John L. Fisher
Department of Biological Science
Northern Arizona University
Flagstaff, Arizona 86001

and

Stephen P. Cross
Department of Biology
Southern Oregon State College
Ashland, Oregon 97520

Battery-Light Tracking as a Technique for Studying Small Nocturnal Mammal Movements

Abstract

Movements of small nocturnal mammals may be monitored by attaching a small battery-light packet to individuals. Detected movements may be plotted in relation to a lighted grid or prominent physical features. The technique provides specific data concerning home range and microhabitat utilization in terms of temporal, spatial, and physical relationships.

Accurate data on movements of small nocturnal mammals are difficult to obtain. The majority of data have been collected by trap-mark-recapture methods, a technique with several limitations (Sanderson, 1966). In addition to having several inherent sources of error, trapping yields few data concerning the manner in which animals actually use the area defined as home range. In reviewing movements of small mammals, both Jewell (1966) and Sanderson (1966) have stressed the need for more information on activities and behavior within what is normally defined as home range. Attempts to provide more accurate data on both size and utilization of home range by using alternative techniques such as radioisotope tagging (see Ambrose, 1960; Godfrey, 1953), paper tracking (Sheppe, 1965; Justice, 1961), sand tracking (e.g., Siniff and Tester, 1965) have met with varying degrees of success. In a recent article, Buchler (1976) suggested the use of a chemiluminescent tag for tracking small nocturnal rodents. The merits of the technique were enumerated and details of procedure given. Also included was a brief reference to the related technique of marking with miniature light bulbs used in combination with small mercury batteries. The purpose of the present paper is to report on the detailed use of this latter technique which we have employed in the tracking of small mammals for several years.

Basically, the technique consists of attaching a "sub-miniature" light and a small mercury battery to an animal so that it may be followed visually at night. This technique is a modification of one used by Bellrose (1958) for tracking wild mallards at night. Additional lights, color coated mount-type pinlights attached to D-cells, are used to mark a grid or identify prominent landmarks so that movement distances of the experimental animals are more easily ascertained. This basic technique has been used on five species of small rodents and some other nocturnal animals with generally good results.

Figure 1. Adult *Peromyscus truei* with battery-light packet attached.

Several combinations of batteries and lights have been tried. The best combination found to date is a size 675 mercury battery and a JKL Components Corporation (2226 Barry Ave., West Los Angeles, CA 90064) WL1516 lamp having a life of approximately 16 hours. The 675 cells may be purchased as a number 177 battery which is a series of 675 cells connected by metal bands. When cut, the bands become tabs which may be used, after notching, as convenient connection points for the lamp leads without soldering. The light from this combination may be seen on a dark night up to 260 m with unaided vision. The battery-lamp pack, which weighs less than 2.5 gm, is attached to the animal by gluing it to the fur (Fig. 1), most successfully on the head between the ears, using Goodyear Pliobond Cement or Weldwood Contact Cement. Mice seem to carry the pack in this fashion without visible impairment of movement or activity. If the battery has a small piece of plastic electrician's tape glued to the base before attachment, it facilitates later removal by allowing separation of the battery from the tape rather than from the fur.

Connection of the lamp to the battery leads and attachment to the animal may be done in the field immediately after capture or in the lab with an animal held over from the previous night's trapping. There are some drawbacks to both methods, but current data from tracking *Peromyscus truei* indicate that apparently normal activity is resumed after animals are held over for a day before tracking. Ideally, the best results might be obtained if an animal were instrumented and tracked immediately after being trapped. This procedure is usually not possible without a trap signal to show when a trap has been entered. The alternative method of frequently checking traps, however, may influence normal activity patterns and trap success. Morning trap check and hold-over has the advantage of providing a larger number of individuals from which to select an experimental animal.

The data obtained by visual observation may be plotted in the field by recording the position of an instrumented animal in relation to the light grid pattern, or outstanding landmarks. A continuous line, with time of observation marked periodically, similar to the technique employed by Siniff and Tester (1965) for plotting some radio telemetry data, has been used successfully. Data plotted in this manner give a good representation of both the temporal and spatial utilization of home range. It represents a refinement of movement data obtained by traditional trapping methods with the added benefit of providing information on specific movement responses to both natural obstacles, such as rocks, vegetation, and waterways, and changing environmental conditions such as wind, rain, moonlight, and cloudcover. The technique also provides a relatively inexpensive and rapid means of locating homesites, important for many kinds of field studies.

Figure 2 is an example of how data collected in this manner may be plotted for interpretation or presentation. The figure shows data for *Peromyscus crinitus*, obtained near Diamond Craters, Harney County, Oregon, on the east edge of Malheur Wildlife Refuge. Several mice were light tracked by Fisher during July, 1975. By plotting the data in relation to a photograph of the habitat, several aspects of behavioral ecology may be noted. In addition to ascertaining overall range and duration of movements

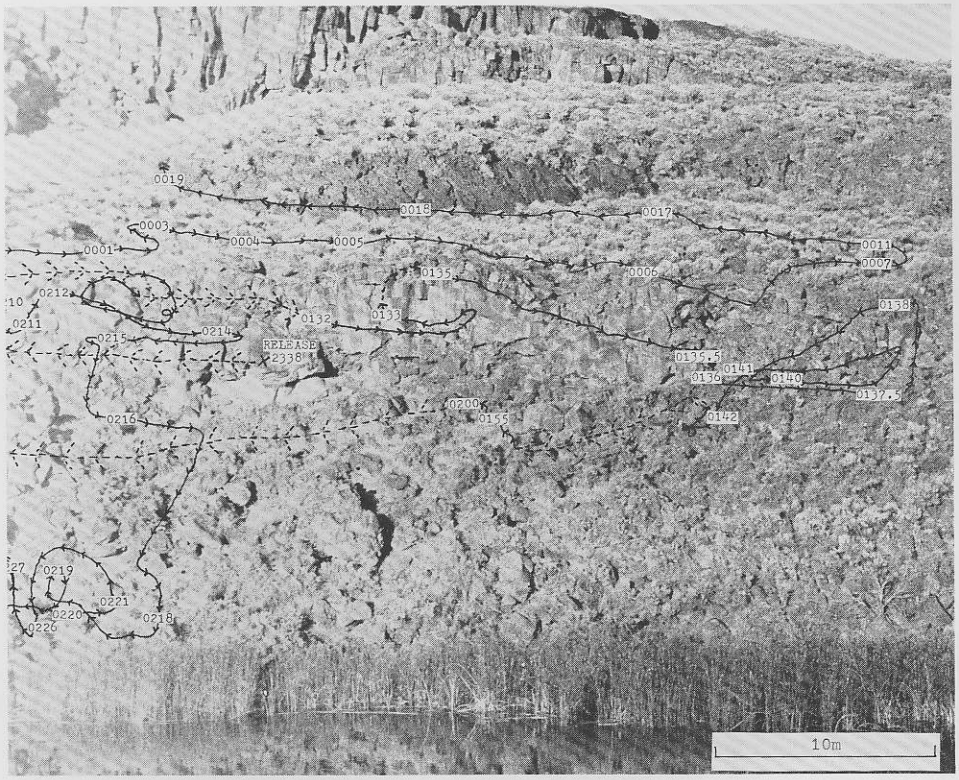

Figure 2. Part of one night's tracking data for a sub-adult male *Peromyscus crinitus*, obtained 14 July 1975, superimposed on a photograph of the corresponding part of the habitat. Location: Diamond Craters, Harney County, Oregon. Numbers=time of observation; solid lines=animal visible; dotted lines=animal not visible.

accurately, the relation to habitat is readily apparent. Referring to the specific case in point, one can deduce that the study animal traveled as fast at 27.3 m per minute between 0135 and 0135.5. More importantly, one can see that virtually all activity was confined to the rocky substrate whereas patches of bare ground and highly vegetated areas were avoided. Extended observations of this type allow precise examination and description of micro-habitat selection, utilization, and dimensions. Trapp (1972) used a generally similar technique for gathering behavioral data on ringtails, *Bassariscus astutus*, in the wild. The data may be treated quantitatively in a manner similar to that used by M'Closkey (1975) in his description of habitat for *Peromyscus leucopus*. Moreover, the observations confirm habitat affinities deduced from trapping studies (Deacon, *et al.*, 1964; Egoscue, 1964).

The technique has been tested, to varying degrees, on five species of nocturnal rodents, *Dipodomys heermani*, *Dipodomys ordi*, *Neotoma fuscipes*, *Peromyscus crinitus*, and *Peromyscus truei*. Cross has also used the technique for tracking homing bats, *Pipistrellus hesperus* and *Antrozous pallidus*. The battery-light package, modified by waterproofing in silicone rubber, has also been used to study the nocturnal movements of the Pacific pond turtle, *Clemmys marmorata*. Although the argument may be made that the weight and light of the tracking device affect the normal behavior of the instrumented animal, experiments with the above mentioned animals show that some aspects of nocturnal movements are more accurately ascertained in this manner than by any other known technique.

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