

2019

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Recommended Citation

Kannan, Ragupathy; Jackson, Jack; and Brooks, Ethan (2019) "History and Current Status of the Inca Dove (*Columbina inca*) in Arkansas," *Journal of the Arkansas Academy of Science*: Vol. 73 , Article 14.

Available at: <https://scholarworks.uark.edu/jaas/vol73/iss1/14>

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History and Current Status of the Inca Dove (*Columbina inca*) in Arkansas

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Running title: Status of Inca Doves in Arkansas

Abstract

Formerly a bird of Central America, Mexico, and the southwestern United States, the Inca Dove (*Columbina inca*) has expanded northward across North America in the past few decades. It first appeared in Arkansas on October 26, 1968 in Saratoga, Howard County. Since then, the statewide range has grown to include at least 36 of 75 counties and is expanding. With the use of Christmas Bird Counts, Breeding Bird Surveys, and 2 citizen science sources, eBird and AR-Birds, we compiled 368 records of the species in the state. Inca Doves were observed year-round in Arkansas and are expanding their range in the state at an average rate of about 1 new county every 7 years and an increase of about 1 new report of the species every year. An overview of its overall range in North America indicates that there is enough data to warrant a redrawing of the range map for the species to include most of Arkansas.

Introduction

Several bird species have expanded their global ranges, with anthropogenic habitat modifications a major causative factor (Hengeveld 1988; Fujisaki *et al.* 2010). There is also strong evidence that many bird species are extending their ranges poleward (Thomas and Lennon 1999; Hickling *et al.* 2006; Kannan and James 2009), ostensibly due to anthropogenic climate change (IPCC 2014). It is important, therefore, to monitor local bird populations for geographic shifts, since an accurate understanding of bird distributions is vital for conservation efforts (Remsen 2001; Kannan *et al.* 2018).

Here we document the rapid progression in the global range of the Inca Dove, with focus on its history and status in Arkansas. This study follows a previous review of the Eurasian Collared-Dove in Arkansas (Fielder *et al.* 2012), which is one of the world's most rapidly expanding bird species (Hengeveld 1993). Of

the 7 species of pigeons and doves (Aves: Columbidae) reported to occur in Arkansas, 3 are relatively new to the state, having arrived following an expansion of their ranges northward. These are Inca Dove *Columbina inca*, Eurasian Collared-Dove *Streptopelia decaocto*, and White-winged Dove *Zenaida asiatica*.

The Inca Dove was considered a bird of Mexico and southwestern United States, but it has expanded northward across North America. Three decades ago it was regarded “a rare transient and winter visitor” in Arkansas (James and Neal 1986), but in recent years there has been a plethora of reports in the state. Globally, Inca Doves used to occur from northwestern Costa Rica to northern Mexico and parts of the United States bordering Mexico (Fig. 1; Mueller 2004). Arkansas is not included in the species’ range in Cornell Lab of Ornithology’s widely used online source of range maps for North American birds (Allaboutbirds.org 2019).

Despite the recent increase in reports of Inca Doves in Arkansas and elsewhere in North America, and the fact that the species has been spreading for at least 3 decades, no systematic review has been done to track its progression and monitor its status. Extralimital information on Inca Doves has only been anecdotal (Hardy 1958; Johnston 1965; Behle 1966; Felis 1976;



Fig. 1. Published global range of the Inca Dove (Allaboutbirds.org 2019 from Mueller 2004).

Bartnicki 1979; Paine 1988; Robbins and Easterla 1992). Therefore, we conducted this study to 1) assess the species' current global distribution, 2) review the species' history, current status, and distribution in Arkansas, and 3) investigate quantitative trends in the species' spread across the state.

Methods

We compiled a comprehensive historical account of Inca Doves in Arkansas using citizen science data in eBird (2019) and archives of the listserv for Arkansas birders, AR-Birds (AR-Birds-L 2019). Data from the eBird database include data from the archives of the Arkansas Audubon Society (2015). We compiled a total of 336 Inca Dove records from these two sources. We took care to avoid duplications between and within the 2 sources. For every report of Inca Doves in the state, we noted date, exact location, number encountered, observers, and general comments. We counted a record as an observation of the species in a particular location, regardless of the number of observers reporting, number of individual birds present, or number of days reported. However, reports that spanned multiple months were counted separately for each month.

We also compiled quantitative information from annual Christmas Bird Counts (CBC) in the state, conducted annually by National Audubon Society (2010) mid-December through mid-January (29 additional unduplicated records). Numbers observed per ten party hours were obtained as in Fielder *et al.* (2012) for Eurasian Collared-Doves in the state.

To get insights into the species' breeding status in the state, we obtained information from Breeding Bird Surveys (BBS) (Robbins *et al.* 1986; Pardieck 2018) in Arkansas (3 records). Altogether, we compiled 368 unduplicated reports of Inca Doves in Arkansas from eBird, AR-Birds, CBC, and BBS. Microsoft Excel was used to plot data and generate regression equations and correlations.

Results

Global Range Progression

Since the 1960s, Inca Doves have steadily expanded their range northward from Mexico and Central America to now include much of the southwestern and southcentral United States (Mueller 2004). Some reports have occurred as far north as Canada (eBird 2019, Fig. 2). In addition, the Inca Doves' range has expanded southward to include southern Costa Rica (Garrigues and Dean 2014) and perhaps Panama (Fig. 2).



Fig. 2. Global Inca Dove range progression through the past 6 decades. Images generated using eBird (www.ebird.org) on March 11, 2019. The scale gives percent of checklists reporting the species.

Status of Inca Doves in Arkansas

Data in eBird from the most recent year (2019) indicate that the current range encompasses most of Arkansas plus portions of all neighboring states (Fig. 2).

History of Inca Doves in Arkansas

The first report of an Inca Dove in Arkansas was of a single bird sighted by Mr. and Mrs. Ira McJenkins in Saratoga, Howard County, from October 26, 1968 to March 24, 1969 (James and Neal 1986, eBird 2019). Two years later, from February 24, 1971 to March 28, 1972, 1 was seen at a feeding station in Pine Bluff, Jefferson County, followed by a recovery of a headless bird in Fayetteville, Washington County, on December 3, 1972 (James and Neal 1986). After a decade-long gap, sightings resumed in 1982 and have since continued almost every year (eBird 2019; James and Neal 1986).

Current Arkansas Range

There were few Inca Dove reports in Arkansas from the 1960s through the late 1970s, but by the late 1990s reports were common. Today reports show that the range covers most of the state (Figs. 2 and 3).

Inca Doves were reported in 36 of the 75 Arkansas counties in eBird/AR-Birds (Fig. 3). The areas without

Inca Dove reports may not necessarily mean they are absent. It is possible that opportunistic birding ventures, if and when conducted, missed the species. There are some counties in the southcentral region without Inca Dove reports, but because of the recorded presence of Inca Doves in all the surrounding counties it is reasonable to assume that Inca Doves are at least occasionally present in the entire portion of the state south of the Arkansas River. Nevertheless, there is currently a significant area in the northern and northeastern parts of the state where the lack of Inca Dove reports indicates that this region may not yet be part of the established Inca Dove range (Fig. 3).

Inca Doves were reported in 20 of 33 counties with portions south of the Arkansas River. These reports from the southwestern portion of the state accounted for 261 (78%) of 336 reports. Overall, judging from the numbers and dates (Fig. 3 and Table 1), it appears that Inca Doves expanded radially from the southwest corner of the state in a northeasterly direction, as can be expected for a species whose original range is southwest of the state. A similar expansion has been documented for the Eurasian Collared-Dove in Arkansas (Fielder *et al.* 2012).

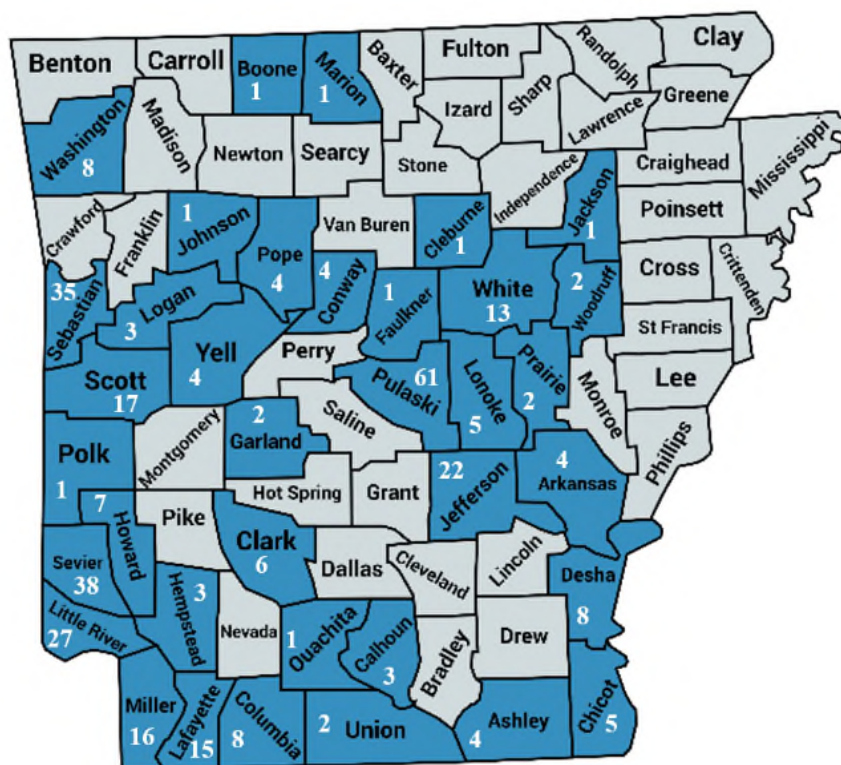


Fig. 3. Distribution of Inca Dove reports from Arkansas. Darker shaded counties indicate the documented presence of Inca Dove. Numbers indicate total number of reports from eBird and AR-Birds. Map created using <https://mapchart.net>.

Quantitative Trends in Arkansas

Of the 32 Arkansas counties that conducted CBC December 1967 to January 2018, only 8 (25%) reported Inca Doves (Table 1). Mean numbers of Inca Doves observed per 10 party hours across all 8 of these counties show an increasing trend with a weak linear correlation ($R^2 = 0.08$) from the first report in 1992 through present (Fig. 4). However, overall Inca Dove densities remain low. The mean number per 10 party hours for 2017 indicates an encounter rate of approximately 1 bird every 37 party hours in these 8 counties. This is near the average for the last 6 years (Fig. 4).

Table 1. Number of individual Inca Doves per 10 party hours from Christmas Bird Counts (CBC) in Arkansas counties reporting the species.

County	First CBC Observed Year	1992-2004	2005-2017
Chicot	1992	0.02	*
Miller	1995	0.10	0.96
Columbia	1998	0.59	0.46
Clark	1998	0.01	0.34
Washington	2011	0.00	0.01
Jefferson	2013	0.00	0.15
Ashley	2014	*	0.07
Sebastian	2016	0.00	0.12
8-county average		0.12	0.24

*There was no CBC done in these periods of time for these locations.

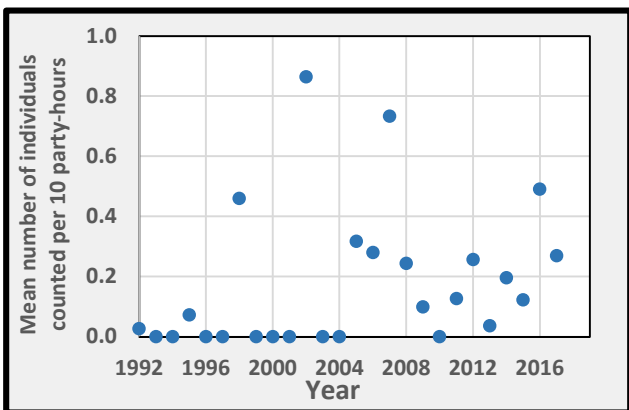


Fig. 4. Mean number of individual Inca Doves observed per 10 party hours in 8 reporting Arkansas counties by year (from CBC)

The average number of Inca Dove encounters per 10 party hours from CBC in these 8 reporting counties has been increasing over time, doubling from 0.12 in 1992-2004 to 0.24 in 2005-2017. Most of these counties show

an increase in birds per party hour between the 1992-2004 and 2005-2017 time periods. In general, the southernmost counties experienced earlier first Inca Dove encounters and a higher encounter rate than more northern CBC counties (Table 1).

More Arkansas counties reported Inca Dove through time (Fig. 5). Using the eBird/AR-Birds datasets, we found a reasonably strong correlation between the number of counties that reported Inca Doves and time (Fig. 5). The trend line indicates an increase of about 1 new county every 7 years.

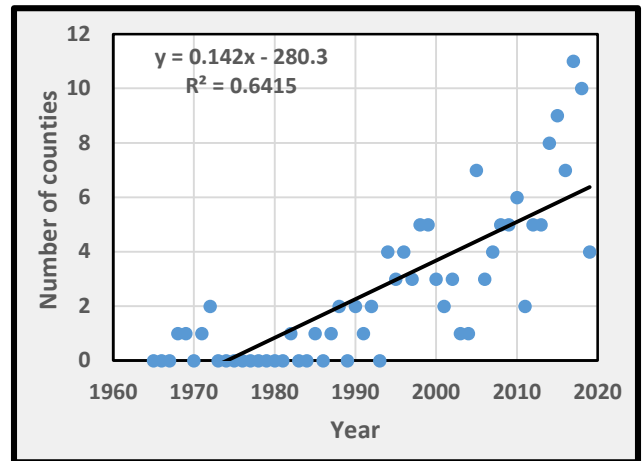


Fig. 5. Number of counties reporting Inca Doves in Arkansas by year (from eBird/AR-Birds)

The annual number of Inca Dove reports in Arkansas increased through time (Fig. 6). The trend line indicates that the number of annual reports will increase by 1 approximately every 3 years.

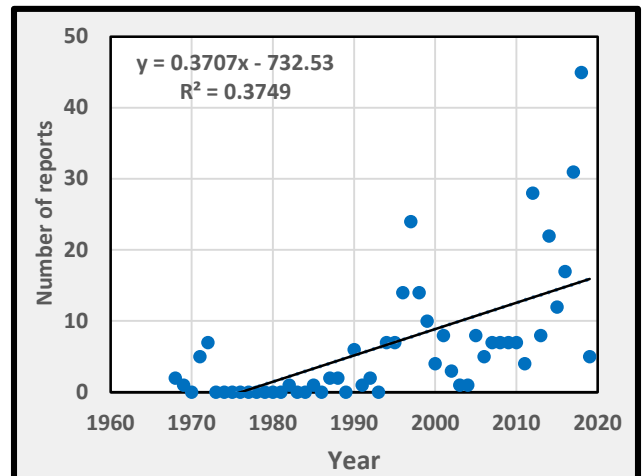


Fig. 6. Number of Inca Dove reports in Arkansas by year (from eBird/AR-Birds)

Status of Inca Doves in Arkansas

Counts of individual birds from eBird/AR-Birds also increased with time (Fig. 7). The trend line suggests that the annual number of individual birds will increase by about 1 per year (Fig. 7). An overview of Figs. 4-7 and Table 1 indicates that the species is steadily increasing its presence in the state and is becoming established.

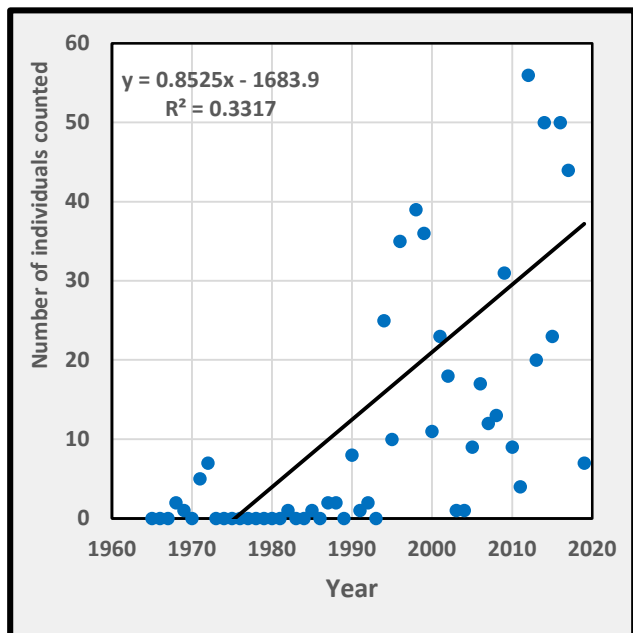


Fig. 7. Number of individual Inca Doves counted in Arkansas by year (from eBird/AR-Birds)

BBS reports in Arkansas were too limited to indicate any significance. Only 5 birds were reported in these surveys, and these reports came from 3 routes (2 in Hope, Hempstead County, in June 2003 and 2008, and 1 in Lockesburg, Sevier County, in June 2016). On May 20, 1995, the first recorded Inca Dove nest from Arkansas was observed in Ogden (Little River Co.), which on June 8 was confirmed to have a live nestling (eBird 2019). From July 10 to 24, 1997, an active nest with 2 fully feathered young was observed in De Queen, Sevier County. On May 28, 1998, the third nesting record was from Little River County (Arkansas Audubon Society 2015). One young bird was observed in a yard in Fort Smith Sebastian County (Sandy Berger, personal communication, month and year unknown).

Phenology of Occurrence in Arkansas

Inca Doves have been observed year-round in Arkansas. A phenology of total encounters in the combined eBird/AR-Birds dataset suggest that the species is sedentary and does not leave the state in

winter (Fig. 8).

Discussion

This paper relies heavily on data collected from citizen science sources. We realize that much of this is not peer-reviewed. However, the collective and crowd-sourced nature of citizen science, wherein a multitude of observers report their sightings, increases sample size and dilutes the effect of any errors in reporting. Moreover, the fact that the Inca Dove is easily identifiable and unlikely to be confused with other species adds to the credibility of this data.

One factor that helps to explain the increased reports of the species in eBird and AR-birds is the increase in number of birders and the preponderance of tools currently available for locating, identifying, and reporting observations. Nevertheless, the data indicate a clear pattern of range expansion of the Inca Dove.

The data we assimilated indicate that the global range maps of Inca Dove need to be revised to keep up with the expansion across North America. We found no evidence to support the hypothesis (Mueller 2004) that the northward range progression of the species may be hindered by cold climates. In fact, there are reports of the species in Canada (Fig. 2), and there are winter (December-February) eBird reports from Montana (2006) and New York (2017). With behaviors like daytime “pyramiding”, in which up to 12 birds stack up on top of each other in 2-3 rows, night-time huddling, and group-basking and sunning, the species seems adapted to tolerate the cold (Johnston 1960; Mueller 2004; Robertson and Schnapf 1987). In fact, the species

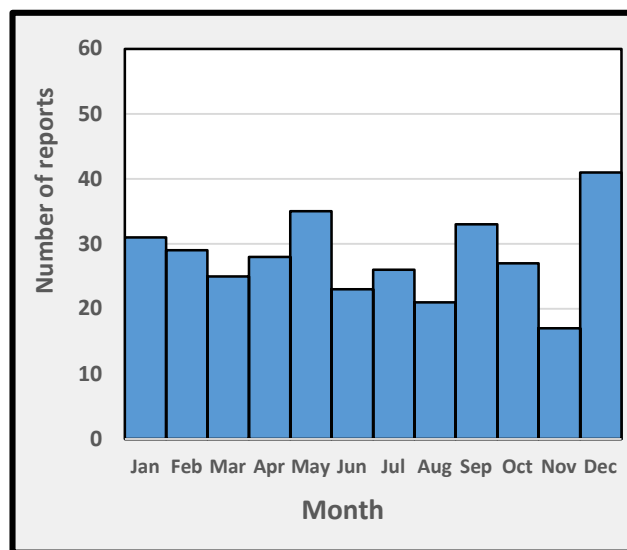


Fig. 8. Phenology of Inca Dove reports in Arkansas (from eBird/AR-Birds)

has been shown to have remarkable physiological flexibility to deal with extreme low temperatures, including reduced pulmocutaneous water loss by metabolic quiescence, and nocturnal hypothermia (Trost and MacMillen 1967a,b).

Mueller (1992) reported that Inca Dove population increased significantly in Texas and southwest United States 1966-1991. His review indicated that 66% of BBS routes in the central region showed increases. However, he also cautioned that the low abundance of Inca Doves (<1/route) made BBS data less reliable.

Our analyses of more recent data show that this expansion has continued to include Arkansas. Although our data strongly show the species' increased spatial and temporal presence in Arkansas, it is unclear at what rate overall densities have increased. This may be because of the relative low proportion of Arkansas counties participating in CBC. With more coverage, a better picture may emerge on population size and density of Inca Doves in Arkansas.

The reason behind the remarkable range expansion of Inca Dove remains unclear (Mueller 2004). While it has apparently benefitted from human settlements in parts of the new range (Phillips 1968; Gibbs *et al.* 2001), similar anthropogenic habitats elsewhere remain uncolonized (Hubbard 1971). Therefore, predicting future trajectories for this species is challenging. In any case, our review strongly indicates that the species is established and increasing its presence in Arkansas.

While the ultimate ramifications of the rapid expansion of Inca Dove are not clear, future studies should focus on the effects of Inca Dove, Eurasian Collared-Dove, and White-winged Dove range expansion on niches of closely related species established in Arkansas, like Mourning Dove *Zenaida macroura*.

Acknowledgments

The project was part of the Undergraduate Research course taken by Ethan Brooks at the Biology department of University of Arkansas—Fort Smith (UAFS). This article would not have been possible without publicly available citizen science data. Our thanks to all birders who reported their information into AR-Birds and eBird, and who participated in CBC and BBS. The UAFS College of Science, Technology, Engineering, and Mathematics supported conference travel and publication charges. Allan Mueller critiqued the manuscript. Dan Scheiman helped with eBird database. Sandy Berger provided anecdotal information.

Comments by 3 anonymous reviewers improved the paper.

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