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Breeding and Migrating Birds in an Amazonian Savanna

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Abstract

Seasonal occurrence, breeding and migration records are presented for about 150 species of birds, monitored during a four years survey in an Amazonian savanna near Alter do Chão, Pará state, Brazil, by means of mist netting and observations along transects and on random walks. About half of the recorded species were Passeriformes. The local avifauna was mostly comprised of residents, with major breeding activities during the dry season, August through February. Thirteen non-resident species were classified as migrants which is considered a rather small fraction. Calculations of the total number of species expected to occur at the study site are presented. The composition of this savanna bird community is discussed under aspects of seasonality and migrational activity. The data are compared with records from other cerrado habitats in Amazonia and elsewhere, especially in Central Brazil.

Resumo

Registros de ocorrência sazonal, reprodução e migração são apresentados para cerca de 150 espécies de aves, monitoradas durante quatro anos de levantamentos em uma savana Amazônica perto de Alter do Chão, Estado do Pará, Brasil, através de redes ornitológicas, observações ao longo de transectos e caminhadas ao acaso. Perto da metade das espécies registradas foram passeriformes. A avifauna local foi constituída principalmente de espécies residentes, com o pico de atividades reprodutivas durante a estação seca, ou seja 80% das espécies reproduzindo de Agosto até Fevereiro. Este padrão se repetiu em 1988 e 1989. Juvenis foram capturados durante todo o ano com picos durante a estação chuvosa. Treze espécies não residentes foram consideradas migrantes os quais são uma pequena fração da comunidade. Estimativas do número total esperado de espécies ocorrendo na área de estudo são apresentados. As capturas com redes ornitológicas em 4 ha resultaram em 41 espécies e para 13 ha, 64 espécies. Quando a área amostrada foi duplicada para 24 ha, o número de espécies aumentou em somente 4 e correspondeu à metade do total registrado para a área. O número assintótico estimado para 13 ha foi de 82 espécies o qual foi similar ao número estimado para 24 ha (80 espécies). A composição desta comunidade de aves de savana é discutida sob os aspectos de sasonalidade e atividades migratórias. Os resultados são comparados com registros de outros habitats de cerrado na Amazônia e outros locais especialmente no Brasil central.

Keywords: Bird community, savanna, cerrado, seasonal breeding, migration records, Amazonia, Brazil.

Introduction

Brazilian birds attracted numerous observers dating back more than 100 years. The accumulated knowledge was presented by Pelzen (1871), Pinto (1947, 1966), Novaes (1974, 1978) and Sick (1997) who also undertook several expeditions into, at that time, unexplored regions of Amazonia. This immense biome is not only comprised of tropical rain forests, but also of intermittent patches of Amazonian savanna (Huber, 1982), a special type of cerrado occurring in varying size in the Brazilian part of the basin (Prance & Lovejoy, 1985). These habitats are characterized by a vegetation differing in many species from the cerrados in central Brazil (Sanaiotti et al., 1997) which also have special soils and climate (Eiten, 1978). Tree diversity in Amazonian savannas is much lower (Sanaiotti et al., 1997) than in the cerrados of central Brazil (Eiten, 1972, 1978). The reasons for the paucity of species in these areas are not clear. Effects of a perched high water-table have been suggested (Sarmiento & Monasterio, 1975). The avifauna of Amazonian savannas has

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not been studied intensively though some early records include respective data (Riker & Chapman, 1891; Hellmayr, 1907; Pinto, 1947), and a number of observations was published more recently (Moskovits et al., 1985; Forrester, 1993; Cintra, 1997; Silva et al., 1997).

About 20% of Brazil are covered with cerrado habitats. Most of the studies on cerrado birds concentrated in southeastern regions (Negret et al., 1984; Cintra, 1988; Cintra & Yamashita, 1990; Cavalcanti & Pimentel, 1988; Silva, 1995). On the central plateau the cerrados are used as resting places by migrating birds (Negret & Negret, 1981), an important aspect yet not considered in the few ornithological studies on Amazonian savannas. The data presented here were obtained in a four years field survey carried out in the lower Amazon region. Breeding activity as well as migration were recorded for about 150 bird species.

Materials and methods

Study site

The study site was a peninsula, approximately 3 km long and 1–2 km wide, on the right margin of the Tapajós River, near the village of Alter do Chão (2°31′S, 55°00′W) in the state of Pará, Brazil. The site is situated at about the center of a much larger savanna area surrounded by deciduous forests. There are four more cerrado areas in Pará but none are located close to the study site (Fig. 1).

The region has a distinct dry season, July to December, and a rainy period, January to June, with most of the annual rainfall of about 2200 mm (mean from 1985 to 1992). The soil is sandy with patches of clay in some areas. The vegetation of the study area is mainly herbaceous, with *Paspalum carinatum* as the dominating grass, interspersed with small patches of trees and shrubs. Miranda (1993) recorded 19 tree species with the most abundant being *Qualea grandiflora*, *Salvertia convallariodora*, *Lafoensia densiflora*, and *Byrsonima crassifolia*. Within the study area, several 'islands' of deciduous forest sized 2–130 ha are found.

Monitoring

Birds were recorded September 1986 through July 1989 throughout the year by (a) capture and recapture using mist nets; (b) walking on 22 parallel transects varying in length between 350 to 800 m and 100 m apart; and (c) random walks covering the entire study area. We used binoculars (Zeiss 8x30) and a spotting scope (Nikon 20–30x) to identify free-ranging birds. Between July 1986 and July 1989, nylon mist nets 12 m long by 2.3 m high and 36 mm mesh, were erected in continuous lines, with the bottom of the lower shelf touching the ground. The nets were usually opened from 06:00 to 09:00 and from 15:30 to 18:00 h. The number of mist nets used, number of capture days per month, and the size of the area sampled varied between months and years (Table 1). June 1986 through August 1988 we ran the mist nets during eight consecutive days, changing the net line position every second day in order to form a grid. However, in December 1988 and January 1989, a single net line at one site only was used. January through July 1989, we changed the net line position again every month in order to form a grid.

To determine the seasonal patterns of reproductive activity, indications of breeding from each of the 3 methods used to record birds were used. During the mist netting, we noted brood patches and estimated age classes for all birds caught.

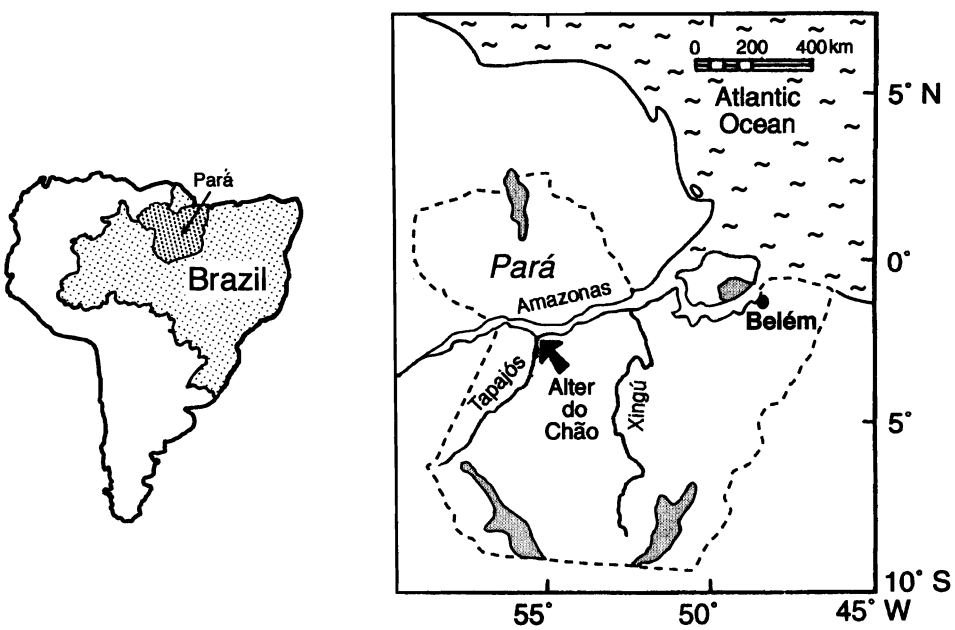

Fig. 1. Location of the study site near Alter do Chão and of other Amazonian savanna areas (cerrados) in the state of Pará, Brazil.

Table 1. Capture effort of mist netting for birds in the Amazonian savanna of Alter do Chão.

Netting period	Jun 86–July 87	Sep 87–Aug 88	Dec 88	Jan 89	Feb 89–Jul 87
No. of months	6	6	1	1	3
No. of days/month	8	8	1	1	1
Netting area (ha)	4	13	18	21	24
Accumulated time (h)	1750	2840	112	110	412

During the transects and random observations, we noted breeding behavior, nesting attempts and young accompanying adults.

Species of which the birds were observed exclusively on the beach/savanna border, forest/savanna or flying over the area, were included in the list but not in the analysis. The classification of migrants followed Sick (1985). We used the nomenclature of Meyer de Schauensee (1970) throughout.

Data analysis

To estimate the number of species against the area sampled, we used the following equation resulting from an asymptotic maximum

$$N = -\frac{K \times S}{(a+S)}$$

with N = number of species of which birds were captured in the nets, K = asymptotic value or maximum number of species catchable in a given area, S = size of area sampled in ha, and a = constant.

Results

A total of 144 bird species of 35 families was recorded, half of which were passeriforms (Table 2). Three families contributed the highest numbers of species, Tyrannidae 17.4%, Trochilidae 7.6% and Thraupidae 6.3%. Specimens of 73 species were captured in mist nets, mostly small birds. Of large birds, exceptionally one hawk, *Buteo magnirostris*, and one tinamou, *Crypturellus parvirostris*, were caught.

Netting 4 ha resulted in a record of 41 species, and that for 13 ha of 64 species. However, although we subsequently almost doubled the sampled area to 24 ha, the number of species increased only by 4. The accumulated number of species caught in 24 ha corresponded to 50% of the total record for the study area. The asymptotic number of species estimated for 13 ha was 80 and, very similar, for 24 ha 82 species.

Twenty-five percent of all species occurred only at the forest/savanna border, 5.9% in the beach/savanna border, and birds of 3 species were only observed flying over the area. Altogether these observations represent 1/3 of the total species record. The remaining 2/3 were recorded exclusively in the savanna (Table 2).

Birds of 49 species were found in some stage of reproductive activity (Table 3). Eighty percent of them were breeding between August and February. For most of the typical savanna species the dry season was the time of nesting. This pattern was observed in all years of our study period (Fig. 2a, b). Young birds were captured throughout the year with peaks during the rainy season (Fig. 2c). At least 13 of the monitored species were non-residents in the study area and are considered migrants. Seven of them, *Piranga flava*, *Pandion haliaetus*, *Sirystes sibilator*, *Myiarchus swainsonii*, *Stelgidopteryx ruficollis*, *Falco femoralis* and *Dendroica striata*, were present between May and November (Fig. 3). We never found individuals of these species reproducing in the area. Six species, *Elaenia parvirostris*, *Hirundo rustica*, *Ictinea plumbea*, *Herpetotheres cachinnans*, *Tersina viridis* and *Tyrannus savana*, were recorded only during the rainy season, January to June.

Discussion

Monitoring efficiency

The use of mist nets did not markedly increase the number of species above that recorded by transect observations: only 2 species were recorded exclusively with mist nets. However, nearly all data on reproductive activity were dependent on mist net captures. An area of 13 ha seems adequate to recognize most of the savanna bird species in our study area because, when increasing the size of the area to 24 ha, the number of species rose by 4 only.

Is there an avifauna specific for Amazonian savannas?

We monitored 144 species of birds at Alter do Chão which included 85 of those recorded in various habitats of Maracá Island, Roraima state (Moskovits et al., 1985); the authors listed 99 species for this dry savanna of which only 38 were observed in our study area. Silva et al. (1997) found 179 species in an Amazonian savanna of Amapá (Embrapa Experimental Field Station), including 70 species recorded also in our study area. For the state of Roraima, Stotz (1997) listed 492 bird species observed in many habitas including savannas of which 106 are common to Alter do Chão. Seventy nine of the about 150 species known from the Venezuelan llanos (Thomas, 1979) also occur at

Table 2. Bird species monitored in the Amazonian savanna of Alter do Chão, Pará state, Brazil. The terms 'common' and 'rare' are subjective and are not resulting from population dynamic studies. 'Rare' means that birds were observed few times and or in small numbers only, 'Common' means that birds were observed many times, alone, in small or large groups.

Taxa	Abundance		Occurrence Season	Habitat
	Common	Rare		
TINAMIDAE				
Crypturellus parvirostris	+		always	savanna, ecotone
Crypturellus undulatus	+		always	savanna, ecotone
ARDEIDAE				
Bubulcus ibis		+	May	savanna
ANATIDAE				
Dendrocygna autumnalis		+	October	savanna
CATHARTIDAE				
Coragyps atratus	+		always	ecotone
Cathartes aura	+		always	savanna
Cathartes melambrotus	+		always	soaring
ACCIPTRIDAE				
Gampsonyx swainsonii		+	always	savanna
Elanoides forficatus		+	April	soaring
Ictinea plumbea		+	March–July	savanna
Harpagus bidentatus		+	August	savanna
Accipter striatus		+	November	savanna
Buteo albicaudatus		+	January–May	savanna
Buteo albonotatus		+	Jan, May, Sep	savanna
Buteo magnirostris	+		always	savanna, ecotone
Buteo nitidus		+	July	savanna
Busarellus nigricollis		+	always	savanna, beach/savanna
Buteogallus urubitinga		+	March	beach/savanna
PANDIONIDAE				
Pandion haliaetus	+		August–May	soaring
FALCONIDAE				
Herpetotheres cachinnans		+	January–May	savanna, ecotone
Milvago chimachima	+		always	savanna, ecotone
Falco rufigularis		+	Mar–May	savanna, ecotone
Falco femoralis		+	July	savanna
Falco peregrinus		+	Oct-Nov	savanna
CRACIDAE				
Ortalis ruficeps		+	always	ecotone
Penelope superciliaris		+	always	ecotone
COLUMBIDAE				
Columba cayennensis	+		always	savanna, ecotone
Columba speciosa		+	November	savanna
Zenaida auriculata	+		always	savanna
Columbina passerina	+		always	savanna, ecotone
Claravis pretiosa	+		always	savanna, ecotone
Leptotila rufaxilla	+		always	savanna, ecotone
Geotrygon montana		+	February–August	ecotone
PSITTACIDAE				
Ara chloroptera		+	March	soaring
Aratinga aurea	+		always	savanna
Brotogeris versicolurus		+	July	soaring
Pionus menstruus	+		always	ecotone, soaring
CUCULIDAE				
Coccyzus melacoryphus		+	July–April	savanna
Piaya cayana	+		always	savanna, ecotone
Crotophaga ani		+	October–May	savanna
Crotophaga major	+		always	beach/savanna
STRIGIDAE				
Otus choliba		+	always	savanna
Asio stygius		+	always	savanna
NYCTIBIIDAE				
Nyctibius grandis		+	always	ecotone
Nyctibius griseus		+	July	ecotone
CAPRIMULGIDAE				
Chordeiles acutipennis	+		always	savanna

Table 2. *cont.*

Taxa	Abundance		Occurrence Season	Habitat
	Common	Rare		
Caprimulgus rufus		+	always	ecotone, beach/savanna
Hydropsalis brasiliana	+		always	savanna, beach/savanna
TROCHILIDAE				
Glaucis hirsuta		+	December	savanna
Phaethornis superciliosus	+		July–February	savanna
Phaethornis longuemareus		+	Sep–Oct	ecotone
Eupetomena macroura	+		always	savanna
Anthracothorax nigricollis	+		always	savanna
Lophornis ornatus		+	February	savanna
Chlorestes notatus		+	September	savanna
Thalurania furcata		+	November–May	savanna
Hylocharis sapphirina		+	March–May	savanna
Polytmus theresiae	+		always	savanna
Amazilia fimbriata	+		always	savanna
TROGONIDAE				
Trogon viridis	+		always	savanna, ecotone
ALCEDINIDAE				
Chloroceryle amazona		+	May	beach/savanna
Chloroceryle americana		+	May	beach/savanna
Chloroceryle aenea		+	June	beach/savanna
BUCCONIDAE				
Notharchus tectus		+	always	savanna, ecotone
Nystalus maculatus	+		always	savanna
Chelidoptera tenebrosa	+		always	savanna, ecotone, beach/savanna
RAMPHASTIDAE				
Pteroglossus aracari	+		August–February	savanna
Pteroglossus inscriptus	+		always	ecotone
Ramphastos vitellinus	+		always	ecotone
PICIDAE				
Colaptes melanochloros		+	always	savanna
Piculus flavigula		+	June–August	ecotone
Celeus elegans		+	Sep–October	ecotone
Dryocopus lineatus		+	June–August	ecotone
Campephilus melanoleucos	+		always	savanna
DENDROCOLAPTIDAE				
Dendrocincla merula		+	July–November	ecotone
Xiphorhynchus picus	+		always	ecotone
Xiphorhynchus guttatus	+		always	ecotone
Lepidocolaptes angustirostris	+		always	savanna, ecotone
FORMICARIIDAE				
Formicivora grisea	+		always	savanna, ecotone
Formicivora rufa	+		always	savanna, ecotone
COTINGIDAE				
Pachyramphus polychopterus		+	Sep–October	ecotone
Tityra inquisitor		+	always	ecotone
Gymnoderus foetidus		+	April	soaring
PIPRIDAE				
Chiroxiphia pareola		+	always	ecotone
Manacus manacus	+		always	ecotone
Neopelma pallescens		+	always	ecotone
TYRANNIDAE				
Sirystes sibilator		+	June–February	savanna
Tyrannus melancholicus	+		always	savanna, ecotone, beach/savanna
Tyrannus albogularis	+		always	savanna, ecotone, beach/savanna
Tyrannus savana		+	February–October	savanna, ecotone, beach/savanna
Tyrannopsis sulphurea		+	Jan–Nov	savanna
Empidonomus varius	+		always	savanna, ecotone, beach/savanna
Legatus leucophaius		+	Sep–Feb	ecotone
Megarynchus pitangua	+		always	savanna, ecotone, beach/savanna
Myiodynastes maculatus		+	always	savanna, ecotone
Myiozetetes cayanensis	+		always	ecotone, beach/savanna

Table 2. *cont.*

Taxa	Abundance		Occurrence Season	Habitat
	Common	Rare		
Pitangus sulphuratus	+		always	savanna, ecotone, beach/savanna
Myiarchus ferox	+		always	savanna, ecotone
Myiarchus tyrannulus	+		always	savanna, ecotone
Myiarchus swainsoni		+	July–October	savanna, ecotone
Tolmomyias flaviventris		+	always	ecotone
Todirostrum cinereum		+	always	ecotone
Hemitriccus striaticollis	+		always	ecotone
Elaenia flavogaster	+		always	savanna, ecotone, beach/savanna
Elaenia parvirostris		+	always	savanna, ecotone
Elaenia cristata	+		always	savanna, ecotone, beach/savanna
Elaenia chiriquensis	+		always	savanna, ecotone, beach/savanna
Myiopagis gaimardii		+	always	ecotone
Suiriri suiriri	+		always	savanna, ecotone, beach/savanna
Phaeomyias murina	+		always	ecotone
Camptostoma obsoletum		+	always	savanna, ecotone
Tyrannulus elatus		+	August–Dec	ecotone
HIRUNDINIDAE				
Tachycineta albiventer	+		always	beach/savanna
Phaeoprogne tapera	+		always	beach/savanna
Stelgidopteryx ruficollis	+		July–November	beach/savanna
Hirundo rustica	+		always	beach/savanna
TROGLODYTIDAE				
Thryothorus leucotis	+		always	ecotone
Troglodytes aedon		+	always	savanna
TURDIDAE				
Turdus leucomelas	+		always	savanna, ecotone
VIREONIDAE				
Cyclarhis gujanensis	+		always	savanna, ecotone, beach/savanna
Vireo olivaceus	+		always	ecotone
Hylophilus pectoralis	+		always	ecotone
ICTERIDAE				
Scaphidura oryzivora	+		always	beach/savanna
Psarocolius decumanus	+		always	ecotone
Cacicus cela	+		always	ecotone
Icterus spp.		+	April	beach/savanna
Leistes militaris		+	September	savanna, beach/savanna
PARULIDAE				
Dendroica striata		+	July	savanna
COEREBIDAE				
Cyanerpes cyaneus		+	always	savanna, ecotone
Dacnis cayana	+		always	savanna, ecotone
TERSINIDAE				
Tersina viridis		+	June–September	savanna
THRAUPIDAE				
Euphonia chlorotica	+		always	savanna, ecotone
Tangara mexicana		+	September	ecotone
Tangara cayana	+		always	savanna, ecotone, beach/savanna
Thraupis episcopus	+		always	savanna, ecotone, beach/savanna
Ramphocelus carbo	+		always	ecotone
Piranga flava		+	July–October	savanna
Tachyphonus rufus		+	always	savanna, ecotone
Nemosia pileata		+	always	savanna, ecotone
Schistochlamys melanopis	+		always	savanna, ecotone
FRINGILLIDAE				
Paroaria gularis	+		always	ecotone, beach/savanna
Volatinia jacarina		+	February–June	savanna, beach/savanna
Oryzoborus angolensis		+	May	savanna
Ammodramus humeralis	+		always	savanna, ecotone

Table 3. Breeding bird records from 1986 to 1989 in the Amazonian savanna of Alter do Chão, Pará, Brazil.

	Carrying nest material	Showing brood patch	Juvenile captured in the nets	Symetric moults	Active nest	Adults feeding fledgling	Juvenile observed perched
Columbina passerina			Ja, Fe	Ja, Ap, Au	Ja, Ju, Au, Se, No, De	Se	
Leptotila rufaxilla	Ja, Fe						
Crotophaga major	Oc						
Chordeiles acutipennis		Se, De	Fe	De	Au, Se, No, De		
Hydropsalis brasiliana			Fe, Ap, Ju, Oc, De	De, Fe, Ap, Ju	Se, Oc, No		No
Phaethornis superciliosus			Ap	Au			
Eupetomena macroura		Se		Se			
Anthracothorax nigricollis			De	Se			
Polytmus theresiae			Fe	Ma			
Nystalus maculatus		De	Fe, Ma, Se	Fe, Ma, Ap, Ju, Se, Oc			
Chelidoptera tenebrosa						Jl	
Xiphorhynchus picus			Fe	Ap, Ju			
Lepidocolaptes angustirostris		Ap, No	Fe, De	Fe, Ap, Ma, Ju			
Formicivora grisea	My	Fe, Ap, Ju, De	Ja, Fe, Ju, Se	Ja, Ap, Ju, Se			
Formicivora rufa		Fe, Ma , Ju, De	De, Ja, Fe, Ma, Ap, Ju, Jl				
Chiroxiphia pareola		Ja	Ap, Jl				
Manacus manacus		Ja, Ap	Ju, Au, Se				
Tyrannus melancholicus		Fe, Ap, Se	Ja, Fe	Fe, Ap	Fe		Ja, Fe
Tyrannus albogularis			Ja, Fe, Ma	Ju	No		Ja
Empidonomus varius		Se, De	Fe		Oc		
Megarynchus pitangua	Oc	Ma		Ma			
Myiodynastes maculatus	Se	Fe, Au	Fe				
Myiozetetes cayanensis					Oc, Fe		
Pitangus sulphuratus			Ja		Oc, Ja, Fe, Ma		Fe
Myiarchus ferox		Se, De					
Myiarchus tyrannulus		Se, Oc, De		Ja, Se	Oc		Fe
Elaenia flavogaster		Au, Se, De, Fe, Ap	Ma	Ja, Fe, Ju			
Elaenia cristata		Au, Se, Oc, De, Fe, Ap	Ja, Fe, Ma, Ap, Ju, Se, De	Ja, Fe, Ma, Ap, Mo, Ju, Au, Se	No, Fe, Ma		
Elaenia chiriquensis		Fe, Ap, Se, Oc, De	Ja, Fe, Ma, My, Ju	Fe, Ap, Ju			
Neopelma pallescens			Au				
Hemitriccus striaticollis		Au, De					
Phaeomyias murina				Au			
Suiriri suiriri		Ju, Au	De, Fe, Ju, Jl				Ja
Camptostoma obsoletum			Se				
Thryothorus leucotis				Ap, My			
Troglodytes aedon			De, Ja				
Turdus leucomelas		Ma, Se	Fe	Ap, Ju	Ja, Fe		Ja
Cyclarhis gujanensis		Fe, Ju, Au	Fe, Ju	Ju, Au, Se			
Vireo olivaceus			Fe, Au, De	Au			
Hylophilus pectoralis			Se, De, Fe	Ap, Se			
Psarocolius decumanus					Se, No		
Euphonia chlorotica			Fe		Oc		
Tangara cayana		Fe, Ap, Oc, De	Fe, Au	Ja, Fe, Ap, My, Se, De	Fe		
Thraupis episcopus		De		Ma, Ju	Ma		
Ramphocelus carbo			Fe				
Schistochlamys melanopis		Ap	Ma, Au	Fe, Ju	Fe		Ja, Se
Paroaria gularis	Oc		Fe		Fe		
Volatinia jacarina			Fe				
Ammodramus humeralis			No, Fe, Ma, Ap, Ju, Au	Fe, Ap, My, Ju, Au, Se	Ma, Ap		Ja, Fe

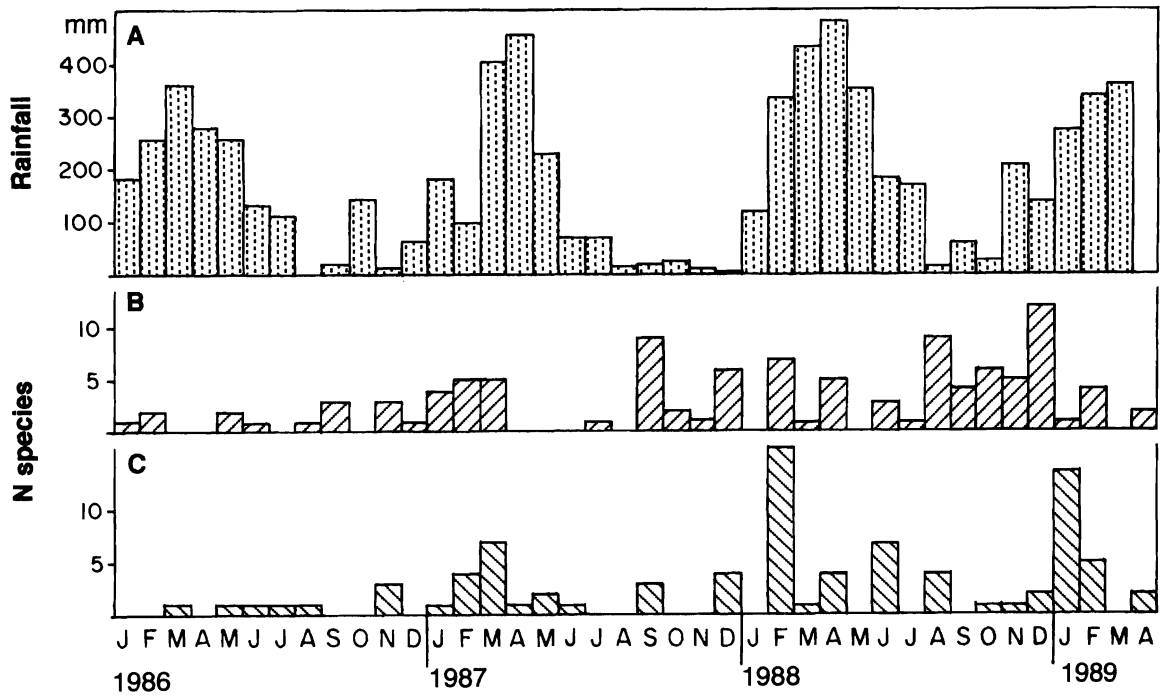

Fig. 2. Relation between precipitation (A) and reproductive activity of the birds (B, C) in an Amazonian savanna near Alter do Chão. (B) breeding or nesting behavior or young following adults with brood patches; (C) young caught in mist nets.

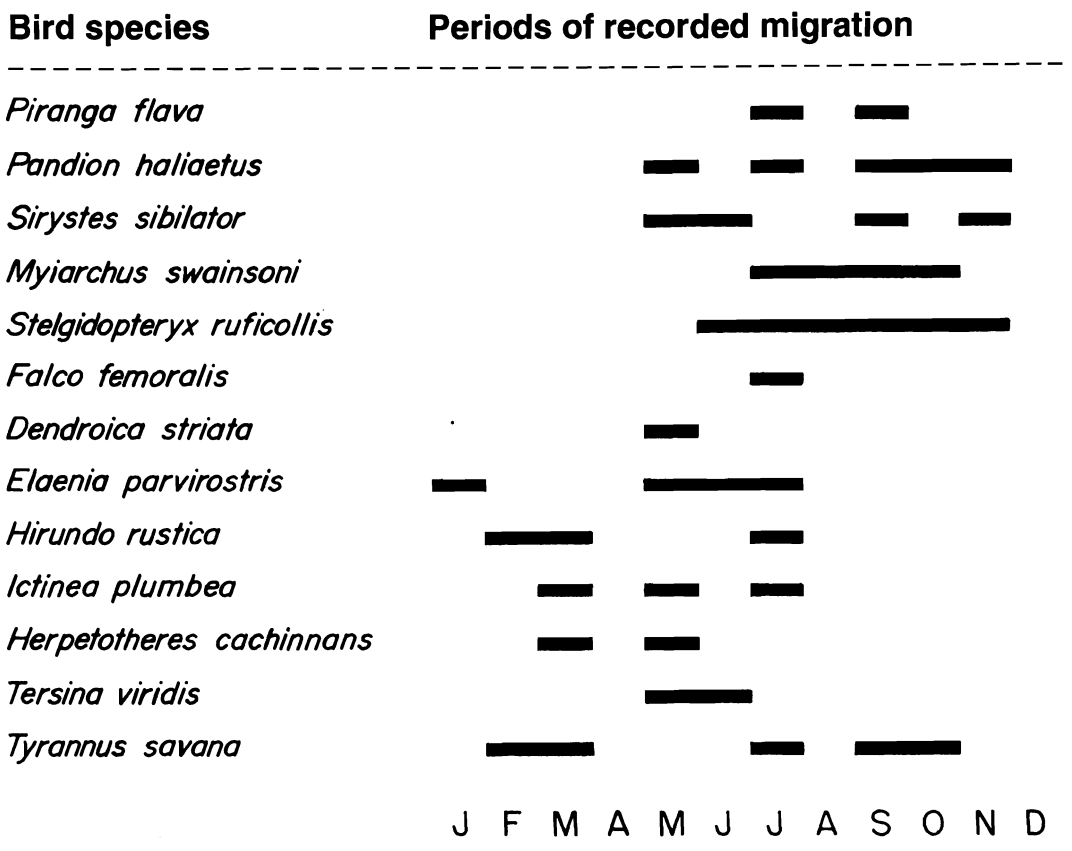

Fig. 3. Bird species of which, during different periods, migrating individuals were recorded in an Amazonian savanna near Alter do Chão.

Alter do Chão. In spite of quite a number of bird species common to several savanna areas in Amazonia, there are pronounced regional differences in the community structures. This may be due in part to the local vegetation cover. Therefore, an avifauna common to all Amazonian savannas cannot be defined.

Breeding period

Of the 49 species for which we obtained data on breeding activity, 77% reproduced between August and December. The highest production of fruit in the savanna of Alter do Chão occurs between December and February (Miranda, 1993; Sanaiotti & Magnusson, 1995) which is also the period of highest availability of insects (Francisco et al., 1995). Hence the time of reproduction of savanna birds, September to December, may be used by most of the species because it is advantageous for the parents to have their young become independent when food availability is highest.

Bird migration

We classified as migrant species those 10% which were most of the time absent from the study area. In cerrados of central Brazil, 16% of the species were found to be migrants (Negret et al., 1984). This, however, depends on the species-specific migration behavior. At our study site, *P. haliaetus* and *D. striata*, species reproducing in North America, were present May through November. *H. rustica* and *I. plumbea* were observed during the rainy season, February through July. In central Brazil, the majority of bird species also spends the rainy season, when insects are more abundant, in the cerrado regions (Negret & Negret, 1981). Studies in a Panamanian savanna (Howe & De Steven, 1979) showed that the migration period of many birds is synchronized with the fruiting time.

Savanna habitats as resting places for migrants

The Amazonian savanna is also an important stopover place for birds which migrate regionally. *M. swainsoni*, *P. flava* and *E. parvirostris* were monitored at Alter do Chão only during three months of the year. Although these species are also migratory in central Brazil (R. Cavalcanti, pers. comm.), we did not capture any banded individual from other regions. *Myiodynastes maculatus*, *V. olivaceus* and *S. sibilator* have been cited as migrants (Sick, 1985; Meyer de Schauensee, 1970). Negret & Negret (1981) mentioned *Chordeiles acutipennis*, *Tyrannus melancholicus* and *E. varius* to be migrants in the central plateau of Brazil, but their respective populations at Alter do Chão appeared to be resident. The number of species monitored by us did not vary by month, probably due to the high proportion of residents and to the flux of migrants throughout the year. Therefore, our data do not allow to draw any conclusion on bird migrations within Amazonia.

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