Modified Clover Trap for Capturing Mountain Goats in Northwest British Columbia

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Abstract: Safe, humane, and effective capture methods are a critical component of mountain goat (*Oreamnos americanus*) research and management. Clover traps are widely used as an effective method for ground capturing mountain goats. The traps, which consist of a metal frame covered with heavy mesh netting, are simple to use, require only 2 people to operate, and can be used in a wide range of terrain, including open alpine ridges. Combined with a skilled capture and handling crew, use of the clover trap can also minimize adverse capture effects such as stress and physical injury. This paper discusses our experience using clover traps to capture mountain goats in Northwest BC and a number of design improvements made to improve trap efficacy. During capture, periods of snow, sleet and very strong winds were frequently experienced. During these periods, failed captures were frequently reported (i.e. goats entering traps were not captured, as confirmed by observations or tracks). Failures appeared to be due to freezing or icing of the trap mesh, the trap release mechanism (a snap-trap), or the trap door drop-bar. Improvements were subsequently made to both the trap-release mechanism and the vertical uprights of the door frame to minimize failed captures. We present an evaluation of these improvements in terms of capture efficacy and discuss other critical factors that influenced capture success in our work.

KEY WORDS British Columbia, clover trap, mountain goat, *Oreamnos americanus*, trigger release, wildlife capture.

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The safe, humane and efficient capture of wildlife is essential to many research and management programs. Several methods exist for capturing mountain goats (*Oreamnos americanus*), including traps (i.e. box traps [McBeath 1941], Stephenson box traps [Rongstad and McCabe 1984], and clover traps [Clover 1956]), nets (i.e. drop nets [Ramsey 1968], and aerial net-gunning [Barrett et al. 1982]), or ground or aerial darting (Crockford et al. 1957). Which method is utilized is dictated by a range of factors such as terrain, financial cost, selectivity of the method, project timelines, and project objectives (Peterson et al. 2003). Although net-gunning is often the most cost-effective method to capture goats, ground based capture is frequently required. For example, our broader study centered on investigation of the interactions between heli-skiing and mountain goats, and the study objectives necessarily precluded aerial-based capture of goats.

Clover traps are a ground-capture method that has been used successfully in a range of mountain goat research and management efforts (Rogers 1960, Hebert et al. 1971, Rideout 1974, Festa-Bianchet and

Côté 2008, L. Ingham, Columbia Basin fish and wildlife compensation program, personal communication). Compared to traditional wooden box traps, clover traps are lighter and more maneuverable, appear more likely to be used by wary animals, and pose less risk of injury to struggling wildlife (Vercauteren et al. 1999). Clover traps can also be used in a wide range of habitats that are prohibitive of other capture methods, including open alpine ridges (Thompson et al 1989). Clover traps also allow for processing of animals without the use of immobilizing drugs, a particular benefit in mountain goat capture due to the negative effects that drugs have been shown to have on kid abandonment rates and the fecundity of young nannies (Côté et al. 1998).

Despite these advantages, several limitations of the clover trap must also be taken into account to ensure both the safety of captured animals and efficacy of the traps. Goats captured in clover traps are exposed both to predators and sources of disturbance while entrapped; as such, traps must be monitored regularly to reduce the risk of capture stress or predation (Vercauteren et al. 1999). In regards to capture efficacy, the conventional rat-trap trigger system (Clover 1956) has been criticized for leading to excessive false releases due to non-target animals and weather effects, and preventing the simple adjustment of the trip-wire tension and position, which also leads to increased rates of both false and missed captures (Rideout 1974, Vercauteren et al. 1999). Finally, the mesh on the sliding trap door can become frozen to the doorframe uprights in times of adverse weather, preventing the door from fully closing and, thereby, resulting in missed captures (Jex 2008).

We used clover traps to capture mountain goats in the Coast Mountains of Northwest British Columbia (56°18', 57°02' N; 129°14',130°32' W). Clover traps were chosen as a practical capture method, as traps had to be set on open alpine ridges, and broader study objectives necessitated a ground, rather than aerial, capture method. Further, clover traps could be easily positioned and set by the 2-person capture crews. Here, we review the challenges experienced during our capture efforts, and make suggestions pertaining to trapping techniques and trap design, both of which increase animal safety and capture efficiency in areas having inclement weather.

STUDY AREA

Captures were carried out in the Skeena Mountains of the Coastal Mountain range in Northwest British Columbia with a protocol approved by the University of Northern British Columbia's Animal Care and Use Committee. This area is influenced by both arctic and coastal climate systems; as such, periods of severe wind, sub-zero temperatures, freezing rain, and snowfall occurred throughout the summer capture sessions. Capture sites were situated on open alpine ridges and plateaus above rugged cliff terrain. Elevation of capture sites ranged between 1500 and 1800 m.

METHODS AND DISCUSSION

We set clover traps along trails in areas of observed high goat use. Pre-baiting of sites for one year prior to trapping was found to be essential for trap success, as it allowed mountain goats to become familiar with bait locations and become accustomed to entering the traps. Trap placement was also an important factor in trapping success, because animals would dig for remnant salt from previous years rather than enter traps for bait salt if traps were not placed in the exact previous location. Salt blocks were placed between the trip-line and the back of the trap, and at least 25 cm from the sides and back of the trap to avoid animals accessing salt from outside. Traps were anchored in place using stakes of rebar and heavy gauge rope to secure the four corners

of the traps. The metal frame and nylon mesh of the clover traps were conventional in size to those used for capturing deer: ~91 cm (3 feet) wide by ~122 cm (4 feet) high by ~152 cm (5 feet) long, with the trap frame composed of ~2.2 cm (7/8 inches) diameter steel pipe (Figure 1).

Figure 1. Photograph showing the modified clover trap *in situ* in the Skeena Mountains, northwest British Columbia, Canada.

Traps were checked visually a minimum of 2-3 times per day, as well as a daily manual test of the release mechanism to ensure that it was functioning properly. When visual monitoring was not possible due to weather, traps were checked remotely using a VHF radio collar (alarm collar) fitted to the trap. The magnet silencing the alarm collar was attached to the sliding bar of the door so that when released, it would pull off the magnet and the alarm collar would begin to transmit. This remote monitoring system ensured that traps fitted with collars could be checked constantly, thereby reducing the risk of capture stress, predation, or nanny-kid separation which may result from an animal being trapped for an extended period of time. This remote alarm system also helped ensure crew safety, as traps could be checked in white-outs, wind storms, and at other times when crew safety may have been compromised by doing a manual trap check. The only disadvantage to the alarm collar system were occasional "false alarms" when the tape holding the magnet onto the collar would fall off, often due to the combination of sub-zero temperatures and precipitation. A solution to this may be holding the magnet onto the collar with an elastic band, rather than tape.

Trap modification 1: Archery trigger release system

Our trigger release system consisted of a trip string (18-kg-test fishing line) tied to a stake approximately 45 cm forward

from the back of the trap with the string tied approximately 45 cm above the ground (Figure 2). The trip line was then brought around an opposing stake on the opposite side of the trap, and attached to the trigger of the modified archery release (typically Cobra Pro Archery Release, Cobra Manufacturing Co, Inc. Bixby, OK). The line was either tied to a three-way fishing swivel with one arm of the swivel attached with tygon tubing to the trigger of the release, or directly to the trigger with a loop in the line and additional tape (Figure 3).

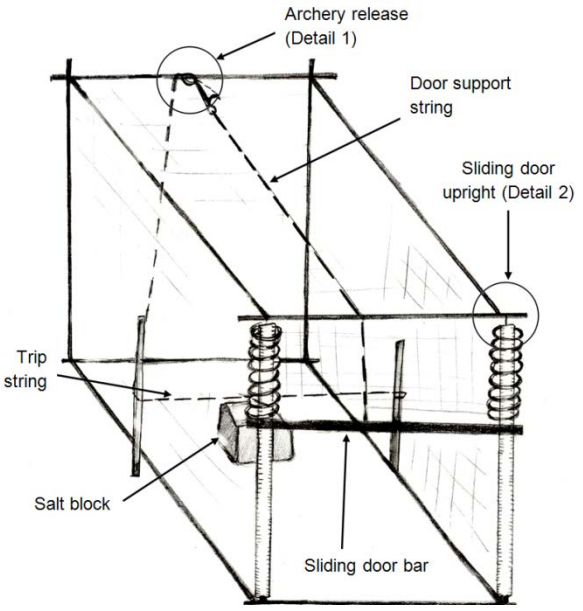

Figure 2. Configuration and major components of the modified clover trap design used in the Skeena Mountains, northwest British Columbia, Canada.

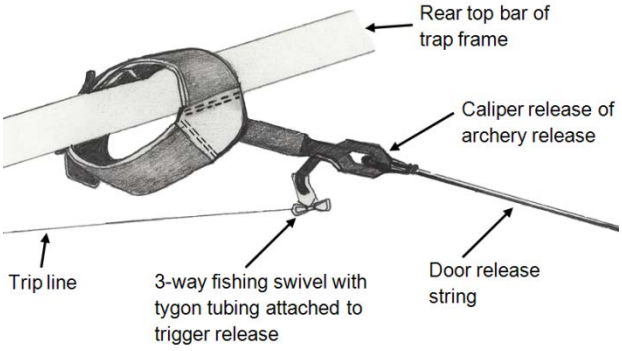

Figure 3. The archery release trap door trigger system of the modified clover trap used in the Skeena Mountains, northwest British Columbia, Canada.

The trap was set by holding the string for the sliding mesh door in the caliper head of the archery release. When a goat entered the trap to access salt and made contact with the trip-string, the trigger of the archery release was pulled back, releasing the door string from the caliper head, and normally capturing the goat.

This release system, devised by Jex (2008), proved to be a more reliable, easily adjustable, and lower maintenance alternative to the conventional rat-trap release system. When using the conventional system, crews often observed either false releases or signs of missed capture (goat tracks and sign in open traps) during times of freezing weather and precipitation. Although these problems were not completely eliminated by the archery release, (components were still somewhat prone to effects of ice accumulation and heavy winds) they were considerably reduced. The minor disadvantage of the archery release system is the financial cost of the trigger components relative to the conventional rat-trap system; archery releases used for the traps cost approximately $40 USD. Considering the time, effort, and expense that is required in mountain goat capture efforts, however, this increased cost is easily offset by the increased capture efficacy of modified traps.

Trap modification 2: Weather-proof Sliding Door. Our sliding door was modified by the fitting of 1” diameter

polyvinyl chloride (PVC) pipe to the vertical uprights that the guide the sliding mesh door (Jex 2008). The fabric loops of the mesh door that thread through the vertical uprights were also replaced with heavy gauge metal rings ~0.6 cm (¼ inch) thick and ~5 cm (2 inches) in diameter (Figure 4).

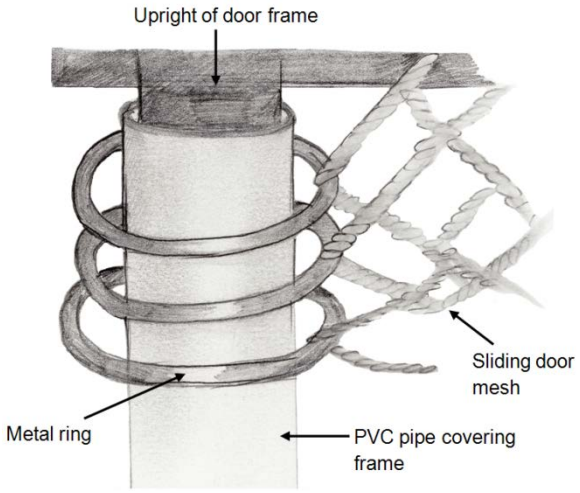

Figure 4. The sliding trap door of the modified clover trap used in the Skeena Mountains, northwest British Columbia, Canada.

In traps with conventional uprights, capture crews reported that ice accumulation would cause the mesh of the sliding door to become frozen to the uprights, thereby preventing the door from closing upon release of the trigger system, and allowing animals to escape. The modifications made to the sliding door system were effective in preventing freeze-up of the sliding door system, and thereby improving the reliability of the system in adverse weather. A potential concern, however, is that the colour and brightness of the PVC pipe may have deterred some animals from entering the trap, as it seemed to be used less often than the unmodified traps with plain metal doorframes (Jex 2008). A possible way to mitigate this problem would be covering the PVC in a darker fabric tape or matte paint or to use a black acrylonitrile butadiene styrene (ABS) covering.

MANAGEMENT IMPLICATIONS

The modifications made to the conventional clover trap, in addition to the use of an alarm collar signalling capture, minimized the disadvantages associated with conventional clover traps, namely concerns of exposure of entrapped animals and unreliable release systems. Modifications resulted in a more reliable trap, which was easier for crews to set and adjust, and yielded improved capture success rates, particularly in times of adverse weather conditions including high winds, freezing rain, or snow. The modifications listed are relatively cost efficient, simple to make, and were found to have a considerable positive effect on capture success in adverse weather. Although capture efforts of this project focused solely on mountain goats, the modifications made would be equally successful in capture programs of other ungulate species requiring the use of clover traps.

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