

BIRDS OF THE LAGUNA KAUCAYA AREA, A SEMI-HUMID VALLEY IN THE ANDEAN FOOTHILLS OF DEPARTAMENTO SANTA CRUZ, BOLIVIA

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Resumen. – *Aves del área de la Laguna Kaucaya, un valle semi-humedo en el pie de monte andino del Departamento de Santa Cruz, Bolivia.* – Basado en estudios realizados en 1978, 1979, 1984 y 2002, caracterizamos la avifauna en los bosques secos (800–1000 m) circundantes a la Laguna Kaucaya, localizada en uno de los valles más orientales de la faja subandina del sur de Bolivia. La avifauna registrada en esta zona es típica de otras localidades subandinas, pero la posición de la misma cerca de las tierras bajas del chaco ha resultado en que ciertas taxa de zonas altas se solapen en su distribución altitudinal con otras de zonas bajas. En este trabajo describimos la intergradación entre formas montañas y formas de zonas bajas del Chinchero chico (*Lepidocolaptes angustirostris*) y del Batará variable (*Thamnophilus caerulescens*). Adicionalmente, reportamos el primer registro del Pato colorado (*Anas cyanoptera*) para el Departamento de Santa Cruz. La Laguna Kaucaya alberga a un grupo diverso de aves acuáticas residentes y migratorias. La agricultura intensiva desarrollada en mucho tiempo y los ciclos de sequía en este sistema acuático han puesto en riesgo la permanencia de este importante sitio para la alimentación, reproducción y paraje de aves acuáticas.

Abstract. – Based on surveys conducted in 1978, 1979, 1984 and 2002, we characterized the avifauna of the dry forests (800–1000 m) surrounding Laguna Kaucaya, a lake located in one of the easternmost valleys of the subandean belt in southern Bolivia. The avifauna is largely typical of other subandean localities, but the position of Laguna Kaucaya near the lowland chaco has resulted in some intermingling of higher elevation and lower elevation taxa. Intergradation between montane and lowland forms of Narrow-billed Woodcreepers (*Lepidocolaptes angustirostris*) and Variable Antshrikes (*Thamnophilus caerulescens*) is described. In addition, we report the first specimen record for the Cinnamon Teal (*Anas cyanoptera*) in Santa Cruz Department. Laguna Kaucaya supports a relatively diverse group of resident and migratory aquatic birds. Intensive agriculture and several years of drought threaten the permanency of this important aquatic breeding ground and stopover point. *Accepted 1 June 2004.*

Key words: Andes, Laguna Kaucaya, avifauna, *Lepidocolaptes angustirostris*, *Thamnophilus caerulescens*, chaco, Bolivia.

INTRODUCTION

The southern subandean belt in Bolivia (Departments of Santa Cruz, Chuquisaca and Tarija) is a complex system of narrow, relatively low (500–2000 m), north to south oriented longitudinal ranges that are separated by wide valleys. The belt is bounded to the west by the main Andean massif that includes the high elevation altiplano, and to the east by the low elevation chaco plain that extends into Paraguay and northern Argentina. Within the belt, the wet Yungas forests, typical of northern Bolivia, are found only on those ridges and peaks of sufficient elevation to be routinely enveloped in clouds (Schulenberg & Awbrey 1998). The avifauna of these wetter tucumano-boliviano forests, though relatively impoverished, is largely representative of more northerly Yungas localities, with Andean foothill taxa such as the Bolivian Tapaculo (*Scytalopus bolivianus*), White-throated Tyrannulet (*Mecocerculus leucobryis*), and the Yungas Manakin (*Chiroxiphia boliviana*) (Schulenberg & Awbrey 1998).

Outside of the wetter tucumano-boliviano forests, the habitat is much drier and corresponds to a mosaic of dry deciduous forests and chacoan scrubs. The avifauna of these habitats represents a blend of dry habitat Andean taxa, such as the Streak-fronted Thornbird (*Phacellodomus striaticeps*), taxa that are characteristic of the dry lowlands to the east, such as the Stripe-crowned Spinetail (*Cranioleuca pyrrhophia*), and widespread taxa that occur in both high elevation and low elevation dry habitats, often with taxonomically differentiated forms in the two levels [e.g., the Variable Antshrike (*Thamnophilus caerulescens*)] (Herzog *et al.* 1997, Schmitt *et al.* 1997).

The birds of the southern subandean belt in Bolivia remain poorly known, particularly at transitional sites where higher elevation chacoan habitats intermix with lowland chacoan habitats (Paynter 1992, Schulenberg &

Awbrey 1998). Here we describe the avifauna at a site in one of the easternmost ridges of the subandean belt. The avifauna and vegetation are largely typical of other chacoan forests at comparable elevations in southern Bolivia (Schulenberg & Awbrey 1998, Mayer 2000, Mayer *et al.* 2000), but the site's proximity to the lowland chaco (Short 1975, Kratter *et al.* 1993) has resulted in some intermingling of higher elevation and lower elevation forms.

STUDY AREA AND METHODS

Birds were surveyed intensively over an area of about 2 km², at sites (800–1000 m) around and including Laguna Kaucaya (alternatively spelled as Laguna Caucaya) (Paynter 1992), a permanent lake located approximately 10 km east of Gutiérrez in Provincia Cordillera, Departamento Santa Cruz, Bolivia (c. 19°24'S, 63°27'W; 875 m) (Fig. 1). Geographic coordinates were determined with a GPS unit.

Hydrological data are lacking for Laguna Kaucaya. However, according to local residents, the expanse and depth of the lake vary considerably between seasons and years. For example, residents reported that, in 1984, water levels were “higher than usual” due to heavy rains (1983 was an El Niño year); the lake was at least 1.25 m deep within 20 m of shore. In 2001, locals reported that the lake dried completely, and a fence was erected across the middle of the lake to keep livestock from moving into the adjacent corn fields.

According to Navarro (2002), the vegetation in the area of Laguna Kaucaya and Gutiérrez corresponds to the chacoan region in the western sector of the boreal chaco, district of the Izozog. The forest had an herbaceous layer dominated by *Bromelia* sp. and a canopy of 6–7 m, with some emergent trees of 9–10 m (Fig. 2). The most common tree species were quebracho-blanco (*Aspidosper-*

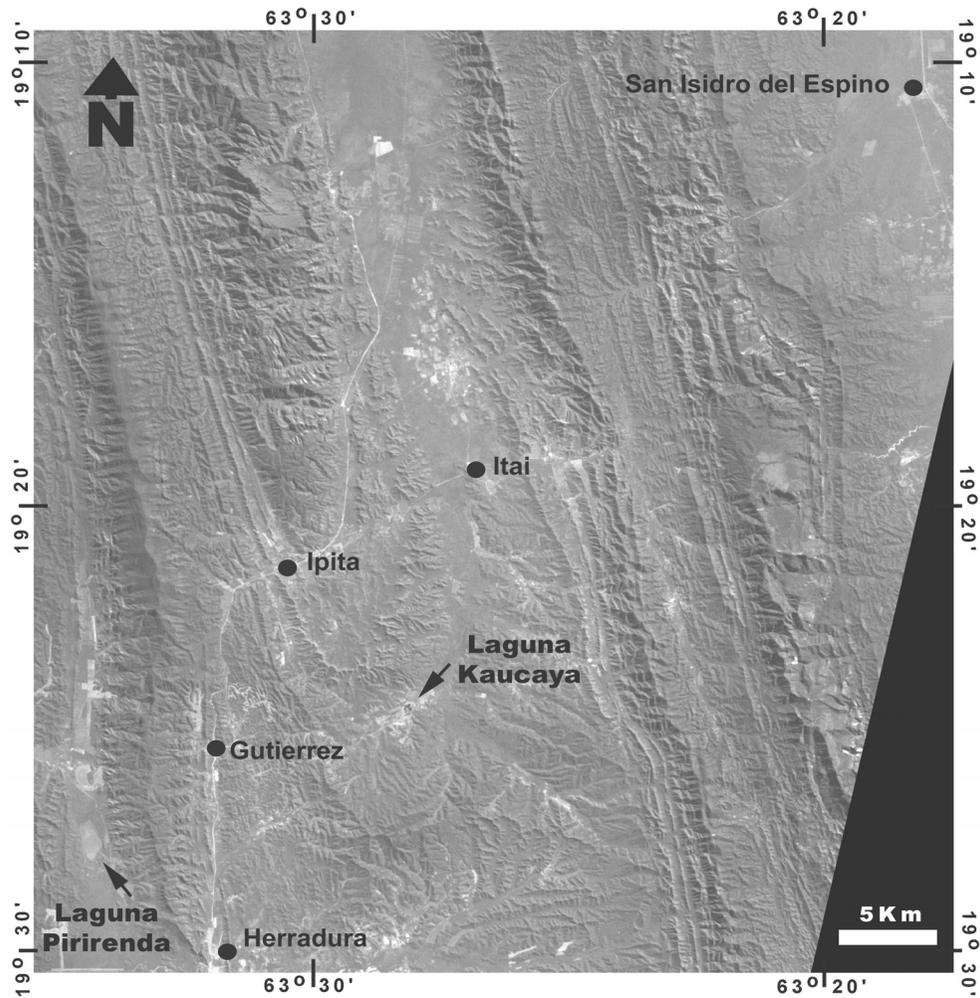


FIG. 1. Landsat ETM image 231-073 (7 July 2000) of the Laguna Kaucaya region (Depto. Santa Cruz, Bolivia) that was surveyed.

ma; Apocynaceae), quebracho-colorado (*Schinopsis*; Anacardiaceae), *Caesalpinia paraguariensis* (Fabaceae) and *Anadenanthera colubrina* (Fabaceae).

The chaco woodland experiences annual flooding during the rainy season. The shrub layer has abundant *Vallesia glabra* (Apocynaceae), and some individuals of *Pereskia sachsiana* (Cactaceae) and *Celtis* sp (Ulmaceae). The tree layer is fairly open (6–8 m in height) and,

during our study, had abundant *Prosopis chilensis* (Mimosaceae) and *Acacia* sp (Mimosaceae). The most abundant epiphytes were *Tillandsia* spp. (Bromeliaceae), *Oncidium bifolium* (Orchidaceae), and *Rhizopalis* spp (Cactaceae).

Sandstone hill chaco forest (2–3 m in height) was present on the slopes, and had abundant *Schinopsis cornuta* and *Annona nutans* (Annonaceae); *Astronium urundeuva* (Anacardiaceae) was present, but less abundant. The



FIG. 2. Lowland chaco forest on the clay-rich soils along the road around Laguna Kaucaya. Photograph by R. T. Brumfield (April/May 2002).

most common genera of herbaceous plants were *Lantana* (Verbenaceae), *Croton* (Euphorbiaceae), *Euphorbia* (Euphorbiaceae), *Vernonia* (Asteraceae), and *Gymnocalycium* (Cactaceae). The vegetation alongside the roads and trails was composed of small pioneer trees and bushes of *Senna spectabilis* (Fabaceae), *S. occidentalis*, *Pterogyne nitens* (Mimosaceae), *Cestrum* spp., *Solanum* aff. *riparium* (Solanaceae), and *Cleistocactus baumannii* (Cactaceae).

In 1979, approximately 75% of Laguna Kaucaya was covered with floating stands of cattails (*Typha domingensis*, Typhaceae), with abundant duckweed (*Lemna* sp., Lemnaceae), and aquatic ferns (*Azolla* sp, Azollaceae) in the open water. Approximately 95% of the lake was covered with *T. domingensis* in 1984. In 2002, only about 25% of the lake was covered with cattails, with little duckweed and aquatic ferns in the open water. Invasive

water lettuce (*Pistia stratiotes*, Araceae) was relatively abundant in the open water in 2002.

The Laguna Kaucaya area has been heavily impacted by cattle and pig farming as well as by extensive timber extraction for fence and home construction. Corn fields or fallow agricultural fields surround Laguna Kaucaya. Beyond these, there is a mosaic of open woodland heavily impacted by cattle grazing. It is likely that the current openness of the woodland understory is a direct result of grazing. Mammal tracks observed at Kaucaya included those of the crab-eating raccoon (*Procyon cancrivorus*) and forest fox (*Cerdocyon thous*).

In 2002, we made smaller scale surveys at a dry lakebed (Laguna Pirirenda), approximately 5 km southwest of Gutiérrez (c. 19°28'S, 63°34'W; 800 m), and in the forests along the road (no longer passable by vehicle)

that connects the villages of Itai and San Isidro del Espino (c. 19°19'S, 63°22'W; 1000 m), approximately 21 km northeast of Gutiérrez (Fig. 1). The vegetation at Laguna Pirirenda was similar to that of Laguna Kaucaya, but drier and scrubbier, probably because it was more heavily affected by agriculture. From Itai, we drove approximately eight road kilometers towards San Isidro del Espino before deep ruts in the road made it impassable. There, the forest was much more lush and humid with a more extensive understory, probably because of the absence of cattle.

C.G.S. and D.C.S. surveyed birds from 30 December 1978 to 18 January 1979, then on 12–20 February 1984, and 6–24 April 1984; the other authors surveyed birds on 4–6, and 28–30 April, then on 5–9 May 2002. O.M.Z. conducted additional surveys of aquatic birds on 12–16 June 2002 and on 22–23 February 2003. In 1978 and 1979, specimens were collected only with the use of mist nets (12-m, 36-mm mesh). From three to eight nets were used daily. In 1984, specimens were collected primarily by four to eight 9-m nets (36 mm mesh), but also with the use of a shotgun. Information on net hours is unavailable for 1979–79 and 1984. In 2002, we operated six to eight 12-m nets for a total of approximately 640 daytime net-h; in addition, shotguns were used to collect specimens.

The relative abundances of species reported in Appendix 1 follow the qualifications of Stotz *et al.* (1996), and are based on encounter rates while hunting and checking nets. No standardized census method was used to estimate these abundances. The abundances are entirely subjective assessments based on visual, mist-netted, and collected birds. Relative abundances for species encountered in 2002 and 2003 were estimated by RTB. All others were estimated by CGS. Except in the case of night birds, we did not use bird sounds in these measures.

Bird specimens are housed at the Burke

Museum of Natural History (UWBM, Seattle), the Delaware Museum of Natural History (DMNH, Greenville), the Louisiana State University Museum of Zoology (LSUMZ, Baton Rouge), or the Museo de Historia Natural Noel Kempff Mercado (MNKM, Santa Cruz de la Sierra). Samples of frozen tissue were preserved from the specimens collected in 2002, and housed in the genetic resources collections at UWBM. Parasitic feather lice collected from some specimens in 2002 are preserved at the UWBM. Avian taxonomy follows the online classification of the South American Checklist Committee (2004).

SPECIES ACCOUNTS

Southern Screamer (*Chauna torquata*). The male specimen (UWBM 76036, no bursa) collected from Laguna Kaucaya on 9 May 2002 may represent the highest recorded elevation for this species in Bolivia. The highest previous record was 600 m (Hennessey *et al.* 2003).

Cinnamon Teal (*Anas cyanoptera*). An adult (skull 100% oss.) male (MNKM, OMZ 201) collected on 6 May 2002 represents the first specimen record of this species in Santa Cruz Department, and the first specimen collected below 2600 m in Bolivia (Hennessey *et al.* 2003). The species was known previously in Bolivia from the higher elevation puna and valley zones of Dptos. Cochabamba, La Paz, Oruro, and Potosí (Fjeldså & Krabbe 1990). The specimen (465 g) had no molt, heavy fat, and left testis 12 x 5 mm. O.M.Z. observed approximately 35 additional males and females in 2002.

Rufous-sided Crake (*Laterallus melanophaius*). The two specimens (male LSUMZ 123456, age ?, testis 5 x 2 mm, 47.8 g; female LSUMZ 123457, age ?, ovary 10 x 7 mm, 49.0 g) collected from Laguna Kaucaya on 17 and 19 April 1984, respectively, may represent the

TABLE 1. Means and standard deviations (sample sizes in parentheses) for three morphometric characters that distinguish *Lepidocolaptes angustirostris bellmayri* and *L. a. certhiolus*. Specimens of pure *bellmayri* are from the Tambo area (Schmitt *et al.* 1997), and specimens of pure *certhiolus* are from the lowland Bolivian chaco (Kratler *et al.* 1993). Intergrades were collected from Laguna Kaucaya or from Abapó (Kratler *et al.* 1993).

	Mass (g)				Wing length (mm)				Tail length (mm)			
	Male		Female		Male		Female		Male		Female	
<i>bellmayri</i> (Tambo)	29.2	0.9 (6)	28.9	1.6 (3)	101.0	1.3 (6)	97.2	1.6 (4)	82.7	3.5 (6)	79.2	3.9 (4)
Intergrades	28.3	1.6 (4)	29.0	1.2 (4)	96.5	1.9 (4)	92.9	1.7 (4)	76.4	6.5 (4)	74.2	4.8 (4)
<i>certhiolus</i> (Chaco)	25.9	1.3 (4)	27.0	1.5 (5)	94.3	1.0 (4)	90.5	1.5 (5)	72.0	0.2 (4)	69.0	3.6 (5)

highest recorded elevation for this species in Bolivia. The highest previous record was about 600 m (Hennessey *et al.* 2003).

Buff-breasted Sandpiper (Tryngites subruficollis). A single specimen (UWBM 76035, female, skull 20% oss.) collected on 9 May 2002 is the first from Laguna Kaucaya, with the closest previous record from Buena Vista (Depto. Santa Cruz), 200 km to the north (Lancot *et al.* 2002). Very little information is available on the importance of stopover sites for this species of conservation interest (Birdlife International 2000, Lancot *et al.* 2002), and the species has been documented at only a handful of localities in Bolivia. Most of these are austral spring (September, October) records from the Amazonian lowlands of northern Bolivia (Deptos. Pando and Beni). Other records are from Lagunas de Tajzara (Depto. Tarija) in extreme southern Bolivia during the austral fall (Lancot *et al.* 2002).

Narrow-billed Woodcreeper (Lepidocolaptes angustirostris). The form (*L. a. bellmayri*) inhabiting the Andean foothills in Cochabamba and northern Santa Cruz Departments is replaced at the eastern base of the Andes near Laguna Kaucaya by the smaller, paler *L. a. certhiolus* (Peters 1945) (Table 1). In

addition to their size differences, *bellmayri* and *certhiolus* are readily distinguishable by plumage. The breast streaking is strongly demarcated in *bellmayri*. In *certhiolus*, the breast streaking is less defined. Nominate *angustirostris*, which replaces *certhiolus* further east in the lowlands of eastern Bolivia and Paraguay, has even more reduced streaking.

Bond & Meyer de Schauensee (1942) reported *bellmayri* from the dry foothill forests of Samaipata (Depto. Santa Cruz) and Ele-Ele (Depto. Cochabamba), and *certhiolus* from dry foothill forests further south in Deptos. Santa Cruz (e.g., Lagunillas) and Tarija. Lagunillas is approximately 25 km southwest of Gutiérrez. We collected specimens of both *bellmayri* and *certhiolus* forms in the forests surrounding Laguna Kaucaya. Both were also collected by LSU personnel during an expedition to Proyecto Abapó-Izozog, 50 km to the north. This region is clearly a zone of intergradation; the specimens from Kaucaya and Abapó are, on average, intermediate between pure *bellmayri* (Schmitt *et al.* 1997) and *certhiolus* (Kratler *et al.* 1993) in several morphological measurements (Table 1). Two Laguna Kaucaya specimens that had *bellmayri*-type plumage were intermediate in shape as well, consistent with intergradation between the two subspecies where they meet.

Variable Antshrike (*Thamnophilus caerule-scens*). The specimens were intermediate in size and plumage between *T. c. dinellii* of the Andean foothills and *T. c. paraguayensis* of the lowland Chaco further east (Brumfield unpubl.), indicating some intergradation between those forms. At the Itai locality (Fig. 1), we recorded *T. sticturus* (Isler *et al.* 1997) and *T. caerule-scens* in syntopy. Parker *et al.* (1993) recorded *T. sticturus* and *T. c. paraguayensis* at Curuyequi, but it is unclear if both were found in the same habitat.

Suiriri Flycatcher (*Suiriri suiriri*). The Laguna Kaucaya specimens probably represent recently arrived austral migrants. All 2002 specimens have a yellowish wash in their otherwise white bellies that is absent in a series of nominate *suiriri* from an arid Andean valley (Tambo, Depto. Santa Cruz), approximately 175 km NW of Gutierrez (Schmitt *et al.* 1997). This same yellowish wash is evident in most specimens collected at the eastern edge of the Andes throughout southern Bolivia and northern Argentina (Short 1975). None of the Kaucaya specimens falls within the distribution of nominate *affinis* in mass (three male Bolivian specimens at LSUMZ ranged from 18.5 – 24.2 g), with Laguna Kaucaya males (14.6 ± 0.9 g, $N = 12$) and females (12.7 ± 0.9 g, $N = 9$) both being significantly smaller.

White-crested Elaenia (*Elaenia albiceps*). Two males (LSUMZ 124563, 21 April 1984, moderate fat; UWBM 76037, 6 May 2002, light fat) and a female (LSUMZ 124565; 21 April 1984, no fat) were netted in shrubs around Laguna Kaucaya. Despite the low fat levels in two of the three specimens, all appear to be of the austral migrant form *E. a. chilensis* (Traylor 1982; Chesser 1997), because the tenth (outermost) primary is longer than the fifth (Zimmer 1941). These specimens are notable because, in September 1990, Kratter *et al.* (1993) collected a female of the sedentary

form of *E. a. chilensis* from Estancia Perforación in the nearby lowland chaco (Traylor 1982), although Chesser (1997) concluded subsequently this and all other Bolivian records represent migrants.

Lesser Shrike-Tyrant (*Agriornis murinus*). The wintering distribution of this austral migrant is poorly known in Bolivia (Chesser 1997). Most records of this species are from between 2300 and 2600 m (Hennessey *et al.* 2003). An adult (skull 100% oss.) male (MNKM; OMZ 209) collected 9 May 2002 from a group of three to five individuals in a corn field adjacent to the lake represents the earliest recorded spring specimen and lowest recorded elevation of this species in Bolivia (Chesser 1997). The specimen (mass 31 g) had no molt, light fat, and its stomach contained small grass seeds.

Unicolored Blackbird (*Chrysomus cyanopus*). A sight record of this species by O.M.Z. at Laguna Kaucaya during the 2002 expedition represents the highest recorded elevation for the species in Bolivia. Previous records are below 400 m and there are no records from the Valles/Boliviano-Tucumano area (Hennessey *et al.* 2003).

DISCUSSION

We recorded 195 species of birds at Laguna Kaucaya and environs during our 1978, 1979, 1984, 2002, and 2003 surveys (Appendix 1). The species can be categorized into three groups: 1) aquatic species that were usually found on or immediately around the lake, 2) species found in agricultural fields or in clumps of trees within or at the immediate edge of agricultural fields, and 3) species found within the forest. Excluding species that were only observed passing over the study site ($N = 9$), the remaining 186 species represent the “core” avifauna (Remsen 1994),

composed of water-associated (N = 49), forest (N = 102) and agriculture-associated (N = 35) species.

Austral migrants clearly represented a portion of the avifauna, but composing a list of candidate migrants was complicated by the fact that many of the species also breed in the Laguna Kaucaya region (Jahn *et al.* 2002). Based on the austral migrant list of Stotz *et al.* (1996), likely austral migrants included Suiriri Flycatcher, Large Elaenia (*Elaenia spectabilis*), White-crested Elaenia, Small-billed Elaenia (*E. parvirostris*) (the 2002 specimens all had heavy fat), Plain Tyrannulet (*Inezia inornata*), Lesser Shrike-Tyrant, Vermilion Flycatcher (*Pyrocephalus rubinus*), Fork-tailed Flycatcher (*Tyrannus savana*), Rufous Casiornis (*Casiornis rufus*), White-banded Mockingbird (*Mimus triurus*), Creamy-bellied Thrush (*Turdus amaurochalinus*), Lined Seedeater (*Sporophila lineola*), and Double-collared Seedeater (*Sporophila caerulea*) (Stotz *et al.* 1996). Other possible austral migrants included Fulvous Whistling-Duck (*Dendrocygna bicolor*), Ringed Teal (*Calonetta leucophrys*), Cinnamon Teal, Black-headed Duck (*Heteronetta atricapilla*), White-tufted Grebe (*Rollandia rolland*), Neotropic Cormorant (*Phalacrocorax brasilianus*), Black-crowned Night-Heron (*Nycticorax nycticorax*), Striated Heron (*Butorides striata*), Turkey Vulture (*Cathartes aura*), Snail Kite (*Rostrhamus sociabilis*), Bicolored Hawk (*Accipiter bicolor*), Plumbeous Rail (*Pardirallus sanguinolentus*), Common Moorhen (*Gallinula chloropus*), Purple Gallinule (*Porphyrio martinica*), White-winged Coot (*Fulica leucoptera*), Southern Lapwing (*Vanellus chilensis*), Pale-vented Pigeon (*Columba cayennensis*), Dark-billed Cuckoo (*Coccyzus melacoryphus*) (a male collected on 21 April 1984 had heavy fat; LSUMZ 123536), Ferruginous Pygmy-Owl (*Glaucidium brasilianum*), Common Potoo (*Nyctibeus griseus*), Rufous Nightjar (*Caprimulgus rufus*), Glittering-bellied Emerald (*Chlorostilbon aureoventris*), Belted Kingfisher (*Ceryle torquatus*), Southern

Beardless-Tyrannulet (*Camptostoma obsoletum*), Mouse-colored Tyrannulet (*Phaeomyias murina*), Greenish Elaenia (*Myiopagis viridicata*), White-bellied Tyrannulet (*Serpophaga munda*), Greater Wagtail-Tyrant (*Stigmatura budytoides*), Bran-colored Flycatcher (*Myiophobus fasciatus*), Euler's Flycatcher (*Lathrotriccus euleri*), White-winged Black-Tyrant (*Knipolegus aterrimus*), Spectacled Tyrant (*Hymenops perspicillata*), Cattle Tyrant (*Machetornis rixosa*), Variegated Flycatcher (*Empidonomus varius*), Tropical Kingbird (*Tyrannus melancholicus*), White-winged Becard (*Pachyramphus polychopterus*), Red-eyed Vireo (*Vireo olivaceus*), Brown-chested Martin (*Progne tapera*), Southern Rough-winged Swallow (*Stelgidopteryx ruficollis*), House Wren (*Troglodytes aedon*), Sayaca Tanager (*Thraupis sayaca*), Guira Tanager (*Hemitraupis guira*), Hepatic Tanager (*Hemitraupis guira*), Rufous-collared Sparrow (*Zonotrichia capensis*), Blue-black Grassquit (*Volatinia jacarina*), and Dark-throated Seedeater (*Sporophila ruficollis*).

As one of the few lakes in the region, Laguna Kaucaya supports a diverse assemblage of resident and migratory aquatic birds. It is unclear whether the species represent resident Laguna Kaucaya populations or visitors from other areas in the region. Most of the water-associated species probably breed in the area. The core forest avifauna included mixed species flocks of Squirrel Cuckoo (*Piaya cayana*), Spot-backed Puffbird (*Nyctalus maculatus*), Narrow-billed Woodcreeper, Small-billed Elaenia, White-bellied Tyrannulet (*Serpophaga munda*), Pearly-vented Tody-Tyrant (*Hemitriccus margaritaceiventer*), Yellow-olive Flycatcher (*Tolmomyias sulphurescens*), White-winged Black-Tyrant (*Knipolegus aterrimus*), Brown-crested Flycatcher (*Myiarchus tyrannulus*), Masked Gnatcatcher (*Poliophtila dumicola*), Rufous-collared Sparrow (*Zonotrichia capensis*), Red-crested Finch (*Coryphospingus cucullatus*), and Tropical Parula (*Parula pitiayumi*). Many flocks contained a subset of these species,

although Narrow-billed Woodcreeper was present in most. Groups of four to six Great Rufous Woodcreepers (*Xiphocolaptes major*) were observed almost daily in 2002. Forest species not observed in mixed-species flocks included Sooty-fronted Spinetail (*Synallaxis frontalis*), Variable Antshrike, and Stripe-backed Antbird (*Myrmorchilus strigilatus*). Suiriri Flycatcher was one of the most common forest passerines, with flocks of six to eight birds common in woodlands.

Large emergent trees in the agricultural fields were important habitat for Suiriri Flycatcher, Vermilion Flycatcher, and White Monjita (*Xolmis irupero*). Flocks composed of 10–20 individuals of Bay-winged Cowbird (*Agelaioides badius*) were common in the second growth at the edge of the fields. In the undergrowth along the fencerows, Great Antshrike (*Taraba major*), Barred Antshrike (*Thamnophilus doliaetus*), House Wren (*Troglodytes aedon*), Black-capped Warbling-Finch (*Pooecetes melanoceus*), and *Sporophila* seedeaters were common. Other common species in the second-growth forest along the road included Rufous-browed Peppershrike (*Cycalbis gujanensis*), Ultramarine Grosbeak (*Cyanocopsa brissonii*), Red-crested Cardinal (*Paroaria coronata*), and Golden-billed Saltator (*Saltator aurantiirostris*). The only sighting of Greater Wagtail-Tyrant (*Stigmatura budytoides*) in 2002 was an individual foraging in forest along the road. This species was fairly common in 1984. In more open trees along the fence row, Rufous Hornero (*Furnarius rufus*) and Rufous-fronted Thornbird (*Phacellodomus rufifrons*) were both fairly common.

The turnover in avian taxa at the eastern edge of the Andes from higher elevation to lower elevation forms reflects changes in moisture and vegetation gradients. Several Andean taxa such as White-tufted Grebe (*Rollandia rolland*) (Schmitt *et al.* 1986), Plumbeous Rail (*Pardirallus sanguinolentus*) (Schmitt *et al.* 1986), White-bellied Humming-

bird (*Amazilia chionogaster*), *Lepidocolaptes angustirostris hellmayri*, *Thamnophilus caerulescens dinellii*, Smoke-colored Pewee (*Contopus sumigatus*), Black-goggled Tanager (*Trichothraupis melanops*), Two-banded Warbler (*Basileuterus bivitatus*), and Saffron-billed Sparrow (*Arremon flavirostris dorbignii*) have their easternmost distributional limits in the low Andean ranges near Gutiérrez. In some cases, intergradation between these taxa and a lowland replacement occurs along the eastern edge of the Andes. Laguna Kaucaya specimens of Narrow-billed Woodcreeper, Variable Antshrike (Brumfield unpubl.) and Suiriri Flycatcher all show evidence of intergradation.

Some differences in the composition of the Laguna Kaucaya avifauna with that described further east in lowland Bolivian Chaco at Estancia Perforación (Kratzer *et al.* 1993) are attributable to the absence of water at Estancia Perforación, the absence of Andean foothill taxa in the lowland Chaco (e.g., Two-banded Warbler), and the fact that some open-country lowland Chaco taxa [e.g., Lark-like Brushrunner (*Coryphistera alaudina*)] do not make it into the foothill forests at the eastern edge of the Andes.

The forest habitat at Laguna Kaucaya remained relatively unchanged between 1978 and 2002. Some species that were common in 1984 such as White Woodpecker (*Melanerpes candidus*), Large Elaenia, and Rufous-bellied Thrush (*Turdus rufiventris*) were undetected in 2002. Because of the limited time spent at Laguna Kaucaya in both periods, it is unclear if these discrepancies represent true differences in the composition of the avifauna. Some species that were common in 2002 were undetected in 1984. Brown-crested Flycatcher was of the most common forest passerines in 2002, but it was not collected in 1978 or 1984. Brown-crested Flycatcher is thought to be a permanent resident throughout most of its Bolivian distribution, except for northern Bolivia where it was present in the winter

(Chesser 1997). It seems unlikely that this species would have been missed in 1978 or 1984, so we consider it possible that the Laguna Kaucaya specimens represent migrants. Two of the six individuals collected in 2002 had moderate fat; all others had light or trace fat.

The biggest changes between 1978 and 2002 at Laguna Kaucaya involved the lake itself. Several recent years of droughts coupled with increases in the magnitude of local farming activities drastically reduced the amount of cattails. In 2001, the lake dried completely. Because aquatic habitats are rare in the dry Andean foothills of southern Bolivia, lakes such as Laguna Kaucaya are critical for both resident and migratory species.

ACKNOWLEDGMENTS

We thank the Montaña (Luis, Carlos y Ruben), Viveros (Modesto), and Pinto (Gerardo and Miguel) families for granting us access to their property. We are grateful to L. Acosta for field assistance in June 2002. Observations by O.M.Z. in February 2003 were made as part of the Censo Neotropical de Aves Acuáticas, coordinated in Bolivia by S. Davis. For logistical and permit assistance in Bolivia we thank E. Guzmán and R. A. Vespa. N. Acheson, S. Davis, J. Fjeldsá, S. Herzog, D. Lane, R. McNeil, J. V. Remsen, Jr., M. B. Robbins, and an anonymous reviewer made helpful comments on the manuscript. B. Marks copied catalog information from the LSUMZ collection for R.T.B. J. L. Woods kindly provided copies of the DMNH catalog. This research was supported by NSF grant DBI-9974235 to R.T.B.

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APPENDIX 1. Species list of birds encountered at Laguna Kaucaya and environs. An “s” indicates species of which at least one specimen was collected. Species that were observed, but not collected, are indicated by an “x”. Relative abundance codes are from Stotz *et al.* (1996): C = greater than or equal to 10 individuals observed per day, FC = 4–10 individuals per day, U = 1–3 per day, and R = less than 1 per day. Primary habitat codes are: A = species found in agricultural fields, or in clumps of vegetation within or in forest at the immediate edge of agricultural fields; F = forest species; O = species seen flying above or through the study site, and W = water-associated species found on or immediately adjacent to the lake. Avian taxonomy follows the classification of the South American Checklist Committee (2004).

English names	Scientific names	2002	1984	1978–1979	Relative abundance	Primary habitat
Tataupa Tinamou	<i>Crypturellus tataupa</i> ^{b,c}	s			U	F
Southern Screamer	<i>Chauna torquata</i> ^f	s		x	U	W
Fulvous Whistling-Duck	<i>Dendrocygna bicolor</i> ^b	x	s	x	FC	W
Comb Duck	<i>Sarkidiornis melanotos</i>			x	U	W
Ringed Teal	<i>Callonetta leucophrys</i> ^{a,b}	x	s		FC	W
Brazilian Teal	<i>Amazonetta brasiliensis</i> ^a	s			FC	W
White-cheeked Pintail	<i>Anas bahamensis</i> ^b		s	x	C	W
Cinnamon Teal	<i>Anas cyanoptera</i> ^a	s			FC	W
Black-headed Duck	<i>Heteronetta atricapilla</i>	x			U	W
Masked Duck	<i>Nomonyx dominicus</i> ^b		s		U	W
Ruddy Duck	<i>Oxyura jamaicensis</i> ^{a,b}	s	s		FC	W
Chaco Chachalaca	<i>Ortalis canicollis</i>	s		x	R	F
White-tufted Grebe	<i>Rollandia rollana</i> ^{a,b}	s	s		U	W
Least Grebe	<i>Tachybaptus dominicus</i> ^b	x	s		FC	W
Pied-billed Grebe	<i>Podilymbus podiceps</i> ^{a,b}	s	s		FC	W
Neotropic Cormorant	<i>Phalacrocorax brasilianus</i>	x			C	W
Black-crowned Night-Heron	<i>Nycticorax nycticorax</i> ^a	s	x		U	W
Striated Heron	<i>Butorides striata</i> ^d	x		s	U	W
Cattle Egret	<i>Bubulcus ibis</i>	x			FC	A
Cocoi Heron	<i>Ardea cocoi</i>	x			U	W
Great Egret	<i>Ardea alba</i>	x	x		FC	W
Whistling Heron	<i>Syrigma sibilatrix</i>	x			U	W
Snowy Egret	<i>Egretta thula</i>	x			U	W
White-faced Ibis	<i>Plegadis chibi</i> ^b	x	s		FC	W
Buff-necked Ibis	<i>Theristicus caudatus</i>	x			U	A

APPENDIX 1. Continuation.

English names	Scientific names	2002	1984	1978–1979	Relative abundance	Primary habitat
Roseate Spoonbill	<i>Platalea ajaja</i>	x			U	W
Maguari Stork	<i>Ciconia maguari</i>			x	U	W
Turkey Vulture	<i>Cathartes aura</i>	x			FC	O
Black Vulture	<i>Coragyps atratus</i>	x			C	O
King Vulture	<i>Sarcorambus papa</i>			x	U	O
Osprey	<i>Pandion haliaetus</i>	x			U	W
Snail Kite	<i>Rostrhamus sociabilis</i>	x			U	W
Bicolored Hawk	<i>Accipiter bicolor</i> ^a			s	R	F
Gray Hawk	<i>Asturina nitida</i>	x			U	F
Great Black Hawk	<i>Buteogallus urubitinga</i>			x	U	F
Savanna Hawk	<i>Buteogallus meridionalis</i>			x	U	F
Harris's Hawk	<i>Parabuteo unicinctus</i>			x	U	F
Roadside Hawk	<i>Buteo magnirostris</i> ^b	x	s		U	F
Southern Caracara	<i>Caracara plancus</i>	x			U	F
Laughing Falcon	<i>Herpetotheres cachinnans</i> ^b		s		R	A
American Kestrel	<i>Falco sparverius</i>			x	U	F
Bat Falcon	<i>Falco rufigularis</i>	x			R	F
Limpkin	<i>Aramus guarauna</i>			x	U	W
Gray-necked Wood-Rail	<i>Aramides cajaned</i> ^b		s	x	U	F
Rufous-sided Crake	<i>Laterallus melanophaius</i> ^b	x	s		R	W
Plumbeous Rail	<i>Pardirallus sanguinolentus</i> ^b		s	x	R	W
Common Moorhen	<i>Gallinula chloropus</i> ^b	x	s	x	FC	W
Purple Gallinule	<i>Porphyrio martinica</i> ^b	x	s		FC	W
White-winged Coot	<i>Fulica leucoptera</i> ^b	x	s	x	FC	W
Red-legged Seriema	<i>Cariama cristata</i> ^b	x	s	x	R	A
Black-legged Seriema	<i>Chunga burmeisteri</i> ^{a,b,c}	s	s		FC	A
Wattled Jacana	<i>Jacana jacana</i> ^{b,d}	s	s	s	C	W
Black-necked Stilt	<i>Himantopus mexicanus</i> ^a	s			C	W
Southern Lapwing	<i>Vanellus chilensis</i> ^b	x	s	x	FC	A
Upland Sandpiper	<i>Bartramia longicauda</i>			x	R	W

English names	Scientific names	2002	1984	1978–1979	Relative abundance	Primary habitat
Greater Yellowlegs	<i>Tringa melanoleuca</i> ^d			s	R	W
Lesser Yellowlegs	<i>Tringa flavipes</i> ^b		s		U	W
Solitary Sandpiper	<i>Tringa solitaria</i> ^{b,d}		s	s	U	W
Spotted Sandpiper	<i>Actitis macularius</i>			x	U	W
White-rumped Sandpiper	<i>Calidris fuscicollis</i> ^{a,c}	s			U	W
Pectoral Sandpiper	<i>Calidris melanotos</i> ^b		s		U	W
Buff-breasted Sandpiper	<i>Tryngites subruficollis</i> ^f	s			U	W
Pale-vented Pigeon	<i>Patagioenas cayennensis</i> ^b	x	s		U	F
Eared Dove	<i>Zenaida auriculata</i>	x			C	A
Ruddy Ground-Dove	<i>Columbina talpacoti</i> ^{a,b,d}	x	s	s	FC	A
Picui Ground-Dove	<i>Columbina picui</i> ^{a,b,c,d}	s	s	s	C	A
Blue Ground-Dove	<i>Claravis pretiosa</i>	x			U	A
White-tipped Dove	<i>Leptotila verreauxi</i>	x			U	F
Chestnut-fronted Macaw	<i>Ara severus</i>	x			R	O
Yellow-collared Macaw	<i>Procyrrhura auricollis</i> ^b		s		U	O
White-eyed Parakeet	<i>Aratinga leucophthalma</i> ^b		s		U	O
Green-cheeked Parakeet	<i>Pyrrhura molinae</i> ^g	s			FC	F
Scaly-headed Parrot	<i>Pionus maximiliani</i> ^g	s			FC	F
Blue-fronted Parrot	<i>Amazona aestiva</i>			x	U	O
Dark-billed Cuckoo	<i>Coccyzus melacoryphus</i> ^{b,d}		s	s	U	F
Squirrel Cuckoo	<i>Piaya cayana</i> ^f	s			R	F
Smooth-billed Ani	<i>Crotophaga ani</i> ^g	s			U	A
Guira Cuckoo	<i>Guira guira</i>	x			FC	A
Tropical Screech-Owl	<i>Megascops choliba</i> ^g	x			U	F
Spectacled Owl	<i>Pulsatrix perspicillata</i>	x			U	A
Ferruginous Pygmy-Owl	<i>Glaucidium brasilianum</i> ^{a,d}	s		s	U	F
Burrowing Owl	<i>Athene cunicularia</i> ^g	s			U	A
Striped Owl	<i>Pseudoscops clamator</i>	x			U	F
Common Potoo	<i>Nyctibius griseus</i>	x			U	F
Rufous Nightjar	<i>Caprimulgus rufus</i> ^{a,c}	s			U	F

APPENDIX 1. Continuation.

English names	Scientific names	2002	1984	1978–1979	Relative abundance	Primary habitat
Glittering-bellied Emerald	<i>Chlorostilbon aureoventris</i> ^a	s			FC	F
Gilded Hummingbird	<i>Hylocharis chrysura</i> ^{a,b}	s	s		U	F
White-bellied Hummingbird	<i>Amazilia chionogaster</i> ^a	s			R	F
Blue-crowned Trogon	<i>Trogon curucui</i> ^b	s	s		FC	F
Ringed Kingfisher	<i>Ceryle torquatus</i>	x			R	A
Blue-crowned Motmot	<i>Momotus momota</i> ^f	s			R	F
Spot-backed Puffbird	<i>Nystalus maculatus</i> ^b	x	s		U	F
Toco Toucan	<i>Ramphastos toco</i>	x			R	F
Piculet	<i>Picumnus</i> sp. ^{a,b,c,d}	s	s	s	U	F
White Woodpecker	<i>Melanerpes candidus</i> ^b		s		U	F
Checkered Woodpecker	<i>Picoides mixtus</i> ^a	s			R	F
Golden-green Woodpecker	<i>Piculus chrysochlorus</i> ^a	x			U	F
Lineated Woodpecker	<i>Dryocopus lineatus</i> ^{a,b,c}	s	s		U	F
Cream-backed Woodpecker	<i>Campephilus leucopogon</i> ^{a,b,c}	s	s		U	F
Olivaceous Woodcreeper	<i>Sittasomus griseicapillus</i> ^{a,b,c}	s	s		U	F
Great Rufous Woodcreeper	<i>Xiphocolaptes major</i> ^{a,b,c}	s	s		FC	F
Narrow-billed Woodcreeper	<i>Lepidocolaptes angustirostris</i> ^{a,b,c,d}	s	s	s	FC	F
Rufous Hornero	<i>Furnarius rufus</i> ^{b,d}	x	s	s	FC	A
Wren-like Rushbird	<i>Phleocryptes melanops</i> ^{b,d}		s	s	R	W
Sooty-fronted Spinetail	<i>Synallaxis frontalis</i> ^{a,b,c,d}	s	s	s	FC	F
Pale-breasted Spinetail	<i>Synallaxis albescens</i> ^b		s		R	F
Ochre-cheeked Spinetail	<i>Synallaxis scutata</i> ^{a,b}	s	s		FC	F
Stripe-crowned Spinetail	<i>Cranioleuca pyrrhophia</i> ^{a,b,c,d}	s	s	s	FC	F
Rufous-fronted Thornbird	<i>Phacellodomus rufifrons</i> ^{a,c,d}	s		s	FC	A
Buff-fronted Foliage-gleaner	<i>Philydor rufum</i>	x			U	F
Streaked Xenops	<i>Xenops rutilans</i> ^e	s			FC	F
Giant Antshrike	<i>Batara cinerea</i>	x			R	F
Great Antshrike	<i>Taraba major</i> ^{a,b,c,d}	s	s	s	FC	F
Barred Antshrike	<i>Thamnophilus doliatus</i> ^{b,c,d}	s	s	s	FC	F
Bolivian Slaty-Antshrike	<i>Thamnophilus sticturus</i> ^e	s			R	F

English names	Scientific names	2002	1984	1978–1979	Relative abundance	Primary habitat
Variable Antshrike	<i>Thamnopbilus caeruleus</i> ^{h,c,d}	s	s	s	FC	F
Stripe-backed Antbird	<i>Myrmorchilus strigilatus</i> ^{a,b,c,d}	s	s	s	FC	F
Black-capped Antwren	<i>Herpsilochmus atricapillus</i> ^f	s			R	F
Black-bellied Antwren	<i>Formicivora melanogaster</i> ^{b,c}	s	s		R	F
Greenish Elaenia	<i>Myiopagis viridicata</i> ^{a,b,c,d}	s	s	s	U	F
Large Elaenia	<i>Elaenia spectabilis</i> ^{h,d}		s	s	U	F
White-crested Elaenia	<i>Elaenia albiceps</i> ^{a,b}		s		R	F
Small-billed Elaenia	<i>Elaenia parvirostris</i> ^{a,b,c,d}	s	s	s	FC	F
Southern Beardless-Tyrannulet	<i>Camptostoma obsoletum</i> ^{b,c}	s	s		U	F
Suiriri Flycatcher	<i>Suiriri suiriri</i> ^{a,b,c}	s	s		C	F
White-bellied Tyrannulet	<i>Serpophaga munda</i> ^{b,c}	s	s		FC	F
Mouse-colored Tyrannulet	<i>Phaomyias murina</i> ^f	s			U	F
Greater Wagtail-Tyrant	<i>Stigmatura budytoidea</i> ^b	x	s		R	F
Plain Tyrannulet	<i>Inezja inornata</i> ^d			s	R	F
Pearly-vented Tody-Tyrant	<i>Hemitriccus margaritaceiventer</i> ^{a,b,c,d}	s	s	s	FC	F
Yellow-olive Flycatcher	<i>Tolmomyias sulphurescens</i> ^{a,b,c}	s	s		FC	F
Bran-colored Flycatcher	<i>Myiophobus fasciatus</i> ^{b,c}	s	s		R	F
Euler's Flycatcher	<i>Lathrotriccus euleri</i> ^f	s			R	F
Fuscous Flycatcher	<i>Cnemotriccus fuscatus</i> ^d			s	R	F
Smoke-colored Pewee	<i>Contopus fumigatus</i> ^f	s			R	F
Vermilion Flycatcher	<i>Pyrocephalus rubinus</i> ^{a,c}	s			U	A
White-winged Black-Tyrant	<i>Knipolegus aterrimus</i> ^f	s			FC	F
Spectacled Tyrant	<i>Hymenops perspicillata</i> ^b		s		U	W
Lesser Shrike-Tyrant	<i>Agriornis murinus</i> ^a	s			R	A
White Monjita	<i>Xolmis irupero</i> ^{a,b,c}	s	s		FC	A
Pied Water-Tyrant	<i>Fluvicola pica</i> ^{a,b}		s		U	W
Cattle Tyrant	<i>Machetornis rixosa</i> ^b	x	s		U	A
Greater Kiskadee	<i>Pitangus sulphuratus</i> ^b	x	s		U	A
Variagated Flycatcher	<i>Empidonomus varius</i> ^d			s	R	F
Crowned Slaty-Flycatcher	<i>Empidonomus aurantioatrocristatus</i> ^{b,d}		s	s	U	F

APPENDIX 1. Continuation.

English names	Scientific names	2002	1984	1978–1979	Relative abundance	Primary habitat
Tropical Kingbird	<i>Tyrannus melancholicus</i> ^{h,d}		s	s	R	A
Fork-tailed Flycatcher	<i>Tyrannus savana</i>	x			R	A
Rufous Casiornis	<i>Casiornis rufus</i> ^{a,b,c}	s	s		FC	F
Swainson's Flycatcher	<i>Myiarchus swainsoni</i> ^f	s			R	F
Brown-crested Flycatcher	<i>Myiarchus tyrannulus</i> ^{a,c}	s			FC	F
White-winged Becard	<i>Pachyramphus polychopterus</i> ^{h,c}	s	s		U	F
Rufous-browed Peppershrike	<i>Cyclarhis gujanensis</i> ^{a,b,c}	s	s		FC	F
Red-eyed Vireo	<i>Vireo olivaceus chinii</i> ^{h,d}		s	s	R	F
Purplish Jay	<i>Cyanocorax cyanomelas</i> ^b		s		R	F
Plush-crested Jay	<i>Cyanocorax chrysops</i> ^{a,b,c}	s	s		U	F
Swallow	<i>Tachycineta</i> sp.	x			FC	W
Brown-chested Martin	<i>Progne taperi</i> ^d			s	R	W
Southern Rough-winged Swallow	<i>Stelgidopteryx ruficollis</i> ^d			s	FC	W
Bank Swallow	<i>Riparia riparia</i>	x		s	FC	W
House Wren	<i>Troglodytes aedon</i> ^{a,c,d}	s			FC	F
Masked Gnatcatcher	<i>Poliophtila dumicola</i> ^{a,b,c,d}	s	s	s	C	F
Swainson's Thrush	<i>Catbarus ustulatus</i> ^d			s	R	F
Rufous-bellied Thrush	<i>Turdus rufigiventris</i> ^{h,d}		s	s	U	F
Creamy-bellied Thrush	<i>Turdus amaurochalinus</i> ^{a,b,c,d}	s	s	s	FC	F
White-banded Mockingbird	<i>Mimus triurus</i> ^{a,b,c}	s	s	s	U	A
Hooded Tanager	<i>Nemosia pileata</i> ^f	s			R	F
Orange-headed Tanager	<i>Thlypopsis sordida</i> ^d				U	F
Black-goggled Tanager	<i>Trichothraupis melanops</i> ^b		s	s	R	F
Sayaca Tanager	<i>Thraupis sayaca</i> ^{b,c,d}	s	s		FC	F
Blue-and-yellow Tanager	<i>Thraupis bonariensis</i> ^b		s	s	R	F
Guira Tanager	<i>Hemitraupis guira</i> ^f	s			R	F
Hepatic Tanager	<i>Piranga flava</i> ^b		s		R	F
Rufous-collared Sparrow	<i>Zonotrichia capensis</i> ^{a,b,c,d}	s	s	s	FC	A
Black-capped Warbling-Finch	<i>Poospiza melanoleuca</i> ^{a,b,c,d}	s	s	s	FC	A
Saffron Finch	<i>Sicalis flaveola</i> ^{a,b,c,d}	s	s	s	C	A

English names	Scientific names	2002	1984	1978–1979	Relative abundance	Primary habitat
Blue-black Grassquit	<i>Volatinia jacarina</i>	x			U	A
Lined Seedeater	<i>Sporophila lineola</i> ^b		s		FC	A
Double-collared Seedeater	<i>Sporophila caerulea</i> ^{b,d}		s	s	U	A
Dull-colored Grassquit	<i>Tiaris obscura</i> ^b		s		U	A
Saffron-billed Sparrow	<i>Arremon flavirostris</i> ^{a,b,c}	s	s		U	A
Red-crested Finch	<i>Coryphospingus cucullatus</i> ^{a,b,c,d}	s	s	s	C	F
Red-crested Cardinal	<i>Paroaria coronata</i> ^{a,b,d}	s	s	s	FC	F
Golden-billed Saltator	<i>Saltator aurantirostris</i> ^{a,b,c,d}	s	s	s	FC	F
Ultramarine Grosbeak	<i>Cyanocopsa brissonii</i> ^{a,b,c,d}	s	s	s	FC	F
Tropical Parula	<i>Parula pitayumi</i> ^{a,b,c,d}	s	s	s	FC	F
Masked Yellowthroat	<i>Geothlypis aequinoctialis</i> ^{b,d}	x	s	s	U	F
Two-banded Warbler	<i>Basileuterus bivittatus</i> ^b		s		U	F
Crested Oropendola	<i>Psarocolius decumanus</i>	x			R	O
Epaulet Oriole	<i>Icterus cayanensis</i> ^b		s		R	F
Unicolored Blackbird	<i>Chrysomitris cyanopus</i>	x			U	W
Bay-winged Cowbird	<i>Agelaioides badius</i> ^{b,d}	x	s	s	C	A
Shiny Cowbird	<i>Molothrus bonariensis</i> ^b		s		FC	A
Giant Cowbird	<i>Molothrus oryzivorus</i>	x			R	O
Hooded Siskin	<i>Carduelis magellanica</i> ^f	s			C	F
Purple-throated Euphonia	<i>Euphonia chlorotica</i> ^{a,c}	s			R	F

^aSpecimen(s) housed at MNKM.

^bSpecimen(s) housed at LSUMZ.

^cSpecimen(s) housed at UWBM.

^dSpecimen(s) housed at DMNH.