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ROOST AND NEST SITES OF COMMON NIGHTHAWKS: ARE GRAVEL ROOFS IMPORTANT?[1]

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Key words: Common Nighthawk; nest-site selection; diurnal roosts; rooftops; radiotelemetry; British Columbia.

It is well-known that Common Nighthawks (*Chordeiles minor*) regularly use flat, gravel roofs for roosting and nesting throughout their range (Gross 1940, Sutton and Spencer 1949, Dexter 1961, Armstrong 1965, Grazma 1967). Thus, much of our knowledge of the nesting and incubation behavior of this species is derived from observations of individuals nesting on rooftops. For example, Armstrong (1965) studied *C. minor* nesting on rooftops in an urban area and found a significant correlation between home-range size and the number of available flat roofs.

The purpose of this study was to determine the nature of roost and nest sites used by individual *C. minor* carrying radio transmitters. Currently, there are no published data concerning the preference by individual *C. minor* for rooftop nest and roost sites vs. natural sites. If the prevalence of reports describing the use of rooftops accurately reflects actual site preference by this species, then I predict a significant proportion of radio-tagged individuals should roost or nest on roofs when such sites are available.

MATERIALS AND METHODS

The study took place near Okanagan Falls, British Columbia, Canada (49°20′N, 199°37′W) from May to August in 1985, 1986, and 1987.

I defined suitable man-made sites as rooftops with an area greater than 35 m² and surfaced with gravel. The criterion of 35 m² was chosen to exclude garages, tool sheds, and other small structures since there are no reports of nighthawks using these. To assess rooftop availability, I identified all suitable sites within 1 km of the location where birds were captured. This area encompassed the village of Okanagan Falls, the only major concentration of buildings within 10 km. Since *C. minor* will potentially use any flat, relatively open area as a roost or nest site (Gross 1940, Godfrey 1986), the availability of natural sites was not quantifiable.

Foraging *C. minor* were captured in mist nets set over the Okanagan River at Okanagan Falls Provincial Park (henceforth "the Park"). Females were distinguished by a buff-colored throat patch compared with the white patch of males, and by the absence of a conspicuous white subterminal tail bar (Selander 1954). All tagged individuals were adults based on plumage. Juveniles retained their immature plumage until September when they molt (Selander 1954).

I glued radio transmitters (Holohil Systems, RR #2 Woodlawn, Ontario, Canada—model PD-2) to a "backpack" made of two elastic hair bands knotted in a figure-eight pattern with epoxy cement (Mills 1986). The transmitter packages had a mean mass of 5.4 g (n = 8), representing about 7.0% of the body mass of a nighthawk.

I tracked individuals with a Merlin 12 receiver (Custom Electronics, Urbana, Illinois) and collapsible five element Yagi antenna. In 1985 I tracked individuals to a precise roost or nest structure on a daily basis, while in 1986 and 1987, after a specific site was located for each bird, I used telemetry to confirm that individuals were in the same area (within 100 m) each day. If individuals continued to roost in the same area, I assumed that they were using the same site. Whenever the signal coming from a tagged individual indicated

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that a roost or nest was near a building, I checked the roof.

RESULTS

Of 449 buildings within 1 km of the Park foraging site, 154 (34%) had flat roofs and of those 65 (14.4%) had gravel surfaces.

During the 3 years of the study, I attached radio transmitters to 27 individual *C. minor* (15 females and 12 males) and collected roosting data for 898 transmitter days. None of the 27 individuals that I tracked ever roosted or nested on flat roofs, nor any other type of man-made structure.

Roosting birds were tracked to sites on the ground or in ponderosa pines (*Pinus ponderosa*). The cryptic behavior and plumage of this species prevented me from visually locating all but one radio-tagged individual roosting in a tree. Radio-tagged individuals changed day roost areas every 3.6 days on average (range = 1–25 days).

All females carrying transmitters roosted on the ground in open areas. The nests of six birds not carrying radio transmitters were located on the ground in open areas. No building roofs I checked had *C. minor* nests on them.

DISCUSSION

My data clearly show that gravel roofs are not used by *C. minor* near Okanagan Falls for either roosting or nesting activities, indicating a preference for more natural sites. Since the birds were all captured while foraging away from their diurnal roosts or nests, the observed roost-site selection should reflect preference in the study area and not a bias resulting from the relative ease of finding nighthawks on rooftops vs. more natural settings.

It is possible that the gravel roofs available in this area are not of the type preferred by *C. minor*. Sutton and Spencer (1949), Dexter (1961), and Grazma (1967) noted that nests of this species tended to be on gravel roofs that were wholly or partially rimmed by walls or parapets. Only four of the buildings in my study area had walls or parapets around them.

Grazma (1967) reported that nests occurred on roofs of buildings ranging in height from 5 to 15 m. Only one of the roofs in my study area was on a building higher than three stories (10 m). A four-story building (12 m), with a flat gravel roof enclosed by a 1-m wall, in Kaleden (10 km from the study area) was not used by nighthawks.

Commuting distance from roost sites to the Park foraging area was not a factor in roost selection. The average commuting distance of radio-tagged birds between roosts and the Park was 2.7 km (SE = 0.1, n = 284 trips), with some individuals traveling as far as 12 km on a nightly basis. These data suggest that the increased energetic cost of commuting to distant tree or ground roosts was balanced by some advantage of these sites because at least 65 flat gravel roofs were available within 1 km of the foraging area. Since tagged individuals changed sites regularly, specific day roost preference also does not appear to be important.

The limited data that I collected on nesting activities at natural sites suggest that there is no major difference from observations made of birds nesting on roofs (Gross 1940, Godfrey 1986). At all six nests, two eggs were laid and males were not observed to incubate. On four evenings of observation at a nest in 1985, I saw the male feed the female twice and the nestlings four times. The same nest site was reused in 1986 although I could not be sure if it was by the same bird. This supports the observations of Dexter (1961) who found that the same rooftop nest site was used in succeeding years.

This study shows that *C. minor* have not uniformly adopted rooftops as nesting and roosting sites throughout their range. The limited environmental disturbance by humans in the study area may have allowed the maintenance of nighthawk behavior representative of times before the construction of gravel roofs. I suspect, however, that published accounts implicating a high frequency of nests on rooftops may in part reflect biased observation rather than actual preference. Alternatively, the roof-nesting/roosting phenomenon may merely reflect the use of these sites when alternatives are not available. Nighthawks nesting in urban areas may be attracted by insects drawn to lights (Shields and Bildstein 1979). In this situation, the abundance of food may outweigh any potential avoidance of rooftop sites. Data collected in the same manner as in this study are needed from an area where *C. minor* is known to use rooftops for nesting or roosting to determine whether *C. minor* actively choose natural over rooftop sites.

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THE IMPLICATIONS OF GERMINATING ACORNS IN THE GRANARIES OF ACORN WOODPECKERS IN PANAMA[1]

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Key words: *Acorn Woodpecker;* Melanerpes formicivorus; *Panama; germinating stored acorns; reduced group size.*

The granary is a central feature in the social organization of Acorn Woodpeckers, *Melanerpes formicivorus* (MacRoberts and MacRoberts 1976, Stacey and Koenig 1984). Groups studied in North America (MacRoberts and MacRoberts 1976, Koenig and Williams 1979) and Belize (Stacey 1981) store ripe acorns on breeding territories for consumption during periods of food scarcity. Granaries of better-studied northern groups average about 1,000–2,000 holes and the extraordinary maximum of 30,000 holes has been reported for some granaries (Stacey and Koenig 1984). Large granaries are maintained by groups of breeding and nonbreeding adult Acorn Woodpeckers that share in the maintenance and consumption of stored acorns.

My observations in Panama of short acorn-storage time, germinating acorns, and oak seedlings in Acorn Woodpecker granaries indicate that acorns represent a perishable and, hence, less dependable stored food source in this part of the woodpecker's range. If group size is related to the maintenance of granaries, then Panamanian Acorn Woodpeckers are expected to occur in smaller groups in a habitat where stored acorns are reduced in importance.

STUDY AREA AND METHODS

I visited the highlands of Chiriqui Province (9° N) in Western Panama during 8–14 August, 6–9 October, and 23–29 December of 1984 and observed Acorn Woodpeckers at four localities. Three sites ranged from east to west on the slopes of Volcán Barú: Finca Menendez, 7.5 km NW Boquete, 1,800 m elevation (visited during October and December); a coffee finca, 2 km SE Bambito, 1,850 m elevation (August, December); Finca Fernandez, 4 km E Cerro Punta, 2,100 m elevation (August, December). The fourth site was on the southern slope of the Cordillera Central near the Costa Rican border: Finca Gonzalo-Batista, 5 km NW Santa Clara, 1,600 m elevation (December). All four sites were open hillside habitats characterized by standing and recumbent trunks of dead oaks (*Quercus* spp.). The Bambito site had 3-m-tall coffee plants spaced in rows whereas the other three sites were sheep or cattle pastures. Mature black oaks occurred individually or in small clumps in the open areas and bordering forest patches.

Six white oak species and three black oak species occurred in the Chiriqui Highlands (Muller 1960). Residents considered "roble," the local name for oaks, common in the area. Panamanian oaks fruited annually (Muller 1960) although crop size may have fluctuated from year to year (R. O'Neal, pers. comm.). In the Boquete area, acorns ripened between mid-July and November (R. O'Neal, pers. comm.), a period of high rainfall (Direccion de Estadistica y Censo 1981 y 1982). Unlike North American acorns, those of Panamanian oaks (Fig. 1a) did not appear to undergo a period of dormancy since I found newly sprouted seedlings in the moist litter beneath acorn-bearing trees in October.

I searched pastures systematically for granaries where greatest woodpecker activity occurred because groups studied elsewhere tended to center their activities near storage trees (MacRoberts and MacRoberts 1976, Roberts 1979, Trail 1980). At each granary, I counted the number of holes present in the main storage tree, the number of acorns and seedlings in holes or cracks and crevices of the storage tree, and the number of acorns and seedlings in the cracks and crevices of fence posts and fallen tree trunks within 20 m of the main storage tree. Group size was determined to be the largest number of woodpeckers seen simultaneously in the vicinity of the granary. For a few groups, it was possible to count members as they emerged from the roosting tree. The foraging activities of Acorn Woodpeckers away from granaries were noted whenever possible.

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