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USING TELEMETRY EQUIPMENT FOR MONITORING TRAPS AND SNARES

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Abstract: Specialized radio transmitters were developed for use in monitoring large mammal trap and snare activity. Prototype devices were manufactured by 4 wildlife telemetry companies based on specifications we developed in consultation with electronic engineering personnel. Power outputs from individual transmitters ranged from 10 to 100 milliwatts (mw). Range testing in the gently rolling terrain of northeastern Colorado indicated that ground-tracking distances with truck-mounted dual beam antennas exceeded 40 km. Field tests were conducted using transmitters with traps and footsnares set for coyotes (*Canis latrans*) in California, black bears (*Ursus americanus*) in Oregon, and mountain lions (*Felis concolor*) in Arizona. Our results indicated that electronic monitoring could be a practical approach to reducing field operating costs and check times for devices set in remote areas. Other applications for the technology, such as use with cage traps in suburban areas, also appear feasible.

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In recent years there has been increased interest by wildlife managers in developing telemetry technology for monitoring activity of animals at traps and snares set in remote areas. Decreased time between trap checks could also ensure quicker responses by trappers, thus reducing the likelihood of stress or injury to captured animals. The use of specialized radio telemetry equipment allows for monitoring of multiple trap sites from great distances, expanding the ability of a single trapper to handle numerous, widely spaced sites.

Past attempts to monitor traps and snares using radio transmitters involved the use of modified radio collars or low-powered transmitters (Anderka 1979, Nolan et al. 1984). Some wildlife managers and researchers found this equipment useful, but effective ranges were limited, particularly in remote rugged terrain. The purpose of this study was to develop long-range telemetry equipment and examine its feasibility for monitoring activity of traps and snares in situations where they are essential tools for managing carnivore predation on livestock in the western United States.

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METHODS AND STUDY LOCATIONS

Performance requirements for telemetry equipment were determined based on discussions with ADC personnel. We determined that transmitters needed to have sufficient power to produce a radio signal that could be received over rough terrain at distances >8 km. Also, they were required to be lightweight, durable, weatherproof, and easy to use. Other requirements included replaceable batteries, an on/off switch, and a magnetic switch to change the pulse rate from 30 to 90 pulses/min to signal activity changes.

Companies manufacturing wildlife telemetry equipment were given the specifications and asked to submit prototype transmitters. Four companies submitted 3 prototype transmitters each for our examination. Individual models were identified as A, B, C, and D (Fig. 1). Reference to trade names or commercial enterprises is for identification only and does not constitute endorsement by the authors or the United States Department of Agriculture. All transmitters were initially bench-tested by electronics personnel to determine if power requirements were achieved.

Initial range tests were conducted in the grasslands of northeastern Colorado by attaching each transmitter to a poly-vinyl chloride (PVC) pipe approximately 1 m above the ground. We used a truck-mounted dual beam yagi antenna system to determine maximum transmitter ranges from the same location on the ground. A Cessna 172 aircraft with a wing-

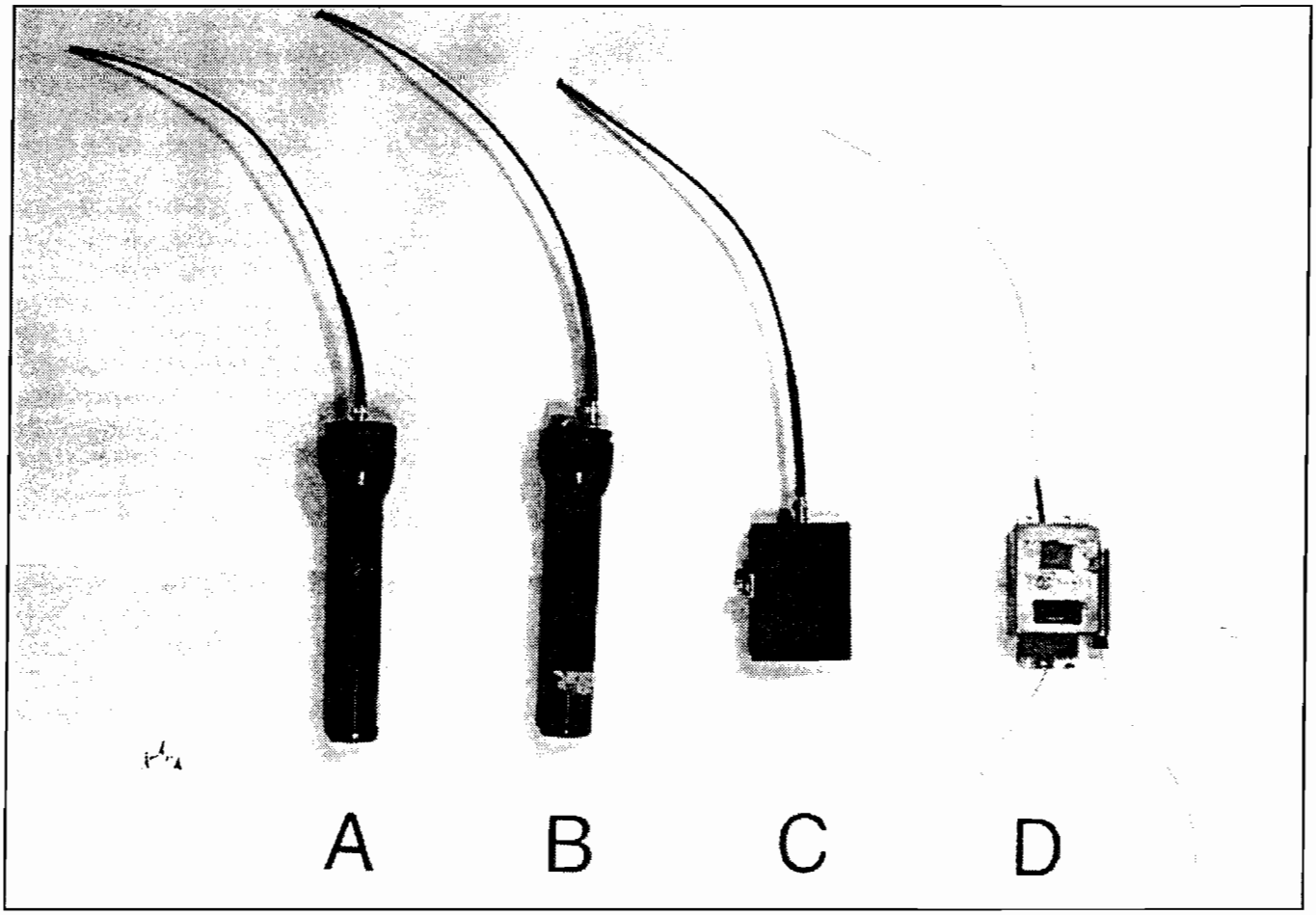

Figure 1. Prototype transmitters from 4 radio telemetry companies.

Table 1. Types, outputs, and ranges of 4 types of transmitters used for trap monitoring.

Transmitter type	Output (mw)	Maximum range from Ground (km)	Maximum range from Aircraft (km)
A	100	40.0	151.0
B	100	32.0	132.0
C	10	26.0	119.0
D	10	18.5	119.0

mounted yagi antenna was used to determine maximum ranges from the air. Maximum range was determined at a distance when the signal could no longer be detected by the receiver.

Field evaluations were conducted from December 1992 to November 1994 using prototype transmitters on traps and footsnares set for coyotes *(Canis Latrans)*, black bears *(Ursus americanus)*, and mountain lions *(Felis concolor)*. We provided prototype units and instructions to several Animal Damage Control Specialists (ADCS) in the ADC program for use in conjunction with their normal activities using traps or snares for problem carnivores.

Our first field trials involved monitoring softcatch traps set for coyotes in gently rolling grasslands in southern California. Transmitters were connected to traps and placed in surrounding vegetation at heights ranging from ground level to 2 m. A string was attached to a magnet located on the magnetic switch and to the bottom of the trap frame. The transmitter pulse rate increased when the magnet was removed by a trap being pulled from its bed.

A second trial was conducted using Aldrich footsnares set to capture black bears in mountainous regions of western Oregon. This area was heavily wooded with Douglas fir (*Pseudotsuga tsuga*) on steep mountain slopes. Transmitters were affixed to trees adjacent to cubby sets containing the Aldrich footsnares (Fig. 2). A string was attached to the throw-arm of the snare and to the magnet on the transmitter. When the throw-arm was released, the magnet was removed from the transmitter, initiating a change in pulse rate of the radio signal.

The third trial was conducted in the rugged desert mountain terrain of southeastern Arizona. This area was characterized by steep rocky canyons and mountains dominated by *Juniperus* spp. and *Acacia* spp. Lackey footsnares were set on trails or at livestock kill sites to capture depredating mountain lions. Transmitters were placed in adjacent trees and strings attached from the magnet to the throw-arms of the snares.

RESULTS AND DISCUSSION

Four telemetry companies provided prototype transmitters ranging in price from $195 to $318 and averaging $242.

The Custom Electronics telemetry receivers used in this study cost $900; the 4-element yagi antennas cost $80. The transmitters varied in construction, but all were designed to meet the specified performance requirements. Individual units had power outputs ranging from 10 to 100 mw (Table 1). Initial range tests showed reception distances ranging from 18.5 to 40 km on the ground to over 151 km from the fixed-wing aircraft at an above-ground altitude of 915 m.

During field trials, project personnel captured 6 coyotes, 2 bobcats (*Lynx lynx*), 4 black bears, and 3 mountain lions. Transmitters functioned properly and trap activity could be monitored from distances up to 21 km. The transmitter did not appear to affect trapping efficiency during any of the 3 tests.

Electronic monitoring of trap sites improved the efficiency of checking equipment set in remote areas. For example, the time required to check bear snares daily in Oregon was reduced from 8.50 to 2.75 hours. Similarly, the time required for checking mountain lion sets in Arizona was reduced from 12 to 4 hours daily. The ADCS were alerted any time snare throw-arms were sprung, or traps were pulled from their beds. Daily radio monitoring of equipment with transmitters also increased the efficiency of traplines by reducing the time that traps and snares were inoperable due to noncapture or nontarget animal disturbances. The ADCS were able to check equipment more frequently to reduce the time an animal was restrained. Faster response times should be helpful in a variety of situations to reduce injuries or exposure of captured animals.

During all captures, transmitters changed pulse rates as required. However, some problems were encountered with attachments of the magnets to transmitters. In 1 case, a snare was dug up by a small mammal. The snare was pulled off the throw-arm rendering it inoperable. Because the throw-arm did not fire, the transmitter did not change pulse rate and the inoperable set could not be detected. In another instance, a bear entered from the backside of a cubby set and removed the bait without activating the snare or the transmitter. At 1 leghold trap set, an animal activated the trap without moving the magnet on the transmitter switch; thus the pulse rate did not change. At another set, a cow moved the string which pulled the magnet from the transmitter. These examples indicated the need for periodic visual inspections of trap sites, or perhaps additional work on triggering mechanisms for transmitters.

We preferred prototypes with transmitters housed in aluminum flashlight cases. This allowed for easy battery changes and for convenient mounting of the units on nearby trees. Transmitters using magnetic on/off switches were preferred to those with push button type switches. Push button switches were often accidently activated during transport or handling of transmitters; activation could only be detected by use of a radio receiver. Magnetic switches ensure the unit is functioning only when the magnet is removed.

Trap monitoring equipment may have several other potential uses that we did not examine. Transmitters could be used on cage traps, as well as on foothold and snares or other animal capture devices. They could be utilized in suburban areas where accidental capture of pets may be a potential problem. Telemetry equipment could be used to monitor equipment set to capture bears or lions in suburban areas or in campgrounds where a captured animal may be a threat to human health and safety. Capture devices equipped with transmitters would ensure quick response times when threatened or endangered species such as gray wolves (*Canis lupus*) or grizzly bears (*Ursus arctos*) must be captured. Electronic monitoring might also be useful as a mitigating measure in areas where threatened or endangered species could be inadvertently captured during animal control operations. In many such cases, the cost of telemetry systems would be recovered by increased program efficiency. Nonetheless, the equipment cost, limitations on availability of radio frequencies, and the continuing need for periodic visual inspection of sites will probably limit the current application of electronic monitoring to specific, appropriate situations.

Figure 2. Trap monitoring transmitter attached to tree.

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