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Avifauna of two Forest Fragments near the City of Altamira, Pará, Brazil

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Abstract: *Our objective was to carry out an avifauna survey in two forest fragments in the municipality of Altamira-Pará. For this purpose, we use the method of listening points. The observations were made in the month of August to October in the dry season. We recorded a total of 13 orders, 26 families, 81 species in 1056 contacts, with a sampling effort of 72 hours. The order with the highest representation was Passeriformes (45%), followed by Piciformes with 12%. The orders with smaller representations were (Accipitriformes, Cathartiformes, Falconiformes, Galliformes, Gruiformes and Trogoniformes). The most representative families were, Thraupidae with 15%, followed by Tyrannidae 14%. For the site I, we registered 57 species (459 contacts), however 24 of these have exclusive registration for said site. For site II, we registered 55 species (577 contacts), of which 22 were registered exclusively on the site. Taking into account that small fragments of forests are not sufficient for the long-term maintenance of wildlife, being an environment conducive to extinction by competition, we suggest keeping forest remnants in the area near the Pedral to function as a corridor or fauna connector the west bank of the Xingu River.*

Keywords: *Xingu River, Surveys,Ester Amazonia, Conservation*

1. INTRODUCTION

The most drastic consequences of forest fragmentation are the long-term changes in the composition of the biota, which may cause disturbances in the distribution of some species, tending to colonize other areas [1] or species extinction. Research on Amazonian fragmentation has found that in highly fragmented landscapes, protecting forest remnants are very important because they tend to be important for animal and plant breeding, as well as 'ecological trampolines' for animals that travel the landscape [2].

According to Neto et al. [3], the reduction of vegetation cover to small fragments, causes negative consequences for the bird, thus causing a decline in the number of more specialized species, favoring the generalists, which became predominant, and such a disruption of forest composition can directly influence the distribution of conditions and resources in an unfavorable way for the group. Already for Cintra et al.[4]. The differences in the number of bird species recorded in forest fragments and continuous forest of the eastern Amazonia were not influenced by forest structure, suggesting that the observed patterns in species composition result from the effects of fragmentation per se rather than from preexisting differences in vegetation structure between sites.

Bregman et al. [5] studied frugivorous and insectivorous birds in southern Amazonia, they found that in both guilds, the forest patch size, quality, and degree of isolation influence the phylogenetic and functional trait structure of communities and that in small and isolated fragments there is a greater propensity for niche competition that may lead to the local extinction of species.

For the Xingu-Tocantins-Tapajós interfluve, few studies with avifauna surveys are known. [6] Carried out a survey of the birds of the Terra do Meio Ecological Station, with observations in Rio Iriri and Rio Novo. In this study, they recorded 242 species. Already, Fávaro in 2011 [7] carried out a survey for birds in the Serra do Pardo National Park, where it found 197 species. These two studies were carried out in the municipalities of Altamira and São Félix do Xingu, in the area known as "Terra do Meio", currently one of the continuous areas of protected forests in the central-southern region of the state of Pará. Given the scarcity of data for avifauna of the region and the high rates of deforestation our study aimed to characterize the avifauna in two fragments of vegetation near the municipality of Altamira, Eastern Amazonia.

2. MATERIAL AND METHODS

2.1. Study Area

The municipality of Altamira belongs to the Southwest microregion of the Pará State, in the eastern Brazilian Aamazonia. The municipal seat has the following coordinates: 03º 12'00 " south latitude and 52º 13 '45' 'longitude west [8]. The sites defined for data collection were the vegetation area of the 51st jungle Infantry Battalion and on the vegetation located on the road that gives access to Balneário Pedral (Figure 1). We named the areas as site I and site II respectively, with a distance between them of 9,782 km in a straight line.

According to [8] the climate of the municipality is of the equatorial type Am and Aw of the classification of Köppen. The equatorial type Am is predominant in the northern part presenting average temperatures of 26ºC and occurrence of annual precipitation near 1,680mm, the rainiest months go from December to May and, the less rainy, from June to November. In the southern part the equatorial Aw type occurs, due to the great extension of the municipality, undergoing a transition until reaching the type of tropical savannah climate. The surplus of water occurs between February and April and the biggest deficiency, in September.

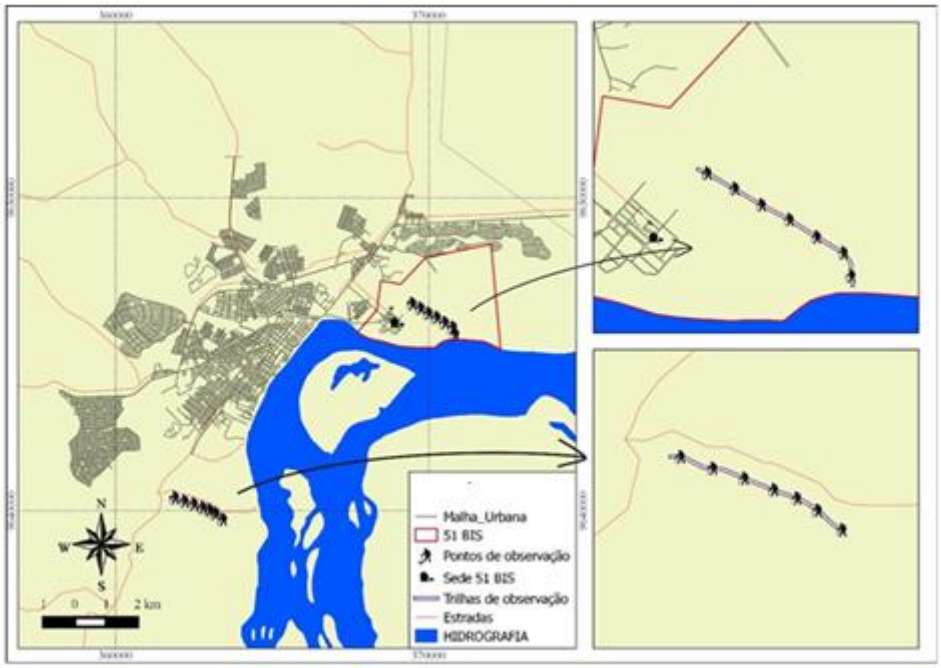

Figure1. *Location map of the trails sampled in their respective sites, Altamira- Pará, Brazil*

2.2. Characterization of Site I

The sampled area of site I is comprised between the geographic coordinates 03º 11' 47" S; 52° 10' 29" W and 03° 12' 19" S; 52º 09' 45" W, in the 51st Jungle Infantry Battalion commonly called 51st BIS, by its acronym in Portuguese. According to Salm et al. [9], the 51st BIS is located on the left bank of the Xingu River at the northern end of the Altamira urban perimeter, with a total area of 1035 ha, is considered one of the main fragments in a 50 km radius.

The structure of the vegetal composition of site I becomes difficult to characterize due to the transformations that the area passed in the middle of the 70s with agricultural activities, developed by colonizers with the construction of the Trans amazon Highway (BR 230). At present, because the site is the 51º BIS base, it is characterized as an area in a state of succession, being its forest composition of primary and secondary forest, but impossible to delimit exactly the limits of such vegetation [9].

2.3. Characterization of Site II

The sampled area of site II is located in the vicinity of Altamira Airport, towards Balneário Pedral between coordinates 03º 15 '08´´ S; 52° 14' 35´´ W and 03° 15' 31´´ S; 52º 13'45´´ W. Characterizing itself as an area degraded by intense anthropization. The vegetation of the place is characterized as an abandoned pasture area with invasive plants and small mosaics of forest, presence of some palm trees in the pasture and in some parts of the trail, presence of *Cecropia* sp.

2.4. Surveying of Avifauna

The study was carried out from August 19 to October 23, 2014. The method of sampling was by listening points (fixed points), in which the observer stays for a certain time observing and noting the species sighted or heard, as suggested By Blondel et al. [10]. Seven sample points were defined, marked at both sites using a GPSMAP 76CSX and distributed every 300 meters equidistant in the pre-existing tracks, totalizing a course of 2,100 m for each site. The minimum distance between the points should be 200 meters, according to [11]. Considering that the minimum distance between the points is 200 meters, we adopted for the study the distance of 300 meters, considering that, the defined distance makes enough for its use in a statistical analysis between the detections [12].

The dwell time for each point was 15 minutes, considering the displacement time of 08 minutes between listening, 3 hours of daily sampling were carried out, starting from 06:00 and extending until 09:00 counting 36 sample hours for each site, in the total of 72 sample hours effected for both sites. Some authors suggest that the residence time is 20 minutes for sites in the Neotropical region [13]. However, the longer the dwell time at one point, the greater the likelihood of detection of the same individual more than once [14]. From this assumption, we define for the said study the residence time 15 minutes for each point as already described. It is worth noting that during the censuses, we performed alternation between the sampling points on different days, to avoid the highest number of records in only one point, as suggested by [14].

The material used to aid in the visualization and recording of the species was a 7x35 binocular, a Mini Digital Voice Recorder, a digital camera Coolpix 1820 zoom 30x. To identify of the corners we consulted the multimedia commercial CD [15], also the information of recording and photographic record were and specialists.

The specialized literature consulted for the identification of birds was from [16]. We utilizedlist of Brazilian Ornithological Committee [17] for the scientific and popular nomenclature of species, distribution and status of conservation. Other bibliographic materials were used to verify the conservation status of bird species at the national and global levels, the IUCN Red List, and the Ministry of Environment list [18].

During the trail, it was chosen to record the species sighted between the points, in order to cover species that might not be possible to be recorded during the census at the fixed points, however these occur in the studied sites, which is considered as a fortuitous record. Disregarding the species that were vocalizing, in order to avoid double registration of the same individual of a certain area, if it has been recorded in the points.

2.5. Data Analyses

In addition to the disposition of species richness by number of contacts in the sites sampled, the Jaccard (J), Constance and Peak Abundance Index (IPA) similarity indexes were estimated.

Considering the information of the days sampled, an accumulation curve (curve of the collector) was elaborated using the PAST program, version 2.17b [19]. The curve of the collector has as function to estimate if the sampling performed was enough to express the total wealth of species of a community [20].

The Jaccard Similarity Index compares qualitatively and quantitatively the similarity between two samples, considering that their value expressed above 25% indicates that there is similarity between the areas.

The constancy of the species was determined by Bodenheimer's formula (1938).

The Point Abundance Index (IPA) allows the comparison of the structure of the bird community between distinct areas based on the relative abundance of each species. It is obtained by calculating the total number of contacts of each species divided by the total number of samples [21]. The IPA is the best estimate of the proportion of a species in the community, as it relates the average number of contacts of this species to samples, and can estimate the proportion of each species in the community [21]

3. RESULTS

We recorded a total of 13 orders, 26 families, 81 species in 1056 contacts, with a sampling effort of 72 hours. The order with the highest representation was Passeriformes (45%), followed by Piciformes with 12%. The orders with smaller representations were (Accipitriformes, Cathartiformes, Falconiformes, Galliformes, Gruiformes and Trogoniformes) (Figure 2).

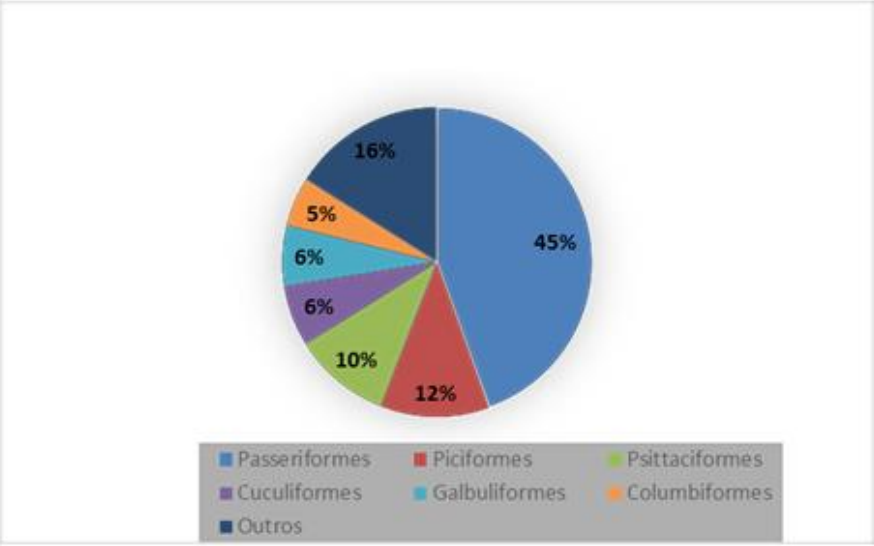

Figure2. *Percentage representation of the orders of birds recorded in the two forest fragments of Altamira, Pará, Brazil*

The most representative families were Thraupidae with 15%, followed by 14% Tyrannidae. The least representative families were Accipitridae, Cathartidae, Falconidae, Fringilidae, Icteridae, Alcedinidae, Contigidae, Cracidae, Dendrocolaptidae, Galbulidae, Heliornithidae, Hirundinidae, Parulidae, Rhynchocyclidae, Tityridae, Troglodytidae, Trogonidae, Vireonidae with 33% in total (Figure 3).

As the record of the species, to the Site I have been recorded 57 species (459 contacts), however 24 of these represent unique record for that site. As for the site II were recorded 55 species (577 contacts), 22 with unique record of the siteII. We found 33 species with common record for the two study sites (Table 1).

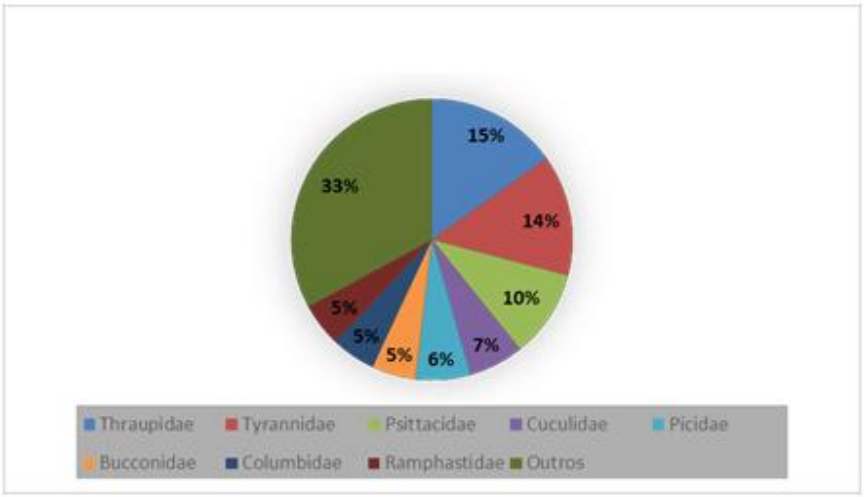

Figure3. *Percentage representation of the families of birds in the two forest fragments of Altamira-Pará, Brazil*

Table1. *Representation of species that present common and exclusive registration in sites I and II. Altamira-Pará, Brazil*

Species	Vernacular name	Sítio I	Sitio II
Amazona amazonica (Linnaeus, 1766)	curica	X	
Amazona farinosa (Boddaert, 1783)	papagaio-moleiro	X	X
Anodorhynchus hyacinthinus (Latham, 1790)	arara-azul-grande		X
Ara chloropterus (Gray, 1859)	arara-vermelha-grande	X	
Ara macao (Linnaeus, 1758)	araracanga	X	X
Ara severus (Linnaeus, 1758)	maracanã-guaçu	X	X
Buteo nitidus (Latham, 1790)	gavião-pedrês		X
Cacicus cela (Linnaeus, 1758)	xexéu	X	X
Campephilus rubricollis (Boddaert, 1783)	pica-pau-de-barriga- vermelha	X	

Cathartes aura (Linnaeus, 1758)	urubu-de-cabeça-vermelha	X	X
Cathartes melambrotus (Wetmore, 1964)	urubu-da-mata	X	
Celeus flavus (Statius Muller, 1776)	pica-pau-amarelo	X	
Chelidoptera tenebrosa (Pallas, 1782)	urubuzinho		X
Chloroceryle amazona (Latham, 1790)	martim-pescador-verde	X	
Troglodytes musculus (Naumann, 1823)	corruíra		X
Coccyzus melacoryphus (Vieillot, 1817)	papa-lagarta-acanelado	X	
Colonia colonus (Vieillot, 1818)	viuvinha	X	
Columbina passerina (Linnaeus, 1758)	rolinha-cinzenta		X
Columbina talpacoti (Temminck, 1811)	rolinha-roxa		X
Coragyps atratus (Bechstein, 1793)	urubu-de-cabeça-preta	X	X
Crotophaga ani (Linnaeus, 1758)	anu-preto	X	X
Crotophaga major (Gmelin, 1788)	anu-coroca	X	
Dacnis cayana (Linnaeus, 1766)	saí-azul	X	X
Dendroplex picus (Gmelin, 1788)	arapaçu-de-bico-branco	X	X
Dryocopus lineatus (Linnaeus, 1766)	pica-pau-de-banda-branca		X
Elaenia chiriquensis (Lawrence, 1865)	chibum	X	X
Elaenia flavogaster (Thunberg, 1822)	guaracava-de-barriga- amarela	X	X
Elanoides forficatus (Linnaeus, 1758)	gavião-tesoura	X	X
Empidonomus varius (Vieillot, 1818)	peitica		X
Euphonia chlorotica (Linnaeus, 1766)	fim-fim	X	X
Euphonia rufiventris (Vieillot, 1819)	gaturamo-do-norte	X	X
Galbula dea (Linnaeus, 1758)	ariramba-do-paraíso	X	
Geothlypis aequinoctialis (Gmelin, 1789)	pia-cobra		X
Graydidascalus brachyurus (Kuhl, 1820)	curica-verde	X	X
Heliornis fulica (Boddaert, 1783)	picaparra	X	
Herpetotheres cachinnans(Linnaeus,1758)	acauã	X	X
Hylophilus semicinereus (Sclater & Salvin, 1867)	verdinho-da-várzea	X	X
Ibycter americanus (Boddaert, 1783)	gralhão		X
Lanio luctuosus (d'Orbigny & Lafresnaye, 1837)	tem-tem-de-dragona-branca	X	
Legatus leucophaius (Vieillot, 1818)	bem-te-vi-pirata		X
Leptotila rufaxilla (Richard & Bernard, 1792)	juriti-gemedeira	X	X
Megarynchus pitangua (Linnaeus, 1766)	neinei		X
Melanerpes cruentatus (Boddaert, 1783)	benedito-de-testa-vermelha	X	
Micrastur mirandollei (Schlegel, 1862)	tanatau	X	
Monasa morphoeus (Hahn & Küster, 1823)	chora-chuva-de-cara-branca	X	
Monasa nigrifrons (Spix, 1824)	chora-chuva-preto	X	
Myiodynastes maculatus (Statius Muller, 1776)	bem-te-vi-rajado		X
Myiornis ecaudatus (d'Orbigny & Lafresnaye, 1837)	caçula	X	
Myiozetetes cayanensis (Linnaeus, 1766)	bentevizinho-de-asa- ferrugínea		X
Notharchus tectus (Boddaert, 1783)	macuru-pintado	X	
Patagioenas speciosa (Gmelin, 1789)	pomba-trocal		X
Penelope pileata (Wagler, 1830)	jacupiranga	X	X
Phaeomyias murina (Spix, 1825)	bagageiro		X
Piaya cayana (Linnaeus, 1766)	alma-de-gato	X	X
Pionus menstruus (Linnaeus, 1766)	maitaca-de-cabeça-azul	X	X
Pitangus sulphuratus (Linnaeus, 1766)	bem-te-vi	X	X
Psarocolius decumanus (Pallas, 1769)	japu	X	X
Pteroglossus aracari (Linnaeus, 1758)	araçari-de-bico-branco	X	X
Pteroglossus inscriptus (Swainson, 1822)	araçari-miudinho-de-bico-riscado	X	X
Querula purpurata (Statius Muller, 1776)	anambé-uma	X	
Ramphastos tucanus (Linnaeus, 1758)	tucano-grande-de-papo- branco	X	X
Ramphastos vitellinus (Lichtenstein, 1823)	tucano-de-bico-preto	X	X
Ramphocelus carbo (Pallas, 1764)	pipira-vermelha	X	X
Rupornis magnirostris (Gmelin, 1788)	gavião-carijó		X
Saltator azarae (d'Orbigny, 1839)	sabiá-gongá-da-amazônia		X
Sporophila americana (Gmelin, 1789)	coleiro-do-norte		X
Sporophila angolensis (Linnaeus, 1766)	curió	X	
Sporophila lineola (Linnaeus, 1758)	bigodinho	X	
Stelgidopteryx ruficollis (Vieillot, 1817)	andorinha-serradora	X	X

Tachyphonus rufus (Boddaert, 1783)	pipira-preta		X
Tangara episcopus (Linnaeus, 1766)	sanhaçu-da-amazônia	X	X
Tangara mexicana (Linnaeus, 1766)	saíra-de-bando	X	
Tangara palmarum (Wied, 1823)	sanhaçu-do-coqueiro	X	X
Tapera naevia (Linnaeus, 1766)	saci		X
Tityra semifasciata (Spix, 1825)	anambé-branco-de-máscara-negra	X	
Trogon viridis (Linnaeus, 1766)	surucuá-grande-de-barriga-amarela	X	X
Tyrannus melancholicus (Vieillot, 1819)	suiriri	X	X
Veniliornis sp.	_	X	
Volatinia jacarina (Linnaeus, 1766)	tiziu		X

3.1. Avifaunistic Composition of Site I

The best represented family for site I was, Thraupidae with 14% of the total sampled species, followed by the Psittacidae family 12%, and some other families with (Accipitridae, Alcedinidae, Columbidae, Contigidae, Cracidae, Dendrocolaptidae, Galbulidae, Helionithhidae, Hirundinidae, Rhynchocyclidae, Tityridae, Trogonidae and Vireonidae with 23% in total (Figure 4).

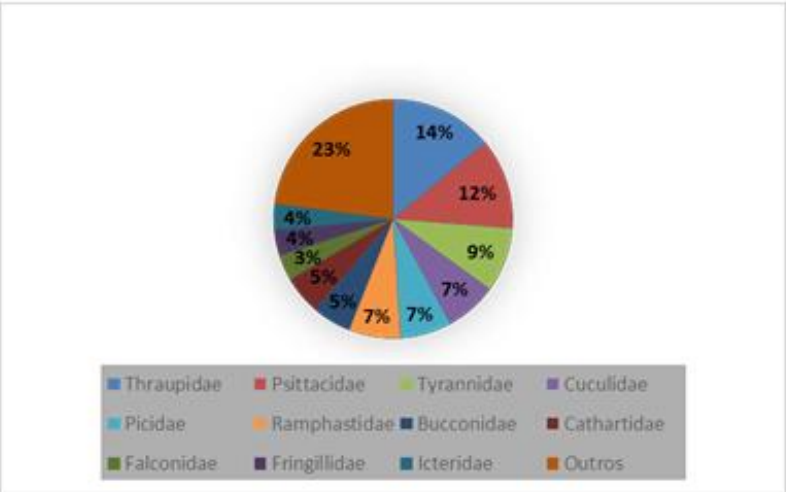

Figure4. *Birds families with their respective representativeness in relation to the number of species for the site I. Altamira, Pará, Brazil*

3.2. Avifaunistic Composition of Site II

The richestfamily for site II was Tyrannidae with 18%, followed by Thraupidae with 15% representation. The less represented families had their total percentage of 16% (Figure 5).

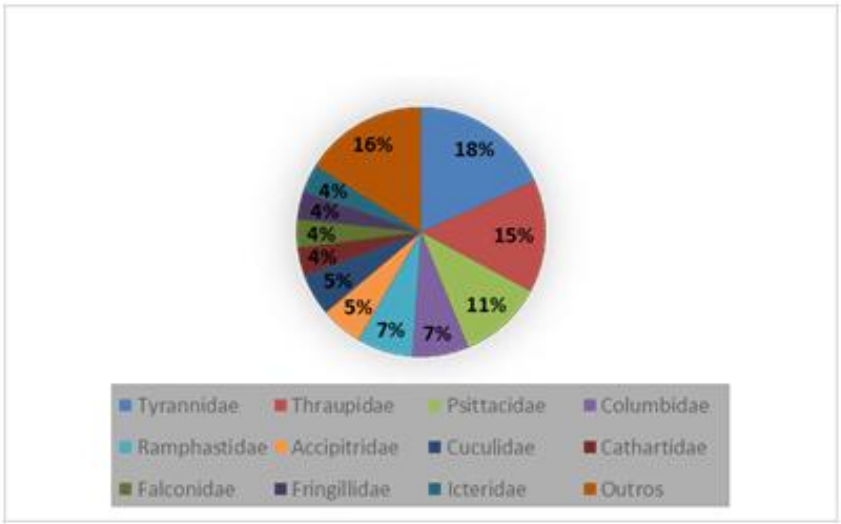

Figure5. *Families of birds with their respective representativeness in relation to the number of species for site II. Altamira, Pará, Brazil*

3.3. Similarity and Constance

Considering that the similarity index is expressed from the value above 25%, you can observe that, there is similarity between the sites sampled, as explicit in (Table 2).

Table2. *Similarity index of site I and II. Altamira- Pará. Legend: common species, b: exclusive species of site I, c: exclusive species of site II*

	Site I	**Site II**
Nº of species	57	55
x		33
B		24
C		22
a+b+c		79
Jaccard		0.42
%		42.0

Through the index of constancy, it was possible to show which species are constant in their respective sites. For the site I, were considered 20 species with the accidental registration, 20 as an accessory registry and 17 species with constant registration during the days of sampling. While for site II, 15 species with accidental registration, 21 species with accessory registry and 19 species considered as constant register.

Among the species with 100% of their register for the site I we have, *Cacicuscela* of the family Icteridae and *Ramphocelus carbo* of the family Thraupidae, followed by the species *Tangarapalmarum* also of the family Thraupidae and *Ramphastostucanus* of the family Ramphastidae.

As for site II, some of the species with constant registration were *Coragypsatratus*(Cathartidae), *Hylophilussemicinereus*(Vireonidae), *Ramphocelus carbo* (Thraupidae) and *Tyrannusmelancholicus* (Tyrannidae) with 100% constancy (Table 3).

Table3. *Constancy index of the species registered at site I and II. Altamira- Pará, Brazil*

	CONSTANCY			
	SÍTIO I		**SÍTIO II**	
	%	**C**	**%**	**C**
ESPÉCIES				
Amazonaamazônica	42	Y	0	Z
Amazonafarinosa	67	X	58	X
Anodorhynchushyacinthinus	0	Z	25	Y
Ara chloropterus	17	Z	0	Z
Ara macao	83	X	33	Y
Ara severus	58	X	58	X
Buteonitidus	0	Z	8	Z
Cacicuscela	100	X	42	Y
Campephilusrubricollis	17	Z	0	Z
Cathartes aura	58	X	50	Y
Cathartesmelambrotus	25	Y	0	Z
Celeusflavus	8	Z	0	Z
Chelidopteratenebrosa	0	Z	25	Y
Chloroceryleamazona	17	Z	0	Z
Cistothorus platensis	0	Z	8	Z
Coccyzusmelacoryphus	8	Z	0	Z
Colonia colonus	25	Y	0	Z
Columbinapasserina	0	Z	42	Y
Columbinatalpacoti	0	Z	67	Z
Coragypsatratus	25	Y	100	X
Crotophagaani	33	Y	75	X
Crotophaga major	33	Y	0	Z
Dacniscayana	17	Z	42	Y
Dendroplexpicus	8	Z	17	Z
Dryocopuslineatus	0	Z	25	Y
Elaeniachiriquensis	75	X	92	X
Elaeniaflavogaster	33	Y	92	X

Elanoidesforficatus	8	Z	17	Z
Empidonomusvarius	0	Z	8	Z
Euphoniachlorotica	17	Z	8	Z
Euphoniarufiventris	42	Y	25	Y
Galbuladea	8	Z	0	Z
Geothlypisaequinoctialis	0	Z	58	X
Graydidascalusbrachyurus	83	X	92	X
Heliornisfulica	8	Z	0	Z
Herpetotherescachinnans	50	Y	42	Y
Hylophilussemicinereus	58	X	100	X
Ibycteramericanos	0	Z	8	Z
Lanioluctuosus	25	Y	0	Z
Legatusleucophaius	0	Z	67	X
Leptotilarufaxilla	8	Z	25	Y
Megarynchuspitanguá	0	Z	17	Z
Melanerpescruentatus	8	Z	0	Z
Micrasturmirandollei	8	Z	0	Z
Monasamorphoeus	42	Y	0	Z
Monasanigrifrons	83	X	0	Z
Myiodynastesmaculatus	0	Z	42	Y
Myiornisecaudatus	8	Z	0	Z
Myiozetetescayanensis	0	Z	8	Z
Notharchustectus	25	Y	0	Z
Patagioenasspeciosa	0	Z	50	Y
Penelope pileata	58	X	25	Y
Phaeomyiasmurina	0	Z	8	Z
Piayacayana	33	Y	17	Z
Pionusmenstruus	25	Y	8	Z
Pitangussulphuratus	8	Z	92	X
Psarocoliusdecumanus	33	Y	58	X
Pteroglossusaracari	42	Y	17	Z
Pteroglossusinscriptus	75	X	8	Z
Querulapurpurata	58	X	0	Z
Ramphastostucanus	92	X	100	X
Ramphastosvitellinus	50	Y	33	Y
Ramphocelus carbo	100	X	100	X
Rupornismagnirostris	0	Z	8	Z
Saltatorazarae Sporophi	0	Z	33	Y
Laamericana Sporophila	0	Z	25	
angolensisSporophilali	25	Y	0	Y
neolaStelgidopteryxrufi	8		0	
collis	8	Z	33	Z
Tachyphonusrufus	0	Z	50	Y
Tangaraepiscopus	58	X	50	Y
Tangaramexicana	8	Z	0	Z
Tangarapalmarum	92	X	92	X
Taperanaevia	0	Z	67	X
Tityrasemifasciata	42	Y	0	Z
Trogon viridis	83	X	42	Y
Tyrannusmelancholicus	50	Y	100	X
Veniliornissp	8	Z	0	Z
Volatiniajacarina	0	Z	75	X

Legend: *Accidental: Z, Accessory: Y, Constant: X.*

3.4. Punctual Index of Abundance

The Point Abundance Index found for each species at site I ranged from 0.39 (33 contacts) to 0.01 with only (one contact). The species with the highest density was *Trogon viridis* (IPA 0.39), followed by *Ramphocelus carbo*, *Cacicuscela* (IPA 0.36), the other species registered for the site had a density equal to or less than (IPA 0.12), (Figure 6). Note that species not represented in the graphs have their respective values in (Table 4).

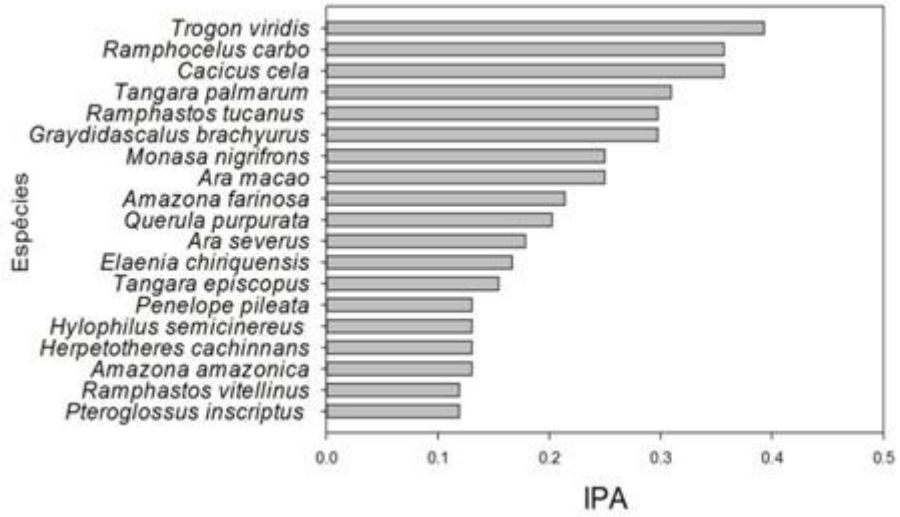

Figure6. *Descending organization of the Abundance Point Indices (IPAs) of the species of birds recorded in the forest fragment of the site I. Altamira, Pará, Brazil*

For site II (Figure 7), the IPA ranged from 2.08 (177 contacts) to 0.01 with only (1 contact). The highest density species recorded at site II were *Coragypsatratus* (IPA 2.08), followed by *Ramphocelus carbo* (IPA 1.11), the others presented density equal to or less than (IPA 0.25).

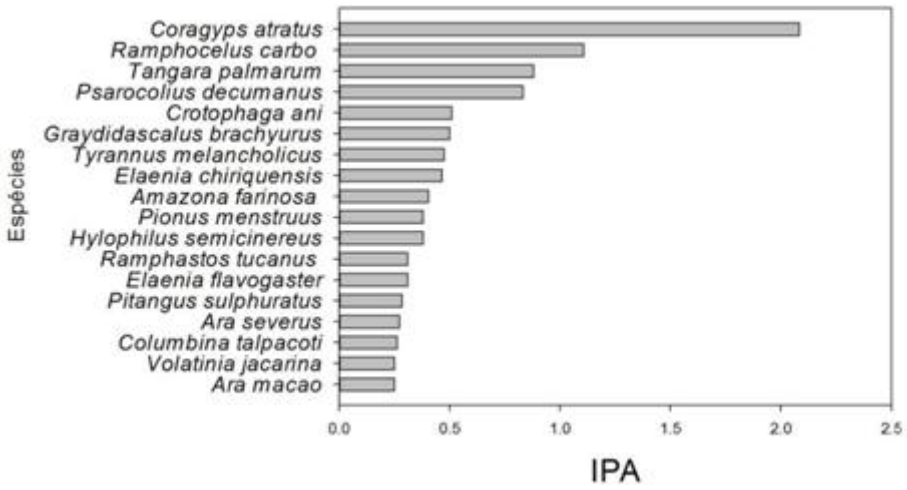

Figure7. *Descending organization of the Point Abundance Indices (IPAs) of the bird species recorded in the forest fragment of site II. Altamira, Pará, Brazil*

Table4. *Birds registered at the two sites studied in the urban perimeter of Altamira Pará, Brazil*

Taxon	**Vernacular Name**	**Ipa 51 Bis**	**Ipa Pedral**	**Distribution**	***Status of Conservationn***
Accipitriformes					
Accipitridae					
Buteo nitidus	gavião-pedrês	_	0.01	R	LC
Elanoides forficatus	gavião-tesoura	_	0.02	R	LC
*Morphons guianensis**	Uiraçu-falso	_	_	R	NT
Rupornis magnirostris	gavião-carijó	_	0.01	R	LC
Cathartiformes					
Cathartidae					
	urubu-de-cabeça-vermelha				
Cathartes aura		0.11	0.13	R	LC
	urubu-da-mata				
Cathartes melambrotus		0.05		R	LC

	urubu-de-cabeça-preta	0.05	2.08	R	LC
Columbiformes					
Columbidae					
Columbina passerina	rolinha-cinzenta	_	0.10	R	LC
Columbina talpacoti	rolinha-roxa	_	0.26	R	LC
Leptotila rufaxilla	juriti-gemedeira	0.01	0.05	R	LC
Patagioenas speciosa	pomba-trocal	_	0.24	R	LC
Coraciiformes					
Alcedinidae					
Chloroceryle amazona	Martim-pescador-verde	0.02	_	R	LC
Cuculiformes					
Cuculidae					
Coccyzus melacoryphus	papa-lagarta-acanelado	0.01	_	R	LC
Crotophaga ani	anu-preto	0.06	0.51	R	LC
Crotophaga major	anu-coroca	0.08	_	R	LC
Piaya cayana	alma-de-gato	0.06	0.02	R	LC
Tapera naevia	saci	_	0.14	R	LC
Falconiformes					
Falconidae					
Herpetotheres cachinnans	acauã	0.13	0.10	R	LC
Ibycter americanus	gralhão	_	0.05	R	LC
Micrastur mirandollei	tanatau	0.01	_	R	LC
*Caracara plancus**	caracará	_	_	R	LC
Galbuliformes					
Bucconidae					
Cheridopteratenebrosa	urubuzinho	_	0,06	R	LC
Monasa morphoeus	chora-chuva-de-cara-	0.08	_	R	LC
Monasa nigrifrons	chora-chuva-preto	0.25	_	R	LC
Notharchus tectus	macuru-pintado	0.04	_	R	LC
Galbulidae					
Galbula dea	ariramba-do-paraíso	0.01	_	R	LC
Galliformes					
Cracidae					
Penelope pileata	jacupiranga	0.13	0.06	R, E	NT
Gruiformes					
Heliornithidae					
Heliornis fulica	picaparra	0.01	_	R	LC
Passeriformes					
Cotingidae					
Querula purpurata	anambé-una	0.01	_	R	LC
Dendrocolaptidae					
Dendroplex picus	arapaçu-de-bico-branco	_	0.04	R	LC
Fringillidae					
Euphonia chlorotica	fim-fim	0.02	0.04	R	LC
Euphonia rufiventris	gaturamo-do-norte	0.07	0.06	R	LC
Hirundinidae					
Stelgidopteryx ruficollis	andorinha-serradora	0.01	0.17	R	LC
Icteridae					
Cacicus cela	xexéu	0.36	0.11	R	LC
Psarocolius decumanus	japu	0.05	0.83	R	LC

Parulidae									
Geothlypis aequinoctialis	pia-cobra	_		0.12		R		LC	
Rhynchocyclidae									
Myiornis ecaudatus									
Thraupidae									
Dacnis cayana	saí-azul	0.02		0.10		R		LC	
Lanioluctuosus	tem-tem-de-dragona-	0.04		_		R		LC	
Ramphocelus carbo	pipira-vermelha	0.36		1.11		R		LC	
Saltator azarae	sabiá-gongá-da-amazônia	_		0.13		R		LC	
Sporophila americana	coleiro-do-norte		_		0.05		R		LC
Sporophila angolensis	curió		0.04		_		R		LC
Sporophila lineola	bigodinho		0.01		_		R		LC
Tachyphonus rufus	pipira-preta		_		0.24	R			LC
Tangara episcopus	sanhaçu-da-amazônia		0.15		0.18	R			LC
Tangara mexicana	saíra-de-bando		0.01		_	R			LC
Tangara palmarum	sanhaçu-do-coqueiro		0.31		0.88	R			LC
Volatinia jacarina	tiziu		_		0.25	R			LC
Tityridae									
Tityra semifasciata	anambé-branco-de-máscara-negra		0.11		_	R		LC	
Troglodytidae									
Troglodytes mmusculus	corruíra	_		0.02		R		LC	
Tyrannidae									
Colonia colonus	viuvinha		0.04		_	R		LC	
Elaenia chiriquensis	chibum		0.17		0.46	R		LC	
Elaenia flavogaster	guaracava-de-barriga-amarela		0.06		0.31	R		LC	
Empidonomus varius	peitica		_		0.02	R		LC	
Legatus leucophaius	bem-te-vi-pirata		_		0.21	R		LC	
Megarynchus pitangua	neinei		_		0.02	R		LC	
Myiodynastes maculatus	bem-te-vi-rajado		_		0.07	R		LC	
Myiozetetes cayanensis	bentevizinho-de-asa-ferrugínea		_		0.01	R		LC	
Phaeomyias murina	bagageiro		_		0.01	R		LC	
Pitangus sulphuratus	bem-te-vi		0.01		0.29	R		LC	
Tyrannus melancholicus	suiriri		0.11		0.48	R		LC	
Vireonidae									
Hylophilus semicinereus	verdinho-da-várzea	0.13		0.38		R		LC	
Piciformes									
Picidae									
Campephilus rubricollis	pica-pau-de-barriga-vermelha		0.04		_	R			LC
Celeus flavus	pica-pau-amarelo		0.01		_	R			LC
Dryocopus lineatus	pica-pau-de-banda-branca		_		0.06	R			LC
Melanerpes cruentatus	benedito-de-testa-vermelha		0.01		_	R			LC
Veniliornis sp.	_		0.01		_	_			LC
Ramphastidae									
	araçari-de-bico-								

Pteroglossus aracari	branco araçari-miudinho-	0.08	0.05	R		LC
Pteroglossus inscriptus	de-bico-riscado	0.12	_	R		LC
Ramphastos tucanus	tucano-grande- de-papo-branco	0.30	0.31	R	LC	
Ramphastos vitellinus	tucano-de-bico- preto	0.12	0.05	R	LC	
Psittaciformes						
Psittacidae						
Amazona amazonica	curica	0.13	_	R		LC
Amazona farinosa	papagaio-moleiro	0.21	0.40	R		LC
Anodorhynchus hyacinthinus	arara-azul-grande	_	0.10	R		EM
Ara chloropterus	arara-vermelha- grande	0.06	_	R		LC
Ara macao	araracanga	0.25	0.25	R		LC
Ara severus	maracanã-guaçu	0.18	0.27	R		LC
Graydidascalus brachyurus	curica-verde	0.30	0.50	R		LC
Pionus menstruus	maitaca-de- cabeça-azul	0.06	0.38	R		LC
Trogoniformes						

3.5. Accumulation Curve

The curve of the collector for the species of both sites was non-stabilized (Figure 8), indicating that the sample hours performed for the aforementioned study were not satisfactory to the point of stabilizing the curve, evidencing that, if they are More sampling times, new records may be available for both sites.

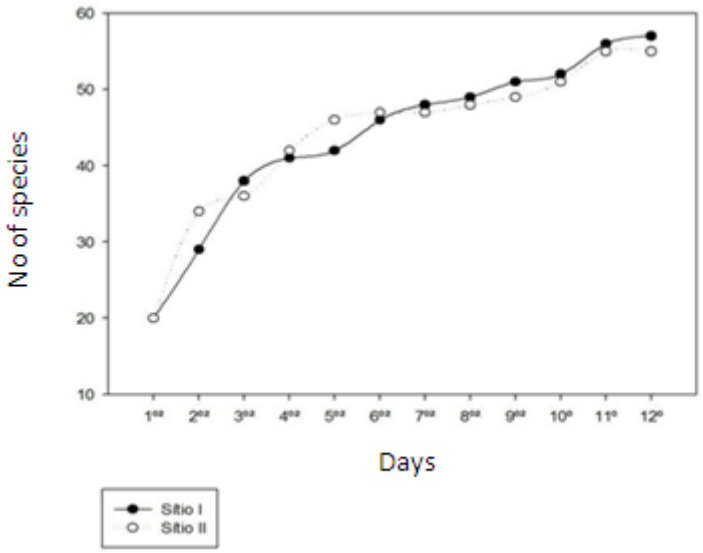

Figure8. *Curve of accumulation of species for two sampling sites north of the municipality of Altamira, Pará, Brazil*

3.6. Registry Fortuitous

The two species recorded by fortuitous registration were *Morphonnusguianensis* (Accipitriformes) for site I and *Caracara plancus* (Falconiformes) for site II.

4. DISCUSSION

The 81 species found in this study, with a sampling effort of 72 hours, represent a greater richness when compared to 49 species observed with a 72-hour effort by [22], in forest fragments in the Atlantic Forest. However, when compared to the data of [23] in Paragominas forest fragments in western Pará, where they found 123 species with only 48 sample hours, our wealth value is lower. Probably because our forest fragments represent a continuum that connects the left bank of the Xingu

River between the remnant of the 51 Bis, the forest area of the airport and part of the Municipal Park of Altamira. Butas indicate the work of [23], the fragments in Paragominas can represent true islands with fauna densification, as already indicated in works with isolated fragments [24]. On the other hand, studies carried out in the Xingu basin indicate relatively high values of species diversity 197 species for Serra do Pardo [7] and 242 for the ecological station Terra do Meio [6], however the methodologies do not are comparable.

Other studies carried out in the State in areas of Ombrophilous forest in the Eastern Amazon point to high diversity of species. For example, [25] reported 263 species, [26] 387 species, [27] 342, [28] 408, and the work of [29] 575 species. However, these studies are based on decades of work and material from different collections in the world, so they are not comparable with our study.

The results obtained in this work indicated that the richest order in number of species was Passeriformes with 53% (35 species). In the studies of [6] 50% of the species were of Passeriformes, whereas in the work of [6] the percentage of Passeriformes decreased. The greater representation in the composition of the order Passeriformes generally preserves the characteristics of the world standard where this order represents 59.1% of the total live birds [30].

In our study the families Thraupidae and Tyrannidae were the richest in number of species, probably indicating the main characteristic of open formation of the region of study. For in a study like that of [6] the families Thamnophilidae, Tyrannidae are the richest.

The similarity between the sites was 42% with respect to the species composition, being considered similar, although the two sites showed differences in the state of conservation of the area. In general, the fact that it belongs to the same riverbank and a little distance can be indicating that the two fragments correspond to the same biogeographic unit.

The constancy of the species in the sites does not draw much attention due to the proximity between the two sampling sites and the fact that the species that presented 100% constancy are species with a wide geographic distribution such as *Coragypsatratus* (Cathartidae) and *Tangarapalmarum* (Thraupidae).

During the survey, it was possible to verify the record of *Penelope pileata* (Cracidae), endemic to Eastern Amazonia, listed in the (almost threatened) category in the [31]. This species was observed seven times in Site I and three times in site II. The preference of the species for the most conserved site can be explained by characteristics of the biology of the species as Sigrist points out in 2013, who indicates that it is a species that has preference for the interior of dense forests.

Anodorhynchushyacinthinus (Psittacidae), also listed in the IUCN [31] quasi-threatened category, was spotted flying over site II three times on different days. In the first registry two individuals flew over the area, for the second record were four individuals and for the third record again two individuals.

The sighting of these two species categorized as almost endangered by the IUCN justifies once again the need to maintain forest remnants in different degrees of disturbance of Site II, as a probable fauna corridor between more conserved areas on the west bank of the Xingu River.

The species *Morphnusguianensis* (Accipritidae) and *Caracara plancus* (Falconidae) were recorded, with only one record.

The species *Morphnusguianensis* is in the category of almost endangered species, according to IUCN (2014). A specimen of the species *Cacaraplancus*was sighted on a palm tree in a pasture area of site II. This species is considered common among open areas, often sighted along roadsides and in areas that have been burned [30].

Although the hawk-shear (*Elanoidesforficatus*) has been a record of the fixed points for both sites, and this is included in the data analysis, it is important to highlight information regarding its classification as regards its distribution to be considered as resident (R) in the list of [17]. There are controversies when compared to some studies, considering this species as migratory [32,33].

The results found in this study are in agreement with other studies carried out in the State of Pará in areas of rainforest in the Eastern Amazon that point to high diversity of species. During the survey it was possible to verify the *Penelope pileata* species (Cracidae), endemic to Eastern Amazonia and listed by the IUCN as species with some degree of threat, which is why it is recommended to conserve forest fragments near the city of Altamira, which function as wildlife corridors.

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