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A HUMANE KILLING TRAP FOR LYNX (*FELIS LYNX*): THE CONIBEAR 330® WITH CLAMPING BARS

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ABSTRACT: The Conibear 330® failed to render irreversibly unconscious in ≤3 min one lynx (*Felis lynx*) struck in the shoulders and two of eight lynx struck in the neck region, in simulated natural environments. A Conibear 330® with two clamping bars rendered unconscious in ≤3 min eight lynx struck in the neck and one struck in the shoulders. The mean (±SE) times to loss of consciousness and heartbeat were 67.2 (±4.0) sec and 196.0 (±10.4) sec, respectively. This modified Conibear 330® can be expected to render ≥70% of captured lynx irreversibly unconscious in ≤3 min ($P < 0.05$).

Key words: Alberta, Conibear 330® trap, experimental study, humane trapping, lynx, *Felis lynx*, rotating-jaw trap.

INTRODUCTION

The lynx (*Felis lynx*) has been commercially exploited for fur purposes since the settlement of North America (McCord and Cardoza, 1982). With the controversy surrounding the use of steel leghold traps (Proulx and Barrett, 1989), trappers have promoted the killing Conibear 330® (Woodstream Corporation, Lititz, Pennsylvania, USA) to trap lynx (Association Provinciale des Trappeurs Indépendants, 1988; Currie and Robertson, 1992). However, little work has been done on the humaneness of killing traps for lynx (Federal Provincial Committee for Humane Trapping, 1981).

According to the most recent work on the development of traps (Proulx and Barrett, 1993, 1994; Proulx et al., 1993a, b), a humane killing trap is a device that has the potential, at a 95% confidence level, to render ≥70% of target animals irreversibly unconscious in ≤3 min. The Conibear 330® was never tested against this research standard for lynx.

The momentum and clamping force of rotating-jaw traps can be enhanced with simple modifications such as increasing the strength of the springs or adding clamping bars to the striking jaws (Cook and Proulx, 1989). Such modifications led to humane killing traps for marten (*Martes americana*) (Proulx et al., 1989a) and mink (*Mustela vison*) (Proulx et al., 1990). As clamping bars can easily be welded on the Conibear 330® striking jaws, this modified trap should be tested with lynx.

Our objective was to determine whether the Conibear 330® trap and a modified model would render lynx irreversibly unconscious in ≤3 min in simulated natural environments.

MATERIALS AND METHODS

This study was conducted from January to April, and from October to December 1991, in 12.2- × 5.2- × 4.4-m test enclosures landscaped with natural vegetation and kept under surveillance with remote control video cameras. Lynx were fed game meat and allowed a 3-day acclimation period before any tests were carried out. The research facilities and equipment, and the husbandry procedures, were given by Proulx et al. (1989b).

The Conibear 330® is a 25- × 25-cm rotating-jaw trap (Fig. 1) with a mean momentum of 2.654 (SE = 0.02) kg m/sec (R. Drescher, unpubl.); calculations were based on a mechanical evaluation of three traps according to Cook and Proulx (1989). At trap openings ranging from 15 to 40 mm (range of distances between trap jaws in a lynx head-neck capture), the trap clamping forces ranged from 0 to 252 Newtons (N). The modified Conibear 330® has two 19.7- × 2.5- × 0.3-cm clamping bars welded to the opposite jaws of a same frame (Fig. 1). This is a more powerful trap with a higher mean momentum of 3.273 (SE = 0.07) kg m/sec, and

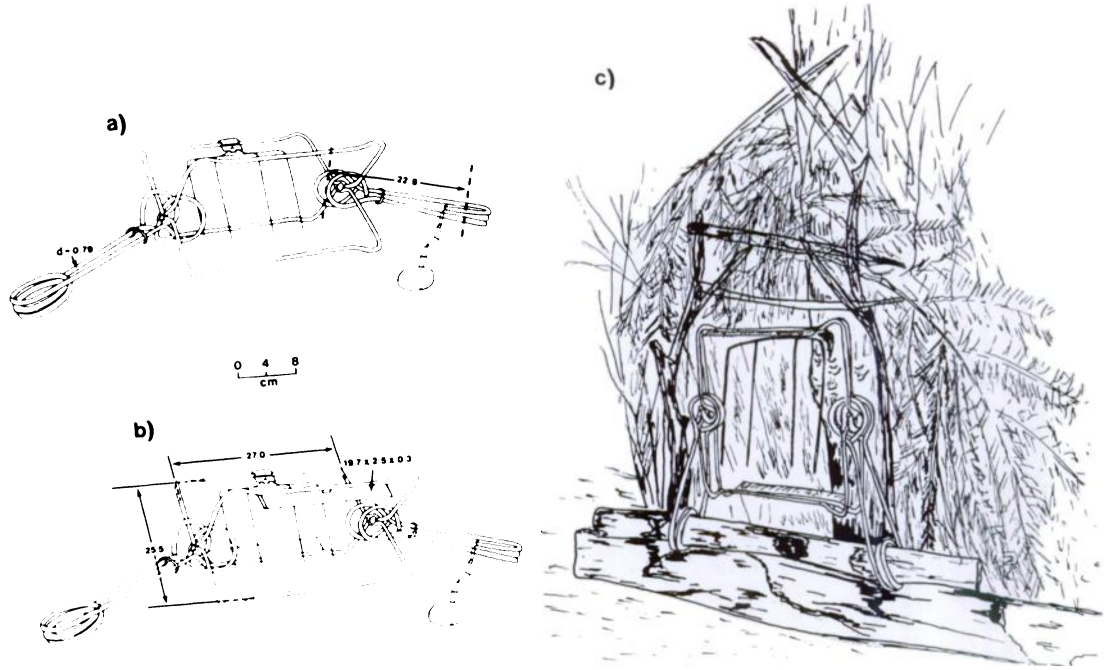

FIGURE. 1. Diagrams of the Conibear 330® trap (a) and the modified model (b), and the cubby set (c).

clamping forces ranging from 271 to 607 N (R. Drescher, unpubl.).

The Conibear 330® trap originally was set with its two-prong trigger in a baited cubby but it failed to position lynx for a proper strike in the head-neck region. We equipped the trap with a one-way four-prong trigger (the center prongs were 75 mm apart; the outside prongs were kept equidistant from the center ones and the trap frame) and set it in a portable cubby made of branches woven in a wire mesh (Fig. 1). The bait was placed at the back of the cubby, in line with the center of the trap; if the bait was placed too low within the cubby, lynx used their paw to reach it and inadvertently fired the trap. The trap passed the approach tests; it properly positioned five of five lynx for a head-neck strike (Proulx, 1991). The data gathered during approach test were used in subsequent preselection and kill tests.

We first evaluated the killing ability of traps in preselection tests with the same lynx used in approach tests to develop the trigger and the trap set after they were immobilized with 10 to 20 mg/kg of ketamine hydrochloride (Austin Laboratories, Joliette, Quebec, Canada). The immobilized animals were situated in traps (one trap/animal) in a position that duplicated placement in the approach tests, and the presence of their eye reflexes was confirmed before firing the trap. Traps passed the preselection tests if they rendered at least five of a maximum of six lynx unconscious in $\leq$3 min (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 (Rowsell et al., 1981). It had to be irreversible (tests were successful only if lynx did not regain consciousness after the 3-min period) and followed by death (loss of cardiac activity determined with a stethoscope).

The muscles of immobilized animals are more relaxed than those of unanesthetized ones and offer less resistance to the striking bars (Proulx et al., 1989b). Therefore, upon success at the preselection-test level, traps were set with a four-prong trigger in a cubby and evaluated in kill tests with unanesthetized animals. We used one trap per animal. All traps were boiled, dyed, and waxed once. Lynx were randomly selected. A trap model passed the kill tests if it rendered nine of nine lynx irreversibly unconscious in $\leq$3 min. On the basis of a one-tailed binomial test (Zar, 1984), a trap with this score could be expected, at a 95% level of confidence, to humanely kill $\geq$70% of all lynx captured on traplines (Proulx et al., 1993c).

In kill tests, upon firing of the trap, researchers ran to the test enclosure to monitor the state of consciousness of lynx. If the lynx 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 anesthetized with an intramuscular injection of ketamine hydrochloride, and euthanized by a 2 ml intracardiac injection of 540 mg/ml sodium pentobarbital (Euthanyl forte; M.T.C. Pharmaceuticals, Cambridge, Ontario, Canada). This allowed us to verify if the traps could consistently render lynx unconscious soon after the 3-min period and if a 5-min period to unconsciousness was a more realistic aim to humanely kill this species. A t-test was used to compare the mean times to loss of consciousness and heartbeat of lynx killed in different traps (Dixon and Massey, 1969). Animals were evaluated by a veterinary pathologist (Alberta Agriculture, Edmonton, Alberta, Canada) for a summary of the pathological changes caused by the traps. All animal husbandry and research procedures were approved by the institutional Animal Care Committee and carried out in accordance to the guidelines of the Canadian Council on Animal Care (1984).

RESULTS

Preselection tests with the Conibear 330™ rendered five of five lynx struck in the neck irreversibly unconscious in ≤3 min. Mean (±SE) times to loss of consciousness and heartbeat were 140.6 (±14.5) sec and 297.8 (±19.2) sec, respectively. In most cases, there were no visible lesions (Table 1). The modified Conibear 330™ also rendered five of five lynx struck in the neck irreversibly unconscious in ≤3 min. Mean (±SE) times to loss of consciousness and heartbeat were 32.0 (±15.7) sec and 242.4 (±23.4) sec, respectively. In the majority of cases, fracture of a cervical vertebra with or without hemorrhage in the spinal canal were recorded (Table 1). There was a significant difference only between the mean times to loss of consciousness ($t = 5.075$, $P < 0.05$) of lynx killed in the two trap models.

In kill tests, the Conibear 330™ rendered six of nine lynx irreversibly unconscious in ≤3 min. The mean (±SE) time to loss of consciousness of these six animals was 137.8 (±12.3) sec; it did not differ from that of the preselection tests ($t = 0.148$, $P > 0.05$). The mean time (±SE) to loss of heartbeat was 232.3 (±11.5); it was significantly different from that of the preselection tests ($t = 3.045$, $P < 0.05$). Trauma consisted of muscle bruising and pulmonary edema or emphysema (Table 1). One lynx struck in the shoulders and two others struck in the neck did not lose consciousness in ≤3 min. All three animals were euthanized. The trap was not recognized as a humane killing trap for lynx.

The modified Conibear 330™ rendered eight lynx struck in the neck irreversibly unconscious in ≤3 min (Table 1). It also rendered unconscious in 78 sec a lynx struck in the shoulders. The mean (±SE) times to loss of consciousness and heartbeat of these nine animals were 67.2 (±4.0) sec and 196.0 (±10.4) sec, respectively. There was a significant difference ($t = 2.732$, $P < 0.05$) between the mean times to loss of consciousness of the preselection and kill tests. Fractures of cervical vertebrae in three animals, a partial dislocation of the first and second cervical vertebrae in one animal, and pulmonary emphysema in another one were the major trauma recorded. In other cases, there were no visible lesions (Table 1). Based on our results, the modified Conibear 330™ can be expected to render ≥70% of captured lynx irreversibly unconscious in ≤3 min ($P < 0.05$).

DISCUSSION

Although the Conibear 330™ often is recommended as a quick-kill trap for lynx (Association des Trappeurs Indépendants, 1988; Currie and Robertson, 1992), we found that it does not have the potential to consistently render the animals unconscious in ≤3 min. A modification as simple as the welding of clamping bars to the trap's jaws sufficed to render the trap humane. The modified Conibear 330™ humanely killed a lynx that moved far into the trap while pushing on the trigger and was struck in the shoulders. However, both trap models did not cause major trauma. Animals died by asphyxiation. Clamping bars, because they reduced the gap between the trap jaws, better occluded the

TABLE 1. Strike locations, ranges of times to loss of consciousness, and trauma of lynx killed in preselection and kill tests with the Conibear 330® and the modified model.

Test series	Number of lynx[a] M	Number of lynx[a] F	Range of weights (kg)	Strike locations Neck	Strike locations Shoulders	Loss of consciousness ≤3 min Number of lynx	≤3 min Range of times (sec)	>3 min Number of lynx	>3 min Range of times (sec)	Trauma[b] I	II	III	IV	V
Preselection														
Conibear 330®	4	1	11–16	5	0	5	105–178	0	0	3	1	1	0	0
Modified model	3	2	8–13	5	0	5	8–92	0	0	1	0	0	2	2
Kill														
Conibear 330®	5	4	7–15	8	1	6	86–165	3	249-E[c]	5	3	0	1	0
Modified model	6	3	10–14	8	1	9	44–81	0	0	4	1	0	3	1

[a] M, male; F, female.
[b] I: No visible lesions, lungs congested or edematous, bruising; II: pulmonary emphysema; III: hemorrhage in spinal canal; IV: dislocation or fracture of cervical vertebrae; V: fracture of cervical vertebrae and hemorrhage in spinal canal.
[c] Euthanized.

trachea and therefore improved the killing performance of the Conibear 330® trap.

The modified Conibear 330® did not damage pelts and could be safely handled with spring safety hooks equipped with an elastic band, quick-links that keep the springs cocked, or safety pliers (Proulx, 1991). However, it was difficult to entice lynx into cubby sets. The success of capture of the modified Conibear 330® with a four-prong trigger should be assessed on traplines and compared to that of rotating-jaw traps with a two-prong trigger and other trapping devices commonly used by trappers.

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