A COMPARISON OF ROCKET NETTING WITH OTHER METHODS OF CAPTURING DALL SHEEP

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ABSTRACT: Rocket netting was the most efficient method we tested for capturing wild Dall sheep *(Ovis dalli)* at a natural mineral lick in interior Alaska. Other methods included drop netting, cannon netting, snaring, and chemical immobilization. Age comparisons of sheep caught in rocket and drop nets suggested mature wild sheep avoid drop net traps. Younger sheep, habituated to the drop net trap all their lives, were equally susceptible to capture by drop net or rocket net. This may indicate that habituation to foreign objects by Dall sheep is a long-term process.

Mountain sheep research and management often require the live capture of individual animals. Chemical immobilization and physical entrapment are the most widely utilized capture techniques for wild ungulates and particularly for Dall sheep. Chemical immobilization usually involves the administration of a chemical agent which interferes with neuromuscular function to render the animal ataxic or immobile. It may involve sophisticated equipment and controlled drugs and is most suitable for large or dangerous animals. Physical capture entails interfering with an animal's freedom of movement to the point that it can be restrained and handled. The common methods of physical capture include enticing an animal into an enclosure such as a corral, or

entangling it in nets or various designs, or snaring. Because Dall sheep are neither large nor particularly dangerous they are good subjects for physical capture, particularly when large numbers of individuals must be handled.

The most widely used capture tool for mountain sheep is the drop net, first used by Erickson (1970) and further refined by Schmidt (1976). Other methods of physical capture including corral traps, box traps, and entanglements have been used with varying success. Cannon or rocket projectile nets have never been reported as successful capture methods for mountain sheep. Schmidt (pers. comm.) tested rocket nets on bighorn sheep *(Ovis canadensis)* and found that a net propelled by 3 rockets was too slow to capture bighorns. Nevertheless, we have been successful in using a rocket projectile net to capture Dall sheep in Alaska. The purpose of this paper is to briefly describe different capture techniques and to compare our efficiency with the rocket net to that with other capture methods we have used on Dall sheep.

MATERIALS AND METHODS

Sheep were trapped druing 1977, 1978, and 1979 for a population study near the Robertson River in interior Alaska. We tested 5 different techniques for capturing Dall sheep including a drop net, chemical immobilization, snares, a rocket net, and a cannon net.

Drop Net

An 18 m x 18 m (60 ft) drop net was used as described by Erickson (1970). Modifications suggested by Schmidt (1976) were made to increase efficiency. Blasting caps were detonated using a standard 12 volt dry cell through 100 m of blasting wire. Poles, guy stakes, rope, deadmen, and the net weighed approximately 225 kg (500 lb) and were transported to the trap site by helicopter. Use of the drop net required a relatively level site. We attempted to enhance the appeal of a favored licking site under the net with various baits.

Chemical Immobilization

Etorphine hydrochloride (M99) was administered to Dall sheep using 2 different dart guns and automatic projectile syringes. Yarn and plastic-finned tailpieces were both tried with the darts, and both Palmer long-range Cap-Chur projector and Simmons dart guns were used. Sheep were injected with 3 mg M99 with 0.8 cc of actylpromazine in a 5 cc dart (Thorne 1971). The remainder of the dart volume was filled with injectible water to provide a constant mass. Darts were shot from a small stone blind constructed 25 m from a frequently used site in the mineral lick. Once handling was completed the immobilized animals were given 5 cc of M50-50 (xylazine hydrochloride) antidote in the lateral saphenous vein.

Snaring

An Aldrich spring-activated bear snare was altered to make it

suitable for capturing sheep. A 6 cm by 8 cm piece of thin plywood was attached to the trigger wire to function as a treadle. The self-locking steel cable was replaced with a soft nylon rope which had no locking device. This soft nylon rope was then attached to a large boulder. The snare was set in an appropriate spot on the trail with the snare mechanism placed in a shallow excavation and carefully concealed with fine soil.

Cannon Nets and Rocket Nets

Projectile netting has not been reported as a successful capture method for mountain sheep. Therefore, we will offer a brief summary of the 2 projectile net systems available today. Simultaneous development of 2 parallel systems for projected net trap deployment occurred during 1948 with the production of a rocket-projected net in England (Scott 1948) and a cannon-projected net in the United States (Dill and Thornsberry 1950). Both systems were developed for capturing waterfowl, and initial reports indicated that cannon nets were more efficient. Subsequently, the rocket net has been successfully used for the capture of other wildlife including turkeys *(Meleagris gallopavo)* (Fleming and Webb 1974) and white-tailed deer *(Odocoileus virginianus)* (Hawkins et al. 1968).

Each system consists of a large net which is propelled over the animals to be captured. The cannon net is projected by slugs fired from seamless steel tubes which function as barrels. The net is attached by ropes to the projectiles or slugs which are muzzle loaded into the barrels. Upon firing, the slugs drag the net over the animals. Rocket net deployment involves high-thrust, recoilless rockets. Instead of firing a projectile, the entire rocket takes off upon ignition, pulling

the net behind it.

We used a homemade cannon net system consisting of 2 cannons which fired 5 cm-diameter steel slugs designed to throw a 6 m by 13 m (20 by 40 ft) net of commercial purse seine leader. The slugs were propelled by empty 12 gauge shotgun shells filled to 2/3 full with Pyrodex or FFFg black powder. The powder was ignited by electric blasting caps using a standard 12 volt dry cell.

A deer/big game type rocket net system was obtained from Wildlife Materials Inc., of Carbondale, Illinois, for $785 in 1977. This system included a 17 m by 13 m (40 X 60 ft) Net-Coat treated net hung on fringe ropes with 4 sets of shroud lines and 5 anchor lines. The net was deployed by 4 recoilless Net-Trap rockets which were fired from launchers which held the rockets slightly more than 1 m above ground level. Rocket fuel and primers were furnished by the supplier. The fuel was either surplus 105 mm howitzer or mortar propellant ignited by an electrical resistance heater surrounded by a mixture of black and smokeless powder. This priming mechanism was activated by attaching the leads to about 100 m of electric wire. The ends of this wire were touched to the terminals of a 12 volt dry cell to fire the rockets.

In 1977 we trapped between July 6-13 and July 20-28 using drop nets and cannon nets. In 1978 the trapping period was July 4-26 using chemical immobilization, a drop net, and a rocket net. Trapping in 1979 was during June 12-23 and June 27-July 3. Only a drop net and a rocket net were used in 1979. During 1977 the trapping crew did not sleep at the trap site but attempted to arrive there at 0400 hrs. Sheep were often present as

we arrived. In 1978 and 1979 the trapping crew lived in a 2.4 m square (8 x 8 ft) plywood blind at the trap site. During these years the traps were monitored nearly 24 hours per day and all sheep entering the traps were captured.

The opportunity to capture sheep with either the drop net or the rocket net occasionally presented itself, and at these times we usually preferred to use the drop net. We also selected in favor of ewes and against rams and attempted to eliminate repeated captures of the same individuals. Various baits, including fresh apple pulp, fresh apple pulp soaked with beer, salt, and anise oil, were tested as attractants under the drop net in 1978. Salt was the only effective attractant bait for sheep, although lambs appeared to be attracted to anise oil. After capture, sheep were given 0.3 to 0.8 cc of acetlypromazine to facilitate their handling and controlled release.

RESULTS

We captured more sheep, more sheep per unit of time, and had fewer mortalities with the rocket net than with any other capture technique (Table 1).

Table 1. Trap-days, total captures, trap efficiency and mortalities by trapping methods.

		Number of Captures				
Year	Trap Days	Drop Net	Rocket Net	Cannon Net	Drugs	Snares
1977	17	1	-	3[1/]	-	-
1978	23	16	12	-	18[2/]	1[3/]
1979	19	20	41	-	-	-
Total Captures		46	53	3	18	1
Captures/Trap-Day		0.8	1.3	0.1	0.5	0.5
Total Mortalities		6	0	0	5[4/]	0

[1/] Cannon net used for 30 days (including 7 days at another trap site)

[2/] Drugs used for total of 35 days (including 12 days at another trap site)

[3/] Snares used only for 2 days

[4/] 5 sheep were killed outright by darting; 2 others were in sufficiently poor condition when released that we suspect they may have died. They were not seen in 1979.

DISCUSSION

Clearly, we did not experiment extensively with some of the capture techniques. For example, our cannon net was usually too slow to catch Dall sheep, so we discontinued its use without extensive testing. Snares were also not practical because they were not selective, and sheep could easily avoid them. The 2 animals which did not avoid the snare were preoccupied by other activities. One lamb tripped the snare but escaped, and 1 large ram was caught while displaying to a nearby group of ewes. The capture rope should be kept as short as practical to reduce the mobility of snared sheep. The modified Aldrich bear snare may be satisfactory for capturing sheep under certain conditions, but its limitations caused us to abandon it after a brief trial.

Chemical immobilization has worked well to capture mountain sheep in many areas. Drugs are usually delivered by darting from helicopters as the sheep are in full flight, although Franzmann and Thorne (1970) and Thorne (1971) reported good success in darting bighorns from the ground. However, they were usually able to approach bighorns more closely than we could approach Dall sheep. Franzmann and Thorne (1970) used a CO_2 powered gun, but the ambient air temperature in our location was so cool that a

CO_2 powered gun was undependable. Therefore, we abandoned CO_2 powered dart guns after a brief test.

We tested a .22 caliber blank powered Palmer longe-range projector and a 5 cc dart with a yarn tail and found the accuracy of this system at long range was inadequate. A 2X scope on the Palmer gun did not improve our accuracy. We killed 5 sheep due to excessive dart penetration during 18 captures. The high impact of the 5 cc metal dart at the velocity necessary to propel it over 25 m made the system unworkable for the lightly muscled, thin-skinned Dall sheep. However, problems with over-penetration may be reduced if sheep are darted when in full winter pelage so dense hair can absorb some of the dart energy.

We subsequently tested the Simmons dart gun. It was much more accurate than the Palmer projector probably bacause finned plastic instead of yarn was used on the dart tailpiece. Still, the velocity necessary to deliver the darts at 25 m coupled with the high sectional density of the 5 cc metal dart injured sheep and caused us to abandon use of chemical immobilization.

Aside from our difficulty with dart guns, we found M99 to be a good drug for immobilizing Dall sheep. Three to 3.5 cc of the drug usually immobilized adults within 6 minutes. Sheep were easily handled and, when given the M50-50 antidote, they were on their feet in less than 1 minute and were soon well coordinated. Use of acetylpromazine as a tranquilizer in the dart may be unnecessary since it can be administered after the animal is in hand. This would allow use of a 3 cc dart with less sectional density and, therefore, decrease the possibility of

serious injury. If a plastic rather than an aluminum dart body could be obtained, the system would be even more desirable.

We had greater success and less mortality with the drop net and rocket net than with any other capture method. Both methods worked well, but the rocket net has several advantages over the drop net. First, the rocket net is easily transported. The entire apparatus can be safely airdropped to a remote capture site, and it is light enough to be packed out by 2 men. As a result, it is cheaper to transport to and from the trap site. Secondly, the rocket net can be used on steep or rough terrain where a drop net can not be set. The slope of our most productive area was about 20 degrees, which is too steep for drop net use. Rocket nets are also easier to operate than drop nets and require less excavation, stake driving, and assembly, which are difficult in extremely rocky soils.

Perhaps the most significant advantage of the rocket net over the drop net is the absence of a visual barrier to which sheep must be habituated before they are vulnerable to trapping. In 1979, when we used only the drop net and rocket net and attempted to capture the maximum number of ewe sheep, a definite age segregation occurred between sheep trapped by the different methods. The drop net was first used in 1977 and has been used every year since that time. Therefore, sheep born in, and subsequent to, 1977 had always seen the drop net in place as they used the mineral lick. During 1979, 40 sheep 3 years old or younger were captured. One- and 2-year old sheep were habituated to the

drop net and 3-year-old sheep saw it for the first time as yearlings. Sixty percent of these sheep were caught in the drop net and 40% in the rocket net. We used the drop net whenever possible because it was located on flat terrain, downhill from the trapping blind and was, consequently, easier to use. This may account for the slight bias toward the capture of younger sheep by the drop net.

In the same trapping period, 28 sheep $\geq$ 4 years old which had not been habituated to the drop net throughout their lives were caught. Only 18% of these were caught in the drop net and 82% were caught in the rocket net. We believe this demonstrated trap wariness to the drop net by older sheep. Earlier data from captures in the drop net in another portion of the Alaska Range (Heimer 1973) appear to confirm this hypothesis

A disproportionate ($\bar{x}$ = 16 months per year) increase in mean age as well as increases in total numbers of non-habituated sheep captured occurred over the course of four trap years from 1968 through 1981. These data may indicate slow acceptance of foreign objects by Dall sheep. That is, foreign objects may eventually "become part" of a sheep's perception of its habitat even though they are introduced during the adult life span of the animal.

When trapping sheep, we think it is important to be aware that sheep not responding to a bait may be wary of drop net traps until they become habituated to them. If 1 goal of trapping is to assess the age structure of a population, it is especially important to note that a drop net will probably capture young animals more readily than animals not used to its presence. This tendency will diminish as adults habituate

to the net and as young are produced that view the net as "normal." These findings may also indicate that mountain sheep habituate slowly to foreign objects in their environments. The initial introduction of foreign objects to, or alteration of terrain in, sheep habitat should be slow and disturbance extremely limited to facilitate habituation of sheep to change.

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QUESTION - RESPONSES

Bill Wishart: Did you ever hit anything with the rocket?

Wayne Heimer: No, just the mountain side. Often after the net has come down they will lie on the ground and sputter awhile and shot flame out the end. I think it's probably the most satisfying explosive since Wyoming was into det-cord for their net dropping.

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