

Bats and Codling Moth Management in Pears

Natasha Neumann¹ and Rachael Freeman Long²

Abstract

Our study on bat activity and bat houses in agricultural areas is being used to determine if bats may be a potential source of biological control of the codling moth and to learn what bat house locations bats prefer. In Suisun Valley, bats fly and exhibit foraging behavior within and below the canopy of pear orchards and certain study sites appear to consistently have more bat activity or codling moth numbers than other sites. Data collected on the placement of 41 bat houses on farms in the Sacramento Valley show that sun exposure is the most important factor in determining occupancy of bat houses.

Objective

- 1) To collect data on bat activity, codling moth numbers, and codling moth damage in pear orchards in proximity to a large colony of Mexican free-tailed bats in Suisun Valley.
- 2) To look for ways to improve the occupancy rate of bat houses in the Sacramento Valley by evaluating where they are placed on the farms.

Procedure

Objective 1: Foraging habits of bats

A total of twenty study sites in pear orchards within 2.5 miles of the Suisun bat colony were sampled over July, August, and September for bat activity. Eight sites were sampled for bat activity within one mile (proximal) of the bat colony and another eight orchards were sampled 1.5 to 2.5 miles (distal) away. Two passive bat-monitoring stations were used to simultaneously record bat activity at one proximal and one distal study site each night for five nights within the same week. These stations consisted of bat detectors that recorded the echolocation frequencies that bats emitted while foraging. Four additional "abandoned" pear orchard study sites were sampled for bat activity in a similar fashion, but they did not fall into the proximal and distal distance categories.

Codling moth pheromone trap counts were recorded at each of the twenty sites on each sample night to determine if there is a relationship between bat activity and codling moth flights.

Samples of 100 pears were gathered from twelve study sites, six proximal and six distal, to determine the percent damage caused by codling moths.

An attempt to collect bat guano samples from flying bats at the study sites was made, but proved to be unsuccessful. Instead bat guano was collected outside the entrance of the Suisun bat colony. This guano will be analyzed for moth content to provide any further evidence that bats flying in the area are eating moths. Unfortunately we cannot determine which species of moths bats are consuming because they thoroughly digest their prey.

¹ California State Polytechnic University, Biological Sciences, 3801 W. Temple Ave., Pomona, CA (626)798-9332

² UCCE, 70 Cottonwood St., Woodland, CA (530)666-8734

Objective 2: Bat House Occupancy

To determine how to improve the occupancy rate of bat houses, we evaluated the characteristics of 41 bat houses that are currently up on farms in the Sacramento Valley. Data collected included type of house, mounting substrate, height of house, and exposure to the sun.

Results

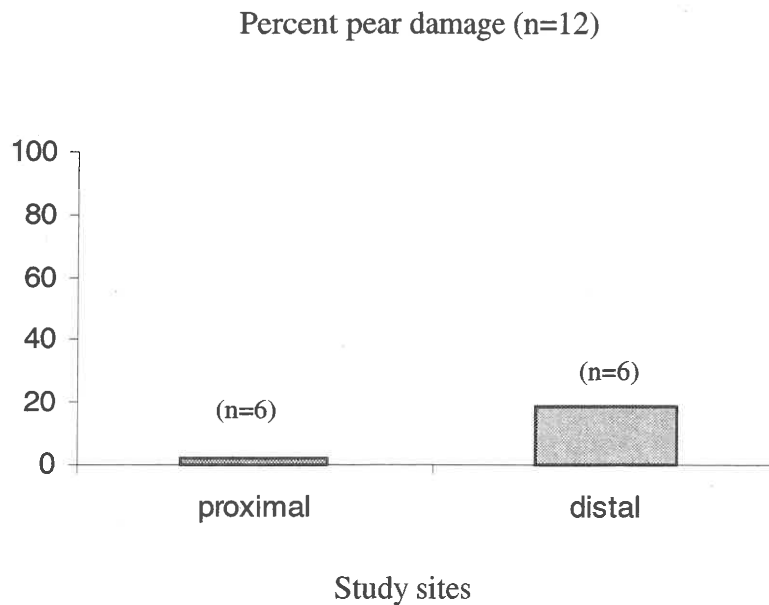
Objective 1: Foraging habits of bats

A statistical analysis of bat activity and codling moth data is still in the works. Yet, the following possible conclusions or patterns have become apparent.

- a) Bat activity occurs at every pear orchard study site.
- b) Bats fly and exhibit foraging behavior within and below the pear orchard canopy.
- c) Some study sites appear to consistently exhibit more bat activity or codling moth numbers than other sites.

Data of the percent damage of pears was analyzed. The average percentage of pear damage from codling moths was 2% at the six proximal study sites and 19% at the six distal sites (figure1). Conducting a two-sample *t* test, however, showed no statistical significant difference between these two means.

Figure 1. Average percentage of pears with codling moth damage at six proximal and six distal study sites.



Objective 2: Bat House Occupancy

Data collected on the placement of 41 bat houses on farms in the Sacramento Valley show that sun exposure is the most important factor in determining occupancy of bat houses (Figure 2). Houses with 2-6 hours of direct sunlight (especially morning sun) had a 79% occupancy rate. Houses with 0-1 or 7-12 hours of sun had an occupancy rate of 42% and 53%, respectively. Houses with 0-1 and 7-12 hours of sun were frequently occupied only part time. In other words, when daytime temperatures were cool, bats selected the houses with more sun exposure; when temperatures rose, the bats all left.

Figure 2. Bat house occupancy of houses placed on farms in the Sacramento Valley relative to exposure to the sun.

