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BIOTELEMETRY — ITS USE IN VERTEBRATE CONTROL STUDIES

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Accurate evaluation of rodent control techniques has always been a laborious undertaking. It generally involves tedious pre- and post-treatment censusing by trapping, marking, track counts, reduction of activity, etc., and results, at best, must necessarily contain a significant amount of speculation by the investigator. The biologist conducting such studies has been constantly harassed by uncontrollable parameters such as trap response, immigration, emigration, predation, disease, and many others. Thus, there has been a pressing need of a more definitive technique for evaluating rodent control trials.

During the last decade, a new tool called biotelemetry has become available to the wildlife biologist. This technique has been defined as, "the instrumental technique for gaining and transmitting information from a living organism and its environment to a remote observer" (Slater 1965). As a practical tool, it is still in its infancy. Among its first reported uses in wildlife work were the telemetering of incubating temperatures of penguin eggs by Ecklund and Charltin (1959), a study of salmon movements by Trefethen et al. (1957), and a study of woodchuck movements by LeMunyan et al. (1959). Since these earlier studies, there has been a significant increase in telemetry studies of wildlife. These vary in complexity from simple movement studies to sophisticated telemetry of physiological variables. Many sizes and species of animals have been involved, such as deer mice, large ungulates, marine mammals, thrushes and buzzards.

Probably the major obstacle to further advances in wildlife telemetry is the inability of the biologist to meet the cost of development. The cost of telemetric systems can be fantastic and often precludes their use by most investigators. Another earlier limiting factor was the bulk of the necessary electronic equipment to be carried by the instrumented animal. However, recent advances in the development of miniaturized components such as the solid-state transistor, mercury cell battery, and printed circuit, have essentially removed this problem. These, plus the ingenuity of biologically oriented electronics personnel, have made wildlife telemetry possible.

Probably the most significant advance in biotelemetry has been the modified Colpitts oscillator circuitry developed by Cochran and Lord (1963). To my knowledge, this is the least complex and most inexpensive system yet developed. It is the type used in all our studies.

The Denver Wildlife Research Center conducts studies directed toward alleviating animal damage to forest and agricultural crops. Many of these studies are currently using radio-tracking or more sophisticated telemetry. Included are investigations of the black bear (Euarctos americanus altifrontaiis), the snowshoe hare (Lepus americanus washingtonii), and the mountain beaver (Aplodontia r. rufa) — all in the Pacific Northwest. Other Center studies using telemetry include those on the black-tailed jackrabbit (Lepus californicus) in southern Idaho, the porcupine (Erithizon dorsatum epixanthum) in northern California and the nutria (Myocastor coypus) in Louisiana. With the exception of the black bear investigation, which is basically a movement study, all involve efficacy evaluations of repellents, toxicants, attractants, or habitat manipulations.

Biotelemetry studies were started at the Olympia, Washington, Field Station in 1964 using the Cochran transmitter with certain modifications to suit our particular target species (Dodge and Church 1965). The transmitter is a simple device of eight electronic components. The antenna also serves as the collar for attachment to the animal. These units weigh from 4 grams to 1.5 kilograms, depending on battery size and the instrumented animal's carrying capacity. The radio-collars are mass-produced in the laboratory to operate on any animal with a normal neck diameter and are then customized to fit individual animals in the field. This technique has proved very successful, and we have had few losses due to improperly functioning transmitters. The life of the units varies with a number of parameters but is basically limited by battery size. The mountain beaver transmitter generally operates for 2 to 4 months, while the larger bear transmitter will function for a year or more.

Tracking receivers are either portable or mobile, depending on the movement of the instrumented animal. The animals with smaller ranges, such as the mountain beaver and hare, require only a small hand-held portable receiver, while the bear's far-ranging habits necessitate a more complex system of mobile receivers and stationary antenna towers.

Animal movements are plotted by logging a series of bearings from which line intercepts can be drawn, thus establishing the position of the instrumented animal. Individual animals are separated by different frequencies and pulses so that it is possible to track a number of them in one area.

Before testing control measures, telemetry is used to acquire data on home range, movement, activity centers, and the like. For instance, these studies have revealed that the mountain beaver's home range rarely exceeds three-fourths of an acre. Adult hares have a variable home range, depending on season, of approximately 10 acres with little overlap. Female black bears, particularly those with cubs, move in a rather restricted area of 2 to 5 square miles. Male bears range incessantly over a 15 to 40 square-mile area (Hartwell, H. 1966. Personal communication). Such data are used to determine the success of a control method.

Current studies of toxic baiting for control of mountain beavers, jackrabbits, and nutria are using telemetry to evaluate results. Screening trials for toxic baits or other methods for controlling mountain beavers employ groups of five radio-tagged animals. These animals are monitored before the trial to establish their home range and during the trial to determine their reactions to the baits, and then the effectiveness of the treatment is evaluated by detection and excavation of those that die. Dead mountain beavers have been accurately located and excavated from burrows 15 feet underground. Thus, telemetry affords an accurate evaluation of the effectiveness of the toxicant, aids in determining the mode of action of the toxicant, and locates the carcass, which yields information on potential secondary hazards, Much the same techniques are being used to evaluate toxic baits for nutria and jackrabbit control. Nutria can be located in their semi-aquatic burrows and the carcasses recovered and examined for detection of bait-marking materials. Dead jackrabbits can be located over long distances in their dense brushland environment where previously this would have been difficult or impossible.

Thus, telemetry affords the biologist a useful tool with which he can more reliably evaluate rodent control trials. It not only expedites the evaluation but is far less costly than previous methods. Adams (1965) estimated that before telemetry, each unit of information cost 1 to 5 dollars. Telemetry has reduced these figures a hundred-fold to 1 or 2 cents per information unit. This is a giant step forward for wildlife research.

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