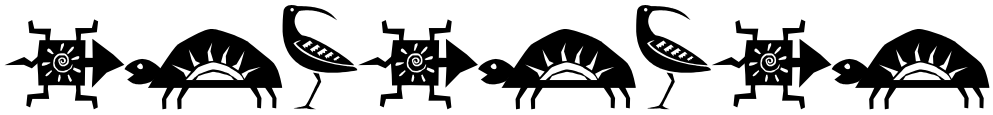

Dusti Becker, Ph.D.
C/O Amercian Wildlands
Box 6669
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Dear 2006 Earthwatch volunteers,

Thank you all again for financially supporting and helping me to conduct the Ecuador Cloud Forest Birds monitoring and research programme. As you experienced, it is a lot of hard work to sort out which birds use various microhabitats in Ecuadorian cloud forest.

Although we are all back in our other worlds, I imagine you still recall our project. Remember wondering if your headlamp was going to last to the top of the hill? Remember how good the food was and our candlelit meals? Remember all the beauty that surrounded you each day in the tropical cloud forest, and the little miracles of tropical birds you held in your hands or watched through your binoculars? I wish we were all there again, right now!

Without your help my efforts to sustain the community protected area at Loma Alta, operate a private cloud forest protected area at Las Tangaras, create conservation-related jobs for local people, and monitor and research the ecology of birds at two cloud forest sites, would be close to impossible.

Hasta luego mis amigos. Mil gracias!

Siempre Verde,

Dr. Dusti Becker

EARTHWATCH INSTITUTE FIELD REPORT 2006

Ecuador's Cloud Forest Birds

Dr. C. Dustin Becker
and
Dr. Susan Wethington

Ecuador's Cloud Forest Birds

Dr. C. Dustin Becker and Dr. Susan Wethington (during team 3)
Co-Director, Life Net, Bozeman, Montana
Director, Hummingbird Monitoring Network, Patagonia, AZ

Research Sites:
1. Las Tangaras Reserve, Mindo, Ecuador (Important Bird Area (IBA))
2. Loma Alta Ecological Reserve, Colonche Hills, Ecuador (IBA)

Research Objectives:

Research and conservation was initiated by Dr. Becker at Las Tangaras in 2001 and at Loma Alta in 1994.

At Las Tangaras Reserve:

1. Long-term monitoring of a tropical cloud forest avian community.
2. Determine birds most sensitive to deforestation (which species avoid edges and open areas).
3. Determine habitat preferences of Andean hummingbirds.
4. Describe male relationships at an Andean Cock-of-the-Rock lek.

At Loma Alta Ecological Reserve:

1. Long-term monitoring of a tropical cloud forest avian community.
2. Determine relationships between nectar resources and hummingbird diversity.
3. Enhance local knowledge and appreciation for biodiversity via research.
4. Explain this region's high diversity of avifauna by exploring a variety of hypotheses: habitat gradient created by elevation, dispersal linkages, etc.

Data Collection and Results

Las Tangaras Reserve:

During July and August 2006, two Earthwatch Institute teams completed the annual bird monitoring protocol at Las Tangaras Reserve. Las Tangaras is located two miles south of the town of Mindo on the north side of the Nambillo River and ranges in elevation from 1,200 to 1,600 metres. The avian monitoring protocol includes a daily tally of birds netted, observed, and heard singing in the reserve area, mist-netting of birds in three habitats (interior forest, second growth riparian forest, and forest edges), and studies of hummingbirds at feeders located in three habitats: forest interior, forest edge, and open pastures. Observations of birds are made along a system of trails that total 10 kilometres. Birds are typically detected within a 25-metre band on either side of the trail resulting in a survey area of approximately 500,000 square metres or 50 hectares.

Team #1 recorded 150 bird species at the reserve and along the road between Mindo village and the reserve. Team # 2 recorded 143 bird species during their 10-day field session. Of the 25 tanagers known in the region, 18 tanager species were recorded at Las Tanagaras reserve by the two teams. New species added to the Las Tangaras Reserve included maroon-tailed parakeet, buff-tailed coronet, white-winged tanager, and

velvet purple coronet. Disturbingly, no torrent ducks were recorded on the Nambillo River during either team and sightings of white-capped dipper were lower than in previous years. We suspect waterfall tourism adjacent to the reserve and associated river pollution may be reducing habitat quality for these two sensitive aquatic birds.

Mist-netting results varied significantly by habitat type both in terms of the types of birds netted and in the numbers of birds caught per net hour (nh). For example, hummingbirds made up 38% of captures in interior cloud forest and 29% in second growth, but represented 55% of the captures in the forest edge and pasture. Increased light in more open areas favours growth of flowers sought by hummingbirds. Frugivores represented 20% of the avian community sampled by mist netting in all three habitat types. Insectivores made up the balance and had the highest proportions in second growth, which is not surprising given this habitat's proximity to the Nambillo River.

Capture rates in mist nets in the forest edge averaged 35 birds per 100 nh, substantially higher than in interior forest where the rate was only 14.6 birds per 100 nh. Capture rate in riparian second growth was intermediate at 29 birds per 100 nh.

Hummingbird observations at feeders totalled 1,778 visits by 18 different species at the six feeder sites (duplicates in three habitats). The probability of detecting a particular hummingbird species varied significantly by habitat. Hummingbird species with significantly low counts in edges and open areas were: booted racket-tail, white-whiskered hermit, and wedge-billed hummingbird. These three species appear to rely heavily on interior forest flowers. Hummingbird species with a higher probability of detection in edges and open areas were the sparkling violetear and the white-necked Jacobin. Both these species are common in gardens. All other species had sample sizes too small for evaluation or were proportionally similar across the three habitat types.

Finally, observations of the Cock-of-the-Rock (COR) were all made at a lek, a place where males gather and display in order to attract mates. One preliminary result dependent upon having marked COR males with colour bands was that individuals appear to display at the same perch repeatedly and duos and trios of the same males display together for extended periods of time. Also, COR males varied in the time they remained on the lek, with some individuals staying to display for as long as five hours per day, nearly 40% of their daily activity budget.

We decided to take COR blood samples using standard collection methods. The blood samples will be used to determine relatedness of the males on the lek. Based on the concept of kin selection, we predict that males within a particular duo or trio will be composed of related males and will show more similarity in genetic markers than between other males that they do not display with on a regular basis.

Loma Alta Ecological Reserve:

2006 was the 10th year of bird monitoring and the 12th year of community conservation work at Loma Alta, Ecuador. Like the protocol at Las Tangaras, research teams combine daily tallies of birds heard or seen, mist netting, and hummingbird feeder watches to monitor the avian community in a tropical cloud forest. Monitoring takes place on Cerro la Torre, between 450 and 700 m in mature closed-canopy cloud forest and on a reforested hilltop. Observations are made along a system of trails that cover

400,000 square metres (about 100 acres). There are three mist-netting sites where 20 nets are operated for five hours during three consecutive mornings. The net sites, Chorillo, Casita, and Ridge are located at 400, 500, and 600 metres respectively.

Earthwatch teams monitor during the driest time of the year, after the fog season and before the start of the rainy season. Similar efforts are made by locally-trained Ecuadorian research teams during May and September, at the end of the rainy season and in the middle of the fog season.

In addition to avian community monitoring in the cloud forest, the second Earthwatch team spent a week in the lowlands determining the relative probabilities of seeing endemic birds associated with the Tumbesian endemic bird region. They also assisted with environmental education about the endangered Esmeraldas Woodstar, a tiny hummingbird species that appears to depend upon flowering booms of *Psychotria hazenii* in the community's ecological reserve.

At the Casita site, 90 birds were captured during 300 net hours, a capture rate of 30 birds per 100 nh. Hummingbirds represented 25.5% of the captures at Casita, which is extremely low for this site compared with other years. At Ridge site, 180 birds were netted during the 300 net-hour sampling session, a capture rate of 60 birds per 100 nh. Hummingbirds represented 30% of the captures here, also relatively low compared to other years. There were few *Psychotria hazenii* in bloom to attract hummingbirds this year, and this probably explains the low proportions of nectarivores captured. When *Psychotria* are in bloom, around 50-75% of the captures are hummingbirds. Still, Esmeraldas woodstars were noted at the feeders and many violet-bellied hummingbirds were also using the feeders. Apparently, many hummingbirds are in the area, but are not attracted to the level of the forest where they are readily sampled by nets.

More than 60 hours of hummingbird feeder observations were completed, along with extensive sampling of nectar quality and quantity in *Psychotria hazenii.* Although the bloom of *Psychotria hazenii* was small this year, there were sufficient flowers to collect more than 1,500 samples.

Team 3 recorded 220 different bird species in the Loma Alta watershed during their 10-day research visit and team 4 recorded 206. The most surprising new find for the area was an oilbird, *Steatornis caripensis,* which occurred at both camps. Perhaps the odour of fruit around our campsites attracted these rare birds.

Forty-five endemic species and birds of conservation concern were observed or netted as follows: Pale-browed Tinamou (lowlands), Gray-backed Hawk (breeding at mid elevations), Rufous-headed Chachalaca (mid-elevations), Ecuadorian Ground Dove (lowlands), Ochre-bellied Dove (cloud forest), Red-masked Parakeet (cloud forest), Anthony's Nightjar (lowlands), Pacific Parrotlet (lowlands), Gray-cheeked Parakeet (lowlands), Choco Screech Owl (cloud forest), Pacific Pygmy-Owl (lowlands), Little Woodstar (cloud forest), Esmeraldas Woodstar (cloud forest and riparian areas in lowlands), Ecuadorian Trogon (mid-elevations), Pale-mandibled Aracari (cloud forest), Choco Toucan (cloud forest), Ecuadorian Piculet (second growth cloud forest), Scarlet-backed Woodpecker (cloud forest), Guayaquil Woodpecker (cloud forest), Pacific Hornero (lowlands, riparian), Neclaced Spinetail (lowlands), Collared Antshrike (lowlands), Immaculate Antbird (cloud forest), Watkin's Antpita (edges uplands and lowlands), Elegant Crescent-chest (edges uplands and lowlands), Tumbes tyrannulet

(lowlands), Pacific Elaenia (lowlands), Tumbes Peewee (lowlands), Gray-breasted Flycatcher (cloud forest), Ochraceous Atilla (mid-elevation and cloud forest), Sooty-crowned Flycatcher (lowlands), Baird's Flycatcher (lowlands), Snowy-throated Kingbird (lowlands), Slaty Becard (lowlands), Plumbeous-backed Thrush (lowlands), Ecuadorian Thrush (lowlands), Dagua Thrush (cloud forest), Fasciated Wren (lowlands), Superciliated Wren (lowlands), Black-lored Yellowthroat (forest edges mid-elevations), Gray-and-gold Warbler (cloud forest), Black-capped Sparrow (lowlands), White-edged Oriole (lowlands), Saffron Siskin (lowlands). Loma Alta continues to be a great birding spot for birders interested in finding a mix of Tumbesian and Choco endemics. That cloud forest and arid dry forest are found in the same watershed is a major factor explaining Loma Alta's high avian diversity.

Significance/Benefits of Research

Long-term monitoring of birds at two biodiversity hot spots in Ecuador's cloud forests provides benchmarks for biodiversity in this habitat type. Only by doing long-term annual monitoring can declines or increases in species be systematically related to short-term environmental changes (season and food abundance), and separated from long-term factors such as climate change and deforestation. By including a habitat study design at Las Tangaras, the number and types of bird species that are extinction prone due to deforestation can be determined. Such knowledge is useful for conservation planning for avian biological diversity, and helps to define bird species that are indicators of cloud forest health. Finally, long-term monitoring can predict the species and associated ecosystem services lost due to landscape level changes caused by a growing human population.

Studies of Andean cock-of-the-rock contribute to our understanding of lekking birds and variation in life history strategies in birds. Likewise, at Loma Alta, our work on hummingbirds and nectar resources will eventually help explain annual patterns of hummingbird diversity on Cerro la Torre. Since birding tourism is important to sustaining the cloud forest at Loma Alta, knowing where and when to find rare hummingbirds is an economic asset for local guides. Our observations of Esmeraldas woodstar courtship displays and female woodstars with forming eggs indicate that the Loma Alta protected area is a nesting site for this endangered hummingbird.

At the local level our monitoring projects provide educational and training benefits for two communities, Mindo and Loma Alta. Both of these communities have a substantial interest and investment in ecological tourism. Both sites are Important Bird Areas and attract birding tourism each year. At the national and international level, our monitoring contributes to information within the two IBAs, contributing to databases that are used to assess the status of avian biodiversity within Ecuador and throughout the world.

Individuals and organisations wishing to sustain these two bird-monitoring efforts in tropical cloud forests may send donations to the non-profit organisation, Life Net, via Dr. Becker or to Dr. Susan Wethington at the Hummingbird Monitoring Network.

Dissemination of Results

This year our work on hummingbirds at Loma Alta was compiled into an environmental education booklet. More than 100 students from grades 5 to 7, and 6 teachers participated in workshops using the booklet describing the life history of hummingbirds,

how they pollinate flowers, global patterns of hummingbird diversity, the hummingbirds found in the Loma Alta watershed, and which hummingbirds are in danger of extinction. Volunteers and local teachers guided and rewarded participants.

Reports are to be provided to CECIA and the Ministry of the Environment as part of a research permit requirement for work in Ecuador. Otherwise, results have been shared at scientific meetings, in publications in scientific journals, and seminars. Drs. Becker and Wethington presented some results of this project at the North American Ornithological Council (NOAC) meeting in Veracruz, Mexico, October 2006. Dr. Becker recently gave a Powerpoint seminar about research at Loma Alta at the University of Missouri (February, 2007).

Publications this year based on research at Loma Alta include:

Becker, C. D., E. A. Richardson, and S. J. Brown. 2007. MtDNA haplotypes, sequence divergence, and morphological variation in Gray-breasted Woodwrens (Henichorina leucophrys) from the Andes and coastal hills of Ecuador. *Journal of Field Ornithology*. (In Press).

Parker, T., Sandercock, B., D. Becker, and A. Agreda. 2006. Apparent Survival Estimates For Five Species of Tropical Birds In An Endangered Forest Habitat In Western Ecuador. *Biotropica* 38-764-769.

Volunteer Tasks and Accomplishments

This year, four Earthwatch teams conducted more than 600 formal survey hours and an untold number of informal birding hours to document abundance patterns of tropical cloud forest birds at Loma Alta and Las Tangaras, Ecuador. They completed 2,700 hours of mist-netting and trapped over 1,500 birds representing 134 species. In addition, volunteers made helpful suggestions for improvements to methods for recording behaviour of Andean cock-of-the-rock at Las Tangaras and for sampling hummingbird behaviour and visitation rates at feeders at Loma Alta. Without the help of cost-sharing volunteers, our work in Ecuador would be almost impossible.

Project Development

The biggest logistical challenge remains adequate communication from the field. Satellite and mobile phones do not work well at either site due to cloud and tree cover. Additionally, such phones require constant charging if they are to be left on to receive calls. This requires more batteries than is practical to transport to the two remote field sites. Solar power is not an option at either site due to cloud and forest cover. If provided the opportunity, I propose that I call Earthwatch every three days, or in case of any moderate emergency, hike to a location where cell phones are functional.

During upcoming field seasons, I will expand on hummingbird-flower relationships while continuing the monitoring protocol and habitat use studies at both sites. I will also continue to develop behavioural studies of Andean cock-of-the-rock at the lek site at Las Tangaras.

Educational Opportunities

The Ecuador's Cloud Forest Birds project has always contributed to education of local children and adults, students, early career scientists and volunteers. Each year we share our data and scientific discoveries with local people who have an interest in conservation of a sustainable environment. We have provided data and suggestions for conservation in written reports, videos, and in oral presentations. We focus on enhancing local value and understanding of avian biodiversity and cultivate opportunities in ecotourism at both research sites. Our efforts to encourage local people to develop ecological tourism at Loma Alta have been so successful that a group of leaders from the village paid their own way to see how another community in the Amazon has developed its ecotourism programme.

This year at Loma Alta we did a series of environmental education activities with students in grades 5-7 from four different villages. With a grant from Washington Crossing Audubon, we created a 25-page booklet with activities focusing on the value and ecology of hummingbirds. More than 100 students and their teachers participated in the workshop and each received their own booklet. Earthwatch volunteers and local teachers conducted the activities with the students. One volunteer had brought colourful wildlife stickers and these were a big hit with students as rewards for making a good effort during the educational activity.

At Las Tangaras we hosted two Ecuadorian interns, Julio Cacao and Geovani Catuto, who learned about techniques in ornithology, monitoring, and ecotourism. Both of the interns are in leadership positions in the community of Loma Alta and can apply what they learned directly in their own community.

Two early career scientists, Carlos Martinez and Drew Ditmer (from University of Missouri - Columbia) participated on team 3 of the projects. They became more aware and interested in wildlife management and ecotourism at Loma Alta. As a result, Drew Ditmer did a project on local attitudes to wildlife and sustainability of wildlife. Making workable rules for use and preservation of wildlife is one of the greatest challenges that the local community of Loma Alta currently faces.

Several Ecuadorian students who have worked on the Ecuadorian Cloud Forest Birds project, Ana Agreda, Orfa Rodriguez, Evelyng Astudillo and Tatiana Santander, have gone on to do Masters degrees in ecology and conservation and at times still help on the project.

Long-term monitoring of birds at Loma Alta has attracted sustainability-oriented people and institutions to work in the area.

Partnerships

The number of organisations working with Loma Alta on environmental sustainability has grown from three in 1995 to 12 in 2006. Partnerships exist or have existed with international, national and regional NGOs due to community interest in sustaining cloud forest. This interest in cloud forest conservation was originally cultivated at Loma Alta by the Ecuador's Cloud Forest Birds project and foundational work by the NGO, People Allied for Nature.

Current partnerships related to avian monitoring and conservation at Loma Alta and Las Tangaras include the following organisations: Life Net (Conservation NGO), CECIA (Conservation NGO), Birdlife International (Conservation NGO), Washington Crossing Audubon Society (Citizen's group), and the Hummingbird Monitoring Network (Conservation NGO). Most of the NGOs provide funding, in-kind support, or affiliation for permitting (CECIA). The Ministry of the Environment provides an oversight of the project and permits for research in Ecuador. CECIA and Birdlife International will use the monitoring data to understand bird populations at two of their designated Important Bird Areas. Other NGOs use the results for scientific data sharing and for conservation planning.

Earthwatch was the most consistent partnership and sustained the projects at Loma Alta and Las Tangaras until January 2007.

Acknowledgements

As the PI for the Ecuador Cloud Forest Birds programme and am grateful for financial and on-the-ground support from:

- > 300 Earthwatch volunteers and Earthwatch Institute
- Comuna Loma Alta
- Ministerio de Ambiente
- Ford Foundation, NSF, IFRI, HSBC
- Aves de Ecuador, CECIA, Flinthills Audubon, Hummingbird Monitoring Network, Hummingbird Society, Planeta Azul, People Allied for Nature, Washington Crossing Audubon
- Mauricio Torres, Pascual Torres, Ana Agreda, Melina Costantino, Geovanny Catuto, Alicia Torres, and many students from KSU, UMo., and Ecuador.