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EVALUATION OF THE BIONIC® TRAP TO QUICKLY KILL FISHER (*MARTES PENNANTI*) IN SIMULATED NATURAL ENVIRONMENTS

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ABSTRACT: The Bionic® trap equipped with a 10 cm aperture bait cone and cocked to eight notches quickly killed nine of nine fishers (*Martes pennanti*) in simulated natural conditions. Mean (±SE) estimated times to loss of consciousness and heartbeat were ≤55 sec and 305 (±8) sec, respectively, after firing the trap. This study confirmed that the Bionic® trap can be expected to render ≥70% of captured fishers irreversibly unconscious in ≤3 min ($P < 0.05$).

Key words: Bionic® quick-kill trap, fisher, humane trapping, *Martes pennanti*, mousetrap, experimental study.

INTRODUCTION

Because of societal concerns regarding trapping, major studies are being conducted to find alternatives to the controversial steel leghold trap (Proulx and Barrett, 1991a). In most regions, the Conibear 220® (Woodstream Corporation, Lititz, Pennsylvania, USA) is promoted as an alternative means for trapping fisher (*Martes pennanti*) (Alberta Vocational Centre, 1987; Baker and Dwyer, 1987; Krause, 1989). However, Proulx and Barrett (1993) showed that this rotating-jaw trap did not have the potential to consistently render fisher irreversibly unconscious in ≤3 min. They recommended that future work be carried out with diverse trap designs.

Proulx and Barrett (1991b) have shown that the Bionic® (W. Gabry, Vavenby, British Columbia, Canada) mousetrap was a powerful device with the potential to quickly kill mink (*Mustela vison*). In the present study, our purpose was to assess the potential of this trap to quickly kill fisher in simulated natural environments. The objective was to determine the ability of the Bionic® trap to render fisher irreversibly unconscious in ≤3 min.

MATERIALS AND METHODS

The study was conducted in winter and fall 1988, in 12.2- × 5.2- × 4.4-m test enclosures landscaped with natural vegetation and kept under surveillance with remote control video cameras. The research facilities and equipment, and the husbandry procedures were presented in Proulx et al. (1989b).

The Bionic® trap is a 27- × -15-cm mousetrap type with a 13.4- × -16-cm jaw that closes 180° on a fixed base; the design is given in Proulx and Barrett (1991b). The jaw is powered by a coil spring that can be set to different power levels, from one to eight notches. The trap is fired by pulling the bait protected by a plastic cone (Proulx and Barrett, 1991b). The Bionic® trap is 3.5 and 4 times more powerful than the Conibear 220® (average momentum: 1.4 kg m/sec; Proulx, 1990) at six and eight notches, respectively (R. Drescher, pers. comm.). When equipped with a 10-cm aperture bait cone, the trap has the potential to consistently strike fishers on the skull (Proulx and Barrett, unpubl.).

The Bionic® trap was evaluated in a test sequence described by Proulx et al. (1989a, b). The killing potential was first assessed in preselection tests with fishers immobilized with ketamine hydrochloride (10 to 20 mg/kg; Austin Laboratories, Joliette, Quebec, Canada). This preliminary assessment allowed the researchers to determine if the Bionic® had the potential to quickly kill fisher without causing suffering. In the first preselection test, the trap was cocked at six notches. However, because it did not quickly kill a fisher, subsequent tests were carried out with traps cocked at seven notches. The immobilized animals were situated in traps in a position that duplicated placement in the approach tests as described in Proulx et al. (1989b). The presence of their eye reflexes was confirmed before firing the trap. Traps passed the preselection tests if they rendered at least five of six fishers unconscious in ≤3 min (Proulx et al., 1989b; Proulx et al., 1990); this was a control level without implied statistical significance to justify subsequent kill tests with unanesthetized animals. Unconsciousness was determined by loss of corneal and palpebral reflexes (Walker, 1979; Horton, 1980; Rowsell et al., 1981). Tests were successful only if fishers did not regain consciousness after the 3-min period and subsequently died, as determined by loss of cardiac activity using a stethoscope.

The killing ability of the Bionic® trap was assessed in three series of kill tests: a) traps cocked at seven notches and set on a tree (Fig. 1); b) traps cocked at eight notches and set on a tree; and c) traps cocked at eight notches and set on the ground (Fig. 1). In the first series of kill tests, traps were baited with beaver (*Castor canadensis*). However, several fishers turned their head sideways to grab the bait and were struck laterally on the skull. In the second and third series of kill tests, the bait consisted of commercial dog food spread on a 6-×-9-cm pasteboard. Fishers could not turn their head sideways while pulling on the bait and were struck dorsoventrally. Traps passed the kill tests if they rendered at least five of six animals irreversibly unconscious in ≤3 min; this also was a control level without implied statistical significance to justify additional kill tests.

Upon success at the kill-test level, the Bionic® trap was evaluated in additional kill tests, termed performance confirmation tests (Proulx et al., 1989a, 1990). The Bionic® trap was considered humane if, during the kill and performance confirmation tests, it rendered nine of nine fishers irreversibly unconcscious in ≤3 min (Proulx et al., 1989a, 1990). At this kill frequency and on the basis of a one-tailed binomial test (Zar, 1984), the Bionic® trap then would be expected, at a 95% level of confidence, to humanely kill ≥70% of all fishers captured on traplines (Proulx et al., 1993).

In the kill and performance confirmation tests, upon firing the trap, researchers ran to the test enclosure to monitor the state of consciousness of fishers. In all tests, if the fishers were struck in vital regions but were still conscious after 3 min, they were left in the trap for an additional 2 min at which time they were euthanized by an intracardiac injection of 540 mg/ml sodium pentobarbital (Euthanyl forte, M.T.C. Pharmaceuticals, Cambridge, Ontario, Canada). This allowed us to verify if the Bionic® could consistently render fishers unconscious soon after the 3-min period and if a 5-min period to unconsciousness was a more realistic aim to humanely kill fishers. Animals were necropsied by a veterinary pathologist at the Alberta Environmental Centre (Vegreville, Alberta, Canada). All animal husbandry and research procedures

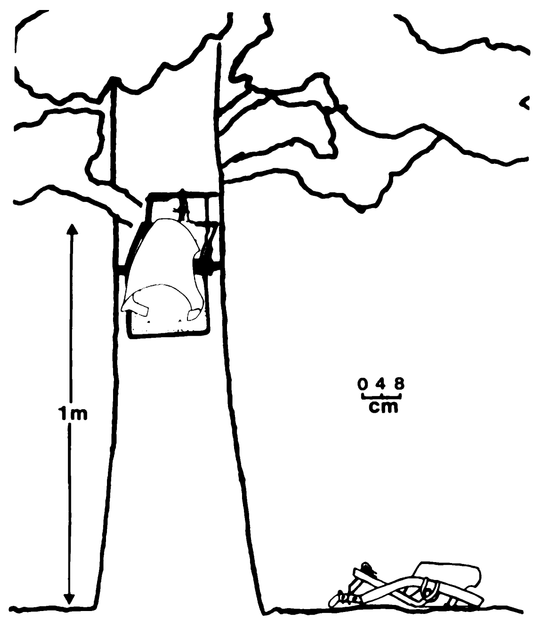

FIGURE 1. Bionic® trap set on a trunk and on the ground.

were approved by an institutional Animal Care Committee and carried out according to the guidelines of the Canadian Council on Animal Care (1984).

RESULTS

In preselection tests, one trap cocked at six notches failed to render a fisher struck laterally on the left ear unconscious in ≤3 min (Table 1). In subsequent tests, traps cocked at seven notches rendered five of five fishers irreversibly unconscious in ≤3 min (Table 1). Mean (±SE) times to loss of consciousness and heartbeat were 5 (±0.4) sec and 223 (±28) sec, respectively. Multiple fractures and extensive brain hemorrhages were noticed in all successful tests (Table 1). The trap passed the preselection tests.

The Bionic® trap cocked at seven notches and set on a tree rendered five of six fishers irreversibly unconscious in ≤3 min (Table 2). Mean times to loss of consciousness and heartbeat were ≤65 sec and 337 sec, respectively. Damage to the central nervous system was apparent in all cases (Table 2). One fisher sustained multiple

TABLE 1. Type and location of strikes, time intervals between trap firing and irreversible loss of corneal/palpebral reflexes and heartbeat, and major trauma of fishers in preselection tests with the Bionic® trap.

Fisher number	Sex[a]	Type and location of strike[b]	Time of loss after firing: Corneal/palpebral reflexes (sec)	Time of loss after firing: Heartbeat (sec)	Major trauma
1009[c]	M	L—left ear	E[d]	—	No fractures but extensive hemorrhage on the left posterior cerebral cortex.
1078[e]	M	Dv—behind the ears	5	247	Multiple fractures of the temporal, occipital, parietal and sphenoid bones; severe lacerations and hemorrhage of the brain; hemorrhage extending back to the third cervical vertebra.
1090[e]	M	Dv—behind the ears	5	203	Multiple fractures of the occipital, parietal, temporal and sphenoid bones; severe compression, hemorrhage and laceration of the brain; meningeal hemorrhage extends back to the third cervical vertebra.
1010[e]	M	L—left ear	7	291	Multiple fractures of the left temporal, occipital and sphenoid bones; extensive meningeal hemorrhage involving almost the entire left brain and down the spinal cord to the seventh cervical vertebra; lungs congested with focal 1 to 10 mm patches of hemorrhage and clotted blood in the trachea and bronchi.
1077[e]	M	Dv—behind the ears	5	247	Multiple fractures of frontal and temporal bones; massive compression and laceration of brain; extensive meningeal hemorrhage on the brain extending back to the second cervical vertebra.
1075[e]	F	Dv—top of skull	5	125	Massive transverse fracture at back of skull involving occipital, temporal, sphenoid and parietal bones; laceration of brain with meningeal hemorrhage extending down to the fifth cervical vertebra.

[a] M, male; F, female.
[b] L, lateral; Dv, dorsoventral.
[c] Trap cocked at 6 notches.
[d] Euthanized.
[e] Trap cocked at 7 notches.

bone fractures and extensive cerebral hemorrhage but did not lose consciousness in ≤3 min; it was euthanized (Table 2). The trap passed the kill tests and became eligible for performance confirmation tests. During the first performance confirmation test, one fisher struck laterally behind the left eye pulled out its head 126 sec after trap firing and walked away. Because the animal survived, the test was considered a failure. In order to pass, the Bionic® trap had to render 18 of 20 fishers irreversibly unconscious in ≤3 min. However, we stopped this series of tests.

In a new series of kill tests with the Bionic® trap set on a tree, the trap was cocked at eight notches and was equipped with a bait pasteboard that ensured dorsoventral head strikes. During the first three kill tests, fishers received major head trauma and lost consciousness rapidly (Table 3). However, during the fourth kill test, one fisher (the same animal that escaped seven months before) was struck on the head and escaped. Because of the suspended weight of the animal, the striking jaw did not remain completely closed. The fisher used its legs to push itself up and, with a rotating

TABLE 2. Type and location of strikes, time intervals between trap firing and irreversible loss of corneal/palpebral reflexes and heartbeat, and major trauma of fishers in kill/performance confirmation tests with the Bionic® trap cocked at seven notches and set on a tree.

			Time of loss after firing		
Fisher number	Sex[a]	Type and location of strike[b]	Corneal/palpebral reflexes (sec)	Heart-beat (sec)	Major trauma
1076	M	L—in front of right ear	E[c]	—	Fractures of the occipital and the right parietal bones; right ear compression and laceration of right temporal muscle; extensive hemorrhage on posterior part of right cerebral hemisphere; hemothorax.
1104	M	Dv—behind the ears	90	300	Multiple fractures of the occipital bone and hemorrhage into overlying soft tissue; compression, laceration and hemorrhage of cerebellum.
1024	M	Dv—in front of ears	66	394	Multiple fractures of occipital, temporal, parietal and sphenoid bones; compression and laceration of the brain with hemorrhage extending to the first cervical vertebra; blood in the trachea and the bronchi.
1177	M	Dv—across the ears	342	342	Fracture of parietal, interparietal and occipital bones with penetration of the brain cavity and herniation of brain tissue; obvious damage to the cerebellum and cerebrum.
1097	M	L—on the right ear	<93[d]	314	Fractures of the sphenoid, frontal and parietal bones, and the zygomatic arch; compression and possibly rupture of the right cerebral cortex.
959	M	Dv—across the ears	42	335	Multiple fractures of the occipital, temporal and parietal bones; compression, laceration and hemorrhage of brain; meningeal hemorrhage extending to the third cervical vertebra
954	M	L—on left ear	S[e]	—	

[a] M, male; F, female.
[b] L, lateral; Dv, dorsoventral.
[c] Euthanized.
[d] Animal was unconscious on arrival of researcher.
[e] S, escaped.

movement, removed its head from the trap. It survived the test. Because of this failure, the kill tests were stopped immediately.

In order to eliminate the impact of the animal's weight on the clampling of the trap's jaw, the Bionic® was set on the ground. It was cocked to eight notches. The trap rendered nine of nine fishers irreversibly unconscious in ≤3 min (Table 4). Mean (±SE) times to loss of consciousness and heartbeat were ≤55 sec and 305 (±8) sec, respectively. Most fishers sustained multiple skull fractures (Table 4). Thus under these circumstances the Bionic® trap could be expected to render ≥70% of captured fishers irreversibly unconscious in ≤3 min ($P < 0.05$).

DISCUSSION

In Proulx and Barrett (1993) and in this study, we demonstrated how difficult it is to quickly render fishers unconscious. A fisher can escape from a lateral head strike by twisting its head while pulling out. Dorsoventral strikes were effective but even there, it was necessary to increase the striking power of the trap and change the set to consistently render fishers irreversibly unconscious in ≤3 min. Obviously, it is not easy to humanely kill medium and large

TABLE 3. Type and location of strikes, time intervals between trap firing and irreversible loss of corneal/palpebral reflexes and heartbeat, and major trauma of fishers in kill tests with the Bionic® trap cocked at eight notches and set on a tree.

			Time of loss after firing		
Fisher number	Sex[a]	Type and location of strike[b]	Corneal/palpebral reflexes (sec)	Heartbeat (sec)	Major trauma
960	U	Dv—across the ears	78	327	Bruising only of muscle related to sagittal crest; evidence of damage to larynx; hemothorax.
955	M	Dv—across the ears	<81[c]	217	Fractures of frontal and parietal bones; bone fragments in brain; compression of soft tissue at the level of the larynx.
1178	F	Dv—behind the ears	<67[c]	337	Multiple fractures of left occipital and parietal bones, and fracture of the first cervical vertebra.
954	M	Dv—top of skull	S[d]	—	—

[a] M, male; F, female; U, unknown.
[b] Dv, dorsoventral.
[c] Animal was unconscious upon arrival of the researcher.
[d] Escaped.

TABLE 4. Type and location of strikes, time intervals between trap firing and irreversible loss of corneal/palpebral reflexes and heartbeat, and major trauma of fishers in kill tests with the Bionic® trap cocked at eight notches and set on the ground.

			Time of loss after firing		
Fisher number	Sex[a]	Type and location of strike[b]	Corneal/palpebral reflexes (sec)	Heartbeat (sec)	Major trauma
1000	U	Dv—across the ears	<69[c]	252	Fractures of parietal and occipital bones that exposed the surface of the brain; hemorrhage around spinal cord from the first to the fourth cervical vertebrae; hemopericardium, hemothorax, and patchy congestion of the lungs.
999	F	Dv—back of skull	<47[c]	306	Fracture and separation of the parietal from the occipital bone; fracture of the sphenoid; complete destruction of the first and second cervical vertebrae; hemothorax and hemopericardium with severe congestion of lungs.
997	M	Dv—across the ears	<78[c]	292	Multiple fractures of the cranium with bone fragments protruding into the brain; dislocation of the atlanto-occipital joint.
945	M	Dv—across the ears	<56[c]	324	Depressed fractures of frontal and parietal bones.
996	F	Dv—across the ears	30	326	Fractures of frontal, left mandible and sphenoid bones, and zygomatic arch and sagittal crest.
652	U	Dv—behind the ears	<58[c]	315	Multiple fractures of frontal, orbital, parietal and sphenoid bones.
650	U	Dv—across the ears	<59[c]	293	Multiple fractures of the occipital, parietal and orbital bones with penetration of bone fragments into the brain; compression of soft tissue over the larynx.

TABLE 4. Continued.

Fisher number	Sex[a]	Type and location of strike[b]	Time of loss after firing: Corneal/palpebral reflexes (sec)	Time of loss after firing: Heartbeat (sec)	Major trauma
645	U	Dv—across the ears	<42[c]	308	Sharply depressed fracture of parietal and orbital bones; fractures of the sphenoid and left mandible; some congestion of the lungs; ventral compression of the soft tissues just anterior to the larynx.
653	U	Dv—atlanto-occipital joint	<54[c]	332	Deep compression of muscle above the first cervical vertebra and fracture of the occipital joint dorsal spine of the second cervical vertebra; perforating fracture of the left temporal bone; hemorrhagic bruise of muscle overlying the larynx.

[a] M, male; F, female; U, unknown.
[b] Dv, dorsoventral.
[c] Animal was unconscious upon arrival of the researcher.

furbearers (Proulx and Barrett, 1990) but it can be done if the behavior of the target species is understood and the trap generates high energy levels.

Proulx and Barrett (1991b) found that the Bionic® trap with a 10 cm bait cone did not capture mink. To capture mink, the bait cone aperture must be reduced to 6 cm. However, fishers are not enticed into a 6 cm aperture bait cone (Proulx and Barrett, unpubl.). Therefore, the Bionic® trap could be used to selectively harvest these two furbearers, and possibly other mustelids.

Proulx and Barrett (1991b) proposed that the Bionic® trap be redesigned to increase its longevity, reduce its manufacturing costs and facilitate trapper acceptance. The trap design now has been simplified and is recommended for limited manufacture (Proulx, 1991). Because of its potential as a humane killing trap, the Bionic® trap should be tested on traplines to compare its capture-efficiency to that of devices commonly used by trappers.

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