A Modified Approach to Rocket Netting White-tailed Deer using a Remote Video System

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Abstract: Capture of white-tailed deer (*Odocoileus virginianus*) is vital for telemetric studies of the species. A variety of methods such as drop nets, clover traps and rocket nets have been employed to capture deer. However, most methods require direct observation of trap sites, which has the obvious limitation of controlling human scent around trap sites. We describe a new technique for capturing deer using rocket nets coupled with wireless remote video. Capture rates for two periods in 2005 using remote video were higher (0.10 and 0.17 deer/h) than the traditional on-site observation method used in 2004 (0.05 and 0.09 deer/h). We suggest that this technique is more efficient than other reported capture techniques for free-ranging white-tailed deer.

Key words: capture, *Odocoileus virginianus*, remote video, rocket net, white-tailed deer

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Capture of white-tailed deer (*Odocoileus virginianus*), hereafter deer, is paramount to the success of telemetry studies of the species. Several methods to capture white-tailed deer are reported in the literature including cannon (rocket) nets (Hawkins et al. 1968), clover traps (Clover 1956), and drop nets (Ramsey 1968). With the exception of clover traps, these methods require a researcher to physically monitor traps for capture. Rocket netting is one of the most common methods employed to capture white-tailed deer, but is not without limitations. Hunted deer populations are sensitive to human scent and most attempts to capture deer occur shortly after hunting season. Therefore, researcher proximity to and scent at the trap site may hinder capture. A new technique that avoids these pitfalls employs a rocket net and remote video system. Use of remote cameras to study wildlife has increased in recent years (Cutler and Swann 1999). Jacobson et al. (1997) used remote still cameras to census deer populations, and video monitoring has been used for food selection (Beringer et al. 2004) and scraping behavior (Alexy et al. 2001) studies. Drop nets monitored remotely by video and triggered remotely by radio signal have been used successfully to capture deer (K. L. Gee, The Noble Foundation, personal communication), but use of remote video to aid in capture of white-tailed deer has not been described in the literature. We describe a technique for using remote video cameras to aid capture of deer, compare effectiveness of this method to the traditional rocket net method, and describe potential applications of this technique in future research.

Study Area

We conducted our study in Amelia County, Virginia, on the Amelia Springs Hunt Club, a 1,538-ha property located on the Piedmont province of central Virginia. Elevation ranged from 76–122 m. Dominant forest cover type was commercial loblolly pine (*Pinus taeda*) plantation. Mesic uplands occurred along streamside management zones and undisturbed sites where white oak (*Quercus alba*), northern red oak (*Q. rubra*), southern red oak (*Q. falcata*), and black oak (*Q. velutina*) dominated. Other hardwoods included yellow poplar (*Liriodendron tulipifera*), American beech (*Fagus grandifolia*), and red maple (*Acer rubrum*). Bottomland forest communities were found along narrow stream valleys, which were subject to frequent flooding, supported river birch (*Betula nigra*) and sycamore (*Platanus occidentalis*). Other common bottomland species included willow oak (*Q. phellos*), water oak (*Q. nigra*) and witch-hazel (*Hamamelis virginiana*).

Methods

We identified potential capture sites large enough to fire a rocket net and baited them with whole kernel corn. When deer began feeding regularly at a site, we placed an 18.2- by 12.1-m knotless nylon net, with 1.3-cm^2 mesh, at the site. We stretched out then pulled back the net towards the back edge, folding the net upon itself until an 18.2- by 0.3-m line was created. We then placed bait in a concentrated pile 1.5 m forward of the back edge of the net at the line's center. We attached four recoilless impulse rockets to the net (patterned after Wildlife Materials [Murphysboro, Illinois] and Winn-Star models [Marion Illinois]), mounted on modified fence posts 1.06 m above the ground using 1.2 m shroud lines. The rocket net was weighted down along the back edge with five metal disks weighing 4 kg each to facilitate tangling of deer in the net. We loaded rockets with charges (Winn-Star) comprised of howitzer propellant and an FFG black powder charge used as an igniter. We attached ignition wires from each charge to an electrical wire, in series, to facilitate simultaneous ignition.

For the traditional on-site method, we stretched heavy gauge multi-strand electrical wire from the rocket circuit to a camouflaged tent blind or tree stand ≤60 m from the net. We used a multi-meter tester (A.W. Speery, Hauppauge, New York) to test the circuit for continuity. We searched for deer visually using night vision scopes (ITT Industries, Roanoke, Virginia) after dark. We waited for deer to approach the bait and begin to feed then fired the net when deer were in the head down position. We detonated the net by completing the circuit with a 6-volt battery. We then proceeded rapidly to the net site and tagged, measured, and placed an ear-tag transmitter (Advanced Telemetry Systems, Isanti, Minnesota) on the animal. Animals 21 months or older at capture were classified adults. We physically restrained deer for 5–10 minutes during processing and then released. We established trapping, handling, and monitoring procedures in January 2004 approved by the animal care committee at Virginia Polytechnic Institute and State University (04-028-F&W). We determined capture myopathy by gross field examination.

For the remote video system method, we used a wireless remote video system (First Witness Video, Mt. Sydney, Virginia) powered by a 12-volt deep-cycle battery. The system was comprised of a weatherproof camera, transmitter, receiver, and video monitor (Fig. 1). The camera incorporated a color camera for daytime display and a black/white night vision camera for night use. The cam-

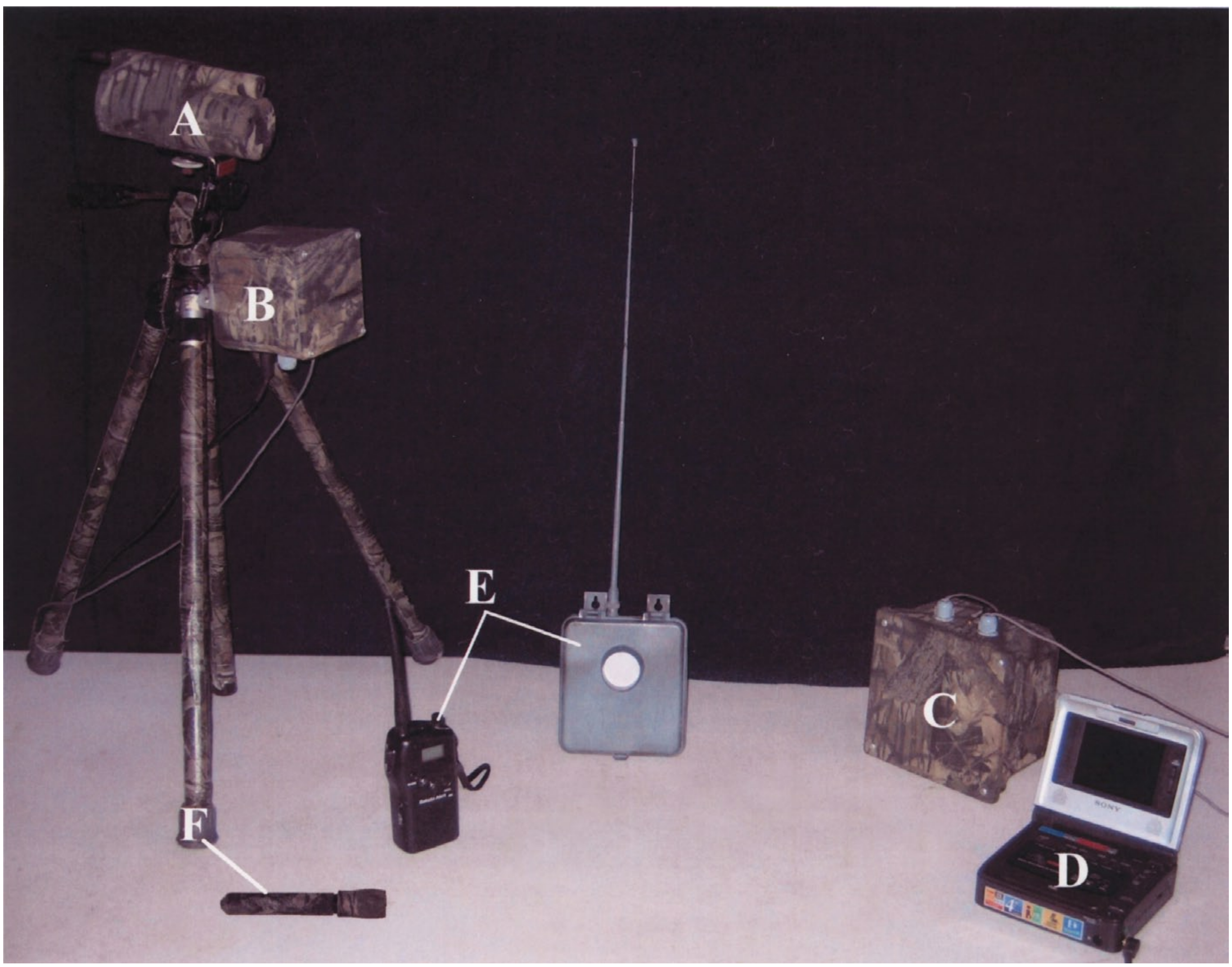

Figure 1. Wireless remote video and monitoring system: (A) day/night camera, (B) wireless transmitter, (C) wireless receiver, (D) Sony video recorder/monitor, (E) Dakota Alert trail monitor, (F) ITT illuminator.

era automatically sensed lighting conditions to select for day or night mode. We set the tripod-mounted camera according to site conditions. Generally, we placed the camera at a 35-degree angle approximately 40 m (average distance) from the bait pile (Fig. 2). The camera was hard-wired to a transmitter, which we oriented towards the receiver site, elevated, and fastened to a nearby tree. The receiver station was a vehicle blind 150-300 m away from the rocket net site, depending upon terrain. We placed a Dakota Alert trail monitoring system (Dakota Alert, Elk Point, South Dakota) transmitter 30 cm behind the net and aimed it at the bait pile. The transmitter was a passive infrared detector activated by a combination of body heat and movement. When activated it sent a voice signal (e.g.,

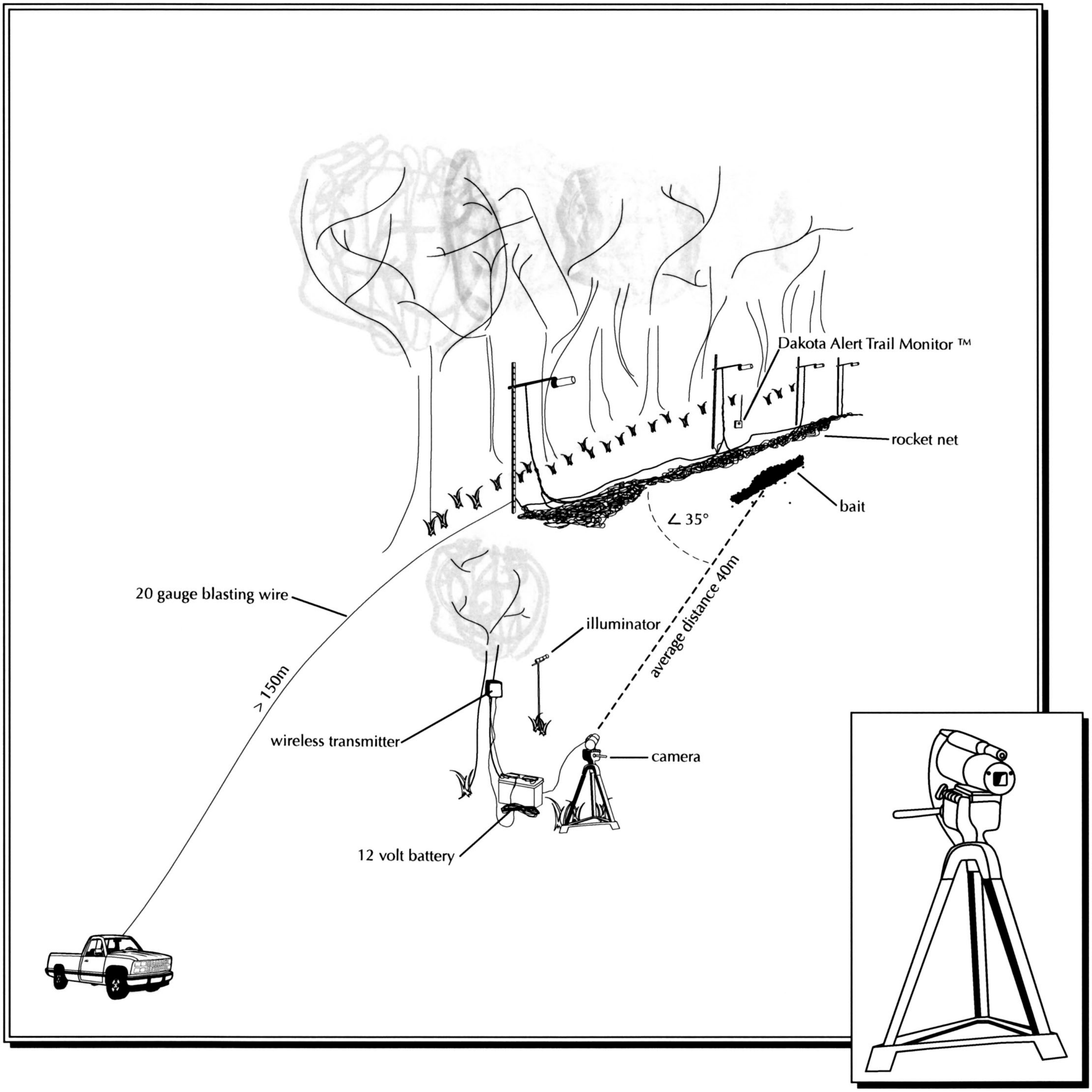

Figure 2. Illustration of typical remote video monitored rocket net with angles and distances for maximum observability.

"alert zone 1") to a handheld transceiver to alert the observer in the vehicle. The unit had a 3.2 -m range and was battery operated.

When lighting conditions were low (e.g., on a clear night with no moon: 0.001 lux), we used a battery-powered infrared illuminator (ITT Industries, Roanoke, Virginia) to augment natural light. The infrared light (not visible to deer or human eyes) was detected by the night vision camera and the image transmitted to the video monitor appeared as a white light shining on the targeted area. The illuminator was placed ≤20 m from the rocket net at the same angle as the camera.

After setting up the video system, we ran 20-gauge blasting wire, which was connected to the rocket circuit, to the vehicle blind. Inside the vehicle blind, the observer oriented a wireless receiver toward the transmitter and plugged it into a Sony GVD 800 video cassette player with a 10.1-cm video screen. The receiver operated on the vehicle's 12-volt power system and an external battery powered the player. We checked the video signal for picture quality and then shut it down to conserve battery power. We used a multi-meter tester to test the circuit for continuity. The handheld Dakota Alert transceiver was then turned on and monitored for an alert signal.

When the observer heard an alert signal, he/she turned on the video player to observe the source of the alert. If a target deer was present, the observer watched the video player until the animal was in shooting position and then detonated the rocket net with a Handi-Blaster model HB10 (Blaster Tool and Supply, Frankfort, Kentucky). The observer drove or ran to the capture site and processed the animal. An additional person was on standby nearby and called via radio to assist with handling. Processing and handling procedures used were identical to the on-site method.

Remote video trapping periods were August 2004, September 2004, January to March (winter) 2005, and June–August (summer) 2005. We used one or two camera systems depending on observer availability during remote video periods. The September 2004 period is reported but not included in summaries due to attempts to capture yearling and adult bucks only.

Results

We captured 50 deer 59 times during all trapping periods; seven deer were recaptured during the remote video period. We captured 15 (5M : 10F) deer with the on-site method and 35 (17M : 18F) deer with the remote video system. One adult male was captured using the on-site method and five adult males were captured using the remote video system. Capture rates using the remote video system method were almost double the capture rate using the on-site method (Table 1 and Fig. 3). On-site observers averaged 4.7 (N = 20, SE = 0.21) hours/night monitoring during winter 2004 and remote video observers averaged 5.7 (N = 62, SE = 0.34) hours/night during winter 2005. During summer 2004 on-site observers averaged 2.7 (N = 42, SE = 0.15) hours/night monitoring and remote video observers averaged 2.5 (N = 16, SE = 0.32) hours/night during summer 2005. During January–March 2004 and 2005, 31.6 (N = 3, SD = 21.2) and 14.0 (N = 25, SD = 11.0) hours passed between captures, respectively. For the summer periods, 2004 and 2005 respectively, 11.3 (N =10, SD = 9.6) and 5.8 (N = 6, SD = 4.6) hours passed between captures. Average handling time was 27.8 (N = 11, SD = 9.4) minutes for the traditional on-site method and 16.8 (N = 34, SD = 10) minutes for the remote video method.

Cost of the wireless remote video system was US$6,995. Additionally, the Dakota Alert trail monitoring system cost $130 and

Table 1. White-tailed deer trapping and monitoring effort (hours) for traditional on-site and remote video methods, Amelia Springs, Virginia, 2004–05.

Net monitoring method	Hours monitoring net	Period	Deer captured	Capture rate (deer/hour)	Capture rate (hours/deer)	Capture mortalities
On-site	94.9	Jan–Mar 2004	5	0.05	19.0	0
On-site	113.5	Jun–Aug 2004	10	0.09	11.3	2
Remote video	6.8	Aug 2004	1	0.15	6.8	0
Remote video	232.4[a]	Sep 2004	2	0.009	116.2	0
Remote video	351.1	Jan–Mar 2005	34	0.10	10.3	2
Remote video	40.7	Jun–Aug 2005	7	0.17	5.8	0
Total	839.4		52			4

a. Trapped for bucks only

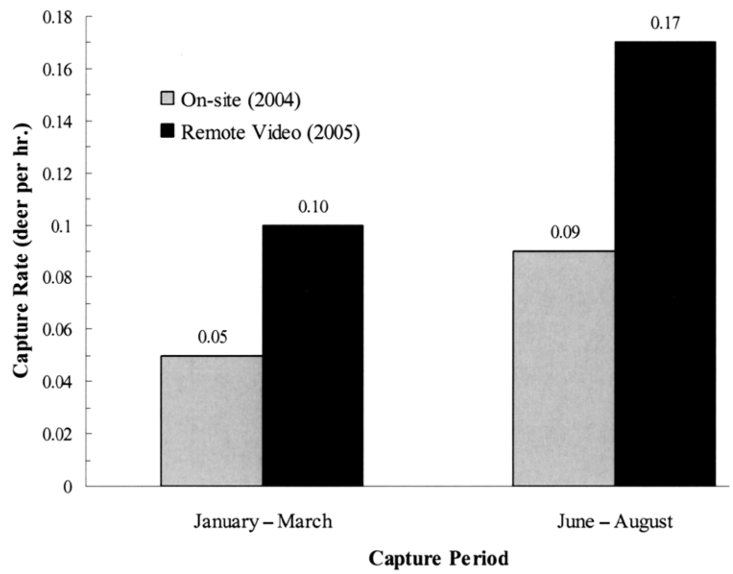

Figure 3. Comparision of white-tailed deer capture rates for on-site and remote video periods, Amelia Springs, Virginia, 2004-05.

the ITT Illuminator, $125. Blasting wire costs were $15/500 feet and a blasting machine $185. A deep-cycle battery and camera tripod added an additional $65. Total system cost above the traditional rocket net set-up cost ($1,400) was just over $7,500.

Discussion

Our results suggest that the remote video system is more efficient for capturing white-tailed deer than the traditional method of sitting on-site. This was particularly true for adult males who may be more wary of rocket net sites than other age/sex groups. We captured twice as many deer with greater comfort to the researcher (i.e., sitting in a climate controlled vehicle) with the video system as with the traditional method. With the on-site method, researchers were exposed to the elements whether in a tent blind or treestand. Scent from the observer was also a problem as deer have a highly-developed sense of smell (Miller and Marchinton 1994). Although care was taken to orient blinds downwind from bait, many times while using the on-site method we experienced the snorting of deer and subsequent flight before the animal reached the trap site, potentially indicating an awareness to human presence. We believe the remote video system eliminates the human scent problem. We also found that our observers were able to stay longer periods of time monitoring a site using the video system.

Although total cost of the video system is expensive ($7,500), thermal imaging cameras, which could be modified for similar use, cost almost twice as much at $13,257 for a comparable unit (Ditchkoff et al. 2005). Less expensive camera units (<$200) utilizing infrared LED illuminators could be modified for use. The drawback of the less-expensive cameras is greatly reduced image quality and camera range (<15m). A less-expensive camera would have to be placed behind the rocket with a narrow view of just the bait pile.

During this study, we had no animal injuries due to rocket net discharge, and capture myopathy rates for this study (7%) were consistent with rates from other studies (Peterson et al. 2003) using rocket nets. A less-expensive camera unit probably would not allow for observation of the entire trap area which may increase risk of an injurious net discharge. An obvious advantage to the behind net setup was ability to determine whether an animal was previously marked, sparing the animal another stressful capture event and the researcher wasted effort and time reprocessing the animal. Additionally, this setup may make it possible to identify the sex of a deer by presence of a pedicle in late winter.

Although our experience suggests that a remote video system increases efficiency of deer capture, we acknowledge that other variables could have influenced our trapping success rates. Different mast conditions, changes in weather, and changes in population size could have caused deer behavior to differ between time periods compared for the two methods. Researcher experience also likely improved over the study period. However, we believe that summer range conditions between years were similar with an abundance of natural foods available, yet capture rates with remote video were approximately twice the on-site method for the same period. Additional research and field experience with remote video systems is needed to confirm benefits we have presented.

Other applications

A remotely-monitored video system has many potential applications to aid in capture and monitoring of wild animals. Such a system has the potential to function for months at a time in remote locations by using a solar charger to recharge the battery. With a range of many miles, rocket nets, cannon nets, drop nets, or any other type of capture device could be monitored from a central location, keeping human influence on-site to a minimum. A potential modification to our system would be wireless remote detonation of the rocket net. A remote video system also could be used to monitor nests, den sites, trails, or food resources. We urge our colleagues who are using similar techniques to present results of their work so that others can evaluate benefits of technological advances in wildlife management.

Acknowledgments

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