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THE NEED FOR AN INTEGRATED CONTROL STRATEGY FOR ORCHARD MOUSE DAMAGE

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During the last six years the N.Y. Coop. Wildlife Research Unit has been involved in research on pine voles. Projects have included studies of reproduction in the laboratory, population biology in orchards and testing of pine vole control toxicants. Field work has been restricted to a few orchards in Ulster and Orange counties in the Hudson Valley. Therefore some of the results may reflect local conditions and should be regarded as preliminary in nature. Work involving control procedures has indicated that hand baiting with anticoagulant pellets under previously established bait stations averages 85 percent reduction in pine vole numbers. Anticoagulant ground sprays average 60 percent reduction in numbers under good conditions. As we see it, three major problems in control procedures remain to be solved. First, orchard managers and available labor must learn to properly place bait stations and baits. Second, optimal timing and frequency of bait application must be determined. Third, and perhaps the largest oversight in the work to date, is that the relationship between a reduction in pine vole numbers and the reduction in apple tree damage must be established. These last two points viewed in a broader context confirm the need to develop an integrated pest management strategy. Its objective is to provide the orchard manager with the information needed to weigh the cost and predicted benefit of a specific control procedure. The optimal method and timing of control can be determined by computer simulation. The data input necessary to do this falls into two broad categories: factors affecting vole numbers and factors affecting the degree of tree damage for a given number of voles.

Potential increase in vole numbers can be calculated using age-specific survivorship and maternal frequency rates if initial population and age structure is known. Degree of tree damage undoubtedly is affected by many factors besides vole numbers including tree variety, age, soil conditions, alternate foods, temperature, rainfall, etc. Unfortunately, little information is available on any of these environmental factors, however considerable progress has been made in our ability to calculate and predict vole numbers.

Life tables have been prepared from three years of laboratory breeding and longevity data. Based on eye lens weight estimates of age, May and October age structures of orchard populations have been determined in both undisturbed and previously depopulated areas. This allows for calculation of realized rate of population increase and some measure of immigration rates. Areas of genetic similarity among the individuals of the population, which are based on electro-

phoretic determination of the occurrence of specific polymorphic alleles, reflect the breeding unit or deme structure of orchard populations.

A separate, long term mark-recapture study has provided replication of several aspects of the above work. Seasonally adjusted survivorship and maternal frequency rates have been estimated based on marked samples of cohorts. Mortality was low and breeding effort was high from September thru March. Young born from March to August never survived as long as 90 days. Eight percent of the population was found to live over one year. Recaptures indicate that the same groups of pine voles consistently were caught in orchard sections of 2 to 6 adjacent trees along the row. Many of these "neighborhoods" were constant in both location and individual composition for 6 to 12 months. In many cases juveniles born in one neighborhood later bred in the same neighborhood. Neighborhoods closely correspond in size and shape to the areas of genetic similarity previously determined.

All the above work is in various stages of analysis and writing. Ongoing research includes investigation of possible toxicity and pathological effects of soil lead residues on pine voles and some initial testing of tetracycline as a toxicant for pine voles.

From our viewpoint the solution to orchard mouse damage problems would be speeded by cooperation among researchers both in sharing of available data and in identifying and coordinating areas of research critical for the development of an appropriate pest management strategy. Emphasis must be on practical measures for control without continuing exclusive dependence on endrin or zinc phosphide. Economic return, labor availability, and annual orchard-block-specific control recommendations are major constraints within which to operate. The basic population biology and ecology of orchard voles is still incompletely known and these must be determined before the optimal control methods can be established.