LANDCARE RESEARCH
MANAAKI WHENUA

Pen testing of the kill efficacy of the podiTRAP™ (pT1000) when used for capturing ferrets

Pen testing of the kill efficacy of the podiTRAP™ (pT1000) when used for capturing ferrets

Grant Morriss

Landcare Research

Prepared for:

Hawke's Bay Regional Council

159 Dalton Street
Private Bag 6006
NAPIER 4142

September 2016

Landcare Research, Gerald Street, PO Box 69040, Lincoln 7640, New Zealand,
Ph +64 3 321 9999, Fax +64 3 321 9998, www.landcareresearch.co.nz

Reviewed by:	*Approved for release by:*
Bruce Warburton Senior Scientist Landcare Research	Daniel Tompkins Managing Invasives Portfolio Leader Landcare Research

Landcare Research Contract Report:	LC2661

Disclaimer

This report has been prepared by Landcare Research for Hawke's Bay Regional Council. If used by other parties, no warranty or representation is given as to its accuracy and no liability is accepted for loss or damage arising directly or indirectly from reliance on the information in it.

Contents

Summary v

1 Introduction 1

2 Objectives 1

3 Methods 1

4 Results 4

5 Conclusions 10

6 Recommendations 10

7 Acknowledgements 10

8 References 10

Appendix Ferrets caught by the pT1000 kill trap during test 6 showing variation in kill bar strike location 11

Summary

Project and client

- Landcare Research, Lincoln, assessed the killing performance of the podiTRAP™ (pT1000) kill trap for ferrets, for Hawke's Bay Regional Council, during April to September 2016.

Objective

- To test the killing efficacy of the podiTRAP™ (pT1000) when capturing ferrets, using the National Animal Welfare Advisory Committee (NAWAC) trap-testing guideline.

Methods

- This work was carried out with the approval of the Landcare Research Animal Ethics Committee (AEC 15/12/01).
- The manufacturer provided pT1000 kill traps for testing their killing performance on wild-caught and captive-bred ferrets. Ferrets were penned individually and trialled in a free-approach test. Once the ferret was struck by the trap, the time to loss of palpebral (blinking) reflex was measured to determine whether the trap rendered the captured animal irreversibly unconscious within 3 minutes. For the trap to pass the NAWAC trap-testing guidelines, 10 of 10 ferrets needed to be rendered irreversibly unconscious within 3 minutes.
- Ferrets that were trapped but remained conscious for longer than 3 minutes were euthanised and then necropsied to determine trap kill-bar strike location.

Results

- The first ferret was killed successfully but the second one pulled out after being trapped for 13 seconds. Testing ceased and the trap was returned to the manufacturer for modification, which included increasing the spring strength and adding a vanilla-scented lure plug in the centre of the trap plate.
- The first ferret tested in the modified trap pulled out after 11 seconds without sustaining any detectable injury. The trap was modified further by doubling the spring strength, increasing the weight of the kill bars and replacing the aluminium setting bar with stainless steel.
- In this modified trap three ferrets were killed successfully, but the fourth was caught by a front paw and pulled out after 13 seconds. Further modifications to the trap set were made, including changing bait location from the bait hook above the trap springs to centrally in front of the trap plate; reducing the trap plate size; tapering down the entrance tunnels into the trap chamber; lifting the trap base 12 mm; and reducing the clearance in the trap tunnel in front of the trap by 10 mm.
- Two more ferrets were killed successfully, but the third ferret was caught by the right cheek. Because the behaviour of this ferret was atypical, testing continued with one

more successful kill before another ferret pulled out of the trap after 1 minute 39 seconds. Testing ceased and the trap was modified again by increasing the mass of the handle and handle links.

- Eight ferrets were killed successfully, but then two ferrets tested remained conscious beyond the 3-minute threshold. Both survivors were large male ferrets that entered too far into the trap and were struck on both the shoulders and head. Testing ceased and the trap was again modified by increasing the spring strength, extending the central kill bars downwards by 4.5 mm, raising the pivoting bar through the centre of the springs and adding a bait trough in the centre of the trap plate. The configuration of the trap frame and setting bar was also modified.
- Ten out of ten ferrets were killed successfully with the final version of the trap.

Conclusions

- The final modified version of the pT1000 kill trap passed the NAWAC trap-testing guideline when tested on ferrets.
- Multiple modifications to the original trap design were required before the trap met the guidelines, and users should have confidence that the trap will kill ferrets quickly.
- Male ferrets were much harder to kill than female ferrets because they were much larger (twice the weight) and much more robust.
- The final version of the podiTRAP™ has very high impact momentum, and so it is expected that all possible non-target captures (e.g. possums, feral cats, stoats, rats, hedgehogs) will also have a high probability of being killed quickly.

Recommendations

- If the Hawke's Bay Regional Council wish to use kill traps that have passed the NAWAC trap-testing guideline, they should consider either the pT1000 kill trap or the DOC 250 for trapping ferrets.

1 Introduction

Landcare Research, Lincoln, assessed the killing performance of the podiTRAP™ (pT1000) kill trap for ferrets, for Hawke's Bay Regional Council during April to September 2016.

2 Objectives

- To test the killing efficacy of the podiTRAP™ (pT1000) when capturing ferrets, using the National Animal Welfare Advisory Committee (NAWAC) trap-testing guideline.

3 Methods

The client provided pT1000 kill traps to test their killing performance on ferrets. Wild-caught ferrets were acclimated to captivity in outdoor cages for at least 2 months before being transferred to observation pens for the trap testing. Five captive-bred ferrets older than 6 months were also used. Ferrets were penned individually and trialled in a free-approach test during the day. In each observation pen a trap was set in a double-ended tunnel, which was firmly pinned to the ground using 30-cm-long rebar rods (Figure 1).

Figure 1 pT1000 kill trap in double-ended tunnel. L: Tunnel opened to show trap. R: Tunnel closed. Six rebar rods were used to pin down the trap tunnel base. Trap and tunnel shown is the final configuration, which is unset in both photos. The trap was firmly bolted to the tunnel base.

When a ferret was struck by the trap, the time to loss of palpebral (blinking) reflex was measured to determine whether the trap had rendered the captured animal irreversibly unconscious within 3 minutes. For the trap to pass the NAWAC trap-testing guideline (2011), 10 of 10 ferrets needed to be rendered irreversibly unconscious within 3 minutes. Once irreversible unconsciousness was identified a stethoscope was used to determine cessation of heartbeat.

During the pen tests the podiTRAP™ was modified five times and the tunnel modified once after failing to kill ferrets in the required time frame. The different tests and trap and tunnel specifications used in each test are listed in chronological order as follows.

Test 1

The trap base was recessed into the tunnel floor so that, when set, the trap plate was level with the floor. The trap was baited with chicken mince placed on the floor of the tunnel behind the hinge of the trap (i.e. at the side of the trap in relation to the line of travel through the tunnel).

Test 2

The spring strength of the trap was increased to increase the impact momentum of the kill bars, and a vanilla-scented lure plug was added to the centre of the trap plate to attempt to centralise the ferret's head position when the trap was sprung. The trap was baited with rabbit meat hung on the hook above the trap springs (Figure 2a).

Test 3

The spring strength of the trap was doubled; the weight and thickness of the kill bars were increased; and the setting arm was changed from aluminium to stainless steel. The trap was baited with venison hung on the hook above the trap springs.

Test 4

The base of the trap was lifted 12 mm so that when it was set the trap plate was no longer flush with the tunnel floor; the trap plate was trimmed so that its width was only 5 mm greater than the width of the kill bars; the roof of the entrance tunnels was tapered down close to the trap chamber; and the clearance between the trap and the front wall of the trap chamber in the tunnel was reduced by 10 mm. The trap was baited with either venison or chicken mince in the cavity centrally in front of the trap plate (Figure 3).

Test 5

The handle and handle links were increased in mass by 79 g to increase impact momentum (Figure 2b). The trap was baited as per Test 4.

Test 6

The spring strength of the trap was increased; the central kill bars (excluding the outer frame) were extended 4.5 mm below the bottom edge of the outer frame; the pivot point was raised so that the kill bars were flatter when they struck the trap plate when the trap was fired; and the shape of the handle and handle links was altered (Figure 2c). The trap was baited with chicken mince in a trough in the centre front of the trap plate (Figure 4). The vanilla-scented lure plug was removed.

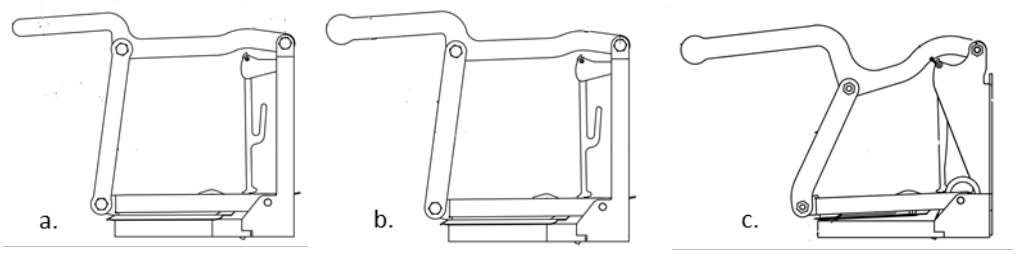


Figure 2 Profile drawings of the revisions of the podiTRAP™ used for capturing ferrets: (a) version used in tests 1–4; (b) version used for test 5; and (c) version used for test 6. A hook for holding bait, located above the trap springs, was part of versions a and b, but was replaced with a bait trough under the trap plate in version c.

Figure 3 The position of bait used with the podiTRAP™ during tests 4 and 5 for capturing ferrets. Bait was placed in the cavity in front of the trap plate. The tunnel is shown hinged open. Note the blue vanilla-scented lure plug in the centre of the trap plate.

Figure 4 The position of bait used with the podiTRAP™ during test 6 for capturing ferrets. Bait was placed in a trough in the centre front of the trap. The tunnel is shown hinged open.

In earlier tests large males were more likely to survive capture in the trap. Some of the wild-caught ferrets used, or available for the tests, had gained excessive weight during captivity (the largest weighed 2.58 kg) and greatly exceeded the maximum weight reported in the wild (1.88 kg; King 2005). It was considered that these larger specimens were not representative

of ferrets in the wild (i.e. those ferrets likely to be caught in the pT1000 trap), so for test 6 only ferrets that weighed 1.88 kg or less were used.

Test animals that escaped and survived were euthanised with an intra-cardiac (0.5 mL/kg bodyweight) injection of pentobarbitone, and then necropsied to identify whether the trap had caused any injury. This work was carried out with the approval of the Landcare Research Animal Ethics Committee (AEC 15/12/01).

4 Results

In test 1 the first ferret was killed successfully but the second ferret pulled out after being held for 13 seconds (Table 1). The second ferret was euthanised and necropsy revealed bruising above the left eye, which suggested the ferret had been facing towards the trap hinge when it was caught. Testing ceased and the trap was returned to the manufacturer for modification, as described in the methods.

In test 2 the first ferret tested pulled out of the trap after 11 seconds without sustaining any identifiable injury, even though it was struck on the head by two kill bars (Table 1). The trap was again returned for modification.

Subsequently, the first three ferrets were killed successfully but the fourth ferret was caught by a front paw and pulled out after 13 seconds (Table 1). Further modifications to the trap set were made.

During test 4 two more tested ferrets were killed successfully before the next ferret was caught by the right cheek. It was considered that this ferret's behaviour was more cautious than normal due to a previous encounter with a trap, so it was discounted and testing continued with one more successful kill before another ferret pulled out of the trap after 1 minute 39 seconds (Table 1). Testing ceased and the trap was again returned to the manufacturer for modification.

In test 5 eight ferrets were killed successfully before a large male remained conscious beyond the 3-minute threshold (Table 1). The ferret weighed 2.02 kg, which was larger than the heaviest reported from the wild (refer Methods section). This ferret (and two others) were discounted and testing continued with an upper weight limit of 1.88 kg, but the next male, which weighed 1.85 kg survived being struck by the trap. Both survivors were large male ferrets that entered too far into the trap and were struck on both the shoulders and head by the kill bars. The additional depth of the ferret's body in line with their shoulders is likely to have reduced the impact momentum of the kill bars on their heads, thereby preventing a fatal strike. Testing ceased and the trap was modified.

Ten ferrets were killed successfully in the final test. Nine of these had fractured skulls after impact by the kill bars. All ferrets were struck by multiple kill bars, but two had turned towards the trap hinge at the time of the strike, resulting in the kill bars striking the skull longitudinally or on an angle. The gap between kill bars was small enough so that even these individuals sustained sufficient head trauma to be rendered irreversibly unconscious within 3 minutes (i.e. the gap was not large enough to miss the brain). Photos of all 10 ferrets are included in the Appendix to show the different kill-bar strike locations.

Table 1 Outcome of tests using the pT1000 kill trap for capturing ferrets

Date	Weight (kg)	Sex	Loss of palpebral reflex (min:s)	Heart stop (min:s)	Strike location	Notes
Test 1						
13/04/2016	1.03	F	2 m 2 s	3 m 9 s	Outer bar back edge of skull; second bar lateral across centre of skull.	Significant fracture in centre of skull.
13/04/2016	1.95	M	-	-	Outer bar strike angled above left eyebrow.	Ferret pulled out at 13 s. No external damage observed. Necropsy revealed bruising above left eye, suggesting ferret had turned towards bait at hinge.
Test 2						
3/05/2016	1.98	M	-	-	Outer & second bar lateral across skull.	Ferret pulled out at 11 s. No external damage observed.
Test 3						
8/08/2016	0.98	F	< 36s	3 m 9 s	Second & third bar lateral across skull; outer bar lateral across neck.	Major flattening of the skull.
8/08/2016	1.95	M	< 2 m 30 s	2 m 30 s	Second & third bars lateral across skull; outer bar lateral across neck.	
8/08/2016	1.06	F	< 42s	1 m 53 s	Second & third bars lateral across skull; outer bar lateral across neck.	Major flattening of the skull.
8/08/2016	1.04	F	-	-	Front left paw.	Pulled out after 13 s; reconstruction of positioning suggests ferret facing toward hinge of trap.

Table 1 (continued)

Date	Weight (kg)	Sex	Loss of palpebral reflex (min:s)	Heart stop (min:s)	Strike location	Notes
Test 4						
9/08/2016	2.00	M	< 38s	4 m 1 s	Second & third bars lateral across skull; outer bar lateral across neck.	Necropsy showed soft tissue damage behind skull; no obvious fractures.
9/08/2016	1.20	F	< 40s	2 m 17 s	Second & third bars lateral across skull; outer bar lateral across neck.	Major flattening of the skull.
11/08/2016	2.01	M	-	-	Right cheek.	Upper right canine broken; damage suggests ferret triggered trap with its nose; this is the same ferret that survived trap 3/05/2016.
12/08/2016	0.89	F	< 44 s	2 m 16 s	Second & third bars lateral across skull; outer bar lateral across neck.	Major skull fracture.
12/08/2016	1.92	M	-	-	Second & third bars lateral across skull; outer bar lateral across neck.	Ferret initially unconscious but revived and pulled out of trap at 1 m 39 s but remained stunned/very sick; necropsy revealed damage to sagittal crest.
Test 5						
17/08/2016	1.98	M	< 3 m	4 m 34 s	Second & third bars lateral across skull; outer bar lateral across back of skull.	Trap tunnel not opened until 3 m because ferret was struggling and may have pulled out if given lateral room; no fracture visible when skull cleaned.
17/08/2016	1.91	M	< 3 m	5 m 10 s	Second & third bars lateral across skull; outer bar lateral across neck.	Trap tunnel not opened until 3 m because ferret was struggling and may have pulled out if given lateral room; no fracture visible when skull cleaned.
17/08/2016	1.79	M	< 3 m	3 m 56 s	Second & third bars lateral across skull; outer bar lateral across neck.	Trap tunnel not opened until 3 m because ferret was struggling and may have pulled out if given lateral room; no fracture visible when skull cleaned.
17/08/2016	1.02	F	< 1 m 10 s	3 m 22 s	Fourth bar lateral across nose; second & third bars lateral across skull; outer bar lateral across neck.	Major skull fracture.

Table 1 (continued)

Date	Weight (kg)	Sex	Loss of palpebral reflex (min:s)	Heart stop (min:s)	Strike location	Notes
Test 5 continued.						
17/08/2016	1.05	F	< 1 m 15 s	2 m 45 s	Fourth bar lateral across nose; third bar lateral across skull; second bar lateral across back of skull; outer bar lateral across neck.	Major skull fracture.
17/08/2016	1.16	F	< 1 m 10 s	2 m 25 s	Second bar along crest of skull; outer bar lateral across neck.	Major skull fracture; nose turned towards trap hinge.
17/08/2016	0.90	F	< 47 s	2 m 58 s	Third bar lateral across in front of ears; second bar lateral across skull; outer bar lateral across neck.	Major skull fracture.
18/08/2016	0.78	F	< 47 s	3 m 0 s	Fourth bar lateral across nose; third bar lateral across skull; second bar lateral across back of skull; outer bar lateral across neck/shoulders.	Major skull fracture.
18/08/2016	2.02	M	-	-	Fourth bar lateral across in front of ears; third bar lateral across skull; second bar lateral across back of skull; outer bar lateral across shoulders.	Ferret initially unconscious but revived; conscious at 3 m; necropsy showed bruising across shoulders as well as skull; bleeding from mouth; suspect additional depth of body reduced impact on head.
24/08/2016	1.85	M	-	-	Fourth, fifth & sixth bars lateral across head; third bar lateral across neck; outer & second bar lateral across shoulders.	No struggling observed; ferret conscious when assessed at 3 m; when released after 5 m ferret ran off but gait suggested damage to forelimb – suspect shoulder injury.

Table 1 (continued)

Date	Weight (kg)	Sex	Loss of palpebral reflex (min:s)	Heart stop (min:s)	Strike location	Notes
Test 6						
7/09/2016	1.76	M	< 1 m 15 s	3 m 54 s	Fifth bar lateral across nose; fourth bar lateral across in front of ears; third bar lateral at rear of skull; outer & second bar lateral across neck.	Skull fracture; no struggling observed; bleeding from nose.
7/09/2016	1.59	M	< 3 m	6 m 10 s	Fifth bar lateral across nose; fourth bar lateral across in front of ears; third bar lateral at rear of skull; outer & second bar lateral across neck.	Struggling up until 3 m; leading edge of the kill bars struck along centre of skull.
7/09/2016	1.00	F	< 1 m 19 s	2 m 24 s	Fourth bar lateral across in front of ears; third bar lateral at rear of skull; second bar lateral across neck; outer bar lateral across shoulders.	Skull fracture; bleeding from nose.
7/09/2016	0.91	F	< 1 m 15 s	2 m 29 s	Third bar angled at front of skull; second bar angled at rear of skull; outer bar angled across neck.	Skull fracture; ferret's nose pointed to front of trap; leading edge of kill bars angled across top of skull.
7/09/2016	0.99	F	< 1 m 8 s	2 m 20 s	Second and third bars longitudinally along skull; outer bar angled across neck.	Skull fracture; ferret's nose pointed towards trap hinge.

Table 1 (continued)

Date	Weight (kg)	Sex	Loss of palpebral reflex (min:s)	Heart stop (min:s)	Strike location	Notes
Test 6 continued.						
7/09/2016	0.94	F	< 38 s	2 m 26 s	Third bar angled in front of ears; second bar angled across ears; outer bar angled across back of skull & neck.	Skull fracture.
7/09/2016	0.94	F	< 32 s	2 m 49 s	Second bar angled across skull; outer bar angled across back of skull & neck.	Skull fracture; ferret's nose pointed towards trap hinge.
7/09/2016	0.84	F	< 30 s	3 m 14 s	Second bar in front of ears; outer bar across skull.	Corner of trap centralised on skull; skull fracture.
14/09/2016	1.82	M	< 1 m 23 s	2 m 57 s	Fifth bar lateral across nose; fourth bar lateral across ears; third bar lateral at rear of skull; outer & second bar lateral across neck.	Skull fracture.
14/09/2016	1.78	M	< 1 m 10 s	3 m 8 s	Fifth bar lateral across nose; fourth bar lateral across ears; third bar lateral at rear of skull; outer & second bar lateral across neck.	Skull fracture.

5 Conclusions

The podiTRAP™ (pT1000) kill trap passed the NAWAC trap-testing guideline when tested on ferrets. Six revisions of the trap design were needed before the trap consistently killed both male and female ferrets.

Male ferrets were significantly heavier than females and were more robust, enabling them to survive capture in the earlier versions of the trap. Females that were successfully killed by all versions of the trap had obvious skull fractures whereas males often did not. However, the final version of the trap caused skull fractures in three of the four male ferrets tested.

The final version of the podiTRAP™ has very high impact momentum, and so it is expected that all possible non-target captures (e.g. possums, feral cats, stoats, rats, hedgehogs) will also have a high probability of being killed quickly.

6 Recommendations

- If the Hawke's Bay Regional Council wish to use kill traps that have passed the NAWAC trap-testing guideline, they should consider either the pT1000 kill trap or the DOC 250 for trapping ferrets.

7 Acknowledgements

Thanks to Pouri Rakete-Stones for providing traps and assisting with the set-up of the pen testing. Thanks also to Hawke's Bay Regional Council for funding, Bruce Warburton and Phil Cowan for review, Ray Prebble for editing and Cynthia Cripps for final formatting of this report.

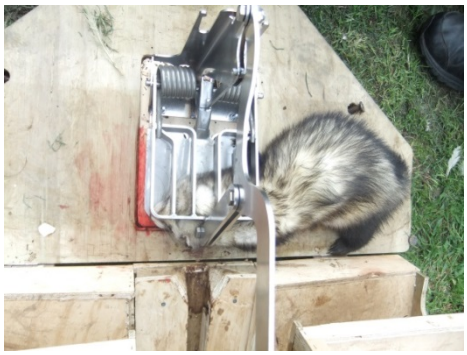
8 References

King CM 2005. Ferret Mustela furo. In: King CM ed. The handbook of New Zealand mammals. Melbourne, Oxford University Press. pp. 294–307.

National Animal Welfare Advisory Committee (NAWAC) 2011. Guideline 09: Assessing the welfare performance of restraining and kill traps 2011. *http://www.mpi.govt.nz/document-vault/8521* (accessed 12 September 2016).

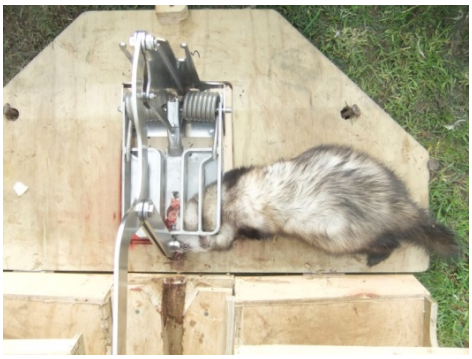
Appendix Ferrets caught by the pT1000 kill trap during test 6 showing variation in kill bar strike location

1.76 kg male



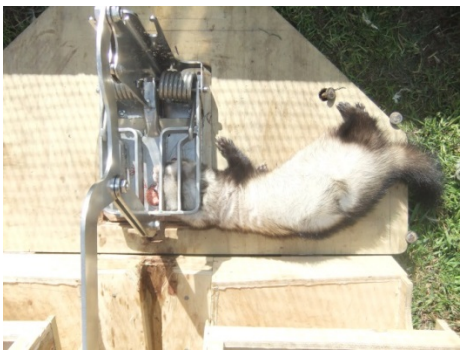
1.59 kg male

1.00 kg female



0.91 kg female

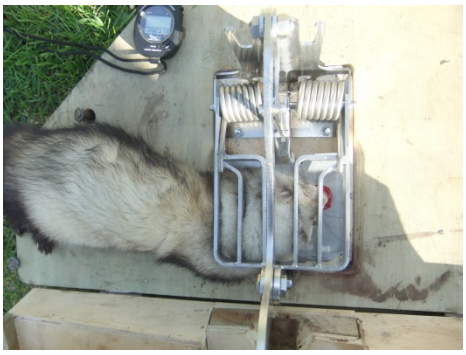
0.99 kg female



0.94 kg female

0.94 kg female

0.84 kg male



1.82 kg male

1.78 kg male