

The lack of males due to illegal trapping is causing polygyny in the globally endangered Yellow Cardinal *Gubernatrix cristata*

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ABSTRACT: We present breeding data from the southernmost populations of the globally “Endangered” Yellow Cardinal *Gubernatrix cristata* in Argentina, confirming the presence of current breeding populations in the region. We monitored a family group in a nesting territory composed of one male and three females throughout the breeding season 2017–2018. We found a low nest success and productivity, probably associated with the lower contribution of the male, since it was attending three reproductive females simultaneously. We attribute this uncommon case of polygyny to the lack of males in the area caused by the high intensity of male trapping for illegal trade.

KEY-WORDS: breeding biology, cage birds, Monte ecoregion, Neotropical birds, threatened species.

INTRODUCTION

The Yellow Cardinal *Gubernatrix cristata* is a Neotropical threatened passerine from the southern cone of South America (Ridgely & Tudor 2009). It is a territorial and socially monogamous species, where mated pairs usually stay together for more than one breeding season (Domínguez *et al.* 2015a, Beier *et al.* 2017). In the past, this species was widely distributed in thorny deciduous shrubland forests of central Argentina, most of Uruguay and part of southern Brazil (Jaramillo 2019). Due to their colour and song, they have been captured for illegal trade in wildlife (mainly the males) and, along with habitat loss, were the main causes of the great population decline and fragmentation for this species (Domínguez *et al.* 2017), now considered as globally “Endangered” and regionally “Threatened” (estimated total population: 1500–3000 individuals; BirdLife International 2018).

Social polygyny, where one male mates with more than one female while each female mates with only one male, is thought to be the fundamental mating system of animals (Bennett & Owens 2002). Under certain circumstances, polygyny among birds may occur when males hold valuable resources, such as high-quality territories, and then females tend to choose superior males (Orians 1969). But most birds, however, are

monogamous because apparently both parents must help to rear the young if the adults are to have much chance of leaving any genes to posterity (Bennett & Owens 2002). In this contribution we present novel information about an uncommon case of polygyny in this socially monogamous cardinal. In addition, we present breeding data from a family group composed of one male and three females throughout the entire breeding season 2017–2018.

METHODS

The study was conducted in a private farm located northeast of General Conesa, eastern Río Negro province, Argentina (39°55'12.32"S; 64°16'29.14"W; Fig. 1). From the National Road 251 (distant 12 km straight line), the access to the study site does not present any restrictions, which is why the area has been used for illegal trapping in recent decades. At present, although the access is still free, the farm-owners chase away the trappers preventing captures in this area. The study area is representative of the Monte ecoregion (Brown *et al.* 2006), with large areas of native xerophytic vegetation altered by extensive and low-density cattle grazing. This region is characterized by warm summers (maximum temperature: 42.3°C) and

cold winters (minimum temperature: -13.5°C), with most precipitations occurring between November–March. The National Meteorological Survey of Argentina from 1985 to 2015 reports mean annual rainfall as 259 mm and mean annual temperature as 15°C .

Following the comment of a local birdwatcher during September 2017 (prior to the start of the breeding season), we detected a family group composed of one male and three females of the threatened cardinal. We then carried out observations in that breeding area during the entire breeding season, from October 2017 to January 2018. The nests were found by systematically searching in potential nest sites and observing the behaviour of territorial breeders. We georeferenced each nest location (Garmin GPS) and we visited nests every 10–15 days during the nesting cycle. We monitored the nests until nestlings fledged or the nest failed. Close to the fledging date, we inspected nests from a distance of 2–4 m to minimize the risk of premature fledging. At each visit, we avoid manipulating the nest content (eggs or nestlings) to avoid disturbances that influence reproductive success.

We considered a nest successful when at least one nestling left the nest. We considered a nest predated if clutch disappeared between two consecutive visits or when the chicks disappeared from their nests before they were old enough to fledge and no parental activity

was detected near the nest (see Segura & Reboreda 2012). None of the monitored nests was abandoned. As individuals were unmarked, we identified each breeder by field observations of unique marks on plumage (mainly in females) and also on the dates of start and end of each breeding attempt. Productivity was calculated as the mean number of fledglings by successful nests. We calculated the apparent nest success as the ratio between the number of successful nests and all monitored nests (Segura *et al.* 2015). We delimited the breeding territory as the maximum area that the male defended, where it nested and where the family group was observed feeding (see Beier *et al.* 2017). To locate the territory and nests in a map, we used an image from Google Earth (02 January 2018).

RESULTS

During the entire breeding season, we found a nesting territory with three females and only one male. During visits, while we were moving from one nest to another, the lonely male accompanied us and defended each of the nests from where one of the three females flushed. We found a total of eight nests (two for one female, two for another and four for another). One nest was found under

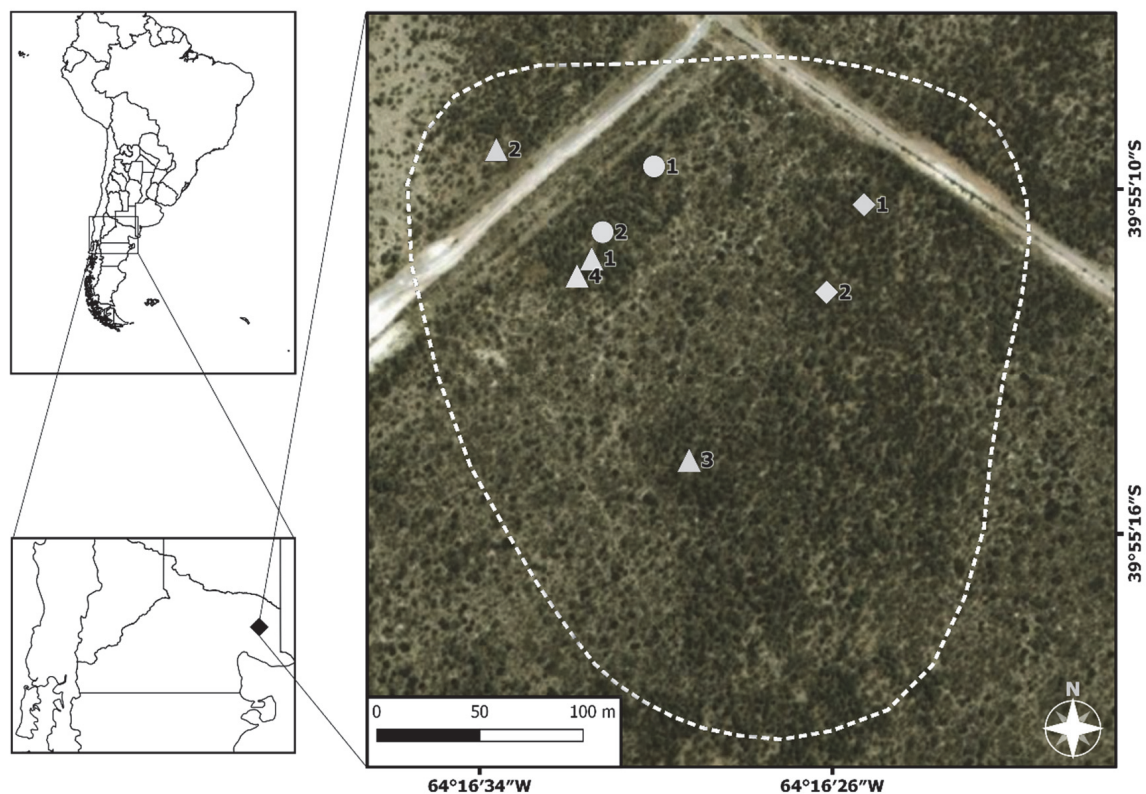


Figure 1. Map showing the location of the study site in southern Argentina, with indication of the breeding territory (dashed line) defended by the Yellow Cardinal male and his three females. Geometric figures (diamonds, triangles and circles) indicate the different females, while numbers indicate the order of each female breeding attempt throughout the breeding season 2017–2018.

construction and the remaining ones during incubation. By backdating from hatching dates, the first evidence of nest initiation was on 02 October (considering 13 days of incubation; Domínguez *et al.* 2015a, Beier & Fontana 2019) and the latest evidence of nest activity was a predated nest on 19 January, thus giving a breeding season length of 108 days. Breeding territory size was ~9 ha (Fig. 1), including movements of the entire family group.

The nest was a semi-spherical cup of ~15 cm external diameter with an external layer of twigs with thorns, and an internal layer of finer branches, horse hair, compacted grass material grass and seeds (Fig. 2). All nests were built in Chañar Tree (*Geoffroea decorticans*) and were located in main branches close to the center of the tree crown, never in the periphery. Mean clutch size was 3.12 ± 0.12 eggs (range = 3–4, $n = 8$ nests). Eggs were ovoid, bluish-green background colour with black spots more concentrated on the wider end of the egg. Mean number of hatchlings per nest was 2.75 ± 0.25 (range = 2–3, $n = 4$ nests) and nest productivity was one fledgling per successful nest ($n = 2$ nests). We did not detect partial egg loss, but partial brood losses were detected in the two nests that reached the fledging stage (in one nest the reduction was from three chicks to one, and in the other from two to one). Of the eight monitored nests, two (25%) were successful and six (75%) were predated (four during incubation and two during the nestling stage). We did not observe nest helpers, nor Shiny Cowbird (*Molothrus bonariensis*) brood parasitism, as well as any agonistic interactions with other conspecifics in the area.

DISCUSSION

We present relevant breeding data from Argentinean populations of the Yellow Cardinal, confirming the presence of current breeding populations in the southern limit distribution for this globally “Endangered” species.



Figure 2. Yellow Cardinal nest with three nestlings observed on 11 November 2017 in a private farm located northeast of General Conesa, eastern Río Negro province, Argentina. Photo author: M. Perelló.

This contribution adds to the few existing breeding studies on the species (Domínguez *et al.* 2015a & b, de la Peña 2016, Beier *et al.* 2017, Beier & Fontana 2019), finding a new problem for the species caused by the low proportion of males (see Pessino & Tittarelli 2006) that may force them to incur a polygynous system in which they have less reproductive success. These results mean that greater control by government authorities to prevent illegal trapping is essential and must be implemented soon.

For these latitudes, the only nesting record for the species dates from 1995 (compiled by de la Peña 2016), where an active nest with three eggs in November was report. Unlike what has been recently published for the species (Beier *et al.* 2017, Beier & Fontana 2019), we did not observe breeding attempts with helpers contributing on the nest defence or the nestling/fledgling provisioning. Similarly, although Shiny Cowbirds are common in the area (L. Segura, pers. obs.), we did not observe brood parasitism in nests (Domínguez *et al.* 2015a, Beier & Fontana 2019). We found that 25% of the nests were successful, which is similar to that found by Beier & Fontana (2019), but less than the ~40% found by Domínguez *et al.* (2015a) or ~50% by Beier *et al.* (2017) for the northern populations of the species. Nest productivity found (only one fledgling per successful nest) was also lower than the 1.6 fledglings per successful nest reported by Domínguez *et al.* (2015a), Beier *et al.* (2017) and Beier & Fontana (2019). In the same sense, partial brood loss detected was higher than reported by Domínguez *et al.* (2015a). As we did not manipulate nestlings, we are unable to determine if brood reduction was caused by starvation. Both the low apparent nest success as well as the low nest productivity (Domínguez *et al.* 2015a, Beier *et al.* 2017, Beier & Fontana 2019) could be associated with the lower contribution of the male in this socially monogamous species (*i.e.*, by reducing the nest defence or the food delivery to the nestlings; Bennett & Owens 2002) since it was attending three active reproductive females simultaneously.

As regards the case of polygyny we are reporting, we are confident that the origin of this uncommon behaviour (considering that the species is typically socially monogamous) is the lack of males in the area, caused directly by the high intensity of male trapping for illegal trade (Collar *et al.* 1992, Pessino & Tittarelli 2006, Bertonatti 2017, SAyDS 2017). Based on farm-owners' comments and local birdwatchers' sightings records (COA Valle de Conesa, unpub. data), captures for illegal trade in the area was severe in the last decades. Then, when females outnumber males, at least shortly in a given breeding area, it is expected that certain breeding anomalies begin to appear (Engen *et al.* 2003). In addition to our case of polygyny, another phenomenon for southern populations

of the cardinal is the presence of hybrids between females Yellow Cardinal and males of the Common Diuca-Finch *Diuca diuca* (BirdLife International 2018), which has been also associated to the lack of males in the breeding areas (Bertonatti & López-Guerra 1997). In addition to our finding, there are some recent records in the area from online databases, such as eBird (<https://ebird.org/>), or the “Censo Nacional de Cardenal Amarillo” (<https://www.avesargentinas.org.ar>) that evidence that the species is still present in the area and that conservation actions must be taken immediately. As the southern populations of the cardinal are genetically isolated (Domínguez *et al.* 2017) and have very few natural protected areas (Brown *et al.* 2006) that ensure adequate nesting habitat for the species, we strongly recommend that government authorities take urgent measures to ensure the conservation of these breeding populations.

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