Goodnature Automatic Traps for Vertebrate Pest Control: Field Trials Using New Kill Traps Targeting Animal Pests in New Zealand

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ABSTRACT: Goodnature Ltd. humane self-resetting kill traps are being developed in New Zealand for use in animal pest control to protect nature conservation values. Two models are commercially available: the Goodnature Ltd. A12™ trap for common brushtail possums and the Goodnature Ltd. A24™ trap for rats and stoats. These species are significant animal pests in New Zealand, contributing to the decline of biodiversity and extinction of native species. Large amounts of conservation effort and resources are targeted at their control and elimination. Current best-practice trapping techniques include the use of single-action possum and rat traps. The A12 and A24 traps have the advantage over the existing single-action traps in that they self-reset. They are powered by compressed carbon dioxide and humanely kill individual animals by striking their skulls, producing instant irreversible unconsciousness. Dead animals clear the trap by falling away; the trap automatically resets, up to 12 times for the A12 and up to 24 times for the A24. This study presents the results of three preliminary field trials that evaluate the effectiveness of these traps as tools in the control of possums and rats. Using 0.75 A12 traps per ha in a 256-ha block at Pouiatoa Conservation Area, we achieved a Residual Trap Catch Index (RTCI) for possums of 5.7%, down from 15%, after 15 months. This RTCI was comparable with the level of control previously achieved using hand-laid cyanide baits, and close to the desired conservation target of 5%. At Ohane, we deployed 290 A12 traps over 476 ha (0.6 traps per ha) and achieved a reduction in RTCI from 22.6% to 6.8%. Field trials for the A24 trap were conducted in a 46-ha block at Rimutaka Forest Park with 1.72 traps per ha. The minimum number of rats caught per trap night declined sharply from 0.15 from the first trapping period to 0.01 after the second trapping period, and remained below 0.03 for the entire 4-month trap trial. The New Zealand Department of Conservation is presently conducting several large-scale operational field trials for both traps.

KEY WORDS: brushtail possum, Department of Conservation, Goodnature Ltd., New Zealand, *Rattus norvegicus*, *Rattus rattus*, self-resetting trap, *Trichosurus vulpecula*

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INTRODUCTION

The impacts of introduced mammalian pests on New Zealand's indigenous flora and fauna have been well documented (King 1985, O'Donnell 1996, Allen and Lee 2006). Control and eradication of introduced mammalian pests is central to conservation efforts to restore threatened species both on islands and protected areas of mainland New Zealand. Two such pests are the common brushtail possum (*Trichosurus vulpecula*) and rats (*Rattus rattus* and *R. norvegicus*). Possums have also become a major wildlife reservoir of bovine tuberculosis, otherwise known as Tb (Coleman and Caley 2000). The development of new, innovative, and socially acceptable tools to detect and kill mammal pests is ranked in the top 10 Strategic Science and Research Priorities for natural heritage with the New Zealand Department of Conservation (DOC) (DOC 2011).

Current best-practice control for brushtail possums and rats in New Zealand includes the use of single-action kill traps. These traps may only be available to catch animals for a period of 12 days each year if a trap is sprung the day it is set (assuming monthly servicing checks), rendering it inoperable until it is manually reset. The unavailability of permanently placed traps for extended periods can be very inefficient, as effective control requires repeated exposure of the target species to set traps.

Increasing the frequency of trap checks or deploying a higher density of traps over a control block is resource intensive. In New Zealand, the ongoing cost of servicing mainland predator trapping zones is significant. DOC currently maintains an estimated 140,000 kill traps for stoats and rats at an approximate cost of NZ$13.4 million per year. Ground-based control for brushtail possums in New Zealand costs the country an estimated NZ$6.8 million per year, with further NZ$1.4 million spent on aerial toxin application. These costs, coupled with the need to access vast areas of remote and rugged terrain, may limit the extent to which large landscape scale control can be implemented.

The self-resetting traps developed by Goodnature Ltd. (Wellington, NZ) offer a means to reduce labour costs and increase the efficiency of control. The Goodnature Ltd. A12 for possums and A24 for rats and stoats have the potential to deliver up to 12 and 24 kills, respectively, thereby reducing the required frequency of trap checks to attain the same level of control for pests. Current best-practice for rats and stoats is fortnightly to monthly trap checks.

Here we describe three pilot field studies in North Island/Te Ika-a-Mau, New Zealand using the A12 and A24 traps for brushtail possums and rats, respectively.

These studies were undertaken to investigate the performance of both traps in an operational environment, and to assess their effectiveness in meeting control targets for possums at two sites and reducing rat numbers at the third site.

METHODS

Trap Design

A12 Possum Trap Description

Goodnature Ltd. automatic traps are toxin-free and meet the New Zealand National Animal Welfare Advisory Committee kill trap testing guidelines (Jansen 2010, Jansen 2011). The A12 trap is powered by a 16-g compressed $C0_2$ canister (Figure 1a). The A12 employs a "bite-pull" trigger: as the possum bites and pulls the trigger to investigate the lure, the trap is activated. The trap works by striking the skull of the animal with a metal rod-shaped striker, killing it instantly. The striker is driven by a measured volume of compressed CO_2 when the animal triggers the trap. Once the animal has been struck, the piston returns by a spring, allowing the animal to drop to the ground. The trap automatically and immediately resets. The A12 trap is usually mounted on a vertical tree trunk or post and is set 70-190 cm above the ground surface.

A24 Rat Trap Description

The A24 trap is powered by the same recyclable 16-g compressed $C0_2$ gas canister as the A12 trap. The small canister will power and reset the A24 trap up to 24 times before needing to be replaced. The A24 trap is triggered when the target animal pushes its head past a wire leaf trigger inside the shroud (Figure 1b). The trap works by striking the skull of the animal with a glass-reinforced polymer striker, killing it instantly. The striker is driven by a measured volume of compressed $C0_2$ when the animal triggers the trap. Once the animal has been struck, the piston returns by a spring, allowing the animal to drop to the ground. The trap automatically and immediately resets. The A24 trap is usually mounted on a vertical tree trunk or post, with the entrance set 12 cm off the ground surface.

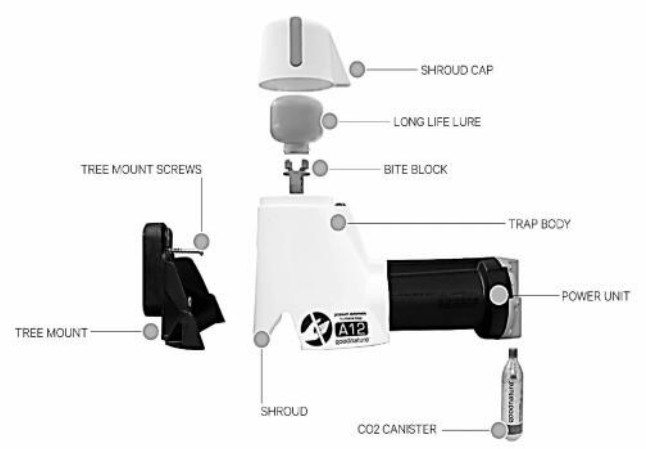

Figure 1a. Goodnature Ltd. A12™ trap for possums.

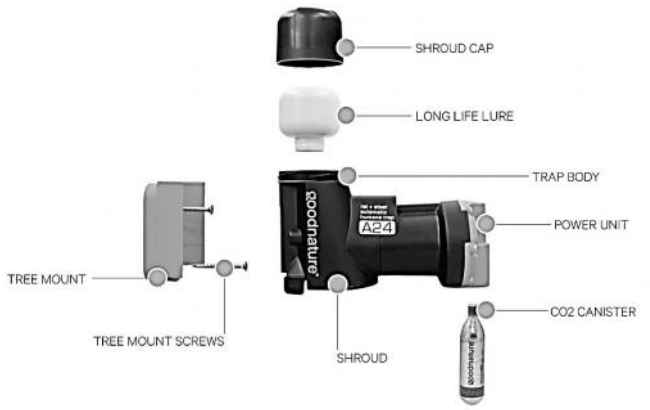

Figure 1b. Goodnature Ltd. A24™ trap for rats and stoats.

Possum Monitoring Methods

A standard technique used to measure possum populations in New Zealand is the Residual Trap Catch Index method (RTCI) (NPCA 2011). The method provides an index of possum abundance based on sampling populations using leg-hold traps (Victor® No. 1 double-coil spring leg-hold traps). Lines of 10 traps spaced 20 m apart are set along a random bearings and checked daily for 3 consecutive nights. The location of trap survey lines is randomly generated to avoid the results being biased by geographic or vegetation factors. Leg-hold traps are either set on the ground, or raised to 70 cm in areas where native ground birds such as kiwi (*Apteryx* sp.) or weka (*Gallirallus australis*) are present. The capture data collected are used to calculate the RTCI for the site surveyed, expressed as a percentage of traps that caught a possum over the number of trap nights available.

Preliminary Field Trials of the A12 Trap

Pouiatoa Conservation Area

We conducted the first A12 trial in a 276-ha block at Pouiatoa Conservation Area (total area 13,000 ha), East Taranaki, New Zealand (Figure 2). Current pest control at Pouiatoa targets multiple pests including stoats, feral goats, rats, and possums. Much of this work is managed by the East Taranaki Environment Trust (ETET) who, as well as using volunteer labour, employ contractors to undertake the majority of pest control work. We chose the central "Quarry Block" at Pouiatoa for one of the trials because it contains heavily-forested rugged terrain, making access by foot for control and monitoring potentially hazardous and resource intensive. While the 3 surrounding blocks were treated for possums once every 3 years, the Quarry Block was about to be treated annually. Control involves laying toxic cyanide baits (Feratox®, Connovation Ltd., Auckland, NZ) and cyanide paste (Trappers Cyanide Ltd., Amberly, NZ) in bait stations, and has achieved results of between 5-10% RTCI since 2009.

ETET were motivated to partner with the DOC to undertake this trial because of concern that their existing pest control operation would be unsustainable. If

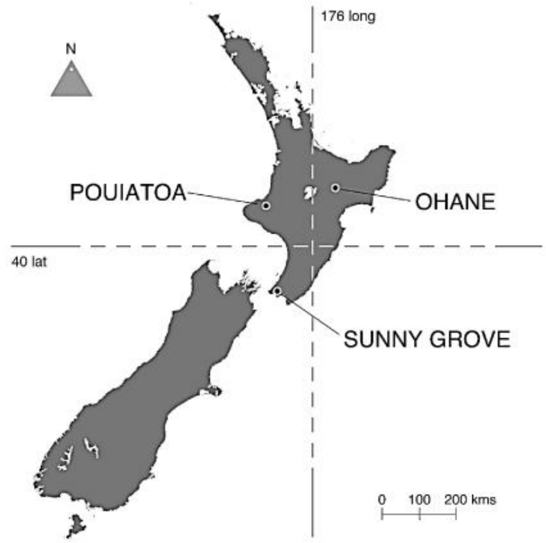

Figure 2. Location of Goodnature Ltd. trap trial sites, North Island, New Zealand.

successful, Goodnature Ltd. A12 traps would offer an additional control tool that had significant advantages over existing methods. ETET also wish to reintroduce the North Island kokako (*Callaeas cinereus*), a bird species whose threat status is "Nationally Vulnerable," to this site, which would require maintaining an RTCI for possums of less than 5% (Innes et al. 1999).

In June 2011, pre-trial monitoring of possums was conducted using the RTCI method as described above. In August 2011 we deployed 206 A12 traps along ridges and spurs at 100-m spacing, and at 50-m spacing along the perimeter lines of the block, yielding an average trap density of 0.75 traps per ha. Trap lines were separated by a distance of 300 to 800 m (Figure 3). A12 traps were set at 130 to 150 cm above the ground on suitable trees. This layout is comparable with local and national best practice standards for ground-based possum control (Nick Kowalewski, pest control contractor, Tarata, NZ, pers. comm.).

We used Ferafeed 219™ ("Smooth in a Tube," Connovation Ltd., Auckland, NZ) non-toxic pre-feed paste as a lure, with paste applied on the bite trigger (Figure 1a), on the tree below where the trap was mounted, and in between traps along the trap lines. Inside the bait cap we used Goodnature Ltd. Long Life Possum Lure™ (1st generation).

For the first month we undertook weekly trap checks and recorded the number of dead possums found below traps, inspected the trap including the gas canister, and reapplied pre-feed paste as described above. Thereafter, for the following 6 months until the end of January 2012, we made fortnightly trap checks. Monthly inspections were made from February to November 2012. Monitoring for possums was undertaken by the Taranaki Regional Council in June 2011, and March and November 2013.

Figure 3. Pouiatoa Conservation Area showing the Quarry Block trial area.

Ohane, Northern Te Uruwera National Park

We established the second A12 trial targeting possums at Ohane (476 ha), a remote and rugged area of northern Te Uruwera National Park (Figure 2). We selected this site because of its high possum numbers and for logistical and operational reasons, including a suitable back-country track and hut network. Ohane also provided an excellent opportunity for DOC to work in partnership with local Maori/tangata whenua, Ruatoki hapu.

Pre-control possum monitoring using 5 lines was undertaken in May 2010 as part of our site assessment for planning the trials. In October 2011 we deployed 290 A12 traps at 100-m spacing along 12 lines (Figure 4). These lines tended to follow main ridge lines and spurs. There was no adjacent possum control to the block, and perimeter control was not used, to keep the method consistent with other permanent possum control blocks within Te Uruwera. The average density of traps was 0.6 traps per ha. Baiting at Ohane was as described for Pouiatoa.

The period between trap inspections ranged from daily to fortnightly-monthly. We recorded the same information at each inspection as we did for Pouiatoa. We conducted possum monitoring checks in April and December 2012 and in March 2013.

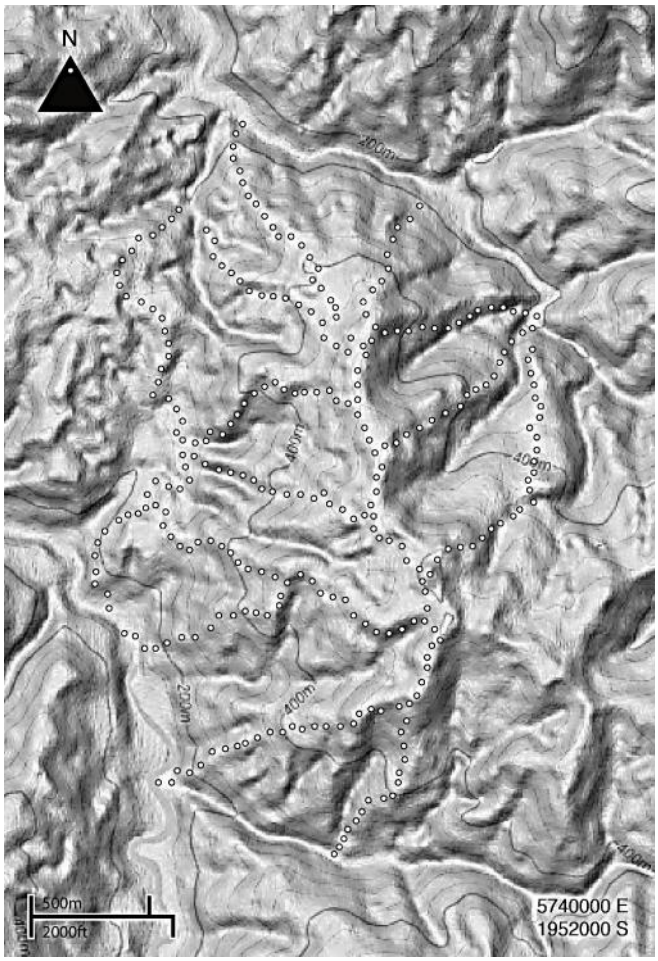

Figure 4. Ohane trial area and trap layout, Northern Te Uruwera National Park.

Preliminary Field Trials of the A24 Trap

Sunny Grove, Rimutaka Forest Park

We selected a 46-ha block at Sunny Grove, Rimutaka Forest Park (Figure 2) to conduct our field trial of the Goodnature A24 trap for rats. This forested site (kamahi and mixed podocarp) was selected due to its ease of access for frequent inspections and presumably high rat numbers. North Island robins are absent from this site (Darren Peters, pers. observ.), suggesting high pest (rat) abundance currently or previously (Powesland 1997).

In July 2013 we deployed 79 A24 traps within a 50 × 100 m grid (Figure 5), yielding an average trap density of 1.72 traps per ha. This layout is consistent with current best-practice within New Zealand for ground based rat control methods (bait stations or traps; DOC current best practice). We used a hip-chain to measure the trap interval spacing on barometric altimeter sidle lines across the northern face within the block. Each sidle line was no greater than 100 m apart.

We used Goodnature Ltd. peanut butter-based rat lure. At each visit we inspected the auto-baiter and squeezed the auto bait bottle, allowing a little fresh bait to pre-feed each site. The same bait was placed directly below the trap on the tree as an additional lure. Traps were visited 2 to 3 times per week for the first 3 weeks in July. Thereafter we undertook checks every 2 to 3 weeks apart. At each inspection we recorded the number of kills and the reliability of the trap by partially unscrewing the gas bottle to gauge the gas pressure. All rats were sexed and placed on the uphill side of the traps and subsequently observed for signs of scavenging. The trial was completed in November 2013.

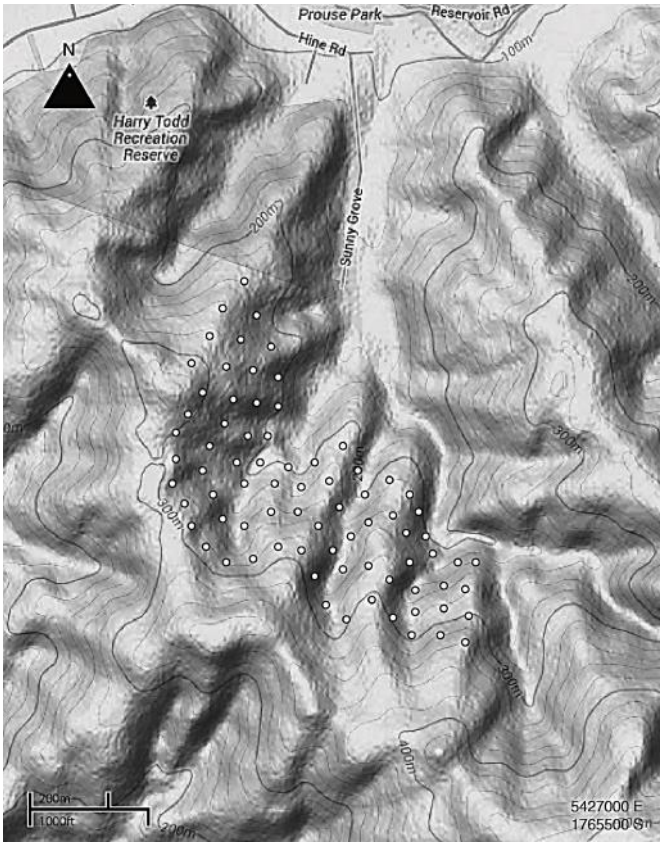

Figure 5. Sunny Grove rat trial block, Rimutaka Mountains Forest Park.

RESULTS

Trap Design

At Pouiatoa, early inspections of traps enabled us to quickly identify problems with the O-ring in the gas canister allowing the CO_2 gas to escape, resulting in the trap failing to reset. For some traps the spring in the power unit was not working properly, also resulting in a failure to reset. Periodically we would remove up to 10 traps from the block and have them serviced. We also encountered problems with the tree mounts: in December 2011, 40 traps had disengaged from their mount, with some sitting on top of the tree mount and others falling to the ground. In December 2012, all tree mounts were redesigned and upgraded; there have been no subsequent issues with the mounting brackets. Similar problems were encountered with the gas canisters and springs in the traps at Ohane; however, fewer ended up being serviced or replaced. We did not experience any problems with the tree mounts in the Ohane trial. We encountered approximately 6% trap failure with the A24 traps at Sunny Grove. There was no one particular issue that we identified that caused the trap failures.

Possum Control at Pouiatoa and Ohane

Pre-treatment monitoring at both Pouiatoa and Ohane indicated moderate possum abundance (Table 1). In the 15-month trial period at Pouiatoa, we recorded a minimum of 420 possum kills. The target of 5% RTCI had not been reached 7 months after the control was initiated. Fifteen months into the trial, the RTCI had dropped to 5.7%. At Ohane we recorded a minimum of 800 possum kills over the 17-month trial period. RTCI had reduced from 22.6% prior to control to 6.8% after 17 months, although it peaked in the month of April, 6 months into the operation (Table 1).

Site	Pre-Control	Control Initiated	Post-Control		
Pouiatoa	June 2011 15%	Aug 2011	Mar 2012 11.67%	Nov 2012 5.71%	
Ohane	May 2010 22.62%	Oct 2011	Apr 2012 34.72%	Dec 2012 10.70%	Mar 2013 6.81%

Rat Control at Sunny Grove

The minimum number of rats caught per trap night declined sharply from 0.15 in the first trapping period in July to 0.01 after the second trapping period in July, and it remained below 0.03 for the entire 4-month trap trial (Figure 6).

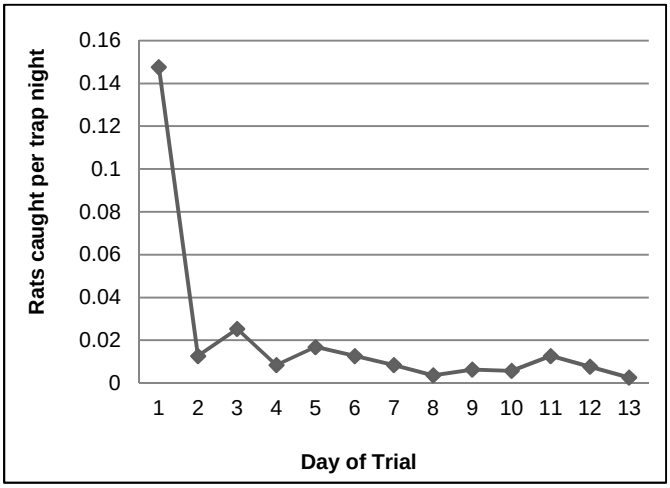

Figure 6. Minimum rat trap catch per trap night using the Goodnature A24 trap.

DISCUSSION

Goodnature A12 traps provided a comparable level of possum control to that of current best-practice possum kill traps. At Pouiatoa, previous control using poison baits in bait stations achieved RTCI's between 5-10%. The A12 trial at Pouiatoa achieved an RTCI of 5.7% after 15 months. At Ohane, the RTCI dropped from 22.6 % to 6.8 % over 17 months. While these results did not meet the conservation target of 5%, we believe sustained control of possums to less than 5% RTCI with A12 traps is achievable. Subsequent trials have been established by ETET at Pouiatoa to assess the optimal distance between trap lines to achieve the target of 5%. The ultimate aim is to replace current methods in the entire 1,000-ha core area with A24 traps, thus eliminating the use of ground-laid poisons and the requirement for volunteers and contractors to have the appropriate handling certificate. Reducing labour costs and mitigating risk to field workers will also make the wider project more sustainable in the long term. At Ohane, the traps have been removed and, following upgrading to the latest design specifications, will be established in a more accessible block for easier monitoring.

At Sunny Grove, we have shown that the A24 trap is an effective tool to control rats. These results are comparable with the work of Craig Gillies et al. (Dept. of Conservation, Hamilton, NZ, unpubl.). Their operational -scale trials using A24 traps at Boundary Stream and Onepu in Northern Te Urewera returned zero (0) rodent tracking using a standard regime of baited rodent tracking tunnels over one night in January 2014. These results gave us the confidence to attempt a small-scale rodent eradication programme on Native Island, adjacent to Stewart Island, NZ, in November 2013. While it is still early days for the Native Island project, rat tracking reduced from 84% in November 2013 to 43% in January 2014.

Undoubtedly the partnership between Goodnature Ltd. and DOC throughout these trials has enabled improvements in the A12 and A24 design. DOC is currently in its fourth year of a NZ$4 million programme assessing operational-scale trials of self-resetting traps for control of possums, rats, and stoats (Gillies 2011). The current focus of this work is to very closely monitor the mechanical performance of the latest (as at mid-2014) versions of the A12 and A24 traps, as well as testing the latest versions of auto-lures Goodnature has on offer. DOC recognises the need to support the Goodnature team to develop their self-resetting traps to the standard which DOC requires, and to fully realise the potential these devices could offer for ground based pest control in New Zealand.

ACKNOWLEDGEMENTS

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