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Lists of Species

Aves, Bosque Oriental de Bogotá Protective Forest Reserve, Bogotá, D.C., Colombia

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Abstract: Baseline information is a priority for conservation plans of protected areas, especially when they are of great importance for the maintenance of biodiversity. However, many nature reserves are lacking this information. Here I present a characterization of the avifauna studied along the La Agüadora - San Rafael trail in the Bosque Oriental de Bogotá Protective Forest Reserve. I recorded 67 species after 18 visits done to the study area. The species accumulation curve indicates that the survey was not sufficient, but noteworthy records for *Elanus leucurus* (Vieillot, 1818), *Megascops albogularis* (Cassin, 1848), *Ciccaba albitaris* (Bonaparte, 1850), *Caprimulgus longirostris* (Sclater, 1866), *Synallaxis subpudica* Sclater, 1874, *Catamenia inornata* Berlepsch, 1885 and *Atlapetes pallidinucha* (Boissoneau, 1840) were obtained. Information provided can be useful for future management plans especially when considering spatial heterogeneity as a key base concept.

Introduction

Colombia is recognized as the country with the highest species richness of birds (Renjifo *et al.* 2002; Franco and Bravo 2005), accounting for about 20% of the world's total (Renjifo *et al.* 2002), and 60% of South America (Asociación Bogotana de Ornitología 2000). Colombia has also part of one of the most threatened hotspots in the world, the Northern Tropical Andes (Mast *et al.* 1997), which is at the same time an important endemic bird area (Stattersfield *et al.* 1998).

Andean ecosystems in Colombia face a high pressure by deforestation (Cavelier 1998) and fragmentation (Etter and van Wyngaarden 2000; Armenteras *et al.* 2003), with only 22% of the original cover remaining and unevenly distributed (Etter and van Wyngaarden 2000; Etter and Villa 2000; Armenteras *et al.* 2003), despite still being regarded as one of the areas with the largest potential for biodiversity conservation (Mast *et al.* 1997; Cavelier 1998).

Tropical Andes represent 24% of the surface of the country (Etter and van Wyngaarden 2000). Approximately 16% of their area in the Eastern mountain range (*Cordillera Oriental*) is protected by the National Protected Areas System (Armenteras *et al.* 2003; Vásquez and Serrano 2009). However, since there is no guarantee of protection for an area solely by its declaration (Armenteras *et al.* 2003), it is necessary to gather base information for appropriate management and conservation plans for many of these areas.

The Bosque Oriental de Bogotá Protective Forest Reserve (BOBPFR) is a conservation area of the National Protected Areas System but its avifauna diversity has not been properly studied. Until now 95 species have been reported inhabiting the reserve (Brand-Prada 1995a, b; Asociación Bogotana de Ornitología 2000; Stiles and Caycedo 2002; Rojas-Nossa 2007; Gutiérrez-Zamora 2008; Rico 2008; Peraza 2009). Records for about ten localities have been obtained (Asociación Bogotana de Ornitología 2000; Rojas-Nossa 2007; Gutiérrez-Zamora 2008; Rico-G. 2008), but only two of them, Aurora Alta and Cerros de Torca, have good records over time, while the rest of localities have short term studies or sporadic observations.

The BOBPFR is an important area because it acts as a provider of environmental services as well as a control of urban expansion in Bogotá city (Vásquez 2005; Alcaldía Mayor de Bogotá et al. 2007; Vásquez and Serrano 2009). Presently there is no management plan for this area and there is little baseline information. Here I present the results of an inventory of birds carried out in part of the trail from La Agüadora to San Rafael reservoir in the Usaquén locality of the reserve, which contributes to fill in this gap for ongoing and future biodiversity conservation actions in the area.

Materials and Methods

Study Area

The reserve is located in a mountain area at the Eastern side of Bogotá D.C. that is locally known as Cerros Orientales (Eastern ridges). It was declared a conservation area in 1976 as a strategy to avoid losing biodiversity and environmental services like water supply, to ensure climate regulation and air purification, as well as to restrain the urban expansion of Bogotá city. The boundaries of BOBPFR were redefined in 2005 with a resulting loss of part of the original established area due to irregular urban expansion (Vásquez 2005; Vásquez and Serrano 2009).

The BOBPFR currently covers an area of about 13,630 ha and its elevation ranges from 2,600 to 3,550 m (Vásquez 2005; Vásquez and Serrano 2009). It is covered by an heterogeneous mosaic of habitats of Andean cloud forest, planted forest (*Pinus* sp.), paramo, and scattered patches of bushy forest edges, stunted shrubby second growth, dwarf forest and bamboo thickets (Asociación Bogotana de Ornitología 2000; Vásquez 2005; Vásquez and Serrano 2009). The reserve is about 52 km in length, and varies from 0.4 to 8 km in width (Vásquez 2005; Vásquez and

Serrano 2009). Precipitation is bimodal with two peaks of rain in April-May and October-November and two dry seasons in January-February and July-August (Mora-Osejo 1995). The climate is drier and elevations are lower in the northern side of the reserve (Mora-Osejo 1995; Alcaldía Mayor de Bogotá *et al.* 2007; Vásquez 2009).

Data Collection

Field work was carried out from 7 September to 24 November 2000. Within this period I did 18 visits to seven stations (Table 1), previously set along a trail of about 4,3 km (Figure 1). I recorded all the birds seen and heard in every station during periods of at least three hours (06:00 to 09:00 h) per station. Additional records were done along the way in an *ad libitum* form, from the beginning of the trail to station three (Figure 1), at the time of arriving and mostly leaving stations for regular censuses. The rest of the trail between stations was not used for this kind of observation due to security problems that affected the area by the time of study. The scope of records around each station was ≤ 50 m.

Additionally, I set three to five mist nets (6.0 x 2.7 m; 36 mm mesh) near stations one, six and seven (one day per station), to confirm some identifications, and to try to capture some secretive species that could be overlooked. Individuals that died or were collected during mist net operations were deposited in the ornithological collection of the Museo Javeriano de Historia Natural (MPUJ) at the Pontificia Universidad Javeriana (see also Peraza 2009).

Data analysis

Since observed species richness is highly dependent on sample effort, especially when data of contiguous habitats are pooled (Gotelli and Colwell 2001; Colwell *et al.* 2005), sample-based rarefaction curves of incidence adjusted to individuals, traditional Coleman cumulative species curve, and the non-parametric species richness estimator Chao 2 were calculated using EstimateS 7,5 (Colwell 2005) to determine data representativeness, and to make data comparable with future surveys (Soberón and Llorente 1993). Confidence intervals of 95% were also calculated for sample-based rarefaction and Chao 2 estimator with the same program.

Results and Discussion

A total of 67 species were recorded at the stations and along the trail after almost 75 h of observations (Table 2). Twenty two individuals from 13 species were netted in a 39 h standard mist-net hour's effort. Species recorded in this area of the BOBPFR are usual inhabitants of this altitudinal belt (Brand-Prada 1995a, b; Asociación Bogotana de Ornitología 2000; Rojas-Nossa 2007; Gutiérrez-Zamora 2008; Rico-G. 2008).

The bird species richness recorded in this study represents 73.6% of the total number of species expected to be observed according to the Chao 2 species richness estimator. This difference is significant, indicating that the survey was insufficient and that the sampling effort was not enough for the recording of all species occurring in the area (Figure 2). However, this does not imply that the information recorded is not valuable. In fact, there is no difference between the traditional Coleman cumulative curve and that one of sampled-based incidence adjusted to individuals, suggesting that the sampling effort made was good since there is no influence in the data neither by the sample ordering nor the spatial arrangement of the stations (Colwell *et al.* 2005).

About 85% of the species were recorded in one to four stations or between stations, and species richness found at each station also varied (Table 2). This can be due to the

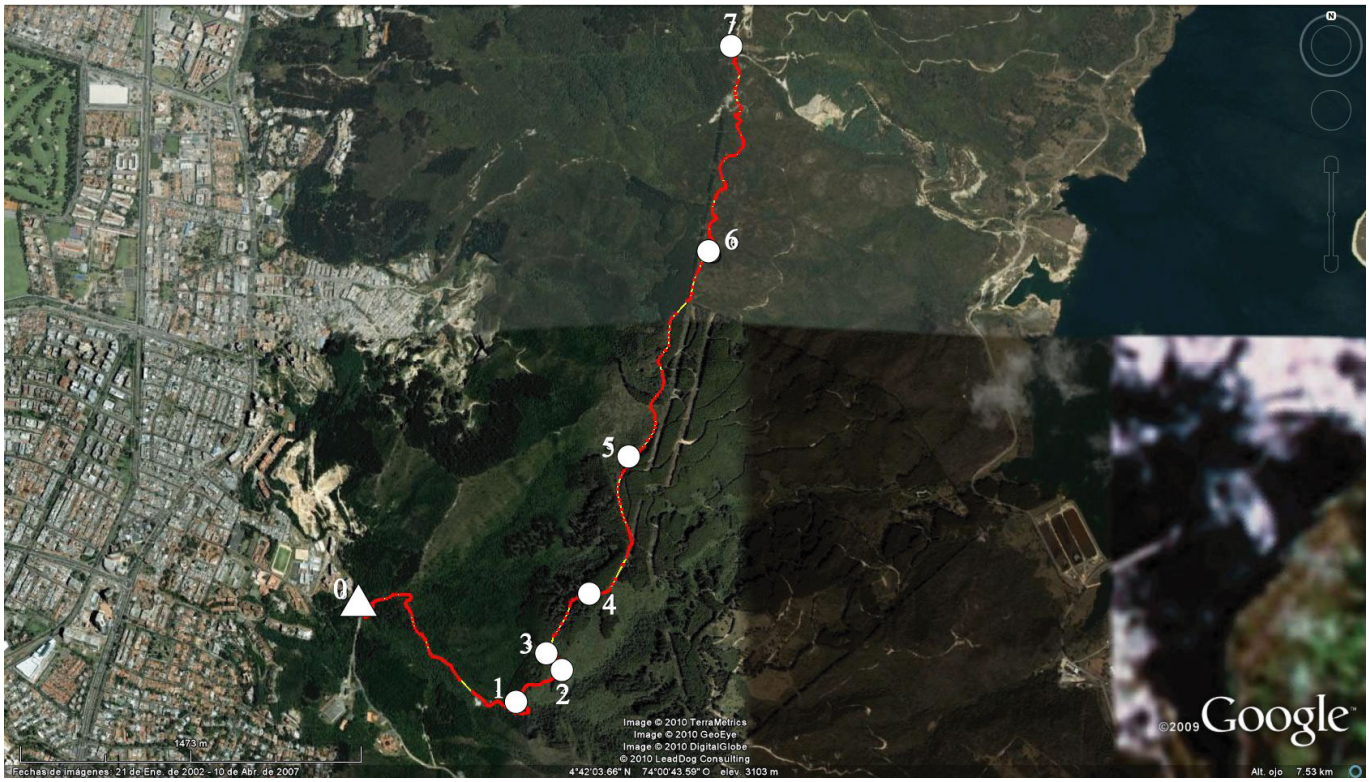

Figure 1. Satellite image comprising the La Agüadora – San Rafael reservoir trail, where birds were surveyed between September and November 2000 at the Bosque Oriental de Bogotá Protective Forest Reserve, Bogotá, D.C, Colombia. Image downloaded from Google Earth version 5.0 (2009).

high habitat spatial heterogeneity along the trail (Figure 1), and to specific factors that are usually related to habitat use by species and their detection in their habitats (Burke and Nol 1998; Boyce and McDonald 1999; Cale 2003). Therefore, it is difficult to know the influences of spatial heterogeneity and sampling effort on the results. However, the low number of species found between stations one and two, and at station four might result mainly of habitat heterogeneity rather than the sampling effort, as these areas of the BOBPFR are covered mainly by planted exotic forest. Seven species had noteworthy records and details on them are provided below.

Table 1. Geographic coordinates (WGS 84) of the seven stations, including the starting point of trail (station 0), where observations were carried out at Bosque Oriental de Bogotá Protective Forest Reserve, Bogotá, D.C, Colombia. Protective Forest Reserve, Bogotá, D.C, Colombia.

Station	Geographic coordinates	Altitude (m)	Number of visits
0	04°41'35" N, 74°1'27" W	2,674	
1	04°41'23" N, 74°1'05" W	2,820	5
2	04°41'28" N, 74°0'59" W	2,900	3
3	04°41'30" N, 74°1'01" W	2,925	3
4	04°41'38" N, 74°0'55" W	3,025	2
5	04°41'56" N, 74°0'50" W	3,065	2
6	04°42'20" N, 74°0'40" W	3,065	4
7	04°42'46" N, 74°0'37" W	3,035	2

Elanus leucurus (Vieillot 1818): This species has been described as one of the beneficiaries of deforestation in Colombia (Hilty 1985), and its population size has been expanding in the Sabana de Bogotá since the 1970s (Asociación Bogotana de Ornitología 2000). It had not been previously recorded in this area.

Megascops albogularis (Cassin, 1848): A left-wing primary feather was found on the floor of a pine plantation border in the transition to dense low native scrub (Matorral Nativo *sensu* Asociación Bogotana de Ornitología 2000), between stations one and two. The color pattern of the feather was compared with those of specimens housed in the ornithological collection of MPUJ to confirm the identity. This record expands its known distribution to the West by almost 20 km from its nearest known locality (Stiles and Rosselli 1998), and confirms its presence in the Cerros Orientales where it was only suspected to occur until now (Asociación Bogotana de Ornitología 2000).

Ciccaba albitarsis (Bonaparte, 1850): On 18 September I observed one individual perched on a branch about 4 m high. It was in dense low native scrubby vegetation next to an old road at the beginning of the trail (Table 1). The owl was in an area that had been recently logged at the understory level. I could hear its vocalization twice: 05:55 h on 21 September and 05:50 h on 27 September (this time it was taped). Its call was as described by Hilty and Brown (1986), but the series was repeated only twice on both occasions. The nearest known locality for this species is almost 20 km to the East (Stiles and Rosselli 1998), and it is suspected to occur in the hills of the Sabana de Bogotá (Asociación Bogotana de Ornitología 2000). Therefore, my records confirm its presence in this Colombian region.

Caprimulgus longirostris (Sclater, 1866): An adult was sighted after flushing on 20 November at 100-150

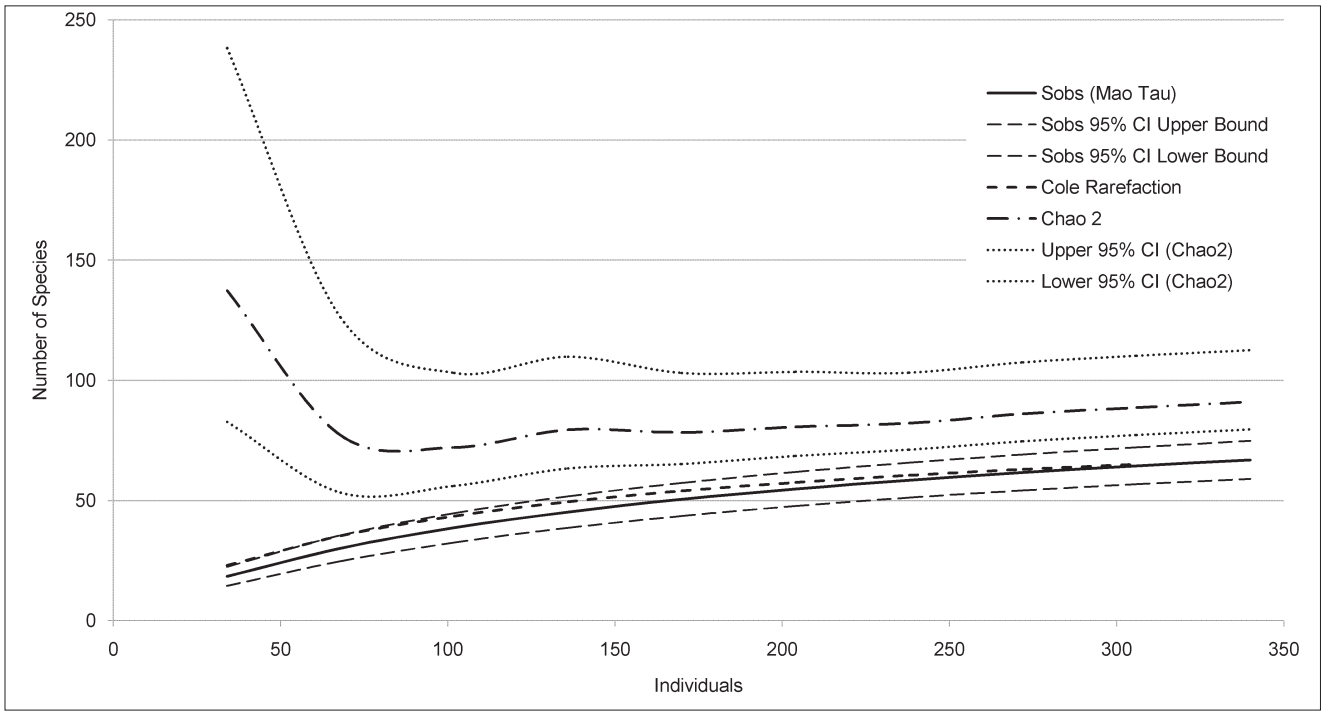

Figure 2. Sample-based rarefaction curve of incidence adjusted to individuals, traditional Coleman cumulative species curve, and non-parametric species richness estimator Chao 2. Confidence intervals of 95% calculated for sample-based and Chao 2 curves are shown. Curves were based on bird species recorded at Bosque Oriental de Bogotá Protective Forest Reserve, Bogotá, D.C, Colombia.

m NE of station seven. With this, one dull white egg in a simple unlined nest (Simon and Pacheco 2005) placed on the ground was found. The bird was next to the egg, not incubating it. The adult did not return to the nest surroundings during this day, but was found there on the next day. The vegetation at this site is similar to that of subparamo (*sensu* Asociación Bogotana de Ornitología 2000). Few grass thickets were around the nest site. Egg dimensions were 28.0 x 21.0 mm.

On 9 November (no year indicated) McKay found one nest of *C. longirostris* in Páramo de Chuza (Hilty and Brown 1986), a place about 30 km SE from station seven. On 3 July (no year indicated), Olivares (1969) collected an egg of 30.0 x 21.0 mm near Bogotá. Hilty and Brown (1986) report a nest found near Bogotá also in July. Apparently, reproduction occurs all year long, because a female with an egg inside the oviduct was found in mid-October in Boyacá (Olivares 1971), and Hilty and Brown (1986) mentions that10 birds in breeding conditions were recorded between February and June (no place specified), as well as female with eggs was found by Carriker (not year indicated) in July at Perijá mountains.

Synallaxis subpudica Sclater, 1874: A female was netted on 13 October, between the beginning of the trail and station one. While it was being transported to be processed, an egg without calcium shell was released in the bag. It weighed 2.2 g, and measured 20.1 x 14.6 mm. I think that the egg was to be laid in about two days, considering that time of capture was 11:30 h and that Proctor and Lynch (1993) mention that the time necessary to form the final exterior shell of calcium inside the uterus section of oviduct is between one and two days. Eggs are reported to be white in color (Olivares 1969). No other breeding dates have been published until now, except Carriker's report of four males in breeding conditions between June and September in the Eastern Andes (Hilty and Brown 1986).

Catamenia inornata Berlepsch, 1885: On 25 October a nest with two eggs was collected (MPUJ-N 002), after having found it on the 19th for the first time. It was found about 100 m NE from station seven. The nest was concealed in the base of a bunch of grass (*Cortaderia* sp.) on the ground, with many of its leaves covering it and resembling a roof. The nest was a low cup base (Simon and Pacheco 2005), ovate in external form and with different heights in both poles of the long axis, built with fine grasses tightly entangled. Its measures were: external diameter: 16.0 x 11.0 cm, outside height: 10.0 and 5.5 cm in opposite sides (long axis), internal diameter: 5.5 cm, depth at the center: 5.0 cm. Lining was made of finer grasses and the bottom of the cup was partially covered by a plant material similar to down. Inside the nest there were two pale greenish blue eggs covered with brownish-ocher blotches of different shapes and sizes, principally around the larger end. The eggs (MPUJ-H 001) measured 19.9 x 15.2 mm and 19.8 x 14.9 mm, and weighed 2.04 and 1.91 g, respectively. I was unable to capture the parental after three attempts, and finally the nest was abandoned by them. This is the first description of a *C. inornata* nest in South America. The only published data for a *Catamenia*'s nest and eggs are those of the Asociación Bogotana de Ornitología (2000). They describe a similar nest and eggs for *C. analis*, but the nest was made of twigs and rootlets.

Atlapetes pallidinucha (Boissoneau, 1840): On 19 October a male with an unusual color pattern was collected at station seven. This specimen had three tail feathers completely white in color. It had the normal number of feathers in its tail. The unusual feathers were four and five on the left, and five on the right (counting from the center outwards). The rest of the individual was normal in color and size. Apparently, this is the first time that this type of abnormality is reported for this species.

Currently, human population growth seems to be exponential, especially in developing countries where fertility is higher than in developed ones, and life expectancy is rising (WRI 2009). As a result, urban settlements are also increasing, not only in number but also in size, with the consequent alteration of urban fringe and its biodiversity (Wheater 1999; Marzluff *et al.* 2001; McKinney 2002; Chace and Walsh 2006). This situation makes the establishment of appropriate management and conservation plans for protected areas close to urban settlements really important, especially if they provide environmental services that could improve the quality of life of its residents.

Cuervo *et al.* (2006) mentions that the distribution ranges of birds in Colombia are still not completely known, since new publications are frequently appearing with new records for previously unexplored or poorly explored areas. This makes publications with baseline information of species highly important. In fact, if they provide noteworthy records on the natural history of species, such as breeding information and abnormalities, they are valuable for the biodiversity conservation. This kind of information is notably scarce not only for Colombian species, but also for many South American species (Ferreira de Vasconcelos and Rodrigues 2006; Echeverry-Galvis and Córdoba-Córdoba 2008). At the same time, such publications contain records that serve as input for improving the distribution maps of species, which are useful in management plans.

Table 2. Bird species recorded at seven survey stations and along sectors between them in the Usaquén region of the Bosque Oriental de Bogotá Protective Forest Reserve, Bogotá, D.C, Colombia. Taxonomy follows Remsen et al. (2010). Authority and date of species name follows Olivares (1969).

Family / Species	Stations or sectors									
	0-1	1	1-2	2	2-3	3	4	5	6	7
Cracidae										
Penelope montagnii (Bonaparte , 1856)		X		X				X		X
Odontophoridae										
Colinus cristatus (Gould, 1843)										X
Cathartidae										
Coragyps atratus (Lichtenstein, 1818)	X			X	X	X	X	X	X	X
Accipitridae										
Elanus leucurus (Vieillot, 1818)									X	X
Buteo platyterus (Vieillot, 1823)									X	X
Falconidae										
Falco sparverius (Cory, 1915)										X
Columbidae										
Patagioenas fasciata Bonaparte, 1854		X		X						X
Zenaida auriculata Bonaparte, 1855		X						X		
Cuculidae										
Coccyzus americanus (Linneo, 1758)							X			
Strigidae										
Megascops albogularis (Cassin, 1848)			X							
Ciccaba albitarsis (Bonaparte, 1850)	X									
Glaucidium jardinii (Bonaparte, 1855)	X									
Caprimulgidae										
Caprimulgus longirostris (Sclater, 1866)	X									X
Trochilidae										
Colibri coruscans (Gould, 1846)	X	X								X
Lesbia nuna (Loddiges, 1832)	X	X						X		X
Ramphomicron microrhynchum (Boissoneau, 1839)		X								
Metallura tyrianthina (Loddiges, 1832)	X	X		X						
Eriocnemis vestita (Lesson, 1838)	X	X			X					X
Eriocnemis cupreoventris (Fraser, 1840)				X		X	X			
Coeligena bonapartei (Boissonneau, 1840)	X	X		X						X
Coeligena helianthea (Lesson, 1838)		X								
Chaetocercus mulsant (Bourcier, 1842)	X									
Picidae										
Picoides fumigatus (d'Orbigny, 1840)		X	X							
Furnariidae										
Synallaxis subpudica Sclater, 1874	X			X				X		X
Asthenes flammulata (Sclater, 1857)	X									
Grallariidae										
Grallaria ruficapilla Lafresnaye, 1842	X	X		X	X	X		X		X
Rhinocryptidae										
Scytalopus griseicollis (Lafresnaye, 1840)	X	X		X		X		X		X
Tyrannidae										
Phyllomyias uropygialis (Lawrence, 1869)	X									
Elaenia frantzii (Sclater, 1871)	X	X		X		X		X		X
Mecocerculus leucophrys (Bonaparte, 1845)	X	X		X		X		X		
Myiotheretes striaticollis (Sclater, 1853)										X
Ochthoeca fumicolor Sclater, 1856										X
Tyrannus tyrannus (Linneo, 1758)								X		

Table 2. ***Continued.***

Family / Species	Stations or sectors									
	0-1	1	1-2	2	2-3	3	4	5	6	7
Pyrrhomyias cinnamomeus (Hartlaub, 1843)	X	X								X
Cotingidae										
Ampelion rubrocristatus (Lafresnaye & d'Orbigny, 1837)	X									X
Hirundinidae										
Orochelidon murina (Cassin, 1853)				X		X	X	X		X
Hirundo rustica Boddaert, 1873				X		X	X	X		
Troglodytidae										
Troglodytes aedon Stone, 1899										X
Cinnycerthia unirufa (Lafresnaye, 1840)	X	X		X						X
Henicorhina leucophrys (Tschudi, 1844)	X	X		X						
Turdidae										
Catharus ustulatus (Tschudi, 1845)	X									
Turdus fuscater Fraser, 1841	X	X	X	X	X	X		X	X	X
Thraupidae										
Hemispingus superciliaris (Lafresnaye, 1840)	X	X								
Hemispingus melanotis (Sclater, 1855)		X			X	X				
Buthraupis eximia (Boissoneau, 1840)										X
Anisognathus igniventris (Du Bus, 1839)	X	X		X	X	X		X	X	X
Dubusia taeniata (Boissoneau, 1840)	X							X		
Iridosornis rufivertex (Lafresnaye, 1842)				X						
Pipraeidea melanonota Sclater,1857								X		
Conirostrum rufum Lafresnaye, 1843										X
Diglossa humeralis (Fraser, 1840)		X								X
Diglossa albilatera Lafresnaye, 1843				X						
Diglossa caerulescens (Tood, 1917)										X
Diglossa cyanea (Lafresnaye, 1840)	X							X		X
Emberizidae										
Zonotrichia capensis Allen, 1891	X							X	X	X
Phrygilus unicolor (Bonaparte, 1853)									X	X
Catamenia analis Chapman, 1915	X							X	X	
Catamenia inornata Berlepsch, 1885									X	X
Arremon torquatus (Boissoneau, 1840)	X	X		X	X					
Atlapetes pallidinucha (Boissoneau, 1840)	X	X		X	X	X		X	X	X
Atlapetes schistaceus (Boissoneau, 1840)		X		X		X				
Parulidae										
Dendroica fusca (Müller, 1776)	X									
Myioborus ornatus (Boissoneau, 1840)		X								
Basileuterus nigrocristatus (Lafresnaye, 1840)	X	X		X	X	X		X		
Basileuterus coronatus Tood, 1929	X									
Icteridae										
Amblycercus holosericeus (Chapman, 1919)	X			X						
Sturnella magna Sclater, 1861									X	X
TOTAL	35	28	3	24	9	14	5	21	11	35

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