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EVALUATION OF MECHANICALLY IMPROVED CONIBEAR 220[®] TRAPS TO QUICKLY KILL FISHER (*MARTES PENNANTI*) IN SIMULATED NATURAL ENVIRONMENTS

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ABSTRACT: Mechanically improved Conibear 220[®] traps failed to render irreversibly unconscious in ≤ 3 min fishers single-struck in the head-neck region, or double-struck in the neck and thorax regions. Although the Conibear 220[®] trap is often recommended as an alternative to the steel leghold trap, it is unlikely that it has the potential to humanely kill fisher.

Key words: Conibear 220[®] trap, fisher, *Martes pennanti*, humane trapping, rotating-jaw trap, experimental study.

INTRODUCTION

The fisher (*Martes pennanti*) is a valuable furbearer and thousands of them are captured every year in North America (Obbard et al., 1987). With the banning of the controversial steel leghold traps in land sets for capturing most furbearers (Barrett et al., 1988), the killing Conibear 220[®] (Woodstream Corporation, Lititz, Pennsylvania, USA) trap has been promoted as an alternative means for trapping fishers (Alberta Vocational Centre, 1987). However, members of the Federal Provincial Committee for Humane Trapping (1981) suggested that this trap did not generate sufficient energy to produce a humane kill.

Cook and Proulx (1989) showed that it was possible to increase both the striking and clamping forces of Conibear[®] traps by increasing the strength of the springs and by adding clamping bars to the striking jaws. In the past, such modifications led to the development of humane killing traps for marten (*Martes americana*) (Proulx et al., 1989a) and mink (*Mustela vison*) (Proulx et al., 1990).

In this study, our objective was to assess the potential of mechanically improved Conibear 220[®] to render fisher irreversibly unconscious in ≤ 3 min in simulated natural environments.

MATERIALS AND METHODS

The study was conducted during spring 1988 and winter 1989 in 12.2- \times -5.2- \times -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 by Proulx et al. (1989b).

The Conibear 220[®] is a 20- \times -20-cm rotating-jaw trap (Fig. 1) with a mean momentum of 1.448 (SE = 0.017) kg m/sec (R. Drescher, pers. comm.; Proulx, 1990). The mechanically improved Conibear 220[®] traps had four clamping bars (Fig. 1). In double-strike tests, where animals were simultaneously struck in the head-neck and thorax regions by the distal and proximal rotating-jaws, we equipped the Conibear 220[®] trap frame with 19 cm long Conibear 280[®] (Woodstream Corporation, Lititz, Pennsylvania, USA) springs. The C220/280 trap had an mean (\pm SE) momentum of 1.904 (\pm 0.095) kg m/sec, based on a mechanical evaluation of the three traps (Cook and Proulx, 1989). During the double-strike tests, the trap jaws were 20 to 80 mm apart at closing time. Clamping forces ranged from 306 to 474 Newtons (N) (R. Drescher, pers. comm.) and were slightly greater than those of the Conibear 220[®] trap (206 to 472 N; R. Drescher, pers. comm.). The trap passed the preselection tests and was eligible for kill tests in enclosures. However, it failed to quickly render unconscious one fisher. On the basis of Proulx et al.'s (1989a, b) work, we decided to further enhance the trap's impact and clamping forces before conducting kill tests. Its springs were replaced by stronger 22.9 cm long Conibear 330[®] (Woodstream Corporation, Lititz, Pennsylvania) springs. This C220/330 trap

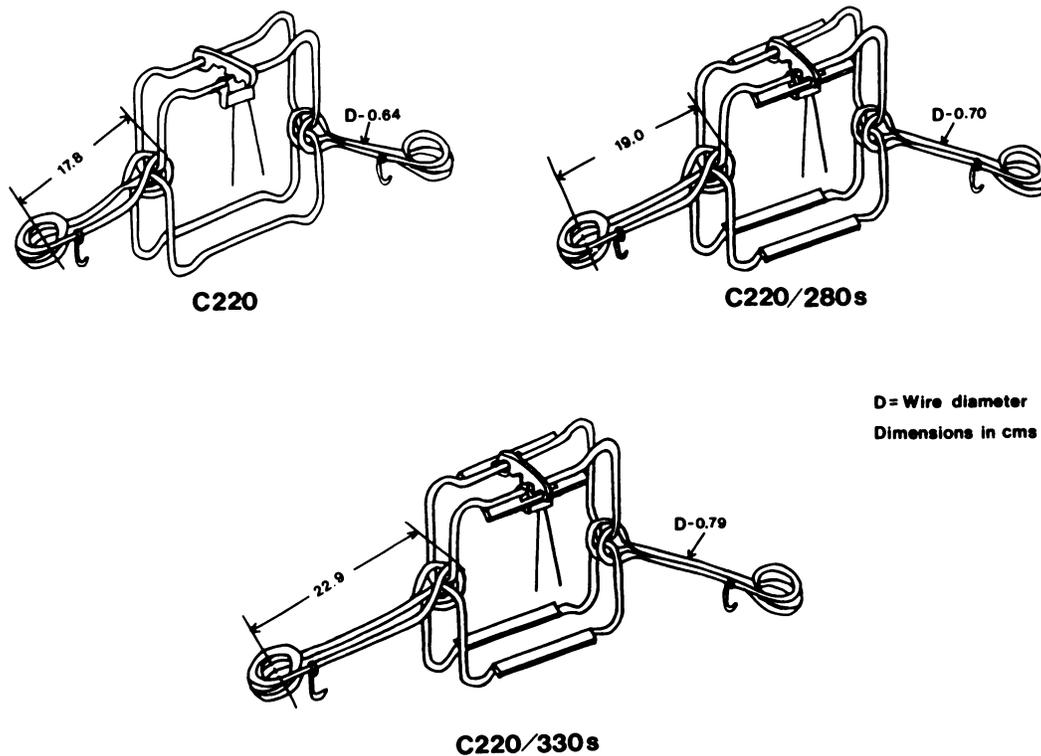


FIGURE 1. Diagrams of the Conibear 220[®], C220/280, and C220/330 traps.

had an average momentum of $2.253 (\pm 0.074)$ kg m/sec and clamping forces ranging from 317 to 633 N for 20 to 80 mm trap openings (R. Drescher, pers. comm.; Proulx, 1990).

In single-strike tests, where the animals were struck in the head-neck region by the proximal rotating-jaws, only the C220/330 trap was used. During these tests, the trap jaws were 10 to 60 mm apart at closing time. Clamping forces ranged from 119 to 633 N (R. Drescher, pers. comm.; Proulx, 1990) and were markedly greater than those of the Conibear 220[®] (21 to 472 N; R. Drescher, pers. comm.).

Six traps were evaluated in each series of preselection and kill tests described by Proulx et al. (1989b). Double-strike preselection tests were carried out with the C220/280 trap only. Because this trap passed the preselection tests, it was judged unnecessary to repeat these tests with the more powerful C220/330 trap. All the kill tests were carried out with the C220/330 trap.

Preselection tests were conducted with fishers immobilized with ketamine hydrochloride (10 to 20 mg/kg; Austin Laboratories, Joliette, Quebec, Canada). The immobilized animals were situated in traps in a position that duplicated placement in the approach tests (Proulx et al.,

1989b), 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 fishers unconscious in ≤ 3 min (Proulx et al., 1989b, 1990); this is 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.

Upon success at the preselection-test level, the C220/330 was evaluated in kill tests with unanesthetized animals. In double-strike kill tests, the trap was equipped with a 12.8- \times -12.8-cm pan trigger used in approach tests to properly position the animals and ensure simultaneous strikes in the head-neck and thorax regions (Proulx and Barrett, unpubl.). The traps were set in baited cubby boxes (Proulx et al., 1990). In single-strike kill tests, the trap was set on a running pole (Barrett et al., 1989) and equipped with trigger systems which consistently positioned the animals for a head-neck strike (Proulx

TABLE 1. Location of strikes, time intervals between trap firing and irreversible loss of corneal/palpebral reflexes and heartbeat, and major trauma of fishers in double-strike preselection tests with the C220/280 trap.

Fisher number	Sex ^a	Location of double strikes	Time of loss after firing		Major trauma
			Corneal/palpebral reflexes (sec)	Heart-beat (sec)	
1096	M	Behind the eyes and thorax	E ^b	—	No strike trauma; severe congestion of the lungs.
1087	M	Neck and thorax	60	120	Compression of muscles dorsal and ventral to the third cervical vertebra; lungs congested.
1085	F	Back of head and thorax	5	48	No strike trauma; lungs congested.
1089	M	Back of head and thorax	76	196	No strike trauma; severe congestion of lungs.
1099	U	Back of head and thorax	75	106	No strike trauma.
1101	F	Neck and thorax	39	174	Dorsoventral compression of soft tissues.

^a M, male; F, female; U, unknown.

^b Euthanized.

and Barrett, unpubl.). One trigger system was a baited two-prong trigger. Fisher fired the trap by pulling on it. The other trigger system was a four-prong pitchfork; the middle prongs were 40 mm apart (Proulx et al., 1989b). Fishers fired the trap by pushing on the trigger in order to reach a bait placed approximately 30 cm behind the trap. The use of these two triggers allowed for a thorough assessment of the trap's ability to kill in the head-neck region, between the back of the eyes and the fourth cervical vertebra, as recommended by the Canadian General Standards Board (1984).

Upon firing of the trap, in the kill tests, we ran to the test enclosure to monitor the state of consciousness of fishers. The trap passed the kill tests if it rendered at least five of a maximum of six animals irreversibly unconscious in ≤ 3 min (Proulx et al., 1989b, 1990). The trap then became eligible for additional kill tests, termed performance confirmation tests (Proulx et al., 1990), in order to be 95% confident that it could be expected to humanely kill $\geq 70\%$ of all captured fishers (Proulx et al., 1993).

The 3-min period to unconsciousness was used as a guideline to identify humane traps (Proulx and Barrett, 1988). However, in previous research, such a time period was unrealistic for some species (Proulx and Barrett, 1988, 1990). It then is necessary to identify traps that can consistently render animals unconscious soon after the 3-min period and a new time period that can be accommodated practically. Therefore, in preselection and kill 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 that time they were eu-

thanzed by an intracardiac injection of 540 mg/ml sodium pentobarbital (Euthanyl forte; M.T.C. Pharmaceuticals, Cambridge, Ontario, Canada). Animals were necropsied by a veterinary pathologist at the Alberta Environmental Centre (Vegreville, Alberta, Canada). All animal husbandry and research procedures were approved by an institutional Animal Care Committee and carried out in accordance with the guidelines of the Canadian Council on Animal Care (1984).

RESULTS

Preselection tests with the C220/280 trap rendered five of six fishers double-struck in the head-neck and thorax regions irreversibly unconscious in ≤ 3 min. Mean (\pm SE) times to loss of consciousness and heartbeat were 51 (± 13) sec and 128 (± 26) sec, respectively (Table 1). In all cases, no major trauma was recorded. The trap passed the preselection tests but, because one fisher struck behind the eyes and in the thorax did not lose consciousness in ≤ 3 min and was euthanized (Table 1), it was replaced by the C220/330 trap in subsequent tests.

The C220/330 trap equipped with the pan trigger was successful in four of six kill tests. Mean (\pm SE) times to loss of consciousness and heartbeat were 107 (± 12) sec and 235 (± 12) sec, respectively (Table

TABLE 2. Location of strikes, time intervals between trap firing and irreversible loss of corneal/palpebral reflexes and heartbeat, and major trauma of fishers in double-strike kill tests with the C220/330 trap with a 12.8 × 12.8 cm trigger.

Fisher number	Sex ^a	Location of double strikes ^b	Time of loss after firing		Major trauma
			Corneal/palpebral reflexes (sec)	Heart-beat (sec)	
1176	M	C ₂ and T ₈	79	209	Severe dorsoventral compression at strike locations.
1100	M	C ₅	E ^c	—	Severe dorsoventral compression with bruising and hemorrhage at strike location. Trachea completely occluded.
1098	M	C ₁ and T ₇	135	225	Dorsoventral compression of soft tissues at strike locations.
1103	M	C ₂ and T ₁₀	100	267	No strike trauma.
1091	M	C ₁ and T ₁₀	115	238	Dorsoventral compression of soft tissues at strike locations.
1028	U	L ₃ and abdomen	E ^c	—	Dorsoventral compression of soft tissues at strike locations.

^a M, male; F, female; U, unknown.

^b C, cervical vertebra; T, thoracic vertebra; L, lumbar vertebra. Subscript refers to vertebra number.

^c Euthanized.

2). No major trauma was apparent. One double-struck fisher pulled its head from the trap, struggled, and ended with a single strike to the neck area. The animal did not lose consciousness in ≤ 3 min; hemorrhage at the strike location and complete occlusion of the trachea were recorded. Another fisher charged forward at firing time and ended with a double-strike in the thoracic and abdominal regions. This an-

imal did not lose consciousness in ≤ 3 min. No severe trauma was apparent (Table 2). The C220/330 trap with pan trigger failed the double-strike kill tests and was not eligible for additional kill tests.

Preselection tests with the C220/330 trap rendered five of five fishers single-struck in the head region irreversibly unconscious in ≤ 3 min. Mean (\pm SE) times to loss of consciousness and heartbeat were 11 (± 4)

TABLE 3. Location of strikes, time intervals between trap firing and irreversible loss of corneal/palpebral reflexes and heartbeat, and major trauma of fishers in single-strike preselection tests with the C220/330 trap.

Fisher number	Sex ^a	Location of strike	Time of loss after firing		Major trauma
			Corneal/palpebral reflexes (sec)	Heart-beat (sec)	
646	F	Across the eyes	25	335	Fracture of nasal bones, maxillae, premaxillae and mandibles; subdural hemorrhage.
663	M	Top of skull	6	254	Multiple fractures of frontal, parietal, temporal and sphenoid bones, and the zygomatic arches.
775	M	Atlanto-occipital joint	10	330	Dorsoventral compression of soft tissues.
774	F	Top of skull	8	210	Massive fracture of parietal bones and zygomatic arches.
664	M	Behind the eyes	6	245	Almost complete severance of the frontal nasal bones.

^a M, male; F, female.

TABLE 4. Location of strikes, time intervals between trap firing and irreversible loss of corneal/palpebral reflexes and heartbeat, and major trauma of fishers in single-strike kill tests with the C220/280 trap.

Fisher number	Sex ^a	Location of strike	Time of loss after firing		Major trauma
			Corneal/palpebral reflexes (sec)	Heart-beat (sec)	
895 ^b	U	Top of skull	<44 ^c	330 ^d	
901 ^b	M	Behind the eyes	E ^e	—	Fracture of the junction of the two mandibles and the right zygomatic arch.
773 ^f	F	Cervical vertebrae 4 and 5	E ^e	—	Displacement and compression of the trachea, hemorrhage into spinal canal; deep bruising of muscles at the fourth and fifth cervical vertebrae.
898 ^f	F	Cervical vertebrae 2 and 3	E ^e	—	Apparent separation of the second and third cervical vertebrae with chip fracture of the second cervical vertebra and fracture of lateral process of the third cervical vertebra, ventral compression of soft tissues overlying the trachea.

^a M, male; F, female, U, unknown.

^b Baited two-prong trigger.

^c Animal was unconscious upon arrival of the observer.

^d Carcass destroyed before autopsy.

^e Euthanized.

^f Four-prong pitchfork trigger.

sec and 275 (± 25) sec, respectively (Table 3). In four cases, massive fractures of the cranial bones were recorded (Table 3).

In the kill tests, the C220/330 trap rendered one fisher struck on the top of the skull irreversibly unconscious in ≤ 3 min. However, it failed to quickly render unconscious two fishers struck behind the eyes and on the lower neck (Table 4). Despite these two failures, a fourth kill test was carried out with a more sensitized pitchfork trigger to obtain an upper neck strike. This fourth kill test was also a failure (Table 4). The C220/330 trap failed the single-strike kill tests and was not eligible for additional kill tests.

DISCUSSION

Although the Conibear 220[®] trap often is recommended as an alternative to steel leghold traps (Alberta Vocational Centre, 1987; Baker and Dwyer, 1987; Krause, 1989), it is unlikely that it has the potential to humanely kill this furbearer. The me-

chanically improved rotating-jaw traps used in this study were much more powerful than the standard model and yet, they did not consistently render fishers irreversibly unconscious in ≤ 5 min. Therefore, these rotating-jaw traps cannot be expected, at a 95% level of confidence, to render $\geq 70\%$ of fishers captured on traplines irreversibly unconscious in ≤ 3 min.

In previous studies with marten (Proulx et al., 1989a) and mink (Proulx et al., 1990), double strikes were effective by causing severe damage to the central nervous system or impeding the respiratory functions of the animals. With fisher, however, it is apparently difficult to produce sufficient trauma to result in a quick death. Failures of kill tests involving double strikes were probably due to a displacement of the striking jaws during the animals' struggle. Also, in any future development of the Conibear 220[®] trap, the striking jaws must hit the animals with adequate force and tightly close around their bodies.

Proulx et al. (1989b) suggested that the standard Conibear 120® trap could humanely kill marten if it would consistently strike the animals in the region extending from the ears to the first cervical vertebra. However, they concluded that it may be impossible to restrict the hits to an area smaller than the head and neck regions because of the variation in the size of the animals, the manner and speed of their approaches, and the sensitivity of the trigger. We believe that this also is true for fishers. In the present study, the majority of the strikes occurred elsewhere than on the back of the skull and they failed to render the animals irreversibly unconscious in ≤ 3 min.

Because there are presently no proven humane killing traps for fisher, the Conibear 220® still remains an alternative to the steel leghold trap. However, in order to humanely kill fisher, even with a 5-min period to unconsciousness, the trap's striking and clamping forces must be improved. In the search of humane traps that render fisher irreversibly unconscious in ≤ 3 min, more work should be carried out on new designs such as mousetraps (Proulx and Barrett, 1991), planar traps (Gilbert, 1981; Proulx, 1990), and others.

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