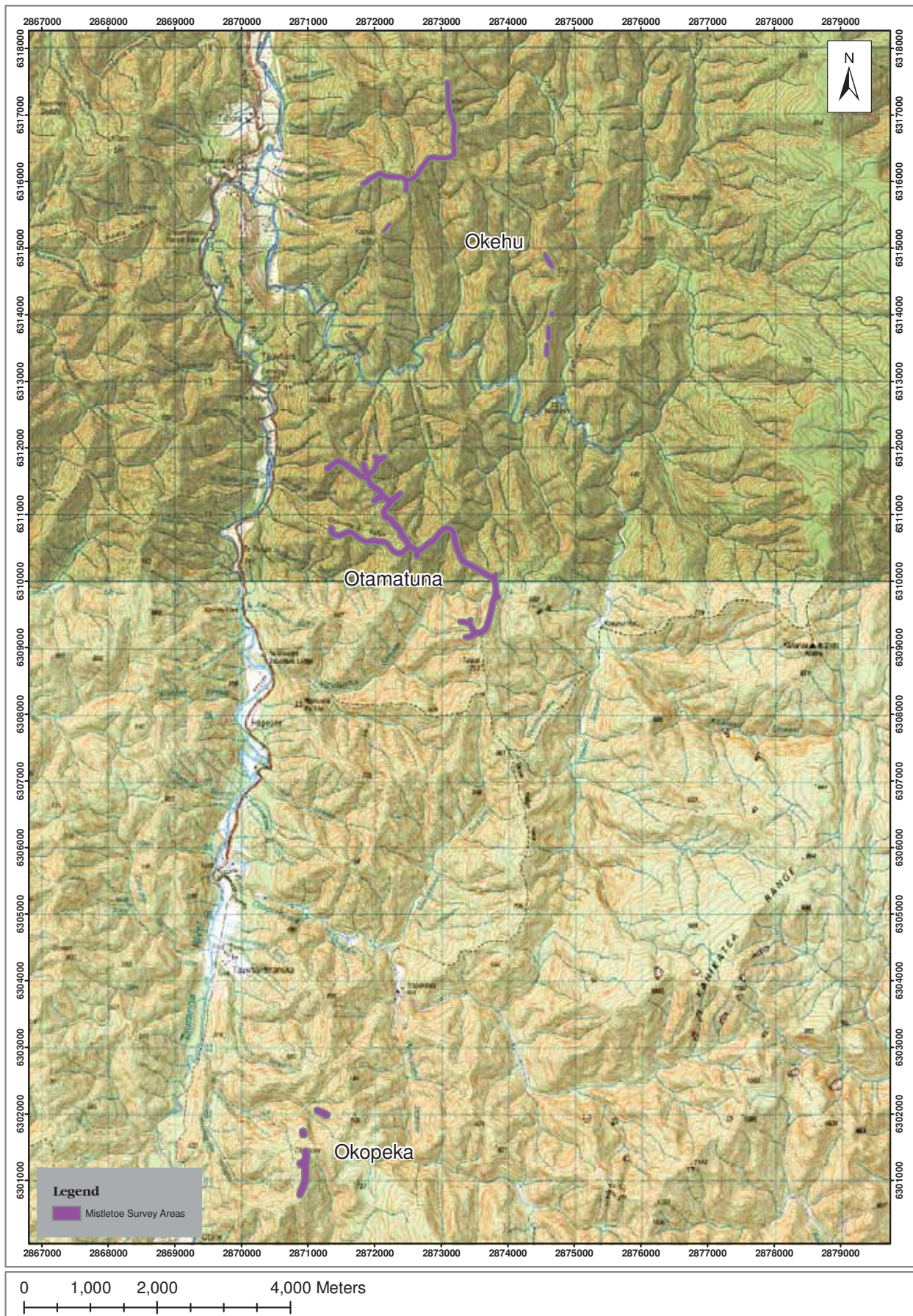


Figure 5.5.1 Location of study sites including survey areas for mistletoe/pirangi monitoring, Te Urewera Mainland Island, 2005/06.

Dieback (DB) is the conspicuous presence of dead branches or branchlets, but not recently defoliated live twigs. Only branches or branchlets that were dead at the time of monitoring were scored. Dieback was scored on the following scale:

- | | |
|--------------------|---------------------------------|
| 0: Nil | affecting <5% of the canopy |
| 1: Light | affecting 5-25% of the canopy |
| 2: Moderate | affecting 26-50% of the canopy |
| 3: Heavy | affecting 51-75% of the canopy |
| 4: Severe | affecting 76-100% of the canopy |
| X: Unable to score | |

Foliar Density (FD) was scored by selecting the appropriate category in a 10-point Foliage Cover Scale (Payton et al. 1997). The trunk, major branches, areas of the canopy that are dead, or foliage within range of ground browsing animals was not included.

The presence of borer insect holes in the lower trunk of each host tree was recorded using the following scale:

- 0: No borer present
- 1: borer present, very few holes
- 2: a moderate number of holes
- 3: many holes present

For mistletoe health scoring, the number and the size of the mistletoe on each host was recorded, and each mistletoe plant was scored for foliar density, dieback, possum browse, insect browse and the presence of flowers and fruit. Foliar density and dieback were scored in the same way as for host tree health.

Mistletoe size was measured by firstly estimating the horizontal distance between the widest points of the plant no matter where on the plant those points were, and secondly estimating the vertical distance between the highest and lowest points of the plant no matter where on the plant those points were.

Possum browse (PB) and insect browse (IB) were scored according to the scale below. Possum and insect browse were distinguished as described in Payton et al. (1997).

- | | |
|-------------|---------------------------|
| 0: Nil | No browse |
| 1: Light | 1-25% of plant affected |
| 2: Moderate | 26-50% of plant affected |
| 3: Heavy | 51-75% of plant affected |
| 4: Severe | 76-100% of plant affected |

Flowers and fruit were scored according to the scale below. Flowers included those starting from green buds or shoots through to mature opened flowers.

- 0: Nil
- 1: Rare
- 2: Occasional
- 3: Common
- 4: Heavy
- X: Unable to score

5.5.5 Results

Table 5.5.2 shows that a considerable reduction in beech-hosted mistletoe abundance occurred between the 2000/01 and 2005/06 surveys, with an equal reduction in the number of known hosts and numbers of mistletoe. This reduction calculates to a 77.8% change in mistletoe and known host abundance. Quintinia-hosted pirirangi abundance remained constant however.

Table 5.5.2 Comparisons of mistletoe abundance between 2000/2001 and 2005/2006 on beech-hosted and quintinia-hosted mistletoe at Okehu (Background Area), Te Urewera Mainland Island

Mistletoe abundance at Okehu

	2000/01	2005/06	2000/01	2005/06
Host species	Beech	Beech	Quintinia	Quintinia
No. trees searched	>783	783	4	4
Known Hosts	9	2	4	4
Mistletoe	9	2	7	6
Mean mistletoe per host	1	1	1.75	1.5
Occupancy Rate (%)	1.15	0.25	100	100

FBI Monitoring

Table 5.5.3 illustrates the range in pirirangi health. Mistletoe at Otamatuna are healthy with the highest foliar density scores and lowest dieback scores. Okehu mistletoe are in an average state of health with good foliar density and average to high dieback scores. Mistletoe at Okopeka are in a degraded state of health with a low foliar density score and a high dieback score. No significant difference exists in host tree health between the three sites.

Table 5.5.3 Comparisons of host and pirirangi health scores (mean values) for quintinia-hosted pirirangi at Otamatuna Core Area, Okehu (Background Area) and Okopeka (non-treatment), Te Urewera Mainland Island, 2005/06

	Host			Mistletoe					
	Number	Foliar Density (%)	Dieback (0-4)	Number	Width (m)	Height (m)	Foliar Density (%)	Dieback (0-4)	Possum Browse (0-4)
Okehu	3	72	0.3	5	0.8	0.9	41	2	0.6
Okopeka	7	59	0.6	13	0.7	0.6	17	3	0.2
Otamatuna	38	71	0.5	51	1.2	1	55	1	0

Table 5.5.4 shows the health scores for alepis at the two sites monitored. One of the two plants at Okehu was healthy whereas the other was almost completely defoliated. This result in combination with the abundance results at Okehu indicates a highly degraded population. At Ogilvies, the population as a whole is in a reasonable state of health.

Table 5.5.4 Host and mistletoe health scores (mean values) for beech-hosted *Alepis flavida* at Okehu and Ogilvies (Otamatuna Core Area) areas, Te Urewera Mainland Island, 2005/06

	Host			Mistletoe					
	Number	Foliar Density (%)	Dieback (0-4)	Number	Width (m)	Height (m)	Foliar Density (%)	Dieback (0-4)	Possum Browse (0-4)
Ogilvies	18	56	0.9	28	1	1	26	2	0.1
Okehu	2	65	0.5	2	1	1	15	2	0

Figure 5.5.2 highlights the relationship between pirirangi dieback and foliar density. In general, there is a trend where if foliar density is high then dieback is low, and the reverse applies where if dieback is high then foliar density will be low. A good relationship is shown at Otamatuna reflecting a healthy population as opposed to Okopeka where a negative relationship is shown indicating a possum-damaged population.

Figure 5.5.2
Mean foliar density and dieback values for pirirangi at Otamatuna Core Area, Okehu (Background Area) and Okopeka (non-treatment area), Te Urewera Mainland Island, 2005/06

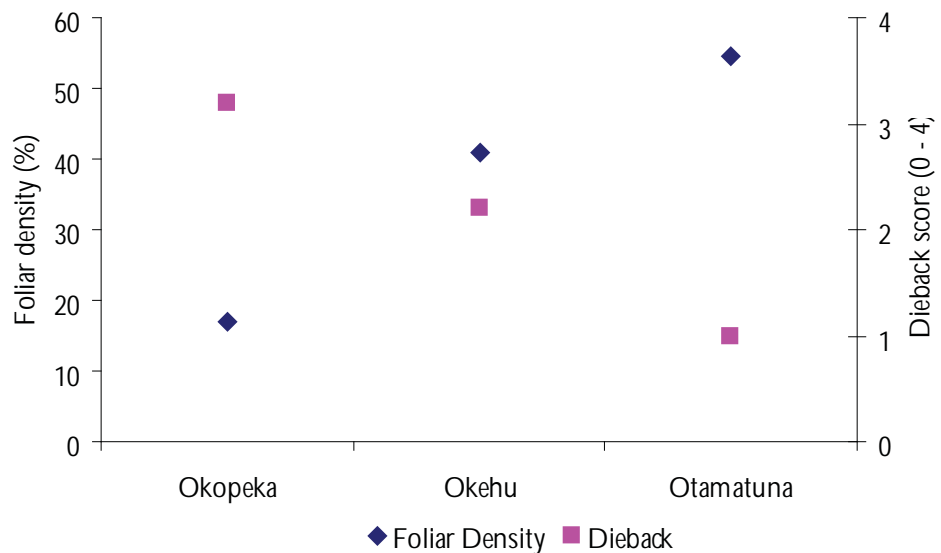
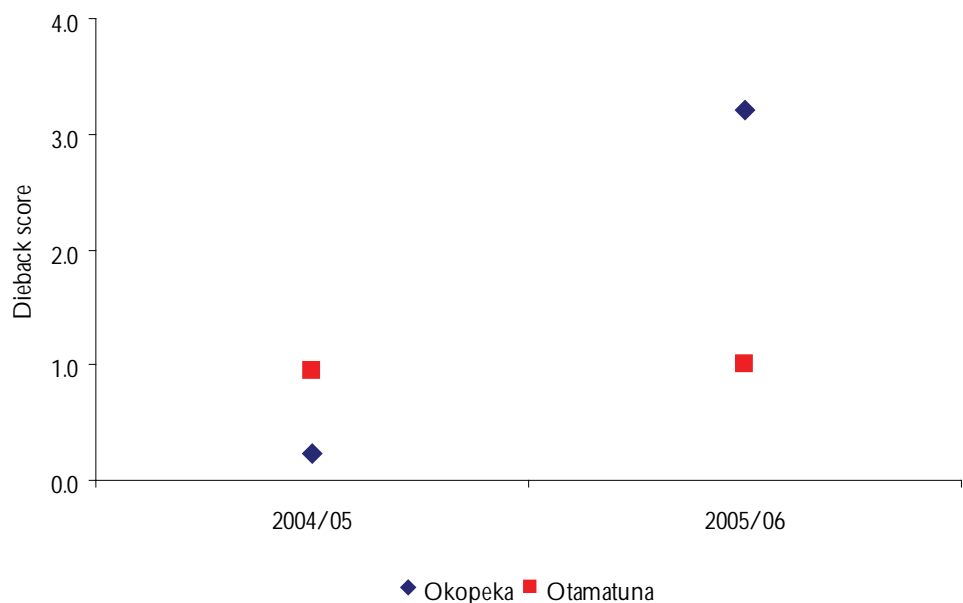


Figure 5.5.3 illustrates the dramatic increase in dieback at Okopeka in the year between the two monitoring periods. The constantly low state of average dieback in Otamatuna is also indicated.

Figure 5.5.3
Mean dieback scores for pirirangi at Otamatuna Core Area and Okopeka (non-treatment area), Te Urewera Mainland Island, 2004/05 - 2005/06



The high abundance of possums at Okopeka and Okehu is indicated in Table 5.5.5. Conversely, low to moderate numbers are shown at the Otamatuna Inner and Outer Core Areas. The three RTC figures given for Okehu prior to the score of 31.5% for this area in 2005/06 are from monitors done post-control whereas the monitor conducted in 2005/06 was undertaken pre-control. This result highlights how possum numbers can rise between periods of control.

Table 5.5.5 Possum residual trap catch index figures (%) for Otamatuna Core Area, Okopeka (non-treatment) and Okehu (Background Area), Te Urewera Mainland Island, 1996/97 – 2005/06

	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
Otamatuna Inner Core	25	0.7	2.4	1.7			5.7		4.5	2.7
Otamatuna Outer Core	25	2.2	2			5.9	5.7		10.4	9.5
Okopeka	26.8				24.5					31.2
Okehu	8.4		3.9				3.9			31.5

5.5.6 Discussion

Mistletoe abundance at Okehu

Prior to this season, Okehu was selected as the most suitable site for monitoring in the Background Area. It was selected due to it being accessible and because it was known to contain at least nine beech-hosted mistletoes and seven quintinia-hosted mistletoe. Potentially the number of mistletoe in this area had increased since this area was last surveyed. The reduction in beech-hosted mistletoe abundance at Okehu this year is a significant result and is likely to be due to the high peaks in possum numbers between periods of control. The presence of possum browse on quintinia-hosted pirirangi is evidence that possums are affecting mistletoe health. Further evidence that possums are the most likely cause of this decline can be drawn from a comparison of *Alepis* abundance at Ogilvies between 2000/01 and 2005/06.

After the completion of surveying at Ogilvies in 2000/01, 22 beech trees hosting 34 individual *Alepis* plants were known to be present there. After the completion of FBI monitoring there this year, it was found that a total of 18 hosts containing 28 plants were present. Although this result indicates a slight reduction in *Alepis* abundance at Ogilvies, the search effort for new plants was significantly less in 2005/06 than in 2000/01. If the search effort between years was similar, more *Alepis* may have been found in the 2005/06 year to replace those that were found in 2000/01 that had died between surveys. Therefore, a reasonable assumption could be made that *Alepis* abundance has remained constant in the last five years.

Possum numbers at Ogilvies have remained between five and ten percent RTC over the past five years that is considerably less than the levels shown at Okehu in the 2005/06 year.

This contrast in possum densities between the two sites explains the difference in mistletoe abundance results, with high possum densities at Okehu causing a rapid decline in mistletoe abundance and low to moderate possum densities at Ogilvies maintaining a constant level of *Alepis* abundance.

Possums were treated in the Okehu area in the 1996/97, 1998/99, and 2002/03 financial years. In all but one of these years (1996/97) the RTC target of 5% was achieved. However, the increase in the RTC percentage to 31.5% this year since this area was last controlled in 2002/2003, illustrates the extent of the peaks in possum densities between periods of control. Even though the sample size in this case is relatively small, the significant reduction in beech hosted mistletoe abundance in the last four years is a conclusive outcome. This rate of reduction is not sustainable and is highly suggestive that the four-year rotational possum control regime is not adequate for maintaining beech-hosted mistletoe populations. These results also indicate that this area is no longer a suitable area for monitoring beech-hosted mistletoe abundance due to the sample size being too small.

The abundance of pirirangi hosted on quintinia was not affected as dramatically however. The reason for this trend could possibly be attributed to the fact that the forest that the quintinia-hosted pirirangi occur in is a much more 'productive' forest type than the beech-forested areas. This is because the variety and quantity of preferred food species for possums within the mixed podocarp forest is higher than in the beech forest. As there are less palatable species within the beech forest, mistletoes would be browsed faster and the rate of reduction in mistletoe abundance would be greater. This theory would explain the reason for quintinia being the most prevalent host for pirirangi in the northern Te Urewera.

It is intended that abundance monitoring of quintinia-hosted pirirangi will no longer occur at Okehu. Instead, monitoring at Oruamananui (the original mistletoe study area in the Background Area, established in the 2003/2004 season) this coming season and in future seasons will provide the required information relating to the effect of this control regime on quintinia-hosted pirirangi abundance. Quintinia-hosted pirirangi at Okehu in fact were not intended to be part of the long-term abundance monitoring there. This is because there are very few potential quintinia hosts (quintinia with no pirirangi) in this area, and due to this, the growth of this population would always be seriously limited. The above results were merely presented as related information to the beech hosted mistletoe results.

FBI Monitoring

Monitoring this year showed a significant increase in the average dieback score for Okopeka mistletoe. The average score rose this year by three points from last year, which translates in simple terms to a major increase in dead branches or branchlets. Possum browse is thought to be a major contributor to this increase.

Related to this was a decrease in the average foliar density score at Okopeka. The combination of these two results shows that over the past year possums have had a considerable impact on pirirangi at Okopeka. The high possum densities and the presence of possum browse observed this year further support this notion. Further monitoring at Okopeka this coming season will continue to measure the effect of possums and will provide further information in relation to the extent of their effects at these levels.

Conversely, Otamatuna pirirangi have remained in a healthy state in the presence of continued low possum densities. The average dieback score for Otamatuna shows the lowest occurrence of dieback of all the sites monitored this year. Similarly, Otamatuna pirirangi have the highest foliar density scores and are larger than mistletoes at other sites. These factors show that the maintenance of possum densities at low levels (<5% RTC) is capable of maintaining and enhancing mistletoe populations. This is important information as it relates directly to the key objective of identifying what level of management is required for benefiting mistletoe populations.

The average dieback and foliar density scores for the Ogilvies *Alepis* population indicate that possums have had some effect on these plants. Possums appear to have affected a small number of plants severely as opposed to affecting all the plants to a lesser extent. Seven of the monitored plants measured 5% or less for foliar density and 4 on the dieback scale. If the scores for these plants were excluded for the average score calculations, the averages would work out at 34 for foliar density and 1.1 for dieback. The calculation of this result indicates that the remaining 21 *Alepis* plants are in a relatively healthy state, with enough healthy individual plants producing seed to ensure the recruitment of new plants into the population. The loss of seven plants however is a sign that possums are having a detrimental effect on this *Alepis* population, and given that this population is the last remaining population within the northern Te Urewera of any significance, it would be advisable to lower possum densities to five percent RTC or less. This would help to ensure the maintenance of this population.

This year's results show a pattern emerging where mistletoes are healthy in the presence of low possum densities but are in a degraded state in the presence of medium to high possum densities. A question mark remains however over the impact of the rotational possum control regime on quintinia-hosted pirirangi. Future abundance and health monitoring will aim to confirm the trends that are emerging and to clarify the questions that need answering.

5.5.7 Conclusions and Recommendations

Monitoring this year showed that possums have had a considerable impact on mistletoe abundance at Okehu. The reduction of beech hosted mistletoe abundance at Okehu is most likely due to the peaks in possum densities between periods of control. This indicates that the four-year possum control rotation is not adequate for maintaining beech-hosted mistletoe.

Possoms also had considerable impact over the last year on Okopeka pirirangi, this is reflected by the significant reduction in foliar density and the increase in dieback scores at this site. At Ogilvies, the low to medium possum numbers have impacted severely on a small number of mistletoe there, but overall the mistletoe at Ogilvies remains in a reasonable state of health. Precautionary measures with increased possum control at Ogilvies should be implemented to avoid further losses to this population however. Monitoring at Otamatuna this year showed pirirangi there remain in a healthy state in the presence of continual low possum densities.

It is recommended to:

- Continue pirirangi monitoring at Otamatuna to ascertain to what extent this level of control maintains and enhances pirirangi;
- Continue pirirangi monitoring at Okopeka to confirm the negative trend in pirirangi abundance and health there;
- Continue pirirangi monitoring in the Oruamananui area to ascertain the effect of the two-year possum control rotation on pirirangi;
- Discontinue abundance monitoring of beech hosted mistletoe at Okehu;
- Continue FBI monitoring of beech hosted mistletoe in the Ogilvies and Okehu areas; and
- Improve the quality of possum control in the Ogilvies area to lower possum densities.

5.6 DEER IMPACTS - DAVE WILSON

5.6.1 Abstract

This season (2005/06) was the eighth year in which seedling/pellet transects has been used to establish changes in deer densities and impacts on palatable understorey species. Monitoring showed that the trend of increasing deer densities has continued, probably largely due to the lack of (commercial) aerial recovery. Seedling densities increased slightly, particularly in the 16 – 45cm height class although this may be a sampling issue rather than a real change. Tawa seedlings were analysed and densities do not appear to have changed over the past eight years.

5.6.2 Introduction

Red deer (*Cervus elaphus scoticus*) have been shown to impact on the regeneration of favoured understorey plant species and to greatly reduce the density of these species within the forest types of the northern Te Urewera. The reversal of this pattern is the long-term aim of deer control within TUMI (Shaw et al. 1996). Extensive background information to the northern Te Urewera deer control program and the associated outcome monitoring is found in previous annual reports (Beaven et al. 1999, 2000).

This season was the eighth year in which seedling/pellet transect lines have been used to measure changes in deer densities and impacts within the Otamatuna Core Area. Deer control operations within Otamatuna began in 1998/99 and are undertaken over a 2500 ha area called the Otamatuna Deer Control Area (OCDA) (Section 4.5).

Pellet lines established by the former New Zealand Forest Service (NZFS) were measured for the tenth consecutive year in both Otamatuna and the greater Onepu/Ohora/Pohatu catchment where no deer control is undertaken. This study site serves as a non-treatment or control site for the Otamatuna Core Area.

Prior measurements have shown oscillating palatable seedling abundances at Otamatuna that appear to relate to changes in deer density. Over the four years prior to this reporting year, deer numbers have been increasing which is likely a result of less hunting effort (both aerial and, at times, ground-hunting at Otamatuna) while the number palatable seedlings in this period has decreased.

Following concerns over the regeneration of tawa (*Beilschmiedia tawa*), the dominant canopy species, this report will also cover the pattern of tawa seedling distribution over the past eight years at both Otamatuna and Onepu.

The current target for deer control in the OCDA is the removal of a minimum of 60 deer (Section 4.5). This target was based on concerns that palatable seedling densities were falling in the OCDA and that a minimum number of deer needed to be set in order to better gauge the impacts of this deer control.

5.6.3 Objective

- To measure the effect of deer control in the Otamatuna Core Area on the abundance of palatable seedlings.

5.6.4 Methods

Seedling/pellet transects were established within the bait station grids of both Otamatuna and Onepu Core Areas in November 1998. The rationale for locating the lines within the rat control area (Inner Core) was to reduce the impact of rats on seedling recruitment. These lines, which were permanently marked, have been re-measured in every subsequent year up to and including 2005/06 (Figure 5.6.1).

The seedling/pellet method is fully described in Beaven et al. (2000). In summary, 20 plots spaced at 10 metre intervals were set on randomly placed, 200m transect lines. Each plot is 1.26m in radius, giving an area of 5m². Therefore each transect line measures a total area of 100m². In each plot, all tree and shrub species were measured and seedlings with a diameter at breast height (DBH) of <2cm were put into height classes of: <15cm, 16-45cm, 46-75cm, 76-135cm, and >135cm. All animal droppings or pig-rooting present in a plot was recorded. The sampling unit for this method is each line.

The expected result of lowered deer densities at Otamatuna would be a rise in the number of seedlings of palatable species present in height classes greater than 15cm; however, the absolute numbers of larger seedlings present for these species are still low on a species by species basis. To increase the sample size, the results for the most abundant palatable species have been added together for each year. The species used were *Coprosma grandifolia*, *C. lucida*, *C. tenuifolium*, *Fuchsia excorticata* (fuchsia), *Geniostoma ligustrifolium* var. *ligustrifolium* (hangehange), *Melicactus ramiflorus* (mahoe) and *Schefflera digitata* (pate). (Note: fuchsia was used in similar comparison in reports prior to 2003/04 but was mistakenly left off the species list).

The methodology for measuring the NZFS pellet lines is described in a previous TUMI annual report (Beaven et al. 1999, p. 25). Briefly, the method consists of compass courses set from stream bed to ridge crest with a 1.26m radius plot every 10 metres where the presence or absence of deer pellets is recorded for each plot. Four lines were measured in each area (Figure 5.6.1).

Data from all eight years of recording of tawa seedlings was also analysed and graphed for this season's report in a similar way to that which has been used for palatable seedlings.

Measuring occurred between November 2005 and January 2006.

All tests for statistical significance were carried out using two-tailed paired sample T-test with 95% confidence limits.

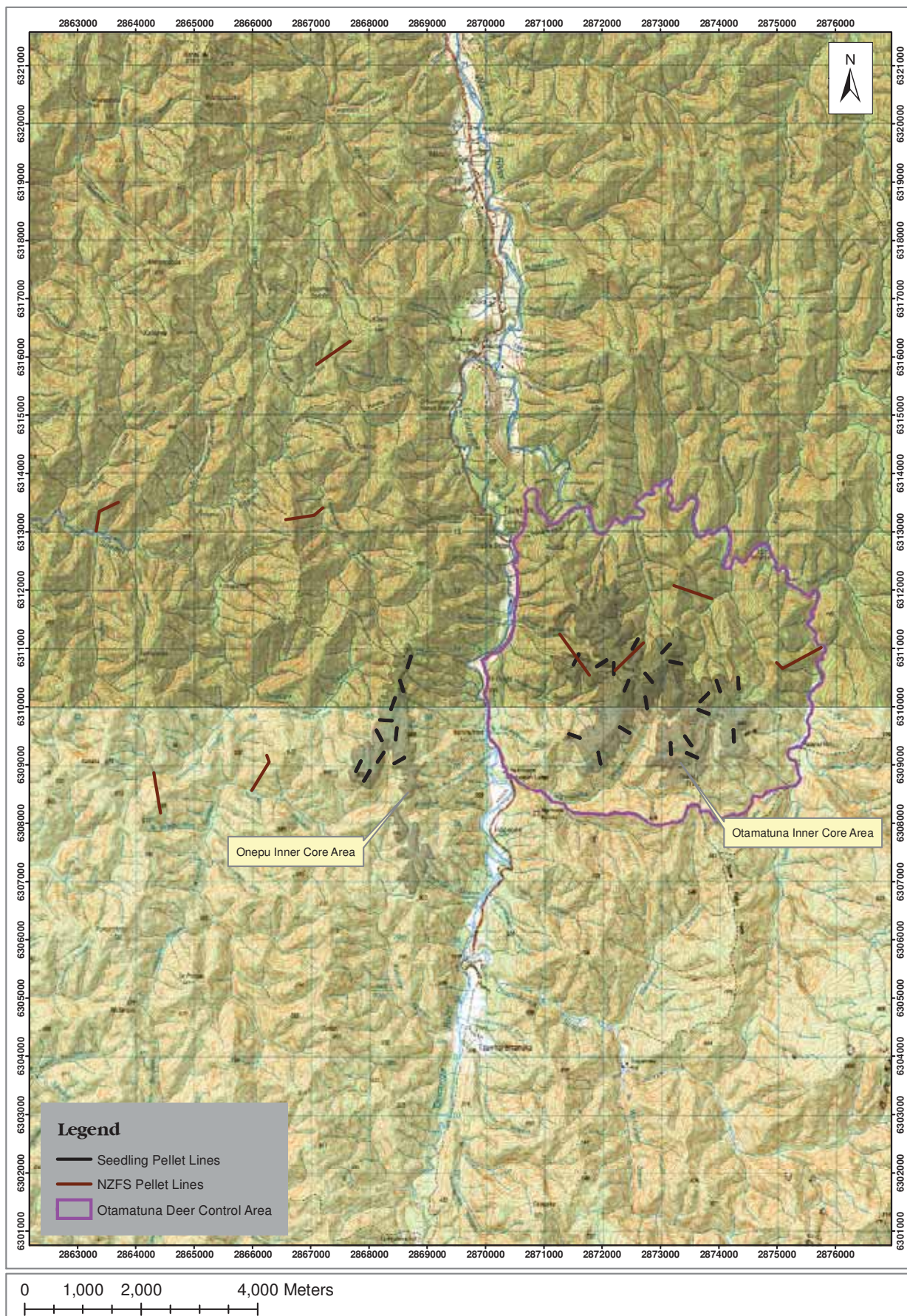


Figure 5.6.1 Location of seedling/pellet lines, New Zealand Forest Service pellet lines and the deer control boundary, Te Urewera Mainland Island, 2005/06.

5.6.5 Results

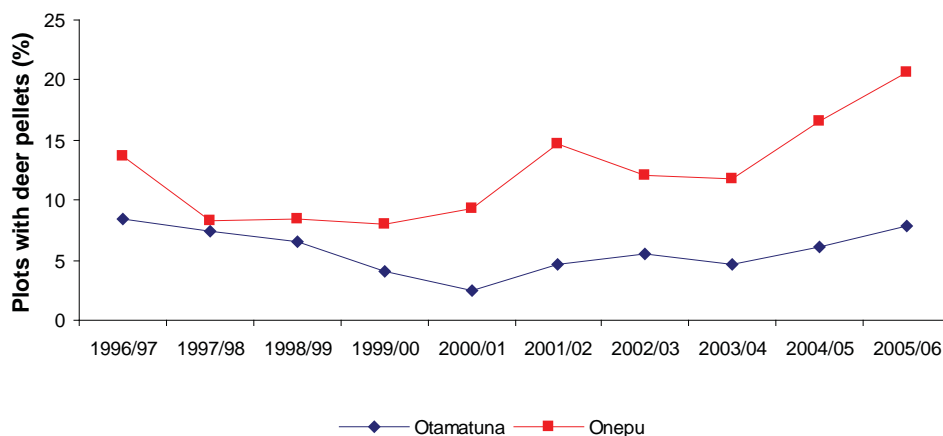
Summaries and comparisons with previous years are shown below for key findings.

NZFS Pellet Lines

The results for the past seven years are shown in Figure 5.6.2.

Figure 5.6.2

Mean proportion of plots containing deer pellets for New Zealand Forest Service monitoring lines at Otamatuna and Onepu Core Areas, Te Urewera Mainland Island, 1996/97 – 2005/06



The results show that counts in both areas are continuing the upward trend that began in 2000/01. This' season's results for Onepu are the highest recorded in any year.

These figures need to be interrupted carefully as each area has only four lines present and there is considerable margin for statistical error. As such, no statistical testing was carried out as the small sample sizes and natural variability between years make the value of these tests somewhat dubious. However, the ongoing upward trend (over what is now a significant period of time) in both areas over an extended period is probably a significant result.

Seedling/Pellet Transects

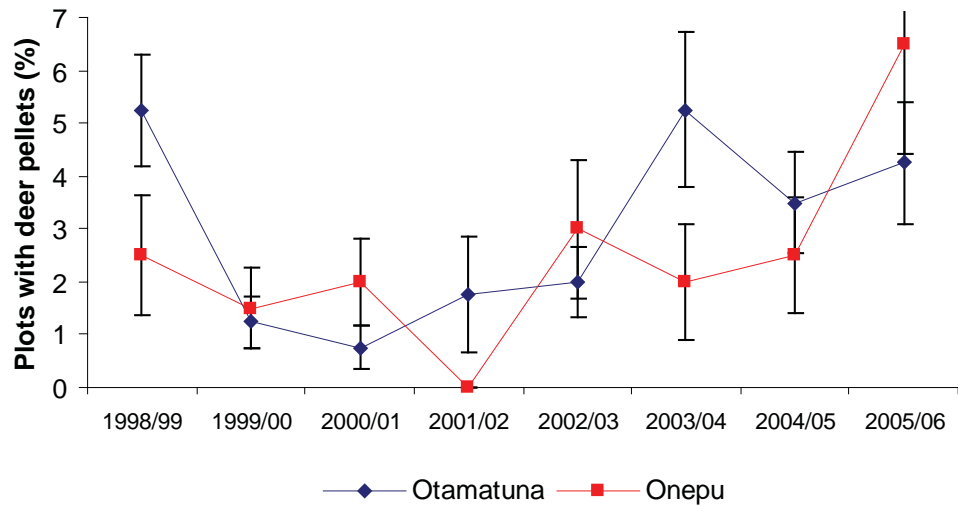
After eight years of measurements the results shown are now beginning to show strong trends which are now highly likely to be reflecting real long term changes rather than being heavily influenced by the chance results of one year's data. The results of pellet and seedling counts will be presented individually.

Pellet Counts

The results of the deer pellet counts for the last eight years for both Otamatuna and Onepu are shown in Figure 5.6.3. Error bars show standard error of the mean.

Figure 5.6.3

Mean proportion per transect line of plots with deer pellets, Otamatuna and Onepu Core Areas, Te Urewera Mainland Island, 1998/99 – 2005/06



The overall pattern at Otamatuna has been a decline in deer abundances from 1998/99 until 2000/01 and then an increase in abundances since. The small increase between 2004/05 and 2005/06 was not statistically different (Paired Sample T-Test where $P=0.61$). The pellet count in 2005/06 was the second highest count recorded since the initial count in 1998/99 and followed directly behind the high counts of 2003/04 and 2004/05. This count appears to be part of an ongoing upward trend in pellet counts since their nadir in 2000/01.

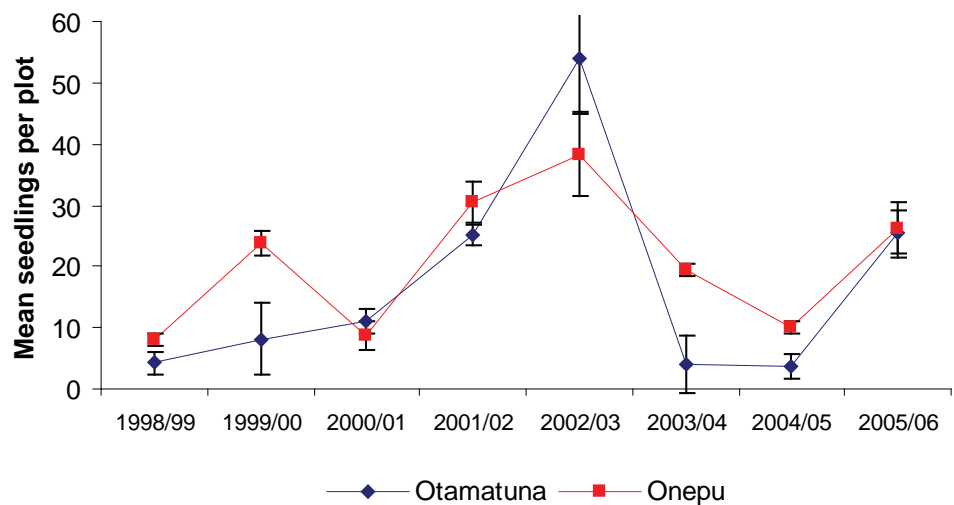
The counts at Onepu are at their highest level at any time since counting began. They are not significantly higher than the initial counts in 1998/99 (Paired Sample T-Test where $P=0.20$) but are significantly higher than the lowest count on Onepu in 2001/02 (Paired Sample T-Test where $P=0.01$). Since that year the count has shown an overall increasing trend.

Seedlings

Figure 5.6.4 shows the total number of palatable seedlings in all height classes over 15 cm high at both Otamatuna and Onepu between 1998 and 2006. All error bars show standard error of the mean.

Figure 5.6.4

Mean number of palatable seedlings greater than 15cm per transect line at Otamatuna and Onepu Core Areas, Te Urewera Mainland Island, 1998/99 – 2005/06



As Figure 5.6.4 shows there was a trend of increase in densities of larger palatable seedlings in both monitored areas between 1998/99 and 2002/03. However, in the years between 2002/03 and 2004/05 the numbers of palatable seedlings greater than 15cm at Otamatuna dropped to levels similar to seedling densities at the start of counting in 1998. During 2005/06 an increase in seedling density was recorded in both Otamatuna and Onepu with seedling densities at similar levels to densities in 2001/02.

Paired sample T-tests (two tailed test with 95% confidence) between 2004/05 and 2005/06 and between 1998/99 and 2005/06 all showed a significant increase between those 2005/06 and those years ($P < 0.000$ in all cases)

The abundance of palatable seedlings in each height class is shown in Figures 5.6.5 – 5.6.9

Figure 5.6.5

Mean number of palatable seedlings per line <15cm at Otamatuna and Onepu Core Areas, Te Urewera Mainland Island, 1998/99 – 2005/06

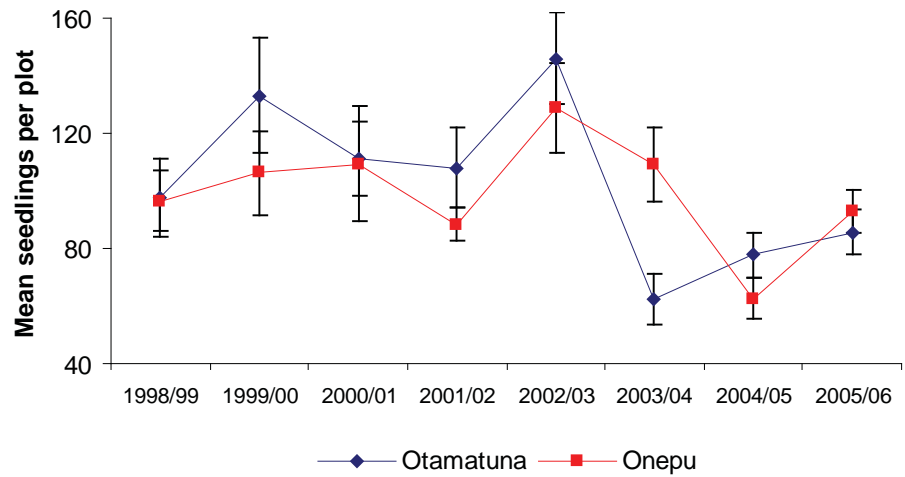


Figure 5.6.6

Mean number of palatable seedlings per line 16 – 45 cm at Otamatuna and Onepu Core Areas, Te Urewera Mainland Island, 1998/99 – 2005/06

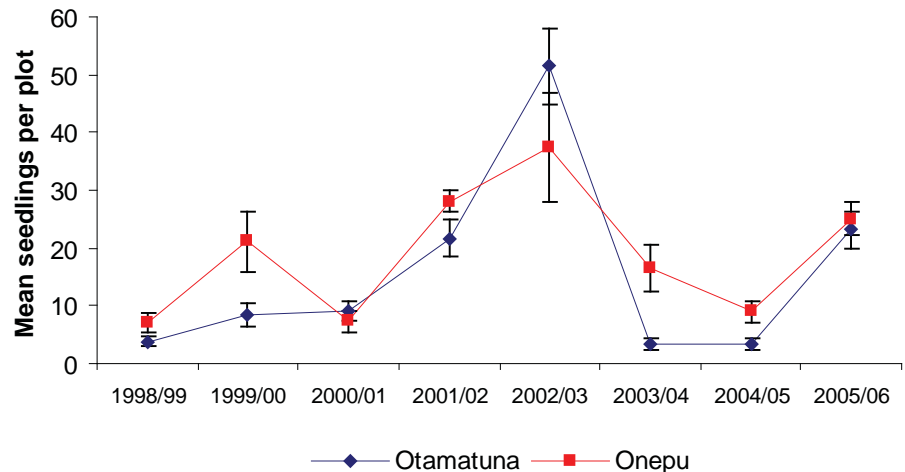


Figure 5.6.7

Mean number of palatable seedlings per line 46 – 75 cm at Otamatuna and Onepu Core Areas, Te Urewera Mainland Island, 1998/99 – 2005/06

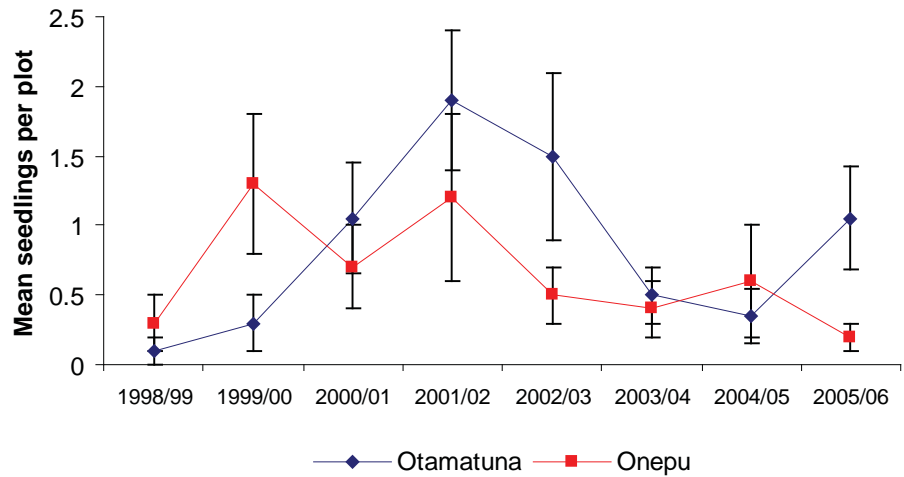


Figure 5.6.8

Mean number of palatable seedlings per line 76 – 135 cm at Otamatuna and Onepu Core Areas, Te Urewera Mainland Island, 1998/99 – 2005/06

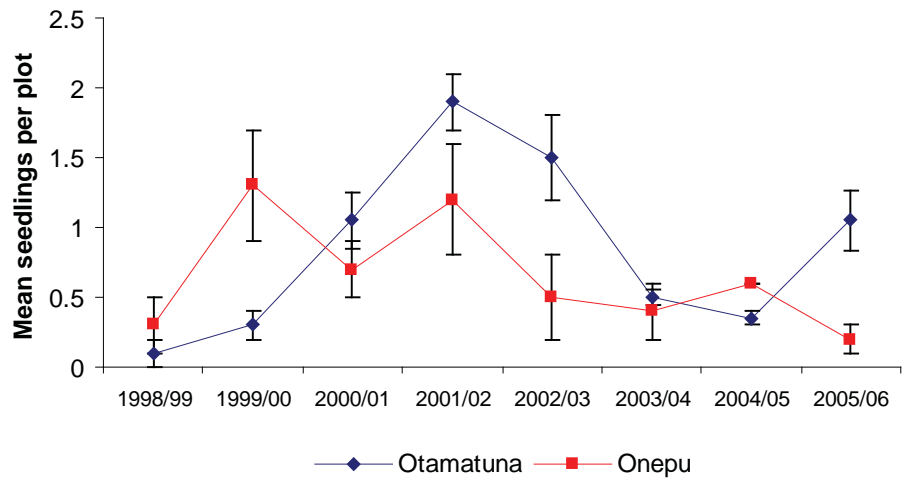
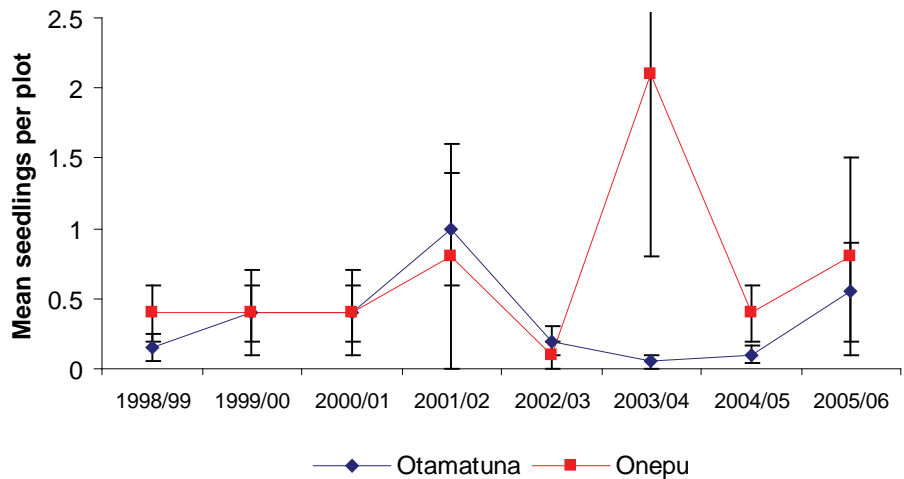


Figure 5.6.9

Mean number of palatable seedlings per line >135 cm at Otamatuna and Onepu Core Areas, Te Urewera Mainland Island, 1998/99 – 2005/06



Tables 5.6.1 and 5.6.2 show the results of paired sample T-tests for 1998/99 v 2005/06 and 2004/05 v. 2005/06 for Otamatuna and Onepu respectively.

Table 5.6.1 Comparison of palatable seedling abundance at Otamatuna Core Area, Te Urewera Mainland Island (significance value calculated at 95% level)

Height class (cm)	2004/05 v. 2005/06		1998/99 v. 2005/06	
	P-value	Significant difference	P-value	Significant difference
0-15	0.45	No	0.23	No
15-45	0.00	Yes	0.00	Yes
45-75	0.14	No	0.03	Yes
75-135	0.01	Yes	0.05	No
>135	0.23	No	0.29	No

Table 5.6.2 Comparison of palatable seedling abundance at Onepu Core Area, Te Urewera Mainland Island (significance value calculated at 95% level)

Height class (cm)	2004/05 v. 2005/06		1998/99 v. 2005/06	
	P-value	Significant difference	P-value	Significant difference
0-15	0.00	Yes	0.86	No
15-45	0.00	Yes	0.00	Yes
45-75	0.22	No	0.73	No
75-135	0.17	No	1.00	No
>135	0.57	No	0.51	No

The results show that there have been significant increases in palatable seedlings in the 16-45cm class at both Otamatuna and Onepu when compared with both the previous 2004/05 year and 1998/99 year. While there have been no other significant increases at Onepu there has been a significant increase for 46-75cm seedlings at Otamatuna compared with 2004/05 and 76-135cm seedling compared with 1998/99.

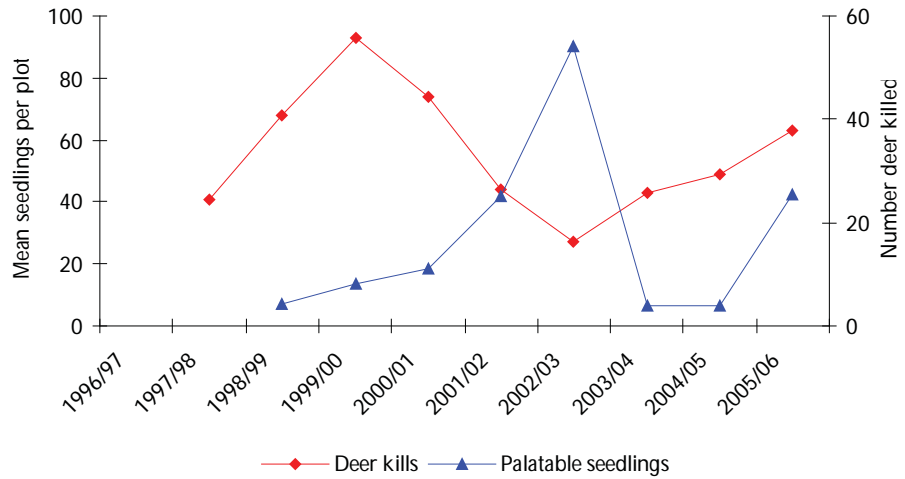
The overall appearance of the graphs is a small increase in larger sized seedlings at Otamatuna but this is still very low numbers and numbers are still largely below the 2001-03 period when it appeared larger seedling densities peaked.

The overall number of seedlings recorded in height classes above 45cm has been small every year with the 05/06 measurement again showed only low numbers with the average number of seedlings per line still less than one seedling in each height class. This makes counts vulnerable to chance events during data gathering.

The number of deer killed in the Otamatuna Core Area has increased for the third consecutive year, while the mean number of palatable seedlings >15cm per plot has increased significantly (Fig 5.6.10).

Figure 5.6.10

Mean number of palatable seedlings per plot (all height classes >15cm) and number of deer killed in the Otamatuna Deer Control Area, Te Urewera Mainland Island, 1998/99 – 2005/06



Tawa Seedlings

Figures 5.6.11 – 5.6.15 show tawa seedling abundances in each height class.

Figure 5.6.11

Mean number of tawa seedlings per line < 15 cm at Otamatuna and Onepu Core Areas, Te Urewera Mainland Island, 1998/99 – 2005/06

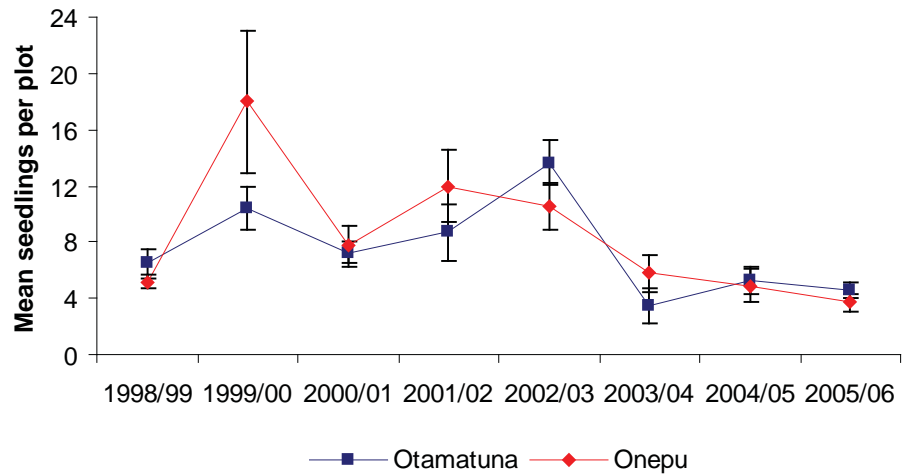


Figure 5.6.12

Mean number of tawa seedlings per line 16 – 45 cm at Otamatuna and Onepu Core Areas, Te Urewera Mainland Island, 1998/99 – 2005/06

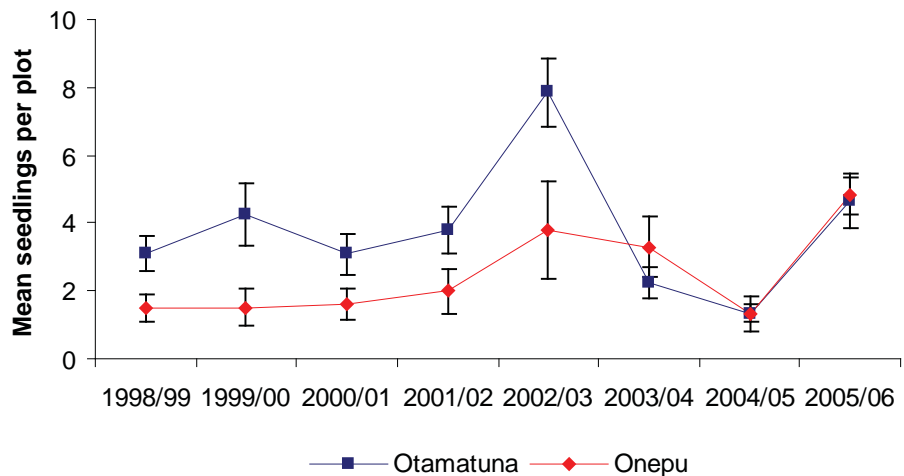


Figure 5.6.13

Mean number of tawa seedlings per line 46 – 75 cm at Otamatuna and Onepu Core Areas, Te Urewera Mainland Island, 1998/99 – 2005/06

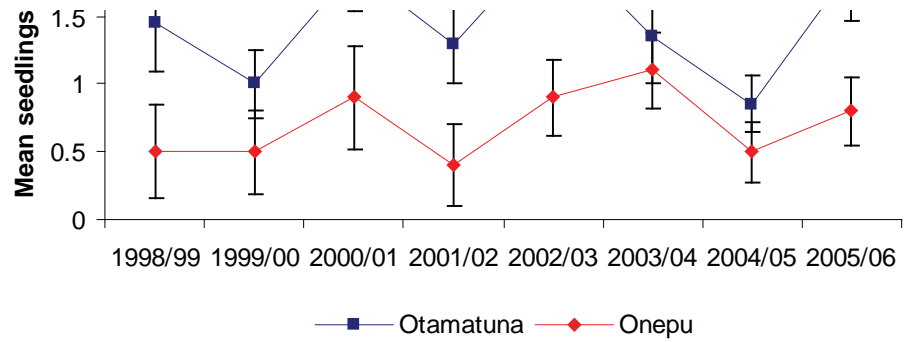


Figure 5.6.14

Mean number of tawa seedlings per line 76 – 135 cm at Otamatuna and Onepu Core Areas, Te Urewera Mainland Island, 1998/99 – 2005/06

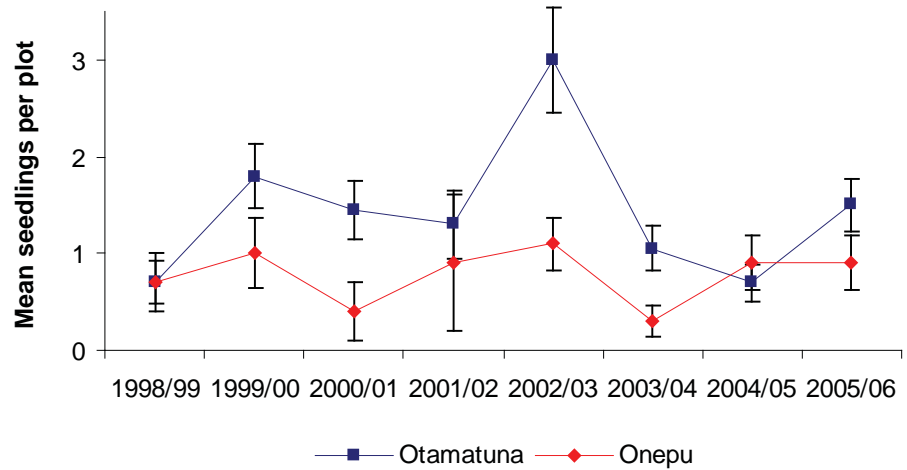
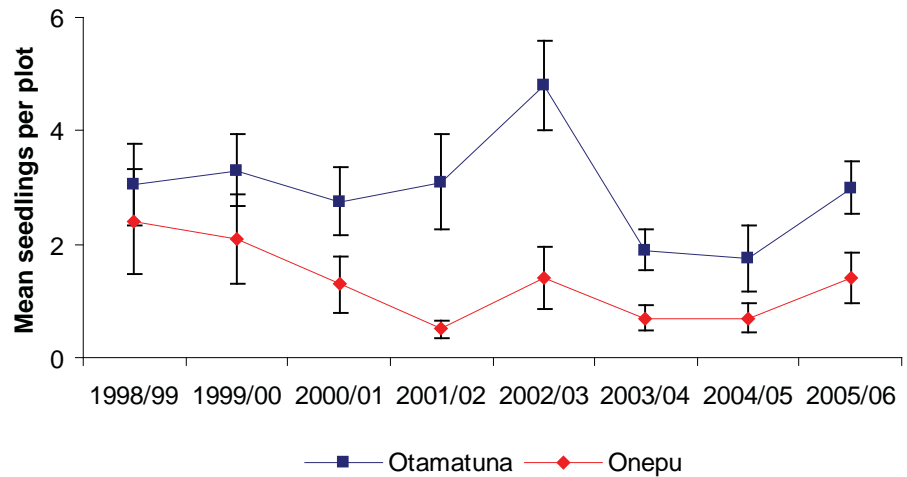


Figure 5.6.15

Mean number of tawa seedlings per line >135 cm at Otamatuna and Onepu Core Areas, Te Urewera Mainland Island, 1998/99 – 2005/06



No statistical analysis has been carried on these graphs; however, the data suggests the following trends:

- Otamatuna has consistently had higher seedlings counts across all height classes since the beginning of seedling counts.
- There has probably been little change in real tawa densities over time with graphs showing relatively consistent levels of tawa seedlings.
- There does appear to be a drop in seedlings 46 – 75cm high in the 2003/04 and 2004/05 years with numbers considerably higher on the years either side. This occurs at both Otamatuna and Onepu.
- There is no evidence of a decline or increase in tawa seedling densities in either area in the study period.

The implications of this will be discussed in the discussion of this report.

5.6.6 Discussion

The results for this year's measurements largely follow existing trends with a few (probably) explicable exceptions.

Deer pellet counts in both areas (using both methods) have increased consistently over the past four to five years and this year's count was no exception to this trend with both study areas again increasing over the previous year's counts. The counts using the NZFS pellet line methodology show Onepu appearing to increase at a greater rate than Otamatuna and this is probably a real difference (bearing in mind small sample sizes) as Otamatuna is still undergoing significant deer control compared with Onepu.

The increase in deer density at Onepu is almost certainly due to the continued reduction in aerial venison recovery which is occurring in the greater area. Increases in deer densities at Otamatuna are probably also due (at least in part) to the reduction in venison recovery allowing more deer to survive in buffer areas.

Varying levels of palatable seedling abundances have raised concerns that regeneration of tawa, the dominant canopy species, may be being affected by current deer levels. The results from the past eight years of seedling counts show no obvious decline in tawa abundance. Given tawa is a slow growing species any loss of larger seedlings would not be quickly replaced in a short period (i.e. two or three years) but would take a significant period of time. Given that the seedling numbers appear to be relatively stable then it would appear that there has been little loss of large seedlings over the study period. This would suggest that deer are not having a significant impact on tawa seedlings over the forest areas studied. This does not mean that deer are not impacting on tawa in some parts of Otamatuna or Onepu; there is for example a noticeable lack of tawa seedling regeneration in heads of streams (DW, pers. obs.) which is also probably the most favoured deer habitat, but that it is not a general impact as is seen with palatable species. However, it is likely that if deer were having a large impact tawa, seedling numbers would have decreased over the study period.

The difference in tawa seedling density between Otamatuna and Onepu is probably due to the differences in topography with proportionately far more head gut habitat at Onepu (due to less altitudinal coverage by the bait station grid which defines outer perimeter of study areas) which appears to hold far less seedlings than steeper faces which are more abundant in the study area of Otamatuna.

The absence of tawa in many (but not all) head gut and large benches may reflect the impacts of regularly rooting by pig. Purely subjective observations in other areas where deer are far less common than in the Urewera (e.g. parts of the Raukumara) or absent altogether (Northland) have shown that tawa (and other canopy species) are often absent as seedlings in areas regularly turned over by pigs. It is possible that pigs will play a significant role in lack of tawa (and other species) regeneration in favoured habitat.

The results from the seedling/pellet transects largely reflect those of an investigation carried out by Landcare Research (Smale 2006) involving measurements of 31 permanent plots in Otamatuna as well as the two exclosures and their control plots (measurements for that study were largely carried out by the author of this report). This study found that there had been no significant changes in larger tawa seedlings (>15cm) over the decade since the plots were established. Likewise, there had been no significant increases in tawa seedlings inside the exclosures (from which deer are excluded) although one of the control plots did show a significant increase in tawa.

5.6.7 Conclusions and Recommendations

As highlighted in previous reports, the impact of the reduction in aerial as well as local hunting pressure is likely to be a significant factor in the density of palatable seedlings in northern Te Urewera. It is apparent from the increasing proportion of monitoring lines that have pellets in them that deer densities are increasing over the wider area.

In the Otamatuna Deer Control Area (ODCA), the benefits gained from an increased number of deer kills (as has occurred this season) will be in part offset by increasing densities on the ODCA periphery and movement of deer into the ODCA will undoubtedly occur. The implication for palatable seedling recovery is that in order to increase densities, more deer will likely need to be killed in the ODCA to cater for both resident and invading animals. However, it is unclear at this time what number of deer will need to be culled. It is expected that deer densities in uncontrolled areas will continue to rise and we will require several years of data to understand the relationship between the number of deer killed, deer densities (from seedling/pellet transects) and densities of palatable seedlings.

Increases in deer densities at both study areas continued and although sampling showed slight increases in palatable seedlings this is probably more likely due to sampling methodology rather than an actual change although this will be clarified in future years. Tawa does not appear to have altered significantly in densities in the past eight years.

It is recommended to:

- Maintain the current effort for deer control and monitoring regimes at Otamatuna and Onepu Core Areas.

5.6.8 Acknowledgments

Pete Livingstone once again carried out the lion's share of the field work, ably assisted by Don McLean.

5.7 CANOPY CONDITION - DAVE WILSON

5.7.1 Abstract

Following another round of measurements using the Foliar Browse Index method there has again been no obvious change in the overall good condition of the kamahi canopy in the Northern Te Urewera. This suggests that the current possum control programme is sufficient for the protection of vulnerable canopy areas. The Opotiki Area Office has moved to measuring trees only once every two years instead of annually and this is a decision that is supported by the long-term stability of the data and the ongoing possum control that is still occurring in the monitored area.

5.7.2 Introduction

Foliar Browse Index (FBI) scoring has been used in Te Urewera Mainland Island (TUMI) since 1998 to assess changes in canopy cover of trees species vulnerable to possum browse. In this period the foliage cover parameter has provided the most consistent and verifiable data and that is what this report concentrates on. The ability of FBI to show large changes in some of the other parameters (especially browse) was severely limited as the FBI scoring system was not available until well after the TUMI possum control program was fairly advanced and possum densities and subsequent impacts had already been heavily reduced.

Experience in the Northern Urewera showed that kamahi (*Weinmannia racemosa*) was the most useful indicator species and it is on this species that this report focuses. Kamahi is a preferred food of possums although compared with some other species is perhaps somewhat more tolerant of browse. As the majority of Te Urewera canopy is made of tawa which is also a possum food (but one less favoured and probably more browse tolerant than kamahi), a healthy kamahi foliage canopy is likely to be indicative of good health in most of the common canopy species.

This report incorporates the data from the 2005 year and compares it with prior data.

5.7.3 Objectives

- To determine the impact of possums on the canopy condition of forest in northern Te Urewera.

5.7.4 Methods

The location of the Foliar Browse Index (FBI) lines and operational areas in northern Te Urewera, including the non-treatment area, are shown in Figure 5.7.1.

The methodology used in scoring trees followed Payton et al (1997). The foliage cover that this report concentrates on is scored using a cue card to estimate percentage of tree with canopy cover. All other FBI parameters are recorded but they are not reported on here.

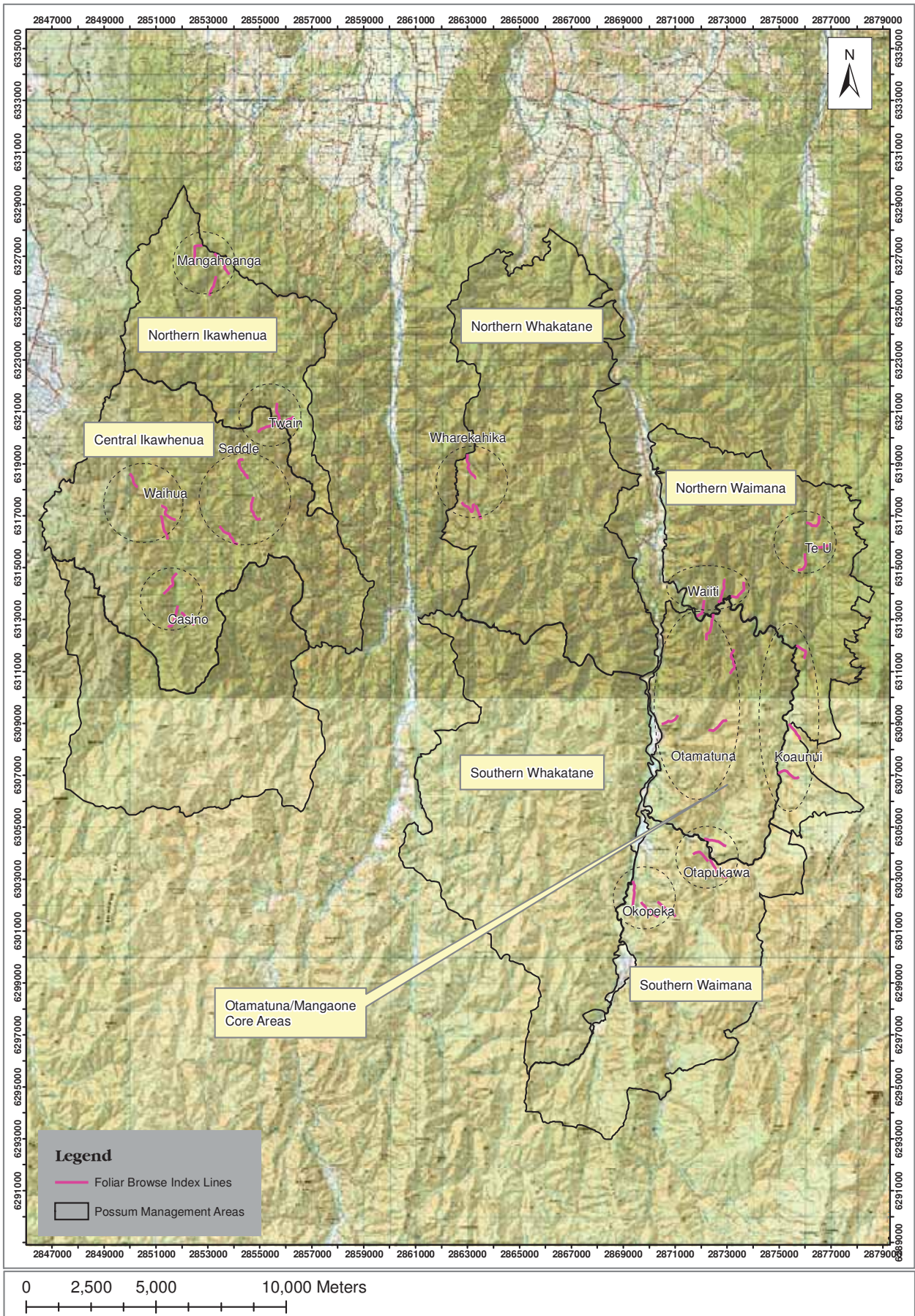


Figure 5.7.1 Location of groups of Foliar Browse Index monitoring lines within possum control areas and non-treatment area (Okopeka), northern Te Urewera, 2005/06.

Data was analysed in a slightly different way from the years prior to 1992 (but in the same way the report produced in and subsequent to that year) with results in some of the means and standard errors altering slightly from reports prior to 2002. Over the four recordings taken at many sites different trees or monitoring lines were missed by observers in one year or other but then recorded in the remaining years. If trees were discarded from the data set after being missed once the sample size would be significantly reduced. As such only trees that are definitely dead or have not been recorded for three consecutive measurements were removed from the data set. When a tree was missed for a year that tree was removed for that year only. This has meant that the actual number of trees graphed and analyzed has altered between years. This variable sample size has meant that there is some small changes in the figures for canopy cover. The changes in data will also make it impossible to use paired sample t-tests (the method used in the past) to compare data sets-instead t-tests assuming unequal variances have been used.

Table 5.7.1 shows the areas where FBI has occurred and associated information.

Table 5.7.1 Location of and year measured for Foliar Browse Index lines in northern Te Urewera, 1998-2005

Line	Possum Management Area	Years Measured							
		1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
Saddle	Central Ikawhenua	✓		✓	✓	✓	✓	✓	✓
Waihua	Central Ikawhenua	✓		✓	✓	✓	✓	✓	✓
Casino	Central Ikawhenua	✓		✓			✓	✓	✓
Twain	Northern Ikawhenua	✓	✓	✓		✓	✓	✓	✓
Mangahoanga	Northern Ikawhenua	✓	✓	✓		✓	✓	✓	✓
Wharekahika	Northern Whakatane		✓	✓		✓	✓	✓	✓
Te U	Northern Waimana	✓	✓	✓		✓	✓	✓	✓
Te Waiiti	Northern Waimana	✓	✓	✓		✓	✓	✓	✓
Koahunui	Northern Waimana	✓	✓	✓		✓	✓	✓	✓
Otamatuna	Otamatuna Core Area	✓		✓	✓	✓	✓	✓	✓
Okopeka	Non-treatment	✓	✓	✓		✓	✓	✓	✓
Otapukawa	Southern Waimana	✓	✓	✓		✓	✓	✓	✓

5.7.5 Results

Results for each area for each year are graphed in Figures 5.7.2 – 5.7.6. Error bars show standard error.

Figure 5.7.2

Foliage cover of kamahi in Central Ikawhenua, northern Te Urewera, 1998/99 – 2005/06

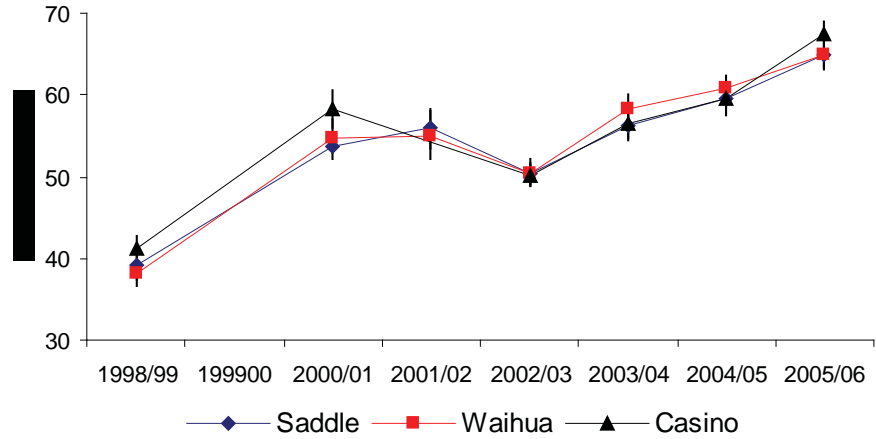


Figure 5.7.3

Foliage cover of kamahi in Northern Ikawhenua, northern Te Urewera, 1998/99 – 2005/06

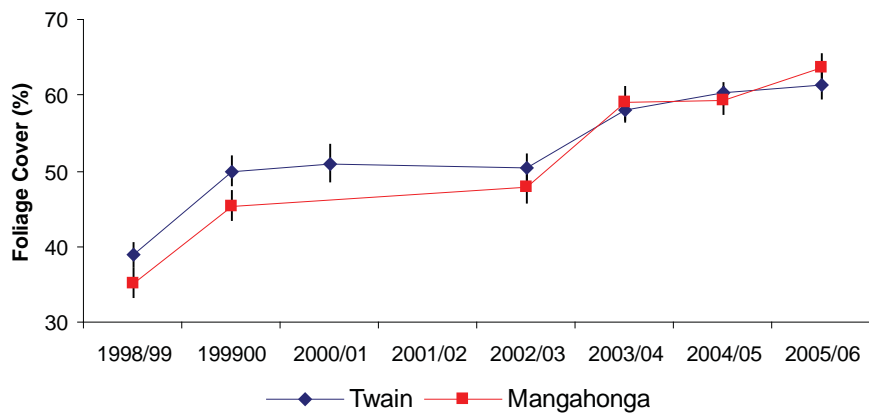


Figure 5.7.4

Foliage cover of kamahi in Southern Waimana, northern Te Urewera, 1998/99 – 2005/06

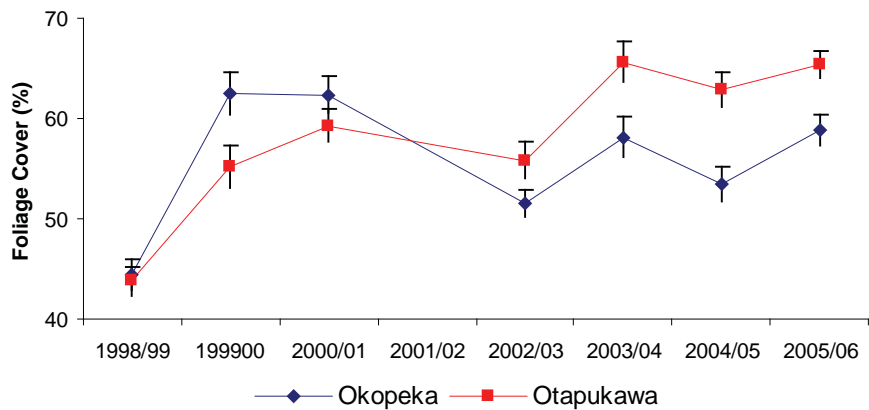


Figure 5.7.5

Foliage cover of kamahi in Northern Waimana and Otamatuna, northern Te Urewera, 1998/99 – 2005/06

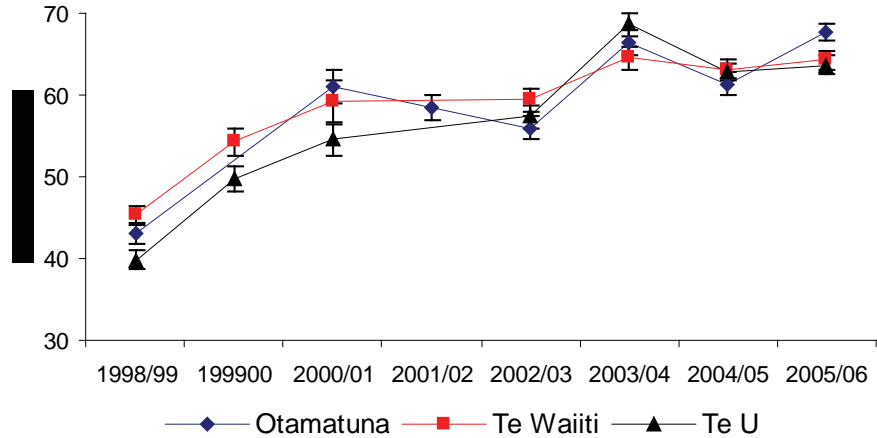
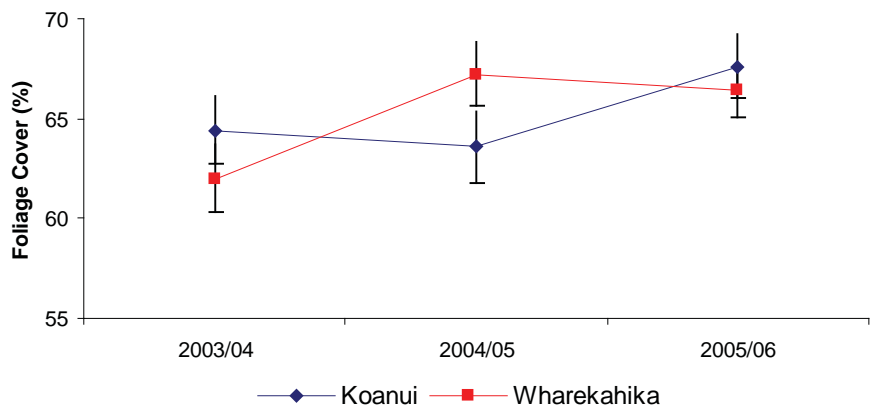


Figure 5.7.6

Foliage cover of kamahi in Koanui and Wharekahika, northern Te Urewera, 1998/99 – 2005/06



The results for the 2005/06 measurements continued to parallel that of the previous measures since the original ones in 1998/99. This is a pattern of apparently stable canopy cover in all areas after a large increase in cover between the 1998/99 measurements and the first follow-up measurement in 1999/00; all of these changes were statistically significant as is shown in Beaven et al (1999). Once again there has appeared to be no real change in the overall good condition of kamahi canopy between 2004/05 and 2005/06.

Due to far less intensive possum control for much of the study period Okopeka was the area most likely to show a major decline in canopy but once again this area has retained a stable canopy with no evidence of major changes in canopy condition.

5.7.6 Discussion

All monitored and operational areas show a similar pattern of a significant increase in kamahi canopy cover between measurements carried out prior to the spring of 1998 and all those carried out subsequently. The latest year of measurement shows a similar pattern to those of previous years since 1998/99.

A long term trend is emerging of relatively steady levels of canopy cover following initial low levels during the first year of measurements. The cause of the low level in the first year is uncertain but has been discussed before in prior reports. Briefly, it appears that similar pattern of canopy condition could be found in the non treatment area of Okopeka and in monitored trees in the Mangatutara Catchment of the Motu (pers. obs.) suggesting a background environmental factor (possibly due to the heavy insect damage occurred that year or the heavy flowering and fruiting that also occurred) may have been the major cause of the low levels in the 1997/1998 and winter of 1998/99 year.

The pattern of relatively stable (and apparently relatively healthy) canopy cover since the 1998 winter suggests that trees are not being seriously impacted by present levels of possums. If severe impacts were occurring it would be expected that canopy cover would be declining as appears to be (subjectively) occurring in those areas of Te Urewera where no possum control has occurred. Certainly in late 2005 the author spent some time in the Waikare Catchment on a private trip and there were noticeable areas of dead and dying kamahi on ridges and in many areas this species had almost been completely removed as a component of the forests and ridges and spurs. Other species such as mahoe that are generally in good condition (as adult trees) in the possum control areas were in obviously poor condition with heavy possum browse evident. The author is certain that systematic monitoring in this area would show much poorer kamahi condition and also an ongoing decline in that condition if it were to be undertaken. The observations in the Waikare are typical or what has been observed in other areas of Te Urewera National Park where possum control is not occurring.

A proposed decision to monitor canopy condition using FBI every two years instead of annually has been shown by these results to be a reasonable move given constraints of finance and staff time. Given the stability of results and that possums will not kill the trees in a period of only one or two years then it is reasonable to expect any increase in possum related canopy decline to be observed in plenty of time for control operations to occur should they be needed. With ongoing control of possums still ongoing there is no reason to expect a significant increase in possum related damage to the canopy of kamahi or other vulnerable tree species.

5.7.7 Conclusions and Recommendations

The patterns of stability in kamahi canopy condition continued over the 2005 year.

It is recommended that:

- The proposed change in the monitoring of canopy condition from annual to bi-annual be implemented.

5.7.8 Acknowledgements

Pete Livingstone carried out the fieldwork for this project with the able support of the Biodiversity (Threats) staff at DOC Opotiki.

5.8 LONG-TAILED BATS - HEMI BARSDSELL

5.8.1 Abstract

The second year of baseline monitoring for long-tailed bat (bat) abundance in the Waimana Valley was completed. Surveying was conducted over three nights along a 16.5km transect mostly along the Matahi Valley Road. Observers used hand-held bat detectors and recorded bats seen and heard. Mean numbers of bat passes, bat sightings and bat encounters were higher this season compared to 2004/05. Further baseline data will be gathered next season to improve data robustness.

5.8.2 Introduction

Pekapeka or Long-tailed bats (*Chalinolobus tuberculatus*) (bats) were once common throughout New Zealand; however, observations over the past century have indicated a steady decline in bat numbers (O'Donnell, 2000) and evidence from recent studies has shown that numbers are continuing to decline in some parts of the country (Molloy et al. 1995). Probable causes of decline include habitat degradation and the effects of introduced predators and competitors.

Little is known of the status of bats in northern Te Urewera. Occasional reports and sightings have indicated that they are present throughout this area, but detailed population knowledge is very limited. In an effort to increase our knowledge of the status of bats, a preliminary survey was conducted in February 2004. The aim of this survey was to identify a suitable area for long-term monitoring and to train staff in survey techniques. The Waimana Valley was chosen as the survey area because of its ease of access, and because it is representative of the wider northern Te Urewera. Long-term monitoring began in February 2005 with the aim of establishing a population baseline against which future trends could be measured.

The primary objective of monitoring this year was to complete the second year of three for gathering baseline population data. This was achieved by replicating the 2004/05 survey. After establishing the baseline, the primary aim will be to identify population trends. This will be achieved by consistent replication of baseline survey methodology. Bat encounters throughout the survey area will provide an index of the population and this knowledge will be essential in determining whether specific conservation management will be required in future.

5.8.3 Objectives

- Continue data baseline establishment by replicating the 2005 monitoring technique.

5.8.4 Methods

The survey area was along Matahi Valley Road from the Oturiamana Stream ford (the first creek south of Whakarae Marae) to the last gate at Tauwharemanukua (GR: E2869500 N6303440) although a circuit around the perimeter of the Te Pakau Clearing (8-Acre Campground) (GR: E2870250 N6307250) was also included. At the Otapukawa Stream ford, surveyors used the road going over the top of the hill (not the road that goes around the side). The survey route totalled 16.5 kilometres including the circuit at Te Pakau. The start and end points of the survey area are shown in Figure 5.8.1. The survey area was divided into four transects: 1) Oturiamana ford to Ogilvies Bridge; 2) Ogilvies Bridge to Lions Hut; 3) Lions Hut to Paradise Valley (GR E2870100 N6306700) including the circuit at Te Pakau; 4) Paradise Valley to end gate. At least four observers walked the transects starting from half an hour after sunset. The direction of travel along transects was alternated between nights and where possible different surveyors were assigned to different transects each night.

Surveying methodology follows O'Donnell and Sedgely (2001) where surveying was conducted over three fine, warm nights, when the temperature was above 10 degrees Celsius; surveying did not take place if the dusk temperature was below 7 degrees Celsius. No surveying was done on windy or wet nights and if the weather deteriorated when surveying had commenced, the survey for that night was abandoned. The survey was timed to be at a similar period as the previous year and was undertaken during the darker phase of the moon.

Observers walked at 3 km/h (or 20 minutes per kilometre) carrying Batbox III (Stag Electronics, UK) bat detectors set at 40 kHz frequency, set to a high volume and held in front of the surveyor pointing diagonally skyward. A GPS unit (Garmin *Etrex*), which was kept on throughout the survey, was used to record locations. If a bat was encountered (either seen or heard), the time and location (14 digit GPS grid reference or GPS waypoint number) were recorded. Bat passes that were obviously from bats that could be seen were not recorded as being heard. (Note: a bat encounter is defined as one or more bat passes or bat sightings at one location, and a bat pass is defined as three or more 'clicks' on the Batbox. A period of silence separates one pass from another. The surveyor may record five bat passes at any one recording location; these five passes being classified as one encounter). Once an encounter had been recorded, the surveyor continued walking with any subsequent encounters recorded separately. The temperature, wind level, insect abundance, weather conditions and cloud cover were recorded at the beginning and the end of the survey, although temperature was usually recorded by one person only. The use of torches for recording and navigation was kept to a minimum.

Surveying this season was undertaken on 20 – 22 February 2006.

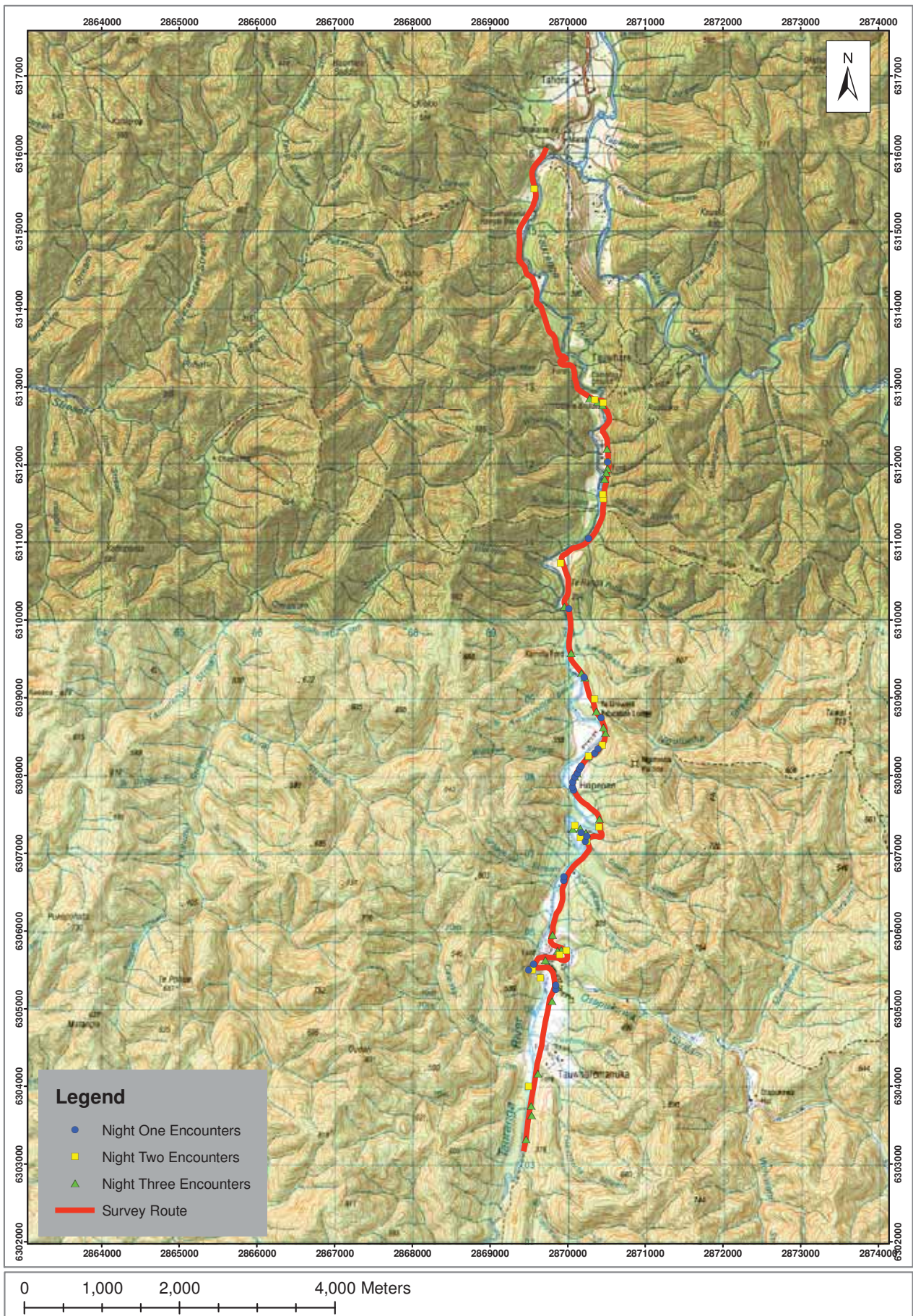


Figure 5.8.1 Long-tailed bat survey route and encounter locations, Te Urewera Mainland Island, 2005/06.

5.8.5 Results

The number of bat passes, number of bats seen and bat encounters for 2004/05 and 2005/06 are presented in Table 5.8.1. The mean number of passes, sightings and encounters increased from 2004/05 to 2005/06. There was a wide range in the number of bat passes recorded in any one any night (minimum = 20, maximum = 90), however relatively few bats are seen. The locations where bats were encountered are shown in Figure 5.8.1.

Table 5.8.1 Long-tailed bat passes, sightings and encounters recorded during surveys, Te Urewera Mainland Island, 2004/05 to 2005/06

Season	Survey date	Bat passes	Bats seen	Bat encounters
2004/05	28/02/2005	37	7	21
	1/03/2005	31	1	15
	2/03/2005	20	0	9
2005/06	20/02/2006	90	1	23
	21/02/2006	65	9	19
	22/02/2006	81	3	32
Mean total		54	4	20

5.8.6 Discussion

Regular encounters from the past two surveys indicate that a good population of bats is present in the Waimana Valley. The main concentration of bats appears to be upstream of the Ogilvies Bridge, with only the occasional encounter recorded north of there. Upstream of Ogilvies Bridge the bats are evenly dispersed with some areas (e.g. Ogilvies Bridge, Hopeone, 8-Acre campsite and the northern end of the Tauwharemanuka flats) being more favoured than other sites. It is likely that these areas are preferred feeding sites for bats, and are possibly close to favoured roost sites. Research from the Eglinton Valley in the mid 1990s studying the movements of radio-tagged bats showed similar patterns. In this study (O'Donnell 2001) it was found that bats have large home ranges (averaging in the vicinity of 2000 ha), but most of their activity (85%) is concentrated in small core areas.

The average home range of bats within the Eglinton suggests that bats within the Waimana Valley survey area are part of a highly mobile population that intermingles with bats to the south of the area. The area of the valley floor (where surveying takes place) that bats are likely to inhabit totals c.440 hectares, knowing that long-tailed bats prefer forest edge habitats and that they do not venture far into the forest interior. In the Waimana Valley, this aspect is highlighted by results showing high rates of activity in areas that are characterised by forest margins and large areas of open grassland and/or riverbed. The fact that areas of the road passing through bush generally are devoid of bat encounters also supports this notion.

After the completion of monitoring this year, it was decided that this survey should be replicated in 2006/07 to bolster the data collected in the first two surveys. By doing this the variability in bat activity and abundance will be reduced to give a more accurate average of bat abundance from which to gauge future changes. A comparison of the results to date shows this year there was a slight increase in activity over the first two nights surveying, whereas on the last night there was considerably more activity this year. These differences are more likely the result of differing patterns of activity due to food availability and perhaps climatic conditions as opposed to an increase in bat numbers. Minor variations in surveying will also be nullified by increasing the sample size. The only point of concern in this regard is the variation that occurs when the surveyor may fail to record a pass when proceeding to start walking again after finishing recording an encounter. This has happened when surveyors have believed that the pass they are receiving is from a bat that they have recorded only seconds previously. This variation in observer recording should not exist if the methods of the survey are followed correctly (and generally, they have been). However, by increasing the sample size of the baseline survey these minor variations will be compensated for.

The results that are generated by this survey will need careful consideration when attempting to quantify bat abundance. Bat passes alone are insufficient as an indicator of bat abundance because bat activity can vary considerably within a night and also between nights. One bat can fly overhead multiple times therefore creating an impression that there may be several bats when there is only one, conversely, one bat pass may be recorded from a bat right on the periphery of a group of bats. The number of bats seen is a good indicator of bat abundance because the surveyor can see and count the bats. The time that bats are visible however is a limiting factor as bats are generally only visible for a maximum of thirty minutes after surveying starts. Bat encounter locations again give a good indication of bat abundance. When the encounter locations are mapped the locations within the survey area that are regularly frequented and the density of these spots within the area give a strong indication of bat abundance. Over time, the number of encounter locations will be a good measure to gauge changes in bat numbers, because if bat numbers are increasing bats may begin to show in areas where previously they were not detected. A combination of the above three factors should be taken into account when quantifying bat numbers.

5.8.7 Conclusions

Monitoring this year saw the completion of the second year of the baseline survey. Initially this amount of monitoring was intended to be adequate for establishing the baseline but a review of the results to date has highlighted the need to repeat this survey again in 2007. This will increase the sample size and give a more accurate indication of bat numbers in the Waimana Valley.

5.8.8 Acknowledgements

Surveying this season was done by Jane Haxton, Andrew Glaser, Greg Moorcroft, Trish Edwards and Hemi Barsdell.

6.0 Community Awareness & Participation

6.1 OBJECTIVES

The project's third overall goal is to "involve, encourage, inform and advocate to the wider community so that: the value of conservation in the community is increased; members of the community support and are involved in the project; and that the view of the local community is represented in management decisions" (Shaw et al. 1996).

6.2 DEVELOPING AND MAINTAINING PROJECT PROFILE

Spreading the Message

Presentations were given to the East Coast Hawke's Bay Conservation Board on various pest control methods used in TUMI. Some of the successes and initiatives of the last year were highlighted, such as the translocation of kokako to Ngapukeariki, and the use of GPS units to track the number of deer killed in the park.

Tools and techniques learned from the project on possum and rat control were shared with other DOC offices in informal talks at Punakaiki, Karamea, Haast, Te Anau, Queenstown, Chatham Island, and Great Barrier Island. This knowledge was also transferred to international audiences in New Caledonia and Norfolk Island. A trial rat control project was initiated in New Caledonia demonstrating techniques developed in TUMI. A report outlining options for improved rat and cat control and reducing risks of preventing rat invasion on offshore islands was presented to the Norfolk Island National Park Advisory Committee, using learnings from TUMI.

Visitors from Puketi Trust and DOC staff from Great Barrier Island spoke to Opotiki staff to discuss pest control methods, and in the case of Puketi Trust these methods were replicated within their management practices.

Staff attended hui at Waimana and Ruatoki to present project results and discuss pest control methods.

6.3 EDUCATION PROGRAMMES

Both Opotiki College and Ashbrook Primary School visited TUMI. Students from the college were shown the different monitoring and protection techniques to check the status of native species populations, and Ashbrook Primary spent a day tree planting and learning about whio.

A DVD was produced on the mainland island as a short film for schools, and information centres, and long film for key stakeholders such as Forest and Bird. The DVD covered the concept and history of TUMI, as well as monitoring and control methods used and the success the project has seen.

6.4 MEDIA LIAISON

The potential threat of dogs to young kiwi chicks is an ongoing concern. News releases were published in the Opotiki News, and Whakatane Beacon on the death of monitored kiwi from dog kills in Te Urewera National Park.

Articles were also published on the requirement for hunting dogs to have gone through avian avoidance training before they can be used in the National Park.

7.0 Acknowledgements

The Department of Conservation wishes to thank the Waimana Kaaku and the Western Tuhoe Executive for their ongoing support.

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9.0 Appendices

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Appendix 9.1 Information on Department of Conservation Best Practice for Rat and Stoat Control

Best practice information for rat and stoat control can be accessed through local DOC offices:

- Kill trapping for rats (DOCDM-29390).
- Trap layout and tunnel construction for Victor Professional rat traps housed in either a wooden or coreflute tunnel: (DOCDM-103712).
- Kill trapping for stoats (DOCDM-29448).

Rat and stoat control can be undertaken with the multi-pest 'DOC' series of traps:

- For 'DOC' series traps see: DOCDM-29856 (DOC150), DOCDM-29855 (DOC 200) and DOCDM-29851 (DOC250).
- Visit www.predatortraps.com for further information on the 'DOC' series of traps, including tunnel specifications and purchasing information.

Appendix 9.2 Wire-mesh stoat trap cover design used at Te Urewera Mainland Island

The trap set consists of two Mark VI Fenn traps placed on the ground, with a white hen's egg placed on the ground between the traps (Fig 9.2.3). The traps and egg are covered by a wire mesh tunnel with internal baffles between the traps and the end of the tunnel (Figs 9.2.1 and Fig 9.2.2). The wire mesh tunnel is itself covered by a semi-opaque plastic cover, although the ends of the tunnel are not covered (Fig 9.2.1). The wire mesh cover and traps are pegged down with no gaps.

Galvanised steel mesh with an internal grid size of 10mm x 10mm is used for the tunnel cover. The wire strands are approximately 1mm thick and therefore each square is approximately 12mm (grid + two wire strands). The cover without baffles can be cut as one piece with the ends of the tunnel being 15 squares wide and high, and the length of the tunnel being 57 squares long; the sides and the top are therefore 15 squares by 57 squares. The baffles are the same dimensions as the tunnel ends (15 squares each way) and are set 16 squares along the length of the tunnel. Access holes are cut into the ends of the tunnel and the baffles; holes in the ends are 5 squares wide and deep, and holes in the baffles are 5 holes wide and 6 holes deep. The wire mesh tunnel and plastic cover are attached or held together with lengths of twist-ties put in appropriate places so as to be able to close the cover without any gaps.

Appendix 9.2 Wire-mesh stoat trap cover design (cont'd)

Figure 9.2.1
Exterior of wire mesh tunnel with plastic cover

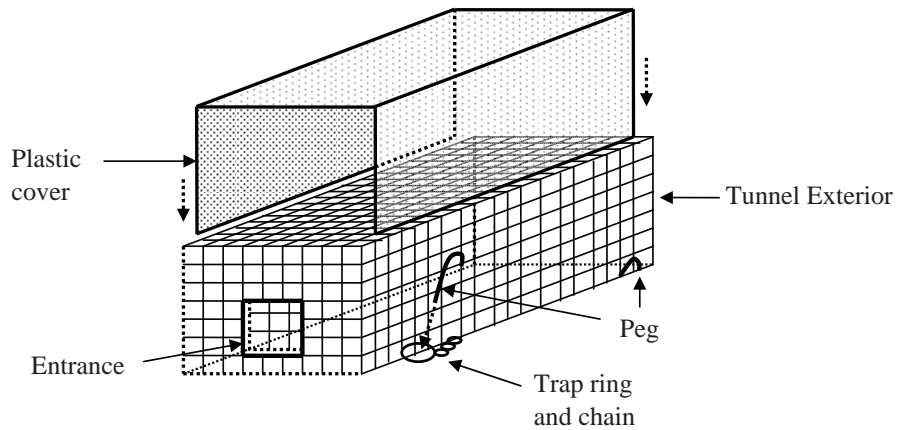


Figure 9.2.2
Arrangement of internal baffles in wire mesh trap tunnel

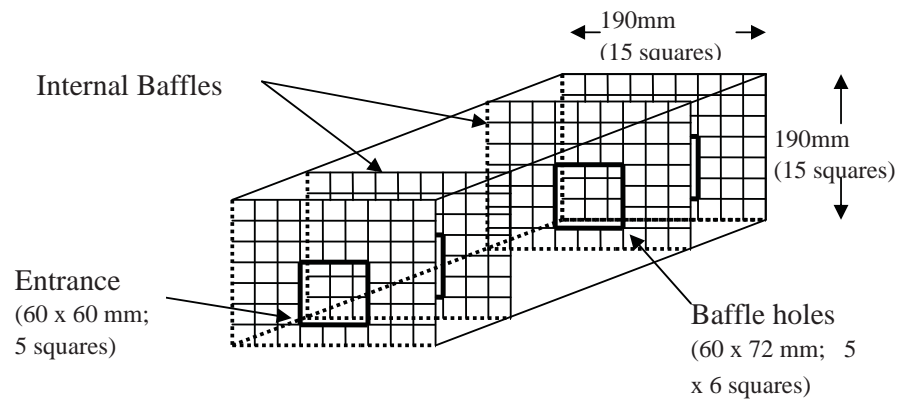
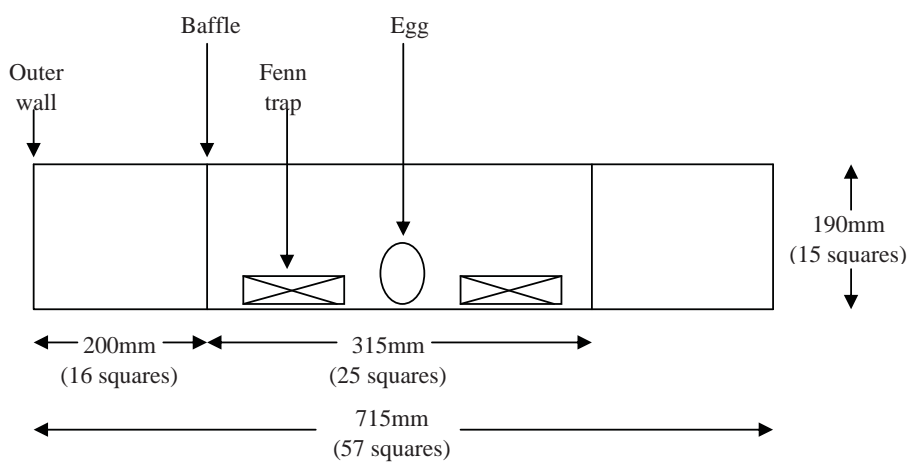


Figure 9.2.3
Cross section of trap set for wire mesh tunnel



Appendix 9.3

Fate of kiwi monitored during 2005/06 in Te Urewera Mainland Island

NTU	Sex	Age at capture	Date start monitoring	Date end monitoring (to 30/6/08)	Fate at 30/6/06	Cause of death	Breeding recorded	Number of Nests
69	M	A	11/01/2001	6/04/2006	Lost		No	
74	M	A	21/08/2001	9/05/2006	Tx dropped		No	
102	M	A	19/05/2004	Ongoing	Alive		No	
103	F	A	3/06/2004	17/01/2006	Dead	Management		
105	U	S	10/06/2004	Ongoing	Alive			
106	F	S	27/05/2005	Ongoing	Alive			
107	M	A	18/10/2005	Ongoing	Alive		Yes	1
108	M	S	14/02/2006	Ongoing	Alive		No	
109	M	A	21/02/2006	Ongoing	Alive		No	
110	U	S	28/02/2006	Ongoing	Alive			
111	U	A	22/03/2006	Ongoing	Alive			
112	M	A	25/03/2006	Ongoing	Alive		No	
113	F	S	25/03/2006	Ongoing	Alive			
114	M	A	30/03/2006	7/06/2006	Tx dropped		No	
115	U	S	6/06/2006	6/06/2006	Dead	Management		

Appendix 9.4**File numbers (DME) for selected Department of Conservation reports and documents**

Reference number	File name (description)	Relevant section(s)
DOCDM-118025	GPS Dowload instructions	4.5
DOCDM-107451	Garmin <i>Etrex</i> use	4.5
DOCDM-29390	Kill trapping for rats	4.3
DOCDM-103712	Trap layout and tunnel construction for Victor Professional rat traps housed in either a wooden or coreflute tunnel	4.3
DOCDM-213908	East Coast Hawke's Bay Animal Pest Management Tendering Procedure Manual for Animal Pest Contracts	4.2
DOCDM-239618	Opotiki Area Office Possum RTC Database	4.2
DOCDM-29856	DOC150 Tunnel and trap specifications	4.3
DOCDM-29855	DOC200 Tunnel and trap specifications	4.3, 4.4
DOCDM-29851	DOC250 Tunnel and trap specifications	4.4
DOCDM-29448	Kill trapping for stoats	4.4

Monitoring data for whoio in the Te Waiiti Stream and upper Tauranga River, Te Urewera Mainland Island, 2005/06

Table 9.5.1 Monitoring data for whoio in the Te Waiiti Stream, Te Urewera Mainland Island, 2005/06

Territory number	Grid reference	Number adults	Number juveniles produced	Number juveniles fledged	Number of surviving whoio
1	W16 713 143	2	5	5	7
2	W16 712 136	2	2	2	4
3	W16 720 130	2	6		2
4	W16 720 131	2			2
5	W16 723 131	2			2
6	W16 726 134	2			2
7	W16 735 135	2			2
8	W16 747 126	2			2
9	W16 745 126	2			2
10	W16 746 127	1			1
11	W16 750 123	2			2
12	W16 755 120	2	4		2
13	W16 755 113	2			2
14	W17 757 110	2	1		3
15	W17 757 106	2			2
16	W17 755 103	2	1	1	3
17	W17 755 103	2	2		2
18	W17 755 097	2	4	2	4
19	W17 749 075	2	3		2
20	W17 750 069	2	3		2
Total		41	31	10	51

Table 9.5.2 Monitoring data for whoio in the Upper Tauranga River, Te Urewera Mainland Island, 2005/06

Territory number	Grid reference	Number adults	Number juveniles produced	Number juveniles fledged	Number of surviving whoio
1	W17 691 992	2	5	3	5
2	W17 703 970	2	4	4	6
3	W17 708 966	2			2
4	W17 706 956	2			2
5	W17 704 940	2			2
6	W17 704 943	2			2
7	W17 703 935	2			2
8	W17 706 928	2			2
Total		18	9	7	23

Bands	Date seen	Date banded	Banding location	River/stream & catchment found	Grid reference	Dispersal distance
3 banded birds	2/02/2002			Otapukawa / Waimana	W17 724 023	11km
M-BG	12/04/2002	19/12/2001	Upper forks	Waiata / Waioeka	W16 826 197	14.3km
RG-M	31/01/2003	2/02/2001	Whakapirau	Otapukawa / Waimana	W17 715 047	8km
YM-G	17/01/2003	16/12/2002	Waipapa	Ogilvies / Waimana	W16 703 163	9.6km
YM-G	13/12/2003	16/12/2002	Waipapa	Ogilvies / Waimana	W16 704 129	2.5km
RM-W	24/01/2003	13/11/2001	Te Pona	Tauranga / Waimana	W17 699 094	4.3km
M-WY	2/02/2003	13/11/2001	Te Pona	Tauranga / Waimana	W17 691 025	11km
M-WY	7/03/2003	13/11/2001	Te Pona	Tauranga (Tauwharemanuka)/ Waimana	W17 691 025	11km
M-WY	13/10/2003	13/11/2001	Te Pona	Tauranga (Tauwharemanuka)/ Waimana	W17 696 049	8.5km
W-GM	24/02/2003	3/12/2002	Waiohinekahā	Tauranga / Waimana	W17 688 016	8.7km
GB-M	24/02/2003	28/11/2001	Kouanui	Makakoere / Waioeka	W17 793 920	20km
1 banded bird	6/03/2003			Tauranga / Waimana	W17 697 159	2.8km
3 banded birds	6/03/2003			Waimana (concrete bridge)/ Waimana	W16 688 223	8km
RM-W	6/03/2003	13/11/2001	Te Pona	Tauranga (Lions Hut) / Waimana	W17 702 091	4.5km
W-BM	7/03/2003	21/12/2001	Waipapa	Tauranga (Ox Bow) / Waimana	W17 693 028	11.6km
W-RM	8/03/2003	17/12/2002		Kahunui / Waioeka	W17 834 014	11.3km
M-W?	26/03/2003		(Te Pona?)	Waikokopu / Rangitikei	W16 507 222	20.5km
R-GM	3/04/2003	3/12/2002	Waiohinekahā	Te Waititi / Waimana	W16 749 124	4.5km
RW-RM	15/06/2003	15/01/2003	Totaras	Whakatane / Whakatane	W16 609 140	15.2km
YM-YR?	31/05/2003	15/1/03?	Kouanui	Pohatuatua / Waimana	W16 708 101	4.5km
WM-B	11/12/2003	4/02/2003	Te Pona	Orouamanui	W16 696 155	3km
WM-B	23/01/2004	4/02/2003	Te Pona	Orouamanui	W16 696 155	3km
M-WR	21/07/2004	2/02/2002	Totara	Tauranga On the Road, (Rifle Range)	W17 700 105	5.5km
RM-W	14/10/2004	13/11/2001	Te Pona	Tauranga (Below Lions)	W17 702 090	3.7km
YM-W	15/10/2004	16/12/2002	Waipapa	Tauranga (Hydro)	W17 707 948	18.8km
WM-B	18/10/2004	4/02/2003	Te Pona	Tauranga (Above 9 mile)	W16 703 134	2.5km
W-RM	18/10/2004	17/12/2002	Kouanui	Tauranga (Above 9 mile)	W16 703 134	6.5km
YM-B	13/12/2003	16/12/2002	Manuka	Tauranga (Ogilvies)	W16 704 127	3.8km
BM-WR	2/12/2004	15/01/2003	Whakapirau	Tauranga (Rifle Range)	W16 697 106	5.9km
1 banded bird	20/01/2005			Waimana (concrete bridge)	W16 687 221	8km
Unsure	20/06/2006	-	Te Waititi	Te U / Waimana	W16 777 147	3.5km