

## SEASONAL USE OF RED-COCKADED WOODPECKER CAVITIES BY SOUTHERN FLYING SQUIRRELS

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Southern flying squirrels (*Glaucomys volans*) can significantly impact red-cockaded woodpecker reproductive success (Laves and Loeb 1999). Thus, exclusion or removal of flying squirrels from red-cockaded woodpecker cavities and clusters may be warranted in small woodpecker populations (U.S. Fish and Wildlife Service 2003). However, development of effective and efficient protocols for southern flying squirrel control requires an understanding of the seasonal dynamics of southern flying squirrel cavity use. Most studies of southern flying squirrel use of red-cockaded woodpecker cavities have been conducted during spring (e.g., Harlow and Lennartz 1983, Rudolph et al. 1990a, Loeb 1993) and no studies have examined the effects of long term flying squirrel control on subsequent cavity use. The objectives of this study were to determine: (1) whether flying squirrel use of red-cockaded woodpecker cavities varies with season or cavity type, and (2) the long-term effect of continuous squirrel removal.

### METHODS

The study was conducted on the Savannah River Site (SRS) in the Upper Coastal Plain of South Carolina. The SRS red-cockaded woodpecker population has been intensively studied and managed since 1986 (Gaines et al. 1995). From 1986 to 1994, all trees in active and inactive red-cockaded woodpecker clusters were climbed and inspected with a light and mirror. Cavity contents and type (natural or artificial cavity insert) were recorded and, in most instances, flying squirrels

were permanently removed. A squirrel use index (SUI) was calculated for each season, year, and cavity type where  $SUI = (\# \text{ of cavity inspections that squirrels were observed} / \# \text{ cavity inspections}) \times 100$ .

## RESULTS

A total of 7,526 cavity inspections occurred: 3,713 in natural cavities, and 3,813 in inserts. Flying squirrels were the most common occupants of red-cockaded woodpecker cavities in all years (Figure 1) and annual use averaged 8.9%. Despite the continuous removal program, there was no significant decline in flying squirrel use of red-cockaded woodpecker cavities over time ( $F_{1,7} = 0.33, P = 0.58$ ).

The SUI varied significantly among seasons ( $F_{3,32} = 3.76, P = 0.02$ ) and was significantly higher in spring than in all other seasons (Figure 2). Use of artificial cavities (SUI = 10.2, SE = 1.14) was significantly greater than use of natural cavities (SUI = 6.4, SE = 1.14;  $P = 0.03$ ). Peak use of both cavity types occurred in spring (Figure 3). The interaction term between season and cavity type was not significant ( $F_{3,30} = 0.87, P = 0.46$ ), indicating that the pattern of seasonal use was similar between cavity types. However, there were some important differences in the magnitude of seasonal use (Figure 3). Use of natural cavities declined significantly in summer and fall whereas use of artificial cavities declined only slightly during these seasons.

## DISCUSSION

Peak use of red-cockaded woodpecker cavities by southern flying squirrels occurred during spring. Thus, kleptoparasitism by southern flying squirrels has the greatest potential to interfere with red-cockaded woodpecker reproductive success. Further, high use of artificial cavities during summer and fall may be problematic because this is the time when young are fledging and attempting to secure their own roost cavity. Because year-round removal does not decrease long-term cavity use, removal of squirrels should be restricted to the most critical times of the year, i.e., spring and summer.

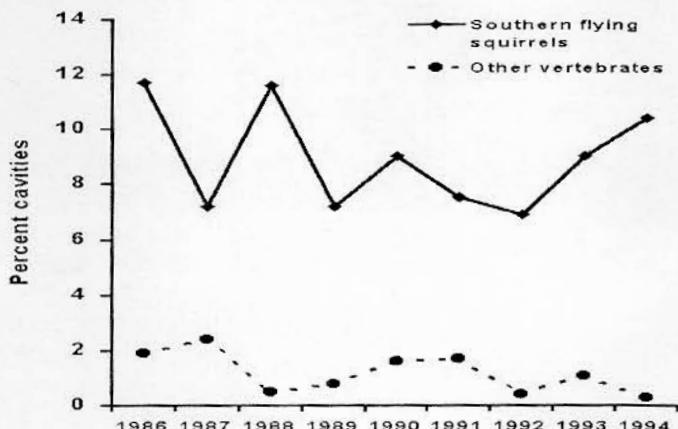


Figure 1. Percent of cavity inspections in which southern flying squirrels and other vertebrates were found in red-cockaded woodpecker cavities in active and inactive clusters on the Savannah River Site, South Carolina.

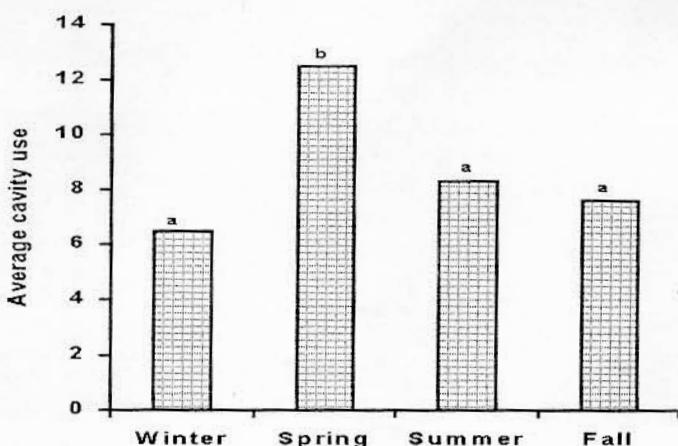


Figure 2. Seasonal use of all red-cockaded woodpecker cavities by southern flying squirrels on the Savannah River Site, South Carolina, 1986-1994. Bars with different letters indicate significant differences in use ( $P < 0.05$ ).

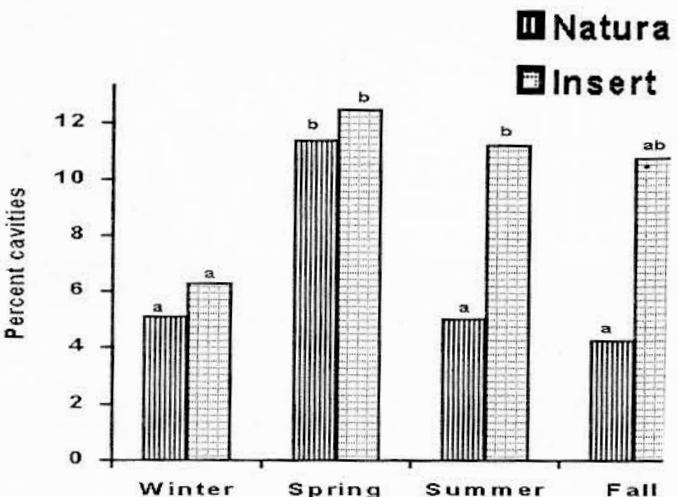


Figure 3. Seasonal use of natural and artificial red-cockaded woodpecker cavities by southern flying squirrels on the Savannah River Site, South Carolina, 1990-1994. Bars with different letters indicate significant differences in use ( $P < 0.05$ ).