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Annotated checklist of birds recorded between 1998 and 2009 at nine areas in the Belém area of endemism, with notes on some range extensions and the conservation status of endangered species

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RESUMO: Lista anotada de aves registradas entre 1998 e 2009 em nove áreas do centro de endemismo Belém, com notas sobre algumas extensões de distribuição e o *status* de conservação de algumas espécies ameaçadas. O centro de endemismo Belém, por incluir a capital do estado do Pará em seus limites, foi um dos mais bem estudados de toda a Amazônia com relação à sua avifauna. Entretanto, atualmente essa região biogeográfica é o setor mais desflorestado de toda a Amazônia devido ao avanço da agropecuária, além da extração de madeira para fabricação de carvão, restando poucos fragmentos de grande tamanho e estado de conservação satisfatório. Com o objetivo de aprimorar o conhecimento sobre a avifauna da região, incluindo uma avaliação do *status* atual de conservação de algumas espécies ameaçadas de extinção, apresentamos aqui dados inéditos de levantamentos de avifauna realizados entre 1998 e 2009, em localidades dos municípios de Capitão Poço, Dom Eliseu, Paragominas, Santa Bárbara do Pará, Tailândia e Tomé-Açu, todos situados no centro de endemismo Belém. O número de espécies registrado durante os levantamentos (441) é significativo em relação ao total já registrado para o centro de endemismo Belém (529 espécies), apontando os fragmentos florestais de maior tamanho e conectividade dos municípios de Paragominas, Tailândia e Tomé-Açu como aqueles que ainda detêm um maior número de espécies, abrigando também o maior número (14) de espécies/táxons de aves ameaçados de extinção de toda a Amazônia. O fato de estes fragmentos estarem situados em propriedades de grupos empresariais ligados aos ramos madeireiros e de bio-combustíveis, demonstra o importante papel e a responsabilidade destes ramos do setor produtivo setores para com a conservação da biodiversidade Amazônica.

PALAVRAS-CHAVE: Amazônia; Centro de endemismo Belém; Conservação; Espécies ameaçadas; Extensão de distribuição.

ABSTRACT: Annotated checklist of birds recorded between 1998 and 2009 at nine areas in the Belém area of endemism, with notes on some range extensions and the conservation status of endangered species. The Belém center of endemism is one of the best known areas in Amazonia from an ornithological standpoint, in part due to the fact that the capital city of the state of Pará is included within its limits. However, the expansion of agribusiness and logging has currently made this the most deforested sector of Amazonia, with only a few large and well-preserved forest tracts. Here we present novel data on the avifauna of this part of Amazonia by reporting on field data collected by us between 1998 and 2009 at some localities in the municipalities of Capitão Poço, Dom Eliseu, Paragominas, Santa Bárbara do Pará, Tailândia, and Tomé-Açu; all situated in the Belém center of endemism. In addition to contributing to the ornithological knowledge of this part of Amazonia, we also sought to evaluate the current conservation status of several threatened species found in the area. Our surveys recorded a total of 441 species, a significant number when compared to the total avian species richness reported so far for the Belém center of endemism (*i.e.*, 529 species). This has indicated that the largest and more connected fragments of Paragominas, Tailândia, and Tomé-Açu have the highest species richness, including 14 endangered species/taxa, which is the highest number recorded so far in the entire Amazon. The fact that those fragments of land are owned by companies linked to the timber and biofuel industries demonstrates the importance and responsibility of these economic sectors to biodiversity conservation in the Amazon.

KEY-WORDS: Amazon; Belém center of endemism; Conservation; Range extension; Threatened species.

Amazonia is not homogeneous in its plant and animal communities, but rather it is a mosaic of distinct areas of endemism separated by large rivers, each with its own evolution and biotic groupings (Silva *et al.* 2005). The forests situated in the west of Pará State, between the right bank (east) of the Tocantins River and the west of Maranhão State, possess diverse endemic taxa, which together are called the Belém center of endemism (hereby referred to as CE Belém; Roma, 1996; Silva *et al.* 2005). This center of endemism is principally formed by *terra-firme* forests, and its size is around 145,000 km² (Silva *et al.* 2005). As expected, the region adjacent to the capital of Pará was the first to be researched in relation to its avifauna. The first inventories of grand stature begin to appear from the second half of the nineteenth century, thanks to the efforts of naturalists and researchers like J. Natterer, E. Goeldi, E. Snethlage. Principally among these is Fernando da Costa Novaes, who significantly contributed to increasing the understanding of birds of CE Belém (Novaes and Pimentel 1973, Novaes and Lima 2009, Roma 1996).

Knowledge of birds from CE Belém may be considered reasonable, owing to its location and easy access. As such, Roma (1996) lists 529 species for all of eastern Pará, while Novaes and Lima (2009) list 482 species for the region of greater Belém (including the municipality near Ananindeua). It is important to note that both studies are a compilation of dozens (in some cases, more than hundreds) of years of intense collecting in this region done by various researchers and professional collectors. In certain cases, some species are cited that were registered only once, like the Blue Macaw (*Anodorhynchus hyacinthinus*) and the Black Acan (*Laterallus jamaicensis* – Novaes and Lima 1994), and were never again registered by any other researcher.

Western Maranhão State and the region east of Pará are among the areas that suffer the most from anthropic action in all of Amazonia. The extensive forests of the region, classified as dense ombrophilous forest and situated below 100 m altitude, are currently considerably fragmented and degraded (Vieira and Almeida 2006). The actions of lumberjacks and the frontiers of colonization begin exactly in this region, forming the eastern portion of the “arc of deforestation”, which extends to the south and west in the direction of Rondônia State. Furthermore, various municipalities of eastern Pará already have 100% of their areas completely altered by human actions (Almeida *et al.* 2010). About 70% of CE Belém is already deforested (Silva *et al.* 2005), and is considered to hold the greatest index of deforestation throughout all of the Amazonian Forest (Capobianco *et al.* 2001, Silva *et al.* 2005). These formerly extensive forests, situated between the west of Maranhão and the Tocantins River, shelter hundreds of taxa of vertebrates and invertebrates, many of them endemic. Furthermore, this is one of the

most important areas in relation to Amazonian vertebrate diversity. Yet despite its biogeographical importance, the percentage of protected areas in CE Belém is insignificant with only 1.4% strictly protected area, 9.77% area of sustainable use, and 6.49% of area occupied by indigenous lands (Silva *et al.* 2005). Most of the areas still forested are under the guard of companies or big landowners, the latter of which still constantly cut down large portions of forest to open the way for pastures (Almeida *et al.* 2010). It is important to note that all taxa of birds threatened with extinction, occurring in the Amazonian biome, occur principally or exclusively in CE Belém (Machado *et al.* 2008). In this sense, recent studies on the avifauna of CE Belém are essential to verify the current status of bird communities, and to furnish information which guides conservation programs in this very singular and important area, at the same time so unprotected.

In this article, we report for the first time the results of fieldwork realized by us between the years 1998 and 2009 in forestal fragment in the municipalities of Capitão Poço, Dom Eliseu, Paragominas, Santa Bárbara do Pará, Tailândia and Tomé-Açu; all sites situated in CE Belém, Pará State. We discuss with special attention those records that imply extensions of considerable distribution, as well as those obtained for species considered threatened from extinction in state and national levels (Machado *et al.* 2008) (SEMA 2007).

MATERIAL AND METHODS

Study Areas

In the years 1998, 2004, 2005, 2006, 2007 and 2009 campaigns were conducted in 9 areas of CE Belém, distributed among the municipalities of Tailândia, Paragominas, Tomé-Açu, Dom Eliseu, Santa Bárbara do Pará and Capitão Poço (Figure 1).

The vegetal covering of CE Belém is classified as dense ombrophilous forest of *terra-firme*, with predominance of liana forests in some regions (Vieira and Almeida 2006). A brief description of visited areas, including periods of sampling and vegetal typology found in each, is presented below. The numbers next to the names of municipalities and localities are the same as in Figure 1.

1) *Santa Bárbara do Pará – Gumna Ecological Park*: This locality constitutes a forestal fragment of private property with around 540 ha of secondary vegetation and significant anthropic influence situated approximately 45 km from the Center of Belém (01°11'57.3"S; 48°17'57.1"W), at the margins of Augusto Meira Highway (Belém – Mosqueiro). It is also flanked by various settlements. The area was sampled by CEBP, MSS and AA on October 8-15, 2005.

2) *Tailândia – Agropalma Group Forestal Reserves (RFGA):*

These are components of *terra-firme* forest from a group of forestal remnants, totaling approximately 75,000 ha, aside from other vegetal formations (e.g., fields). They were sampled by FS and LFS between January 18 – February 5, and August 28 – September 6, 2004, and between January 3-15 and September 1-10, 2006, totaling 34 days of fieldwork. The following localities were selected for sampling, considered the most relevant in terms of forest quality: Maçaranduba (02°36'0.07"S; 48°47'0.00"W); Maxixe (02°38'S; 48°55'W); Águas Claras (02°33'S; 48°53'W); Amapalma (02°40'S; 48°55'W); Amapalma, line 67 (02°24'S; 48°49'W); Agropalma Forestal Reserve (02°36'S; 48°44'W); Agropalma – Trail II (02°37'S; 48°48'W); Dendê (02°38'S; 48°48'W); and Aiu-açu (02°33'S; 48°53'W).

3) *Tomé-Açu – SAFs:* In this area, the predominant vegetation is dense ombrophilous lowland forest. Secondary vegetation is distributed in small fragments, with

the presence of pastures and areas in which agro-forestal systems are implemented (SAFs). The area was sampled by CEBP, FP, MSS and AA on March 22-27, 2005, when the following localities considered the most relevant in terms of forest quality were sampled: Arai Farm (02°30'6.8"S; 48°17'30.8"W); Inada Farm (02°27'41.6"S; 48°18'37.4"W); and the Cultural Association of Tomé-Açu – ACTA (02°35'50.9"S; 48°20'30.7"W). Between December 16-21, 2009, CEBP and LCS visited a fourth locality in the same area: Madeiracap Farm (02°31'49.6"S; 47°58'51.7"W).

4) *Paragominas – (Estrada Vicinal) Side Road:* The municipality of Paragominas possesses heterogeneous levels of forestal fragmentation and degradation at different points. The portion south of the municipality, near the border with the neighboring municipality of Ulianópolis, was briefly sampled by AA on May 13, 2005 along a side road (03°45'19.8"S; 48°03'53.4"W), where areas of pasture and agro-forestal systems (SAFs) predominate.

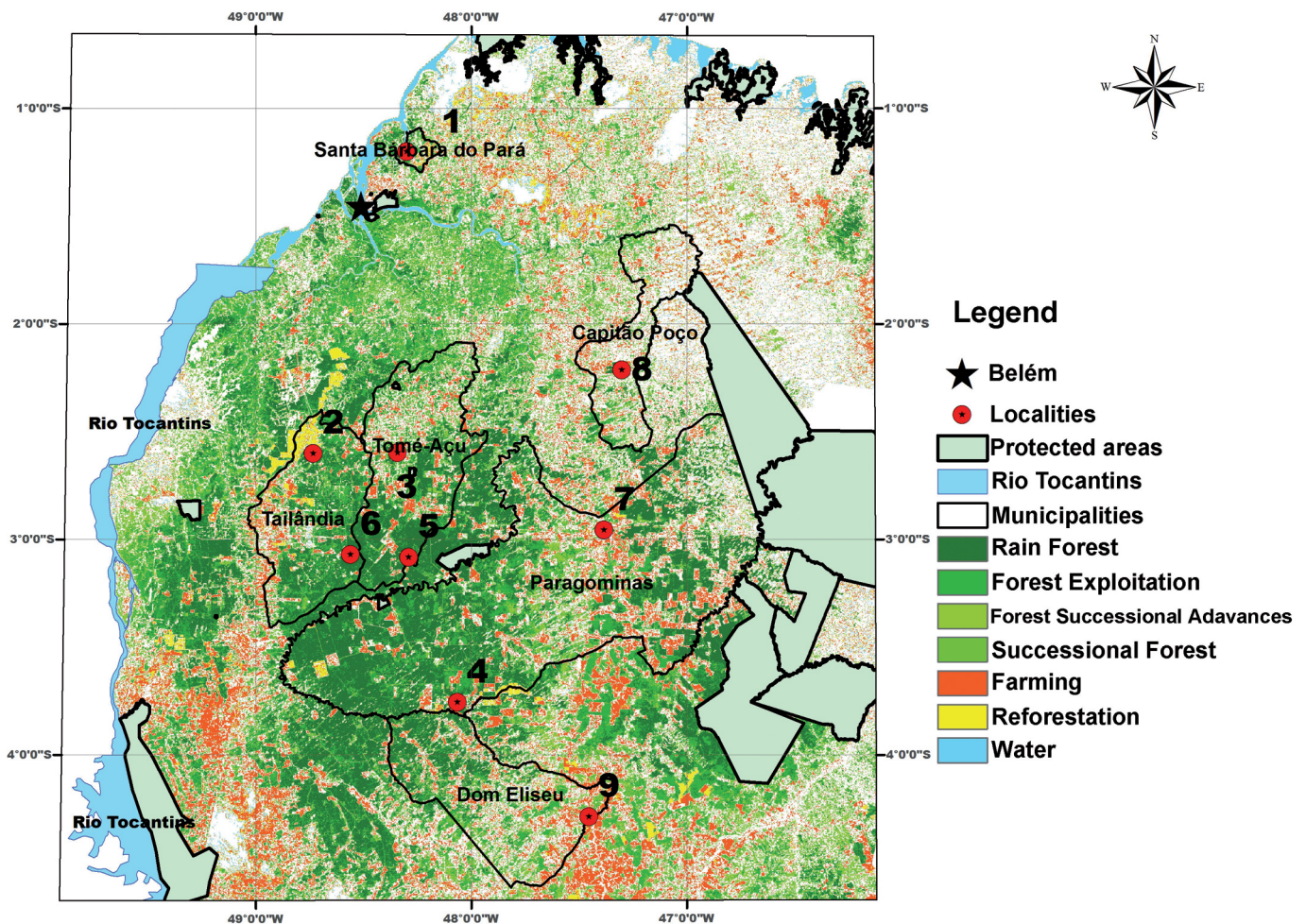


FIGURE 1: Map with municipalities, landscapes, vegetation types, and surroundings associated with localities surveyed for birds between 1998 and 2009, in the Belém area of endemism, state of Pará, Brazil. Red dots depict actual sampling points numbered as follows (see text for a detailed description of localities): 1 = Santa Bárbara do Pará (Gunma), 2 = Tailândia (RFGA), 3 = Tomé-açu (SAFs), 4 = Paragominas (Side Road), 5 = Tomé-Açu (Cauaxi Farm), 6 = Tailândia (Rio Capim Farm), 7 = Paragominas (Vitória Farm), 8 = Capitão-poço (São Marcos Farm), and 9 = Dom Eliseu. Map based on vegetation and land-use data from Vieira and Almeida (2006).

5) *Tomé Açú – Cauaxi Farm*: This location (situated at 03°04'52.2"S; 48°17'25.7"W) was sampled during three distinct periods: January 16-25 and August 3-11, 1998 (AA); and May 9-15, 2005 (CEBP, FP, MSS and AA). Cauaxi Farm is situated adjacent to Rio Capim Farm. Both are connected to a large forestal fragment, which is one of the largest still existent in CE Belém (Figure 1).

6) *Tailândia – Rio Capim Farm*: Rio Capim Farm (situated at 03°04'10.7"S; 48°33'34.7"W) covers an area of 150,000 ha, in which 95,000 ha are occupied by primary forest. A second forestal fragment with different levels of degradation is approximately 30,000 ha, and extends outside the limits of the farm. This area was visited from July 10-30, 2005 by CEBP and MSS, from June 22-23, 2007 by AA and FP, and from August 28 – September 3, 2007 by KJZ and AW.

7) *Paragominas – Vitória Farm*: The area sampled constitutes a small degraded forestal fragment of 280 ha, completely isolated by pastures and plantations. Situated in the periphery of Paragominas (02°57'21.4"S; 47°22'59.1"W), it was visited by AA on May 13-14, 2005.

8) *Capitão Poço – São Marcos Farm*: This municipality was originally covered by dense ombrophilous *terra-firme* forest (Vieira and Almeida 2006); a reduced number of fragments currently remaining (Figure 1). The area sampled is a forestal fragment of about 3, 500 ha (situated at 02°12'42.5"S; 47°18'3.3"W), visited by CEBP and MSS on October 11-20, 2005. It is constituted by secondary forest and bordered by large areas of pasture.

9) *Dom Eliseu*: In this area, vegetation of dense ombrophilous lowland forest predominates, along with secondary vegetation and a matrix of agricultural areas. The sampled area (situated at 04°17'09.0"S; 47°27'12.3"W) was visited by CEBP and LSC on December 9-14, 2009.

Sampling of Avifauna

Species of birds were identified visually with the aid of 10 × 40 and 8.5 × 45 binoculars. The diverse sonorific manifestations emitted by birds were recorded in analog format (Sony TCM 5000 EV Recorder and Sennheiser ME 66 Microphone), and in digital format (Sharp MD DR7 Recorder, Marantz PMD 670 and Sennheiser ME 66 Microphone). To capture and collect the birds we used mist-nets extended in open transects at chosen areas. Birds of large stature and those that inhabit more elevated strata of vegetation are more difficult to capture by mist-nets. Therefore, for their collection and sampling, rifles were used of .22, .20, .28 and .36 caliber. Generally, the

activities of avifauna sampling began around 5:00 in the morning and extended until around 20:00 for the observation of nocturnal birds. Mist-nets were usually opened at 6:00 in the morning and closed at 11:00. The number of mist-nets varied according to locality, always maintaining a number of nets between 10 and 20 (12 meters in length and 2.40 m high – from 36 to 30 mm mesh).

Birds collected were taxidermied in standard positions for systematic studies. Some examples collected in duplicate were fixed whole in 4% formaldehyde, and subsequently preserved in 70% ethanol, as were all carcasses of birds that were taxidermied. Biometric data (mass and total length), and coloration of bare parts were also noted for each example collected. Tissue samples (pectoral musculature) were taken from all birds collected, serving for future genetic studies. All materials collected were deposited at the Museu de Zoologia da Universidade de São Paulo, São Paulo, SP (MZUSP), and at the Coleção Ornitológica Fernando C. Novaes of the Museu Paraense Emílio Goeldi, Belém, PA (MPEG).

RESULTS AND DISCUSSION

In all, 441 species belonging to 60 families were registered along the course of this study (Appendix). Of this total, 231 species have voucher specimens deposited at MPEG and/or MZUSP. Table 1 demonstrates the species richness registered in the study area, aside from the number of taxa endemic to CE Belém (Cracraft 1985, Roma 1996, Stotz *et al.* 1996), threatened (Machado *et al.* 2008, SEMA 2007, IUCN 2010), and with restricted distribution (Stotz *et al.* 1996).

Within all of the sampled localities, those situated in the municipalities of Tailândia (Forestal Reserves of the Agropalma Group and Rio Capim Farm), as well as Tomé-Açu (Cauaxi Farm, Madeiracap Farm and SAFs), had the most global richness of species/taxa, including those that are threatened and those with restricted distribution (Table 1). That is besides others of special interest related to conservation, such as migrants of North America (*Ictinia mississippiensis* and *Progne subis*), which serve as indicators of good environmental quality (*Morphnus guianensis*, *Harpia harpyja*, *Spizaetus* spp. and *Neomorphus geoffroyi*) and of high hunting value (*Aburria cunjubi*, *Pauxi tuberosa* and *Crax fasciolata pinima*). This can be explained by the existence of large, connected, dense ombrophilous forestal fragments in good state of conservation in the municipalities of Paragominas, Tailândia and Tomé-Açu (Figure 1). On the other hand, the forestal matrix of the municipalities of Capitão-Poço, Dom Eliseu and Santa Bárbara do Pará, besides part of the municipality of Paragominas, principally include forestal fragments of relatively reduced size and in advanced stage of degradation (Figure 1). This explains the presence of

TABLE 1: Richness and number of endemic, threatened, and range-restricted taxa/species recorded during bird surveys carried out between 1998 and 2009 at several localities in the Belém area of endemism, state of Pará, Brazil.

Locality	Number of observed species	No. endemic taxa*	No. threatened species/taxa**	No. species with restricted distribution***
Santa Bárbara do Pará – Gumna	155	8	3	6
Tailândia – RFGA	330	15	12	9
Tomé-açu – SAFs	226	17	9	6
Paragominas – Side Road	39	—	—	—
Cauaxi Farm	241	18	13	9
Rio Capim Farm	233	18	11	8
Vitória Farm	128	6	3	2
Capitão Poço – São Marcos Farm	28	3	2	1
Dom Eliseu	106	6	4	—

* Taxa endemic to the Belém area of endemism according to Cracraft (1985), Roma (1996), and Stotz *et al.* (1996).

** Species/taxa regarded as Vulnerable, Endangered, and Critically Endangered according to Machado *et al.* (2008), SEMA (2007), and IUCN (2010).

*** According to Stotz *et al.* (1996).

more impoverished bird communities with smaller numbers of species that are of special interest for conservation (Table 1).

Among all taxa threatened with extinction and/or endemic to CE Belém (Roma 1996; Machado *et al.* 2008), only two were not registered from the sampled localities: *Threnetes leucurus medianus* (Trochilidae) and *Dendrexetastes rufigula paraensis* (Dendrocolaptidae). In relation to the first taxon, it is possible that more intense sampling using mist-nets would bring individuals of this subspecies to the register, as it is a silent hummingbird that inhabits the dense understory of *terra-firme* forest, especially near creeks. However, in the case of *Threnetes leucurus medianus*, it is possible that the sampling was not sufficiently intense to register this species with naturally low density. On the other hand, the complete absence of records of *Dendrexetastes rufigula paraensis* seems to reflect a true local extinction in the sampled localities, as this is a species with a highly conspicuous vocalization. It makes worrisome the conservation of this taxon endemic to CE Belém, listed as threatened with extinction (Machado *et al.* 2008). The only recent records in CE Belém attributed to this taxon were realized by Sidnei de Melo Dantas on the west bank of the Tocantins River in the region of the hydroelectric plant of Tucuruí, during the period between 2005 and 2007 (Dantas, *pers. comm.*, 2007). In contrast, the intense degradation of the original forestal matrix in parts of CE Belém, as verified in some of the sampled localities, lead to a recent invasion of a species typically associated with open landscapes and usually absent from this biogeographical region of Amazonia, as is the case of *Furnarius rufus* (Furnariidae); or to the populational expansion of other species generally restricted to *várzea* environments and cerrado enclaves in the biome of Amazonia (*e.g.*, *Crypturellus parvirostris* – Tinamidae, *Melanerpes candidus* – Picidae, *Ramphastos toco* – Ramphastidae, *Synallaxis albescens* – Furnariidae, *Piranga flava* – Thraupidae and *Sturnella militaris* – Icteridae).

Relevant Records

Crax fasciolata pinima

This subspecies is one of the least known taxa of the family Cracidae (Silveira 2008), listed as “Endangered” in the national level (Silveira 2008), as well as in the state of Pará (SEMA 2007). Endemic to CE Belém, it was originally found in *terra-firme* forests between the west of Maranhão and the east of the Tocantins River in Pará State. There is no information on the ecology, habits, and habitat of this bird that has not been seen in nature since the end of the 1970s, when the last specimens were collected (del Hoyo 1994, Silveira 2008). Among all of the localities sampled, this species was only registered at the Agropalma Group Forestal Reserves (Appendix) through reports given to LFS by local inhabitants. The inhabitants affirmed that the Bare-Faced Currawong is still can be found in the region, but in very low density in the most conserved patches of forest. It is rarer than *Pauxi tuberosa*, which is larger and very sought after by hunters (Silveira 2008).

Psophia obscura

This endemic taxon of CE Belém is considered as “Endangered” in the national (Machado *et al.* 2008) and at the state level in Pará (SEMA 2007) and recently received a species status (Oppenheimer and Silveira 2009). Among all localities sampled, this taxon was found only in those with the best and most extensive fragments of dense ombrophilous forest: Agropalma Group Forestal Reserves, Cauaxi Farm, and Rio Capim Farm (Figure 1; Appendix). Generally, flocks varying between 3 and 19 individuals were observed on the ground of dense ombrophilous *terra-firme* forest. Hunting, destruction of habitat, and activities like keeping wild pets (still practiced in various localities) are the principal causes of its

decline in CE Belém. Remaining populations probably still occur in fragments still well-conserved in the north-east of Pará and west of Maranhão (Oppenheimer and Silveira 2009).

Guarouba guarouba

This parrot is considered as threatened since 1981 (Laranjeiras 2008). It is listed in IUCN (2010) in the category “Endangered”, aside from being considered threatened on the national level (Silveira 2008), and in the state of Pará where it is listed as “Vulnerable” (SEMA 2007). Among all of the sampled localities, this taxon was found only in those with the best and most extensive fragments of dense ombrophilous forest: Agropalma Group Forestal Reserves, Cauaxi Farm and Rio Capim Farm (Figure 1; Appendix). Generally, flocks varying between 3 and 7 individuals were observed perched or flying overhead the dossal of dense, ombrophilous *terra-firme* forest. Intense reproductive activity was verified in the Agropalma Group Forestal Reserves (Silveira and Belmonte 2005). Through technical work realized by CEBP in nearby localities (Goianésia do Pará and Breu Branco) this species also was registered with relative frequency.

Pyrrhura lepida lepida

This taxon is considered as “Endangered” in the national level (Silveira 2008), as well as at the state level in Pará (SEMA 2007). Among all localities sampled, this taxon was found only in those with the best and most extensive fragments of dense, ombrophilous forest (Agropalma Group Forestal Reserves, Cauaxi Farm, Rio Capim Farm and Tomé-Açu – SAFs; Figure 1; Appendix), where it occurred in the forest as well as in hutches and borders of woods. Generally, flocks of up to 15 individuals were observed in the forest dossal and bordering wooded areas. Despite an apparent tolerance for degraded forests, this taxon is found to be threatened by extensive deforestation, aside from clandestine commerce of wild birds which still imposes pressure on remaining populations (Silveira 2008).

Neomorphus geoffroyi

A couple of this species was observed by AW and KJZ on September 2, 2007 at Rio Capim Farm, following army ants. The following day, one sole individual was observed and recorded at the same location. These records confirm the strategic importance of existing forestal fragments in the municipalities of Tomé-Açu, Paragominas and Tailândia for the conservation of species which serve as bioindicators of environmental quality in CE Belém. This is the case of *N. geoffroyi*, a species that occurs in low population density, even in well-preserved areas (Payne 1997).

Nyctibius leucopterus

At dusk on August 9, 1998, AA heard the typical territorial call of an individual of this species at the border of a *terra-firme* forest along a road in Cauaxi Farm. Subsequently, KJZ and AW registered the species along a road in Rio Capim Farm on August 28 and on September 2, 2007. These represent the first records of *N. leucopterus* for CE Belém, constituting the easternmost obtained until now for this species in Amazonia (InfoNatura 2007). The register the record closest to these hereby reported are from Juruti, also in Pará State around 850 km to the west (Santos *et al.* submitted). The new records for CE Belém appear to confirm the prevision of Cohn-Haft (1999) that *N. leucopterus* is probably distributed locally throughout all of Amazonia.

Pteroglossus bitorquatus bitorquatus

This taxon endemic to CE Belém is considered as “Vulnerable” in the national (Silveira 2008) and “Endangered” at the state level in Pará (SEMA 2007). It was found at most of the localities sampled in primary and secondary forests, except Capitão-Poço, Paragominas – Side Road, Paragominas – Vitória Farm and Santa Bárbara do Pará (Figure 1; Appendix). This indicates a certain tolerance for degradation and forestal fragmentation, as per what was confirmed by CEBP in the region of Jacundá, also in CE Belém, where a species was registered in fragments less than 100 ha.

Piculus chrysochloros paraensis

This taxon is considered as “Endangered” on the list of threatened species of Pará (SEMA 2007). Among all the localities sampled, this taxon was found only at two of those with the best and most extensive fragments of dense ombrophilous forest: Agropalma Group forestal reserve and Cauaxi Farm (Figure 1; Appendix). In these localities, the taxon was rare, and on one occasion (at Cauaxi Farm) a solitary individual was observed foraging in the company of a mixed band. The low population density of this taxon, linked with its restricted distribution, and associated only to the best forestal fragments among those sampled, suggests that it should be listed as threatened on the national level as well.

Celeus torquatus pieteroyensis

This taxon, with restricted distribution to CE Belém and the forested portion of Marajó Island, is considered as “Endangered” on the list of threatened species of Pará State (SEMA 2007). During fieldwork, this taxon was registered solely at Cauaxi Farm in 2005 in *terra-firme* ombrophilous forest, where one single individual was

heard and recorded. The low populational density of this taxon, linked with its restricted distribution and associated with the best forestal fragments among those sampled, suggests that it should be listed as threatened on the national level as well.

Thamnophilus aethiops incertus

This taxon endemic to CE Belém is considered as “Endangered” on the list of threatened species of Pará State (SEMA 2007). This taxon was commonly found in primary and secondary forests of *terra-firme* at almost all localities sampled, except Paragominas – Side Road (Figure 1; Appendix), which indicates a reasonable degree of tolerance to the degradation and forestal fragmentation currently present in CE Belém.

Phlegopsis nigromaculata paraensis

This taxon endemic to CE Belém is considered as “Endangered” in the national (Machado *et al.* 2008) and at the state level in Pará (SEMA 2007). This taxon was found in primary and secondary forests of *terra-firme* at almost all of the localities sampled, except Paragominas – Side Road and Paragominas – Vitória Farm (Figure 1; Appendix), which indicates a reasonable degree of tolerance to the degradation and forestal fragmentation currently present in CE Belém.

Dendrocolaptes certhia medius

This taxon, with restricted distribution to CE Belém in Amazonia and CE Pernambuco in the northeastern Atlantic Forest, is considered as “Endangered” in the national (Machado *et al.* 2008) and at the state level in Pará (SEMA 2007). Solitary individuals or couples were regularly registered in primary and secondary *terra-firme* Forest at most of the localities sampled, except Dom Eliseu, Paragominas – Side Road and Santa Bárbara do Pará (Figure 1; Appendix), which indicates a reasonable degree of tolerance to degradation and forestal fragmentation. The record of one population of this taxon in a forest fragment of about 8,000 ha, situated in the municipality of Marituba (in the metropolitan region of Belém), corroborates this idea (Dantas, *pers. comm.*, 2010).

Dendrocincla merula badia

This taxon endemic to CE Belém is considered as “Endangered” in the national (Machado *et al.* 2008) and at the state level in Pará (SEMA 2007). Among the localities sampled, this taxon was found only at those with the best and most extensive dense, ombrophilous forest fragments in good state of conservation: Agropalma Group Forestal Reserves, Cauaxi Farm, Rio Capim Farm and

Tomé-Açu – SAFs (Figure 1; Appendix). The high degree of ecological specialization of this taxon, as well as its strict association to little-fragmented forests in good state of conservation, are attributes that make it one of the most threatened species of CE Belém (Machado *et al.* 2008).

Synallaxis rutilans omissa

This taxon endemic to CE Belém is considered “Endangered” on the list of threatened species of Pará State (SEMA 2007). It was found in primary and secondary *terra-firme* forests at almost all localities sampled, except Dom Eliseu, Paragominas – Side Road and Paragominas – Vitória Farm (Figure 1; Appendix), which indicates a reasonable degree of tolerance to degradation and forestal fragmentation.

Hemitriccus minimus

On the morning of May 10, 2005, AA heard and recorded the typical territorial call of at least two individuals of this species at the border of a *terra-firme* forest along one of the roads at Cauaxi Farm. These represent the first records of *H. minimus* in CE Belém, apparently to confirm the prevision of Fitzpatrick *et al.* (2004) that this species is probably distributed locally throughout all of Amazonia.

Phylloscartes virescens

This monotypical species, even with restricted distribution to the Guyana Shield, occurs in Brazil in the states of Amapá, Amazonas and Pará (Fitzpatrick *et al.* 2004, Aleixo *et al.* in press). On August 31, 2007, an individual was seen, heard and recorded by KJZ. The next day (September 1st), AW recorded a couple on a different trail, also seen on September 3rd when AW and KJZ together observed and recorded a couple of the species. On all occasions, the observed individuals were foraging in mixed canopy flocks. This is the first register of the species outside of the Guyana Shield (Fitzpatrick *et al.* 2004).

Tolmomyias assimilis paraensis

This taxon endemic to CE Belém is considered “Endangered” on the list of threatened species of Pará State (SEMA 2007), having been found in low densities in primary and secondary forests at Cauaxi Farm, Rio Capim Farm, Vitória Farm, Santa Bárbara do Pará, and Tomé-Açu SAFs (Figure 1; Appendix). This indicates a certain degree of tolerance for degradation and forestal fragmentation.

Conopias parvus

AA registered this species through a single audio contact along a road at Rio Capim Farm on May 23, 2007.

Subsequently, KJZ registered a species through a single individual vocalizing at the same locality. These records are the first for CE Belém and represent the easternmost known of the species (Fitzpatrick *et al.* 2004). Recent fieldwork has revealed the presence of this species in at least three localities of the Madeira – Tapajós interfluvium in the states of Amazonas (Poletto and Aleixo 2005, Dantas *et al.* submitted) and Pará (Santos *et al.* submitted).

Piprites chloris griseicens

This taxon endemic to CE Belém is considered “Endangered” on the list of threatened species of Pará State (SEMA 2007), found in low densities only in those localities of primary forest in good state of conservation: Cauaxi Farm, Rio Capim Farm, Agropalma Group Forestal Reserves, and Dom Eliseu (Figure 1; Appendix). This indicates a certain degree of vulnerability to degradation and forestal fragmentation. The low populational density of this taxon, aligned with its restricted distribution, and associated only with the best forestal fragments among those sampled, suggest that it should be listed as threatened on the national level as well.

Hylophilus hypoxanthus

Audio records of this species obtained by AA in 1998 and 2005 at Cauaxi Farm, and by AW and KJZ in 2007 at Rio Capim Farm (where one individual was recorded on September 2nd) apparently constitute the first records for CE Belém (Ridgely and Tudor 1989, InfoNatura, 2007). On all occasions, the species was registered in mixed canopy flocks.

Tangara velia signata

This taxon endemic to CE Belém is considered “Endangered” on the list of threatened species of Pará state (SEMA 2007). The taxon was found in low densities only at three localities of forestal fragments in the best state of conservation: Cauaxi Farm, Rio Capim Farm and Tomé Açu – SAFs (Figure 1; Appendix). This indicates a certain degree of vulnerability to degradation and forestal fragmentation. Low populational density of this taxon, aligned with its restricted distribution, and associated only with the best forestal fragments among those sampled, suggest that it should be listed as threatened at the national level as well.

Cyanerpes nitidus

Visual records with 1-5 individuals of this species were obtained daily from August 29 through September 2 at Rio Capim Farm by AW and KJZ, apparently constituting the first records for CE Belém (Ridgely and Tudor 1989, InfoNatura, 2007), considerably amplifying

its known distribution. On all occasions, the species was registered in mixed canopy flocks.

Political-Environmental Scenario of Eastern Pará

The greatest rates of deforestation in Amazonia occur in the region known as the “Arc of Deforestation”, situated in CE Belém. This is explained by a strong pressure from economic groups that occupy public and private lands for the development of agricultural production, logging and cattle-raising (Vieira *et al.* 2008). The state of Pará in particular, on the whole being the region to the east of the Tocantins River, registers the greatest areas of deforestation in absolute terms inside lawful Amazonia (Silva *et al.* 2005). As a result, many species of fauna may have gone locally extinct, as stated in this article. It is not surprising, therefore, that most Amazonian taxa of birds, currently considered threatened in the national and in the state of Pará, are endemic or have their distributions concentrated in CE Belém. So that the conservation of animals and plants of this region may be guaranteed, it is urgent and necessary to create Conservation Units (CUs), whether they be public or private (*e.g.*, RPPNs). Only 1.4% of CE Belém is completely protected by CUs, while 9.77% are occupied by sustainably used CUs, and 6.49% by indigenous lands (Silva *et al.* 2005). Many forested areas of this center of endemism encountered today are highly fragmented and altered (Figure 1). Those in the best state of conservation are remarkable, as is the case of areas with the greatest relevance for avifauna among those sampled in this study: Rio Capim and Cauaxi Farms (administered by business groups of Cikel forestal management) and of Agropalma Group Forestal Reserves (of the biofuel field). It is desirable that an effort be made together by these owners so that the effective conservation of these forestal remains in the area may be guaranteed, including protection from hunters. Strategies like waving or reducing taxes for proprietors that maintain the forest can be efficient in guaranteeing the conservation of the best fragments of forest in CE Belém. Furthermore, the fomentation of long-term fauna monitoring programs (especially of threatened taxa) constitutes another important strategy in the conservation of birds in CE Belém.

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APPENDIX: Checklist of birds recorded between 1998 and 2009 at nine areas in the municipalities of Santa Bárbara do Pará (Gunma), Tailândia (RFGA and Rio Capim Farm), Tomé-açu (SAFs and Cauaxi Farm), Paragominas (Side Road and Vitória Farm), Capitão-poço (São Marcos Farm), and Dom Eliseu, all situated in the Belém center of endemism, state of Pará, Brazil (see Figure 1). Nomenclature and taxonomy follow CBRO (2011).

TAXON	GUNMA	RFGA	SAFs	Vicinal	Cauaxi	Rio Capim	Vitória	São Marcos	Dom Eliseu
Tinamidae									
<i>Tinamus tao</i>		X			X	X			
<i>Tinamus major</i>		X							
<i>Tinamus guttatus</i> ^{* 1}					X				
<i>Crypturellus cinereus</i>	X	X	X			X			X
<i>Crypturellus soui</i>		X	X				X		X
<i>Crypturellus strigulosus</i> *	X	X	X		X	X	X		X
<i>Crypturellus variegatus</i> *	X	X	X		X	X			
<i>Crypturellus parvirostris</i>		X		X			X		
Anatidae									
<i>Dendrocygna viduata</i>		X							
<i>Cairina moschata</i>		X			X				
<i>Amazonetta brasiliensis</i>				X	X				
Cracidae									
<i>Ortalis superciliaris</i> *	X	X	X						X
<i>Penelope superciliaris</i> *		X	X						X
<i>Penelope pileata</i> ^{rr 2}		X	X		X				
<i>Aburria kujubi</i> *					X	X			
<i>Pauxi tuberosa</i>		X				X			
<i>Crax fasciolata pinima</i> ^{T 3, En 4}		X							
Odontophoridae									
<i>Odontophorus gujanensis</i> *		X			X	X			
Phalacrocoracidae									
<i>Phalacrocorax brasilianus</i>		X							
Anhingidae									
<i>Anhinga anhinga</i>		X							
Ardeidae									
<i>Tigrisoma lineatum</i> *			X	X					X
<i>Cochlearius cochlearius</i>		X							
<i>Butorides striata</i>			X						
<i>Bubulcus ibis</i>		X							
<i>Ardea alba</i>		X							
<i>Pilherodius pileatus</i>		X							
<i>Egretta thula</i>		X							
Threskiornithidae									
<i>Mesembrinibis cayennensis</i>		X							
Cathartidae									
<i>Cathartes aura</i> *	X	X	X		X	X		X	X
<i>Cathartes burrovianus</i> *	X	X			X				
<i>Cathartes melambrotus</i> *		X	X		X	X			
<i>Coragyps atratus</i>	X		X		X	X	X	X	X
<i>Sarcoramphus papa</i>					X	X			
Accipitridae									
<i>Leptodon cayanensis</i> *		X	X						
<i>Chondrobierax uncinatus</i>						X			
<i>Elanoides forficatus</i>		X	X			X	X		
<i>Gampsonyx swainsonii</i> *		X				X			
<i>Elanus leucurus</i>		X							
<i>Rostrhamus sociabilis</i>		X							
<i>Harpagus diodon</i>		X							
<i>Accipiter superciliosus</i>						X			
<i>Accipiter bicolor</i>		X							
<i>Ictinia mississippiensis</i>		X							
<i>Ictinia plumbea</i>		X	X		X				X

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TAXON	GUNMA	RFGA	SAFs	Vicinal	Cauaxi	Rio Capim	Vitória	São Marcos	Dom Eliseu
<i>Busarellus nigricollis</i>		X							
<i>Geranoospiza caerulescens</i>		X							
<i>Urubitinga urubitinga</i>			X		X				
<i>Rupornis magnirostris</i> *	X	X	X		X	X			
<i>Geranoaetus albicaudatus</i>		X			X	X			
<i>Pseudastur albicollis</i> *		X							
<i>Leucopternis kuhli</i> *		X			X				
<i>Buteo nitidus</i> *		X	X				X		X
<i>Buteo brachyurus</i>		X							
<i>Morphnus guianensis</i>		X			X	X			
<i>Harpia harpyja</i> *		X			X	X			
<i>Spizaetus tyrannus</i> *		X			X				
<i>Spizaetus ornatus</i>			X		X	X			
Falconidae									
<i>Daptrius ater</i>		X	X		X				
<i>Ibycter americanus</i> *		X		X	X	X			X
<i>Caracara plancus</i>		X			X		X		X
<i>Milvago chimango</i>		X							X
<i>Herpetotheres cachinnans</i>		X			X		X		X
<i>Micrastur ruficollis</i> *	X	X			X	X			
<i>Micrastur mintoni</i> * ^{††}	X	X			X	X			
<i>Micrastur mirandollei</i> *			X						
<i>Micrastur semitorquatus</i>		X							X
<i>Falco sparverius</i>		X							
<i>Falco rufigularis</i>		X	X		X	X			
<i>Falco femoralis</i>		X							
Eurypygidae									
<i>Eurypyga helias</i>		X				X			
Aramidae									
<i>Aramus guarauna</i>		X							
Psophiidae									
<i>Psophia viridis obscura</i> ^{T, En}		X	X		X	X			
Rallidae									
<i>Aramides cajanea</i>		X							
<i>Laterallus viridis</i>		X	X	X			X		X
<i>Laterallus melanophaius</i>		X							
<i>Porzana albicollis</i>		X							
<i>Gallinula galeata</i>		X							
Charadriidae									
<i>Vanellus cayanus</i>		X							
<i>Vanellus chilensis</i>	X	X		X					
Scolopacidae									
<i>Gallinago paraguaiae</i>		X							
<i>Actitis macularius</i> *		X							
<i>Tringa solitaria</i> *		X							
<i>Tringa melanoleuca</i>		X							
<i>Tringa flavipes</i>		X							
Jacanidae									
<i>Jacana jacana</i>		X		X	X			X	
Columbidae									
<i>Columbina passerina</i>	X	X	X	X		X	X		
<i>Columbina talpacoti</i>	X	X	X	X	X	X	X		X
<i>Columbina squammata</i>		X		X					
<i>Claravis pretiosa</i>						X			
<i>Patagioenas speciosa</i>		X			X				
<i>Patagioenas cayannensis</i>	X	X	X						X
<i>Patagioenas plumbea</i> *	X	X	X		X	X			
<i>Patagioenas subvinacea</i> *	X	X	X		X	X			X

TAXON	GUNMA	RFGA	SAFs	Vicinal	Cauaxi	Rio Capim	Vitória	São Marcos	Dom Eliseu
<i>Zenaida auriculata</i>							X		
<i>Leptotila verreauxi</i>		X					X		
<i>Leptotila rufaxilla</i>		X	X				X		X
<i>Geotrygon montana*</i>		X	X		X		X	X	
Psittacidae									
<i>Ara macao*</i>		X				X			
<i>Ara chloropterus*</i>	X	X	X		X	X			X
<i>Guaruba guarouba*^{rs, T}</i>		X			X	X			
<i>Aratinga leucophthalma</i>			X						
<i>Pyrrhura lepida lepida*^{T, En}</i>		X	X		X	X			
<i>Pyrrhura amazonum</i>			X		X				X
<i>Forpus passerinus</i>	X	X							
<i>Brotogeris versicolurus</i>	X	X							
<i>Brotogeris chrysoptera*</i>		X	X		X	X	X		X
<i>Touit purpuratus*</i>							X		
<i>Pionites leucogaster*</i>	X	X	X		X	X			
<i>Pyrrhura leucogaster*^{rs}</i>		X	X		X	X			
<i>Pionus menstruus*</i>	X	X	X	X	X	X	X		X
<i>Pionus fuscus*</i>	X	X	X		X	X			
<i>Amazona farinosa*</i>	X	X	X		X	X			
<i>Amazona amazonica*</i>	X	X	X		X		X		X
<i>Deroptryus accipitrinus*</i>		X	X		X	X			
Cuculidae									
<i>Coccyzina minuta</i>		X							
<i>Piaya cayana*</i>	X	X	X		X	X	X		X
<i>Crotophaga major</i>		X							
<i>Crotophaga ani*</i>	X	X	X	X	X	X			X
<i>Tapera naevia</i>	X	X	X		X		X		
<i>Dromococcyx phasianellus</i>									X
<i>Dromococcyx pavoninus</i>		X				X			
<i>Neomorphus geoffroyi*</i>						X			
Tytonidae									
<i>Tyto alba</i>		X							
Strigidae									
<i>Megascops choliba</i>	X	X	X		X				
<i>Megascops usta*</i>		X			X	X			
<i>Lophotrix cristata</i>		X			X	X			
<i>Pulsatrix perspicillata</i>		X							
<i>Strix virgata</i>		X			X				
<i>Strix hubula</i>					X				
<i>Glaucidium hardyi*</i>		X	X		X	X			
Nyctibiidae									
<i>Nyctibius grandis*</i>		X	X						
<i>Nyctibius aethereus</i>			X						
<i>Nyctibius griseus*</i>		X	X						
<i>Nyctibius leucopterus</i>					X	X			
Caprimulgidae									
<i>Nyctiphrynus ocellatus*</i>		X			X	X			
<i>Antrostomus rufus*</i>		X							
<i>Lurocalis semitorquatus</i>		X			X	X			
<i>Hydropsalis nigrescens*</i>	X	X							
<i>Hydropsalis albicollis*</i>	X	X			X	X	X		
<i>Hydropsalis parvula</i>		X							
Apodidae									
<i>Chaetura spinicaudus*</i>		X	X		X	X			
<i>Chaetura cinereiventris</i>					X		X		
<i>Chaetura meridionalis</i>							X		
<i>Chaetura brachyura</i>	X	X	X		X	X			

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TAXON	GUNMA	RFGA	SAFs	Vicinal	Cauaxi	Rio Capim	Vitória	São Marcos	Dom Eliseu
<i>Tachornis squamata</i>		X							
<i>Panyptila cayennensis</i>					X				
Trochilidae									
<i>Glaucis hirsutus*</i>	X	X	X		X				
<i>Phaethornis ruber*</i>	X	X	X		X	X	X		X
<i>Phaethornis superciliosus*</i>	X	X	X		X	X	X	X	X
<i>Campylopterus largipennis*</i>	X	X	X		X	X	X		X
<i>Eupetomena macroura</i>					X				
<i>Florisuga mellivora*</i>	X	X	X		X	X	X		
<i>Anthracoceros nigricollis*</i>		X							
<i>Topaza pella*</i>		X							
<i>Chrysolampis mosquitus</i>						X			
<i>Lophornis gouldii</i>						X			
<i>Discosura longicaudus</i>		X				X			
<i>Thalurania furcata*</i>	X	X	X		X	X	X		X
<i>Hylocharis sapphirina*</i>		X	X		X	X			
<i>Hylocharis cyanus*</i>	X	X			X	X			
<i>Polytmus theresiae</i>		X							
<i>Amazilia fimbriata</i>			X						
<i>Heliobryx auritus*</i>		X	X		X	X	X		
<i>Heliomaster longirostris</i>			X		X				
Trogonidae									
<i>Trogon melanurus*</i>	X	X			X		X		
<i>Trogon viridis*</i>	X	X	X		X	X			X
<i>Trogon ramonianus*</i>		X	X						
<i>Trogon curucui</i>			X						X
<i>Trogon rufus*</i>	X	X	X		X	X			
Alcedinidae									
<i>Megaceryle torquata</i>		X		X	X				
<i>Chloroceryle amazona</i>		X							
<i>Chloroceryle americana</i>		X							
<i>Chloroceryle inda</i>		X	X						
Momotidae									
<i>Momotus momota*</i>	X	X	X		X	X			X
Galbulidae									
<i>Brachygalba lugubris*</i>		X			X	X			
<i>Galbula cyanicollis*</i>		X	X		X	X		X	X
<i>Galbula ruficauda</i>				X	X				
<i>Galbula dea*</i>	X	X			X	X			
<i>Jacamerops aureus*</i>		X			X	X			
Bucconidae									
<i>Notharchus hyperrhynchus*</i>		X	X		X	X			
<i>Notharchus tectus*</i>		X	X		X				
<i>Bucco tamatia</i>		X			X				
<i>Bucco capensis*</i>	X				X				
<i>Nystalus striolatus*</i>	X	X	X		X	X			X
<i>Malacoptila rufa*</i>	X	X	X		X	X		X	
<i>Monasa nigrifrons</i>		X							
<i>Monasa morphoeus*</i>	X	X	X		X	X	X		X
<i>Chelidoptera tenebrosa*</i>	X	X	X		X				
Ramphastidae									
<i>Ramphastos toco</i>							X		
<i>Ramphastos tucanus*</i>	X	X	X		X	X	X	X	X
<i>Ramphastos vitellinus*</i>	X	X	X		X	X	X		X
<i>Selenidera gouldii*</i>					X	X			
<i>Pteroglossus inscriptus*</i>			X		X	X			
<i>Pteroglossus bitorquatus bitorquatus*^{T, En}</i>		X	X		X	X			X
<i>Pteroglossus aracari*</i>	X	X	X		X	X	X		

TAXON	GUNMA	RFGA	SAFs	Vicinal	Cauaxi	Rio Capim	Vitória	São Marcos	Dom Eliseu
Picidae									
<i>Picumnus exilis</i>						X			
<i>Melanerpes candidus</i>				X					
<i>Melanerpes cruentatus</i>	X	X	X		X	X			X
<i>Veniliornis affinis*</i>	X	X	X		X	X	X		X
<i>Piculus flavigula*</i>		X	X		X	X	X		
<i>Piculus chrysochloros paraensis*^T</i>		X			X				
<i>Colaptes melanochloros</i>							X		
<i>Celeus undatus*</i>		X	X		X	X			
<i>Celeus flavus</i>			X						
<i>Celeus torquatus pieteroyensis^T</i>					X				
<i>Dryocopus lineatus</i>	X	X	X	X			X		
<i>Campephilus rubricollis*</i>	X	X	X		X	X	X	X	X
<i>Campephilus melanoleucos</i>		X	X			X			X
Thamnophilidae									
<i>Myrmornis torquata*</i>					X	X	X		
<i>Myrmeciza atrothorax</i>	X				X				
<i>Myrmotherula multostriata</i>				X					
<i>Myrmotherula huxwelli*</i>	X	X	X		X	X	X	X	X
<i>Myrmotherula axillaris*</i>	X	X	X		X	X	X		X
<i>Myrmotherula longipennis*</i>	X	X	X		X	X	X	X	X
<i>Myrmotherula menetriesii*</i>	X	X	X		X	X	X		
<i>Formicivora grisea</i>	X	X	X	X		X	X		
<i>Thamnomanes caesioides*</i>	X	X	X		X	X	X	X	X
<i>Dysithamnus mentalis*</i>	X	X			X	X	X		
<i>Herpsilochmus rufimarginatus*</i>	X	X	X		X	X			X
<i>Thamnophilus doliatus</i>				X					X
<i>Thamnophilus palliatus</i>		X	X				X		
<i>Thamnophilus schistaceus</i>			X			X			
<i>Thamnophilus stictocephalus</i>			X				X		
<i>Thamnophilus aethiops incertus*^{T, En}</i>	X	X	X		X	X	X		X
<i>Thamnophilus amazonicus*</i>		X	X	X	X	X			X
<i>Taraba major*</i>	X	X		X			X		X
<i>Sclateria naevia</i>		X	X						
<i>Hypocnemoides maculicauda*</i>		X	X						
<i>Pyriglena leuconota*</i>	X	X	X		X	X	X		X
<i>Cercomacra cinerascens*</i>	X	X	X		X	X	X		X
<i>Cercomacra laeta*</i>	X	X	X		X	X	X		X
<i>Willisornis poecilinotus*</i>	X	X	X		X	X	X	X	X
<i>Phlegopsis nigromaculata paraensis*^{T, En}</i>	X	X	X		X	X		X	X
Conopophagidae									
<i>Conopophaga roberti*^T</i>	X	X	X		X	X	X		
Grallariidae									
<i>Grallaria varia*</i>					X	X			
<i>Hylopezus macularius*</i>					X	X			
Formicariidae									
<i>Formicarius colma*</i>		X	X		X	X			
<i>Formicarius analis*</i>		X	X		X	X			
Scleruridae									
<i>Sclerurus mexicanus*</i>	X	X	X		X	X		X	
<i>Sclerurus rufigularis*</i>					X				
<i>Sclerurus caudacutus*</i>					X				
Dendrocolaptidae									
<i>Dendrocincla fuliginosa*</i>	X	X	X		X	X	X	X	
<i>Dendrocincla merula badia*^{T, En}</i>		X	X		X	X			
<i>Deconychura longicauda zimmeri*^T</i>		X			X	X			
<i>Certhiasomus stictolaemus*</i>		X	X		X	X			
<i>Glyphorhynchus spirurus*</i>	X	X	X		X	X	X	X	

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TAXON	GUNMA	RFGA	SAFs	Vicinal	Cauaxi	Rio Capim	Vitória	São Marcos	Dom Eliseu
<i>Dendrocolaptes certhia medius</i> * ^T		X	X		X	X	X	X	
<i>Dendroplex picus</i>		X	X				X		X
<i>Xiphorhynchus spixii</i> * ^{rr}	X	X	X		X	X			
<i>Xiphorhynchus obsoletus</i> *		X	X						X
<i>Xiphorhynchus guttatus</i> *	X	X	X		X	X	X		X
<i>Lepidocolaptes albolineatus</i> *	X		X		X	X	X		X
Furnariidae									
<i>Xenops minutus</i> *	X	X	X		X	X	X	X	
<i>Xenops rutilans</i>		X							
<i>Furnarius rufus</i>			X		X				
<i>Automolus paraensis</i> * ^{rr}	X	X			X	X			
<i>Automolus rufipileatus</i>			X			X			
<i>Philydor ruficaudatum</i> *		X			X	X		X	
<i>Philydor erythrocerum</i> *		X	X		X	X		X	X
<i>Philydor erythropterum</i> *					X				
<i>Philydor pyrrhodes</i>						X			
<i>Certhiaxis cinnamomeus</i>		X							
<i>Synallaxis albescens</i>		X			X		X		
<i>Synallaxis rutilans omissa</i> * ^{En}	X	X	X		X	X		X	
<i>Synallaxis gujanensis</i> *	X	X	X						
<i>Cranioleuca gutturata</i>						X			
Pipridae									
<i>Tyrannetes stolzmanni</i> *	X	X	X		X	X	X		X
<i>Pipra rubrocapilla</i> *	X	X	X		X	X			
<i>Lepidothrix iris</i> * ^{rr}	X				X	X		X	
<i>Manacus manacus purissimus</i> * ^{En}	X	X	X		X	X			X
<i>Dixiphia pipra</i> *	X	X	X		X	X		X	
<i>Chiroxiphia pareola</i> *	X	X	X		X	X			
Tityridae									
<i>Oxyruncus cristatus</i>					X	X			
<i>Onychorhynchus coronatus</i> *	X	X			X	X	X	X	
<i>Terentotriccus erythrurus hellmayri</i> * ^{En}		X			X	X	X	X	
<i>Myiobius barbatus</i> *	X	X	X		X	X			X
<i>Schiffornis turdina</i> *	X	X	X		X	X		X	
<i>Laniocera hypopyrra</i> *		X			X				
<i>Iodopleura isabellae paraensis</i> * ^{En}					X	X			
<i>Tityra inquisitor</i>		X			X	X			X
<i>Tityra cayana</i> *		X				X	X		
<i>Tityra semifasciata</i>		X	X		X		X		
<i>Pachyramphus viridis</i>			X		X				
<i>Pachyramphus rufus</i> *	X	X	X	X	X		X		X
<i>Pachyramphus castaneus</i>					X				
<i>Pachyramphus polychopterus</i> *	X	X				X	X		
<i>Pachyramphus marginatus</i> *	X	X			X	X			
<i>Pachyramphus minor</i> *					X	X	X		
<i>Pachyramphus validus</i>						X			
Cotingidae									
<i>Lipaugus vociferans</i> *	X	X	X		X	X	X	X	
<i>Xipholena lamellipennis</i> * ^{rr}	X	X	X			X			
<i>Cotinga cotinga</i> *	X					X			
<i>Cotinga cayana</i>	X	X			X	X			
<i>Haematoderus militaris</i> *					X				
<i>Querula purpurata</i> *	X	X	X		X	X	X		X
<i>Phoenicircus carnifex</i> *						X			
Incertae sedis									
<i>Platyrrinchus saturatus</i> *	X	X	X		X	X			
<i>Platyrrinchus coronatus</i>						X			
<i>Platyrrinchus platyrhynchos</i> *	X	X	X		X	X			

TAXON	GUNMA	RFGA	SAFs	Vicinal	Cauaxi	Rio Capim	Vitória	São Marcos	Dom Eliseu
<i>Piprites chloris griseicens</i> * T, En		X	X		X	X			X
Rhynchocyclidae									
<i>Taeniotriccus andrei</i> *		X							
<i>Mionectes oleagineus</i> *		X	X						
<i>Mionectes macconnelli</i> *	X	X				X	X		
<i>Corythopsis torquata</i> *					X	X			
<i>Phylloscartes virescens</i>						X			
<i>Rhynchocyclus olivaceus</i> *	X	X							
<i>Tolmomyias sulphurescens mixtus</i> * En		X	X			X	X		
<i>Tolmomyias assimilis paraensis</i> * T, En	X		X		X	X	X		
<i>Tolmomyias poliocephalus</i>	X		X				X		
<i>Tolmomyias flaviventris</i>	X	X	X	X		X	X		X
<i>Todirostrum maculatum</i>	X	X							
<i>Todirostrum cinereum</i>				X			X		
<i>Todirostrum chrysocrotaphum</i>	X		X						
<i>Poecilatriccus sylvia</i>	X	X	X	X		X	X		
<i>Myiornis ecaudatus</i>	X	X	X		X	X	X		
<i>Hemitriccus minimus</i>					X				
<i>Lophotriccus galeatus</i> *	X	X	X			X	X		X
Tyrannidae									
<i>Zimmerius gracilipes</i> *	X		X		X	X	X		
<i>Ornithion inermis</i> *	X	X	X		X	X	X		
<i>Camptostoma obsoletum</i>		X	X	X		X			X
<i>Elaenia flavogaster</i> *	X	X	X			X	X		
<i>Elaenia spectabilis</i>						X			
<i>Elaenia chiriquensis</i>							X		
<i>Myiopagis gaimardii</i> *	X	X	X		X	X	X		X
<i>Myiopagis caniceps</i>			X		X	X	X		
<i>Tyrannulus elatus</i>	X	X	X	X	X	X			
<i>Phaeomyias murina</i> *	X	X	X	X	X		X		
<i>Attila spadiceus</i> *	X	X	X		X	X	X		
<i>Legatus leucophaeus</i> *		X	X		X	X			
<i>Ramphotrigon ruficauda</i> *		X	X		X				
<i>Myiarchus tuberculifer</i> *	X		X		X	X	X		X
<i>Myiarchus ferox</i>	X	X	X			X	X		
<i>Sirystes sibilator</i>			X		X	X			
<i>Rhytipterna simplex</i> *	X	X	X		X	X	X		
<i>Casiornis fuscus</i>			X						
<i>Pitangus sulphuratus</i> *	X	X	X	X	X	X	X		
<i>Philohydor lictor</i>		X							
<i>Machetornis rixosa</i>					X				
<i>Myiodynastes maculatus</i> *		X			X	X			
<i>Megarynchus pitangua</i>	X	X	X		X				X
<i>Myiozetetes cayanensis</i> *	X	X	X		X	X	X		X
<i>Myiozetetes similis</i>				X					X
<i>Tyrannus melancholicus</i> *	X	X	X		X	X			
<i>Griseotyrannus aurantioatrocristatus</i>							X		
<i>Empidonomus varius</i> *	X	X	X		X	X	X		X
<i>Conopias parvus</i>						X			
<i>Colonia colonus</i>						X			X
<i>Myiophobus fasciatus</i>				X	X		X		
<i>Sublegatus obscurior</i> *	X					X			
<i>Arundinicola leucocephala</i>			X						
<i>Lathrotriccus euleri</i>			X		X				
Vireonidae									
<i>Cyclarhis gujanensis</i> *		X			X	X	X		X
<i>Vireo olivaceus</i> *						X			X
<i>Hylophilus semicinereus</i> *		X	X			X			X

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TAXON	GUNMA	RFGA	SAFs	Vicinal	Cauaxi	Rio Capim	Vitória	São Marcos	Dom Eliseu
<i>Hylophilus pectoralis</i>		X					X		
<i>Hylophilus hypoxanthus</i>					X	X			
<i>Hylophilus ochraceiceps rubrifrons</i> * ^{En}			X		X	X			
Hirundinidae									
<i>Atticora tibialis</i>						X			
<i>Stelgidopteryx ruficollis</i> *	X	X	X		X	X	X		
<i>Progne tapera</i>		X							
<i>Progne subis</i> *		X							
<i>Progne chalybea</i>	X	X	X		X	X			X
<i>Tachycineta albiventer</i>		X							
Troglodytidae									
<i>Microcerculus marginatus</i> *	X	X	X		X	X			
<i>Troglodytes musculus</i> *	X	X	X		X	X	X		
<i>Campylorhynchus turdinus</i>									X
<i>Pheugopedius genibarbis</i> *	X	X	X		X	X	X		X
<i>Cantorchilus leucotis</i>		X							
Donacobiidae									
<i>Donacobius atricapilla</i>		X							
Poliopitidae									
<i>Ramphocaenus melanurus austerus</i> * ^{En}	X	X	X		X	X	X		
<i>Poliopitila plumbea</i>		X	X						
<i>Poliopitila guianensis</i> *						X			
Turdidae									
<i>Turdus leucomelas</i>	X	X			X		X		
<i>Turdus fumigatus</i>		X	X						
<i>Turdus albicollis</i> *	X	X	X		X	X			
Coerebidae									
<i>Coereba flaveola</i> *	X	X	X		X	X	X		
Thraupidae									
<i>Saltator grossus</i> *		X	X		X	X	X		X
<i>Saltator maximus</i> *	X	X	X	X	X	X	X		X
<i>Saltator coerulescens</i>		X							
<i>Lamprospiza melanoleuca</i> *		X	X		X	X			X
<i>Tachyphonus rufus</i>	X	X	X		X		X		X
<i>Ramphocelus carbo</i> *	X	X	X		X	X			X
<i>Lanio cristatus pallidigula</i> * ^{En}		X	X		X	X			X
<i>Lanio cucullatus</i>							X		
<i>Lanio versicolor</i>		X							
<i>Lanio surinamus</i> *	X	X	X			X			X
<i>Tangara gyrola</i> *	X	X							
<i>Tangara mexicana</i>		X	X						X
<i>Tangara chilensis</i>			X						X
<i>Tangara velia signata</i> * ^{En}			X		X	X			
<i>Tangara punctata</i> *	X	X							
<i>Tangara episcopus</i> *	X	X	X		X	X			
<i>Tangara palmarum</i> *	X	X	X		X	X	X		X
<i>Cissopis leverianus</i>		X							X
<i>Shistochlamys melanopsis</i>		X							
<i>Tersina viridis</i>			X						
<i>Dacnis lineata</i> *		X	X			X			
<i>Dacnis cayana</i> *		X	X			X			X
<i>Cyanerpes nitidus</i>						X			
<i>Cyanerpes caeruleus</i> *	X	X	X		X	X			
<i>Cyanerpes cyaneus</i> *					X				
<i>Chlorophanes spiza</i> *		X	X		X	X			
<i>Hemithraupis guira</i>		X	X		X	X	X		X
Emberizidae									
<i>Zonotrichia capensis</i>	X	X					X		

TAXON	GUNMA	RFGA	SAFs	Vicinal	Cauaxi	Rio Capim	Vitória	São Marcos	Dom Eliseu
<i>Ammodramus aurifrons</i> *	X	X	X			X			
<i>Sicalis columbiana</i>		X							
<i>Emberizoides herbicola</i>		X		X					
<i>Volatinia jacarina</i>	X	X	X	X		X	X		
<i>Sporophila plumbea</i> *		X							
<i>Sporophila americana</i>		X	X		X		X		
<i>Sporophila collaris</i>			X						
<i>Sporophila lineola</i>				X					
<i>Sporophila nigricollis</i> *		X			X				
<i>Sporophila caerulea</i>			X	X			X		
<i>Sporophila minuta</i> *		X					X		
<i>Sporophila castaneiventris</i> *		X			X				
<i>Sporophila angolensis</i> *		X	X	X			X		X
<i>Arremon taciturnus</i> *	X	X	X		X	X	X		
Cardinalidae									
<i>Granatellus pelzelni paraensis</i> * ^{En}	X		X		X	X	X		
<i>Caryothraustes canadensis</i> *		X	X		X	X			
<i>Periporphyrus erythromelas</i> * ^{rr}		X	X		X		X		
<i>Cyanoloxia cyanooides</i> *	X	X	X			X			
Parulidae									
<i>Geothlypis aequinoctialis</i>							X		
<i>Phaeothlypis rivularis</i> *		X	X			X	X		
Icteridae									
<i>Psarocolius viridis</i> *		X				X			
<i>Psarocolius decumanus</i>		X	X						X
<i>Psarocolius bifasciatus bifasciatus</i> * ^{En}	X	X	X		X				
<i>Procacicus solitarius</i>					X				
<i>Cacicus haemorrhous</i>		X			X		X		
<i>Cacicus cela</i> *	X	X	X		X	X	X		X
<i>Icterus cayanensis</i>		X	X		X				X
<i>Chrysomus ruficapillus</i>		X							
<i>Molothrus oryzivorus</i>		X	X			X			
<i>Molothrus bonariensis</i> *	X	X		X	X				X
<i>Sturnella militaris</i>		X	X	X					
Fringillidae									
<i>Euphonia chlorotica</i>		X							
<i>Euphonia violacea</i> *			X						X
<i>Euphonia chrysopasta</i>					X	X			
<i>Euphonia minuta</i>		X							
<i>Euphonia cayennensis</i> *	X	X	X		X	X			
Passeridae									
<i>Passer domesticus</i>		X					X		

Key to the Appendix

¹ Taxon/species names followed by an asterisk (*) denote those for which specimens were collected in or nearby the sampled areas in the Belém area of endemism. Specimens are deposited at Museu Paraense Emílio Goeldi, Belém, Pará (MPEG) and Museu de Zoologia da Universidade de São Paulo, São Paulo (MZUSP).

² Taxon/species names followed by the acronym (rr) indicate those with restricted or comparatively small ranges following Stotz *et al.* (1996).

³ Taxon/species names followed by the acronym (T) indicate those regarded as Vulnerable, Endangered, and Critically Endangered according to Machado *et al.* (2008), SEMA (2007), and IUCN (2010).

⁴ Taxon/species names followed by the acronym (En) indicate those endemic to the Belém area of endemism according to Cracraft (1985), Roma (1996), and Stotz *et al.* (1996).