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# ARE BARN OWLS A BIOLOGICAL CONTROL FOR GOPHERS? EVALUATING EFFECTIVENESS IN VINEYARDS AND ORCHARDS

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**ABSTRACT:** Several rodent species cause damage in vineyards and orchards. Current efforts to reduce chemicals used to control rodents are encouraging development of alternative practices, such as biological control. For several years growers in California have been installing artificial owl nest boxes to attract barn owls with the hope of reducing rodents, especially gophers, through predation. Effectiveness of barn owls as biological control of gophers in vineyards and orchards is unknown. The purpose of the study was to use grower surveys and diet analysis to assess the effectiveness of installing barn owl nest boxes to control gophers. Surveys of growers that installed artificial nest boxes reported that 40% of boxes were occupied within six months of installation. Of those growers with occupied nest boxes, however, only 23% felt that barn owls were effective in controlling gophers on their lands. The diet results indicated that barn owls most frequently prey upon gophers and voles. Barn owls prey upon both adult and juvenile gophers, and juvenile gophers were especially vulnerable during spring and summer. The findings provide little evidence that barn owls are effective in controlling gophers. With further research the approach might prove useful, but only when used in concert with other control approaches such as trapping and rodenticides.

**KEY WORDS:** barn owls, *Tyto alba*, survey, pocket gophers, *Thomomys bottae*, rodent control, diets

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## INTRODUCTION

Bottas pocket gopher (*Thomomys bottae*) is a serious rodent pest in many California orchards and vineyards. Active throughout the year, they can increase to high numbers if not controlled, causing damage and loss of vines and trees and interfering with irrigation and other cultural operations (Salmon et al. 1992). Pocket gophers are often managed by trapping and use of toxic bait, usually strychnine, delivered manually by a probe or by a mechanical bait applicator (Marsh 1992). While strychnine baiting continues to be a primary control method on many farms, an increasing number of farmers are seeking alternatives to the use of rodenticides because of safety concerns for domestic animals, raptors, and other animals.

As a result of the desire to continue gopher control and reduce rodenticide use, hundreds of farmers in California and nationwide have installed artificial nest boxes to attract barn owls (*Tyto alba*) to farms as part of a rodent management strategy. The prey species most often taken by barn owls are meadow voles (*Microtus californicus*), pocket gophers, and mice (*Cricetid* sp.) (Ingels 1995). Barn owls readily adapt to artificial nest boxes (Marti et al. 1979). Availability of nest sites appears to be the factor limiting barn owl population growth in habitats disturbed by humans, including agricultural areas (Taylor 1994). Barn owls rarely display any territorial behavior, except in the vicinity of the nest site (Smith et al. 1974; Taylor 1994) which enables farmers to attract many breeding pairs to relatively small areas.

Despite the widespread interest in attracting barn owls to farms, the efficacy of artificial nest boxes in promoting owl numbers and controlling rodents in vineyards and

orchards is unknown. The purpose of this study was to use grower surveys and diet analysis to assess the potential of installing barn owl nest boxes in gopher management. The results of the survey will provide information on nest box occupancy characteristics and on the perceived effectiveness of this rodent control. Pellets regurgitated by barn owls contain intact skeletal remains of rodent prey consumed and can be used to ascertain composition of diet.

## METHODS

### Surveys

In 1995, questionnaires were mailed to 207 farmers which had previously received information packets on barn owls from the Sustainable Agricultural Research and Education Program, at University of California, Davis, from 1993 to 1995. Farmers were asked about: 1) reasons the growers wanted to install barn owl nest boxes; 2) the severity of pest problems, particularly in regards to voles and gophers; 3) the proportion of nest boxes occupied within the first year; and 4) the perceived effectiveness of barn owl presence in controlling vertebrate pests.

### Diet Analysis

Ten growers in the Lodi Grape Growing District of the northern San Joaquin Valley were randomly selected to participate in the field research studying the composition of barn owl diets. Crop types within 100 meters of nest boxes consisted of: 1) vineyards; 2) orchards; 3) vineyards and orchards; 4) vineyards and fallow land; 5) vineyards and alfalfa; and 6) orchards, vineyards and alfalfa. The authors selected 38 nest boxes installed by ten growers and collected pellets deposited by

barn owls from within and beneath each nest box at regular intervals throughout the nesting season in 1996.

Individual pellets were gently broken up by hand and all skeletal parts were analyzed for prey identity. Skeletal remains were identified by comparison with mammal and bird specimens in the Museum of Wildlife and Fisheries Biology, University of California, Davis. Percent frequency of occurrence of prey items among pellets for each collection interval were calculated. To determine the average number of gophers eaten by one pair of owls during the nesting season, the number of right mandibles of gophers found in pellets were counted. The mandible length was measured to estimate occurrence of juvenile gophers in barn owl diets.

## RESULTS

A total of 88 people responded to the survey for a 43% response rate. Of the respondents, 55 had installed a total of 241 artificial nest boxes. Only survey results from 55 respondents that had installed nest boxes are reported. Forty-eight percent of farmers reported that the most important reason they installed owl nest boxes was to control vertebrate pests. Thirty-six percent of the individuals installed boxes for a hobby, 2% of respondents hoped to increase wildlife on their farm, and the remaining 12% installed boxes for other reasons.

Pocket gophers were considered a moderate to severe pest problem by 77% of respondents prior to nest box installation; 18% of people replied that gophers were only a slight or non-existent problem and the remaining individuals were unsure. Only 9% of farmers answered that meadow voles were a moderate or severe pest. Thirty percent of people felt meadow voles were a slight or non-existent pest problem and the remaining 61% were not sure or had no answer.

Respondents reported that 40% of the nest boxes were occupied by barn owls in 1995. Seven percent of individuals felt that installation of nest boxes to attract barn owls was very effective in controlling gophers. Another 16% of respondents considered nest box installation somewhat effective, and 11% thought they had no effect at all. The remaining 66% were not sure or had no answer. Installation of owl boxes to control meadow voles was considered very effective by 2% of respondents and somewhat effective by 7%. Twelve percent of individuals thought the approach was not effective and the remaining 79% were not sure, or had no answer.

Preliminary diet analysis indicated that gophers and voles were the two most abundant prey in barn owl pellets, each occurring in over one-third of pellets. Occurrence of gophers increased in spring and summer, probably because barn owls were preying upon abundant juvenile gophers. On average, a pair of nesting barn owls consumed a minimum of almost one gopher per day during the nesting season. Predation on gophers did not appear to vary according to crop type; when comparing boxes located in vineyards with those located in orchards, both frequency of gophers on diets and minimum number of gophers eaten were similar.

## DISCUSSION

Results of the survey indicate that controlling vertebrate pests was the most common reason why

respondents had installed nest boxes. Most respondents had previously received literature on barn owl nest boxes as alternatives to vertebrate pest management; this literature included estimates of nesting pairs of owls and young consuming over a thousand rodents per nesting season (Colvin 1986). Installation of nest boxes for barn owls has been shown to double the number of breeding pairs in a given area and also produce significantly larger clutches (Johnson 1994). The recent increase in installation of barn owl nest boxes may reflect a concern with the risks posed to non-target wildlife and domesticated animals.

The survey showed that installation of nest boxes is successful in attracting barn owls. Farmers replied that about 40% of boxes had been occupied. Many respondents indicated that they had installed the boxes during or after the nesting season, after which owls were unlikely to occupy nests. The reported occupancy may be underestimated. Although literature had been previously distributed to farmers to help in assessing owl occupancy, determination of occupancy often requires physical inspection inside the box.

Most individuals considered pocket gophers a moderate to severe pest problem prior to nest box installation, but only a few considered meadow voles a moderate to severe pest. Although almost one-quarter of farmers felt that the installation of nest boxes that attracted barn owls had an effect on their gopher problems, over two-thirds were not sure of any effect or had no answer. A few people felt that nest box installation had an impact on their vole problems, while most were not sure. Even though sample sizes were small in the survey, the results suggest that there is little substantive evidence for growers to ascertain positive effects of nest box installation reducing gopher or vole problems.

Previous diet studies in California indicate that pocket gophers are an important prey item of barn owls (Smith and Hopkins 1937; Hawbecker 1945; Fitch 1947; Clark and Wise 1974). Although previous studies show that various predators will take vertebrate pests, only one study to date has shown a dramatic decline in the pest species after the initiation of a large-scale owl nest box program. A pest management strategy in the oil palm estates of peninsular Malaysia used barn owls as a biological control to reduce toxic baiting in control of rats (Duckett and Karuppiyah 1990). The objective was to increase barn owl population density with the installation of 200 nest boxes on 1,000 hectares of oil palms. Within 19 months predation by barn owls, without any baiting program, had reduced rat damage to palms from a record high of 19.5% in June of 1988 to 1.4% by January of 1990 (Duckett and Karuppiyah 1990). Other evidence that predators may control pest populations comes from studies conducted in pine plantations in Chile where habitat modifications appears to have increased predation of rodent and rabbit species by barn owls and foxes (Munoz and Murua 1990). Observations during a radio-telemetry study on barn owls hunting in agricultural areas in Israel showed a reduction in voles and house mice (Kahila 1991).

The diet analysis indicates that gophers and voles are the major prey of barn owls and suggests that juvenile

gophers are especially vulnerable during spring and summer. Gophers are substantially larger than voles, indicating that gophers are the dominant prey of barn owls. Crop type does not appear to influence vulnerability of gophers to owl predation. However, the fact that barn owls prey principally upon gophers and eat substantial numbers does not mean that barn owls can control gopher numbers.

In conclusion, the results indicate that installation of artificial nest boxes will attract barn owls. However, whether or not this will result in effective gopher control is unknown. Some growers felt that attracting barn owls was effective in controlling gophers, but the number was relatively small. Further, the fact that barn owls eat numerous gophers does not mean that this predation is sufficient to effectively reduce gopher populations and reduce damage. Perhaps the installation of nest boxes would prove useful in an integrated approach that also incorporates the use of trapping or rodenticides.

Many people install barn owl boxes as a hobby or to improve wildlife on their farms, and the authors support these efforts. However, for those who install boxes in hopes of controlling gophers, the authors believe it is essential that they realize there is little, if any, evidence that their efforts will be effective.

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