

The Raven

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Activities undertaken by the Society include the following:

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2. Other forays or field trips lasting a day or more and scheduled throughout the year so as to include all seasons and to cover the major physiographic regions of the state.
3. A journal, *The Raven*, published twice yearly, containing articles relevant to Virginia ornithology as well as news of the activities of the Society and its chapters.
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6. Study projects (nesting studies, winter bird population surveys, etc.) aimed at making genuine contributions to ornithological knowledge.

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The Raven

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The Composition of Wintering Bird Communities in an Agricultural Landscape of the Northwestern Dominican Republic

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ABSTRACT

Hispaniola, the second largest and most topographically complex island in the Antilles of the Caribbean, is home to a wide variety of habitats for resident birds as well as overwintering migrants from North America. Over three consecutive years, we conducted winter surveys in a remote agricultural region of the northwest Dominican Republic in Dajabon province. We monitored four survey plots, each representing a different habitat common to the study area, including a riparian broadleaf forest, a managed pine stand, a shade coffee plantation, and an abandoned field. We recorded 1,616 detections of 48 avian species, including 38 year-round residents and 10 wintering New World Warbler species (Parulidae). Migrants accounted for 23.6% of total detections. The species composition of the avian assemblages varied significantly across survey plots but not among years. The field plot consistently had lower abundance of birds, but not necessarily lower diversity than the three forested habitats. Shade coffee and field – generally more modified habitats – hosted relatively fewer migratory species than pine stand and riparian forest habitats. These surveys present important baseline data on the distribution and relative abundance of resident and wintering migrant birds in a poorly documented area of the island of Hispaniola.

Keywords: Neotropical migrants, Caribbean, Hispaniola, winter residents

INTRODUCTION

The tropical and subtropical forests of the Caribbean islands provide important wintering grounds for numerous Neotropical migrant land birds native to Virginia and the eastern United States. An estimated 23 species consistently overwinter in the Greater Antilles and the Bahamas, including Yellow-bellied Sapsucker, Indigo Bunting, White-eyed Vireo, Bicknell's Thrush, Gray Catbird, and numerous New World warblers (Wunderle and Waide 1994, McFarland et al 2013). Many of these species can spend 6 months or more of the calendar year on their wintering grounds with the non-breeding period presenting a major life history stage in determining survival and fitness (Norris 2005, Norris and Marra 2007).

The islands of the Caribbean, while relatively small in land mass, offer a surprising diversity of topography and ecosystems. Perhaps nowhere is this better seen than on the island of Hispaniola. Hispaniola, which is divided politically into Haiti and the Dominican Republic, is the second largest island in the Caribbean and is home to the greatest diversity of vegetation communities in the region with nine life zones ranging from coastal mangroves and desert scrub to subalpine pine forests at elevations up to 3098 meters (Holdridge 1972, Wunderle and Waide 1994). The island is known to provide wintering grounds for migratory populations of 12 species of New World warblers (Latta et al 2010). Lowland and midland tropical wet

forests historically accounted for at least 60% of the island's land area but has been reduced to less than one third of its original cover by advancing settlements and agricultural practices (Dinerstein et al 1995). Most remaining wet forest habitat is distributed in the Dominican Republic, consisting of secondary forest that is heavily fragmented by pastures and cultivation or otherwise degraded (e.g., selective logging, grazed understory). While avian communities have been reasonably well catalogued in the nation's relatively few protected areas (Latta et al 2003, Rimmer et al 2003, Latta 2005), surveys in rural agricultural regions remain relatively rare.

In this paper, we present the findings of surveys conducted over three consecutive winter periods (2016-2018) in an agricultural landscape of the northwestern Dominican Republic in Dajabon province. Surveys were carried out on four plots representing the predominant habitats in the study area by a team of experienced birders with aim of (1) documenting diversity and relative abundance of resident and wintering migrant species in the landscape, (2) determining the extent to which wintering bird assemblages differ among habitats and between years, and (3) relating patterns of species distribution and abundance to their ecology and life history.

METHODS

STUDY AREA: This study was conducted over 3 consecutive winter seasons (December-January) in a small farming village known as *Los Cerezos*, approximately 10 km south of Loma de Cabrera in Dajabón province of the Dominican Republic. The site is located at approximately 700 m above sea level in the foothills of the northwestern end of the Cordillera Central. The native biome of the region is primarily broadleaf subtropical humid forest. Stands of the endemic creole pine (*Pinus occidentalis*), while more typical of higher elevation, also occur through a combination of intentional planting and natural propagation. As a result of historic forest loss during the colonial era and sustained agricultural practices in the time since, native habitats have largely been displaced and fragmented by settlements, grazing pastures, and a variety of cultivation practices (Hooghiemstra et al 2018).

With site access facilitated by local partners and permission from private land owners, we selected four plots of land to monitor over the three-year period. Sites ranged from 0.35-0.45 ha in area and were irregularly shaped according to the natural boundaries of the defined habitat and man-made fences. The riparian forest plot consisted of a relatively undisturbed patch of trees arranged as a vegetation buffer approximately 20 meters on either side of an ephemeral stream with an overstory of *Cecropia schreberiana*, *Ocotea* spp., *Zanthoxylum elephantiasis*, *Schefflera morotoni*, *Cupania americana* and *Mangifera* sp. as well as an understory of small trees (e.g., *Trichilia pallida*, *Allophylus crassinervus*) and shrubs (e.g., *Miconia* spp., *Piper* spp.). The pine stand plot was dominated by large > 40 year-old pines (*Pinus*

occidentalis) mixed with large *Schefflera morotononi* trees and an understory of mostly invasive grasses and shrubs (e.g., *Psidium guava*). The shade coffee plot had an overstory of large trees of various species such as *Schefflera morotoni*, *Guarea guidonia*, *Cupania americana*, *Cordia* sp., and *Ocotea leucoxylon*, and the understory was largely absent with mostly bare soil and light debris and leaf litter scattered between young coffee shrubs planted the year before the surveys initiated. The field plot consisted primarily of invasive grasses, abandoned bean plants, with the only woody vegetation being an isolated mango tree (*Mangifera* sp.) and live fence trees (*Gliricidia sepium*) bordering the plot.

SURVEY METHODS: Plots were surveyed during three consecutive winter periods (i.e., Dec-Jan) beginning in the winter of 2016/2017, with the exception of the pine stand site, which was added to the study in the second year. All surveys consisted of visits by different observers on three consecutive days in teams of 2-3 during each winter period. Year 1 surveys were conducted 12-14 Dec 2016. Year 2 surveys were conducted on 6-8 Jan 2018. Year 3 surveys were conducted 9-11 Dec 2018. Hereafter, these will be referred to as 2016, 2017, and 2018 for simplicity. Each plot visit consisted of approximately 2 hours of search effort between the hours 0830-1130. During each survey, we walked within the boundaries of each plot in non-standardized area searches using auditory and visual cues to identify and estimate the number birds. We relied on observer judgement to discard likely double-detections from surveys to estimate the minimum number of birds of each species simultaneously occupying the plot, based on the relative positions of individuals of the same species and whether they were detected simultaneously or likely to be the same individual.

STATISTICAL ANALYSES: All analyses were conducted in R 3.5.2 (R Development Core Team 2018) using the 'vegan' package and Microsoft Excel 2016. We first produced basic summaries of the survey data for general comparison among the survey areas. These data summaries included the total number of bird detections, the number of migratory and resident species, the total number of species (i.e., species richness), and Shannon diversity measures. Next, we further scrutinized the survey data from each winter period as: (1) The total number of detections of each species by survey day on each of the three visits during the three winter periods, and (2) estimates of the number of birds of each species occupying survey plots during each winter season based on the median value of abundance during each winter period. Thus, in the latter case, species that were only detected by one survey team were counted as present but were omitted from our analyses of cross-site and cross-year comparisons. We consider distinguishing between daily detections and "occupants" as a necessary step for avoiding pseudoreplication and minimizing the effects of transient visitors to the sites in favor of distinguishing those species that consistently depend on the habitat within the plots (i.e., territories, consistent foraging grounds).

To qualitatively analyze the similarity in species composition between the sites in each winter season, we used nonmetric multidimensional scaling (NMDS) to graphically represent communities in ordination space based on the Bray-Curtis Index (Clarke 1993). The performance of the ordination is evaluated by a measure of stress, which varies from 0 to 1, and where values between 0 and 0.20 are considered representative of the similarity between pairs of samples. We used permutational multivariate analysis of variance (PERMANOVA) to statistically test whether plot or year had a significant effect on the species composition of the survey plots.

Finally, we examined the patterns of species distribution among our study plots comparing resident and migratory species as well as on the basis of dietary guild. For the latter, we classified status based on the Elton Traits 1.0 database for foraging attributes of birds of the world (Wilman et al 2014). Given that nearly all birds consume substantial proportions of arthropod prey, we chose to consider any species with $\geq 80\%$ of arthropods in the diet as “insectivorous”. Species were assigned as nectivores, frugivores, or granivores if the proportion of nectar, fruit, or seed respectively was $\geq 30\%$. As the only species found within plots that consistently consumes vertebrate prey, the American Kestrel was assigned as a carnivore.

RESULTS

Summary of Survey Results

Over the course of the three winter surveys we recorded 1,616 detections of 48 avian species, including 38 year-round residents and 10 wintering migrants. Of the resident species, 12 were endemic to Hispaniola and 2 were introduced or naturalized species. All 10 of the wintering migrants were New World Warblers (Parulidae). Migrants accounted for 23.6% of detections compared to 76.4% for residents. From the total survey list, 36 species were determined to be persistent occupants of one or more of the four survey plots (Table 1, see pages 24-25 for complete table).

Habitat Patterns and Interannual Change in Bird Compositions

The number of birds occupying each survey plot ranged 20–62 and species richness ranged 14–22. While no plot consistently had greater numbers or diversity of birds, the field plot was consistently the most depauperate in terms of abundance (Table 2). Species composition varied

significantly among the four plots, but not by year (Table 3). Generally, field and riparian forest plots had distinct avian assemblages, while the pine stand and shade coffee farm were similar to one another (Figure 1).

Table 3: PERMANOVA testing effects of habitat plot, year, and their interaction on the variation of species composition. Habitat was found to be the only factor with significant differences among groups.

Factor	df	Sum of Squares	R ²	F	P
Habitat	3	0.73877	0.55190	3.2616	0.002
Year	2	0.08311	0.06209	1.1008	0.366
Habitat*Year	3	0.29021	0.21680	1.2812	0.270
Residual	3	0.22651	0.16921		
Total	11	1.33860	1.00000		

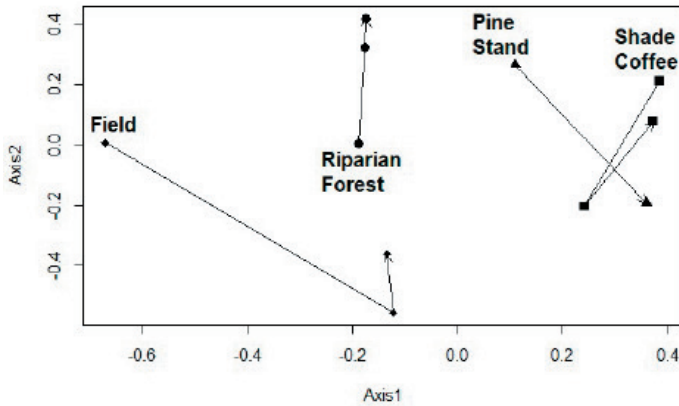
The most abundant resident species included Hispaniolan Woodpecker, Black-crowned Palm Tanager, and Narrow-billed Tody, which were seen in all four plots during all survey years (Table 1). Other habitat generalists included Palmchat, Hispaniolan Lizard Cuckoo, Broad-billed Tody, Antillean Euphonia, and Gray Kingbird. Several resident species were more restricted in their distribution among survey plots. For example, the only plot where Smooth-billed Ani recurrently occupied in each year’s survey was the field plot, while Red-legged Thrush and Hispaniolan Spindalis did not register a single detection in the field plot.

Of the wintering migrant warblers, the Black-throated Blue Warbler, American Redstart, Black-and-white Warbler, and Cape May Warbler were the most abundant (Table 1). These species were consistent occupants of all four survey plots with the exception of the Cape May Warbler which was only transient in the shade coffee plot. Other warblers showed apparent habitat preferences. For example, the Yellow-throated Warbler was almost exclusively found in the pine stand site and was a mainly transient visitor to pine trees on the fringes of the riparian forest plot. Similarly, the Common Yellowthroat was restricted to the field and pine stand sites, both of which had thick grassy or shrub cover at ground level. Other less common migratory species included Ovenbird, Palm Warbler, Prairie Warbler, and Northern Parula.

Table 2: Summary of abundance and diversity attributes of the four survey plots across three years.

Feature	Riparian Forest			Pine Stand			Shade Coffee			Field		
	'16	'17	'18	'16	'17	'18	'16	'17	'18	'16	'17	'18
# of Birds	44	54	35	NA	43	52	62	52	37	40	24	20
Resident Species	15	13	11	NA	11	16	11	15	12	12	11	10
Migratory Species	5	6	5	NA	7	6	3	3	3	7	4	5
Species Richness	20	19	16	NA	18	22	14	18	15	19	15	15
Shannon Diversity	2.88	2.71	2.53	NA	2.74	2.91	2.24	2.68	2.55	2.73	2.58	2.58

Figure 1: Nonmetric multidimensional scaling plot of the species composition of bird species at each site in successive years. Ordination Stress = 0.08198693. The pine stand and shade coffee plots had the most similar communities, while the communities in the riparian forest and field plots were consistently distinct from these and from one another.



Habitat Associations by Dietary Guild

The abundance of nectivorous birds (i.e., hummingbirds and bananaquits) was generally low across all study years with no consistent association with any particular survey plot. Granivorous birds (i.e., grassquits and doves) were also uncommon. While the Red-tailed Hawk was observed in the landscape (i.e., seen flying in the distance), American Kestrel was the only carnivorous species confirmed as an occupant in the pine stand plot.

Insectivorous birds and frugivorous birds consistently occupied all survey plots, with the former being the most abundant (Figure 2). However, frugivorous birds accounted for a substantial proportion of occupants in the shade coffee plot. This was particularly true in 2016, when approximately 50% of detections were of frugivorous species, most notably Red-legged Thrush and Hispaniolan Spindalis (Table 1).

DISCUSSION

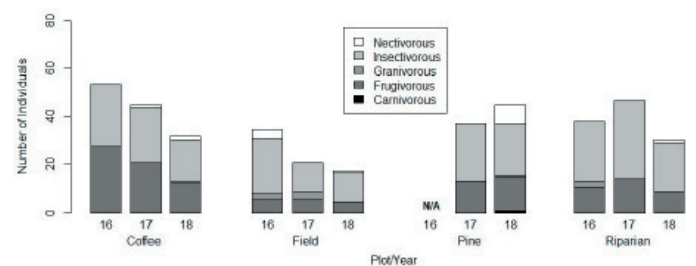
We found the avian assemblage in the study area was dominated by resident birds, with migrants representing 21% of all species and similarly 23.6% of all detections. The relative diversity and abundance of migratory species compared to resident species was considerably lower than other studies community-wide diversity in the Caribbean and Hispaniola. Regionally, migratory species have been estimated to account for 30-47% of species at a given site during the winter period (Arendt 1992, Wunderle and Waide 1993). Latta et al, (2003), for example, found that wintering warblers accounted for approximately 30% of both species richness and abundance across multiple habitats in an elevational gradient in the Sierra de Bahoruco region of the southeastern Dominican Republic. While the distance of islands from the North American continent may play a role in determining the number of overwintering migrant species in the Caribbean (Terborgh and Faaborg 1980, Wunderle and Waide 1993), previous

research has shown that overwintering communities can differ markedly among habitat types, evidencing the varying capacity of different habitats to support resident and migratory populations (Wunderle and Waide 1994).

As expected, the field plot consistently held the lowest abundance of birds when compared to the other three relatively forested habitats. However, this did not necessarily correspond to diversity measures. Most notably, the coffee farm had the lowest diversity and relative abundance of migratory warblers. This finding contrasts the prevailing view of shade coffee plantations as offering high quality habitat for migratory birds in disturbed landscapes (Perfecto et al 1996). Yet, the characteristics of the shade coffee plot surveyed offer some potential explanations. First of all, the coffee plants in the understory of the plot had not grown taller than 1 meter in height by the third year of the study and did not provide a meaningful perching or foraging substrate for most birds. Consequently, the coffee plot used for our study lacked the understory and midstory habitat structure that would be more typical of a mature shade coffee plantation. The diversity of foraging substrates is known to have a strong positive effect on the diversity of migrant warblers in other forested habitats of the Caribbean (Latta and Wunderle 1998). Two of the warbler species frequenting the shade coffee plot – American Redstart and Black-throated Blue Warbler – are known to aggressively defend canopy foraging space where insects are abundant in parts of their wintering territories to exclude both conspecifics and heterospecifics competitors (Marra 2000, Marra and Holmes 2001, Smith et al 2012). Such dynamics potentially explain the lower migrant diversity in the shade coffee survey plot.

While our study was mostly exploratory in nature and did not include rigorous replication of survey plots in the habitats of interest, several habitat use relationships emerged from the survey data. Most birds detected in our surveys showed generalist tendencies regarding habitat

Figure 2: The relative abundance of occupants of each plot across the three study years according to dietary guild. Insectivorous and frugivorous birds were pervasive in all habitats. Nectivorous birds were found to occupy all habitats, but their presence varied greatly and inconsistently among years. Granivorous birds were predominantly found in the field, and only one carnivorous species – the American Kestrel – was classified as an occupant in the pine stand in 2018.



use, although a substantial proportion of the total species could not be evaluated due to either low abundance or only transient use of the survey plots selected for this study. The only relatively clear case of specialization was seen with the Yellow-throated Warbler in its almost exclusive detection in pine trees. Indeed, this habitat preference has been well documented by prior studies (Lack and Lack 1972, Emlen 1977, Terborgh and Faaborg 1980, Wunderle and Waide 1993).

Overall, insectivorous species had the greatest relative abundance in all survey plots followed by frugivorous birds. A relative peak in the abundance of frugivorous birds in the shade coffee plot, particularly in 2016, was largely influenced by the availability of ripe fruits in this plot. In particular, there was high foraging activity of several species on ripe fruits of one large *Schefflera morototoni* tree, including Red-legged Thrush, Hispaniolan Spindalis, Black-crowned Palm Tanager, Palmchat, and Hispaniolan Woodpecker. Although we classified the Hispaniolan Woodpecker as insectivorous according to published information, field observations from other parts of the island have indicated that this species opportunistically feeds on a wide variety of fruits (Wunderle Jr and Latta, 1998, Schubert unpubl. data). Carlo et al, (2004) documented a similar tendency of frugivorous birds to feed on *S. morototoni* in shade coffee farms of Puerto Rico as well as several other plant species common to forests and shade canopies in our study area such as *Cecropia schreberiana*, *Guarea guidonia*, and *Miconia* spp. While some of the migratory birds encountered during our surveys, such as Black-throated Blue Warbler and Cape May Warbler are known to feed on fruits at their wintering sites (Latta et al 2003, Latta 2018), we did not observe any evidence of frugivory by warblers.

Overall, our surveys present important baseline data on the distribution and relative abundance of resident and wintering migrant birds in a poorly explored area of the island of Hispaniola.

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Table 1: The estimated number of individuals of each avian species occupying the surveyed sites. Species are classified based on their status: resident (R), endemic (E), migratory (M), and introduced/naturalized (I/N). Diet guild categories are classified as insectivore (I), frugivore (F), nectivore (N), granivore (G), and carnivore (C). Data expressed as numbers represent the median count for a species that was present in at least two of the repeated surveys each winter. "X" indicates a species was present in a single survey but not persistently detected. The pine stand plot was surveyed in only two of the three years.

Bird Species	Status	Diet	Riparian Forest			Pine Stand			Shade Coffee			Field			Total
			'16	'17	'18	'16	'17	'18	'16	'17	'18	'16	'17	'18	
Ardeidae															
Great Egret	R	I	0	0	0	NA	0	0	0	0	0	X	0	0	X
Cattle Egret	R	I	X	1	0	NA	X	X	0	0	X	0	1	0	2
Charadriidae															
Killdeer	R	I	X	0	0	NA	0	0	0	0	0	0	0	0	X
Columbidae															
Scaly-naped Pigeon	R	F	X	2	X	NA	1	X	2	2	3	0	1	X	11
Plain Pigeon	R	F	0	0	X	NA	0	0	0	0	0	0	0	0	X
Common Ground-Dove	R	G	1	0	0	NA	0	X	0	0	0	0	0	0	1
Mourning Dove	R	G	0	X	0	NA	0	0	0	0	0	1	X	0	1
Cuculidae															
Smooth-billed Ani	R	I	4	0	X	NA	X	0	X	5	0	3	2	4	18
Hispaniolan Lizard-Cuckoo	E	I	3	4	2	NA	1	1	1	2	1	2	1	1	19
Accipiteridae															
Red-tailed Hawk	R	C	0	0	0	NA	0	X	0	0	0	0	0	0	X
Falconidae															
American Kestrel	R	C	X	0	X	NA	X	1	X	0	0	0	0	0	1
Apodidae															
White-collared Swift	R	I	0	X	0	NA	0	0	0	0	0	0	0	0	X
Antillean Palm-Swift	R	I	0	X	0	NA	0	X	X	0	0	0	0	0	X
Trochilidae															
Antillean Mango	R	N	0	X	1	NA	X	3	0	0	0	0	X	X	4
Hispaniolan Emerald	E	N	0	X	X	NA	X	0	X	0	0	2	X	0	2
Vervain Hummingbird	R	N	0	X	0	NA	X	4	0	0	0	X	0	0	4
Todidae															
Narrow-billed Tody	E	I	2	5	5	NA	2	3	5	5	5	1	1	1	35
Broad-billed Tody	E	I	2	2	1	NA	X	1	2	X	0	1	1	1	11
Picidae															
Hispaniolan Woodpecker	E	I	5	4	3	NA	6	6	14	7	6	1	3	1	56
Antillean Piculet	E	I	0	X	X	NA	X	1	0	2	X	0	0	0	3
Tyrannidae															
Hispaniolan Pewee	E	I	1	1	1	NA	X	0	0	0	X	1	0	X	4
Stolid Flycatcher	R	I	X	X	X	NA	0	X	0	0	0	0	0	0	X
Loggerhead Kingbird	R	I	2	1	1	NA	1	2	1	X	1	X	X	0	9
Gray Kingbird	R	F	2	1	0	NA	1	2	1	2	2	0	0	1	12

