EFFECTS OF SOIL DISTURBANCE ON SMALL MAMMAL CAPTURE RATES

Jeffrey Root[1], Department of Range, Wildlife, and Fisheries Management, Texas Tech University, Lubbock, TX 79409
Eric E. Jorgensen, USEPA, P.O. Box 1198, Ada, OK 74820
Stephen Demarais, Department of Wildlife and Fisheries, Mississippi State University, Mississippi State, MS 39762

Key words: disturbance, microhabitat, New Mexico, small mammals.

INTRODUCTION

Small mammal trap-sites often are prepared to enable trap placement on a level surface. This is frequently accomplished by scraping one's foot across the substrate. Soil disturbance at individual trap-sites may increase rodent capture probability (*Sensu* Thompson 1982). Whereas several studies since Price (1978) have investigated microhabitat effects, none have quantitatively examined the effect of soil disturbance caused by trap-site preparation on small mammal capture rates. Jorgensen and Demarais (1999) hypothesized that disturbance may cause a qualitatively different trap response by small mammals in open microhabitats compared to those covered by shrubs and detritus.

Due to the importance of small mammal microhabitat partitioning to theories, concepts, and models of community ecology, it is important that all of the factors that may bias observations of it be understood. Additionally, observations that do not agree with the existing paradigm, or affect its generality (e.g., Morris 1987, Thompson 1987, Bowers 1988, Jorgensen et al. 1995, Jorgensen and Demarais 1999) need to be reconciled. Notably, Douglass (1989) indicated that microhabitat selection by free-roaming deer mice (*Peromyscus maniculatus*) significantly differed from that determined by live-trapping.

We investigated the effect of minimal soil disturbance on small mammal capture rates by comparing capture rates for traps placed on undisturbed soil to traps placed within a small area of disturbed soil. Additionally, we tested microhabitat effects by comparing capture rates for traps placed under shrubs in the presence of detritus to traps placed in open microhabitats free of detritus to detect disturbance x microhabitat interactions.

The study was conducted in mixed desert scrub habitat in south-central New Mexico. Common shrub species included mesquite (*Prosopis glandulosa*), creosotebush (*Larrea tridentata*), and mariola (*Parthenium incanum*). Common grasses included bush muhly (*Muhlenbergia porteri*) and sand dropseed (*Sporobolus cryptandrus*).

We identified and flagged 32, 30- x 200-m study plots during February 1996. Treatments were randomly assigned to study plots. The two levels of trap-site disturbance were disturbed and undisturbed. The two levels of microhabitat were under a mesquite bush with detritus and an open area lacking vegetation and detritus. Thus, eight study plots were delineated as open/undisturbed, eight as open/disturbed, eight as shrub/undisturbed, and eight as shrub/disturbed.

Two 200-m trap-lines spaced approximately 20 m apart were established within each study plot. Each trap-line typically contained 25 trap-sites. Some trap-lines contained slightly more or fewer trap-sites because of microhabitat availability although all study plots contained 50 trap-sites. We did not visit or

[1]Current address: Department of Microbiology, Colorado State University, Fort Collins, CO 80523

disturb study plots after February 1996 until the experiment was conducted in April 1996. Study plots were sampled in a random order for two consecutive nights each using 7.7 x 7.7 x 23-cm Sherman folding, aluminum live-traps during 7-14 April 1996. We placed a consistent quantity of bait (quick oats) with measuring spoons inside (15 ml) and outside (0.6 ml at the door) of each trap. Animals were marked with permanent ink.

Soil disturbance quantifiably simulated that often caused by scraping the substrate with one's foot during trap-site preparation. We scraped the substrate with the edge of a hand trowel each evening when setting traps. A frame measuring 48x20 cm delineated the disturbed area. Disturbance depth was approximately 4 cm the first night and slightly greater the second night. We placed traps within the disturbed area and minimized trap-site disturbance on the undisturbed study plots by using 1.22-m snake tongs to set and check traps.

We compared capture rates using two-way factorial analysis of variance for each species. First capture and recapture data were analyzed separately to account for cases where responses to novel items (first capture) may differ from responses to familiar items (recaptures). We assessed normality with Shapiro-Wilk test and used square-root transformations to near normality (Johnson and Wichern 1992). Heteroscedascity was tested with Levene's test. Analyses were conducted with SPSS for windows (Norusis 1993) and Statistix (Analytical Software 1991).

We recorded 1149 captures of 831 individual small mammals during 3200 trap-nights. Species captured most frequently included Merriam's kangaroo rat (*Dipodomys merriami*; $n = 299$), desert pocket mouse (*Chaetodipus penicillatus*; $n = 153$), cactus mouse (*Peromyscus eremicus*; $n = 134$), Ord's kangaroo rat (*Dipodomys ordii*; $n = 65$), northern grasshopper mouse (*Onychomys leucogaster*; $n = 52$), deer mouse ($n = 44$), and southern plains woodrat (*Neotoma micropus*; $n = 21$).

First captures of cactus mice occurred more frequently at undisturbed sites compared to disturbed sites ($P = 0.004$). Recaptures of cactus mice failed to show this effect ($P = 0.394$), but were affected by microhabitat ($P = 0.048$) being more frequent under shrubs. Captures of other species were not affected by disturbance or microhabitat main effects ($P > 0.05$).

One species exhibited a microhabitat x disturbance interaction ($P < 0.05$). Southern plains woodrats were captured less frequently at undisturbed sites than at disturbed sites in the open ($P = 0.035$). The effect was not observed under shrubs. Thus, our treatments affected only two species ($P < 0.05$), cactus mice and southern plains woodrats.

Data from southern plains woodrats, which were captured less at undisturbed sites in the open for first capture data ($P = 0.035$), supported the hypothesis that microsite disturbance may affect capture rates unequally between microhabitats. This gives only limited support to the idea that observer-induced bias may be present in previous microhabitat studies. Notably, only two species exhibited any response to disturbance during this study, one positive and one negative.

This study supported the hypothesis of observer-induced bias from differential trap-site disturbance between microhabitats for only one species. However, we believe that additional evaluation of the hypothesis, particularly relative to kangaroo rats, needs investigation in other areas under different climatic regimes and different conditions of small mammal abundance.

ACKNOWLEDGEMENTS

We thank B. Hampton, N. Marlenee, S. Davis, and B. Weeks for field assistance. Funding was provided by the U.S. Army Construction and Engineering Research Laboratory through the Texas Cooperative Fish and Wildlife Research Unit. During the conduct of this research the authors were employed by the Department of Range, Wildlife, and Fisheries Mangement, Texas Tech University. This is Texas Tech University College of Agricultural Sciences and Natural Resources technical publication T-9-784.

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Received 11 June 2002
Accepted 4 September 2002

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