THE STATUS OF RESIDENT AND MIGRANT BIRD COMMUNITIES IN CUBAN ECOSYSTEMS

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Abstract.—We worked in 34 areas in 10 localities in Cuba from 1988 to 1999 to evaluate terrestrial bird communities. We used circular plots counts and capture by mist-nets in our efforts. In addition, we sampled vegetation plots to learn the structure and composition of plant communities within these localities. We estimated the composition and abundance of terrestrial bird communities during fall migration and resident periods. The parameters that most influence bird populations are canopy cover, ground cover, and foliage density between 0 and 1 m. Migratory birds demonstrated a high fidelity to wintering area, especially Black-throated Blue Warbler (*Dendroica caerulescens*). The results that we obtained in 12 localities of six regions of Cuba during fall migration suggest that many individuals and species of migrant birds use the regions of Guanahacabibes, Peninsula de Hicacos, Cayo Santa Maria, Cayo Coco, and Gibara.

Key words: *abundance*, *community*, *Cuba*, *fidelity*, *habitat*, *migrant and resident birds*, *mist-nets*, *vegetation*

Resumen.—ESTADO DE LAS COMUNIDADES DE AVES RESIDENTES Y MIGRATORIAS EN ECOSISTEMAS CUBANOS. Trabajamos en 34 áreas de 10 localidades de Cuba entre 1988 y 1999 para evaluar las comunidades de aves terrestres. Usamos el método de conteo de parcela circular y la captura con redes ornitológicas. Marcamos parcelas de vegetación donde medimos diferentes parámetros de su estructura. Estimamos la composición y abundancia de las comunidades de aves durante la residencia invernal y la migración otoñal. Los parámetros de la vegetación que más influyeron sobre las poblaciones de aves fueron la cobertura del dosel, cobertura del suelo y el follaje de 0 a 1 m. Las aves migratorias mostraron una alta fidelidad a las áreas de invernada y se destacó la Bijirita Azul de Garganta Negra o Reinita Azul Golinegra (*Dendroica caerulescens*). Los resultados obtenidos en 12 localidades de seis regiones de Cuba durante la migración otoñal indican que una gran cantidad de especies e individuos usan las regiones de Guanahacabibes, península de Hicacos, cayo Santa María, cayo Coco y Gibara.

Palabras clave: *abundancia, aves residentes y migratorias*, *comunidad*, *Cuba*, *fidelidad*, *hábitat*, *redes ornitológicas*, *vegetación*

Résumé.—STATUT DES COMMUNAUTÉS D'OISEAUX SEDENTAIRES ET MIGRATRICES DES ECOSYSTÈMES DE CUBA. Nous avons travaillé dans 34 zones de 10 localités cubaines entre 1988 et 1999 pour étudier les communautés d'oiseaux terrestres. Nous avons utilisé des comptages par point et la capture au filet pour nos études. Nous avons également échantillonné la végétation pour connaître la structure et la composition des associations végétales dans ces localisations. La composition et l'abondance des communautés d'oiseaux terrestres ont été évaluées pendant les migrations d'automnes et pour les espèces résidentes. Les facteurs qui influencent le plus les populations d'oiseaux sont la couverture de la canopée, la couverture du sol et la densité du feuillage entre 0 et 1 mètre. Les espèces migratrices présentent une forte fidélité aux lieux d'hivernage, particulièrement la Paruline bleue (*Dendroica caerulescens*). Les résultats obtenus dans 12 localisations de 6 régions de Cuba en migration d'automne suggèrent que beaucoup d'espèces et d'individus d'oiseaux migrateurs utilisent les régions de Guanahacabibes, Peninsula de Hicacos, Cayo Santa Maria, Cayo Coco et de Gibara.

Mots-clés: *abondance, communauté, Cuba, fidélité, habitat, oiseaux migrateurs et résidents, capture au filet, végétation*

INTRODUCTION

SOME INVESTIGATIONS conducted in the United States (Robbins *et al.* 1989), Puerto Rico (Faaborg and Arendt 1989, 1992), Jamaica (Diamond and Smith 1973), and Virgins Islands (Askins *et al.* 1990) show that migrant birds populations have declined in the last decades, along with original habitats, although it is important to emphasize that many migrant birds use the secondary vegetation and agriculture ecosystems (Waide and Wunderle 1989, Blake and Loiselle 1992, Petit *et al.* 1993).

With Cuba's location, extension in the Caribbean Sea, considerable number of migratory birds using its ecosystems during migration, and the declines

their populations have suffered in recent years because of diverse problems, it is necessary to carry out investigations to determine the status of these populations and the factors which affect them, and to implement management plans for rationally conserving and improving the habitats that migrants use. For these reasons, we have systematically developed ecological studies within communities of resident and migratory birds in several localities of Cuba (Llanes *et al.* 1987; García y Rodríguez 1988; González *et al.* 1990, 1992a,b,c, 1997, 2000; Sánchez *et al.* 1992a,b, 1994, 1998; Rodríguez *et al.* 1994; Rodríguez y Sánchez 1995; Wallace *et al.* 1996).

Toward this goal, we have set the following objectives:

- To determine the influence of the different kinds of forests and regions on distribution, composition, abundance, and status of migratory and resident birds communities during migration and residence periods.
- To determine possible migration routes.
- To make recommendations to area managers to protect the birds and their habitat.

MATERIALS AND METHODS

Sampling areas and periods

For terrestrial birds, 13 potential regions of great importance were chosen to study the resident and migratory birds, taking into account the representatives kinds of vegetation and protected areas.

Studies were conducted in semideciduous forest, mangrove, swamp, rain forest, pine grove, coastal xeromorphic forests, as well as dry xeromorph serpentine shrub-woods of lowlands.

The studies were carried out in 34 sampling areas of 10 localities of Cuba (Table 1), 31 of them in winter residence and 14 in fall migration periods.

General methodology

For sampling terrestrial birds, we surveyed using circular plots and capture with mist-nets (Hutto *et al*. 1986, Ralph *et al*. 1993). The use of both methods complemented the advantages and disadvantages of each.

Fifteen points with two mist-nets, each separated by 100 m from the other, and eight circular plots were alternatively selected, so that they were 200 m from each other. Each point was uniquely numbered and each bird was marked with Fish and Wildlife Service bands.

Eight vegetation plots were sampled per habitat, using the methods of James and Shugart (1970) and Noon (1981). Habitat plots were in the same kind of vegetation where the counts and captures of birds were made.

We applied the Correspondence Canonical Analysis to the richness and abundance parameters of the bird communities and vegetation structural variables.

RESULTS AND DISCUSSION

Winter residence

The winter residence period lasts from 16 November to 15 March of the following year and is when migratory birds remain in Cuba and mix with resident species to use their ecosystems during the winter period of temperate zones.

During banding of birds, 104 species were captured — 36 were winter residents (WR), 45 permanent residents (PR), and 23 transients (T).

Within Guanahacabibes, the area El Veral is exceptional in its species richness and high capture rates (Table 2). In this locality 38 new bird species were recorded.

In Mil Cumbres, we obtained the highest values of species, capture rates, and relative abundance in El Cayo pine grove (Table 2). In this locality, as well as La Guira, all the species of birds are new because the region had not been studied previously. Within La Guira, El Salvador semidiciduous forest was remarkable in richness of species, although higher values of abundance were recorded in Cabañas pine grove.

In such important regions as Ciénaga de Zapata, the most important areas relative to richness of resident and migratory bird species were Los Sábalos and Caleta del Toro (Table 1), although in general all the areas had a great diversity and abundance of birds (Table 2).

We observed the highest richness and capture rates at Cayo Coco, in Petrolera mixed mangrove forest, Vereda Márquez low semideciduous forest, and Playa Dorada coastal xeromorphic forest. This locality was the only one where we were able to conduct a study throughout a yearly cycle to determine the composition and abundance in all the months of the year. In this way we confirmed that the greater number of species were observed in February and October, whereas the highest values of abundance were registered in September, October, and November. This is influenced by fall migration, because a great number of migratory birds arrive in

Table 1. Richness of total species (Rtot), winter residents (SWR), permanent residents (SPR), and transients (ST) in 34 areas of 10 localities of Cuba during the periods of winter residence and fall migration, 1989–1999.

Locality	Area[1]	Rtot	SWR	SPR	ST
Guanahacabibes	Cabo Corrientes	33	12	21	0
	El Veral	41	19	20	2
	Las Tumbas	44	21	15	8
	El Faro	49	23	10	16
Total		73	28	25	20
Güira	Salvador	17	6	11	0
	S. Venado	19	8	11	0
	Las Cabañas	24	9	15	0
Total		33	14	19	0
Mil Cumbres	Cayo	30	12	18	0
	San Marcos	15	4	11	0
	Sierra	22	7	15	0
Total		33	13	20	0
Punta Hicacos	Punta Francés	32	18	10	4
Ciénaga de Zapata	Sábalos	46	21	25	0
	Camilo	26	9	17	0
	Cenote	34	13	21	0
	El Brinco	25	12	13	0
	Lindero	17	5	12	0
	Caleta Buena	22	7	15	0
	Caleta del Toro	24	9	15	0
	Santo Tomas	23	13	10	0
Total		52	23	29	0
Cayo Sta. María	Caletas	37	18	16	3
	Estrella	23	13	10	0
Total		38	19	16	3
Cayo Coco	Sitio Viejo (BSDa)	32	13	19	0
	Camino Potrero (BSDm)	40	21	19	0
	Vereda Marquez (BSDb)	26	11	15	0
	Las Coloradas (MXSc)	33	16	17	0
	Playa Dorada (MXC)	47	20	23	4
	La Petrolera (M)	48	20	27	1
Total		64	27	32	5
Gibara	Caletones	42	18	20	4
Mayarí	Caridad	28	12	15	1
	Mensura	19	8	11	0
	Guayabal	17	5	12	0
Total		35	13	21	1
Piedra la Vela	Pinar	16	7	9	0
	Pluvisilva	22	7	15	0
	Siempreverde	16	7	9	0
Total		26	11	15	0

[1]BSDa = high semideciduous forest, BSDm = moderate elevation semideciduous forest, BSDb = low semideciduous forest, MXSc = subcoastal xeric scrub, MXC = coastal xeric scrub, M = mangrove forest.

Table 2. Relative Abundance (RA) (birds/count), Capture Rate (CR) (birds/100 net-hours), and Number of species by area and year for winter residents (WR) and permanent residents (PR) in the winter residence period in Cuba.

		RA			CR			No. species	
Areas[1]	Year	WR	PR	Net-hours	PR	WR	total	WR	PR
El Veral	1990	2.50	11.87	270.0	22.44	14.74	37.18	18	31
El Veral	1991	4.27	13.46	220.0	36.82	20.45	57.22	19	31
El Veral	1994	1.06	6.69	570.0	4.39	5.26	9.65	13	21
Cabo Corrientes	1991	1.37	18.63	108.0	32.41	12.96	45.37	11	26
Cabo Corrientes	1994	0.75	9.37	420.0	19.28	4.05	23.33	6	24
San Marcos	1993	0.75	7.07	643.5	5.13	1.40	6.53	11	29
S. Cajálbana	1993	1.06	10.51	657.0	20.70	6.09	26.79	10	27
El Cayo	1993	1.32	14.58	642.0	32.40	9.19	41.59	14	36
Cabañas	1994	0.80	16.82	722.5	15.64	3.18	18.82	13	30
El Salvador	1994	1.13	10.03	720.0	7.22	2.78	10.00	16	31
S. del Venado	1994	1.43	10.03	737.5	7.32	2.03	9.35	13	27
Sábalos	1988	2.23	10.50	1662.0	8.36	14.56	22.92	19	38
Sábalos	1989	2.98	13.53	1896.0	6.80	11.49	18.29	20	30
Sábalos	1995	4.00	5.94	450.0	10.89	18.20	29.09	14	30
Cenote	1991	1.00	18.87	720.0	8.75	8.75	17.50	11	28
Cenote	1992	0.87	6.07	629.5	7.31	3.81	11.12	14	22
Cenote	1995	2.43	5.32	450.0	12.44	12.44	24.88	11	23
Camilo	1991	1.44	11.62	360.0	11.11	3.05	14.17	9	26
Camilo	1992	0.50	3.81	697.5	12.62	3.87	16.49	10	22
Caleta Buena	1992	6.73	11.14	652.5	9.65	9.81	19.46	12	20
Caleta Buena	1995	2.55	6.76	450.0	8.44	8.00	16.44	10	22
Lindero	1992	0.62	3.50	615.0	10.89	2.44	13.33	11	24
Brinco	1992	2.25	7.00	690.0	11.01	6.81	17.82	17	24
Caleta Toro	1992	3.25	8.00	667.5	10.64	3.89	14.53	15	33
Estrella	1995	0.86	5.35	420.0	14.28	8.82	23.10	12	17
Caletas	1995	0.87	2.75	420.0	9.05	12.86	21.91	14	16
Sitio Viejo	1994	1.95	7.55	720.0	15.83	15.56	31.39	13	17
Potrero	1993	3.26	7.74	672.0	5.96	6.40	12.36	12	12
Playa Dorada	1993	1.40	5.20	735.0	29.26	9.80	39.06	14	19
Vereda Márquez	1993	2.60	8.50	735.0	31.16	16.46	47.62	14	18
Playa Coloradas	1994	2.36	7.84	720.0	17.08	7.36	24.44	16	17
La Petrolera	1994	3.62	4.74	714.0	30.42	22.07	52.49	19	25
Caletones	1998	1.06	8.44	540.0	15.00	5.37	20.37	8	23
Caletones	1999	0.87	3.38	648.0	7.25	5.09	12.35	8	17
La Caridad	1997	0.69	6.37	720.0	14.72	1.94	16.67	5	16
La Caridad	1998	1.13	10.56	540.0	22.22	1.11	23.33	8	19
Mensura II	1997	2.06	6.31	720.0	2.08	1.53	3.61	7	12
Mensura II	1998	3.62	7.88	720.0	2.78	2.22	5.00	10	15
Guayabal	1997	2.56	10.31	720.0	6.25	1.94	8.19	6	20
Guayabal	1998	3.12	12.37	720.0	3.06	3.06	6.11	6	21
P.A.H. Pinar	1997	0.63	2.19	450.0	2.89	4.44	9.56	4	14
P.A.H. Pinar	1998	1.94	1.44	676.0	5.03	1.92	6.95	9	13
P.A.H. Pinar	1999	2.88	3.06	339.0	7.37	6.19	13.57	5	14
P.A.H. Pluv.	1997	0.75	2.43	450.0	19.56	8.00	27.78	6	18
P.A.H. Pluv.	1998	1.13	3.63	694.0	3.75	10.09	15.42	8	18
P.A.H. Pluv.	1999	1.19	5.44	489.0	3.68	10.02	13.70	6	18
P.A.H. BSV	1997	1.38	3.56	450.0	5.11	8.00	13.11	6	17
P.A.H. BSV	1998	1.88	5.63	640.0	5.00	4.22	9.22	6	23
P.A.H. BSV	1999	3.44	7.81	459.0	6.10	3.70	9.80	10	23

[1]P.A.H. = Alejandro de Humbolt National Park, Pinar = Pine Forest, Pluv. = Rain Forest, BSV = Evergreen Forest.

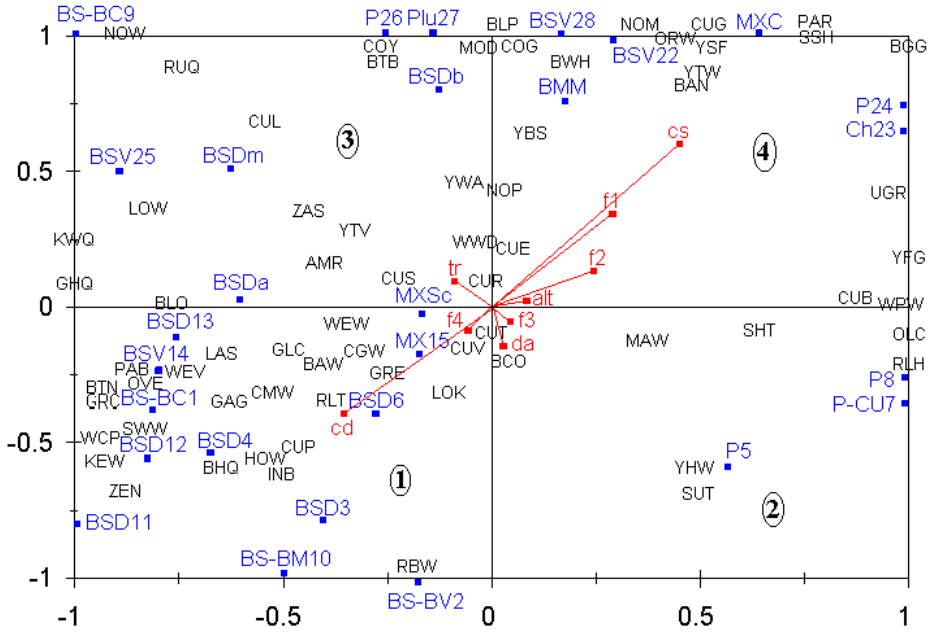

Fig. 1. Canonical Correspondence Analysis among bird species (69) and structure variables of vegetation in 28 habitats. cd = canopy cover, cs = ground cover, f1–f4 = foliage density (different heights), alt = vegetation height, da = density trees, tr = density branch, BS = Semideciduous Forest, BM = Mangrove Forest, P = Pine Forest, MXC = Xeromorphic Forest, BC = Swamp Forest.

Cuba in these months.

In the localities of Gibara and Nipe's high plateau, we verified that the higher richness and abundance of birds were found in the Caletones and Guayabal evergreen forests. Sixteen new species were detected in Gibara.

The highest diversity and abundance of resident and migratory birds were found in the evergreen forest of Alejandro de Humbolt National Park.

Relationship between bird-fauna and vegetation

By applying the Correspondence Canonical Analysis to the richness and abundance parameters of bird communities and vegetation structural variables in 28 habitats, an ordering diagram was attained (Fig. 1). The structural variables with greatest influence on the ordering of habitat and on bird populations were canopy cover, ground cover, and 0–1 m foliage density.

Most semideciduous forests group in the first quadrant, which is because of a higher resemblance among them in relationship to the vegetation structure, canopy cover being the most influencing element.

The Cayo Coco semideciduous forests are separated from other habitat of this vegetative formation in the third quadrant because the coastal influence determines structural characteristics differing from other Cuban forests.

The pine grove forests, the Caletones (BSV22) and Alejandro de Humbolt National Park (BSV28) evergreen forests, as well as Cayo Coco (MXC) coastal xeromorphic forests are found in the second and fourth quadrants. This ordering is set up in favor of a higher ground cover and foliage density in the lower layers of vegetation. These characteristics contribute to the occurrence of species in this habitat, which forage in the low strata and prefer more open habitat, with greater herbaceous cover.

The majority of resident species occur at the center of the graph, indicating no habitat preference, and demonstrating that they are more general than migratory birds with regard to use of sampled habitat.

In general, the majority of migrant birds prefer the semideciduous forest during winter season, with the exception of *Seiurus noveboracensis* and *S. motacilla*, which prefer wet forest. *Geothlypis trichas* and *Dendroica caerulescens* are common in Pine Forest (P26) and Pluvisilva Forest (Plu27); *D. palmarum* is present in Pine Forest (P8 and P-CU7)

Table 3. Distance from site of original capture where migrant birds were recovered in subsequent years in Cuba.

Species	Code	Distance from original site of capture (m)					Total no.
		0	100	200	300	> 300	
Dendroica carolinensis	GRCA		1				1
Dendroica caerulescens	BTBW	15	9	3		1	28
Dendroica magnolia	MAWA			1			1
Dendroica palmarum	WPWA	3	5	1	2	1	12
Mniotilta varia	BAWW	3	1		1	1	6
Setophaga ruticilla	AMRE	9	1			1	11
Limnothlypis swainsonii	SWWA		2			1	3
Seiurus aurocapillus	OVEN	5	6			1	12
Seiurus noveboracensis	NOWA	11	4			1	16
Geothlypis trichas	COYE	5	3	2			10
Hermitheros vermivorus	WEWA	2	1	1	1		5
Dendroica discolor	PRAW	2	2				4
Dendroica tigrina	CMWA			1	1		2
Totals		55	35	9	5	7	111

Table 4. Relative Abundance (RA) (birds/count), Capture Rate (CR) (Birds/100 net-hours), and Number of species by area and year for Migratory species (M) and Permanent Residents (PR) during fall migration in Cuba.

Areas	Year	RA		Net-hours	CR			No. species	
		WR	PR		PR	WR	total	WR	PR
El Veral	1996	1.37	5.25	450.0	5.55	8.00	13.55	11	20
C. Corrientes	1996	1.87	2.62	450.0	5.71	13.93	19.64	36	29
Las Tumbas	1997	1.12	4.06	840.0	5.71	13.92	19.63	36	29
Las Tumbas	1998	2.37	5.00	900.0	4.44	7.11	11.55	21	17
El Faro	1998	-	-	98.0	5.71	44.13	49.80	28	10
El Cayo	1994	2.38	10.15	420.0	27.86	9.52	37.48	13	28
S. Cajálbana	1994	1.30	7.63	420.0	16.90	1.67	18.57	6	25
Península de Hicacos	1989	7.81	3.51	401.6	16.68	45.12	61.80	20	14
Península de Hicacos	1990	8.69	4.01	420.5	12.39	50.48	62.87	23	15
Caletas	1994	5.17	3.58	660.0	13.68	83.33	97.00	22	18
Vereda Márquez	1992	5.80	14.50	144.0	25.69	42.33	68.02	13	11
Playa Dorada	1992	1.10	7.40	144.0	38.86	17.05	55.91	14	16
Petrolera	1992	4.80	17.20	128.0	53.12	60.93	114.06	13	14
Vereda Márquez	1993	1.99	4.17	144.0	36.80	61.80	98.60	9	6
Playa Dorada	1993	0	0.30	144.0	57.63	28.46	86.11	11	14
Petrolera	1993	0.33	2.51	144.0	48.61	68.05	116.67	12	9
Caletones	1989	-	-	692.0	12.86	33.96	46.82	15	12
Caletones	1990	-	-	480.0	13.96	16.67	30.63	16	15
Caletones	1997	1.38	4.13	720.0	22.38	17.78	40.16	16	22
La Caridad	1996	3.93	9.86	422.0	37.86	26.20	64.05	9	17
La Caridad	1997	2.56	10.81	510.0	33.33	16.86	50.20	9	17
Mensura II	1996	2.19	4.31	540.0	5.37	3.33	8.70	8	9
Mensura II	1997	2.31	6.56	450.0	6.22	3.78	10.00	8	13

and *D. striata* occur in the evergreen forest of Caletones (BSV22).

These results confirm that the influence of habitat on the bird communities' composition and abundance.

In relation to migrant birds banded in one year and recovered in another year, we found that 49.6% were recovered in the same net where they were banded and 31.5% were recovered within 100 m of where they were banded (Table 3). This demonstrates that migratory birds manifest a high fidelity to the wintering area, especially Black-throated Blue Warbler (*Dendroica caerulescens*), Ovenbird (*Seiurus aurocapillus*), Northern Waterthrush (*Seiurus noveboracensis*), American Redstart (*Setophaga ruticilla*), and Common Yellowthroat (*Geothlypis trichas*).

Fall migration

The fall migration of birds is one of nature's most impressive events and occurs in response to the needs of bird populations with yearly climate changes occurring in different regions of the world. The position of the Cuban archipelago in the West Indies makes it one of the most important regions within the Neartic-Neotropical migration system.

The results obtained in our 12 sampling areas of six Cuban localities demonstrated that a large number of migratory terrestrial Neartic-Neotropical species passes through Guanahacabibes, Península de Hicacos, Cayo Santa María, Cayo Coco, and Gibara or remain there (Table 4). Noteworthy among these sites was Guanahacabibes, mainly Las Tumbas and El Faro, where large numbers of transient birds were detected. In addition, the capture rates for migratory birds are high, indicating that their abundance during this period is very high. In this sense, Cayo Santa María, Peninsula de Hicacos, and Cayo Coco are notable.

We point out that most of these localities are being transformed through tourism development, so economic and conservation interests should be developed to attain a sustainable development compatible with management for avian habitat.

Our results are being considered by responsible institutions for the development of a plan for management and nature tourism.

CONCLUSIONS

1. The composition and abundance of terrestrial bird communities in each area depend on the type of vegetation, geographic locality, and season.
2. The variable structure of the vegetation that most affect composition and abundance of bird populations are canopy cover, ground cover, and the vertical density of foliage in lower stratus of the vegetation.
3. The Ciénaga de Zapata, Guanahacabibes, Cayo Coco, Pinares de Mayarí, and Alejandro de Humbolt National Park constitute Important Bird Areas because of the diversity and abundance of endangered and endemic species.
4. The most important regions for migratory birds during fall migration are Guanahacabibes, Península de Hicacos, Cayo Santa María, Cayo Coco, and Gibara.

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