A Pilot Evaluation of Trap Monitors by the USDA Wildlife Services Operational Program

Patrick A. Darrow and **John A. Shivik**
USDA APHIS Wildlife Services, National Wildlife Research Center, Logan, Utah

Abstract: Public interest in capture devices and potential injuries to animals has resulted in changing of trapping regulations in a variety of states and countries. Within the U.S., some states have revised trapping regulations to require more frequent trap-check intervals. Such regulatory changes may impact the USDA Wildlife Services (WS) Operational Program by reducing the ability of WS specialists to efficiently provide services over wide areas. Remote trap monitors, however, may provide a technology that can assist WS in meeting new trap check requirements. The National Wildlife Research Center's (NWRC) Logan, Utah Field Station recently assisted with the distribution, operation, and evaluation of radio-telemetry trap monitors by the WS Operational Program. Transmitters, receivers, antennas, and on-site training were provided to personnel in 7 states in 2005 and 16 states in 2006. Feedback from the states receiving trap monitors indicated that trap monitors, when used in appropriate situations, could save WS specialists time and resources, but the monitors were most useful in areas where traps or other capture devices are difficult to access and radio signals can be heard from the greatest distance. Improved designs (using cell phone and satellite technology) could be helpful in other situations in the future.

Key Words: devices, evaluation, trap monitoring, radiotelemetry, trapping, traps, USDA Wildlife Services

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INTRODUCTION

In wildlife damage management, traps to capture problem animals are often set in remote locations that require extensive time and resources to check. Remote trap monitor use has been studied as a possible way to quickly and efficiently monitor traps and snares (Hayes 1982, Nolan 1984, Halstead et al. 1995). Trap monitors have been used to reduce disturbance and human presence at trap sites (Marks 1996, Proudfoot and Jacobs 2001) that may reduce trapping effectiveness by making target animals more wary. Remote trap monitors can reduce the amount of time an animal spends in the trap or snare, thus minimizing injury to animals that are captured (Larkin et al. 2003, Ó Néill et al. 2007).

Public interest in capture devices and in reducing injuries to animals, both within the U.S. and elsewhere, has resulted in changes to trapping regulations within various states and countries. In the U.S., trapping bans or restrictions have been accomplished or attempted at the federal, state, and local level in recent years (Andelt et al. 1999), and such efforts continue. For example, in 1990 the California State Legislature passed Senate Bill 756, requiring daily trap checks for all steel-jawed leghold traps. WS state programs that assist in wolf management are also affected by 24-hour trap checks. Additional jurisdictions may impose more frequent trap check requirements, which would impact the USDA Wildlife Services (WS) Operational Program by reducing the ability of WS specialists to maintain and monitor capture devices over wide areas. Automated trap monitor devices, however, may assist WS in meeting new trap check requirements. Halstead et al. (1995) developed and examined a variety of trap monitors, with the assistance of WS personnel, finding that such devices could significantly reduce the time required to check traps and snares in remote areas field, thus reducing operating costs.

Renewed interest in trap monitor technology has led WS' National Wildlife Research Center Logan, Utah Field Station to assist with the distribution, operation, and evaluation of trap monitors by the WS Operational Program. Our objective was to provide technical support for the use and distribution of commercially available trap monitor systems. We provide a summary of observations made by biologists and specialists using the monitors.

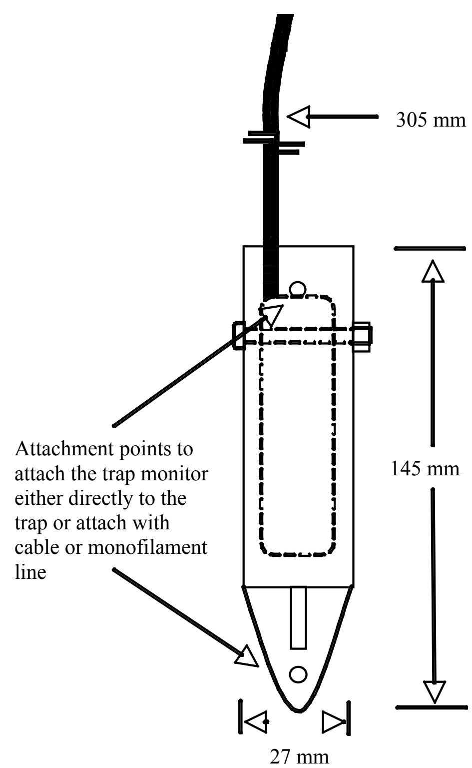

Figure 1. A diagram of an Advanced Telemetry Systems motion-activated M4010 mammal trap monitor.

Table 1. A diagram of an Advanced Telemetry Systems motion-activated M4010 mammal trap monitor.

Brand	Cost	Activation Method	Operational Life	Effective Distance
Telonics	~$160 based on number bought	Sprung trap pulls magnet from monitor to activate it	7 years	½ - 16 miles depending on line of sight (2 mile average)
Advanced Telemetry Systems	~$205 based on number bought	Slight but sudden motion will activate the monitor	4 years	½ - 16 miles depending on line of sight (2 mile average)

METHODS

In 2005 and 2006, we distributed commercially available trap monitors and associated radiotelemetry equipment to WS Operational Program personnel. During the summer of 2005, the WS Deputy Administrator provided funds for 72 ATS trap monitors, 4 receivers, and 4 yagi antennas. WS Operations in each state were contacted to determine where interest in using trap monitors existed. States that were interested in using the trap monitors then submitted proposals stating what species and equipment with which the trap monitors would be used. Eleven states expressed interest in using trap monitors in 2005. After contacting each state and discussing the use of the monitors, 4 states decided not to particiaate in the evaluation. We attempted to maximize both the type of species and equipment with which the trap monitors were used as well as the number of states that were able to receive the monitors. In order to have enough monitors for the 7 remaining states, the Logan Field Station bought 3 additional receivers and yagi antennas.

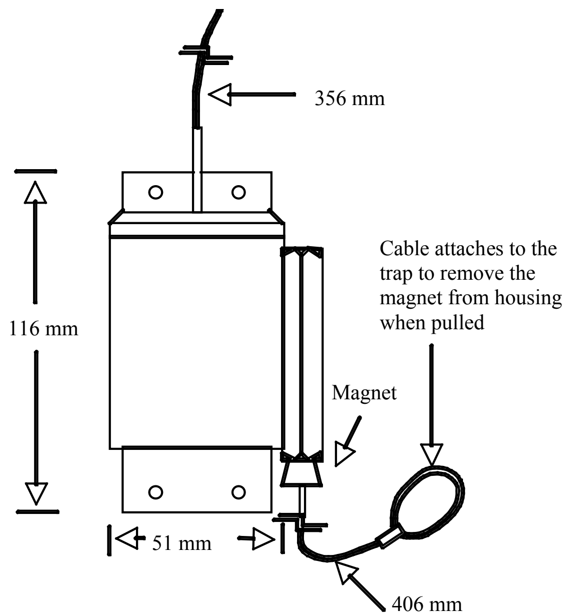

Figure 2. A diagram of a Telonics TBT 500 magnet-activated trap transmitter.

The two types of trap monitors used were the Advanced Telemetry Systems M4010 (ATS, Isanti, MN), and a TBT 500 trap monitor manufactured by Telonics, Inc. (Mesa, AZ) (Table 1). The ATS M4010 mammal trap monitor (Figure 1) is a motion-activated monitor consisting of a resin-encapsulated 2-stage transmitter housed in an aluminum housing, with a cable antenna protruding from one end. The transmitter is turned on by removing a magnet from the outside of the aluminum housing. When placed and left undisturbed, the ATS monitor transmits at a slow radio frequency pulse rate (40 pulses / min). Upon motion activation (e.g., a slight but sudden movement, such as a trap being pulled from the trap bed), the pulse rate doubles, and the transmitter sends an 8-part binary pulse code that enables the specialist to determine the time elapsed since activation.

The Telonics TBT 500 trap monitor (Figure 2) begins emitting a slow pulse (35 pulses / min) when a magnet is removed from the outside of the transmitter housing. When a second magnet (attached to the trap or other device with a cable or monofilament line) is removed from the transmitter, the pulse rate increases (75 pulses / min), which alerts the specialist that the trap or snare has been sprung. Both brands of monitors have a unique frequency assigned to each individual trap monitor so the trapper can identify individual traps.

During May and June 2005, we distributed a total of 72 ATS trap monitors and provided training on their use to WS personnel in the following 7 states: Florida, Idaho, Minnesota, Oklahoma, Oregon, Utah, and Wisconsin (Table 2). Along with the monitors we provided IC-R10 receivers (Icom America Inc., Bellevue, WA) (frequency capability 0.5 - 1300 MHz), Lotek SRX 400 receivers (Lotek Wireless Inc. Newmarket, Ontario, Canada), and Advanced Telemetry Systems 3-element folding yagi antennas.

In 2006, additional funding for the purchase of trap monitors was provided by the WS Deputy Administrator, and the WS Eastern and Western Regions and WS State programs were again invited to submit requests for trap monitors. In 2006, we were able to supply trap monitors to all states that requested them. During August and September 2006, a total of 104 ATS and 70 Telonics trap monitors were distributed to WS personnel in 16 state programs: Alabama, Arizona, Colorado, Florida, Georgia, Idaho, Louisiana, New Mexico, North Carolina, Oregon,

Table 2. 2005 distribution of trap monitors and telemetry equipment to Wildlife Services programs by Region and State.

Western Region		Eastern Region	
Oklahoma	***Utah***	***Florida***	***Wisconsin***
14 ATS monitors	8 ATS monitors	9 ATS monitors	7 ATS monitors
1 Icom R10 receiver	2 Lotek receiver	1 Icom R10 receiver	1 Lotek receiver
1 yagi antenna	1 yagi antenna	1 yagi antenna	1 yagi antenna
Oregon	***Idaho***	***Minnesota***	
10 ATS monitors	17 ATS monitors	7 ATS monitors	
1 Icom R10 receiver	1 yagi antenna	1 Icom R10 receiver	
1 yagi antenna		1 yagi antenna	

Table 3. 2006 distribution of trap monitors and telemetry equipment to Wildlife Services programs by Region and state.

Western Region		Eastern Region	
Arizona	***Texas***	***Alabama***	***North Carolina***
10 Telonics monitors	9 ATS monitors	10 Telonics monitors	9 ATS monitors
1 yagi antenna	1 Icom R20 receiver	1 yagi antenna	1 yagi antenna
1 Icom R20 receiver	1 yagi antenna	1 Icom R20 receiver	1 Icom R20 receiver
Colorado	***Utah***	***Florida***	***South Carolina***
9 ATS monitors	9 ATS monitors	10 Telonics monitors	10 Telonics monitors
1 Icom R20 receiver	1 Icom R20 receiver	1 yagi antenna	1 yagi antenna
1 yagi antenna	1 yagi antenna	1 Icom R20 receiver	1 Icom R20 receiver
Idaho	***Washington***	***Georgia***	***West Virginia***
12 ATS monitors	9 ATS monitors	9 ATS monitors	9 ATS monitors
2 Icom R20 receivers	1 Icom R20 receiver	1 yagi antenna	1 yagi antenna
1 yagi antenna	1 yagi antenna	1 Icom R20 receiver	1 Icom R20 receiver
New Mexico	***Wyoming***	***Louisiana***	
10 Telonics monitors	9 ATS monitors	10 Telonics monitors	
1 yagi antenna	1 Icom R20 receiver	1 yagi antenna	
1 Icom R20 receiver	1 yagi antenna	1 Icom R20 receiver	
Oregon			
9 ATS monitors			
1 Icom R20 receiver			
1 yagi antenna			

South Carolina, Texas, Utah, Washington, West Virginia, and Wyoming (Table 3). For 2006, the IC-R10 receiver was replaced with the IC-R20 model (frequency range of 0.15 - 3304.980 MHz). Specialists were also provided Advanced Telemetry Systems 3-element folding yagi antennas. Some specialists also used omnidirectional antennas they already had mounted on their vehicles.

When using the trap monitors, no changes in damage management activities were required of WS Operational personnel. That is, WS specialists attempted to capture animals as necessary, according to standard procedures. However, when setting the traps, a trap monitor was attached to the trap. The trap monitor could be attached either directly to the trap chain with a link of chain, an S-hook, or connected with a string or monofilament line to the trap or snare. Subsequently, WS specialists used the handheld receiver during their regular trap check interval to check the radio-telemetry signal being emitted from each trap.

After the specialists had an opportunity to use the trap monitors for at least 4 months, we contacted them via telephone or email to gather information on the specialist's impressions of the trap monitors. Specialists were asked a standard set of questions (e.g., species and traps types the monitors were used with, distances from which the signal was received, general impressions). The anecdotal information was then compiled and made into an information sheet for distribution to WS Operational programs throughout the United States.

RESULTS

Specialists used the trap monitors in a variety of situations and in conjunction with a diversity of capture equipment including conibear traps, foothold traps, foot snares, neck snares, cage traps, and culvert traps. Some specialists used the monitors as a signal device for animal activity at bait stations. WS personnel used monitors when capturing or attempting to capture coyotes (*Canis latrans*), raccoons (*Procyon lotor*), black bears (*Ursus americanus*), white-tailed deer (*Odocoileus virginianus*), mountain lions (*Puma concolor*), nutria (*Myocastor coypus*), wolves (*Canis lupus*), raptors, feral pigs (*Sus scrofa*), striped skunks (*Mephitis mephitis*), beaver (*Castor canadensis*), and feral dogs (*Canis familiaris*).

As with any new and different device, some specialists noted they needed time and practice before they could build up complete confidence in the trap monitors. However, WS personnel did not report any instances where an animal was caught and the trap monitor failed to activate. However, ATS monitors did emit false alarms (activated by wind, for example), especially when suspended off the ground.

Terrain was reported to be the greatest factor that influenced a transmitter's effective distance. Clear line of sight was extremely important. When the monitor is hung above ground on a hillside, the monitor could be detected from 8 miles (13 km) away. One Oregon WS Specialist reported hearing the trap monitor from 12 miles (19 km) away, and a West Virginia specialist picked up a signal from 16 miles (26 km) away. However, if the trap monitor is completely buried or used in areas with rolling hills, the effective distance may be only half a mile (0.8 km). In relatively flat terrain with thick vegetation, the trap monitors above ground could be heard from about 2 miles (3.2 km) away.

Oklahoma WS specialists suggested using the trap monitors for beaver work to decrease time spent and the hazard of wading through beaver sloughs to check conibear traps. A Wyoming specialist used the monitors to alert him if a wolf trap was activated in areas inhabited by grizzly bear (*Ursus horribilis*), so that he could get additional help before going into thick brush to check the trap. Several states used the devices to remotely monitor multiple bait piles when trying to remove depredating deer or feral pigs. When used to monitor bait piles, a string was strung over the bait pile and then attached to the trap monitor, which was secured to a stationary objected. When animals came to feed at the bait pile, if the string was moved, it would activate the Telonics trap monitor by pulling the magnet from the housing, or move the ATS monitor enough to activate it. On Eglin Air Force Base, Florida, WS specialists used the monitors to remotely check traps when access was temporarily prevented due to weapons testing; activated monitors allowed the specialists to prioritize which traps to check first when the area was reopened. Arizona WS specialists suggested the use of monitors in urban damage situations to minimize the number of times field personnel would need to enter private property. Finally, an Oregon specialist calculated that the trap monitor saved him 2 hours of driving time daily when checking his bear snares along logging roads.

However, trap monitors were not useful in all situations, with limited range of acquiring the radiotelemetry signal being the principal limiting factor. Monitors were reported to be most useful when:

- frequent visitation to trap or other device is difficult or undesirable
- trap sites are on a mountainsides that can be seen from several miles away
- trap sites are in low-lying areas that can be seen from high spots
- prioritization of checking individual traps is important
- accessing the site is difficult

Trap monitors were reported to be less useful:

- in rolling terrain where there is not a good line-of-sight
- in areas of very dense vegetation, where long reception distances are required
- on flat land, where traps are easily accessible
- when used as the only trap check method

Specialists mentioned possible improvements they would like on the trap monitors, such as field-replaceable batteries, and a replaceable antenna. When the ATS trap monitors were attached directly to the trap, animals caught in the trap often chewed the antenna, damaging it so as to reduce its effective range. Four of the 7 states (Florida, Idaho, Utah, and Oregon) that received trap monitors in 2005 requested additional trap monitors in 2006, indicating the specialists found the trap monitors beneficial enough to continue or expand their use. The 3 states (Minnesota, Oklahoma, and Wisconsin) that did not request additional trap monitors had situations, such as difficult terrain or vegetation, that limited the effective range for receiving the trap monitors' signal.

DISCUSSION

As this was a pilot evaluation of trap monitors, our analyses are descriptive and anecdotal and were designed to collect information from specialists. Our results indicated that trap monitors, when used in appropriate situations, can save WS specialists time and energy. Specialists who used the monitors showed much ingenuity in setting the trap monitors and found new uses for them. Trap monitors allowed specialists to prioritize visual inspection of trap sites in areas of high visibility or human use, to cause less disturbance at trap sites, and to more easily find equipment and animals that were caught in traps with drags. They also saved specialists time hiking into remote locations or riding in by horseback or all-terrain vehicle.

Even with monitors, visual inspection of traps may be necessary because trap monitors may not indicate if a trap moved from the trap bed. During this evaluation, some WS specialists mentioned there were incidences of foothold traps or snares being uncovered or closed but not disturbed enough to activate the monitor. In these cases, the trap was not functional and would not have been noticed if a visual inspection of the trap had not been made.

Because of the potential importance of trap monitors, future research that examines the cost effectiveness of the monitor and satisfaction of specialists using them would be beneficial. Continued development in technology has provided other options for remote trap monitors. For example, cell phone technology has been used with trap monitors to send a message to a designated phone when a trap has been activated (Larkin et al. 2003, Ó Néill et al. 2007), but this is useful only in areas with cell phone coverage. Other available trap monitor technologies include commercially available motion-activated trail cameras that transmit real-time photographs to a website while also sending a text message to a designated cell phone. Also, satellite systems have the advantage of not being limited by cell phone coverage or limited range; however, their current costs may be prohibitive for many applications.

Though trap monitor use in some areas is not practical at this time, continuing to get state-of-the-art trap monitor technology into the hands of WS personnel will allow these programs to more efficiently provide service over wide areas.

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