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OBSERVATIONS ON FOOD HABITS AND SOCIAL ORGANIZATION OF ACORN WOODPECKERS IN COSTA RICA¹

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Key words: Acorn Woodpecker; cooperative breeding; foraging; food caching; Costa Rica; *Quercus costaricensis*.

Intraspecific comparisons of ecology and behavior across habitat gradients are excellent sources of information concerning the adaptive significance of social traits. Here I report observations on (1) group size, (2) foraging behavior, and (3) acorn use in a Costa Rican population of Acorn Woodpeckers (*Melanerpes formicivorus*). Acorn Woodpeckers, a species well-known at higher latitudes for acorn storage and cooperative breeding, range from Oregon to the Colombian Andes (Koenig and Mumme 1987). Throughout this area, these birds are found in association with oak woodland. However, aspects of the ecology of this species vary considerably between the north temperate and equatorial portions of its range.

From 16 to 19 March 1988, I observed Acorn Woodpeckers (*M. f. striatipectus*) near the village of San Juan de Chicua (9°57'N, 83°50'W) on the slopes of Volcan Irazu, Cartago Province, Costa Rica. The site was approximately 2,800 m in elevation and was dominated by remnant oak forest and pasture. I made observations on six different woodpecker groups in the area, concentrating on two groups and activities at a heavily visited fruiting oak.

GROUP SIZE

Throughout their range Acorn Woodpeckers live in groups of varying sizes; groups of five to 10 birds are found in both California and Colombia (Koenig and Mumme 1987, Kattan 1988). Several suites of observations support the hypothesis that the birds at Volcan Irazu were group living: (1) I observed at least three

adult birds in all of the six territories that I found. (2) At one territory, five adult birds were seen sitting and foraging together without aggressive encounters. (3) I once observed at least 11 birds foraging in a single oak tree. Though all 11 probably did not form a single group (chasing and displacement were common), groups of up to four birds were commonly observed sitting together in surrounding trees. At one point I observed, after a single alarm note, a group of eight birds depart the fruiting oak tree simultaneously and in the same direction. (4) While roost watching at one of my focal groups I saw on one night six and on the second night five birds engage in prerost activities. On this latter night four, possibly five, birds roosted together in the same cavity.

As all of these observations were made prior to the breeding season, these groups were unlikely to have consisted of parents and dependent young. Rather, Acorn Woodpeckers at Volcan Irazu appear to live in groups with an observed range of three to at least eight individuals. Across much of their range, Acorn Woodpecker groups are comprised of multiple mate-sharing breeders and nonbreeding helpers, the latter being 1- to 4-year-old nondispersing young of the breeders (Koenig and Mumme 1987). I did not ascertain whether nonbreeding helpers, mate sharing, or both occur in the groups observed in Costa Rica.

FORAGING BEHAVIOR

The foraging behavior of this species varies across its range in expected and unexpected ways. In California, Acorn Woodpeckers eat both fresh and stored acorns, sap, buds, catkins and, especially, insects hawked from the air (MacRoberts and MacRoberts 1976, Koenig and Mumme 1987). Considering this catholic diet, it is not surprising that in the tropics individuals probe for insects in bromeliads, drink flower nectar, and are partially frugivorous (Leck 1972, Stacey 1981, Kattan 1988). I report here on a foraging mode often practiced

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by a congener, the Lewis' Woodpecker, *Melanerpes lewis* (Bock 1970), but rarely seen in the Acorn Woodpecker—ground foraging.

A typical bout of ground foraging lasted 5 to 20 min and was often a group activity. A bird drops to the ground one to eight times, though not always from the same perch or to the same area. During a bout, the individual sits 1 to 2 m off the ground, either on a tree trunk or, more commonly, on a fence post, and spends most of the bout in such a position scanning its grazed grass surroundings. The bird then flies to the ground and pecks at the grass and hops around making occasional pecks for insects. Birds remained on the ground for up to 2 min, usually only covering a few square meters of the pasture.

Though Skutch (1969) reports fly catching to be the most important means of obtaining insect prey by Costa Rican Acorn Woodpeckers (as it is in the temperate zone), I observed ground foraging to be the more prominent mode in mid-March on my study area. The fly catching that I did see usually occurred in the context of ground foraging and within 2 m of the ground. This contrasts with temperate fly catching, which usually takes place above the tops of large trees.

ACORN USE

Acorn use and storage is another variable aspect of the ecology of Acorn Woodpeckers. Though these birds are well-known for building individual storage holes for acorns (MacRoberts and MacRoberts 1976, Koenig and Mumme 1987), such holes are not a prerequisite for successful long-term acorn storage. Acorn Woodpeckers in central coastal California sometimes, and those in central Mexico often, store most of their acorns in bark crevices rather than in storage holes (MacRoberts and MacRoberts 1976; P. Hooge, pers. comm.). Though use of both bark crevices and woodpecker-made storage holes has been reported in Panama (Eisenmann 1946, Wong 1989), Skutch (1969) found no evidence of acorn storage in Costa Rica. Nor did Kattan (1988) in Colombia. At Volcan Irazu I found no bird-built storage holes in any of the groups I observed. Though this does not preclude crevice storage, I found no such storage facilities in my searching.

Proximate differences in acorn use between Acorn Woodpeckers in the United States and Costa Rica may stem mainly from differences in the size and shape of the acorns utilized. All California oaks usually produce acorns that can be transported in the bill of a woodpecker. Acorns are plucked whole from the tree and carried, usually capless and with the cap end facing the throat, to another location for either consumption or storage.

I found two oak species at Volcan Irazu: *Quercus costaricensis* and *Q. copeyensis*. Though *Q. copeyensis* acorns are suitable for transportation by Acorn Woodpeckers, none of the few trees I found were fruiting. Only *Q. costaricensis* (the far more numerous species) acorns were available during my visit. These acorns weigh up to 30 g, 40% of the average body weight of *M. formicivorus*. Besides being too heavy to transport whole, their shape also makes them difficult to carry, as they are spherical and up to 4 cm in diameter. During 9 hr of observation at a nearly continuously occupied

fruiting tree, I saw only three instances of birds transporting an acorn from the tree, and in all cases the acorns removed were already partially eaten, making them lighter and providing an edge to grip.

Because of these size and shape constraints, the Acorn Woodpeckers at Volcan Irazu were forced to feed on acorns in situ. If the woodpecker can maintain footing, it pecks a circular hole in the acorn shell—small at first and growing wider as needed to gain access to the endosperm within. Feeding at a given acorn occurred for no more than 5 min or so. Though feeding woodpeckers were commonly displaced from an acorn by conspecifics, they also left partially eaten acorns for no apparent reason. In fact, most feeding episodes that I observed occurred on previously opened acorns. A single acorn was visited and fed upon by different birds many times during the course of a day.

It was not always necessary for birds to peck through the shell of the acorn to gain access to the meat. Many of the acorns of *Q. costaricensis* had split shells (gap width often > 5 mm) while still on the tree, facilitating access to the endosperm.

This novel use of the acorns of *Q. costaricensis* extends the known foraging flexibility of the Acorn Woodpecker. Yet despite their heavy use of these acorns, Acorn Woodpeckers on Volcan Irazu did not or could not store them and defend exclusive access to this resource. The fact that birds from two or more groups simultaneously shared this resource brings into question the nature of territoriality in this Costa Rican population. More importantly, what role does the spatio-temporal availability of acorns play in the evolution and maintenance of group living in this species? Kattan (1988) found that, although acorns are a preferred food item, neither granaries nor even acorns were apparently required for group breeding in his population in Colombia.

It is not known whether the oaks of this Costa Rican forest provide a reliable food source for Acorn Woodpeckers. Burger (1983) reports that the acorns of *Q. costaricensis* often take two growing seasons to mature. Moreover, he suggests that this species fruits irregularly but synchronously as an herbivore-satiation strategy. I observed that some, but not all, *Q. costaricensis* at Volcan Irazu were producing ripening acorns. Interestingly, the trees that were dropping acorns were simultaneously flowering. Kattan (1988) hypothesizes that in some areas inhabited by Acorn Woodpeckers, acorns are not a reliable food source and that granaries are thus not worth building. To test this hypothesis at Volcan Irazu will require reliable information on the long-term fruiting phenology of both *Q. costaricensis* and *Q. copeyensis*. With these data and an understanding of the constraints to transportation and storage that large round acorns present, one could begin to compare the relationships between acorns and woodpeckers at these southern latitudes with those known farther north, with the hope of detecting new clues to the group-living habits of this species.

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ADDITIONAL NOTES FROM ISLA CLARION, MEXICO¹

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Key words: Isla Clarion; Townsend's Shearwater; feral pigs; Laysan Albatross; Clarion Wren.

Everett (1988) summarized his findings on Isla Clarion, the westernmost island of Las Islas Revillagigedo, following a visit there in January 1986. We spent 19 to 22 February 1988 on and around Isla Clarion and, as our observations update and differ somewhat from those of Everett (1988), we report them here.

The state of the garrison and buildings was as described by Everett (1988) but the recently constructed airstrip was overgrown and its use discontinued. Feral rabbits, not hares as reported by Everett (1988), were abundant over the island and we saw two to three sheep but no goats (c.f. Everett 1988). Feral pigs and evidence of their rooting were widespread but we saw fewer than 50 pigs in total and doubt that the population was as high as the 800-1,000 animals indicated by Everett (1988).

All nesting sites of Townsend's Shearwaters (*Puffinus auricularis*) that we found had been thoroughly rooted by pigs, and numerous shearwater carcasses littered parts of the island. As *P. auricularis* breeds only on islas Clarion and Socorro, in Las Islas Revillagigedo, and on Socorro it is preyed upon by cats (Jehl and Parkes 1982), we express serious concern for its survival.

A total of 380-470 pairs of Masked Boobies (*Sula dactylatra*) was observed at five sites but no eggs had been laid. Only one of the sites corresponded to Everett's three sites (W. T. Everett, pers. comm.) and, as he thought, pigs may cause abandonment and shifting of colonies. We estimated 3,010-3,210 pairs of nesting Red-footed Boobies (*S. sula*) at five sites, the majority with one egg. Later timing of our visit and greater coverage of the island may explain the differences between our counts and those of Everett (1988).

At least 30 Laysan Albatrosses (*Diomedea immutabilis*) were on land, including two birds incubating eggs (details to be published separately). The species was previously unrecorded from Clarion (Brattstrom and Howell 1956, Jehl and Parkes 1982, Everett 1988).

The endemic Clarion Wren (*Troglodytes tanneri*) was common. A survey of all but the easternmost end of the island revealed at least 115-140 pairs and we estimated the population at 170-200 pairs. Everett (1988) noted only "up to 20" wrens; our observations indicate that the wrens could have been incubating during Everett's visit and hence less conspicuous than when feeding young in February 1988. The highest density was around the buildings and adjacent areas. Likewise, the Clarion Island Mourning Dove (*Zenaidura macroura clarionensis*) was common. We estimated a minimum population of 55-75 pairs vs. "no more than 20" seen (Everett 1988). Breeding was mainly at the courtship stage though one group of fledglings was being fed by an adult. Both wrens and doves were well distributed throughout suitable habitat and appear to be in no

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