Northern Te Urewera Ecosystem Restoration Project

Annual Report
July 2002 - June 2003

East Coast Hawke's Bay Conservancy

Department of Conservation
Te Papa Atawhai

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Large whio (blue duck) brood in Te Waiiti Stream, Northern Te Urewera National Park.
Photo: Rhys Burns/DOC.

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NTUERP Annual Summary 2002/2003

HIGLIGHTS AND KEY LEARNINGS

Pest Management

- Ground control successfully reduced possum numbers to <5% RTC over 13500 ha; however the project can no longer absorb the increasing costs of control in order to achieve future result targets.
- Major extensions have been made to the rat trapping regime at Waikokopu Core Area in response to a static number of kokako pairs at this site.
- A new A-line Core Area has been initiated at Pakoakoa (southern Waimana Valley), which will be completed next season. This will be the fifth Core Area within NTUERP.
- Wire tunnels proved superior to both wooden tunnels and buried tunnels at trapping stoats in a trial undertaken at Otamatuna.

Outcome Monitoring

- 50% kokako nesting success at Otamatuna despite relatively high rat tracking index.
- 50% kiwi chick survival to 1000 g in the 4000 ha stoat trapping area at Otamatuna/Mangaone.
- Several monitored adult kiwi found dead this season with some confirmed as being killed by dogs, the first season this has occurred in NTUERP.
- Large decline in the kiwi call count rate at Otamatuna/Mangaone, from 4.77 calls/hour in August 2001 to 2.58 calls/hour in May 2003.
- A minimum of 45 from 47 (96%) of whio chicks fledged in the stoat trapped Te Waiiti Stream, and 18 of 19 (95%) in the non-treatment Tauranga River.
- Banded whio fledglings were found dispersed up to 20 km from their natal territory in other catchments, and one is known to have successfully bred.
- Pirirangi (red mistletoe) baseline monitoring populations established in new Pakoakoa Core Area and Background Area at Oruamananui.
- Stable kamahi canopy cover at all sites measured in Core Areas and 5% RTC Back ground Area; a decline in canopy cover observed at non-treatment Okopeka.
- Deer control at Otamatuna is currently sufficient to increase palatable seedling density.
- Onepu non-treatment deer area also has an increasing palatable seedling density; this may be linked to intensive aerial deer recovery in recent seasons, and these gains may be jeopardised if this form of control declines.
- The experimental seedling/pellet transect measurements appear to be providing consistent results that reflect general observations of seedling understorey condition.
- Hochstetter's frog (*Leiopelma hochstetteri*) found within the boundaries of NTUERP for the first time, 15 km west of the nearest known population.
- The first confirmed population of the root parasite *Dactylanthus taylorii* found within NTUERP, 20 km east and 20 km north of the nearest known populations.
- Raukumara tusked weta (*Motuweta riparia*) found at Otamatuna for the first time.

List of Abbreviations/Acronyms

DBH	Diameter at Breast Height
DOC	Department of Conservation
EBOP	Environment Bay of Plenty
EEF	Environmental Enhancement Fund
FBI	Foliar Browse Index
GPS	Global Positioning System
GSP	German short-haired pointer
ha	hectare
NPCA	National Possum Control Authority
NTUERP	Northern Te Urewera Ecosystem Restoration Project
NZFS	New Zealand Forest Service
RTC	Residual Trap Catch
STAG	Stoat Technical Advisory Group
Tb	Tuberculosis

CONTENTS

1.0 Introduction

This Annual Reference Report describes in detail all work undertaken by the Northern Te Urewera Ecosystem Restoration Project (NTUERP) from 1 July 2002 to 30 June 2003. The report is designed primarily as a reference document for the work in this period.

This was the seventh year of the NTUERP "Mainland Island" concept, with aims of restoring ecosystem processes to 50,000 ha of tawa/broadleaf/podocarp forest in northern Te Urewera National Park. The Background Area possum control has continued with ground trapping, and the four Core Areas have continued to be subjected to more intensive multi-pest control. A new Core Area (Pakoakoa) was initiated in February 2003 thanks to funding from Environment Bay of Plenty's Environmental Enhancement Fund. This will be completed in the 2003/2004 year.

2.0 Core Area Concept

The Core Area concept is the major experimental landscape-scale ecosystem restoration technique developed by NTUERP. This technique is dependent upon two differing types of control: possum-only control in the "Background Area" to 5% Residual Trap Catch (RTC); and "Core Areas" dispersed over the 50,000 ha landscape in areas of high biodiversity, where more intensive multi-pest control is undertaken.

The Background Area has possum control undertaken by ground-based contractors using traps and cyanide poison in approximate 300 ha sized blocks (Section 3.1). Each block must be reduced to 5% RTC before final payments are made to the contractor. Each block is controlled on a rotational basis, the next treatment being in accordance with a joint experimental undertaking with Landcare Research. This experiment is examining the most efficient re-treatment method: either on a set timeframe (2 or 4 years); on a series of percentage RTC pre-treatment figures (10% or 25%); or on a scale of FBI monitoring data (canopy condition measured to be deteriorating).

The Core Areas have again undergone a further year of treatment, almost all using similar treatments to the previous year. However, there has been one major change: the Waikokopu Core Area has undergone a significant expansion (Section 3.1 and 3.2), due to the very low number of kokako pairs that are now found there despite intensive pest control since 1999/2000. Rat trapping was extended at this area from 5 km to 8 km of ridgeline, and a "B-line" of rat trapping was added to one side of the ridge in this Core Area.

A new Core Area, Pakoakoa, south of the current Onepu Core Area was initiated in autumn 2003, along 5km of ridge-line. This area supports the most southern viable population of kokako remaining in Te Urewera National Park.

Table 2.1 outlines the various pest control and outcome monitoring undertaken at each Core Area, the Non-treatment Area and the Background Area during the 2002/2003 season.

Table 2.1 Management of NTUERP - 2002-2003

	Otamatuna	Mangaone	Onepu	Waikokopu	Pakoakoa	Okopeka	Oruamananui	Background Area
Management Regime	ABC-line	A-line	A-line	A(B)-line	A-line	Non-treatment	Background Reference	Background Area
Pest Control								
Possums	✓	✓	✓	✓	✓[a]		✓[b]	✓
Rats	✓	✓	✓	✓				
Stoats	✓	✓		✓[c]				
Deer/pigs	✓							✓
Pest Monitoring								
Possums [d]	✓	✓	✓	✓		✓	✓	✓
Rats	✓	✓	✓	✓			✓	
Stoats	✓	✓						
Deer & pigs	✓							
Outcome Monitoring								
Kokako	✓	✓[e]	✓[e]	✓	✓[f]		✓[g]	✓[e]
Kiwi	✓	✓						
Whio	✓	✓						✓[h]
5-minute bird counts	✓[i]		✓[g]					✓
Mistletoe					✓		✓	
Northern rata	✓[i]							
Canopy condition	✓							✓
Understorey	✓		✓					

[a] *same control as Background Area this season*
[b] *2-year rotational control of possums – last performed in 2001/02.*
[c] *limited trapping - only 20 double-set Fenn trap tunnels along main ridge at 300m intervals*
[d] *RTC monitoring not undertaken every year in each Core Area*
[e] *part of dispersal study from Otamatuna*
[f] *pre-treatment monitoring this season, incorporated as part of kokako dispersal study*
[g] *last performed in 2001/02*
[h] *Tauranga River (non-treatment site) and dispersal study*
[i] *last performed in 2000/01*

3.0 Pest Control

3.1 POSSUMS

Lindsay Wilson - Department of Conservation, Opotiki Area Office.

3.1.1 Introduction

Possum control has been undertaken by the Department of Conservation in the northern part of the Te Urewera National Park since 1992. Ground control using performance based contractors has been the major control method; these contractors primarily use leg-hold traps in conjunction with cyanide poison as paste or pellets. One aerial 1080 operation was carried out in 1997 as an initial knockdown in the Southern Ikawhenua area. 'Core Areas' have been managed using toxins placed in bait stations. Toxins previously used in these areas have included brodifacoum, pindone, cholecalciferol and cyanide. Since 2000 cyanide has been the only toxin in use.

The vegetation within NTUERP is mainly lowland forest, predominantly tawa/tawhero (kamahi) forest with emergent rimu and northern rata. The forest includes semi-coastal components such as kohekohe and nikau to the north with red beech more prominent on ridges to the south. The altitude in the northern Te Urewera ranges from 150 meters in the valley floors to more than 1000 meters on the ridges. The climate of the northern-most fringes is generally mild and humid, with around 2000-2200 hours of sunshine per annum, and the area experiences warm summers and mild winters. The bulk of the northern Te Urewera is less sunny, with cooler winters, frequent ground frosts, and rainfall averaging 2000-2400 mm per annum. Snow falls a few times a year on the higher ridges. Severe rain storms occur once every few years.

3.1.2 Objective

To reduce possum numbers to d" 5% RTC for the 2002-2003 year over the described area.

3.1.3 Methods

A total area of 18,488 ha was treated for possums this season. Of this, 13588 ha occurred in the Background Area (Appendix 3.1.1): Northern Ikawhenua (4523 ha); Central Ikawhenua (214 ha); Northern Waimana (5209 ha); and Southern Whakatane (3642 ha). Another 4569 ha was controlled within the more intensively managed multi-pest control Core Areas of Otamatuna/Mangaone (4013 ha), Onepu (179 ha) and Waikokopu (377 ha).

Within the Background Area, contractors were employed on performance-based contracts. Contract blocks were kept small (approximately 300 ha) and where possible contractors were allocated clusters of three to four adjoining blocks. The main control method was trapping using Victor No. 1 leg-hold traps set against the base of a tree, or above ground level where kiwi populations are present. While trapping was the predominant method, cyanide poison, either as a paste (60% sodium cyanide) or encapsulated 'Feratox'

(80% potassium cyanide, encapsulated and coated with cereal) was also used. These toxins were set either in a bait station or laid on the ground, except where a kiwi population exists (baits must then be in a container or 700 mm above ground). Cyanide was applied by approved operators (DOC staff or contractors employed by DOC). Pre-feeding with non-toxic bait (flour, cereal pellets or maize) sometimes preceded toxin application. Within Core Areas, contractors were employed on a prescriptive basis and the existing bait station grid (150 m x 100 m) was utilised in addition to the above methods. Two applications consisting of two 'Feratox' pellets mixed in with a handful of 'Ferafeed' pre-feed pellets per bait station were carried out during the year. Additional applications of 'Feratox' in bait stations and bags were made at sites in response to sign observed. At Waikokopu Core Area, a more intensive possum trapping operation was initiated. Bait stations were installed along ridge lines and along new perimeter lines and were filled with prefeed and Feratox tablets (encapsulated cyanide), and bagged feratox was also distributed along all of the other lines.

Kibbled maize at Otamatuna; long-life cyanide bait may have been implicated in death of a juvenile kiwi (Section 4.2).

The NPCA trap catch protocol is designed for large operational areas, not small blocks under 500 ha that are used in NTUERP. Five lines of 10 traps were used to monitor each block (approximately 300 hectare average size). This is less than the recommended minimum of 10 lines per block, but the subsequent total number of lines in each operational area is much larger than the recommended minimum giving 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.

Monitoring lines are allowed to be located right up to the boundary of contract blocks, not the 200m minimum specified in the protocol. This variation was necessitated by the small block size, a 200m buffer would exclude a large portion of the block, including in many instances prime possum habitat along ridges. It is a common practice to use magnetic north as the standard trap line bearing. This can result in tactical control by contractors, especially where block shapes preclude a monitoring line being able to fit in some parts of the block. To avoid this, a random bearing is used for the monitoring lines within each contract block (this is allowed for in the protocol but seldom occurs).

3.1.4 Results

An average residual trap-catch of 3.45% was achieved over the Background Area this season (Table 3.1.1). Pre-control possum densities ranged from 14 to 33%, estimated on the basis of limited sampling. A total of 21,115 possums were reported killed by contractors within these areas.

Monitoring was undertaken within the Otamatuna Core Area and the surrounding Otamatuna Buffer area. A 5.7% RTC index was recorded within both areas. At Otamatuna all bait station lines were poisoned with 'Feratox' cyanide at the beginning of October, then again in March. The buffer area surrounding Mangaone Core Area received an intensive poisoning and trapping effort from November to February and a total of 432 possums were removed. Onepu Core Area was treated with 'Feratox' in bait stations in response to rat tunnel interference throughout the year, but no formal monitoring was undertaken.

Waikokopu Core Area and the adjoining buffer area was poisoned with 'Feratox' and main ridges trapped, with approximately 800 possums recorded killed. No RTC monitoring was undertaken within this site this year. Operational area summaries and associated statistics are detailed in Appendix 3.1.2.

Table 3.1.1 Possum RTC Results of Treatment Areas within NTUERP from 1996/97 to 2002/03.

	1996/ 1997	1997/ 1998	1998/ 1999	1999/ 2000	2000/ 2001	2001/ 2002	2002/ 2003
BACKGROUND AREA							
Northern Ikawhenua		3.6			2.38		3.23
Central Ikawhenua					2		5.4
Southern Ikawhenua		0.8					
Northern Whakatane	9.5	4.4		3.07		2.77	
Southern Whakatane	5.9	3.2		2.86		3.6	3.08
Northern Waimana	10.8		3.85				3.86
Central Waimana	15.6		2.79			4.08	
Southern Waimana		9.4				4.19	
CORE AREAS							
Otamatuna Buffer	25	2.2			5.9		5.7
Otamatuna Core Area	2	0.7		1.7			5.7
Mangaone Core Area			1.7				2.8
Onepu Core Area		1.45		6.1			
Waikokopu Core Area							

3.1.5 Discussion

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

While steadily increasing costs have been partially offset by the reduced possum densities being managed, the current funding level is insufficient to sustain the previous intensity of control over the management area. This has serious implications for the Conservancy's commitment to the Adaptive Management Programme (Parkes & Choquenot, 1999) and the objectives of NTUERP. Techniques to reduce control costs are constantly being investigated. The move towards an open competitive tendering process, scheduled to commence in the 2003/2004 season may affect the cost per hectare. An increase in funding levels is likely to be required to meet the desired conservation objectives. A proposal is being developed for application to the Biodiversity Strategic Fund for top-up funding next season.

The mechanics of future management of possums within the northern part of Te Urewera National Park has been determined in the medium term by the regimes specified in Parkes & Choquenot (1999). As part of this national experiment East Coast Hawke's Bay Conservancy is committed to managing possum densities over a large portion of the management area in accordance with a variety of triggers (RTC thresholds, temporal, asset condition),

Core Areas will continue to have ongoing intensive multi pest management to achieve the desired conservation outcomes. Possums are to be maintained at less than 5% RTC within these areas.

With reduced possum densities over much of the operational area, it may be timely to investigate the cost/benefit of managing areas continuously at a reduced possum density (as occurs within core areas already) rather than the current pulsed regime used in the background control areas. Contractors could be given longer term contracts (2-3 year) to maintain possum densities below a given density, this approach is being adopted by the Animal Health Board in some Tb control areas. There would be obvious advantages in retaining contractors (an increasingly difficult problem), reduced contractor management requirements and could be expected to have improved conservation outcome. The cost differential needs investigation.

3.1.6 General Recommendations

Possum contractors using ground control techniques in NTUERP are operating with consistent success in remote conditions in the largest remaining forest tract in the North Island. These operations are low risk financially (performance-based), operationally (minimum non-target effects, proven and reliable technique) and socially. DOC possum control operations have the potential to generate opposition from the general public. This maintenance control operation employs local people using traps and cyanide, and has engendered good support from the local community.

The current approach to possum control is highly successful and should be continued. The progression to fully open tendering is likely to affect costs and may impact on retention of experienced contractors. Current preferred contractors must be assisted through this transition.

Result monitoring is a large cost and the opportunity exists to reduce this cost with larger block sizes. There is however a greater risk of contractors failing associated with larger block sizes and the costs (to the contractor) of reworking large blocks can be punitive. The prospect of contracting out larger blocks, possibly as longer term contracts sustaining possums at determined densities should be investigated.

3.1.7 Acknowledgements

Thanks to all the ground-based possum hunters: Colin Cartwright; Gary Peratiaki; Allan Foster; Glenn Craddock; Jon Williams; Lyn Thyne; Marina Geary; Pete Livingstone; Gary Thyne; KLM Holdings; Ben Black; Sonny Biddle; Chris Titoko; Joseph Rako; Robert Black; Micheal Thrupp and Walter Kilgour; contractors undertaking post-control RTC monitoring: Total Backcountry Solutions Ltd.; Daniel Baigent; Alan Harms; and helicopter support: Faram Helicopters, Gisborne; Central Helicopters, Opotiki. Also Shane Gebert, Pete Livingstone and Michelle Gutsell, DOC Opotiki, for contract and data management.

3.2 RATS

Lindsay Wilson - Department of Conservation, Opotiki Area Office.

3.2.1 Introduction

The ship rat (*Rattus rattus*) has been identified as a major threat to the native ecosystem of northern Te Urewera (Beaven *et al.*, 1999). In previous seasons, poisons such as Talon (brodifacoum anticoagulant toxin; used in 1996/1997 and 1997/1998 at Otamatuna) and Pindone (used in 1998/1999 and 1999/2000 at Otamatuna) have been utilised in rodent control operations over the 3-month bird breeding season from late spring, with mixed results being achieved. However more socially and economically viable methods have been sought in recent years that have led to the implementation of a trapping-only methodology.

This method of rodent control had been successfully implemented in smaller area (200-300 ha) with target results of 5% rat tracking index being achieved. The same method was used in the much larger Otamatuna Core Area (557 hectares) in October 2000 and again targets of below 5% rat tracking index were reached for the 2000/2001 season (Wilson, 2001). This tracking index was also achieved at Mangaone, Onepu and Waikokopu during 2001/2002, however the target tracking index at Otamatuna was not achieved, and some possible reasons for this are outlined in Wilson, 2002.

Rat trapping was again undertaken at four Core Areas during 2002/2003: Otamatuna; Mangaone; Onepu; and Waikokopu Core Areas. Rat monitoring occurred within the four Core Areas and at Oruamananui, a non-treatment site within the Background Area of possum control.

3.2.2 Objectives

To reduce and maintain rat tracking indices to less than 5% year-round in all four Core Areas.

3.2.3 Methods

Otamatuna (557 hectares)

2279 "Victor professional" traps were housed within coreflute plastic tunnels with one trap per tunnel and a single entry point. The distance between ridge, A, B and C- lines is approximately 150m between each line. Sets had been placed 50m apart on ridge, A, and B lines. Sets on the C-line (boundary line) have been placed at 25m intervals to prevent reinvasion into the Core Area (Appendix. 3.2.1). These intervals were decided upon after observing a number of successful rat control operations and opting for what was seen as an efficient compromise. Rat territory research as reported by Innes (1999), found that ship rat's held a territory that extended for approximately 50m and rarely exceeded 100m in the forest environment. Therefore 25m placements were deemed an adequate barrier to reinvasion and the 50m trap placements within this boundary line would be sufficient to remove rats remaining inside the Core Area boundaries.

The high rat indices recorded in 2001/2002 prompted the addition of a trap between every existing trap on the B-lines, giving a trap spacing of 25 metres on both B and C lines. Traps were covered with a white 'coreflute' cover as previously. These additional traps were set up prior to regular trapping commencing for the 2002/2003 year. Trapping in the 2002/2003 year began with the first check on 15/08/02, and a further eight checks were completed over the next five weeks, daily initially and then at up to four day intervals. These frequent checks were undertaken to reduce the population to a lower level prior to the commencement of the regular monthly rounds. From 2 October 2002, trap were checked at least monthly. Traps were originally baited with peanut butter or beef fat, then white chocolate due to its persistence in extreme weather conditions. At present all traps are being baited with both white chocolate and peanut butter. To monitor rat density, a rat tracking index was obtained using five random lines with 10 run-through tunnels on each line (Appendix 3.2.2). Monitoring was carried out using peanut butter in July, August, September, October and December 2002, and April 2003.

Mangaone (232 hectares)

1032 'Victor professional traps" were housed within plastic coreflute tunnels with one trap per tunnel and a single entry point. Sets were placed 25m apart on both ridgelines and A-lines (Appendix 3.2.1). A-lines and ridgelines remain at approximately 150m apart over the entire Core Area. Trapping commenced on the 30 July 2002 and has continued on a year-round basis since this time. Clearance intervals have been maintained at 4 weeks. Traps were normally baited with white chocolate due to its persistence in wet or humid summer conditions. Periodically peanut butter was used, either with or without chocolate.

<u>Monitoring Rat Density</u>

To monitor rat density, rat tracking index results were measured utilising 10 random lines with five run-through tunnels on each line, giving a total of fifty tunnels (Appendix 3.2.2). This season monitoring was undertaken in July and September 2002, and April 2003.

Onepu (179 hectares)

1079 "'Victor professional traps" were housed within plastic core flute tunnels with one trap per tunnel and a single entry point. Sets were placed 25m apart on both ridgelines and A-lines (Appendix 3.2.3). A-lines and ridgelines remain at approximately 150m apart over the entire Core Area. Trapping commenced on the 2002 and has continued on a year round basis since this time. Clearance intervals were maintained at approximately 4 weeks. Traps were normally baited with white chocolate due to its persistence in wet or humid summer conditions. Periodically, peanut butter was used, either with or without chocolate.

Monitoring Rat Density

To monitor rat density, rat tracking index results were measured utilising 10 random lines with five run-through tunnels on each line, giving a total of fifty tunnels (Appendix 3.2.3). This season (2002/2003) monitoring was undertaken in November 2002 and April 2003.

Waikokopu (377 hectares)

926 "Victor professional traps" housed within plastic core flute tunnels with one trap per tunnel and a single entry point were set out in 1999. The controlled area was extended from being approximately 200 hectares to 377 hectares in September 2002 with the addition of a B line in the south west and a further 4.5 km of ridgeline with associated A-line to the west. This increased the total number of traps to 1715. Traps in the new sites were placed on the sides of trees at breast height. Sets were placed 25m apart on both ridgelines and A-lines (Appendix 3.2.4). A-lines and ridgelines remain at approximately 150m apart over the entire core area. Trapping this season commenced on 2 August 2002, with clearance intervals of approximately 4 weeks. Traps were normally baited with white chocolate due to its persistence in wet or humid summer conditions. Periodically peanut butter was used, either with or without chocolate.

Monitoring Rat Density

To monitor rat density, rat tracking index results were measured utilising 10 random lines with five run-through tunnels on each line, giving a total of fifty tunnels (Appendix 3.2.4). This season monitoring was undertaken in December 2002.

3.2.4 Results

Otamatuna

A total of 4122 rats were caught during the 19 rounds of trap checking in 2002-2003 (Appendix 3.2.5). Additional detailed data is in 'Otamatuna Rat Summary 2002-2003', DME; WGNHO-151821.

Mangaone

A total of 1059 rats were caught during the 10 rounds of trap checking in 2002-2003 (appendix 3.2.6). Additional detailed data is in 'Mangaone Rat Trapping Summary 2002-2003', DME; WGNHO-151818.

Onepu

A total of 355 rats were caught during the 8 rounds of trap checking in 2002-2003 (Appendix 3.2.7). Additional detailed data is in 'Mangaone Rat Trapping Summary 2002-2003', DME; WGNHO-151818.

Waikokopu

A total of 355 rats were caught during the 8 rounds of trap checking in 2002-2003 (Appendix 3.2.8). Additional detailed data is in 'Mangaone Rat Trapping Summary 2002-2003', DME; WGNHO-151818.

3.2.5 Discussion

Otamatuna

High rat numbers were present throughout the 2002/2003 year and even after nine checks in close succession catch numbers remained high. These high capture rates were reflected in the monitoring data. It was not until December that lower monitoring results were achieved (10%) and the target of less than 5% was not achieved until April 2003 (4%). It is important that the flexibility exists to increase trap clearance frequency in response to high rat numbers being present. Rat numbers per clearance are provide in Appendix 3.2.5.

Mouse tracking indices remained at less than 15% tracking index, however a total of 1008 mice were caught. Other non-target captures included 4 stoats and 15 birds. The number of birds captured, while being probably insignificant at a population level, is none the less cause for concern. The new tunnel design adopted has a smaller, round entrance hole, 50 mm in diameter, and this design may minimise future bird captures.

Mangaone

Rat tracking indices were relatively high at Mangaone this season ranging from 20-26% during the kokako breeding season, with a total of 1113 rats caught. Mouse indices were between 18-56% with 170 recorded captured in the traps. Animals caught per round are provided in Appendix 3.2.6.

Onepu

Rat tracking indices ranged between 4% and 14% in the 2002-2003 year and the total number of rats caught was only 355, compared with a high of 3018 in 1999/2000. Mouse tracking indices were high (40-50%), and 427 mice were recorded in the traps. The number of mice reported is likely to be an underestimate as many mouse carcasses are degraded or scavenged beyond recognition when cleared and re-baited the following month. The non-target captures consisted of seven stoats, and no bird captures were recorded.

Trapping data is provided in Appendix 3.2.7.

Waikokopu

There were high numbers of rats caught within both Otamatuna and Mangaone Core Areas, and it is possible this may be a result of the intense stoat control present within and around these areas and/or the ample food resources resulting from the history of possum and rat control. Overall, there were 7189 rats caught by rat traps at all four Core Areas this season. In addition, 1674 mice and 16 stoats were caught by rat traps in three Core Ares (only rat captures were recorded at Waikokopu Core Area).

While tracking indices were higher than the 5% tracking index target at Otamatuna and Mangaone, rat numbers overall were suppressed sufficiently to permit a good level of kokako nesting success within those areas being monitored (Section 4.1). It seems that rat indices of higher than 5% may be acceptable for successful kokako nesting success in areas with low possum and stoat densities. Not withstanding this, improvements in trapping strategies are needed to cope with high rat populations. Possible improvements include: increased frequency of rat trap checking; greater consistency of rat trap check intervals; a longer life bait; more targeted increase in trap checking (e.g. check perimeter lines more frequently than internal lines); and a process in place to respond to increasing numbers of rats caught or monitored with appropriate changes in technique.

Trapping data is provided in Appendix 3.2.8.

3.2.6 Acknowledgements

This season's rat trappers: Dave Wilson; Ross Hurrell; Jo Rurehe; Total Backcountry Solutions Ltd.

Those involved in increasing the density of traps on the B-line at Otamatuna and undertaking intensive multi-round trapping at Otamatuna during August 2002: Tiki Hutching, Ross Hurrell, Dave Thonig, Daniel Baigent, (contractors); Jane Haxton, Rhys Burns, Andy Glaser, Mike Paviour, Michelle Gutsell, Lester Bridson and Pete Livingstone (DOC, Opotiki); Mike Thorsen and John Lucas (DOC, Gisborne).

Also: Grant Jones, DOC Opotiki for organising and extending the rat trapping regime at Waikokopu Core Area; Shane Gebert and Michelle Gutsell for contractor management.

3.3 STOATS

Rhys Burns - Department of Conservation, Opotiki Area Office.

3.3.1 Introduction

Stoats (*Mustela erminea*) alongside weasels (*Mustela nivalis vulgaris*) and ferrets (*Mustela furo*) were introduced into New Zealand to control rabbit infestations on farming properties in the late 19th century. Since then, they have been implicated in the extinction of a variety of naïve native bird and reptile species, and remain a constant threat to many species that still survive on the mainland. The most stoat-vulnerable bird species remaining in NTUERP is the North Island brown kiwi, and kiwi chick survivorship is used as an indicator of the effectiveness of stoat control (Section 4.2). Stoat trapping has been undertaken since August 1996 at NTUERP, increasing from an initial 1100 ha to 4000 ha by 2001/02.

3.3.2 Methods

Stoat control is performed over 4000 ha by trapping using two No. 6 Fenn traps set within a 13 mm square wire weld-mesh tunnel, with each tunnel having a sheet of clear plastic secured over it. Tunnels are laid out at 150m intervals (hip-chained) on trapping lines that are stationed along ridges, spurs and watercourses (Appendix 3.3.1). This season there were 819 tunnel sites in the stoat trapping operation at Otamatuna/Mangaone.

Tunnels were all lured with white hen eggs this season, although brown eggs were sometimes used when white eggs were difficult to obtain. EBOP and Forest and Bird are continuing to fund part of the stoat trapping in NTUERP, servicing 256 tunnel sites.

Another stoat trapping trial was initiated by NTUERP this season, with funding coming from DOC's STAG (Stoat Technical Advisory Group) group. This trial compared three different tunnel designs (wire weld-mesh, wood and buried coreflute), to determine which design was most effective at catching stoats. 150 different sites, each containing all three of the tunnel designs were installed at the sites of greatest historical stoat capture rates at Otamatuna/Mangaone (Appendix 3.3.2). This was done to maximise the number of stoats caught per trap, to increase the sample size of stoats, as funding was not sufficient to undertake this experiment throughout the 4000 ha trapping area. All tunnels were run-through tunnels, each containing two No. 6 Fenn traps. The wire and wooden tunnels were of similar dimensions, but the buried tunnel was shorter due to no baffles used on this tunnel type. The area in which the traps were placed were the same dimensions as the other two tunnels, however. None of the tunnels had a base – all traps were placed directly on the ground. This is a departure from the usual wooden stoat tunnels which have a wooden floor; however by constructing the tunnels in this way a direct comparison between the type of tunnel cover itself could be made. The buried coreflute tunnel is a unique design, and was covered with a piece of wooden plyboard, anchored in place with pegs to act as a roof of the buried tunnel, and often covered with soil.

Traps were checked in July and September and then every 2 weeks from October to April, with the white-coloured egg lures replaced every 6 weeks. The EBOP-funded area continued to be checked every 2 weeks throughout the year. All stoats trapped were recorded and retained for age and sex analysis, which is still being completed.

Some stoat traps (20 double-set Fenn traps in wire weld-mesh tunnels) were also added to Waikokopu Core Area this season for the first time, in response to decreasing kokako pair numbers (Section 4.1).

3.3.3 Results

Approximately 260 stoats were caught this season by the Fenn trapping regime, which is consistent with previous years trapping over 4000 ha.

The trapping trial has not been fully analysed, but preliminary results are given in Table

Table 3.3.1 Results of stoat 3-tunnel trapping trial, Otamatuna/Mangaone, 2002/03.

	Wire tunnel	Wooden tunnel	Buried tunnel	TOTAL
No. stoats caught	29	11	10	50

Chi-square analysis shows that the wire tunnel caught significantly more stoats than the other two tunnel types, $c^2 = 13.720$; $c^2_{0.005, 2} = 10.597$, $0.001 < P < 0.005$.

3.3.4 Discussion

In comparison with previous years, a similar number of stoats were caught. Analysis of the distribution of the stoat captures has not yet been attempted, but anecdotally it appears that a higher proportion of stoats are caught per trap near the edge of the 4000 ha stoat trapping area than towards the middle of the block. This could indicate that there is a relatively low stoat density in the centre of the block, and kiwi juvenile survivorship (Section 4.2) is used as the outcome monitoring tool to indicate the relative success of the stoat trapping operation.

The statistically significant finding that wire tunnels are preferred by stoats compared to wooden tunnels and buried coreflute tunnels is justification for the continued use of these tunnel types at NTUERP. There is much debate nationally as to which tunnel design is the most effective, and this experiment both contradicts and supports previous experiments which have attempted to address this crucial management question. Fifty stoats were caught during the experiment, but ideally the experiment would have been run for longer over several seasons. However, the STAG funding secured for this season was the last of the five years in which this funding was available, and so the trial could only be run for one season.

It is envisaged that a further experiment will be performed in the future to directly compare the efficacy of the wire tunnels against the wooden tunnels. Most stoat trapping regimes throughout New Zealand use wooden tunnels to trap stoats, but this result questions the wisdom of this.

The trial supports continued trapping at Otamatuna/Mangaone using the wire weld-mesh tunnels as they have proven to be preferred by stoats to wooden or buried coreflute tunnels. Because this was only performed over one year, however, unknown environmental variables or learned behaviour may influence stoat preferences over time. Ideally this trial would be undertaken for many years and at other sites before more generalised extrapolations to other forested ecosystems can be made.

3.4 DEER AND PIG CONTROL

Lindsay Wilson - Department of Conservation, Opotiki Area Office.

3.4.1 Introduction

The Otamatuna Deer Control Project commenced in 1997/98 to complement other pest control being undertaken for ecosystem restoration within the Otamatuna study area. Red deer (*Cervus elaphus scoticus*) have been present in the Waimana area since the early 1960's (B. Tamiana, *pers. comm.*). Currently, deer numbers are considered to be at a moderate to low level within northern Te Urewera. The Otamatuna operational area consists of 2513 ha (Appendix 3.4.1). The Onepu study area (200 ha) is used as a non-treatment area for comparison, and receives background commercial and recreational hunting pressure only.

Forest structure has been modified throughout Te Urewera National Park by red deer, pigs (*Sus scrofa*), possums (*Trichosurus vulpecula*), rats (*Rattus sp.*; Wallis and James 1972) and, in some areas, rusa deer (*Cervus timorensis*). Of the deer species, only red deer are known to be present in the Otamatuna study area. Ungulates have caused major changes in this forest's shrub and small tree tier (Bockett, 1999). Those vegetative species present within the existing shrub tier are predominately of low palatability to deer and possums. The seedlings of many palatable species are currently scarce on the forest floor.

The purpose of this on-going control operation is to determine whether deer and pig populations can be reduced by conventional hunting methods to levels that enable the increased establishment and survival of palatable plant species (Section 3.6).

3.4.2 Methods

Ground hunting by contractors using indicator dogs (Labrador X whippet; German wire-haired pointer) was the only control method used this year in the Otamatuna operational area. All dogs used at this site have passed DOC training qualifications and are used to indicate the presence of nearby deer and pigs. Animals were then stalked and shot using a high-powered rifle (.243). An accurate record was kept of hours spent hunting, total number of animal encounters, and total number of animals killed. Hunting success was measured using hunting hours per kill and hunting hours per encounter.

The right lower jawbone was removed from all deer shot to be sent to Landcare Research, Christchurch, to be aged by measuring tooth dentine layers (REF). Jaw length was also measured to determine the physical condition of the deer (REF). Demographic trends for shot animals will be determined in the future, specifically to monitor any change in age structure, sex ratio or condition over time.

Meat and liver samples have been taken from most of the deer and pigs shot by staff and contractors within the Otamatuna operational area, the Onepu study area and within five kilometres of these areas. Samples were sent to Manaaki Whenua/Landcare Research, Christchurch and tested for the presence of brodifacoum residues (REF). Brodifacoum, an anticoagulant with a long biological half-life (REF), was used extensively for rat and possum control at Otamatuna for two seasons in 1996/97 and 1997/98.

Ungulate exclosure plots have been established within Otamatuna (Appendix 3.4.2). These are remeasured every 2 years, according to the protocol set out in Allen (1979).

3.4.3 Results

A total of 24 deer and 21 pigs were shot in the Otamatuna operational area this year (Table 3.4.1). This was less than in previous years, and can be partially attributed to a decrease in the hours spent hunting by contractors this season, and possibly due to a new hunter being used.

Table 3.4.1. Summary of deer and pigs killed and hunter effort per month, NTUERP, 2001/2002.

Month	Hours hunted	Deer kills	Pig kills	Additional Deer Contacts	Additional Pig Contacts
July	0	0	0	0	0
August	0	0	0	0	0
September	0	0	0	0	0
October	79	2	2	6	1
November	81	2	1	3	1
December	99	5	2	6	2
January	0	0	0	0	0
February	0	0	0	0	0
March	124	4	1	6	0
April	141	4	10	9	0
May	67	1	1	5	1
June	102	6	4	5	0
Total	**693**	**24**	**21**	**40**	**5**

In addition, another 5 deer and 1 pig were shot by staff members over this year at Otamatuna. Since recording began in 1996 a total of 378 deer and 81 pigs are known to have been shot within the operational area (Table 3.4.2).

Table 3.4.2. Summary of animal kills per hunter effort by season, Otamatuna, NTUERP.

Year	Hours hunted	Deer killed	Pigs killed	Hours/deer kill[b]	Hours/total kills
1996/1997	0	28[a]	0	n/a	n/a
1997/1998	0[c]	42	0	n/a[c]	n/a[c]
1998/1999	665	68	8	9.8	8.8
1999/2000	1241.5	93	35	13.3	9.7
2000/2001	1072	74	6	14.5	13.4
2001/2002	847	44	10	19.3	15.7
2002/2003	693	24	21	28.9	15.4
TOTAL	**4518.5**	**373**	**80**	**14.9[d]**	**11.8**
Additional kills[e]		5	1		
TOTAL		**378**	**81**		

[a] *deer killed by staff before contracted hunter employed*
[b] *pigs not included in this statistic due to perceived higher variability in abundance*
[c] *hours not recorded by contractor in 1997/1998*
[d] *mean hours required to kill each deer by contractors: (4518.5 hours / [373 - (28 + 42)] deer)*
[e] *animals killed by staff members; as this area is off-limits to recreational hunters, it is assumed no other animals were shot in this area*

Other Monitoring

Pellet counts were again performed to estimate the abundance of deer and pigs at Otamatuna (Section 4.6). Vegetation monitoring was undertaken as an outcome of the deer and pig control (Section 4.6).

3.4.4 Discussion

To assess whether intensive ground-hunting alone can reduce the ungulate population at Otamatuna to allow an increase in palatable seedling survival (Section 4.6), the continued control and monitoring of ungulates is essential. A long timeframe may be needed to determine whether the measured variation in seedling survival in different years is linked to a variation between seasons or due to the long-term control of deer and pigs in this area.

As animal numbers reduce, the hunting will become increasingly difficult. This can be seen with the trend of increasing hunter hours required per deer kill, from 9.8 in 1998/1999 to 28.9 hours per kill this season (Table 3.4.2). However, a new hunter was operating this season, and it may take some time before they get to know the area and become more efficient at locating animals. It is important that hunters are motivated and maintain a consistent hunting effort even though the kill per day rate may be declining. Ground control should continue to be the main technique employed, possibly supplemented with some aerial shooting if this is considered to be more economic, particularly if the number of hunter hours per deer kill continues to increase.

Successful long-term ungulate control at Otamatuna is expected to result in an increased biomass and species equitability of the forest shrub tier, leading to the survival of palatable canopy species. Some of these species would be abundant fruit-bearing components of the forest understorey in the absence of ungulates and important contributors to indigenous food webs and ecosystem processes.

Commercial venison recovery by aerial hunting has had a significant impact on deer numbers throughout most of NTUERP, especially in recent seasons when venison prices have been very high (about $7/kg). However, the newly imposed commercial limitations on wild animal recovery, combined with a much lower commercial price, will lead to much less commercial recovery and inevitably lead to higher deer numbers throughout NTUERP. High deer numbers around Otamatuna will lead to more deer dispersing into the area, due to the lower deer density and higher numbers of palatable understorey plants within the block. If this continues, it may be expected that both hunter hours per kill, and the density of palatable understorey plants, will stabilise.

Exclosure plots should be re-measured bi-annually and 20 x 20 metre plots should be measured at least every two years. Seedling/pellet transects should continue to be measured annually (Section 4.6).

This season, 100 hunter-days were financed for the deer and pig control operation, at a cost of $29,500.

3.4.5 Acknowledgements

Thanks to the deer and pig hunters: Wayne Looney and Zac (German wire-haired pointer); and Shane Gebert and Brooke (labrador x whippet).

4.0 Outcome Monitoring

4.1 KOKAKO

4.1.1 Introduction

Monitoring of kokako within NTUERP this season was predominantly confined to determining breeding success at the Otamatuna Core Area, a survey at Waikokopu Core Area, and a dispersal survey of kokako from the Otamatuna and Onepu Core Areas (Section 4.7).

4.1.2 Monitoring

Otamatuna

At Otamatuna this season, seven pairs of kokako were monitored for breeding success following standard methodology (Flux & Innes, 2001). Four pairs successfully fledged chicks on their first attempt with one further pair succeeding on their second attempt, giving a breeding success rate of 50%. Considering the difficulty of reducing rats to target levels at Otamatuna (Section 3.2) this was seen as a very good result.

More pairs were not monitored because the main effort was concentrated on dispersal studies in conjunction with Landcare Research (Section 4.7).

Waikokopu

Possums were last controlled by possum contractors in this area during 1997/98. This Core Area has an A-line system of rat traps (Section 3.2) that were installed during spring 1999. Contractors employed in 1999/2000 to undertake the rat trapping also continued trapping and poisoning possums during the nesting season. The contractors monitored kokako nests and observed that of the seven pairs, five attempted to nest and one pair succeeded in fledging two chicks. It appeared possum numbers in the area may have been too high to allow a high breeding success rate; the following year the contractors trapped the area and achieved a 2% RTC. Rat monitoring lines indicated the rat trapping was very effective at holding rat densities below the desired 5% tracking index, and this level of control was expected to result in an increase in the number of kokako pairs.

A kokako survey was undertaken in Waikokopu and adjacent areas during winter 2002 which also included adjacent areas in case extend the pest control area to include more kokako pairs. However, the survey indicated that the kokako population had declined to four pairs inside the managed area. Observations by rat trapping contractors and survey staff were that stoats were eating trapped rats from the tunnels and many stoat droppings were sighted on the tunnels indicating stoats were travelling along lines looking for a free food source. It is possible that stoats may have been responsible for reducing kokako pair numbers in this area. Female kokako are most at risk while sitting on nests and this risk increases with higher stoat density. Low rat numbers could also increase the chance of stoats prey switching to target birds. The state of the Ikawhenua kokako population is vulnerable and a decision was made to expand and intensify the existing managed area by adding a B-line rat trapping area to one section. Double-set stoat tunnels were also added (Section 3.2)

The four pairs of kokako were checked post-breeding and two pairs had one juvenile each with them.

4.2 NORTH ISLAND BROWN KIWI

Rhys Burns - Department of Conservation, Opotiki Area Office.

4.2.1 Introduction

North Island brown kiwi (*Apteryx mantelli*) are monitored at Otamatuna and Mangaone as an outcome measure of the stoat trapping at this site. Kiwi are very vulnerable to stoat predation in the first few months of life, but appear to be able to defend themselves more and more effectively as they approach 1000g in weight: After this weight threshold is reached there appears to be very little stoat predation on wild kiwi. Therefore, the effectiveness of the stoat trapping operation can be quantified by monitoring kiwi chick survival to 1000g.

4.2.2 Methods

Adult kiwi are targeted for capture, and when caught, have an especially designed 20g adult kiwi radio transmitter (Sirtrack Ltd., Havelock North, NZ) attached to one leg. This is achieved by threading a baby hospital band through the transmitter loop, then securing snugly to the leg and fastening with the non-release button clasp. Then plastic electrical sticking tape (Nitto) is wound on to the hospital band in several (up to 6) 20-30 cm lengths.

Adult kiwi can be caught in several ways, but the most common method employed at NTUERP is using a trained, muzzled dog to catch them at night. The current dog being used by NTUERP, “Q”, is a border collie bitch that received final full kiwi certification from DOC in February 2002. She has caught several kiwi at night, and has also found kiwi hiding in roosts during daylight hours.

Once the transmitter has been attached, kiwi can be monitored remotely for up to a year, the life of the adult transmitter battery. After this time, the kiwi must be tracked down and handled again to replace the transmitter with a new one. Adult kiwi are only handled once per year to minimise stress levels in order to monitor as closely as possible natural breeding rates. Kiwi are extremely sensitive to handling, and while they do not die of stress when handled, they may modify their behaviour as a result of handling. This is readily displayed when handling nesting males: they almost always desert their nests after being handled, particularly during the early stages of egg incubation. All adult transmitters have an in-built “mortality mode”: once the mercury switch within the transmitter senses no movement for a 24 hour period, it switches the radio pulse rate from 20 to 40 pulses per minute.

North Island brown kiwi in northern Te Urewera change roost sites after every night of feeding, but with males, this behaviour changes abruptly when they begin to incubate a nest. Kiwi are remote monitored from a number of known sites, usually within their territory, every week from July onwards. Therefore, their approximate location can be readily ascertained; when this location remains essentially the same, it can be assumed the male has started incubating eggs of a nest. North Island brown kiwi eggs have an incubation period of approximately 85 days, with up to two eggs being laid per nest. Due to the large size of the egg in relation to the female's body mass, eggs are laid approximately 3 weeks apart. Furthermore, once hatched, the male can remain with the chicks in the nest for up to 3 weeks. Therefore, a male may be expected to have the same daytime site for up to four months when nesting. Kiwi usually nest twice per season, so males may be associated with nesting for eight months of the year. Monitoring on a weekly basis is of sufficient frequency to determine when nesting behaviour commences. Approximately 75 days after nesting behaviour is first observed, the nest is carefully located by radio tracking during daylight hours. The vicinity of the nest is marked with tape tied to nearby vegetation. After approximately 85 days of incubation, checks on the nests themselves are performed at night, after the male has left to feed for a few hours. Any disturbance of the male when in the vicinity of the nest may result in abandonment of the nest, and the failure of any eggs to hatch. Any eggs or chicks are recorded, with chicks being weighed and measured. A small radio transmitter (9g; Sirtrack Ltd.) with external aerial is attached to a leg using a hospital band, much in the manner of the adult transmitter described above. However, only one piece of tape is used to wind around the hospital band 1½ times.

Chicks are tracked down every two to three weeks to monitor their progress and change their transmitter band, to accommodate the increasing girth of their leg. When weighing approximately 800g, a larger more powerful juvenile transmitter is attached, and at 1000g, an adult transmitter is attached. It is only when weighing approximately 1200-1300 g that their leg is of sufficient size for a permanent metal band containing a unique identifying number to be attached. Most kiwi in NTUERP have a "R" band attached, but some females have legs that are too large for these bands; in these cases a "RA" band is fitted.

Transponders (Allflex Ltd.) were again used this season (the second season they have been used). These small transponders (11.1 x 2.1 mm) are sterile and coated with inert glass. They contain a unique 14-digit code which can be read by the appropriate scanner when placed very close (maximum of a few cm) from the transponder. The transponders are bought from the manufacturer inside a sterile large-bore needle. The sterile needle is then attached to a "gun" to allow precision insertion of the transponder. These are inserted subcutaneously, posterior to the left wing, using ethanol swabs to sterilise the insertion point to minimise the risk of infection.

The monitoring of sub-adult kiwi from 1000g through to breeding adults is also being attempted with the kiwi chicks monitored. It is not known how far, or to what extent, North Island brown kiwi naturally disperse. After an adult transmitter is placed on a sub-adult kiwi at 1000g, it is tracked down every three to six months for band or transmitter replacement. Sub-adult kiwi are to be tracked in this manner until evidence of breeding is found. Aerial support, using helicopters or fixed-wing aircraft fitted with the appropriate radio-telemetry equipment, are used when funding allows.

Kiwi call count monitoring was undertaken at Otamatuna/Mangaone in May 2003. Six sites throughout this area with good listening coverage were surveyed for kiwi calls during the first two hours of dark for four nights each. If weather allowed, these surveys were performed on successive nights. Calls were recorded by sex, bearing and approximate distance from observer. Due to the difficulty of accurately determining the distance from kiwi calls in the rugged terrain of this area, distance was recorded as being either close (<150m), medium (150-500m), or distant (>500m). Other than this modification, all data was recorded consistent with the specifications of the national Kiwi Call Survey cards.

4.2.3 Results

Kiwi Productivity

Ten adult male kiwi were monitored for either the whole or part of the season. Of these, four were known to have incubated at least one nest (Table 4.2.1; Appendix 4.2.1).

Table 4.2.1. Monitored adult kiwi, NTUERP, 2002/2003

Transmittered adult kiwi	Male/Female (partner)	Date caught	Date tx removed	Previously bred?	Bred during 2002/2003?
NTU-21	F	30/04/1998	[a]	Yes; first attempt 2001/02	Unknown
NTU-36	M	19/02/99 & 8/11/01	[b]	No	No
NTU-44	F (NTU-90)	30/06/1999 &21/11/02		Unknown	No
NTU-54	M	8/02/2000		No	No
NTU55	F (NTU-64)		17/12/2002	Yes	Yes; mate abandoned 2 nests
NTU-61	M	1/11/2000	21/01/03a	Unknown	No
NTU-64	M (NTU-55)	9/11/2000	[a]	Yes	Yes; abandoned 2 nests
NTU-67	M	14/12/2000		Yes	Yes
NTU-68	M (NTU-	10/01/2001		Yes	No
NTU-69	M	11/01/2001		No	No
NTU-70	F	23/01/2001	[a]	Unknown	No
NTU-74	M	21/08/2001		Unknown	No
NTU-81	M	2/05/2002		Unknown	Yes
NTU-83	M	8/05/2002		Unknown	Yes
NTU-85	F	10/09/2002		Unknown	Unknown
NTU-90	M (NTU-44)	16/12/2002		Unknown	No
NTU-91	F	14/01/2003		Unknown	Unknown

[a] *found dead this season*
[b] *transmitter found fallen off this season*

Table 4.2.2. Adult male kiwi productivity and chick survivorship, NTUERP, 2002/2003.

Adult Male kiwi	No. nests	No. eggs			No. chicks	% hatching	No. chicks surviving	% chick survival
		1st clutch	2nd clutch	Total				
NTU-36	0	0	0	0	0	-	-	-
NTU-61	0	0	0	0	0	-	-	-
NTU-64	2	2	2	4	0	0[a] (0/4)	-	-
NTU-67	2	?[b]	1	1+	1	100 (1/1)	0	0 (0/1)
NTU-68	0	0	0	0	0	-	-	-
NTU-69	0	0	0	0	0	-	-	-
NTU-74	0	0	0	0	0	-	-	-
NTU-81	2	?[b]	2	2+	2	100 (2/2)	1	50 (1/2)
NTU-83	2	2	2	4	4	100 (4/4)	3	75 (3/4)
NTU-90	0	0	0	0	0	-	-	-
unknown[c]	1+	1+	?	1+	1+	? (1/?)	0	0 (0/1)
Total	**9+**	**5+**	**7**	**11+**	**8**	**66 (7/11)**	**4**	**50 (4/8)**

[a] both nests abandoned, possibly due to interference. This bird appears to have been particularly sensitive to any approach to its nest whether it was present or not.
[b] these nests were monitored and checked according to schedule of 85 days for hatching. However, when approached to check nests, male had already started incubating second nests, and no chicks could be located from these first nests. Shell remains in both nests confirmed the presence of eggs, but their fate is unknown
[c] parent male for this chick is unknown: chick was found by kiwi dog Q near Omutu Stream (Appendix 4.2.2) weighing 350g, 1-2km from any known transmittered male. It is not known how many eggs were in the clutch or the hatching percentage, so this chick is only included in chick survival statistics.

In addition, one juvenile kiwi was caught this season, weighing under 1500g (Table 4.2.3). A list of all kiwi processed by NTUERP since its inception in 1996 is in Appendix 4.2.2. The fate of all young kiwi monitored in this time is found in Appendix 4.2.3.

Table 4.2.3. Additional young kiwi captured during 2002/2003 season.

Sub-adult Kiwi	Date	Sex	Weight (g)	Bill Length (mm)
NTU-97	13/05/2003	unknown	1320	83.6

Progress of Kiwi Chicks

The major dates in the monitoring of kiwi chicks this season are given in Table 4.2.4.

Table 4.2.4. Major monitoring dates of kiwi chicks, 2002/2003.

Kiwi	Approx hatch date	Date tx'd	Transponder #	Date Juvenile tx attached (age in days)	Date Adult tx attached (age in days)	Date found dead (approx. age in days at death)
NTU-86	15/10/2002	22/10/2002	982/009100726109	8/01/2003	n/a [a]	n/a
NTU-87	30/10/2002	6/11/2002	982/009100722921	8/1/03 (70)	18/3/03 (139)	n/a
NTU-88	15/10/2002	10/11/2002	982/009100655415	n/a	n/a	16/12/02 (55)
NTU-92	18/01/2003	21/01/2003	n/a		n/a	5/3/03[b]
NTU-93	5/03/2003	12/03/2003	982/009100717200	1/05/2003		
NTU-94	10/03/2003	12/03/2003	n/a		n/a	1/5/03[c]
NTU-95	5/03/2003	12/03/2003	982/009100640397			
NTU-96	25/03/2003	2/04/2003	982/009100729998	15/05/2003		

[a] *juvenile tx battery ceased before tx changed to adult*

[b] *signal difficult to locate and in all likelihood dead for several weeks before being found*

[c] *dead in nest. Took several attempts to find – well buried under nest lining*

Autopsy of Dead Kiwi

This was the first season where dead adult birds were found – all were sent to Massey University for autopsy. DOC has only recently purchased this service, giving professional autopsy diagnoses from veterinarians. Autopsies were performed by Brent Guttrell and/or Maurice Alley, with results listed in Appendix 4.2.4.

Monitored kiwi that were found dead were collected and either sent to Massey University or retained where cause of death was evident. Table 4.2.5 lists all kiwi found dead this season, and a summary of diagnoses obtained.

Table 4.2.5. List of dead kiwi, NTUERP, 2002/2003

Kiwi	Sex	Age Class	Date recovered (approx age of carcass in days)	Last known weight (date)	Site description	Autopsy description	Intercanine spacing	Most likely cause of death
Unknown adult	M	adult			On ridge track	Systemic infection	n/a	Septicaemia following neck trauma
Unknown juvenile	?	juvenile		?	Next to bait station	Too decayed	n/a	Unknown – no kibbled maize or poison
NTU-21	F	adult	29/04/2003 -25	1890g ( )	10m from track	Pelvis & abdomen trauma		Dog predation
NTU-61	M	adult	21/01/2003 -60	2190g ( )	In small stream	None – bones only		Unknown
NTU-64	M	adult	30/04/2003	2070g ( )	Under log; almost completely buried	Puncture wounds	24 mm & 26 mm	Dog predation
NTU-70	F	adult	26/06/2003	2900g ( )	Against log in open ground near stream	Gizzard only; teeth marks (?) on transmitter tape.	n/a	Possible dog
NTU-88	unknown	juvenile	16/12/2002 -10	450g (27/11/02)	Partly in hole lined with kiwi feathers		n/a	Stoat
NTU-92	unknown	juvenile	5/03/2003 -30	350g (21/1/03)	In large root system cavity	Tx has 3 sets of small canine prints	?????	Stoat/ weasel?
NTU-94	unknown	chick	1/05/2003	330 (12/3/03)	In nest buried under leaf layer			Stoat
NTU-96	unknown	juvenile	26/06/2003			Hindquarters eaten		Cat

Sub-adult Dispersal

Surviving kiwi chicks have been continuously monitored since 1999/2000 season in an attempt to discover how far they disperse before setting up territories and breeding. This season, six sub-adults were attempted to be tracked (the four surviving chicks from this season, one survivor from 2001/2002 and one from 1999/2000 season). A table of all dispersal birds is shown in Table 4.2.6, and a map of their last known location is provided in Appendix 4.2.5.

One bird (NTU-44) that was caught weighing 600g in June 1999, and had its transmitter removed in October 1999 when weighing 950g, was caught again this year by kiwi dog Q, and appeared to be gravid. She was found near Mangaone hut, a dispersal distance of 5 km. She had been heard duet calling with a male, who was subsequently caught, but no nesting behaviour was observed from the pair this season, despite the apparent carrying of an egg.

Table 4.2.6. Dispersal of kiwi

Kiwi	First Process			Latest processing				Current status	Dispersal complete?
	Date	Weight (g)	Grid Ref	Date	Weight (g)	Grid Ref	Dispersal (km); [bearing]		
NTU-21	30/04/1998	825	731108	28/06/1999 9/12/2002	1750 1890	713108	1.8; [W]	Unknown	Yes
NTU-44	30/06/1999	600	723098	21/11/2002	n/a	742052	5.0; [SE]	Paired	Yes
NTU-51	17/10/1999	270	725113	15/03/2001	n/a	736138	2.5; [NE]	Unknown	No
NTU-54	28/02/2000	300	714093	29/08/2002	1900	764117	6.5; [NE]	Unknown	Yes
NTU-78	29/01/2002	270	734083	29/10/2002	1280	719064	2.4; [SW]	Sub-adult	No
Mean	-	**453g**	-	-	-	-	**3.64 km**		

** NTU-44: recaught on 21/11/02; was metal banded on 20/10/99 (Appendix 4.2.2) when tx was removed. For results of how kiwi were captured, see Appendix 4.2.6.*

For kiwi that have completed their dispersal, the mean distance is 4.4 km. Any kiwi that were caught weighing below 1000g can be included in this dispersal study (J. McLennan, *pers. comm.*), as North Island brown kiwi do not begin to disperse until they reach a mean weight of about 1300g. Therefore, any kiwi weighing below 1000g can safely be assumed to still be residing in or very near its parents' territory.

Adult Captures

One of the major difficulties in studying kiwi is capturing sufficient adult males to follow breeding success rates. Capturing adult kiwi is a difficult, intense process, and a variety of methods are undertaken. A list of how adult kiwi have been caught in NTUERP is given in Appendix 4.2.6.

Kiwi Call Count Survey

The mean call rate of kiwi at the six sites at Otamatuna/Mangaone (Appendix 4.2.7) was 2.58 calls/hour (Table 4.2.7).

Table 4.2.7. Call counts at Otamatuna/Mangaone, 2002/03.

Site	Initial[a]	Date	Male	Female	Total	Mean calls/hour
1	MG	26/05/2003	7	1	8	
	MG	27/05/2003	1	1	2	
	MG	28/05/2003	1	1	2	
	MG	29/05/2003	3	1	4	2
2	JH	26/05/2003	6	1	7	
	JH	27/05/2003	10	0	10	
	JH	28/05/2003	7	1	8	
	JH	29/05/2003	3	1	4	3.625
3	RB	25/05/2003	10	2	12	
	RB	26/05/2003	6	0	6	
	RB	27/05/2003	8	0	8	
	RB	28/05/2003	4	0	4	3.75
4	MP	26/05/2003	7	1	8	
	MP	27/05/2003	5	1	6	
	MP	28/05/2003	1	0	1	
	MP	29/05/2003	3	2	5	2.5
5	AG	26/05/2003	1	0	1	
	AG	27/05/2003	3	0	3	
	AG	28/05/2003	3	0	3	
	AG	29/05/2003	2	0	2	1.125
6	GJ	26/05/2003	7	2	9	
	GJ	27/05/2003	5	3	8	
	GJ	28/05/2003	1	0	1	
	GJ	29/05/2003	1	1	2	2.5
Total			**105**	**19**	**124**	**2.58**

[a] *initials as described in acknowledgements.*

4.2.4 Discussion

This is the most number of kiwi chicks that have been monitored in a single season by NTUERP since its inception in 1996, and therefore this season has provided the most reliable information on the true survivorship of kiwi chicks within the stoat trapping regime. The 50% survival rate recorded, if consistent over the area, reflects an excellent result. Assuming an 8% annual mortality rate, a 16% chick survivorship is required per year to maintain the kiwi population in the area (J. McLennan, Ref). Therefore, assuming this statistic, the kiwi population in this area can be expected to increase as a result of the chick survivorship this season.

However, two main factors may significantly alter this equation. Firstly, the dispersal distances of kiwi sub-adults in this area are largely unknown, and this urgently needs to be established. Even a low percentage of surviving kiwi sub-adults leaving the trapped area will undermine the ability of the trapping regime to increase the kiwi population and density in the area. It can reasonably be assumed that the progeny of those kiwi that disperse out of the trapped area will have a very low chance of survival, predominantly due to stoat predation. If most kiwi are dispersing out of the trapped area, and therefore having little progeny survival, it may be necessary to increase the trapped area so that a significant proportion of kiwi sub-adults disperse within the trapped area, with population modelling giving an increase of kiwi in the area. This may increase costs significantly, and so will ultimately be a management decision.

Secondly, the deaths of several monitored adult kiwi this season will significantly impact on the kiwi population in Otamatuna/Mangaone. Of the 17 monitored adult kiwi, 4 died this season. If this is a reflection of the true state of the adult mortality rate this season, the population is in a critical state. No kiwi population can afford to lose 25% of its adult population in a single year. Of the four deaths, three are known to be by predation, with dogs likely accounting for all three deaths. The issue of dogs within NTUERP and their impact on kiwi populations is a highly contentious one, but one that urgently needs to be resolved. The use of dogs for pig hunting is widespread throughout NTUERP, however no hunting is permitted in the 2510 ha Otamatuna area (Appendix 3.4.1; the area in which no dogs are permitted has very recently been expanded (DOC, 2003), to include the entire 4000 ha stoat trapping area).

Acknowledgements

Brett Gartrell, Maurice Alley (Massey University) for undertaking autopsies on dead kiwi; those involved in the kiwi call count survey: Andy Glaser (AG); Michelle Gutsell (MG); Jane Haxton (JH); Grant Jones (GY); Mike Paviour (MP).

4.3 WHIO

Andrew Glaser - Department of Conservation, Opotiki Area Office.

4.3.1 Introduction

Whio or blue duck (*Hymenolaimus malacorhynchos*) is currently classed as a "nationally endangered" species. Whio occupy an ecological niche in the upper trophic level within New Zealand riverine ecosystems and may serve as an indicator of riverine ecosystem health and completeness (Adams *et al.*, 1997). 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).

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 has been shown to be the main contributing factor in their decline (Adams 2000; Holmes 2000; Williams *et al* 2001).

The Blue Duck Recovery Group has recommended that as a minimum, there should be protection of 30 interrelated pairs in eight different regions throughout New Zealand, four in the North Island (Northern Ruahine, Northern Ruapehu, Te Urewera and the Motu Catchment) and four in the South Island (Fiordland, South Westland, Central Westland and Kahurangi). The East Coast/Hawke's Bay Conservancy is responsible for two of these regions (Te Urewera and Motu) and share responsibility in another (Northern Ruahine). The Te Waiiti Stream, located within NTUERP, is already established as one of the eight regional protected sites.

Te Waiiti Stream is within the boundaries of NTUERP (Appendix 4.3.1) 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 whio conservation and meet key objectives of the Blue Duck Recovery Plan.

NTUERP has been conducting intensive mustelid control over 1100-1300 ha in the adjacent Otamatuna study area for seven consecutive years from August 1996, an area that was increased to 2500 ha by August 2000. With the benefit of a grant from Environmental Bay of Plenty's Environmental Enhancement Fund, the trapping area was again increased from August 2001 to control stoats along an additional eight kilometres of Te Waiiti Stream and the Mangaone area, treating a total of 4000 ha and the entire length of Te Waiiti Stream (Section 3.3).

Whio monitoring in Te Waiiti Stream primarily focuses on 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 is also being studied through the continued banding of this population. 2002/2003 was the third consecutive year of whio monitoring within Te Waiiti Stream, following baseline data gathered in 1998/1999.

Over the past three years whio roosts sites have been documented throughout Te Waiiti Stream. This work will enable an assessment and characterisation of each roost, and may lead to an understanding of the relative importance of these features in defining the quality of whio habitat.

The Tauranga River was also surveyed this year for comparative purposes as the non-treatment area (Appendix 4.3.1). This catchment provides a further non-treatment area, in addition to the Kaharoa Stream (Appendix 4.3.1). The Tauranga River is also unmodified with similar terrain and vegetation cover to the Te Waiiti Stream and has been surveyed five times (1996, 2000, 2001, 2002 and 2003) as a 'one-off' walk-through survey of another catchment within the Opotiki Area.

Additional whio sighting and reports received from staff, contractors and the general public throughout the year were also recorded.

4.3.2 Objectives

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

4.3.3 Methods

Survey

The 'walk-through' method **(ref)** 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 (Adams, J., *in prep*), 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 (Adams, J., *in prep*). Between December and late January is the preferred time to survey, when adults with young are likely to be found together on main rivers. This also gives an indication of the number of juveniles available for recruitment into the adult population.

Te Waiiti Stream

The entire 18 kilometres of stream systems of the Te Waiiti valley was surveyed on 15-19 December 2002 (Appendix 4.3.1). 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. This also helped verify the result and was invaluable during specific banding expeditions to locate birds in hiding. Contractors undertaking stoat control in the valley floor every two weeks also monitored pairs productivity and documented survival throughout the season. Additional surveys by Departmental staff and volunteers were also conducted at various times to assess the age class of chicks as a prelude to banding. Whio were banded as they were encountered during the December survey to maximise efficiency. Three different banding trips were required to capture different broods before they fledged due to some variation in clutch hatching dates.

Kaharoa

A tributary of the Te Waiiti Stream, Kaharoa Stream (Appendix 4.3.1) was again surveyed to assess pair productivity, juvenile survival and juvenile dispersal. This survey was conducted on 16-17 December 2002. The whio indicator dog was not used to survey this area. Banding has previously occurred at this site but was not conducted this season.

Tauranga River

The Tauranga River was surveyed to act as a non-treatment area for comparison with the Te Waiiti Stream (Appendix 4.3.1). Surveys were conducted every two weeks to assess productivity and juvenile survivorship according to Whio Monitoring Plan protocols. The whio indicator dog was not used to survey this area. No banding was undertaken at this site.

Juvenile Dispersal Survey

A juvenile dispersal survey was undertaken this season in rivers and catchments surrounding the Te Waiiti Stream. The majority of the survey was undertaken from late January to April 2003, when broods and juveniles had begun to disperse. Surveys were undertaken according to the whio monitoring protocols by DOC staff, volunteers and included reported sightings from members of the public (Appendix 4.3.2). Band combinations were recorded as well as the location and social status (i.e. pair, territory holding, etc.) of the bird, some of which can only be ascertained by multiple encounters.

Some areas of stream or river were surveyed more than once due to the nature of the survey (e.g. surveying upstream and then back down the same route). The “distance surveyed” is the sum length of each waterway within the survey, and differs from the “total survey effort”, which is the total sum of all waterways surveyed, including both distances up and back along the same route, and duplicated surveys. The highest number of birds encountered in a single survey is the result tabulated for that section of river.

Whio Capture and Banding

Banding of the Te Waiiti Stream population was undertaken for the third time during the course of this year’s survey. Whio were captured by stretching a butterfish net across a waterway and then herding the whio into the net. All birds were banded with a metal band and a colour band combination. Pairs were given the same colour combination but could be individually distinguished due to the differing position of the metal band. All juveniles of a pair were banded with the same bottom colour band as their parents, combined with one of six other colours. Once these combinations were used an additional colour band the same colour as the parents was put over the metal band. This enables juveniles of a pair and their corresponding natal area to be immediately identified.

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 would 'whistle' when approached and are generally larger, while females emit a 'rattly growl' and generally have a smaller body size. Juvenile birds do not generally call in the company of their parents but just 'peep'. If the sex of the captured birds was unable to be determined by the above methods, sex was determined through cloacal examination. The age class of a bird was ascertained through the colour of the bird's iris or size difference. This method is only suitable to distinguish adults from juveniles, but is not suitable for determining the age of an adult bird in years. Juveniles have a dark brown iris while an adult's iris is yellow. The colour of a bird's bill is also a distinguishing feature; adults have a pale yellow beak, while juveniles have a pale blue/grey colour.

Roost Sites

Over the past three years an effort was made to find all the known whio roost sites in the Te Waiiti Stream. This was conducted primarily for future reference to identify where birds may be hiding, to develop an understanding of roost importance and also to contribute to a study undertaken by Brenda Baillie (Forest Research Institute, Rotorua) on the role of in-stream debris as a function of whio habitat requirements. Roosts were identified by using a whio indicator dog (GSP) working along the river margins scenting whio in hiding or sign that they had left in the roosts. When whio were not found in a roost that the dog indicated, an inspection would be made to find faeces, feathers or feather scale or dust to confirm a roost site. Whio are more likely to be present in a roost between the hours of 10 am and 4 pm, when they are at rest and less likely to be feeding. Roosts were catalogued, photographed and described according to their diameter, character and position (eg. large wood debris parallel to the stream bank on the true left).

Reported Sightings

Sightings of whio 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 whio in short sections of river.

4.3.4 Results

A total of 78 individual whio were encountered over the 18 km of river/stream systems of the Te Waiiti valley during the 2002/2003 breeding season (Appendix 4.3.3 and 4.3.5). This comprised 15 territorial pairs, one single adult female and 47 juveniles (Table 4.3.1 and Table 4.3.2). Records suggest that a minimum of 45 of the 47 known juveniles (96%) fledged this season (Table 4.3.2). Three of the 15 pairs did not rear any chicks. All but two of the productive pairs fledged the majority of their broods before the end of December, indicating high first clutch survival to fledglings. Large broods were again seen this season, with two broods of six and two of five, all of which fledged (Appendix 4.3.3 & 4.3.5).

Mean juvenile production was 3.1 per pair, with a mean of 3.8 fledglings per productive pair, (range 1-6; Table 4.3.2). Adult numbers have increased, with 13% more territorial pairs than last season. There has been a 150% increase in pair numbers on Te Waiiti Stream since 1999 with a mean annual increase of 36% (Table 4.3.1 and Fig. 4.3.1). The mean territory length was 1.2 kilometres of stream per pair, compared to 1.6 kilometres last season and 3.0 kilometres in 1999. The number of known fledglings decreased by one from last season, but this compares with a 2.5-fold increase (155%) in fledglings since 1999. There were 2.5 chicks produced per kilometre of stream. The combined total increase of whio in Te Waiiti Stream is 126% (2.2-fold) for the 18 kilometres of stream surveyed (Table 4.3.1 and Fig 4.3.1).

Twenty-one birds were found in the Kaharoa Stream (three pairs, one single and 14 juveniles) in the 13 kilometres surveyed (Table 4.3.2; Appendix 4.3.3). Clutches of seven, five and two are known to have fledged from this river. Surveys in January 1999 found two birds in this stream and three pairs in 2000. Birds were notably hard to find on this occasion and only appeared very late on the river system most likely due to moulting.

Banding

A total of 46 birds were banded, nine adults and 35 juveniles/sub-adults. This brings the total number of banded birds to 108 in Te Waiiti Stream since December 2000 (35 adults and 73 juveniles/sub-adults; (Table 4.3.3; Appendix 4.3.6).

During this year's banding operation it was noted how much quicker the bands were deteriorating in the Te Waiiti Stream compared to other streams. Two birds needed to be re- banded after only one year.

Of the 14 individual birds (7 pairs) that were originally banded as pairs in the 2000/2001 season, 10 (71%) remain in Te Waiiti Stream (Table 4.3.3). Four of the original seven pairs (57%) have remained monogamous within the first year. The remaining original pairs of 2000/2001 had either lost their mate or paired with another unbanded bird.

Four of the sixteen banded 2000/2001 fledged juveniles (25%) were encountered (i.e. a one-off sighting, implying a prospecting or vagrant bird) on Te Waiiti Stream in the following 2001/2002 season, and six (38%) were encountered this season (Appendix 4.3.6). One banded female fledgling from 2000/2001 formed a pair on Te Waiiti Stream in the 2001/2002 season and successfully bred, fledging three chicks.

Of the six 2000/2001 banded fledglings found this season, two had paired together, and the female that had successfully bred in 2001/2002 had re-paired to an unbanded bird while holding the same territory. Both pairs bred and fledged chicks. In addition, three of the 20 (15%) banded fledglings from 2001/2002 were encountered on Te Waiiti Stream this season.

Table 4.3.1. Te Waiiti Stream population, 1998/1999 to 2002/2003.

Date	Survey Area	Monitored length (km)	Pairs	Fledged Juveniles	TOTAL
Jan-99	Te Waiiti	18	6	18	34
Dec-00	Te Waiiti	18	11	20	42
2001/2002	Te Waiiti	18	13	47	74
2002/2003	Te Waiiti	18	15	46	77

Table 4.3.2. NTUERP whio productivity, 2002/2003.

Stream	No. Territorial Pairs	No. Singles (sex)	Pairs Fledging Young	Fledglings per total No. Pairs	Known chicks produced	Known fledged young	% chicks fledged
Te Waiiti	15	1 (f)	12	3.1	47	45	96
Kaharoa	3	1 (unk)	3	4.7	n/a[a]	14	n/a
Tauranga	6	2 (m, m)	4	3	19	18	95

[a] *no post-hatch surveys conducted*

Fig. 4.3.1. Number of whio recorded during surveys of the Te Waiiti Stream, 1999/00 to 2002/03.

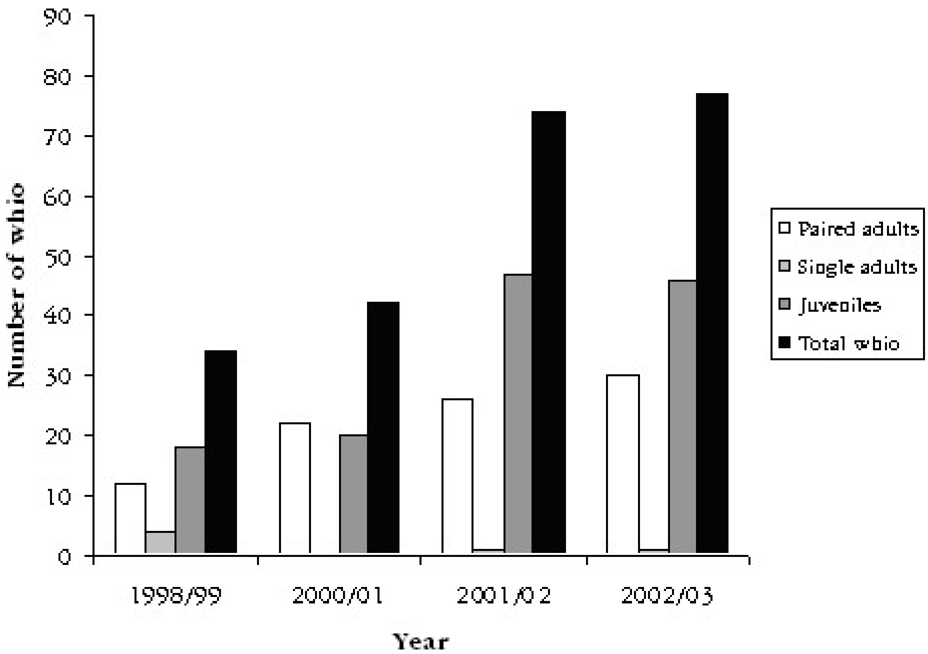


Table 4.3.3. Te Waiiti Stream banding and population data, 2000/2001 – 2002/2003

	2000/01	2001/02	2002/03	Total
Banded whio	28	34	46	108
Banded adults	12	14	9	35
Banded adult males	6	7	5	18
Banded adult females	6	7	4	17
Banded juveniles	16	20	37	73
Banded new pairs	7*	6	2	14
Original pairs present	-	4 (57%)	2 (50%)	6 of 12 (50%)
Original adults present	-	2	6	20 of 28 (71%)
Unbanded paired adults	0	2	3	5
Missing males	-	1	2	3
Missing females	-	2	3	5
Natal juveniles	-	4	9	9
Paired natal juveniles	-	1	2	3
Breeding natal juveniles	-	1	2	2

[a] *Two Sub Adults paired*

Tauranga River

The Tauranga River, part of the upper Waimana catchment in Te Urewera National Park (Appendix 4.3.1) was also surveyed intensively this season, to act as a non-treatment river system to Te Waiiti Stream. Monitoring was conducted every fortnight through the breeding season to maintain an equivalent effort to that undertaken in Te Waiiti until the juveniles fledged. The Tauranga River has been surveyed on four prior occasions (Table 4.3.4) in conjunction with other non-related work as a snap-shot of this population's status. Monitoring had previously been undertaken during autumn, in March on two occasions, once in April and once in May, at a time when juveniles are not generally found with their parents. A total of 32 whio (six pairs, two single adults and 18 juveniles) were counted during the Tauranga survey in 9 km of river by the walk-through method, without using the whio dog (Appendices 4.3.4 & 4.3.7).

Adult numbers appear to have increased since 1996, from eight to 14 birds. However, there was significantly more survey work undertaken this season and one more kilometre surveyed so this is not directly comparable. The average territory length was 1.6 km per pair. Two of the six pairs did not rear any chicks.

Juvenile productivity and survivorship was very high, with 95% juvenile survival (Table 4.3.2). Mean juvenile production for the total number of pairs present was 3.0 per pair (Table 4.3.2), and the mean number of fledglings per productive pair was 4.5, with a range of 2 to 7 (Appendix 4.3.7).

Table 4.3.4. Tauranga River Surveys 1996, 2000, 2001, 2002 and 2002/2003

Date	Survey Area	Distance	Pairs	Juveniles	TOTAL
March 1996	Tauranga	9 kilometres	4	1	9
March 2000	Tauranga	9 kilometres	4	2	12
May 2001	Tauranga	9 kilometres	3	0	6
April 2002	Tauranga	9 kilometres	5	0	11
2002/2003	Tauranga	9 kilometres	6	18	32

Te Waiiti Stream Juvenile Dispersal Survey

A survey that attempted to gain some understanding of juvenile dispersal was undertaken this year in catchments and rivers surrounding Te Waiiti Stream. With a mean pair territory length of 1.2 km, there is little room for juveniles to establish territories. Only nine of 73 (12%) of juveniles that have been banded have been found on Te Waiiti Stream. This survey, combined with other reports, found 22 banded juveniles outside their natal stream (Table 4.3.4). The "survey distance" covered during the juvenile dispersal survey was 213 km of waterway in sixteen different river systems covering three different catchments (Appendix 4.3.8). The most distal banded juvenile from its natal origin was more than 20.5 km away in a direct line. The mean distance travelled was 9 km (range 2.8 - 20.5). Four juveniles were found in different catchments, one of which had crossed over two ranges. One of the juveniles was a chick from 2001/02 season, and so is only a year old. This bird had paired and successfully reared chicks and represents only the third whio known to have settled and bred outside its natal area (Williams, M., *pers. comm.*). Some juvenile bands were not able to be positively identified so their precise territorial origin on Te Waiiti Stream is not known.

Juveniles are very mobile at this point of their life cycle, as demonstrated by the sighting of a banded juvenile 11 km from Te Waiiti Stream in a different catchment, which was then again seen the following day back in the Te Waiiti Stream.

Four juveniles from one 2001/2002 brood were found, indicating high post-fledging survivorship of this brood. There appeared to be an even sex ratio of birds found and band details obtained (seven females and eight males). The mean dispersal distance from its natal origin for female whio encountered was 9.9 km and 11.0 km for males.

Most of the 22 banding reports were received from members of the public or staff during other non-related work, with nine found during the specific dispersal surveys. This illustrates the difficulty of quantifying the nature and extent of whio juvenile dispersal using this "one-off survey" method.

During the survey, a total of 142 whio were encountered, comprising 33 pairs, 27 singles and 49 juveniles (Appendix 4.3.8). Of these, 47 were encountered in Te Waiiti Stream, with the remaining 95 found throughout the other 193.2 km of river surveyed. The Tauranga River (37 km) was also noted as having a high whio density (Appendix 4.3.8); however the lower 8.3 km of this river forms the western boundary of the 4000 ha stoat trapping area (Appendix 3.3.1).

The mean territory length per pair for all rivers surveyed is 6.4 km, but when Te Waiiti Stream is excluded, this increases to 8.4 km per pair, compared to 1.8 km in Te Waiiti Stream at the time of the survey. It should be noted that this is not an optimal time to survey for adult birds due to their cryptic nature whilst in moult but vagrant juveniles should be found more easily.

Correction Factor

The result of the Te Waiiti Stream "one-off juvenile survey" (10 pairs found), was compared to the known banded population on Te Waiiti Stream (15 pairs). This encounter rate (66%) was used an estimate of the proportion of whio pairs likely to found using this method at this time of year. Therefore, a correction factor of 1.5-fold could be applied to other survey results in an attempt to better approximate the true number of whio pairs present. As 23 pairs were found (Appendix 4.3.8), this could equate to 35 pairs existing within the surveyed area.

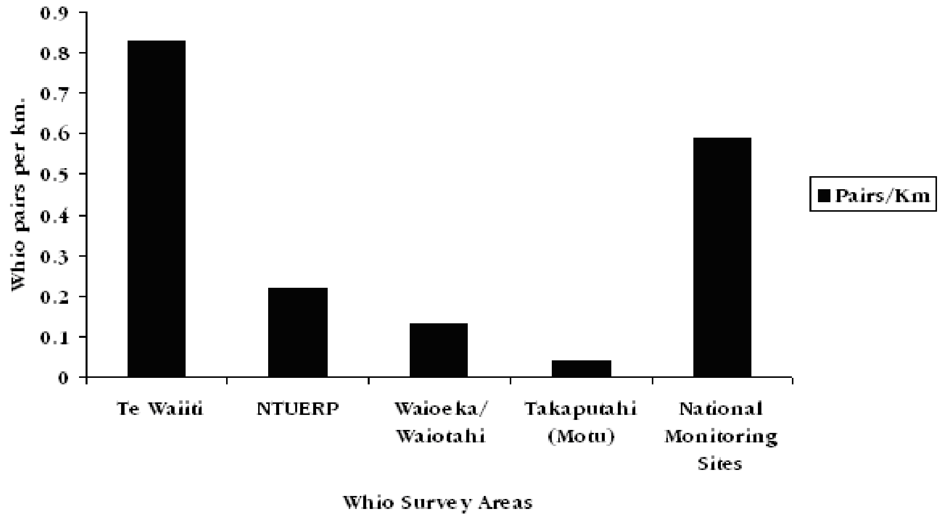
Comparisons of pair density in Te Waiiti Stream, waterways within NTUERP and Waioweka/Waiotahi catchments (Appendix 4.3.8) are shown in Fig. 4.3.2.

Table 4.3.5. Banded juvenile whio

Date	Band Combination	Banding Date and Location	River Found	Grid Ref.	Dispersal distance
2/02/2002	3 banded birds		Otapukawa	W17 724 023	11km
12/04/2002	M-BG	19/12/2001 Upper forks	Waiata	W16 826 197	14.3km
31/01/2003	RG-M	2/2/01 Whakapirau	Otapukawa	W17 715 047	8km
17/01/2003	Y-GM	3/12/2002 Waiohinekaha	Waimana	W16 703 163	9.6km
24/01/2003	RM-W	13/11/2001 Te Pona	Tauranga	W17 699 094	4.3km
2/02/2003	M-WY	13/11/2001 Te Pona	Tauranga	W17 691 025	11km
2/02/2003	W-GM	3/12/2002 Waiohinekaha	Tauranga	W17 688 016	8.7km
24/02/2003	GB-M	28/11/01 Koaunui	Makakoere (Waioeka catchment)	W17 793 920	20km
6/03/2003	1 banded		Tauranga (Whakarae)	W16 697 159	2.8km
6/03/2003	3 banded birds		Waimana (Concrete Bridge)	W16 688 223	8km
6/03/2003	RM-W	13/11/2001 Te Pona	Tauranga (Lions Hut)	W17 702 091	4.5km
7/03/2003	M-WY	13/11/2001 Te Pona	Tauranga (Tauwharemanuka)	W17 696 049	8.5km
7/03/2003	W-BM	21/12/01 Waipapa	Tawhana (Ox Bow)	W17 693 028	11.6km
8/03/2003	W-RM	17/12/2002	Kahunui (Waioeka catchment)	W17 834 014	11.3km
26/03/2003	M-W?	Possible Te Pona	Waikokopu	W16 507 222	20.5km
3/04/2003	R-GM	3/12/2002 Waiohinekaha	Te Waiiti	W16 749 124	4.5km
15/06/2003	RW-RM	15/01/2003 Totaras	Whakatane	W16 609 140	15.2km
31/05/2003	YM-YR?	15/1/03 ? Koaunui	Pohatuatua	W16 708 101	4.5km

The mean pair density (pairs per km) of the surveyed waterways in Te Waiiti Stream, surveyed catchments within and outside NTUERP in 2002/03, Takaputahi River (Glaser, 2003), and nationally monitored waterways (Godfrey *et. al.*, 2003), were calculated (Fig. 4.3.2). Data from 2002/03 surveys have been adjusted using the 1.5-fold correction factor described above, giving an estimate of pair density.

Fig. 4.3.2. Calculated mean pair density of whio from local and national waterways. NTUERP and Waioeka/Waiotahi are estimates based on 2002/03 survey with 1.5-fold correction factor applied.



Te Waiiti Stream Roost Sites

During the past three years, a total of 36 individual roosts have been located in Te Waiiti Stream (Appendix 4.3.9). Roosts sites were of varying nature and included undercut banks, log jams, single stems, rock caves, root plates or a combination of these types. The most common roost type was undercut banks. Pairs could occupy several roosts within their territory, with a maximum of five so far discovered within one territory. All roosts were close to the water's edge and may constitute an essential component of high quality whio habitat.

Reported Sightings

From 1 July 2002 to 30 June 2003 the Opotiki Area Office received 40 reports of whio from various locations within the Opotiki Area. A total of 159 whio were reported, comprising 46 pairs, seven single adults and 60 juveniles, representing an increase on previous years reports (Table 4.3.6). This figure is in addition to whio that were seen during other surveys conducted within the area such as the juvenile dispersal or Tauranga surveys.

Table 4.3.6 Total reported sightings of whio in the Opotiki Area 1996/97 to 2002/03

Year	No. of Reports	Pairs	Juveniles	Singles	TOTAL
1996/97	21	16	41	5	78
1997/98	41	32	29	11	104
1998/99	49	44	21	10	119
1999/00	86	64	46	21	244
2000/01	55	36	31	14	117
2001/02	28	16	12	24	68
2002/03	40	46	60	7	159

4.3.5 Discussion

Some excellent results have been achieved this year with whio management; an increased understanding of population dynamics, juvenile productivity/survival, juvenile dispersal and recruitment has resulted from this season's work.

There appears to be stability in the Te Waiiti Stream adult banded population with 71% remaining after three years of banding. Five unbanded adults have come into this population from external sources during the past three years; whether these new pairings are due to natural licentious behaviour, predation, or natural mortality is not known. Nine natal juveniles were found in Te Waiiti Stream within the last year, with only three known to have paired. This may appear to be a small number but due to the perseverance of adult pairs there is little space available. Mean territories lengths of 1.2 km per pair at Te Waiiti Stream are a higher density than the mean national pair density (1.7 km per pair) of monitored whio populations (Godfrey *et al.* 2003). The Te Waiiti Stream results contrast with a National Whio Monitoring Scheme site at Takaputahi River (Motu catchment), that is also conducted by the Opotiki Area Office. With no management at this site, the population on this river has shown a long-term decline over 12 consecutive years of monitoring (Glaser, 2003).

As stoats have been implicated as a major predator of whio, trapping in the Te Waiiti valley and surrounds (Appendix 3.3.1) could be expected to provide increased juvenile productivity and survival compared to areas without stoat trapping. This season, however, the non-treatment Tauranga River had 95% juvenile survivorship, compared to 97% in Te Waiiti Stream, indicating that within the NTUERP area, in some seasons at least, whio can have high juvenile survivorship in the absence of any specific control measures. This result could indicate a fundamental difference in the ecology of predator-prey interactions in podocarp forests compared to beech forests, especially those of the South Island, where whio juvenile survivorship has been negligible in monitored rivers. However, pair density on the Tauranga River is still much lower than on Te Waiiti Stream. Future monitoring may determine if these differences in management result in long-term differences in pair density on these two waterways.

Comparison of the intensively managed Te Waiiti Stream with other rivers produces some intriguing results. The mean pair density of Te Waiiti Stream (possum and stoat control) is 0.83 pairs/km; rivers surveyed within the NTUERP boundary (possum control) have 0.4 pairs/km (after correction factor incorporated); while rivers in the unmanaged Waioeka and Waiotahi catchments have a mean 0.1 pairs/km (Fig. 4.3.2). Thus, the higher pair density both within NTUERP and in the Te Waiiti Stream may be attributable to NTUERP management.

However, the mean pair density in rivers studied as National Whio Monitoring Sites is 0.59 pairs/km (Fig. 4.3.2). This is substantially higher than that found within either NTUERP or Woioeka/Waiotahi rivers, and may reflect a very high quality of river selected as being suitable for monitoring sites. Also, the level of management at each of these sites has not been indicated (Godfrey, *et.* al, 2003), so this high density may also be able to be attributable to some management actions. Even so, the Te Waiiti Stream whio mean pair density is higher than the mean pair density found at these monitoring sites nationally, so represents one of the densest known whio populations.

The juvenile dispersal survey was undertaken this season to determine the nature and extent of juvenile dispersal, settlement and survival of fledged juveniles from Te Waiiti Stream. This will also assist in defining the benefits of NTUERP management to whio in the greater Te Urewera National Park and surrounding areas. This survey is also to test the prevailing hypothesis that although juveniles may disperse beyond their natal catchment, they show a high level of philopatry, sufficient to inhabit the widespread natural establishment of new populations or the recolonisation of a former range (Adams *et al.*, 1997).

This behaviour was not typical in this study; Te Waiiti Stream fledglings were found up to 20.5 kilometres form their natal birth site (e.g. one bird was found in the Galatea foothills, traversing two main mountain ranges of 1000m in altitude). Thus, the hypothesis can be rejected for northern Te Urewera whio.

The reasons for this behaviour can currently only be speculated upon, but it is possible that this may have been exacerbated by the high territory occupancy of Te Waiiti Stream, forcing juveniles to find vacant territories in neighbouring tributaries and catchments. This emphasises the potential nature of juvenile dispersal behaviour, and raises questions about what can be considered to be an independent whio population.

This finding shows the importance of large scale forest management for whio populations, and lends support to the concept of the division of whio into large management regions, in accordance with the recommendations of the Blue Duck Recovery Group (Section 4.3.1). In one particularly significant case, one juvenile dispersed 20 km, established a territory and successfully bred, proving they have the potential to recolonise and populate new areas. The result from this survey clearly establishes that juvenile whio dispersal is widespread and provides some indication of the population dynamics of whio. It also demonstrates whio are not constrained by geographic land form and may be more constrained by unsuitable habitat.

The nature and extent of whio dispersal from Te Waiiti Stream is not currently understood, and so the absolute extent and full benefit this consistently highly-productive waterway may have for the population of the greater Te Urewera National Park and surrounding conservation estate is unknown. Survival rate of dispersing juveniles is also unknown, due to the nature of the chance encounters with vagrant juveniles. A study into juvenile dispersal using satellite radio transmitters would measure the extent and survival of dispersing birds, more accurately quantifying the benefits of mainland island management.

The whio dog again proved to be invaluable for locating whio for capture when banding, indicating roosts sites and verifying the Te Waiiti Stream survey result. The whio dog enabled easy location of whio outside hours of high whio activity, increasing the efficiency of surveys compared to ordinary "walk-through" surveys. The whio dog was used throughout the Te Waiiti Stream survey because of the minimal time available to band and complete this year's survey.

The cataloguing of roost sites within Te Waiiti Stream has led to some inference of their importance to whio. Whio will occupy a number of roosts sites within their territory; these can be as minimal as a drooping toitoi over the waters edge, and as complex as a giant root mat with a labyrinth of tunnels and holes. There are some common factors that these sites share: they are all within close proximity of the waters edge, and provide cover where whio are unable to be seen. These roosts not only provide shelter from the elements but may also provide sanctuary when birds are in moult, defence for hiding their young and protection from avian and terrestrial predators. Roosts may be a key part of determining whether a particular waterway is suitable for whio occupation. The number of roosts a pair will have is dependent upon the location of the pair in the river system and the stability and availability of roosting material. These roost sites appear to be denser in the upper reaches and mid-range of Te Waiiti Stream. This may be due to channel morphology (i.e. lower flow and greater river stability) in these sections. Areas in the lower river sections still provide the same water quality but flow rates can vary to a much larger degree than the mid- to upper sections. Another factor may be due to broadening of the river in the lower section, resulting in potential roost-forming debris to be washed away. For example, one pair in the lower Te Waiiti Stream is only known to occupy two roosts, whereas pairs in the mid section occupy as many as five. During surveys, some whio are consistently found on the same small section of stream; all are associated with known stable, large roosts that have prevailed over time. These roosts may be limiting factors for pair density.

Historically whio occupied the lower river systems (M. Williams, *pers. comm.*) but due to land clearance and river riparian modification many of these river sections are now of sub-optimal habitat quality. Due to the current low whio density nationally, it is not necessary for whio to occupy these areas, due to the many vacant territories containing more suitable habitat. This work is to be further analysed by Brenda Baillie (FRI, Rotorua), researching the importance of wood debris within river systems.

Avian predators such as falcon, harrier hawk, weka, morepork and the extinct laughing owl are the likely historic predators of whio and would therefore regulate whio population growth. The behavioural traits that whio demonstrate such as roosting in or under cover, maintaining low flight along river courses, flying in late evening and primarily using the water for their escape (including chicks' ability to manoeuvre competently in fast-flowing water systems) all suggest their evolutionary behaviour has been influenced by avian predators. Whio use camouflage as a defence, and may not move, even when approached very closely. Introduced mammalian predators, with a highly evolved olfactory capability can exploit this whio evolutionary behaviour, and have been documented killing juvenile and adult whio. Nesting female whio may be particularly at risk, as well as the eggs they are incubating. Increased levels of predation may inhibit population growth and if severe, may increase the probability of extinction. However, natural events would have also shaped historic whio populations, such as large floods, landslides and volcanic eruptions.

The Te Waiiti Stream predator control has the potential to provide a model for intensive and extensive control of mustelids within large forest areas for the benefit of whio conservation. However, it does not investigate the minimum level of predator control required to enhance whio survivorship in a North Island riverine system.

4.3.6 Acknowledgements

Special thanks to Environment Bay of Plenty for their continued support through the Community Environmental Enhancement Fund, that has enabled the Department to supplement predator control in the Te Waiiti valleys. Thanks also to the staff, contractors, volunteers, land owners and other supporters for their assistance in the whio monitoring programme: Jane Haxton, Lester Bridson, Mike Paviour, Michelle Gutsell, Rhys Burns, Grant Jones, Pete Livingstone, Leigh Glaser, Sonny Biddle, Paki Te Pou, Rahim, Cody Thyne, Brenda Baillie, Keith Beale, Ross Hurrell, Jillian Houghton, CraigMills, Terry Mulhern, Peter King and Russel Joblin. Special thanks to Lenka Matauesk and Uli Toene, two German volunteers who conducted a large proportion of the Juvenile Dispersal survey.

4.4 PIRIRANGI (RED MISTLETOE) MONITORING

4.4.1 Introduction

In northern Te Urewera, the red mistletoe, or pirirangi (*Peraxilla tetrapetala*), is usually found hosted on quintinia (*Quintinia serrata*) and has been monitored as an indicator of forest health (Shaw, 2001), as pirirangi is known to be sensitive to possum (*Trichosurus vulpecula*) browse (Ogle, 1997). Therefore it is hypothesised that with reductions in possum densities, pirirangi populations will begin to recover. Before this season, pirirangi monitoring has been concentrated at Otamatuna Core Area and the Okopeka non-treatment area.

During the 2002/2003 season, however, monitoring occurred at Oruamananui and the soon to be established Pakoakoa Core Area, the first of the two seasons required to establish a baseline population estimate. Pirirangi monitoring at these two sites has been established for two main reasons:

1. to assess the long-term influence of different pest management regimes on pirirangi populations;

2. to provide an understanding of the current status of pirirangi within NTUERP.

The Pakoakoa Core Area was in the process of being established in early 2003, with possum and rat control programmed to commence by August 2003. Possums will be controlled using toxins in Philproof bait stations at 100m intervals along the A-line and the ridgeline. Prior to the set-up of this A-line regime, Pakoakoa has been part of the Background Area where possums are controlled by ground-based trappers to 5% RTC on a three-year rotational basis. Oruamananui remains part of the Background Area.

The pest control regimes at these two sites differ from those at the previous monitoring sites of Otamatuna and Okopeka. Otamatuna has the most intensive pest control of the four mistletoe monitoring sites, with an ABC-line regime for rat trapping (Section 3.2) and poisoning for possums with Philproof bait stations (Section 3.1). Stoats are also trapped on all major ridges and spurs (Section 3.3). Okopeka is the non-treatment site 5 kilometres south of Otamatuna.

4.4.2 Objectives

Annual

- To locate, tag, and record a representative sample of pirirangi and 'potential host' trees at Pakoakoa and Oruamananui.
- To establish the population baseline for both sites.

Medium-term

- To carry out recruitment surveys of potential host trees, on a 3-year rotational basis.
- To compare pirirangi health and abundance between the four sites.
- To include Foliar Browse Index methodology to monitor pirirangi health.

Long-term

- To increase understanding of pirirangi ecology.
- To identify what level of management is required to benefit pirirangi populations.
- To survey for pirirangi across the greater northern Te Urewera.
- To restore pirirangi populations throughout northern Te Urewera to more natural levels.

4.4.3 Methods

At the beginning of the 2002/2003 season, quintinia were sequentially tagged and mapped. Quintinia were located by walking main ridges and spurs. All quintinia above the height of 4 metres were tagged. These quintinia were selected because field observations over the past ten years have shown that pirirangi occur exclusively in trees above this size in the northern Te Urewera (P. Shaw, *pers. comm.*).

When quintinia were located, searches underneath the tree for pirirangi flower remnants were conducted. Pirirangi were also directly searched for using binoculars to look at all potential host trees. Hosts are labelled sequentially with an 'M' prefix if found to contain pirirangi. When pirirangi were located, the host was tagged, and sketch diagrams of the pirirangi location in the host were drawn to aid their relocation in subsequent seasons. The diagrams also avoid confusion between different pirirangi plants when there is more than one plant hosted in the same tree. The search period for both seasons commenced in early December and finished in late January/early February. These months represent the flowering period for pirirangi in the Waimana Valley.

A small proportion of adult pirirangi do not flower every season. However, data from previous years monitoring has shown that adult plants will flower after a non-flowering season (Shaw, 1999). Therefore, to be confident of locating all adult pirirangi, baseline surveys were conducted over two consecutive seasons.

In past seasons, the "flowering period" (Shaw, 1999) of pirirangi had been measured as an indicator of pirirangi health at Otamatuna and Okopeka. This measurement will no longer be used, due to doubt as to whether this measure accurately reflects the "health" status of individual pirirangi. Also, this method requires a large time commitment to achieve accurate results, so this measure has been deemed to be of lower management priority. If future monitoring indicates flowering period is changing, remeasurements can be undertaken at Otamatuna and Okopeka and compared with existing flowering period data. It is intended that pirirangi monitoring in the future will concentrate on recruitment of potential host trees, and individual mistletoe health (using FBI), as the main indicators.

4.4.4 Results

Pakoakoa

132 quintinia over 1.5 kilometres of ridgeline were located and tagged. Eight of these trees were found to host pirirangi. M5 was found with five, and M6 with six pirirangi. The other six host trees had one pirirangi each. In total, 17 individual pirirangi were located. This equates to an occupancy rate of 6.06%.

Oruamananui

123 quintinia were located and tagged over approximately 7 kilometres of ridgeline. 36 individual pirirangi were found in 19 quintinia. A number of the hosts contained more than one pirirangi, giving an occupancy rate for Oruamananui of 15.5%.

Table 4.4.1 Results of pirirangi monitoring at Oruamananui and Pakoakoa, 2002/2003.

Site	No. of Quintinia	No. Hosts	No. Pirirangi	Host Occupancy Rate (%)	Mean no. pirirangi per quintinia monitored
Oruamananui	123	19	36	15.5	0.29
Pakoakoa	132	8	17	6.06	0.13

4.4.5 Discussion

Possum control by ground-based trappers began at both these sites in 1994. By 1998 the possum RTC index had declined to the desired 5% level (L. Wilson, *pers. comm.*), so it is likely that changes in the pirirangi populations have already occurred as a result of lowered possum densities. Ideally, pirirangi baseline studies would have been conducted before the commencement of possum control in 1994. However, as a baseline population should be established after monitoring next season, long-term trends will soon be able to be measured.

Pirirangi, and mistletoe in general, are slow growing plants, so the plants currently monitored may represent plants that already existed before high possum densities occurred within Te Urewera, and have now recovered to some extent due to decreased possum browsing. Continued monitoring may result in observations of new pirirangi establishing on quintinia, which would confirm the re-establishment of an ecosystem process that has been largely compromised within northern Te Urewera.

4.5 CANOPY CONDITION MONITORING (FBI)

4.5.1 Introduction

Foliar Browse Index (FBI) scoring has been used in Northern Te Urewera since 1998 to assess changes in canopy cover of tree species vulnerable to possum browse. The foliage cover parameter has provided the most consistent and useful data, so only this aspect of FBI monitoring is reported and discussed. The ability of the FBI methodology to reveal meaningful changes in other parameters (especially browse) was particularly limited, as this aspect of the FBI scoring system was introduced several years after the commencement of the northern Te Urewera possum control programme, and possum densities would have already been heavily reduced.

Previous monitoring within northern Te Urewera has indicated that kamahi (tawhero; *Weinmannia racemosa*) is by far the most useful indicator species, and so this species only is reported on and discussed.

4.5.2 Methods

Canopy monitoring in northern Te Urewera uses several modifications of the standard FBI methodology (Payton et al, 1997), the main difference being scoring kamahi canopy cover only on ridge lines. Foliage cover is scored using a cue card to estimate the percentage of the tree with canopy cover. All other results are recorded, but they are not analysed or reported on here.

Monitoring lines (Appendix 4.5.1) were first established in 1996/97, and this season lines at Otamatuna and Te U were remeasured.

Three FBI monitoring lines are measured at each location except Otamatuna, where four lines are measured.

Analysis

Data collected from this season was analysed slightly differently than in previous years due to complications in the continuity of data sets between successive measurement years (Section 4.5.4).

4.5.3 Results

Results are graphed below. Names of each area measured are grouped into their broader regions of northern Te Urewera, and the locations of each line is shown in Appendix 4.5.1.

Fig. 4.5.1. Kamahi percentage canopy cover in central Ikawhenua, 1997/98 to 2001/02 (± standard error).

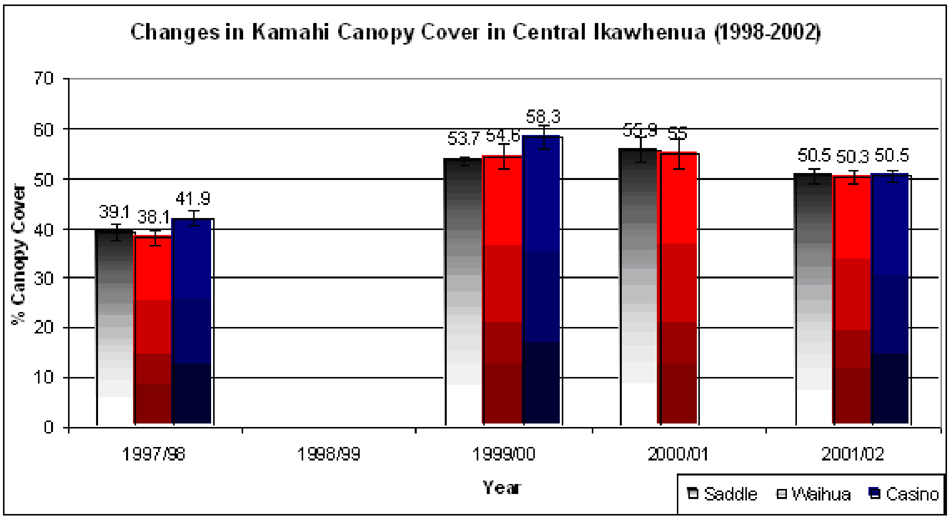


Fig. 4.5.2. Kamahi percentage canopy cover in northern Ikawhenua, 1997/98 to 2001/02 (± standard error).

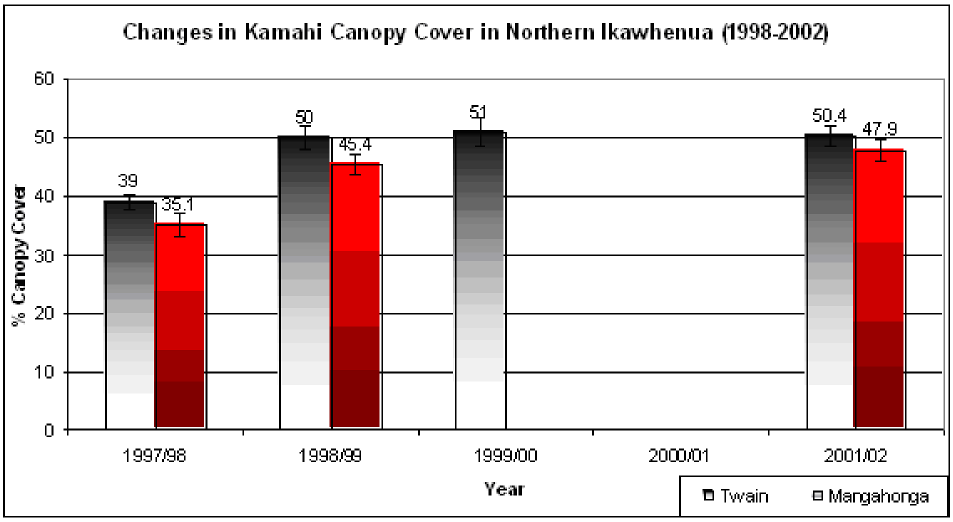


Fig. 4.5.3. Kamahi percentage canopy cover in northern and central Waimana, 1997/98 to 2002/03.

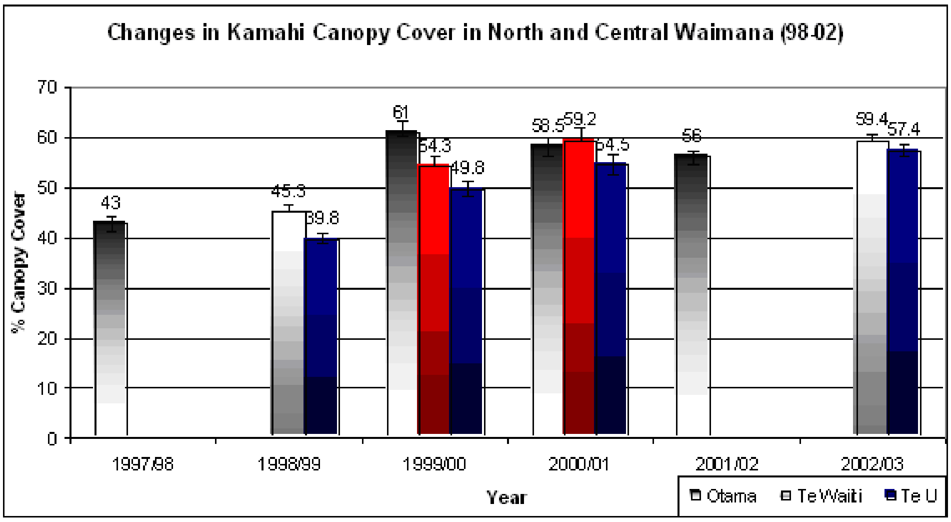


Fig. 4.5.4. Kamahi percentage canopy cover in Southern Waimana, 1997/98 to 2002/03.

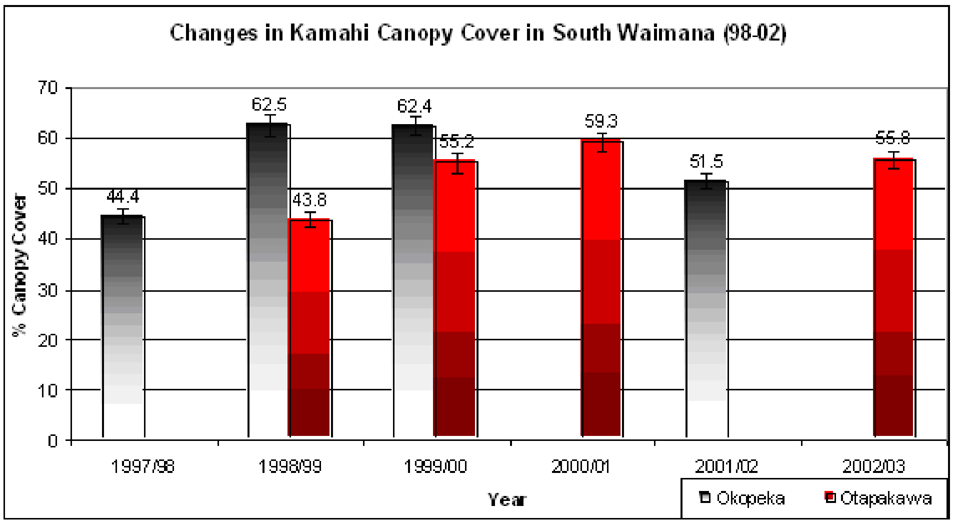


Table 4.5.1. General area of FBI line locations and dates lines have been measured.

Operational Area	Location	Dates Measured
Central Ikawhenua	Saddle (Mangaawai)	Feb 1998, 2000
Central Ikawhenua	Waihua	Feb 1998, 2000
Central Ikawhenua	Casino	May 1998, 2000
Northern Ikawhenua	Twain (Waipotiki)	May 1998, 1999, 2000
Northern Ikawhenua	Mangahoanga	May 1998, 1999, 2000
Northern Whakatane	Wharekahika	Aug 1999
Northern Waimana	Te U	Aug 1998, 1999
Northern Waimana	Te Waiiti	July 1998, 1999
Northern Waimana	Koaunui	July 1998, 1999
Central Waimana	Otamatuna	April 1998, 2000, 2001, 2002
Southern Waimana	Okopeka	March 1998, 1999? 2000, 2002
Southern Waimana	Otapukawa	Oct 1998, 1999, 2000, 2002

All areas had a large increase in percentage canopy cover following the initial 1997/98 measurement. All changes were statistically significant (Beaven *et. al*, 1999). In subsequent years, no area has recorded a lower average canopy cover than was recorded in 1997/98. Most areas have subsequently had a relatively stable percentage mean canopy cover since 1998/99, even though a potential bias could have occurred up until 2001/02 with all measurements undertaken by one observer. However, in 2002/03, another observer undertook these measurements, decreasing the risk of operator bias. The only decrease in mean canopy cover of greater than 10% (10% of 100% rather than of actual canopy cover) at any time since 1997/98 has occurred at Okopeka, an area that is now being used as a non-treatment possum area. Although Okopeka had a similar increase to other areas in mean canopy cover in 1998/99, it is also the only area to have ever shown a subsequent large decrease, with kamahi percentage mean canopy cover decreasing from 62.4 to 51.5 between 1999/00 and 2001/02. This is a highly significant decrease **($P<0.000$).**

4.5.4 Discussion

All monitored operational areas show a similar pattern of a significant increase in kamahi percentage mean canopy cover between 1997/98 and 1998/99. The latest mean kamahi canopy cover scores appear to be similar to those of 1998/99 despite a different person scoring the bulk of the trees this season.

A long-term trend is emerging of relatively steady levels of canopy cover following initial low levels during the first year of measurements in 1997/98. The cause of the low level in the first year is uncertain but given the similar patterns found in all operational areas, non-treatment Okopeka, and in monitored trees in the Mangatutara catchment of the Motu river (D. Wilson *pers comm.*) it appears that a background environmental factor may have been the major cause of the low levels in the 1997/1998 and winter of 1998/99 year. Over that period it was noted that trees were heavily damaged by insects and that there was exceptionally heavy flowering and fruiting (which may have resulted in less emphasis on growing leaves this season).

Although the possum non-treatment area at Okopeka initially followed a similar pattern there was a decrease in mean tree foliar cover from 62% in 1999/00 to 51% in 2001/02. Unfortunately a year's data was not collected in 2000/01, so whether this decrease has occurred suddenly within the past year, or is part of a longer-term decline in foliar cover is unclear. If there is an ongoing decline in canopy cover in Okopeka and other areas retain a greater canopy cover, it is likely this decline is due to the much higher possum densities present at Okopeka compared with elsewhere in northern Te Urewera.

The relatively stable canopy cover measured since winter 1998 suggests that trees are not being seriously impacted by the present levels of possums. Even the non-treatment Okopeka area has previously undergone possum control and the relative health of trees in this area may be due to a lag effect from that control. During the past six months the author of this report has had the occasion to carry out fieldwork for other agencies in forest areas immediately adjacent to (and contiguous with) the area covered in the NTUERP possum control. This work in areas where no possum control has occurred has shown extremely high impacts on kamahi with most trees dead or dying and surviving trees heavily browsed. In one location of 300-400 standing kamahi, only 25-35 trees still showed signs of life, the rest appeared to be standing dead trees. There are also anecdotal reports of the large-scale dieback of kamahi trees in the the Waiotahi and parts of the Whakatane Valley, that are not receiving possum control.

It is likely that canopy cover increased significantly over the period of the early to mid 1990's when northern Te Urewera possum control began, but the surge of new growth was over by the time in which FBI was established. Evidence for this from the formerly used canopy loss scoring method was presented in Beaven et al (1998).

4.5.5 Conclusions

Measurements of kamahi canopy cover throughout northern Te Urewera appear to be quite similar, with all areas recording an increase in canopy cover since the first year of measurements in 1997/98. A stable canopy cover appears to have been in place since this time over all areas measured within northern Te Urewera. The sole exception may prove to be the Okopeka non-treatment area, where despite a similar pattern over the first three years as the rest of northern Te Urewera, the decrease in canopy cover measured this season may be the beginning of a long-term decline. There is also evidence of large-scale dieback of vulnerable kamahi forest in nearby forest that is contiguous to the northern Te Urewera where possum control is not occurring.

A change in observers seems to have made little difference to the measurements obtained for foliar cover.

4.5.6 Acknowledgements

Edited from Report No. OPR009 prepared by Total Backcountry Solutions Ltd., PO Box 500, Opotiki. The bulk of the FBI monitoring in the past 18 months has been carried out by Pete Livingstone, DOC, Opotiki. Thanks also to the WAC staff and contractors of DOC Opotiki for their assistance over the years.

4.6 DEER AND PIG DENSITY AND IMPACTS

4.6.1 Introduction

This was the fifth year in which seedling/pellet transects have been used to measure both deer density and the impacts of deer on understorey condition at the Otamatuna Core Area. These result and outcome measures are confined to the 2500 ha of deer control (Section 3.4), with a non-treatment area at Onepu Core Area. Pellet lines established by the New Zealand Forest Service (NZFS) were measured for the seventh consecutive year in both Otamatuna and the greater Onepu/Ohora/Pohatu catchment (Appendix 4.6.1)

Red deer (*Cervus elaphus scoticus*) have been shown to cause a decline in 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 long-term aim of the deer control programme at Otamatuna is to determine if ground hunting can increase this regeneration to significantly higher sustainable levels compared to non-treatment areas (Beaven et al 1999, 2000).

Sampling over the past five years has shown a recovery of palatable seedling densities at both Otamatuna and Onepu, although there is still no evidence of major increases in size classes greater than 45 cm. This increase is probably as a result of low deer numbers. Deer numbers appear to be low but stable or increasing slightly in both core areas. Major changes have occurred in the venison recovery industry over the past year and these may mean that the issues surrounding deer will need to be re-examined.

4.6.2 Method

Seedling/pellet transects were installed within the bait station grids of both Otamatuna and Onepu in November 1998 (Appendix 4.6.1). These permanently marked lines were remeasured in November 1999, 2000, 2001 and 2002.

The seedling/pellet method is fully described (Beaven *et. al,* 2000). Briefly, transects were randomly placed at both the Otamatuna treatment site (20 transects within ABC-line) and Onepu non-treatment site (10 transects within A-line), each consisting of 20 plots spaced at 10 metre intervals, giving a total transect length of 200m (Appendix 4.6.1). Each plot is 1.26m in radius, giving an area of $5m^2$. Therefore each transect measures an area of $100m^2$. In each plot all tree and shrub species are measured and placed into height classes of: <15cm, 15-45cm, 45-75cm, 75-135cm, and >135cm, with all seedlings having a Diameter at Breast Height (DBH) of less than 2 cm. All animal droppings or pig rooting present in a plot is recorded. The sampling unit for this method is each line.

The methodology of NZFS animal pellet lines has also been described (Beaven, 1999). Briefly the method consists of compass courses 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. There are four lines measured at both Otamatuna and Onepu (Appendix 4.6.1). Both seedling/pellet and animal pellet lines were measured from November to January 2003, a similar time to previous years.

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

4.6.3 Results

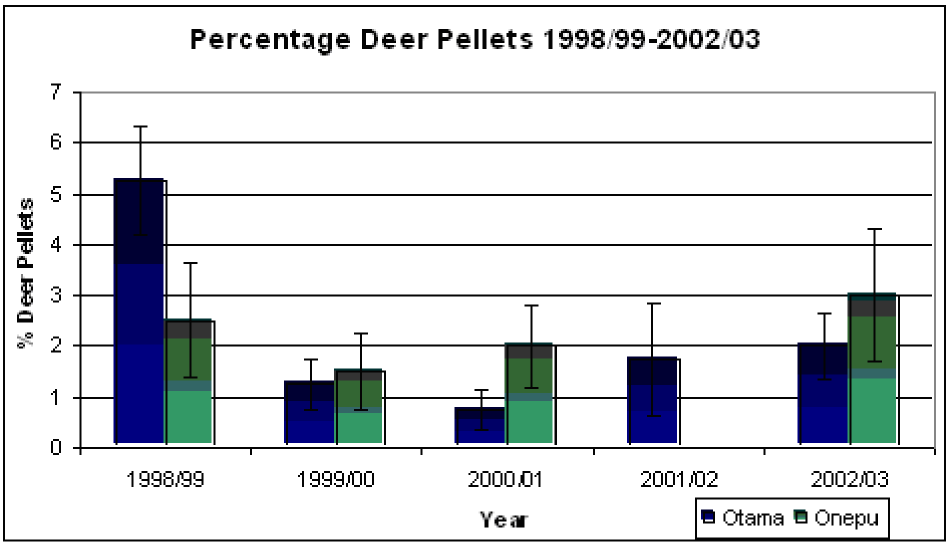
The full results for the measurements in the 2002/03 year are shown in Appendix 4.6.2. Summaries and comparisons with previous years are shown below for key findings.

Seedling/Pellet Transects

Pellet Counts

The results of the deer pellet counts for the last four years for both Otamatuna and Onepu are shown in figure 1. Error bars show standard error of the mean.

Fig. 4.6.1. Mean frequency of deer pellets/line, Otamatuna and Onepu 1998/99-2002/03.



The overall pattern at Otamatuna has been a decline in deer densities from 1998/99 until 2000/01 and then stable or slightly increasing densities since. At Onepu numbers appear to have been relatively stable although there was a zero count in 2001/02 and the 3% in 2002/03 was the highest recorded.

The changes at Otamatuna between 2001/02 and 2002/03 were not significant (P=0.85) nor were those at Onepu (P=0.05).

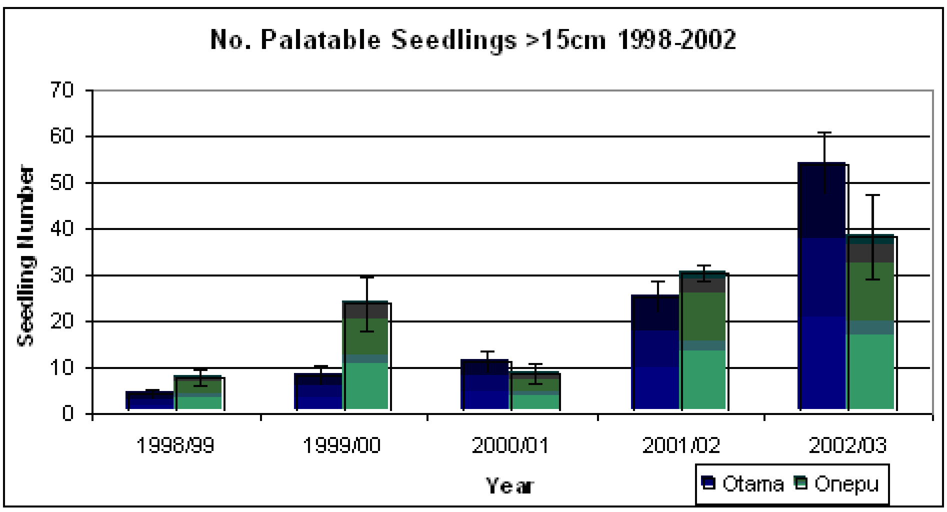
At low deer densities such as those being measured at both areas, very small changes in numbers of pellet groups counted can disproportionately influence results meaning all individual year's results need to be treated cautiously and viewed as part of a long-term trend. It would be wrong to draw strong conclusions from any short-term year-to-year variations.

Seedlings

The expected result of reduced deer density at Otamatuna would be an increase in the number of deer-palatable seedlings in height classes greater than 15cm. The absolute numbers of larger seedlings present for these species is still low per species. To increase the sample size the results for the most abundant palatable species have been summed each year to create a larger sample size for comparative purposes. The palatable species analysed like this were *Coprosma grandifolia, C. lucida, C. tenuifolium, Geniostroma rupestre* (hangehange), *Melicytus ramiflorus* (mahoe) and *Schefflera digitata* (pate).

In areas with moderate deer impacts it would be expected that there will be few palatable seedlings higher than 15cm. Figure 4.6.2 shows the total number of palatable seedlings in all height classes over 15 cm at both Otamatuna and Onepu. All error bars show standard error of the mean.

Figure 4.6.2. Total number of palatable seedlings greater than 15cm (all height classes) at Otamatuna and Onepu, 1998/99 to 2002/03 (mean no. seedlings/line).



There has been a trend of increasing density of larger palatable seedlings in both monitored areas (Fig. 4.6.2). Between 2001/02 and 2002/03 the numbers of palatable seedlings >15cm doubled at Otamatuna. There was also a smaller increase in seedling density at Onepu.

Paired sample T-tests (two tailed test with 95% confidence) between 1998/99 and 2001/02 showed a significant increase in the number of palatable seedlings present at Otamatuna ($P<0.001$). There was also a significant increase at Otamatuna between 2001/02 and 2002/03 ($P<0.001$).

Paired sample T-test for Onepu also showed significant increases between 1998/99 and 2002/03 ($P<0.001$) however the increase between 2001/02 and 2002/03 was not significant ($P=0.38$).

The abundance of palatable seedlings in each height class is shown in Figure 4.6.3 to 4.6.7.

Fig. 4.6.3. Total number of palatable seedlings less than 15cm at Otamatuna and Onepu, 1998/99 to 2002/03 (mean no. seedlings/line).

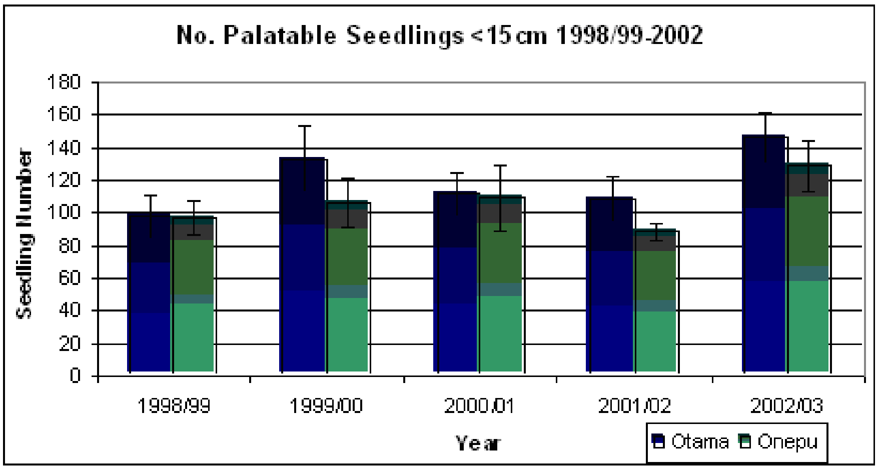


Fig. 4.6.4. Total number of palatable seedlings between 15 and 45cm at Otamatuna and Onepu, 1998/99 to 2002/03 (mean no. seedlings/line).

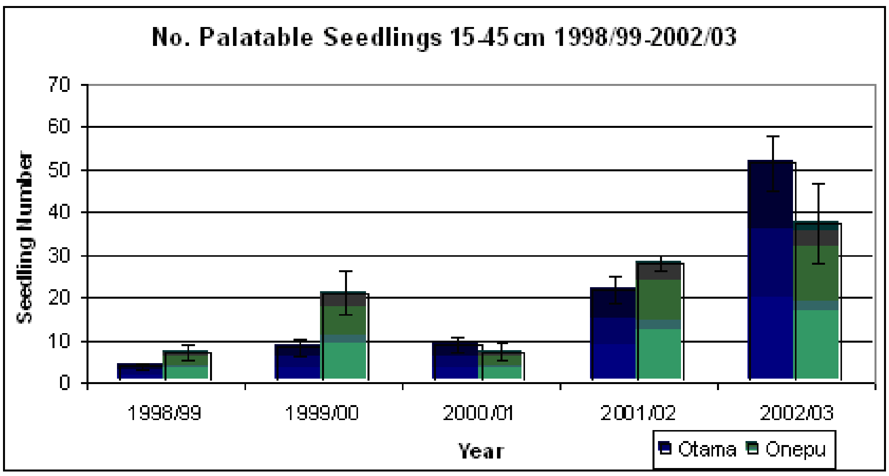


Fig. 4.6.5. Total number of palatable seedlings between 45 and 75cm at Otamatuna and Onepu, 1998/99 to 2002/03 (mean no. seedlings/line).

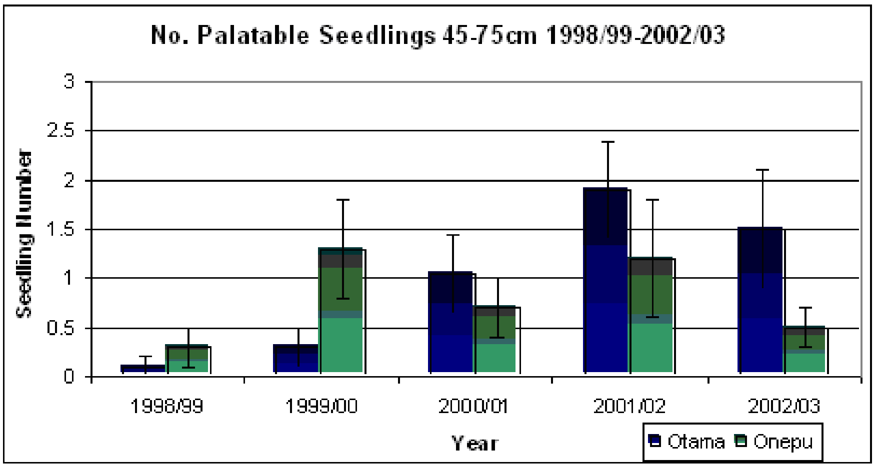


Fig. 4.6.6. Total number of palatable seedlings between 75 and 135 cm at Otamatuna and Onepu, 1998/99 to 2002/03 (mean no. seedlings/line).

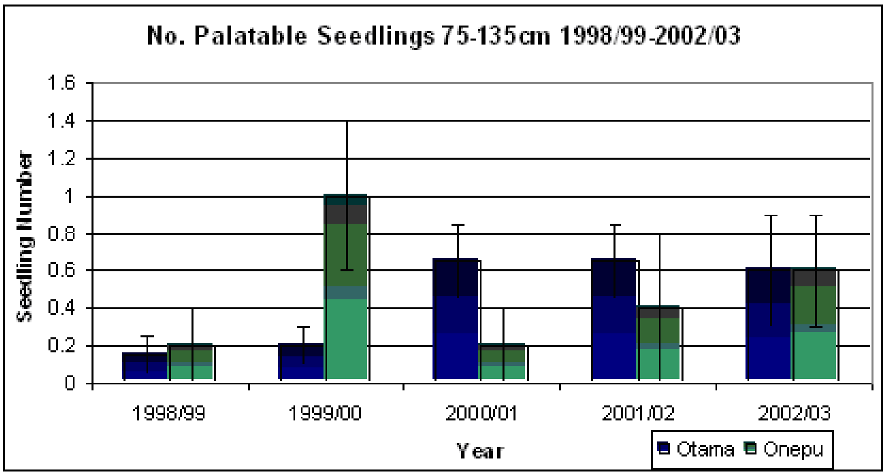
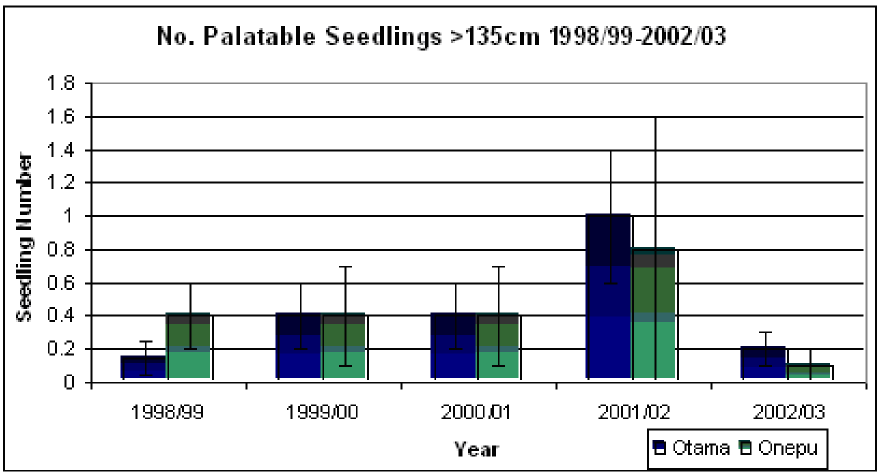


Fig. 4.6.7. Total number of palatable seedlings more than 135 cm in height at Otamatuna and Onepu; 1998/99 to 2002/03 (mean no. seedlings/line).



Tables 4.6.1 and 4.6.2 show the results of paired sample T-tests for 1998/99 v 2001/02 and 2000/01 and 2001/02 for Otamatuna and Onepu respectively.

Table 4.6.1. T-test for palatable seedlings at Otamatuna. Significant differences are calculated at 95% CI level.

	2001/02 v 2002/03		1998/99 v 2002/03	
Height class (cm)	**P value**	**Sig. Dif Y/N**	**P value**	**Sig. Dif Y/N**
0-15	0	Y	0	Y
15-45	0	Y	0	Y
45-75	0.57	N	0.049	Y
75-135	0.84	N	0.08	N
>135	0.06	N	0.67	N

Table 4.6.2. T-test for palatable seedlings at Onepu.

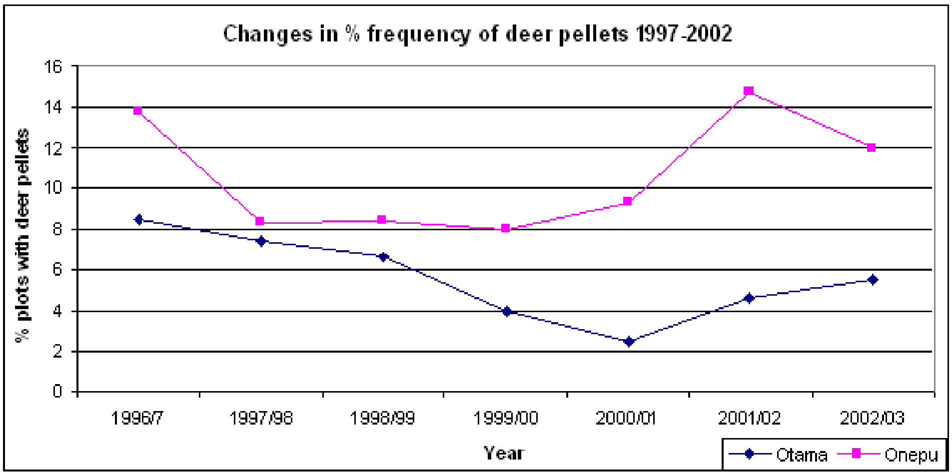
	2001/02 v 2002/03		1998/99 v 2002/03	
Height class (cm)	**P value**	**Sig. Dif Y/N**	**P value**	**Sig. Dif Y/N**
0-15	0.03	Y	0.06	Y
15-45	0.31	N	0.01	Y
45-75	0.37	N	0.56	N
75-135	0.73	N	0.17	N
>135	0.41	N	0.44	N

The figures show an overall trend of increasing number of seedlings in all height classes above 15 cm in the years between 1998/99 and 2001/02 in both areas although Omahuru had a decline in seedling density for some size classes between 1999/00 and 2000/01 before density again increased in 2001/02. While this trend continued in 2002/03 for seedlings in the 15-45 cm height class in both Otamatuna and to a lesser extent Onepu there were decreases in the numbers of seedlings in those height classes above 45 cm (except for an increase in seedlings in the 75-135 cm class at Onepu). The overall number of seedlings in height classes above 45cm was small, which re-emphasises the large statistical effect small changes can have in a small sample.

NZFS Pellet Lines

Results for the past seven years, including 2002/03 are shown in Figure 4.6.8. These show a sustained increase in pellet frequency at Otamatuna, while Onepu has retained most of the large increase in pellet counts recorded in 2001/02. These figures need to be interpreted carefully as each area has only four lines present and there is a considerable margin for statistical error. No statistical testing was carried out as the small sample sizes make the value of these tests somewhat dubious.

Figure 4.6.8. Percentage frequency of deer pellets at Otamatuna and Onepu 1996/97-2002/03



4.6.4 Discussion

Deer densities as measured by both pellet counting methods have increased at Otamatuna for the last two years following the low counts (by both methods) in 2001/01. Although these changes may not be statistically significant it would be of concern to management if this trend was to continue in subsequent years.

Onepu deer density also showed an increase by both monitoring methods. The Onepu Core Area has had a marked increase in deer sightings by rat trapping personnel and this is likely to be related to almost a year without significant aerial hunting meaning more deer present in the areas that the monitoring lines occur in.

As with previous years care still needs to be taken about drawing strong conclusions from the pellet data as absolute pellet numbers are still low and even very small changes in deer pellet counts can have a high influence on results at these frequencies. Long-term trends and patterns, which are now beginning to emerge from this data, is likely to indicate changes in deer populations. Short-term data will always be subject to considerable fluctuation and variability due to chance events.

Seedling/pellet transect results continued the trend of increasing palatable seedling densities in height classes over 15 cm at both areas. The bulk of this increase continues to be in the 15-45 cm size class with little significant change in the larger height classes; indeed many have declined since 2001/02 despite several years of increasing numbers of seedlings in the 15-45 cm class.

It would be expected that if deer density remains low, increasing seedling numbers in both the 15-45 cm size class and above would result. The failure of this to occur so far may be due to slowing seedling growth or some other natural factor. It may also be possible that deer numbers are low enough to allow an increase in small seedling establishment, but not low enough to allow larger (and probably more visible) seedlings to survive. Whether deer density is low enough to allow further recovery of a palatable seedling understorey will only be answered by continuing the deer hunting and monitoring the vegetation responses.

Confounding the lack of seedling growth found by the seedling/pellet transects is the conspicuous growth of large palatable seedlings in some areas of Otamatuna. This seedling growth however seems to be largely found on tracks, rat trapping lines and other infrastructural areas of Otamatuna. These areas have a high light intensity which may allow increased plant growth and are also heavily used by people and so may be avoided by the heavily hunted and wary deer. Also, these areas make up only a small proportion of the entire Otamatuna area but are disproportionately used by field workers, possibly giving a biased view of the state of the palatable understorey condition. There is also an awareness that large palatable seedlings 'should' be present so the presence of what may still be a rare or localised phenomena may unduly influence subjective observations.

Since the fieldwork undertaken in 2001/02, major changes have occurred to the venison recovery industry. Very little aerial hunting has been undertaken since April 2002 (apart from approximately one month in August-September 2002). This has meant that even over the highly productive spring hunting period when the bulk of helicopter harvest normally occurs, very few deer were killed by this method. Although more deer may have been shot by increased recreational hunting success this would not have off-set the absence of aerial hunting. If aerial recovery was to restart in the next year the increase in deer numbers is likely to be a temporary aberration as many of the naïve or bold animals would be quickly removed. However if recovery does not start again within 3-5 years it is likely that there will be a large increase in deer density with associated greater impacts on forest understorey.

There appears to be the beginnings of significant vegetation recovery in some areas of Te Urewera and the Waioeka (Burns & Shaw, 2002). Unfortunately there has been little monitoring of Te Urewera vegetation condition over the past 15 years to coincide with an overall decline in deer density. The impacts of increased deer density are unlikely to be linear and will differ considerably between different areas. For example, doubling deer density in areas of current low density containing an intact understorey, such as parts of the Motu catchment, may result in considerable loss of that understorey; whereas a doubling of density in areas in which the understorey is largely missing, such as Te Urewera may not result in significantly higher understorey destruction as most palatable species are already heavily. The lack of this information will make it difficult to establish the actual change in deer impact.

If the wild venison industry does not recover, the impact of the increasing deer population will need to be understood to enable effective targeting of control. There is likely to be a window of two to three years in which monitoring could establish a baseline in deer numbers and impacts before large-scale changes are likely. If there is no record of the present state of vegetation condition or index of deer population then it will be very difficult to understand what changes are occurring. An understanding of deer/forest/aerial deer recovery dynamics is probably needed to assist with long-term management of Te Urewera. It is unfortunate that over the past few years there has been no knowledge of the number of deer recovered from DOC estate in the East Coast despite helicopters providing the main control on deer populations and probably significantly reducing them in some areas. It is also unfortunate that no broad-scale information gathering on vegetation condition has occurred, however it needs to be acknowledged that collecting this data would be costly and time consuming.

4.6.5 Conclusions

Sampling over the past five years has shown a recovery in deer palatable seedling density at both Otamatuna and Onepu, although there is still no evidence of major increases in size classes greater than 45 cm. This increase is probably as a result of low deer numbers. Deer numbers appear to be low but stable or increasing slightly in both core areas. In the rest of Te Urewera there is almost certainly an increase in deer density due to the halting of aerial deer recovery. The extent of this increase and change in impacts is unknown but unless helicopter hunting restarts major changes are likely. If these changes are to be understood or recorded, significant forest monitoring needs to commence in the next two to three years.

4.6.6 Acknowledgements

Edited from a report compiled by Total Backcountry Solutions Ltd., PO Box 500, Opotiki (Report OPR009). Thanks to Pete Livingstone who carried out most of the fieldwork, and Colin Cartwright for an enjoyable couple of nights during Onepu Pellet line measurements. Finally to everyone who has spent time discussing all things related to deer.

4.7 KOKAKO AND ROBIN DISPERSAL SURVEY

4.7.1 Introduction

Information on the dispersal pattern of kokako and robins within large areas of undisturbed forest is limited. However the growth of the Te Urewera population has allowed an opportunity to increase understanding of the dynamics of kokako and robin dispersal within such habitats. Monitoring has shown that both kokako and robins have been increasing in density within Core Areas since 1996, with an estimated adult kokako population in 2003 of 220 individuals.

A kokako (*Calleas cinera wilsonii)* and North Island robin (*Petroica australis)* dispersal survey was undertaken in northern Te Urewera National Park in February and March 2003. This study was a follow-up to the previous year's survey for dispersed banded juvenile kokako. However, this season the main aim was to determine kokako density both inside and outside the Otamatuna and Onepu Core Areas.

4.7.2 Methods

Kokako Survey

- Local song dialect was played along preordained survey lines (Appendix 4.7.1)

- All birds heard or seen on the ridge and within 100m either side of the ridge were recorded. Birds located further than 100m from the ridge crest were, if possible, "dragged up" with tape to be within 100m of the ridge, indicating that their territory extended to this position, and were therefore included in the survey results
- All lines were surveyed from first light until approximately 12 pm, as kokako are more responsive to tape playback during these hours
- Local song dialect was played at intervals no greater than 100m along all survey lines to increase the likelihood of eliciting a response from all kokako in the locality.
- Surveying for kokako was only undertaken in fair weather conditions, defined for these purposes as being either fine, overcast, light drizzle or rain, with little or no wind.
- No surveying for kokako was undertaken in adverse weather conditions. All weather conditions on the dates of individual bird sightings were recorded (Appendix 4.7.4).
- In an effort to exclude bias from the results no extra survey effort was undertaken in any one location or survey line. Information collected on each bird included Core Area location, grid reference, any band combination seen, single or pair status and the presence of any chicks (Appendix 4.7.4).

Robin Survey

- Robins were surveyed in a similar method to that of kokako and the same survey lines were followed (Appendix 4.7.1).
- Robin song was played at intervals no greater than 100m along survey lines.
- All robins heard and not sighted off the ridge beyond 50m were counted as single birds only.
- All robins on the ridge were noted as either single or pairs and the presence of chicks was also recorded.
- Robins were surveyed for throughout the day.
- Surveying for robins was undertaken in fair weather conditions as defined above (Appendix 4.7.5 and 4.7.6).

4.7.3 Results

The location of all kokako and robins were mapped using GPS and downloaded onto GIS software (Appendix 4.7.2 and 4.7.3).

For a summary of results see Appendices 4.7.4, 4.7.5 and 4.7.6.

4.7.4 Discussion

It will be possible to produce a graph for both kokako and robin dispersal from the data that has been obtained from this survey. This may clarify source/sink issues as far as these two species are concerned as well as giving a guide to the value of protection of Core Areas. It is possible that further dispersal surveys in the future may reveal quite different results once carrying capacity is reached within the Core Areas, but this conjecture.

The density of kokako and robins within Otamatuna is very high but there appears to be adequate room for the existing birds to maintain territories. This suggests that until the unknown carrying capacity is reached, within the management boundaries, dispersal to outlying areas will be restricted.

The results from the Onepu Core Area are less conclusive. This could be because old remnant populations outside the Core Area may have been reinforced by dispersed juveniles produced within the Onepu Core Area. This remains an unknown factor because this population was not banded.

Otamatuna differed in that there were no remaining kokako populations after 1996 within hearing distance (3 km) of the area. This excludes a small remnant population east of the Te Waiiti Stream and Onepu Core Area itself which have banded kokako from Otamatuna reinforcing these populations.

Robin densities inside and outside the Onepu Core Area showed no great variation, whereas outside Otamatuna, density declined very quickly. The reason for this difference is unknown

The mean number of kokako encountered per kilometre of ridge line was used to calculate the kokako density over survey routes. This established what percentage of the kokako population was dispersing and what effect dispersal was having on areas surrounding the Core Areas. The results clearly showed that only around 10% of located kokako had dispersed and most of these numbers were within a kilometre of the Core Areas.

One interesting result of the survey indicated that kokako numbers in the Onepu Core Area have not increased at the rate population modelling would indicate they should. When compared to Otamatuna or Mangaone, which have maintained consistent increases per year, the Onepu population has remained static. There are two main differences between treatments of these Core Areas: the much larger ABC-line rat trapping regime is used at Otamatuna (and some excess birds may well supplement the adjacent Mangaone Core Area), and stoats are trapped over 4000 ha at both Otamatuna and Mangaone (Section 3.3), but no stoat trapping occurs at Onepu Core Area.

4.8 OTHER SPECIES

This season two discoveries of species previously unknown within the boundaries of NTUERP occurred. Both species, Hochstetter's frog (*Leiopelma hochstetteri*) and dactylanthus (*Dactylanthus taylorii*) were found by contract possum hunters, which highlights the worth of these individuals and their perceptive observations.

4.8.1 Hochstetter's Frog

Hochstetter's frog has a strong population in the East Coast region, with high numbers found in the Raukumara Conservation Area, with a lower density in the Urutawa Conservation Area and Waioeka Scenic Reserve. Up until this discovery, Hochstetter's frog was not known to be present in Te Urewera National Park, with the nearest known population inhabiting the true right of the Waioeka River.

The discovery by Alan Foster of the presence of these frogs in Clearing Creek (Appendix 8.1) extends the known range of the East Coast Hochstetter's frog population by approximately 15 km westwards. A survey of this area was conducted in the late 1970's by the New

Zealand Forest Service, with no frogs located (A. Saunders, *pers. comm.*). It has been assumed that the westward distribution of frogs from the stronghold in the Raukumara Ranges was limited by a combination of changes in habitat type, landform, and/or historic volcanic activity (namely the Taupo eruption in approximately 180 AD). The Waioeka River has also been considered to be a natural barrier to frog dispersal, as established populations are known to exist on the true right side, but until this discovery none were known to be present on the true left side of the river.

The range and magnitude of the Hochstetter's frog population in this area is not known, but initial surveys have confirmed its existence in several waterways nearby to Clearing Creek. Legally, this creek is part of the Waiotahi Scenic Reserve, even though it is contiguous with Te Urewera National Park. However, some frogs have now also been found within the legal boundary of Te Urewera National Park.

The degree of isolation of this frog population to those further eastwards is also currently unknown, as are any potential genetic differences in this population. It is possible the population has been isolated for many hundreds of years, presumably since the Taupo eruption; equally this may be reflect a recent extension of the range of these frogs by natural dispersal mechanisms.

The recent decline of frog species both within New Zealand and worldwide caused by infections by the South American chitrid fungus means that this population may be susceptible to disease. Ongoing monitoring of this low density population could serve as an early warning of a disease outbreak for the strongholds of the frog in the Raukumara Ranges, and steps could be taken to reduce the risk to these frogs. However, Hochstetter's frogs may be more resilient than other species to this fungus, as no cases of fungus infections have been recorded, and populations are remaining stable throughout their range. Therefore, Hochstetter's frogs are currently not considered to be at great risk by this fungus.

Threats to Hochstetter's frog could include people, rats, stoats, weasels, cats, eels and trout. However, the severity of these various potential threats is unknown in this area. The only currently known population exists in an area where possum control only is being undertaken, and there are no plans to undertake any additional pest control at this site.

4.8.2 Dactylanthus

The cryptic root parasite *Dactylanthus taylorii* was discovered by Colin Cartwright, a contracted possum trapper, in the Onepu Stream catchment this season. This is a significant discovery, as it the first population found within the boundary of NTUERP. The nearest known populations are 20 km west in Kopuriki Stream and 20 km south in the Waikare River catchment – these populations are within Te Urewera National Park, but not within NTUERP. This population, however, is near the centre of the possum control Background Area and so may have a greater chance at being able to fulfil a more natural ecosystem role, as high possum numbers in these other areas may be affecting their long-term viability.

The extent and magnitude of this population is currently unknown, but it is planned to undertake a more extensive survey of the area next season. These plants are found in an area of low possum numbers, so the condition of any new plants may reflect this control level.

There is also a possibility that short-tailed bats could be caught and subsequently radio-tracked to roost sites from these plants when they flower in late summer. Currently, the status of short-tailed bats in northern Te Urewera is uncertain, and no roost sites are known.

4.8.3 Raukumara Tusked Weta

The Raukumara tusked weta (*Motuweta riparia*) was found at Otamatuna for the first time this season. Two adult female weta were found in the head of Te Mapou Stream. This species was first found in the Motu catchment in 1995, and has since been found distributed over a large area, in streams throughout the Raukumara, Waioeka, Urutawa and Te Urewera catchments. This discovery adds to the distribution records within NTUERP, with previous records coming from the Ikawhenua Range in 1996, the Otapukawa Stream and mouth of the Mangaone Stream in 1998, and Tawhana Stream in 2002.

5. Public Awareness and Community Participation

5.1 PUBLIC AWARENESS

Jane Haxton - Department of Conservation, Opotiki Area Office.

5.1.1 Introduction

Public awareness and community participation is an important component to develop and expand the NTUERP. As one of six mainland island projects within New Zealand, it is extremely important to circulate results and techniques, both within DOC and out to the wider community. Information presented to communities and DOC staff assists in raising awareness of the uniqueness and strategic importance of NTUERP.

Significant groups associated with NTUERP are: Tuhoe as tangata whenua; DOC managers and staff; East Coast/ Hawke's Bay Conservation Board; research organisations i.e. Manaaki Whenua/Landcare Research; associates, e.g. Forest and Bird, hunters and tramping clubs; schools; media; and the local community.

5.1.2 Objectives

Annual Objectives

- To communicate key aspects of the project to tangata whenua and community interest groups.
- To seek participation from tangata whenua on key aspects of project planning and implementation.

Long-term Objectives

- To engender understanding and support from tangata whenua and community interest groups.
- To promote the uniqueness and strategic significance of the project to interest groups nationally.

5.1.3 Methods

All members of the NTUERP have been involved in promotion of the project. The key promotion methods have included attending hui with tangata whenua, hosting various groups at the Otamatuna Core Area, media releases, talks, circulation of the annual reports and attending conferences throughout the country.

5.1.4 Results

Talks

Staff attended hui at Waimana, Ruatoki and Waiohau communities. These forums allowed staff to present project results and discuss pest-control methods for the various Core Areas. The Waimana Kaaku DOC liaison attended the annual strategic meeting to discuss any issues concerning tangata whenua and consult on future operational activities and direction of the project. This strategic meeting also included DOC representatives from East Coast/ Hawke's Bay Conservancy, Bay of Plenty Conservancy, Science and Research and Northern Regional Office.

Staff members gave public speeches to over 350 people on a variety of aspects of the project. Groups included Forest and Bird, Waimana School, Girl Guides, and a range of DOC staff from other Area Offices and Conservancies.

In February 2003, a delegation of Kanaks from New Caledonia visited the Otamatuna Core Area. There were two main focuses for this trip. The first was to look at the pest control methods applied within the Restoration Project. The second was to look at the interaction and involvement of local Maori. In June 2003, Lindsay Wilson (Programme Manager, Biodiversity Threats) and Alan Saunders (Mainland Islands Technical Coordinator, Science & Research) visited New Caledonia. The objective of their trip was to determine the feasibility of intensively controlling pest mammals in forests on Mont Panié.

Funding was provided for a Community Advocate with the aim of increasing awareness of NTUERP. This season the advocate focused on the Waiohau Community visiting schools, community groups and marae (Section 5.2). This funding is to be continued in 2003/2004 with the main focus being on the Waimana Community, while continuing with follow-up events in the Waiohau area. This funding also has been applied for in the 2004/2005 season with the focus moving into the Whakatane Valley and surrounding communities.

Two NTUERP staff participated in the Mainland Hui at Hurunui in August 2002. The hui involves representatives from DOC managed mainland islands, sanctuaries, similarly managed projects, community trusts and other interested parties. The stimulus behind this annual hui is to exchange ideas and experiences. The main focus was on pest control, in particular rat control.

A number of groups visited the Otamatuna Core Area and were guided through the site by staff. Visitors included Darren Peters (National Predator Officer, Biodiversity Recovery Unit), and Craig Gillies (Scientific Officer, Science and Research), Forest and Bird members and a variety of school and community groups.

Other Public Awareness

News releases were published in the *Opotiki News, Whakatane Beacon* and *Eastern Bay News*. Article topics included kiwi, kokako, whio, and animal control.

Pesticide summaries were sent out to all relevant groups within the Opotiki and Whakatane regions and also to all hunters requesting hunting permits for Te Urewera National Park.

Table 5.1.1. Communication avenues used by NTUERP staff, 2002/2003.

	TV	Newspaper	Public Talks	Radio	Publications	Internal Publications
No of Events	0	4	16	0	0	2

5.2 COMMUNITY REPORT -WAIOHAU

5.2.1 Introduction

Waiohau is situated on the north-western boundary of the NTUERP control area. Because of the close proximity of the NTUERP to Waiohau it was deemed important to inform the community about Departmental activities in this area. This information transfer is important due to the historical and spiritual relationship this community has with Te Urewera as the majority of the community are affiliated with the Tuhoe iwi, tangata whenua of Te Urewera.

During May 2003 Hemi Barsdell was employed by the Opotiki Area Office to conduct community awareness work among the Waiohau community. The objective of this position was to promote awareness in this community about NTUERP, its objectives and the outcomes that have currently been achieved.

This report outlines the work undertaken within the Waiohau community during this period, along with recommendations for future public advocacy.

5.2.2 Methods

After contacting key individuals in Waiohau it was discovered that the main target groups were the Waiohau Community Runanga and the local schools. The Waiohau Runanga is a representation of the community who gather occasionally to discuss matters relevant to their area. Unfortunately, due to the short period of the contract and the irregular meetings of the Runanga, a meeting with the Runanga did not eventuate.

Talks at all three schools within the Waiohau area were arranged: Te Mahoe School; Te Kura Kaupapa Maori o Waiohau; and Galatea School. All of these schools cater for year 1 to year 7 students.

A one hour presentation was designed and targeted to provide information about NTUERP for the students of these schools. The presentation introduced the concept of conservation, what it is and why it is important. The Department of Conservation and their role in Te Urewera was also explained. The general concept of how a forest ecosystem functions was explained to help the audience develop an understanding of some of the interactions between introduced and native species. Various media, including a predator-prey video, overhead transparencies and activities were used to aid the audience's understanding of these concepts. The need for pest control and the way in which NTUERP achieves this were explained once the audience had an increased understanding of the impacts of introduced pests in Te Urewera.

5.2.3 Results

A total of 250 students at the three schools participated in the talks. Feedback from the teachers and the students was very positive. The teachers commented that the talks were appropriately pitched to the students ability to grasp the messages trying to be conveyed, with the students consequently being able to understand this information.

5.2.4 Discussion

The presentation design was important due to the age range (5-13 years old) of the audience. To avoid making it too complicated for the younger students, or too simple for the older students, considerable thought had to be put into making the presentation suitable for all students.

By using various visual and aural aids the audience remained interested throughout the talks. Activities were designed that would suit this age group. For example, a bird song game where they had to match the bird song to the appropriate bird. A predator video showing nests being preyed upon by various pests also appealed to this age range. The presenter had to be flexible in the delivery of the talks, and be prepared to move away from the schedule of the presentation. While presenting it was essential to be able to improvise. This was helped by having various resources available.

The notion of 'conservation', and the impact some introduced species have on native ecosystems were two essential concepts that were stressed. This is due to these concepts being integral components of NTUERP. Of great importance was illustrating to the audience that without the conservation activities established with the commencement of NTUERP, further extinctions would occur among our native species in Te Urewera.

An evaluation session at the end of each talk directed questions to the audience to reinforce the main messages. Answers to these questions revealed that the majority of the students understood the main concepts of the NTUERP.

Feedback from the teachers at the schools revealed a desire for more of these visits by Department of Conservation staff. Teachers also thought that follow-up talks would be beneficial to the students. Teaching resources that focussed on the conservation message expressed in these talks were also requested.

Talks with the Waiohau Runanga would have been ideal for increasing awareness among this community. The short duration of this contract prevented a suitable meeting being arranged. Future community relations work in Waiohau should attempt to communicate with the Runanga.

Aside from the work in Waiohau, the Conservation Course from Employment Plus in Whakatane was accompanied on an overnight trip to the Otamatuna Core Area. The objective of this fieldtrip was to expose the trainees to a practical conservation programme and the NTUERP in particular. This 'outdoor education' approach was ideal, as the trainees understanding of the NTUERP was significantly enhanced by seeing first-hand the conservation practices in Otamatuna. Six trainees and their course instructor visited Otamatuna.

5.2.5 Conclusion

The Waiohau Community Runanga was the main target audience for this position, as they are the group that best represents the Waiohau community. Time restraints however prevented a meeting between the Community Advocate and the Waiohau Runanga being arranged. Any future advocacy work should again attempt to converse with the Runanga.

Feedback from the three Waiohau schools was positive. The content of the presentation appealed to the age range of the audience, and those that participated came away with a good understanding of the conservation actions being undertaken within Te Urewera.

5.2.6 Recommendations

- Future advocacy work in Waiohau should attempt to converse with the Runanga.
- Time restraints should be considered for the duration of the advocate's contract.
- Teaching resources should be designed to be left with schools.
- There needs to be an increase in communication about NTUERP and the role of the Department in Te Urewera with more communities and schools within the boundaries of the Opotiki Area Office.

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7. Appendices

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