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THE C120 MAGNUM: AN EFFECTIVE QUICK-KILL TRAP FOR MARTEN

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The rotating-jaw Conibear 120® (C120) trap (Woodstream Co., Niagara Falls, Ont.) is marketed as a quick-kill device to harvest marten (*Martes americana*), and its use is recommended in trapping and conservation manuals (Can. Trappers Fed. 1984, Alta. Energy and Nat. Resour. 1985). However, Cook and Proulx (1989*a*) reported that the impact and clamping energies of this trap were lower than the marten kill threshold standards established by the Canadian General Standards Board (CGSB) (1984). Furthermore, Proulx et al. (1989) found that, in a series of tests in a simulated environment, the C120 did not meet criteria established for acceptance as a potentially effective kill trap, i.e., it did not render 5 of 6 animals unconscious within 3 minutes.

After some experiments with the C120 factory model and the C120 Mark IV (Cook and Proulx 1989*a*, Proulx et al. 1989), we designed a more powerful trap, the C120 Magnum (Fig. 1). Objectives of our study were to perform a

mechanical evaluation of this new prototype, and to evaluate its potential to effectively kill marten under simulated natural conditions.

STUDY AREA AND METHODS

We conducted the study in a 2.2-ha forested compound of the Alberta Environmental Centre, Vegreville, Alberta. The compound included holding facilities, test enclosures equipped with remote control video cameras, and a building with video-room. Facilities and equipment were detailed by Proulx et al. (1989).

Mechanical Evaluation

Mechanical evaluation of the C120 Magnum involved determination of average trap momentum and clamping force at diverse openings (Cook and Proulx 1989*b*). We plotted these values on a threshold graph where traps with the potential to render marten irreversibly unconscious in ≤3 minutes (time period adopted by the Federal Provincial Committee for Humane Trapping [FPCHT] [1981]) must rate above a line defined by CGSB (1984):

$$p \geq 2.6 - 0.0058F,$$

where

p = momentum (kg m/sec), and
F = clamping force (Newtons).

Research Protocols

Kill Tests.—We evaluated the ability of the C120 Magnum to effectively kill 6 marten with 6 traps placed in a cubby set described by Proulx et al. (1989). Traps were originally equipped with a 30-mm pitchfork trigger (Proulx et al. 1989). However, we found that wild marten reluctantly pushed their head through the prongs of the trigger, which covered too much of the trap's opening. Also, some animals did not penetrate far enough into the trap and were improperly struck (Proulx et al., unpubl. data). Consequently, we enlarged the opening at the center of the trap by shortening the middle prongs by 3.0 cm. Traps were considered to be potentially effective if they successfully rendered 5 of 6 animals unconscious in ≤3 minutes (as determined by loss of the corneal and palpebral reflexes [Walker 1979, Horton 1980, Rowsell et al. 1981]) with inevitable subsidence into death (determined by loss of cardiac activity).

Performance Confirmation Tests.—Upon success at the kill-test level, we evaluated the C120 Magnum in additional kill tests in order to be 95% confident that it could be expected to effectively kill >79% of all captured marten of a true population. Our calculations, based on the normal approximation to the binomial distribution (Fleiss 1981), indicated that the C120 Magnum would be expected to be that effective on traplines if, during the kill and performance confirmation tests, it rendered 9/9 (0 failure), or 13/14 (1 failure), or 18/20 (2 failures) marten irreversibly unconscious in ≤3 minutes.

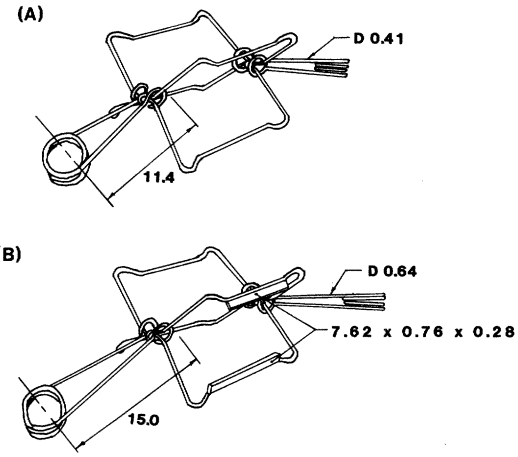

Fig. 1. Diagrams of (A) Conibear 120 and (B) C120 Magnum. Dimensions are in centimeters (D = wire diameter).

All kill and performance confirmation tests were videotaped. Upon firing of the trap, we ran approximately 125 m to the test enclosures to monitor the state of consciousness of the animals. Marten struck correctly but still conscious after 3 mintues were left in the trap for an additional 2 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.). Animals were necropsied by a veterinary pathologist.

All animal husbandry and research procedures were carried out in accordance with the Guidelines of the Canadian Council on Animal Care (1984). Protocols for the kill tests were referred to the Council for review before implementation.

RESULTS

Mechanical Evaluation

The C120 Magnum had an average momentum of 1.0898 kg m/second (SE = 0.0085). At openings >5 mm, average clamping forces ranged from 325 to 473 Newtons and 231 to 456 Newtons before firing and after 10–12 firings, respectively. At 5-mm opening, the average clamping force was 254 Newtons before firing, but was 0 after 10 firings (Fig. 2).

The striking and clamping forces of the C120 Magnum were more than double those of the

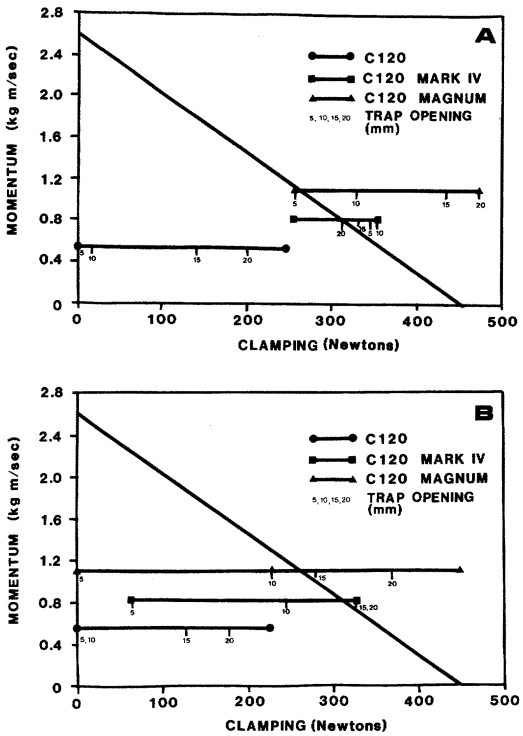

Fig. 2. Performance of Conibear 120, C120 Mark IV, and C120 Magnum on threshold graph for marten at (A) 0 firings and (B) after 10 firings.

Table 1. Location of strike and time interval between trap firing and irreversible loss of corneal and palpebral reflexes and heartbeat in kill tests of marten with the C120 Magnum trap.

Marten No.	Type and location of strike[a]	Time (sec) of loss after trap firing: Corneal and palpebral reflexes	Time (sec) of loss after trap firing: Heartbeat
2020	S, anterior to the ears	102	238
2019	S, anterior to the ears	≤59[b]	235
2017	D, top of skull and thorax (T_3–T_4)	≤30[b]	235
2021	D, mid-neck and mid-thorax	≤70[b]	180
2023	S, anterior to the ears	≤50[b]	242
1754	D, occipital and thorax (T_7–T_9)	≤40[b]	198
1755	D, C_2 and thorax (T_7–T_8)	≤47[b]	130
2041	S, neck (C_2–C_3)	E[c]	
1889	S, neck	110	193
1890	S, anterior to the ears	≤75[b]	163
2191	D, occipital and thorax (T_8–T_9)	≤60[b]	117
2034	S, neck (C_1–C_2)	130	368
2035	D, top of skull and thorax (T_5–T_6)	≤65[b]	130
2018	S, anterior to the ears	≤47[b]	215

[a] S = single strike, D = double strike.
[b] Animal was unconscious upon arrival of the observer.
[c] E = euthanized.

C120, and one-third greater than those of the C120 Mark IV (Fig. 2). The C120 Magnum was the only trap to rate well above the kill threshold line.

Kill and Performance Confirmation Tests

Thirteen of 14 kill tests were successful (Table 1). In the majority (77%) of kills, corneal and palpebral reflexes had been lost upon arrival of the observers, and the average time to loss of consciousness was <68.1 seconds (SE = 8.2) (Table 1). The heartbeat was lost, on average, 203.4 seconds (SE = 18.4) after the firing of the trap. In all head hits, bone fractures and brain hemorrhages or lacerations were present. In 2 neck hits, trauma was superficial or non-apparent.

Six of 14 animals penetrated farther into the trap and received a double strike, i.e., the proximal jaws with welded bars (which usually strike in the head and neck region) captured the animals by the thorax and the distal jaws without bars struck the animals in the head and neck region. Our research protocol identified only the head and neck as target areas. However, when the first double strike occurred (third kill in the series of 14 tests), the animal was unconscious upon arrival of the observer, 30 seconds after firing the trap (Table 1). Loss of consciousness was so rapid that no attempt was made to modify the trigger and avoid double strikes. In all 6 double strike kills, corneal and palpebral reflexes were lost when observers arrived and loss of consciousness occurred, on average, ≤52 seconds (SE = 6.4) after firing the trap. In double strikes, the heartbeat was lost, on average, 165 seconds (SE = 19.1) after

firing the trap. This time interval for loss of cardiac activity was shorter ($P = 0.005$) than the interval ($\bar{x} = 263.3$, SE = 24.5) estimated for single strikes.

One marten (No. 2041) struck on the neck did not lose consciousness in ≤5 minutes and was euthanized (Table 1). This failure resulted because an outside prong of the pitchfork trigger was too long and interfered with the jaws.

DISCUSSION

From 1968 to 1981, pioneering work by the Canadian Federation of Humane Societies and the FPCHT did not develop any effective trapping devices to the point that they were recommended for marketing (Barrett et al. 1988). The C120 Magnum is the first kill trap to pass all laboratory and compound tests of this research program and to be found effective according to requisites of CGSB (1984).

Abdinoor et al.'s (1977) work with anaesthetized animals showed that most effective strikes were those that struck animals on the head, anterior portion of the neck, or thorax. However, because it may not be possible to consistently strike an animal in the thorax while missing the abdominal area and pectoral girdle (Gilbert 1981*a*), the head and neck region remained the primary target area of this work. In our study, thorax strikes were always accompanied by a head or neck strike. Gilbert (1981*b*), working with mink (*Mustela vison*), concluded that double strikes with Conibear-type traps were probably not as efficient as single strikes. Although impact force is maintained, clamping force in the critical area may be reduced as much as 50%. However, the modified C120 that Gilbert (1981*b*) tested was much less powerful than the C120 Magnum. Our study suggests that with a powerful trap such as the C120 Magnum, double strikes were as effective as single strikes by causing severe damage to the central nervous system or impeding the respiratory functions of marten.

The C120 Magnum clamping force decreased after the trap had fired 10 times because the frame bent from high impact momentum. This defect could be solved by building the trap frame from larger diameter wire.

We found that the C120 Magnum was as safe to use as the C120. Its longer springs were easier to cock and were equipped with safety hooks identical to those of the Conibear 220™ trap (Woodstream Co., Niagara Falls, Ont.). We also used a Conibear Safety Gripper™ (Woodstream Co., Niagara Falls, Ont.) while setting the trap to hold the jaws together in case the trap was triggered inadvertently. Although the C120 Magnum is similar to the factory C120, it is a more powerful trap which kills marten quickly, without damaging pelts. Its potential as a quick-kill trap warrants capture efficiency tests on traplines.

SUMMARY

A mechanically improved rotating-jaw C120 Magnum trap set in a cubby successfully killed 13 of 14 marten in simulated natural environments. The average times to loss of consciousness and heartbeat were estimated at <68 seconds (SE = 8.2) and 203 seconds (SE = 18.4), respectively, after firing the trap. This study confirmed that the C120 Magnum can be expected to render >79% of captured marten unconscious in ≤3 minutes ($P = 0.05$). The C120 Magnum is the first killing trap to meet the requisites of the Canadian General Standards Board regarding killing traps.

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