

SOD-Induced Changes in Foraging and Nesting Behavior of Insectivorous, Cavity-Nesting Birds¹

Kyle Apigian² and Barbara Allen-Diaz³

Key words: chestnut-backed chickadee, oak titmouse, foraging, sudden oak death, *Phytophthora ramorum*

Abstract

Sudden oak death (SOD) is a tree disease caused by a recently described pathogen, *Phytophthora ramorum*. The disease affects dozens of plant species, but its effects are particularly pronounced in stands of coast live oak (*Quercus agrifolia*), often resulting in large stands with dead canopies and many downed trees. Such disease-induced habitat changes may impact bird populations both directly and indirectly. For example, forest dieback can result in changes to insect populations, which subsequently impact insectivorous birds by forcing them to switch prey items, change foraging substrates, or increase foraging time. This can ultimately impact the nesting success of these birds. The goal of this study is to examine the effects of SOD-induced changes in oak woodlands on insectivorous cavity-nesting birds, particularly oak titmice (*Baeolophus inornatus*) and chestnut-backed chickadees (*Poecile rufescens*).

We have been examining the impacts of SOD on these birds by investigating the population status of their common prey items, their foraging ecology, and their nesting behavior. We established study plots in the San Francisco Bay Area in several stands that represent a gradient from high SOD impact (many downed trees, high infection) to low impact from the disease. We used branch clipping to compare arthropod populations on coast live oaks and California bay-laurel (*Umbellularia californica*) trees, as well as symptomatic versus asymptomatic coast live oaks. Direct foraging observations of birds on our plots allowed us to determine preferred tree species for foraging, as well as the changes to foraging that result in areas of high SOD impact. We used artificial nest boxes and video cameras to examine nestling diet, foraging effort (length of foraging trips), box occupancy, and nestling survivorship. This scheme allowed us to measure the impacts of SOD at two trophic levels (prey and predator) and through several aspects of cavity-nesting bird natural history (foraging, diet, and nesting).

Our diet studies indicate that foliage-dwelling arthropods, particularly Lepidoptera larvae, are important to chickadees and titmice during the breeding season. There were significantly greater numbers of arthropods on coast live oak trees than California bay laurel trees throughout the spring. One group of arthropods (“leaf-feeders”, including Lepidoptera) was greater on asymptomatic oaks than on

¹ A version of this paper was presented at the Sudden Oak Death Second Science Symposium: The State of Our Knowledge, January 18-21, 2005, Monterey, California

² P.O. Box 261, Amherst N.H. 03031, 510-520-1845, kapigian@nature.berkeley.edu

³ ESPM Department, 137 Mulford Hall, University of California, Berkeley, CA 94720, 510-643-1367, ballen@nature.berkeley.edu

symptomatic oaks early in the spring. Our foraging observations show that coast live oak is the primary foraging substrate for oak titmice, while chestnut-backed chickadees prefer to forage on a diverse range of tree species. Both species avoid bay trees for foraging, most likely as a result of the low arthropod abundance on bays. In heavily affected stands, birds tend to switch to a variety of other trees and shrubs (but *not* bays) as foraging substrates, rather than feed more heavily on remaining oaks. As a result, the loss of oaks may be particularly detrimental to oak titmice, as they are forced to switch to sub-optimal foraging locations. Chickadees may be better able to adjust to the loss of some oaks, due to their more flexible foraging niche. Foraging effort, measured as time away from the nest on a foraging trip, was greater on heavily affected sites, while diet composition remained relatively stable. This indicates that the birds may spend more time foraging in heavily affected sites to find the same types of food. Low sample sizes prevented us from making conclusive results about box occupancy and survivorship, but we have limited evidence that nestling survivorship was lower on heavily affected sites.

These results indicate that sudden oak death may affect insectivorous birds through a number of different pathways, including prey reduction and loss of foraging substrates. Changes to these environmental factors affect where these bird species forage, the amount of time spent foraging, and survivorship of nestlings. We suggest that any management plans related to SOD recognize the importance of protecting healthy coast live oaks while promoting diverse stands in affected areas.