A TRACKING TECHNIQUE TO LOCATE SMALL MAMMALS AT LOW DENSITIES

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To optimize our livetrapping of low-density populations of lemmings (*Dicrostonyx kilangmiutak*) and voles (*Microtus oeconomus*) (0.2-0.4 animals/ha) in the Arctic tundra, we developed a powdered-slide tracking technique to determine if burrows were occupied. Painted microscope slides covered with talcum powder on a thin oil base were placed at all burrows on trapping grids, and only those burrows showing activity were trapped. Our capture success per trap tripled with this method in comparison with standard grid-stake trapping, and our effort per grid decreased by >50% after all burrows were initially located. This technique also should be useful in similar arid environments such as deserts, for obtaining relative indices of density, and for following toe-clipped animals.

Key words: ***Dicrostonyx, Microtus,* tracking techniques, Arctic**

Low-density populations of small mammals are difficult to study because the amount of data obtained per unit effort is low (e.g., Mihok et al., 1988). Hence, there is a tendency to study populations at times when they are abundant or only in good-quality habitat. Two major problems confront an investigator working on low-density populations. First, it may be difficult to locate the few active sites in a wide expanse of vacant habitat. This problem is compounded when there may be ample evidence (e.g., burrow sites, runways) that the animals have been there, but because of a recent population decline most sites are inactive. Second, even after active sites have been located, frequent movements may make repeated live capture difficult. Both problems plagued us in a study of the collared lemming, *Dicrostonyx kilangmiutak,* and the tundra vole, *Microtus oeconomus.*

Burrows of lemmings and voles are obvious throughout the Arctic tundra, and lemming burrows in particular appear to be long lasting (≥1–2 years). Some burrows in the Churchill, Manitoba, region appear to last >15 years (R. J. Brooks, pers. comm.). Though in some cases it is obvious that a burrow is occupied because of fresh digging (Brooks and Banks, 1971), radiotelemetry and livetrapping indicate that burrows often were occupied without any observable fresh sign, especially when newly weaned young are present in the population. We needed a simple tracking technique to indicate the presence of animals. Three methods generally have been used to record the footprints of small mammals on tracking boards: a smoked-paper technique (Johns, 1979; Justice, 1961; Marten, 1972; Sheppe, 1965), metal plates coated with liquid talcum powder in silicone (Brown, 1969), and white tiles, partially covered with a mixture of printing ink and mineral spirits (Lord et al., 1970). With all of these, the production of tracking boards can be time consuming, messy, and produce a strong odor (Lord et al., 1970). We developed a simple tracking

technique to identify active burrows and, when combined with livetrapping, we maximized our efficiency in studying small mammals in the Arctic tundra of northern Canada.

Materials and Methods

Since 1987, we have conducted population studies of collared lemmings and tundra voles at Pearce Point, Northwest Territories, Canada (69°49'N, 122°41'W). This site is on the Arctic coast and is characterized by coarse, shallow, slightly calcareous soils supporting a *Dryas-Salix arctica* discontinuous tundra (Ritchie et al., 1987). We established livetrapping grids in a row-and-column fashion with trapping stations spaced 30.5 m apart. All grids were trapped weekly from June through August. In 1987, we used only standard livetrapping techniques, placing one Longworth trap ≤5 m from every second station. Traps were moved to the adjacent station in alternate weeks so that the entire area was trapped every 2 weeks.

In 1988, because of extremely poor trap success the previous year, we abandoned the scheme of trapping at grid stakes and instead trapped only at active burrow sites. These were determined by a powdered-slide technique we developed that was simple, inexpensive, and rapid, and one in which the tracking surfaces, slides, fit nicely inside small-mammal burrows. Unfrosted, glass microscope slides (2.5 by 7.5 cm) were spray painted on both sides with a black, matte enamel paint. Slides were then coated with a thin film of light oil, dipped into a jar of talcum powder, and prior to being taken to the field, were stored in microscope slide boxes containing 25 or 100 positions; we found that the smaller, plastic slide boxes were more convenient in the field. We found that the best oil producing a uniform film on the slide was machinist's oil (Tellus Oil 10, Shell Company). Oil containing detergents (e.g., standard motor oils) were less satisfactory as they caused beading on the slide and resulted in an uneven talcum coat. A film of oil was applied by a soft cloth saturated in the oil. The same procedure was used for new slides and for soiled slides brought in from the field. In one stroke, the cloth both cleaned the soiled slides and applied a new oil film. One person was able to prepare up to 300 slides/h.

All burrows within the study area were located by a systematic search at the start of the season and were marked with surveyor's flags. Slides were then placed inside the entrance to each burrow (the width of the slide being slightly less than the diameter of the burrow) and left overnight. The next day, all slides were removed and those sites with positive sign received a Longworth trap and a flag of a different color. On permanent trapping grids, those burrows without active sign retained the original flag, and thus there were flags of two colors present at active burrows and one flag at inactive burrows. All burrows could be reassessed again rapidly with powdered slides prior to a subsequent trapping. On removal areas, flags were removed from inactive burrows.

Results and Discussion

In 1987, the trapping effort was labor intensive, occupying one person's time for 2 days/week, yet was unproductive. Trapping success during the first 6 weeks (number of animals caught/trap/2-day trapping session × 100) was low ($\bar{X}$ = 9.0%, SE = 1.9, n = 13). In subsequent years, we trapped only at active sites as determined by the powdered-slide tracking technique.

We present only the data collected in 1989 on four grids to indicate the efficacy of this technique. These grids averaged 23.3 ha (SE = 2.7; range, 18.6–28.4) in size. Though the initial effort to locate all burrows was time consuming ($\bar{X}$ = 18.0 h/grid; SE = 2.8; range, 14–26), subsequent placing of powdered slides at burrow sites that had already been located reduced the effort by >50% ($\bar{X}$ = 6 h/grid; SE = 1.2; n = 3; range, 4–8; these data were recorded for only three grids). These three grids had an average of 418.8 burrows/grid (SE = 54.4; range, 325–575), of which 26.6% (SE = 3.8; range, 10–37) were deemed active, and each of which received a livetrap. The average trapping success increased to 31.9% (SE = 3.8; n = 7; range, 14–42) and hence was >3× that obtained with simple grid-stake trapping. We assumed that the densities of small mammals in these 2 years were comparable, and that the lower success in 1987 was related to poor trap placement. Population demography for the other years (1988–1990) was similar, with low densities occurring every

summer (0.2–0.4/ha), and we suggest that 1987 was a replicate of subsequent years. Thus, lemmings and voles at these low densities and with low vegetative cover do not appear to seek out the traps, and trapping at active burrow sites is the most efficient method to study them.

There are a number of reasons why trapping success still remained at about one-third of the traps set at active burrow sites. First, though most burrow systems usually contained only one animal, most burrow systems had two or more entrances and traps were placed at each of these. Second, some animals were trap-shy (Andrzejewski et al., 1971; Tanaka, 1980; Tanton, 1965) as they were known to be in the burrow because they carried a radiocollar from a previous capture (Boonstra et al., 1990). Finally, some burrows probably were misclassified as active because other factors, such as wind moving grass over the slide or large spiders crawling over the slide, made scratches on the slides.

We have used this technique simply to indicate presence or absence of animals prior to livetrapping, and thus all demographic information (densities, survival, recruitment) was still based on actual capture of animals. The technique optimized our effort in this low-density environment. This technique also should be valuable in other open areas such as sagebrush flats, arid grasslands, or any other area in which burrow sites or runways are readily obvious. The technique could be used independently of livetrapping to give relative indices of population density (Caughley, 1977). A number of studies have reported using powdered-tracking techniques to individually identify toe-clipped animals (Brown, 1969; Justice, 1961; Sheppe, 1965). The thin coat of talcum on the slides provides an ideal surface for recording the fine detail of footprints and hence should prove useful for these purposes. In conjunction with toe clipping, the powdered-slide technique could provide an indication of the presence and number of unmarked individuals in the population.

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