EVALUATION OF THE BIONIC® TRAP TO QUICKLY KILL MINK (MUSTELA VISON) IN SIMULATED NATURAL ENVIRONMENTS

EVALUATION OF THE BIONIC® TRAP TO QUICKLY KILL MINK (MUSTELA VISON) IN SIMULATED NATURAL ENVIRONMENTS

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ABSTRACT: The Bionic® trap, with a bait placed at the back of a 6 cm aperture plastic cone, successfully killed nine of nine wild mink (*Mustela vison*) in simulated natural conditions. The average times to loss of consciousness and heartbeat were estimated at <60 (±26) sec and 340 (±55) sec, respectively, after firing the trap. This study confirmed that the Bionic trap can be expected to render >79% of captured mink unconscious in ≤3 min ($P < 0.05$).

Key words: Bionic quick-kill trap, humane trapping, mink, *Mustela vison*, mousetrap, experimental study.

INTRODUCTION

From 1973 to 1981, the Federal Provincial Committee for Humane Trapping in Canada received 348 ideas or trap prototypes of which 16 were eventually judged as offering "humane potential" (Barrett al., 1988). However, many of them were subsequently field tested and found deficient in terms of reliability, portability, efficiency or "humaneness" (Dwyer, 1984). On the basis of three kill tests which rendered mink (*Mustela vison*) irreversibly unconscious within 3 min, Gilbert (1980) recommended the Bionic® (W. Gabry, Vavenby, British Columbia, Canada V0E 3A0) trap as a potential quick-killing trap. Dwyer (1984) did not field test this trap and Proulx et al. (1989a) considered that a sample size of three was unacceptably low to reach a satisfactory conclusion about the true effectiveness of any trap.

This study aimed to re-assess the potential of the Bionic® trap to quickly kill mink in simulated natural environments. The objectives were to determine its ability (1) to consistently strike mink in the head-neck region; and (2) to render the animals irreversibly unconscious in ≤3 min.

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MATERIAL AND METHODS

The study was conducted in spring 1988, in 12.2 × 5.2 × 4.4 m test enclosures landscaped with natural vegetation and kept under surveillance with remote control videocameras. The research facilities and equipment, and the husbandry procedures, were detailed by Proulx et al. (1989c).

The Bionic® trap is a 27 × 15 cm mousetrap-type device with a 13.4 × 16 cm jaw which closes 180° on a fixed base (Fig. 1). The jaw is powered by a coil spring composed of 0.5 cm diameter steel turned around a 23 cm long crank pipe (outside diameter: 1.7 cm) equipped with a cogwheel. A rod and a 6 cm long stopper allow one to set the spring tension up to eight notches, which are 2.7 cm equidistant from each other on the cogwheel, after the striking bar is set for firing. The trap is fired by pulling the bait protected by a plastic cone. The trap was boiled to remove human odors. It was set on the ground, wired to a tree, with the spring wound up to six notches. A beaver (*Castor canadensis*) meat bait was first placed at the center of the plastic cone. It was later put on top of the spring, at the back of the cone (Fig. 1). Three Bionic® traps were repeatedly used.

The Bionic® trap was evaluated in approach, kill and performance confirmation tests described by Proulx et al. (1989a, c). In previous studies (Proulx et al., 1989b, c), the killing power of a trap was first assessed in pre-selection tests with animals immobilized with ketamine hydrochloride. However, because the Bionic® trap previously rendered unconscious in ≤3 minutes mink struck in the head-neck region (Gilbert, 1980), these tests were judged unnecessary.

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FIGURE 1. Diagram of the Bionic® trap (a), with a 10 cm aperture bait cone (b), and a 6 cm aperture bait cone (c).

SCALE

0 2 4 6 8
cm
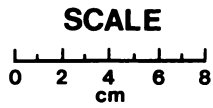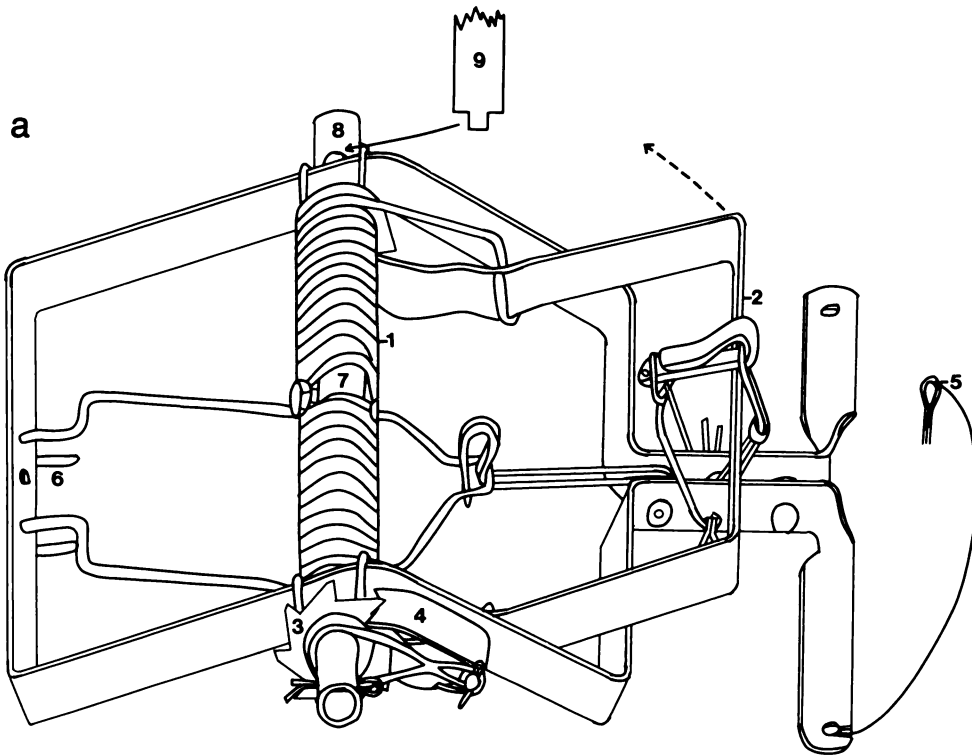
LEGEND

1-Coil spring
2-Striking jaw
3-Cogwheel
4-Stopper
5-Safety catch
6-Bait location (original)

7-Bait location (final)
8-Crank pipe
9-Crank pipe rod
10-Plastic bait cone ——
11-Plastic floor – –
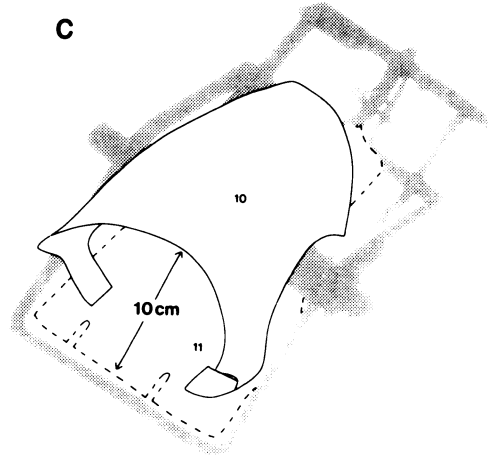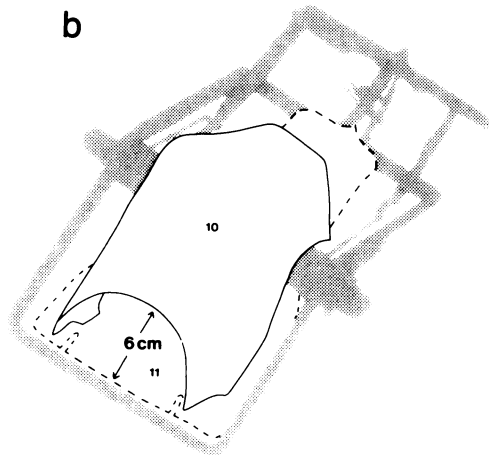
In the approach tests, the Bionic® trap (wired in the set position so that it could be triggered but could not injure the animals) would pass if the animals were successfully placed (head-neck region in the strike zone) in at least five of six approaches. The trap was tested with 10 cm and 6 cm aperture bait cones.

In the kill tests, the Bionic® trap would be considered to be potentially effective if it rendered five of six animals irreversibly unconscious in ≤3 min. Irreversible unconsciousness was determined by loss of corneal and palpebral reflexes (Walker, 1979; Horton, 1980; Rowsell et al., 1981) with inevitable death (loss of cardiac activity determined with a stethoscope). Finally, in order to be 95% confident that the Bionic® trap could be expected to effectively kill >79% (performance level selected according to the binomial distribution to minimize the number of animals tested and provide sound statistical evaluation) of all captured mink, the trap was tested in additional kill tests. On the basis of the normal approximation to the binomial distribution (Fleiss, 1981), the Bionic® trap would be expected to effectively kill >79% of mink on traplines if, during the kill and performance confirmation tests, it rendered nine of nine (0 failure), or 13 of 14 (1 failure), or 18 of 20 (2 failures) mink irreversibly unconscious in ≤3 min.

In the kill tests, upon firing of the trap, researchers ran to the test enclosure to monitor the state of consciousness of the mink. Animals were necropsied by a veterinary pathologist at the Alberta Environmental Centre (Vegreville, Alberta, Canada T0B 4L0). The pelts were examined for damage before and after skinning the animals.

All animal husbandry and research procedures were carried out in accordance with the Guidelines of the Canadian Council on Animal Care (1984).

RESULTS

In approach tests, the trap with its original 10 cm aperture bait cone failed to consistently position mink in appropriate locations. The animals picked at the bait and quickly jerked back their heads at firing time. In one case, a mink would have been struck laterally on the nose. In two other tests, the striking jaw would have completely missed the animals. A 6 cm aperture bait cone interfered with the back thrust of the animal's head and this re-

sulted in six successful approaches where all animals would have been struck across or slightly behind the eyes, or on top of the skull.

Two kill tests using the 6 cm bait cone were unsuccessful. In both cases, the animals were struck on the nose. They sustained a multiple fracture of the nasal bones but they did not lose consciousness in ≤3 min, and were euthanized. However, when the videotapes were paused at firing time and the striking bar was projected on the animals (as was done during the approach tests), the strike locations were estimated to be behind the eyes. Therefore, strike locations projected during the approach tests were incorrect because of the rapid but variable backing speed of the mink at firing time.

With the bait placed on the top of the spring, mink entered further into the cone and did not back up fast enough to avoid a strike in the head-neck region, typically behind the eyes. The first eight kills were effective and occurred without difficulties (Table 1). At the ninth kill test, the mink was struck on the eyes and the period of time to loss of consciousness could not be ascertained. However, the animal laid motionless and no breathing was apparent 193 sec after firing the trap. Although the ninth animal most likely lost consciousness in ≤3 min, a supplementary kill test was carried out. The tenth mink entered deeply into the trap and at an angle, and was struck across the neck and the right shoulder. The base of the trap broke upon impact. The animal lost consciousness 127 sec after firing.

Most mink sustained multiple skull fractures and damage to the central nervous system (Table 1). The average time to loss of consciousness for nine animals was <60 (±26) sec. The loss of cardiac activity was determined for eight of those animals and averaged 340 (±55) sec. This study showed that the Bionic® trap can be expected to render >79% of captured mink irreversibly unconscious in ≤3 min ($P < 0.05$).

TABLE 1. Location of strikes, time intervals between trap firing and irreversible loss of corneal and palpebral reflexes and heartbeat, and major trauma of mink in kill and performance confirmation tests with the Bionic® trap.

Mink number	Location of strike	Time (sec) of loss after firing		Major trauma
		Corneal/palpebral reflexes	Heart-beat	
970	Back of skull	<58[a]	460	Multiple fracture of occipital and temporal bones with extensive compression of brain.
968	Across the ears	<61[a]	273	Multiple fracture of occipital, sphenoid, temporal and parietal bones with complete severance of the brain.
969	Across the ears	<42[a]	310	Multiple fracture of the skull with complete severance of the brain. Extensive congestion (60%) of the lungs.
1105	Across the ears	<55[a]	—[b]	Multiple fracture of the skull with complete transverse severance of the brain.
966	Across the ears	<45[a]	337	Multiple and massive fracture of the skull with complete transverse severance of the brain.
952	Atlas	<52[a]	338	Multiple and massive fracture of atlas and complete severance of the spinal cord. Fracture of occipital bone. Small (1 cm) hemorrhage on top of cerebellum.
1003	Back of skull	<47[a]	340	Multiple fracture of skull with complete transverse severance of the brain.
974	Back of skull	<50[a]	309	Multiple fracture of skull involving temporal, parietal, occipital and sphenoid bones with complete transverse severance of the brain.
964	Across the eyes	—[b]	372	Multiple fracture involving frontal, lacrimal, nasal and maxillary bones. Massive pulmonary edema.
1005	Vertebrae C_1–C_2	127	356	Extensive subcutaneous hemorrhage; meningeal hemorrhage (2 cm) extending from C_1 to C_2; no evidence of compression of the central nervous system.

[a] Animal was unconscious upon arrival of the researcher.
[b] Not assessed.

DISCUSSION

The Bionic® trap is an example of how an old concept, the mousetrap, can be mechanically improved to quickly kill small furbearers such as mink. However, the present study reaffirms, as did the work of Cook et al. (1973) and Proulx et al. (1989c), that the killing ability of a trap cannot be assessed and developed without understanding the behavior of the target species. The original Bionic® trap with a bait centered under a large plastic cone could not consistently strike mink in vital regions and render them irreversibly unconscious in ≤3 min. However, by reducing the size of the bait cone and relocating the bait, it was possible to entice mink further into the trap, to slow down their withdrawal at firing time, and to ensure effective kills. When set properly, the Bionic® is a powerful trap which quickly kills mink without damaging the pelts. Its potential warrants capture efficiency tests on traplines.

The Bionic® trap is safe to handle and easy to set. Furthermore, it has the necessary potential to quickly kill other small furbearers such as marten (Martes americana). However, its construction is complex and involves several moving pieces. Therefore, some redesigning will be necessary to increase its longevity, reduce its manufacture costs and facilitate trapper acceptance.

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