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# Non-lethal Radio Activated Guard for Detering Wolf Depredation in Idaho: Summary and Call for Research

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**Abstract** With the reestablishment of wolves in the western United States, managing adverse interactions between wolves and livestock is re-emerging as an issue for resource managers. Lethal control of wolves is often difficult to implement due to the constraints of the Endangered Species Act, predator population goals, and public disfavor for lethal control. In response to the need to manage wolf predation in a non-lethal manner, we developed and tested a behavior contingent system for disrupting predation events. The Avian Systems Model 9000 Frightening System, also called a Radio Activated Guard (RAG), is activated by signals from nearby wolf radio collars. The strobe light, tape player with 30 different recorded sound effects, and behaviorally contingent activation are designed to minimize habituation to the system. Based on studies in Idaho, we believe RAG boxes are effective for protecting livestock in small pasture situations. Limitations of the scare device include electronic complexity, area coverage, and price. We continue to develop and test the limitations of their effective use in ongoing experimental research.

**Key Words:** *Canis lupus*, non-lethal, radio activated guard, scare device, wolves

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## INTRODUCTION

With the reestablishment of wolves (*Canis lupus*) in the United States, managing adverse interactions between wolves, livestock, and domestic pets is critical to diffuse hostility from local rural residents, maintain political support for reintroduction efforts, and prevent illegal killing of wolves. Lethal control of problem wolves is often difficult and undesirable to implement because of the constraints of the endangered species act, predator population goals, and public disfavor for lethal control (Reiter et al. 1999). Alternative non-lethal methods can provide tools that are supported by wolf advocacy groups, the general public, and livestock producers. However, very little is known about the effectiveness and limitations of most non-lethal devices for use in wolf management. It is imperative that new devices are tested thoroughly so that false expectations are not formed about the utility and effectiveness of the devices and that they can be used wisely.

Visual and acoustic repellents act as disruptive stimuli to reduce a predator's desire to enter or stay in the area where livestock are located (Smith et al. 2000, Shivik and Martin 2001). These stimuli include lights and sounds produced by strobes, sirens, or pyrotechnics that may startle or frighten an animal and cause it to retreat from a particular area. Flashing highway lights and sirens have been tried to deter wolves on farms in Minnesota (Fritts 1982, Fritts et al. 1992), though it is

unknown whether wolves were actually deterred. No other research has been conducted to test the effect of frightening devices on reducing livestock depredations by wolves (Smith et al. 2000).

One of the major limitations of frightening devices is that individuals can quickly habituate to the stimuli (Koehler et al. 1990, Bomford and O'Brien 1990). Rapid habituation can occur when the stimuli are not linked to any particular behavior of the predator. Thus devices that fire frequently without being linked to any animal behavior will rapidly lose their effectiveness (Shivik and Martin 2001). However, devices that are behavior contingent (i.e., fire only when target animals are performing undesirable behaviors) should slow habituation and increase the utility and effectiveness of the device.

In response to the need to manage wolf predation in a non-lethal manner, we developed and are currently testing a Radio Activated Guard (RAG) scare device that is a behaviorally contingent and designed to disrupt predation events in small areas ( $\leq 40$ -60 acres). Here we report on preliminary results of ongoing testing of RAG boxes. The two questions we address are 1) do RAG boxes effectively deter wolves from depredating cattle, and 2) how long does it take wolves to habituate to RAG boxes? Here we describe the equipment, report 3 case histories from central Idaho in which RAG boxes were used to protect cattle, and discuss limitations of the

equipment. We end by describing plans for more rigorous tests of the device.

## EQUIPMENT

### Frightening Device

The Avian Systems Model 9000 Frightening Device utilizes signals from radio collars to trigger the system. The base station has a scanning receiver (Quick Track Model QTR-5000+) that can be programmed to scan for predetermined radio frequencies. By adjusting the gain and the volume, the sensitivity of the receiver is adjusted so that it fires only when individuals enter the area being protected. The radius of protection can be as small as 20 m, which may keep wolves out of dead animal pits or other small areas, or as large as 300 m, which would be effective for protecting small pastures containing infant livestock.

Activation of the device triggers a strobe light and loud sound effects from the tape player. In order to reduce the ability of animals to habituate to the device, there are 30 different recorded sounds, and each time it triggers a different sound is played. Within each RAG box we have installed a small electronic monitor (HOBO<sup>®</sup>-Onset Computer Corp., Bourne, MA) that records the date and time whenever a RAG box fires.

### Monitor

We used monitors to evaluate the performance of the RAG boxes and monitor behavioral responses of wolves to the scare device. Monitors consist of a receiver and a data collection computer that collects and stores data received from transmitters. Data collected includes the animal frequency, date and time of animal presence and the number of pulses received during a predetermined time interval. Similar to the RAG boxes, the range that monitors are able to detect animals can be adjusted by adjusting the gain.

We used RAG boxes and monitors together to gather data on the effectiveness of RAG boxes and whether or not wolves were habituating to the devices. The activation distance of a RAG box and the distance that a monitor would log data were set to a similar distance (Figure 1). We did this by taking a test collar to the desired distance and then adjusted the gain on the receiver in the RAG box and monitor so that each unit would detect the test collar.

## CASE HISTORIES

### Case History 1: Salmon River

From mid-January through mid-March 2000, the first commercially produced RAG box was used on a ranch with approximately 350 cow/calf pairs along the Salmon River near the confluence of the East Fork of the Salmon. The private land along the river is used for calving grounds from mid-January through May. During this period, cattle are confined to small pastures (40-50 acres) where scare devices should be effective at deterring predation. Public land with good wintering habitat for

deer and elk surrounds the ranch, which likely attracts wolves into the area.

In mid-January, wolves from the Twin Peaks pack (3 of which wore radio collars) were spotted near the pasture containing cattle. In an effort to prevent depredation from occurring, 1 RAG box was placed in the pasture. Over the next month, the Rag Box fired on 3 separate occasions. On one of these occasions fresh snow allowed us to follow tracks the morning after the box fired. The tracks indicated that at least 1 wolf was walking towards the pasture then suddenly turned and ran away from the pasture. The same individual went around a ridge then attempted to enter the pasture from another side but again turned around suddenly and ran away (Figure 2). Data from the HOB0 indicated that the box had fired twice that night and both areas where the wolf turned and began running were near the perimeter of the protected area. Wolves did not kill any cattle during this 30-day period.

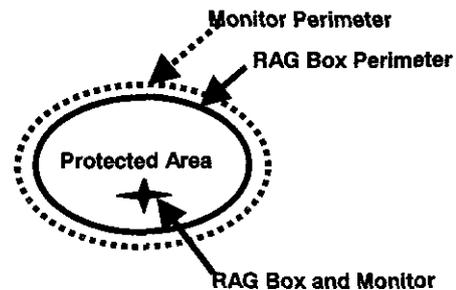


Figure 1. A conceptual diagram demonstrating the preferred setup of a Radio Activated Guard (RAG) box and monitor used to test the effectiveness of RAG boxes for deterring wolves. Both monitor and RAG box are set up in the center of the protected area with the perimeter size set by adjusting the gain of each receiver to a test collar at the perimeter of the protected area. The monitor and RAG box perimeter should be similar to attain reliable data on the ability of the RAG box to deter wolves.

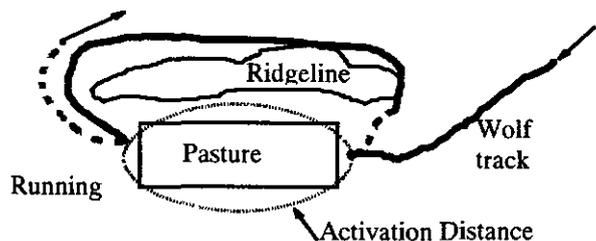


Figure 2. Anecdotal evidence that a Radio Activated Guard (RAG) deterred a wolf from entering a small pasture containing cow-calf pairs along the Salmon River, Idaho. Snow tracking revealed a wolf approached the pasture (solid line) and presumably being frightened (dashed line represents the track of the wolf running) when the RAG box activated. The wolf then went around a ridge and tried to enter the pasture from another direction. The RAG box fired again and the wolf ran again and left the area.

In late February, half of the cattle were moved from the protected pasture to an unprotected pasture. One night after the cattle were split, wolves killed a calf in the unprotected pasture. Over the next week, 5 more calves were killed in the unprotected pasture. No other RAG boxes were available to put in the unprotected pasture; therefore lethal control was implemented to end the depredation and resulted in the death of 4 wolves and the collapse of the pack.

#### **Case History 2: East Fork of the Salmon River**

Approximately 5 miles of bottomland along the East Fork of the Salmon River is privately owned and utilized as calving grounds in late winter and early spring. Cattle are kept in small pastures (40-80 acres) until they are moved to grazing allotments in early June. Wolves are attracted to this area (likely because of the high abundance of wintering deer and elk) and have caused problems in the past. During late winter and spring of 1999, wolves from the White Cloud pack killed 5 calves. As a result, 2 wolves from the pack were captured and relocated. During winter and spring of 2000 the same pack of wolves killed 5 calves and resulted in the lethal removal of 5 wolves, the relocation of another 5 wolves, and the collapse of the pack.

The following year, winter 2001, wolves from the White Hawk pack moved into the East Fork drainage. The pack was comprised of 7 to 8 wolves, 4 of which wore radio collars. In an effort to prevent wolf depredation, 5 RAG boxes were placed in small pastures containing cow/calf pairs. Of approximately 1,000 cow/calf pairs, we estimated that RAG boxes protected 70% of the cattle. RAG boxes were used from late February through May and monitors were included with RAG boxes in mid-March.

From late February through March 18<sup>th</sup>, the RAG boxes activated approximately 10 times total presumably due to the presence of wolves. During this period no calves were killed. On the night of March 18, 2001, wolves killed a calf in a pasture presumably protected by a RAG box. One wolf was shot that night and the rest of the pack left the pasture. Data from the HOBO indicated that the RAG box had failed to fire although radio-collared wolves passed within 20 m of the box. We learned that the box failure was due to the receiver being switched off scanning mode. The cause of the malfunction was determined and corrected. After March 18<sup>th</sup>, the White Hawk pack was present in or near the fields almost on a nightly basis for another 25 days. RAG boxes in the valley fired approximately 20 times over this period, and monitors indicated the scare devices were firing while wolves were present. Monitors also recorded wolves leaving the pastures after RAG boxes had fired. After mid-April the White Hawk pack moved out of the valley and little visitation was noted for the remainder of the year. Though the March 18<sup>th</sup> incident was unfortunate for both cattle and wolves, it is noteworthy that no cattle

were killed before or after this incident and we speculate that had the RAG box worked properly, wolves would not have entered the pasture and killed a calf that evening.

#### **Case History 3: Chalis Dump**

In mid-April 2001, 6 wolves (3 of which wore radio collars) were found scavenging in a dead animal pit at the city dump approximately 1 mile from Chalis, Idaho. On April 17<sup>th</sup> 5 leg-hold traps were set to capture and collar addition members of the pack. The next morning we found 2 traps had been triggered by wolves, and though no wolves were captured it appeared the experience frightened them from the area. That afternoon we placed a monitor at the dump to determine whether any wolves would return. After 9 days, on the night of April 27<sup>th</sup>, a collared wolf that had visited the garbage dump previously returned and stayed for several hours. The next day a RAG box was placed at the dead animal pit and at approximately 2:30 AM on April 29<sup>th</sup> the same wolf returned and the RAG box activated. After a couple of hours, the wolf left the dump area and 3-4 days later was located approximately 50 miles from the dump and to date has not returned.

#### **DISCUSSION**

Preliminary results indicate that RAG boxes are effective at deterring wolves from depredating cattle in small pastures. To date no calves have been killed in pastures that were protected by RAG boxes (Table 1), whereas wolves continue to be problems in unprotected pastures. However, further monitoring should occur before more conclusive statements are made about the effectiveness of RAG boxes for wolf management.

To date, there is no indication that wolves exposed to RAG boxes have habituated to the scare devices. During the winter and spring of 2001, wolves from the White Hawk pack on the East Fork of the Salmon were in the vicinity of cattle for at least 60 days and activated RAG boxes on approximately 15-20 different occasions.

Monitoring data showed no signs that wolves had habituated to the devices. Here again, these results are preliminary in nature and further monitoring is necessary to gain more reliable information about the propensity of wolves to habituate to RAG boxes.

#### **Limitations**

Though RAG boxes appear to be useful for non-lethal management of wolves, there are limitations of the device that should be recognized. Perhaps the most important limitation is that wolves or other carnivores threatening livestock must be wearing a radio transmitter to activate the device. Despite this limitation, the application of RAG boxes may still prove cost effective in many management situations because of the high costs of other management strategies (e.g., relocation or lethal control). Another limitation of RAG boxes is that they are not designed to protect cattle in open range situations

**Table 1. The number of calves killed and the number of wolves killed or (relocated) in protected and unprotected pastures by Radio Activated Guard (RAG) boxes. Trials occurred in two pastures located in central Idaho. "Days" represents the approximate number of days that wolves were near pastures containing cattle but does not represent the number of cattle that were being protected.**

Pasture/year	With RAG Box			Without RAG Box		
	Days	Wolves	Calves	Days	Wolves	Calves
Salmon/00	37	0	0	7	4	5
East Fork/99	0	n/a	n/a	60	(2)	5
East Fork/00	0	n/a	n/a	60	5 (5)	5
East Fork/01	45	0	0	10	1	1
<b>Total</b>	<b>82</b>	<b>0</b>	<b>0</b>	<b>137</b>	<b>10 (7)</b>	<b>16</b>

This limitation may be overcome somewhat by altering stewardship in conjunction with altering the use of RAG boxes. For example, it may be a viable option to gather livestock into groups near herders for the night and use the RAG box simply as a detection mechanism to warn of the presence of wolves in the area. Other limitations of RAG boxes include the complexity of the device, which necessitates training personnel in their proper use, and the expense of each unit (\$3,800 per unit).

#### Future Research

To gain more reliable knowledge about the benefits and limitations of RAG boxes for managing wolves, further monitoring is necessary and implementation of better experimental design is highly desirable. Though preliminary evidence from the case histories indicated that RAG boxes were effective and wolves showed no tendency to habituate to the devices, the evidence is anecdotal. Two changes in our monitoring efforts would lead to more conclusive data about the effectiveness of RAG boxes. The first is to match pastures that are protected by RAG boxes with pastures that are not and monitor both for amount of wolf activity and number of calves killed. The second is to monitor pastures before and after setting up a RAG box and then compare the amount of time wolves spend in each pasture. Both strategies are problematic because of the potential costs to the livestock producers and the highly political nature of working with wolves. However, we are hopeful that opportunities will present themselves to apply these study designs in the future. At minimum, continued monitoring in a variety of management situations and over a longer period of time will provide better understanding of these devices and their effectiveness for managing wolves.

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