CANYON WRENS BREEDING IN DESERT RIPARIAN VEGETATION: FIRST RECORDS IN A NOVEL HABITAT

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ABSTRACT: The Canyon Wren (*Catherpes mexicanus*) is widespread but uncommon in the arid regions of western North America, typically breeding in rock faces and cliffs. Here we present the first records of the Canyon Wren breeding in riparian woodland, a habitat considered atypical for this species. Additionally, we recorded the species' first known nesting in a live palm tree (*Washingtonia filifera*). As part of long-term monitoring of riparian birds for the Lower Colorado River Multi-Species Conservation Program, we recorded 89 nesting territories of the Canyon Wren from 2011 to 2014. Of 75 mapped territories, 31 were within dense riparian vegetation that included no cliffs or rocks.

The Canyon Wren (*Catherpes mexicanus*) is one of the least studied birds of North America, though it is widespread if uncommon in arid habitats throughout the West (Jones and Dieni 1995, Jones et al. 2002). The species is thought to be largely restricted to rocky areas that feature cliffs and/or rock outcrops, in which it nests (Jones and Dieni 1995). Nests have also been found far from rocky areas, including in buildings and other artificial structures that feature covered ledges (Bancroft 1930, Bent 1948, Howell and Webb 1995, Corman and Wise-Gervais 2005), as well as in a tree stump (Kaufman 1996). It is generally assumed that the species is not tied to a particular vegetation community but rather to the presence of cliffs, steep-sided canyons, rocky outcrops, and boulder piles (Jones and Dieni 1995, Jones et al. 2002, Johnston and Ratti 2002, Unitt 2004). The microsite a nest requires is thought to be a crevice inside larger rocks that can maintain consistent temperatures throughout the breeding season, presumably to avoid thermal stress to the nestlings (Johnston and Ratti 2002).

The Canyon Wren has not previously been reported to nest in riparian woodlands, although after the breeding season the birds forage in dense riparian areas along the Bill Williams River in Arizona (Rosenberg et. al. 1991), in desert washes with steep banks (Phillips et al. 1964), and along narrow riparian corridors and canyons lacking rocks (D. Vander Pluym pers. obs.). In this study, we present data on the status and territories of Canyon Wrens breeding in riparian vegetation along the Bill Williams River, as well as detailed information on a nest within a California fan palm (*Washingtonia filifera*).

METHODS

Study Area

Our study area spanned the main stem of the lower Colorado River from Separation Canyon (just upstream of Lake Mead) to the international boundary with Mexico. It also included the lower Bill Williams River in west-central Arizona, from Alamo Dam to its confluence with the Colorado River.

Figure 1. Overview of the Bill Williams River National Wildlife Refuge depicting extensive riparian corridor adjacent to steep rocky cliffs.

Photo by Elisabeth Ammon

Data presented in this paper are almost exclusively from Bill Williams River National Wildlife Refuge, although we also recorded a few Canyon Wren territories on the main stem of the Colorado River. The refuge is unique among our riparian study sites in that arid upland mesas end abruptly in cliffs that descend into the dense riparian forest (which lacks rocky areas) on the river's floodplain (Figure 1). The site also stands out in the lower Colorado River valley as the last remaining large intact gallery forest. The forest is dominated by Fremont cottonwood (*Populus fremontii*) and Goodding's willow (*Salix gooddingii*), although the non-native saltcedar (*Tamarix* sp.) is also present. The Buckskin Mountains to the south and Bill Williams Mountains to the north surround the alluvial fan of the Bill Williams River where it enters the Colorado River. These mountain ranges feature cliffs of exposed bedrock that are characterized by uneven layers of coarsely foliated rocks and connect with other mountains farther north and east of the confluence of the Bill Williams and Colorado rivers.

Study Design

For the larger study that spans the main stem of the Colorado River and Bill Williams River National Wildlife Refuge, in each year from 2011 to 2014, we randomly selected 80 plots throughout the study area and an additional 80 plots within habitat conserved under the Lower Colorado River Multi-Species Conservation Program (GBBO 2012, USBR 2014). We selected all

plots by using a stratified random sampling design with strata being defined by river reach and riparian vegetation type (for details, see GBBO 2012).

The surveys entailed a three-tiered area-search method used for double sampling (Bart and Earnst 2002), with all selected survey plots visited twice (rapid surveys), a subset of plots visited eight times (intensive surveys), and a further subset visited 16 times (enhanced intensive surveys). On each survey, we systematically grid-searched each plot, recording all birds detected, their locations, and any evidence of breeding, using rankings modified from Floyd et al. (2007). We report territories as field-delineated areas where, during the breeding season, Canyon Wrens repeatedly sang from the same set of perches, associated as pairs, defended a site through scolding, carried food or nest material to a site, and/or where nestlings were audible to the surveyor. The purpose of the larger study was to use these methods for delineating the territories of breeding riparian birds, including the Canyon Wren.

We defined riparian territories as those that were at least one territory's diameter (based on average territory size in the study area and an assumed circular shape) in distance from any significant cliffs and rocks, located with aerial imagery. We calculated the average size of a Canyon Wren territory on the basis of territories with six or more location records, and the territories included had an average of 14 (range 6–27) location records. The minimum of six locations was based on the study of Canyon Wren territories by Jones et al. (2002). To estimate the overall density of territories, we included data from 2013 only, since the majority of the riparian areas in the refuge (105 ha) were randomly selected to be included that year, which thus represented the most comprehensive survey.

During a survey, we passed within 50 m of every point within the study plot to ensure complete coverage. Surveys extended from early April until the middle of June to maximize coverage during the breeding season of most riparian passerines in the study area. We began surveys at sunrise and ended no later than noon in order to minimize surveys during high temperatures (>100 °F) and periods of low bird activity. We recorded all birds detected and territory boundaries directly onto a gray-scale aerial photograph with a 50-m UTM grid, which also included aerial photography of the immediate surroundings (20–100 m) of the plot. We entered all bird locations recorded on survey maps into ArcGIS (ArcGIS software version 10.2, ESRI, Redlands, CA) and plotted territories by creating minimum convex polygons. Although this study is part of long-term monitoring, the data we report here were recorded from 2011 to 2014 only. For a thorough description of our survey methods, see GBBO (2012).

RESULTS

General Observations

From 2011 to 2014, we recorded 89 territories of breeding Canyon Wrens, 75 of which had location data sufficient for territory mapping in ArcGIS. A total of 88 territories were documented just within the Bill Williams River drainage, and one territory was found in a narrow riparian corridor along the northeastern side of Lake Havasu (notably, this territory was over 1 km from what is considered typical Canyon Wren habitat).

The average size of a Canyon Wren territory in the study area was 0.75 ha (range 0.10–2.8 ha, n = 20). We found that the number of territories recorded in cliffs and rocks was similar to the number of territories recorded in riparian vegetation; specifically, 44 territories contained cliffs or rocks, while 31 lacked them, being exclusively in riparian vegetation. Figure 2 illustrates the typical settings of cliff-and-rock and riparian territories.

Using 98 m as the average diameter of a territory and assuming a circular shape, we found that five of the 31 riparian territories (16%) were located greater than five territory diameters (>490 m) distance from the nearest cliff or rock. Twenty-one of the riparian territories (67%) were located at a distance of two to five territory diameters (196–490 m) from any significant cliff or rock, while the remaining ones were at least one territory diameter distant. We rarely observed birds that had cliff-and-rock territories feeding in riparian vegetation during breeding, although they did use riparian areas after the young had fledged.

Within the riparian zone the density of Canyon Wren territories was eight territories per 105 ha. We did not estimate the density of cliff and rock territories as part of this study, but in one study plot we recorded four territories along 0.5 km of cliffs.

In six riparian territories we also obtained sufficient evidence (carrying food, dependent young, or clear nest-defense behavior of the adults) to confirm the general area of the nest but could not pinpoint the location. In each case the nest was in either a palm or willow tree in dense riparian vegetation. We also confirmed one nest in a palm.

Canyon Wren Nesting in Fan Palm

On 21 of 26 visits from 12 April to 11 June 2013, three surveyors engaged in double-sampling a riparian plot observed an active Canyon Wren nest in a palm. The tree, estimated to be 10 m tall, grew in the understory of a cottonwood gallery forest that exceeded 20 m in canopy height (Figure 3). The nest was at a height of 4 m inside a dying frond, 1.5 m long, angling downward on the southwest side of the trunk. The palm frond was curled inward, creating a small hollow that the wrens entered from below, and a shelf formed by multiple fronds served as the nest substrate inside this natural cavity. The nest was located roughly 50 cm from the lower tip of the fronds and was constructed of sticks, dead leaves, and other fibrous material.

We observed Canyon Wrens entering the cavity with food on five visits to the plot, and we recorded a Canyon Wren singing from the nest tree on 16 visits. On 24 April and 1 May 2013, we heard the nestlings calling while food was brought to the nest. From 10 May through 21 May, we made no observations of Canyon Wrens near the nest tree and seldom detected them on the plot, presumably because the nestlings had fledged, but on 21 May and 23 May, we observed three Canyon Wren fledglings begging within 50 m of the nest. We recorded the size of this pair's territory as 0.5 ha, but because of the difficulty of finding silently foraging adults in the dense vegetation, the home range may have been larger. In the springs of 2014 and 2015, Canyon Wrens were again observed using the same fan palm. Although we could not locate the nest, in 2015 a Canyon Wren was again carrying food into the palm.

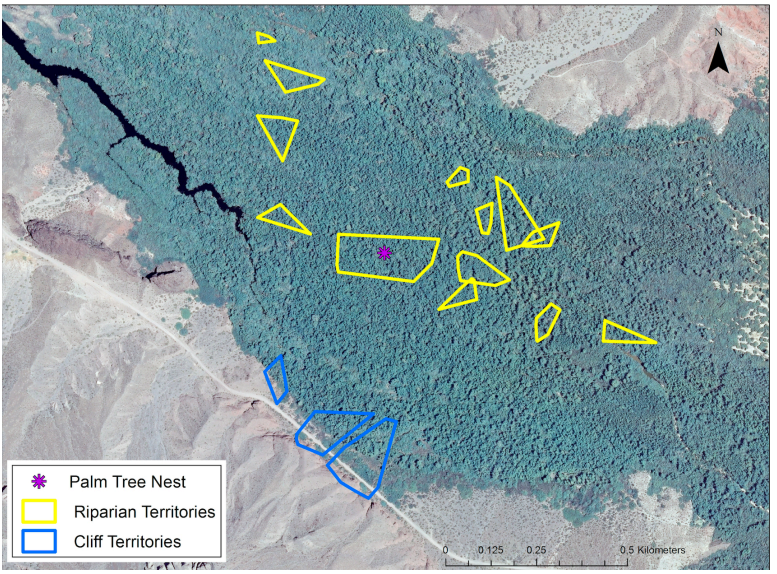

Figure 2. Example of Canyon Wren territories mapped within the Bill Williams River National Wildlife Refuge during this study. Territories in yellow are exclusively in riparian habitat; those in blue contain significant cliffs or rocks.

DISCUSSION

Nearly all Canyon Wren territories within our entire lower Colorado River study area occurred along the Bill Williams River, with just one territory documented elsewhere. We believe in general that the palm tree itself is not an essential component for this species breeding within the riparian corridor of the Bill Williams River, as there are only a handful of palm trees occurring along this stretch of river and the other Canyon Wren territories recorded didn't contain palm trees. Our data suggest that this species breeds regularly in the riparian woodlands of the Bill Williams River. It is, to the best of our knowledge, the first documentation of Canyon Wrens using live vegetation as a nesting substrate and selecting nesting territories without regard to the presence of cliffs or rocks.

It is unclear whether this discovery represents a recent shift in habitat use, as the Canyon Wren has been thought to require rocky substrates for nesting throughout its range (e.g., Jones and Dieni 1995, Jones et al. 2002, and Corman and Wise-Gervais 2005). Possibly it began using the riparian forest in the Bill Williams delta after the construction of the Alamo dam in 1968. The magnitude of floods on the Bill Williams River was drastically reduced after the dam was built (Shafroth et al. 2002). This reduction in flow and flooding allowed time for more mature trees to establish themselves (Shafroth et al 2002), creating the decadent forest seen along the Bill Williams River today. Additionally, the increase in *Tamarix* since the

Figure 3. Palm tree that contained a Canyon Wren nest.

Photo by Lauren Harter

building of the dam has increased the woodland's density (Shafroth et al 2002). These changes in vegetation structure could have promoted the Canyon Wren's establishing territories within the riparian corridors. Nevertheless, from 1974 to 1984 Rosenberg et al. (1991) did survey this area after the dam's construction yet found no Canyon Wrens nesting in the riparian forest. Possibly these surveys occurred too soon after the completion of the dam for the forest to have reached the stage of

density and decadence attractive to the Canyon Wren. The Canyon Wren population of the Bill Williams River we have described is, however, restricted enough that its nesting in the dense riparian gallery forest may have been overlooked. This study therefore constitutes a reminder of the importance of surveying areas and habitat types that are not considered typical or even suitable for a given species.

The Bill Williams River population appears to be denser than has been reported for the Canyon Wren elsewhere, and its average territory size of 0.75 ha is also smaller than the averages of 0.91 ha (Jones and Dieni 1995) and 1.3 ha (Jones et al. 2002) reported from the Front Range of Colorado. Within the riparian areas, the territory density of 8 pairs/105 ha is almost twice the estimated density (4.5 pairs/100 ha) reported from the Rocky Mountain region (Jones et al. 2002). Although we calculated density in only one year, the number of Canyon Wren territories recorded in the other three years of the study implies these estimates are typical for this species in the Bill Williams delta. Additionally, the density of territories along one cliff side was higher than previously documented, with up to one territory per 0.13 km of linear cliff at the Bill Williams River compared with reports of one territory per 0.6 km (Jones and Dieni 1995) and one observation per every 0.53 km (Johnston and Ratti 2002), suggesting other unique aspects to the nesting population here.

Weathering of the bedrock cliff faces along the Bill Williams River has created an abundance of rocks with fissures, crevices, caves, and ledges, which provide possible locations for nest sites. Within this band of vertical habitat adjacent to the riparian corridor, Canyon Wren densities are especially high, possibly causing spillover into the nearby cottonwood gallery forest. The high densities within our study area may also be a result of higher winter survivorship due to the more moderate winter climate and access to winter feeding areas in the riparian corridor of the Bill Williams River. The high density and small territories of the population along the Bill Williams River could also suggest higher habitat quality in this area, a question meriting further study. While not explicitly studied, nest success and site fidelity in the area appear high, with multiple broods fledging throughout the area and a pair nesting in the same palm tree from 2013 through 2015. Future studies should address the role of riparian woodlands in the Canyon Wren's reproductive performance in this unique area.

Microclimate is an important factor in the Canyon Wren's selection of a nest site, most nests being enclosed in rocky substrate that shelters them from the elements and provides a stable microclimate during the summer heat (Johnston and Ratti 2002, Jones et al. 2002). The cavity inside the palm frond, combined with the moderating effect of the riparian forest, most likely maintained a microclimate cooler and more stable than at random sites in the surrounding area and may mimic the microhabitat of nests in more typical rocky substrates.

We recommend that future research include more detailed studies of the nests and reproductive output of diverse populations of the Canyon Wren to assess how this species uses environments that appear novel, including atypical vegetation. Other studies of the life history of the Canyon Wren

are also warranted, including investigations into winter survivorship, which is considered to be a limiting factor in the colder Front Range of Colorado (Jones et al. 2002).

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