Pen testing the animal welfare performance of the BT200 kill trap within a 'baffled' wooden tunnel to kill stoats

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Summary

Project

Zero Invasive Predators assessed the welfare performance for stoats (*Mustela erminea*) of the BT200 kill trap, housed within a wooden tunnel (with baffles), during February and March, 2019.

Methods

This work was carried out with approval of the Lincoln University Animal Ethics Committee (AEC#2017-42, December 2017 – amendment secured January 2019).

The project was conducted using the standard stainless-steel version of the BT200 kill trap produced by National Springs and Wire Products NZ Ltd, in a double set, double entrance wooden tunnel.

Stoats were penned individually and trap tested in a free-approach test. Once a stoat was struck by the trap, the time to loss of corneal reflex was measured to determine whether the trap had rendered the trapped animal irreversibly unconscious within 30 seconds.

Ten wild-caught stoats were individually tested.

The results were assessed against the National Animal Welfare Committee (2011) guideline for assessing animal welfare performance of kill traps. This guideline requires that all 10 animals within the sample lose corneal reflex within 30 seconds of the trap event, to achieve Class A performance.

Results

Each of the ten stoats tested triggered the trap. All 10 strike events resulted in irreversible unconsciousness of the animal in less than 30 seconds.

Conclusions

The double set BT200 trap housed inside a wooden tunnel box passed the NAWAC (2011) guideline with Class A performance level when tested on 10 wild-caught stoats.

1. Introduction

Greater Wellington Regional Council (GWRC) intend to establish a trapping network on the Miramar Peninsula targeting stoats as part of the Predator Free Wellington project. Their intention is to use an animal welfare 'approved' trap. Consequently, in February, 2019, GWRC asked ZIP to test the animal welfare performance of the BT200 kill trap for stoats (*Mustela erminea*) against the National Animal Welfare Advisory Committee (NAWAC) guideline (2011).

The BT200 is a replica of the DOC200 kill trap, a commonly used trap targeting stoats throughout New Zealand. This replica is produced by National Springs and Wire Products NZ Ltd. The trap features a stainless-steel frame, along with stainless steel springs and bait plates. The trap tested in this trial was a double set version housed within a wooden (treated pine) tunnel that contained wire-mesh baffles. The wooden box was constructed according to the manufacturer's instructions (see Appendix B).

2. Purpose

This document reports on a project undertaken to assess the welfare performance of the BT200 kill trap to kill stoats according to NAWAC (2011) guideline.

3. Methods

3.1 Kill trap

The project was conducted using the standard stainless-steel version of the BT200 kill trap manufactured by National Springs and Wire Products NZ Ltd, in a double set, double entrance wooden tunnel constructed by the Greater Wellington Regional Council.

The tunnel contains two wire mesh baffles at each end. These baffles are designed to (i) minimise the risk of non-target species being struck by the trap when used in the wild, and (ii) slow an animal's movements through the trap and orient the animal's body towards and across the kill plate (Figures 1.1 and 1.2 below).

Figure 1.1: Outside view of BT200 trap tunnel

Figure 1.2: Internal view of BT200 trap tunnel showing double set BT200 traps and wire mesh baffles

3.2 Test enclosure

The project involved a series of tests carried out within a 2.4 x 1.1 metre testing pen at the ZIP predator behaviour facility, at Lincoln, Canterbury. The pen has two plywood sides, with mesh doors on each end and a mesh roof. The base of the pen sits flush on the floor, and was layered with sawdust to provide a more natural base to the pen. As per the conditions of the animal ethics permit, food (piece of fresh rabbit meat) and water was provided.

A Techview QV-3140 home security system with four cameras (full D1 resolution, 100 frames per second, IR illumination) was installed to provide: (i) a wide-angle view of the testing pen from above, (ii) a close-up view of the outside of the trap box from the side showing one of the entrances, (iii) an full length internal view of the trap from above one entrance of the box, and (iv) a close-up view of the examination table. These camera angles allowed researchers to trace the movements of an animal for the entire time it was inside the testing pen.

Figure 2.1: Side view of pen, including examination table with camera

Figure 2.2: Top view of the pen

Figure 2.3: Internal view of trap box in the pen

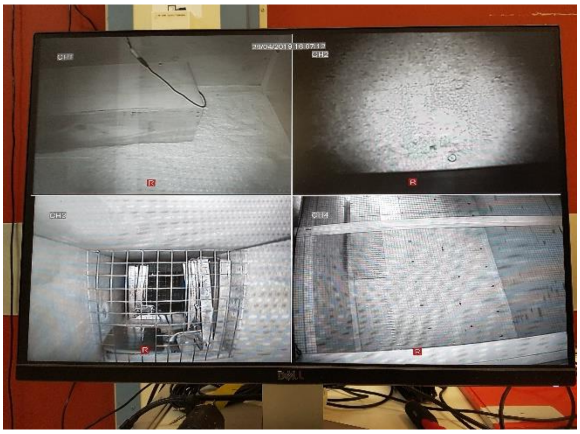

Figure 2.4: View of camera set up from outside the testing room

3.3 Animals

As per the NAWAC guidelines, researchers must decide on a sample size prior to beginning trap testing – removing the ability of researchers to keep testing animals until the required number of humane kills is achieved. An important consideration for deciding on the sample size of these trials was the difficulty and expense of trapping, transporting, and caring for live caught, wild stoats. A sample size of 10 animals was agreed upon prior to the commencement of trialling – the minimum sample size allowed under the guideline.

A total of 10 wild-caught stoats (sourced from both Murchison, Nelson and Wanaka), were supplied to ZIP by independent contractors. The animals comprised: 9 male stoats, with a body weight range of 256–373 grams, and 1 female with a body weight of 188 grams.

All of the stoats were acclimatised to captivity in individual, outdoor cages for at least two weeks before being exposed to the pen.

3.4 Pen trials

Prior to each test, the double set BT200 kill trap tunnel located inside the testing pen was baited with an egg and fresh rabbit meat (using the 3 nail prongs between the two traps) and set according to the manufacturers' instruction. The trigger weight for each trap was set at 80 grams and tested several times to confirm this.

Animals were captured from within the outside cages in Edgar live capture traps (King and Edgar 1977) the night before each test, and transported to the inside animal facility the following morning. The animals were then released into the testing pen, which contained a nest box with a lid that could be opened and closed from outside. The animal was then given 30 minutes to investigate the pen and acclimatise to it, prior to the introduction of the kill trap. This was done to minimise the risk of an animal investigating the trap in an unnatural fashion during its acclimatisation period. In placing the trap into the pen, research staff entered the room, placed the wooden tunnel containing kill trap inside the test pen and exited immediately.

A researcher remained outside of the test room throughout each trial, and observed each animal's interactions with the trap via a series of infrared cameras. Following a trap event, the researcher was required to enter the room, open the pen, retrieve the trap and perform the appropriate welfare tests within 30 seconds.

After the BT200 was triggered and had trapped an animal (labelled a trap event for the purpose of this report), the trap box removed from the testing pen was placed on the examination table, and the top was opened in front of the camera. The camera above the examination table allowed us to document the assessment of consciousness for each trapped animal.

Corneal reflex tests were then carried out to determine the time taken to loss of corneal reflex, indicating the animal had been rendered irreversibly unconscious. The corneal reflex test (often referred to as a blink test) is a commonly used laboratory and veterinary method for assessing an animal's state of consciousness (Erasmus, Turner and Widowski 2010). It is often used during trap welfare assessments, as it is the last response that remains immediately before death can be confirmed. The blowing of air or light pressing of a blunt instrument on the corneal muscles around the eye should invoke an involuntary blinking response. A lack of response to the corneal reflex test suggests the animal has suffered brain death, and is technically irreversibly unconscious.

Once an animal was confirmed deceased, it was labelled, bagged and stored frozen for a pathological assessment at a later date.

Between trials, the trap was cleaned down and rebaited. Extra sawdust was added to the arena as required. At the conclusion of all trials, the footage was downloaded onto hard drives and stored for review.

All tests were carried out with permission from the Lincoln University Animal Ethics Committee.

3.5 Pathological Assessment of Carcasses

On the 11th of April, 2019, veterinarian Donald Arthur (BVSc, Dip ACVP) of Selwyn Rakaia Vets performed a pathological assessment of several of the animal carcasses. The purpose of the assessment was to analyse the signs of injury, and review footage of the kill events, to determine whether the grading assigned by the research staff was representative of the level of animal suffering, and provide an insight into the level of trauma inflicted by the BT200 kill trap.

Donald's assessment is provided as Appendix A.

4. Results

The overall results of the trials are presented in Table 1.

Table 1: Results of the trials to assess the animal welfare performance of the BT200 kill trap to kill stoats

Trial #	Date	Stoat ID:	Weight:	Sex:	Trial Result	Strike Position
1	2/24/2019	127	188g	F	Kill under 30 seconds	Strike on middle of spine, behind ears and front of skull.
2	2/25/2019	131	256g	M	Kill under 30 seconds	Strike on middle of spine, behind ears and front of skull.
3	2/26/2019	170	280g	M	Kill under 30 seconds	Strike on middle of spine, behind ears and front of skull.
4	2/26/2019	110	366g	M	Kill under 30 seconds	Strike on middle of spine, behind ears and front of skull.
5	2/27/2019	108	373g	M	Kill under 30 seconds	Strike on middle of spine, across ears and front of skull.
6	2/28/2019	158	270g	M	Kill under 30 seconds	Strike on upper spine and neck, front of skull and nose.
7	3/1/2019	151	300g	M	Kill under 30 seconds	Strike on upper spine and neck, front of skull and nose.
8	3/5/2019	121	277g	M	Kill under 30 seconds	Strike on middle of spine, neck and across ears.
9	3/6/2019	137	297g	M	Kill under 30 seconds	Strike across upper spine, across ears and nose.
10	3/7/2019	162	262g	M	Kill under 30 seconds	Strike across middle-upper of spine, and neck.

4.1 Killing effectiveness

All 10 animal trap events resulted in irreversible unconsciousness in under 30 seconds.

With a sample size of 10, the NAWAC (2011) specification for acceptable killing effectiveness of Class A kill traps allows a maximum number of 0 animals to retain corneal reflexes after 30 seconds. ZIPs research staff are confident that the BT200 kill trap meets this specification.

The veterinarian's assessment confirmed that the level of trauma associated with the animal carcasses meant that death would have been almost instantaneous for each of the ten individuals. Test subject #3 was struck on the head (representative of nine of the ten animals killed) and was found to have bone fractures across the skull and significant sub-dural haemorrhaging within the skull cavity. This haemorrhage spilled over into other regions of the brain. The vet concluded that this level of trauma was consistent with instant loss of consciousness in this stoat (and most likely the eight others struck in a similar position). Only one animal out of the sample size of ten was not struck by any part of the kill bar on the skull (test #10). Instead, the kill bar struck this animal across the upper spine region. A pathological examination of this animal found the same level of sub-dural haemorrhaging around the cervical spinal cord and brainstem. The veterinarian confirmed that death for this animal would also have been very rapid. This veterinarian assessment validates the researchers' determination of the corneal reflex result post-each trap event.

5. Discussion

5.1 Difficulties associated with assessing killing effectiveness

We noted that there is often difficulty with assessing the killing effectiveness of the BT200 kill trap using the corneal reflex test to determine consciousness. The use of corneal reflex assessment as the primary indicator of consciousness relies on researchers being able to access the eyeballs and surrounding muscle tissue of each stoat. Severe head trauma of the trapped animal sometimes made performing corneal reflex assessments almost impossible. In these instances, other indicators used to determine consciousness were checking for a heartbeat, breathing and directional leg movement, although these can also be difficult to monitor. Checking for a heartbeat can be made difficult due to the position of the kill bar, and breathing can last for 2-3 minutes following irreversible unconsciousness (Jane Arrow 2018, personal communication). When an animal's central nervous system is struck, muscle twitches can cause involuntary movement of limbs. However, if these leg movements appear as an animal's conscious attempts to extract itself from a trap, it might suggest the animal has survived the initial impact. Although involuntary limb movement can occasionally be difficult to distinguish compared with an animal's attempts to extract itself from a trap, when a kill bar has obscured the head region and made checking for a heartbeat difficult, it can be a useful measure of consciousness.

We concluded that because strike-based kill traps result in kill events with more complicated outcomes (c.f. methods, such as strangle traps, where an animal's eyes are not affected) a combination of tests to confirm consciousness might be more appropriate.

5.2 Kill bar strike location

As previous researchers involved with testing the welfare performance of kill traps have found, the strike location of the kill bar is a key predictor of how humane an individual kill event will be (Jane Arrow 2018, personal communication). Animals that had crossed more than one-quarter of the width of the plate before committing sufficient body weight to trigger the device were more likely to have one of the bars on the kill arm strike them between the eyes and the top of the skull, resulting in irreversible unconsciousness within 30 seconds. 9 out of the 10 animals tested experienced strike events in this region and are likely to have died instantly; while the other animal experienced similar levels of trauma (from a spinal strike) and is likely to have died almost instantly – as confirmed by the veterinarian pathology report in Appendix A.

5.3 Trigger weights

We have found in previous testing that the trigger weight of kill plates is an important aspect in assessing the humaneness of any trap, as traps with trigger weights that are too light for their target species risk striking animals across limbs or front of the skull.

The trigger weight for the BT200 traps inside the wooden box was set to 80 grams. This weight requires any stoat to commit approximately half of its body weight onto the plate before it will spring off, which increases the likelihood of a clean strike and a humane kill.

6. Conclusions

For stoats, the BT200 kill trap, in a double set, double entrance 'baffled' wooden tunnel manufactured to the designs and dimensions used by GWRC met the NAWAC (2011) specification for acceptable killing effectiveness of a Class A kill trap.

7. Acknowledgements

We acknowledge and thank the following people for their help in designing and running these trials, and interpreting and publishing the results:

- Glen Falconer and James Wilcocks (Greater Wellington Regional Council and Predator Free Wellington), particularly for establishing this project and working closely with us during the permissions and testing set up phases.

- Dr Jim Gibbs (Lincoln University Vet), particularly for providing the necessary training to ZIP staff for corneal reflex/palpebral reflex testing.

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- Donald Arthur (Vet for Selwyn Rakaia Vets), particularly for performing the pathological assessment of a selection of carcasses for added confidence in the testing result.
- Graham Barrell (Lincoln University Animal Ethics Committee Chair), particularly for reviewing the animal ethics applications surrounding this work and approving amendments to the trial design.
- Jane Arrow (Mannaki Whenua – Landcare Research Animal Facility Manager), particularly for providing advice on the complications of performing consciousness assessments on animals used in NAWAC trials.
- Tim Sjoberg (formerly ZIP, now Department of Conservation), particularly for design and construction of the testing pen.
- Our ZIP colleagues, Phil Bell, Susannah Aitken and Joseph Arand.

8. References

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Appendix A: Pathological Assessment of Stoat Carcasses

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To whom it may concern,

I have recently completed a pathological assessment of the animals used in kill trap testing for NAWAC approval of the BT200 kill trap, by Zero Invasive Predator (ZIP) staff at Lincoln University. Although not required as an official evaluation of the results for a kill trap, I was asked to necropsy a selection of carcasses in relation to the strike position of the kill bar and determine the relative level of associated trauma. This step was performed to provide researchers with confidence in their original assessment of the traps' overall welfare.

Based on corneal reflex testing completed within 30 seconds of each trap event, the research staff from ZIP have assessed the trap as having met the requirements of a Class A NAWAC standard. The ZIP staff mentioned that corneal reflex tests were not always possible, due to the position of the kill bar blocking access to the animal's eyes. In these circumstances, they used other methods of detecting consciousness, such as presence or absence of heart beat and respiration.

Nine of the animals used during testing received strikes across the skull. Test animal #3 was subjected to a necropsy examination of the head and neck region. There were multiple large bone fractures in the dorsal skull and locally extensive sub-dural haemorrhage within the skull cavity. This haemorrhage was overlying all regions of the brain, forebrain, midbrain, and hindbrain. This level of trauma is consistent with instant loss of consciousness in the stoat.

Only one animal out of the sample size of ten was not struck by any part of the kill bar on the skull (test #10). Instead, the kill bar struck this animal across the upper cervical spine region. A necropsy of this animal revealed a moderate amount of sub-dural haemorrhage around the cervical spinal cord and brainstem. The death of this stoat would also have been very rapid, as backed up by the result of the researchers' corneal reflex test.

I am confident that the score graded by the researchers matches the relative level of trauma within the carcasses of these animals. The power of the trap clearly delivers a hit from the kill bar which is not survivable for small mammals such as stoats when hit on the skull or spine.

Kind regards,

Donald Arthur (BVSc, Dip ACVP)
Practice Owner, Selwyn Rakaia Vets

Appendix B: Specifications for BT200 Tunnel Construction

DOC200 double set tunnel weka length design (as used by GWRC for BT200 trap tunnel)

These tunnels are designed to exclude non target species, guide target species into the trap and provide public safety. All timber materials are H4 treated radiata pine, and the lid is 17mm H3.2 plywood. The ends and baffles are 20mm galvanised weld mesh. 75mm galvanised groove decking nails/screws are used to construct the box. The total tunnel length is 950mm, the distance from the end meshes to the internal mesh is 265mm. External and internal mesh holes are to be cut flush with no sharp protruding wire. Internal mesh baffles must move freely, not too loose or tight.