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AVIFAUNAL COMPOSITION, SPECIES RICHNESS, AND STATUS IN THE TIBAGI RIVER BASIN, PARANA STATE, SOUTHERN BRAZIL

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Resumo. A bacia do rio Tibagi cobre uma área de 24,530 km² no Estado do Paraná, sul do Brasil. O objetivo deste estudo é fornecer uma análise inicial da riqueza específica, do status e da distribuição nos habitats das aves na bacia do rio Tibagi. Foram avaliados dados de 19 localidades. Um mosaico de 8 habitats podem ser identificados: floresta, borda de floresta, capoeira, campo seco, campo úmido, banhado, ambiente aquático e cerrado. Um total de 476 espécies foram registradas: 201 não-passeriformes, 151 passeriformes suboscines e 124 passeriformes oscines. O mais rico habitat em número de espécies foi floresta (235), seguido por borda de floresta (217), capoeira (180), banhado (71), campo seco (65), campo úmido (57), cerrado (39) e ambiente aquático (56). Suboscines foram estreitamente relacionados à floresta, mais que não-passeriformes e oscines os quais foram relacionados à capoeira, à borda de floresta e às áreas abertas. Ocorrem dois tipos de floresta na bacia do rio Tibagi: a floresta estacional semidecidual no norte, de clima mais quente, e a floresta ombrófila mista no sul, de clima mais frio. O número de espécies de aves nestes dois tipos de floresta foi similar. Entretanto, a composição da avifauna foi um tanto diferente (índice de Sørenson: 0,70). A relativamente constante oferta de alimento na floresta estacional semidecidual favoreceu a presença de grandes frugívoros como, por exemplo, Psittacidae e Ramphastidae, enquanto que a sazonalidade na oferta de alimento na floresta ombrófila mista favoreceu a ocorrência de pequenas aves insetívoras como Furnariidae e alguns Dendrocolaptidae.

Abstract. The Tibagi River Basin (TRB) in Paraná state, southern Brazil, covers an area of 24,530 km². The goal of this study is an initial analysis of avian species richness, status, and distribution based on their habitats at 19 localities in the TRB. The vegetation mosaic consists of 8 habitats: forest, forest edge, scrub, grassland, wetland, marshland, *cerrado*, and lakes. Of the 476 bird species recorded in the TRB, 201 are non-passerines, 151 are suboscine passerines, and 124 are oscine passerines. The habitat supporting the greatest number of bird species is the forest (235), followed by edge (217), and scrub (180), while marshland (71), grassland (65), wetland (57), lakes (56), and *cerrado* (39) each have fewer species. Suboscines were closely tied ecologically to forests, more so than non-passerines and than oscines, which were more closely associated with scrub, edge, and open areas. Two forest types occur in the TRB: seasonal semideciduous forest in the warmer north, and mixed temperate rain forest with closed canopy in the cooler center and south. Although the numbers of bird species in these two forest types were similar, their avifaunal composition was rather different (Sørenson index: 0.70). The relatively constant food supply in the seasonal semideciduous forest favored the presence of large frugivores, e.g., Psittacidae and Ramphastidae, while the seasonality of food supply in the mixed temperate rain forests favored instead the occurrence of small insectivorous birds like Furnariidae and some Dendrocolaptidae. *Accepted 25 June 1997.*

Key words: Tibagi River Basin, Paraná, southern Brazil, avifauna, species richness, status, habitat distribution.

INTRODUCTION

In the northern hemisphere birds have been regarded as biological indicators of environmental quality in various management programs (e.g., Morrison 1986, Jenjins 1988). Unfortunately, given the fact that much of the natural environment of South America has been greatly disturbed by man's activities, this useful conservation tool is often rendered ineffective by our poor knowledge of the Neotropical avifauna. For example, there have been very few studies of local species richness (Haffer 1990, Vielliard & Silva 1990), while distribution of species according to habitat, an important piece of information in any conservation strategy (Bernstein *et al.* 1991), remains little evaluated. The natural environment of southern Brazil (the states of Paraná, Santa Catarina, and Rio Grande do Sul, compris-

ing a total area of 577,214 km²) has been so altered by man that only a few patches of natural vegetation remain, the majority of them near the coast, except for the Iguaçu National Park (7260 km²), which contains the Iguaçu Falls. The natural forest cover of Paraná state has declined dramatically from 84 % of 199 709 km²) in 1930 (Maack 1981) to 5 % in 1979 (Ipardes 1982).

The purpose of this paper is an initial analysis of avian species richness and distribution according to habitat in the Tibagi River Basin (TRB) to provide data for a conservation program.

There is published information on bird distribution from the central and southern TRB regions. This knowledge comes from the expeditions of Johann Natterer at the beginning of the 19th century (Straube 1993), and of Tadeusz Chrostowski and Tadeusz Jaczewski in the early 20th century (Sztolcman 1926), which passed through the TRB. Recent data can be found in Berndt (1992), Scherer-Neto *et al.* (1992), and Anjos & Graf (1993). Only one study in the northern part of the basin, that of Westcott (1980), has been made. He published a list of non-passerine birds of the urban area of Londrina city (4500 ha). Westcott also carried out observations in the Mata dos Godoy State Park (656 ha), but he died before he could publish them.

DESCRIPTION OF THE TIBAGI RIVER BASIN

The TRB covers an area of 24,530 km²) in Paraná state, southern Brazil (Fig. 1). The river has a total length of 550 km. From its source at Santa Rita Farm in the south of Paraná (25°15'S, 49°55'W) to its confluence in the north with the Parapanema River (22°50'S, 51°00'W), the Tibagi River decreases in altitude from 1150 m to 335 m. The altitudinal difference creates a relatively high water velocity in certain parts of the river system (up to 3.2 m/s). The water volume is normally fairly stable (c. 230 to 330 $m^3 \times s^{-1}$) during the year. The TRB is a large hydrographic network consisting of 65 direct tributaries and nearly 1200 smaller streams (Maack 1981, Instituto de Terras Cartografia e Florestas 1987). According to altitude, the TRB can be subdivided into three distinct zones: the Upper Tibagi (UT), 1150—800 m, in the south (Ponta Grossa city, 952 m), the Middle Tibagi (MT), 800—600 m, (Telêmaco Borba, 729 m), and the Lower Tibagi (LT), 600—300 m, in the north (Londrina city, 610 m) (Fig. 1).

Over the year the temperature is normally higher in the northern, lower part of the basin than in the southern, higher region (Fig. 1). In the south, annual rainfall averages 1400 mm, in the north only 1200 mm. The highest altitude is about 1300 m in the central eastern region, the lowest about 300 m at the mouth of the river (Fig. 2). Most of the basin's soils are of Permian origin; however, the northern region is younger (Jurassic and Cretaceous) than the east-central and south-eastern regions (Ordovician, Cambrian, and Devonian).

VEGETATION DESCRIPTION

The vegetation mosaic in the TRB consists of 8 habitats: forest, forest edge (thereafter named edge), scrub, grassland, wetland, marshland, *cerrado*, and lakes (Figs. 2, 3, 4, and 5).

Forest. Forest is the principal vegetation type in the basin and originally covered approximately 70 % of the total area (Fig. 2). Today this habitat is so reduced in extent that less than 3 % of the basin contains natural forest, arable land and pastural agriculture being the principal land use. Two forest types can be found in the basin: mixed temperate rain forest in the south and seasonal semideciduous forest in the north. The tallest tree species in these forests are very important for their habitat classification: *Araucaria angustifolia* (Araucariaceae) in the mixed temperate rain forest, and *Aspidosperma polyneuron* (Lauraceae) in the semideciduous forest.

Edge. Forest edge is the typical habitat of many bird species. In the east-central and south-eastern regions, small sparse patches of mixed temperate rain forest exist in grassland. When we refer to edge we have in mind mostly the borders of these patches.

Scrub. This habitat is composed of vegetation in varying stages of succession. Like edge it also occurs at the forest boundary but has a quite different vegetation structure, mainly bushes and small trees. We also considered as scrub disturbed forest where secondary succession is in progress.

Grassland/Wetland. Both of these habitats, con-

sisting mainly of Poaceae and Asteraceae, make up about 30 % of the area of the basin, particularly the upper reaches of the river (Fig. 2). The basic difference between these two habitats is the local variation in the amount of water, which contributes to their differing species composition: *Axonopus* spp. (Poaceae) are more common in grassland, whereas *Baccharis* spp. (Asteraceae) are more characteristic of wetland. Large patches of open natural forest exist in the grassland/wetland areas.

Marshland. The presence of species of Cyperaceae characterizes this habitat. Because small patches of marshland are scattered throughout the study area, it is difficult to establish the total area of this habitat, estimated to cover about 1—3 % of the basin.

Cerrado. Cerrado is a type of savanna in Brazil, generally in the central western part of the country. In the TRB, outside its main area of occurrence, it appears only in fragments which represent the southern limit of the geographical distribution of many typical savanna plants, such as *Ouratea parviflora* (Ochnaceae) and *Stiphnoderon barbatimad* (Mimosaceae) (Ab'Saber 1983). However, this habitat has been so disturbed in the basin that it is poorly represented today. Only two areas were found, covering a total of about 4 ha.

Lakes. Under this heading we include all aquatic habitats such as ponds, rivers, and lakes and their banks. These habitats account for 2—3 % of the area of the basin.

The vertical stratification of forest vegetation was examined with regard to avian richness, including edge and scrub habitat. Five levels were recognized: (1) ground, (2) zero to two meters, (3) two to seven meters, (4) above seven meters, (5) aerial.

The present-day succession in the vegetation of the TRB can be attributed to climatic change in the region since the Pleistocene (alternation of dry and wet periods). Grassland, typical of a dry period, is being replaced by mixed temperate rain forest. This change is visible in the appearance of natural patches of this forest type in the grasslands of the south-eastern and central eastern regions, which represent well preserved areas of this landscape. At the boundaries of these patches it is possible to identify natural succession in progress as the forest invades the grassland. These areas of encroachment constitute what is called scrub in this study. However, this climatic change is producing conditions too wet even for mixed temperate rain forest, so this kind of forest is being replaced by seasonal semideciduous forest in a natural succession in the north and extreme south-east of the basin. (Klein 1960, Klein & Hatschbach 1971; Figs. 1, 2, 3.)

METHODS

Field methods. Bird data from the following 19 representative localities were evaluated for this study (Fig. 1): 5 in the UT (1-Rio Azul & Mallet, 2-Angaí, 3-Represa de Alagados, 4-Vila Velha State Park, and 5-Santa Rita Farm), 6 in the MT (6-Imbauzinho, 7-Klabin Ecological Park, 8-Varanal, 9-Tibagi, 10-Caxambú State Park, and 11-Cunhaporanga River), and 8 in the LT (12-Rolândia, 13-Mata dos Godoy State Park, 14-Londrina, 15-Guaravera, 16-Maravilha, Serra do 17-Cadeado, 18-Sertaneja, and 19-Cornélio Procópio). Besides our own species records from these localities, published data are included in the analysis (Westcott 1980 for Londrina; Scherer-Neto *et al.* 1992 for Vila Velha State Park; Anjos & Graf 1993 for Santa Rita Farm), as well as information from an unpublished report from Caxambú State Park (Scherer-Neto *et al.* 1984) and an unpublished thesis from Klabin Ecological Park (Berndt 1992). Data from Rio Azul and Mallet (locality 1, Fig. 1) were also used (Pichorin & Boçon 1996), although they are 30—50 km away from the TRB. Due to a similar vegetation structure we have assumed that their avifauna largely resembles that of the TRB. The field study periods in these localities are provided together with information on habitat and status (disturbed, unprotected, protected) in Table 1.

Observations were made visually (using 7 x 20 and 16 x 50 binoculars) and aurally. Some specimens were captured in mist-nets to ensure exact identification. Voice playback was often employed, using a tape-recorder (Uher 4400), a microphone and a parabolic reflector. The recordings (1601 tape segments representing 414 species) are deposited in the bioacoustic laboratory of the Universidade Estadual de Londrina.

DATA ANALYSIS

The relationship between each bird species and its habitat and vertical level was derived from the number of records: species with few records (below 20 %) in determined habitat and stratum were considered as 'tolerant', while those with records above 20 % were considered as preferring that particular habitat and stratum. Where a species was recorded in only one habitat it was termed 'exclusive' (Appendix). The systematic treatment follows Meyer de Schauensee (1982), actualized after Sick (1993).

The Sørenson index (C_s) was used to analyze the similarity among habitats with regard to their bird species (Magurran 1988): $C_s = 2j/(a + b)$ where j is the number of species common to both sites, a is the number of species in site A, and b is the number of species in site B. The Chi^2-test was applied when species numbers were compared between habitats. Differences were considered as statistically significant when $P<0.05$.

RESULTS

Species richness. 476 species were recorded in the 24,530 km² of the TRB; 201 non-passerines and 275 passerines (Table 3). There were more suboscines (151) than oscines (124); the best represented family was the Tyrannidae (73 species), followed by the Fringillidae (35), Thraupidae (31), Furnariidae (27), and Formicariidae (21). Of the non-passerines, the Trochilidae had the most species (20), then the Accipitridae (17), Columbidae (14), and Picidae (13) (for details see Appendix). The majority of species are sedentary in the study area, and an estimated 17 % are migratory, using the TRB mostly for breeding. The family with most migratory species was the Tyrannidae with 32.

Status. Some species were recorded only rarely during the study period. Taxa recorded only once or twice at any locality were considered rare (a total of 53), and taxa recorded two or three times at two or three localities were considered uncommon (41). Habitat disturbance, sometimes combined with a naturally small population size, is the principal reason for the low number of records for 22 species (12 rare, 10 uncommon). The rare species in this category are *Mergus octosetaceus, Buteo brachyurus, Spizastur melanoleucus, Pandion haliaetus, Pipile jacutinga, Phibalura flavirostris, Pyroderus scutatus, Xolmis velata, Anthus nattereri, Molothrus rufoaxillaris, Sporophila falcirostris,* and *Sporophila plumbea.* The uncommon species are *Mycteria americana, Plegadis chihi, Sarcoramphus papa, Buteo leucorrhous, Claravis pretiosa, Gubernetes yetapa, Alectrurus tricolor, Piranga flava, Cyanoloxia glaucocaerulea,* and *Oryzoborus angolensis.*

For another 23 rare and 10 uncommon species, the TRB is at the limit of their geographical range, according to Meyer de Schauensee (1966, 1982), Pinto (1978), Dunning (1987), Ridgely & Tudor (1989, 1994), and Scherer-Neto & Straube (1995). The 23 rare species in this category are *Nyctibius aethereus, Phaetornis squalidus, Hylocharis cyanus, Chloroceryle aenea, Campylorhamphus trochilirostris, Formicarius colma, Piprites pileatus, Myiobius atricaudus, Onychorhynchus coronatus, Molothrus badius, Scaphidura oryzivora, Psarocolius decumanus, Agelaius cyanopus, Cyanerpes cyaneus, Dacnis nigripes, Orthogonys chloricterus, Cypsnagra hirundinacea, Neothraupis fasciata, Orchesticus abeillei, Saltator atricollis, Paroaria coronata, Sporophila collaris,* and *Arremon taciturnus.* The 10 uncommon species are *Mesembrinibis cayennensis, Sarkidiornis melanotos, Buteo swainsoni, Crax fasciolata, Fulica leucoptera, Ciccaba virgata, Chrysolampis*

FIG. 1. a. Location of Paraná state (shaded) in Brazil. b. Location of Tibagi River Basin (TRB) with major cities in Paraná state. c. Geographical coordinates of TRB and locations of principal towns, Londrina (Lower Tibagi), Telêmaco Borba (Middle Tibagi), and Ponta Grossa (Upper Tibagi), with their average annual temperatures. The sites studied in this survey are: 1—Rio Azul and Mallet, 2—Angaí, 3—Represa de Alagados, 4—Vila Velha State Park, 5—Santa Rita Farm, 6—Imbauzinho, 7—Klabin Ecological Park, 8—Varanal, 9—Tibagi, 10—Caxambú State Park, 11—Cunhaporanga River, 12—Rolândia, 13—Mata dos Godoy State Park, 14—Londrina, 15—Guaravera, 16—Maravilha, 17—Serra do Cadeado, 18—Sertaneja, 19—Cornélio Procópio (after Anjos & Schuchmann 1997).

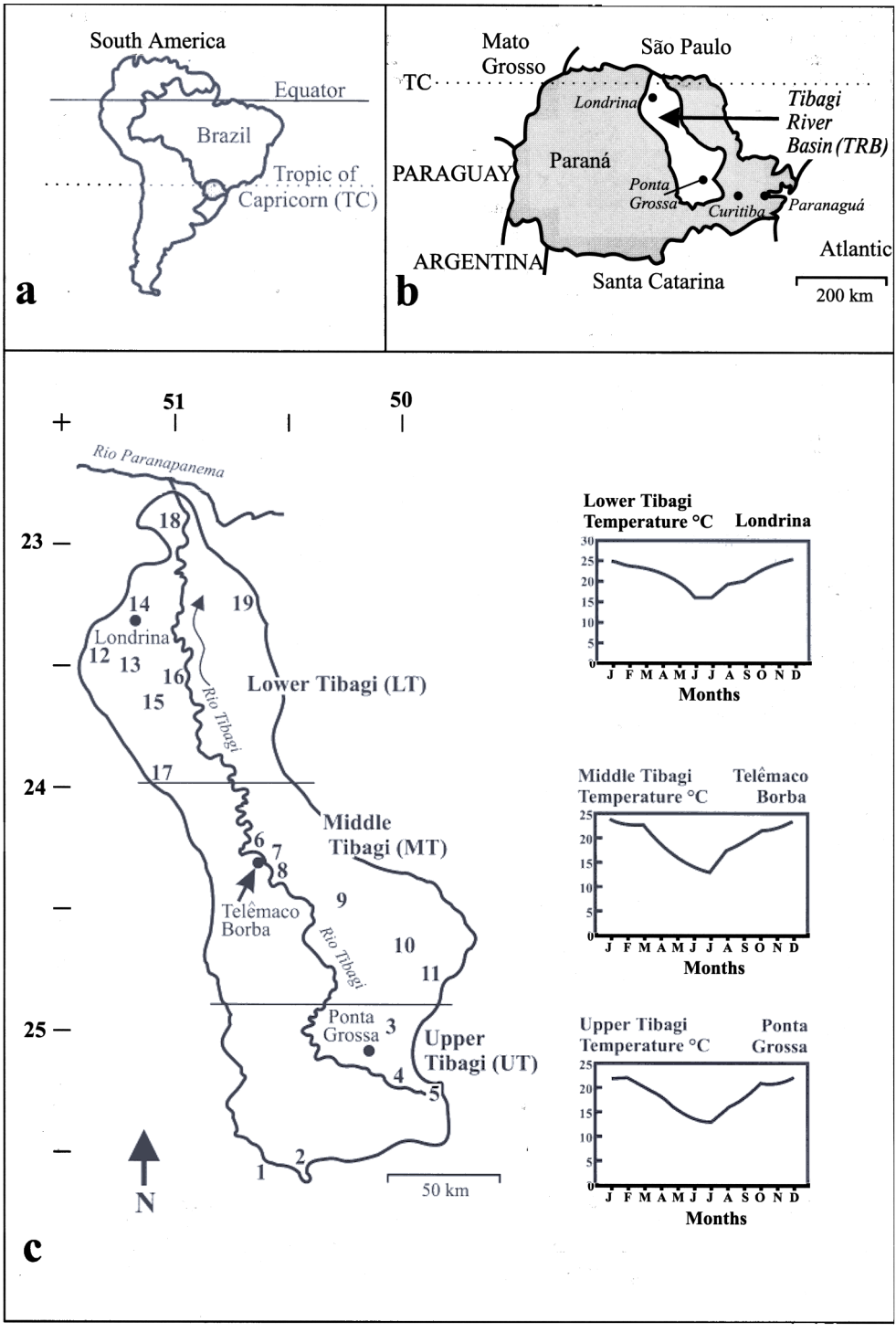
South America
Equator
Brazil
Tropic of
Capricorn (TC)
a
Mato
Grosso
São Paulo
TC
Londrina
Tibagi
River
Basin (TRB)
PARAGUAY
Paraná
Ponta
Grossa
Curitiba
Paranaguá
Atlantic
ARGENTINA
Santa Catarina
200 km
b
51
50
23
24
25
Rio Paranapanema
Londrina
Lower Tibagi (LT)
Rio Tibagi
Middle
Tibagi (MT)
Telêmaco
Borba
Ponta
Grossa
Upper
Tibagi (UT)
50 km
N
c
Lower Tibagi
Temperature °C
Londrina
Middle Tibagi
Temperature °C
Telêmaco
Borba
Upper Tibagi
Temperature °C
Ponta
Grossa
J F M A M J J A S O N D
Months

TABLE 1. Details of the locations surveyed in Tibagi River Basin, as shown in Fig. 1. A — area in hectares. B — intensity of field observation in months, each month corresponding to 3 or 4 days of surveys. C — habitat: ce — *cerrado*, ed — forest edge, fo — forest, gr — grassland, la — lakes, ma — marshland, sc — scrub, we — wetland. D — status: di — disturbed; un — unprotected, pr — protected.

Locality †	A	B	C	D
Upper Tibagi				
1. Rio Azul (1)* 25°45'S, 50°47'W		monthly February 1992—January 1993	ed,fo,la,sc	di
Mallet (1)* 25°55'S, 50°50'W		monthly February 1992—January 1993	ed,fo,la,sc	di
2. Angaí 25°35'S, 50°25'W	50 ha	March of 1993	ed,fo,sc	di
3. Represa de Alagados 25°0'S, 50°05'W	1000 ha	April of 1991	fo, la	un,pr
4. Vila Velha State Park (2)* 25°15'S, 50°0'W	1300 ha	each 2 months during the year of 1984	ed,fo,la,ma,sc,we	un,pr
5. Santa Rita Farm (3)* 25°15'S, 50°0'W	2000 ha	sporadically 1984—1989 and monthly during 1990	ed,fo,la,ma,sc,we	
Middle Tibagi				
6. Imbauzinho 24°15'S, 50°40'W	150 ha	each 2 months during 1993	ed,fo	un
7. Klabin Ecological Park (4)* 24°20'S, 50°35'W	450 ha	each 2 months during 1993 and 1994	ed,fo,la,ma,sc	un,pr
8. Varanal 24°25'S, 50°35'W	1000 ha	each 2 months during 1993 and 1994	ed,fo,gr,la,sc	un,pr
9. Tibagi 24°30'S, 50°20'W	1500 ha	March/April of 1996	ce,ed,fo,gr,we	un,pr
10. Caxambú State Park (5)* 24°40'S, 50°0'W	1050 ha	each 2 months during 1984 and October/November of 1995	ed,fo,ma,sc	di,pr
11. Cunhaporanga River 24°50'S, 49°50'W	450 ha	October/November of 1989	ed,fo,ma	un
Lower Tibagi				
12. Rolândia 23°50'S, 51°50W	25 ha	September-November of 1993	ed,fo,sc	di
13. Mata dos Godoy State Park 23°27'S, 51°15'W	656 ha	each 2 months from 1993—1996	ed,fo,sc	un,pr
14. Londrina (6)* 23°15'S, 51°10'W	550 ha	monthly from 1992—1996	la,sc	di
15. Guaravera 23°40'S, 51°05'W	50 ha	October of 1994	sc	di
16. Maravilha 23°30'S, 50°57'W	15 ha	July—October of 1991	la,sc	di
17. Serra do Cadeado 23°55'S, 51°10'W	20 ha	May of 1994	ed,fo,sc	di
18. Sertaneja 22°58'S, 50°58'W	250 ha	March/October of 1995	la,ma,sc	di
19. Cornélio Procópio 23°15'S, 50°40'W	150 ha	September of 1995	ed,fo,la,sc	di

* Data source: (1) Pichorin & Boçon 1996, (2) Scherer-Neto *et al.* 1994, (3) Anjos & Graf 1993, (4) Berndt 1992, (5) Scherer-Neto *et al.* 1984, (6) Westcott 1980.
† Numbers refer to localities shown in Fig. 1.

mosquitus, Anabazenops fuscus, Attila rufus, and *Tangara peruviana.*

The secretive habits and/or poorly known vocalizations (both are typical problems for ornithologists carrying out research in the Neotropics), and migratory behavior leading to a short period of residence in the TRB, could explain the low number of records of an additional 18 rare and 21 uncommon species. However, we have little knowledge about the status of many of these birds due to a lack of field work. Among these 18 rare species are five migratory species from North America: *Tringa melanoleuca, Actitis macularia, Calidris fuscicollis, Calidris melanotos,* and *Dolichonyx oryzivorus.* The others are: *Ixobrychus involucris, Aramus guarauna, Rallus sanguinolentus, Himantopus himantopus, Coccyzus euleri, Pulsatrix perspicillata, Campylorhamphus falcularius, Philydor dimidiatus, Myiobius barbatus, Phylloscartes paulistus, Phyllomyias virescens, Phyllomyias griseocapilla, Anthus correndera.* The 21 uncommon species also comprise two migratory species from North America: *Tringa solitaria* and *Tringa flavipes.* The others are: *Podilymbus podiceps, Oxyura dominica, Rallus maculatus, Laterallus melanophaius, Gallinago undulata, Bubo virginianus, Asio stygius, Asio flammeus, Notharcus macrorhynchus, Philydor atricapillus, Biatas nigropectus, Dysithamnus xanthopterus, Neopelma pallescens, Ramphotrigon megacephala, Suiriri suiriri, Cistothorus platensis, Icterus cayanensis, Sporophila bouvreuil,* and *Poospiza nigrorufa.*

The 382 species that had 4 or more records were classified as moderately common or common, and we estimate that their populations in the TRB are relatively stable. Among these are the Columbidae *Columbina picui, Columba picazuro,* and *Zenaida auriculata*; the last-mentioned is the most abundant. *Bubulcus ibis* (Ardeidae), a self-introduced species, can also be considered abundant (Sick 1985, 1993).

Species richness partitioned by major habitat

Forest, edge, and scrub. The three richest habitats were forest (235 bird species; 49 %), edge (217; 45 %), and scrub (180; 38 %) (Fig. 3), where a total of 368 species was found (77 %). Many species were found in two or three of these three habitats, so increasing their similarity index (Table 3).

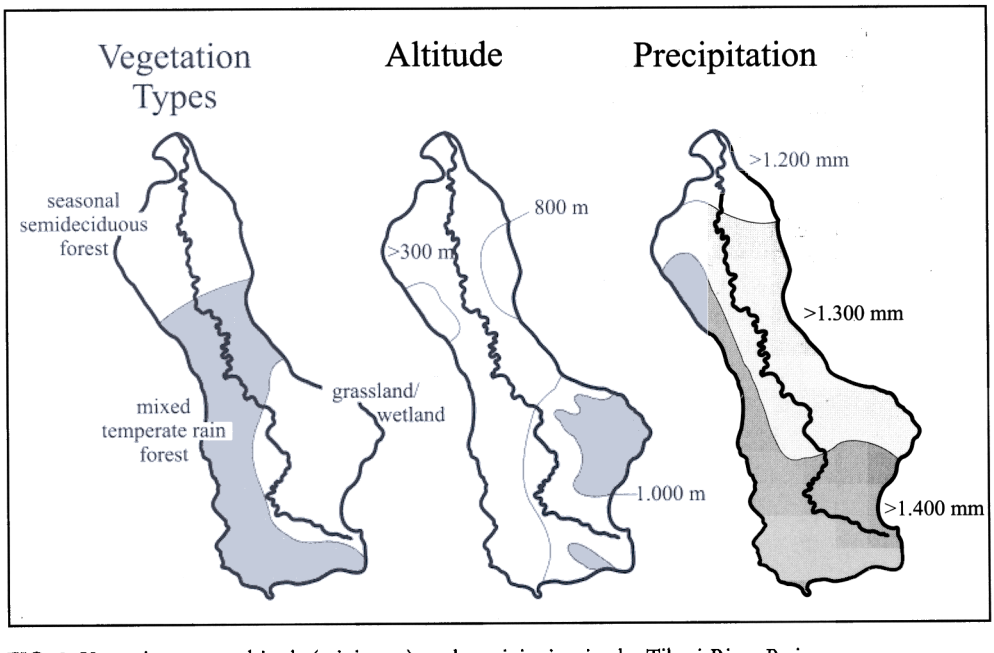

FIG. 2. Vegetation types, altitude (minimum), and precipitation in the Tibagi River Basin.

The number of suboscines is higher in forest (99 species; 66 %) than in any of the other habitats. Additionally, 71 % of suboscines were found exclusively in forest, indicating a close relationship with this habitat. Numbers of non-passerines (88 species; 44 %) and oscines (48; 39 %) were lower, and also the proportion of these groups recorded exclusively in forest, 15 % and 11 % respectively, was low compared with other habitats (Table 2).

Among the suboscines, the Rhinocryptidae (3 species) and the Pipridae (7 species) were found only in forest. All species of the Dendrocolaptidae were recorded in this habitat too, though *Campylorhamphus trochilirostris* and *C. falcularius* are also found in edge and *Lepidocolaptes angustirostris* in scrub. The majority of the Formicariidae (90 %) were recorded in forest (*Dysithamnus mentalis* occurs in edge, *Thamnophilus ruficapillus* and *Drymophila malura* in scrub). All the Cotingidae occur in forest. However, they are more common in edge (60 %) and scrub (40 %) than the Formicariidae. The Furnariidae and Tyrannidae are found in lower species numbers in forest (74 % and 40 % respectively). However, the Furnariidae are more closely tied to a given habitat than are the Tyrannidae, which occur in forest, edge, and scrub in similar species numbers (Chi^2 P>95 %). The Tyrannidae clearly have the highest number of species in edge (38 species) and scrub (40). However, sedentary species of the Tyrannidae are more associated with forest than migratory species, which are more frequently found in edge and scrub (Table 2).

There are more non-passerine species in edge (101 species) and scrub (73) than either suboscines (53 in edge and 53 in scrub) or oscines (63 and 54 species respectively). However, 37 % of the non-passerine families do not occur in forest, edge or scrub. The non-passerine family with the strongest forest preference is the Tinamidae. The Falconidae, Cuculidae, and Picidae had similar numbers of species in forest, edge, and scrub; the Accipitridae and Psittacidae are more associated with forest and edge than with scrub; the Columbidae and Trochilidae are more common in edge and scrub than in forests (Table 2).

The oscines have slightly higher numbers of species in edge (63) than in forest (48) or in scrub (54) (Fig. 5). The Fringillidae and Thraupidae, the most species-rich oscine families, have differing distributions: the former have higher numbers in edge and scrub whereas the latter has species that are equally distributed among the three habitats (Chi^2 P>95 %). All the other abundant and/or species-rich oscine families (the Turdidae, Icteridae, Parulidae, and Coerebidae) are similar to the Thraupidae in distribution. Only the Motacillidae (only genus *Anthus*) is not found in any of these habitats (Table 2): pipits are open-country birds (Sick 1985, 1993).

Distribution appears clearer when we consider the preference of a species for a particular habitat. Suboscines are so highly attached to forest that few species are found elsewhere, except the Tyrannidae. Although 17 species of the Tyrannidae occur exclusively in forest, the majority prefer edge (36 species) or scrub (37). Most non-passerines and oscines show a preference for a certain habitat (220 and 146 species respectively) but only a few species are exclusively attached to a single habitat (38 and 17).

Distribution according to vertical level in tree-related habitats. The majority (79 %) of forest, edge, and scrub species are found in level 3, followed by level 4 and 2 (both 54 %), and level 1 (28 %) (Table 4). Level 5 (aerial), with 7 %, is represented only by the Nyctibiidae, Caprimulgidae, Hirundinidae, and some species of the Accipitridae. Species using exclusively one habitat level are rare; this is the case for 23 species (9 in level 1, 4 in level 2, 0 in level 3, and 10 in level 4).

Suboscines tended to be more closely associated with levels 2 and 3 (95 and 109 species respectively), non-passerines with levels 3 and 4 (107 and 93), and oscines with level 3 (75 species).

Of the non-passerines, the Tinamidae was the family with the strongest preference for level 1, with all species in the family found there. The Columbidae was the most generalist family since it occurred in relatively high proportions in all levels. The Falconidae, Cuculidae, and Trochilidae were more common in levels 2 and 3, and the Accipitridae, Psittacidae, and Picidae in levels 3 and 4. Other non-passerine families were represented in the study area by only a few species or have only a weak preference for forests, edge or scrub.

The Furnariidae were found in almost the same proportions in all levels (Chi^2 P>95 %); the Rhinocryptidae was closely associated with

TABLE 2. Number of bird species of each family in each habitat of the Tibagi River Basin: fo — forest, ed — forest edge, sc — scrub, gr — grasland, we — wetland, ma — marshland, la — lakes, ce — *cerrado*, to — total number of species. Tyrannidae: (1) — sedentary species, (2) — migrants. Sequence and nomenclature follow Meyer de Schauensee (1982), actualized after Sick (1993).

Taxa	fo	ed	sc	gr	we	ma		la	to
Tinamidae	5	2	0	2	2	0	0	0	7
Podicipedidae	0	0	0	0	0	0	0	2	2
Phalacrocoracidae	0	0	0	0	0	0	0	1	1
Ardeidae	0	0	0	2	2	3	0	7	9
Ciconiidae	0	0	0	0	0	1	0	0	1
Threskiornithidae	1		0	0	0	1	0	1	3
Anatidae	0	0	0	0	0	0	0	6	6
Cathartidae	3	3	2	2	0	0	0	0	3
Accipitridae	10	11	4	3	3	2	2	1	17
Pandionidae	0	0	0	0	0	0	0	1	1
Falconidae	4	6	3	5	1	0		0	8
Cracidae	4	0	1	0	0	0	0	0	4
Phasianidae	1	0		0	0	0	0	0	1
Aramidae	0	0	0	0	1		0	0	1
Rallidae	1	0	0	0	4	7	0	5	11
Cariamidae	0	0	0	1	1	0	1	0	1
Jacanidae	0	0	0	0	0	0	0	1	1
Charadriidae	0		0	1	1	1	0	0	1
Scolopacidae	0	0	0	2	5	6	0	6	9
Recurvirostridae	0	0	0	0	0	1	0	1	1
Columbidae	6	9	9	1	0	0	4	0	14
Psittacidae	10	11	5	0	0	0	1	0	12
Cuculidae	3	5	5	2	0	1		1	9
Tytonidae	0		0	0	0	0	0	0	1
Strigidae	7	7	5	1	3		4	1	12
Nyctibiidae	0	2	2	0	0	0	2	0	2
Caprimulgidae	0	8	5	3	2	3	3	0	9
Apodidae	0	2	2	1	3	3	0	3	5
Trochilidae	12	20	18	1	0		4	0	20
Trogonidae	3	0	0	0	0	0	0	0	3
Alcedinidae	0	0	0	0	0	0	0	4	4
Momotidae	1	0	0	0	0	0	0	0	1
Galbulidae	0	1	1	0	0		0	1	1
Bucconidae	2	1	0	0	0	0	1	0	3
Ramphastidae	4	0	0	0	0	0	0	0	4
Picidae	11	8	10	1	0	0	3	0	13
Total non-passerines	88	101	73	28	28	33	27	42	201
Dendrocolaptidae	9	2	1	0	0	0		0	9
Furnariidae	20	6	6	0	0	1		2	27
Formicariidae	19	1	2	0	0		0	1	21
Rhinocryptidae	3	0	0	0	0	0	0	0	3
Cotingidae	10	6	4	0	0	0	0	0	10
Pipridae	7	0	0	0	0	0	0	0	7
Tyrannidae (1)	24	14	15	5	6	5	1	3	41
Tyrannidae (2)	6	24	25	5	2	5	0	0	32
Oxyruncidae	1	0	0	0	0	0	0	0	1
Total suboscines	99	53	53	10	8	12	3	6	151

TABLE 2. Continued.

Taxa	fo	ed	sc	gr	we	ma	ce	la	to
Hirundinidae	0	5	1	7	6	3	0	2	9
Corvidae	2	1	1	0	0	0	1	0	3
Troglodytidae	1	1	1	0	0	1	0	0	2
Mimidae	0	1	1	0	0	1	0	0	2
Turdidae	4	3	3	0	0	0	0	0	6
Sylvidae	1	1	1	0	0	0	0	0	1
Motacillidae	0	0	0	4	2	0	0	0	4
Vireonidae	2	1	2	0	0	0	0	0	3
Icteridae	4	5	3	5	1	5	0	3	15
Parulidae	3	2	3	0	0	1	0	2	5
Coerebidae	4	2	5	0	0	0	0	0	5
Tersinidae	0	1	1	0	0	0	0	0	1
Thraupidae	21	24	15	0	0	1	5	1	31
Fringillidae	6	16	17	9	12	14	3	0	35
Ploceidae	0	0	0	1	0	0	0	0	1
Estrildidae	0	0	0	1	0	0	0	0	1
Total oscines	48	63	54	27	21	26	9	8	124
Σ	235	217	180	65	57	71	39	56	

level 1. The Formicariidae and Pipridae were more common in levels 2 and 3; the Cotingidae and Dendrocolaptidae in levels 3 and 4. The Tyrannidae was found mostly in levels 2, 3 and 4 (Table 4).

Within the species-rich oscine families, almost all comprised species closely associated with level 1. The Turdidae was frequently observed here, though it is more typical of levels 2 and 3. The same is true of the Parulidae, but this family is the most generalist of the oscines, being found equally in all levels up to 4. The Fringillidae is common in levels 2 and 3, the Vireonoidae, Coerebidae, Icteridae, and Thraupidae prefer levels 3 and 4 (Table 4).

Grassland, wetland, and marshland. Grassland (65 species), wetland (57), and marshland (71) were similarly rich in species as a proportion of the total (14 %, 12 %, and 15 % respectively) (Fig 4). These habitats show a high similarity to each other, especially grassland and wetland (Table 3). There is a clear gradient among them in the amount of water present, nevertheless some birds occur in all three habitats, which increases their similarity index. Grassland and marshland have the highest ratios of exclusive species (14 % for both), as opposed to 7 % in wetland, but otherwise wetland can be considered as intermediate between the first two habitats (Fig 4).

Among the suboscines, only members of the Tyrannidae were found in these open areas, but they are much more important for the oscines with 10 species occurring in at least one of them. A total of 21 Fringillidae species was recorded in these habitats, or 60 % of the species in the family. The figure was particularly high in marshland, with 14 species (Table 2). Grassland and wetland are important for the Hirundinidae, with 78 % and 67 % of species in the family present respectively. The Motacillidae is the family most closely associated with grassland and wetland, the four species of which are found exclusively in the two habitats. A total of 20 families of non-passerines was recorded in the open areas. As expected, those families most closely attached to water increased their species numbers from grassland through wetland to marshland, i. e., the Ardeidae, Rallidae, and Scolopacidae, while the Tinamidae and Falconidae, which prefer dry habitats, decreased in number of species (Table 2).

Cerrado. A total of 39 species was recorded in the *cerrado* (Fig. 5). Although it covers only a small area of the TRB, two species were recorded exclusively in the relict patches of this habitat,

Cyanocorax cristatellus and *Neothraupis fasciata*. Non-passerines (27 species) were more common in the *cerrado* than passerines (12). Of the non-passerines, the Columbidae, Strigidae and Trochilidae were represented by most species, while the Thraupidae and Fringillidae were the most species-rich passerine families in the *cerrado* (Table 2). This habitat is most similar to scrub (Table 3).

Lakes. A total of 56 species were found in the true aquatic habitats (those classified as lakes) of the TRB. The majority of them are exclusive to aquatic habitats (31 species; 55 %), a fact that helps to explain the lower similarity index. The index was only relatively high for marshland (Fig. 5 and Table 3). Non-passerines were more common (42 species; 75 %) than passerines (14; 30 %) in this habitat. As expected, bird families closely associated with water were the most abundant, such as the Podicipedidae, Ardeidae, Anatidae, and Alcedinidae.

DISCUSSION

Species richness

Vielliard & Silva (1990) have called attention to the problems of comparative analysis of bird species richness using species lists: insufficient data, variability in number and composition of the habitats used as study areas, and varying intensity of observation. These restrictions are also true when the species richness of the TRB is compared with that of other Neotropical areas. The TRB size and the frequency of data collecting in this area may account for the greater number of species recorded there.

Being aware of these problems, we compare our data with those of Stotz & Bierregaard (1989) who identified 352 species in an area of 450 km^2 of forests and pasture 80 km north of Manaus (Amazonia) during an intensive 7-year banding and observational study. Although the area investigated by them was considerably smaller than the TRB, the number of species they recorded is high, particularly of suboscines closely associated with forests, e. g., the Dendrocolaptidae, Formicariidae, or Pipridae. Suboscine birds, more closely attached to forests than oscines, account for 65 % of passerines in Amazonia and 55 % in the TRB. The ratio suboscines/oscines is lower in Tibagi (1.22) than in the area studied by Stotz & Bierregaard (1.88). The high number of species of the Fringillidae, Thraupidae, and Icteridae in Tibagi contributed to the low ratio there. In the rest of South America, excluding the Amazon region, this relationship results in a figure lower than in the TRB (Slud 1976, Haffer 1990). Haffer (1990) summarized the data on the Dendrocolaptidae, Furnariidae, Formicariidae, and Tyrannidae from various South American localities. The numbers of species of the Dendrocolaptidae and Formicariidae in the TRB were very low compared with the Amazon region, but the number of species of the Furnariidae were similar to that in the most species-rich part of the Amazon in Peru, 27 and 28 respectively. The number of Tyrannidae was also high, 73 in the TRB and 86 in Peru. The high number of species in these families is probably due to the extensive areas of scrub and edge in the TRB. The number of non-passerines is also very high, probably because of the variety of open habitats.

Willis & Oniki (1990) recorded 442 species at 10 localities between Chapada de Guimarães and

TABLE 3. Sørenson index of habitat similarity for bird species in the Tibagi River Basin.

	Forest	Edge	Scrub	Grassland	Wetland	Marshland	Cerrado
Edge	0.41						
Scrub	0.39	0.46					
Grassland	0.03	0.23	0.11				
Wetland	0.01	0.09	0.02	0.52			
Marshland	0.01	0.14	0.15	0.20	0.35		
Cerrado	0.06	0.20	0.25	0.15	0.17	0.10	
Lakes	0.01	0.04	0.03	0.04	0.11	0.34	–

the upper Guaporé river in north-western Mato Grosso state, Brazil. This area, 1000 km northwest of the TRB, has a similar habitat mosaic to that of our study area.

Closer to the TRB, and the biggest protected area in Paraná state, is the Iguaçu National Park (7260 km²), where 288 species have been identified (Mahler 1994). However, observation intensity was low and large areas of the Park were not surveyed.

Willis (1979) identified 185 species in Morro do Diabo, São Paulo state (370 km²), around 70 km west of the TRB, during a total of 75 hours. He also recorded 202 species at Barreiro Rico Farm, São Paulo state (14 km²), 100 km northeast of the TRB, during 3 days per month over 2 years. Vielliard & Silva (1990) identified 278 species during 2 years of intensive observation on a 165 km²) farm at Lençóis Paulista, São Paulo state, roughly 100 km north of the TRB. They estimated the local species richness for the interior of São Paulo state at 280 species.

In the TRB, a total of 273 species was recorded in Mata dos Godoy State Park (656 ha, Lower Tibagi), the figure was 298 in Varanal (10 km²), Middle Tibagi), while 302 species were identified on the Santa Rita Farm (20 km²), Upper Tibagi). Vielliard & Silva (1990) emphasized the similarity in species richness values in different areas of São Paulo state despite the variation in

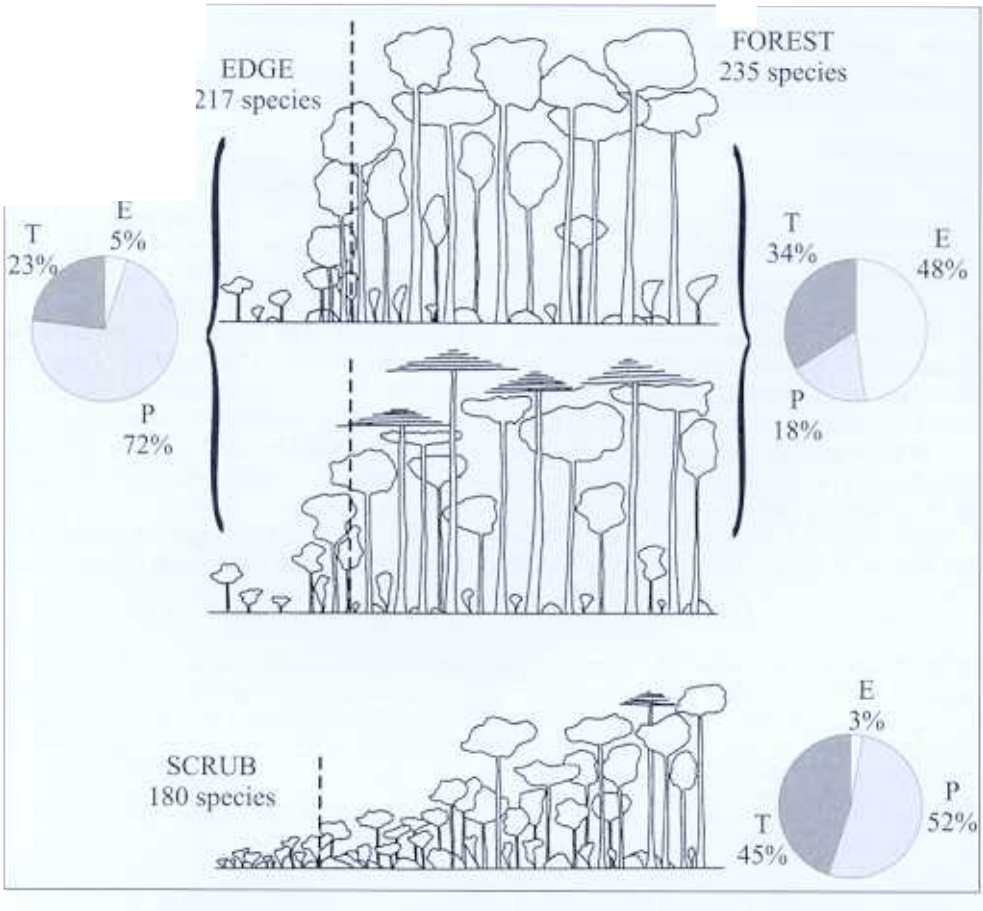

FIG. 3. Ratio (%) of exclusive (E), tolerant (T) and preferent (P) bird species in forest (top: seasonal semideciduous forest, "*Aspidosperma* forest;" middle: mixed temperate rain forest, "*Araucaria* forest"), forest edges, and scrub.

TABLE 4. Number of species of each family at various vegetation heights in forest habitats of the Tibagi River Basin. 1 — ground, 2 — lower stratum (up to two meters), 3 — middle stratum (two to seven meters), 4 — canopy (above seven meters), 5 — aerial. Tyrannidae: (1) — sedentary species, (2) — migrants.

Taxa		2	3	4	5
Tinamidae	5	0	0	0	0
Ardeidae	1		0	0	3
Cathartidae	0	0	0	3	0
Accipitridae	1	0	12	12	5
Falconidae	4	7	8	4	0
Cracidae	4	0	4	4	0
Phasianidae	1	0	0	0	0
Rallidae	1	0	0	0	0
Charadriidae	1	0	0	0	0
Columbidae	14	8	13	11	0
Psittacidae	1	0	12	12	1
Cuculidae	4	7	8	2	0
Tytonidae	0	0		1	0
Strigidae	1	1	8	9	0
Nyctibiidae	0	0	0	2	2
Caprimulgidae	0	0	0	0	8
Apodidae	0	0	0	0	2
Trochilidae	0	17	16	11	0
Trogonidae	0	0	3	3	0
Momotidae	1	1	1	0	0
Galbulidae	0	1	1	0	0
Bucconidae	3	3	3	3	0
Ramphastidae	1	0	4	4	0
Picidae	3	9	13	12	0
Dendrocolapidae	0	4	9	8	0
Furnariidae	11	14	16	12	0
Formicariidae	7	15	12	5	0
Rhinocryptidae	3	1	0	0	0
Cotingidae	0	1	8	9	0
Pipridae	0	7	7	1	0
Tyrannidae (1)	4	29	32	13	0
Tyrannidae (2)	2	14	24	19	0
Hirundinidae	0	0	0	0	5
Corvidae	1	1	2	1	0
Troglodytidae	1	1	1	0	0
Mimidae	1	1	1	0	0
Turdidae	4	5	6	1	0
Sylviidae	0	0	1	1	0
Vireonidae	0	0	3	3	0
Icteridae	5	4	9	7	0
Parulidae	1	2	2	2	0
Coerebidae	0	2	5	5	0
Tersinidae	0	1	1	1	0
Thraupidae	4	10	27	23	0
Fringillidae	9	21	17	5	0
Σ	102	199	292	197	26

observation effort and in habitat composition in these areas. The average figure they give (280 species) is similar to the local richness in the TRB, where the slight increase in richness towards the south results from the presence of a more varied habitat mosaic, including, especially, open areas. The particularly rich avifauna of Santa Rita Farm has also been correlated with habitat diversity (Anjos & Graf 1993). In biogeographic terms the state of Paraná is a transition area where different ecosystems are represented, a characteristic that is particularly evident in the TRB.

However, it is possible to standardize the species richness of Mata dos Godoy State Park, Varanal, and Santa Rita Farm by considering only the bird numbers occurring in the three richest habitats, i. e., forest, edge, and scrub. The species richness in these three localities is very similar: 260, 257, and 252 species respectively. If only the forest is considered, the figures are 165, 161 and 160, again showing that species richness values are very close when the same habitat is compared in different locations of the TRB. This similarity comes as a surprise because the species composition is rather different. There are 103 species that occur in these three localities. A total of 63 species are exclusive to one locality: 29 in Mata dos Godoy State Park, 12 in Varanal, and 22 on the Santa Rita Farm. Based on the Søren-

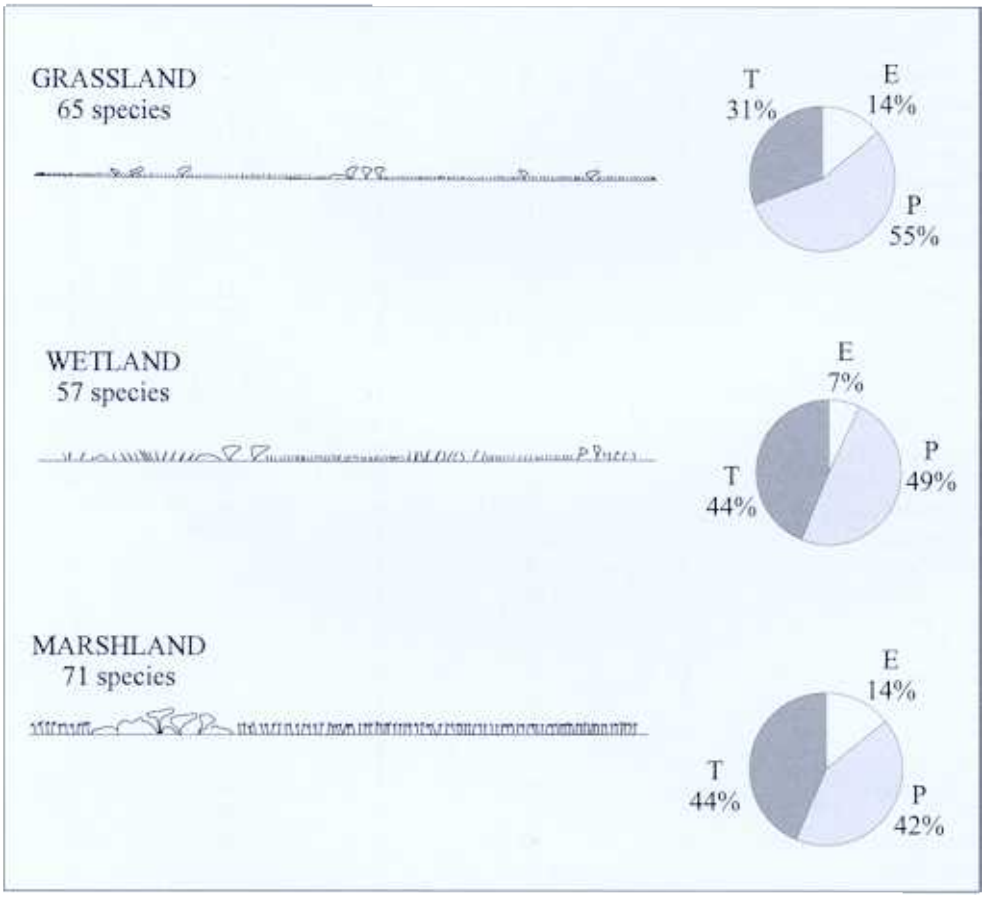

FIG. 4. Ratio (%) of exclusive (E), tolerant (T), and preferent (P) bird in grassland, wetland, and marshland.

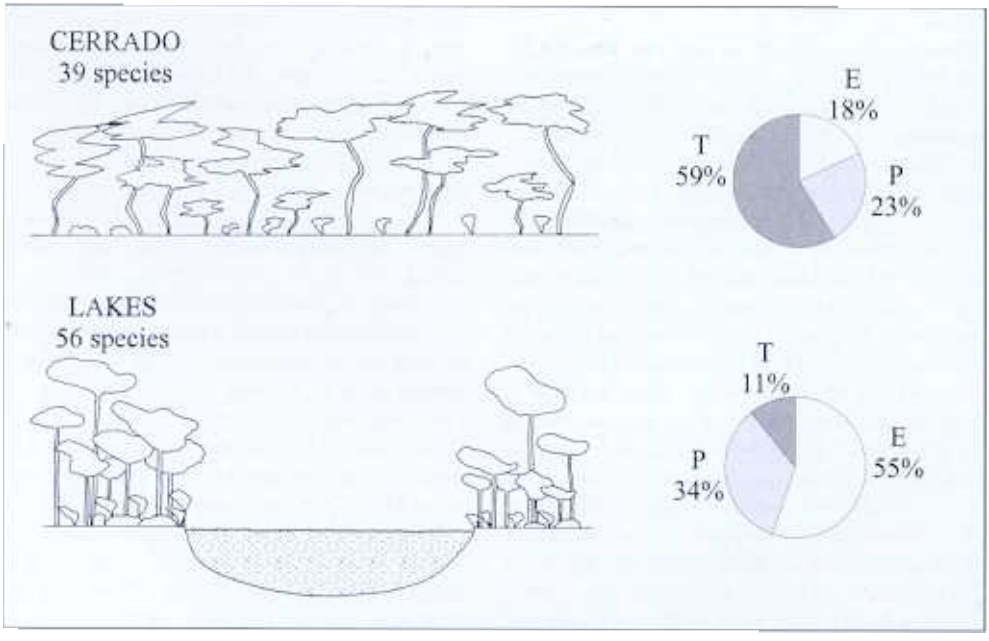

FIG. 5. Ratio (%) of exclusive (E), tolerant (T), and preferent (P) bird species in *cerrado* and lakes.

son index, the similarity is lower between Mata dos Godoy State Park and Santa Rita Farm (0.70) than either is to Varanal (0.77 and 0.79 respectively).

The Mata dos Godoy State Park is slightly richer in forest non-passerines like the Tinamidae (5 species), Psittacidae (9), Trochilidae (8), Bucconidae (3), and Ramphastidae (4) than Santa Rita Farm, which has 2, 6, 6, 0, and 2 species respectively. Santa Rita farm is richer in passerines such as the Dendrocolaptidae (8 species) and Furnariidae (18) than the Mata dos Godoy State Park (5 and 8). The figures in Varanal are intermediate between these two locations, which may be due to the geographical transition between Santa Rita Farm in the south and Mata dos Godoy State Park in the north contributing to an overlap of species from both directions.

Willis & Schuchmann (1993) compared the avifaunas of cloud forests in south-eastern Brazil and western Colombia. They found similar numbers of species (202 and 194 respectively) and similarities in avifaunal structure. They explained the minor differences by slight differences in vegetation composition. Although the distances among the study sites in the TRB are much smaller than the distances in the Willis & Schuchmann (1993) study, the structure of the avifauna in the Godoy State Park and Santa Rita Farm is rather different. This fact can be attributed to historical differences between the younger seasonal semideciduous forest and the older mixed temperate rain forest. The former is related to a warmer climate with an almost constant vegetation period throughout the year (fruits are usually available year-round) while the latter is related to a cooler climate (seasonal fruit production). The more stable conditions in the seasonal semideciduous forest at the Mata dos Godoy State Park favor the occurrence of large frugivorous birds like the Psittacidae and Ramphastidae or minute nectarivores like the Trochilidae. In the mixed temperate rain forest the more unstable annual food supplies support communities of small insectivorous passerine birds belonging to families like the Furnariidae and the Dendrocolaptidae.

Status

A total of 12 species we recorded in the TRB are classified by Collar *et al.* (1992) as "threatened" in the Neotropics: *Mergus octosetaceus, Pipile jacutinga, Amazona vinacea, Triclaria malachitacea, Biatas nigropectus, Lipaugus lanioides, Piprites pileatus, Phylloscartes paulistus, Anthus nattereri, Dacnis nigripes, Tangara peruviana,* and *Sporophila falcirostris.* We consider that *Amazona vinacea, Triclaria malachitacea,* and *Lipaugus lanioides* are common in our study area. These three species are frequently found in certain localities with apparently stable populations (e. g., *Amazona vinacea* in Ponta Grossa, Santa Rita Farm, Varanal, and Imbauzinho; *Triclaria malachitacea* in Mata dos Godoy State Park, and *Lipaugus lanioides* in Santa Rita Farm and Godoy State Park). We did not consider *Biatas nigropectus* or *Tangara peruviana* to be common, but we believe their populations are stable (*Biatas nigropectus* in Santa Rita; *T. peruviana* in Varanal and Cunhaporanga River). The other seven species are rare in the TRB.

Collar *et al.* (1992) also compiled a list of "near-threatened" species in the Neotropics. Nineteen of these we considered to be common in the TRB (*Tinamus solitarius, Ara maracana, Macropsalis creagra, Baillonius bailloni, Picumnus nebulosus, Leptasthenura setaria, Philydor dimidiatus, Psilorhamphus guttatus, Procnias nudicollis, Muscipipra vetula, Idioptilon nidipendulum, Phylloscartes eximius, Phylloscartes oustaleti, Culicivora caudacuta, Polioptila lactea, Cyanocorax caeruleus, Saltator maxillosus, Amaurospiza moesta,* and *Euphonia chalybea*). Seven protected areas, Mata dos Godoy State Park, Santa Rita Farm, Vila Velha State Park, Imbauzinho, Klabin Ecological Park, Varanal, and Caxambú State Park, are of great importance as population reservoirs for the conservation of these species in the TRB. In addition, it is crucial that a mosaic of habitats be preserved since the majority of species are often not restricted to only one habitat. Although forests is the most species-rich habitat, threatened birds are present in others as well and also need protection.

Avian habitat distribution

We predicted elsewhere in this paper that forests would have the highest number of species, the majority of them exclusive to that habitat. The high ecosystem complexity of the two forest habitats results in a much more varied food supply than is found, for example, in open areas. Scrub and edge are habitats that are closely related to forests; they have few exclusive species, which is not surprising as these habitats are ecotonal between forests and grassland.

The other tree-related habitat, the *cerrado,* is poorly represented today in the TRB. Nevertheless, 39 species have been recorded in the remaining fragments, almost all of them not restricted to this habitat only. Cavalcanti (1992) pointed out the importance of the forest edge to *cerrado* birds depending on the season. In the TRB, the edge and scrub, being the distributional limit of the forests, may have enabled certain *cerrado* species to survive, especially generalists like *Cypsnagra hirundinacea.*

It seems clear that, at least in the TRB, suboscines have a clear ecological attachment to closed habitats whereas oscines are more tied to open areas. Suboscines have probably been in South America for a longer period and so are more adapted to forests (e. g., Sick 1985); they have high species numbers in this habitat (55 % in the TRB). This species richness is a feature of the group mainly because different species can occupy different vertical zones in the forests (Traylor & Fitzpatrick 1982, Haffer 1990). The vertical level distribution of suboscines found by Haffer in the Amazon basin as a whole shows no significant difference from that of the suboscines in the TRB: the Rhinocryptidae, Pipridae, and Formicariidae in the lower levels, the Dendrocolaptidae in the mid-levels, the Cotingidae in the highest, and the Furnariidae and Tyrannidae throughout. The families that occupy the higher strata were more successful in edge and scrub, i. e., the Cotingidae, Tyrannidae and Furnariidae. In these habitats, the Rhinocryptidae and Pipridae are absent while the Formicariidae and Dendrocolaptidae are poorly represented.

The oscine family that is best represented, in terms of species numbers, in the forests, the frugivorous Thraupidae, includes birds typical of a foraging guild found in the highest strata, where food supply is reliable year-round. This is to be expected because, as pointed out above, the oscines are otherwise strongly associated with open areas. The Icteridae and Fringillidae, the most generalists of the oscine families, are poorly

represented in the forests, where there seems to be significant competition with the suboscines.

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APPENDIX. Data on habitat, vertical distribution, and status of bird species in the Tibagi River Basin, Paraná state, southern Brazil. Records (x) are from Mata dos Godoy State Park (M); Varanal (V); Santa Rita Farm (R). Habitat: ce — *cerrado*, ed — forest edge, fo — forest, gr — grassland, la — lakes, ma — marshland, sc — scrub, we — wetland. Vertical distribution: g — ground, ls — lower stratum (up to two meters), ms — middle stratum (two to seven meters), c — canopy (above seven meters), a — aereal. Status. 1 — rare, 2 — uncommon, 3 — common. Bold letters indicate preferred habitat and vertical distribution. Sequence and nomenclature follow Meyer de Schauensee (1982), * — acutlized after Sick (1993)

Taxa	Localities			Habitat	Vertical distribution	Stat
	M	V	R			
Tinamidae						
Tinamus solitarius				**fo**	**g**	
Crypturellus obsoletus				**fo**	**g**	
Crypturellus undulatus				**fo**	**g**	
Crypturellus parvirostris		x		**ed**,fo		
Crypturellus tataupa		x		ed,**fo**		
Rhynchotus rufescens		x		**gr**,we		3
Nothura maculosa		x		**gr**,we		3
Podicipedidae						
Podiceps dominicus				**la**		
Podilymbus podiceps				**la**		

APPENDIX. Condinued.

Taxa	Localities		Habitat	Vertical distribution	Status
	M	R			
Phalacrocoracidae					
Phalacrocorax olivaceus			la		3
Ardeidae					
Ardea cocoi	x	x	la		3
Casmerodius albus	x	x	la,ma		3
Egretta thula	x	x	la,ma		3
Butorides striatus	x		la,ma		3
Bubulcus ibis	x	x	gr,we		3
Syrigma sibilatrix	x	x	gr,we		3
Nycticorax nycticorax	x		la		3
Tigrisoma lineatum	x		la		3
Ixobrychus involucris			la		1
Ciconiidae					
Mycteria americana			ma		2
Threskiornithidae					
Theristicus caudatus			ed,fo	g,ls,c	3
Mesembrinibis cayennensis			la		2
Plegadis chihi			ma		2
Anatidae					
Dendrocygna viduata			la		3
Amazonetta brasiliensis			la		3
Sarkidiornis melanotos			la		2
Cairina moschata			la		3
Mergus octosetaceus			la		1
Oxyura dominica			la		2
Cathartidae					
Sarcoramphus papa			ed,fo	c	2
Coragyps atratus			ed,fo,gr,sc	c	3
Cathartes aura			ed,fo,gr,sc	c	3
Accipitridae					
Elanus leucurus	x	x	ed,gr,we	a	3
Elanoides forficatus	x	x	ed,sc	a	3
Leptodon cayanensis	x	x	ed,fo	ms,c	3
Harpagus diodon	x	x	fo	ms,c	3
Ictinia plumbea	x	x	ed,fo,sc	ms,c	3
Accipter striatus	x		fo	ms,c	3
Geranoaetus melanoleucus	x	x	fo	ms,c	3
Buteo albicaudatus		x	ce,ed,gr,we	a	3
Buteo swainsoni			ed	a	2
Buteo magnirostris	x	x	ed,sc	ms,c	3
Buteo leucorrhous			fo	ms,c	2
Buteo brachyurus			fo	ms,c	1
Buteo nitidus	x		ed,fo,sc	ms,c,a	3
Heterospizias meridionalis	x	x	ce,gr,ma,we		3
Buteogallus urubutinga			ed,ma	g,ms,c	3
Spizastur melanoleucus	x		ed,fo,la	ms,c	1
Geranospiza caerulescens			ed,fo	ms,c	3

APPENDIX. Continued.

Taxa	Localities		Habitat	Vertical distribution	Status
	M	R			
Pandionidae					
Pandion haliaetus			la		
Falconidae					
Herpetotheres cachinnans			ce,ed,**fo**,sc	g,ls,ms,c	3
Micrastur semitorquatus			fo	g,ls,ms,c	?
Micrastur ruficollis			fo	g,ls,ms,c	
Milvago chimachima			**ed**,gr,sc	g,ls,ms	
Polyborus plancus			**ed**,fo,gr,sc	g,ms,**c**	
Falco peregrinus			ed,**gr**,we	ls,**ms**	3
Falco femoralis			ed,**gr**	ls,**ms**	?
Falco sparverius			ed,**gr**	ls,**ms**	
Cracidae					
Penelope obscura			fo	g,**ms**,c	
Penelope superciliaris			**fo**,sc	g,**ms**,c	
Pipile jacutinga			fo	g,**ms**,c	
Crax fasciolata			fo	g,**ms**,c	
Phasianidae					
Odontophorus capueira		x	**fo**,sc	g	
Aramidae					
Aramus guarauna			**ma**,we		
Rallidae					
Rallus sanguinolentus			ma		1
Rallus nigricans		x	**ma**,**we**		3
Rallus maculatus			ma		2
Aramides cajanea			la,**ma**,**we**		3
Aramides saracura			**fo**,ma,we	g	3
Porzana albicollis			ma		3
Laterallus melanophaius	x		**ma**,we		2
Gallinula chloropus			la		3
Porphyrula martinica			la		3
Porphyrula flavirostris			la		3
Fulica leucoptera			la		2
Cariamidae					
Cariama cristata			ce,**gr**,we		
Jacanidae					
Jacana jacana			la		3
Charadriidae					
Vanellus chilensis	x		**ed**,**gr**,ma,**we**	g	
Scolopacidae					
Tringa solitaria			la		2
Tringa flavipes			la		2
Tringa melanoleuca			la		1
Actitis macularia			ma,la		1
Calidris fuscicollis			la,**ma**,**we**		1
Calidris melanotos			la,**ma**,**we**		1

APPENDIX. Continued.

Taxa	Localities		Habitat	Vertical distribution	Status
	M	R			
Bartramia longicauda			gr,we		3
Gallinago gallinago			**ma**,we		3
Gallinago undulata			ma		2
Recurvirostridae					
Himantopus himantopus			**la**,ma		
Columbidae					
Columba speciosa		x	fo	g,ms,**c**	3
Columba picazuro		x	ce,**ed**,sc	g,**ms**,**c**	3
Columba maculosa		x	**ed**,fo,sc	g,ls,**ms**,c	3
Columba cayennensis	x	x	ed,sc	g,**ms**,**c**	3
Columba plumbea	x	x	fo	g,**ms**,c	3
Zenaida auriculata	x	x	ce,**ed**,gr,**sc**	g,**ls**,**ms**,c	3
Columbina minuta			ed,**sc**	g,**ls**,**ms**,c	3
Columbina talpacoti			ed,**sc**	g,**ls**,**ms**,c	3
Columbina picui			ed	g,ls,**ms**,c	3
Claravis pretiosa			ed,sc	g,**ms**,**c**	2
Scardafella squammata			ce,**ed**	g,**ls**,**ms**,c	3
Leptotila verreauxi			ce,**fo**,**sc**	g,ls,ms	3
Leptotila rufaxilla			fo,sc	g,ls,ms	3
Geotrygon montana			fo	g	3
Psittacidae					
Ara maracana	x		**ed**,fo	ms,**c**	3
Aratinga leucophthalmus	x		**ed**,fo	ms,c	3
Aratinga solstitialis	x		**ed**,fo	ms,**c**	3
Aratinga aurea	x		ce,ed,sc	g,**ms**,**c**	3
Pyrrhura frontalis	x	x	**ed**,**fo**,sc	ms,c	3
Forpus xanthopterygius	x	x	**ed**,sc	ms,c	3
Brotogeris tirica	x	x	**ed**,fo,**sc**	ms,c	3
Pionopsitta pileata	x	x	fo	ms,**c**	3
Pionus maximiliani	x	x	ed,**fo**,	ms,**c**	3
Amazona aestiva	x		**ed**,fo,**sc**	ms,**c**,a	3
Amazona vinacea			ed,fo	ms,**c**	3
Triclaria malachitacea			ed,fo	ms,**c**	3
Cuculidae					
Coccyzus americanus			**fo**,sc	ls,**ms**	3
Coccyzus euleri			ed,**sc**	ls,**ms**	1
Coccyzus melacoryphus			fo,**sc**	ls,**ms**	3
Piaya cayana			ce,ed,fo	ms,c	3
Crotophaga major			la,ma		3
Crotophaga ani			**ed**,gr	g,**ls**,ms	3
Guira guira			**ed**,gr	g,**ls**,ms,c	3
Tapera naevia			sc	g,**ls**,ms	3
Dromococcyx pavoninus			ed,sc	g,**ls**,ms	3
Tytonidae					
Tyto alba			ed	ms,c	
Strigidae					
Otus choliba			ce,**ed**,**fo**,sc	ms,c	
Otus atricapillus			ed,**fo**	ms,c	

APPENDIX. Continued.

Taxa	Localities			Habitat	Vertical distribution	Status
	M		R			
Bubo virginianus	x			**ed**,**fo**,la,sc	ls,ms,c	2
Pulsatrix perspicillata	x			fo	ms,**c**	1
Pulsatrix koeniswaldiana	x		x	fo	ms**c**	3
Glaucidium brasilianum	x		x	ce,ed,sc	ms,c	3
Speotyto cunicularia	x		x	**ed**,**gr**,we	g,ls	3
Ciccaba virgata			x	fo	ms,**c**	2
Strix hylophila			x	**ed**,fo,sc	ms,**c**	3
Rhinoptynx clamator			x	ce,**ed**,sc	ms,**c**	3
Asio stygius				ce,we		2
Asio flammeus				ma,we		2
Nyctibiidae						
Nyctibius aethereus	x			ce,ed,sc	c,a	1
Nyctibius griseus	x			ce,ed,sc	c,a	3
Caprimulgidae						
Lurocalis semitorquatus	x		x	**ed**,sc	a	3
Chordeiles acutipennis	x			ce,**ed**,gr,ma,we	a	3
Chordeiles minor	x			ed,sc	a	3
Podager nacunda	x		x	ce,**ed**,gr,ma,we	a	3
Nyctidromus albicollis	x	x	x	**ed**,sc	a	3
Caprimulgus rufus	x			ed	a	
Caprimulgus parvulus			x	gr		3
Hydropsalis brasiliana				ce,ed,ma,sc		3
Macropsalis creagra		x		**ed**,sc		
Apodidae						
Streptoprocne zonaris				gr,la,ma,we		3
Cypseloides senex				**la**,ma,we		3
Cypseloides fumigatus				**la**,ma,we		3
Chaetura cinereiventris	x			ed,sc		3
Chaetura andrei	x			ed,sc		3
Trochilidae						
Phaethornis eurynome				ed,**fo**,**sc**	**ls**,ms	3
Phaethornis squalidus				ed,**fo**	ls	1
Phaethornis pretrei				ed,**fo**	**ls**,ms	3
Eupetomena macroura				ed,sc	ls,ms,c	3
Melanotrochilus fuscus				ed,sc	ls,ms,c	3
Colibri serrirostris				ce,**ed**,sc	ls,ms,c	3
Anthracothorax nigricollis				**ed**,fo,**sc**	ls,ms,c	3
Chrysolampis mosquitus				ce,**ed**,sc	**ls**,**ms**,c	2
Stephanoxis lalandi	x	x		ce,ed,ma,**sc**	**ls**,**ms**,c	3
Chlorostilbon aureoventris	x	x		ed,sc	ls,ms	3
Thalurania glaucopis	x	x		ed,fo,sc	ls,ms	3
Hylocharis sapphirina	x	x		ed,fo,sc	**ls**,**ms**,c	3
Hylocharis cyanus				ed,**sc**	ls,ms	1
Hylocharis chrysura	x			**ed**,fo,**gr**,**sc**	ls,ms,c	3
Leucochloris albicollis	x			**ed**,fo,**sc**	**ls**,**ms**,c	3
Amazilia versicolor				**ed**,fo,**sc**	**ls**,**ms**,c	3
Amazilia fimbriata				**ed**,fo,**sc**	**ls**,**ms**,c	3
Amazilia lactea				ed,fo,sc	**ls**,**ms**,c	3
Heliomaster squamosus				**ed**,**fo**,sc	ls,ms,c	3
Calliphlox amethystina		x		ce,ed,sc	**ls**,**ms**,c	3

APPENDIX. Continued.

Taxa	Localities		Habitat	Vertical distribution	Status
	M	R			
Trogonidae					
Trogon viridis			fo	ms,c	
Trogon rufus		x	fo	ms,c	
Trogon surrucura		x	fo	ms,c	
Alcedinidae					
Ceryle torquata	x		la		3
Chloroceryle amazona	x		la		3
Chloroceryle americana	x		la		3
Chloroceryle aenea	x		la		1
Momotidae					
Baryphthengus ruficapillus			fo	g,ls,ms	3
Galbulidae					
Galbula ruficauda			ed,la,ma,sc	ls,ms	3
Bucconidae					
Notharcus macrorhynchus			fo	g,ls,ms,c	2
Nystalus chacuru			ce,ed	g,ls,ms,c	3
Nonnula rubecula			fo	g,ls,ms,c	3
Ramphastidae					
Pteroglossus aracari			fo	ms,c	3
Selenidera maculirostris			fo	ms,c	3
Baillonius bailloni	x		fo	ms,c	3
Ramphastos dicolorus	x		fo	g,ms,c	3
Picidae					
Picumnus nebulosus			ed,fo,sc	ls,ms,c	3
Picumnus temminckii			fo,sc	ls,ms,c	3
Picumnus cirratus			fo,sc	ls,ms,c	3
Colaptes campestris	x		ed,gr	g,ls,ms	3
Colaptes melanochloros *	x		ce,ed,fo,sc	ms,c	3
Piculus aurulentus	x		fo	ms,c	3
Celeus flavescens	x		ed,fo,sc	g,ls,ms,c	3
Dryocopus lineatus	x		ce,ed,fo,sc	ls,ms,c	3
Melanerpes flavifrons	x		ed,fo,sc	ms,c	3
Leuconerpes candidus	x		ce,ed,sc	g,ls,ms,c	3
Veniliornis spilogaster	x		fo,sc	ls,ms,c	3
Phloeoceastes melanoleucos			ed,fo,sc	ls,ms,c	
Phloeoceastes robustus			fo	ms,c	
Dendrocolaptidae					
Dendrocincla turdina *		x	fo	ls,ms	3
Sittasomus griseicapillus		x	fo	ms,c	3
Xiphocolaptes albicollis		x	fo	ls,ms,c	3
Dendrocolaptes platyrostris		x	fo	ms,c	3
Lepidocolaptes angustirostris		x	ce,fo,sc	ms,c	3
Lepidocolaptes squamatus		x	fo	ms,c	3
Lepidocolaptes fuscus		x	fo	ms,c	3
Campylorhamphus trochilirostris			ed,fo	ls,ms,c	1
Campylorhamphus falcularius			ed,fo	ls,ms,c	1

APPENDIX. Continued.

Taxa	Localities		Habitat	Vertical distribution	Status
	M	R			
Furnariidae					
Clibanornis dendrocolaptoides			**fo**,sc	g,ls	
Furnarius rufus			ed	g,ls,c	
Leptasthenura striolata			fo	c	
Leptasthenura setaria			fo	c	
Synallaxis ruficapilla			ed,**fo**,sc	g,**ls**,ms	
Synallaxis frontalis			ce,sc	g,**ls**	
Synallaxis spixi			sc	g,**ls**	
Synallaxis cinerascens			fo	g,**ls**	
Certhiaxis cinnamomea			**la**,ma		
Cranioleuca obsoleta			ed,**fo**	**ms**,c	
Cranioleuca vulpina			ma		
Cranioleuca pallida			**fo**,ed	**ms**,c	
Anumbius annumbi			ed	g,ls,**ms**	
Anabazenops fuscus			fo	g,ls,**ms**	
Syndactyla rufosuperciliata			ed,**fo**,**sc**	g,**ls**,ms	
Anabacerthia amaurotis			fo	g,**ls**,ms	
Philydor atricapillus			fo	ms,**c**	2
Philydor dimidiatus			fo	ms,**c**	1
Philydor lichtensteini			fo	ms,**c**	3
Philydor rufus			fo	ms,**c**	3
Automolus leucophthalmus			**fo**,sc	**ls**,ms	3
Cichlocolaptes leucophrys			fo	ls,**ms**	
Heliobletus contaminatus			fo	ls,**ms**,c	3
Xenops rutilans			fo	**ms**,c	3
Xenops minutus			fo	**ms**,c	3
Sclerurus scansor			fo	g,ls	3
Lochmias nematura			**la**		3
Formicariidae					
Hypoedaleus guttatus			fo	ms,**c**	
Batara cinerea	x	x	fo	g,**ls**,ms	
Mackenziaena leachii	x	x	fo	**ls**,ms	
Mackenziaena severa	x	x	fo	**ls**,ms	
Biatas nigropectus		x	fo	ls,**ms**	
Thamnophilus doliatus			la,ma		
Thamnophilus caerulescens			fo	ls,**ms**	
Thamnophilus ruficapillus			sc	**ls**,ms	
Dysithamnus stictothorax			fo	**ms**,c	
Dysithamnus mentalis			ed,fo	ls,**ms**	
Dysithamnus xanthopterus			fo	c	2
Herpsilochmus rufimarginatus			fo	c	3
Drymophila ferruginea			fo	ms,**c**	
Drymophila malura			fo,**sc**	**ls**,ms	
Pyriglena leucoptera			fo	ls,ms	3
Chamaeza campanisoma			fo	g,ls	3
Chamaeza ruficauda			fo	g,ls	3
Formicarius colma			fo	g,ls	1
Grallaria varia			fo	g,ls	3
Hylopezus ochroleucus			fo	g,ls	3
Conopophaga lineata			fo	g,**ls**	3

APPENDIX. Continued.

Taxa	Localities			Habitat	Vertical distribution	Status
	M		R			
Rhinocryptidae						
Psilorhamphus guttatus	x			fo	g,ls	3
Scytalopus speluncae				fo	g	3
Scytalopus indigoticus				fo	g	3
Cotingidae						
Phibalura flavirostris	x			fo	ms,c	1
Lipaugus lanioides	x			fo	ls,ms	3
Pachyramphus viridis	x			ed,fo,sc	ms,c	3
Pachyramphus castaneus	x			ed,fo,sc	ms,c	3
Pachyramphus polychopterus	x			ed,fo,sc	ms,c	3
Pachyramphus validus *	x			ed,fo,sc	ms,c	3
Tityra cayana	x			ed,fo	c	3
Tityra inquisitor	x			ed,fo	c	3
Pyroderus scutatus				fo	ms,c	1
Procnias nudicollis				fo	ms,c	3
Pipridae						
Pipra fasciicauda	x			fo	ls,ms	3
Manacus manacus	x			fo	ls,ms	1
Chiroxiphia caudata	x	x		fo	ls,ms	3
Neopelma pallescens		x		fo	ls,ms,c	2
Piprites pileatus				fo	ls,ms	1
Piprites chloris				fo	ls,ms	3
Schiffornis virescens		x		fo	ls,ms	3
Tyrannidae						
Xolmis cinerea		x		ce,gr,we		3
Xolmis velata				gr,we		1
Xolmis dominicana				gr,we		3
Colonia colonus				ed,fo	ms,c	3
Gubernetes yetapa				ma,we		2
Alectrurus tricolor				gr,we		2
Knipolegus lophotes				gr		3
Knipolegus nigerrimus				gr		3
Knipolegus cyanirostris	x			ed,ma,sc	ls,ms,c	3
Muscipipra vetula	x			ed,sc	ms,c	3
Fluvicola pica				la		3
Arundinicola leucocephala	x	x		ma,we	ls	3
Pyrocephalus rubinus	x	x	x	ed,ma,sc	ls	3
Satrapa icterophrys	x	x	x	ed,ma,sc	ls,ms	3
Machetornis rixosus	x	x	x	ed	g,ls,ms	3
Sirystes sibilator	x	x		ed,sc	ms,c	3
Muscivora tyrannus	x	x	x	ed,gr,sc	g,ls,ms,c	3
Tyrannus melancholicus	x	x	x	ed,sc	ms,c	3
Empidonomus varius	x	x	x	ed,sc	ms,c	3
Legatus leucophaius		x	x	ed,sc	ms,c	3
Conopias trivirgata				ed,sc	ls,ms,c	3
Megarhynchus pitangua	x	x		ed,sc	ms,c	3
Myiodynastes maculatus	x	x		fo,sc	ms,c	3
Myiozetetes similis	x	x		ed,sc	ms,c	3
Pitangus sulphuratus	x	x	x	ed,gr,la,ma,sc	g,ls,ms,c	3

APPENDIX. Continued.

Taxa	Localities		Habitat	Vertical distribution	Status
	M	R			
Attila rufus			fo,**sc**	g,**ls**,**ms**,c	2
Pseudattila phoenicurus			**ed**,fo,**sc**	ls,ms,**c**	3
Myiarchus ferox			ed,sc	ls,**ms**,c	3
Myiarchus swainsoni			ed,**sc**	ls,**ms**,c	3
Contopus cinereus			**ed**,sc	**ms**,c	3
Empidonax euleri			fo	**ls**,ms	3
Cnemotriccus fuscatus			fo	**ls**,ms	3
Myiobius barbatus			fo	ls	1
Myiobius atricaudus			fo	ls	1
Myiophobus fasciatus			ed,ma,**sc**	**ls**,ms	3
Hirundinea ferruginea			we		3
Onychorhynchus coronatus			fo	ls	1
Platyrinchus mystaceus			fo	**ls**,ms	3
Tolmomyias sulphurescens			ed,fo,**sc**	ms,**c**	3
Ramphotrigon megacephala			fo	**ls**,ms	2
Todirostrum cinereum			**ed**,fo,**sc**	ls,ms,**c**	3
Todirostrum plumbeiceps			ed,**sc**	**ls**,ms	3
Idioptilon nidipendulum			fo	**ls**,ms	3
Idioptilon margaritaceiventer			sc	**ls**,ms	3
Myiornis auricularis			fo,sc	ls,**ms**	3
Hemitriccus diops			fo	**ls**,ms	3
Hemitriccus obsoletus	x		fo	**ls**,ms	3
Phylloscartes eximius *	x		fo	ls,**ms**	3
Phylloscartes silviolus *	x		ed,**fo**,sc	ls,**ms**,c	3
Phylloscartes ventralis	x		ed,fo,sc	ls,**ms**,c	3
Phylloscartes oustaleti	x		fo	**ls**,ms	2
Phylloscartes paulistus			fo	ls,**ms**	3
Capsiempis flaveola			**ed**,sc	**ls**,ms	3
Euscarthmus meloryphus			**sc**	**ls**,ms	3
Culicivora caudacuta			gr,we		3
Serpophaga subcristata			ed,ma,**sc**	ls,**ms**	3
Serpophaga nigricans			la		3
Elaenia flavogaster			ed,sc	ms,**c**	3
Elaenia parvirostris			ed,sc	ls,**ms**,c	3
Elaenia mesoleuca			ed,sc	ls,**ms**,c	3
Elaenia chiriquensis			**ed**,gr	ls,**ms**,c	3
Elaenia obscura			**ed**,sc	ls,**ms**	3
Myiopagis caniceps			**ed**,fo,sc	ms,**c**	3
Myiopagis viridicata			ed,**fo**	**ms**,c	3
Suiriri suiriri			ed,sc	**ms**,c	2
Camptostoma obsoletum			**ed**,**fo**,sc	ms,**c**	3
Phyllomyias virescens *			**ed**,**fo**,sc	ms,**c**	1
Phyllomyias fasciatus			**ed**,sc	ms,**c**	3
Phyllomyias griseocapilla *			**ed**,sc	ms,**c**	1
Phyllomyias burmeisteri *			fo	ls,**ms**	3
Leptopogon amaurocephalus			fo	**ls**,ms	3
Pipromorpha rufiventris			fo	g,**ls**,ms	3
Corythopis delalandi			fo	g,ls	3
Oxyruncidae					
Oxyruncus cristatus			fo	ms,**c**	3

APPENDIX. Continued.

Taxa	Localities		Habitat	Vertical distribution	Status
	M	R			
Hirundinidae					
Tachycineta albiventer			la		3
Tachycineta leucorrhoa			ed,**gr**,**we**		3
Phaeprogne tapera			**ed**,gr,we		3
Progne chalybea			**ed**,gr,we		3
Notiochelidon cyanoleuca			**ed**,gr,sc		3
Alopochelidon fucata			**gr**,ma,**we**		3
Stelgidopteryx ruficollis			ed,**la**		3
Hirundo rustica			**gr**,ma,**we**		3
Petrochelidon pyrrhonota			**gr**,ma,**we**		3
Corvidae					
Cyanocorax caeruleus			fo	ms,**c**	3
Cyanocorax cristatellus			ce		3
Cyanocorax chrysops			ed,**fo**,sc	g,ls,**ms**	3
Troglodytidae					
Cistothorus platensis			**ma**		2
Troglodytes aedon			**ed**,fo,**sc**	g,**ls**,ms	3
Mimidae					
Mimus saturninus			**ed**,sc	g,ls,ms	3
Donacobius atricapillus			ma		3
Turdidae					
Platycichla flavipes			fo	**ms**,c	2
Turdus nigriceps			fo	g,ls,**ms**	3
Turdus rufiventris			ed,fo,sc	g,ls,**ms**	
Turdus leucomelas			ed,**sc**	g,ls,**ms**	
Turdus amaurochalinus			**ed**,sc	g,ls,**ms**	
Turdus albicollis			fo	**ls**,ms	
Sylviidae					
Polioptila lactea			**ed**,fo,sc		
Motacillidae					
Anthus hellmayri			**gr**		3
Anthus lutescens			gr,**we**		3
Anthus correndera			gr,we		
Anthus nattereri			gr		
Vireonidae					
Cyclarhis gujanensis			ed,sc	**ms**,c	
Vireo olivaceus			fo	ms,**c**	
Hylophilus poicilotis			**fo**,sc	ms,**c**	
Icteridae					
Molothrus bonariensis			**ed**,**gr**,sc	g,**ls**,**ms**,c	
Molothrus rufoaxillaris			**ed**,**gr**,sc	g,**ls**,**ms**,c	
Molothrus badius			**ed**,**gr**	g,ls,ms	
Scaphidura oryzivora			ed,gr	g,ls,ms	
Psarocolius decumanus			fo	ms,**c**	1
Cacicus haemorrhous			fo	ms,**c**	3
Cacicus chrysopterus			fo	**ms**,**c**	3
Gnorimopsar chopi			ed	g,ms,**c**	3

APPENDIX. Continued.

Taxa	Localities			Habitat	Vertical distribution	Status
	M		R			
Agelaius thilius				la,ma		
Agelaius ruficapillus				la,ma		
Agelaius cyanopus				la,ma		1
Icterus cayanensis				**fo**,sc	ms,**c**	2
Pseudoleistes guirahuro				ma,we		3
Leistes superciliaris				gr		3
Dolichonyx oryzivorus				ma		1
Parulidae						
Parula pitiayumi	x		x	**ed**,**fo**,sc	ms,**c**	3
Geothlypis aequinoctialis	x		x	la,ma		3
Basileuterus culicivorus	x		x	ed,**fo**,sc	ls,**ms**,c	3
Basileuterus leucoblepharus	x		x	**fo**,sc	g,**ls**	3
Basileuterus rivularis				la		3
Coerebidae						
Coereba flaveola				ed,sc	**ls**,**ms**,c	3
Conirostrum speciosum				**fo**,sc	ms,**c**	3
Cyanerpes cyaneus				**fo**,sc	ms,c	1
Dacnis cayana				ed,**fo**,sc	ms,c	3
Dacnis nigripes				**fo**,sc	ms,**c**	1
Tersinidae						
Tersina viridis		x		**ed**,sc	ls,ms,**c**	3
Thraupidae						
Chlorophonia cyanea				**ed**,fo	ms,**c**	3
Euphonia musica			x	**ed**,fo	ms,**c**	3
Euphonia chlorotica			x	ce,**ed**,**fo**,**sc**	ms,**c**	3
Euphonia violacea				**ed**,**fo**,sc	ms,**c**	3
Euphonia pectoralis			x	ed,**fo**	ms,**c**	3
Euphonia chalybea			x	ed,fo	ms,**c**	3
Pipraeidea melanonota			x	**ed**,**fo**,sc	**ms**,c	3
Tangara seledon				ed,**fo**,sc	ms,**c**	3
Tangara desmaresti			x	ed,fo	ms,**c**	3
Tangara preciosa			x	ed,fo,sc	ms,c	3
Tangara peruviana				ed,**fo**,**sc**	ms,c	2
Tangara cayana				ce,ed,sc	ms,c	3
Stephanophorus diadematus			x	ed,sc	ls,**ms**,**c**	3
Thraupis sayaca			x	ed,sc	ls,**ms**,**c**	3
Thraupis palmarum				ed	ms,**c**	3
Thraupis bonariensis				ed,sc	ms,**c**	3
Ramphocelus carbo				**la**,ma		3
Piranga flava		x		ed,fo	ls,**ms**,**c**	2
Orthogonys chloricterus		x		fo	c	1
Habia rubica	x	x	x	fo	g,**ls**,ms	3
Tachyphonus coronatus	x	x	x	**ed**,**fo**,sc	g,ls,**ms**	3
Trichothraupis melanops	x	x	x	fo	g,ls,**ms**	3
Cypsnagra hirundinacea				**ce**,sc	g,ls,ms	1
Pyrrhocoma ruficeps				fo	g,**ls**,ms	3
Nemosia pileata				ce,**ed**,sc	ls,ms	3
Hemithraupis ruficapilla				ed,fo	ms,c	3
Hemithraupis guira				ed,fo	ms,**c**	3

APPENDIX. Continued

Taxa	Localities		Habitat	Vertical distribution	Status
	M	R			
Neothraupis fasciata			ce		1
Orchesticus abeillei			ed,**fo**	**ms,c**	1
Cissopis leveriana			**ed**,fo,sc	ls,**ms**,c	3
Schistochlamys ruficapillus			ed,sc	ls,**ms**,c	3
Fringillidae					
Saltator similis			ed,fo,sc	ls,**ms**,c	
Saltator maxillosus			ed,fo	ls,**ms**,c	3
Saltator atricollis			**ce**,sc	ls,**ms**	1
Pitylus fuliginosus			fo	ls,**ms**	3
Paroaria coronata			ed,**ma**	ms	1
Cyanocompsa cyanea			ed,ma,sc	ls,**ms**	3
Cyanoloxia glaucocaerulea			ed,sc	ls,**ms**	2
Volatinia jacarina			ed,**gr**,we	**ls**	3
Tiaris fuliginosa			**fo**,ma,sc	**ls**,ms	3
Sporophila falcirostris			ed,**ma**,**sc**,	**ls**,ms	
Sporophila plumbea			ce,**gr**,ma,**sc**,we	**ls**,ms	
Sporophila collaris			ma		
Sporophila lineola			**ed**,sc	ls,ms	3
Sporophila caerulescens			**ed**,**gr**,ma,sc	ls,ms	3
Sporophila bouvreuil			we		2
Sporophila hypoxantha *			we		
Sporophila melanogaster			we		3
Oryzoborus angolensis			**ma**,sc	ls,**ms**	2
Amaurospiza moesta			**fo**,sc	**ls**,ms	3
Sicalis citrina			**gr**,we		3
Sicalis flaveola			**ed**,sc	g,**ls**,**ms**,c	3
Sicalis luteola			gr,**we**		3
Haplospiza unicolor			fo	g,**ls**	3
Coryphospingus cucullatus			ce,**sc**	g,**ls**	3
Arremon taciturnus			ed	g,**ls**	1
Arremon flavirostris			ed	g,ls	3
Myospiza humeralis			**gr**,we		3
Zonotrichia capensis			ed,ma,sc	g,**ls**,**ms**,c	3
Emberizoides herbicola			**gr**,ma,**we**		3
Emberizoides ypiranganus			gr,**ma**,**we**		3
Donacospiza albifrons			gr,**ma**,**we**		3
Poospiza nigrorufa			ed,ma,**sc**	g,**ls**,ms	2
Poospiza lateralis			ed,sc	g,**ls**,ms	3
Embernagra platensis			**ma**,we		3
Spinus magellanicus			ed,sc	g,ls,ms,**c**	3
Estrildidae					
Estrilda astrild			gr		
Ploceidae					
Passer domesticus			gr		