Outdoor Facts

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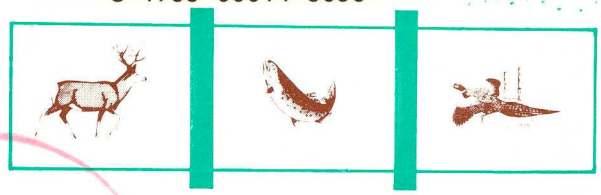

Game Information Leaflet **Number 105**

HEART-RATE MEASUREMENTS IN MULE DEER RESEARCH[1]

Two areas of mule deer research have recently been initiated in Colorado. One thrust concerns estimating "carrying capacity" of deer winter ranges (Carpenter 1976). The second effort will focus on the effects of harassment on mule deer (Freddy 1977). Within both research projects, ascertaining heart-rates of deer will be important.

The idea of a finite carrying or grazing capacity for a range is not new, having been advanced by Stoddart and Smith (1955). However, the concept of carrying capacity based on energetics of wild animals is relatively new (Moen 1973). During winter an animal survives by expending energy (fat reserves) to consume energy (plant material). To properly estimate carrying capacity the amount of plant energy available to the animal must be determined and the amount of energy the animal expends to consume the plant energy must be determined. Simply stated, an energy budget must be formulated for the animal.

Nutritional values of plants can be approximated by chemical analyses (Robbins et al. 1975). However, energy expended by free-ranging animals is difficult to estimate. An accepted technique used to measure energy expended by an animal is to measure oxygen consumed (Brody 1945). This can be accomplished by using a facemask apparatus or placing the animal in a respiration chamber. Each of these approaches restricts the activity of the animal.

An indirect method of estimating energy expended without restricting the activity of the animal involves measuring heart-rate. Several studies (Bradfield et al. 1969; Datta and Ramanathan 1969; Morhardt and Morhardt 1969; Webster 1967; Wyndham et al. 1959) have established a relatively strong relationship between heart-rate and oxygen consumption, thereby indirectly estimating energy expended. Work by Kautz (1977) established a positive relationship between heart-rate and oxygen consumed in semitame mule deer fawns. Holter et al. (1976) also found a positive relationship between heart-rate and metabolic rate in captive, adult white-tailed deer. These studies form a basis for pursuing heart-rate monitoring of free-ranging deer to estimate energy expended by animals and thus potentially improve estimates of carrying capacity.

Measurements of heart-rate can also aid in assessing the effects of harassment on deer. According to Gove (1965), to harass means to worry or impede by repeated raids, or exhaust, fatigue, or annoy continually or chronically. Implicit in this definition is an emotional stress (worry) and a physical stress (fatigue). Ideally, then, if we are to quantify the effects of harassment on deer, both types of stress should be investigated.

The close relationship between the adrenal hormones, epinephrine and norepinephrine, secreted during emotional stress and elevation of heart-rate is well documented in humans (Ganong 1973). Changes in heart-rate can thus serve as an index to emotional stress, or stress not necessarily eliciting an overt behavioral response.

Heart-rate can also quantify physical stress. The true cost of harassment to deer is the unnecessary expenditure of energy to overtly respond to harassment (Geist 1971; Severinghaus 1975). If heart-rate can function as an estimator of energy expended, then the physical cost of harassment can be ascertained.

Recent advances in microbiotelemetry (Cupal et al. 1974) provide instrumentation that allows monitoring of heart-rates of free-ranging deer. A heart-pulse transmitter is surgically implanted near the sternum of a deer. This transmitter transmits the heart-pulse signal to a transceiver neck-collar on the deer. The neck-collar retransmits the signal to allow radio-monitoring of heart-rate for up to 5 miles (Figs. 1 and 2). This

[1]*Contribution from Federal Aid Project W-38-R.*

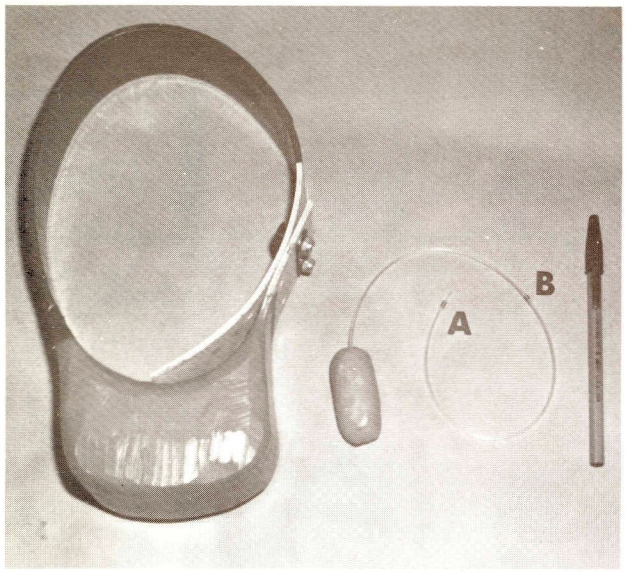

Fig. 1. Transceiver neck-collar, left, and heart-pulse transmitter, right, used to monitor heart-rates of deer. Two stainless steel electrodes exit from transmitter within a protective teflon plastic tube and surface outside the tube (points A and B) to contact animal tissue. (Photo by F. Waugh)

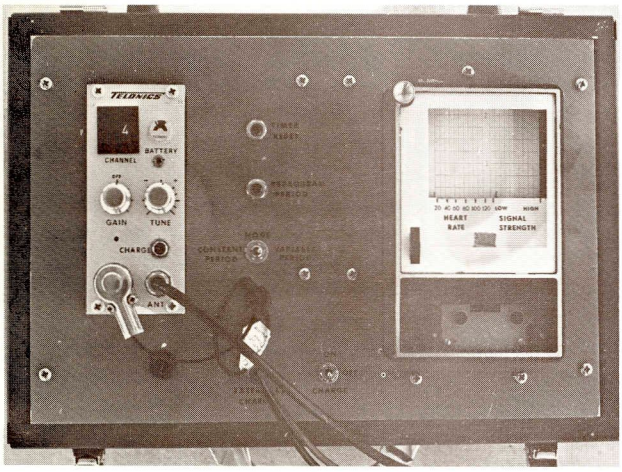

Fig. 2. Receiver and strip-chart recorder used to receive heart-rate signals. (Photo by D. J. Freddy)

system places minimal restraints on deer and will be used in carrying capacity and harassment research.

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