AN EVALUATION OF BREAKAWAY SNARES FOR USE IN COYOTE CONTROL

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ABSTRACT: Seven types of breakaway snares were evaluated for breaking strength and variability using a universal testing machine. Maximum tension before breakage for individual snares ranged from 142 to 486 pounds. Sheet metal locks which ripped out, and S-hooks which straightened, provided the least variable results. Coyotes (Canis latrans), mule deer (Odocoileus hemionus), domestic calves and lambs were tested to determine the tension loads they applied to snares. Differences in tension loads among coyotes and nontarget species should allow for the development of snares that will consistently hold coyotes and release most larger nontarget animals.

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INTRODUCTION

Snaring is one of the oldest methods used by man to capture wild animals. Snares have evolved from simple slip knots tied with twisted bark, rawhide, or hair cords, to the sophisticated and reliable models used today. Significant progress has been made in the construction of cable, swivels and attachments, and locking devices. Snares are widely used for fur trapping and in animal damage control. In some areas, snares have been restricted due to problems associated with the accidental capture of livestock and wildlife. Some states restrict the use of certain types of snares because of public concern over the capture of nontarget species. The accidental capture of livestock has resulted in a number of claims against the Federal government's Animal Damage Control Program in California and Montana (Darrell Gretz, pers. comm.).

Guthery and Beasom (1978) reported on the effectiveness and selectivity of neck snares used in a predator control program in south Texas. Boddicker (1982) discussed the advantages and disadvantages of snares compared to other tools used in predator control and recognized the need for improving breakaway lock systems to avoid the capture of nontarget species.

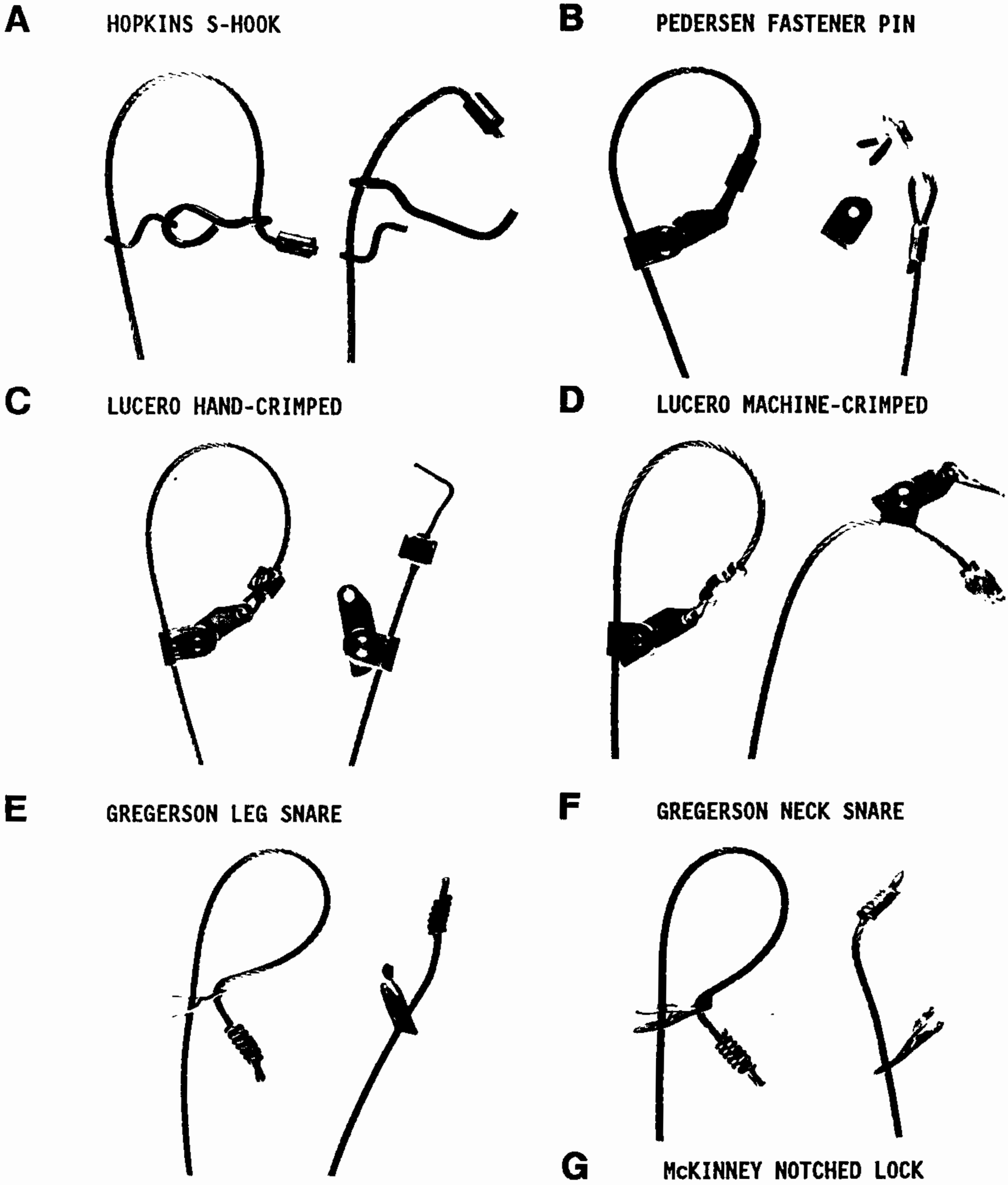
Despite the widespread use of snares, there has been no previous research to examine the mechanics of breakaway lock systems or the physical forces that captured animals apply to snares. This paper reports on the preliminary results of research aimed at developing a safe, selective, and efficient snare that will reduce the accidental capture of big game and livestock in snares set for coyotes. Specific objectives of the study were: 1) to test and evaluate the breakaway characteristics of commercially available coyote snares, and 2) to determine the tension load placed on snares by coyotes, mule deer, lambs, and calves. Reference to snare manufacturers does not constitute endorsement by the authors or the U.S. Department of Agriculture.

METHODS

To our knowledge, there have been no established techniques for testing the physical strength characteristics of snares or measuring the tension that different animals apply to snares and snare locks. We tested 7 types of coyote snares that were provided to us by commercial manufacturers (Fig. 1). Samples of each type of snare (n = 12) were connected to a Southwark-Emery universal testing machine (UTM; Baldwin Locomotive Works, Philadelphia, Penn.) to determine the tension required to break the locks or release mechanisms. Each snare was attached to the UTM by placing the snare loop around a 3-in diameter steel rod and anchoring the other end of the snare to the base of the machine with a 1/4-in bolt (Fig. 2). As the machine slowly tightened the snare loop, the amount of tension on the snare was digitally displayed on a recorder. The maximum tension was recorded when the snare lock or release mechanism separated from the snare. This testing procedure was not intended to simulate the forces an animal applies when captured by a snare. However, it did allow us to develop a standardized comparison for snare locks when they are subjected to a slow and steady pull by the UTM. A one-way Analysis of Variance and Duncan's multiple range test were used to distinguish tension differences in the mean loads for different types of snares.

The tension that coyotes, mule deer, lambs, and calves applied to snares was measured using an electronic load cell. Mean weights for test animals were 22.0 lbs for coyotes, 66.3 lbs for mule deer fawns, 129.4 lbs for adult mule deer, 239.1 lbs for domestic calves, and 79.0 lbs for domestic lambs. The snare cable was attached to individual test animal by placing the snare loop around the animal's neck or leg and anchoring it to the load cell (Fig. 3). Coyotes were tested using both leg and neck attachments. Only leg attachments were used for deer, lambs, and calves. Each snared animal was released and allowed a free run acceleration distance of approximately 5.0 or 11.0 feet to the end of the tether. The peak tension applied to the snare generated a voltage from the load cell proportional to the tension. This output was measured and displayed on a storage oscilloscope for conversion of the voltage output to pounds of force. The scope trace was also photographed for future reference (Fig. 4).

The magnitude of the tension created on the snares by running animals requires explanation. The actual magnitude of the stopping force is determined by the velocity and weight (mass) of the animal and the rigidity of the tether's anchor. It is possible to create extremely large forces by using an anchor with minimum flexibility. On the other hand, an automobile coasting at 60 miles per hour can be stopped with a minimal force providing that a large stopping distance is allowed. Therefore, the tension forces reported in this paper reflect the rigidity of our anchoring methods. Altering the anchor with springs, tethers that stretch, loose fitting collars on the animals, or other flexible mechanisms would completely change the results.



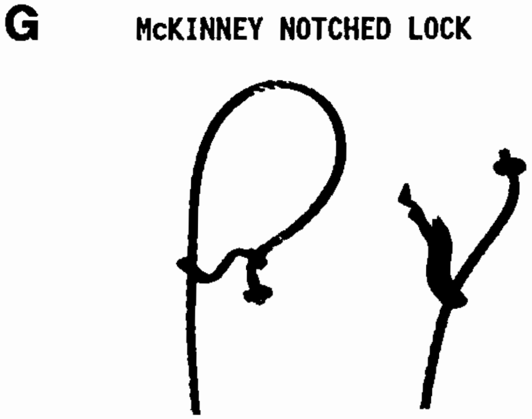


Fig. 1. Composite photo showing 7 types of breakaway snare lock systems that were tested with the universal testing machine. Each individual photo shows the lock before and after separation from the cable. A) Hopkins S-Hook B) Pedersen Fastener Pin on a Cam-loc C) Lucero Hand-crimped Wire Pin on a Cam-loc D) Lucero Machine-crimped Wire Pin on a Cam-loc E) Gregerson Sheetmetal Leg Snare F) Gregerson Sheetmetal Neck Snare G) McKinney Notched lock.

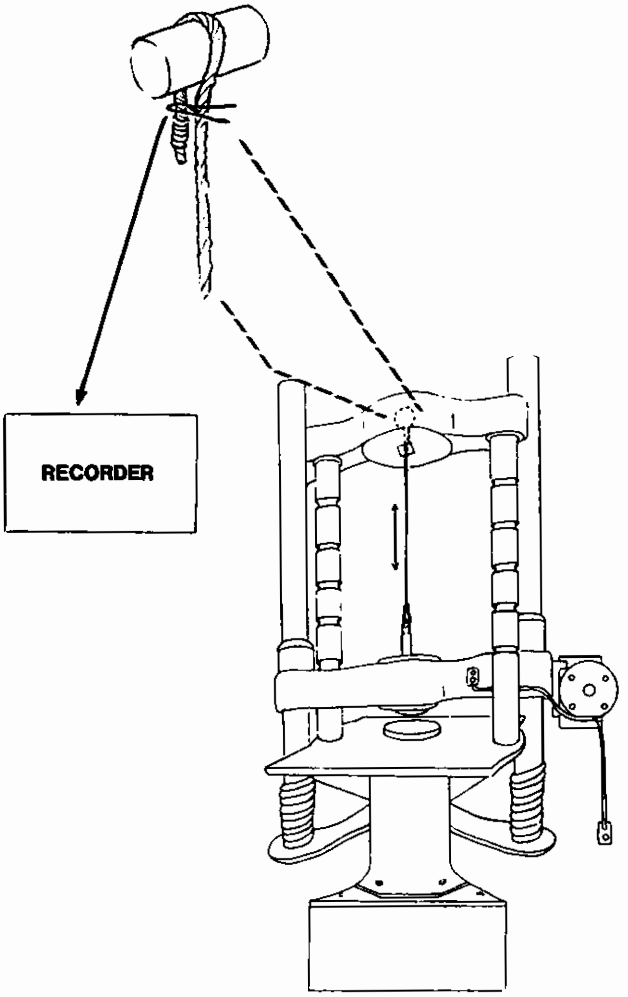


Figure 2. Sketch showing a universal testing machine and how it places tension on a snare lock.

It is therefore important to evaluate the relative magnitudes of the tensions created by the various animals rather than the absolute value.

RESULTS

Individual breakaway tensions for commercial snares that were tested ranged from 142.0 to 486.0 pounds. The Hopkins S-hook snare lock was the weakest, while the McKinney notched lock was the strongest. The Gregerson leg lock produced the most consistent results (SE = 6.9) followed by the Hopkins S-hook (SE = 8.6) (Table 1). The consistent performance of several types of snares was impressive considering that they were developed on a "trial and error" basis without the aid of test equipment. Statistical differences in the mean strength of all 7 commercial snare lock systems tested are shown in Table 2.

Thirty-six coyotes, 12 mule deer, 12 calves, and 9 lambs were tested to measure the tension they apply to snare locks. Maximum tension loads for coyotes ranged from 110 to 410 pounds. With 11 foot snares attached to their front leg or neck, coyotes produced average tension loads of 310 and 302 pounds, respectively. When the snare length (acceleration distance) was reduced to 4.5 feet, the average tension load dropped to 192 pounds (Table 3).

Mule deer fawns produced tension loads ranging from 140 to 360 pounds and averaged 257 pounds. Lambs, adult mule deer, and calves produced much higher readings, averaging 563, 690 and 1183 pounds, respectively (Table 3).

DISCUSSION

The data from our tests provide a scientific basis for developing snare locks that will consistently hold coyotes and release most nontarget species. The overlap in restraining tension was most evident for deer fawns (weighing < 75 pounds) and coyotes. The difference in maximum tension between individuals of the species tested using a 4.5 foot snare was 110 pounds and a mean difference of 65 pounds. We believe that under field conditions where wild coyotes and fawns are captured in snares, these differences would be about the same. Our test data indicated that if we had used a snare lock designed to break at 265 pounds, all neck-snared coyotes would have been held, while 4 of 8 deer fawns would have been released.

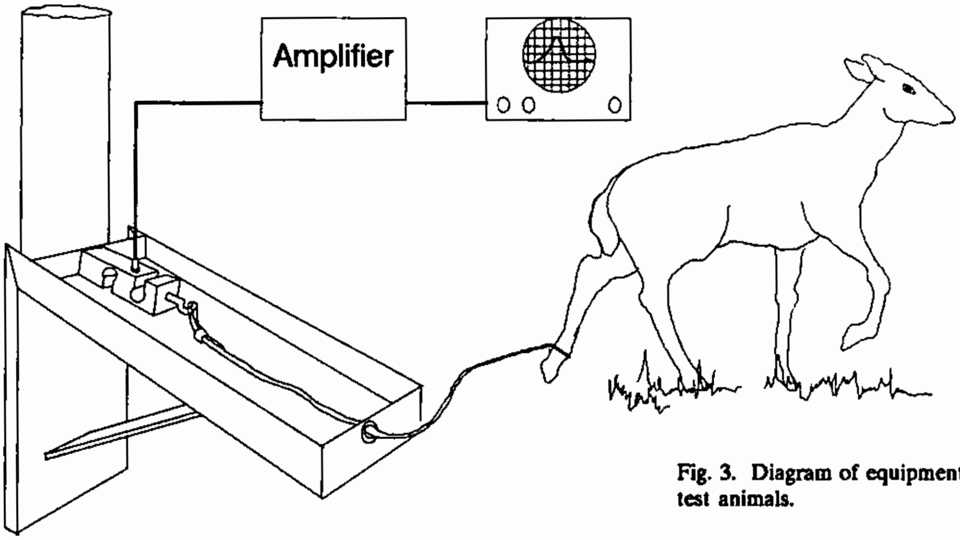


Fig. 3. Diagram of equipment used to obtain tension readings from test animals.

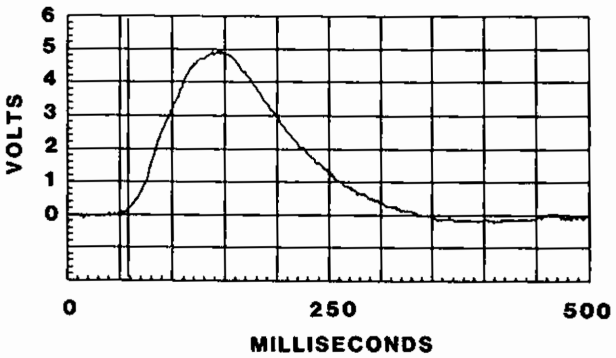


Figure 4. Graphic reproduction of an oscilloscope trace; 1 volt equals 100 pounds of tension.

Table 1. Comparison of the maximum tension (pounds) for 7 types of snares with different breakaway locks or devices. Twelve snares of each type were tested.

Snare type	Min.-Max. (Range)	mean	Standard error
Hopkins S-Hook	171-254 (83)	212.4	8.6
Pedersen Fastener Pin	157-317 (160)	230.7	13.2
Lucero Hand-Crimped Wire Pin	142-389 (247)	283.2	21.4
Lucero Machine-Crimped Wire Pin	225-416 (191)	312.0	14.3
Gregerson Leg Snare	303-380 (77)	335.7	6.9
Gregerson Neck Snare	301-402 (101)	338.9	10.0
McKinney Notched Lock	290-486 (196)	365.2	16.4

We recognize there is a wide array of behavioral differences in the way individual animals respond to snares. Some animals will remain passive in a snare while others will exert substantial force against the snare lock or release device. These variations in behavior were observed in our pen tests. For example, some deer fawns (with a snare attached to their leg) simply lunged forward after release, while others accelerated rapidly. Those that accelerated produced the higher tension readings. On the other hand, all coyotes tended to maximize their acceleration following release in a snare trial.

It was obvious from our results that most larger animals (those weighing over 100 lbs) have the ability to easily break all of the commercial snare lock systems we tested. This would include adult deer, pronghorn (Antilocapra americana), elk (Cervus canadensis), cattle, and sheep.

Table 2. A comparison of differences in mean breaking strength (n = 12) for 7 types of breakaway snares. Means are significantly different (experiment-wise error rate is .05) if they have no letter in common.

Snare type	Mean	Letter			
Gregerson Leg Snare	335.7	a	b		
Gregerson Neck Snare	338.9	a	b		
Hopkins S-Hook	212.4				d
Lucero Hand-Crimped Wire Pin	283.2			c	
Lucero Machine-Crimped Wire Pin	312.0		b	c	
McKinney Notched Lock	365.2	a			
Pedersen Fastener Pin	230.7				d

Table 3. A comparison of maximum tension (in pounds) placed on cable snare locks by coyotes, mule deer, calves, and lambs. The average weight (in pounds) for test animals of each species is shown in parentheses.

Snare length and method of attachment	n	Mean	Range	Standard error
		Coyotes (22.0)		
11′ front leg	12	310.0	160-400	24.7
11′ neck	12	302.1	220-410	18.0
4.5′ neck	12	191.7	110-250	14.5
		Mule Deer		
		fawns (66.3)		
4.5-5.0′ hind leg	8	256.9	140-360	26.6
		adults (129.4)		
	4	690.0	560-800	53.4
		Calves (239.1)		
4.5-5.0′ hind leg	12	1183.3	760-1680	79.0
		Lambs (79.0)		
4.5-5.0′ hind leg	9	563.3	300-800	49.8

The physical forces (maximum tension) we measured in our tests do not replicate all of the individual lunges that a captured animal may apply to a snare lock. Metal fatigue on some locks is an important factor and we were unable to measure this effect. A series of slow lunges may produce the same effect as a single quick jerk sustained at a higher tension. Future research should be directed toward better understanding these forces and improving the consistency of breakaway lock systems.

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