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ASSESSMENT OF POWER SNARES TO EFFECTIVELY KILL RED FOX

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The perceived cruelty associated with the use of the foothold trap has been the subject of antitrapping campaigns which, in Canada, threaten aboriginal people's way of life and an industry worth approximately $600 million to an estimated 105,000 Canadians (Standing Committee on Aboriginal Affairs and Northern Development 1986). Olsen et al. (1986, 1988) showed that padded foothold traps could substantially reduce limb injuries in canids. However, in view of the current status of traps, trapping, furbearer management, and public attitudes, Linhart (1986) and Barrett et al. (1988) recommended that performance data be acquired on innovative new capture devices.

No quick-killing trapping device has yet been developed for red fox (*Vulpes vulpes*). However, Todd (1987) indicated that from a standpoint of relative need for research and development of humane capture methods, the red fox was placed in priority category No. 1. Research to date has shown that manual snares (where the animal provides the energy necessary to tighten the snare) do not have the potential to consistently produce a quick death (Federal Provincial Committee for Humane Trapping [FPCHT] 1981). However, Rowsell et al. (1981) suggested that power snares (where the killing energy is provided by one or many springs) may be quick-killing devices. In our study, we assessed the potential of power snares to kill red fox and the practical limitations of these trapping devices.

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STUDY AREA AND METHODS

We conducted the study during 1987 in a 2.2-ha forested compound at the Alberta Environmental Centre in Vegreville, Alberta. The compound included a building with laboratory and video-room, outdoor kennels and 2 test enclosures of approximately 700 m^2 each. One enclosure encompassed an open field with scattered willow (*Salix* spp.) bushes; the other was in a mature aspen (*Populus* spp.) forest. Both enclosures had a 2.4-m-high contour fence with a 1.2-m overhang. A wooden snow fence was stretched across the center of each enclosure in order to direct fox movements towards two 0.6-m openings where power snares were set.

Power Snares

We tested 3 types of commercially available power snares: the King (Western Creative Services Ltd., Winnipeg, Manit.), the Mosher (W. C. Mosher, Mayerthorpe, Alta.), and the Olecko (R. Olecko, Winnipeg, Manit.). They all consisted of a cable (1.2-mm diameter for Olecko and 1.6-mm diameter for King and Mosher) powered by 1 or 2 torsion springs to tighten around an animal's neck. We modified the cables of the King and the Mosher by adding a Norlock lock (Ontario Trapper's Association, North Bay, Ont.) to maintain the maximum constricting pressure on the animal's neck. It was not possible to place a lock on the Olecko's cable where the pressure is maintained by the arms of the torsion spring.

Humaneness Criterion

FPCHT (1981) defined a "humane" death as a death during which an animal was rendered irreversibly unconscious as rapidly as possible. At first, a 10-minute period of time to irreversible unconsciousness was judged acceptable but, after several studies, a 3-minute period was eventually adopted by FPCHT (1981) and implied in the Canadian General Standards Board's (CGSB) (1984) kill threshold values for different furbearer species. Also, Proulx et al. (1989*a*,*b*) used a 3-minute period of time to unconsciousness in their assessment of killing traps for marten (*Martes americana*).

However, the CGSB's (1984) standards refer to mechanically powered, trigger-activated killing traps with striking bars and do not apply to snares (manual or

spring-powered). In our study, we initially worked with the 10-minute period to irreversible unconsciousness but, on the basis of the preselection test results with anaesthetized foxes, we reduced this period to 5 minutes for the kill test with unanaesthetized animals.

Preselection Tests

The preselection of trapping devices previously required that 5 of 6 animals lose consciousness within a specific period of time (Proulx et al. 1989*b*). However, we had 15 foxes only and we felt that power snares which would render 4 of 5 animals unconscious within 10 minutes, with inevitable death (determined by loss of cardiac activity), should be further evaluated as potential killing devices. Unconsciousness was diagnosed by the loss of the corneal and palpebral reflexes (Walker 1979, Horton 1980, Rowsell et al. 1981).

Preselection tests were recorded with 1 control video-camera connected to a video-recorder equipped with date and time generators. Foxes were immobilized with Ketamine HCl (10–20 mg/kg) (Austin Lab., Joliette, Que.) and put on a table, ventral side down, with their head projecting over the edge. Power snares were solidly secured in a vice and the noose of the cable was applied loosely around the neck of the animals.

Kill Tests

We assessed the effectiveness of power snares to kill unanaesthetized red foxes in large enclosures. At least 3 snares of each model which passed the preselection tests were used with naive red foxes (i.e., individuals that presumably had never approached a snare before). A new snare cable was used with each new fox. Snare cables were boiled with bark. They were set according to professional trappers' recommendations, with a 20-cm diameter noose, at approximately 15 cm from the ground (Alberta Energy and Natural Resources 1985). The testing involved 1 animal at a time and took place within 24 hours after its introduction to an enclosure. We walked in the forest adjacent to test enclosures in order to incite the fox to move around and engage the snare. When the fox appeared to be properly snared, we approached the animal after it had stopped struggling and we monitored its state of consciousness. Foxes that had been properly snared in the neck region but were still conscious after 5 minutes were left in the snare for an additional 3 minutes at which time they were euthanized by an intrathoracic injection of 540 mg/ml sodium pentobarbital (euthanyl forte, M.T.C. Pharmaceuticals, Cambridge, Ont.). When an animal was improperly snared (caught with a paw or a leg in the noose or not caught in the neck region), we ran to the enclosure and immediately euthanized it. Power snares were judged effective if they rendered 5 of 6 animals irreversibly unconscious within 5 minutes. Only the tests involving neck captures were considered in the assessment of the killing effectiveness of power snares. The testing of a power snare model was stopped when this model failed to render irreversibly unconscious 2 neck-captured foxes within 5 minutes or when we concluded (usually after 2 improper captures) that we could not consistently restrict the positioning of the snare to the neck region only. Kill tests were videotaped with 2 remote control Panasonic WV1854 cameras (Avicom Industrial Communications, Edmonton, Alta.) equipped with a high efficiency 500-watt infrared (invisible to mammalian eyes) light illuminator. Videotapes were analyzed with 2 NV-8500 Panasonic VHS editing recorders (Avicom Industrial Communications, Edmonton, Alta.).

All procedures were reviewed by the Centre's Animal Care and Use Committee. Animals were necropsied by a veterinary pathologist. During the preselection tests, a dye was injected into the carotid and jugular at the site of the capture, before the release of the cable, to determine if these vessels were occluded.

RESULTS

Preselection Tests

All power snares successfully passed the preselection tests. A series of 5 tests was necessary with the King power snare only. One of the foxes was euthanized when the noose of the snare closed on the processes of the atlas vertebra and failed to fully occlude the major blood vessels and the trachea. No significant ($P > 0.05$) difference existed between the average times to loss of consciousness calculated for the other preselection tests with the King ($n = 4$, $\bar{x} = 182$ seconds, SE = 10), the Mosher ($n = 4$, $\bar{x} = 164$, SE = 7) and the Olecko ($n = 4$, $\bar{x} = 207$, SE = 24) power snares. No bone fractures were recorded. The carotid and jugular were occluded and the trachea was usually displaced dorsally.

Kill Tests

In 2 kill tests with the King power snare, foxes lost consciousness within 5 minutes (Table 1). However, their capture locations were not ideal. One animal was caught by the head, with the noose tightening across the ears and right behind the jaws. In the other case, the noose was tightened diagonally on the animal's chest and neck but the one front limb within

the noose did not interfere with the closing of the snare. It proved difficult to properly capture foxes with this snare. In 2 more tests, animals were captured by the body or the back legs and the experiments were stopped.

Two neck captures with the Mosher power snare rendered foxes unconscious in 5–7 minutes (Table 1). Experiments were stopped when 1 fox was caught by the back legs and 2 others were captured with a front leg in the noose.

Five neck captures were achieved with the Olecko power snare (Table 1). In two cases, foxes lost consciousness within 5 minutes. In two other cases, it was difficult to assess the state of consciousness of the animals. Approximately 5 minutes after firing the snare, they closed their eyes and their corneal and palpebral reflexes were very weak and difficult to detect. Unconsciousness was confirmed 6 minutes after firing the trap. However, the pupils of fox No. 1081 were dilated 290 seconds after firing the snare, and this animal may have lost consciousness 5 minutes after firing. We considered that this kill test was acceptable and we continued with more kill tests. One other neck-captured fox was euthanized (Table 1). Two bad captures also occurred: 1 by the nose and 1 with a front paw in the noose.

Table 1. Location of capture on body, and time interval (sec) between firing and irreversible loss of corneal and palpebral reflexes (unconsciousness) and loss of heartbeat (death) of red foxes in kill tests with the King, Mosher, and Olecko power snares, Alberta, Canada, 1987.

Fox No.	Body location of capture	Time to loss after firing: Corneal and palpebral reflexes	Time to loss after firing: Heartbeat
King			
1111	Back legs	E[a]	
1109	Neck and chest	141	252
1174	Behind the jaws	124	273
1184	Chest	E	
Mosher			
1106	Neck	306	454
1107	Neck and leg	E	
1108	Back legs	E	
1201	Neck	378	367
1202	Neck and leg	E	
Olecko			
1080	Neck	140	260
1081	Neck	350	410
1092	Neck	360	425
1203	Neck and paw	E	
1204	Neck	E	
1205	Neck	285	423
1206	Nose	E	

[a] E = euthanized.

DISCUSSION

We showed that power snares have the potential to render neck-captured red foxes irreversibly unconscious within 6 minutes. With more powerful springs and different types of cables and locks, we could anticipate reducing this time period to under 5 minutes. However, in spite of this performance, we do not believe that further testing of power snares is now warranted.

Only the Olecko power snare had a sensitive trigger system which favored neck captures. The triggering of the King and Mosher snares was slow and neck captures occurred only when the snare lock slid as soon as the animal passed its head through the noose. If the snare closure was not immediate, the animals invariably squeezed in a leg or the whole body before firing the torsion spring.

Our assessment of the power snares may have been affected by the behavior of some foxes which were abnormally cautious in their movements or which detected the presence of snares. These individuals tried to pass through the noose without touching it, but were captured by the body or the back legs. Others would rush through the snow fence opening and get captured by the neck but with a leg in the noose as well. An analysis of the videotapes indicated that these animals ran with their front paw passing very close to their bottom jaw, thus explaining the improper capture. However, incorrect captures are common on traplines (R. Stardom, Manitoba Fish and

Wildlife Branch, pers. commun.) and a reliable set to consistently snare red foxes by the neck only still needs to be developed.

Power snares which can kill red foxes relatively quickly may never be allowed in urban and suburban areas where cats (*Felis silvestrus*) and dogs (*Canis familiaris*) are encountered frequently. In the southern regions of most Canadian provinces, the manual snare is outlawed already. In open areas (e.g., prairies and tundra), power snares would be difficult to camouflage and their capture efficiency is unproven. Therefore, remote, forested traplines may be the only areas where the use of power snares may be justified. However, these very powerful devices have the potential to seriously injure nontarget animals, including big game and people. Power snares developed to quickly kill large furbearers appear to have limited application as we search for humane trapping methods.

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