Primate Diversity, Distribution and Relative Abundances in the Rios Blanco y Negro Wildlife Reserve, Santa Cruz Department, Bolivia

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Abstract

We document primate diversity in the Ríos Blanco y Negro Wildlife Reserve and compare encounter rates between primate species and the field sites examined. We also present an encounter rate for overall primate biomass at each field site. Primate diversity encountered within the Reserve appears typical of other sites in eastern lowland Bolivia but interesting patterns in species distribution and abundance are discussed.

Key Words: Primate diversity, Census, Amazon, Bolivia

Introduction

Until recently, little information had been published on the distribution of primate species in the Bolivian eastern lowlands. Primate surveys have been restricted to two protected areas (Braza and Garcia, 1988; Garcia and Tarifa, 1988; Wallace *et al.*, 1998), with other distributional information coming from specimens collected at scattered locations (Brown and Rumiz, 1985; Anderson, 1997). The Rios Blanco y Negro Wildlife Reserve (RBYNWR) covering 14,239 km² (Figure 1), was created in 1990, and forms part of the Bajo Paragua Forestry Reserve (BPFR) of 33,882 km². The reserve is divided into forestry concessions that reach areas of up to 3,113 km² (FAN/PL480/WCS, 1994), and which have been selectively logged for three high-value timber species; *Swietenia macrophylla*, *Amburana cearensis*, and *Cedrela odorata*. Selective logging has intensified in lowland Bolivia in recent years and is typically associated with technically illegal, heavy hunting of larger wildlife species.

In terms of biodiversity, the area was almost unexplored until 1992-1993 when multi-disciplinary surveys were carried out as part of a project designed to produce a management plan for the reserve (FAN/PL480/WCS, 1994). These surveys were necessary to provide baseline data for future ecological monitoring, as well as to assess the impact of human activities on biodiversity within the reserve. In this report we document primate diversity in the Rios Blanco y Negro Wildlfe Reserve and compare group and individual encounter rates between primate species and the field sites examined. We also calculate an "encounter rate" for overall primate biomass at each field site.

Study Area

The Rios Blanco y Negro Wildlife Reserve (RBYNWR) is situated in the north-west of Santa Cruz Department, and includes two distinct biogeographical regions: the Beni alluvial plain which lies west of the Rio Blanco, and the Brazilian Shield which forms the eastern part of the Reserve (Fig. 1). The forests found within the reserve are broadly classified as either Humid Forest of the Brazilian Shield or Lowland Humid Forest (Killeen *et al.*, 1993). The Wildlife Reserve was sparsely populated during successive rubber booms but has been largely uninhabited since the 1950's. Eight survey sites were selected within the reserve. Five sites were directly accessible through existing logging roads; Arroyo Chuchui, San Martin, San Luis, Oquiriquia, and El Tutumo. Three others were accessible by river and/or plane; Perseverancia, Pajaral, and Rio Negro de Caimanes (Figure 1). Further information regarding survey sites is provided in Table 1.

Methods

Each field site was visited for approximately three weeks. Line transects were employed to survey the areas using standard techniques (Burnham *et al.*, 1980; Brockelman and Ali, 1987; Buckland *et al.*, 1993). With sufficient transect encounters, density estimates can be calculated using this methodology. However, since at least 40 encounters of each species are required for reliable estimates, many researchers have been restricted to presenting relative abundances using encounter rates (Branch, 1983; Mate and Colell, 1995). Nevertheless, encounter rates are a useful long-term monitoring tool and can also allow site comparisons, providing the area censused along a standard transect length is similar (Wallace *et al.*, 1998).

Diurnal transects were run by two observers in fair weather conditions between 06:00 to 11:30 and 15:00 to 18:00, along existing logging trails or roads and/or newly established trails cut by the survey team. Transect speed ranged from 1-2 km per hour and depended on trail conditions and associated noise levels. Periods of walking were regularly interspersed with brief "listening stops" in order to increase the probability of detecting more cryptic species. Nocturnal censuses were conducted over shorter distances between 19:00 and 23:00

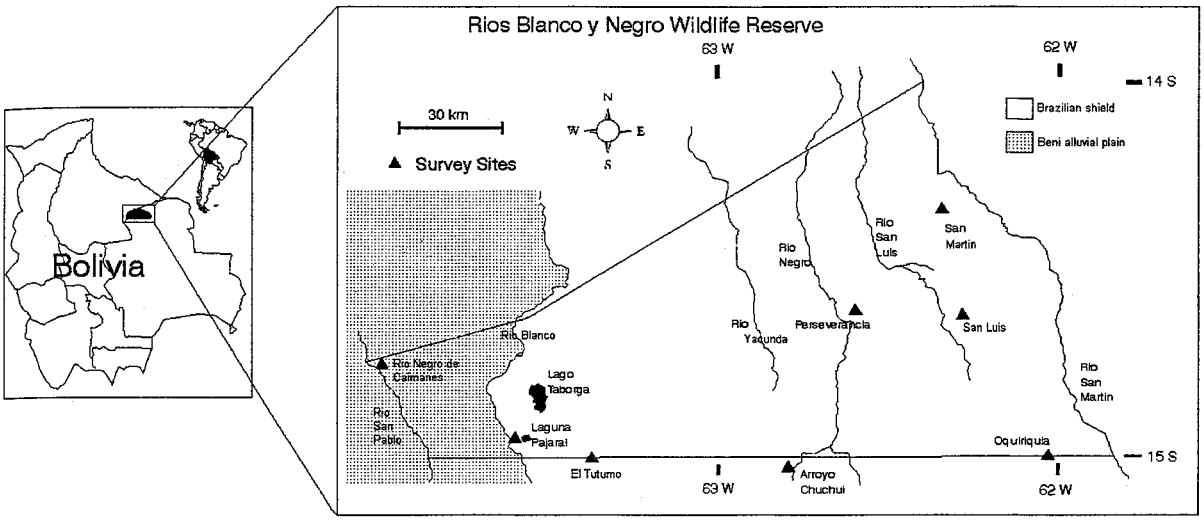

Figure 1. Location of the eight survey sites within the Rios Blanco y Negro Wildlife Reserve, Santa Cruz Department, Bolivia.

and were generally walked at a slower speed. Details regarding the diurnal transect and nocturnal census effort at each site are presented in Table 1. The following information was recorded for all groups of primates encountered on transects: species, group size (and where possible age/sex composition), date and time detected, observation duration, transect position, habitat type, and the perpendicular distance from the transect trail to the estimated geometric centroid of the group. Incidental non-transect observations and primate vocalizations also provided information on primate diversity.

Results are expressed as relative abundances, calculated as the number of group encounters for each primate species per 10 km censused (groups/10 km). For *Ateles, Cebus,* and *Saimiri* the transect width was truncated at 40 m from the trail for all sites considered. *Alouatta, Aotus* and *Callithrix* sightings were truncated at 20 m from the trail due to the more cryptic nature of these species. These analytical norms were established to ensure that the transect width, and hence the area censused at each site, was similar. Individual encounter rates are expressed as the number of observed individuals of each species encountered per 10 km censused (inds/10 km). Primate biomass encounter rates for each site are expressed as the observed primate biomass per 10 km censused (kg/10 km). Primate body weights were taken from Ford (1994). Since data on group composition was difficult to obtain during censuses, and weights for other age/sex classes unknown, for the purposes of analysis all animals were assumed adult, and adult sex ratios were assumed 1:1 for all species at all sites. Statistical procedures follow Siegel and Castellan (1988), and significance was set at the 0.05 level.

Results

A total of seven non-human primate species were registered within the reserve: black-tailed marmoset (*Callithrix melanura*), owl monkey (*Aotus azarae*), Bolivian squirrel monkey (*Saimiri boliviensis*), brown capuchin monkey (*Cebus apella*), black howler monkey (*Alouatta caraya*), red howler monkey (*Alouatta seniculus*), and black spider monkey (*Ateles chamek*). In addition, at three sites within the reserve (Perseverancia, Rio Negro de Caimanes, Oquiriquia) groups of *Cebus* were observed which included only very pale and more slender individuals. These three sightings may represent white-fronted capuchin monkeys (*Cebus albifrons*), however, *Cebus apella* is renowned for within population variation in pelage colour (Emmons and Feer, 1990). Thus, until specimens and/or further observations are available we prefer to treat these sightings as *Cebus apella.*

Table 1. Transect kilometres and location of the eight field sites within the Rios Blanco Y Negro Wildlife Reserve, Santa Cruz Department, Bolivia.

Survey Site	Diurnal (km)	Nocturnal (km)	Biophysical Region[1]	Location	Survey Period
Perseverancia	165	27.5	BS	14, 38' S; 62, 37' W	June – July 1992
Pajaral	98	16	BS/BAP	14, 57' S; 63, 31' W	August 1992
Arroyo Chuchui	54.8	13.5	BS	15, 35' S; 62, 45' W	October 1992
San Martin	69	33.6	BS	14, 30' S; 62, 06' W	November 1992
Rio Negro Caimanes	101.6	20.9	BAP	14, 43' S; 63, 58' W	June 1993
San Luis	108.9	25	BS	See Figure 1	August 1993
Oquiriquia	93.2	16.2	BS	15, 03' S; 61, 48' W	September 1993
El Tutumo	99.7	21.5	BS/BAP	15, 03' S; 63, 19' W	October 1993

[1]BS = Brazilian Shield, BAP = Beni Alluvial Plain, BS/BAP = Ecotone between Brazilian Shield and Beni Alluvial Plain.

Four species were encountered at all of the sites visited within the reserve: *Callithrix melanura, Aotus azarae, Cebus apella,* and *Ateles chamek.* Howler monkeys appear to have a more limited distribution: *Alouatta caraya* was only observed in the semideciduous forests at Pajaral, and *Alouatta seniculus* was observed in seasonally inundated forest at Perseverancia, Pajaral, Rio Negro de Caimanes, and Arroyo Chuchui. Squirrel monkeys (*Saimiri boliviensis*) were registered at four sites: Perseverancia, Pajaral, Rio Negro de Caimanes and El Tutumo. The most diverse sites were Pajaral with seven primate species, and Perseverancia and Rio Negro de Caimanes with six species (see Table 2).

Group and individual encounter rates are presented in Table 2, and details for each species are as follows:

Callithrix argentata: Individual encounter rates were significantly different between sites (Chi-squared = 65.99, d.f.7, p<0.001), and encounter rates were low for all sites considered, both in terms of observed groups (0.1-0.5 grps/10 km) and individuals (0.1-2.8 inds/10 km).

Aotus azarae: Insufficient encounters prevented a statistical test, but group and individual encounter rates for owl monkeys varied among sites (0.4-3 grps/10 km, 0.8-7.4 inds/10 km). Arroyo Chuchui had a group encounter rate over twice that of any other site, although the individual encounter rate for El Tutumo (7.4 inds/10 km) was higher than that of Arroyo Chuchui (5.2 inds/10 km) due to site differences in mean group size.

Saimiri boliviensis: Only observed on transects at two sites, individual encounter rates varied from 4.9-9.8 inds/10 km.

Alouatta seniculus: Only observed on transects at three sites, individual encounter rates varied from 0.3-1.8 inds/10 km.

Alouatta caraya: This species was only registered during non-transect observations at Pajaral.

Cebus apella: In terms of individuals, capuchin monkeys were consistently the most frequently encountered diurnal primate, and individual encounter rates (4.4-14.7 inds/10km) were significantly different between sites (Chi-squared = 97.01, d.f.7, p<0.001). Group encounter rates varied from 0.6-1.6 grps/10 km censused. The three highest sites for both group and individual encounter rates were Pajaral, Rio Negro de Caimanes and Arroyo Chuchui.

Ateles chamek: Individual encounter rates were also significantly different between sites for spider monkeys (Chi-squared = 357.95, d.f.7, p<0.001). Both group (0.1 - 0.3 grps/10km) and individual (0.3-2.3 inds/10km) encounter rates were low for all sites considered except Arroyo Chuchui, where individual encounter rates reached 11.5 inds/10km censused.

Primate biomass encounter rates varied between 15.3-148.2 kg/10 km censused (mean = 49.2, SD ± 41.8). Notably, at Arroyo Chuchui (148.2 kg/10 km) we encountered over double the primate biomass of any other site, the nearest being Pajaral (57.2 kg/10 km). Four sites (Perseverancia, San Martin, Rio Negro de Caimanes and El Tutumo) had similar primate encounter rates (36.5-38.2 kg/10 km). Finally, the primate biomass encounter rates at San Luis (15.3 kg/10 km) and Oquiriquia (23.5 kg/10 km) were relatively low.

Discussion

Primate diversity within the Rios Blanco y Negro Wildlife Reserve, at seven species, appears typical of other protected areas in eastern lowland Bolivia (Braza and Garcia, 1988; Garcia and Tarifa, 1988; Wallace *et al.*, 1998). A notable absence was the dusky titi monkey (*Callicebus donacophilus*) which is frequently observed in forests bordering the city of Santa Cruz to the south of the reserve, but appears absent in northern Santa Cruz Department (Braza and Garcia, 1988; Wallace *et al.*, 1998; this study). Nevertheless, in the Lago Caiman region *C. brunneus* is present on the Brazilian side of the Iteñez River (Wallace *et al.*, 1996).

To our knowledge the Bolivian squirrel monkey (*Saimiri boliviensis*) has as yet not been registered east of Perseverancia in Santa Cruz Department, although anecdotal reports suggest it may reach as far east as the upper San Martin River. Where registered, squirrel monkey troops were frequently observed in close association with *Cebus apella* troops. This association has been noted in previous studies in the Neotropics (Terborgh, 1983).

This study also underlines the apparent rarity of howler monkeys in the expansive seasonally evergreen forests of the Brazilian Shield. *Alouatta seniculus* appears to be confined to floodplain forest where it is found at relatively low densities (Wallace

Table 2. Primate diversity, group (and individual) encounter rates (per 10km), and primate biomass encounter rates at eight sites within the Rios Blanco y Negro Wildlife Reserve, Santa Cruz Department, Bolivia.

Species	Perseverancia	Pajaral	Arroyo Chuchui	San Martin	Rio Negro de Caimanes	San Luis	Oquiriquia	El Tutumo
Callithrix melanura	0.2 (1.9)	*	0.2 (1.8)	0.1 (0.1)	0.2 (0.6)	0.1 (0.5)	0.5 (2.8)	0.1 (0.4)
Aotus azarae	1.1 (2.2)	0.6 (1.2)	3.0 (5.2)	0.9 (1.8)	*	0.4 (0.8)	*	1.4 (7.4)
Saimiri boliviensis	*	0.7 (9.8)	-	-	0.2 (4.9)	-	-	*
Cebus apella	0.7 (8.3)	1.6(14.7)	1.3 (14.0)	0.9 (6.2)	1.5 (9.0)	0.6 (4.4)	1.2 (7.4)	0.8 (6.3)
Alouatta caraya	-	*	-	-	-	-	-	-
Alouatta seniculus	*	0.1 (0.3)	0.4 (1.8)	-	0.3 (1.2)	-	-	-
Ateles paniscus	0.2 (1.6)	0.1 (0.7)	1.8 (11.5)	0.3 (2.3)	*	0.1 (0.3)	0.1 (0.3)	0.1 (1.6)
Total Species	5	7	5	4	6	4	4	5
PBER (Kgs/10km)	38.2	57.2	148.2	37.2	36.5	15.3	23.5	37.1

* Species registered in off-transect conditions. PBER = Primate Biomass Encounter Rate

et al., 1998). The black howler monkey (*Alouatta caraya*) also appears to be restricted to certain habitats, mainly semideciduous forests. The restrictive use of habitats by this genus may be due to the floristic composition of the forests, and/or poor nutrient background of the soils, which may limit folivory as a dietary niche (Wallace *et al.*, 1998). These factors are certainly important in explaining variations in *Alouatta* abundance in lowland Brazilian Amazonia (Peres, 1997).

Apart from the presence or absence of *Saimiri* and *Alouatta* spp., primate community structure also varied in the relative abundances of the more widespread species: *Callithrix*, *Aotus*, *Cebus* and *Ateles*. Although encounter rates varied for *Callithrix*, they were rare at all sites, indicating low population densities for this region. The variations in *Aotus* encounter rates should be treated with some caution, as censuses were run during different phases of the moon at different sites. *Aotus* are more conspicuous around the full moon due to increased calling behavior (pers. obs.). *Cebus* encounter rates also varied and capuchins were the most commonly encountered diurnal primate at all visited sites. Previous studies have demonstrated a considerable adaptability in habitat use by *Cebus apella* and have suggested that this is linked to their generalist diet (Terborgh, 1983). This adaptability may account for their numerical dominance at the sites considered here.

Due to their superior body weight, spider monkey density variations account for much of the variation in overall primate biomass encounter rates. *Ateles* were infrequently encountered at most sites, suggesting that typically spider monkey population densities are relatively low for this region. Arroyo Chuchui features markedly high *Ateles* encounter rates and is characterized by the presence of rocky escarpments that result in a local diversity of forest habitats. Surveys conducted at Lago Caiman in Noel Kempff Mercado National Park (Wallace *et al.*, 1998) revealed a high primate biomass encounter rate (109.4 kg per 10 km censused) which was also due to increased *Ateles* encounter rates (see Table 3). Lago Caiman features a prominent quarzite escarpment, again resulting in local habitat diversity. We suggest that local habitat diversity provides an abundance of fruit resources at differing times of the year, resulting in increased *Ateles* densities. Phenology results and ranging patterns from a recent long-term autoecological study on *Ateles* at Lago Caiman support this hypothesis (Wallace, 1998).

Aside from these anomalies, it appears that primate biomass encounter rates are greater in the westernmost sites, which are either on or bordering the Beni alluvial plain. Surveys from other protected areas in lowland Bolivia support this generalization. The Beni Biosphere Reserve, situated *c.*190 km west of the western border of the Wildlife Reserve, in the Beni Department, has a high primate encounter rate of 72.8 kg per 10 km censused (see Table 3). Similarly, surveys in the nearby Chimane Forest revealed an even higher primate encounter rate (146.9 kg per 10 km censused), even though the larger primate species have suffered long-term hunting pressure. The Beni alluvial plain is also associated with higher densities, relative to the Brazilian Shield, of many terrestrial frugivores. This biogeographical variation is thought to be linked to the relative densities of important fruit resources such as figs and palms (Painter *et al.*, in prep.), which are particularly abundant on the Beni alluvial plain (FAN/PL480/WCS, 1994).

The most immediate threat to the Rios Blanco y Negro Wildlife Reserve is the logging industry. However, the survey results reported here are insufficient to draw conclusions about how much logging disturbance levels are affecting primate populations in this region. Comparisons between sites are problematic since pre-logging differences in primate abundance are unknown. In addition, accurate details regarding the history of logging activities at each site are difficult to obtain, and any differences could prove important when interpreting results. In any case, although spider monkeys, which have been identified as being particularly prone to habitat disturbance (McFarland Symington, 1988), were rarely encountered at many of the sites where logging activities were occurring (e.g., San Luis, Oquiriquia), this was not always the case (e.g., Arroyo Chuchui). Nevertheless, high-value timber populations have been greatly reduced and attention is switching to a number of potential secondary timber species. This will not only result in increasing extraction intensities and associated damage, but in addition many of these secondary species are important fruit trees for forest frugivores, for example, *Hymenaea courbaril*, *Spondias mombin*, *Ficus* sp., *Ampelocera ruizi* (Wallace and Painter, unpubl.). In the long term, significant reductions in the densities of important frugivore resources could prove limiting to wildlife populations.

Table 3. Diurnal primate encounter rates (per 10 km) for the Beni Biosphere Reserve, Bosque Chimanes, and Noel Kempff Mercado National Park.

	Beni Biosphere Reserve[1]		Bosque Chimanes[2]		Noel Kempff Mercado[3]	
Species	Group ER	Individual ER	Group ER	Individual ER	Group ER	Individual ER
Callithrix melanura	-	-	-	-	0.1	0.2
Saimiri boliviensis	0.6	20	1.7	36.4	-	-
Cebus apella	1.2	14.1	3.7	31.4	1.1	8.6
Alouatta seniculus	0.4	1.7	0.9	4.0	-	-
Ateles chamek	0.3	0.8	0.2	0.5	1.9	10.6
PBER		72.8		146.9		109.4

PBER = Primate Biomass Encounter Rate.

Source: Adapted from [1]Painter *et al.*, 1995, [2]Rumiz and Herrera, 1994 and [3]Wallace *et al.*, 1998

The surveys did uncover considerable evidence of hunting by logging crews and other employees. Logging-associated hunting threatens several wildlife species, most notably ungulates and cracids (Townsend *et al.*, in prep.). Although primates are rarely hunted by logging crews in this region (Solar, 1996), the most frequently taken species, *Ateles chamek*, is particularly sensitive to this activity due to its prolonged inter-birth interval and a low intrinsic rate of increase (McFarland Symington, 1988). Spider monkey juveniles also appear to be popular as camp pets, later to be sold in the markets of Santa Cruz (Wallace, pers. obs.). This results in a preference to hunt adult females, which further decreases the population's ability to recover. In terms of the logging industry, at present extraction intensities hunting probably has the most negative effect on larger wildlife species in lowland Bolivia (Rumiz *et al.*, in press; Townsend *et al.*, in prep.). Every effort must be made to enforce this aspect of the new law in the future.

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References

Anderson, S. 1997. Mammals of Bolivia - taxonomy and distribution. *Bull. Amer. Mus. Nat. Hist.* 231:1-652.

Anonymous. 1996. *Reglamento General de la Ley Forestal.* La Paz, Bolivia.

Branch, L. C. 1983. Seasonal and habitat differences in the abundances of primates in the Amazon (Tapajós) National Park, Brazil. *Primates* 24: 424-431.

Braza, F. and Garcia, J. E. 1988. Rapport preliminaire sur les singes de la region montagneuse de Huanchaca, Bolivie. *Folia Primatol.* 49: 182-186.

Brockelman, W. Y. and Ali, R. 1987. Methods of surveying and sampling forest primate populations. In: *Primate Conservation in the Tropical Rain Forest*, C. W. Marsh and R. A. Mittermeier (eds.), pp. 23-62. Alan R. Liss, New York.

Brown, A. D. and Rumiz, D. I. 1985. Distribución y conservación de los primates en Bolivia. Estado actual de su conocimiento. Unpublished report, New York Zoological Society, Bronx, NY.

Buckland, S. T., Anderson, D. R., Burnham, K. P. and Laake, J. L. 1993. *Distance Sampling - Estimating Abundance of Biological Populations.* Chapman and Hall, London.

Burnham, K. P., Anderson, D. R. and Laake, J. L. 1980. Estimation of density from line transect sampling biological populations. *Wildlife Monographs* 72. 202 Pp.

Emmons, L. H. and Feer, F. 1990. *Neotropical Rainforest Mammals: A Field Guide*, University of Chicago Press, Chicago.

FAN/PL480/WCS. 1994. *Plan de Manejo. Reserva de Vida Silvestre de Rios Blanco y Negro.* Santa Cruz, Bolivia.

Ford, S. M., 1994. Evolution of sexual dimorphism in body weight in platyrrhines. *Amer. J. Primatol.* 34: 221-244.

Garcia, J. E. and Tarifa, T. 1988. Primate survey of the Estación Biológica Beni, Bolivia. *Primate Conserv.* (9): 97-100.

Killeen, T. J., Garcia, E. and Beck S. G. (eds.). 1993. *Guia de Arboles de Bolivia.* Herbario Nacional de Bolivia & Missouri Botanical Garden.

Mate, C. and Colell, M. 1995. Relative abundances of forest cercopithecines in Ariha, Bioko Island, Republic of Equatorial Guinea. *Folia Primatol.* 64: 49-54.

McFarland Symington, M., 1988. Environmental determinants of population densities in *Ateles*. *Primate Conserv.* (9): 74-79.

Painter, R. L. E., Wallace, R. B. and Pickford, D. 1995. Relative abundances of peccaries in areas of different human pressures within the Beni Biosphere Reserve, Bolivia. *Ibex, J. Mountain Ecol.* 3: 49-52.

Peres, C. A. 1997. Effects of habitat quality and hunting pressure on arboreal folivore densities in Neotropical forests: A case study of howler monkeys (*Alouatta* spp.). *Folia Primatol.* 68: 199-222.

Rumiz, D. I. and Herrera, J. C. 1994. Mammal and large bird surveys in Bosque Chimanes. Unpublished Report, Wildlife Conservation Society, New York.

Rumiz, D. I., Giunart, D, Solar, L. and Herrera, J. C. In press. Logging and hunting in community forests and logging concessions: Two contrasting case studies in Bolivia. In: *Conserving Wildlife in Managed Tropical Forests: An Assessment of Logging Impacts and Options for Conserving Wildlife and their Habitat in Production Forests*, R. A. Fimbel, A. Grajal and J. G. Robinson (eds.). Columbia University Press, New York.

Siegel, S. and Castellan, N. J. Jr. 1988. *Nonparametric Statistics for the Behavioral Sciences.* McGraw-Hill International Editions.

Solar, R. L. 1996. Aprovechamiento de la fauna silvestre, y actividades de busqueda maderera en el Bajo Paragua. Unpublished thesis, Universidad Autonoma Gabriel Rene Moreno, Santa Cruz, Bolivia.

Terborgh, J., 1983. *Five New World Primates: A Study in Comparative Ecology.* Princeton University Press, Princeton, NJ.

Townsend, W. R., Solar L. and Rumiz, D. I. In prep. The impact on wildlife populations made by logging personnel in Bolivian tropical dry forests.

Wallace, R. B. 1998. The behavioural ecology of black spider monkeys in north-eastern Bolivia. Doctoral thesis. University of Liverpool, Liverpool, U.K.

Wallace, R. B., Painter, R. L. E., Taber, A. B. and Ayres, J. M.1996. Notes on a distributional river boundary and southern range extension for two species of Amazonian primates. *Neotrop. Primates* 4(4):149-151.

Wallace, R. B., Painter, R. L. E. and Taber, A. B. 1998. Primate diversity, habitat preferences and population density estimates in Noel Kempff Mercado National Park, Santa Cruz, Bolivia. *Am. J. Primatol.* 46: 197-211.