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Proximity to Active *Accipiter* Nests Reduces Nest Predation of Black-chinned Hummingbirds

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ABSTRACT.—A variety of bird species have been shown to derive protection from nest predators by nesting in association with more aggressive or predatory species. We provide the first evidence of this interaction for a hummingbird. Black-chinned Hummingbird (*Archilochus alexandri*) nests in southeast Arizona were found near the nests of two species of *Accipiter* raptors. Mayfield estimates of nest survival indicated nests within 300 m of active *Accipiter* nests have significantly higher probabilities (46 vs. 9%) of successfully fledging young. Received 27 December 2008. Accepted 19 March 2009.

Nest predation has been demonstrated to be a major factor limiting nesting success and shaping spatial distributions of breeding birds (e.g., Ricklefs 1969, Suhonen et al. 1994, Roos and Pärt 2004, Fontaine and Martin 2006), making selection of a safe breeding habitat a fundamentally important aspect in avian population ecology (Newton 1998). Breeding birds are expected to choose nest sites which reduce exposure to predators including nesting in association with more aggressive or larger predatory birds whose presence reduces abundance of nest predators in the immediate vicinity (e.g., Norrdahl et al. 1995, Prop and Quinn 2003). This type of interspecific association, however, has not been reported for any hummingbird species.

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The Black-chinned Hummingbird (*Archilochus alexandri*) nests from southern British Columbia to extreme northern Mexico and southern Texas, over-wintering from southern Texas to south-central Mexico (Baltosser and Russell 2000). Black-chinned Hummingbirds within this region nest in riparian zones, breeding from early April to August (Baltosser and Russell 2000). Most information on breeding biology of Black-chinned Hummingbirds has come from work in southeastern Arizona and southwestern New Mexico.

We noticed that nests of Black-chinned Hummingbirds in southeastern Arizona exhibit clustered distributions on the landscape (Fig. 1), despite availability of suitable riparian nesting habitat available elsewhere (Baltosser 1983, Baltosser and Russell 2000). We found upon closer examination that these groups appeared to occur near active *Accipiter* nests. We test the idea that proximity to active *Accipiter* nests reduces predation on Black-chinned Hummingbird nests in a *post-hoc* examination of nesting success.

METHODS

We made all observations in the vicinity of the American Museum of Natural History's Southwestern Research Station (31° 53' N, 109° 12' W, 1,600 m elevation), west of Portal in the Chiricahua Mountains, Cochise County, in southeastern Arizona (an area described by Marshall 1957). We searched for Black-chinned Hummingbird and *Accipiter* spp. nests along riparian areas near the station from 14 April to 4 June 2007. We searched the entire area in a regular zig-zag pattern to insure that all areas were visited equally. Upon location of a hummingbird nest, we made note of

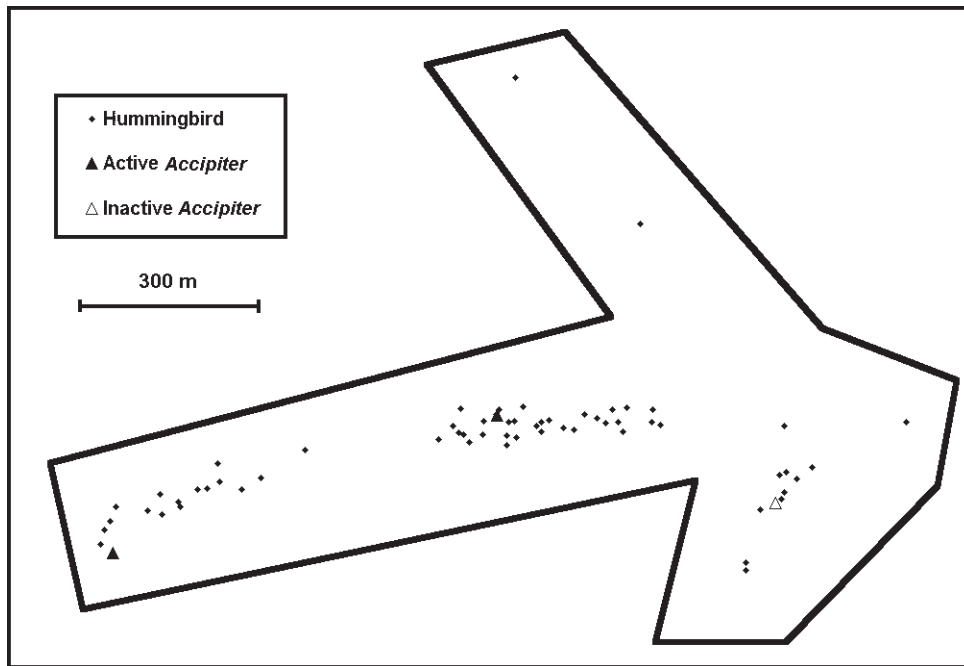


FIG. 1. Location of Black-chinned Hummingbird and *Accipiter* nests within a riparian zone search area in southeastern Arizona. The active *Accipiter* nest on the far left was that of Northern Goshawk.

its stage (building, incubation, nestlings). We assigned nest stage by observing the nest contents either directly or with a mirror pole. We used adult behavioral cues (such as sitting long periods and/or adding material or feeding nestlings) in the case of nests over 7 m above the ground. We checked nests every 2–3 days to assess their status and considered nests to have been depredated when their contents disappeared prior to the expected fledging date. We predicted fledge date using known incubation and nestling periods (Baltosser and Russell 2000), and by estimating nestling age using plumage development (Greeney et al. 2008). We excluded nests that were abandoned during any stage, leaving the contents intact. We included in our analyses only nests that contained eggs or young during our observations. We used a Global Positioning System (GPS) to calculate the shortest distance to the nearest active *Accipiter* nest from each hummingbird nest.

We used methods developed by Mayfield (1975) and Johnson (1979), and calculated daily nest survival rates (DSR) (\pm SE) and 95% confidence limits for nests within 100-m distance intervals from active *Accipiter* nests (e.g., 0–100, 101–200 m). We chose these distance categories to insure there were sufficient hummingbird nests

in each sample for meaningful comparisons. We compared DSRs between 100-m distance categories following Johnson (1979).

RESULTS

We found and monitored 61 Black-chinned hummingbird nests within our search area that fit our criteria. Fifteen were closest to an active Northern Goshawk (*Accipiter gentilis*) nest and 46 were closest to an active Cooper's Hawk (*A. cooperii*) nest (Fig. 1). We found no evidence of additional active raptor nests despite exhaustive searching for additional *Accipiter* nests that may have been within 400 m of our principle search area, but found an inactive nest that had been used by Cooper's Hawks the previous year (Dave Jasper, pers. comm.). Ten of the 15 nests >300 m from an active *Accipiter* nest occurred within 300 m of the inactive nest (Fig. 1).

There were no significant differences in DSR's between 100, 200, and 300-m distance intervals of hummingbird nests (Fig. 2), but nests >300 m from active *Accipiter* nests were significantly (Johnson's $z = 2.42$, $P = 0.016$) less successful than those within 300 m. Nests within 300 m of the inactive nest, but >300 m from an active *Accipiter* nest, did not show

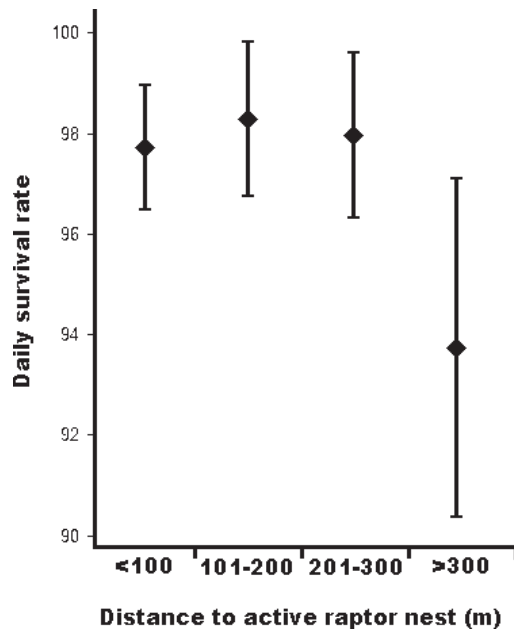


FIG. 2. Daily survival rates with 95% confidence intervals of Black-chinned Hummingbird nests within four distance categories from active *Accipiter* nests.

improved success. The DSR of nests within 300 m of an active *Accipiter* nest was $97.9 \pm 0.04\%$ (46 nests, 1135 successful days, 24 days with failures), while the DSR of nests >300 m was $93.7 \pm 0.17\%$ (15 nests, 194.5 successful days, 13 days with failures). Predicted fledging success for hummingbird nests in these two distance categories was 46 and 9%, respectively, using a 2-day laying period, 14 days of incubation, and a 21-day nestling period (Baltosser and Russell 2000).

DISCUSSION

Black-chinned Hummingbirds nesting in proximity to active *Accipiter* nests experienced reduced predation. Similar interactions, where a “timid” species reduces the rate of predation of its own nests by capitalizing on the superior defense capabilities of a more “aggressive” species, have been found in a phylogenetically and geographically diverse array of avian species (e.g., Norrdahl et al. 1995, Bogliani et al. 1999, Ueta 2001, Prop and Quinn 2003). We did not quantify predator abundance within our search area but believe it is likely that presence of raptors around their nests may depress predator densities, as suggested by previous authors (Ueta 2001, Prop and Quinn 2003).

Clustering of nests has been reported for several other species of hummingbirds (Smith 1969, Greeney et al. 2006, Solano-Ugalde 2008). These studies suggested that clustering was a result of limited nesting sites within appropriate habitat. We documented hummingbirds nesting near inactive raptor nests as well as around active nests and it is possible that *Accipiter* and *Archilochus* have similar, although undocumented, nesting site preferences. The differences in success associated with proximity to active *Accipiter* nests suggest that other factors may affect spatial distributions of *Archilochus* nests. These patterns in Black-chinned Hummingbirds and other species deserve further attention to more thoroughly test this phenomenon. Further investigations of this pattern should focus on additional potential benefits and costs of mixed-species and conspecific nesting aggregations (Dyrce et al. 1981, Götmark and Andersson 1984, Burger 1985).

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