

Birds of the urban area of Palmas, TO: composition and conservation

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RESUMO: Aves da área urbana de Palmas, TO: composição e conservação. A capital do estado do Tocantins, Palmas, iniciou sua construção em 1990, promovendo alterações significativas na paisagem local. A vegetação do cerrado foi rapidamente substituída por largas avenidas e quadras residenciais. Em vinte anos, a cidade acumula três planos diretores, sendo que o último, publicado em dezembro de 2007, estabeleceu a criação de sete Unidades de Conservação dentro do perímetro urbano, entretanto, nenhuma ainda foi implementada. Inventários avifaunísticos realizados entre 2003 e 2008 revelaram a presença de 324 espécies, sendo 27 com centro de distribuição Amazônico e apenas um Atlântico, oito endêmicas Amazônicas e sete do Cerrado, cinco espécies quase-ameaçadas e uma ameaçada, localmente extinta. A implementação das Unidades de Conservação urbanas, bem como a criação de novas áreas de conservação, paralelamente à realização de atividades socio-econômicas como a exploração do turismo de observação de aves, são alternativas sugeridas para manutenção da rica e diversa avifauna na cidade de Palmas, TO.

PALAVRAS-CHAVE: Aves, Palmas, urbanização, conservação, Tocantins.

ABSTRACT: Tocantins State's capital, Palmas, begun its construction in 1990, promoting accelerated alterations to the local landscape, being that the cerrado vegetation was replaced by wide avenues and large residential blocks. In twenty years the city accumulated three Urban Plans. The last one, published on december 2007, created seven conservation units in Palmas' urban area; however, none has been implemented. Bird inventories performed between 2003 and 2008, found 324 species, varying the presence of 27 species with centers of distribution in the Amazonian Biome and only one characterized as an Atlantic element. Eight are considered endemic in the Amazon, and seven of the Cerrado. Five species are considered near threatened and one endangered, however it is locally extinct. Conservation Units implementation, and new conservation areas creation, together with socioeconomic initiatives like birdwatching, are suggested alternatives to maintain Palmas' rich and diverse avifauna.

KEY-WORDS: Birds, Palmas, urbanization, conservation, Tocantins.

The region where, on May 20th, 1989, the cornerstone of the Tocantins State's future capital was cast, had an exuberant cerrado vegetation, which spread from the Tocantis River banks to the foot of the Lajeado Mountain Range, from west to east, and between the Água Fria stream, to the north, and the Taquaruçu Grande stream, to the south, occupying an area of 11,085 hectares. The city's construction process begun in 1990 and promoted accelerated alterations to the local landscape, being that the cerrado vegetation was replaced by wide avenues and large residential blocks, which characterize Brazil's last planned capital in the 20th century (Adorno and Figuera 2005).

News of a new national "Eldorado" spread throughout Brazil, causing sudden migration by thousands of people, from various localities, seeking opportunities and stability (Nascimento 2007). Predicting this intense populational inflow, the first Palmas Urban Plan was elaborated in 1989, based on the 1988 Constitution, which established the connection between environmental preservation principles and quality of life. Residential, industrial, commerce and service areas were defined along with areas for the conservation of natural environments. However, the adopted conduct for removing the native vegetal cover greatly diverged from planned definitions, causing soil erosion and threatening stream sources (Adorno and Figuera 2005).

Although a law approving the Municipal Environmental Policy, Law nº 1.011 was passed on June 4th, 2001, no actual positive changes have been noticed regarding the capital's environmental protection. According to Figuera (2005), 98% of the cerrado vegetation has been destroyed over 12 years due to deforestation, fires and illegal raw material removal for paving purposes. On its seventeenth anniversary, Palmas received its third Urban Plan through the Complementary Law nº 155, published on December 28th, 2007. This last version created, through its Article 29, twelve Conservation Units, seven of which within Palmas' urban area; however, none has been implemented.

During the 90's, despite the negative environmental impact caused by the city's construction efforts, a few portions of cerrado vegetation still remained within the urban perimeter limits. However, due to the construction of the Luis Eduadro Magalhães Hydroelectric Power Plant), the Tocantins River banks were flooded on an average 6 kilometer width throughout over 60 km in length, not only submerging the riparian forest along the Tocantins River, but also all adjacent environments, which represented an 18% reduction of Palmas' municipal area (Nascimento 2007). A little known biodiversity succumbed, which was later revealed by flora and fauna inventories performed within the hydroelectric power plant's impact area, which includes the city of Palmas (Brito *et al.* 2001; Maciel 2001; Brandão and Péres Júnior 2001; Bagno and Abreu 2001; Pérez-Maluf 2004; Pavan and Dixo 2004; Puerto and Barbini 2004; Pinheiro 2004a; Passamani 2001, 2004).

Historically, the few naturalist expeditions which passed through Tocantins throughout the 19th century and early 20th century did not perform ornithological assessments within Palmas' city limits (Pohl 1975). Only in 2001, Bagno and Abreu published a list of birds within the Hydroelectric Power Plant's impact area, identifying 347 species, and Pinheiro (2004a) added 31 species for the same region. However, while non-systematic surveys have extended from the Lajeado municipality to Brejinho de Nazaré, comprising an area of approximately 630 km² and a 172 km extension, sample points have been scarcely distributed, being that none are located within Palmas' urban limits.

Additional systematic studies within the city's urban limits were only performed as of 2003. Pinheiro (2004b) created the first avifauna list, recording 195 species within Palmas' urban area and 284 within the municipality. Many specific efforts were later performed within the urban limits, which resulted in the publication of many bird lists comprising the Cesamar Municipal Park, with 154 bird species Reis and Pinheiro (2004), the Brejo Comprido stream, with 81 species Pinheiro *et al.* (2005), the Universidade Federal do Tocantins Campus, with 124 species Reis and Pinheiro (2006a) and the Green Area

(AV) of the Prata brook, with 206 species (Dornas and Barbosa 2007, Barbosa and Dornas 2008).

Many other efforts aimed to study the effects of the urbanization process on Palmas' avifauna. Reis and Pinheiro (2006b) found more elevated predation rates concerning artificial nests within the urban area when compared to protected natural areas around the city. Rodello and Pinheiro (2006) observed a greater presence of hemoparasites on urban birds when compared to birds within the State Protected Conservation Units. On the other hand, Roriz and Pinheiro (2006), while comparing the underwood bird community within the urban area's riparian forests, did not find significant differences regarding the abundance and diversity of species, demonstrating that the effects of the urbanization process have not yet negatively affected these communities.

The obtained ornithological knowledge concerning Palmas' urban area has revealed an abundant and diverse avifauna which has been losing its characteristics due to the loss and transformation of natural habitats, a fact that can be observed in other urbanized areas. Therefore, our objective is to gather and combine the accumulated knowledge regarding the composition and conservation of Palmas' avifauna, as well as to suggest environmental, socioeconomic and educational actions.

MATERIALS AND METHODS

The area of study corresponds to Palmas' urban area limits, according to the Municipal Law nº 386, from February 17th, 1993, comprising an area of 9,180 km², limited to the north by the Água Fria brook and to the south by the Taquaruçu Grande stream. Besides the urban environments (squares, avenues, residential areas, etc.), all birds recorded in well preserved natural areas, concerning urban standards, and in suburban areas (county houses), which extend to the limits of the APA Serra do Lajeado (Environmental Protection Area of the Lajeado Mountain Range) were considered. The urban green areas were, respectively, Sussuapara brook (10°10'29"S, 48°19'24"W), Brejo Comprido brook (10°12'18"S, 48°19'36"W), Prata brook (10°13'32"S, 48°21'14"W) and cerrado vegetation remainders.

The list of birds presented in this study results from various author records between the years of 2003 and 2008, gathered through the visual method, using binoculars (8x42, 7x35, 10x50), and the auditive method (playback was eventually used). The documentation of species was performed using a digital recorder (Marantz PMD 670), a unidirectional microphone (Sennheizer ME66) and digital photography. Mist net (12 m x 3 m x 36 mm) captures were performed along the Brejo Comprido stream, totaling 1440 hours/net. In addition, species which were not recorded by the authors but had been

photographically documented by the biologists Ciro Albano and Arthur Macarrão, in July, 2008, and species pertaining to the ornithological collection of the CO-CEULP/ULBRA, Palmas Lutheran University Center were also considered.

In order to characterize the recorded species, the degree of threat, endemisms and singular ecological and biogeographical aspects were considered. The nomenclature follows the Brazilian Committee of Ornithological Records (2008).

RESULTS AND DISCUSSION

A total of 324 bird species, within 63 families, were recorded in Palmas' urban and suburban areas. The greatest recorded abundance concerned the Tyrannidae family, with 49 species, followed by Thraupidae, with 18, and Emberizidae, with 16 species. The families Psittacidae, Trochilidae and Picidae must be highlighted, for they presented 12, 12 and 11 species, respectively.

One of the outstanding characteristics of the cerrado's avifauna, according to Silva (1996), is the strong influence of Amazonian and Atlantic avifauna elements. Within Palmas' urban area, 27 species with centers of distribution in the Amazonian Biome were verified; however, only one species in the region (*Corythopsis delalandi*) was characterized as an Atlantic element.

In the recent past, there was an extended riparian forest along the Tocantins River banks, within Palmas' municipal limits, which, along with riparian forests within the capital's green areas, explains the occurrence of Amazonian avifauna in the region, confirming a statement by Silva (1996) declaring that these vegetation types favor the penetration of bird species from neighbor biomes into the Cerrado. In addition, Silva (1996) states that this influence in the Cerrado may vary according to the adjacent biome's proximity, which can be clearly noticed in Palmas. The Tocantins State capital is separated from the Amazonian biome transition limits by a few hundred kilometers, while its borders with the Atlantic Forest are over one thousand kilometers away.

Among the 27 identified species having Amazonian distribution centers, eight are considered endemic in the Amazon: *Avocettthula recuvirostris*, *Bucco tamatia*, *Campephilus rubricollis*, *Thamnophilus amazonicus*, *Hypocnemoides maculicauda*, *Xiphorhynchus guttatus*, *Machaeropterus pyrocephalus* and *Hylophilus pectoralis* (Stotz 1996), (Table 1). The most outstanding species is *Avocettthula recuvirostris*, whose records in Palmas meant a great extension of its geographical distribution (Pinheiro *et al.* 2008). Among the species with Amazonian distribution centers, *Notharchus macrorhynchus* is highlighted, which was observed in the Prata AV; in case its presence is confirmed, its occurrence area will be significantly increased.

Regarding Cerrado endemisms, seven species were recorded within Palmas' urban area: *Alipiopsitta xanthops*, *Melanopareia torquata*, *Antilophia galeata*, *Cyanocorax cristatellus*, *Porphyrospiza caerulescens*, *Charitospiza eucosma* and *Saltator atricollis*. Among these, *A. xanthops*, *C. eucosma* and *P. caerulescens* are considered almost-endangered (IUCN 2008), as well as *Rhea americana* and *Neothraupis fasciata*. However, the collection of *Penelope ochrogaster* (Ornith. Coll. CEULP/ULBRA N° 167) within Palmas' municipal limits suggests a past occurrence of this species, which is classified as vulnerable by the IUCN (2008), when the Tocantins River's riparian forests still existed. Its current occurrence in Palmas' urban area would be unlikely, mainly due to a set of factors which result from the human urbanization process, such as the suppression and deformation of forests, urbanization and the increase of illegal hunting.

Among birds which are considered migratory (CBRO 2008), the occurrence of four visiting nearctic species was verified: *Pandion haliaetus*, *Tringa flavipes*, *Callidris fuscicollis* and *Progne subis*. However, *Turdus amaurochalinus* and *Turdus subalaris* were also recorded in Palmas. Although they are not considered as austral migratory birds (CBRO 2008), these species' winter migratory movements from Southern and Southeastern Brazil to Central Brazil makes them austral migrants to the Cerrado Silva (1995a, b), Silva and Santos (2005), being that the record of *Turdus subalaris* (Ornith. Coll. CEULP/ULBRA N° 167) would mean the inclusion of a new migratory bird as well as a new species for the Cerrado biome.

From an ecological point of view, the avifauna found in the urban area plays an important role in maintaining the local ecological balance. Among these different groups, special attention must be given to the potential seed dispersers of Families Cracidae (1 species), Ramphastidae (5 sp.), Turdidae (4 sp.) and Thraupidae (18 sp.), to pollinators, represented by 12 species of Family Trochilidae and insectivores of Families Tyrannidae (49 sp.) Caprimulgidae (7 sp.), Apodidae (3 sp.), Thamnophilidae (10 sp.), and Hirundinidae (7 sp.) which play an important role in arthropod control.

The record of 324 bird species within Palmas' urban and suburban areas provides a great representation of the regional avifauna, when compared to the 378 bird species described within the impacted area of the Luis Eduardo Magalhães Hydroelectric Power Plant. The number of species may even be greater, due to the fact that a few localities within the urban area such as the Vila União AV and the 1312 Sul AV, as well as the Aurenys, Taquaralto and Taquari neighborhoods haven't been sampled.

Within Palmas' urban center, two localities must be highlighted for their abundance of species, being the Brejo Comprido brook Green Area (AV) Pinheiro *et al.* (2005) and the Prata Green Area (AV) (Dornas and Bar-

TABLE 1: Bird species registered on Palmas urban and suburban area, Tocantins State. Taxonomy according the Brazilian Committee of Ornithological Register (CBRO 2008). ^A Brazilian Fauna Threatened Species List (MMA 2003), ^B IUCN Globally Threatened Species Red List (IUCN 2008). * Bird species found on Cerrado with Amazon distribution center (Silva 1996). # Bird species found on Cerrado with Atlantic distribution center (Silva 1996). FAM – photographic register made by Arthur Macarrão <http://arthurmacarrao.multiply.com>. FCA – photographic register made by Ciro Albano <http://ciroalbano.multiply.com>. Relative abundance: Common (C): species registered between 100% and 75% of field visits; Relatively common (RC): species registered between 74% and 50% of field visits; Uncommon (I): species registered between 49% and 25% of field visits; Rare (R): species registered between 24% and 6% of field visits; Extremely Rare (ER): species registered with less than 5% of field visits. Habitat: F1 – Forest dependent; F2 – Forest that use open areas; C1 – Open areas dependent; C2 – Open area that use forests; A – Aquatic (rivers, lakes, shores). Endemism: ENC – Cerrado endemism (Silva 1997, Silva e Santos 2005); ENA – Amazonian endemism (Stotz *et al.* 1996). Threat level: NT – Near threat; VU – Vulnerable. Migratory Status: VN – Nearctic migrant.

Espécies	Área Urbana	Área Suburbana	Habitat	Status	Espécies	Área Urbana	Área Suburbana	Habitat	Status
Rheidae					<i>Sarcoramphus papa</i>	R	E	F2	
<i>Rhea americana</i>		E	C1	NT ^B	Pandionidae				
Tinamidae					<i>Pandion haliaetus</i>	E	E	A	VN
<i>Tinamus tao</i> *		E	F1		Accipitridae				
<i>Crypturellus cinereus</i> *	E	E	F1		<i>Elanoides forficatus</i>	C	C	F2	
<i>Crypturellus soui</i>	C	C	F1		<i>Gampsonyx swainsonii</i>	A	A	F2	
<i>Crypturellus undulatus</i>	E	C	F1		<i>Elanus leucurus</i>	E	E	C1	
<i>Crypturellus parvirostris</i>	MA	MA	C2		<i>Rostrhamus sociabilis</i>	E		A	
<i>Rhynchotus rufescens</i>	E	A	C1		<i>Ictinea plumbea</i>	C	C	F2	
Anhimidae					<i>Circus buffoni</i>	R		C1	
<i>Anhima cornuta</i>	E	E	A		<i>Ictinea plumbea</i>	C	C	F2	
Anatidae					<i>Heterospizias meridionalis</i>	C	A	C2	
<i>Dendrocygna bicolor</i>	E	E	A		<i>Busarellus nigricollis</i>	E		A	
<i>Dendrocygna viduata</i>	E	E	A		<i>Rupornis magnirostris</i>	A	MA	C2	
<i>Cairina moschata</i>	E	E	A		<i>Buteo nitidus</i>	E		F2	
<i>Amazonetta brasiliensis</i>	E	E	A		Falconidae				
Cracidae					<i>Ibycter americanus</i>		E	F2	
<i>Penelope superciliaris</i>	E	E	F1		<i>Caracara plancus</i>	A	MA	C2	
Podicipedidae					<i>Mivalgo chimachima</i>	A	MA	C2	
<i>Tachybaptus dominicus</i>		R	A		<i>Herpetotheres cachinnans</i>	R	A	F2	
Phalacrocoracidae					<i>Micrastur semitorquatus</i>	R		F2	
<i>Phalacrocorax brasilianus</i>	E	C	A		<i>Falco sparverius</i>	A	MA	C1	
Anhingidae					<i>Falco rufigularis</i>		E	F2	
<i>Anhinga anhinga</i>	E	C	A		<i>Falco femoralis</i>	E		C1	
Ardeidae					Aramidae				
<i>Tigrisoma lineatum</i>	E	C	A		<i>Aramus guarauna</i>	E		A	
<i>Agamia agami</i>	R		A		Rallidae				
<i>Butorides striata</i>	E	C	A		<i>Aramides ypecaha</i>	C		F2	
<i>Bubulcus ibis</i>		C	C2		<i>Aramides cajanea</i>	C	A	A	
<i>Ardea cocoi</i>	E	C	A		<i>Laterallus viridis</i>	E		C2	
<i>Ardea alba</i>	E	C	A		<i>Porzana albicollis</i>	C		C2	
<i>Pilherodius pileatus</i>	R		A		<i>Porphyrio flavirostris</i>	E		A	
<i>Egretta thula</i>	E	C	A		<i>Porphyrio martinica</i>	E	E	A	
Threskiornithidae					Heliornithidae				
<i>Mesembrinibis cayennensis</i>	E		F2		<i>Heliornis fulica</i>	E		A	
<i>Theristicus caudatus</i>	E	E	C2		Cariamidae				
Ciconiidae					<i>Cariama cristata</i>		A	C1	
<i>Mycteria americana</i>	R		A		Charadriidae				
Cathartidae					<i>Vanellus cayanus</i>	A	A	A	
<i>Cathartes aura</i>	E	C	C2		<i>Vanellus chilensis</i>	MA	MA	A	
<i>Cathartes burrovianus</i>		E	C2		<i>Charadrius collaris</i>	R	R	A	
<i>Coragyps atratus</i>	MA	MA	C2		Scolopacidae				

Espécies	Área Urbana	Área Suburbana	Habitat	Status	Espécies	Área Urbana	Área Suburbana	Habitat	Status
<i>Gallinago paraguayiae</i>		E	A		<i>Athene cunicularia</i>	A	MA	C2	
<i>Tringa flavipes</i>	E	E	A	VN	Nyctibiidae				
<i>Calidris fuscicollis</i>	E		A	VN	<i>Nyctibius grandis</i>	E		F1	
<i>Actitis macularius</i>	E		A		<i>Nyctibius griseus</i>	R	E	F2	
Jacanídae					Caprimulgidae				
<i>Jacana jacana</i>	C	A	A		<i>Chordeiles pusillus</i>	E	C	C2	
Sternidae					<i>Chordeiles acutipennis</i>	E		C1	
<i>Sternula superciliaris</i>	E		A		<i>Podager nacunda</i>	E	E	C1	
<i>Phaetusa simplex</i>	C	A	A		<i>Nyctidromus albicollis</i>	A	A	F2	
Rynchopidae					<i>Caprimulgus maculicaudus*</i>	R		C2	
<i>Rynchops niger</i>	E	E	A		<i>Caprimulgus parvulus</i>	E	E	C2	
Columbidae					<i>Hydropsalis torquata</i>	R	E	C2	
<i>Columbina talpacoti</i>	MA	MA	C2		Apodidae				
<i>Columbina squammata</i>	MA	MA	C2		<i>Streptoprocne zonaris</i>		C	C1	
<i>Claravis pretiosa</i>	R	E	F2		<i>Chaetura meridionalis</i>	C	A	C2	
<i>Uropelia campestris</i>		E	C1		<i>Tachornis squamata</i>	E	C	C2	
<i>Columba livia</i>	MA	MA	C1		<i>Panyptila cayennensis</i>	R		C2	
<i>Patagioenas speciosa</i>	E		F2		Trochilidae				
<i>Patagioenas picazuro</i>	A	MA	C2		<i>Glaucis hirsutus</i>	R	C	F1	
<i>Patagioenas cayannensis</i>	E	A	F2		<i>Phaethornis ruber</i>	A	A	F1	
<i>Leptotila verreauxi</i>		E	F2		<i>Phaethornis pretrei</i>	A	A	F2	
<i>Leptotila rufaxilla</i>	E	C	F2		<i>Eupetomena macroura</i>	A	A	F2	
<i>Geotrygon montana</i>		C	F1		<i>Anthracothonax nigricollis</i>	C	C	C2	
Psittacidae					<i>Avocettula recurvirostris*</i>	R	R	F2	
<i>Ara ararauna</i>	C	A	C2		<i>Chrysolampis mosquitus</i>	A		C2	
<i>Orthopsittaca manilata</i>	C	A	F2		<i>Thalunania furcata</i>	C	C	F2	
<i>Diopsittaca nobilis</i>	E	C	C2		<i>Amazilia versicolor</i>	C	C	F2	
<i>Aratinga leucophthalma</i>	E	C	C2		<i>Amazilia fimbriata</i>	C	C	C2	
<i>Aratinga jandaya</i>		C	F2		<i>Heliactin bilophus</i>	C	C	C1	
<i>Aratinga aurea</i>	MA	MA	C2		<i>Heliomaster longirostris*</i>		E	F2	
<i>Forpus xanthopterygius</i>	E		F2		Trogonidae				
<i>Brotogeris chiriri</i>	MA	MA	F2		<i>Trogon viridis*</i>		C	F1	
<i>Alipiopsitta xanthops</i>	R	E	C2		<i>Trogon curucui</i>	C	A	F1	
<i>Pionus menstruus*</i>		E	F1		Alcedinidae				
<i>Amazona aestiva</i>		E	C2		<i>Megaceryle torquata</i>	C	A	A	
<i>Amazona amazonica</i>	MA	MA	F2		<i>Chloroceryle amazona</i>	C	A	A	
Cuculidae					<i>Chloroceryle aenea</i>	C	A	A	
<i>Coccyzus melacoryphus</i>		R	C2		<i>Chloroceryle americana</i>	C	A	A	
<i>Micrococcyx cinereus</i>	R		C2	FAM	<i>Chloroceryle inda</i>	E	C	A	
<i>Piaya cayana</i>	E	C	F2		Momotidae				
<i>Coccyzus euleri</i>	E		F1		<i>Momotus momota</i>	E	C	F1	
<i>Crotophaga major</i>	E	E	F2		Galbulidae				
<i>Crotophaga ani</i>	MA	MA	C2		<i>Brachygalba lugubris</i>	R	R	F1	
<i>Guira guira</i>	MA	MA	C2		<i>Galbula ruficauda</i>	A	MA	F2	
<i>Tapera naevia</i>		E	F2		Bucconidae				
Tytonidae					<i>Notharchus(cf) macrorhynchos*</i>	R		F1	FCA
<i>Tyto alba</i>	R	E	C2		<i>Notharchus tectus*</i>	E	E	F1	
Strigidae					<i>Bucco tamatia*</i>	E	C	F1	ENA
<i>Megascops choliba</i>	E	C	F2		<i>Nystalus chacuru</i>	C	A	C1	
<i>Strix hubula*</i>			F2		<i>Nystalus maculatus</i>	C	A	C2	
<i>Glaucidium brasilianum</i>	E	C	F2		<i>Nonnula rubecula</i>	R		F2	

Espécies	Área Urbana	Área Suburbana	Habitat	Status	Espécies	Área Urbana	Área Suburbana	Habitat	Status
<i>Monasa nigrifrons</i>	C	MA	F2		<i>Leptopogon amaurocephalus</i>	E	E	F1	
<i>Chelidoptera tenebrosa</i>	E	C	F2		<i>Corythopis delalandi</i> #		E	F1	
Ramphastidae					<i>Hemitriccus striaticollis</i> *	E	A	F1	
<i>Ramphastos toco</i>	C	A	C2		<i>Hemitriccus margaritaceiventer</i>	E	A	F2	
<i>Ramphastos vitellinus</i>	E	A	F1		<i>Todirostrum cinereum</i>	E	A	F2	
<i>Pteroglossus inscriptus</i>	C		F1		<i>Euscarthmus meloryphus</i>	E	A	F2	
<i>Pteroglossus aracari</i>	E	C	F2		<i>Myiopagis gaimardii</i>	E	C	F1	
<i>Pteroglossus castanotis</i>		E	F2		<i>Myiopagis viridicata</i>	E	C	F1	
Picidae					<i>Myiopagis caniceps</i>	C	C	F2	
<i>Picumnus albosquamatus</i>	C	A	F2		<i>Phaeomyias murina</i>	C	C	C1	
<i>Melanerpes candidus</i>	C	A	C2		<i>Elaenia flavogaster</i>	E	C	C2	
<i>Melanerpes cruentatus</i> *	E	C	F2		<i>Elaenia parvirostris</i>	C	A	C1	
<i>Piculus chrysochloros</i>	R		F2		<i>Elaenia cristata</i>	A	MA	C1	
<i>Veniliornis passerinus</i>	E		F2		<i>Elaenia chiriquensis</i>	A	MA	C1	
<i>Colaptes melanochloros</i>	C	A	C2		<i>Ornithion inermis</i> *		E	F1	
<i>Colaptes campestris</i>	A	MA	C2		<i>Camptostoma obsoletum</i>	E	C	F2	
<i>Celeus flavescens</i>	E	A	F2		<i>Suiriri suiriri</i>	R		C2	
<i>Dryocopus lineatus</i>		C	C2		<i>Tolmomyias sulphurescens</i>	E	C	F1	
<i>Campephilus rubricollis</i> *	R	E	F2	ENA	<i>Tolmomyias flaviventris</i>	C	A	F1	
<i>Campephilus melanoleucos</i>	E	C	F2		<i>Platyrrinchus mystaceus</i>	C	C	F1	
Melanopareiidae					<i>Myiophobus fasciatus</i>	E	C	C2	
<i>Melanopareia torquata</i>	E	C	C1	ENC	<i>Myiobius atricaudus</i>		E	F2	
Thamnophilidae					<i>Hirundinea ferruginea</i>		E	C1	
<i>Taraba major</i>	E	C	F2		<i>Lathrotriccus eulerei</i>	E	C	F1	
<i>Thamnophilus doliatus</i>	E	C	F2		<i>Cnemotriccus fuscatus</i>	E	C	F1	
<i>Thamnophilus pelzelni</i>		C	C2		<i>Pyrocephalus rubinus</i>	C		C1	
<i>Thamnophilus torquatus</i>	C		C2		<i>Xolmis cinereus</i>	C	A	C1	
<i>Thamnophilus amazonicus</i> *		E	F1	ENA	<i>Xolmis velatus</i>	E	C	C1	
<i>Dysithamnus mentalis</i>	E	C	F1		<i>Fluvicola albiventer</i>	E	E	A	
<i>Herpsilochmus atricapillus</i>	E	C	F1		<i>Fluvicola nengeta</i>	E	E	A	
<i>Formicivora grisea</i>	A	MA	F2		<i>Arundinicola leucocephala</i>	E	E	A	
<i>Formicivora rufa</i>	A	MA	C2		<i>Legatus leucophaius</i>	E	C	F2	
<i>Hypocnemoides maculicauda</i> *	C	A	F1	ENA	<i>Myiozetetes cayanensis</i>	C	A	F2	
Dendrocolaptidae					<i>Myiozetetes similis</i>	C	A	F2	
<i>Dendrocincla fuliginosa</i> *		R	F1		<i>Pitangus sulphuratus</i>	MA	MA	C2	
<i>Sittasomus griseicapillus</i>	E	C	F1		<i>Myiodynastes maculatus</i>	C	A	F2	
<i>Dendrocolaptes platyrostris</i>	R	E	F1		<i>Megarynchus pitanga</i>	A	A	F2	
<i>Dendroplex picus</i>	E	C	F2		<i>Tyrannopsis sulphurea</i> *		R	F2	
<i>Xiphorhynchus guttatus</i>		E	F1	ENA	<i>Empidonomus varius</i>	E	E	F2	
<i>Lepidocolaptes angustirostris</i>	C	A	C2		<i>Griseotyrannus aurantioatrocristatus</i>	E		C2	
Furnariidae					<i>Tyrannus albogularis</i>	A	A	C1	
<i>Furnarius rufus</i>	C	A	C2		<i>Tyrannus melancholicus</i>	MA	MA	C2	
<i>Synallaxis frontalis</i>		R	C1		<i>Tyrannus savanna</i>	A	A	C1	
<i>Synallaxis albescens</i>		C	C1		<i>Sirytes sibilator</i>	C		F1	
<i>Synallaxis scutata</i>		R	C1		<i>Casiornis rufus</i>		E	F2	
<i>Certhiaxis cinnamomeus</i>	E	E	A		<i>Myiarchus tuberculifer</i> *		R	F2	
<i>Phacellodomus ruber</i>	E	E	C2		<i>Myiarchus swainsoni</i>	E	E	F2	
<i>Berlepschia rikeri</i>	C		F2		<i>Myiarchus ferox</i>	E	C	F2	
<i>Lochmias nematura</i>		R	F1		<i>Myiarchus tyrannulus</i>	E	C	F2	
<i>Xenops rutilans</i>		R	F1		Cotingidae				
Tyrannidae					<i>Querula purpurata</i> *		E	F1	

Espécies	Área Urbana	Área Suburbana	Habitat	Status	Espécies	Área Urbana	Área Suburbana	Habitat	Status
Pipridae					<i>Cypsnagra hirundinacea</i>				
<i>Neopelma pallescens</i>		E	F1			C	C	C1	
<i>Machaeropterus pyrocephalus*</i>	E	E	F1	ENA	<i>Piranga flava</i>	E	C	C2	
<i>Manacus manacus</i>	C	C	F1		<i>Eucometis penicillata</i>	E	E	F1	
<i>Antilophia galeata</i>	C	C	F1	ENC	<i>Tachyphonus rufus</i>	E	E	F2	
<i>Chiroxiphia pareola*</i>		E	F1		<i>Ramphocelus carbo</i>	A	MA	F2	
<i>Pipra fasciicauda</i>	A	A	F1		<i>Thraupis sayaca</i>	MA	MA	C2	
Tityridae					<i>Thraupis palmarum</i>	MA	MA	F2	
<i>Tityra inquisitor</i>		E	F1		<i>Tangara cayana</i>	A	A	C2	
<i>Tityra cayana</i>	E	C	F1		<i>Tersina viridis</i>	C	C	F2	
<i>Tityra semifasciata*</i>		E	F1		<i>Dacnis cayana</i>	A	A	F2	
<i>Pachyrhamphus polychopterus</i>		E	F2		<i>Cyanerpes cyaneus*</i>	C	C	F1	
<i>Xenopsaris albinucha</i>	E		C2		<i>Hemithraupis guira</i>	C	C	C2	
Vireonidae					<i>Conirostrum speciosum</i>	E	E	F2	
<i>Cyclarhis gujanensis</i>	C	A	F2		Emberizidae				
<i>Vireo olivaceus</i>	A	A	F2		<i>Zonotrichia capensis</i>	R		C1	
<i>Hylophilus pectoralis*</i>	E	E	F1	ENA	<i>Ammodramus humeralis</i>	C	A	C1	
Corvidae					<i>Porphyrospiza caerulescens</i>	E	E	C1	NT ^{A,B} ENC
<i>Cyanocorax cristatellus</i>	C	A	C1	ENC	<i>Sicalis columbiana</i>	E	E	A	
<i>Cyanocorax cyanopogon</i>	C	A	F2		<i>Emberizoides herbicola</i>	E	E	C1	
Hirundinidae					<i>Volatinia jacarina</i>	MA	MA	C1	
<i>Tachycineta albiventer</i>	E	C	A		<i>Sporophila plumbea</i>	C	C	C1	
<i>Progne tapera</i>	C	C	C2		<i>Sporophila lineola</i>	E	E	C1	
<i>Progne subis</i>	C		C1	VN	<i>Sporophila nigricollis</i>	E	E	C2	
<i>Progne chalybea</i>	C	C	C2		<i>Sporophila caerulescens</i>	E	E	C2	
<i>Riparia riparia</i>					<i>Sporophila bouvreuil</i>	E	E	C2	
<i>Stelgidopteryx ruficollis</i>	E	C	C2		<i>Sporophila angolensis</i>	E	C	C2	
<i>Pygochelidon melanoleucaC</i>		R	A		<i>Sporophila leucoptera</i>	E		C2	
Troglodytidae					<i>Arremon taciturnus</i>	C	C	F1	
<i>Troglodytes musculus</i>	A	A	C2		<i>Charitospiza eucosma</i>	E	C	C1	NT ^{A,B} ENC
<i>Pheugopedius genibarbis</i>	A	A	F1		<i>Coryphospingus pileatus</i>	C	C	C2	
<i>Cantorchilus leucotis</i>	A	A	F1		Cardinalidae				
Donacobiidae					<i>Saltator maximus</i>	C	C	F2	
<i>Donacobius atricapilla</i>	R	E	A		<i>Saltator similis</i>	E	E	F2	
Poliopitidae					<i>Saltator atricollis</i>	A	A	C1	ENC
<i>Poliopitila dumicola</i>	A	A	F2		Parulidae				
Turdinae					<i>Basileuterus culicivorus</i>	A	A	F1	
<i>Turdus leucomelas</i>	MA	MA	F2		<i>Basileuterus hypoleucus</i>	R	R	F1	
<i>Turdus amaurochalinus</i>	E	C	C2		<i>Basileuterus flaveolus</i>	C	C	F1	
<i>Turdus subalarisC</i>		R	F2		Icteridae				
<i>Turdus rufiventrisC</i>		R	F2		<i>Psarocolius decumanus</i>	E	C	F2	
Mimidae					<i>Cacicus solitarius</i>	C	C	F2	
<i>Mimus saturninus</i>	A	A	C1		<i>Cacicus cela*</i>	C	C	F2	
Coerebidae					<i>Icterus cayanensis</i>	E	C	F2	
<i>Coereba flaveola</i>	A	A	F2		<i>Gnorimopsar chopi</i>	MA	MA	C2	
Thraupidae					<i>Molothrus bonariensis</i>	E	E	C2	
<i>Schistochlamys ruficapillus</i>	C	C	C2		Fringilidae				
<i>Schistochlamys melanopsis</i>	C		C2		<i>Euphonia chlorotica</i>	A	A	C2	
<i>Neothraupis fasciata</i>	R		C1		<i>Euphonia violacea</i>	C	C	F2	
<i>Nemosia pileata</i>	C	C	F2		Passeridae				
<i>Thlypsopsis sordida</i>	E	E	F2		<i>Passer domesticus</i>	MA	A	C1	

bosa 2007, Barbosa and Dornas 2008). Important records were made for both areas; in the Prata brook AV, the *Berlepskia rikeri* ovenbird was recorded for the first time in the Lajeado Mountain Range area Dornas and Barbosa (2007) and, in the Cesamar Municipal Park, next to the Brejo Comprido stream, the first documented record of *Avocettula recurvirostris* for the Tocantins State was made (Pinheiro *et al.* 2008).

Although many areas within Palmas' urban limits are Permanent Protection Areas (APPs) from a legal perspective, their insufficiency in the preservation of the local avifauna is clear, once the majority of these areas are almost exclusively protecting vegetal formations adjacent to watercourses.

On the other hand, typical species of open Cerrado formations are those whose populations would be more vulnerable to the urbanization process. Preliminary assessments of Palmas' urban center revealed a significant reduction of bird abundance and diversity using an urbanization gradient, presenting losses of up to 75% of species in urbanized residential areas when compared to non-urbanized areas (R. T. Pinheiro, unpublished data). These results indicate the need for not only preserving isolated cerrado fragments, as predicted by the municipal legislation, but also for establishing corridors with typical cerrado vegetation within the urban area, connecting Palmas' protected areas and other nearby protected cerrado areas, allowing the displacement of the biota and enabling the survival of more species.

In Palmas' urban area, other problems which directly or indirectly affect the avifauna may be verified. Fires are recurrent in the APPs, allegedly protected by law, as well as in the entire cerrado vegetation within the urban center. Organic waste, construction waste and household utensils, among others, are illegally disposed on green areas. The illegal hunting of medium size mammals and birds (large mammals no longer exist within the city) may be verified from bullet traces, trails, abandoned baits and hunter benches. Xerimbabo (capturing birds to be used as pets) is clearly practiced due to the presence of bird catchers in these areas, being that the most sought species are the *Sporophila angolensis* and *Sporophila leucoptera* songbirds.

Aiming to minimize the effects of the urbanization process on the avifauna of Palmas' urban area, both handling and conservation actions regarding its protected natural areas would be necessary. One alternative would be the implantation of a Protected Conservation Unit within the capital's city limits. The ARSOS (acronym for Southwest Residential Area) region, between the Prata and Cajú beaches, would be the most appropriate region for this purpose. This region, with an area of over 1,100 ha, maintains an environmentally heterogeneous cerrado vegetation (veredas, *sensu strictu* cerrado, cerrado woodlands and riparian forests) where a significant part of Palmas' birds is certainly established.

Besides the conservation of the regional biodiversity, this Conservation Unit would play a fundamental role concerning environmental education and Birdwatching tourism, which would be one of the reference points for the population's awareness. This activity would consequently become a local tourism option, once Brazil has become one of the main Birdwatching locations, as well as a dissemination tool for the natural abundance present in Palmas and in the Tocantins State's Cerrado.

Therefore, the conservation of Palmas' natural resources and biodiversity may represent a socioeconomic alternative, because it enables local and State tourism and favors the population's awareness concerning the preservation of the Cerrado and its natural abundance.

REREFENCES

- Adorno, L. F. M. e Figuera, D. R. (2005). A trajetória política ambiental de Palmas enquanto capital ecológica: entre discursos e contradições, p. 205-223. Em: M. G. Almeida (org.) *Tantos Cerrados: Múltiplas abordagens sobre a biogeodiversidade e singularidades sociocultural*. Editora Vieira.
- Bagno, M. A. e Abreu, T. L. S. (2001). Avifauna da região da Serra do Lajeado, Tocantins. *Humanitas*, 3:51-70, Palmas, TO.
- Barbosa, M. O. e Dornas T. O. (2008). Avifauna da Área Verde do Prata e sua contribuição para a conservação de ambientes naturais no plano diretor de Palmas, TO. Resumo de Congresso. *Livro de resumos do XVI Congresso Brasileiro de Ornitologia*. Palmas, TO. p. 304.
- Brandão, R. A. e Péres Júnior, A. K. (2001). Levantamento da herpetofauna na área de influência do aproveitamento hidroelétrico da UHE Luís Eduardo Magalhães, (Palmas, TO). *Humanitas*, 3:35-50.
- Brito, B., R.; Trovati, G. e Prada, M. (2001). Levantamento de mamíferos terrestres de médio e grande porte a área de influência da UHE Luís Eduardo Magalhães, região central do Tocantins. *Humanitas*, 3:7-28.
- Comitê Brasileiro de Registros Ornitológicos. (2008). Listas das aves do Brasil. Versão 5/10/2008. Disponível em www.cbro.org.br (acesso em: 20/12/2008).
- Dornas, T. O. e Barbosa, M. O. (2007). Levantamento da avifauna da Área Verde do Prata: implicações preliminares à conservação das aves silvestres em Palmas, TO. Resumo expandido, Anais do In: *2º Congresso Científico e III Seminário de Iniciação Científica da Universidade Federal do Tocantins*. CD-Rom.
- Figuera, D. R. (2005). *A efetividade do projeto de cidade Ecológica de Palmas pelos seus espaços verdes*. Dissertação de Mestrado. Palmas: Universidade Federal do Tocantins.
- IUCN. (2008). Lista de espécies ameaçadas de extinção. www.iucn.org (acesso em: 18/12/2008).
- Maciel, M. A. F. (2001). Levantamento das espécies de primatas na área de influência da UHE Luís Eduardo Magalhães (Palmas, TO) *Humanitas*, 3:29-34
- Nascimento, J. B. (2007). *Conhecendo o Tocantins: Historia e Geografia*. 5ª Edição Editora KELPS Palmas.
- Passamani, M. (2001). Pequenos mamíferos não voadores da área de influência da UHE Luis Eduardo Magalhães (Palmas, TO): inventário e uso do habitat. *Humanitas*, 3:21-28.
- Passamani, M. (2004). Pequenos mamíferos não voadores. *Humanitas*, 4:31-38.
- Pavan, D. e Dixo, M. (2004). Herpetofauna da área de influência do reservatório da Usina Hidrelétrica Luís Eduardo Magalhães, Palmas, TO. *Humanitas*, 4:13-30.

- Pérez-Maluf, R. (2004). Levantamento da Entomofauna geral na área de influência da Usina Hidrelétrica Luís Eduardo Magalhães, Lajeado, TO. *Humanitas*, 4:7-12.
- Pinheiro, R. T. (2004a). Captura e recaptura de aves na Região Central do Tocantins. *Humanitas*, 4:39-54.
- Pinheiro, R. T. (2004b). Avifauna de Palmas, uma amostra da diversidade do Cerrado Tocantinense. Resumo de Congresso. *Livro de resumos do XII Congresso Brasileiro de Ornitologia*. Blumenau, SC. p. 130.
- Pinheiro, R. T.; Reis, E. S. e Rodello, D. (2005). Diversidade de aves em um corredor de biodiversidade urbano. Resumo de Congresso. *Livro de resumos do XII Congresso Brasileiro de Ornitologia*. Belém, PA. p. 188.
- Pinheiro, R. T.; Reis, E. S. e Rodello, D. (2008). Ampliação da Área de Distribuição do beija-flor-de-bico-virado *Avocettula recurvirostris* (Swainson, 1822) para o Cerrado do Estado do Tocantins, Brasil. *Revista Brasileira de Ornitologia*, 16 (2):181-183.
- Pohl, J. E. (1975). *Viagem no interior do Brasil*. Tradução Milton Amado e Eugênio Amado. Belo Horizonte: Editora Itatiaia, São Paulo: EDUSP
- Puerto, G. e Barbini, C. C. (2004). Coleção Herpetológica do Museu de Zoologia do Centro Universitário Luterano de Palmas – MZCEULP. *Humanitas*, 4:31-38.
- Reis, E. S. e Pinheiro, R. T. (2004). Avifauna do Parque Cesamar. Resumo de Congresso. *Livro de resumos do XII Jornada Científica*, Universidade do Tocantins Palmas, TO. p. 84.
- Reis, E. S. e Pinheiro, R. T. (2006a). Riqueza avifaunística da Universidade Federal do Tocantins em Palmas. Resumo de Congresso. *Livro de Resumos do II Seminário de Iniciação Científica*. Universidade do Tocantins Palmas, TO. CD-Rom.
- Reis, E. S. e Pinheiro, R. T. (2006b). Predação de Ninhos Artificiais em uma área urbana e uma área de Proteção Ambiental no Estado de Tocantins. Resumo de Congresso. *Livro de resumos do XIV Congresso Brasileiro de Ornitologia*. Ouro Preto, MG. p. 188.
- Rodello, D. e Pinheiro, R. T. (2006). Hemoparasitismo em aves silvestres de áreas fragmentadas e contínuas do cerrado tocantinense. Resumo de Congresso. *Livro de resumos do XIV Congresso Brasileiro de Ornitologia*. Ouro Preto, MG. p. 175.
- Roriz, H. M. S. e Pinheiro, R. T. (2006). Efeito da urbanização sobre a comunidade de aves de sub-bosque na cidade de Palmas, TO. Resumo de Congresso. *Livro de resumos do XIV Congresso Brasileiro de Ornitologia*. Ouro Preto, MG. p. 150.
- Silva, J. M. C. (1995a). Avian inventory of the cerrado region, South America: implications for biological conservation. *Bird Conservation International*, 5:315-328.
- Silva, J. M. C. (1995b). Bird of the Cerrado Region, South America. *Steenstrupia*, 21:69-92.
- Silva, J. M. C. (1996). Distribution of Amazonian and Atlantic birds in gallery forest of the Cerrado Region, South America. *Ornitologia Neotropical*, 7:1-18.
- Silva, J. M. C. (1997). Endemic bird species and conservation in the Cerrado Region, South America. *Biodiversity and Conservation*, 6:435-450.
- Silva, J. M. C. e Santos, M. P. D. (2005). A importância relativa dos processos biogeográficos na formação da avifauna do Cerrado e de outros biomas brasileiros, p. 224-233. Em: A. Scariot, J. C. S. Filho e J. M. Felfili (org.) *Cerrado: Ecologia, Biodiversidade e Conservação*. Editora Brasília: Ministério do Meio Ambiente.
- Stotz, P. D. F.; Fitzpatrick, J. W.; Parker, T. A. e Moskvits, D. K. (1996). *Neotropical Birds: Ecology and Conservation*. Editora Hardcover.