3-4-1981

Spacing, Movements, and Social Organization of a Free-Ranging Population of Pine Voles *Microtus pinetorum*

Randall W. FitzGerald
State University of New York at Binghamton

Dale M. Madison
State University of New York at Binghamton

Spacing, Movements, and Social Organization of a Free-Ranging Population of Pine Voles *Microtus pinetorum*

Randall W. FitzGerald and Dale M. Madison
Department of Biological Sciences

State University of New York at Binghamton
Binghamton, New York 13901

Abstract: Free-ranging pine voles (*Microtus pinetorum*) were radio-tracked in a maintained orchard environment from August to November 1980. Pine voles existed in discrete non-overlapping family units with an average of 6.5 individuals per family unit. Home ranges of family members overlapped extensively, and all the members of a single family unit utilized one or two communal nest sites within the family's territory. Males ranged slightly farther than females, and females spent more time in the nest than did males. The mating system appeared to be promiscuous with a high degree of social tolerance among pregnant and lactating females and scrotal males of the same family group.

INTRODUCTION

The development of an effective integrated pest control program depends on a complete understanding of the biology and ecology of the pest species. This includes a thorough understanding of how the pest is socially organized in time and space. Social behavior influences the immediate effectiveness of a control measure, and is probably involved in the compensatory breeding that follows the sudden population declines resulting from the control.

Besides the anecdotal evidence that pine voles are 'loosely colonial' (Paul, 1970; Boyette, 1966) or occur in locally abundant aggregations (Benton 1955; Hamilton, 1938), little is known about the social structure of this major pest species in an orchard habitat. The present study was designed to provide a detailed description of the pine vole social system. Such information could lead to the development of new control techniques, or permit the application of present controls with better timing and greater effectiveness.

METHODS

A 0.7 hectare (1.75 acre) study grid was established within a large apple orchard block in Modena (Ulster County), New York. The study grid consisted of eight rows (10 meters apart) of sixteen trees each (5 meters apart). The grid was live trapped every two months using two Sherman live traps at each tree (128 trees; 256 traps). First, the traps at odd (or even) numbered trees were opened, baited and checked at three hour intervals for a total of four checks. Then, the traps at even (or odd) numbered trees were opened, baited and treated in the same manner. Each census period took four days to complete.

Captured animals were marked (toe clip), sexed, weighted, checked for reproductive condition (males: scrotal or non-scrotal; females: pregnant, lactating, perforate and/or imperforate), examined for pelage status (adult or juvenile) and aged. Animals under 16 grams were considered to be juveniles; animals 16 to 20 grams, subadults (unless they were reproductively active in which case they were considered to be adults); and animals greater than 20 grams, adults.

Radiotelemetry was employed in order to record the exact position of individual voles in time and space. Conventional radiotelemetry equipment was used (AVM Instrument Co., Champaign Illinois), including SM-1 transmitters, multiple LA-12 radioreceivers, and handheld Yagi and mini-loop antennae. Voles to be given radiotransmitters were transported to the lab in individual cages. After ether anesthesia, each vole was given a radiotransmitter package, which was encapsulated in wax and surgically implanted into the abdominal cavity (I.P.) through an incision in the ventrolateral abdominal wall. Each radiotransmitter-battery unit was pretuned to a different frequency, and each weighed approximately 10% of the vole's total weight. Voles with implants were returned to their original capture sites within six hours of their capture, and data collection was delayed several days to allow the animals to adjust to the package.

Since we were looking for a maximum amount of vole interaction, and since preliminary recapture data suggested very little cross-row movement, voles within a single central tree row were chosen to be radiotagged. Every pine vole greater than 20 grams, and selected pine voles greater than 16 grams, were implanted with transmitters on two separate occasions. The first telemetry session covered a period from August 25 to September 10, 1980, and involved 18 animals (10 males, 8 females). The second session ran from October 21 through November 15, 1980, and involved 22 animals (12 males, 10 females). Each telemetry session consisted of recording hourly positions on each individual for a total of five 24 hour periods.

RESULTS AND DISCUSSION

Trapping data suggested that certain individuals could be grouped together, since they were consistently caught in the same traps within the same row (Fig. 1). Only six out of 256 recaptures exhibited cross row movement.

Telemetry data confirmed the group associations found in the trapping data and clearly demonstrated cohesiveness within groups and segregation between groups. Cohesiveness within groups was shown by the extensive overlap between members of each social group (Fig. 2). Telemetry and trapping data indicated that group members were individuals belonging to the same family, since young grew to adult size voles within their parental groups. The average family unit of the five monitored contained 6.5 individuals, with an average composition of 1.7 adult scrotal males, 0.8 adult non-scrotal males,

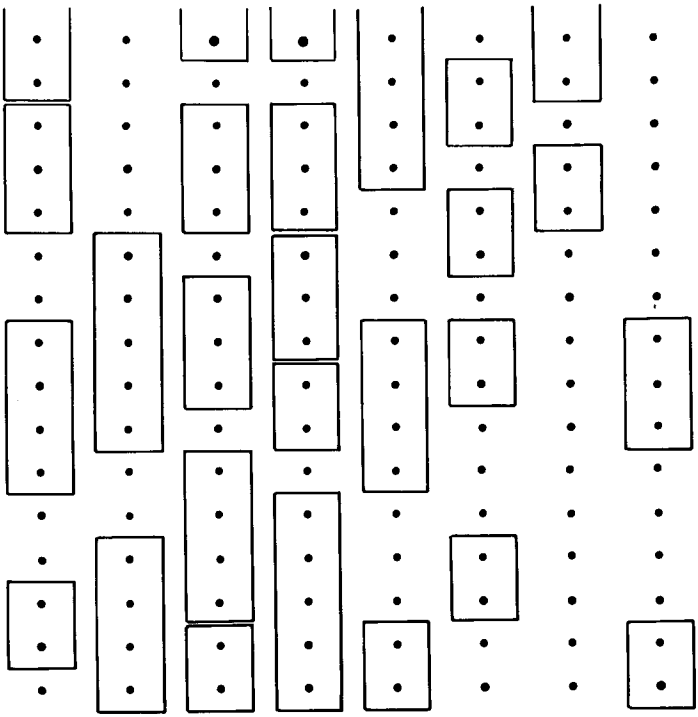


Fig. 1. Individual groupings of pine voles revealed by trapping data. Dots = trees, boxes = groups of associated individuals.

1.7 reproductively active females (i.e. pregnant, lactating and/or perforate), 0.7 subadults, and 1.6 juveniles. All family members utilized one or two communal nest sites within the family territory, and it was not uncommon to find all the members of a single family unit in the same nest at the same time. Nest sites were assigned to those locations which constituted a minimum of 20% of the total positions for all family members. Our criterion for nest sites was confirmed in preliminary studies and when predators (skunks?) excavated some nest locations in the present study. Fifty-three percent of all positions for all males were recorded at next sites, while this figure was 57% for females.

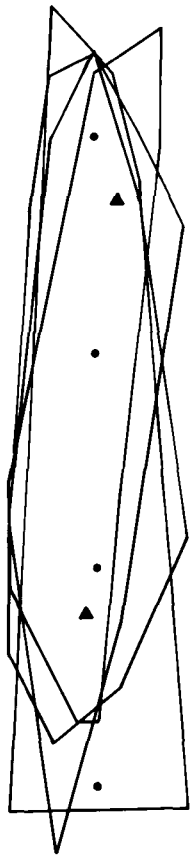


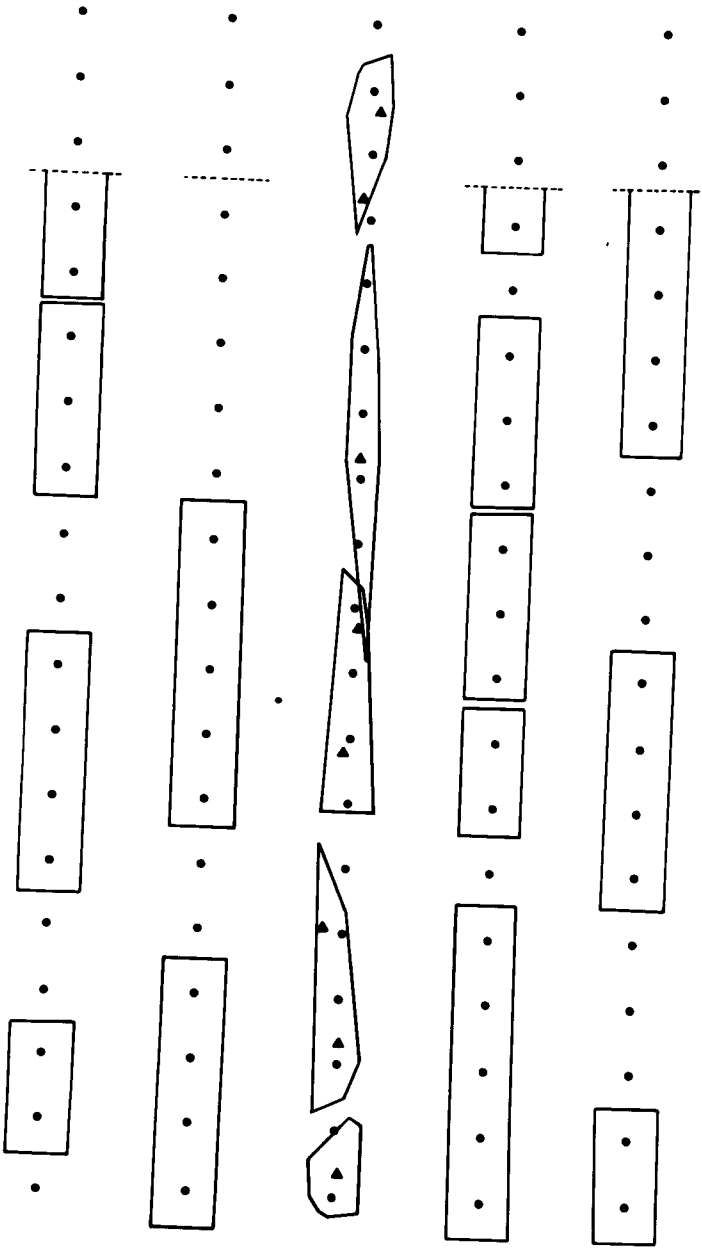
Fig. 2. Telemetry derived home ranges of four family unit members. Each range is represented by the area enclosed by a line connecting the outermost positions recorded during one telemetry session. Dots = trees, triangles = nest sites. Distance between adjacent trees = 5 meters.

The mating system appears to be promiscuous within family groups; and a high degree of social tolerance exists between all family members, regardless of age or reproductive condition. Pregnant and lactating females were often found together at the same nest site, as were scrotal males.

A second significant finding reinforced by telemetry was that each family unit was a discrete, non-overlapping entity, primarily restricted to several trees within a single tree row (Fig. 3). Family units demonstrated a high degree of impermeability and permanence, thus existing as closed social units.

Home range estimates derived from the telemetry data indicate linear ranges with an average width for both males and females of three meters (conforming to the approximate dripline of the trees within the row). Males had slightly longer home ranges ($\bar{X}$ = 18.6 meters, N = 22) than those estimated for females ($\bar{X}$ = 14.1 meters, N = 18). The average family unit occupied a territory 16.6 meters long and 3.0 meters wide (N = 5).

Fig. 3. (on next page) Home ranges of the widest ranging individual from each family unit (polygons). Segregation between family units is nearly complete. Boxes illustrate the degree of segregation apparent from trapping data. Dots = trees, triangles = nest sites.



Future research will include a continuation of the censusing procedure for the collection of base line data on reproduction, mortality and dispersal. In addition, three more telemetry sessions are scheduled (March-April, May-June and July-August). These sessions, along with trapping data, should provide the information needed to answer the following questions:

1) How permanent are these family units? Are they stable throughout the year?

2) To what extent are the family units impermeable to outsiders? Do scrotal males or receptive females cross social boundries during the peak breeding season?

3) What is the mode of dispersal? How are the new family units formed?

4) How much time is spent in and out of the nest, by which family members, on what timetable?

Hopefully, these and other questions will be answered in the upcoming months.

ACKNOWLEDGEMENT

This investigation was made possible by a research grant from the U.S. Fish and Wildlife Service (Contract 14-16-0009-79-066). We thank Jay McAninch, Ralph Pagano, Donna Stockrahm and Jeff Hill for their assistance. We would also like to thank all the Hudson Valley fruit growers that have cooperated with us on this study, especially Stanley Cohn and Steve Clarke.

LITERATURE CITED

Benton, A.I. 1955. Observations on the life history of the northern pine mouse. J. Mammal., 36(1):52-62.

Boyette, J.G. 1966. A behavioral study of the pine mouse, Pitymys pinetorum pinetorum (Le Conte). Ph.D. Dissertation, North Carolina State of the University of North Carolina at Raleigh.

Hamilton, W.J. 1938. Life history notes on the northern pine mouse. J. Mammal., 19(2):163-170.

Paul, J.R. 1970. Observations on the ecology, populations and reproductive biology of the pine vole, Microtus pinetorum, in North Carolina. Reports of Investigations, No. 20, Illinois State Museum, Springfield, Illinois.