

# **CLOUDBRIDGE BIRD DIVERSITY AND DISTRIBUTION**

## **Mist Netting and Banding**

Nathan Marcy  
Cloudbridge Nature Reserve  
July 2007



## **INTRODUCTION**

Cloudbridge is a private reserve in the Talamanca mountain range of Costa Rica. Ranging in elevation from 1500m to 2750m, Cloudbridge borders the Chirripo National Park, a UNESCO World Heritage site. This report summarizes the results of the first round of mist netting and bird banding done at Cloudbridge. An addition to the Cloudbridge Bird Diversity and Distribution study (see [cloudbridge.org/researchreports.htm](http://cloudbridge.org/researchreports.htm)), the mist netting was designed to complement previously collected point count data. The combination of these survey methods will create a much clearer picture of bird communities at Cloudbridge than either could alone. Certain biases are inherent to point counts; birds are more easily detected in some habitats than in others, and some species are more conspicuous than others. Mist netting helps to even out these disparities.

Mist netting also offers insight into many other aspects of the lives of birds. When examining birds in the hand, it is often possible to distinguish males from females in species that do not differ in plumage. It is also possible to determine which species are currently breeding. Data such as weight, fat deposits, and feather condition provide a way to compare the fitness of birds living in different habitats. Recaptures can lead to better estimates of population density, and an understanding of how birds move within and between different habitats. Over time, constant effort netting can track seasonal and long-term population changes.



## **METHODS**

Mist netting and banding were conducted during February and March of 2007. Six nets were operated at three sites (described below) which were chosen to represent the

diversity of habitats in the reserve. The sites were run in rotation until each had been run seven times. Nets were opened at sunrise and remained open between four and six hours, depending on conditions. All nets were 12 m long and 2.6 m high, with four shelves and 36 mm mesh.



All captured birds were given a numbered leg band, except those that were too small (hummingbirds) or too large for the available bands. Hummingbirds were marked by clipping the ends of tail feathers in unique combinations. Each bird was identified to species. When possible its sex and approximate age were determined. A range of other data were collected, including the net and time of capture, weight and wing chord (length), breeding status, and feather molt and wear.

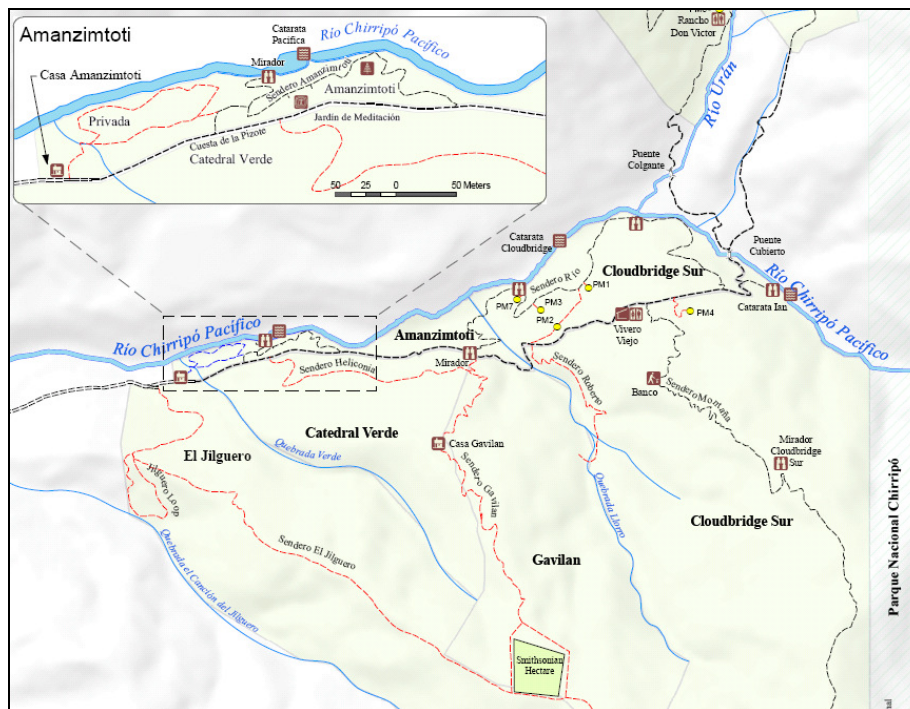
## **SITES**

**River Trail (RIVE):** This site encompasses a section of the River Trail on both sides of its intersection with the Maintenance Trail. The nets are numbered in order from 1 to 6, with net 1 being at the eastern, upstream end. The habitat throughout the site is early successional, composed of open grassy areas, clusters of shrubs, and scattered small trees. The terrain is relatively flat, with an elevation of approximately 1680 m.

**Gavilan (GAVI):** This site surrounds the Gavilan house. It is roughly half a kilometer southwest and uphill from RIVE. The nets are numbered in order from 1 to 6, with net 1 at the northern, downhill end. The habitat is the most diverse of the three sites. Nets 1 and

2 are in mostly open, early successional vegetation similar to that of RIVE. Nets 3 and 4 abut the edge of secondary forest, and nets 5 and 6 are inside the forest. The terrain is moderately steep, with an elevation of approximately 1780 m.

Smithsonian Hectare (SMIT): This site, roughly half a kilometer south and uphill from GAVI, lies within the hectare that was established for the Smithsonian biomonitoring project. The habitat throughout the site is primary forest. A total of seven nets were run at this site, though never more than six at a time. Net 5 was abandoned after two days and replaced by net 7. The terrain is steep, with nets placed on the crests of two ridges. The elevation is approximately 1960 m.



Cloudbridge Nature Reserve, showing Casa Gavilan, the river Trail (Sendero Rio), and the Smithsonian Hectare.

## RESULTS

Over 21 days, and a total of 512 net-hours, 381 birds of 65 species were captured.

At the River Trail site, 143 birds of 38 species were captured (Table 1). With nets having been open for a combined 165.2 hours, these totals represent 0.87 birds and 0.23 species per net-hour. An average of 3.8 birds were captured per species. Of all captures, 17 birds (11.9 percent) were recaptures. The most frequently captured species were Common Bush-Tanager (17), Yellow-thighed Finch (12), Black-faced Solitaire (10), Gray-tailed Mountain Gem (10), Mistletoe Tyrannulet (9), and Silver-throated Tanager (9). Of the species captured, 16 showed anatomical evidence of being in an active phase of breeding (Table 4); 25 percent of the breeding individuals were female.



At the Gavilan House site, 147 birds of 49 species were captured (Table 2). With nets having been open for a combined 179 hours, these totals represent 0.82 birds and 0.27 species per net-hour. On average, 3 birds were captured per species. Of all captures, 16 birds (10.9%) were recaptures. The most frequently captured species were Tennessee Warbler (12), Common Bush-Tanager (10), Green Violet-ear (10), Yellow-thighed Finch (9), Gray-breasted Wood-wren (7), and Slate-throated Redstart. Of the species captured, 14 showed evidence of breeding; 41 percent of the breeding individuals were female.

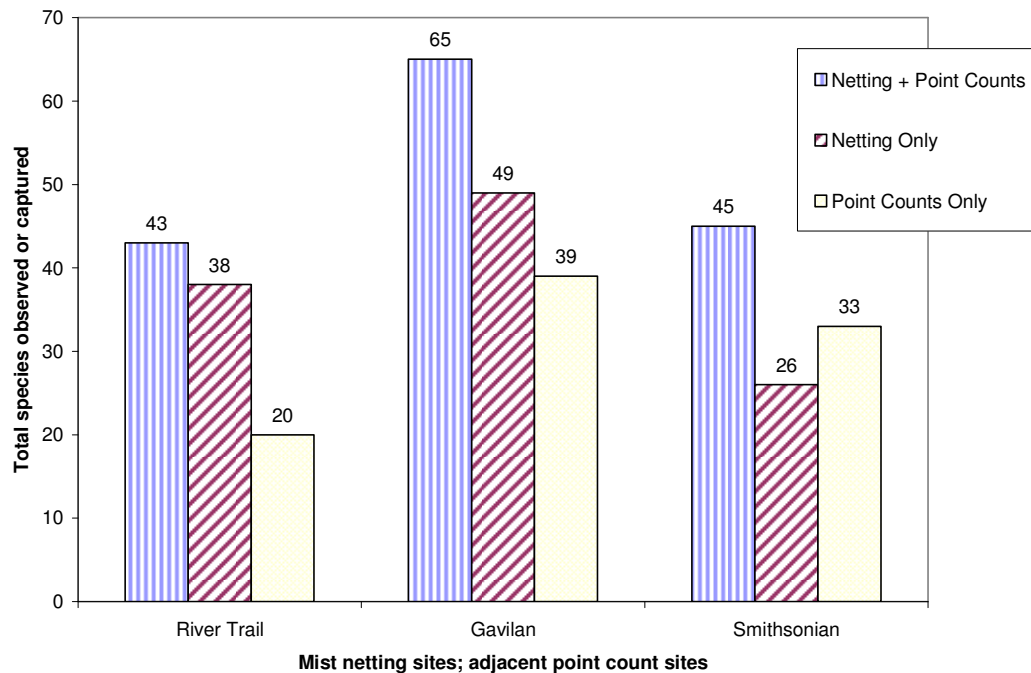
At the Smithsonian Hectare site, 91 birds of 26 species were captured (Table 3). With nets having been open for a combined 167.8 hours, these totals represent 0.54 birds and 0.15 species per net-hour. On average, 3.5 birds were captured per species. Of all captures, 8 birds (8.8%) were recaptures. The most frequently captured species were Olive-striped Flycatcher (14), Gray-tailed Mountain Gem (11), Slate-throated Redstart (8), Common Bush-Tanager (5), Green-crowned Brilliant (5), and Golden-crowned Warbler (5). Of the species captured, 11 showed evidence of breeding; 39 percent of the breeding individuals were female.



## DISCUSSION

As a measure of diversity, the results of mist netting roughly mirror those of the point counts. Figure 1 compares the species totals of the three netting sites with the two point count sites closest to each. In both cases the greatest number of species was found in mixed/forest edge habitats, as exemplified by the Gavilan site. However, whereas point counts recorded the lowest diversity in open habitats, such as that of the River Trail site, mist netting tallied the fewest species in the forested Smithsonian site. The Smithsonian was the only site for which the point count total was greater than the mist netting total. This is very likely due to the fact that many forest birds are active primarily or exclusively in the canopy, far beyond the reach of the nets.

**Fig. 1: Contribution of Mist Netting and Point Counts to Species Totals**



When netting and point counts are combined, the Smithsonian and River Trail sites have nearly identical species totals. However, the results suggest that future netting will add species at a greater rate in the forested site. While netting alone represents 88 percent of the combined species total on the River Trail, it represents only 58 percent of the Smithsonian total. There are more new species in the forest that could potentially be captured, even if some never descend to net level. Also, recaptures in the Smithsonian account for only 8.8 percent of all captures, compared to 11.9 percent of captures on the River Trail. Thus, each bird caught in the forest is more likely to be a first-time capture. And because fewer individuals were caught per species in the forest (3.5 versus 3.8 on the River Trail), it is slightly more likely that each capture will be a new species. As more mist netting is done, its measures of diversity will likely trend toward convergence with those of the point counts; the highest diversity will continue to be found in mixed habitats, forest habitats will host upwards of 80 percent as many species, and open habitats will support roughly half as many.

It is more difficult to interpret other aspects of the mist netting data at this point. No birds were recaptured at sites other than the one where they were first caught. Although this may be evidence that birds seldom move between different habitats, it is too



early to reach that conclusion. It may be that they do not move significantly on a daily basis, but do so seasonally. It is also possible that the three sites are simply too far apart to record such movement. Future netting efforts should seek to establish new sites between the three original ones, in order to seek positive evidence of movement.

There are also not enough data to make statistically significant comparisons of the physical characteristics (e.g. weight) of birds in different habitats. Still, such comparisons reveal interesting patterns that should be followed up with future netting work. Three non-hummingbird species (Common Bush-Tanager, Slate-throated Redstart, and Olive-striped Flycatcher) were captured at least twice at all three sites. The weight of these species appears to be positively correlated with forest cover. Their combined average weight was 41.1 grams on the River Trail, 42.6 grams at Gavilan, and 42.9 grams at the Smithsonian. For all three species, the lowest average weight was recorded on the River Trail. The weights of three hummingbird species captured at all sites (Green Hermit, Gray-tailed Mountain Gem, and Striped-tailed Hummingbird) appear to show roughly the opposite trend. Their combined average weight was 15.8 grams on the River Trail, 15.9 grams at Gavilan, and 15.1 grams at the Smithsonian. Perhaps the first group of species, being largely insectivorous, finds more food in the forest, while more flowers are available to the nectar-feeding hummingbirds in open habitats.

The breeding-status data (Table 4) also suggest interesting patterns. At each site, the numbers of breeding individuals and species caught were in rough proportion to the total capture rate. In all cases more breeding males were captured than females. This is not surprising, since females are more likely to be incubating or brooding at the nest while males forage. However, while approximately 40 percent of the breeding birds captured at Gavilan and the Smithsonian were female, only 25 percent of those on the River Trail were. This may be evidence that fewer birds were nesting in the area, or that males nesting in other habitats are traveling to the River Trail to forage.

## **FUTURE WORK**

The data collected so far allows only limited conclusions. A very large volume of data is needed for the tools of mist netting and banding to meet their full potential. I hope that an ongoing banding program will be established at Cloudbridge, with a netting effort comparable to this first round repeated at least once, and preferably twice, a year.

---

Acknowledgements: This research was supported by a Cloudbridge Ornithology Grant donated by Ian and Genevieve Giddy through the Cloud Forest Conservation Alliance. Thanks to Daniel Paradis for assistance in the netting and banding.

Note: the underlying data, recorded in Excel spreadsheets, are available upon request. Address correspondence to the author at [ngmarcy@cloudbridge.org](mailto:ngmarcy@cloudbridge.org).

Table 1.

**RIVER TRAIL MIST NETTING SPECIES LIST**

**February - March 2007**

<b>SPECIES</b>	<b>SP. CODE</b>	<b>CAPTURES</b>	<b>STATISTICS</b>	
Common Bush-tanager	COBT	17	SPECIES	38
Yellow-thighed Finch	YTFI	12	CAPTURES	143
Black-faced Solitaire	BFSO	10	SP. / CAP.	0.27
Gray-tailed Mountain Gem	GTMG	10	RECAPTURES	17
Mistletoe Tyrannulet	MITY	9	RECAP. / CAP.	0.12
Silver-throated Tanager	STTA	9		
Green Hermit	GRHE	7	NET HOURS	165.16
Olive-striped Flycatcher	OSFL	6		
Clay-colored Robin	CCRO	5	SP. / HOUR	0.23
Rufus-collared Sparrow	RCSP	5	CAP. / HOUR	0.87
Emerald Toucanet	EMTO	4		
Green Violet-ear	GRVE	4		
Striped-tailed Hummingbird	STHU	4		
Slate-throated Redstart	STRE	4		
Violet Sabrewing	VISA	4		
Buff-throated Saltator	BTSA	3		
Snowy-bellied Hummingbird	SBHU	3		
Tennessee Warbler	TEWA	3		
Chestnut-capped Brush Finch	CCBF	2		
Ruddy-capped Nightingale-thrush	RCNT	2		
Yellow-faced Grassquit	YFGR	2		
Yellow-throated Brush Finch	YTBF	2		
Collared Trogon	COTR	1		
Flame-colored Trogon	FCTA	1		
Gray-breasted Wood-wren	GBWW	1		
Green-crowned Brilliant	GCBR	1		
Green-fronted Lancebill	GFLA	1		
Golden-hooded Tanager	GHTA	1		
House Wren	HOWR	1		
Orange-billed Nightingale-thrush	OBNT	1		
Philadelphia Vireo	PHVI	1		
Resplendent Quetzal	REQU	1		
Red-faced Spinetail	RFSP	1		
Scintillant Hummingbird	SCHU	1		
Slaty Flowerpiercer	SLFL	1		
Spectacled Foliage-gleaner	SPFG	1		
Squirrel Cuckoo	SQCU	1		
Wilson's Warbler	WIWA	1		

Table 2.

**GAVILAN MIST NETTING SPECIES LIST****February - March 2007**

<b>SPECIES</b>	<b>SP. CODE</b>	<b>CAPTURES</b>	<b>STATISTICS</b>	
Tennessee Warbler	TEWA	12	SPECIES	49
Common Bush-tanager	COBT	10	CAPTURES	147
Green Violet-ear	GRVE	10	SP. / CAP.	0.33
Yellow-thighed Finch	YTFI	9	RECAPTURES	16
Gray-breasted Wood-wren	GBWW	7	RECAP. / CAP.	0.11
Slate-throated Redstart	STRE	7		
Green Hermit	GRHE	6	NET HOURS	179
Striped-tailed Hummingbird	STHU	6		
Chestnut-capped Brush Finch	CCBF	5	SP. / HOUR	0.27
Gray-tailed Mountain Gem	GTMG	5	CAP. / HOUR	0.82
Silver-throated Tanager	STTA	5		
Green-crowned Brilliant	GCBR	4		
Rufus-collared Sparrow	RCSP	4		
Snowy-bellied Hummingbird	SBHU	4		
Swainson's Thrush	SWTH	4		
Golden-crowned Warbler	GCWA	3		
Red-faced Spinetail	RFSP	3		
Three-striped Warbler	TSWA	3		
Wilson's Warbler	WIWA	3		
Yellow-throated Brush Finch	YTBFB	3		
Mistletoe Tyrannulet	MITY	2		
Olive-striped Flycatcher	OSFL	2		
Speckled Tanager	SPTA	2		
Scarlet-thighed Dacnis	STDA	2		
Yellowish Flycatcher	YEFL	2		
Brown-capped Vireo	BCVI	1		
Black-faced Solitaire	BFSO	1		
Clay-colored Robin	CCRO	1		
Dusky-capped Flycatcher	DCFL	1		
Empidonax Species	EMPI	1		
Emerald Toucanet	EMTO	1		
Flame-colored Trogon	FCTA	1		
Golden-bellied Flycatcher	GBFL	1		
Golden-winged Warbler	GWWA	1		
House Wren	HOWR	1		
Lineated Foliage-gleaner	LIFG	1		
Mountain Elaenia	MOEL	1		
Plain Wren	PLWR	1		
Rufus-breasted Wren	RBWR	1		
Ruddy-capped Nightingale-thrush	RCNT	1		
Scintillant Hummingbird	SCHU	1		
Spotted-crowned Woodcreeper	SCWO	1		
Slaty Antwren	SLAN	1		
Spotted Barbtail	SPBA	1		
Spotted Wood-quail	SPWQ	1		
Scarlet-rumped Tanager	SRTA	1		
Violet Sabrewing	VISA	1		
White-tailed Emerald	WTEM	1		
Yellow-faced Grassquit	YFGR	1		



Table 3.

**SMITHSONIAN MIST NETTING SPECIES LIST**

**February - March 2007**

<b>SPECIES</b>	<b>SP. CODE</b>	<b>CAPTURES</b>	<b>STATISTICS</b>	
Olive-striped Flycatcher	OSFL	14	SPECIES	26
Gray-tailed Mountain Gem	GTMG	11	CAPTURES	91
Slate-throated Redstart	STRE	8	SP. / CAP.	0.29
Common Bush-tanager	COBT	5	RECAPTURES	8
Green-crowned Brilliant	GCBR	5	RECAP. / CAP.	0.09
Golden-crowned Warbler	GCWA	5		
Mountain Robin	MORO	4	NET HOURS	167.84
Spectacled Foliage-gleaner	SPFG	4		
Striped-tailed Hummingbird	STHU	4	SP. / HOUR	0.15
Brown-capped Vireo	BCVI	3	CAP. / HOUR	0.54
Green Hermit	GRHE	3		
Spotted-crowned Woodcreeper	SCWO	3		
Violet Sabrewing	VISA	3		
White-throated Spadebill	WTSB	3		
Yellowish Flycatcher	YEFL	3		
Black-faced Solitaire	BFSO	2		
Ruddy-capped Nightingale-thrush	RCNT	2		
Black-cheeked Warbler	BCWA	1		
Chiriqui Quail-dove	CHQD	1		
Collared Trogon	COTR	1		
Lineated Foliage-gleaner	LIFG	1		
Spotted Barbtail	SPBA	1		
Three-striped Warbler	TSWA	1		
Wedge-billed Woodcreeper	WBWO	1		
Wilson's Warbler	WIWA	1		
Unknown Hummingbird Sp.	???	1		

Table 4.

**BREEDING BIRDS CAPTURED AT EACH SITE**

**RIVER TRAIL**

SPECIES	Male	Female
Black-faced Solitaire	5	1
Buff-throated Saltator	2	0
Chestnut-capped Finch	1	0
Clay-colored Robin	1	0
Common Bush-tanager	6	6
Flame-colored Tanager	1	0
Green Hermit	1	0
Mistletoe Tyrannulet	1	0
Olive-striped Flycatcher	0	1
Ruddy-capped Nightingale-thrush	1	0
Rufus-collared Sparrow	3	1
Slaty Flowerpiercer	0	1
Silver-throated Tanager	4	2
Violet Sabrewing	2	0
Yellow-throated Brush Finch	1	0
Yellow-thighed Finch	8	0

SPECIES: 16  
 MALE: 37  
 FEMALE: 12  
 PERCENT FEMALE: 24.5%

**GAVILAN**

SPECIES	Male	Female
Black-faced Solitaire		1
Chestnut-capped Brush Finch	3	0
Common Bush-tanager	4	0
Flame-colored Tanager	1	0
Golden-bellied Flycatcher	0	1
Olive-striped Flycatcher	0	1
Rufus-collared Sparrow	1	2
Speckled Tanager	0	1
Scarlet-thighed Dacnis	1	0
Slate-throated Redstart	1	2
Silver-throated Tanager	1	2
Wilson's Warbler	1	0
Yellow-throated Brush Finch	0	2
Yellow-thighed Finch	5	2

SPECIES: 14  
 MALE: 19  
 FEMALE: 13  
 PERCENT FEMALE: 40.6%

**SMITHSONIAN**

SPECIES	MALE
Brown-capped Vireo	0
Black-cheeked Warbler	1
Black-faced Solitaire	1
Common Bush-tanager	2
Collared Trogon	0
Golden-crowned Warbler	2
Lineated Foliage-gleaner	0
Ruddy-capped Nightingale-thrush	1
Spotted-crowned Woodcreeper	0
Spectacled Foliage-gleaner	0
Slate-throated Redstart	4

SPECIES: 11  
 MALE: 11  
 FEMALE: 7  
 PERCENT FEMALE: 38.9%