

AVIFAUNA OF THE NORTHERN PARAGUAYAN CHACO

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Resumen. – Avifauna chaqueña del norte de Paraguay. – Inventarios llevados a cabo en cinco sitios en el chaco del norte de Paraguay indicaron la presencia de 233 especies de aves, incluyendo a Mosqueta Boreal (*Empidonax alnorum*), la cual se registra por primera vez en el país. Se documentaron por primera vez tres especies por medio de especímenes [Chiripepé de Cabeza Gris (*Pyrrhura molinae*), Pijúí Ocráceo (*Poecilurus scutatus*) y Batará Boliviano (*Thamnophilus sticturus*)] y una por grabaciones de cantos [Piojito Trinador ³*Serpophaga griseiceps*]. Se registraron dos especies nuevas para el chaco de Paraguay, y 22 especies nuevas para las zonas del Alto Chaco o Matogrosense (*sensu* Hayes 1995). Comparaciones preliminares entre sitios, junto con información adicional publicada, apoyan a la idea de que el recambio de especies de sitio a sitio es considerable en el bioma del chaco. La recién declarada Reserva de Biosfera del Chaco, si se implementa y se protege efectivamente, representa un paso importante hacia la conservación de la avifauna del norte del chaco.

Abstract. – Surveys at five sites in the chaco biome in northern Paraguay revealed the presence of 233 bird species including one species, Alder Flycatcher (*Empidonax alnorum*) new for the country. Four species were documented for the first time with specimens [Green-cheeked Parakeet (*Pyrrhura molinae*), Ochre-cheeked Spinetail (*Poecilurus scutatus*), and Bolivian Slaty-Antshrike (*Thamnophilus sticturus*)] or tape-recordings [Gray-crowned Tyrannulet (*Serpophaga griseiceps*)]. Two additional species were new for the Paraguayan chaco and 22 species for the regions of Alto Chaco or Matogrosense (*sensu* Hayes 1995). Preliminary comparisons among sites, along with other published information, support the idea that site-to-site turnover of species is high in the chaco biome. The recently declared Reserva de Biosfera del Chaco, if effectively implemented and protected, will represent an important step towards the conservation of the northern chaco avifauna. Accepted 3 October 2002.

Key words: Paraguay, chaco, Neotropical, faunal turnover, austral migration, conservation.

INTRODUCTION

Effective biodiversity conservation depends critically on quality data regarding the geographic distributions of species in remote

areas still holding primary vegetation (Peterson *et al.* 1993). Paraguay holds an important portion – almost 25% – of the South American dry-forest biome called the chaco, representing 61% of the national territory (Madroño 1995, Vera *et al.* 2000). As Short (1975) underscored in his treatise on the chaco avifauna, northern Paraguay and southeastern Bolivia hold the last “extensive uncultivated stands” of dry woodland in the region. Given

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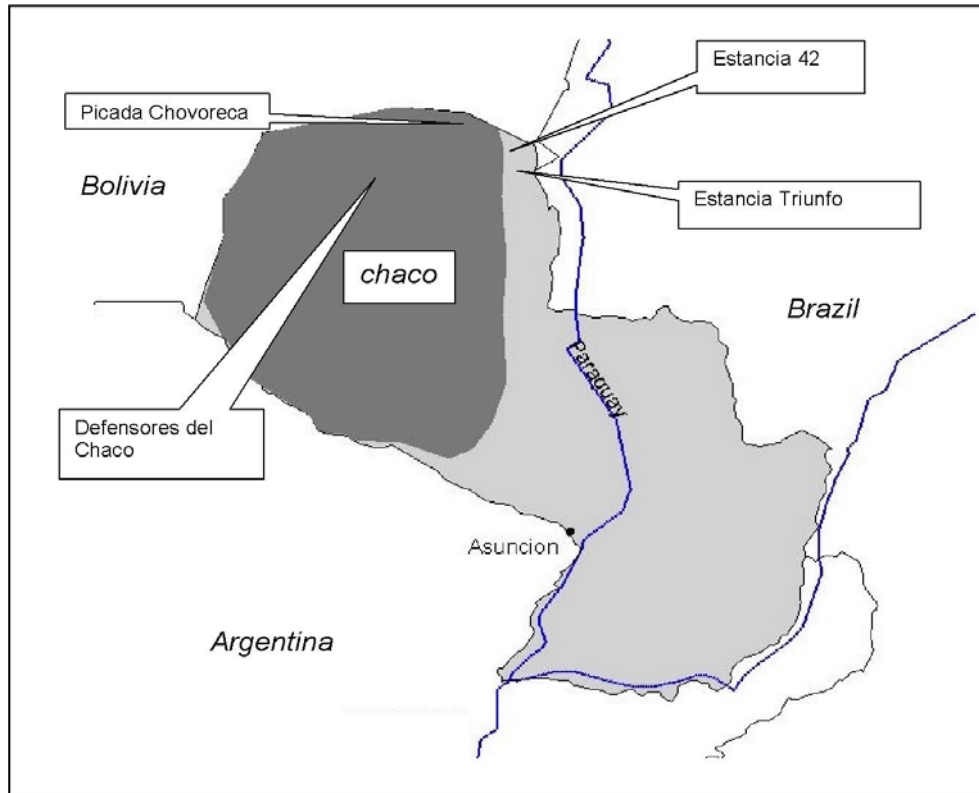


FIG. 1. Map of Paraguay, showing the location of the five study areas and other important features mentioned in the text. Shading denotes the approximate extent of Paraguayan chaco.

broad patterns of species turnover across the chaco (Short 1975, Kratter *et al.* 1993), and given that the chaco of northern Paraguay has never seen detailed ornithological survey, new inventories become important for establishing optimal strategies for conservation in the region. Indeed, the only detailed single-site surveys of the Paraguayan chaco are those of Short (1976) at Lichtenau, depto. Presidente Hayes, and Brooks (1997) at Estancia Toledo, depto. Boqueron, both of which lie c. 250 km south of our southernmost site.

In 1975, Paraguay decreed the 7800 km² Parque Nacional Defensores del Chaco (Fig. 1), one of the first protected areas to be established in the country. An initiative to extend

the area protected as far as the Bolivian border recently came to fruition with presidential decree 13202 of 21 May 2001, that boldly declared the entire northern Paraguayan chaco (a total of 47,072.5 km², or 10% of the national territory) as the “Reserva de Biosfera del Chaco.” This nationally recognized biosphere reserve includes three existing protected areas (Parque Nacional Defensores del Chaco, Parque Nacional Teniente Agripino Enciso, and the now expanded Monumento Natural Cerro Chovoreca) and incorporates three new reserves within the national system of protected areas (Parque Nacional Río Negro, Reserva Natural Cerro Cabrera-Timané, and Parque Nacional Médanos del

Chaco). This massive area of well-preserved habitat has seen no published avifaunal list, with the exception of that included within the rapid ecological assessment of Defensores del Chaco (DPNVS 1999). The present study thus seeks to provide preliminary avifaunal surveys for five sites in extreme northern Paraguay—two within the Parque Nacional Los Defensores del Chaco, and three near the Bolivian border (Fig. 1). Our inventory work at the latter three sites represents the first avifaunal surveys from within the Monumento Natural Cerro Chovoreca and the newly created Parque Nacional Río Negro.

STUDY AREAS AND METHODS

Study areas

Parque Nacional Defensores del Chaco. Two sites within the Parque Nacional Los Defensores del Chaco, depto. Alto Paraguay, were surveyed in late October 1995 by Robbins, Zyskowski, Rosalía Fariña, and Sergio Villanueva. The first, Cerro León (20°26'S, 60°19'W), was surveyed from the evening of 21 October through the morning of 25 October. The second site, Madrejón (20°40'S, 59°50'W; c. 54 road km E of Cerro León), was surveyed from the afternoon of 25 October through the early morning of 31 October 1995, and briefly (c. 5 h) by Zyskowski, Bostwick, and Peterson on 17 September and 10 October 1999.

Conditions at Cerro León were extremely windy, hot, and dry. Strong winds, from the northeast and east, persisted day and night for virtually our entire stay at Cerro León. Temperatures peaked at 42° C by mid-afternoon and remained at 40° C until after sunset. Surface water was limited to two shallow (one a few cm deep, the other about 30 cm deep) pools. Most trees and bushes were either devoid of leaves, or still in the process of losing them. The above conditions, combined with very limited shade (cloudless

every day) and limited mobility (all areas accessed on foot), restricted the number of mist-nets at this site (8), which were constantly filled with dry leaves by the strong winds. Censuses were conducted up to c. 7 km north and c. 5 km south of our road-based camp.

At Madrejón, climatic conditions were the same as at Cerro León until a strong cold front arrived from the west at 19:00 (GMT-4 h) on 27 October 1995. By the morning of 28 October, the temperature had dropped to 17° C with a completely overcast sky. At 15:30, rain began and continued until c. 09:30 the next morning. By 17:00 on the 29 October, the wind had ceased and the sky had cleared completely. The sky was overcast on 30 October. Censuses were limited to 3–4 road km north, west, and south of park headquarters.

Cerro Chovoreca. The study site was chosen so as to be situated as far north as possible in the dry forests of the Paraguayan chaco. The initial goal was to arrive at the Bolivian border (Cerro Chovoreca, Hito VII; Fig. 1). However, access from the direction originally planned (via Base Aérea Adrián Jara, or Base 5) proved impossible, and the main access route (Picada Chovoreca) was both impassable and surrounded by naturally disturbed habitat (perhaps an old burn) within a few kilometers north of Línea 3. For these reasons, activities were focused along Picada Chovoreca immediately south of Línea 3 (center 19°35'S, 59°16'W) in an area of about 10 km². Sampling was carried out during 19–24 September 1999 by Zyskowski, Peterson, Bostwick, and Amarilla.

The study site included two principal habitat types: relatively tall dry forest and scrubby woodland. The forest was 10–15 m tall, with a fairly uniform canopy. At the time of our fieldwork, just prior to the normal onset of rains and following four months of drought, only about 5% of trees had leaves. The

scrubby woodland averaged 1–3 m tall, with occasional tall trees and palms. There, essentially none of the vegetation had leaves. This habitat appeared to be the result of a combination of topographic effects (low-lying terrain) and disturbance, perhaps a major forest fire. We found no surface water, which led to serious problems with moisture-seeking honeybees (*Apis* sp.). Both habitats were sampled, although efforts focused more on the forest (about 70% of effort) than on woodland (30%).

Estancia 42. During 5–12 September 1997, Clay, Ian Burfield, Dave Capper, Rosalía Fariña, Corinne Kennedy, Mirna Perrens and Rob Pople conducted ornithological surveys at Estancia 42, 35 km northwest of Puerto Bahía Negra (20°03'S, 58°10'W). The estancia and surrounding areas were originally covered with semihumid, medium-height forest (10–20 m), but we observed few areas of the property with closed canopy forest of height greater than 10–15 m. Surveys, including mist-netting, were conducted along the last 5 km of the principal access track, and along the network of surrounding trails. In addition to forest, the survey area included a small freshwater marsh, patches of regenerating scrub and implanted pasture, and small bodies of standing water alongside the access track. Munitions cartridges and various hearths with the remains of brocket deer (*Mazama* sp.), peccary (*Tayassu* sp.), and tegu lizards (*Tupinambis* sp.) suggested that considerable hunting occurred in the area, perhaps explaining the notable absence of Chaco Chachalaca (*Ortalis canicollis*) and the overall scarcity of large mammals. Details of some of the highlights of the ornithological surveys at this property have been presented elsewhere (Clay *et al.* 1998; Capper *et al.* 2001a, 2001b).

Estancia Triunfo. During 5–9 October 1999, Zyskowski and Bostwick sampled a block of

dry forest at Estancia Triunfo, c. 14 road km W of Bahía Negra (20°06'S, 58°16'W). This privately-owned ranch included a small patch (c. 12 x 7 km) of relatively undisturbed dry forest adjacent to the more degraded scrub and pastures. Censuses and mist-netting were conducted along a 7 km long narrow hunting trail that traversed the patch, and along the last 5 km of the access road. The forest was about 15 m tall and carpeted with terrestrial bromeliads (*Bromelia serrata*). The only standing water in the area was two artificial, 10 m diameter ponds along the main road. Despite former hunting, the forest was still inhabited by numerous tinamous (*Crypturellus*, two species), Chaco Chachalacas, and two species of monkeys (*Aotus azarae* and *Callicebus donacophilus*); we also observed a single Giant Anteater (*Myrmecophaga tridactyla*).

Methods

Sampling. Work was oriented towards a preliminary inventory of the birds at each site. Three principal approaches were employed: mist-netting (c. 65 net-h at Cerro León, 612 in the Chovoreca forest, c. 200 at Estancia 42, and c. 80 at Estancia Triunfo), visual observations (c. 95 h of observation by teams of 1–3 experienced observers at Chovoreca, 130 h at Estancia 42), and sound recordings. To document identifications, as well as to permit more in-depth studies at a later date, scientific specimens of most of the species were collected using mist-nets and shotguns, and are deposited at the Museo Nacional de Historia Natural del Paraguay, and at the University of Kansas Natural History Museum. Sound recordings are deposited at the Macaulay Library of Natural Sounds, Cornell Laboratory of Ornithology, Ithaca, New York (KZ and MBR), and National Sound Archive, Wildlife Section, London (RPC). Taxonomy and nomenclature follow Hayes (1995), as amended by AOU (1998) and other recent publications where appropriate.

RESULTS

Species diversity. Some 235 species were recorded at the five study sites: 117 at Cerro León, 135 at Madrejón, 101 at Chovoreca, 92 at Estancia Triunfo, and 160 at Estancia 42. Species accumulation curves for Chovoreca indicated that the inventory was approaching completion, likely better than 90% complete (Peterson & Slade 1998); however, it must be emphasized that this statistic refers to those species “present” and “detectable”² at the time of the inventory.

Alder Flycatcher (*Empidonax alnorum*) was recorded for the first time in Paraguay, and three additional species: Green-cheeked Parakeet (*Pyrrhura molinae*), Ochre-cheeked Spinetail (*Poecilurus scutatus*), and Bolivian Slaty-Antshrike (*Thamnophilus sticturus*) had not been documented previously with specimens. Details of the first records of the Bolivian Slaty-Antshrike, a species essentially endemic to the dry forests of Bolivia and Paraguay (Isler *et al.* 1997), are reported elsewhere (Clay *et al.* 1998, Capper *et al.* 2001a). Voice recordings of Gray-crowned Tyrannulet (*Serpophaga griseiceps*) from Estancia 42 appear to represent the first documentation of this species' presence in Paraguay (see Species accounts).

The presence of Barred Forest-Falcon (*Micrastur ruficollis*) and Pheasant Cuckoo (*Dromococcyx phasianellus*) in the Paraguayan chaco was documented for the first time, while 22 species were recorded for the first time in the Alto Chaco or Matogrosense regions (as defined by Hayes 1995). Species recorded for the first time in the Alto Chaco region were: Yellow-collared Macaw (*Primolius auricollis*), Yellow-chevroned Parakeet (*Brotogeris chiriri*), Rufous Nightjar (*Caprimulgus rufus*), Little (*Veniliornis passerinus*) and Pale-crested (*Celex lugubris*) woodpeckers, White-lored Spinetail (*Synallaxis albiflora*), Streaked Xenops (*Xenops rutilans*), Fawn-breasted Wren (*Thryothorus*

guarayanus), Chestnut-vented Conebill (*Conirostrum speciosum*), Green-winged Saltator (*Saltator similis*), and Saffron-billed Sparrow (*Arremon flavirostris*). The following species were recorded for the first time in the Matogrosense region, details of which, with the exception of White-naped Xenopsaris (*Xenopsaris albinucha*, see Species accounts), were published by Capper *et al.* (2000a, 2000b): Tataupa Tinamou (*Crypturellus tataupa*), Plumbeous (*Ictinia plumbea*) and Swallow-tailed (*Elanoides forficatus*) kites, Pavonine Cuckoo (*Dromococcyx pavoninus*), Spectacled Owl (*Pulsatrix perspicillata*), Rufous Nightjar, Lined Woodpecker (*Dryocopus lineatus*), Small-billed Elaenia (*Elaenia parvirostris*), White-naped Xenopsaris, Orange-headed Tanager (*Thlypopsis sordida*), and Dull-colored Grassquit (*Tiaris obscura*).

Breeding condition. Almost no breeding behavior was observed at Cerro León and Madrejón [see Plain Inezia (*Inezia inornata*) species account for an exception] until rains arrived on 28 October. Immediately after the front passed, however, columbids and virtually every passerine began courtship behavior, with persistent singing and territorial defense. As a result of the dramatic increase in vocalizations, our perception of species numbers and composition literally changed overnight, with eight species recorded for the first time the following morning.

Unfortunately, because of prior transportation arrangements, we were unable to remain to fully document post-rain changes in the avifauna's breeding status. Gonadal data from specimens deposited at the University of Kansas Natural History Museum document that some individuals of at least 13 of 45 species were already experiencing dramatic physiological changes prior to the 28 October rains; gonadal enlargement may have commenced as a result of heavy rains that passed through the Filadelfia/

Defensores region on 19–20 October. Ten of 33 species collected at Cerro Chovoreca showed some signs of enlarged gonads, in spite of the 6+ months of zero rainfall that preceded our visit.

Ant-following birds. We observed two antswarms during the surveys. On 6 September 1997 the following species were associated with an antswarm at Estancia 42: 1 Gray-necked Wood-Rail (*Aramides cajanea*), 1 Pale-crested Woodpecker, 3 Black-banded Woodcreepers (*Dendrocolaptes picumnus*), 2 Bolivian Slaty-Antshrikes, 3 White-backed Fire-eyes (*Pyriglena leuconota*), 5 Purplish Jays (*Cyanocorax cyanomelas*), 3 Plush-crested Jays (*Cyanocorax chrysops*), 2 Fawn-breasted Wrens, and 3 White-lined Tanagers (*Tachyphonus rufus*). At Cerro Chovoreca on 22 September 1999, a sizeable group of birds was assembled around a swarm; the following individuals were present, among perhaps 10 others: 1 White-barred Piculet (*Picumnus cirratus*), 2 Black-banded Woodcreepers, 2 Narrow-billed Woodcreepers (*Lepidocolaptes angustirostris*), 2 Bolivian Slaty-Antshrikes, 2 Black-bellied Antwren (*Formicivora melanogaster*), 1 unidentified tyrannid, and 1 House Wren (*Troglodytes aedon*).

Migration. Our study period at Cerro Chovoreca coincided with the arrival of a suite of species that likely represented north-bound austral migrants. Crowned Slaty Flycatcher (*Griseotyrannus aurantioatrocristatus*), Vermilion Flycatcher (*Pyrocephalus rubinus*), and Swainson's Flycatcher (*Myiarchus swainsoni*) were not recorded for the first 4–5 days of the Chovoreca inventory, but were sighted commonly and in relatively large numbers thereafter; collected individuals had heavy subcutaneous fat. Blue-black Grassquit (*Volatinia jacarina*) and Red-eyed Vireo (*Vireo olivaceus*) similarly were unrecorded for 4–5 days, and then became common, but were not collected, so fat levels

could not be confirmed. The latter species was collected at Cerro León, and showed enlarged gonads and no fat. Streaked Flycatcher (*Myiodynastes maculatus*), although sighted on the second day of the Chovoreca inventory, increased considerably in abundance during the study period. These observations made clear that several species were in the process of arriving in the Chovoreca area during the study period.

The passage of the 28 October 1995 atmospheric front at Madrejón also highlighted the migration of several Nearctic migrants. This was most evident in the Hirundinidae. Immediately after the passage of the front, the following species and numbers were observed: 20+ Bank Swallows (*Riparia riparia*), 2 Cliff Swallows (*Petrochelidon pyrrhonota*), and 100+ Barn Swallows (*Hirundo rustica*). Other boreal migrants included Mississippi Kite (*Ictinia mississippiensis*, see Species accounts), six species of shorebirds (Charadriidae, Scolopacidae; see Appendix 1), and Common Nighthawk (*Chordeiles minor*).

SPECIES ACCOUNTS

Mississippi Kite (*Ictinia mississippiensis*). Two adult kites, that appeared to be moving in association with the late October 1995 front, were studied for a few minutes by MBR as they circled overhead at Madrejón. The relatively pale underparts and lack of tail bands and rufous in the primaries distinguished them from Plumbeous Kite (*Ictinia plumbea*). This sighting and the previous record by Brooks (1997) are the only reports of Mississippi Kite from the Alto Chaco region. However, they are not surprising given that the species has been found in relatively large numbers from mid-September through October in the Bolivian chaco (Davis 1989). The extent of the wintering grounds of Mississippi Kite in southern South America remains to be delineated.

Green-cheeked Parakeet (*Pyrrhura molinae*). Hayes (1995) evaluated two earlier records of this species and concluded that they were too unreliable to document the occurrence of Green-cheeked Parakeet in Paraguay. The first reliable sightings of this species in the country were those at Estancia 42 (Capper *et al.* 2001a). Our observations of flocks of up to eight individuals in the tall forest of Picada Chovoreca represent only the second locality within the Alto Chaco region. We document for the first time the presence of this species with specimens and recordings of vocalizations. The specimens (KU 90195, MNHNP; skins) correspond to the subspecies *P. molinae sordida*, known to occur in adjacent areas of Brazil and Bolivia (Forshaw 1989, Juniper & Parr 1998).

Pheasant Cuckoo (*Dromococcyx phasianellus*). We provide the first Paraguay record of this cuckoo to the west of the Río Paraguay. A single individual was heard and tape-recorded on 20–23 September 1999 in tall forest along Picada Chovoreca. The bird sang actively, but did not approach in response to playback. The species had not been recorded previously from the chaco (Short 1975, Hayes 1995, Kratter *et al.* 1993), though there is at least one subsequent record from the Matogrosense region (RPC).

Ochre-cheeked Spinetail (*Poecilurus scutatus*). The spinetail was fairly common in the tall forest of Picada Chovoreca. Most individuals were seen foraging in pairs low above or directly on the ground. We document the presence of the species in Paraguay for the first time with specimens (KU 90049 and 90224, MNHNP; skins, frozen tissues) and sound recordings. Ochre-cheeked Spinetail has been reported previously in the country by López (1985) but no details were provided and Hayes (1995) considered the record as hypothetical.

Giant Antshrike (*Batara cinerea*). We recorded two single individuals of this antshrike, separated by c. 8 km along Picada Chovoreca. The male was heard singing on two consecutive mornings from a low dense scrub, and only briefly climbed to an exposed perch in response to playback. The female was seen foraging in vine tangles c. 3 m above a dry stream bed within tall forest. Our sightings bridge the apparent distributional gap between the earlier Paraguayan records further south (Hayes 1995) and Bolivian records to the north (Kratter *et al.* 1993).

Black-bellied Antwren (*Formicivora melanogaster*). Prior to our fieldwork this antbird species was only known in Paraguay from Parque Nacional Defensores del Chaco (Madroño *et al.* 1994, Hayes 1995). We recorded it at Cerro León in 1995 and at Madrejón in 1999. Outside of Defensores del Chaco, a male Black-bellied Antwren was recorded by RPC in 1997 at Estancia Kamba Aka, depto. Alto Paraguay (19°47'S, 58°44'W), while in 1999 the species was found to be abundant along Picada Chovoreca and a pair was seen on 18 September around Base Aérea Adrián Jara.

Gray-crowned Tyrannulet (*Serpophaga griseiceps*). Taxonomy of the *Serpophaga subcristata/munda/griseiceps* complex is controversial, but the form recognized by Straneck (1993) as *S. griseiceps* is gradually gaining acceptance as a valid species. The first report (without details) of this tyrannid in Paraguay would appear to be that of Contreras (1989) at Estancia Co'e Pyahú, depto. Boquerón (20°38'S, 61°57'W). We document for the first time the presence of Gray-crowned Tyrannulet in Paraguay with tape-recordings of two separate individuals at Estancia 42 on 9 September 1997. Small numbers of individuals were heard and seen at this site on most days during fieldwork. The taxon has since been recorded widely throughout

Paraguay, primarily during the austral winter (RPC).

Plain Inezia (*Inezia inornata*). We found Plain Inezia to be relatively common at Cerro León, Madrejón and Estancia 42, with a pair observed copulating at the first site. Hayes (1995) lists this species as “rare” for the Alto Chaco region.

Alder Flycatcher (*Empidonax alnorum*). Two adults were mist-netted at Cerro León in 1995: male on 23 October and female on 24 October (MNHNP and KU 87986, respectively; skins and frozen tissues). These records are the first of this tyrannid for Paraguay and among the southernmost for the continent (Ridgely & Tudor 1994). Winter distributions of Alder Flycatcher and its sibling species, Willow Flycatcher (*E. traillii*) remain poorly understood because they are difficult to identify; usually, the two species are treated together when depicting range maps (e.g., Ridgely & Tudor 1994, Paynter 1995).

White-naped Xenopsaris (*Xenopsaris albinucha*). A single adult male, foraging silently in a leafless tree, at Estancia Triunfo represents the first record of the xenopsaris for the Matogrosense region; however, this was expected given that there are several records for the chaco (Hayes 1995) and a recent record for the adjacent cerrado (Robbins *et al.* 1999).

DISCUSSION

The existing information regarding the biota of the Paraguayan chaco is so limited as to beg very simple questions about the composition of its avifauna. The present surveys of five sites, all brief and at the same season, confirmed the presence of five species for the country, two species for the Paraguayan chaco, and 22 species for the regions of Alto

Chaco or Matogrosense. No threatened species, as defined by BirdLife International (2000), were detected.

Another question is that of the uniformity of the distributions of species across the region. As suggested by Short (1975), and reinforced by Kratter *et al.* (1993), species turnover in the region is considerable, apparently along moisture and vegetation structure gradients. These ideas were further supported by our results. For example, Pale-crested Woodpecker, Bolivian Slaty-Antshrike, Black-capped Antwren, Black-tailed Tityra (*Tityra cayana*), Flavescent Warbler (*Basileuterus flaveolus*), and Chestnut-vented Conebill all are present at Chovoreca, but absent farther south. Spot-winged Falconet (*Spizziapteryx circumcinctus*), Chaco Earthcreeper (*Ochetorhynchus certhioides*), and Stripe-capped Sparrow (*Aimophila strigiceps*) have been found near Filadelfia to the south, and at one site in Bolivia, but not at any of the sites we surveyed. Moreover, grassland and open habitats were not present in our study sites, thus we failed to record a number of species, e.g., Greater Rhea (*Rhea americana*), Brushland Tinamou (*Nothoprocta cinerascens*), Red-legged Seriema (*Cariama cristata*), White-banded Mockingbird (*Mimus triurus*), and Wedge-tailed Grass-Finch (*Emberizoides herbicola*), that were recorded by Kratter *et al.* (1993) and are known from appropriate habitat just a few hundred kilometers to the south in Paraguay.

The results of this study emphasize the need for large-scale reserves towards the effective conservation of biodiversity in the chaco. A broad transect of protected areas is the only strategy that offers promise. Indeed the Reserva de Biosfera del Chaco represents an impressive first step in this direction: a combination of effective well-planned zoning, strict enforcement of its boundaries and protection against grazing, clearing, and tilling, would make the area one of the premier biotic reserves in southern South America.

ACKNOWLEDGMENTS

We thank our field companions Francisco Brusquetti, Ian Burfield, Pierre Cacciali, Dave Capper, Rosalía Fariña, Corinne Kennedy, Pedro Luis Marti, Mirna Perrens, Rob Pople, and Sergio Villanueva, and in particular drivers Pío Angel Amarilla and Lider Hermosa, who made our northern advance possible. Employees of the Dirección de Ordenamiento Ambiental del Paraguay provided maps, satellite images, and GPS coordinates of Cerro Chovoreca region. Josephine Pryor organized access to Estancia 42 and the late Paniagua provided logistical support in Bahía Negra during September 1997. The 1995 and 1999 expeditions were funded by the Nathaniel S. Goss Fund and Panorama Society Fund of the KU Natural History Museum and the Burroughs Audubon Society. Fieldwork during September 1997 was primarily funded by the BP Conservation Programme, the Lindeth Charitable Trust, the People's Trust for Endangered Species, and the Gilchrist Educational Trust. We are grateful to Dan Brooks and Andy Kratter for improving the final manuscript.

REFERENCES

- BirdLife International. 2000. Threatened birds of the world. Lynx Edicions and BirdLife International, Barcelona, Spain, and Cambridge, UK.
- Brooks, D. M. 1997. Avian seasonality at a locality in the Central Paraguayan chaco. *Hornero* 14: 193–203.
- Capper, D. R., R. P. Clay, A. Madroño N., J. Mazar Barnett, I. J. Burfield, E. Z. Esquivel, C. P. Kennedy, M. Perrens, & R. G. Pople. 2001a. First records, noteworthy observations and new distributional data for birds in Paraguay. *Bull. Br. Ornithol. Club* 121: 23–37.
- Capper, D. R., R. P. Clay, A. Madroño N., & J. Mazar Barnett. 2001b. New information on the distribution of twenty-two bird species in Paraguay. *Ararajuba* 9: 57–59.
- Clay, R. P., D. R. Capper, J. Mazar Barnett, I. J. Burfield, E. Z. Esquivel, R. Fariña, C. P. Kennedy, M. Perrens, & R. G. Pople. 1998. White-winged Nightjars *Caprimulgus candicans* and cerrado conservation: The key findings of Project Aguara Ñu 1997. *Cotinga* 9: 52–56.
- Contreras, J. R. 1989. La avifauna de la Estancia Co'ë Pyahú y sus cercanías, Nueva Asunción, República del Paraguay. *Not. Faun.* 17: 1–6.
- Davis, S. E. 1989. Migration of the Mississippi Kite *Ictinia mississippiensis* in Bolivia, with comments on *I. plumbea*. *Bull. Br. Ornithol. Club* 109: 149–152.
- DPNVS (Departamento de Parques Nacionales y Vida Silvestre). 1999. Motivos iniciales para proteger el Parque Nacional Defensores del Chaco: Evaluación ecológica rápida. Unpubl. report, Departamento de Parques Nacionales y Vida Silvestre, Asunción, Paraguay.
- Forshaw, J. M. 1989. Parrots of the world. 3rd ed. Blandford Press, London, UK.
- Hayes, F. E. 1995. Status, distribution and biogeography of the birds of Paraguay. *Monogr. Field Ornithol.* 1: 1–230.
- Isler, M. L., P. R. Isler, & B. M. Whitney. 1997. Biogeography and systematics of the *Thamnophilus punctatus* (Thamnophilidae) complex. *Ornithol. Monogr.* 48: 355–381.
- Juniper, T., & M. Parr. 1998. Parrots. Yale Univ. Press, New Haven, Connecticut.
- Kratter, A. W., T. S. Sillett, R. T. Chesser, J. P. O'Neill, T. A. Parker III, & A. Castillo. 1993. Avifauna of a chaco locality in Bolivia. *Wilson Bull.* 105: 114–141.
- López, N. 1985. Avifauna del departamento de Alto Paraguay. *Volante Migratorio* 4: 9–13.
- Madroño N., A. 1995. El chaco Paraguayo: ambientes naturales, sus aves y problemas de conservación. *Cotinga* 4: 25–29.
- Madroño N., A., J. Abelaira R., & B. Jiménez de Miguel. 1994. *Formicivora melanogaster* una especie nueva para el Paraguay (Aves: Formicariidae). *Not. Faun.* 65: 1–4.
- Parker, T. A., III, A. H. Gentry, R. B. Foster, L. H. Emmons, & J. V. Remsen, Jr. 1993. The lowland dry forests of Santa Cruz, Bolivia: A global conservation priority. Rapid Assessment Program (RAP) Working Papers No. 4, Conservation International, Washington, DC.
- Paynter, R. A., Jr. 1995. Nearctic passerine

- migrants in South America. *Publ. Nuttall Ornithol. Club* 25: 1–126.
- Peterson, A. T., O. A. Flores V., L. S. León P., J. E. Llorente B., M. A. Luis M., A. G. Navarro S., M. G. Torres C., & I. Vargas F. 1993. Conservation priorities in northern Middle America: Moving up in the world. *Biodivers. Lett.* 1: 33–38.
- Robbins, M. B., R. C. Faucett, & N. H. Rice. 1999. Avifauna of a Paraguayan cerrado locality: Parque Nacional Serranía San Luis, depto. Concepción. *Wilson Bull.* 111: 216–228.
- Short, L. L. 1975. A zoogeographic analysis of the South American chaco avifauna. *Bull. Am. Mus. Nat. Hist.* 154: 1–352.
- Short, L. L. 1976. Notes on a collection of birds from the Paraguayan chaco. *Am. Mus. Novit.* 2597: 1–16.
- Straneck, R. J. 1993. Aportes para la unificación de *Serpophaga suberistata* y *Serpophaga munda*, y la revalidación de *Serpophaga griseiceps* (Aves: Tyrannidae). *Rev. Mus. Argent. Cienc. Natur. “Bernardino Rivadavia”* 16: 51–63.
- Vera, V., F. Barboza, O. Camé, R. P. Clay, A. van Humbecck, F. Fracchia, R. Ortiz, G. Terol, & V. Torean. 2000. Iniciativas transfronterizas de conservación en el chaco Paraguayo: Plan de acción de conservación 2000–2004. Unpubl. report, Departamento de Parques Nacionales y Vida Silvestre, Asunción, Paraguay.

APPENDIX 1. Species detected at five localities in northern Paraguayan chaco. CL = Cerro León, M = Madrejón. “Doc” indicates the form of documentation for records, including collected (c), photographed (p) and vocal recordings (v).

Species	Defensores del Chaco			Chovoreca	Estancia Triunfo	Estancia 42	
	CL	M	Doc	Doc	Doc	Doc	
Undulated Tinamou (<i>Crypturellus undulatus</i>)	x	x	v	x	c	x	v
Tataupa Tinamou (<i>Crypturellus tataupa</i>)	x		c	x		x	v
Neotropic Cormorant (<i>Phalacrocorax brasilianus</i>)						x	
Anhinga (<i>Anhinga anhinga</i>)						x	
Rufescent Tiger-Heron (<i>Tigrisoma lineatum</i>)	x					x	
Whistling Heron (<i>Syrigma sibilatrix</i>)						x	
Cocoi Heron (<i>Ardea cocoi</i>)	x					x	
Great Egret (<i>Ardea alba</i>)	x		p	x		x	
Cattle Egret (<i>Bubulcus ibis</i>)	x	x				x	
Snowy Egret (<i>Egretta thula</i>)				x		x	
Striated Heron (<i>Butorides striatus</i>)	x						
Capped Heron (<i>Pilherodius pileatus</i>)						x	
Black-crowned Night-Heron (<i>Nycticorax nycticorax</i>)		x					
Plumbeous Ibis (<i>Theristicus caerulescens</i>)	x	x	v			x	
Roseate Spoonbill (<i>Platalea ajaja</i>)						x	
Jabiru (<i>Jabiru mycteria</i>)	x					x	
Wood Stork (<i>Mycteria americana</i>)		x				x	
Maguari Stork (<i>Ciconia maguari</i>)		x				x	
Black Vulture (<i>Coragyps atratus</i>)	x	x		x	x	x	
Turkey Vulture (<i>Cathartes aura</i>)	x	x		x	x	x	
Lesser Yellow-headed Vulture (<i>Cathartes burrovianus</i>)	x	x		x	x	x	
King Vulture (<i>Sarcoramphus papa</i>)	x	x		x		x	
Southern Screamer (<i>Chauna torquata</i>)	x					x	

APPENDIX 1. Continuation.

Species	Defensores del Chaco			Chovoreca	Estancia Triunfo		Estancia 42
	CL	M	Doc	Doc	Doc	Doc	Doc
Ringed Teal (<i>Callonetta leucophrys</i>)		x					
Muscovy Duck (<i>Cairina moschata</i>)	x	x					x
Brazilian Teal (<i>Amazonetta brasiliensis</i>)							x
Gray-headed Kite (<i>Leptodon cayanensis</i>)					x	c	x
Hook-billed Kite (<i>Chondrohierax uncinatus</i>)	x	x					
Swallow-tailed Kite (<i>Elanoides forficatus</i>)							x
Snail Kite (<i>Rostrhamus sociabilis</i>)		x					
Mississippi Kite (<i>Ictinia mississippiensis</i>)		x					
Plumbeous Kite (<i>Ictinia plumbea</i>)	x			x	c	x	x
Bicolored Hawk (<i>Accipiter bicolor</i>)	x	x	c	x	c	x	x
Crane Hawk (<i>Geranospiza caerulescens</i>)	x	x		x	c	x	x
Great Black-Hawk (<i>Buteogallus urubitinga</i>)	x	x					x
Savanna Hawk (<i>Buteogallus meridionalis</i>)	x	x					x
Harris's Hawk (<i>Parabuteo unicinctus</i>)	x	x					
Black-collared Hawk (<i>Busarellus nigricollis</i>)		x					x
Roadside Hawk (<i>Buteo magnirostris</i>)	x	x	c	x	c		x
White-tailed Hawk (<i>Buteo albicaudatus</i>)	x		p,v				
Southern Caracara (<i>Caracara plancus</i>)	x	x					x
Yellow-headed Caracara (<i>Milvago chimachima</i>)	x	x	c	x	c		x
Chimango Caracara (<i>Milvago chimango</i>)				x			
Barred Forest-Falcon (<i>Micrastur ruficollis</i>)	x	x	v	x			
Collared Forest-Falcon (<i>Micrastur semitorquatus</i>)		x	v	x			x
Laughing Falcon (<i>Herpetotheres cachinnans</i>)				x	v	x	c
Aplomado Falcon (<i>Falco femoralis</i>)				x			
Bat Falcon (<i>Falco rufigularis</i>)				x		x	c
Chaco Chachalaca (<i>Ortalis canicollis</i>)	x	x	v			x	v
Gray-necked Wood-Rail (<i>Aramides cajaneus</i>)	x	x	c				x
Giant Wood-Rail (<i>Aramides ypecaha</i>)							x
Limpkin (<i>Aramus guarauna</i>)							x
Black-legged Seriema (<i>Chunga burmeisteri</i>)		x	v				
Southern Lapwing (<i>Vanellus chilensis</i>)	x						x
American Golden-Plover (<i>Pluvialis dominica</i>)		x					
Collared Plover (<i>Charadrius collaris</i>)		x					
Wattled Jacana (<i>Jacana jacana</i>)	x	x					x
Greater Yellowlegs (<i>Tringa melanoleuca</i>)		x					
Lesser Yellowlegs (<i>Tringa flavipes</i>)		x					
Solitary Sandpiper (<i>Tringa solitaria</i>)		x					x
Upland Sandpiper (<i>Bartramia longicauda</i>)	x	x					
White-rumped Sandpiper (<i>Calidris fuscicollis</i>)		x					x
Picazuro Pigeon (<i>Columba picazuro</i>)	x	x	v	x		x	x
Pale-vented Pigeon (<i>Columba cayennensis</i>)						x	x
Eared Dove (<i>Zenaida auriculata</i>)		x		x		x	
Scaled Dove (<i>Scardafella squamata</i>)		x					

APPENDIX 1. Continuation.

Species	Defensores del Chaco			Chovoreca	Estancia Triunfo	Estancia 42
	CL	M	Doc	Doc	Doc	Doc
Ruddy Ground-Dove (<i>Columbina talpacoti</i>)	x	x				
Picui Ground-Dove (<i>Columbina picui</i>)				x	x	x
Blue Ground-Dove (<i>Claravis pretiosa</i>)						x
White-tipped Dove (<i>Leptotila verreauxi</i>)	x	x	v	x	c	x
Yellow-collared Macaw (<i>Primolius auricollis</i>)				x	c	x
Blue-crowned Parakeet (<i>Aratinga acuticaudata</i>)	x	x		x	v	
White-eyed Parakeet (<i>Aratinga leucophthalmus</i>)	x	x	v	x		x
Black-hooded Parakeet (<i>Nandayus nenday</i>)					x	
Green-cheeked Parakeet (<i>Pyrrhura molinae</i>)				x	c	x
Monk Parakeet (<i>Myiopsitta monachus</i>)		x			x	
Yellow-chevroned Parakeet (<i>Brotogeris chiriri</i>)				x		
Scaly-headed Parrot (<i>Pionus maximiliani</i>)		x		x	c	x
Blue-fronted Parrot (<i>Amazona aestiva</i>)	x	x		x	c	x
Dark-billed Cuckoo (<i>Coccyzus melacoryphus</i>)	x	x	c			
Squirrel Cuckoo (<i>Piaya cayana</i>)				x	x	x
Striped Cuckoo (<i>Tapera naevia</i>)	x	x			x	
Pheasant Cuckoo (<i>Dromococcyx phasianellus</i>)				x	v	
Pavonine Cuckoo (<i>Dromococcyx pavoninus</i>)						x
Greater Ani (<i>Crotophaga major</i>)	x	x	c			
Smooth-billed Ani (<i>Crotophaga ani</i>)	x	x			x	x
Guira Cuckoo (<i>Guira guira</i>)	x	x		x	x	c
Tropical Screech-Owl (<i>Otus choliba</i>)	x	x		x	c	x
Spectacled Owl (<i>Pulsatrix perspicillata</i>)						x
Great Horned-Owl (<i>Bubo virginianus</i>)	x	x	p,v			x
Ferruginous Pygmy-Owl (<i>Glaucidium brasilianum</i>)	x	x	v	x	x	x
Chaco Owl (<i>Strix chacoensis</i>)				x	c	
Common Nighthawk (<i>Chordeiles minor</i>)		x				
Pauraque (<i>Nyctidromus albicollis</i>)						x
Rufous Nightjar (<i>Caprimulgus rufus</i>)				x	v	x
Little Nightjar (<i>Caprimulgus parvulus</i>)	x	x	c	x	c	x
Scissor-tailed Nightjar (<i>Hydropsalis torquata</i>)		x				x
Common Potoo (<i>Nyctibius griseus</i>)	x	x	c		x	
Sick's Swift (<i>Chaetura meridionalis</i>)	x	x	v			x
Unidentified swift (<i>Chaetura</i> sp.)				x		
Glittering-bellied Emerald (<i>Chlorostilbon aureoventris</i>)	x	x	c	x	c	x
Gilded Hummingbird (<i>Hylocharis chrysura</i>)		x	v	x	x	c
Blue-tufted Starthroat (<i>Heliomaster furcifer</i>)		x		x	c	x
Blue-crowned Trogon (<i>Trogon curucú</i>)	x		c	x	c	x
Blue-crowned Motmot (<i>Momotus momota</i>)	x					x
Ringed Kingfisher (<i>Ceryle torquata</i>)	x	x				
Toco Toucan (<i>Ramphastos toco</i>)					x	c
White-barred Piculet (<i>Picumnus cirratus</i>)	x	x	c	x	c	x
White-fronted Woodpecker (<i>Melanerpes cactorum</i>)					x	

APPENDIX 1. Continuation.

Species	Defensores del Chaco			Chovoreca	Estancia Triunfo		Estancia 42		
	CL	M	Doc	Doc	Doc	Doc	Doc		
White Woodpecker (<i>Melanerpes candidus</i>)					x	v			
Little Woodpecker (<i>Veniliornis passerinus</i>)				x	c		x		
Checkered Woodpecker (<i>Picoides mixtus</i>)		x	c			x			
Green-barred Woodpecker (<i>Colaptes melanochloros</i>)		x	c						
Golden-green Woodpecker (<i>Piculus chrysocloros</i>)		x	v	x	c	x	v	x	
Pale-crested Woodpecker (<i>Ceelus lugubris</i>)				x	c	x	c	x	v
Lined Woodpecker (<i>Dryocopus lineatus</i>)								x	
Crimson-crested Woodpecker (<i>Campephilus melanoleucos</i>)								x	
Cream-backed Woodpecker (<i>Campephilus leucopogon</i>)	x	x		x	c	x		x	
Common Hornero (<i>Furnarius rufus</i>)		x	c			x	c	x	
Crested Hornero (<i>Furnarius cristatus</i>)		x	v						
Chotoy Spinetail (<i>Schoeniophylax pbryganophila</i>)	x					x	c	x	
Sooty-fronted Spinetail (<i>Synallaxis frontalis</i>)	x	x	c	x	c			x	p,v
Pale-breasted Spinetail (<i>Synallaxis albescens</i>)	x	x						x	
White-lored Spinetail (<i>Synallaxis albilora</i>)	x	x	c			x	c	x	p
Ochre-cheeked Spinetail (<i>Poecilurus scutatus</i>)				x	c				
Yellow-chinned Spinetail (<i>Certhiaxis cinnamomea</i>)		x						x	
Stripe-crowned Spinetail (<i>Cranioleuca pyrrhophia</i>)		x	c			x	c		
Rufous-fronted Thornbird (<i>Phacellodomus rufifrons</i>)						x	c		
Greater Thornbird (<i>Phacellodomus ruber</i>)								x	
Brown Cacholote (<i>Pseudoseisura lophotes</i>)		x	c						
Streaked Xenops (<i>Xenops rutilans</i>)				x	c	x		x	
Olivaceous Woodcreeper (<i>Sittasomus griseicapillus</i>)	x	x	v	x	c	x	c	x	p,v
Scimitar-billed Woodcreeper (<i>Drymornis bridgesii</i>)		x	c						
Great Rufous Woodcreeper (<i>Xiphocolaptes major</i>)	x	x	c	x	c	x	c	x	
Black-banded Woodcreeper (<i>Dendrocolaptes picumnus</i>)	x	x	c	x	c			x	p
Narrow-billed Woodcreeper (<i>Lepidocolaptes angustirostris</i>)	x		v	x	c	x	c	x	v
Red-billed Scythebill (<i>Campylorhynchus trochilirostris</i>)	x	x		x		x	c	x	
Giant Antshrike (<i>Batara cinerea</i>)				x	v				
Great Antshrike (<i>Taraba major</i>)	x	x	v	x	v	x	c	x	v
Barred Antshrike (<i>Thamnophilus doliatus</i>)	x	x	v	x	v	x	v	x	v
Variable Antshrike (<i>Thamnophilus caeruleus</i>)		x	v			x	c		
Bolivian Slaty-Antshrike (<i>Thamnophilus sticturus</i>)				x	c	x	c	x	p,v
White-backed Fire-eye (<i>Pyriglena leuconota</i>)								x	p,v
Mato Grosso Antbird (<i>Cercomacra melanaria</i>)								x	
Stripe-backed Antbird (<i>Myrmorchilus strigilatus</i>)	x	x	c	x	v	x	c	x	v
Black-capped Antwren (<i>Herpsilochmus atricapillus</i>)				x	c				
Black-bellied Antwren (<i>Formicivora melanogaster</i>)	x	x		x	c				
Southern Beardless-Tyrannulet (<i>Camptostoma obsolum</i>)	x	x		x				x	
Chaco Suiriri (<i>Suiriri suiriri</i>)								x	

APPENDIX 1. Continuation.

Species	Defensores del Chaco			Chovoreca	Estancia Triunfo	Estancia 42	
	CL	M	Doc	Doc	Doc	Doc	Doc
Southern Scrub-Flycatcher (<i>Sublegatus modestus</i>)		x	c	x	c		
Large Elaenia (<i>Elaenia spectabilis</i>)	x		c				
Small-billed Elaenia (<i>Elaenia parvirostris</i>)	x	x	c				x
White-crested Tyrannulet (<i>Serpophaga subcristata</i>)				x	c		x
Gray-crowned Tyrannulet (<i>Serpophaga griseiceps</i>)							x v
Plain Inezia (<i>Inezia inornata</i>)	x	x	c	x	v	x	c x v
Greater Wagtail-Tyrant (<i>Stigmatura budytoides</i>)		x	c				
Tawny-crowned Pygmy-Tyrant (<i>Euscarthmus meloryphus</i>)	x		c				x v
Pearly-vented Tody-Tyrant (<i>Hemitriccus margaritaceiventer</i>)	x	x	c	x	c	x	v x p,v
Yellow-olive Flycatcher (<i>Tolmomyias sulphureus</i>)	x	x	c	x	c	x	c x v
Bran-colored Flycatcher (<i>Myiophobus fasciatus</i>)	x	x					
Euler's Flycatcher (<i>Latbrotricus euleri</i>)	x	x	c			x	x v
Alder Flycatcher (<i>Empidonax alnorum</i>)	x		c				
Fuscon Flycatcher (<i>Cnemotriccus fuscatus</i>)	x	x	c	x	c	x	c x p,v
Vermilion Flycatcher (<i>Pyrocephalus rubinus</i>)		x		x	c		
Cinereous Tyrant (<i>Knipolegus striaticeps</i>)	x	x	c				x
Spectacled Tyrant (<i>Hymenops perspicillatus</i>)	x	x				x	c
Black-backed Water-Tyrant (<i>Fluvicola albiventer</i>)	x	x	c				x
Cattle Tyrant (<i>Machetornis rixosus</i>)		x					x
Rufous Casiornis (<i>Casiornis rufa</i>)	x	x	c	x	c	x	x c,v
Brown-crested Flycatcher (<i>Myiarchus tyrannulus</i>)	x	x	c	x	c	x	x p,v
Swainson's Flycatcher (<i>Myiarchus swainsoni</i>)	x			x	c		
Great Kiskadee (<i>Pitangus sulphuratus</i>)	x	x	c			x	x v
Streaked Flycatcher (<i>Myiodynastes maculatus</i>)	x		c	x	c		
Variagated Flycatcher (<i>Empidonomus varius</i>)		x					
Crowned Slaty Flycatcher (<i>Griseotyrannus aurantioatrocristatus</i>)	x	x	c	x	c		x
Tropical Kingbird (<i>Tyrannus melancholicus</i>)	x	x					
Fork-tailed Flycatcher (<i>Tyrannus savana</i>)	x	x				x	c x
White-naped Xenopsaris (<i>Xenopsaris albinucha</i>)						x	
Green-backed Becard (<i>Pachyrhamphus viridis</i>)	x						x
Black-tailed Tityra (<i>Tityra cayana</i>)				x			
Red-eyed Vireo (<i>Vireo olivaceus</i>)	x	x		x		x	
Rufous-browed Peppershrike (<i>Cycarbis gujanensis</i>)	x	x	v	x	c	x	x
Purplish Jay (<i>Cyanocorax cyanomelas</i>)	x			x	c	x	c x v
Plush-crested Jay (<i>Cyanocorax chrysops</i>)	x		v	x		x	c x
Brown-chested Martin (<i>Progne tapera</i>)		x				x	c
White-rumped Swallow (<i>Tachycineta leucorrhoa</i>)							x
Southern Rough-winged Swallow (<i>Stelgidopteryx ruficollis</i>)							x
Bank Swallow (<i>Riparia riparia</i>)		x					

APPENDIX 1. Continuation.

Species	Defensores del Chaco			Chovoreca	Estancia Triunfo		Estancia 42	
	CL	M	Doc	Doc	Doc	Doc	Doc	Doc
Cliff Swallow (<i>Petrochelidon pyrrhonota</i>)								x
Barn Swallow (<i>Hirundo rustica</i>)		x				x		x
Swallow unidentified (Hirundinidae sp.)				x				
Fawn-breasted Wren (<i>Thryothorus guarayanus</i>)				x	c	x	c	x v
House Wren (<i>Troglodytes aedon</i>)	x			x		x		x
Masked Gnatcatcher (<i>Poliopitila dumicola</i>)	x	x		x		x		x
Creamy-bellied Thrush (<i>Turdus amaurochalinus</i>)	x	x	c	x	c			x
Rufous-bellied Thrush (<i>Turdus rufiventris</i>)						x		x p
Chalk-browed Mockingbird (<i>Mimus saturninus</i>)	x	x	c					
Yellowish Pipit (<i>Anthus lutescens</i>)	x	x	c					
Tropical Parula (<i>Parula pitiayumi</i>)	x	x		x	c			x v
Masked Yellowthroat (<i>Geothlypis aequinoctialis</i>)	x	x						x
Flavescent Warbler (<i>Basileuterus flaveolus</i>)				x	c			x
Chestnut-vented Conebill (<i>Conirostrum speciosum</i>)				x				x
Purple-throated Euphonia (<i>Euphonia chlorotica</i>)						x	c	x
Sayaca Tanager (<i>Thraupis sayaca</i>)	x	x	c			x	c	x
Hooded Tanager (<i>Nemosia pileata</i>)								x
White-lined Tanager (<i>Tachyphonus rufus</i>)	x	x				x	c	x p
Orange-headed Tanager (<i>Thlypopsis sordida</i>)								x
Unidentified tanager (Thraupidae sp.)				x				
Grayish Saltator (<i>Saltator coerulescens</i>)				x		x		x
Green-winged Saltator (<i>Saltator similis</i>)				x	c			x
Golden-billed Saltator (<i>Saltator aurantiirostris</i>)	x	x	c	x				
Black-backed Grosbeak (<i>Pheucticus aureoventris</i>)	x	x						
Ultramarine Grosbeak (<i>Cyanocompsa brissonii</i>)		x		x		x	c	x
Red-crested Cardinal (<i>Paroaria coronata</i>)	x	x	c			x		x
Yellow-billed Cardinal (<i>Paroaria capitata</i>)						x		x
Red-crested Finch (<i>Coryphospingus cucullatus</i>)		x	c	x	c	x	c	x
Many-colored Chaco-Finch (<i>Saltatricula multicolor</i>)	x		v	x	c			x
Blue-black Grassquit (<i>Volatinia jacarina</i>)		x		x		x		x
Saffron-billed Sparrow (<i>Arremon flavirostris</i>)				x	v	x	c	x v
Rusty-collared Seedeater (<i>Sporophila collaris</i>)								x
Double-collared Seedeater (<i>Sporophila caeruleascens</i>)								x
White-bellied Seedeater (<i>Sporophila leucoptera</i>)								x
Unidentified seedeater (<i>Sporophila</i> sp.)	x	x						
Dull-colored Grassquit (<i>Tiaris obscura</i>)								x p
Saffron Finch (<i>Sicalis flaveola</i>)	x	x				x		
Black-capped Warbling-Finch (<i>Poospiza melanoleuca</i>)	x	x	v	x		x		
Grassland Sparrow (<i>Ammodramus humeralis</i>)	x							
Rufous-collared Sparrow (<i>Zonotrichia capensis</i>)						x		x v
Chestnut-capped Blackbird (<i>Agelaius ruficapillus</i>)		x	c					
Chopi Blackbird (<i>Gnorimopsar chopi</i>)						x	c	
White-browed Blackbird (<i>Sturnella superciliosa</i>)	x	x	c					x

APPENDIX 1. Continuation.

Species	Defensores del Chaco			Chovoreca	Estancia Triunfo		Estancia 42	
	CL	M	Doc	Doc	Doc		Doc	
Shiny Cowbird (<i>Molothrus bonariensis</i>)	x	x			x			
Bay-winged Cowbird (<i>Molothrus badius</i>)	x							
Epaulet Oriole (<i>Icterus cayanensis</i>)	x		c	x	x	c	x	v
Orange-backed Troupial (<i>Icterus croconotus</i>)	x	x						
Golden-winged Cacique (<i>Cacicus chrysopterus</i>)				x	x	c	x	
Solitary Cacique (<i>Cacicus solitarius</i>)					x	x		
Crested Oropendola (<i>Psarocolius decumanus</i>)					x	c	x	v
Hooded Siskin (<i>Carduelis magellanica</i>)					x			