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hour period. The average catch in 12 netting operations was 43 jackrabbits; the maximum number captured in one night was 79. With an experienced crew, it has been frequently possible to capture 80 percent or more of the jackrabbits sighted. Jackrabbit mortality from netting has been less than 3 percent; most mortalities are a result of animal injury by an overzealous netter, or contact with the vehicle.

LITERATURE CITED

CUMMINGS, G. E., AND O. H. HEWITT. 1964. Capturing waterfowl and marsh birds at night with light and sound. J. Wildl. Mgmt. 28(1):120–126.

DREWIEN, R. C., H. M. REEVES, P. F. SPRINGER, AND T. L. KUCK. 1967. Back-pack unit for capturing waterfowl and upland game by night-lighting. J. Wildl. Mgmt. 31(4):778–783.

JACKSON, D. G. 1962. Dollars from jacks. New Mexico Conserv. Dept. Wildl. 7(3):22.

LABISKY, R. F. 1968. Nightlighting: its use in capturing pheasants, prairie chickens, bobwhites and cottontails. Illinois Nat. Hist. Survey Biol. Notes 62. 12pp.

LINDMEIER, J. P., AND R. L. JESSEN. 1961. Results of capturing waterfowl in Minnesota by spotlighting. J. Wildl. Mgmt. 25(4):430–431.

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AUTOMATED RECORDINGS OF BODY TEMPERATURE FROM FREE-RANGING YELLOW-BELLIED MARMOTS

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Abstract: A simple, portable system for the automatic collection and storage of radio-telemetry data is described. Data on the deep body temperatures of two yellow-bellied marmots (*Marmota flaviventris*) are reported for 3 days.

The advent of radio-telemetry has initiated the development of few automated recording and tracking systems (Cochran et al. 1965, Cochran 1967). While telemetry methods provide the potential of gathering vast amounts of data on the behavior and physiology of animals, most of these data are not collected or used because data-gathering techniques are inadequate. This paper describes the design of a portable, self-contained receiving and recording system for the automatic collection of telemetered data and reports some data retrieved by that system. The study was supported by an NSF Grant to K. B. Armitage, the University of Kansas.

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METHODS

Our design criteria were as follows: (1) portability; (2) low maintenance; (3) 100–200 m range; (4) high reliability. A block diagram of this system is given in Fig. 1. An incoming signal from a temperature-sensitive, pulsed transmitter (Pauley et al. 1968) is received by a portable receiver (Shirer and Downhower 1969). The receiver runs continuously; its output is connected to a battery-operated, portable tape recorder. (The tape recorder should have a capstan drive and an effective AGC (Consumer's Reports 1969) through a switching circuit controlled by a windup clock.) The switching circuit turns on the tape recorder for about 80 seconds every 30 minutes and allows the output from the

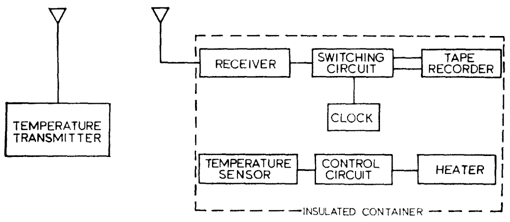

Fig. 1. A block diagram of the transmitting and receiving systems. Details of the receiving and recording system and the temperature control system are given in the text.

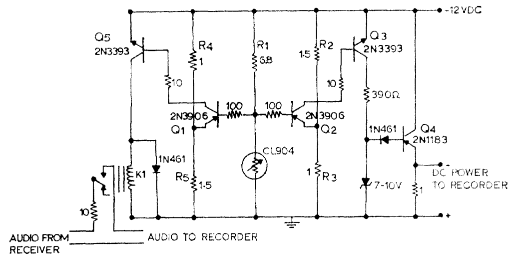

Fig. 2. Schematic of the switching and timing circuits. All resistances are × 1000 unless otherwise noted.

receiver to be recorded for about 70 seconds of that time. The entire system, with the exception of the battery and antenna, is placed in a plastic foam food chest. The receiving antenna consists of a 108-inch whip antenna with a four-element ground plane. The operating frequency of the system is 27 MHz. For maximum receiver and recorder stability, the interior of the food chest is maintained at 30 C by a thermostat circuit. Power is supplied by a 12-volt automobile battery.

Fig. 2 is a diagram of the switching circuit. As long as sufficient light reaches the photocell, its resistance remains low and transistors Q1 and Q2 do not conduct. As the columnated light is interrupted by the minute hand (which has been widened and has had a 180° extension added to give light interruption every 30 minutes) the resistence of the photocell increases, turning on Q2, and then, about 5 seconds later, Q1. The 5-second delay is due to the different bias voltages on the emitters of Q1 and Q2. Q2 biases Q3 into conduction, which sends power to the tape recorder via Q4. When Q1 comes on, relay K1 is energized through Q5, which couples the audio output of the receiver into the tape recorder. As the light begins to reach the photocell again, relay K1 is de-energized, followed 5 seconds later by the interruption of power to the recorder.

Temperature stability of the food chest is maintained through a sensitive Schmitt trigger (Q6 and Q7) which switches power "on" or "off" to four 30-ohm heater resisters through Q8 and Q9 (Fig. 3). Temperature sensing is provided by a thermister in the input bias to Q6. The operation of the circuit is made independent of minor changes in battery voltages by using zener diodes CR1 and CR2. The voltage generated over CR1 is used with Q10 to provide power to the receiver.

The system, as described above, was serviced daily to replace the recording tape and to wind the clock. We found that a 3¼-inch reel of ½-mil tape, recorded at 1⅞ inches per second would record for 24 hours. Every third day the battery was exchanged and recharged.

The transmitters used in this study were calibrated in a constant temperature water bath at 30, 35, and 40 C. Both transmitters showed a linear increase in pulse with temperature (An increase in pulse rate of 1 pulse/minute was equivalent to an increase in temperature of 0.1 C).

The animals used in this study were yellow-bellied marmots from one of several colonies located in the vicinity of Gothic, Colorado (Downhower 1968).

Two animals were instrumented in the summer of 1968 with transmitters surgically implanted in the peritoneal cavity (Down-

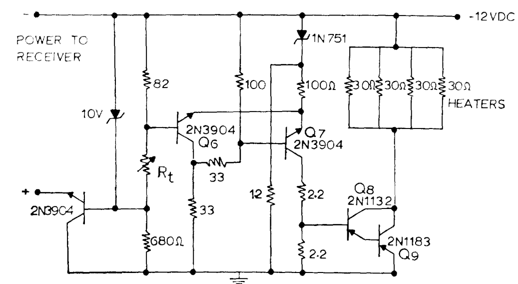

Fig. 3. Schematic of the temperature control circuit. R_t = 100K @ 25 C. All resistances are × 1000 unless otherwise noted.

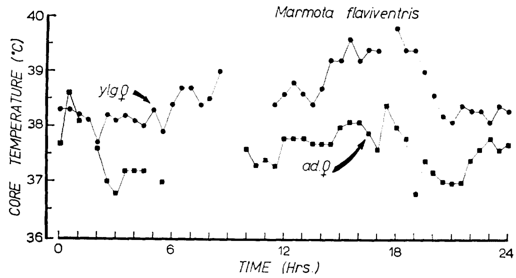

Fig. 4. Thirty minute averages for 3-day periods for two yellow-bellied marmots.

hower 1968). The experimental animals were released back into the colony the day following the operation, but no temperature data were collected for at least 1 week subsequent to the operation.

RESULTS

One of the experimental animals was a yearling female, the other a resident adult female. Temperature data were collected on each female for 3 days. Approximately 80 percent of all the expected records were obtained. It was later determined that the rf output of the transmitter was not as great as we had anticipated, hence the working range of the system was reduced to about 30 m. As the receiving unit was placed in the center of the colony, recordings were obtained only when the animals were in that area; when the animals left the burrow area to forage, they moved beyond the range of the receiver and consequently no data was collected at those times.

Recording from the yearling female was initiated on June 13. On June 15, the yearling disappeared from the colony and was not seen again. Recording was then shifted to the adult female and data were retrieved from her transmitter for the subsequent 3 days. Thirty minute averages for the 3 days for each of these two animals are presented in Fig. 4.

The yearling maintained consistently higher body temperatures than the adult. For both individuals it appeared that at this time of year, the average body temperature increased throughout the day and peaked at about sunset. Body temperatures dropped precipitously (circa 2 C.) after that time for both females, but the differences in body temperature between the two animals were maintained.

LITERATURE CITED

COCHRAN, W. W. 1967. Radiolocation and tracking of animals—an inexpensive triangulation recorder. A.I.B.S. BioInstrumentation Advisory Council Info. Module M-14. 31pp.

———, D. W. WARNER, J. R. TESTER, AND L. B. KUECHLE. 1965. Automatic radio-tracking system for monitoring animal movements. BioScience 15(2):98–100.

CONSUMER'S REPORTS. 1969. Battery tape recorders. Consumers Rept. 34(12):244–245.

DOWNHOWER, J. F. 1968. Factors affecting the dispersal of yearling yellow-bellied marmots (*Marmota flaviventris*). Univ. Kansas, Lawrence. Ph.D. Thesis. 161pp.

PAULEY, J. D., H. W. SHIRER, AND D. D. PIPPITT. 1968. A simple pulsed transmitter for telemetering body temperature from free ranging animals. I. E. E. E. Natl. Telemetering Conf. Rec., L. Winner, Editor. Pp. 386–390.

SHIRER, H. W., AND J. F. DOWNHOWER. 1969. Radio tracking of dispersing yellow-bellied marmots. Trans. Kansas Acad. Sci. 71(4): 463–479.

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