Manaaki Whenua
Landcare Research

Pen testing of the kill efficacy of the Trapper® T-Rex® rat trap when used for capturing ship and Norway rats

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Pen testing of the kill efficacy of the Trapper® T-Rex® rat trap when used for capturing ship and Norway rats

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Grant Morriss

Manaaki Whenua – Landcare Research

Reviewed by:	*Approved for release by:*
Bruce Warburton	Chris Jones
Team Leader	Portfolio Leader – Managing Invasives
Manaaki Whenua – Landcare Research	Manaaki Whenua – Landcare Research

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Summary

Project and client

- Manaaki Whenua – Landcare Research, Lincoln, assessed the killing performance of the Trapper® T-Rex® rat trap for ship (*Rattus rattus*) and Norway (*Rattus norvegicus*) rats, for Key Industries, during May and June 2018.

Objective

- To test the killing efficacy of the T-Rex rat trap when capturing ship and 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).
- Key Industries provided Protecta® EVO® Ambush® and Sidekick® bait stations, and new T-Rex rat traps to test their killing performance on wild-caught ship and Norway rats. Predator Free NZ wooden trap tunnels provided for a previous trial by Greater Wellington Regional Council were also used.
- Rats were penned individually and trialled in a free-approach test. Once the rat 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 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 the trap jaw strike location was identified.

Results

- T-Rex rat traps were initially set inside Ambush bait stations. The first two captive ship rats tested were caught by their neck, side-on, and remained conscious beyond 3 minutes so were euthanised. Testing ceased and the bait station was modified by adding a corflute baffle inside the bait station in front of the trap to deter rats from accessing the trap along the front edge of the trap.
- Two ship rats were killed successfully in the modified trap set, before a third was caught by the neck side-on and survived. Testing restarted with traps set inside Sidekick bait stations.
- Using this trap set, two ship rats remained conscious beyond 3 minutes, with one caught across the middle of the body and the second caught by the front leg. A third rat ran into the bait station/trap and was killed successfully. The trap set was further modified by moving the trap forward to the front edge of the bait station.
- The first ship rat was caught by the front leg and survived. The traps were then set inside a wooden tunnel, as used for deploying traps by Predator Free NZ.

- Ten out of ten ship rats were killed successfully with the T-Rex trap set in the wooden tunnel.
- The T-Rex trap in the wooden tunnel failed to kill the first adult Norway rat tested. The rat was caught by the neck, but was still able to breathe and remained conscious beyond 3 minutes. Testing ceased.

Conclusions

- The T-Rex rat trap set in a Predator Free NZ wooden tunnel passed the NAWAC trap-testing guideline when tested on ship rats but failed the guideline for Norway rats.
- Frontal approach to the T-Rex trap resulted in consistent head and neck strike locations with all the ship rats captured.
- When the T-Rex trap was used inside Ambush and Sidekick bait stations, rats were struck inconsistently and were not rendered unconscious within 3 minutes. This indicated that side approaches to the trap in these stations results in poor welfare outcomes for captured rats.
- The T-Rex rat trap appears to have insufficient impact momentum and/or clamping force to consistently kill rats greater than 240 g, which most adult Norway rats are. Larger rats may be securely held in the trap, but could remain conscious for an extended period.

Recommendation

- Key Industries should promote the use of T-Rex rat traps in Predator Free NZ wooden tunnels to individuals and community groups for trapping ship rats.
- Monitoring of the strike locations, species and weights of rats captured using T-Rex rat traps as part of a community group trapping initiative should be encouraged in order to provide information on the likely effectiveness of this trap for killing Norway rats.

1 Introduction

Manaaki Whenua – Landcare Research, Lincoln, assessed the killing performance of the Trapper® T-Rex® rat trap for ship (*Rattus rattus*) and Norway (*Rattus norvegicus*) rats, for Key Industries, during May and June 2018. The Trapper® T-Rex® is also sold as the Tomcat® Rat Snap Trap.

2 Objective

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

3 Methods

The client provided Protecta® EVO® Ambush®, and Sidekick® bait stations (designed to hold both bait and traps) and Trapper® T-Rex® rat traps (Bell Laboratories, Wisconsin, USA) to test the traps' killing performance on wild-caught ship and Norway rats. Predator Free NZ wooden trap tunnels (https://shop.predatorfreenz.org/products/victor-professional-rat-trap-tunnel accessed 20 June 2018) had been provided to Manaaki Whenua – Landcare Research for previous testing of the Snap-E rat trap (Morriss 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. Rats were confined individually and trialled in a free-approach test during late afternoon or evening. In each arena a trap was set in a double entrance bait station or single-ended tunnel (Figure 1).

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). Arenas are shown with Predator Free NZ wooden trap tunnels in place.

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 guideline (2011), 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.

During the pen tests the T-Rex rat trap set was modified five times after failing to kill rats within the required time frame. The different tests are listed in chronological order below.

Test 1

The trap was set inside an Ambush bait station (Figure 2). Smooth peanut butter was placed in the removable bait well, level with the top of the well.

Test 2

A corflute baffle was attached inside the Ambush bait station in front of the trap to create a barrier to deter rats from triggering the trap with their head side-on at the front edge (Figure 3). When the bait station was closed, the barrier was held securely by the station roof in a vertical orientation. The trap was baited as in test 1 above.

Test 3

The trap was set inside a Sidekick bait station (Figure 4). The trap was placed fully back in the trap recess so that rats had access to the trap along its front edge. The trap was baited as in the previous tests.

Test 4

A Sidekick bait station was used with the trap placed forward in the trap recess so that the leading edge of the trap was flush with the wall of the bait station. Rats accessed the trap from the side (Figure 3).

Test 5

The trap was set inside a Predator Free NZ wooden trap tunnel (Figure 5). The trap was baited with smooth peanut butter, Nutella or walnut paste.

Test 6

For testing on Norway rats the trap was set as in the previous test (Figure 5), differing only in that it was baited with bacon fat.

Figure 2. A set un-baited T-Rex rat trap inside an open Ambush bait station. The entrance holes in the bait station base are on the right and are offset from where the trap is positioned so rats approach the trap from around a corner. The Ambush bait station was used for tests 1 and 2.

Figure 3. Unset T-Rex rat trap in an open Ambush bait station showing the added corflute barrier. When the bait station was closed, the barrier was held securely by the station roof in a vertical orientation.

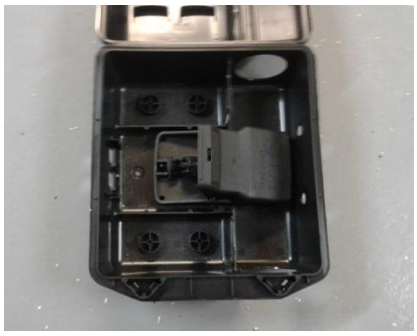

Figure 4. Unset T-Rex rat trap in an open Sidekick bait station. *Left:* Trap placed fully back in the trap recess so that rats had access to the front edge of the trap, as used for test 3. *Right:* Trap placed forward in the trap recess so that the leading edge of the trap was flush with the wall of the bait station. This set was used for test 4.

Figure 5. The Predator Free NZ wooden trap tunnel used for tests 5 and 6. 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 T-Rex trap was set 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, or pushed too close to the entrance hole in the front mesh.

Test animals that survived were euthanised by cervical dislocation. No rats were necropsied because all trapped rats were securely held and trap strike location and resulting injury were obvious. This work was carried out with the approval of the Manaaki Whenua – Landcare Research Animal Ethics Committee (AEC 15/12/01).

4 Results

In test 1, the first two ship rats tested were caught by their neck side-on and remained conscious beyond 3 minutes, so were euthanised (Table 1). Testing ceased and the bait station was modified as described in the methods.

In test 2, two ship rats were killed successfully in the modified trap set, before a third was caught by the neck side-on and survived (Table 1). Testing ceased and the trap was modified further.

Subsequently (test 3), two ship rats were caught in the trap but remained conscious beyond 3 minutes, with one caught across the middle of the body and the second caught by the right front lower leg. A third rat was trapped in quick succession when it ran into the bait station/trap and was killed successfully (Table 1). Testing ceased and the trap set was further modified.

During test 4, one ship rat was caught by the front left foreleg and survived (Table 1). Testing ceased and the trap set was modified again.

In test 5, 10 out of 10 ship rats were killed successfully (Table 1). All of these were struck on the neck or head and rendered irreversibly unconscious quickly. The palpebral reflex was only detected in two rats, with the remainder unconscious when first assessed. Five rats had obvious skull fractures and were likely to have been rendered irreversibly unconscious instantly, although the time taken to open up the test arena and access the

rat in the trap tunnel prevents rapid assessment of consciousness. Photos of these 10 rats are included in Appendix 1 to show the consistent trap jaw strike locations.

The T-Rex trap set in a Predator Free NZ trap tunnel failed to kill the first adult Norway rat tested (Table 2). The rat was securely held by the neck, but still managed to breathe and remained conscious beyond 3 minutes. Testing ceased.

Table 1. Outcome of tests using the T-Rex rat trap for capturing ship rats

Date	Weight (g)	Sex	Loss of palpebral reflex (min:s)	Heart stop (min:s)	Strike location	Notes
Test 1						
1/05/2018	186.0	M	-	-	Neck side-on	Caught on front edge of trap; breathing freely; trap jaws on side of neck; securely held
1/05/2018	148.1	F	-	-	Neck/upper shoulder side-on	Caught on front edge of trap; breathing freely; trap jaws on side of neck; securely held
Test 2						
8/05/2018	95.7	M	<1 min 33 s	<3 min 19 s	Neck/upper shoulder	Side entry to trap; no heartbeat detected; compression of upper chest by trap jaws
8/05/2018	120.9	F	<59 s	3 min 29 s	Neck/upper shoulder	Side entry to trap; compression of upper chest
14/05/2018	128.1	F	-	-	Neck side-on	Side entry to trap; breathing freely; trap jaws on side of neck; securely held
Test 3						
17/05/2018	86.8	M	-	-	Rear of chest (diaphragm)	Still able to breathe; slowly going unconscious but still conscious at 5 min
17/05/2018	122.0	M	-	-	Right front lower leg	Also had bloody nose; securely held
17/05/2018	130.4	F	1 min	<1 min 30 s	Chest	Ran into bait station/trap; no heartbeat detected
Test 4						
18/05/2018	144.2	M	-	-	Front left foreleg	Vocalising; securely held
Test 5						
22/05/2018	70.9	F	<1 min 8 s	<1 min 8 s	Neck	No heartbeat detected; central front entry to trap; securely held
24/05/2018	141.0	M	<30 s	4 min 49 s	Head between ears and eyes	Fractured skull; probably instantly unconscious; breathing/movement up to 3 min
24/05/2018	133.7	F	<37 s	4 min 24 s	Head between ears and eyes	Fractured skull; probably instantly unconscious; caught by corner of trap jaws

Date	Weight (g)	Sex	Loss of palpebral reflex (min:s)	Heart stop (min:s)	Strike location	Notes
Test 5, con't						
11/06/2018	107.8	F	<54 s	3 min 19 s	Head back of skull	Fractured skull; probably instantly unconscious; central front of trap
11/06/2018	96.6	M	<30 s	3 min 16 s	Head across ears	Fractured skull; probably instantly unconscious; central front of trap
14/06/2018	120.1	F	1 min 5 s	3 min 29 s	Immediately behind head	Ran into tunnel; had palpebral reflex initially; airway occlusion probable cause of death
16/06/2018	129.4	M	<54 s	3 min 16 s	Head back of skull	Fractured skull; probably instantly unconscious; central front of trap
16/06/2018	66.6	F	1 min 31 s	2 min 48 s	Immediately behind head	Central front of trap; had palpebral reflex initially; airway occlusion probable cause of death
18/06/2018	168.4	M	<1 min 23 s	3 min 27 s	Head across ears	Central front of trap; no palpebral reflex detected; airway occlusion probable cause of death
18/06/2018	103.2	M	<1 min 1 s	3 min 25 s	Neck and front right paw	Central front of trap; no palpebral reflex detected; airway occlusion probable cause of death

Table 2. Outcome of tests using the T-Rex rat trap for capturing Norway rats

Date	Weight (g)	Sex	Loss of palpebral reflex (min:s)	Heart stop (min:s)	Strike location	Notes
Test 6						
31/05/2018	245.2	F	-	-	Neck	Rat still able to breathe; caught just behind head; securely held; central front of trap

5 Conclusions

The T-Rex rat trap set in a Predator Free NZ wooden trap tunnel passed the NAWAC trap-testing guideline when tested on ship rats but failed the guideline for Norway rats. Frontal approach to the T-Rex trap in the wooden tunnel resulted in consistent head and neck strikes on all ship rats captured. Half of the ship rats in the final test had fractured skulls, which indicates that the impact momentum is sufficient to quickly kill rats of the size tested. All rats captured in the T-Rex trap were securely held, demonstrating that the trap had sufficient clamping force for the size of rats tested, and if the trap jaw impact hadn't caused a skull fracture would have contributed to the airway occlusion that was observed.

When the T-Rex trap was used inside Ambush and Sidekick bait stations, ship rats were struck inconsistently and rats were not rendered unconscious in less than 3 minutes, indicating that side approaches to the trap in these stations result in extended times to death for captured rats. With traps set in this way, rats may be trying to pass over the trap treadle rather than eating the bait, resulting in inconsistent contact with the trap treadle and consequently varied trap jaw strike locations on the rats.

The T-Rex rat trap appears to have insufficient impact momentum and/or clamping force to consistently kill rats greater than 240 g, which most adult Norway rats are. Larger rats caught in the trap may remain securely held, but could remain conscious for extended periods. It is unknown whether the T-Rex rat trap has sufficient impact momentum to consistently cause skull fractures when larger rats (>240 g) are struck on the head. However, a Manaaki Whenua staff member who set a T-Rex trap privately caught a 299 g male Norway rat, with the trap jaw causing a skull fracture between the ears and eyes, so the trap has potential to work effectively on Norway rats if the strike location can be limited to the head. Monitoring the strike locations, species and weight of rats captured using T-Rex rat traps as part of a community group trapping initiative could provide answers to this question.

6 Recommendations

- Key Industries should promote the use of T-Rex rat traps in Predator Free NZ wooden tunnels to individuals and community groups for trapping ship rats.
- Monitoring of the strike locations, species and weight of rats captured using T-Rex rat traps as part of a community group trapping initiative should be encouraged to provide information on the likely effectiveness of this trap for killing Norway rats.

7 Acknowledgements

Thanks to Animal Facility staff for animal husbandry, Key Industries for funding, Bruce Warburton for review, Ray Prebble for editing and Cynthia Cripps for final formatting of this report.

8 References

Morriss G 2017. Pen testing of the kill efficacy of the Snap E rat trap when used for capturing ship and Norway rats. Landcare Research Contract Report LC2995.

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 21 June 2018).

Appendix 1 – Ship rats caught by the T-Rex rat trap during test 5, showing consistency in trap jaw strike location

70.9 g female

141.0 g male

133.7 g female

107.8 g female

96.6 g male

120.1 g female

129.4 g male

66.6. g female

168.4 g male

103.2 g male