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ASSESSING POPULATION SIZE OF THE CHESTNUT-CAPPED FOLIAGE-GLEANER

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ABSTRACT

Chestnut-Capped Foliage-Gleaner (*Hylocryptus rectirostris*) is a Neotropical ovenbird species (*Furnariidae*) endemic to gallery forests of the Cerrado region of central Brazil. While it is not considered globally threatened, the degree of habitat loss occurring throughout much of its known distribution may warrant its inclusion on red lists beyond just the state of São Paulo. The primary objective of this study is to evaluate the conservation status of Chestnut-Capped Foliage-Gleaner according to those criteria adopted by the IUCN. Results of censuses conducted in the Serra do Cipó National Park were used to estimate the entire population size of the Chestnut-Capped Foliage-Gleaner and refine our understanding of its actual geographic distribution. Census results indicate that the species has a population density of 3.8 pairs/100 ha and occupies only a quarter of its preferred habitat in the study area, which is well below the carrying capacity. The total population size estimate, accounting for its entire extent of known occurrence, is just over 54,000 pairs. The geographic distribution and total population size estimated in this study do not indicate that the Chestnut-Capped Foliage-Gleaner should be considered a threatened species according to IUCN criteria. However, it was not possible to evaluate this species' conservation status based on information concerning population fluctuations over time, another of the IUCN criteria. Nonetheless, the rate of habitat destruction in the Cerrado during the last century has certainly resulted in a population decline of greater than 10%, a factor sufficient enough to warrant its inclusion in the IUCN category of vulnerable.

KEY-WORDS: Cerrado; Conservation; Endemism; Gallery forests; Habitat loss; Range distribution.

INTRODUCTION

Recent studies have emphasized the importance of detecting vulnerable species whose numbers are declining (Berry *et al.* 2010). Identifying ecological traits that have accelerated the decline of a species,

and thus have placed it at risk of extinction, will help to predict the vulnerability of the species before becoming threatened (Manne *et al.* 1999; Manne & Pimm, 2001; Mattila *et al.* 2008).

The Chestnut-Capped Foliage-Gleaner (*Hylocryptus rectirostris*) is a highly specialized Neotropical

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ovenbird species endemic to riparian (also called gallery) forest in the Cerrado region, the largest savannah-like ecosystem of Central South America (Silva, 1996; Vielliard & Silva, 2001). The species is completely dependent on the gallery forest habitat for feeding and breeding. Chestnut-Capped Foliage-Gleaner forages alone or in pairs in search of arthropods, preferably gleaning in the middle of leaves found in soil, always at a short distance from watercourses. The nest is built in ravines along water courses, and consists of a straight tunnel that is tilted upward. Both sexes participate in all stages of reproduction, nest building, egg incubating, and feeding the nestlings (Faria *et al.* 2007, 2008a, b).

Among the various habitat types present in the Cerrado biome, gallery forest is perhaps the most noteworthy. Despite having a very limited spatial distribution constituting of only 5% of the entire Cerrado region (Azevedo & Adámoli, 1988), gallery forest areas encompass a major proportion of the biome's total biodiversity, particularly with respect to vertebrates such as birds and mammals (Redford & Fonseca, 1986; Silva, 1996; Rodrigues & Faria, 2007). Despite being protected by the 'Brazilian Forest Code' (Law 4771 of 15 September 1965), the conservation of gallery forests remains precarious, as it continues to be destroyed illegally in many places.

While the Chestnut-Capped Foliage-Gleaner is not considered globally threatened, it is included on the list of endangered species occurring in the state of São Paulo (São Paulo, 1998). The ongoing disturbance of gallery forest habitats may ultimately result in its inclusion on future red lists.

Our aim was to evaluate the current global conservation status of this species, assessing some ecological traits such as its range distribution, density and global population size. We used our local ecological data to estimate its population size and carrying capacity throughout its entire known range, and finally we compare these results to its actual conservation status at the International Union for the Conservation of Nature and Natural Resources (IUCN). In doing so we have establish a baseline by which its conservation status can be objectively assessed, and against which future estimates can be compared.

METHODS

Study area

The Cerrado is the second largest Neotropical biome and one of the richest areas in the world in

terms of biodiversity (Oliveira & Marquis, 2002). Although the Cerrado originally covered 1.86 million km², a highly accelerated process of fragmentation characterizes the tragic history and current situation of this unique biome, justifying its inclusion among the 25 global biodiversity hotspots (Myers *et al.* 2000). Just 20% of the original Cerrado region remains undisturbed and only 1.2% has been formally recognized as protected area (Silva & Bates, 2002).

The current study was conducted in the Serra do Cipó National Park, which is located in the southern portion of the Espinhaço Mountain Range, between 19° and 20°S and 43° and 44°W in the state of Minas Gerais, southeastern Brazil. The park covers a total area of 33,800 hectares and varies in altitude from 715 to 1,697 m. The study was conducted in the western part of the park, at around 800 m, which is dominated by Cerrado biome (see details in Rodrigues *et al.* 2005).

Extent of occurrence

According to the IUCN, extent of occurrence is defined as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon, usually calculated using the minimum convex polygon method (MCP) (IUCN, 2001).

Geographic localities of occurrence for the Chestnut-Capped Foliage-Gleaner were obtained through literature reviews, consulting museum collections, and querying researchers for the existence of unpublished records. These geographic records were mapped as point localities, or in the case of records without exact geographic coordinates, the coordinates of the nearest municipality were used (Figure 1). The species' total extent of occurrence was then calculated using the minimum convex polygon method (MCP) (Odum & Kuenzler, 1955), and compared to the extent of occurrence of the species proposed by Ridgely & Tudor (1994) using the 'GPS Trackmaker' geo-referencing program (Professional Version 4.2 for Windows, 2007).

Population census at local level

Population censuses of the Chestnut-Capped Foliage-Gleaner were conducted following the Cipó River starting from its tributary, Mascates River, using the access trail from Bandeirinhas Canyon from a

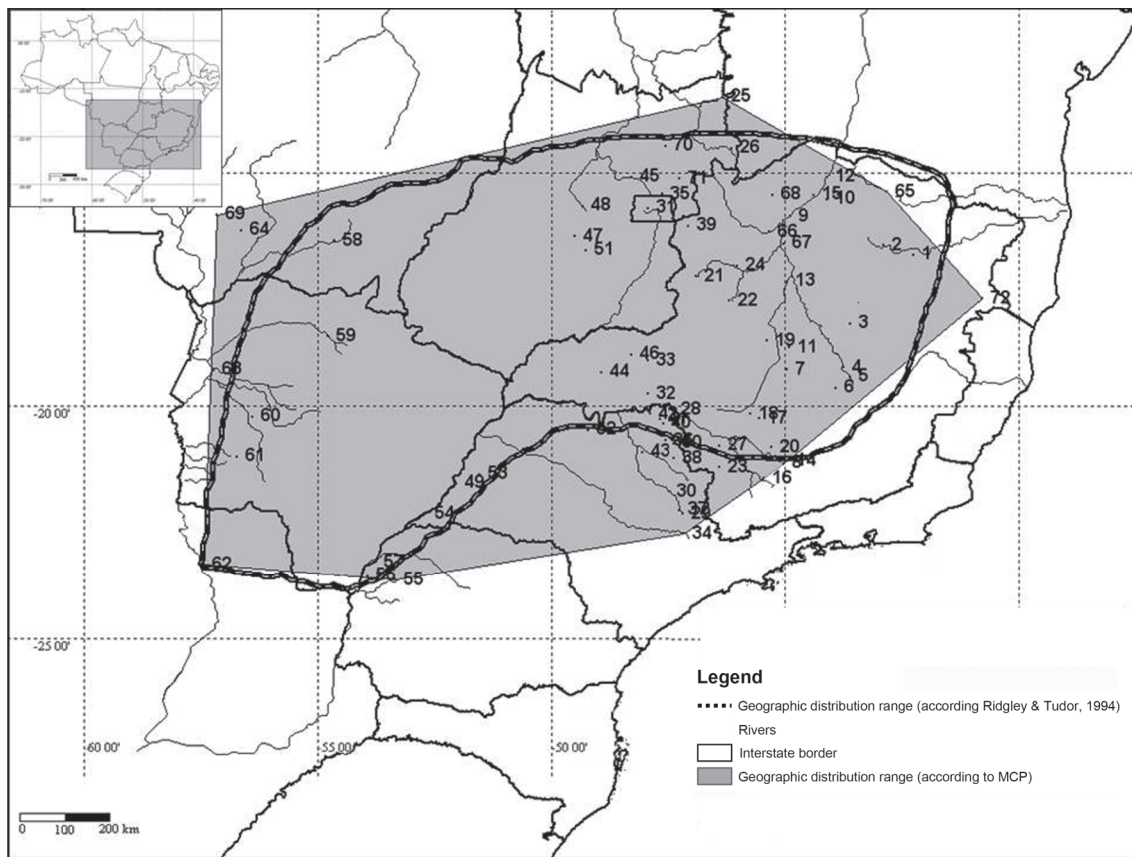


FIGURE 1: Extent of occurrence of Chestnut-Capped Foliage-Gleaner according to the minimum convex polygon (MCP) method that includes all the geographic localities consulted (in gray: 142,630,749 ha), and according to Ridgely & Tudor (1994) (out in bold: 121,891,895 ha). The records with numbers correspond to localizations on the map and their respective reference bibliographies are listed. Codes: DZ-UFGM: Coleção do Departamento de Zoologia da Universidade Federal de Minas Gerais; PUC-MG: Coleção do Museu da Pontifícia Universidade Católica de Minas Gerais; UNB: Coleção da Universidade de Brasília; MZUSP: Museu da Universidade de São Paulo; MNRJ: Museu Nacional do Rio de Janeiro.

1. Virgem da Lapa (MG) (16°45'S, 42°14'W) Capão Farm (Faria & Carrara, 15/11/2005, *pers. obs.*).
2. Grão Mogol (MG) (16°33'S, 42°52'W) DZ-UFGM (2003).
3. Diamantina (MG) (18°14'S, 43°35'W) PUC-MG (1990).
4. Santana do Riacho (MG) (19°11'S, 43°43'W) Paraúna River (Faria & Carrara, 12/06/2007, *pers. obs.*).
5. Santana do Riacho (MG) (19°23'S, 43°35'W) Cipó River, PARNA Serra do Cipó (Rodrigues *et al.*, 2005; Melo-Júnior *et al.*, 2001).
6. Santa Lagoon (MG) (19°37'S, 43°53'W) (Cory & Hellmayr, 1925; Pinto, 1952; Warming & Ferri, 1973).
7. Pompéu (MG) (19°13'S, 44°56'W) DZ-UFGM (1968, 1971), PUC-MG (1984).
8. Lavras (MG) (21°14'S, 44°59'W) Vasconcelos *et al.* (2002), Lavras (MG), d'Angelo Neto *et al.* (1998).
9. São Francisco (MG) (15°56'S, 44°51'W) Mattos *et al.* (1991).
10. Campo Alegre de Minas (MG) (15°35'S, 44°05'W) DZ-UFGM (1980).
11. Felixlândia (MG) (18°45'S, 44°53'W) Santa Cruz Farm, M. Rodrigues and L.C.P. Faria, DZ-UFGM (2004).
12. Itacarambi (MG) (15°06'S, 44°05'W) PARNA Peruacu Caverns, Kirwan *et al.* (2001).
13. Pirapora (MG) (17°20'S, 44°21'W) Lower Rio das Velhas River, Kirwan *et al.* (2001), Left margin of São Francisco River, MNRJ (1973).
14. Ijaci (MG) (21°10'S, 44°55'W) Vasconcelos *et al.* (2002).
15. Januária (MG) (15°28'S, 44°21'W) Mattos *et al.* (1991).
16. Varginha (MG) (21°33'S, 45°25'W) Verde River, division of the municipalities of Varginha and Elói Mendes, Lopes (2006).
17. Arcos (MG) (20°16'S, 45°32'W) Betini *et al.* (1998).
18. Iguatama (MG) (20°10'S, 45°42'W) Betini *et al.* (1998).
19. Morada Nova de Minas (MG) (18°36'S, 45°21'W) DZ-UFGM (2004), São Francisco River, Falls of Indaiá River, MNRJ (1947).
20. Campo Belo (MG) (20°53'S, 45°16'W) PUC-MG (1986).
21. Paracatu (MG) (17°13'S, 46°52'W) Mattos *et al.* (1991).
22. João Pinheiro (MG) (17°44'S, 46°10'W) Lages Farm, (Pinto, 1950; Mattos *et al.*, 1991).
23. Monte Belo (MG) (21°19'S, 46°23'W) Muzambinho River, Betini *et al.* (1998).
24. Brasília de Minas (MG) (17°00'S, 46°00'W) Paracatu River, Brejo Farm, (Rodrigues & Faria, 2007; Faria *et al.*, 2009).
25. São Domingos (GO) (13°23'S, 46°19'W) Monte Alto District, Lopes (29/03/2004, *pers. comm.*).
26. Mambai (GO) (14°29'S, 46°06'W) MZUSP (2001).
27. Alpinópolis (MG) (20°51'S, 46°23'W) Embankment of Furnas Reservoir, Brina *et al.* (1994).
28. Rifaina (SP) (20°06'S, 47°22'W) Ribeirão Bom Jesus, Pal-Flex Farm (Willis & Oniki, 2003).
29. Conchal (SP) (22°19'S, 47°10'W) Mogi-Guaçu River (Betini *et al.*, 1998).
30. Porto Ferreira (SP) (21°51'S, 47°28'W) Porto Ferreira Forestal Reserve (Willis & Oniki, 2003).
31. Brasília (DF) (15°46'S, 47°55'W) Sick (1958); MNRJ (1957), Vida Silvestre Riacho Fundo Sanctuary (Abreu *et al.*, 2000), UNB (Silveira *et al.*, 1998), FunPEB (Reis, 2001).
32. Uberaba (MG) (19°44'S, 47°55'W) (Brandt & Souza, 1992).
33. Indianópolis (MG) (19°02'S, 47°55'W) Embankment of Furnas Reservoir (DZ-UFGM, 1987).
34. Paulínia (SP) (22°45'S, 47°09'W) 300 km south of Batatais (Betini *et al.*, 1998).
35. Planaltina (DF) (15°27'S, 47°36'W) (MNRJ, 1927; Sick, 1958), Águas Emendadas Ecological Station (UNB, 1989; Tubelins, 2004; Lopes *et al.*, 2005).
36. Batatais (SP) (20°43'S, 47°31'W) Recanto da Mata Farm, Macaúba Farm, Cortado Farm, Cerrado km 69 (Willis & Oniki, 2003).
37. Araras (SP) (22°15'S, 47°14'W) Woods of Riachuelo Farm (Willis & Oniki, 2003).
38. Altinópolis (SP) (21°08'S, 47°21'W) Ribeirão do Cervo Farm (Willis & Oniki, 2003).
39. Unai (MG) (16°08'S, 47°02'W) Rio Preto (Lopes, 12/09/2001, *pers. comm.*).
40. Jeriquara (SP) (20°22'S, 47°35'W) Cerrado do Zé Costa (Willis & Oniki, 2003), Woods of Japão Farm (Willis & Oniki, 2003).
41. Burizital (SP) (20°17'S, 47°39'W) Alto Bandeira Bridge (Willis & Oniki, 2003).
42. Miguelópolis (SP) (20°11'S, 47°53'W) Mouth of Rio das Pedras River (Willis & Oniki, 2003).
43. Pontal (SP) (21°01'S, 48°02'W) 80 km southwest of Batatais (Betini *et al.*, 1998), Bela Vista Farm, Montana Farm (Willis & Oniki, 2003).
44. Prata (MG) (19°18'S, 48°55'W) Salto e Ponte Forestal Park (Motta-Júnior *et al.*, 1994).
45. Padre Bernardo (GO) (15°06'S, 48°17'W) Maranhão Lopes River (23/01/2003, *pers. comm.*).
46. Uberlândia (MG) (18°55'S, 48°16'W) (DZ-UFGM, 1971; MNRJ, 1972; Brandt & Souza, 1992).
47. Jaraguá (GO) (15°44'S, 49°18'W) Rio das Almas, Tomé Pinto Farm (MZUSP, 1934; Pinto, 1936).
48. Jaraguá (GO) (15°44'S, 49°18'W) Rio das Almas, Tomé Pinto Farm (MZUSP, 1934; Pinto, 1936).
49. Presidente Epitácio (SP) (21°41'S, 52°01'W) São Paulo Lagoon (Willis & Oniki, 2003).
50. Patrocínio Paulista (SP) (20°49'S, 47°22'W) Sapucaí-Mirim River, Colorado Farm (Willis & Oniki, 2003).
51. Goiânia (GO) (16°40'S, 49°15'W) (MZUSP, 1966, 1968).
52. Nova Granada (SP) (20°32'S, 49°11'W) Ribeirão São João (Willis & Oniki, 2003).
53. Dracena (SP) (21°28'S, 51°31'W) Rio do Peixe State Park (Mallaco & Garcia, 2006).
54. Guaná (SP) (22°19'S, 52°40'W) Guanã Farm (Willis & Oniki, 2003).
55. Umuarama (PR) (23°44'S, 53°19'W) Paraná River Island (Straube & Bornschein, 1989).
56. São Jorge do Patrocínio (PR) (23°41'S, 53°55'W) (Straube *et al.*, 1996).
57. Porto Camargo (PR) (23°22'S, 53°44'W) (Pinto & Camargo, 1955; Straube & Bornschein, 1989), Paraná River (MZUSP, 1954).
58. Rondonópolis (MT) (16°28'S, 54°38'W) (MZUSP, 1937) Septentrional margin of the Vermelho River, runoff of the São Lourenço River (Pinto, 1940).
59. Coxim (MS) (18°30'S, 54°45'W) Right margin of the Taquari River (Pinto, 1940), Recreio Farm, Ribeirão Preto (MZUSP, 1937).
60. Miranda (MS) (20°14'S, 56°22'W) (Cory & Hellmayr, 1925).
61. Bonito (MT) (21°07'S, 56°42'W) Serra da Bodoquena National Park (Braz, 2003).
62. Concepción (Paraguai) (23°24'S, 57°25'W) (Storer, 1899).
63. Corumbá (MS) (19°15'S, 57°13'W) District of Inhelândia (Weinberg, 1984).
64. Poconé (MT) (16°15'S, 56°37'W) (Cintra & Yamashita, 1990).
65. Mato Verde (MG) (15°24'S, 42°47'W) Campos Gerais (LeCroy & Sloss, 2000).
66. Urucuaia (MG) (16°16'S, 45°18'W) Urucuaia River (Faria & Carrara, 16/10/2007, *pers. obs.*).
67. Ponto Chique (MG) (16°31'S, 45°00'W) Paracatu River (Faria & Carrara, 16/10/2007, *pers. obs.*).
68. Serra das Araras (MG) (15°29'S, 45°14'W) Pardo River (Faria & Carrara, 16/10/2007, *pers. obs.*).
69. Sangradouro (MT) (15°55'S, 57°08'W) Córrego Sangradouro (Cory & Hellmayr, 1925).
70. São João da Aliança (GO) (14°25'S, 47°32'W) Tocantinzinho River (Antas, 28/05/2008, *pers. comm.*).
71. Formosa (GO) (15°07'S, 47°13'W) Recanto Pedra Grande Farm (Abreu, 21/06/2008, *pers. comm.*).
72. Carlos Chagas (MG) (17°42'S, 40°45'W) Rio Pampa (Faria & Carrara, 26/09/2009, *pers. obs.*).

point upstream (19°23'13"S, 43°35'04"W; 804 m asl) to the park's boundary downstream (19°20'42"N, 43°37'07"W; 786 m asl). Census observations were made from the rivers using an inflatable boat moving downstream at an average speed of 2 km/h. A recording of the species' territorial call was played-back intermittently while following the course of the river in order to stimulate a response from individuals that may have been present at that time. Following each journey down river, any individual that was registered for the first time was then captured using mist nets (36 mm mesh) and differentially marked and sexed (Faria *et al.* 2007, 2008a, b).

All observed individuals were classified as being solitary or paired. The exact location of each individual, the census route and the outline of the gallery forest habitat were recorded using a global positioning device (Garmin e-Trex Legend). This geographic data was transferred to the 'GPS Trackmaker' geo-referencing program (Professional Version 4.2 for Windows, 2007), which was then used to calculate the gallery forest area and length of the river descent.

Four separate censuses were conducted, three before the breeding season of 2005 (see details in Faria *et al.* 2008b) on May 10th, May 25th and June 15th, and one at the end of the breeding season on November 4, 2005. We assumed that outside the breeding season censuses appropriately reflected the abundance of the population. There was no statistical difference in response to playbacks between the reproductive and non-reproductive periods, as shown by Faria *et al.* (2007), reinforcing this assumption.

Population density and carrying capacity in the study area

Based on the average number of all pairs recorded during the four separate censuses, we were able to estimate the population density with respect to gallery forest area (hectares) and river distance (km).

Carrying capacity is defined as the maximum number of individuals that a particular environment can support (Ricklefs, 1996). The carrying capacity of the population observed in our study area was estimated based only on the number of breeding pairs, according to the IUCN (2001) criteria, because this represents the reproductive portion of the population. Our estimate also assumes that the entire gallery forest habitat sampled is adequate to support the presence of the species. The values of some key parameters used to calculate the carrying capacity of the current study area were obtained from Faria *et al.* (2008a): the

average area of gallery forest habitat available for each breeding pair was 6.7 ha and the average length of the river occupied by each breeding pair was 405 m.

Using a map (1:100.000 scale) acquired from the Brazilian Institute of Geography and Statistics (IBGE), the total area of gallery forest habitat was calculated within the geographic limits of the Serra do Cipó National Park. Two key parameters were considered to make this estimate: altitude below 1000 m and the presence of gallery forest, both necessary prerequisites for the occurrence of the species (Silva, 1996; Vielliard & Silva, 2001).

Population size and carrying capacity in the total extent of occurrence

The estimated population size of the Chestnut-Capped Foliage-Gleaner throughout its entire known geographic distribution was based on the fact that this species is restricted to gallery forest habitat occurring within the Cerrado biome. It has been estimated that gallery forest constitutes just 5% of the diversity of habitats that characterize the entire Cerrado biome (Azevedo & Adámoli, 1988). This value can be considered the species' area of occupancy according to the IUCN (2001), that is the area within its 'extent of occurrence' which is occupied by a species as represented by the presence of its required habitat. We also considered two different situations: the integrity of the gallery forest habitat as required by environmental law, and the conservation status of the biome itself, estimated to be about 20% (Silva & Bates, 2002).

For each situation we made two population size estimates. The first estimate was based on the population density that we calculated for the species in the Serra do Cipó National Park, while the second estimate was derived from our calculation of the species' carrying capacity in the study area, *i.e.*, the maximum density.

RESULTS

Our extensive review of locality records for the species resulted in an increase of 17% in the total extent of occurrence of Chestnut-Capped Foliage-Gleaner as compared to the range map presented by Ridgely & Tudor (1994). The map generated by this study certifies its presence in six different river basins (São Francisco, Tocantins, Paraná, Jequitinhonha, Pardo and Mucuri), in 70 cities occurring in six Brazilian states, the Federal District and Paraguay, covering a total area of 142.6 million hectares (Figure 1).

TABLE 1: Parameters used to estimate the population and carrying capacity of the Chestnut-Capped Foliage-Gleaner in the study area, and extent of occurrence considering the preserved Cerrado and 20% of its area retained.

Study area	
Gallery forest area (ha)	165
Mean number of birds (N = 4)	14
Mean number of pairs (N = 4)	6.25
Mean area of available habitat within territories of pairs (ha) (Faria <i>et al.</i> 2008a)	6.7
Density (pairs/ha)	$6.25/165 = 0.0378$
Carrying capacity in the study area (pairs)	$165/6.7 = 24.6$
Geographic range	
Extent of occurrence (estimated by the present study) (ha)	142,630,749
Area of occupancy (gallery forest within the extent of occurrence – 5% of the Cerrado) (Azevedo & Adámoli, 1988) (ha)	$142,630,749 \times 0.05 = 7,131,537$
Carrying capacity (pairs) – based on the carrying capacity of the study area and considering full conservation for the gallery forests of the Cerrado as required by Brazilian law	$24.6/165 \times 7,131,537 = 1,064,409$
Carrying capacity (pairs) – based on the carrying capacity of the study area and considering 20% of the Cerrado retained	$1,064,409 \times 0.2 = 212,882$
Population (pairs) – based on the study area population and considering full conservation of the gallery forests of the Cerrado as required by Brazilian law	$7,131,537 \times 0.038 = 270,134$
Population (pairs) – based on the carrying capacity of the study area and considering 20% of the Cerrado retained	$285,261 \times 0.2 = 54,027$

We surveyed the occurrence of Chestnut-Capped Foliage-Gleaner along the Mascates and Cipó rivers, which are bordered by 165 hectares of gallery forest, for a total length of 10.6 kilometers. We recorded 15 individual adults, including six pairs with established breeding territories and three solitary birds. During the second census effort we were able to confirm the presence of all the previously recorded individuals. Aside from one additional unmarked pair that was recorded during the final survey effort, no other birds were observed in the study area.

The average number of individuals and breeding pairs registered during our surveys was 14.0 ± 0.8 and 6.3 ± 0.5 , respectively (N = 4). The population density was found to be 3.8 pairs per 100 ha of gallery forest. Along the river population density was 0.59 pairs/km, or one pair for every 1.7 km of river.

The capacity of the study area to support Chestnut-Capped Foliage-Gleaner, calculated with respect to the total area of forest available and the length of the river, was estimated to be 24.6 and 26.2 pairs, respectively. These estimates are equivalent to 14.9 pairs/100 ha and 2.5 pairs/km.

The study area represents nearly all the available habitat that can theoretically support the existence of the species in the Serra do Cipó National Park. Just over 6% of the park is below 1000 m and only 15% of this area is actually covered by gallery forest. Therefore, just 0.9% of this entire protected area can realistically be said to contribute to the conservation of this species.

Based on our calculation of the carrying capacity of the gallery forest habitat present in the study area, approximately 1,064,000 pairs of Chestnut-Capped Foliage-Gleaner could occur throughout its entire known geographic range. However, if we consider that the conservation index of the Cerrado biome is only about 20%, the total population size estimate for this species decreases to almost 213,000 pairs.

On the other hand, if we extrapolate from just the population that was surveyed in gallery forest along the Cipó River and account for the area of all currently protected gallery forest habitats in the Cerrado, the total population size estimate of the species throughout its entire known distribution is about 270,000 pairs. If we assume that the conservation status of all gallery forest habitats is equivalent to that of the Cerrado biome in which it occurs, which is quite likely, the estimated population size of Chestnut-Capped Foliage-Gleaner throughout its distribution is slightly more than 54,000 breeding pairs (Table 1).

The estimates obtained from our calculation of an extent of occurrence, the area of occupancy, and the total population size of Chestnut-Capped Foliage-Gleaner throughout its entire known distribution do not warrant its inclusion in the category of threatened, not even when considering the most conservative population size estimates according to the criteria B1, B2 and C of the IUCN (2001).

Still, considering the direct proportionality between its the population size and the total area occupied by gallery forest habitat in the Cerrado, as

well as the destruction higher than 10% of the biome over the last century alone (Chaves, 2008), the species would be classified as vulnerable according to criterion E of the IUCN (2001).

DISCUSSION

Extent of occurrence

Distribution maps represent some very basic information about a species' biology and are essential to many types of research, but unfortunately they are very rarely updated aside from major taxonomic revisions or new comprehensive references. Furthermore, new localities are often omitted or simply overlooked (*e.g.*, Rodrigues & Gomes, 2004). In the case of the suboscines Passerine bird species, researchers may repeatedly rely on the information compiled by W.L. Brown and presented in Ridgely & Tudor (1994), in which the exact geographic locations of a particular species' occurrence records are not given and the contour maps are often necessarily subjective, little discerning and generally not geo-referenced.

The thorough survey of locality records for Chestnut-Capped Foliage-Gleaner and the range map presented in the current study considerably expands the known distribution of this species in comparison to the map given by Ridgely & Tudor (1994).

Such observations raise questions about the accuracy of some species distributions given by Ridgely & Tudor (1994), chiefly with respect to the sampled area. The Espinhaço Mountain Range, as represented by the Serra do Cipó in the area of the current study, presents a sharp natural boundary to the easternmost distribution of the focal species (Melo-Júnior *et al.* 2001; Rodrigues *et al.* 2005; Vasconcelos & Rodrigues, 2010; Rodrigues *et al.* 2011). However, Ridgely & Tudor (1994) give the range of Chestnut-Capped Foliage-Gleaner as extending 100 km further east, an assumption they may have also exercised in representing the northern limit of its distribution, where there are locality records on the border between Minas Gerais and Bahia. It is noteworthy that the southern portion of this species' distribution, extending into the state of São Paulo, would have been included in the range given by Ridgely & Tudor (1994) if they employed the MCP method to minimize the subjectivity of geographic contours.

Although the list of locality records compiled here can certainly be incomplete, it does represent an improved basis for making more accurate revisions to the geographic distribution of the Chestnut-Capped

Foliage-Gleaner in the future. Marini *et al.* (2009) provide an estimate of the current distribution of *Hylocryptus rectirostris* based on niche modeling, which resembles, but is slightly larger (164 million hectares) than those mentioned in this study. That study also provides a forecast loss of 41-45% of the geographical distribution until 2099, supporting the concerns of conservation of this species. Close review and relevant revision of the known range of this and other bird species should be encouraged because of the direct implications such basic information has on conservation efforts.

Local situation (study area)

Based on demographic studies conducted in the Amazon Forest, Terborgh *et al.* (1990) considered those species with a population density of less than 1 pair/100 ha to be rare, while Thiollay (1994) considered this threshold to be 2 pairs/100 ha. The species density in the Cipó Valley (3.8 pairs/100 ha) is similar to that of other ovenbird species not considered to be rare in previous studies, which estimated population densities between 2.5 and 7.0 pairs/100 ha (Terborgh *et al.* 1990; Thiollay, 1994). Moreover, a demographic study in Panama (Brawn *et al.* 1995) estimated the population densities of 25 different forest-based Passerine species to all be greater than that of the Chestnut-Capped Foliage-Gleaner. The contrasting results of these studies must cast some degree of doubt on the accuracy and consistency of methods used to estimate the population density of a particular species when some proportion of the individuals are not color marked (Faria *et al.* 2008a).

Two factors support the conclusion that Chestnut-Capped Foliage-Gleaner has a low population density in our study area: the presence of solitary adult males for long periods (Faria *et al.* 2008a, b), and a population size that is four times less than the carrying capacity.

Our own observations of its reproductive biology indicated the presence of several solitary males with established territories that did not reproduce, probably due to the absence of enough unpaired females. The low recruitment of reproductive females renders the conservation situation of this particular population somewhat more critical when one considers the sex determination results of young produced in 2004 and 2005, which was found to be 80% males (Faria *et al.* 2008b). The demographic stochasticity caused by such an imbalanced sex ratio can pose a serious threat to the perpetuation of a species (Primack

& Rodrigues, 2001), a situation that seems to be occurring with the Chestnut-Capped Foliage-Gleaner population in the Serra do Cipó National Park.

Some local residents have reported the existence of illegal hunting activities targeting Chestnut-Capped Foliage-Gleaner, especially during the breeding season when birds can be easily captured in their nest. It is possible that this unfortunate hunting activity has caused the population to decline, even more so because its breeding season is very short (Faria *et al.* 2008a). Furthermore, frequent summer flooding may destroy nests and hinder successive reproductive attempts (Faria *et al.* 2008b), delaying the recovery of the local population.

It should be emphasized that the population studied here is located in one of the easternmost limits of the species' entire geographic distribution and the study area is stuck in a deep valley that is skirted by the Espinhaço Mountain Range (Rodrigues *et al.* 2005). On the opposite side, downstream of the study area and outside of the park boundaries, the gallery forest habitat was completely extirpated along at least 3.5 km of the river's course.

Therefore, the study area is fairly isolated and we suggest that an effort should be made to restore the gallery forest habitat adjacent to the park in order to connect it to the unspoiled habitat within the park and facilitate the expansion of the species back into the damaged area. Furthermore, studies designed to assess the degree of genetic variation present in the local population should be initiated to help shed more light on the actual degree of reproductive isolation. We also propose that an annual population census should be conducted to monitor the population and help determine whether the translocation of individuals from other areas, especially females, may be a necessary measure to employ in order to ensure the continued existence of this species in the Serra do Cipó National Park.

Global situation

Among the various population size estimates presented here, the estimate indicating that there are approximately 54,000 pairs of Chestnut-Capped Foliage-Gleaner is probably the most realistic because it is based on the most detailed study of a single population and it accounts for the conservation status of the whole Cerrado biome. The other estimates assume that gallery forest habitats in the Cerrado are fully preserved and that populations are saturated, *i.e.*, at the limit of their carrying capacity. Such estimates may not

be a realistic representation of the current situation of the species, but they do offer an idea of what the population numbers may have been like prior to human occupation of the Cerrado and its subsequent alteration.

In addition to being considered a rare to uncommon species (Ridgely & Tudor, 1994; Stotz *et al.* 1996), as well as its inclusion on the red list for the state of São Paulo (São Paulo, 1998), a low population density and its absence from four protected areas in the Federal District was also discovered during a study conducted in Brasília (Braz & Cavalcanti, 2001). Population censuses conducted in Brasilândia de Minas (Faria *et al.* 2009), Felixlândia (Rodrigues & Faria, 2007), and Virgem da Lapa (L. Faria and L. Carrara *pers. obs.*) in the state of Minas Gerais also observed a low population density for this species. These observations are consistent with the situation we discovered in the area of the current study, suggesting that populations of Chestnut-Capped Foliage-Gleaner are below their carrying capacity throughout much of their total geographic range.

Low abundance, a highly specialized diet, and/or very specific habitat requirements are features that may predispose a species to extinction (Bibby, 1996; Johnson, 1998). The low population density of Chestnut-Capped Foliage-Gleaner in the area of the current study, the low level of recruitment of reproductive females, and the highly specialized habitat requirements, particularly with respect to foraging and breeding, collectively reveal a delicate situation for this species. However, its wide extent of occurrence, even considering that it is restricted to a gallery forest habitat that is not quantitatively representative of the Cerrado biome in which it occurs, favors the existence of a global population of Chestnut-Capped Foliage-Gleaner without serious risk of extinction in the short term, at least according to the estimates presented here.

However, the complete absence of any previous monitoring data in the study area or any place else where Chestnut-Capped Foliage-Gleaner is known to occur, prevents us from making more accurate inferences about possible population declines, which is one of the criteria also considered to be important by the IUCN (2001). However, the accelerated rate of habitat destruction in the Cerrado region during the last century, mainly beginning in the 1970s (Chaves, 2008), suggests a considerable reduction in the total geographic area suitable for Chestnut-Capped Foliage-Gleaner and, consequently, a direct impact on its actual population parameters. Cerrado destruction during the last century has most certainly caused a decline in the total population of Chestnut-Capped

Foliage-Gleaner that amounts to greater than 10%, the level considered sufficient by the IUCN to warrant the inclusion of a species in the category of vulnerable. This particular criterion would justify the inclusion of virtually all species with restricted habitat requirement, especially in the Cerrado and Atlantic Forest biomes, given the accelerated rates of habitat destruction worldwide throughout the last century.

The current study presents valuable baseline data and demographic estimates that can be used in comparisons with data collected during the course of future research efforts. Additional studies should be conducted in other locations to compare population size and density estimates of this species throughout the extent of its occurrence, and to facilitate more accurate assessment of population fluctuations over time.

The conclusion that Chestnut-Capped Foliage-Gleaner should not be considered a threatened species according to IUCN criteria does not preclude the necessity of establishing sufficient conservation measures for this and many other species. Avoiding the inclusion of any additional species on the official listing of threatened fauna has proven to be more an effective means of biodiversity conservation than an attempt to recover the population of a species already included in any of the IUCN categories (Galetti *et al.* 2002). Therefore, the recovery of disturbed riparian areas and preservation of existing gallery forest habitat should be considered a top priority in future efforts to conserve populations of Chestnut-Capped Foliage-Gleaner throughout the Cerrado biome.

Moreover, this species may be used as an excellent tool in the evaluation of gallery forest areas in the Cerrado because of its exclusive dependence on gallery forest habitats. Furthermore, its occurrence in several river basins and easy detection in the field favor its use as a bioindicator of environmental quality. The disappearance and absence of this species from certain gallery forest areas in the Cerrado should indicate the need for some degree of intervention to restore gallery forest habitat.

RESUMO

Hylocryptus rectirostris é uma espécie de furnariídeo neotropical (Furnariidae) endêmico das matas ciliares da região do Cerrado do Brasil central. Embora não seja considerada globalmente ameaçada, o grau de perda de habitat que ocorre em grande parte da sua distribuição conhecida pode justificar a sua inclusão em listas vermelhas além do estado de São Paulo. O principal objetivo deste estudo é avaliar o estado de conservação

de *Hylocryptus rectirostris* de acordo com os critérios adotados pela IUCN. Resultados de censos realizados no Parque Nacional da Serra do Cipó foram usados para estimar o tamanho de sua população inteira e refinar nossa compreensão da sua real distribuição geográfica. Resultados do Censo indicam que a espécie tem uma densidade populacional de 3,8 pares/100 ha e ocupa apenas um quarto de seu habitat preferido na área de estudo, o que está bem abaixo da capacidade de suporte. A população total estimada, pela sua extensão total de ocorrência conhecida, é de pouco mais de 54.000 pares. A distribuição geográfica e o tamanho da população total estimada neste estudo não indicam que *Hylocryptus rectirostris* deva ser considerada uma espécie ameaçada de acordo com os critérios da IUCN. No entanto, não foi possível avaliar o estado de conservação desta espécie baseado em informação relativa às flutuações de população ao longo do tempo, outro dos critérios da IUCN. A taxa de destruição de habitat no Cerrado durante o último século certamente resultou em um declínio populacional superior a 10%, um fator suficiente para justificar a inclusão de *Hylocryptus rectirostris* na categoria IUCN de vulnerável.

PALAVRAS-CHAVE: Cerrado; Conservação; Endemismo; Matas de Galeria; Perda de habitat; Distribuição geográfica.

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