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Range contraction and conservation of the endangered Yellow Cardinal

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Abstract

The Yellow Cardinal (*Gubernatrix cristata*) is distributed in Argentina, Uruguay and Brazil, inhabiting environments of xerophytic woodland and savannah; it is considered globally Endangered since 1994. Populations are under pressure from loss

and modification of habitat and from capturing for the cage bird trade. We compared in a geographical analysis the past (1826–1994) and recent (1995–2018) distributional ranges of the Yellow Cardinal and its affinities to ecoregions, land use cover and presence in protected areas, and assessed continuity vs. fragmentation of the current distribution using the method of Medium Propinquity. We used 1191 location records from reviewed sources and our field observations. We found a reduction of the original distribution to areas where native savannahs are still in good condition. In Argentina, the species has disappeared from 8 out of 16 provinces. The altitudinal range of the species extends up to 1100 m, rather than 700 m as reported in earlier reviews. It is clearly associated with savannah, shrubland, and grassland land cover categories. In regions where it disappeared, suitable habitat remained at 33% of points where it was formerly present, with capturing for the cage bird trade as a likely cause of disappearance. Medium propinquity analysis showed as yet little fragmentation in the current distribution, except for a separation between northern and southern populations. The Yellow Cardinal is distributed mainly outside protected areas; it is found in 31 Important Bird Areas, 22 of which are not protected and are under threat from habitat loss through the expansion of agriculture. We urge improved control of illegal capturing and the maintaining of native vegetation in population strongholds of the Yellow Cardinal.

Introduction

The distribution of a species is defined by biogeographic, ecological and physiological factors (Gaston & Blackburn, 2000; Hengeveld, 1990), and the area it occupies can be favoured or restricted by its response to external factors such as temperature (MacArthur, 1975) and availability of food (Cueto, Milesi, Sagario, López de Casenave, & Marone, 2011), among others. To define conservation strategies, it is essential to understand the biogeographical species patterns that allow detecting sectors with a higher concentration of species, endemics or endangered species, since threats and possible solutions have a strong geographical context (Arzamendia & Giraudo, 2012; Chen et al., 2019; Giraudo & Arzamendia, 2018). In recent decades, studies of the distribution of species have increased, documenting the patterns, sizes and overlap of the areas they occupy (Gaston & Blackburn, 2000; Orme et al., 2006; Palacio & Girini, 2018; Vergara-Tabares, Lammertink, Verga, Schaaf, & Nori, 2018). Biogeographical analysis is key to the identification of priority areas for conservation and for the development of efficient systems of protected areas (Bibby, Burgess, Hill, & Mustoe, 2000; Hockey & Branch, 1994; Turpie, Beckley, & Katua, 2000). However, protected areas networks sometimes do not include the main populations of some endangered species (Giraudo, Krauczuk, Arzamendia, & Povedano, 2003; Rodrigues et al., 2004). A potential example is the Yellow Cardinal (*Gubernatrix cristata*), an endangered bird species that may not be adequately represented in the systems of protected areas in its distributional range.

The Yellow Cardinal (Fig. 1) is a passerine in the Thraupidae family (Campagna et al., 2011; Remsen et al., 2019). It is the monotypic species in its genus and the resulting evolutionary distinctiveness enhances its conservation priority (Isaac, Turvey, Collen, Waterman, & Baillie, 2007). It was originally common and widespread in northern and central Argentina, Uruguay and the southern half of Rio Grande do Sul in Brazil (Azpiroz, 2017; Belton, 1994; BirdLife International, 2019; Olrog, 1979; Ridgely & Tudor, 2009; Sclater & Hudson, 1888). In addition, there are some historical records, coming from museum specimens, for Paraguay, but the label data is imprecise (Collar et al., 1992). It lives in xerophytic woodlands, savannahs and shrublands with a reported altitudinal range up to 700 m (Domínguez, Ayarragaray, & Lapido, 2015; Azpiroz, 2017; BirdLife International, 2019; Collar et al., 1992; Dias, 2008; Domínguez, Mahler, & Reboreda, 2014; Martins-Ferreira, Repenning, & Damiani, 2013; Morrone, 2001; Pessino & Tittarelli, 2006). The distribution area of the Yellow Cardinal is characterized by an intensive land use for production purposes, where the advance of agriculture, livestock ranching, and urbanization has changed extensive areas of woodlands and savannahs (Arturi, 2005; Maldonado, Sione, & Aceñolaza, 2012; Matteucci et al., 2012). Moreover, the Yellow Cardinal has long suffered from exploitation as a songbird for the cage bird market (Barrows, 1883; Collar & Butchart, 2014; Collar et al., 1992; Pessino, Banchs, Fern&ez, & Dolsan, 2002; Rodríguez & Bertonatti, 2018; Sclater & Hudson, 1888; Shufeldt & Allen, 1896). The combination of a high capture rate and loss of habitat is considered the main causes of the population decline of the

species (Azpiroz, 2017; BirdLife International, 2019; Collar et al., 1992; Loydi, 2008; Pessino & Tittarelli, 2006;). Population sizes are thought to have declined sharply, and populations are believed to be highly fragmented (2017, Belton, 1985; Domínguez, Reboreda, & Mahler, 2016; Martins-Ferreira et al., 2013). This context led to the inclusion of Yellow Cardinal on the IUCN Red List as globally Endangered in 1994 (BirdLife International, 2019). At national level, it is considered endangered in Argentina (Ministerio de Ambiente y Desarrollo Sustentable & Aves Argentinas, 2017) and Uruguay (Azpiroz, 2017), while in Brazil it is considered critically endangered (Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio) (2016)). The estimated world population is between 1500 to 3000 individuals in the wild, with between 1000 and 2000 mature individuals (BirdLife International, 2019). Recent studies have shown that the Yellow Cardinal is negatively affected by brood parasitism by Shiny Cowbird (*Molothrus bonariensis*) and parasitism by botflies of the genus *Philornis* (Azpiroz, 2015; Domínguez et al., 2014). Additionally, it is affected by hybridisation with Common Diuca-Finch *(Diuca diuca)* in the southern region of its distribution in Argentina (Bertonatti & López-Guerra, 1997, 2001; Domínguez et al., 2016; Pessino et al., 2002; Rodríguez & Bertonatti, 2018).

Earlier reviews of the distribution of the Yellow Cardinal were mostly based on museum specimens (Collar et al., 1992) or were restricted to eastern Argentina and Uruguay (Azpiroz, 2017; López-Lanús, Ibañez, & Velazco, 2016; Marateo, Archuby, Piantanida, Sotelo, & Segura, 2018; Ortiz, 2008). So far, there are no studies

that have analysed and determined in detail the distribution of this species throughout its entire distribution and assessed changes in distribution over time.

In this study, we compare historical and recent distribution patterns of the Yellow Cardinal in Argentina, Uruguay and Brazil. In addition, we examine whether the recent distribution of the Yellow Cardinal is restricted to particular ecoregions, and land cover categories, and to what degree the recent distribution is included in protected areas.

Section snippets

Study area

Our distributional analysis of the Yellow Cardinal encompasses the entire range of the species, which is located in the southeast of South America. Particularly, in the extreme south of the state of Rio Grande do Sul in Brazil, Uruguay, and north, northeast and centre-south of Argentina (Ridgely & Tudor, 2009). The area is covered by subtropical and temperate woodlands, savannahs,

shrublands and grasslands (Olson et al., 2001). These environments are threatened by overgrazing by domestic…

Results

Our review of Yellow Cardinal presence data yielded a total of 1157 points with records between 1826 and 2018. These records represent 2164 individuals. Of these, 306 (26.4%) were historical records (1826–1994) and 851 (73.6%) recent records (1995–2018). Argentina yielded the largest number of the recent records with 704 records (82.7%), followed by Uruguay with 82 records (9.6%) and Brazil with 65 (7.6%) records.

Comparison of Fig. 2A and B shows that both the historical and current…

Discussion

For both the historical and recent periods we reviewed, the distribution of Yellow Cardinal showed largely the same pattern, with dense clusters of records in the northeast and south of the distribution, and with fewer and scattered records in the central part of the distribution (Fig. 2). The extent of occurrence of Yellow Cardinal was reduced in Argentina, in places where records were always scarce. Recent records added the provinces of Mendoza, Argentina (Sosa, Martín, & Zarco, 2011) and the …

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