

**POTENTIAL OF BATS AS PREDATORS OF ADULT CODLING MOTHS,
CYDIA POMONELLA, IN PEAR ORCHARDS IN CALIFORNIA**

MASTER'S THESIS
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Abstract

I studied bat activity in the pear orchards of Fairfield, California during the summers of 2000 and 2001 to determine the potential of bats (order Chiroptera, suborder Microchiroptera) as predators of the codling moth (*Cydia pomonella*), one of the main pests of pears. A few nights of bat surveys were also carried out in the summers of 2002 and 2003. Data on the activity and diet of bats were gathered and compared to codling moth activity and pear damage to determine if any ecological patterns existed that would provide evidence that bat predation on codling moths occurred. In particular, comparisons of bat activity, male codling moth activity, and pear damage were made between pear orchards at locations proximal and distal to a colony of thousands of Mexican free-tailed bats (*Tadarida brasiliensis*). Comparisons in bat activity, codling moth activity, and pear damage were made between summers as well. The identification of bat species and their population levels were also investigated in my study.

Bat activity and foraging behavior were detected in every Fairfield pear orchard that was surveyed and occurred during periods when the codling moth was expected to be active. Significantly higher levels of bat activity occurred in "proximal" pear orchards than "distal" pear orchards in 2000, but not in 2001. No significant difference was found in bat activity in pear orchards proximal to a large bat colony between 2000 and 2001. Yet, significantly higher levels of bat activity were found in "distal" pear orchards in 2001 than in 2000. Bat foraging activity was positively related to bat activity. A significant positive relationship occurred between bat activity and codling moth activity in 2001, but not in 2000.

Moths (order Lepidoptera) made up a small portion of the diet of a large colony of *T. brasiliensis* in 2000 and a large portion of their diet in 2001. The consumption of moths by *T. brasiliensis* was significantly higher in 2001 than in 2000.

Six species of bats were detected and/or captured in the pear orchards of Fairfield. *T. brasiliensis* made up the highest percentage of a randomly selected sample of bat minutes recorded in pear orchards in 2000 and 2001. Populations of *T. brasiliensis* appeared to be larger in 2001 than 2000. The California myotis (*Myotis californicus*) Yuma myotis (*Myotis yumanensis*), red bat (*Lasiurus blossevillii*), and pallid bat (*Antrozous pallidus*) were also detected in pear orchards and are known to consume a large portion of moths in their diets. The big brown bat (*Eptesicus fuscus*) was detected in pear orchards as well, but this species is known to rarely eat moths. The pallid bat and red bat are of major concern to conservationists.

No significant differences were found in overall codling moth activity and pear damage between pear orchards proximal and distal to the large *T. brasiliensis* bat colony. However, overall pear damage was significantly higher in 2001 than 2000.

My study supports the following conclusions: 1) bats foraged throughout the pear orchards in Fairfield and were probably consuming codling moths; 2) more similar levels of bat activity occurred from year to year in pear orchards proximal to a large colony of Mexican free-tailed bats (*T. brasiliensis*) than those distal to the same colony; 3) some bat species were more attracted to pear orchards and consumed more moths when codling moth activity was high.

Although no evidence was found in this study to indicate that bat activity reduced overall codling moth populations, bats are probably natural predators of the codling moth and should be encouraged, along with other less toxic means of pest control, to help control codling moth populations in pear orchards. By attracting bats to pear orchards and decreasing the use of toxic pesticides, we may provide more suitable habitat for some of our California bat species and perhaps help protect our own health as well.