Bird Counts in Two Areas of the Sierra Nevada*

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INTRODUCTION

Close correlations have been shown to exist between habitat diversity and bird species diversity (MacArthur, 1965). There is also evidence that uneven-aged mixed conifer stands harbor a richer avifauna than even-aged pure stands (Mackenzie, 1948; MacDonald, 1965). However, habitat diversity alone cannot always explain the differences in bird density in different areas. The availability of food as a limiting factor (Lack, 1954) and the ability of birds to adapt to and to utilize a special food source are also considered in explaining census differences.

The observations reported here were made during an investigation of vertebrate predators of the western pine beetle (*Dendroctonus brevicomis*) while at the University of California.

Description of Area: The study was conducted in two 12 ha (30 acres) plots at Blodgett Research Forest of the University of California, located 16 km NE of Georgetown, El Dorado County, in the central Sierra Nevada. Elevation varied from 1,250 to 1,310 m above sea level.

Plot I — Contained a temporary creek running through the southwest corner of the plot. This dried up by midsummer. The forest cover was a pure, even-aged, second-growth type consisting of ponderosa pine, *Pinus ponderosa* white fir, *Abies concolor;* incense-cedar, *Libocedrus decurrens,* and a few scattered sugar pine, *Pinus lambertiana.* Most of the trees were between 50 and 80 years old, although a considerable number of old-growth pine and fir still remained from the original stand. The stand had supported a moderate western pine beetle infestation since 1955 (Stark, 1970).

Plot II — Was located approximately 3 km SSE of Plot I and had no record of bark beetle infestation. The stand consisted of a mixture of residual, mature white fir; California black oak, *Quercus kelloggi,* and several age classes of both ponderosa pine and incense-cedar, and was approaching an uneven-aged mixed structure. Plant names are those used in Munz (1970), and names of birds follow the A.O.U. Check-list, 1957

METHOD

Monthly counts were made from September 1965 to December 1967 in Plot I and from January 1966 to December 1967 in Plot II. Bird counts were made using a modified strip-plot census technique (Otvos, 1965). The plots were transected by marked survey lines 20 m apart and these were walked slowly (about 1.0 km/hour) stopping every 7-10 m. Bird calls, song or the flight sound of birds were investigated and the birds identified up to 10 m on either side of the census line. Only foraging birds were recorded, birds "crossing" census lines or flying "ahead" were not recorded unless they landed and foraged within 10 m on either side of the line or ahead of the observer. Those that were censused once and observed to move to another foraging location were not recorded the second time; each plot was censused in about 3.0 to 3.5 hours. It was assumed that using this speed and recording only

*From a thesis submitted in partial fulfillment for the Ph.D. degree, University of California, Berkeley, 1969 The investigations were supported in part by grants from the National Science Foundation (G-21004), the T.B. Walker and Surdna Foundations and the Canadian National Research Council.

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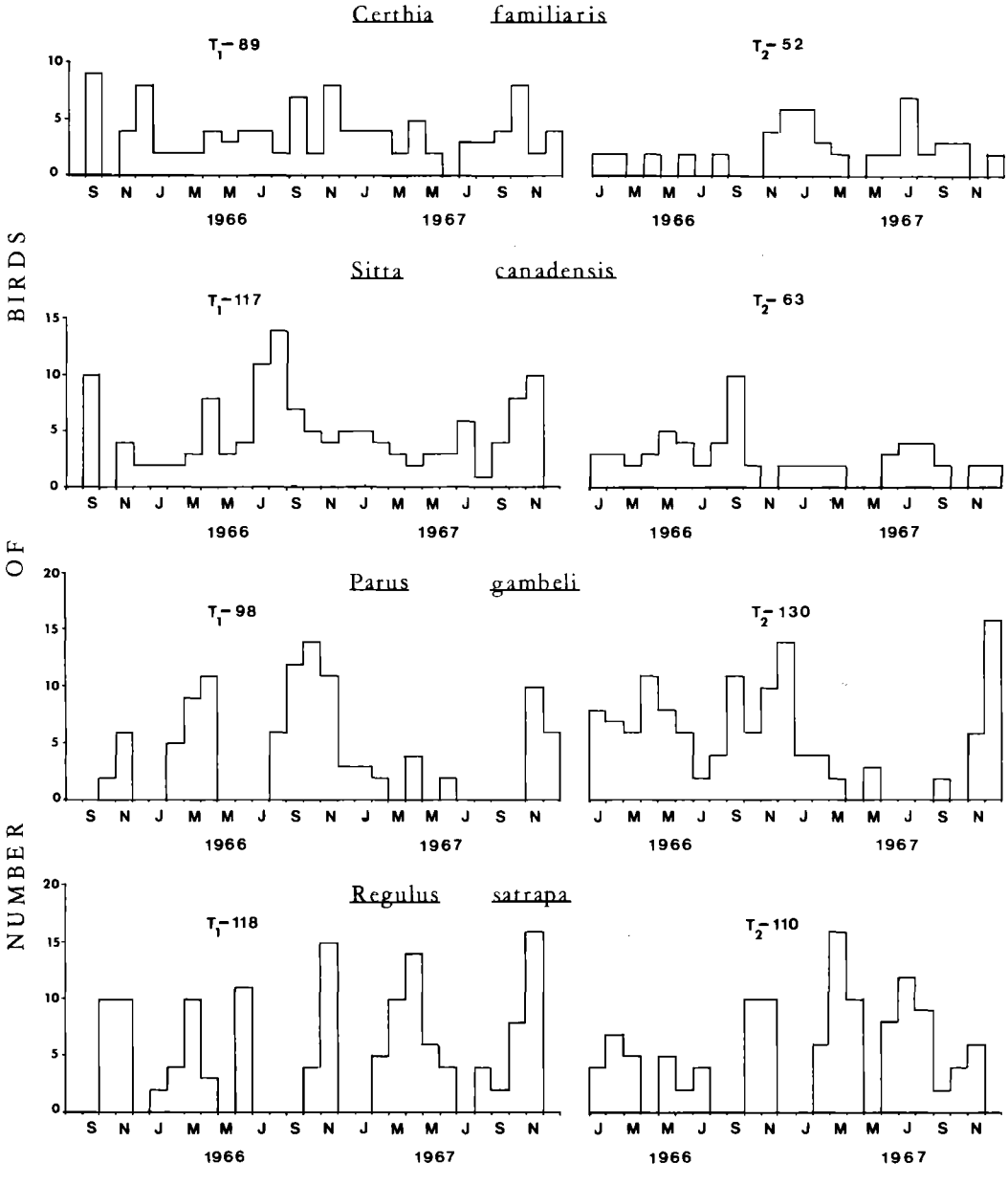

Figure 1. Passerine bird counts in two areas of the Sierra Nevada. T_1 — in a bark beetle infested, even-aged pure ponderosa pine forest, T_2 — in an uninfested, uneven-aged mixed conifer type forest, T — totals for 1966 and 1967.

foraging birds, reduced the chances of counting the same birds more than once.

Censusing was done under various weather conditions and at different times of the day. The effects of the latter were averaged by alternating the order of census of the plots in successive months; i.e. if Plot I was censused in the morning and Plot II in the afternoon in one month; this order was reversed the following month.

The censuses aimed at passerines and piciformes only because these two groups were considered to be most important avian predators of the western pine beetle. Occasionally a few raptorial birds were seen but these were not recorded. This paper discusses only passerines. Piciformes will be treated elsewhere.

All snags, stubs and high stumps were removed from Plot I in December 1966 to minimize the effect of the availability of nesting and roosting sites on cavity nesting species and to favor the comparison on the influence of food supply on the bird census of the two plots.

RESULTS AND DISCUSSION

There is no general agreement on the best method to census birds (Kendeigh, 1944; Davis, 1965). The technique employed usually varies with the species of birds, their habits and habitats. Although the strip-plot type of census is not considered reliable for song birds, it was used because the study was also concerned with woodpeckers and the latter group was assumed to be more important as predators of the western pine beetle. In spite of the shortcomings of the strip plot method the census data is considered representative of the actual condition.

The number of major passerine birds recorded in the two plots are shown in Figure 1. Brown Creepers and Red-breasted Nuthatches were more numerous in the beetle-infested, even-aged forest of Plot I than in the uninfested, uneven-aged mixed conifer type, Plot II. Both species were observed on numerous occasions foraging on trunks of trees infested by bark beetles and "hammering" at the bark like woodpeckers. Close examination of some of these bark areas has shown that both larvae and adults of bark beetles had been retrieved from the bark.

Mountain Chickadees on the other hand, were more numerous in Plot II than in Plot I. This crown-feeding species was probably less affected by the abundance of bark beetles as a special food source than by the more diversified nature of Plot II and the more variable type of food available in it. The Golden-crown Kinglet, another crown-feeding species, had virtually the same numbers in both plots. Flycatchers and "Oregon" Juncos were only seen in Plot I. The presence of flycatchers in Plot I can perhaps be explained by the feeding habit of these birds; their favorite method is to perch on dead branches from where they can soar forth to capture their prey in flight. Trees killed by bark beetles over the years provided a plethora of such "watch posts" and the birds were observed to capture insects from these posts during the flight period of the bark beetle Stomach contents of a single flycatcher collected from one of these watch posts consisted of 35 per cent bark beetles.

With the exception of the Golden-crowned Kinglet, there was a decline in the total number of birds of each species in 1967 as compared with 1966. Since this decline existed in both plots, the reason for this must have been other than food or habitat.

ACKNOWLEDGEMENTS

I wish to express my appreciation to Dr. R W Stark, University of Idaho, Moscow, Idaho, formerly with the University of California, Berkeley, California for his encouragement during the study; special thanks are due to Dr. M.D.F. Udvardy, California State University, Sacramento, for his critical review of the manuscript.

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