Outdoor Fa

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A VIDEO TIME-LAPSE SYSTEM FOR WILDLIFE SURVEILLANCE[a]

The inability of researchers to make continual and accurate observations over extended periods of time limits their understanding of the nocturnal behavior of animals. Ozoga and Gysel (1965) reported on a mechanical recorder for measuring deer activity. Richter (1955) used "Scotchlite" tape and artificial light to identify small animals. Prenzlow (1969) tested a pulsating neon light embedded in a canvas collar on elk.

Photographic recorders have also been used. Dodge and Snyder (1960) used a 16 mm camera triggered by a solar cell. A more recent wildlife photographic system produced by Lund Electronics utilized an infrared sensor to trigger a super 8 mm camera. Patton et al. (1972) and Temple (1972) likewise discussed application of a super 8 mm camera with time-lapse capability. All such photographic systems, however, are limited by the sensitivity of the film to the low light levels prevailing at night.

Several types of night vision devices, such as described by Swanson and Sargeant (1972), and surveillance systems developed primarily for military or research purposes, have become available for commercial use. One such system involves the use of a silicon diode camera and a time-lapse video recorder. The present paper describes a system utilizing the silicon diode camera at twilight to deep twilight and under low artificial light (10.0 to 1.0 Lux[b]) levels.

METHODS AND MATERIALS

In the course of evaluating deer *(Odocoileus hemionus hemionus)* behavior near a deer underpass in western Colorado, a video surveillance system was used from May 19 to June 30, 1972, and from October 17 to November 23, 1972, during the spring and fall migrations. Components of the system were enclosed in a housing for the purpose of maintaining relatively low humidity and constant temperature. A shroud was placed over the observation window (Fig. 1).

Fig. 1. The housing containing the video surveillance system was stationed near the Vail deer underpass. (Photo by authors)

The thermopane glass window covering could readily be removed or replaced from inside the housing. Externally, the housing was painted forest green in order to blend with the background. The housing size, 5 feet high, 4 feet wide, and 5 feet long, allowed sufficient space for a seated occupant to operate the equipment, situated so as to place the camera approximately 25 or 30 feet from the underpass entrance area, covering a 30° field of view.

The basic components, including the TV camera, video recorder, and monitor, are shown inside the housing in Figure 2. The camera (RCA PK-501) was equipped with silicon diode array vidicon (pick-up tube), with a spectral response image tube of 0.45 to 1.1 μ, 0.7 to 1.1 μ

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[a] Contribution from Federal Aid Project W-38-R

[b] 1.0 Lux equals 0.093 foot-candles

being in the infrared range. Both infrared and visible light (0.4 to 0.7 μ) may therefore, be used as a light source. Most important, however, was the sensitivity of the image tube to low light levels (down to about 1.0 Lux). The time-lapse video recorder was a Panasonic NV-8020P, factory set to record at normal (60 fields/sec) and 24-hour time-lapse (1.5 fields/sec) speeds on 1/2-inch video tape. Table 1 summarizes the total components of the system and lists the approximate costs.

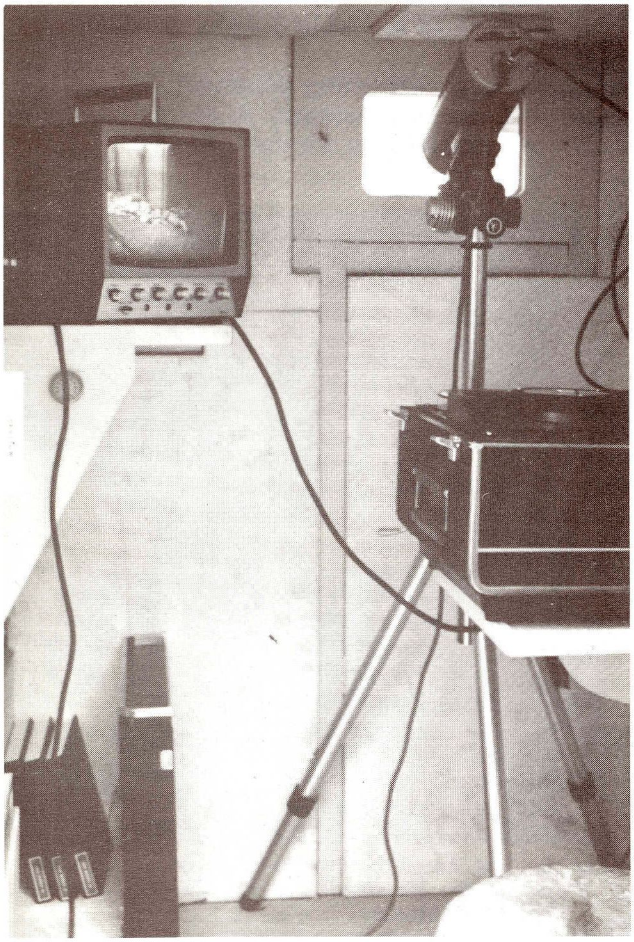

Fig. 2. The basic components of the video surveillance system included the TV camera, video recorder, and monitor. View of underpass entrance is shown on the monitor. (Photo by authors)

Monitoring deer behavior at the underpass was carried out daily, May 18-July 1 (except for several recorder failures) and October 17-November 23, 1972. The system was activated in the evening to provide approximately 12 hours of continuous recording. In the morning, an operator replayed the video tape, using the normal speed (58.5 more fields/sec faster than recorded) for locating the presence of deer imagery or for quick review, and the 24-hour, time-lapse speed (same as recorded) for more detailed observations. The number of recorded deer approaches, entrances, and exits were tallied, and behavioral responses exhibited at the underpass entrance, such as wariness, flight reaction and investigative behavior, were noted.

Table 1. Components and approximate costs of video time-lapse system.

Component	Approximate Cost
RCA[a] PK-501 camera w/silicon diode array vidicon	$1,595
Camera lens:	
1. Fujinon CCTV CF 25 B-4EE auto iris (25 mm f/1.4)	325
2. Ampex televsion lens LE610 (25 mm f/.95)[b]	140
Panasonic NV-8020P time-lapse video recorder	1,750
Panasonic 9-inch TN-95 monitor	295
Husky 4 tripod with TV head	82
Ampex 0.5-inch video tapes (2400 D) 5 @ $22 each	110
Total	$4,297

[a]Trade and company names are used for the benefit of the reader and do not imply endorsement or preferential treatment by the Colorado Division of Wildlife.

[b]Used only as an alternate and back-up lens.

RESULTS AND DISCUSSION

The surveillance system was most effective during early morning and evening hours (twilight), but gave satisfactory results at night under low artificial light levels (two baffled 150w outdoor floodlights). Imagery of deer recorded under these conditions was later reviewed with acceptable to good definition. Most deer were found to make several approaches to the underpass before entering. During the test period, 890 entrances occurred at the underpass and 2,234 approaches (Table 2) were recorded, or 2.5 approaches per entrance. The number of passages was calculated by subtracting the number of exits from the number of entrances. Using this method, 3.1 approaches per passage were determined, based on 728 passages.

Table 2. Number of deer approaches, entrances, exits, and passages recorded by video system at the Vail deer underpass during the spring and fall migrations, 1972.

Month	Entrances	Exits	Passages[a]	Approaches[b]
May[c]	93	26	67	289
June[d]	186	23	163	728
October	273	49	224	525
November	338	64	274	692
Total	890	162	728	2,234

[a]Number of net passages equal number of entrances minus number of exits.

[b]Number of times deer appeared in the field of view.

[c]May 19 and May 26-31, 7 days.

[d]June, except 16th, 18th, and 22nd, 27 days.

Many deer looked overhead during approaches and before making entrances (Fig. 3). Others occasionally showed flight reaction, leaving the field of view or exiting the underpass rapidly.

Fig. 3. Photograph from the monitor screen during video replay shows deer entering underpass. The close-up photograph failed to show the same clarity as displayed on the monitor. Note deer looking overhead. (Photo by authors)

Six collared animals were recorded by the video system (Fig. 4) during the spring migration and 7 during the fall. These included several deer banded with automatic tagging devices (Siglin 1966). Based on tagging locations, the deer had traveled a minimum of 0.76 mile along the 8-foot fence before arriving at the underpass entrance.

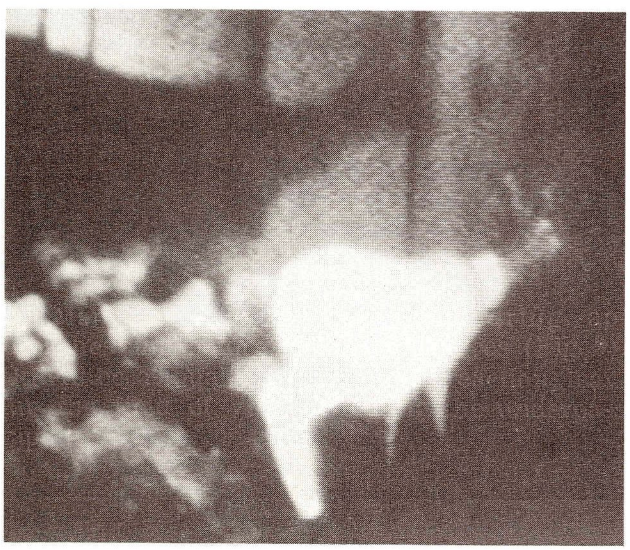

Fig. 4. Photograph from monitor screen shows one of several collared animals recorded entering the underpass. (Photo by authors)

Use of the time-lapse video surveillance system has provided a new method of recording deer activity and should prove valuable for other animal-behavior studies.

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Dale F. Reed
Assistant Wildlife Researcher

Thomas M. Pojar
Assistant Wildlife Researcher

Thomas N. Woodard
Senior Research Technician

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