

**Ornithological Field Investigations
in Macaya Biosphere Reserve, Haiti,
2-10 February 2006**

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Summary: We surveyed the montane forest bird community at three sites in the Macaya Biosphere Reserve, Haiti during 2-10 February 2006. We detected 41 species of birds among 188 mist net captures, 41 point count detections, and 461 total observations. These included 13 North American migrant species and 28 permanent resident species, of which 11 were Hispaniolan endemics. The three sites differed markedly in habitat type, but less so in diversity and abundance of birds. All field methods yielded more species and individuals in mesic karst broadleaf forest at 1175-1250 m elevation than in wet montane broadleaf forest at 1825-1915 m elevation or pine-dominated forest at 2100-2250 m elevation. We reconfirmed Black-capped Petrel on Pic Formon, via a single fly-over individual and a distant vocalizing bird, but we were unable to conduct surveys on Pic Macaya, due to inclement weather. We found Bicknell's Thrush at the two broadleaf forest sites, but detected only 7 individuals and captured only 2. The single bird detected and mist-netted at the karst broadleaf site was a recaptured individual from 2004. Overall, we recaptured 9 individuals that were banded at this site in 2004 (5% of the total original bandings). Six of these were permanent residents, while 3 were overwintering migrants. A significant finding was our observation of 6 Hispaniolan Parrots flying over secondary, fragmented forest at 965 m elevation in the Morne Cavalier area, outside our primary study sites. On Pic Macaya, our observations indicated that, despite a damaging fire during the summer of 2005, the ridgeline forest is minimally disturbed by humans. Broadleaf forests on Pic Formon are moderately disturbed, while karst forest in the Morne Cavalier area continues to be seriously threatened by habitat loss and fragmentation. However, we observed little or no further forest loss since 2004 within a 0.5 km radius of our study site; some formerly cultivated areas were fallow and regenerating, while cows appeared to be absent. Despite this encouraging development, we recommend that more stringent conservation measures be combined with local educational efforts to ensure that no additional habitat loss occurs.

Introduction and Background

Haiti's Massif de la Hotte has long been recognized as one of Hispaniola's most biologically rich, yet endangered, areas (Stattersfield et al. 1998, Paryski et al. 1989, Sergile and Woods 2001, Keith et al. 2003). Its high level of amphibian endemism has recently earned Massif de la Hotte the highest ranking in a worldwide assessment of areas most at risk from extinctions (AZE 2005). At the Massif's core lies the Macaya Biosphere Reserve, a 5,500 hectare protected area established by governmental decree in 1983. While Macaya supports the largest block of intact forest remaining in Haiti, it faces intense and unrelenting pressures from a variety of human sources (Sergile and Woods 2001). The diverse forested habitats of Macaya range from wet limestone forest at lower elevations to a complex mosaic of pine and cloud forest at upper elevations. These remnant forests are among the island's most endangered, as deforestation has steadily encroached on Macaya's last remote areas (Woods and Ottenwalder 1992, Rimmer et al. 2005). Chronic socioeconomic hardships and political instability have hindered efforts to implement an effective, sustainable conservation plan for Macaya Biosphere Reserve (Sergile and Woods 2001).

An explicit stewardship plan for the Pic Macaya region outlined by Woods and Ottenwalder (1992) and Woods et al. (1992) has been largely ignored, as few resources have been available for its execution (Sergile and Woods 2001) or to conduct follow-up monitoring of ecological conditions (F. Sergile and C. Woods, pers. comm.). However, Macaya's immense biodiversity value and international realization that time is short to ensure its long-term protection, have spurred development of a concrete action plan. At the heart of this plan is a building a coalition of conservationists within and outside of Haiti to create a locally-based, self-sustaining program for biodiversity conservation. The Société Audubon Haïti (SAH) has taken the lead in this effort. They are building partnerships and momentum, both within the Haitian conservation community and with established conservation groups such as Birdlife International, Conservation International, The Nature Conservancy, The Northwoods Institute, the Sociedad Ornitológica de Hispaniola (SOH), The Nature Conservancy, U.S. Fish and Wildlife Service, and the Vermont Institute of Natural Science (VINS). The Haitian Ministry of the Environment fully supports this initiative.

In February of 2004, we conducted a field expedition to the Macaya region (Rimmer et al. 2005). Our primary goal was to assess changes in habitats and bird populations since the pioneering work of Charles Woods and colleagues 15-30 years earlier. In 2006, we organized a second expedition, with the following objectives:

1. Follow-up documentation of the avifauna and specific habitat conditions within Macaya Biosphere Reserve, as a further means to assess changes since 1989 (the final year of Woods' formal biotic surveys) and 2004, the immediacy of conservation threats, and needs for a concrete action plan. Field plans included resurveying an established site in karst broadleaf forest and conducting bird population surveys on Pic Macaya
2. Targeted surveys for species of conservation concern, such as Black-capped Petrel (*Pterodroma hasitata*), Bicknell's Thrush (*Catharus bicknelli*), White-winged Warbler (*Xenoligea montana*), Gray-crowned Palm-Tanager

- (*Phaenocophilus poliocephalus*), and Western Chat Tanager (*Calyptophilus tertius*).
3. Field training of Haitian biologists, students and local park rangers, as a means to build technical capacity within the Haitian biological community and to generate local interest and conservation commitment.
 4. Coordinated distribution of donated field equipment to local guides and park rangers, in order to provide them with the resources necessary to work effectively in remote parts of the park.
 5. Re-evaluation of specific protection needs for Macaya Biosphere Reserve and continued development of strategies to achieve them.

Led by scientists and conservation planners in several disciplines (botany, malacology, entomology, herpetology, and ornithology) and from several countries (Haiti, Dominican Republic, Belgium, Slovakia, and the United States), a team of more than 20 participants arrived by vehicle at Kay Michel, Durand on 2 February 2006. Here we met with the Macaya Guide Association, and we were joined by several local guides and park rangers. Kay Michel served as the group's logistic base of operations until our departure for Les Cayes on 11 February. The core group consisted of the following 19 participants:

Philippe Bayard, Société Audubon Haïti, President of the Board of Directors
Jean Vilmond Hilaire, Société Audubon Haïti, Executive Director/Botanist
Jean Denis Chery, Société Audubon Haïti, Field Coordinator
Judex Edouarzin, Haitian Ministry of the Environment
Antoine Fresnor Jules, Macaya Biosphere Reserve, Park Guide
Reynold Jules, Macaya Biosphere Reserve, Park Guide
Louis Jacques, Macaya Biosphere Reserve, Park Guide
Samson Compere, American University of the Caribbean, Student Trainee
Enold Louis Jean, American University of the Caribbean, Student Trainee
Eladio Fernandez, Sociedad Ornitología de Hispaniola, President/Naturalist
Brigido Peguero, Jardín Botánico de Santo Domingo Mosocoso Puello, Botanist
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Chris Rimmer, Vermont Institute of Natural Science, Ornithologist
Juan Klavins, Vermont Institute of Natural Science, Ornithologist
James Goetz, Cornell Laboratory of Ornithology, Ornithologist
John Gerwin, North Carolina State Museum, Ornithologist

Study Areas and Field Methods

Field research and training were conducted at three sites in Macaya Biosphere Reserve. From 2-6 February we revisited a field site, named “Rak Bwa”, that we had surveyed in February of 2004 (Rimmer et al. 2004). This site is located in a wet karst limestone forest about 2.5 km north of Kay Michel, at elevations from 1175-1250 m.. Using an established foot and livestock trail through this forest, we positioned 18 mist nets (12-m x 2.6-m, 36-mm mesh) from dawn to dusk on 3-5 February and from dawn until 0845 EDST on 6 February. Apart from two new net locations, we used the same sites as in 2004. Nets were checked hourly and closed at night. We also conducted Bicknell’s Thrush surveys of forested areas within a 1-2 km radius from our main study site, by broadcasting vocal playbacks of recorded calls to elicit thrush responses. We targeted sites that we had surveyed in 2004. All captured birds were processed at a central location. Each individual was identified, banded, aged, and sexed. A series of morphometric measurements were taken to the nearest 0.1 mm, and weight was recorded to the nearest 0.1 g. We collected 50-150 μ l of blood from selected individuals by brachial venipuncture, and we stored samples in plastic vials with 1.0 ml Queen’s lysis buffer. We also collected blood samples for determination of mercury concentrations, and stored these in heparinized capillary tubes inside vacutainers. In addition to mist-netting, we recorded all incidental observations of birds encountered during the 4-day visit, and we conducted five unlimited-distance, 10-minute point counts between 0700-0745 EDST on 6 February, using the same points surveyed in 2004.

We conducted field work at a second site, “Pic Formon”, located 3.1 linear km north of Rak Bwa, from 7-10 February, at elevations from 2050-2175 m. This site was characterized by wet karst broadleaf-dominated forest, considerably more stunted than similar lower elevation forests, and characterized by scattered dense thickets of climbing bamboo (*Arthrostyidium haitiense*). We worked at this site only because our progress to Pic Macaya was slowed by the need to cut a trail. We operated up to 10 mist nets (12-m x 2.6-m, 36-mm mesh) at Pic Formon from dawn to early afternoon and from 1715-1815 EDST on 7-8 February, from dawn to 1330 EDST on 9 February, and from 0730-1300 EDST on 10 February. Netting and banding protocols followed those at the Rak Bwa site. As at Rak Bwa, we recorded all incidental observations of birds encountered during the 4-day visit, although we did not conduct point counts.

Between 1915-2115 EDST on 7 and 8 February, we conducted surveys for Black-capped Petrels on the north slope of Pic Formon and along the narrow ridge that extends to the peak’s north. Surveys consisted of 20-45 minutes of passive listening at 4-6 points each night.

Our third study site was on the broad pine-dominated ridge of Pic Macaya, where we made camp very near the summit on 9 February, at nearly 2335 m elevation. Habitat on the ridgeline was characterized by scattered stands of huge emergent pines (*Pinus occidentalis*), some of which we estimated to be 1.5 m diameter-at-breast-height (DBH) and 35-40 m tall. Most of the ridge is covered by pines of varying ages, ranging in DBH from 0.5-1.0 m. Pockets of dense broadleaf forest are interspersed along the upper slopes of the ridge, particularly on its east and northeast flanks. Many of these occupy narrow ravines, or karst sink-holes. A damaging fire within the past six months had devastated most of the upper western slope and the entire summit of Pic Macaya. Most pines <0.5 m

DBH had been killed, and some larger trees appeared dead or nearly so. The largest emergent pines received little damage, however. All broadleaf patches had been completely burned, and the fire had penetrated 50-100 m down the eastern slope, in some places jumping over small broadleaf patches. Walking was extremely difficult through burned areas, with many downed pines.

Heavy rains fell throughout the night of 9-10 February, making nocturnal petrel surveys impossible. The weather cleared just before dawn, and we left camp at 0645 EDST to conduct surveys of the Pic Macaya ridgeline and upper slopes, returning to camp at 1230. Surveys were not systematic, but consisted of observations and frequent playbacks of Bicknell's Thrush vocalizations to elicit responses. We departed Pic Macaya at 1400 on 10 February, returning to our Pic Formon base camp at 1730.

Results and Discussion

We recorded 41 species of birds among 188 mist net captures, 41 point count detections, and 461 total observations during our eight days of field work in Macaya Biosphere Reserve (Table 1). These included 13 North American migrant species and 28 permanent resident species, of which 11 were Hispaniolan endemics. The Rak Bwa site differed markedly in avian diversity and abundance from Pic Formon and Pic Macaya. Overall, we captured or observed 1.5 times the number of species at Rak Bwa (33) as at Pic Formon (22), and nearly twice the number as at Pic Macaya (15); 14 species were recorded at all 3 sites (Table 1). Mist net capture rates were nearly identical at Rak Bwa and Pic Formon (Table 1). Overall detections of individual birds at the 3 sites did not markedly differ.

The proportion of migrant to resident species captured in mist nets was higher at Rak Bwa (43%) than at Pic Formon (31%), while the percentage of migrant individuals captured was nearly identical (31% at Rak Bwa vs. 30% at Pic Formon; Table 1). One migrant and one resident species were detected only through mist netting at Rak Bwa, while all mist-netted resident species were also detected visually or aurally. Eleven species at Rak Bwa and 9 species at Pic Formon were detected only by point counts or general observations. Among total detections at the 3 sites, the proportion of endemic species was higher at Pic Macaya than at Rak Bwa or Pic Formon.

Five species accounted for 54% of all passive mist net captures at Rak Bwa, while the 5 most commonly mist-netted species at Pic Formon accounted for 65% of captures (Table 1). Rufous-throated Solitaire (*Myadestes genibarbis*) was the most frequently captured species at Rak Bwa, while Greater Antillean Bullfinch (*Loxigilla violacea*) ranked first in mist net captures at Pic Formon and second at Rak Bwa. Black-throated Blue Warbler (*Dendroica caerulescens*) was the only migrant that ranked among the 6 most abundant species in mist net captures at the two sites.

The overall return rate of birds banded in 2004 was 6.2%, as we mist-netted 9 individuals of 7 species (Table 1). Three of these were migrants (9.5% of birds banded in 2004), while 6 were residents (4.3% of 2004 bandings). Both proportions are lower than we expected. Woods (1975) recaptured 14% of the migrant warblers he banded in Miragoâne, Haiti during the following winter. Banding studies of resident species on Hispaniola have documented return rates of 30-63% between winters (Latta et al. 1999,

Rimmer and McFarland unpubl. data), while the percentage of overwintering migrants that return between years ranges from 26-55%, with most species returning at rates of 30-40% (Wunderle and Latta 2000, Latta unpubl. data, Rimmer and McFarland unpubl. data). On other Greater Antillean islands, return rates of 12% for residents and 13% for migrants have been documented in Cuba (González-Alonso et al. 1992). In Jamaica, 51% of migrant American Redstarts (*Setophaga ruticilla*) were recaptured in the first winter following banding, while the percentage of Black-throated Blue Warblers that returned was 46% (Holmes and Sherry 1992). The two-year interval between our banding work at Rak Bwa may have resulted in lower return rates than would have resulted with only a single year's gap. However, the comparatively low return rates at Rak Bwa are puzzling. Whether this reflects poor between-year or within-winter survival, high rates of dispersal among wintering sites, or artifacts of our sampling method will require additional field work.

Selected Species Accounts

Black-capped Petrel (*Pterodroma hasitata*) – this was a target species for surveys on Pics Formon and Macaya. Black-capped Petrels have declined throughout their breeding range in recent decades (Woods 1987, Simons et al. 2002) and are listed as Endangered by the IUCN (Birdlife International 2004). Follow-up surveys of the La Visite area in 1984 by Woods and Ottenwalder (1992) indicated a 40% decline in petrel numbers since Wingate's 1961 counts. Surveys of the Macaya area by Woods et al. in 1984 and 1985 documented the presence of petrel colonies, but no abundance estimates were obtained (Woods and Ottenwalder 1986). During our 7 February survey on Pic Formon, we heard a bird pass rapidly overhead at 1925 EDST, 15-20 m above our stationary vantage point. Its powerful wingbeats cutting loudly through the air indicated a large bird that could only have been a Black-capped Petrel. The direction of its flight was approximately northwest, in the direction of the Pic Formon cliffs, or just slightly west of the Pic Macaya cliffs. Shortly after 2100 EDST, both Gerwin and Rimmer heard distant calls in the direction of Pic Macaya that appeared to be those of a petrel. Gerwin was confident that the calls were made by petrels, and it is likely that they originated from the Pic Macaya colony. No other evidence of petrels was obtained that night or during the following night's survey from 1915-2115 EDST.

On 10 February, we reached the Pic Macaya summit ridgeline at 1350 EDST, after ascending the steep south ridge, which passed by the south-facing cliffs that were the location of the main petrel colony located by Woods et al. in 1984. Our plans to conduct a listening survey above the cliffs that night were thwarted by heavy rain that began at 1530 EDST and continued until about 0500 EDST on 11 February. Logistic constraints necessitated our departure at 1345 that day, thus we were unable to make a second attempt to survey the Pic Macaya colony. The south-facing cliffs, which are only sparsely vegetated, appeared to have escaped the damaging effects of the fire.

Hispaniolan Parrot (*Amazona ventralis*) – although outside our three primary study sites, we observed a flock of 6 parrots flying over a small forested ridge 1.6 km southeast from Kaye Michel, at 965 m elevation. This was our only observation of the species, which we did not detect in 2004. Hispaniolan Parrots appear to have declined dramatically in Macaya during the past 20-30 years. Woods and Ottenwalder (1992) reported flocks of up to 80 birds in the Massif de La Hotte during 1975 and described the

species as “common in ... small flocks” in karst forests on the Plain of Formon in the early and mid-1980s. They observed a flock of 24 birds in 1985. This species is typically noisy and conspicuous, and we believe it is unlikely that we failed to detect additional parrots that may have been present. An island-wide decline has been documented since the 1930s, with many local extirpations (Keith et al. 2003, Latta et al. 2004). Hispaniolan Parrots appear to be extirpated in Parc National La Visite (Davalos and Brooks 2001, Rimmer et al. 2005), and should be considered endangered throughout Haiti. Careful investigations of this species’ status should be conducted in Macaya Biosphere Reserve, and a program of nest box placement should be considered, as recommended by Woods and Ottenwalder (1992). Large standing dead trees should also be carefully protected to encourage natural nesting.

Antillean Piculet (*Nesocittes micromegas*) – we mist-netted a single individual of this species at the Rak Bwa site, our only capture in either 2004 or 2006. We heard 4 vocalizing birds at this site, 2 fewer than we detected in 2006. Piculets are restricted to mesic karst broadleaf forests at middle elevations in Massif de la Hotte. The species is relatively common in both mature and disturbed forests, but is absent from montane forests above 1700 m elevation (Woods and Ottenwalder 1992). Because mid-elevation karst forests are threatened by ongoing deforestation, Woods and Ottenwalder (1992) ranked Antillean Piculet as the fifth most threatened bird species in the Macaya Biosphere Reserve.

Golden Swallow (*Petrochelidon euchrysea*) – we recorded fewer individuals of this species than in 2004, particularly at the Rak Bwa site, where we observed only 2. We also observed at least 2 swallows overhead on several occasions at Pic Formon, and 4 birds foraging over the saddle between Pics Formon and Macaya. The status of this species continues to be poorly known in Haiti, but it is believed to have declined sharply (Keith et al. 2003) and is considered “Near Threatened” globally (Stattersfield et al. 1998). Rimmer et al. (2005) observed as many as 20 birds in high elevation openings in Parc National La Visite, while Woods and Ottenwalder (1986) reported Golden Swallows almost exclusively at higher elevations (c. 1900 m) in Macaya. As in 2004, our limited observations suggest that the species regularly inhabits lower elevation karst forest habitats. We continue to believe that a coordinated program of nest box placement in the Morne Cavalier area might enhance breeding opportunities for Golden Swallows and provide educational benefits for local residents and visitors.

Bicknell’s Thrush (*Catharus bicknelli*) – we detected a total of 7 Bicknell’s Thrushes in Macaya Biosphere Reserve and captured 2 of these (Table 1). At Rak Bwa, where we encountered 4 birds in 2004, we heard only one individual calling shortly after dawn on 6 February, our final morning at the site. Despite having frequently walked past, and broadcast tapes at, the location during 3-5 February, we heard no spontaneous or elicited vocalizations during those 3 days. At 0700, we passively mist-netted this individual, which we had captured and banded near the same net site in 2004. We found no thrushes at the other three sites occupied in 2004. At Pic Formon, thrush densities were higher than at Rak Bwa, but birds were patchily distributed and seldom remained in one location during our 4 days of field work. Although we detected 6 individuals on Pic Formon, these were spread over nearly 2 km of trail. We actively mist-netted one bird during the evening of 7 February, after hearing it call repeatedly, but this individual was not heard in the same vicinity at any other time. Three other individuals detected within our netting

area never responded to tapes and were only rarely heard vocalizing in the same vicinity more than once. Although our observations were obtained during a brief period of time in both 2004 and 2006, it appears that Bicknell's Thrushes in the Macaya region exhibit low within- and between-year site fidelity. The reasons for this are unclear, as birds in montane forests of Sierra de Bahoruco, Dominican Republic maintain discrete territories throughout the winter and have relatively high return rates (Rimmer et al. 2001, J. Townsend unpubl. data). Within-season movements of thrushes may reflect weak territoriality, which could be a consequence of low population densities, patchy habitat quality, dispersed food resources, or other factors.

In our single morning of surveying on Pic Macaya, we did not detect any Bicknell's Thrushes. Although several of the intact broadleaf patches appeared suitable for occupancy, many had been destroyed by the fire. Most of the undamaged or lightly burned patches were small (< 100 x 100 m) and seemed marginal for Bicknell's Thrush, as they lacked the dense understory preferred by this species. We suspect, however, that broadleaf forest on the upper slopes of Pic Macaya may support Bicknell's Thrush in most winters, and we believe that more concerted follow-up surveys are warranted.

Black-throated Blue Warbler (*Dendroica caerulescens*) – as in 2004, this species outnumbered any other migrant in mist net captures, point count detections, and overall detections at all 3 sites, with the exception of flocking Yellow-rumped Warblers observed on Pic Macaya. (Table 1). Females again predominated over males, as in other montane broadleaf forest habitats of Hispaniola (Keith et al. 2003, Latta et al. 2003), accounting for 87% of all mist net captures (7 of 9 birds at Rak Bwa, 7 of 7 birds at Pic Formon). Second-year birds outnumbered 2+ year-old individuals 11:5 (10 of 14 females, 1 of 2 males). At Rak Bwa we captured 2 females that had been banded in 2004.

Yellow-rumped Warbler (*Dendroica coronota*) – not having recorded this species in 2004, we were surprised to find it commonly in the vicinity of Kay Michel and on Pic Macaya. Although we did not observe Yellow-rumped Warblers at either the Rak Bwa or Pic Formon sites, we encountered a flock of > 20 birds in a cultivated area with scattered young pines between Kay Michel and Rak Bwa, and an additional 3 birds at Kay Michel. On Pic Macaya, the species ranked first in abundance, with at least 35 individuals observed (Table 1). Yellow-rumped Warblers numbers on Hispaniola and throughout the Caribbean are known to fluctuate considerably among years (Raffaele et al. 1998, Keith et al. 2003, Latta et al. 2006), as well as in other areas of the Neotropics (Ridgeley and Gwynne 1989, Paynter 1995). During late January of 2006, in pine-dominated forests at 1400 m elevation in Sierra de Bahoruco, we also observed numbers of this species that were much higher than in any year since monitoring began in 1995.

Swainson's Warbler (*Limnothlypis swainsonii*) – we mist-netted 3 Swainson's Warblers (2 at Rak Bwa, 1 at Pic Formon), providing further evidence that this species is a regular winter inhabitant of Macaya. Although Swainson's Warblers were not detected during intensive avian surveys of Macaya throughout the 1980s by Woods et al., it now appears to be a regular, if relatively uncommon, overwintering migrant in broadleaf montane forests from Sierra de Bahoruco of the Dominican Republic to Macaya in Haiti. Questions remain whether the species' recent discovery on Hispaniola represents a winter range expansion and/or increases in local abundance.

White-winged Warbler (*Xenoligea montana*) – as in 2004, we found White-winged Warblers only at the Rak Bwa site, where the species appeared to be less abundant than during our previous surveys. We banded only 3 individuals (10 in 2004) and detected 18 birds overall (25 in 2004). Birds were encountered in groups of 3-6 individuals in both single- and mixed-species flocks. Although Woods and Ottenwalder (1983) reported several sightings of the species in wet broadleaf forest between 1650-1900 m elevation on the ridge of Pic Formon, we did not encounter White-winged Warblers there or on Pic Macaya. Considered Haiti's most endangered bird species by Woods et al. (1992) and assigned a global status of "Vulnerable" by Birdlife International (Stattersfield et al. 1998), the current Haitian distribution of White-winged Warblers appears to be restricted to Massif de La Hotte. It is likely extirpated from Massif de la Selle (Woods et al. 1992). Our limited observations in 2004 and 2006 suggest that the species is restricted in Macaya to karst limestone broadleaf forest, which we continue to believe is the most threatened habitat type in the park. We reiterate that more focused research and monitoring are needed to clarify the Haitian population and conservation status of White-winged Warbler, arguably among Hispaniola's least-known endemic species. The recovery plan outlined by Woods et al. (1992) provides a practical and still-relevant model on which virtually no action has been taken.

Gray-crowned Palm-Tanager (*Phaenicophilus poliocephalus*) – this species occurred at all three study sites, although it appeared to be less abundant than in 2004. At Rak Bwa, we mist-netted only 4 individuals (10 in 2004), one of which was a return. At Formon, where the habitat resembled that at our 2004 Plaine Boeuf study site (Rimmer et al. 2005), we captured 4 Gray-crowned Palm-Tanagers (7 at Plaine Boeuf in 2004) and detected 8 individuals (14 at Plaine Boeuf). On Pic Macaya, we observed 4 individuals. This is the only Hispaniolan endemic bird species with its range effectively confined to Haiti (Keith et al. 2003, Latta et al. 2006); few reliable records have been obtained from Sierra de Bahoruco of the Dominican Republic, and no recent documentation has been obtained from Massif de la Selle. Massif de la Hotte is unquestionably the species' stronghold. Gray-crowned Palm-Tanagers are habitat generalists and appear to be locally common in all forested habitats of Macaya Biosphere Reserve, as noted by Woods et al. (1992) in the 1980s.

Western Chat-Tanager (*Calyptophilus tertius*) – we encountered this species at all three sites, but its relative abundance was higher in the dense broadleaf forest on the Pic Formon ridgeline and in broadleaf patches on Pic Macaya (Table 1). Woods and Ottenwalder (1983, 1992) also found Western Chat-Tanagers at all elevations sampled in the 1980s, but they considered it among the most endangered birds in Haiti. Birdlife International designates the *Calyptophilus* complex as globally "Vulnerable" (Stattersfield et al. 1998). Our observations indicate that the species is locally common, especially in higher elevation forests, and we believe its status in Macaya may be more secure than those of species that are more restricted to the broadleaf karst forests.

Hispaniolan Crossbill (*Loxia megalaga*) – we observed flocks of crossbills in pine-dominated forests on both Pic le Ciel and Pic Macaya. Two flocks estimated at 4-6 birds were heard flying overhead on Pic le Ciel, while several groups of 5-12 birds were observed on Pic Macaya, feeding in the canopies of pines. Because foraging flocks were often loosely dispersed and difficult to observe, our estimate of 30 birds is conservative. As many as 40-50 Hispaniolan Crossbills may have been present in the flocks we

encountered. This species was not documented in Massif de La Hotte until 1984 (Woods and Ottenwalder 1992), and its persistence 22 years later strongly suggests the existence of an established breeding population. Woods and Ottenwalder (1992) considered the species to be endangered in Haiti, although there are no reliable estimates of its abundance. We suspect it is reasonably secure on Pic Macaya, although its viability in forests that are accessible to selective logging of large emergent pines may be tenuous. A recovery plan for the Hispaniolan Crossbill was outlined by Woods et al. (1992), with primary goals of preventing further loss of mature pine forest habitat and determining the species' current population status. This plan is no less relevant 25 years later.

Comparison with Previous Studies

Several species recorded by Charles Woods and his associates during the late 1970s and 1980s in Macaya Biosphere Reserve were unrecorded during our surveys. We did not detect any of the following resident species, all of which were reported by Woods and Ottenwalder (1983) during January of 1983 in the Formon area between 1200-1950 m elevation: Vervain Hummingbird (*Mellisuga minima*), Broad-billed Tody (*Todus subulatus*), and Pine Warbler (*Dendroica pinus*). These species are common in other areas of Hispaniola, and their presumed absence during our surveys may have been due simply to our failing to detect them or because we did not visit areas in which they currently occur. We did, however, encounter Hispaniolan Parrots and Hispaniolan Pewees (*Contopus hispaniolensis*), neither of which were detected in 2004. We also confirmed the presence of 5 passerine species not detected in 2004 (Table 1).

The limited timeframe and geographic scope of our surveys preclude any rigorous comparison between our findings and those of earlier studies. Although we visited two sites (Pic Formon ridgeline and Pic Macaya) surveyed by Woods et al. in the 1970s and 1980s, our surveys were far less extensive than theirs. Our results can provide only general context for evaluating changes in patterns of avian distribution and abundance during the >15 years since Charles Woods' last published surveys. We are currently unable to detect evidence of any dramatic declines or increases in avian populations of Macaya, and it appears that the overall status of most common resident species has changed little, with the possible exception of Hispaniolan Parrot. We believe that our most noteworthy findings include confirmation that Black-capped Petrels still occur in the Pic Macaya area, the discovery of a small flock of Hispaniolan Parrots on the Plain of Formon, the continued relatively high abundance of White-winged Warblers in karst broadleaf forests at Rak Bwa, and the presence of an apparently healthy population of Hispaniolan Crossbills on Pic Macaya.

Habitat Assessment

With only limited firsthand experience in Macaya Biosphere Reserve, we have little historical context for evaluating habitat changes that have occurred in the past 10-15 years. Our observations since February of 2004 indicated that little further loss of karst limestone forest habitat had occurred in the Morne Cavalier area since our previous visit in February of 2004. However, this forest type continues to be very limited in extent, heavily fragmented, and seriously threatened by subsistence agriculture. We noted some early regeneration of karst forests near our Rak Bwa study site since 2004, and we suspect this may be due to an increased presence of park guards in the area. These

mature broadleaf forests support Macaya's highest avian and floristic diversity (Woods et al. 1992), yet they are largely unprotected. Their proximity and relative accessibility to the human population in Macaya Biosphere Reserve's vicinity, and the fact that many are outside the park's poorly-defined boundaries, have contributed to a crisis situation. From a vantage point on Pic Formon's southwest slopes on 8 February, we were able to view the entire forested escarpment that contains the Rak Bwa site. This ridge appeared to be 70-75% intact, and it almost certainly constitutes the largest patch of mid-elevation karst broadleaf forest in the Macaya region. We believe that its complete protection is necessary, to enable its regeneration to a solid, unfragmented tract of this forest type. Preventing further loss of karst forests will require more concerted and stringent measures than are currently being implemented.

The forests in the vicinity of Pic Formon and Pic Macaya appear to be much less seriously threatened than those in the Morne Cavalier area. Outside of our extended group, we observed no local inhabitants passing through either site, little evidence of human-caused habitat loss, and no agriculture. These forests are relatively inaccessible, and thus reasonably secure at present. Intense fires appear to be the primary threat to forests of *Pinus occidentalis* in the higher elevations of Macaya. Mature trees appear to be resistant to fire, which primarily damages or kills small and mid-sized pines. Mature individuals are the primary producers of cones and seeds in the species, and they may provide essential local habitat for Hispaniolan Crossbills. They likely also perform important ecological functions such as shading and moisture retention. The protection of mature pines throughout Macaya Biosphere Reserve should be a high priority.

Field Training

We trained our Haitian professional colleagues and student interns, as well as the Macaya Biosphere Reserve guides, in various aspects of our field work, particularly mist-netting and banding. Whenever possible, we relayed information on bird identification and biology, and several participants practiced techniques of bird handling and mist net extraction. We engaged in regular discussions of conservation issues related to Macaya Biosphere Reserve, and we solicited input from all participants. A total of 5 Haitians, including two biology students from American University at Les Cayes, received hands-on field training, while others observed without directly participating. We believe that our training exercises were an invaluable component of the trip.

Conservation and Management Recommendations

Our recommendations differ little from those we outlined in 2004. The comprehensive stewardship plan proposed by Woods et al. (1992) details concrete actions that are as urgent and relevant today as they were 14 years ago. We believe that this plan must be carefully revisited, and that strong local coordination must be marshaled to ensure its implementation. A committed network of Haitian conservationists, led by the Société Audubon Haïti and the Ministry of Environment, must work in tandem with international scientists and conservation planners to collectively achieve sustainable conservation of Macaya Biosphere Reserve. This will require significant human and financial resources.

We add or reiterate only the following to our 2004 recommendations:

- 1) Immediate measures must be taken to protect karst broadleaf forests in the Morne Cavalier area, and wherever else they occur. Further loss and fragmentation of these forests are not sustainable, and we believe they constitute the single most important and endangered habitat type within Macaya Biosphere Reserve. We recommend implementation of the following specific actions:
 - a) Accurate park boundary surveys must be conducted in the Morne Cavalier area, and boundaries must be clearly delineated on the ground. If significant areas of karst broadleaf forest are found to lie outside current park boundaries, these must be immediately expanded to include all or as many intact forest patches as practicable.
 - b) The entire forested ridgeline to the north of Caye Michel should be protected via active exclusion of any human uses that degrade or destroy habitat. This tract, which includes our Rak Bwa study site, is probably the largest intact patch of karst broadleaf forest in Massif de la Hotte. We estimate that 25-30% of this tract is currently impacted by agriculture and tree extraction; the entire area should be made completely off-limits to consumptive human activities and designated as a core ecological reserve. Measures to accomplish this could include physical exclusion of livestock and farmers by means of barriers, increased presence of park guards to police the area and educate local residents, and strategic placement of informational/warning signs. These and other immediate stop-gap measures are needed to prevent further habitat loss of this remnant forested tract.
 - c) The forest patch that we named Rak Bwa should be specifically designated as a special area for biological research and monitoring, as well as for environmental education and ecotourism. Its minimum size should be 25 hectares, and its boundaries must be surveyed and delineated. This tract has outstanding potential to serve as the centerpiece of a sustainable conservation plan for karst broadleaf forests in Macaya.
 - d) A management plan specific to karst broadleaf forests and surrounding agricultural areas must be developed and implemented. This should include delineation and mapping of all current habitat patches through GIS analyses, consolidation and connectivity of existing fragments through actual or potential habitat corridors, natural or human-aided regeneration of disturbed areas, and concerted education of local residents as to the importance of this habitat type.
 - e) A small educational and field research facility should be developed in Rak Bwa. This could serve as a resource for local residents, as a destination for ecotourism groups that visit Macaya, and as a base of operations for future field studies. It should be linked to educational displays and other information that need to be developed at Kay Michel. Such a facility might be constructed near our banding site in the clearing midway along the main foot trail on which we operated our mist nets in 2004 and 2006. This trail could become an established nature trail, with interpretive signs and designated observation sites.
- 2) A long-term avian monitoring and research program should be designed and implemented in Macaya Biosphere Reserve. The scope of such a program should

- also include other animal groups, as well as plants. We recommend that Rak Bwa be designated as one site within a network of monitoring sites. It offers numerous opportunities, due to its proximity to Caye Michel, its logistic accessibility, its diverse avifauna, and its status as a relatively intact patch of karst broadleaf forest. Additional sites should be established in high elevation broadleaf and pine forests. We recommend that one such site be located on Pic Macaya.
- 3) Kay Michel must be further developed as the Park's headquarters and educational center. Infrastructure and security of the building must be upgraded, a Park Supervisor should be stationed there, and educational displays should be constructed. A large wall map depicting Macaya's boundaries, topography, primary trails, and major habitats types should be prominently featured. Pocket versions of this map should be available to local residents and visitors.
 - 4) A program of training and certification of park guides and agents should be instituted. There are several outstanding candidates for these positions, and their regular involvement in park activities will help ensure their commitment to Macaya's conservation. As residents of local communities, they should also be advocates for conservation needs and actions within Macaya. These individuals must be properly equipped, educated and trained.

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Table 1. Birds mist-netted and observed in Macaya Biosphere Reserve, Haiti, 2-10 February 2006.

Species	Rak Bwa				Pic Formon		Pic Macaya
	# New Bandings	# Returns	# in Point Counts	Total # Detected ^a	# New Bandings	Total # Detected ^b	Total # Detected
Black-capped Petrel (<i>Pterodroma hasitata</i>)						2	
Sharp-shinned Hawk (<i>Accipiter striatus</i>)							
Red-tailed Hawk (<i>Buteo jamaicensis</i>)				3		3	
American Kestrel (<i>Falco sparverius</i>)							
Plain/Scaly-naped Pigeon (<i>Columba</i> sp.)				2			
Hispaniolan Lizard-Cuckoo (<i>Saurotheria longirostris</i>)			1	3			
White-collared Swift (<i>Streptoprocne zonaris</i>)						1	
Hispaniolan Emerald (<i>Chlorostilbon swainsonii</i>)	10 ^c		4	15	6 ^c	15	18
Hispaniolan Trogon (<i>Priotelus roseigaster</i>)			3	5			1
Narrow-billed Tody (<i>Todus angustrostris</i>)	9	1	3	12	3 ^c	6	5
Antillean Piculet (<i>Nesocittes micromegas</i>)	1			4			
Hispaniolan Woodpecker (<i>Melanerpes striatus</i>)	4		8	6	1	2	1
Greater Antillean Elaenia (<i>Elaenia fallax</i>)	2			7		2	2
Hispaniolan Pewee (<i>Contopus hispaniolensis</i>)	1					1	
Loggerhead Kingbird (<i>Tyrannus caudifasciatus</i>)				1			

Species	Rak Bwa				Pic Formon		Pic Macaya
	# New Bandings	# Returns	# in Point Counts	Total # Detected ^a	# New Bandings	Total # Detected ^b	Total # Detected
Golden Swallow (<i>Petrochelidon euchrysea</i>)				2		≥2	4
Rufous-throated Solitaire (<i>Myadestes genibarbis</i>)	22		9	16	3	8	16
Bicknell's Thrush (<i>Catharus bicknelli</i>)		1		1	1 ^d	6	
Red-legged Thrush (<i>Turdus plumbeus</i>)	9			6	1	5	1
Northern Parula (<i>Parula americana</i>)				3			
Magnolia Warbler (<i>Dendroica magnolia</i>)				2			
Cape May Warbler (<i>Dendroica tigrina</i>)				1			
Black-throated Blue Warbler (<i>Dendroica caerulescens</i>)	7	2	3	12	7	15	14
Yellow-rumped Warbler (<i>Dendroica coronata</i>)							35
Blk-throated Green Warbler (<i>Dendroica virens</i>)				2			
Black-and-white Warbler (<i>Mniotilta varia</i>)	5			2		1	2
American Redstart (<i>Setophaga ruticilla</i>)	3			4			
Worm-eating Warbler (<i>Helminthos vermivorus</i>)	4			1		2	
Swainson's Warbler (<i>Limnithlypis swainsonii</i>)	2				1		
Ovenbird (<i>Seiurus aurocapillus</i>)	5			3	1		
Common Yellowthroat (<i>Geothlypis trichas</i>)	1			1			

Species	Rak Bwa				Pic Formon		Pic Macaya
	# New Bandings	# Returns	# in Point Counts	Total # Detected ^a	# New Bandings	Total # Detected ^b	Total # Detected
White-winged Warbler (<i>Xenoligea montana</i>)	3		2	18			
Bananaquit (<i>Coereba flaveola</i>)	11	1	2	12	3	3	1
Antillean Euphonia (<i>Euphonia musica</i>)				1			
Hispaniolan Spindalis (<i>Spindalis dominicensis</i>)	7	2	5	20	1	6	5
Gray-crowned Palm-Tanager (<i>Phaenicophilus poliocephalus</i>)	4	1		4	2	8	4
Western Chat-Tanager (<i>Calyptophilus tertius</i>)	5			6	2	8	8
Black-faced Grassquit (<i>Tiaris bicolor</i>)	3		1	8	7	6	3
Yellow-faced Grassquit (<i>Tiaris olivacea</i>)	1			4			
Greater Antillean Bullfinch (<i>Loxigilla violacea</i>)	18	1		6	8	4	
Hispaniolan Crossbill (<i>Loxia megaplaga</i>)						12	>30
Total # of individuals	136	9	41	193	43	118	150
Total # of species	23	7	11	33	15	22	17
Total # mist net-hours	588				169		--
# birds/100 net-hours	24.66 ^e				25.44 ^f		--
# birds/point count			8.2				--
% migrant species (# species/# individuals)	43 (9/32)	29 (2/3)	9 (1/3)	18 (6/30)	31 (4/13)	18 (4/24)	18 (3/51)
% resident species (# species/# individuals)	57 (12/138)	71 (5/6)	91 (10/38)	82 (27/268)	69 (9/36)	82 (18/94)	82 (14/99)
% endemic species (# species/# individuals)	29 (6/58)	43 (3/4)	64 (7/26)	30 (10/149)	46 (6/26)	36 (8/58)	47 (8/72)

- ^a Excludes mist-netted birds and those recorded during point counts, although some of these individuals were likely encountered at other times and are thus included in totals.
- ^b Includes area from Pic Le Ciel to unnamed peak north of Peak Formon; excludes mist-netted birds, although some of these individuals may have been encountered at other times and are thus included in totals
- ^c Hispaniolan Emeralds tail-clipped, not banded.
- ^d Mist-netted with vocal playback lure.
- ^e Includes both new bandings and returns.
- ^f Includes 1 Bicknell's Thrush netted with vocal playback.

