Den control of stoats (*Mustela erminea*) in Trounson Kauri Park, Northland

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CONTENTS

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ABSTRACT

Locating natal stoat dens using trained predator dogs and controlling any containing female stoats and dependent young near a managed conservation area is potentially an effective management method, reducing the summer influx of young stoats into the ecosystem at a particularly vulnerable period for newly hatched kiwi chicks. A pilot study started in September 2001 was intended to test the effectiveness of targeting and controlling stoat dens in Trounson Kauri Park (a mainland island) and its environs. Once located by trained dogs, stoat dens had the specified number of Magtoxin® pellets placed inside and all entrances were then sealed. Out of fifteen possible dens only two were effectively controlled with Magtoxin (with two others possibly controlled, although the animals from them were not recovered, and the female from another was trapped and killed). The main reason for the ineffectiveness of control was that not all tunnels to a den were located and blocked. It was also thought that Magtoxin might not be appropriate to use for some dens and might need to be used in conjunction with trapping. It was suggested that the timing of future den searching be shifted to October and November, and a combination of control methods be used.

Keywords: Stoats, *Mustela erminea*, den control, Magtoxin, control techniques, Trounson Kauri Park.

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1. Introduction

Stoats (*Mustela erminea*) are a critical threat to New Zealand's avian biodiversity (King et al. 2001). Because control is labour-intensive and costly, the Department of Conservation (DOC) has developed an integrated stoat control research programme and continually seeks more efficient and sustainable ways of dealing with this voracious predator.

Control is particularly difficult as stoats have an efficient reproductive strategy (King 1990). They have litters of 6–10 young, and the female kits are sexually mature at only a few weeks old and are almost always fertilised before leaving the den. In summer, the family groups break up and the young disperse, as is evident from the large increases in trapped stoats in those areas where traps are set. In Northland and elsewhere, the summer influx of young stoats into the ecosystem occurs at a particularly vulnerable period for newly hatched kiwi chicks. Evidence from research at Trounson Kauri Park in Northland suggests that many of these juvenile stoats are probably locally reared animals (C. Gillies & P. Graham, unpubl. data).

At present, stoat control relies solely on traps and poison baits, which targeted animals can potentially avoid. Use of trained dogs to actively search out these predators in their dens so that they can be controlled would provide a means of management additional to waiting until they are captured in traps or take poison bait. Both male and female stoats use dens throughout the year, most using 1–3 dens regularly (Murphy & Dowding 1995). The particular advantage of this proactive technique is that we can target females (which are arguably harder to trap), especially when they are breeding, or individuals of either sex that are known to be avoiding traps/toxins. This method of control potentially has value in ongoing management sites, sensitive species sites, offshore islands, predator exclosure sites and also for contingency work.

A recent Northland Conservancy project using 'new initiative' funding has demonstrated that natal dens can be located by trained predator dogs. The dogs show far stronger reactions when the target animal is present than when there is old scent or no animal present.

Locating (using dogs) and destroying any occupied den sites containing female stoats and dependent young near a managed area has the potential to kill a large number of stoats in one action. If several den sites were located and controlled prior to the young becoming independent, the amplitude of the summer influx of young stoats could be significantly reduced. Magnesium phosphide pellets (Magtoxin®), which produce phosphine gas when in a moist environment, are effective against burrowing or below-ground pests, including mustelids, when the burrow entrances are closed off.

A pilot study started in September 2001 was intended to scientifically apply and test the effectiveness of this method of targeting and controlling stoat dens in Trounson Kauri Park and its environs.

1.1 BACKGROUND

Trounson Kauri Park (580 ha) is situated at Aranga, South of Waipoua Forest in the upper Kaihu Valley (NZMS260 007), Northland, New Zealand (Fig. 1) at altitudes between 150 and 300 m a.s.l. It became one of the Department of Conservation's six official Mainland Islands in 1996. It is a historic site, and also contains one of the finest remaining stands of kauri (*Agathis australis*). Protection of the area began in 1890, when the Government set 3.34 ha aside as a Scenic Reserve when milling was being extended up the Kaihu Valley. James Trounson helped in preserving the rest of the forest (378.5 ha) and E. Wrigley donated 13 ha of adjoining regenerating forest.

The main forest type is mixed kauri podocarp hardwood. Mature kauri dominate higher slopes and ridgelines; at lower altitudes they are more

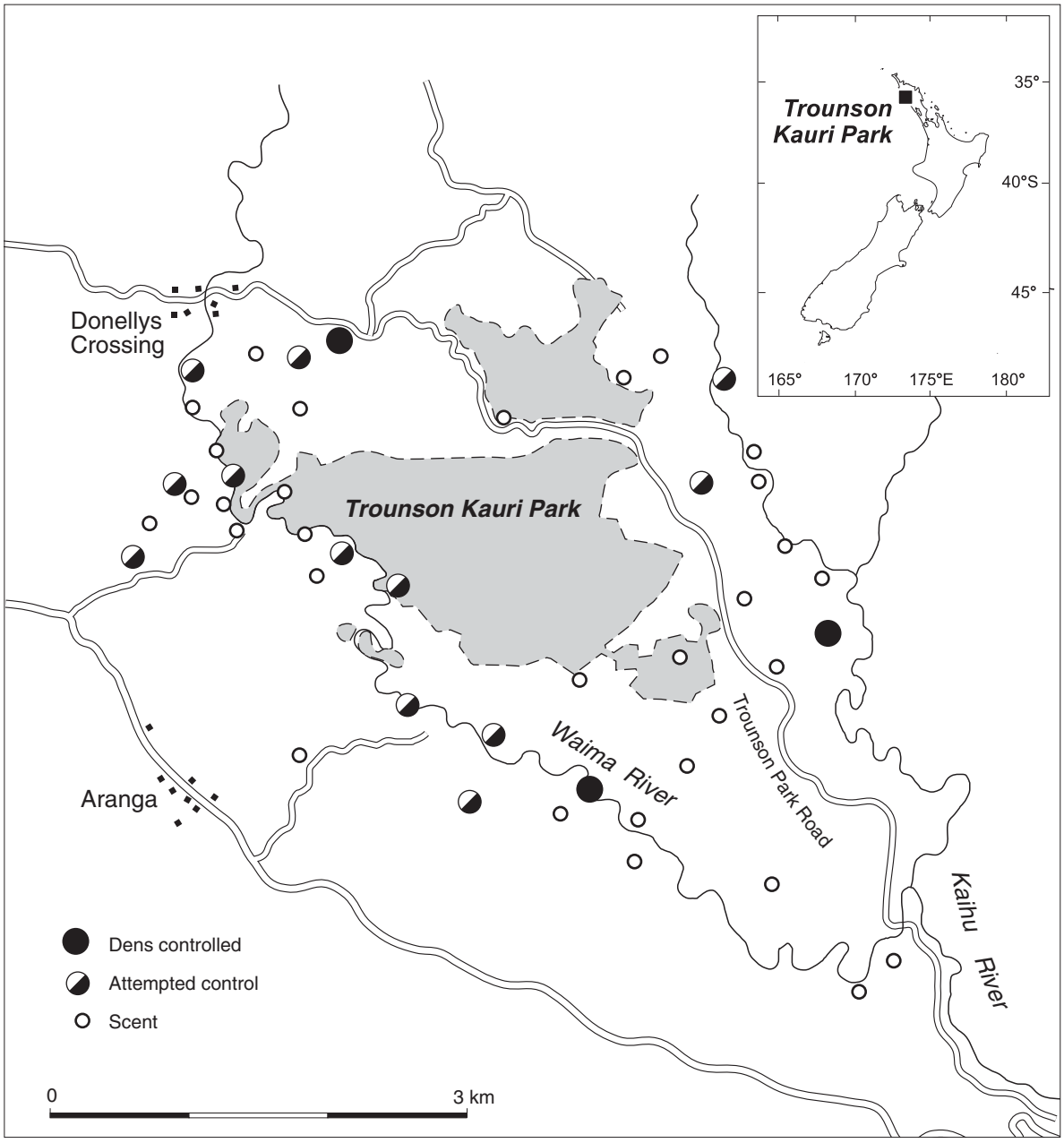

Figure 1. Location of Trounson Kauri Park, Northland, and of stoat dens located in this trial.

scattered amongst a mixture of podocarp, tawa (*Beilschmiedia tawa*), taraire (*Beilschmiedia tarairi*) and kohekohe (*Dysoxylum spectabile*). Significant areas of regenerating secondary forest are also present. Diversity of tree species is high and includes nine species of podocarp. Pest control is carried out in the Park and also in some of the surrounding pasture and privately owned farmland.

Threatened species in the area include North Island brown kiwi, *Apteryx mantelli* (Category A), and New Zealand pigeon, kukupa, *Hemiphaga novaeseelandiae* (Category B).

As part of the restoration programme for a Mainland Island, control measures have been used against pests (rodents, possums) and predators (cats, stoats, weasels and ferrets) since mid-1996 (Department of Conservation 2000). Trapping regimes have been used for the control of predators and toxic bait regimes for pest control. A large number of hedgehogs are also trapped as bycatch. Rodent tracking tunnel indices are recorded monthly along with possum wax block monitoring. Trap catch indices for possums are also conducted twice yearly. Vegetation monitoring, five-minute bird counts, and pigeon counts are also conducted at the Park. Predation of kiwi chicks is used as an indicator of the effectiveness of the predator-trapping regime. Staff at Trounson Park are continually developing and evaluating new methods of conservation management.

1.2 OBJECTIVES OF THE PILOT STUDY

1. To investigate the effectiveness of Magtoxin as a method of destroying stoats in natal dens once they have been located by trained dogs.
2. To evaluate the effectiveness and efficiency of targeting stoats in this manner as a way of supplementing existing control operations and relieving the pressure on sensitive biota during the juvenile stoat dispersal phase.

This first year was a pilot study designed to test the viability and effectiveness of the technique, including the finding of dens, time needed to survey the area, and suitability of the toxin used. If possible, any control outcome would be observed by comparing the trap catch and kiwi chick survival over the summer months (peak capture period) with previous years' data. Funding would be sought for a further two years to more robustly test and develop the findings.

If the whole project was successful, there could be a significant decrease in the number of juvenile stoats trapped in the Trounson mustelid control regime in December and January following den control operations. A monitored conservation outcome would be the survivorship of kiwi chicks.

2. Methods

2.1 TREATMENT AREA

The area studied included Trounson Kauri Park and adjoining privately owned land in a 1- to 2-km radius around the Park boundaries, making a total of about 1000 ha (Fig. 1).

2.2 CONSULTATION AND NOTIFICATION

2.2.1 Consultation

All landowners within the operational area gave written consent for access to the land and the use of Magtoxin on their land. Landowners were met, spoken to and provided with information on the toxin, the target animal and the proposal. No issues were raised; all were supportive of the operation.

One landowner later requested that land around her horses was not surveyed, and her worker, for other reasons, rescinded the consent for doing this work on her property.

Te Iwi o Te Roroa were informed of the operation.

2.2.2 Consents

Animal Ethics Committee approval was given for the period 1 Sep–31 Oct 2001.

No provisional registration was required.

2.2.3 Notification

Landowners were notified prior to their land being accessed.

The DOC Area Manager, Programme Manager, Conservancy Scientist, and Kaupapa Atawhai Manager were all notified, as were the Medical Officer of Health, lessees, concessionaires, and the District Council.

2.3 SEARCH FOR DEN SITES

The Predator Dog Ranger (ST) used his fully certified conservation (predator) dog Tui to search for den sites during September and October 2001 at Trounson Kauri Park and its surrounding environs. Predator dogs are trained to be target-specific. They are fully certified by a national certifier.

A diary was kept recording all information: area searched, time spent searching to evaluate effort, number of dens located, control outcome (where possible), location of dens, etc.

Once a den was located, control was attempted. Whenever possible, the den was later excavated to determine the outcome of the control attempt.

2.4 PESTICIDE APPLICATION

The pesticide used was Magtoxin pellets (toxin concentration: 66% magnesium phosphide).

Magtoxin is a non-controlled pesticide used as a fumigant against pests in cereal grains, dried fruits, dried vegetables, peanuts, coffee beans, tobacco, etc. The toxin is phosphine gas, produced from the action of moisture on the phosphide pellets. Phosphine rapidly disperses on ventilation. There would be little effect on soil/water values. In addition:

- the Ministry of Health was notified
- the pesticide was not used close to drinking water supplies
- the pesticide was not used in public areas, i.e. campground (when open), walking track, near houses, etc.
- schools and Kauri Coast Holiday Park were outside the operational area

Once located by the trained dog, stoat dens had the specified number of Magtoxin pellets placed inside them (in accordance to directions: 10 pellets/m^3 producing 2 g phosphine/m^3) and all entrances were then sealed. The volume of each den was assessed individually, erring towards a slight over-estimation rather than under-estimation.

The pellets were placed into the den and the entrances were blocked. The pellets react with moisture in the atmosphere and release phosphine gas, which is effective against burrowing or below-ground pests including the *Mustela* family.

Mark 6 Fenn traps were available in case not all entrances were found and blocked so that the animal was not contained for the gas to be effective.

3. Results and discussion

The total area covered was approximately 1500 ha. A total of 15 stoat dens were located, poisoned and sealed (Table 1). The location of these dens is shown in Fig. 1.

Out of these 15 dens only two were effectively controlled with Magtoxin (two others were possibly controlled, although the animals from them were not recovered). All dens were opened to ascertain results.

TABLE 1. HOURS SEARCHED AND NUMBER OF STOAT DENS LOCATED.

	HOURS SEARCHED	NO. OF DENS LOCATED
September	66	11
October	50	4
Total	116	15

A further den was controlled using traps after attempted control with Magtoxin failed.

3.1 DETAILS OF SUCCESSFULLY CONTROLLED DENS

Den 2 (11 Sep 01)

This den was located as a burrow into the earth bank on the edge of a steep riverbank along the Waima River. Two entrances were located. The den volume was estimated at 1 m^3 and eight Magtoxin pellets were used for control. Control took place at 1445 hours, and the den site was excavated the next morning.

One 260 g pregnant female stoat was recovered. She contained nine embryos 15.1 mm in length. Nest material contained a young rabbit without its head, the shoulders of a second young rabbit, and eighteen freshwater mussel shells (that had all been opened in the same way. These shells were typical of rat predation, so the site is likely to have previously been a rat den.

There were no symptoms of distress in the dead female: no vomiting; no anal scent; and no self mutilation, i.e. chewing of paws. The only symptom perhaps indicative of stress was that its tail was fluffed out. The stoat was located at the second entrance. The animal was kept and frozen for later examination.

Den 13 (3 Oct 01)

A den was located at 1600 hours on a steep siding off an old farm track, approximately 1 km from Trounson Park. It was in solid soil with rocks and tree roots around it. Six entrances were located and sealed, and six pellets were used in one hole and four in another. The following morning (17 hours later) CG and ST went back to the den and started digging. One of the entrances had been dug out (by the stoat). Soon afterwards the female stoat bolted out of an entrance that had not been blocked. Further digging revealed three live kits. As the female stoat stayed nearby trying to retrieve her babies, the kits were humanely destroyed and used to lure her into a tunnel containing Fenn traps. Within ten minutes of setting this up, the mother was captured and killed. There seemed to be up to eight or more entrances to the den, which had one chamber where the three kits were found, and a latrine chamber that the female had been using.

Control using the Magtoxin was not successful because not all entrances were located and blocked, and the area requiring control was larger than was estimated, so insufficient Magtoxin was used.

The female stoat weighed 340 g and had three productive teats, corresponding to the three kits recovered. The kits each weighed 25 g, and were thought to be 2–3 weeks old, as they had a prominent mane and measured: head and body length (HBL) 110 mm, tail length (TL) 22 mm; HBL 102 mm, TL 25 mm; HBL 110 mm, TL 25 mm.

Den 15 (25 Oct 01)

This den site was in an area of bush about 1 km from Trounson Park and located in a mound of earth and roots under a big totara tree. Two entrances were found, one larger than the other, and ten Magtoxin pellets were put down each,

and the holes were blocked with firm, damp earth. Tui located the den at 1400 hours on 24 October and was taken back next morning along with a trainee stoat detection pup (Punga). When the main hole was dug out, it revealed an adult female stoat with 6–8 wet teats and 5 kits. The nest was made of kiwi feathers and a few fern leaves, and contained two kiwi legs, a skull with the beak, and some neck skin. All stoats were found dead without any obvious signs of stress.

The female stoat weighed 225 g and measured HBL 265 mm, TL 95 mm. The kits were: 1 male 23 g, HBL 104 mm, TL 22 mm; 1male 23 g, HBL 109 mm, TL 22 mm; 1 male 26 g, HBL 112 mm, TL 25 mm; 1 male 23 g, HBL 106 mm, TL 24 mm; and 1 female 20 g, HBL 104 mm, TL 23 mm.

3.2 TRAP MONITORING

Successful den control of stoats in the vicinity of Trounson Park would be expected to reduce the numbers trapped over the peak dispersal period of juvenile stoats, December–January. The numbers of trapped stoats in the Trounson Park traps over this period are recorded annually for comparison with previous years' data.

Mustelids have been controlled at Trounson Park for five years since 1996. No.6 Fenn traps in wooden tunnels are used around the perimeter of the park along bush edges and key re-invasion avenues, i.e. along the Waima River and roadways. Two regimes have been trialled, each for a minimum of two years. In the first two years, a total of 120 double-set Fenn traps were run, baited with rabbit meat. In the third year, additional Fenn trap sites were established; an internal line and an increase in the outer buffer perimeter sets brought the total number of tunnels up to 180. This regime was continued in the fifth year. The five years of trapping (Aug 1996–Jul 2001) have resulted in the capture of a total of 219 stoats. High numbers of stoats—double the third year's—were trapped in the fourth year, but high stoat numbers were noted throughout the country that summer. The fifth year also recorded high numbers.

The numbers of stoats trapped in Trounson Park from November to December since 1996/97 are shown in Table 2. There was no obvious effect of the den control trial on the numbers of stoats trapped compared with previous years. However, the three lactating females confirmed as killed over the two-month trial period is equal to the total number of lactating females ever caught in the Trounson Park traps over the total of the five years of predator control.

TABLE 2. NUMBERS OF STOATS TRAPPED IN TROUNSON PARK DURING THE PEAK SUMMER MONTHS.

	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	TOTAL
1996/97	1	10	12	2	25
1997/98	2	7	7	4	20
1998/99	0	5	7	7	19
1999/00	8	26	11	5	50
2000/01	0	17	17	2	36
2001/02	1	16	20	2	39

3.3 OUTCOME MONITORING FOR KIWI CHICKS

Kiwi chicks are especially vulnerable to predators, and a major part of their mortality at Trounson Park has been attributed to stoats. To assess the effectiveness of the trapping regimes at Trounson Park, a sample of 16 kiwi chicks is monitored each year, and the survival rate of those attaining 1000 g body weight is calculated, using a year's season of breeding (i.e. two clutches). The chicks are obtained from nests of adult males with transmitters attached or found using a trained dog. Young chicks of unknown parentage found by the dog have also been used to reach the desired sample size.

Before predator control was instituted, no more than 1 chick usually survived. In the first two years of trapping at Trounson, only four of the 16 kiwi chicks survived, most deaths being due to predators, principally mustelids. In the third and fourth years, 11 survived and most of the rest were lost track of, while eight of the chicks survived in the fifth year. Of the ten kiwi chicks currently monitored, three are dead as a result of predation, three are lost track of, and four are alive and being monitored.

As this pilot study was designed primarily to demonstrate proof of concept for den control, no attempt was made to relate it to kiwi chick survival.

4. Conclusions

4.1 VIABILITY OF THE TECHNIQUE

This was a pilot study to test the viability and effectiveness of the technique. The results proved encouraging.

The dogs effectively located the stoat dens, but further investigation needs to be undertaken on the successful control of dens once located. Magtoxin may be inappropriate for some dens, so we may need to use a variety of means of control, e.g. traps, as well as poisoning.

The main reason for the failure of control was that not all tunnels were located and blocked. The openings of several of these were 2–3 m from the main point of entry to the den and, being of small diameter, were hidden in the grass. In addition, it was not easy to accurately estimate den area from external observations.

It also seemes likely that September was too early to look for dens containing kits. The stoats were only starting to den in September. For the 2002/03 season, it is proposed that a week in mid-September be spent determining the timing for that season and the main den searching period be during October and November when the kits will have been born and there will be more scent around the den for detection.

There was no significant decrease in the number of stoats trapped in the Trounson Park regime as a result of this den control trial, but this was not unexpected, as the study was mainly concerned with feasibility and techniques.

Similarly, there was not expected to be an outcome in terms of measured survival of kiwi chicks.

4.2 COSTS

Science & Research Unit, DOC, granted $10,000 from the stoat control research programme to cover expenditure and salaries for the season.

4.3 FUTURE MANAGEMENT OF THIS TREATMENT AREA

The Department has given support for the continuation of this work. It is recognised that such den control could be a significant management tool.

The pilot study has shown how effective dogs can be in locating stoat dens, the control of which needs to be perfected. Stoat den survey and control work will again be carried out at Trounson Park later during the 2002/03 breeding season and repeated for a third season after that to more robustly test/develop findings. The timing of the second season of den searching will be shifted to a month later, in October and November 2002, and a combination of control methods (poisoning and trapping) will be used.

This project has a high public profile. The work being carried out on private land surrounding Trounson Park has called for public support and involvement. Various articles were written in the newspapers, particularly in regard to the den with five kits and an eaten kiwi chick, and footage was used on the Rangers Documentary on TV1, 18 March 2002. The project, and particularly the dogs, have received much attention and is proving a good advocacy tool for both the control of predators/stoats and the usefulness of purpose-trained dogs in various aspects of conservation work.

5. Acknowledgements

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