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Landcare Research

Pen testing of the kill efficacy of the Victor® Professional rat trap and the Modified Victor stoat and rat trap for capturing ship and Norway rats

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Pen testing of the kill efficacy of the Victor® Professional rat trap and the Modified Victor stoat and rat trap for capturing ship and Norway rats

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Summary

Project and client

- Manaaki Whenua – Landcare Research (MWLR), Lincoln, assessed the killing performance of the Victor® Professional rat trap for ship (*Rattus rattus*) and Norway (*R. norvegicus*) rats, and the Modified Victor stoat and rat trap for Norway rats, between November 2018 and March 2019. The project was jointly funded by Predator Free 2050 Ltd and the Ministry of Business, Innovation and Employment through the Strategic Science Investment Fund.

Objective

- To test the killing efficacy of the Victor® Professional rat trap when capturing ship and Norway rats, and the Modified Victor stoat and rat trap when capturing Norway rats, using the National Animal Welfare Advisory Committee (NAWAC) trap-testing guideline.

Methods

- This trap testing was carried out with the approval of the Manaaki Whenua – Landcare Research Animal Ethics Committee (AEC 15/12/01).
- New Victor® Professional rat traps and Modified Victor stoat and rat traps were sourced from Pest Control Research, Rolleston. The traps were set in Predator Free NZ wooden trap tunnels obtained from Greater Wellington Regional Council for a previous trial.
- Wild-caught rats were penned individually and tested in a free-approach test. Once the rat was struck by the trap, the time to loss of palpebral (blinking) reflex was measured. For the trap to pass the NAWAC trap-testing guidelines as a Class B trap, 10 of 10 rats needed to be rendered irreversibly unconscious within 3 minutes.
- Rats that were trapped but remained conscious for longer than 3 minutes were euthanised and, for all captures, the trap jaw-strike location was identified and recorded.

Results

- Ten out of ten ship rats were killed successfully with the Victor® Professional rat trap set in the wooden tunnel.
- The Victor® Professional rat trap in the wooden tunnel failed to kill the first adult Norway rat tested. The rat was caught by the neck, side-on, but was still able to breathe and remained conscious beyond 3 minutes. The following seven Norway rats were killed successfully before another rat was caught by the front paw and remained conscious. Testing ceased.
- Nine out of ten Norway rats were killed successfully with the Modified Victor stoat and rat trap set in the wooden tunnel. Another rat was rendered unconscious within 3 minutes but euthanised at 20 minutes. An 11th rat was tested: it was struck by the kill bar on top of the head and stunned, but remained conscious.

- Four of the larger Norway rats (body mass ≥ 296 g) tested with the Modified Victor stoat and rat trap pulled out after being struck by the kill bar. Three were rendered irreversibly unconscious within 3 minutes, but the fourth remained conscious.

Conclusions

- The Victor® Professional rat trap set in a Predator Free NZ wooden tunnel passed the NAWAC trap-testing criterion when tested on ship rats but failed for Norway rats.
- The Modified Victor stoat and rat trap set in a Predator Free NZ wooden tunnel passed the NAWAC trap-testing criterion when tested on Norway rats, but the trap's performance should be considered marginal for trapping large Norway rats.
- The frontal approach to both trap types when used in the Predator Free NZ wooden tunnel resulted, with few exceptions, in consistent head and neck strike locations with both rat species. Of the 30 rats tested, only one Norway rat was mis-caught (by the front paw).
- The four large rats that pulled out after being struck by the kill bar of the Modified Victor stoat and rat trap indicate that the clamping force was insufficient to hold large rats. If these larger rats are struck by the kill bar between the ears and the eyes, then it is likely they will be killed successfully.

Recommendations

- Predator Free 2050 should promote the use of Victor® Professional rat traps or Modified Victor stoat and rat traps in Predator Free NZ wooden tunnels to individuals and community groups for trapping ship rats.
- If Norway rats are targeted, then the Modified Victor stoat and rat trap is recommended, with the proviso that some large rats may survive capture. Using DOC series traps, which have higher impact momentum, would increase the probability of killing large Norway rats.
- If Norway rats are likely to be caught in either of these traps, then users should be encouraged to check the trap frequently.

1 Introduction

Manaaki Whenua – Landcare Research (MWLR), Lincoln, assessed the killing performance of the Victor® Professional rat trap for ship (*Rattus rattus*) and Norway (*R. norvegicus*) rats, and the Modified Victor stoat and rat trap for Norway rats, between November 2018 and March 2019. The project was jointly funded by Predator Free 2050 Ltd and the Ministry of Business, Innovation and Employment through the Strategic Science Investment Fund.

2 Background

In 2000 the National Animal Welfare Advisory Committee (NAWAC) approved 'NAWAC guideline 09: Assessing the welfare performance of restraining and kill traps'¹ to guide the testing of traps in New Zealand. Since then many traps used for capturing pests in New Zealand have been assessed against the guideline's performance criteria.

In 2016 the New Zealand Government announced an aspirational goal to rid New Zealand of possums (*Trichosurus vulpecula*), stoats (*Mustela erminea*) and rats (*Rattus* spp.) by 2050, which has since had a groundswell of support across the country. As part of this there has been a demand by trap-users for information on the welfare performance of rat kill-traps. The Victor® Professional rat trap, which is also known as the Victor® Easy Set® rat trap, has been widely recommended for use by community groups to trap both ship and Norway rats, but not all variations of this trap that are commercially available have been tested for their animal welfare performance.

In 2001 the Victor® Professional rat trap with a 'home-made' cover over the yellow treadle was tested and met the NAWAC criteria for Norway rats (MAF 2010), and research starting in 2011 developed modifications to the Victor® Professional rat trap (now marketed as the Modified Victor stoat and rat trap) that resulted in it passing the NAWAC criteria for stoats and ship rats (Morris & Warburton 2014). To fill the information gaps on the welfare performance of these traps, the standard unmodified Victor Professional rat trap needed to be tested with both rat species, and the Modified Victor stoat and rat trap tested with Norway rats.

3 Objective

- To test the killing efficacy of the Victor® Professional rat trap when capturing ship and Norway rats, and the Modified Victor stoat and rat trap when capturing Norway rats, using the National Animal Welfare Advisory Committee (NAWAC) trap-testing guideline.

¹ <http://www.mpi.govt.nz/document-vault/8521>, accessed 21 March 2019

4 Methods

Victor® Professional rat traps and Modified Victor stoat and rat traps were sourced from Pest Control Research, Rolleston, to test the traps' killing performance on wild-caught ship and Norway rats. Predator Free NZ wooden trap tunnels² had been provided to MWLR for previous testing of the Snap-E rat trap (Morris 2017) and were reused for this trial.

Wild-caught rats were acclimatised to captivity in cages before being transferred to test arenas for the trap testing (Figure 1). Rats were confined individually in each arena and tested in a free-approach test during late afternoon or evening. In each arena, a trap was set in a Predator Free NZ wooden tunnel (Figure 2).



Figure 1. The four arenas used for trap testing. Rats were provided with a nest box, had free access to water, and were fed with standard rodent pellets (ProLab RHM 1800 LabDiet, PMI Nutrition International, MO, USA). Two arenas are shown with Predator Free NZ wooden trap tunnels in place.

² <https://shop.predatorfree.nz/products/victor-professional-rat-trap-tunnel>, accessed 18 March 2019



Figure 2. The Predator Free NZ wooden trap tunnel. A 50 × 50 mm entrance hole was cut in the mesh at the far end of the tunnel (not visible) and the mesh at the closed end of the tunnel was removable to allow access to the trap. The Victor® Professional rat trap or Modified Victor stoat and rat trap was set 1–2 cm into the tunnel from the closed end. Two tacks were nailed into the trap tunnel floor in front of the trap to prevent it being pulled forward by a rat or pushed too close to the entrance hole in the front mesh when deployed.

When a rat 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 criterion (2011) as a Class B trap, 10 of 10 rats needed to be rendered irreversibly unconscious within 3 minutes. Once irreversible unconsciousness was identified, a stethoscope was used to determine cessation of heartbeat.

The different tests are listed in chronological order below.

4.1 Test 1. Victor® Professional rat trap on ship rats

The traps were set in Predator Free NZ wooden tunnels and baited with either walnut paste, Nutella® or smooth peanut butter, applied in the purpose-made bait well near the pivot on the yellow treadle (Figure 3). Once set, the trap was placed in the tunnel so that the back edge of the trap was about 1–2 cm in from the rear mesh, so that there was enough room in front of the trap to allow a rat to fully enter the tunnel. Two tacks were nailed into the trap tunnel floor in front of the trap to prevent it being pulled forward by a rat or pushed too close to the entrance hole in the front mesh when the trap was placed in the tunnel. Testing started on 27 November 2018 and was completed on 9 December 2018.



Figure 3. Baited unset Victor® Professional rat trap showing placement of bait in the purpose-made bait-well.

4.2 Test 2. Victor® Professional rat trap on Norway rats

The traps were set and baited as in test 1 above, differing only in that bacon fat was used as the bait. Testing was carried out from 20 to 29 January 2019.

4.3 Test 3. Modified Victor stoat and rat trap on Norway rats

The traps were set inside Predator Free NZ wooden tunnels as in tests 1 and 2. The trap was baited with a slice of Mustelid and Cat lure³ smeared with either a small quantity of bacon fat or smooth peanut butter on the upper surface of the lure (Figure 4). Testing was carried out from 13 to 28 February 2019.



Figure 4. Baited unset Modified Victor stoat and rat trap showing method of baiting (shroud removed) with Mustelid and Cat lure block and slices.

Test animals that survived were euthanised by cervical dislocation (if not struck on the neck) or an intracardiac injection of pentobarbitone (0.5 ml/kg bodyweight; when struck on the neck), and then necropsied to identify whether the trap had caused any obvious injury. This work was carried out with the approval of the MWLR Animal Ethics Committee (AEC 15/12/01).

4.4 Size comparison of ship and Norway rats

All rats were weighed, and the results compared with the weights of rats previously tested by MWLR since August 2001.

³ <https://www.traps.co.nz/mustelid-and-cat-lure-1kg-pail>, accessed 18 March 2019

5 Results

5.1 Test 1. Victor® Professional rat trap on ship rats

All 10 ship rats tested were struck by the kill bar between the eyes and the neck and rendered irreversibly unconscious in under 3 minutes (Table 1; Appendix 1). Most rats were irreversibly unconscious when first assessed, with only one individual retaining consciousness for 1 min 14 s after it was struck. All ship rats tested had fractured skulls or necks. They had a mean weight of 146 g (range 102–220 g).

5.2 Test 2. Victor® Professional rat trap on Norway rats

The first Norway rat tested was caught by the neck, side-on, and survived as it was still able to breathe freely. Testing continued, and the next seven rats were killed successfully. The ninth rat tested was caught by the front right toes and survived, and testing ceased (Table 2; Appendix 2). Four of the rats that were killed successfully had fractured skulls, and one struck on the neck had an obvious cervical dislocation. The remaining two rats that were killed were caught by the neck, but there was no obvious dislocation or fracture. The mean weight of the Norway rats tested was 250 g (range 180–338 g).

5.3 Test 3. Modified Victor stoat and rat trap on Norway rats

Nine out of ten Norway rats were killed successfully with the Modified Victor stoat and rat trap set in the Predator Free NZ wooden tunnel (Table 3; Appendix 3). Another rat appeared to have turned at the same time the trap fired and therefore was struck longitudinally on the skull resulting in a fracture to the skull and damage to the right eye. This rat was unconscious when first assessed and remained so until euthanised at 20 min. Because it was considered a marginal kill, an additional rat was tested, and this 11th rat, although struck by the kill bar on top of the head, was stunned but remained conscious. Testing ceased.

Of the 11 rats tested, five were struck side-on, with four of those showing obvious skull fractures. All of these were rendered irreversibly unconscious within the 3-minute threshold. The four largest Norway rats tested with the Modified Victor stoat and rat trap pulled out after being struck by the kill bar. Of these, two were killed successfully (weight: 306 g and 415 g), one was the 'marginal' kill referred to above (296 g), and the fourth survived (348 g). The mean weight of the Norway rats tested was 255 g (range 129–415 g).

Table 1. Outcome of tests using the Victor® Professional rat trap for capturing ship rats (test 1)

Date	Weight (g)	Sex	Loss of palpebral reflex (min:s)	Heart stop (min:s)	Strike location	Notes
27/11/2018	220.3	M	<30 s	2 min 31 s	Neck/back edge of skull	Fractured skull; central to the front of the trap
28/11/2018	102.1	F	<47 s	3 min 19 s	Skull just behind eyes	Major skull fracture; central to the front of the trap
30/11/2018	169.5	M	<27 s	2 min 52 s	Skull just behind eyes	Major skull fracture
30/11/2018	137.1	F	<41 s	2 min 36 s	Neck	Neck fracture
3/12/2018	126.1	M	<1 min 4 s	3 min 29 s	Back edge of skull/RHS front paw	Fractured skull; central to the front of the trap
5/12/2018	105.5	F	<35 s	2 min 21 s	Back edge of skull/LHS front paw	Fractured skull; central to the front of the trap
7/12/2018	163.1	M	<42 s	3 min 22 s	Neck/back edge of skull	Fractured skull; central to the front of the trap
8/12/2018	162.9	F	1 min 14 s	4 min 2 s	Neck	Neck fracture
8/12/2018	145.7	M	<35 s	3 min 29 s	Skull just behind eyes	Major skull fracture
9/12/2018	124.4	M	<35 s	3 min 2 s	Across eyes	Major skull fracture; central to the front of the trap

Table 2. Outcome of tests using the Victor® Professional rat trap for capturing Norway rats (test 2)

Date	Weight (g)	Sex	Loss of palpebral reflex (min:s)	Heart stop (min:s)	Strike location	Notes
20/01/2019	276.4	F	-	-	Neck side on	Rat still able to breathe and vocalise; securely held
23/01/2019	338.1	M	<40 s	4 min 15 s	Across ears	Fractured skull with copious bleeding
23/01/2019	191.9	M	<35 s	3 min 23 s	Across ears	Fractured skull
24/01/2019	321.1	F	<37 s	6 min 3 s	Back edge of skull	Fractured skull
27/01/2019	179.8	F	<29 s	5 min 39 s	Neck	No obvious fracture or dislocation
27/01/2019	243.5	M	<47 s	4 min 13 s	Back edge of skull	Fractured skull
28/01/2019	182.3	M	1 min 2 s	5 min 3 s	Neck	Obvious dislocation
28/01/2019	238.8	M	57 s	4 min 47 s	Neck	No obvious fracture or dislocation
29/01/2019	277.3	M	-	-	RHS front paw	Pulled out after 40 s

Table 3. Outcome of tests using the Modified Victor stoat and rat trap for capturing Norway rats (test 3)

Date	Weight (g)	Sex	Loss of palpebral reflex (min:s)	Heart stop (min:s)	Strike location	Notes
13/02/2019	217.6	M	<35 s	4 min 44 s	Just behind eyes	Fractured skull
13/02/2019	129.2	F	<33 s	3 min 4 s	Across ears side on	Fractured skull
14/02/2019	228.7	M	<34 s	4 min 12 s	Between ears and eyes	Fractured skull
15/02/2019	295.8	M	<52 s	20 min	Longitudinal skull RHS eye damaged	Fractured skull; not held by trap; continued breathing with periodic limb extension and shake; remained unconscious and was euthanised at 20 min
17/02/2019	240.3	M	<41 s	5 min 12 s	Between ears and eyes	Fractured skull
18/02/2019	206.4	F	<32 s	4 min 6 s	Between ears and eyes side on	Fractured skull
18/02/2019	150.9	F	<32 s	4 min 44 s	Across ears side on	Fractured skull
21/02/2019	271.8	M	<54 s	4 min 41 s	Between ears and eyes side on	Fractured skull
24/02/2019	415.1	M	<1 min 11 s	5 min 5 s	Between ears and eyes side on	Initial breaths but stopped by 2 min; not held by trap
24/02/2019	305.8	M	<52 s	3 min 8 s	Across eyes	Fractured skull with copious bleeding; not held by trap
28/02/2019	347.9	M	-	-	Between ears and eyes	Stunned but did not lose consciousness; necropsy showed soft tissue damage on RHS of the top of the skull but no obvious fracture; not held by trap

5.4 Size comparison of ship and Norway rats

A total of 112 wild-caught Norway rats and 102 wild-caught ship rats have been used for trap testing between August 2001 and February 2019 (including the testing reported here). The mean weight of the Norway rats tested previously was 254 g (range 90–510 g), which was consistent with the mean weight of those used in trials 2 and 3 reported here: 250 g (range 180–338 g) and 255 g (range 129–415 g), respectively. The mean weight of all ship rats tested previously was 135 g (range 28–202 g). The mean weight of ship rats used in trial 1 was 146 g (range 106–220 g).

Ship rats had a narrower weight range than Norway rats, with large adult Norway rats being over twice the weight of adult ship rats (Figure 5) which was consistent with weight ranges reported in other New Zealand rat populations (Innes 2005a, 2005b).

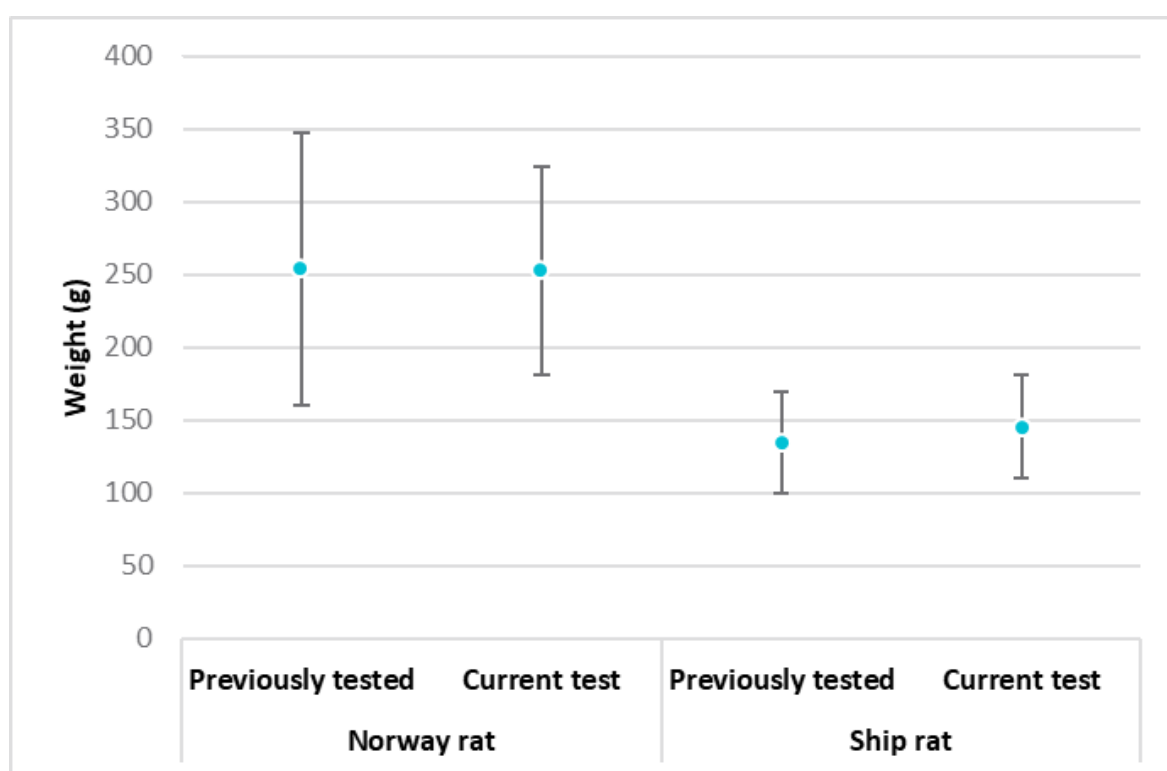


Figure 5. Mean rat weights for Norway and ship rats in previous and current trap testing trials carried out by Manaaki Whenua – Landcare Research, 2001–2019. Mean weights are shown as points, and error bars are ± 1 standard deviation.

6 Conclusions

6.1 Victor® Professional rat trap on ship rats

The Victor® Professional rat trap set in a Predator Free NZ wooden tunnel met the welfare criteria in the NAWAC trap-testing guideline when tested on ship rats (see Appendix 4 for summary of Victor® rat trap tests). All 10 of the ship rats tested had fractured neck vertebrae or skulls, which indicates that the impact momentum is sufficient to quickly kill

rats of the size tested. Frontal approach to the trap when used in the Predator Free NZ wooden tunnel resulted in consistent head and neck strike locations with ship rats.

6.2 Victor® Professional rat trap on Norway rats

The Victor® Professional rat trap set in a Predator Free NZ wooden tunnel failed for Norway rats. The first rat that survived the test when hit sideways on the neck suggesting that the impact momentum of the kill bar is not always adequate to cause cervical dislocation. The second survivor that was caught by the front paw is an indication of the variation of target species positioning when a treadle trigger is used and the trap fires.

6.3 Modified Victor stoat and rat trap on Norway rats

The Modified Victor stoat and rat trap set in a Predator Free NZ wooden tunnel passed the NAWAC trap-testing guideline when tested on Norway rats. One rat in this test was euthanised after being unconscious for 20 minutes but had a fractured skull, which was expected to be an unsurvivable injury. Nevertheless, it may have regained consciousness, albeit briefly, if left longer than 20 minutes. It is very rare for an animal to receive significant head trauma but continue to breathe. This has only been recorded once before in 18 years of trap testing by MWLR, when a stoat caught in the Goodnature A24 rat and stoat trap remained unconscious and was euthanised after 70 minutes. This rat was considered a “pass” and therefore enabled the Modified Victor stoat and rat trap to meet the NAWAC guideline’s welfare criterion.

Nine of the 11 (82%) Norway rats tested had fractured skulls, which indicates that the impact momentum is sufficient to quickly kill rats of the size tested. That four rats (body mass $\geq 296\text{g}$) pulled out after being struck by the kill bar suggests that the clamping force of the Modified Victor stoat and rat trap was insufficient to hold larger rats. When even these larger rats are struck by the kill bar between the ears and the eyes, most will be killed successfully.

In 2001 the Victor® Professional with a ‘home-made’ cover over the yellow treadle trigger was tested on Norway rats (MAF 2010). In that trial, two large individuals (weighing 353 and 467 g) were killed successfully after being struck on the head. These results suggest the Victor® Professional trap does have enough impact momentum to kill most Norway rats. However, the 11th Norway rat in the current Trial 3 that survived being hit on top of the skull indicates that the Victor® Professional rat trap or Modified Victor stoat and rat trap is only marginally effective for larger Norway rats ($>350\text{ g}$). If trapping is carried out in areas where Norway rats are the predominant species, then a trap design with higher impact momentum that has passed the NAWAC guideline (i.e. DOC150, DOC200 and DOC250) may be required for consistent kills of larger individuals.

The five Norway rats caught side-on with the Modified Victor stoat and rat trap may have been a result of them attempting to lick the bacon fat on top of the lure horizontally rather than biting the lure itself. Side-on captures can be survivable if a rat is caught on the neck, as seen with the first Norway rat tested with the Victor® Professional rat trap in trial 2. Because the Modified Victor stoat and rat trap has a cover and pull trigger rats are

centralised to the front of the trap and cannot reach in as far as with an uncovered treadle trigger, and therefore these five rats were positioned correctly and rendered irreversibly unconscious.

The Modified Victor stoat and rat trap achieved more consistent strike locations on Norway rats compared to the Victor® Professional rat trap. Setting both trap types in the Predator Free NZ wooden tunnel ensured frontal approach to the traps by the rats, which increased the probability of optimal strikes. Using a treadle trigger (as in the Victor® Professional rat trap) has a greater likelihood of mis-strikes when rats depress the edge of the treadle before they are centralised over the bait well. The cover and pull trigger on the Modified Victor were developed to improve welfare of trapped animals (Morris & Warburton 2014) and these results confirm that greater consistency.

6.4 Size comparison of ship and Norway rats

The users of Victor® Professional and Modified Victor stoat and rat traps should note the difference in mean weight of ship and Norway rats and use appropriate traps for the species in the areas they trap.

7 Recommendations

- Predator Free 2050 should promote the use of Victor® Professional rat traps or Modified Victor stoat and rat traps in Predator Free NZ wooden tunnels to individuals and community groups for trapping ship rats.
- If Norway rats are targeted, then the Modified Victor stoat and rat trap is recommended, with the proviso that some large rats may survive capture. Using DOC series traps which have higher impact momentum would increase the probability of killing large Norway rats.
- If Norway rats are likely to be caught in either of these traps, then users should be encouraged to check the trap frequently.

8 Acknowledgements

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Appendix 1 – Ship rats caught by the Victor® Professional rat trap during test 1, showing consistency in trap jaw strike location



220.3 g male



102.1 g female



169.5 g male



137.1 g female



126.1 g male



105.5 g female



163.1 g male



162.9 g female



145.7 g male



124.4 g male

Appendix 2 – Norway rats caught by the Victor® Professional rat trap during test 2, showing trap jaw strike location



276.4 g female (fail)



338.1 g male



191.9 g male



321.1 g female



179.8 g female



243.5 g male



182.3 g male



238.8. g male



277.3 g male (fail)

Appendix 3 – Norway rats caught by the Modified Victor stoat and rat trap during test 3, showing trap jaw strike location and size relative to the trap



217.6 g male



129.2 g female



228.7 g male



295.8 g male



240.3 g male



206.4 g female



150.9 g female



271.8. g male



415.1 g male



305.8 g male



347.9 g male

Appendix 4 – Summary of NAWAC testing of various Victor® rat trap sets on Norway and ship rats

Year	Trap type	Trap set description	Species	Pass/Fail
2001	Victor® Professional	Home-made cover over yellow treadle trigger; set without tunnel	Norway rat	Pass
2012	Modified Victor stoat and rat trap	Commercial cover over bait holder trigger; set in plastic tunnel	Ship rat	Pass
2018	Victor® Professional	Yellow treadle trigger; set in Predator Free NZ wooden tunnel	Ship rat	Pass
2019	Victor® Professional	Yellow treadle trigger; set in Predator Free NZ wooden tunnel	Norway rat	Fail
2019	Modified Victor stoat and rat trap	Commercial cover over bait holder trigger; set in Predator Free NZ wooden tunnel	Norway rat	Pass