Animal pest field trial report for the efficiency of un-baited run-through trap tunnels versus baited trap boxes for killing stoats

By Kerry Brown and Warwick Ward

1. Field trial summary

This trial compared the efficacy of run-through trap tunnels versus baited trap boxes at killing stoats. The trial was carried out over two years from 10/08/2013 to 09/08/2015 in the Wairau Valley, at Rotoiti, South Island. Traps were swapped between alternate trap sites after year one as a reverse treatment to strengthen the design. Significantly more stoats, rats, hedgehogs, mice and rabbits were caught in the run-through tunnels than in the standard trap boxes (Table 1). Very few possums, ferrets, weasels, cats and birds were caught with no significant differences between the capture rates in the run-through tunnels and standard trap boxes. The traps also acted as a relative index of rat and stoat abundance as their numbers increased in response to a beech seed mast.

2. Introduction

This field trial was carried out to determine if un-baited run-through single DOC 200 traps in wooden tunnels are as efficient at catching stoats as "standard" baited DOC 200 single traps in wooden boxes in montane beech forest. Run-through traps proved useful in catching stoats that avoided baited DOC series box traps on Secretary Island (Peter McMurtrie pers comm.) and Kapiti Island (Colin Giddy pers comm.). Double set DOC 150 box traps were almost four times more successful at catching stoats compared with single set un-baited run-through DOC 150 traps in the Murchison Mountains, Fiordland (Sanjay Thakur unpub. data). In Te Urewera double set DOC 200 traps were 7.3 times as effective as single set DOC 200 traps at catching stoats (Beaudoin & Ducatillon 2012) indicating that boxes with two traps can be more effective than with one only. A trial in the Hawke's Bay indicated that run-through tunnels were also more effective at catching rats (ZIP 2015). Potential concerns are that run-throughs could catch more non-targets and be less humane. This trial was run by Friends of Rotoiti a volunteer group that has been trapping at Rotoiti since 2001 and now runs 40 kilometres of stoat trap lines in and around Nelson Lakes National Park.

3. Trial design

Seventy seven run-through trap tunnels with single DOC200 traps were set alternately with seventy six established standard DOC 200 traps set in wood boxes on an existing line in the Wairau Valley between 10/08/2013 and 09/08/2014. This treatment was reversed by swapping alternate box trap designs between trap sites from 10/08/2014 to 09/08/2015. In this second treatment 76 run-throughs and 77 standard boxes were used. Each trap tunnel/box was placed 100m apart along an existing stoat control line.

The run-throughs each containing a single DOC 200 trap that was un-baited and tunnels were made from ply (800mm long, 210mm wide and 211mm high). The run-throughs had wooden ramps to ensure the trap bases are level with the trap plate but the standard boxes did not. Tunnel entrances were fitted with three Number 8 wires placed horizontally across each end giving spaces of approximately 50mm. Tunnels were 800mm long to avoid weka interference. A trial using cheese placed at different distances from the entrance found weka could not quite reach 330m into the tunnels hence the 800mm length (Warwick Ward pers obs).

The “standard” single DOC 200 trap boxes were only 595mm long though the other dimensions were approximately the same as the run-throughs. There was 12 x 12 mm wire mesh at each end of the trap with a hole of 48 mm square cut in one end to allow target animal access. For details refer to www.friendsofrotoiti.org.nz. “Standard” traps were baited with “mustelids and cat” fish based polymer baits (Trappers Cyanide™). The bait was changed every 6-8 weeks or more frequently if eaten. The traps were checked weekly in summer and fortnightly or monthly over the rest of the year. All traps were checked each trap check session.

Possum trapping was carried out in association with the trial. Nine Sentinel traps were placed along the line and likely minimised possum captures though possum number were low.

Data sheets were developed (DOC-1208622) and data added to the Friends of Rotoiti trapping database (DOC-2611733). Each time the trial trap line was checked the operators recorded; the trap line and individual trap type and number, the date and the name of the operator. For each trap checked the operators recorded; the status of the trap (sprung, no capture – SPR) or the species captured – e.g. stoat, rat etc and sex where possible.

Data was analysed using logistic regression with a random effect for site, and fixed effects for year and tunnel/box type. The samples were the trap checks which for each species were either 1 if that species was caught, or 0. Analysis was carried out using the package lme4 (Bates et al. 2015) in R (R Core Team 2015).

4. Results

Significantly more stoats, rats, hedgehogs, mice and rabbits were caught in the run-through tunnels than in the standard tunnels (Table 1). Very few of the other species were caught (possums, ferrets, weasels, cats and birds) and there were no significant differences between the capture rates in the run-through and standard box traps. Significantly more rats, stoats and mice were caught in year two compared to year one ($p_{rats}<0.001$, $p_{stoats}<0.001$, $p_{mouse}<0.001$). Of the four birds caught a thrush, sparrow and starling were caught in the run-throughs and a sparrow in the standard traps.

Table 1: Rotoiti run-through versus standard box trap trial results. P is the probability that there was no difference in capture rates between traps in run-through and standard tunnels.

	Treatment/year 1		**Reverse treatment/year 2**		**Treatment 1 & 2 combined data**		**P**	
Species	***RT***	***Standard***	***RT***	***Standard***	***RT***	***Standard***		***Total***
stoat	9	9	57	26	66	35	0.009**	101
ferret	2	2	5	6	7	8	0.805NS	15
weasel	1	2	3	4	4	6	0.531NS	10
cat	4	3	4	4	8	7	0.780NS	15
hedgehog	56	6	48	9	104	15	<0.001***	119
rat	73	46	287	204	360	250	<0.001***	610
possum	1	0	0	0	1	0		1
mouse	0	2	8	20	8	22	0.040*	30
rabbit	7	2	8	1	15	3	0.003**	18
bird	1	0	2	1	3	1	0.303NS	4
							TOTAL	923

The traps acted as a relative index of rat and stoat abundance recording an increase in numbers in response to a large beech seed mast. Numbers of stoats and rats caught on the same line using DOC 200 and 250 traps from mid August to mid August between 10/11 and 13/14 were reasonably similar prior to the major mast event commencing in spring 2014. There was limited seeding in 2011 and 2012 (DOCDM-1365121).

Table 2: Numbers of stoats and rats caught at Rotoiti annually on the trial line between mid August 2011 and mid August 2015.

Year	Stoats caught	Rats caught	Large mast
10/11	25	100	No
11/12	33	68	No
12/13	66	163	No
13/14	18	119	No
Average 10/11 to 13/14	36	113	N/A
14/15	83	493	Yes

5. Discussion

Are run-throughs more effective at catching stoats?

Significantly more stoats were caught in run-through traps compared to baited standard traps at Rotoiti. Elsewhere on the mainland in the Murchison Mountains run-through tunnels were less effective than standard traps (baited DOC150 traps in boxes) though this trial was unbalanced. Nearly four times as many stoats (94 versus 25) were caught when 200 traps in 100 standard boxes baited with eggs and meat when compared with 100 hundred un-baited run-through traps from September 2012 until October 2015 (Sanjay Thakur unpub. data). The comparison used was not balanced because two traps per box were compared against one and two traps were shown to be more effective than one at Te Urewera (Beaudoin & Ducatillon 2012).

Run-through traps have proven more effective on islands with low stoat abundance. On Kapiti Island, two female stoats were caught in run-through traps despite there being fewer run-throughs set for a shorter time. Only 40 DOC 150 traps in run-through tunnels were used for one month compared to 130 DOC series traps (DOC200's and DOC150's) used for six months. The only other stoat on Kapiti was a male caught in a standard trap with female stoat bedding as a lure (prior to the run-throughs being used). Meanwhile on Secretary Island 218 stoats were caught (between May 2011 and August 2015) in either standard single set DOC 150 box traps or DOC150 run-through tunnels. While only 12 stoats were caught in run-throughs and 206 in standard traps there was 100 times more standard traps (approximately 900 to nine). Therefore, 17% of stoats were caught in 1% of traps.

This combined data strongly suggests that run-through tunnels can be very useful tools for managing stoat incursions on islands and for stoat control on the mainland. Even numbers of stoats (9 versus 9) were caught at Rotoiti in year 1 when food was not plentiful (rat numbers moderate) and stoat numbers low (see Table 2). However significantly more (57 versus 26) stoats were caught in run-through tunnels when rats were abundant. This suggests that run-through tunnels may be particularly effective when natural food is abundant (on islands or in mast years on the mainland). It is possible that stoats may be less inclined to go into enclosed box traps unless hungry.

Run-through tunnels and Island Biosecurity

Baited tracking tunnels are typically used to detect rodent and stoat incursions on islands. These are usually more confined in structure than run-through trap tunnels and can suffer from bait interference by non-target animals. Norway rats avoided "standard" trap boxes during the 2011 Mana Island and 2015 Ulva Island incursions (pers. obs.) and stoats avoided using tracking tunnels during the 2011 Kapiti Island stoat incursion (pers. obs.). Theoretically, un-baited run-through tunnels with tracking cards enclosed would be less vulnerable to non-target interference and could be more effective than current tracking tunnel designs at detecting rats and stoats. This theory is currently untested.

How important is bait?

While trap boxes and tunnels were of similar dimensions (run-through tunnels were longer) and both contained only one trap of the same size, standard traps were baited while run-through tunnels were not. The more balanced design would be to bait/lure both traps types. Repeating this trial when both trap/box types were baited could be a worthwhile test. However this trial indicates that baiting did not enhance catch rates. If un-baited traps can be shown to catch equal or more stoats elsewhere they will offer a far more cost-effective alternative to baiting. Baiting costs include the procuring and handling of bait and the frequency of checks required to maintain fresh bait in the field.

Different bait could be more attractive to stoats. Erayz#8 (a rabbit based oven dried bait from Connovation Ltd) has been used elsewhere and has been found to be as effective as hens eggs (Steffens 2010) and potentially more so in the absence of mouse interference. Hen's eggs are commonly used stoat bait (Brown 2003). However, the relative attractiveness of "mustelids and cat" fish based polymer baits and Erayz#8 have not been compared. Mouse consumption of bait was patchy and an issue particularly in February and March of 2014. Few baits were completely eaten and baits were replaced as required. Mouse interference was likely reduced by bait blocks being attached to the underside of the lid by a screw driven down through the lid.

Why were more hedgehogs caught in run-throughs?

The most likely explanation why more hedgehogs were caught in run-through traps is because they could more easily gain access. Anecdotal evidence from elsewhere suggests that 48mm square trap entrance holes exclude most hedgehogs. To achieve hedgehog eradication on Motutapu Island trap entrance holes were increased to 110mm x 110mm and baffles were removed to facilitate humane kills (John Neilson pers comm.).

Why were more stoats and rats caught in year two?

Increases in rat and stoat numbers in beech forests are driven by increases in food availability following beech seeding. More rats and stoats were caught in 14/15 at the time of a large mast event than in other years (see Table 2). The traps have acted as an index of rat and stoat relative abundance with trends consistent with tracking tunnel data from Rotoiti (Josh Kemp unpub. data) and seed fall data (DOCDM-1365121).

Were run-throughs less humane?

Concerns about possums being caught by the paw in run-through traps have been raised (Sanjay Thakur unpub. data). Only one possum was caught in this trial (in a run-through tunnel). How animals were caught (by the head assuming a quick death or otherwise) was not recorded. Questioning of trappers indicates that most animals appeared to have been killed cleanly though run-throughs did catch low numbers of animals (i.e. one cat, one hedgehog and three ferrets) by the foot (Peter Hale pers comm.) and at least one ferret was caught by the paw in a standard box (W. Ward pers ob). Humaneness of traps is worth quantifying in future trials.

What is a standard DOC series trap/box?

There is no such thing as a standard DOC series trap box combination in practise though best practise specifications are provided (docdm-29856, docdm-29855 & docdm-29851). There are three different DOC series traps - DOC 150, DOC200 and DOC 250. Trap box dimensions (including length) differ as does entrance whole size, bait/lure used, baffle design and the number of traps per box. There was also variation in run-through design between those used on Kapiti Island, Secretary Island and as part of this trial. Zero Invasive Predators Limited (ZIP) is also trialling a different double trap run-through design (Phil Bell pers comm.).

Friends of Rotoiti have modified the “standard” stoat trap best practise design in an attempt to improve efficacy. Their intention has been to make traps easier to check and clean and potentially increase kills. Examples of changes made by Friends of Rotoiti to the “standard” design include using a wooden rather than a wire baffle with a large “archway” rather than a 50 mm diameter hole and a hinged top section to allow easier access to the trap (See www.friendsofrotoiti.org.nz.). It is possible that a wire baffle that offers more draft and a “through view” may be more effective than a wooden baffle but this idea is untested.

Field trial design

The DOC Field trial SOP (DOCDM-51573) is a valuable tool for making robust comparisons between different tools but is infrequently used (DOCDM-99462). The lack of robust trials nationally has resulted in uncertainty about the efficacy of different trapping tools. This trial did use the DOC Field Trial SOP process and has come up with reliable results. Also it ran for two consecutive years that included mast and non-mast years providing different results in different years (as did Steffens 2010), making the results more useful to managers.

Where to from here?

This trial indicated that run-through tunnels are as equally efficient as standard baited trap boxes in a non-beech mast year and more efficient in a beech mast year at catching stoats. Beaudoin and Ducatillon (2012) showed that multiple traps are more efficient than single traps. A future trial could be carried out to test the effectiveness of two traps in run-through tunnels versus two traps in "standard" baited trap boxes (as is currently used by some projects). If multiple traps in run-through tunnels are shown to be more effective they could provide a very cost effective alternative to current trapping programmes that require numerous visits annually to change baits. Trap lines that required infrequent visits to clear traps and/or change bait would allow for expanded trap networks providing increased protection for the same cost.

6. Recommendations

1. A repeat of this trial comparing double set un-baited run-through traps to double set baited (with Erayz#8) standard traps (with wire baffles) should be considered.

2. Cameras could be used to provide information of animal behaviour that could inform trap box design and help explain results achieved.

3. Future trials should record the animals caught by the head or otherwise to enable an assessment of humaneness.

4. Trials in beech forests should attempt to include mast and non-mast years to provide information that can inform management in both mast and non-mast years.

7. References

Amandine Beaudoin, Laurie Ducatillon 2012. Traing period report – Trapping analysis in Te Urewera National Park – June to July 2012. Unpublished Report, Department of Conservation, East Coast, Bay of Plenty. P. 35.

Douglas Bates, Martin Maechler, Ben Bolker, Steve Walker. 2015. Fitting Linear Mixed-Effects Models Using lme4. Journal of Statistical Software, 67(1), 1-48. doi:10.18637/jss.v067.i01.

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R Core Team. 2015. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

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8. Costs

Resource code	description	Approved budget	Actual costs	Explanation
N/A as was carried out by Friends of Rotoiti	Standard 200 box	N/A	$18.20 x 72 = $1310.40	N/A
	Run through box		$17.15 x 72 = $1234.80	
	DOC 200 traps		$41 x 154 = $6314	
	Polymer baits		$00.31 x 1152 = $357.12	
Total material cost			$9216.32	
	Person hours trap construction		120hrs x $21.50 = $2580	

	Person hours trap checks		1005hrs x $21.50 = $21607.5	
Total labour cost			$22897.5	
	Vehicle running		3752 km x $0.75 = $2814	
Total vehicle running cost			$2814	
Total cost		$	$34927.82	

9. Acknowledgements

Thanks to Grant Harper for helping to setup the trial design, Friends of Rotoiti volunteers of making it happen, DOC Rotoiti staff for logistical support, Peter McMurtrie, Sanjay Thakur, Colin Giddy for providing unpublished data, Craig Gillies and Peter Hale for peer review, and Graeme Elliot for doing the statistical analysis.

10. Approval

After the trial report has been peer-reviewed the accountable manager must review the report and give approval/signoff for distribution.]

Manager's name:	John Wotherspoon, Operations Manager
Signature:	
Date:	28 / 02 / 2016

11. Appendices

Previous operational and trial report(s)

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Trial data

- Data is stored in a custom designed (for this trial) MSExcel spreadsheet held on the DOC Nelson Lakes Area Office server

Map of treatment area

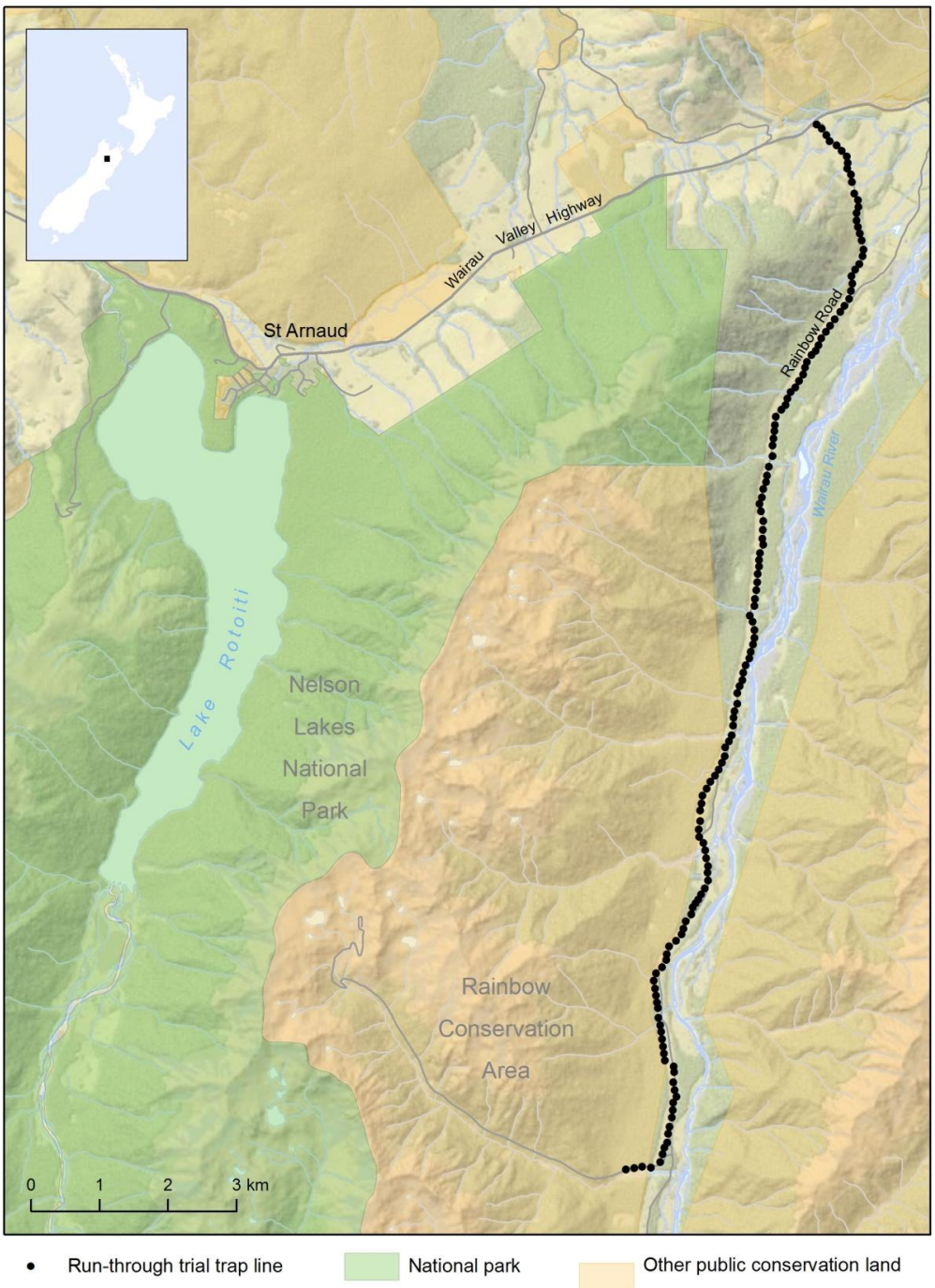

Photo of run-through tunnel