Operational Report – Te Kauae O Maui 2013 to 2015

Red Admiral Ecology

RED ADMIRAL ECOLOGY CONTRACT REPORT 2016/9
July 2016

Cover photo: Nationally at Risk *Pittosporum virgatum* on regenerating kauri spur.

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Contents

Summary

Small scale intensive ecological restoration inputs within the 97 hectare (ha) Te Kauae o Maui (TKOM) project area are reviewed in this report (2013 – 2015). Following on from commissioning a restoration plan residents and visitors established a network trapping system to control mammalian predators to low densities. Under represented semi-coastal forest was supported by the control of invasive plant pests and additionally through the planting of locally rare species such as pohutukawa, kowhai and tree fuchsia.

At total of 453 person days effort (PDE) was logged during the three year period. Of this 63 person days effort (14%) was funded and the balance, 390 PDE (86%) was non paid work by residents and volunteers.

Possums were controlled to low densities but continued to reinvade the treatment area, especially during autumn 2015. Informal photo monitoring showed possum browse on palatable species to be much reduced after just one year. Capture rates of mobile species such as cats and feral pigs also remained relatively constant, reinforcing the vulnerability of small treatment areas to continued reinvasion of mobile predators.

KaMate™ rodent trap rat capture rates and small mammal index (SMI) tracking tunnel rates indicate that rat densities were suppressed in treatment areas for the three year period. Data showed that densities increased during autumn but these were quickly suppressed.

Kiwi call rates increased over the time and kaka were observed mating.

Gecko monitoring was inconclusive and more effective method is required.

In this instance committed residents produced measurable benefits to biodiversity within the area of interest and the challenge ahead is to maintain these gains.

1. Introduction

1.1 Objectives

This report details the results of ecological restoration efforts in the Te Kauae o Maui over a three year period. The objectives are to:

1. Summarise restoration efforts.
2. Assess performance of the of pest management programme.
3. Recommend any improvements.

1.2 Background

Te Kauae o Maui was established in 1980 by a private group of people who purchased the valley for lifestyle purposes and several house sites were established about eastern margins.

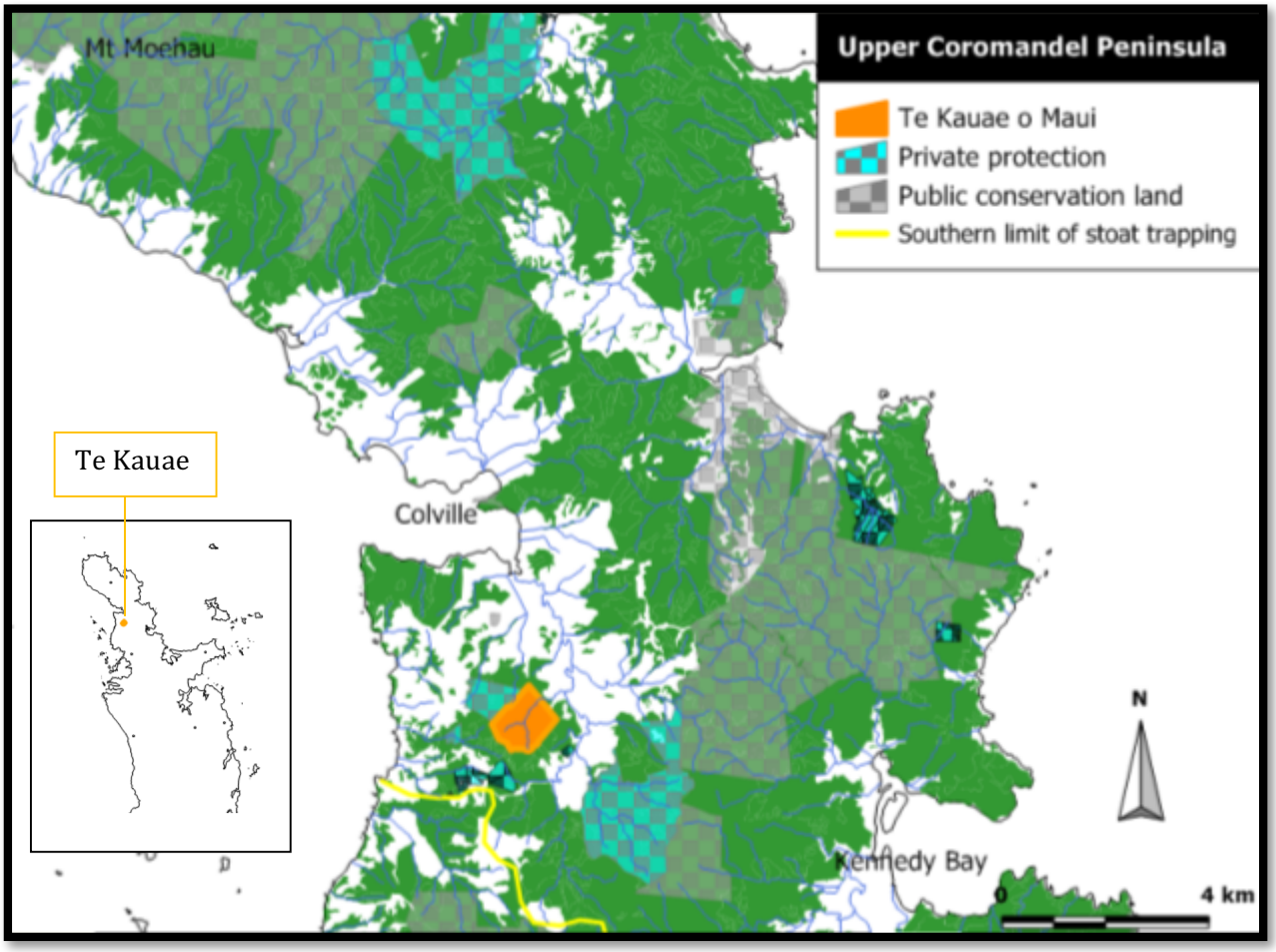

FIGURE 1: TE KAUAE O MAUI NATURE RESERVE LOCATION

Te Kauae O Maui is located on the true left of the Colville Valley in north-west of the Colville Ecological District (ED). The area encompasses a forested unnamed tributary to the Umangawha Stream which drains into Colville Bay. Terrain grades from low angle slopes about the lower reaches of the stream to high angle slopes in headwaters. Elevation range is from 20 to 285 m above sea level.

Parent rock is of volcanic origin (GNS, 2011), and the brown clay soils are considered to be of relatively low fertility and poor drainage (McLeod and Briggs, 2009).
The site is not formally protected. It forms a key linkage function between outlying public and private protected lands and to the Coromandel Range (FIGURE 1). It also directly buffers a total of 339.45 hectares (ha) of surrounding forest.

Much of the coastal/lowland forest about Colville has been converted for pastoral/forestry purposes since European settlement. This has resulted in habitat loss/fragmentation, the introduction of mammalian browsers/predators and associated degradation of forest processes. Restoration efforts were tailored to be realistic in terms of the present situation but also look to the future in terms of what type of habitat will provide opportunity for future generations (Stewart 2011).

Te Kauae O Maui also forms an important anchor role for local biodiversity restoration as it is surrounded by remnant habitat clusters which singularly are unlikely to substantively contribute to improved biodiversity due to issues of scale and fragmentation. E.g. there are a number of linked privately and publicly protected natural areas to the west in the Waitete Valley (FIGURE 1).

1.3 Te Kauae vision

The Te Kauae project aims to "Restore natural processes/species through a holistic kaitiakitanga or guardianship", and these are in alignment with the New Zealand Biodiversity Strategy (DOC & MfE, 2000) which seeks to reverse biodiversity decline in key natural areas. The initiative aims to showcase how local key ecological processes and threatened species recovery can be attained in a rural lifestyle community. It also seeks to contribute to recovery of populations such as kiwi and kaka across the Upper Coromandel landscape.

2. Flora

Vegetation is contiguous from the Colville Valley to the crest of the low coastal dividing ridge. Remnant vegetation patterns suggest that broadleaved tarairi-kohekohe associations originally dominated gullies and these graded to kauri-podocarp/broadleaved associations on spurs and slopes. There is also evidence that pohutukawa was an associate on upper spurs and ridges throughout the area.

The area falls within the semi coastal bioclimatic zone. Diagnostic features to support this classification include tawapou (*Planchonella costata*) and houpara (*Pseudopanax lessonii*) (one instance of each species only), whau (*Entelia arborescens*) in the old growth gully and coastal influence to *Metrosideros spp.* throughout the area. Semi-coastal forest[1] is under represented within the Colville Ecological District (Leithwick et al, 1995)).

In general terms the lower slopes are dominated by a regenerating kauri/kanuka association (10 - 15 m high) which grades to manuka (5 m) on steep spurs that also support some very dense stands of regenerating kauri and tanekaha (*Agathis australis* & *Phyllocladus trichomanoides*). The Nationally At Risk *Pittosporum virgatum* is also observed in two discrete areas. Common hardwood species such as hangehange (*Geniostoma ligustrifolium*), heketara (*Olearia rani*) and *Coprosma spp*. are present in the kanuka understory. On manuka spurs prone to drought more hardy species such as mingimingi (*Leucopogon fasciculatus*), divaricating *Coprosma spp*. and akepiro (*Olearia furfuracea*) are typically encountered.

Gully systems are less modified and support mature rata/tarairi-kohekohe (*Beilschmiedia taraire-Dysoxylum spectabile*) forest, but in the upper catchment, tawa (*Beilschmiedia tawa*) replaces tarairi on steep slopes. Much of the hardwood forest association has been logged and old bulldozer routes are readily identified by lines of kanuka through the broadleaved forest. Nikau is commonly observed as a canopy and also sub canopy species and puriri was observed throughout the catchment.

[1] The semi-coastal bioclimatic zone has not been delineated in the Colville ED (Stanway et al, 1990)

3. Fauna

The sanctuary supports several resident terrestrial threatened species. Kiwi, kaka, Hochstetter's frog, brown and green geckos are present. Those observed over the last sixteen years are summarised below in TABLE 1. Classification rankings are from (Miskelly et al. 2008) and (Newman *et al*. 2010).

TABLE 1: RESIDENT THREATENED SPECIES OBSERVED IN TE KAUAE O MAUI , 2000-2016

SPECIES	COMMON NAME	CLASSIFICATION	MONITORED
Apteryx mantelli	Coromandel Brown Kiwi	Nationally vulnerable	YES
Woodworthia maculatus or	Common gecko or	Not threatened	YES
Dactylocnemis pacificus	Pacific gecko	At risk	YES
Naultinus elegens	Auckland green gecko	At risk	NO
Leiopelma hochstetteri	Hochstetter's frog	At risk	NO
Nestor meridionalis septentrionalis	NI kaka	Nationally vulnerable	YES

4. Results

4.1 Summary of effort

A total of 453 PDE was recorded by the project co-ordinator across all facets of the project. Eighty-nine % of effort was put directly into field work and the remaining time utilised for administration, advocacy and maintenance (FIGURE 2). These figures do not include the transport of goods and services to the project site or factor in depreciation of equipment.

Of this 63 person days effort (14%) was funded and the balance, 390 PDE (86%) was non paid work by residents and volunteers. The rat control network which provides permanent control required 0.125 PDE/hectare (or $19.31/ha) each year[2].

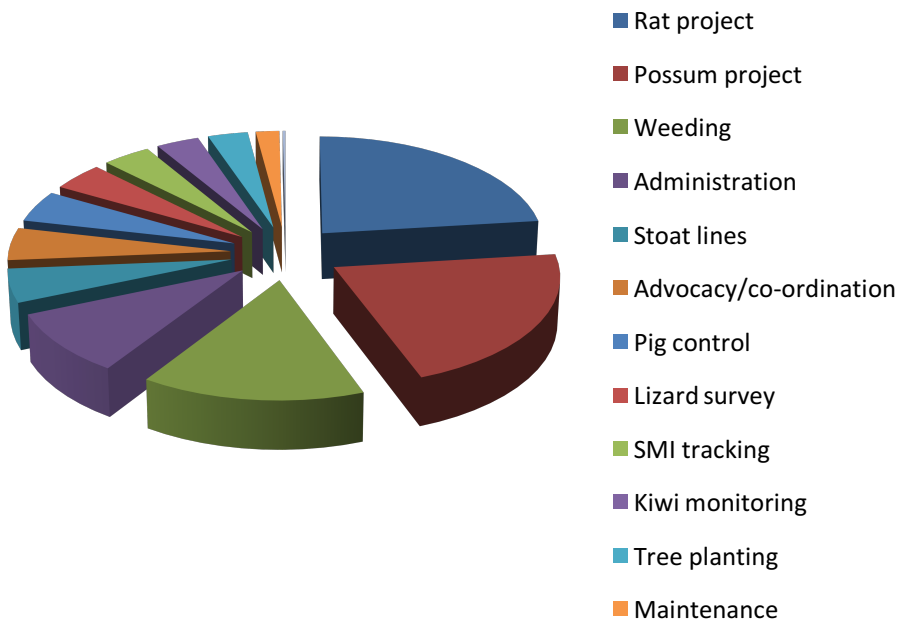

FIGURE 2: PROPORTION OF EFFORT BY TASK AT TE KAUE O MAUI 2013 - 2015

4.2 Restoration of uncommon flora

Amongst the mosaic of forest types there were several species/forest associations that were uncommon at Te Kauae and these have been identified with the objective of restoration and also improving nectar/fruit productivity. Several of the uncommon species are not presently classified as Nationally Threatened/At Risk.

Fourteen PDE were invested in planting 130 trees which included pohutukawa, kowhai and tree fuchsia (FIGURE 3). *Pittosporum virgatum* and houpara were not planted as these species were not available. Funding for trees was courtesy of the Honda Tree Foundation and Project Crimson.

[2] Includes cost of trap purchase

FIGURE 3: PLANTING POHUTUKAWA ON UPPER SHRUBLAND SLOPES

4.3 Weeds

Ecological plant pests
Priority: High
Non target effects: Potential for rare/uncommon flora to be cleared while plant pests are being removed. All weeding sessions were supervised and no native species were adversely affected.

Residents and volunteers put in a total of 67 PDE to clear weed infestations about the eastern margins of the area (FIGURE 4). This effort resulted in the initial knockdown and continued control of all High and Medium priority species (TABLE 2).

TABLE 2: PRIORITISATION OF PLANT PEST CONTROL, TE KAUAE

SPECIES	COMMON NAME	PRIORITY	KNOCK DOWN ACHIEVED
Hedychium gardnerianum	Kahili ginger	High	Yes
Asparagus asparagoides	Smilax/climbing asparagus	High	Yes

Solanum jasminoides	Jasmine	High	Yes
Solanum mauritianum	Woolly nightshade	Medium	Yes
Phytolacca octandra	Climbing passion fruit	Medium	Yes
Not determined	Unidentified succulent	Medium	Yes
	Mexican daisy	Medium	No
Ageratina adenophora	Mexican devil weed	Low	No
Phytolacca octandra	Ink weed	Low	Yes
Tradescantia fluminensis	Tradescantia	Low	Yes
Plectranthus ciliatus	Plectranthus	Low	No

FIGURE 4; BAGGING UP CLIMBING ASPARGUS FOR DISPOSAL

4.4 Avifauna

Kiwi protection and monitoring

TKOM is the core component of an important remnant kiwi population[3] documented since the early 1990s (Marsh, 1993). Stoat trapping commenced in 2000 when 23 stoat traps were established about the 97 ha site.

This effort was substantively bolstered in 2005 when the Moehau Environment Group established landscape scale stoat trapping throughout the local area. It can be seen in FIGURE 1 that Te Kauae O Maui is near the southern limit of continuous landscape protection in the Upper Coromandel peninsula and is also potentially exposed to invasion by ferrets.

A kiwi listening survey in 2010 determined that at least 6 pair were considered to be predominately inside the eastern 40 ha of TKOM (T. Herbert, pers. comm.). This equates to approximately one pair per 7 ha and densities such as this are found only in discrete locations in the Coromandel ER (pers, obs). There is also some historical chick survivorship information as a male (Barney) was monitored for three years. He hatched four chicks each year (not all were able to be monitored as some chicks were inaccessible in burrows). Three of the six chicks that were radio tracked survived to 1000g. Two of these were killed by dogs and the third settled within the TKOM treatment area. Two of the other chicks died from stoat predation and the sixth dropped its transmitter prior to reaching 1000g and so its fate is unknown.

More recently two other adult kiwi are known to have died (trapping and dog) on land buffering TKOM and a sub adult has taken residence behind one of the houses and so although kiwi persist in the greater Umangawha area, it is presently unclear what happens to young birds moving out across the greater landscape.

Building on this work TKOM constantly followed through with the following:

- Reduced threats to kiwi by continuing to advocate dog aversion training in the local area.
- Encourage local trappers to used kiwi safe trap setting methods.
- Minimised threats to birds about dwelling sites.

[3] Umangawha kiwi hotspot

- Reduced the frequency of feral pig and dog visitation into Te Kauae.
- Continued listening surveys to monitor the adult calling population (16 PDE over 2013 – 2015 period).

Kaka

This species utilise old growth trees to roost and nest within the treatment area. Breeding by resident kaka was observed in 2014 (N. McCauley, pers comm), but to date no nests have been detected.

4.5 Herpetofauna

Frogs

Hochstetter's frog is present at Te Kauae. Preferred habitat for these frogs is restricted to 1st order streams and monitoring of this species was not undertaken due to the potential disturbance of refugia which are sparse and relatively unstable.

Lizards

Brown and green gecko's have previously been detected about lower Te Kauae scrubland areas, usually under old drums and iron and while gathering firewood (N & N McCauley, pers. comm.). Coromandel Striped Gecko (*Toropuku stephensi var. coromandel*) is potentially present, as it has been detected within 600 m of TKOM (Chappell, 2007).

A total of 19 person days effort was put into lizard surveys. Tree wraps were established and checked. G-Minnows, SMI, pitfalls, tree wraps and night spotting utilised. No lizard detections were made from this work.

Expert support was obtained from the Department of Conservation and staff from Ecogecko Ltd. Brown lizards (forest and pacific gecko) were confirmed to be present and so it appears a more nuanced monitoring method will need to be developed.

Tracking tunnels were baited with pear biennially[4]. Area A tracking rates were variable and average tracking tunnel rates for skinks and geckos were 3% and 1% respectively over the three year period.

4.6 Trapping

Possums

[4] Cat food also used in 2015

Priority: High to restore broadleaved forest canopy condition.
Non target effects: No kiwi were caught during the trapping operation.

Local landowners and the Department of Conservation (DoC) began controlling possums on the Upper Coromandel Peninsula in the late 1980's when forest canopy condition was just beginning to decline due to possum impacts (Burns, 1985). The establishment of possums was relatively late on the Upper Peninsula compared to other mainland North Island areas and they have been controlled intermittently since 2000 at Te Kauae O Maui. A similar number of possums were caught each year over the three year period (TABLE 3).

TABLE 3: POSSUM TRAPPING RESULTS TE KAUAE O MAUI, 2013 - 2015

YEAR 1	YEAR 2	YEAR 3
445	554	551

Monthly capture rates were higher on the Perimeter line more often than in the interior (FIGURE 5). Interior capture rates were higher during Year 2 autumn.

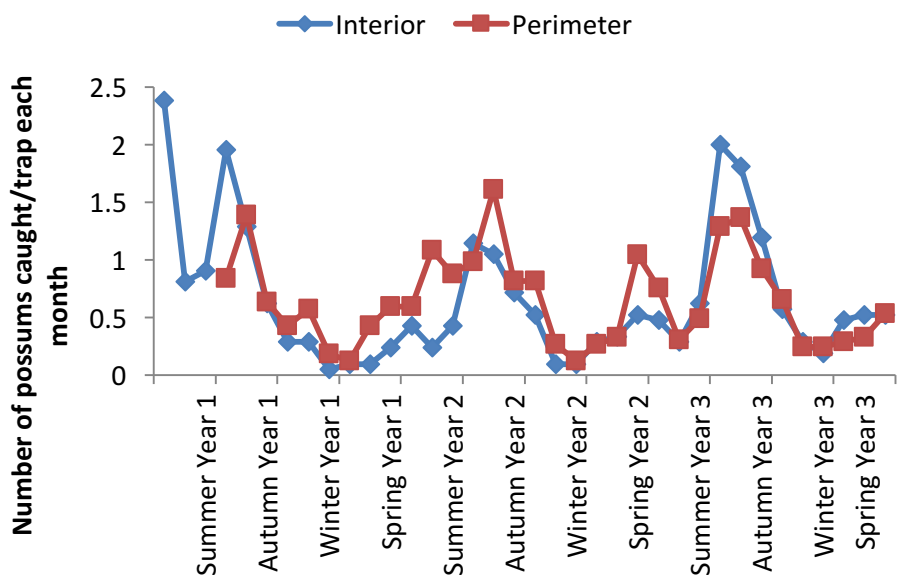

FIGURE 5: POSSUM TRAP CAPTURE RATES/MONTH, TE KAUAE O MAUI 2013 - 2015

Mustelids
Priority: Continued maintenance and monitoring.

Non target effects: Potential to capture small forest birds in stoat traps.

Twenty-three Fenn traps in stoat boxes were established in accordance with best practice in 2000 (at 200m intervals). The Fenn traps were replaced with DoC 200s and maintained the throughout the three year period, including when external funding was unavailable. A total of 31 mustelids were captured (TABLE 4).

TABLE 4: MUSTELID CAPTURES, 2013 – 2015

Species	YEAR 1	YEAR 2	YEAR 3
Ferrets	0	0	0
Stoats	7	10	6
Weasels	0	4	4

Goats
Priority: Presently low
Non target effects: Not applicable at present

Goats established in the Upper Coromandel around the 1870s (Moore and Cranwell 1934), and reached medium to heavy infestation levels by 1950. Goats cause substantial damage to the forest understory. Large mobs were present throughout the local area and hunted for sport during the early 1970's (pers obs). Subsequently a large proportion of them were removed by members of the public and finally hunted to functional extinction in the late 2000's by DoC hunters. Goat sign was not observed over the three year period.

Cats
Priority: High
Non target effects: None - cage traps are utilised.

Cats were targeted when sign was observed. A total of thirteen were caught (TABLE 5)

TABLE 5: FERAL CAT CAPTURE RESULTS TE KAUAE O MAUI 2013 - 2015

YEAR 1	YEAR 2	YEAR 3
5	6	2

Feral pigs
Priority: High
Non target effects: None detected. Kiwi call rates within the area continued to increase over the period.

Feral pigs were also targeted as they have been shown to impact on forest regeneration (C. Krull, pers comm.) and predate on native frogs (pers obs.). They also attract

trespassing pig hunters and dogs in to the area and are also considered a vector for kauri collar rot fungus (*Phytophthora taxon Agathis*).

A total of 21 PDE was invested. Cage traps and a kiwi certified hunter caught a total of 23 pigs (TABLE 6).

TABLE 6: FERAL PIG CAPTURE RESULTS TE KAUAE O MAUI 2013 - 2015

YEAR 1	YEAR 2	YEAR 3
4	7	12

Rodent control

Priority: High

KaMate™ traps were deployed at densities of 8 traps/ha in each treatment area. All of the traps were screwed around 120mm off the ground onto trees (FIGURE 6). They were checked twice within five days of opening to gain maximum knock-down and there-after monthly.

FIGURE 6: RAT CAUGHT IN A KAMATE RODENT TRAP

Three trapping areas of approximately 20 ha each (FIGURE 7) were established each year. Area A was treated over all three years; Area B in years two and three and Area C

in year three. One hundred and four PDE was invested in total. Establishment required 0.3 PDE/ha to install the network and trap checking 0.125 PDE/ha each year. Based on figures from over the three year period ongoing maintenance is calculated to be to $6.28/ha each year for the 17 years.

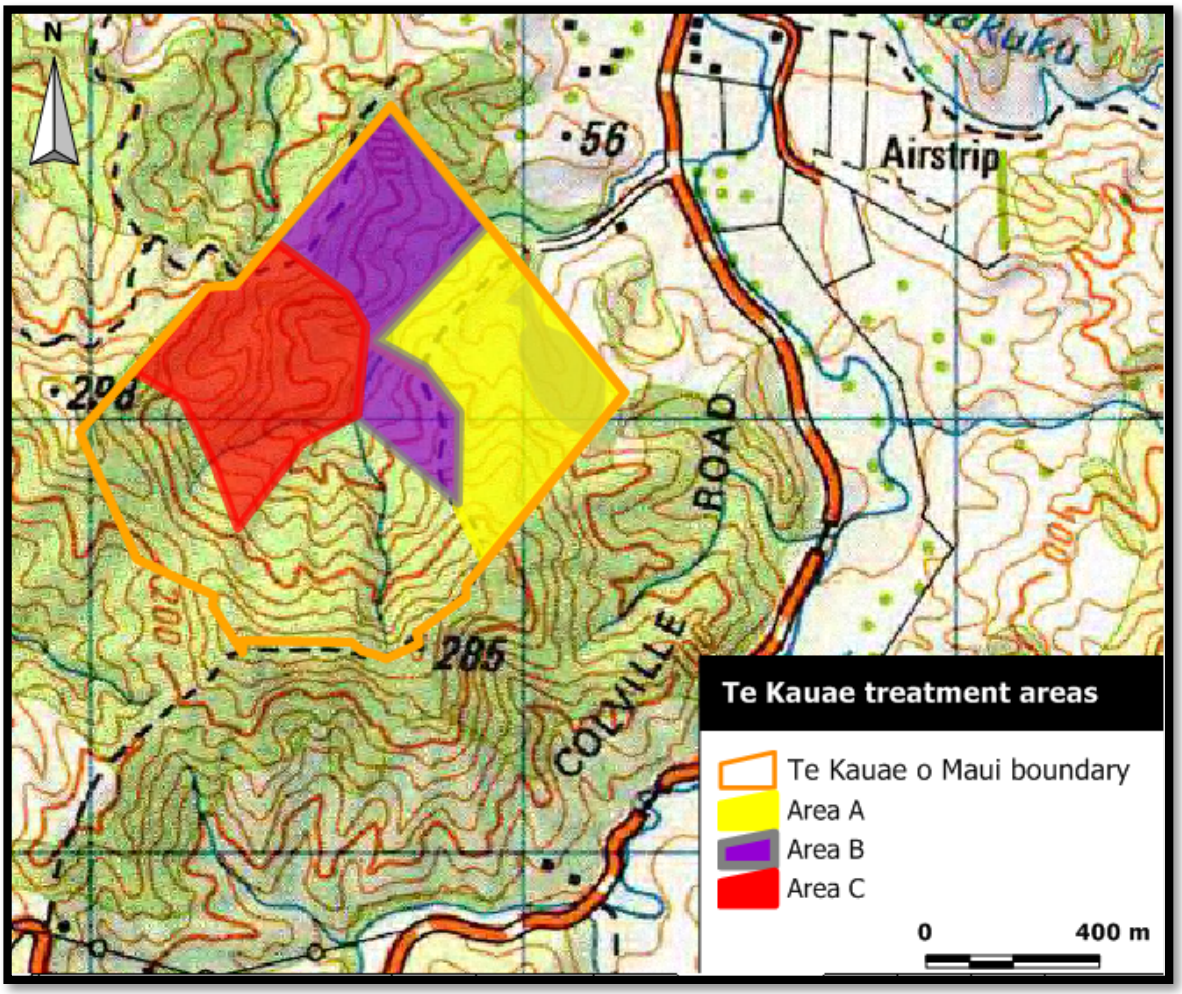

FIGURE 7: RAT TRAPPING AREAS, TEKAUE 2013 - 2015

Area summaries

Area A rat captures decrease sharply after the first two months of trapping (FIGURE 8). An increase in capture and tracking rates was detected in autumn 2014. Except for the autumn 2014 increase it can be seen that rat numbers were constantly suppressed over the three season treatment period in Area A.

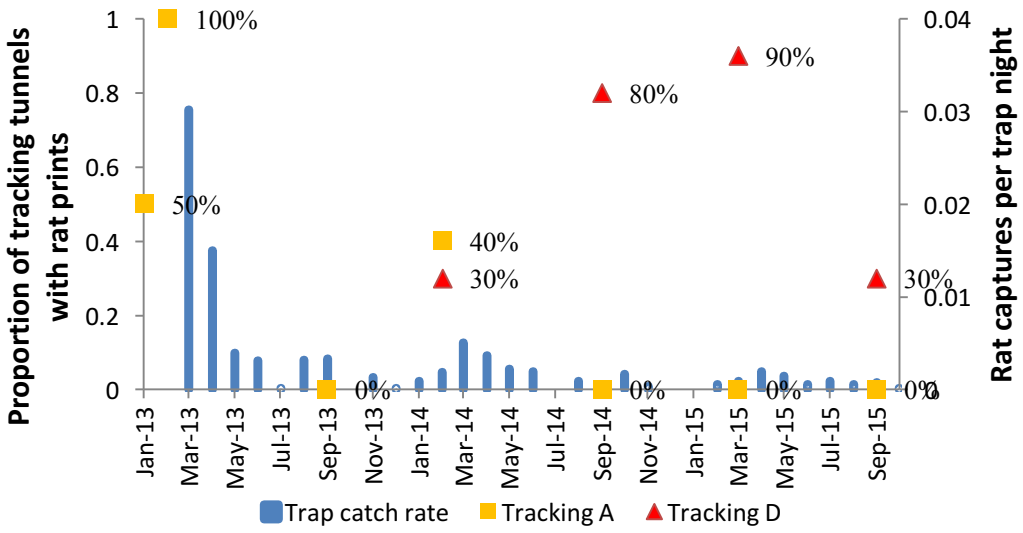

FIGURE 8: RAT CAPTURE AND TRACKING RESULTS FOR AREA A, TE KAUAE O MAUI 2013 - 15

Area B was trapped for two seasons. Trap captures initially declined but tended to increase for several months and then declined (FIGURE 9). Tracking card data shows that densities stayed well below the non-treatment Area D.

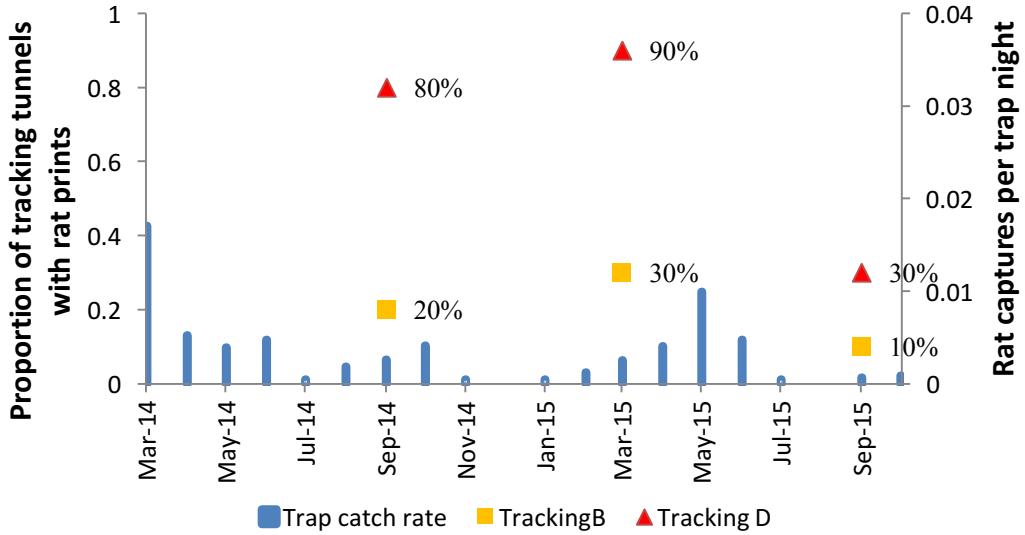

FIGURE 9: RAT CAPTURE AND TRACKING RESULTS FOR AREA B, TE KAUAE O MAUI 2014 - 15

Area C was trapped for a six month period. Capture rates remained low after the first month of treatment (FIGURE 10).

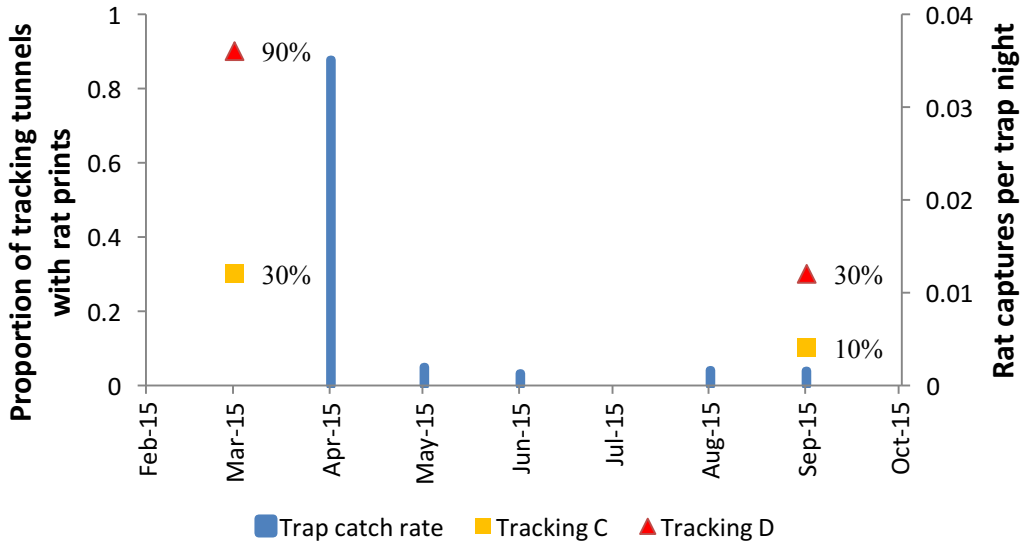

FIGURE 10: RAT CAPTURE AND TRACKING RESULTS FOR AREA C, TE KAUAE O MAUI 2015

Project progress over time

Trapping was restricted to Area A for the initial thirteen month period. Trapping and tracking rates indicate that densities were maintained at low densities until early autumn 2014 when a spike in tracking rates is observed (FIGURE 11)

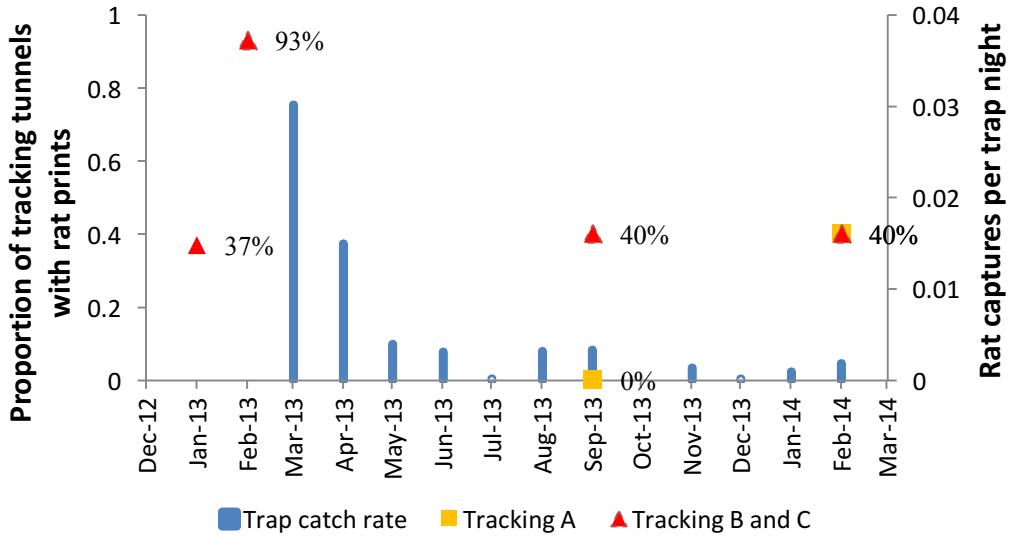

FIGURE 11: RAT CAPTURE AND TRACKING RESULTS FOR AREA A, TE KAUAE O MAUI 2013 - 14

Area B traps were opened in March 2014. The combined A and B tracking results show densities were substantially lower than in the untreated C and D areas when monitored in Spring 2013 and Autumn 2014 (FIGURE 12).

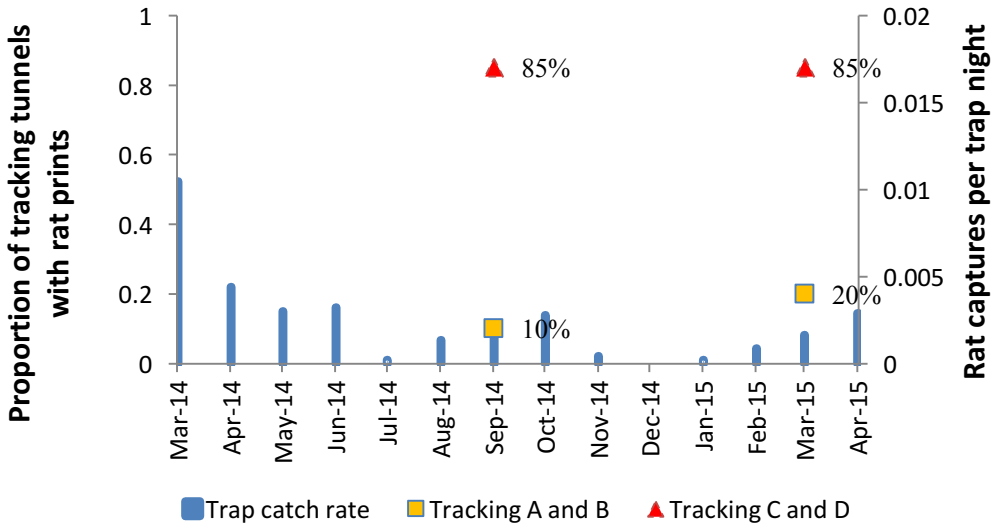

FIGURE 12: RAT CAPTURE AND TRACKING RESULTS FOR AREAS A and B, TE KAUAE O MAUI 2014 – 15

Trapping rates in Area A, B and C combined were elevated during in autumn 2015 when area C traps were opened. Tracking data 2015 indicates that rat densities were relatively low heading into spring (FIGURE 13).

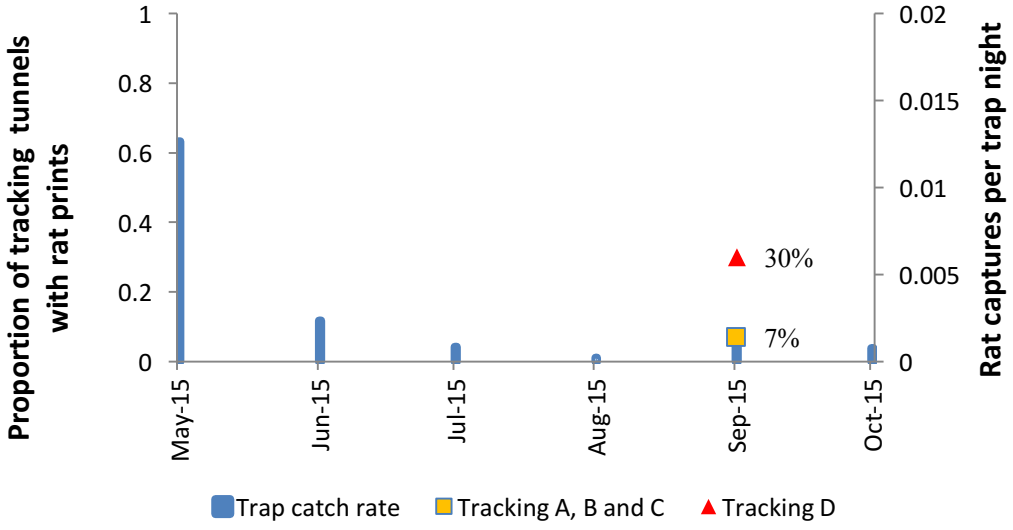

FIGURE 13: RAT CAPTURE AND TRACKING RESULTS FOR AREAS A, B and C, TE KAUAE O MAUI 2015

Magpie control

Priority: High

Magpies were not identified as a serious pest threat to the forested TKOM Project area in the 2011 management plan. Subsequently community members found out from Doug Ashby that they are predators of lizards and so subsequently they were targeted.

TABLE 7: MAGPIE CONTROL TE KAUAE O MAUI 2013 - 2015

YEAR 1	YEAR 2	YEAR 3
0	18	29

5. Discussion

Summary

Work productivity rates were very effective as field workers resided on site and did not need to travel. At least 4 hours of productive volunteer effort was logged for each hour funded. The rat control network which provided permanent control required $19.31/ha each year. Based on these figures annual maintenance would cost $6.28/ha Nationally there is urgent need to provide robust results from ship rat control operations to enable fair comparison between various methods (Brown et al, 2015). The financial figure would remain relatively constant for approximately 20 years (the lifespan of a KaMate™ trap).

These figures show that skilled members of the community are able to successfully implement permanent rat control programs at very competitive rates, provided they live close to the treatment area.

Rat control

The highlight of the three year project was the control of rats with single action traps to low densities within the discrete treatment areas. These areas are vulnerable to reinvasion. The key action required for successful rat control is initial population knockdown and other trapping operations have previously failed to do this (E.g. Coastal Forest at Stony Bay, E Murphy DoC, pers comm). In contrast to the Stony Bay result there have also been successful rat trapping operations, such as in the nearby Mist

Preservation Society's 20 ha lowland forest Archey's frog Node area. In this instance rat trapping and tracking rates were constantly reduced over a seven year period after initial knockdown (T. St George, unpublished data). Subsequent sampling of rat vulnerable nikau productivity showed a significant increase of seedling survivorship in the Node trapped area (Stewart and Hasenbank, 2013) and so performance of trapping operations on the Coromandel is somewhat mixed.

KaMate™ rodent trap rat capture rates and SMI tracking tunnel rates at Te Kauae indicate that relative abundances were suppressed in treatment areas for the three year period (FIGURES 8 – 13). There were instances where indices increased above 10% (E.g. Area B, see FIGURE 9), but this is to be expected as rodent populations increase in autumn. There were only 10 monitoring tunnels in each treatment area and so the tracking index data is vulnerable to large swings as just one rat print would indicate a 10% increase in the calculated tracking rate, which is above rat control targets in broadleaved forest restoration programs. Using a combination of trap catch and SMI tracking data could be useful in small treatment areas rather than simply relying on SMI data.

Results from Area A and C showed a clear pattern of knockdown and continued suppression (FIGURES 8 and 10). Area B results were not so clear cut and it can be seen that capture rates were somewhat higher than those in Area A (FIGURES 8 AND 9). There is proportionally more mature rata in Area B and it is possible that forest type such as this has a higher carrying capacity for rodents and that ship rats may actually spend less time on the forest floor than in less diverse forest types. Capture rates increased dramatically around poor weather conditions (N. McCauley, pers comm). Further investigation of optimal baiting periods may help small scale network efficacy.

Other mammals

Possums were controlled to low densities but continued to reinvade the treatment area, especially during autumn of Year 2015. This is not surprising as previous data on Mount Moehau showed that possums from untreated forest consistently invaded up to 450 m into a bait station buffer zone along a three km front (pers obs). A possum control network

will be required at Te Kauae for the near future as reinvasion from adjacent un-treated properties continues over time.

Capture rates for cats and feral pigs also remained relatively constant, reinforcing the vulnerability of small treatment areas to continued reinvasion of mobile predators. One disadvantage of not using toxins is that pig hunters without permission targeted the area as well and this carries inherent risks to kiwi as dogs roam throughout the treatment area.

Avifauna

Kiwi call rates have continued to increase over the time about Te Kauae but there is an adult survivorship issue across the landscape (Moehau Environment Group data). In addition a ferret has recently been captured behind Coromandel Town (D. Prince, pers comm). There have been reports of ferrets across the Upper Coromandel landscape for the last fifthteen years and the issue remains to be addressed.

The benefit of small scape projects relative to kaka nesting success in small treatment areas is not well understood, likely to be labour intensive and best completed by a landscape scale project.

Herpetofauna

Initial capture techniques were inconclusive. Lizards were not caught, yet both green and brown geckos were detected during observer surveys. Gecko tracking tunnel monitoring was refined towards the end of the three year period, but a robust monitoring method needs to be developed for Te Kauae.

Plant pests

A substantial amount of effort was put into controlling weeds and also propagating uncommon species (18% of fieldwork). These tasks often do not enjoy the same high profile as flagship fauna species, but many species rely on intact systems to prosper and continued maintenance in this area is essential.

Conclusion

In this instance skilled residents produced measurable benefits to biodiversity within the area of interest and the challenge ahead is to maintain these gains. These results provide valuable information regarding project efficacy and cost and also a template for other operations in similar habitat types on the Coromandel Peninsula.

6. Recommendations

- Continue to maintain plant and animal pest operations.
- Explore optimal ship rat treatment periods in northern modified forests relative to weather events.
- Source *Pittosporum virgatum* and houpara saplings to enhance forest diversity.
- Obtain funding to develop an outcome monitoring regime for lizards.

Acknowledgements

Contribution to the project by::

Katee Shelley, Tony Wasley, Nathan, Nicole, Mischa and LukeMcCauley, Rob Kershaw and Annette Olsen, Sharron, Chris, Jordan and Josh Goggin, Paul and Noa McAllister, Beth Jones, Chrissea Tao, Paul Thompson, Dave Roberts, Linda Dare, Mitra Wolfkamp, Helen Curtis, Steve Carson, Trinette Bush, Ness Mack, Josh Kemp, Bruce Thomas, Luke Fenton, Rob Chappel, Meg Kemahan, Alex Moshensky, Ralf Kessel, Francois and Suzanne, Tansy Bliss, Shaya Cohen and Ido Yerushalmy, Adam Lambert, Jaycie Pucha, Nelly Friquet, Joe McKee, Lars Hobrecht, Gray Lee, Benedikt Bartussek, Joe McKee (NZ), Russel Inglis, Lea Voss, Johanna Murr, Ondrej Prihoda, Martin Kontuik, Rhys Davies, Christopher Paolino, Lara Bischofberger, Claudia de Moya, Kati Ludwig, David Herold, Florian Rosenauer, James Bolton and any others not included above.

John Smith-Dodsworth† identified the tawapou specimen in 2011.

Te Kauae o Maui is grateful to the Biodiversity Condition Fund for funding this report.

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