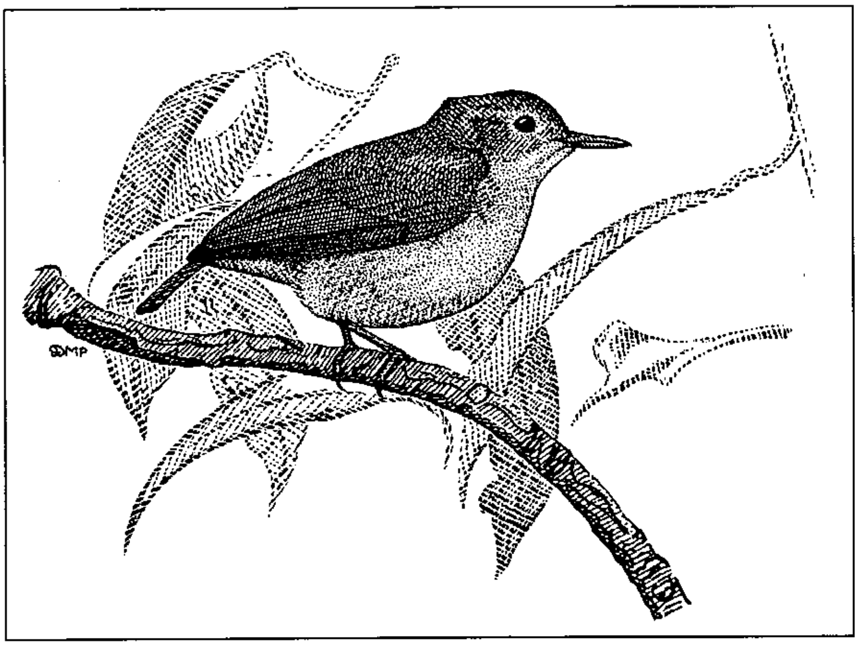
A Preliminary Investigation of the Ornithological Importance of Parque Nacional Carrasco, Cochabamba Department, Bolivia



Final Report of the '*Threatened Birds of the Bolivian Yungas 1998*' project

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Bolivia 1998 : Threatened Birds of the Bolivian Yungas

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Bolivia 1998: Threatened Birds of the Bolivian Yungas

Marianne Dunn
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September 20, 2001

Dear Marianne,

Please find enclosed a copy of the final report of the Threatened Birds of the Bolivian Yungas 1998 project. I am sorry for the delay in submitting the report but hope you find the report of interest. Please also let me know if you wish to have any copies of photographic material (birds, sites etc) for you archives.

On behalf of the members of the project, we would like to thank the BP Conservation Programme for generously supporting the project. Without this support the project would have been less effective.

Yours sincerely

Allan

Allan Mee
Bolivia 1998: Threatened Birds of the Bolivian Yungas

Final Report: Bolivian Yungas 1998

Compiled by Allan Mee, June 2001

Section on Parque Nacional Cotapata by R. Denny
Netting data by K. Fairclough

Contents

Cover: Yungas Antwren *Myrmotherula grisea*, Río Sajta, by D. M. Pullan

With the support of:

- BP/BirdLife/Fauna & Flora International Conservation Programme
- Glasgow University Court
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- Karen Hassen Trust
- Glasgow Natural History Society
- World Pheasant Association
- David Shepherd Conservation Foundation
- Royal Naval Birdwatching Society
- IUCN/BirdLife/WPA Cracid Specialist Group

In collaboration with:

- Coleccion Boliviana de Fauna, La Paz, Bolivia
- Parque Nacional Carrasco, Cochabamba, Bolivia

Executive Summary

Humid foothill and montane forests on the eastern slope of the Andes are home to some of the greatest diversity of terrestrial organisms in the world. Such forests also hold a disproportionate number of bird species that are threatened or have extremely small breeding ranges. Thus, the eastern Andean slopes are an extremely high priority for conservation. Such forests, known as 'yungas' forest in southern Peru, Bolivia and northern Argentina, are, characteristically, extremely steep and wet montane and sub-montane evergreen forest, with lower elfin forest on exposed ridges and at upper levels near the treeline. Yungas forest occupies an elevational zone between the lowland forest of Amazonia and the upper montane puna grassland of the highlands.

As the "Threatened Birds of the Bolivian Yungas" project, we carried out fieldwork from August-October 1998 in within one of the key areas for birds in the Bolivian yungas: Parque Nacional Carrasco (PNC), Chaparé Province, Cochabamba Department. Fieldwork was mainly confined to two areas, the montane and foothill forests of the Serranía de Callejas (800-1850m) in the north-west of the park, and the Río Leche area (500-950m) in the north-east of the park. Brief visits were also made to upper montane forest in the Serranía de Callejas (2000-2300m) and foothill forest along the Río San Mateo (600-900m). In addition to fieldwork at PNC, short periods were spent in the Chulumani valley (1580-2050m) and Parque Nacional Cotapata (1550-2200m). Our primary aim was to determine the status of species of conservation concern within PNC, specifically those considered to be globally threatened, near-threatened or those having restricted breeding ranges. Further, we planned to gather information on behaviour, habitat associations and potential threats to these key species. Finally, we aimed to gather baseline data on all forest-dependant species within the Yungas.

Located to the east of Cochabamba City, the park holds substantial tracts (622,600ha) of humid montane and sub-montane forest as well as areas of puna grassland above the treeline. PNC also adjoins another substantial protected area, Parque Nacional Amboró (180,000ha) in Santa Cruz Department, at its eastern boundary. Together,

both parks constitute one of the most extensive contiguous stretches of formally protected humid Andean forest. PNC comprises part of the Bolivian and Peruvian Lower and Upper Yungas Endemic Bird Areas (EBAs 054 & 055 respectively) and is a prospective Important Bird Area (IBA), holding at least four of the five globally threatened species confined to the lower (EBA 054) and upper Yungas (EBA 055).

The major finding of the project was the location of a population of the globally threatened Horned curassow *Pauxi unicornis* in the Río Leche area of north-eastern PNC. Several birds were recorded calling in early-mid October from 580-955m, the upper limit of the Río Leche survey area. A single bird was also flushed from the ground during surveys. This finding confirms the existence of *Pauxi* within PNC, one of only two protected areas from which the species is known in Bolivia. Further surveys are likely to reveal other populations of the species with PNC. Another significant discovery was that of a single female Yungas *antwren Myrmotherula grisea*, a threatened Bolivian endemic. This bird was located at 345m, in disturbed lowland forest, just outside the boundary of PNC. This elevation is the lowest at which the species has been recorded and suggests *the M. grisea* may occasionally occur in lowland forest along the base of the Andes. Three other threatened birds known from the Bolivian yungas, the Bolivian Recurvebill *Simoxenops striatus*, Yellow-rumped Antwren *Terenura sharpei*, and Scimitar-winged Piha *Lipaugus uropygialis*, were not found during this survey, although two (*S. striatus* and *L. uropygialis*) have been recorded along the boundary or just within PNC.

Several other species of conservation concern were recorded, including the restricted-range Striped faced Wood-Quail *Odontophorus balliviani*, White-throated Antpitta *Grallaria albigula*, Rufous-faced Antpitta *Grallaria erythrotis*, Hazel-fronted Pygmy-tyrant *Pseudotriccus simplex*, Yungas Tody-tyrant *Hemitriccus spodiops*, Unadorned Flycatcher *Myiophobus inornatus*, Yungas Manakin *Chiroxiphia boliviana* and Straw-backed Tanager *Tangara argyrofenges*. Other noteworthy species recorded included Fasciated Tiger-Heron *Tigrisoma fasciatum*, Solitary Eagle *Harpyhaliaetus solitarius*, Black-and-white Hawk-Eagle *Spizastur melanoleucus*, Black-and-chestnut Eagle *Oroaetus isidori* and Scarlet-breasted Fruiteater *Pipreola frontalis*. Several species had not previously been reported from Cochabamba Department, including Ornate Hawk-eagle *Spizaetus ornatus*, White-throated Hawk *Buteo albigula*, Crested Owl

Lophostrix cristata, Striped Owl *Rhinoptynx clamator*, Collared Trogon *Trogon collaris*, White-necked Puffbird *Notharchus macrorhynchus*, Long-tailed Woodcreeper *Deconychura longicauda*, Gray-throated Leaftosser *Sclerurus albigularis*, Mottle-backed Elaenia *Elaenia gigas* and Olive-striped Flycatcher *Mionectes olivaceus*. The little known Lanceolated Monklet *Micromonacha lanceolata* was also recorded from Parque Nacional Cotapata, La Paz Department. This was the third record of this puffbird in Bolivia and is the most southerly report of the species to date.

The results of this project, the first such study in PNC, confirm the importance of the park as a key site for bird species of conservation concern. PNC is one of only two protected areas known to hold the globally threatened *Pauxi unicornis*. Further survey work is likely to reveal the presence of other threatened species. Although much of the montane and foothill forest within PNC remains pristine, threats to the integrity of the forest are increasing. Extensive forest clearance has been ongoing for some years along the northern boundary of the park. In 1998, forest clearance in the Río Leche-Valle Sajta area just north of PNC had reached to within 100-200m of the boundary (500m.a.sl), and some illegal tree-felling had occurred within the park. All lowland forest outside PNC, in this area, was either heavily degraded or cleared. In the El Palmar area in the north-west of the park, some small-scale cultivation was observed within forest just inside the park boundary. Further, mining and water-extraction operations occur within the park. Although the southern side of PNC was not visited, recent problems with settlers within the park have resulted in the park boundaries being redrawn and, consequently, a reduction in the area of the park. Further, the small number of park-guards (14) means that the ability of park authorities to patrol the park boundaries and monitor activities within PNC is severely limited.

Despite these ever-increasing threats, PNC has the potential to safeguard a substantial area of the yungas forest within Cochabamba Department and ensure the existence of populations of species of conservation concern such as *Pauxi unicornis*. Important efforts are being made by park staff to communicate with settlers and encourage respect for forest resources. Such efforts should be urgently supported to prevent or minimise further forest degradation and loss within the park. A priority should also be placed on the recruitment of more park guards.

Conclusions and Recommendations

As "Threatened Birds of the Bolivian Yungas", we carried out ornithological surveys within the yungas forest zone of PNC. Most importantly, we located a population of the globally threatened Horned curassow *Pauxi unicornis* within the park, confirming PNC as one of two protected areas known to hold populations of this cracid in Bolivia. Further work is needed to establish the density and extent of populations of *Pauxi* within PNC. Only a single individual of the threatened Yungas antwren *Myrmotherula grisea* was located (and none inside the park). Intensive studies are needed to confirm or reject the hypothesis that *M. grisea* is extremely rare within its range. Likewise, searches for the other threatened yungas species, the Bolivian Recurvebill *Simoxenops striatus*, Yellow-rumped Antwren *Terenura sharpei*, and Scimitar-winged Piha *Lipaugus uropygialis* are needed.

As well as further work at sites visited in this preliminary study, other parts of PNC should be investigated. Further, urgent survey work is needed in the biologically unexplored Cordillera de Mosetenes, also in Chaparé Province. Mosetenes holds an extensive area of montane and sub-montane forest to the north and west of PNC and is likely to hold many bird species of conservation concern. The area is however the centre for the illegal production of cocaine making survey work risky at present. As well as birds, work on other little-studied taxonomic groups should be encouraged.

Following this preliminary investigation, we recommend that, in the immediate to mid-term, ornithological projects in PNC should aim to:

- Relocate and determine estimate populations densities of *Pauxi* in the Río Leche and other areas.
- Identify habitat associations of *Pauxi* and the timing of breeding within PNC.
- Search for populations of other threatened yungas endemics such as *S. striatus*, *M. grisea*, *T. sharpei* and *L. uropygialis*.
- Investigate the avifauna of the upper montane zone of PNC (1800-timberline).

Our results confirm that PNC is a very high priority site for conservation in Bolivia. Future ornithological surveys and studies on other taxonomic groups are likely to enhance this status. However, threats to the integrity of yungas forest within the park are growing and there is an urgent need to consolidate the park boundaries and control forest degradation (see Threats and Conservation Opportunities). Such efforts have already resulted in conflict between settlers and park authorities on the south side of PNC. Nevertheless, such efforts are vital if the park is to have a real future as an effectively protected area. On this basis, we recommend that:

- More park guards should be deployed in all the key areas (i.e., settlements near the park boundary and access routes into the park).
- The park boundary should be well defined in order to quantify and control incursions into the park (already the case in the Río Leche area).
- The park boundary should be redefined to include the Valle de la Luna geophagy site, an important resource for psittacines in the Valle Sajta/Río Leche area (see Appendix 5).
- Increased support should be given to park guards to engage with local people in an educational role, emphasising the need for forest conservation and its value to local communities.
- Park guards should be able to identify key species such as *Pauxi* (especially by call) and should be trained in standard and repeatable faunal survey methods.
- The ecotourism potential of the park should be promoted to a greater degree as a means of funding the park. Where possible, local people should be employed in such ventures, either as guides, cooks or helpers, thus increasing the value of the park to local people.

Organisation Profiles

Colección Boliviana de Fauna:

Colección Boliviana de Fauna (CBF) was created in 1989 by agreement between the Natural History Museum, (Museo Nacional de Historía Natural) and the Institute of Ecology at the University of San Andres, La Paz. CBF contributes to the understanding and conservation of Bolivian fauna though scientific investigation and environmental awareness. At present, CBF is carrying out long-term studies on birds in the La Paz valley.

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Parque Nacional Carrasco (PNC):

The Headquarters of PNC are located next to the University (Universidad Mayor de San Simon) in Cochabamba city (see address below). Park guard stations are located at Guacharos, Sajta, Israel and Nueva Ichoa along the northern boundary of the park, at Incachaca at the western edge of the park and at Suehencas in the southern part of the park (see Fig. 1). Permission to enter the park and carry out research must be sought from the park authorities, the latter normally in collaboration with a Bolivian NGO or university research group.

Ivan Cesar Davalos, Director, Parque Nacional Carrasco
José Vega Canedo, Jefe de Guarda Parques (Head of Park Guards)
Ministerio de Desarrollo Sostenible y Medio Ambiente
PNC Office: Julian María López N° 1194, Ciudad de Cochabamba, Bolivia
Post: Casilla (P.O. Box) 4633, Ciudad de Cochabamba, Bolivia.

Glasgow University Exploration Society:

Glasgow University Exploration Society is a voluntary society bringing together researchers and students from a wide range of disciplines, mostly from the earth and life sciences. The aim of the Society is to promote and encourage student groups to formulate and carry out research projects out-with the UK, usually in collaboration with students from host country institutions. Projects endorsed by the Society have carried out research projects as diverse as the long-term population monitoring of turtles in Cyprus, studies of tree-frog surface adhesion, etc.

Glasgow University Exploration Society
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Threatened Birds of the Bolivian Yungas 1998: Participants

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Rebecca Denny (MSc): Sutherland, Scotland.
Alison Devey: University of Glasgow, Scotland.
Heather Duguid: University of Glasgow, Scotland.
Tim Fawcett (BSc): University of Bristol, Scotland.
Keith Fairclough (BSc): Royal Society for the Protection of Birds, Orkney, Scotland.
Dan Gates (BSc): University of Glasgow, Scotland.
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Aidan MacCormack: University of Glasgow, Scotland.
Miguel Marzo: University of Glasgow, Scotland.
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Dave Pullan: Professional bird artist and tour guide, Strathspey, Inverness-shire.
Cadi Schiffer: University of Glasgow, Scotland.
William Boyd-Wallis (BSc): John Muir Trust, Sutherland, Scotland.

Participants joined the project for varying lengths of time over a three-month period (early August to late October 1998).

Acknowledgements

The project benefited from the help and encouragement of several people in the U.K., Bolivia and elsewhere. Ivan Cesar Davalos, Director of PNC, gave us permission to work in Carrasco. Jose Vega Canedo, Jefe de Guarda Parques, PNC, assisted us before and during fieldwork in the park, with advice and suggestions. Our Bolivian counterparts, Colección Boliviana de Fauna, and in particular Carmen Quiroga (Ornithology) and James Aparicio Effen (Director), helped us greatly in setting up the project, negotiating the necessary permits, finding us a vehicle and much more. Bennett Hennessey, IBA program co-ordinator at Fundación Armonía, gave us much expert help and advice. Sebastian Herzog and Michael Kessler gave us invaluable help at the pre-expedition stage and were instrumental in directing us to areas most in need of baseline fieldwork. David Wege, Americas Officer at the BirdLife Secretariat, also gave us much needed help. We are especially indebted to Richard Ranft at the National Sound Archive, London, for the loan of sound-recording equipment. Andrea Priori, Laboratory of Natural Sound at Cornell, provided us with some valuable recordings. Finally, we wish to acknowledge the invaluable assistance of the PNC Park Guards, in particular Nico (Guacharos, El Palmar) and Pedro (Israel/Valle Sajta).

We are also grateful to Sra. Lupe Andrade, Director of La Paz City Council, for her enthusiasm and interest in the project and for letting us stay at Estancia Marchcamarca, Chulumani. We would also like to acknowledge the hospitality of Sr. and Sra. Portugal during our visits to the Apa-Apa forest.

Last but not least, we are most grateful to our funding bodies: the BP/BirdLife/Fauna & Flora International Conservation Programme, the Carnegie Trust for the Universities of Scotland, the Royal Geographical Society, the Explorers Club of New York, the Albert Reckitt Trust, the Cross Trust, the Karen Hassen Trust, the David Shepherd Conservation Foundation, the Gilchrist Educational Trust, Glasgow Natural History Society, Glasgow University Court, the World Pheasant Association and the Royal Navy Birdwatching Society. Aerolineas Argentinas and Subbuteo Books generously gave us discounts on flights and field guides respectively.

Overview

Introduction

With some 3,600 species, 39% of the world's avifauna, found on just 16% of the world's land area, the Neotropics are home to the greatest bird diversity on earth (Wege & Long 1995). However, some 850 (24%) species (c980 species including the Caribbean islands) have been identified as having restricted ranges, breeding ranges of less than 50,000km^2 (Stattersfield *et al* 1998), with more than 600 (17%) listed as national endemics (Wege & Long 1995). Further, some 320 species (33%) occurring in the Neotropics are considered to be at risk of extinction (Collar *et al* 1992, BirdLife International 2000).

Bolivia, with nearly 1,400 species recorded, has one of the most diverse avifaunas in the Neotropics despite being entirely land-locked (Remsen & Traylor 1989; Armonía 1995). Of these species, 61 (4%) have restricted ranges and 27 (2%) are considered to be globally threatened (BirdLife International 2000). A further 36 species are considered to be near-threatened, being close to meeting the criteria set for classification as threatened species (BirdLife International 2000). In Bolivia as elsewhere in the Neotropics, habitat destruction or degradation is the major causal factor resulting in the threatened status of many bird species. Trapping for the wild-bird trade and overhunting are additional threats to psittacines (macaws and parrots) and cracids (chachalacas, guans and curassows) in particular (Silva & Strahl 1991; Brooks & Strahl 2000; Wright *et al* 2001).

Setting global priorities for bird conservation

The major overriding factor affecting the conservation status of threatened bird species is habitat loss or alteration (Collar *et al* 1997; BirdLife International 2000). Further, most threatened birds (75%) are affected by the destruction or degradation of tropical forests (BirdLife International 2000). The unsustainable exploitation of forest resources and loss of forest cover resulting from commercial logging and increased human settlement following road-building programmes, have been instrumental in this process. Thus, in terms of threats to bird species, logging and forest clearance for agriculture are the primary causes of loss of forest cover affecting threatened species (BirdLife International 2000). Alarmingly, the rate of forest clearance has accelerated dramatically during the latter half of the 20th century (Whitmore 1997; Laurance 1998).

Despite the widespread and increasing nature of such threats, the concentration of threatened and restricted-range bird species in "hotspots" presents real opportunities for species conservation (Stattersfield *et al* 1998; Myers *et al* 2000). Moreover, congruence between hotspots for birds and those of other taxonomic groups suggests that birds may be good indicators of priority sites for conservation (Balmford & Long 1995; Long *et al* 1996). Establishing and effectively managing protected areas is considered the major priority for the conservation of threatened bird species (BirdLife International 2000). Thus, identifying areas of importance for threatened and restricted-range bird species is fundamental to achieving this goal.

Defining hotspots for globally threatened and restricted-range bird species has been an important first step in setting priorities for conservation effort. Recently defined criteria have provided a framework within which to identify areas of particular importance for species of concern to conservation. Important Bird Areas (IBAs) are defined as areas "*of global importance for threatened species, species with restricted ranges, biome-restricted species and species exposed to danger by virtue of their congregationary habits*" (Stattersfield *et al* 1998). IBA inventories are being carried out in Bolivia at the moment with the aim of identifying a national network of sites critical for the conservation of these species and their habitats. Endemic Bird Areas (EBAs) hold "*at least two restricted-range bird species, and thus represent areas where global extinctions are likely to occur unless the integrity of habitat can be guaranteed*" (Stattersfield *et al* 1998). A global inventory of EBAs has recently been published by BirdLife International (see Stattersfield *et al* 1998) and provides a definitive baseline for conservation action based on such hotspots for endemism.

The Yungas

The slopes of the Andean chain hold the greatest concentrations of endemic bird species within South America (Stattersfield *et al* 1998). Humid foothill and montane forests on the eastern slope of the Andes are also home to some of the greatest diversity of terrestrial organisms in the world (Remsen & Parker 1995). Such forest, known as Yungas in south-east Peru, Bolivia and Argentina, is a characteristic vegetation zone of the eastern slopes of the Andes, from 500-3700m in elevation. However, in southern Bolivia, yungas forest is confined to a much narrower elevational band between 1500 and 2500m (Schulenberg *et al* 1998). Much of the Bolivian yungas is wet montane and sub-montane evergreen forest with a profusion of moss and epiphytes, especially at higher altitudes (Remsen 1985). The slopes of the yungas are usually extremely steep with occasional landslides creating open areas in the forest. Ridges are often narrow, with vegetation usually associated with cloud forests of the upper montane zone occurring at lower elevations.

At its upper limits near the treeline, yungas forest merges into lower, stunted forest and shrubs before giving way to the puna grasslands. In the puna zone of the highlands, the climactic conditions become drier again and fires set by villagers in the highlands burn increasingly lower downslope in some areas. This may have dramatic effects on scrub and forest habitats by lowering the treeline and preventing regeneration (Kessler & Herzog 1998). As a consequence of this, populations of birds restricted to this upper forest zone may be greatly reduced and fragmented (Kessler & Herzog 1998). This appears to be the case in northern Cochabamba and the Cordillera de Mosetenes in particular, where settlements are located above the treeline (S. Herzog pers. comm.). Thus, the integrity of this important forest zone and its characteristic avifauna is under threat from human activity and degradation at both its upper and lower limits.

All or most of the yungas forest zone is represented within three EBAs, the Bolivian and Peruvian lower yungas (EBA 054), the Bolivian and Peruvian upper yungas (EBA 055) and the Argentine and south Bolivian yungas (EBA 057; see Stattersfield *et al* 1998). EBA 054 extends from Madre de Dios Dept. in south-east Peru, through the Depts. of La Paz, Cochabamba and Santa Cruz to north-east Chuquisaca, Bolivia.

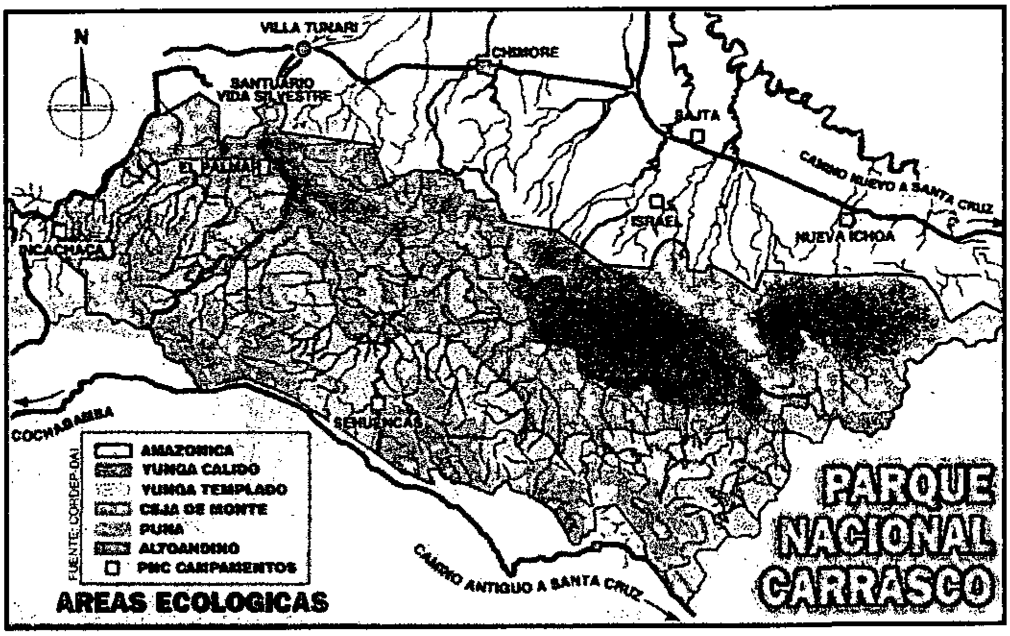
Yungas forest in this EBA ranges from 400-2000m, but occasionally higher, overlapping with EBA 055 at its upper limit (Stattersfield *et al* 1998). EBA 055 extends from north-western Cuzco Dept., Peru, to western Santa Cruz Dept., Bolivia, with forest between 1800m and 3700m. EBA 057 extends from northern Chuquisaca and extreme south-west Santa Cruz Dept., Bolivia, south through to La Ríoja Province in north-west Argentina. Yungas forest in this EBA ranges between 800m and 3100m with Andean alder *Alnus acuminata* and *Podocarpus* dominating at higher altitudes (Stattersfield *et al* 1998).

Parque Nacional Carrasco: ornithological importance

Located to the east of Cochabamba city in western central Bolivia (Fig. 1), Parque Nacional Carrasco (PNC) covers some 622,600 hectares from the lowlands to 4500m along the eastern slopes of the Andes (Ergueta & Gómez 1997). The park holds substantial tracts of montane and lower tropical rainforest and on its present standing ranks as an Important Bird Area for threatened birds in Bolivia, holding at least four of the five globally threatened species occurring in EBA 054 and 055 (Table 1). In addition, PNC is one of only two protected areas in Bolivia, along with Parque Nacional Amboró in Santa Cruz Dept., known to hold populations of the threatened Horned curassow *Pauxi unicornis* (Herzog & Kessler 1998). Indeed the type-specimen of *Pauxi* appears to be have been located just inside the present boundary of PNC (Bond & Meyer de Schauensee 1939). One threatened species yet to be recorded in PNC, the endangered Yellow-rumped antwren *Terenura sharpei*, was found in 1979 in Chaparé province to the north of the park (Wege & Long 1995). Collar *et al* considered it likely that *T. sharpei* does occur in PNC and, if so, the park may constitute the southerly limit of the species range.

In terms of bird conservation priorities, the most important species known from the PNC are *P. unicornis*, *S. striatus*, *M. grisea* and *L. uropygialis* (Table 1). Cracids are the most important bird family in the Neotropics for subsistence hunters, both in terms of absolute numbers and biomass (Silva & Strahl 1991). Given the large number of settlers located along access routes into the park along the northern boundary, hunting pressure on *Pauxi* is likely to have a detrimental effect on any populations occurring

Fig.1 Parque Nacional Carrasco, Cochabamba Department, Bolivia, showing major life zones and location of park-guard stations (PNC campamentos).



within a few kilometres of roads or settlements. Bolivia ranks as the fourth most important country (after Brazil, Columbia and Peru) in terms of cracid conservation priorities in the Neotropics (Brooks & Strahl 2000) while *P. unicornis* is considered vulnerable (BirdLife International 2000) and a very high priority for conservation action (Brooks & Strahl 2000). Apart from *P. unicornis*, further work is also urgently needed to determine the conservation status of other threatened bird species within PNC as well as that of other taxa of conservation concern (see Baillie & Groombridge 1996).

Parque Nacional Carrasco: previous biological exploration

Prior to this study there had been few intensive efforts to compile an inventory or quantify bird populations within PNC. Palmar (presumably El Palmar) in the north-west of the park was the site of an old collecting locality (Wege & Long 1995). Apart from *Pauxi unicornis* (Bond & Meyer de Schauensee 1939), *Simoxenops striatus* and *Myrmotherula grisea* were also collected at the El Palmar site (Wege & Long 1995). More recently, Herzog (1998) recorded 155 bird species at the Río Colomelin near the

Table 1. Forest dependant restricted-range bird species known from the Yungas of Cochabamba, recorded or likely to occur in Parque Nacional Carrasco (excluding some restricted-range species largely confined to timberline habitats).

Species	Status	Elevation (m)	Habitat
Stripe-faced woodquail *Odontophorus balliviani*	lc	2,000-3050	montane forest
Horned curassow *Pauxi unicornis koepckeae*	Vu	450-1200	foothill and montane forest
Hooded mountain-toucan *Andigena cucullata*	lc	2500-3300	montane-cloud forest canopy
Bolivian recurvebill^{E}* *Simoxenops striatus*	Vu	670-1100	undergrowth, vine tangles to low-canopy level
Upland antshrike *Thamnophilus aroyae*	lc	800-1700	forest borders, undergrowth
Yungas antwren^{E} *Myrmotherula grisea*	Vu	600-1650	forest, secondary forest
Yellow-rumped antwren *Terenura sharpei*	En	1100-1680	forest borders, canopy
Rufous-faced antpitta^{E}‡ *Grallaria erythrotis*	lc	2000-3050	forest borders, gaps
White-throated antpitta *Grallaria albigula*	lc	800-1700	forest, forest borders
Hazel-fronted pygmy-tyrant** *Pseudotriccus simplex*	lc	1300-2515	undergrowth, forest borders
Yungas tody-tyrant^{E} *Hemitriccus spodiops*	lc	800-1600	forest borders, clearing and landslide gaps
Bolivian tyrannulet *Zimmerius bolivianus*	lc	1000-2600	forest borders, canopy, secondary forest
Unadorned flycatcher *Myiophobus inornatus*	lc	1000-2000	low-mid canopy, forest borders
Rufous-bellied bush-tyrant *Myiotheretes fuscorufus*	lc	1900-2900	forest borders, secondary forest, understorey
Yungas manakin *Chiroxiphia boliviana*	lc	650-2150	forest shrub and understorey
Scimitar-winged piha† *Lipaugus uropygialis*	Vu	1800-2575	forest, forest borders
Orange-browed hemispingus *Hemispingus calophrys*	lc	2300-3350	bamboo thickets, forest edge
Slaty tanager *Creurgops dentata*	lc	1500-2150	forest, forest borders
Straw-backed tanager *Tangara argyrofenges*	lc	1,300-1,700	forest, forest borders

Species: Endemic to Bolivia (E). Status: Endangered (En), Vulnerable (Vu); least concern (lc).
Source: Parker *et al* (1996), Ridgely & Tudor (1989; 1994), Stattersfield *et al* (1998), unless stated.
**Simoxenops striatus*: Elevational range 670-900m in Stattersfield *et al* (1998) but recorded from 1080-1090m by Whitney *et al* (1994).
‡*Grallaria erythrotis*: Range Cochabamba-St. Cruz in Stattersfield *et al* (1998) but several specimens from La Paz Dept. (Remsen *et al* 1982).
***Pseudotriccus simplex*: Elevational range 1300-2000m in Stattersfield *et al* (1998) but recorded from 2515m in Serranía de Siberia, St. Cruz Dept. (Whitney *et al* 1994).
†*Lipaugus uropygialis*: Range Cuzco-La Paz in Stattersfield *et al* (1998) but recorded from Cochabamba Dept. in 1977, also specimen Locotal, Cochabamba Dept. (Remsen *et al* 1982).

north-east boundary of the park. Occasional visits have also been made by birders and bird-tour guides to sites along the old Cochabamba-St. Cruz road above the community of El Palmar in the north-west of the park (S. Herzog & B. Hennessey pers. comm.). An ongoing study involving researchers from the University of Leicester (U.K.) and the Universidad Mayor de San Simon at Cochabamba, is attempting to relate bird diversity within PNC with habitat features on a landscape scale using satellite imagery (A. Millington pers.comm.). Most recently, further work is being carried out on the newly discovered population of *P. unicornis* in PNC as a follow-up to the findings of this project (MacLeod & Duguid 2000).

The importance of PNC for most other major vertebrate taxa apart from birds appears to be less well known and an intensive assessment of other vertebrate and invertebrate groups apart is needed to determine the importance of PNC from a broader biological perspective.

Threats and conservation opportunities

PNC was designated a National Park in 1991, thus protecting a substantial area (622,600ha) of foothill and montane forest in the Yungas of Cochabamba. Along with the adjacent Parque Nacional Amboró (180,000ha), St. Cruz Dept., the two parks constitute the most important area of contiguous yungas forest yet to be formally protected. Both PNC and Amboró form part of a proposed Important Bird Area. Importantly, PNC (four sites) and Amboró (two sites) hold all the known populations, both historic and extant, of the globally threatened *P. unicornis* in Bolivia (see Table 4). Thus, maintaining the integrity of the yungas forest of both parks will help protect the most important known populations of this cracid (perhaps the 'core' population *of P. u. unicornis*), as well as other threatened bird species such as *Simoxenops striatus* and *Myrmotherula grisea.*

Threats to the integrity of both PNC and Amboró are, however, nor inconsequential. Since its designation in 1991, PNC has had part of its northern boundary redrawn some kilometres to the south following extensive forest clearance by newly arriving settlers. In the Israel-Río Leche Area in the north of the park, almost all lowland forest to the north of the present park boundary had been cleared for agriculture or heavily degraded by the time of our visit in 1998. Forest clearance had advanced to within 100m of the park boundary to the west of the Río Leche and some small-scale, illegal logging was recorded just inside the park in this area. Commercial timber removal was also recorded between the settlement at Israel and the Río Leche, outside the park. Several newly cleared and still burning areas of forest were also observed in this area. While the rate of forest clearance was impossible to assess (without repeated visits), given the contraction to the south of the park boundary, the still active forest clearance in progress during our brief visit and the number of settlers in the Sajta-Israel area, forest destruction is likely to have been fairly rapid.

In the El Palmar area, communities have been longer established and settlers are present at and near the park boundary. We noted small forest patches cleared for agriculture within the park and much of the forest near the access road (the old St. Cruz-Cochabamba road) at and just inside the park boundary (to 900m) was regenerating secondary forest. Within the park, the only other human activity noted was the small mining operation above Limbo (c2200m a.s.l), several kilometres into the park. Hunters were rarely encountered (mostly miners) although this is likely to be much greater near settlements, where we spent little time. Several cleared trails were found in the forest above El Palmar suggesting that the level of hunting may be greater that we detected. Moreover, moderate to large sized mammals known to be important to subsistence hunters were rarely encountered (see Appendix 5).

Although no settlers are at present living permanently within PNC in the north, at least in the areas we visited, this is not the case in the south of the park. The settlement at Suehencas has been present prior to the establishment of the park and is the site of a park guard station (Fig. 1). In 1998, we were advised not to visit the area, due to tension between the communities there and park authorities. Although we do not know what the basis for this conflict is, it is undoubtedly related to land use within the park. The compatibility or otherwise of humans (whether indigenous or recent settlers) living within protected areas with the objectives of habitat and species conservation has long been controversial (e.g., Redford & Stearman 1993; Peres & Terborgh 1995; Schwartzman *et al* 2000). One possible outcome of this conflict may be a further redrawing of the park boundary on the south side, presumably to exclude areas that are now heavily settled and degraded. Such a continual contraction in the area of PNC due to encroachment by settlers mirrors the situation at Parque Nacional Amboró where degradation by settlers along the parks boundary resulted in a reduction in the area of the park.

A key question, therefore, is whether PNC can maintain the integrity of its boundary and forest cover, especially where roads allow access to settlers? As well as monitoring activities with PNC, park guards are employed to cut and clear a boundary-line along the northern boundary of the park (at least this is the case in the Israel-Río Leche Area). This provides a means by which park-guards and locals can identify the limits of the park in situ and allows guards to locate any incursions. Delineating a clear boundary on the ground (as well as on paper) is likely to be critical where human encroachment occurs. The ability of PNC to maintain its boundaries is, however, severely limited by the shortfall in park guards (just 14 in the whole of PNC in 1998). Despite this, important efforts are being made by park staff to engage with settlers within the park and at the park boundaries. Moreover, an ongoing programme of education as to the objectives of biodiversity conservation, and the long-term value of maintaining forest cover and animal populations within the park to local people themselves, will play a crucial role in the effectiveness of PNC as a biological entity.

Outwith PNC, the potential remains for extending the area of yungas forest in Cochabamba Dept. under formal protection, particularly in those areas as yet largely unsettled. The Cordillera de Mosetenes, a continuation of the eastern Andean foothills to the north-west of the western boundary of PNC in Chaparé province, holds extensive areas of yungas forest and remains biologically unexplored (S. K. Herzog pers. comm.). It seems likely that most or all the species of conservation concern found in the yungas zone (Table 1) occur in the Cordillera de Mosetenes, and the area should be an urgent priority for future baseline survey and research work. However, the area is also a centre for the production of cocaine and is patrolled by the Bolivian Army, along with personnel from the US Drug Enforcement Agency, based at Chimore. In 1998, we were advised against visiting the area for our own safety. Should the situation improve however, fieldwork should be possible in the area.

Threatened Birds of the Bolivian Yungas 1998: aims of the project

The aims of the project were developed largely in response to the lack of information on bird species of concern to conservation in the yungas and the ever-increasing threats to species and ecosystems posed by the rapid scale of habitat destruction in the eastern foothills of the Andes. Our primary aim was to locate and investigate the status of globally threatened and restricted-range bird species in PNC. Second, we planned to collect data on the species behaviour and make initial assessments of the species habitat associations. Finally, we aimed to gather baseline data on all forest birds with an emphasis on those of conservation concern.

Technical report

Methods: summary
ornithological fieldwork
PNC: study area summary
access and sites

Methods

Summary

Fieldwork was carried out at three main sites in PNC (see study area summary) between August 7 and October 8 1998. Brief periods were also spent at two sites in La Paz Dept., at Chulumani (October 13-18) and Parque Nacional Cotapata (October 22-27). Preliminary data were collected on species of conservation concern under the constraints of time, accessibility and difficulties in locating species that occur at low densities. Target species were searched for in the course of general fieldwork. However, where possible, playback of pre-recorded tapes was used to try and detect some of these key species. To gain qualitative information of bird species diversity, we used annotated Mackinnon lists (Mackinnon & Phillips 1993) as well as information from casual observations. We used standardised methods (point counts) of estimating the relative abundance or densities to generate quantitative data on bird populations. In addition, we made sound-recordings to aid in species identification and carried out mist-netting where time permitted. Mist-netting was used to provide a qualitative assessment of the composition of the terrestrial-understorey avifauna, with particular emphasis on species that might otherwise go undetected.

Ornithological fieldwork

Species lists: When collecting data for species lists, we followed the methods outlined in Poulsen *et al* (1997). We used 20 species lists at two sub-sites in the Serranía de Callejas (one centred on a camp at 1200m and the other at 1590m). Time was too short to complete sufficient lists at the Río San Mateo site, while 10-species lists were used at the Río Leche site (500-950m) because of the length of time taken to accumulate enough species to complete lists (indicating a lower species diversity at this site). Cut transects, already existing trails and a disused road (the old Cochabamba-St. Cruz road in the Serranía de Callejas) were used to compile lists. Forest-based lists (transects and trails) were kept separate from edge-lists (road) to compare these two 'habitats' in terms of species diversity and composition. Most lists were compiled in the early morning (0530-0800hrs) when birds were most active and vocal and thus, more easily detected, but also late afternoon (1530-1800hrs). Where target species (species of conservation concern) were encountered, we gathered behavioural notes and habitat-related information if possible. Although the results of species lists are not presented here, much of the information on species of conservation concern was accumulated in the process of compiling lists and during timed point-counts.

Point-counts: Relative abundance and population densities of tropical forest birds are normally determined by 'distance sampling' (Buckland *et al* 1993) using one of two standardised methods: line transects and point-counts. Line transects were ruled out as a feasible method in this study due to the extreme steepness of the terrain (transects were cut up-slope) which made bird location and identification while moving very difficult as much time is spent trying to walk safely on transects. Point counts have the advantage that the observer remains at one spot, the census station, during the observation period. Thus, the census period is devoted solely to bird observation. Another advantage is that relevant habitat data can be easily collected at each station at the end of fieldwork and related to the presence or absence of bird species (Bibby *et al* 1998).

In the Serranía de Callejas, point counts were carried out partially on the disused road but predominantly along cut routes or existing trails in forest. A single 2km route was used at both lower (1200-1600m) and upper (1400-1840m) camps (see below for more details). Routes were partially cut at the Río San Mateo site but were abandoned due to the extreme difficulty of the terrain and torrential rainstorms. A single route was cut at the Río Leche site (500-950m). This also followed part of the park boundary (at 500m).

The point count method used was the Variable Circular Plot method (Reynolds *et al* 1980). Census stations were situated as 200m intervals along the 2km route, giving 10 census stations per route. Although longer routes would have been preferable, the length was determined by constraints of time and the difficulty taken in cutting new routes in very difficult terrain. Census stations at a distance of 200m apart was considered the minimum distance possible between stations, as smaller inter-station distances may result in double-counting the same birds at adjacent stations (especially where birds are identified by vocalisations). The census time at each station was 10 minutes, with a one-minute 'settling down' period following arrival at the station for birds disturbed by the observer on arrival. At each station, the observer recorded the identity of each contact (visual or aural) and estimated its distance from the observer. Where birds recorded were not specifically identified at the time (these tended to be birds heard but not seen), sound-recordings were made of vocalisations and the census station bird list annotated so that all such contacts could be identified at a later stage. This was done by either identifying the individual's vocalisation to species with the use of commercial tapes, or by subsequently locating the species later in the census, or opportunistically during fieldwork, and confirming it's identity visually.

Apart from the species identity, other information such as height in vegetation, sex and group-size were recorded for visual contacts. Birds encountered leaving the census station area on arrival, presumably having been disturbed by the observer, were also recorded. In this case the distance between the observer and the bird at the point of departure was taken as the bird-contact distance. Birds that over-flew or flew into the census station area during the census period were not counted.

Sound-recording: Recordings were made using a Marantz CP430 cassette recorder and Sennheiser unidirectional gun microphone, and less frequently with a Sony TCS-580V cassette recorder and Sony microphone. Where possible, we made species identifications from recordings on site with the help of commercial tapes or those compiled from various sound archives. Playback was also used occasionally to confirm species identification. As well as using sound-recording as a census tool in combination with species lists and point counts, we made a number of continuous 'pre-dawn' sound-recordings. This was used as a method of locating species that are only or largely vocal during this period. At this time we recorded continuously at stations at least 200m apart for 15 minutes, terminating recording just after dawn. Apart from noting the location, weather details, and the start time at each station, the

15-minute recording consisted only of vocalisations. These were checked at a later date to identify species.

Mist-netting: Up to six mist-nets (16.5mm^2 mesh) were used to sample understorey and ground level avifaunas (total length = 78m). In one study area, Serranía de Callejas, most net-rides were along the side of a disused road (the old Cochabamba-St. Cruz road) running through primary forest (see below). At the Río San Mateo and Río Leche study sites, net-rides were situated in primary forest, at the latter along the previously cut transect marking the boundary of PNC. Nets were set at ground level in all habitats. Nets were normally opened at dawn (0600hrs) and kept open until late morning (1100hrs) but were closed during rain showers. Nets were also open during the late afternoon (1500-1600hrs) where possible. Nets were checked every 30-45mins depending on the volume of birds and processing times. Birds were extracted by experienced netters only. Standard biometrics were taken and birds were temporarily marked to identify retraps by clipping two central tail feathers.

Netting was carried out at three sites in the Serranía de Callejas study area over a five-week period. At the 'Palmar Lower' site (1250m), netting was carried out over six days (August 8-13). Nets were placed along the old road through forest with dense, scrub at the forest border. Both sides of the road were steep with forest being fairly open and with a relatively low canopy (4-10m) in the vicinity of the road. At the 'Palmar Upper' site (1570-1590m), netting was carried out in two different areas over two weeks (August 15-29), one in primary forest some 20m below the old road (1570m), and another along the old road (1590m). The latter was adjacent to scrub and low forest (5-8m), with terrain on both sides of the road being extremely steep. Landslides were frequent in the area producing large open areas with low regenerating scrub. At the 'Limbo' site (2020m), netting was carried out briefly over a two-day period (September 10-11), again along the old road. The nets were positioned adjacent to low forest (5-10m) near the top of a steep ridge.

At the Río San Mateo (880-900m), netting was carried out over a five-day period (August 29-September 6). Net-rides were cut in primary forest on the side of a steep gully some 100-150m above the river. Nets ran uphill parallel to the gully, on a moderate to steep slope. Canopy cover was dense (80-90%) in the netting area with a sparse to moderate ground-shrub layer. At the Río Leche, netting was carried out at two sites (October 1-7), one in a small patch of remnant forest and also riverine scrub (350m) outside PNC near the Río Leche, and the other in primary forest at the boundary of PNC (510-520m). At the former site, the terrain was flat with a moderate canopy cover in the forest block (40-50%) while the riverine scrub site was some 80-100m from the forest patch. At the latter site within PNC, nets were set along the previously cleared park boundary, which ran perpendicular to the slope on flat-moderately sloping terrain. Canopy height within the forest was 8-15m while the canopy cover was closed (80-90%). The ground-shrub layers were moderately dense.

Map location and elevation: Study sites were located on 1:50,000 maps (Instituto Geográfico Militar, La Paz, Bolivia; Edition 2-IGM, Series H731) using a Global Positioning System (GPS). The Serranía de Callejas and Río San Mateo sites were located on the Comunidad Avispas map (Sheet 6442 I). The Río Leche study site was located on the Colonia Libertador Simón Bolivar (Sheet 6642 III) map. A hand-held, pre-calibrated altimeter was used to determine altitude to the nearest five metres.

Parque Nacional Carrasco: study area summary

Location	Chaparé, Tiraque and Carrasco Province, Cochabamba Department
Grid reference	Serranía de Callejas: 17°05'50S; 65°34'31W (Palmar Lower); 17°05'75S; 65°35'56W (Palmar Upper); 17°07'69S; 65°37'64W (Limbo) Río San Mateo: 17°08'89S; 65°33'86W; Río Leche: 17°17'58S; 65°45'83W;
Elevation (census routes)	Serranía de Callejas: 1200-1600m (Palmar Lower); 1400-1840m (Palmar Upper); 2000-2200m (Limbo) Río San Mateo: 800-950m Río Leche: 500-950m; also area outside PNC (300-500m)
Major habitat types	Serranía de Callejas: primary forest, scrub, landslide gaps Río San Mateo: primary forest; riverine scrub, flood plain Río Leche: primary forest, riverine scrub
Fieldwork	Serranía de Callejas: 24 days (Palmar Lower: August 7-13, Palmar Upper: August 14-29; Limbo: September 10-11) Río San Mateo: 11 days (29 August-September 8) Río Leche: 13 days (September 23-26; September 30-October 8)

An overview of PNC and its biological importance has been presented earlier. PNC lies between the cities of Cochabamba and St. Cruz de la Sierra, between latitudes of 17°05'S and 17°50'S and longitudes of 65°45'W and 64°20'W. The park is largely mountainous, the main range running in a WNW-ESE direction (although on the eastern slope of the Andes, PNC is located just west of where the main eastern Andean chain bends south towards southern Bolivia and Argentina). Because PNC covers a wide range of elevations (280-4500m), several life zones are represented within the park. These include lowland tropical forest at the base of the foothills (<500m), foothill and montane yungas forest (500-3500m), cloud and elfin forest (c3500m but sometimes much lower on ridges), puna grassland above the timberline (>3500m), high Andean summits (to 4500m) as well as lakes in the high mountains. However, most of PNC is composed of sub-montane and montane yungas forest.

Along the northern edge of the park, the foothills of the eastern Andes rise abruptly out of the flat Amazonian plain to the north. Within PNC the terrain is typically extremely precipitous with thickly forest slopes dropping to deep ravines cut by fast-flowing streams and rivers. In the Serranía de Callejas in the north-west of the park, some of the higher peaks are reached within a few kilometres of leaving the lowland Amazonian forest to the north, some of which rise above the treeline where they support puna grassland habitats (see Kessler & Herzog 1998). Although slopes are almost equally steep further east, most of the peaks are somewhat lower in elevation (most between 1000-2000m) and are completely forested. The highest elevations in the park (above 4000m) are found in the west and along the southern boundary.

Access and study sites

The study in PNC focussed on three areas: the montane forests of the Serranía de Callejas, foothill forest and riverine scrub along the Río San Mateo (both areas in the north-west of the park), and the foothill forest of the Río Leche area (Fig. 1). The Serranía de Callejas and Río San Mateo are easily accessed from the main (new) Cochabamba-St. Crux highway c6.5km to the south-west of the town of Villa Tunari (Comunidad Paracti in map Sheet 6542 IV). The access road into the park follows the old and now disused St. Cruz-Cochabamba road to the community of El Palmar at the northern edge of the park (c19km by dirt road from the highway). The park-guard station at 'Guacharos' (Santuario Vida Silvestre) is located c1km east of this access route on the west bank of the Río Can Mateo/Ivirizu). The Oilbird *Steatornis caripennis* caves at the Cavernas de la Repechon are reached by crossing the river by cable, under guidance from park guards, from this station.

Serranía de Callejas: The 'Palmar Lower' camp (1200m) was located approximately 3km west of El Palmar (c4.5km by road), on the old road (there were no suitable areas for a camp anywhere apart from on the road itself, until Limbo, due to the steepness of the terrain). In 1998, the access road was still in good condition, apart from occasional landslides at higher levels (at 1600m). The road was used as a part of a census route (1200-1600m) for species list and point count data gathering. In addition, a line was cut vertically through forest to give a two kilometre census route (1.8 km forest and 0.2 km on road). Apart from the road (gentle-moderate gradient), the census route was very steep (mean angle of slope = 37°). Forest canopy tended to be more open with a more dense ground vegetation cover that along the Palmar Upper census route (Table 2).

The 'Palmar Upper' camp (1,585m) was also located on the old road, approximately 5km south-west of El Palmar (9km by road). Again the road was part of a census route (1400-1840m) that also used part of a pre-existing trial and a newly cut line to give a two-kilometre census route (1.8 km forest and 0.2 km on road). The forest part of the census route was moderate-steep in the lower section (1400-1550m) but very steep in the upper section (1590-1800m), until the crest of a ridge was reached (1800-1840m).

The 'Limbo' camp (2020m) was also located just off the old road, approximately 9.5km south-west of El Palmar (c24km by road). This site was on the crest of a narrow ridge with very steep drops on both sides. A short distance further on (c1km), the road reached the head of a valley where the vegetation was noticeably different from the lower sites, especially in the greater profusion of epiphytes and mosses. Higher up, a small mining camp was reached (2200m) where a narrow uphill trail off the road proved to be an excellent and exciting birding route.

Table 2. Elevational and vegetation data collected at forest point count census stations in the Serranía de Callejas (Palmar Lower & Upper) and Río Leche study areas (expressed as mean and excluding data from points along roads).

Sites	Elevation and vegetation data ($\bar{x}$) Elevation (m)	DBH (cm)	No trees >1m	Canopy cover (%)	Canopy height (m)	Ground cover (%)
Palmar Lower	1200-1600	12.9	73	52	6.3	76
Palmar Upper	1400-1840	9.7	64	63	6.3	56
Río Leche	500-950					

DBH: Diameter at Breast Height of 10 nearest trees with DBH >10mm
No trees >1m: Number of trees >1m in height in radius of 20m

Río San Mateo: The study area was reached on foot, via an easy trail from the village, approximately 4km along the San Mateo river, south-west of El Palmar. The route along the river required a number of river crossings, which were difficult after heavy rain. The camp itself was located some 1km inside the park, the boundary of PNC being marked on riverside boulders. Upstream from the camp (860m), the river formed a floodplain (dry riverbed) some 0.2-0.4km wide with patches of riverine scrub, until narrowing again, flowing through a seemingly impassable gorge. A census route was cut through forest near the Río Chillahuara (a tributary of the Río San Mateo) on the west slope of Cerro Santa Clara. However, this had to be abandoned due to a flash flood, which marooned us on the opposite side of the river for a number of days. Thus, most bird work was confined to the river area (860-950m).

Río Leche: This study area was also reached on foot along the Río Leche, some 2.5km south of the end of the dirt track from the community of Israel, the site of a park-guard station (another park guard station is at the settlement of Sajta, by the main Cochabamba-St. Cruz highway, which is the turn-off for access to Israel). From the road end the boundary of PNC was reached easily, via the beautiful lunar landscape of the Valle de la Luna, an important geophagy site for psittacines (see Appendix 5). As previously mentioned, a line had been cleared by park-guards to delineate the park boundary. This was used as part of our census route. Additionally, a line (500-950) was cut through forest along a moderate-steep ridge that ran perpendicular to the boundary into the park. The census route was entirely in closed-canopy primary forest, although forest clearance outside PNC had reached within 100m of the park boundary in 1998 (see Threats and Conservation Opportunities).

Although outside the park, some time (September 20-22) was spent birding in disturbed or recently cleared forest areas near Israel and along the Río Sajta, the latter area less than 1km to the north of the park boundary. This was the site of the discovery of a female Yungas antwren *Myrmotherula grisea* (see Biological Records).

Yungas of La Paz: Short periods of time were spent at Chulumani (six days) and Parque Nacional Cotapata (six days) in La Paz Dept. In the Chulumani area, we visited a small remnant forest patch at Estancia Marchacamarca (1750-2000m) and a much larger, intact forest at the Bosque Ecological Apa-Apa (1800-2100m) between October 13-18. Both are privately owned and, so far as we could ascertain in the short time in the area, the only remaining forest patches in the Chulumani area (other, more extensive, but also somewhat degraded forested areas were located along the Sud-Yungas road (Chulumani-La Paz) to the west of Chulumani). Much of the area is given over to coca growing.

The forest patch at Marchacamarca was mostly degraded, having few mature trees and an extensive ground cover of invasive grasses. Only one Formicarid species was recorded (*Pyriglena leuconata* in forest-edge scrub) suggesting that the forest patch was too small or degraded to support viable populations or the ecosystem processes on which some species depend (i.e., ant-swarms). However, the restricted-range *Chiroxiphia boliviana* was common here and in tiny forest patches nearby suggesting that the species is highly resilient to forest fragmentation (see also Biological Surveys). The more extensive Bosque Ecological Apa-Apa (800ha) is on a moderately steep forested hillside, surrounded by pasture and coca plantation on the lower slopes. The forest appeared to be largely intact, having a closed canopy and large, mature trees with extensive lianas and epiphytes. Although the forest was visited only briefly, it is likely to hold several species that were not recorded during our visit (See Appendix 2). There are a number of trails through the forest that can be visited by prior arrangement with the owner (telephone Sr. Ramiro Portugal on 0811-6106).

Parque Nacional Cotapata is located several miles west of the town of Coroico, La Paz Dept. Six days were spent in the park between 22nd and 27th October 1998. The park was accessed by hiring a truck from Coroico most of the way to Chairo (23km). The remaining stretch over the river and a further 8-10km to the base camp was travelled on foot. The base camp was located at the Estación Biológica Tunquini at an elevation of 1540m. The Estación is run by the Instituto de Ecologia in the Facultad de Ciencias Puras y Naturales of the Universidad Mayor de San Andres, La Paz. During this visit, the Estación was in the process of being built, but is now available for use with permission from Luis Pacheco, Co-ordinator, Instituto de Ecologia.

Access into much of the study area was gained via previously cut paths and old mining roads, some of which are overgrown almost beyond recognition. All areas visited, except those above 1900m, were disturbed, there being few trees with a diameter at breast height of more than 0.5 metres. Much of the area had been burnt and was being cultivated for coffee, bananas, avocados and citrus fruits. One homestead towards the outer edge of the study area held pigs. The most pristine areas of forest were only partially entered into because of poor weather conditions and inaccessibility. The gully of the river, which passes through the study site, is largely inaccessible but contains some impressive unspoilt forest.

Birds were recorded along five routes from the base camp: (i) The main road from the base camp (5km in length) on north side of river towards Chairo, at 1200-1550m, the most open and productive area. (ii) Along the upper path (1km) which zigzags up from main road (i) towards cultivation and the homestead at 1550-1650m. This held a good variety of habitats. (iii) The main track (2km) from base camp over the bridge at 1550-1650m, onto the south side of river heading east. This passes through recently burnt, heavily disturbed areas. (iv) An enclosed path (1km) which branches off main track at 1560-1700m (iii) and climbs into abandoned cultivation and derelict housing with poor forest habitat. (v) A mining road (3km), overgrown and not obvious, also branches off the main track (iii), gradually zigzags from 1560m to beyond 2000m, and holds the least disturbed areas of forest.

Biological Surveys

Avifauna: threatened species
near-threatened species
other noteworthy species

Avifauna: Threatened, near-threatened and other noteworthy species

- Two of the four threatened bird species known from the yungas forest of Bolivia were recorded during fieldwork in Parque Nacional Carrasco. Most importantly, we located a population of the Horned curassow *Pauxi unicornis* in the north of the park, confirming PNC as one of only two protected areas for the species in Bolivia. The Yungas antwren *Myrmotherula grisea*, a globally threatened Bolivian endemic, was located just outside the PNC boundary. Eight other restricted-range species were recorded in PNC while nine bird species recorded in or near PNC were new for Cochabamba Department. Further, the poorly-known Lanceolated monklet *Mincromonacha lanceolata* was recorded for only the third time in Bolivia, at Parque Nacional Cotapata, La Paz Department. Our findings confirm the importance of PNC for threatened bird species of the yungas forest zone. In total, 274 bird species were recorded during fieldwork in the yungas of Cochabamba, 241 within PNC.

Introduction

Survey work in Parque Nacional Carrasco and other yungas sites focussed on bird species of special concern for conservation, namely those identified as globally threatened and near-threatened (Collar *et al* 1992; Collar *et al* 1994), those having restricted-ranges (Stattersfield *et al* 1998) and those which are more widespread but appear to be genuinely scarce or poorly known (Ridgely & Tudor 1989, 1994; Stotz *et al* 1996). All of these species are forest dependent and, therefore, are vulnerable to habitat loss or degradation. Moreover, some species also have extremely restricted elevational ranges. Given the rate of forest destruction and degradation on the eastern slopes of the Andes, and particularly in the foothill zone of the yungas, there is an urgent need to identify areas important for these key species.

Four threatened and seven restricted-range bird species are known from the yungas forest of PNC (Wege & Long 1995; Herzog 1998; Herzog & Kessler 1998; Stattersfield *et al* 1998). Several other species of conservation concern are also likely to occur in PNC but have yet to be recorded there (Table 1). During this study, two

Table 3. Species of conservation concern and other notable records from Parque Nacional Carrasco, Cochabamba Department, Bolivia, in 1998.

	Project records				
Species	**Site**	**Strata**	**Elevation (m)**	**% Days recorded**	**Abundance**
Threatened					
Pauxi unicornis	RL	T	580-955	36	U
Myrmotherula grisea^{E}	VS	U-MC	345	*	R
Restricted-range species					
Odontophorus balliviani	SC	T	-1760	11	U
Grallaria albigula	SC	T	1200-2090	14	U
Grallaria erythrotis^{E}	SC	T	2015-2250	10	U
Pseudotriccus simplex^{E,T}	SC	U	1495-2240	29	U
Hemitriccus spodiops^{E}	SC	U	1400-1550	-	R
Myiophobus inornatus	SC	LC	1550	5	R
Chiroxiphia boliviana^{E}	SC/RSM	U	900-1600	57	FC
Tangara argyrofenges	SC	LC	1515	5	R
Other noteworthy species					
Cryptutellus soui	SC	T	850-1670	21	U
Tigrisoma fasciatum	RSM/VS	T-U	325-860	18	U
Harpagus bidentatus	RSM	MC	860	5	R
Harpyhaliaetus solitarius	SC/RSM	A	1450-2080	11	U
Buteo albigula†	SC	LC	2240	5	R
Spizastur melanoleucus	RL	MC	940	9	R
Spizaetus ornatus	RL	UC	350	9	R
Oroaetus isidori	SC/RSM	U-LC	1000-2250	5	R
Lophostrix cristata†	RL	?	505	9	R
Rhinoptynx clamator†	RL	?	515	18	U
Heliangelus amethysticollis	SC	U	1625-2000	11	U
Microstilbon burmeisteri	SC	U	2180	5	R
Trogon collaris†	RL	U-LC	540	9	R
Notharchus macrorhynchus†	VS	SG	255	-	R
Malacoptila fulvogularis‡	SC	U	1250	5	R
Micromonacha lanceolata‡	CO	SG	1550	-	R
Deconychura longicauda†^{T}	RL	U	540	9	R
Sclerurus albigularis†^{T}	RL	T-U	540	9	R
Chamaeza mollissima	SC	T	1700-2090	10	U
Elania gigas†	RSM/RL	RS	460-900	18	U
Mionectes olivaceus†^{T}	SC	U	1450	5	R
Silvicultrix pulchella	SC	U	1820	5	R
Pipreola frontalis^{T}	SC	U-UC	1300-1800	32	U

Species: Endemic to Bolivia (E); Trapped (T). †New Departmental record for Cochabamba; ‡Recorded from P.N. Cotapata, La Paz Dept.
Site: Serranía de Callejas (SC), Río San Mateo (RSM), Río Leche (RL); P.N. Cotapata (CO)
Forest strata: Terrestrial (T); Understorey (U), Low canopy (LC), Mid-canopy (MC), Upper canopy (UC), Aerial (A). Other forest and non-forest habitats: Second-growth (SG), Riparian scrub (RS).
% Days recorded: % Days recorded at site/s; *not recorded at a study site
Abundance: Rare (R), Uncommon (U), Fairly common (FC), Common (C).
Key: Abundance assessment (criteria based on % days recorded):
Rare (R) = <10% days; Uncommon (U) = 10-50% days; Fairly common (FC) = 50-90% days.

globally threatened and restricted-range species, the Horned curassow *Pauxi unicornis* and Yungas antwren *Myrmotherula grisea* were recorded in or near PNC (Table 3). Further, eight other restricted-range species were recorded (Table 3). Several other noteworthy species were recorded including nine species new to Cochabamba Department. In total, 274 bird species were recorded during fieldwork, 241 of these within the PNC boundary (Appendix 1). Of these, 137 birds of 52 species were trapped during mist-netting (Appendix 6). Further, We made daily observations of pcittacines attracted to a geophagy site at the Valle de la Luna, Río Leche (Appendix 5).

Here, we outline current knowledge of the status and distribution of threatened and noteworthy species, our records from PNC and other yungas sites visited. We also include brief accounts of the status of threatened species not recorded during the project. Species are presented in descending order of conservation concern. Species are listed in taxonomic order within each category following Parker *et al* (1996). Site data, including forest strata occupied, elevational range and abundance classification, are summarised for key species recorded in PNC (Table 3). A complete list of all species recorded during fieldwork in PNC is presented later (Appendix 1). A list of species recorded at sites in the yungas of La Paz, Estancia Marchcamarca and Bosque Ecological Apa-Apa near Chulumani, and Parque Nacional Cotapata, near Coroico, La Paz Department is also presented (Appendix 2). These included the third Bolivian record of the poorly known Lanceolated monklet *Micromonacha lanceolata* from P. N. Cotapata (see below).

Initials in parentheses after records denote the observer/s responsible for the location or identification of the bird: Ruairidh Campbell (RC), Rebecca Denny (RD), Keith Faiclough (KF), Isobel Gomez (IG), Aidan Macormack (AMC), Allan Mee (AM), Manuel Oliviera Andrade (MOA), Dave Pullan (DP), Cadi Schiffer (CS), Will Boyd-Wallis (WBW).

Globally threatened species

Horned Curassow *Pauxi unicornis*

Global status: Known from just three or four areas in Bolivia and two in Peru (Table 4), this cracid was previously considered to be endangered (Collar *et al* 1994) but is now treated as vulnerable (BirdLife International 2000). The species is considered to be a very high priority for cracid conservation effort (Brooks & Strahl 2000). Bolivian records of *P. unicornis* are confined to the eastern foothills of the Andes in Cochabamba and Santa Cruz Depts. (Cox *et al* 1997) where it inhabits dense and often steep lower montane forest with high rainfall (del Hoyo 1994). Interestingly the type-locality for *Pauxi* is described as "*in the hills above Bolivar, near Palmar* ", near or possibly in PNC, where two specimens were taken in 1937 at 760m (Bond & Meyer de Schauensee 1939).

Table 4. Known locations of *Pauxi unicornis* in Peru and Bolivia.

	Sites	Location	Summary data
Peru			
Huánuco Dept.	Cerros del Sira	9°26'S 74°45'W	newly described sub-species *P.u.koepckeae*[1]
Puno Dept.	Cerros de Távara	13°30'S 69°41'W	sight record of single bird[2]
Bolivia			
Cochabamba Dept.	El Palmar	17°06'S 65°29'W	type-specimens collected[3]
	Comunidad Guanay	17°18'S 65°13'W	specimens collected[4]
	Río Colomelin	17°23'S 64°24'W	sight record of 3-4 birds[4]
	Río Leche	17°18'S 64°46'W	sight record of single and at least 4 birds calling[5] 20+ birds in 1999[6]
Santa Cruz Dept.	Río Surutu, PN Amboro	17°42'S 63°44'W	0.2-1 bird/km^2[7]
	Campamento Macunucu	17°43'S 63°34'W	sight record of 2 birds[4]

Source: [1]Weske & Terborgh (1971); [2]T.A. Parker in Collar *et al* (1992); [3]Bond & Meyer de Schauensee (1939); [4]Herzog & Kessler (1998); [5]Mee (1999); [6]MacLeod & Duguid (2000); [7]Cox *et al* (1997).

Today *P. unicornis* is best known from Parque Nacional Amboró, St. Cruz Department, where the species has been located and studied in semi-open forest on steep slopes at 700m (Cox & Clarke 1988). Males are thought to "*boom* " in dispersed leks at the onset of rains in October and a census of calling birds gave an estimate of 40 birds within a 1km^2 plot. More recent results have located booming birds at densities of 0.2-1 per hectare (Cox *et al* 1997). *Pauxi* was also thought to occur in PNC and a few individuals have recently been recorded at the Río Colomelín, in the extreme north-east of the park (Herzog & Kessler 1998). Despite its disjunct distribution, *P. unicornis* is considered to have a restricted-range, occurring in two EBAs, the Peruvian East Andean foothills (EBA O53), and the Bolivian and Peruvian lower yungas (EBA O54) (Stattersfield *et al* 1998).

Project records: *P. unicornis* was recorded at a single locality at 580-955m in 1998, near to the Río Leche, in the north of PNC (17°17'58S; 65°45'83W). The first calling individual was heard at 800m on October 4, some 1km south of the park boundary (AM). Forest at this site was composed of a large number of mature trees with the majority having a diameter at breast height (DBH) greater than 30cm. The understorey (ground and shrub layers) was fairly open with a visibility of 50m. At least four different individuals were heard between 580-945m on October 5 (AM). Individuals were also heard calling from a steep-sided slope below the ridge summit at 955m on October 6 (AM, RD, WW). The forest here was very open with little ground cover (<5%) and a sparse understorey and occasional boulder patches. Again, forest composition was dominated by tall (20-25m) mature trees with a closed canopy (80-90%). One individual was heard and seen briefly at 830m on October 8 (AM). The habitat at this site was largely similar to the previous site with scattered large (seven >1m DBH in a 25m radius), mature (34 >30cm DBH in 25m) trees. The booming frequency of birds (n = 7) was, characteristically, four booms per minute ($\bar{x}$ = 14.1-15.5 seconds between booms with a range of 13-18 seconds). This is very similar to the frequency reported from Amboró by Cox *et al* (1997).

It seems likely that we located *Pauxi* at the Río Leche at the beginning of the breeding season and therefore not all potentially breeding males may have begun to boom. However, our results show that there is probably at least 4 calling males (assuming none of those recorded on October 5 moved sites during the 3-4 hour census period) suggesting a minimum of population of 8 birds in the study area (assuming all males ‘pair’ successfully. However, if as claimed by Cox *et al* 1997, males establish dispersed leks, some males may get a disproportionate proportion of matings while other males may fail to attract mates. Females, on the other hand, may sample a number of males, moving over a wide area before commencing breeding. Thus, determining the social mating system would allow for a better estimation of the species population size). The study area was estimated to be 92ha in area (based on the maximum distance at which *Pauxi* vocalisations can be detected and the length of transect). Assuming a population density of one bird per 11.5ha (8.7 birds/km^2) the population of *P. unicornis* at Río Leche would be somewhat smaller than that recorded at Amboró (Cox *et al* 1997). However, until more intensive survey work is done on the population during the breeding season, these densities should be regarded as speculative. Moreover, the area censused may be at the periphery of the Pauxi population at the Río Leche and may thus be unrepresentative sample (e.g., if such populations were more likely to be affected by hunting than 'core' populations or if populations are greater in areas with a greater elevational range).

It should be noted that Razor-billed Curassows *Mitu tuberosa* were also booming in the Río Leche area and thus there could be, potentially, a risk of misidentification where birds are flushed and not seen well. However, we recorded *Mitu* only at lower altitudes (up to 550m) in both disturbed and primary forest and the last calling bird was heard on October 5, before most *Pauxi* had begun calling. Furthermore, the call of *Pauxi* appeared to be audible at greater distances than that of *Mitu* (based on the number of syllables heard and the distance to calling birds when located or flushed). There are also diagnostic differences in the booming pattern of both curassows (Cox *et al* 1997).

Cracids are one of the most important sources of wild meat for forest dwelling people and subsistence hunters (Silva & Strahl 1991; Begazo & Bodmer 1998; Peres 2000), and overhunting has been implicated as a primary or contributory factor in the decline of some globally threatened species such as the Wattled curassow *Crax globulosa* (Santos 1998). However, we found no evidence to suggest that *Pauxi* was subject to intensive hunting pressure at the Río Leche site. No hunters were encountered during fieldwork at the site and settlers living on the edge of PNC were unfamiliar with *Pauxi*. Hunters were, however, encountered at the boundary of PNC north of Israel. Interestingly, *Mitu* was recorded from disturbed lowland forest within 100m of recently cleared land suggesting that hunting pressure has not as yet wiped out all cracids in the vicinity of settlements.

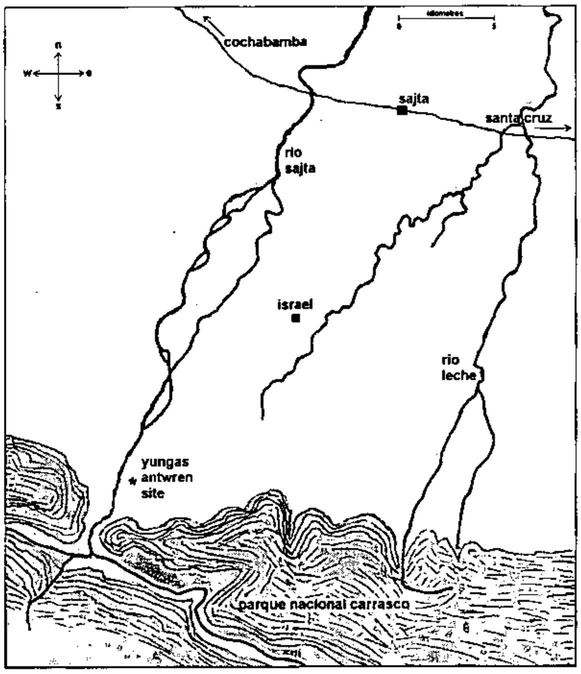
A more immediate threat to *Pauxi* and indeed all other forest dwelling species is the continuing encroachment of the human population in the north of the park. In 1998, forest clearance had reached the park boundary in the area north of Israel (at 350m elevation) and near the Río Leche (500m elevation). We found recently cleared and burnt primary forest throughout this area. Evidence that trees were being logged just inside the park boundary was also found. In the Río Leche area, we found *Pauxi* presently occurring within 0.5km of the park boundary. In this area, forest clearance had reached within 50-100m of the park and undoubtedly will have reached the park boundary, or encroached within the park, at the present time. Thus, *Pauxi* populations are likely to face increasing pressure, directly from habitat destruction, and indirectly from hunting associated with human encroachment. Limiting the negative effects of these pressures will depend on the ability of the park to maintain the integrity of its boundaries.

Yungas Antwren *Myrmotherula grisea*

Global status: Also known as the Ashy Antwren, this Bolivian endemic has been recorded from six or seven localities between 600 and 1650m in La Paz, Cochabamba and Santa Cruz Depts., where it inhabits tall, humid forest (Remsen *et al* 1982). The type specimen, along with five other individuals, was collected in 1934 at Santa Ana, La Paz Dept., at 670m (Carriker 1935) although apparently predated by two specimens taken in 1917 (Remsen *et al* 1982). A female collected in 1960 at 1100m at 'Alto Palmar', Cochabamba Dept. (Remsen et al 1982), presumably refers to forest above the settlement of El Palmar, within PNC. In 1979, Remsen and Parker netted three individuals in tall, humid forest at 1650m near Serranía Bellavista, La Paz Dept, while Ridgely observed another three birds at 1400m in that year (Remsen *et al* 1982). *M. grisea* has since been collected or recorded from three sites at 500-1,200m in Santa Cruz Dept. and two sites at 800m and 1100m in Cochabamba Dept. (Collar *et al* 1992). Parker *et al* (1992) observed two pairs at 650-800m and a single bird at 1000m in Parque Nacional Amboró, St. Cruz Dept. in 1979, foraging with middle-storey and lower canopy mixed species flocks. Most recently *M. grisea* has been recorded from PNC along the now disused old St. Cruz-Cochabamba road (S. Herzog pers. comm.). Previous records suggest that the species is largely confined to foothill and montane forest in the Bolivian yungas and "*does not extend appreciably into the Amazonian lowlands*" (Remsen *et al* 1982).

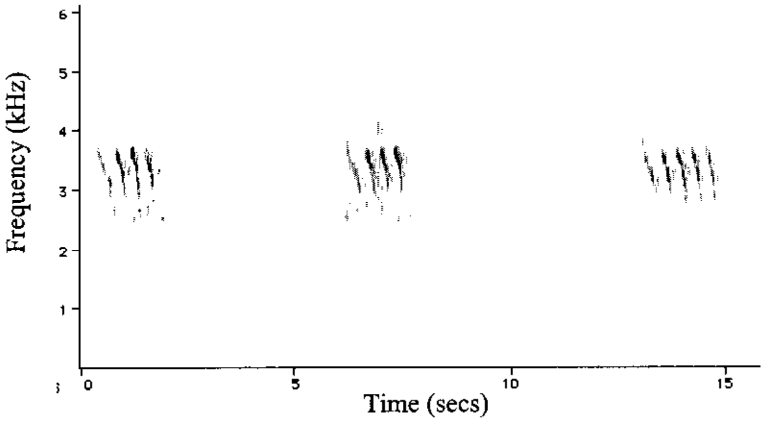
Project records: We recorded a female *M. grisea* at a site close to the PNC boundary on 21 and 22 September 1998 (Fig. 2). This site was in very dense and apparently disturbed forest to the south of the community of Israel close to the Río Sajta (17°16'25S 64°53'19W). The forest was at an elevation of 345m, on flat ground near to the foothills. The bird was first heard singing at 1100hrs on 21 October, some 10-30m from the Río Sajta track (AM). A sound recording was made of its song and this was compared with a previous tape of a male *M. grisea* in song (by S. Herzog). While the song of the Sajta female and the pre-recorded male appeared to be identical in structure, the female song was somewhat slower (Fig. 3). Its identity was confirmed when we relocated the bird later in the same area. Playback of Herzog's tape was also used to see if it elicited a response. Within a few seconds of starting playback the bird responded by flying in to within a few metres of us, remaining mostly 6–8m up in the understorey.

Fig. 2 Location of Yungas antwren *Myrmotherula grisea* recorded on September 21-22 1998, just north of the Parque Nacional Carrasco boundary.



M. grisea sang regularly between 1100 and 1300hrs but much less often soon after mid-day. The bird was extremely active, moving constantly at 6-10m in the low to mid-canopy, apparently behaving like a territorial individual attempting to attract a mate. Because of this behaviour (singing, apparent territoriality), the possibility that this bird was an immature male was considered. However, all immature males show some male-type plumage features soon after fledging and do not resemble females (J. Van Remsen pers. comm.). During the period of observation the bird was rarely seen to feed. The following day little song was heard (AM, DP, KF). We relocated what was presumed to be the same female some 100m from the original site, where it sang briefly at 5-6m in the low canopy (canopy height at the site was 8-15m). Here also the forest was very dense, with visibility up to 6-15m and a canopy cover of 75-80%. There was a dense ground cover (15-20%) and a total absence of large or mature trees. Further site details as well as notes on the plumage, ecology and behaviour of *M. grisea* are presented later (Appendix 4).

Fig. 3. Song of female Yungas antwren *Myrmotherula grisea* recorded on September 21 1998.



Despite spending some 3 weeks fieldwork in the Río Leche area of PNC, approximately 13.5km ESE of the site where we recorded *M. grisea*, no other individuals were encountered. Unlike nearby PNC where we carried out fieldwork, forest at the antwren site had extensive ground, shrub and understorey cover as well as a more open canopy indicative of recent habitat disturbance. The absence of large mature trees also suggested that some logging had taken place some time in the past. Further, we found recently cleared and cultivated land within 0.25 kilometres of this site.

M. grisea is undoubtedly a very rare bird species and probably occurs at low densities where it does exist. However, the potential for under-recording the species is great when it is not vocalising. Had the individual located at Sajta not been in song, it would almost certainly have been overlooked. Future searches for *M. grisea* in this and probably other areas should ideally be timed to coincide with periods when the species (or other *Myrmotherula* antwrens) is most vocal. Playback may also be useful in locating birds and could be incorporated into standardised survey methodology.

Bolivian Recurvebill *Simoxenops striatus*

Global status: Until recently this rare endemic furnariid was known only from four specimens collected by Carriker in 1935 at Santa Ana (670m), La Paz Dept., and at Palmar (800m), Cochabamba Dept (Parker *et al* 1992). The latter presumably refers to the site of an old collecting locality near the community of El Palmar, now located just outside the boundary of PNC. Today *S. striatus* is best known from Parque Nacional Amboró, Santa Cruz Dept. (700-800m) where it was relocated in 1989 (Parker *et al* 1992). It was also recorded in 1992 at 1080-1090m, from near the St. Cruz – Cochabamba highway, 48km south-west of Villa Tunari, on the western edge of PNC (Whitney *et al* 1994). The species has been recorded from Pilón Lajas Biosphere Reserve and Indiginous Territory, La Paz Dept. (BirdLife International 2000).

S. striatus was not recorded during the project although it has recently been observed near the PNC boundary at El Palmar (Herzog 1998). Several unsuccessful attempts were made to attract birds by playback using pre-recorded tapes (courtesy of the National Sound Archive, U.K.). However, limited time was spent in the species core elevational range (670-1100m). *S. striatus* almost certainly occurs within PNC where it's apparently preferred habitats (such as dense undergrowth and vine tangle) exist.

Yellow-rumped Antwren *Terenura sharpei*

Global status: Another rarely encountered antwren, *Terenura sharpei* is known from a handful of localities in the yungas of Bolivia (La Paz & Cochabamba Depts.) and south-east Peru (Collar *et al* 1992). It was regularly recorded by Remsen and Parker during fieldwork at Serranía Bellavista, La Paz Dept., in 1979, and pairs were seen at 1350m on four occasions by Remsen in 1980 (Remsen *et al* 1982). An individual was also seen by Ridgely in Chaparé province, Cochabamba Dept., at 1110m in 1979 (Remsen *et al* 1982). Given the proximity of this last record, it seems likely that the species does occur within PNC. However *T. sharpei* was not recorded from PNC during the project.

Previously treated as vulnerable (Collar *et al* 1994), the species is now considered to be endangered due to its small, apparently disjunct range and the likelihood that any populations that do exist are declining, or under threat due to the widespread habitat destruction (BirdLife International 2000). An extensive search for *T. sharpei* should be a priority for future ornithological work within PNC given its apparent rarity. The species probably occurs in the Cordillera de Mosetenes to the north-west of PNC in Chaparé, an as yet biologically unexplored region with extensive intact yungas forest (S. K. Herzog pers. comm.).

Scimitar-winged Piha *Lipaugus uropygialis*

Global status: A poorly known cotinga of montane forest and forest borders, this restricted-range species is known only from a few localities in the upper yungas of La Paz and Cochabamba (Remsen *et al* 1982). To date, *L. uropygialis* has been recorded at elevations between 1800-2575m (Remsen *et al* 1982). The species was recorded at 1800m from Chaparé province, along the Cochabamba-St. Cruz road in 1977 (Remsen et al 1982) and again in the early 1980s (Ridgely & Tudor 1994) in what is now PNC. Further, a specimen from Locotal, Cochabamba Dept. (Remsen et al 1982), probably refers to the locality of that name in the extreme west of PNC. *L. uropygialis* has not previously been treated as threatened but is now considered vulnerable due to its small known range and the ongoing loss of forest habitat in parts of its range (BirdLife International 2000). The species was not recorded during fieldwork in PNC in 1998, although little time was spent within its elevational range.

Restricted-range species

Striped faced Wood-Quail *Odontophorus balliviani*

Global status: Known only from south-east Peru and northern and central Bolivia (La Paz to Santa Cruz Depts.), *O. balliviani* is found in humid Andean forest between 1000-3050m (Parker *et al* 1996). The world population may be less than 50,000 individuals (McGowan *et al* 1995). However, forest dwelling Odontophorids are notoriously elusive, making them difficult to find, let alone estimate population densities. Group vocalisations at dawn and dusk may be the best method of locating and recording birds.

Project records: Birds were heard calling below 1750m, some 2km above the Palmar Upper camp, Serranía de Callejas, PNC, at dusk on August 21 and 24 (AM). Identification was made with reference to "Birds of Bolivia" (Mayer 1996). Unidentified Odontophorids were also heard calling at 1760m just before dusk on August 23. Stattersfield *et al* (1998) place *O. balliviani* in the Bolivian and Peruvian upper yungas EBA (EBA 055). However, the species elevational range may justify its inclusion in the Bolivian and Peruvian lower yungas EBA (EBA 054).

White-throated Antpitta *Grallaria albigula*

Global status: Found between 800-1700m (1500–3200m in Parker *et al* 1996) in Andean forest from south-east Peru to north-west Argentina (Ridgely & Tudor 1994). Considered uncommon to locally common in parts of its range, *G. albigula* remains apparently unrecorded in La Paz Dept. (Ridgely & Tudor 1994; Armonía 1995). The species occurs in two EBAs, the Bolivian & Peruvian lower yungas (EBA 054) and the Argentine & south Bolivian yungas (EBA 057).

Project records: All records were from the Serranía de Callejas, PNC. A single bird was heard near Limbo at 2080m on August 24, calling from extremely steep, dense forest, some distance lower down-slope from the ridge (AM). Several birds were heard calling between 1620-1885m on August 25 (AM, AMC). A single bird was heard calling at 1200m on August 26 and several individuals were also heard on August 27 and September 9-11, between 1500-2090m (AM, RC). The species appears to be much less restricted in its elevational preferences than *G. erythrotis*.

Rufous-faced Antpitta *Grallaria erythrotis*

Global status: A Bolivian endemic, *G. erythrotis* is known from montane primary and secondary forest between 2000-3000m where it appears to be common (Remsen *et al* 1982). The species is erroneously omitted from La Paz Dept. by Stattersfield *et al* (1998) although it has been observed and collected there (Remsen *et al* 1982). It is confined to the Bolivian and Peruvian upper yungas EBA (EBA 055). Remsen *et al* (1982) also list "El Limbo, 2200 metres, Prov. Chaparé" among sites at which *G. erythrotis* was collected. This is almost certainly the same site, known to PNC staff as Limbo, at which we recorded the species (see below). Interestingly, during a collecting expedition in 1979, Remsen found it to be "common in thickets along roadsides, landslides and clearings" while "it was noted only once in deep forest" (Remsen *et al* 1982).

Project records: Again, all PNC records were from the Serranía de Callejas. At least four birds were heard calling between 2050 -2140m on August 24 and two were sound recorded at 2035m near Limbo on August 25. One bird responded to playback by approaching to within 20 metres. Another bird was heard at 2015m on the same date (AM). Several birds were also heard calling between 2090-2250m on September 11-12 (AM, KF, DMP). *G. erythrotis* was also heard calling from a very-steep forested slope at 2890m near the Chulumani road, in the yungas of La Paz, on October 13.

Yungas Tody-tyrant *Hemitriccus spodiops*

Global records: A Bolivian endemic, *H. spodiops* is found in humid foothill and montane forest between 800-1600m from La Paz to St. Cruz Dept. (Ridgely & Tudor 1994; Armonía 1995). The species appears to favour forest borders, shrubby second-growth and regenerating landslide gaps (Remsen *et al* 1982; Ridgely & Tudor 1994). *H. spodiops* is known from in or near PNC by specimens from 'Alto Palmar' and

Palmar (Remsen *et al* 1982) and is confined to the Bolivian and Peruvian lower yungas EBA (EBA 054).

Project records: *H. spodiops* was not seen or trapped in the field during the project. However, the species was subsequently identified from sound-recordings made between the Palmar lower and upper sites, at c1400-1550m, in August 1998 (by S. Mayer, per AMC).

Hazel-fronted Pygmy-tyrant *Pseudotriccus simplex*

Global records: Confined to montane forest and forest borders between 1300-2515m, *P. simplex* appears to uncommon throughout its range from south-east Peru to Santa Cruz Dept., Bolivia (Ridgely & Tudor 1994; Armonía 1995; Parker *et al* 1996). The species is placed in the Bolivian and Peruvian lower yungas EBA (EBA 054) by Stattersfield *et al* (1998) although it has been recorded from 2515m in the Serranía de Siberia, St. Cruz Dept. (Whitney *et al* 1994).

Project records: All records of *P. simplex* within PNC were from the Palmar Upper and Limbo areas, Serranía de Callejas. Four individuals were trapped at 1590m on August 27-28 and September 9. Birds were also observed and sound recorded between 1515-1620m on August 13 and September 9-11 (AMC, AM). Several birds were also heard in song between 2210-2240m near Limbo on August 11 (AM, KF, DMP). Outwith PNC, we recorded *P. simplex* from disturbed forest at 1495m on the Villa Tunari-Cochabamba road (AM, KF, DMP). The species was also recorded at 1850-2010m in remnant forest at Marchcamarca and Bosque Ecological Apa-Apa, Chulumani, La Paz Dept. (AM).

In the field, birds were very unobtrusive and difficult to locate. However, we found and sound-recorded several birds by the snapping sounds produced by birds, as well as their distinctive high-pitched song. Interestingly, most records of the species were from a few widely disparate locations suggesting that the distribution of *P. simplex* is extremely patchy within its range. The Palmar Upper site was characterised by an open canopy (probably regenerating gaps created by tree-falls or landslides) and a dense ground and shrub layer. Birds were observed within a few metres of the ground, foraging in the undergrowth.

Unadorned Flycatcher *Myiophobus inornatus*

Global records: Considered to be rare to uncommon in montane forest between 1000-2000m (1350–2000m in Parker *et al* 1996) from south-east Peru to Cochabamba Dept., Bolivia (Ridgely & Tudor 1994; Armonía 1995*). M. inornatus* is confined to the Bolivian and Peruvian lower yungas EBA (EBA 054).

Project records: A single individual was recorded near the Palmar Upper camp on at 1550m on September 22 (MOA, AM). This bird was seen calling and perched in the lower canopy and understorey. Although it is very likely given the unobtrusive nature of *Myiophobus* flycatchers that *M. inornatus* went under-recorded, the species is probably truly scarce within PNC.

Yungas Manakin *Chiroxiphia boliviana*

Global status: Now regarded as a full species, distinct from the Blue-backed Manakin *C. pareola* of Amazonia, the species inhabits foothill and montane forest on eastern Andean slopes between 650-2150m from Cuzco Dept., Peru to Chuquisaca Dept., Bolivia (Ridgely & Tudor 1994). Apparently locally common in parts of its range, *C. boliviana* is placed in two EBAs, the Peruvian East Andean foothills (EBA 053) and the Bolivian and Peruvian lower yungas EBA (EBA 054).

Project records: Recorded almost daily between 800-1550m in the Palmar Upper area, Serranía de Callejas, PNC, where it was found to be one of the most commonly encountered bird species (see Table 3 & Appendix 1). Although often difficult to see, the presence *of C. boliviana* could be determined even at great distance due to the loud, far-carrying calls. Birds were less common in the Río San Mateo area and the species was not recorded at the Río Leche site. However, the maximum elevation surveyed at both these sites was 900m and 960m respectively, which is at the lower edge of the species elevational range (Ridgely & Tudor 1994).

The species was also recorded daily at 1580-2035m from Estancia Marchcamarca and Apa-Apa near Chulumani, as well as at 1550-1815m in Parque Nacional Cotapata, La Paz Dept. (see also Appendix 2). As well as in closed-canopy forest, birds were heard calling from tiny, remnant and heavily degraded forest patches (Marchacamarca), often at some distance (1.5-2km) from the only remaining forest in the valley (Apa-Apa). Thus, the species appears to be able to persist in heavily man-altered habitats where at least some forest patches survive.

Straw-backed Tanager *Tangara argyrofenges*

Global status: Several seemingly disjunct populations are known from northern and central Peru and the yungas of Bolivia from La Paz to Tarija Depts. (Ridgely & Tudor 1989; Armonía 1995). This little known tanager inhabits humid montane forest between 1300–2100m in Bolivia (Armonía 1995) but occurs to 2700m in Peru (Stattersfield *et al* 1998). Because of the fragmented nature of its range, *T. argyrofenges* is placed in three EBAs, the Ecuador-Peru East Andes (EBA 044), the Peruvian East Andean foothills (EBA 053), and the Bolivian and Peruvian lower yungas EBA (EBA 054).

Project records: A single individual was observed foraging briefly in the low canopy of forest at 1515m below in the Palmar Upper area, Serranía de Callejas, PNC, on 9 September (AM). *T. argyrofenges* appears to be extremely scarce, at least in the area surveyed within its elevational range. Reasons for the species apparent rarity is unknown and, as such, *T. argyrofenges* deserves some attention.

Other noteworthy records

Little Tinamou *Cryptutellus soui*

Global status: Occurs from the northern Neotropics to southern South-America where it is found along forest edge, river-edge and in secondary forest habitats from the lowlands to at least 1500m (Parker *et al* 1996). *C. soui* appears to be common throughout its range although it has, apparently, only recently been recorded from

Cochabamba Dept. (Herzog 1998) and there are no published reports from that Department.

Project records: A single bird was heard calling below 1670m in the Palmar Upper area, Serranía de Callejas, PNC, on August 26 (AM). Birds were also heard between 1500-1580m on August 27 (AM), and between 850-900m on August 28-29 (AM).

Fasciated Tiger-Heron *Tigrisoma fasciatum*

Global status: Widely but patchily distributed throughout the Neotropics, *T. fasciatum* is located along rivers and streams from the lowlands to 2400m (Parker *et al* 1996). The species' breeding biology is poorly known and it may be threatened in parts of its range (Parker *et al* 1996).

Project records: Two birds were observed on the Río San Mateo between 780-850m inside the PNC boundary, on August 30-31. A single, probably one of the previous, was recorded near the Río San Mateo camp at 860m on September 2 (AM, DP, KF). A single bird was also recorded at 325m on the Río Sajta near Comunidad Israel on September 20 (AM). However, the species was not recorded in the Río Leche area during 2 weeks of fieldwork.

Double-toothed Kite *Harpagus bidentatus*

Global status: Widely distributed from Central America through to the Atlantic Forest of south-east Brazil, where it inhabits lowland and montane forest up to 1500m (Parker *et al* 1996) and occasionally higher (Bierregaard 1994). Although known to be fairly common in parts of its range, *H. bidentatus* does not tolerate extensive deforestation (Bierregaard 1994). The species has been recorded from Pando, Beni, La Paz and Santa Cruz Depts. in Bolivia (Armonía 1995) but only recently from Cochabamba Dept (Herzog 1998), and there are no published reports from that Department.

Project records: A single bird was observed perched in treetops of open, sparsely wooded flood-plain at 860m, near the Río San Mateo, PNC, on September 6 (DP, KF, AM).

Solitary Eagle *Harpyhaliaetus solitarius*

Global status: *H. solitarius* is widely distributed through Central and South America, occurring mainly in foothill and montane forest at 600-2200m (Parker *et al* 1996). Nominate *H. s. solitarius* is largely confined to the Andes from Columbia to north-west Argentina (Bierregaard 1994). Despite its wide distribution, the species is poorly known and almost no data exists on its breeding biology (Bierregaard 1994) or prey (Bierregaard 1995). The species was previously considered to be near-threatened (Collar *et al* 1994).

Project records: At least four individuals were recorded from the Serranía de Callejas, PNC. Two distant birds were seen in flight together at 1450m on August 16 (MOA). A pair was seen soaring low over a forested ridge near Limbo at 2080m on August 24 and two birds were also observed soaring over steep forested terrain above the Río San Mateo, inside PNC, on August 30 (AM).

White-throated Hawk *Buteo albigula*

Global status: A largely Andean species, *B. albigula* occurs from Venezuela to Chile in montane forest as well as arid scrub between 1700-3500m (Parker *et al* 1996), but occasionally to near sea level in Chile (Bierregaard 1994). Rare to uncommon throughout its range, the species breeding biology is unknown, and little or no data exists on its prey species or its migratory behaviour (Bierregaard 1995). *B. albigula* was not reported from Bolivia by Remsen & Traylor (1989) but has since been recorded from La Paz, Santa Cruz and Chuquisaca Depts. in Bolivia (Armonía 1995).

Project records: A single individual was observed and photographed at 2240m above Limbo, Serranía de Callejas, PNC on September 11 (KF, AM, DMP). The bird was flushed from on or near the ground onto a nearby tree where it remained perched, allowing us to approach to 8-10 metres. Soon after we moved away, the bird was seen to return to the ground, probably to retrieve or feed on recently killed prey. This appears to be the first report of *B. albigula* from Cochabamba Dept.

Black-and-white Hawk-Eagle *Spizastur melanoleucus*

Global status: Widely distributed but apparently scarce in most areas from the northern Neotropics to north-east Argentina, *S. melanoleucus* occurs in lowland and lower montane forest to 1200m (Bierregaard 1994; Parker *et al* 1996). Only a single nest has been described and consequently the species breeding behaviour is very poorly known (Bierregaard 1995). *S. melanoleucus* was previously considered to be near-threatened (Collar *et al* 1994).

Project records: A single adult was observed perched in the forest canopy at 940m, some 1.5km inside the PNC boundary, near the Río Leche, on October 6 (WBW, RD, AM). Good views were had of the bird's diagnostic head pattern, basically a pure white head with a thin dark crest, dark orbital patch, yellow iris and orange, dark-tipped bill.

Ornate Hawk-eagle *Spizaetus ornatus*

Global records: Apparently fairly common throughout its extensive range, the species has been recorded from several departments in Bolivia (Remsen & Traylor 1989; Armonía 1995).

Project records: An adult was observed perched in disturbed forest at 350m near the Rio Leche, on September 23 (KF). There are no previously published reports of *S. ornatus* from Cochabamba Department.

Black-and-chestnut Eagle *Oroaetus isidori*

Global status: Another poorly known raptor, *O. isidori* occurs from Venezuela to Bolivia (and formerly Argentina) where its distribution closely follows the Andean chain (Bierregaard 1994). The species appears to be largely confined to heavily forested montane forest between 1500-2800m, but occasionally to sea-level and up to

3500m (Bierregaard 1994) and may be vulnerable to loss of its forest habitat (Bierregaard 1994).

Project records: Individuals were recorded from the Serranía de Callejas, PNC. An adult was observed in flight near the Río San Mateo, at 1000m, on September 3 (AMC). An adult was seen to take a Band-tailed Pigeon *Columba fasciata* in flight in dense forest at 2250m above Limbo on September 11 (KF, AM, DMP). Amazingly, this individual landed momentarily some 4m up in a low branch within a few metres of our heads while clutching its prey. The bird raised its crest (in alarm?) while perched facing us before flying off low out of view.

Crested Owl *Lophostrix cristata*

Global status: Uncommon to fairly common in lowland and montane evergreen forest to 1000m from the northern Neotropics to southern Amazonia and Andean foothills (Parker *et al* 1996). *L. cristata* has been recorded from Pando, Beni, La Paz and Santa Cruz Depts. in Bolivia (Armonía 1995).

Project records: At least one bird was heard calling soon after nightfall at 505m in forest near the Río Leche, PNC, on September 24 (AM). The bird was tape-recorded and identification confirmed by referring to commercial tapes (Voices of the New World Owls by Hardy *et al*). There are no previously published reports of *L. cristata* from Cochabamba Dept.

Striped Owl *Rhinoptynx clamator*

Global status: Widely distributed from the northern Neotropics to the Pampas of Argentina, *R. clamator* is found in grassland and scrub from the lowlands to 1400m (Parker *et al* 1996). The species appears to be uncommon throughout its range and has been recorded from Pando, Beni, La Paz and Santa Cruz Depts. in Bolivia (Armonía 1995).

Project records: At least one bird was heard calling soon after dusk in forest at 515m, near the Río Leche, on September 23-24 (AM). This site was just within the PNC boundary in undisturbed forest close to the river edge. Identification was confirmed by reference to commercial tapes (Voices of the New World Owls by Hardy *et al*). There are no previously published reports of *R. clamator* from Cochabamba Dept.

Amethyst-fronted Sunangel *Heliangelus amethysticollis*

Global status: An Andean hummingbird, *H. amethysticollis* occurs from Venezuela to Bolivia where it inhabits montane and secondary forest between 1800-3300m (Fjeldså & Krabbe 1990; Parker *et al* 1996). However, it is most frequently observed above 2400m (Heynen 1999). The species has been recorded from La Paz, Cochabamba and Santa Cruz Depts. in Bolivia (Armonía 1995).

Project records: Two birds were recorded from the Serranía de Callejas, PNC. A single bird was recorded at 1625m above the Palmar Upper camp on August 25 (AM, AMC). This appears to be an extremely low elevation for the species. Another was observed at 2000m near Limbo on September 11 (AM).

Slender-tailed Woodstar *Microstilbon burmeisteri*

Global status: Distributed from the central Andes through southern South America, *M. burmeisteri* is known from tropical deciduous forest and arid montane scrub from the lowlands to over 2000m (Fjeldså & Krabbe 1990; Parker *et al* 1996) but principally at 1600-2600m (Züchner 1999). The species is thought to be uncommon although in Bolivia it has been recorded from La Paz Dept. in the north to Tarija Dept. in the south (Armonía 1995), although the former may be based on a single specimen from the yungas of La Paz (Züchner 1999).

Project records: Two individuals observed together at 2180m near Limbo, Serranía de Callejas, PNC, on August 24 were the only birds recorded (AM).

Collared Trogon *Trogon collaris*

Global status: Widely distributed and throughout the Neotropics from southern Mexico to Bolivia and eastern Brazil, *T. collaris* is common in lowland and montane forests to 2500m (Parker *et al* 1996). The species has been recorded from Pando, Beni, La Paz and Santa Cruz Depts. in Bolivia (Armonía 1995).

Project records: A single bird was observed at 540m perched in the understorey of forest near the Río Leche, PNC, on 30 September (AM). There are no previously published reports of *T. collaris* from Cochabamba Dept.

White-necked Puffbird *Notharchus macrorhynchus*

Global status: Widely distributed throughout the Neotropics, *N. macrorhynchus* is thought to be fairly common in lowland and secondary forest to 900m (Parker *et al* 1996). The species has been recorded from Pando, Beni, La Paz and Santa Cruz Depts. in Bolivia (Armonía 1995).

Project records: A single individual was seen 0.5km south of Comunidad Israel, Valle Sajta, at 255m on September 20 (AM). The bird was perched inconspicuously in trees on the edge of heavily disturbed and recently cleared forest, some 6-7km north of the PNC boundary. There are no previously published reports of *N. macrorhynchus* from Cochabamba Dept.

Black-streaked puffbird *Malacoptila fulvogularis*

Global status: *M. fulvogularis* occurs in the understorey of humid montane forest at 1050-2100m on Andean slopes from Columbia to Bolivia (Parker *et al* 1996). The species is uncommon and poorly known but not apparently immediately threatened.

Project records: One was netted but escaped at 1250m near the Palmar Lower camp on August 8 (AMC, CS). No birds were otherwise seen in the field at PNC. At least two birds were recorded at 1540-1560m in Parque Nacional Cotapata, La Paz Dept., on October 27 (RD).

Lanceolated Monklet *Micromonacha lanceolata*

Global status: Although *M. lanceolata* is found from Costa Rica south through northern South America, it appears to occur at low density or is patchily distributed in lowland and montane evergreen forest from 300-2100m (Parker *et al* 1996). The species most southerly limit was, up until recently, known to be northern Peru (Gandy 1995). Although not listed for Bolivia by Remsen & Traylor (1989) or Armonía (1995), the species was collected at Calabatea, La Paz Dept, in 1993 (J.V. Remsen pers. comm.) and subsequently recorded in the field at another site in La Paz Dept. (B. Hennessey pers. comm.).

Project records: A single *M. lanceolata* was recorded at 1550m in Parque Nacional Cotapata, La Paz Dept., on October 26 (RD). Observations were made on the main track leading to the Estación Biologica Tunquini, approximately 150m from the field station (under construction in 1998). The bird was first observed feeding on a large Orthopteran while perched three metres up and four metres from the edge of the track. After 5 minutes, during which time it remained motionless, the bird flew down into thicker secondary growth and out of sight. No calls were heard. Habitat in the area where *M. lanceolata* was located was heavily disturbed secondary growth. The bird was located near a small clearing, with patches of fairly dense, thin (<10cm DBH) re-growth. Some forest in the clearing area appeared to have been recently cut to provide building materials for the nearby field station.

The individual observed at Tunquini appeared to be an adult, having a white band above the (large) bill, bordered black between the eyes and heavy dark streaking on the underparts from the chin down (see refs in Gandy 1995). This record is the third report of *M. lanceolata* from Bolivia (none as yet published) and, to date, PN Cotapata represents the most southerly extension in the species disjunct distribution.

Long-tailed Woodcreeper *Deconychura longicauda*

Global status: Occurs in lowland and foothill forest to 1700m from the northern Neotropics to southern Amazonia (Ridgely & Tudor 1994; Parker *et al* 1996). *D. longicauda* appears to be rare to uncommon throughout its range and has not, been reported from Cochabamba Dept., Bolivia, (Remsen & Traylor 1989; Armonia 1995) until recently (Herzog 1998).

Project records: A single bird was mist-netted in forest at 540m near the Río Leche, PNC, on October 3 (AM). This bird most closely fitted the description of the nominate subspecies *D. l. pallida*, being ochorous buff below and sparsely streaked on the upper breast. The species was not otherwise recorded in the field during survey work suggesting that it is either occurs at very low densities or is extremely unobtrusive and therefore may have gone undetected. This appears to be only the second report of *D. longicauda* from Cochabamba Dept. (none as yet published).

Gray-throated Leaftosser *Sclerurus albigularis*

Global status: Patchily distributed from Costa Rica through to Bolivia, *S. albigularis* inhabits lowland and montane forest between 700-2100m (Ridgely & Tudor 1994; Parker *et al* 1996). The species appears to be rare to uncommon throughout its range and is known in Bolivia from Beni, La Paz and Santa Cruz Depts. (Remsen & Traylor 1989; Armonía 1995).

Project records: A single individual was mist-netted in forest at 540m near the Río Leche, PNC, on October 4. As with *Deconychura longicauda*, this species may occur at very low densities across its range and/or may be easily overlooked. There are no previously published reports of *S. albigularis* from Cochabamba Dept.

Barred Antthrush *Chamaeza mollissima*

Global status: An Andean species, *C. mollissima* occurs from Columbia through to Bolivia (although there are few records from Ecuador and Peru) where it inhabits montane forest between 1800-3000m (Ridgely & Tudor 1994; Parker *et al* 1996). It is considered rare or local throughout its range and has been recorded from La Paz and Cochabamba Depts. in Bolivia (Armonía 1995).

Project records: Recorded between 1700-2090m from the Palmar Upper areas and near Limbo, Serranía de Callejas, PNC, on August 15 and 25 and September 9-11

(MOA, AM). Identity was confirmed with reference to commercial recordings (Birds of Bolivia, Mayer 1996).

Mottle-backed Elaenia *Elania gigas*

Global status: Known from lowland and foothill habitats along the Andean chain from Columbia to Bolivia, *E. gigas* is rare to locally common in clearings with riparian and second-growth scrub to 1200m (Ridgely & Tudor 1994; Parker *et al* 1996). The species was not has been recorded from La Paz and Santa Cruz Depts. in Bolivia (Armonía 1995).

Project records: Single birds were recorded in riparian scrub at 800-900m near the Río San Mateo, PNC, on September 3 and 9 (AMC, AM). Up to two birds were observed at 460-480m, also perched openly in riparian bushes in the Valle de la Luna, Río Leche, approximately 1km outside the PNC boundary, on September 30 and October 1 (AM).

Olive-striped Flycatcher *Mionectes olivaceus*

Global status: Distributed from Venezuela through to Bolivia, mainly in lowland and foothill forest along the Andes, *M. olivaceus* is thought to be fairly common in both primary and secondary forest to some 1800m (Parker *et al* 1996) and locally to 3000m in Venezuela (Ridgely & Tudor 1994). The species was not listed for Bolivia by Remsen & Traylor (1989) but has since been recorded from La Paz Dept. (Armonía 1995).

Project records: An individual was trapped at 1450m in the Serranía de Callejas, PNC, on August 12 (MOA, IG). *M. olivaceus* has not been previously reported from Cochabamba Dept. This record would, therefore, represent a significant extension of its known range and the most southerly record of the species to date.

Golden-browed Chat-Tyrant *Silvicultrix (Ochthoeca) pulchella*

Global status: Confined to the eastern side of the Andes of Peru and Bolivia, this small forest dwelling flycatcher is apparently uncommon (Ridgely & Tudor 1994) or rare (Fjeldså & Krabbe 1990) in montane forest at 2000-2800m (However Parker *et al* 1996 regard *S. pulchella* as fairly common!). St. Cruz Dept., Bolivia, represents the most southern extremity of the species range (Ridgely & Tudor 1994, Armonía 1995).

Project records: Two birds were observed at 1820m along a forest transect at Palmar Upper, Serranía de Callejas, PNC, on August 17 (AM). The bird perched low down at 0.5–2 metres up and gave a short antwren-like "scolding" call, presumably alarm calls. When not vocalising *S. pulchella* was inconspicuous and difficult to relocate. Fjeldså & Krabbe (1990) note that *S. pulchella* occurs above 2000m while Ridgely & Tudor (1994) give an elevational range of 2000-2800m with birds occasionally found somewhat higher or lower. The site at which the PNC birds were recorded was at the crest of a ridge with a low canopy height, dense undergrowth and a profusion of epiphytes. Thus, vegetation here was more characteristic of montane forest at higher altitudes and it seems likely that *S. pulchella* may occur occasionally at lower altitudes (to 1800m at least) where ecological conditions permit.

Scarlet-breasted Fruiteater *Pipreola frontalis*

Global status: Confined to the Andes of Ecuador, Peru and Bolivia, *P. frontalis* appears to be uncommon to locally common in montane forests between 1100-2000m (Ridgely & Tudor 1994; Parker *et al* 1996). In Bolivia, the species has been recorded from La Paz, Cochabamba and Santa Cruz Depts. *P. frontalis* was formerly considered near-threatened (Collar *et al* 1994).

Project records: We recorded *P. frontalis* only from the Palmar Upper area, Serranía de Callejas, PNC. A female was observed at 1560m and two others at 1600m and 1300m on August 14 (MOA, IG). A male and female were seen perched three metres up in track-side trees at 1580m on August 14-15 (CS). A single bird was seen at 1500m on August 16 (MOA). Two were seen at 1800m and a male at 1600m on August 17 (MOA, CS). A male and female, perhaps the same pair as seen previously, were observed at 1590m on August 18, in an apparently aggressive encounter with a Versicolored Barbet *Eubucco versicolor* (AMC). At least two birds were again recorded at 1585-1600m on August 22-23 and September 9 (MOA, CS, AM). Finally, a female was seen at 1610m on August 24 and one was trapped at 1580m on August 27 (AMC, CS). It seems likely that some of these records are repeat observations of a small number of individuals. Most sightings were of birds foraging in the low to mid-canopy of trees bordering the disused Cochabamba road.

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Appendices

- Appendix 1. Elevation and abundance of birds recorded in the Parque Nacional Carrasco area, Cochabamba Department, Bolivia, between August 7-October 8, 1998.
- Appendix 2. Elevation and abundance of birds recorded at yungas sites at Chulumani (Marchacamarca and Bosque Ecological Apa-Apa) and Parque Nacional Cotapata, La Paz Department, Bolivia.
- Appendix 3. Netting data summary for Parque Nacional Carrasco.
- Appendix 4. Mammal species recorded from Parque Nacional Carrasco, August 7-October 8 1998.
- Appendix 5. Observations of psittacines at a geophagy site in the Valle de la Luna, Río Leche, Cochabamba Department, Bolivia.
- Appendix 6. Habitat associations and notes on *Pauxi unicornis* in Parque Nacional Carrasco, Bolivia. Asociaciones de habitat y notas de *Pauxi unicornis* en el Parque Nacional Carrasco, Bolivia. Cracid Specialist Group Bulletin 9, 15-20.
- Appendix 7. Notes on the Yungas Antwren *Myrmotherula grisea*: a little known Bolivian endemic.
- Appendix 8. Project budget and sponsors.

Appendix 1. Elevation and relative abundance of 274 bird species from the Parque Nacional Carrasco area (241 species within PNC), Cochabamba Dept., Bolivia, August 7 – October 8 1998.

Species		Elevational range (m)	% Days recorded	Abundance by site			
				SC	RSM	VS	RL
Tinamus tao	Gray tinamou	540-850	44				U
Crypturellus cinereus	Cinerous tinamou	1200-1800	32	U			
Crypturellus soui	Little tinamou	1500-1740	21	U			
Crypturellus obsoletus	Brown tinamou	1200-1650	14	U			
Phalacrocorax brasilianus	Neotropic cormorant	420-500	-			R	
Tigrisoma fasciatum	Fasciated tiger-heron	760-860	18		U	-	
Tigrisoma lineatum	Rufescent tiger-heron	420-760	27		U	U	
*Pilherodius pileatus**	Capped heron	430	-			R	
*Butorides striatus**	Striated heron	480	-			R	
*Bubulcus ibis**	Cattle egret	430-480	-			U	
*Egretta thula**	Snowy egret	480	-			R	
Marganetta armata	Torrent duck	860-950	36		U		
Coragyps atratus	Black vulture	420-1600	21	U		U	U
Cathartes aura	Turkey vulture	400-1400	5/90	R	U		C
*Sarcoramphus papa**	King vulture	440-480	8			R	
Chondrohierax uncinatus	Hook-billed kite	1810	5	R			
Elanoides forficatus	Swallow-tailed kite	440-1700	58/55	FC	FC	-	FC
Harpagus bidentatus	Double-toothed kite	440-860	5		R	R	
Ictinia plumbea	Plumbeous kite	420-820	5/20	R	U	U	
Leucopternis schistacea	Slate-colored hawk	530	8				R
Leucopternis albicollis	White hawk*	420	-			R	
Buteogallus urubitinga	Great black hawk	420-1200	5/10	R	U	U	
Harpyhaliaetus solitarius	Solitary eagle	1100-2080	11/9	U	R		
Buteo magnirostris	Roadside hawk	400-900	5/20/8	R	U	FC	R
Buteo brachyurus	Short-tailed hawk	750-1250	11/9	U	R		
Buteo albigula	White-throated hawk	2240	5	R			
Spizastur melanoleucus	Black-and-white hawk-eagle	940	8				R
*Spizaetus ornatus**	Ornate hawk-eagle	350	-			R	
Oreaetus isidori	Black-and-chestnut eagle	2250	5/9	R	R		
*Falco rufigularis**	Bat falcon	420	8				R
Ortalis guttata	Speckled chachalaca	1420-1650	10	U			
Penelope montagnii	Andean guan	1550-2000	33	U			
Penelope jacuacu	Spix's guan	480-1600	38/8	U	?	U	R
Mitu tuberosa	Razor-billed curassow	420-520	23			U	U
Pauxi unicornis	Horned curassow	580-960	40				U
Odontophorus balliviani	Stripe-faced wood-quail	1600-1700	10	U			
Odontophorus sp.	Wood-quail sp.	1760	-	?			
Aramides cajanea	Gray-necked wood-rail	900	5	R			
Eurypyga helias	Sunbittern	700-800	10	U	R		
Actitis macularia	Spotted sandpiper	440-860	36/40		U		U
*Columbina talpacoti**	Ruddy ground-dove	420	5	R		R	
Columba fasciata	Band-tailed pigeon	1200-2180	15	U			
Columba plumbea	Plumbeous pigeon	610-1800	29/40	U			U
Columba subvinacea	Ruddy pigeon	420-1150	5	R		U	
Leptotila rufaxilla	Gray-fronted dove	350-820	8			U	R
Geotrygon montana	Ruddy quail-dove	440-1840	24/25	U			U
Geotrygon frenata	White-throated quail-dove	1300	5	R			
*Ara ararauna**	Blue-and-yellow macaw	480-510	-			U	
*Ara chloroptera**	Red-and-green macaw	460-510	-			U	
Ara severa	Chestnut-fronted macaw	400-510	8			LC	R
Aratinga mitrata	Mitred parakeet	1200	5	R			
Aratinga weddellii	Dusky-headed parakeet	460-510	15			LC	U
Pyrrhura molinea	Green-cheeked parakeet	860-1760	71/27	FC	U		
Pionus menstruus	Blue-headed parrot	350-900	5	R		LC	
Pionus tumultuosus	Plum-crowned parrot	1450	5	R			
Amazona mercenaria	Scaly-naped parrot	800-1700	81/36	FC	U		
Amazona farinosa	Mealy parrot	420-820	87			FC	FC
Piaya cayana	Squirrel cuckoo	350-1700	24	U		U	
Piaya minuta	Little cuckoo	420-1630	5	R		R	
*Crotophaga ani**	Smooth-billed ani	400-800	5	R		U	
Otus choliba	Tropical screech-owl	1200-1600	24	U			
Lophostrix cristata	Crested owl	510	5				R
Rhinoptynx clamator	Striped owl	520	5				R
*Nyctibius grandis**	Great potoo	440	-			R	
Podager nacunda	Nacunda nighthawk	1590	10	U			
Nyctidromus albicollis	Parauque	440-520	8				R

Species		**Elevational range (m)**	**% Days recorded**	**Abundance by site**			
				SC	**RSM**	**VS**	**RL**
Caprimulgus rufus	Rufous nightjar	2100	5	R			
Caprimulgus longirostris	Band-winged nightjar	1400-1420	10	U			
Hydropsalis climacocerca	Ladder-tailed nightjar	440-780	9/40		R		U
Cypseloides rutilus	Chestnut-collared swift	440-1650	10	LC	LC		LC
Streptoprocne zonaris	White-collared swift	350-440	9/8		U	U	R
Chaetura brachyura	Short-tailed swift	420-1805	5	LC		?	
Doryfera ludoviciae	Green-fronted lancebill	1350-1650	14	U			
Phaethornis malaris	Great-billed hermit	510-1590	10/50	U		?	FC
Phaethornis ruber	Reddish hermit	510-1200	5/63	R			FC
Colibri thalassinus	Green violetear	880-1710	33/9	U	R		
Thalurania furcata	Fork-tailed woodnymph	420-780	10/23	U		U	U
Adelomyia melanogenys	Speckled hummingbird	900-2100	43/18	U	U		
Heliodoxa leadbeateri	Violet-fronted brilliant	1200-1250	10	U			
Coeligena coeligena	Bronzy inca	1590	5	R			
Heliangelus amethysticollis	Amethyst-fronted sunangel	2100	5	R			
Ocreatus underwoodii	Booted racket-tail	1250-1700	43	U			
Metallura tyrianthina	Tyrian metaltail	1200-1600	14	U			
Aglaiocercus kingi	Long-tailed sylph	1270-1650	14	U			
Schistes geoffroyi	Wedge-billed hummingbird	1570	5	R			
Microstilbon burmeisteri	Slender-tailed woodstar	2180	5	R			
Pharomachrus antisianus	Crested quetzal	2150	5	R			
Pharomachrus auriceps	Golden-headed quetzal	1770	5	R			
Trogon collaris	Collared trogon	540	5				R
Trogon personatus	Masked trogon	1200-2000	81	FC			
Trogon curucui	Blue-crowned trogon	510-1600	38/9/78	U	R		FC
Ceryle torquata	Ringed kingfisher	420-860	73		FC	U	
Chloroceryle amazona	Amazon kingfisher	420-520				U	
*Notharchus macrorhynchus**	White-necked puffbird	260	5			R	
Malacoptila fulvogularis	Black-streaked puffbird	1250	5	R			
Eubucco versicolor	Versicolored barbet	1150-1550	14	U			
Aulacorhynchus prasinus	Emerald toucanet	1250-1700	38	U			
Aulacorhynchus derbianus	Chestnut-tipped toucanet	1200-1400	14	U			
Aulacorhynchus coeruleicinctus	Blue-banded toucanet	1200-2150	43	U			
Pteroglossus castanotis	Chestnut-eared aracari	420-1200	5	R		U	?
Pteroglossus beauharnaesii	Curl-crested aracari	515	5				R
Ramphastos vitellinus	Channel-billed toucan	530-1300	10/9	U			R
Ramphastos tucanus	Red-billed toucan	430-940	100			?	C
*Melanarpes cruentatus**	Yellow-tufted woodpecker	420	-			U	
Veniliornis nigriceps	Bar-bellied woodpecker	1200-1590	14	U			
Veniliornis fumigatus	Smoky-brown woodpecker	1200	5	R			
Veniliornis frontalis	Dot-fronted woodpecker	1200-1450	10	U			
Veniliornis affinis	Red-stained woodpecker	1200	14	U			
Piculus rubiginosus	Golden-olive woodpecker	900-1300	14/9	U	R		
Piculus rivolii	Crimson-mantled woodpecker	1300-2000	48	U			
Dryocopus lineatus	Lineated woodpecker	420-1500	10	U		U	
*Celeus flavus**	Cream-colored woodpecker	420	-			R	
Campephilus melanoleucos	Crimson-crested woodpecker	870-1550	14	U			
Campephilus rubricollis	Red-necked woodpecker	420-1230	14/22	U		?	U
Dendrocincla fulginosa	Plain-brown woodcreeper	420-580	8			U	R
Deconychura longicauda	Long-tailed woodcreeper	510	5				R
Sittasomus griseicapillus	Olivaceous woodcreeper	1600	5	R			
Xiphocolaptes promeropirhynchus	Strong-billed woodcreeper	890-2000	48/8	U			R
Dendrocolaptes picutinus	Black-banded woodcreeper	1100-1600	57	C			
Xiphorynchus ocellatus	Ocellated woodcreeper	1250-1700	38	U			
Campylorhamphus trochilirostris	Red-billed scythebill	650	5				R
Synallaxis azarae	Azara's spinetail	1200-2105	62	FC			
Margarornis sqaumiger	Pearled treerunner	2190	5	R			
Premnoplex brunnescens	Spotted barbtail	1300-1650	29	U			
Pseudocolaptes boissonneautii	Streaked tuftedcheek	1580-2040	14	U			
Syndactyla rufosuperciliata	Buff-browed foliage-gleaner	1150-1580	19	U			
Anabacerthia striaticollis	Montane foliage-gleaner	1250-2000	19	U			
Automolus ochrolaemus	Buff-throated foliage-gleaner	1200	5	R			
Thripadectes holostictus	Striped treehunter	1630	5	R			
Sclerurus mexicanus	Gray-throated leaftosser	510	5				R
Thamnophilus aethiops	White-shouldered antshrike	520	16				U
Thamnophilus aroyae	Upland antshrike	900	?		U		
Thamnophilus caerulescens	Variable antshrike	1470-1600	14	U			
*Myrmotherula brachyura**	Pygmy antwren	420	-			R	
Myrmotherula longicauda	Stripe-chested antwren	840	5	R			
Myrmotherula axillaris	White-flanked antwren	1100	5	R			

Species		Elevational range (m)	% Days recorded	Abundance by site			
				SC	RSM	VS	RL
Pyriglena leuconota	White-backed fire-eye	860	5		R		
Myrmoborus myotherinus	Black-faced antbird	420-650	67				FC
Myrmeciza hemimeleana	Chestnut-tailed antbird	430-1000	14/100	U		?	C
Hylophylax naevia	Spot-backed antbird	510-580	56				FC
Formicarius analis	Black-faced antthrush	510-890	100				C
Chamaeza campanisona	Short-tailed antthrush	1200-1800	86	FC			
Chamaeza mollissima	Barred antthrush	2000-2020	10	U			
Grallaria guatimalensis	Scaled antpitta	1400-1590	10	U			
Grallaria albigula	White-throated antpitta	1200-2000	14	U			
Grallaria erythrotis	Rufous-faced antpitta	2010-2140	10	U			
Conopophaga ardesiaca	Slaty gnateater	1400-2100	14	U			
Scytalopus parvirostris	Unicolored tapaculo	1700-2140	14	U			
Scytalopus bolivianus	White-crowned tapaculo	900-2180	76/9	FC	R		
Elaenia gigas	Mottle-backed elaenia	480-900	9		R	R	
*Elaenia parvirostris**	Small-billed elaenia	400	-			R	
Serpophaga cinerea	Torrent tyrannulet	780-920	45		U		
Phyllomyias sclateri	Sclater's tyrannulet	1550	5	R			
Mecocerculus leucophrys	White-throated tyrannulet	1250-2020	24	U			
Mecocerculus hellmayri	Buff-banded tyrannulet	1250-1700	14	U			
Mionectes striaticollis	Streak-necked flycatcher	900-1570	24/27	U	U		
Mionectes olivaceus	Olive-striped flycatcher	1450	5	R			
Mionectes oleagineus	Ochre-bellied flycatcher	440-520	56			FC	FC
Phylloscartes ophthalmicus	Marble-faced bristle-tyrant	1200	5	R			
Phylloscartes ventralis	Mottle-cheeked tyrannulet	810-1600	10	U			
Pseudotriccus simplex	Hazel-fronted pygmy-tyrant	1530-2250	29	U			
Hemitriccus spodiops	Yungas tody-tyrant	1200-1595	10	U			
Todirostrum plumbeiceps	Ochre-faced tody-flycatcher	1650	5	R			
Rhynchocyclus sp.	Flatbill sp.	515	-			U	
Rhynchocyclus fulvipectus	Fulvous-breasted flatbill	1590	10	U			
Platyrinchus mystaceus	White-throated spadebill	1340-1750	10	U			
Myiophobus inornatus	Unadorned flycatcher	1300-1550	10	U			
Pyrrhomyias cinnamomea	Cinnamon flycatcher	1380-2000	48	U			
Contopus fumigatus	Smoke-colored pewee	2050-2170	10	U			
*Pyrocephalus rubinus**	Vermillion flycatcher	440	-			R	
Sayornis nigricans	Black phoebe	440-1000+	100/16		C	FC	U
Ochthoeca pulchella	Golden-browed chat-tyrant	1820	5	R			
Rhytipterna simplex	Grayish mourner	610	8				R
Myiarchus cephalotes	Pale-edged flycatcher	1600	5	R			
Myiarchus sp.		1480-1650	-	?			
Megarynchus pitangua	Boat-billed flycatcher	420-800	5	R		R	
Myiozetetes similis	Social flycatcher	480-800	10	U		U	
Myiodynastes chrysocephalus	Golden-crowned flycatcher	530-860	5/8	R			R
Myiodynastes maculatus	Streaked flycatcher	420-800	5/33	R		U	U
Tyrannus melancholicus	Tropical kingbird	440-1500	10/82/33	U	FC	C	U
Pachtramphus minor	Pink-throated becard	510	5				R
*Pachyramphus validus**	Crested becard	420	-			R	
Tityra semifasciata	Masked tityra	400-1590	29	U		U	
Schiffornis major	Thrush-like mourner	510-1200	5/8	R			R
Chiroxiphia boliviana	Yungas manakin	900-1600	57/18	C	U		
Pipra chloromeros	Round-tailed manakin	420-610	44			FC	U
Pipreola intermedia	Band-tailed fruiteater	800-2250	19	U			
Pipreola arcuata	Barred fruiteater	1200-2090	10	U			
Pipreola frontalis	Scarlet-breasted fruiteater	1200-1690	32	U			
Cephalopterus ornatus	Amazonian umbrellabird	750-830	10/18	U	U		
Rupicola peruviana	Andean cock-of-the-rock	600-2000	24/55	U	FC		
Notiochelidon cyanoleuca	Blue-and-white swallow	900-2020	14/18	U	U		
Notiochelidon flavipes	Pale-footed swallow	2050-2090	10	U			
Cinclus leucocephalus	White-capped dipper	860-950+	36		U		
*Campylorhynchus turdinus**	Thrush-like wren	400-480	-			U	
Thryothorus genibarbis	Moustached wren	510	5				R
*Troglodytes aedon**	House wren	400-500	-			U	
Troglodytes solstitialis	Mountain wren	1200-1800	38	U			
Henicorhina leucophrys	Gray-breasted wood-wren	860-1810	67/36	FC	U		
Microcerculus marginatus	Southern nightingale-wren	510-890	100				C
Myadestes ralloides	Andean solitaire	1400-2000	19	U			
Entomodestes leucotis	White-eared solitaire	1590-2000	29	U			
Catharus fuscater	Slaty-backed nightingale-thrush	2100-2200	5	R			
Catharus dryas	Spotted nightingale-thrush	1200-2150	57	FC			
Turdus fuscater	Great thrush	1580-1870	10	U			

Species		Elevational range (m)	% Days recorded	Abundance by site			
				SC	RSM	VS	RL
Turdus serranus	Glossy-black thrush	1560-2050	24	U			
Turdus nigriceps	Slaty thrush	1200	5	R			
Turdus rufiventris	Rufous-bellied thrush	1650	5	R			
*Turdus amaurochalinus**	Creamy-bellied thrush	420-440	-			U	
Turdus albicollis	White-necked thrush	420-1450	10/9/8	U	R		R
Ammodramus aurifrons	Yellow-browed sparrow	420-900	36/22		U	FC	U
*Sporophila caerulescens**	Double-collared seedeater*	480	-			R	
Arremon taciturnus	Pectoral sparrow	350-510	8			?	U
Atlapetes rufinucha	Rufous-naped brush-finch	1200-2000	57	FC			
Atlapetes fulviceps	Fulvous-headed brush-finch	1450	5	R			
Atlapetes torquatus	Stripe-headed brush-finch	1200-2000	19	U			
Catamblyrhynchus diadema	Plush-capped finch	2040	5	R			
Pheucticus aureoventris	Black-backed grosbeak	510-2000	48/9	U	R		
*Caryothraustes humeralis**	Yellow-shouldered grosbeak	420	-			R	
Saltator maximus	Buff-throated saltator	510	5				R
Cyanocompsa cyanoides	Blue-black grosbeak	500-520	22				U
Cissopis leveriana	Magpie tanager	480-910	14	U		U	
Chlorornis riefferii	Grass-green tanager	1400-2200	14	U			
Chlorospingus ophthalmicus	Common bush-tanager	900-2040	86/9	FC	R		
Hemispingus melanotis	Black-eared hemispingus	1200-2000	29	U			
Thylpopsis ruficeps	Rust-and-yellow tanager	500-1670	24/8	U			R
Chlorothraupis carmioli	Olive tanager	510-850	67				FC
Lanio versicolor	White-winged shrike-tanager	510-530	10				U
Tachyphonus luctuosus	White-shouldered tanager	510-600	33				U
Habia rubica	Red-crowned ant-tanager	530-610	22				U
Piranga flava	Hepatic tanager	520	8				R
Piranga leucoptera	White-winged tanager	900	27		U		
Ramphocelus carbo	Silver-beaked tanager	400-900	14/45/22	U	U	FC	U
*Thraupis palmarum**	Palm tanager	420				U	
Anisognathus igniventris	Blue-winged mountain-tanager	1200-2040	71	FC			
Pipraeidea melanonota	Fawn-breasted tanager	1800	5	R			
Euphonia laniirostris	Thick-billed euphonia	900-1200	5/9	R	R		
Euphonia xanthogaster	Orange-bellied euphonia	1200-1800	43	U			
Chlorochrysa calliparaea	Orange-eared tanager	1250-1400	10	U			
*Tangara mexicana**	Turquoise tanager	420	-			U	
Tangara chilensis	Paradise tanager	420-690	8			U	R
*Tangara schrankii**	Green-and-gold tanager	420	-			R	
Tangara arthus	Golden tanager	1020-1250	10	U			
Tangara xanthocephala	Saffron-crowned tanager	1270-1650	52	C			
Tangara gyrola	Bay-headed tanager	440-1300	10/8	U		R	R
*Tangara cyanicollis**	Blue-necked tanager	430	-			R	
Tangara argyrofenges	Straw-backed tanager	1520	5	R			
Dacnis lineata	Black-faced dacnis	530	8				R
*Dacnis cayana**	Blue dacnis	420				U	
*Chlorophanes spiza**	Green honeycreeper	400	-		R		
*Cyanerpes caeruleus**	Purple honeycreeper	420				U	
Diglossa glauca	Deep-blue flowerpiercer	1550	5	R			
Parula pitiayumi	Tropical parula	900-1200	5/18	R	U		
*Geothlypis aequinoctialis**	Masked yellowthroat	-				R	
Myioborus miniatus	Slate-throated whitestart	860-2000	48/45	U	U		
Myioborus melanocephalus	Spectacled whitestart	1510-2000	10	U			
Basileuterus bivittatus	Two-banded warbler	1200	5	R			
Basileuterus flaveolus	Flavescent warbler	750-900	10/36	U	U		
Basileuterus signatus	Pale-legged warbler	2000+	5	R			
Basileuterus coronatus	Russet-crowned warbler	1250-2000	29	U			
Basileuterus tristriatus	Three-striped warbler	900-2000	57/27	FC	U		
*Coereba flaveola**	Bananaquit	400				U	
Vireo olivaceus	Red-eyed vireo	420-570	22			U	U
Hylophilus hypoxanthus	Dusky-capped greenlet	500-610	22				U
Hylophilus sp.	Greelet sp.	750-900	5/9	R	R		
Psarocolius decumanus	Crested oropendola	350-1500	33/36	U	U	?	
Psarocolius atrovirens	Dusky-green oropendola	800-1750	62/55	FC	FC		
Psarocolius angustifrons	Russet-backed oropendola	350-1500	14/55/44	U	FC	FC	U
Psarocolius bifasciatus	Amazonian oropendola	400-800	5/9	R	R	?	
Cacicus cela	Yellow-rumped cacique	420-900	10	U	R		
Cacicus haemmorrhous	Red-rumped cacique	1300	5	R			
Cacicus leucoramphus	Mountain cacique	1600-2000	21	U			
Cacicus holosericeus	Yellow-billed cacique	?	5	R			
*Icterus cayenensis**	Epaulet oriole	420	-			R	
Molothrus bonariensis	Shiny cowbird	840-900	5	R			

Species		Elevational range (m)	% Days recorded	Abundance by site			
				SC	RSM	VS	RL
Cyanolyca viridicyana	Collared jay	1550-2000	14	U			
Cyanocorax cyanomelas	Purplish jay	420-900	22/27	U	U	U	
Cyanocorax yncas	Green jay	1100-1790	57	FC			

*Species recorded just outside the PNC boundary.

Key to sites:
Serranía de Callejas (SC): 800-2200m
Río San Mateo (RSM): 800-950m
Valle Sajta (VS): 300-500m (including the Río Leche area outside the PNC boundary)
Río Leche (RL): 500-960m

Key to abundance at sites
Common (C): detected on >90% of days
Fairly common (FC): detected on 50-90% of days
Uncommon (U): detected on 10-50% of days
Rare (R): detected on <10% of days
Locally common (LC): may be uncommon or rarely detected but occurs at high densities or in large aggregations where detected

Appendix 2. Elevation and abundance of 114 bird species from Chulumani (Marchacamarca & Bosque Ecological Apa-Apa) and Parque Nacional Cotopata, Yungas of La Paz, Bolivia.

Species		**Elevational range (m)**	**Abundance by site**		
			Mar	**Apu**	**Cot**
Crypturellus obsoletus	Brown tinamou	1550-2015	U	U	U
Coragyps atratus	Black vulture	1000-2000	C	U	U
Cathartes aura	Turkey vulture	1000-2000	C	U	C
Ictinia plumbea	Plumbeous kite	1550-1600			R
Buteo magnirostris	Roadside hawk	1250-1575			U
Phalcoboenus megalopterus	Mountain caracara	1560			R
Ortalis guttata	Speckled chachalaca	1550-1985	C	R	?
Penelope montagnii	Andean guan	1760-2005	U	U	
Odontophorus speciosus	Rufous-breasted wood-quail	1810	R		
Columba fasciata	Band-tailed pigeon	1570-2025		U	U
Columba plumbea	Plumbeous pigeon	1540-2025	FC	R	U
Geotrygon montana	Ruddy quail-dove	1800-1910	U	R	
Pyrrhura molinea	Green-cheeked parakeet	1550-2035	FC	U	U
Hapalopsittaca melanotis	Black-eared parrot	1540-1570			U
Pionus sordidus	Red-billed parrot	1580-2020	FC	U	
Amazona mercenaria	Scaly-naped parrot	1580-1785	U		
Piaya cayana	Squirrel cuckoo	?			R
Cypseloides rutilus	Chestnut-collared swift	1600-1815	U		R
Streptoprocne zonaris	White-collared swift	?	U		
Colibri thalassinus	Green violetear	1780-1895	U	R	
Adelomyia melanogenys	Speckled hummingbird	1540-1800	U		U
Heliodoxa leadbeateri	Violet-fronted brilliant	1550			R
Coeligena coeligena	Bronzy inca	1880			R
Ocreatus underwoodii	Booted racket-tail	1800		R	
Trogon personatus	Masked trogon	1540-1985		U	R
Momotus momota	Blue-crowned motmot	1500-1765			FC
Malacoptila fulvogularis	Black-streaked puffbird	1540-1560			R
Micromonacha lanceolata	Lanceolated monklet	1550			R
Eubucco versicolor	Versicolored barbet	1650-1880	R		U
Aulacorhynchus prasinus	Emerald toucanet	2870*			
Aulacorhynchus coeruleicinctus	Blue-banded toucanet	1810-2035	U	U	R
Piculus rubiginosus	Golden-olive woodpecker	1500-2035	R	R	U
Dryocopus lineatus	Lineated woodpecker	1515-2030		R	R
Campephilus rubricollis	Red-necked woodpecker	1590			R
Sittasomus griseicapillus	Olivaceous woodcreeper	1560-1795	R		U
Xiphocolaptes promeropirhynchus	Strong-billed woodcreeper	1540-2035		U	R
Dendrocolaptes picutinus	Black-banded woodcreeper	1810	R		
Xiphorhynchus triangularis	Olive-backed woodcreeper	1560			U
Synallaxis azarae	Azara's spinetail	1650-1910	U	U	
Anabacerthia striaticollis	Montane foliage-gleaner	1650-1910			U
Thripadectes holostictus	Striped treehunter	1910		R	
Xenops rutilans	Streaked xenops	1560			R
Pyriglena leuconota	White-backed fire-eye	1580-1800	U		
Chamaeza campanisona	Short-tailed antthrush	1500-2015		U	FC
Grallaria erythrotis	Rufous-faced antpitta	2870*			
Scytalopus parvirostris	Unicolored tapaculo	1985		R	
Scytalopus bolivianus	White-crowned tapaculo	1540-2035	U	U	FC
Elaenia sp.		1780	R		
Mecocerculus leucophrys	White-throated tyrannulet	2035		R	
Mionectes striaticollis	Streak-necked flycatcher	1550-2035		R	U
Mionectes oleagineus	Ochre-bellied flycatcher	1560			R
Phylloscartes ophthalmicus	Marble-faced bristle-tyrant	1540-1690			FC
Pseudotriccus simplex	Hazel-fronted pygmy-tyrant	1850-2010	R	R	
Pyrrhomyias cinnamomea	Cinnamon flycatcher	1570			U
Sayornis nigricans	Black phoebe	1200-1300			-
Ochthoeca rufipectoralis	Rufous-breasted chat-tyrant	2870*			
Satrapa icterophyrs	Yellow-browed tyrant	1570			R
Myiarchus cephalotes	Pale-edged flycatcher	1650			R
Myiodynastes chrysocephalus	Golden-crowned flycatcher	1540-1600			U
Tyrannus melancholicus	Tropical kingbird	1580-1865	FC	U	R
Pachyramphus polychopterus	White-winged becard	?	R		
Tityra semifasciata	Masked tityra	1650			R
Chiroxiphia boliviana	Yungas manakin	1550-2035	C	C	FC
Pipreola intermedia	Band-tailed fruiteater	1550-1705			U

Species		**Elevational range (m)**	**Abundance by site**		
			Mar	**Apu**	**Cot**
Pipreola sp.		1985		R	
Rupicola peruviana	Andean cock-of-the-rock	1200-1650			FC
Notiochelidon murina	Brown-bellied swallow	2870*			
Notiochelidon cyanoleuca	Blue-and-white swallow	1200-1700	U		R
*Troglodytes aedon**	House wren	1580-1800	U		
Henicorhina leucophrys	Gray-breasted wood-wren	1540-1960			C
Myadestes ralloides	Andean solitaire	1560			R
Catharus fuscater	Slaty-backed nightingale-thrush	1540-1580			U?
Catharus dryas	Spotted nightingale-thrush	1895-2890*		U	
Turdus albicollis	White-necked thrush	1865		R	
Atlapetes rufinucha	Rufous-naped brush-finch	1560-2870*			R
Atlapetes torquatus	Stripe-headed brush-finch	1800-1850	R		
Chlorospingus ophthalmicus	Common bush-tanager	1550-1815			U
Chlorospingus parvirostris	Short-billed bush-tanager	1550-1780			FC
Hemispingus melanotis	Black-eared hemispingus	?			R
Piranga leucoptera	White-winged tanager	1560-1720			U
Ramphocelus carbo	Silver-beaked tanager	1560-1600	?		U
Thraupis sayaca	Sayaca tanager	1580-1795	U		
*Thraupis palmarum**	Palm tanager	1795-1800	U		
Thraupis cyanocephala	Blue-capped tanager	2890*			
Thraupis bonariensis	Blue-and-yellow tanager	1800	R		
Anisognathus igniventris	Blue-winged mountain-tanager	1560-2035		FC	U
Euphonia cyanocephala	Blue-hooded euphonia	1560			R
Euphonia mesochrysa	Bronze-green euphonia	1560			R
Euphonia xanthogaster	Orange-bellied euphonia	1560			R
Chlorophonia cyanea	Blue-naped euphonia	1550			R
Tangara arthus	Golden tanager	1560-1590			U
Tangara xanthocephala	Saffron-crowned tanager	1550-2035		R	FC
Tangara punctata	Spotted tanager	1540-1560			U
Tangara ruficervix	Golden-naped tanager	1530-1835	R		FC
Tangara cyanotis	Blue-browed tanager	1560			R
*Tangara cyanicollis**	Blue-necked tanager	1550			R
Tangara nigroviridis	Beryl-spangled tanager	1540-1750			FC
*Cyanerpes caeruleus**	Purple honeycreeper	1560			U
Diglossa carbonaria	Gray-bellied flower-piercer	2890*			
Diglossa glauca	Deep-blue flowerpiercer	1550-1820			U
Tersina viridis	Swallow tanager	1580-1800	FC		R
Parula pitiayumi	Tropical parula	1580-2035	R	R	R
Myioborus miniatus	Slate-throated whitestart	1540-1985	U	U	FC
Myioborus melanocephalus	Spectacled whitestart	1560-2870*			R
Basileuterus coronatus	Russet-crowned warbler	1800-1820			R
Basileuterus tristriatus	Three-striped warbler	1540-2035	U	FC	FC
*Coereba flaveola**	Bananaquit	1700-1795	FC		
Vireo olivaceus	Red-eyed vireo	2035		R	
Psarocolius decumanus	Crested oropendola	1200-1850	FC		U
Psarocolius atrovirens	Dusky-green oropendola	1200-1800			C
Psarocolius angustifrons	Russet-backed oropendola	1545-1895	U	U	U
Cacicus holosericeus	Yellow-billed cacique	2870*			
Cyanolyca viridicyana	Collared jay	2870*			
Cyanocorax cyanomelas	Purplish jay	1540-1865	FC	R	U
Cyanocorax yncas	Green jay	1610			R

Key to sites:

Estancia Marchacamarca, Chulumani (Mar): 1580-1800m

Bosque Ecological Apu-Apu, Chulumain (Apu): 1800-2100m

Parque Nacional Cotapata (Cot): 1550-2000m

Key to abundance at sites

Common (C): detected on all days

Fairly common (FC): detected on most days

Uncommon (U): detected on 2-3 days

Rare (R): detected on one day only

Appendix 3. Summary of 1998 netting data from Parque Nacional Carrasco, Cochabamba Department, Bolivia.

Results of netting

A total of 137 birds were trapped involving 52 different species (total species including an unidentified hummingbird species). Five birds, three flatbills and two hummingbirds of the same species, were unidentified. There was uncertainty over another species: Lesser/Short-Billed Elaenia.
Of the 137 birds trapped, no data was supplied for 25 birds, two because they were released unprocessed after long extractions.

A site by site breakdown is given in Table 1:-

Table 1. Summary of netting data by site at Parque Nacional Carrasco, Bolivia, in 1998.

Site	**Elevation (m)**	**No species**	**No birds**	**Site distinctiveness***
PA1	1250	21	52	14 of 20 spp.
PA2	1590	16	26	7 of 16 spp.
PA3	1570	12	20	3 of 12 spp.
PA4	1760	3	4	0 of 4 spp.
Limbo	2020	8	9	4 of 8 spp.
Río San Mateo	900	4	4	1 of 4 spp.
Valle Sajta	350	3	4	0 of 3 spp.
Río Leche	510	30	69	20 of 30 spp.

*No of species not trapped at any other site

The majority of the passerines encountered were actively engaged in breeding, i.e., mid-August to early October. Some were still establishing a territory by September but the majority were incubating or feeding young throughout the latter period. The majority of birds trapped therefore were adults although a few juveniles were caught late in the trapping period e.g. flatbills and manakins.
There was little attempt at analysing moult strategies and moult scores were not taken. However moult was noted in several adults.

The majority of species trapped were photographed from a number of angles and in a number of poses in order to record the salient features. In a number of cases, more than one individual of the same species was photographed for comparison. Whenever, there was any uncertainty regarding the identification of a bird in the hand a full feather-by-feather description was taken and these are held in the files/notebooks of the expedition members for future reference if necessary. In some, but by no means all species, full or partial details of the wing formulae were taken.

Numbers of birds trapped are presented in Table 2.

Table 2. Species trapped in Parque Nacional Carrasco in order of abundance.

Species	No. birds	Sites
Round-tailed Manakin *Pipra chloromeros*	11	RL
Ochre-bellied Flycatcher *Mionectes oleagineus*	11	RL, VS
Speckled Hummingbird *Adelomyia melanogenys*	9	PA, L, RSM
Creamy-Bellied Thrush *Turdus amaurochalinus*	5	RL
Great-billed Hermit *Phaethornis malaris*	5	PA, RS, RL
Hazel-fronted Pygmy-tyrant *Pseudotriccus simplex*	5	PA
Streak-Necked Flycatcher *Mionectes striaticollis*	5	PA, L, RSM
Stripe-headed Brush-finch *Atlapetes torquatos*	5	PA
Fork-tailed Woodnymph *Thalurania furcata*	4	RL
Chestnut-tailed Antbird *Myrmeciza hemimelaena*	4	PA, RL
Rufous-naped Brush-finch *Atlapetes rufinucha*	4	PA, L
Common Bush-tanager *Chlorospingus ophthalmicus*	4	PA, L
Spotted Barbtail *Premnoplex brunnescens*	3	PA
Flatbill sp. *Rhynchocyclus sp.*	3	RL
Pectoral Sparrow *Arremon taciturnis*	3	RL
Red-crowned Ant-tanager *Habia rubica*	3	RL
Russet-crowned Warbler *Basileuterus coronatus*	3	PA
Three-striped Warbler *Basileuterus tristriatus*	3	PA
Reddish Hermit *Phaethornis ruber*	2	RL
Bronzy Inca *Coeligena coeligena*	2	PA
Plain Xenops *Xenops minutus*	2	Rl
Spot-backed Antbird *Hylophylax naevia*	2	RL
Fulvous-breasted Flatbill *Rhynchocyclus fulvipectus*?	2	PA
White-throated Spadebill *Platyrinchus mystaceus*	2	PA
Gray-breasted Wood-wren *Henicorhina leucophrys*	2	PA
White-necked Thrush *Turdus albicollis*	2	RSM, RL
Blue-black Grosbeak *Cyanocompsa cyanoides*	2	RL
Black-eared Heminspingus *Hemispingus melanotus*	2	PA
Silver-beaked Tanager *Ramphocelus carbo*	2	RL
Wedge-billed Hummingbird *Schistes geoffroyi*	1	PA
Long-tailed Woodcreeper *Deconychura longicauda*	1	RL
Buff-browed Foliage-gleaner *Syndactyla rufosuperciliata*	1	PA
Gray-throated Leaftosser *Sclerurus albigularis*	1	RL
White-shouldered Antshrike *Thamnophilus aethiops*	1	RL
White-backed Fire-eye *Pyriglena leuconata*	1	RSM
Black-faced Antbird *Myrmoborus myotherinus*	1	RL
Black-faced Antthrush *Formicarius analis*	1	RL
White-crowned Tapaculo *Scytalopus bolivianus*	1	PA
Small-billed Elaenia *Elaenia parvirostris*	1	RL
White-throated Tyrannulet *Mecocerculus leucophrys*	1	L
Cinnamon Flycatcher *Pyrrmomyias cinnamomea*	1	PA
Band-tailed Fruiteater *Pipreola intermedia*	1	L
Scarlet-breasted Fruiteater *Pipreola frontalis*	1	PA
Thrush-like Mourner *Schiffornis major*	1	RL
Moustached Wren *Thryothorus genibarbis*	1	RL
Southern Nightingal-wren *Microcerculus marginatus*	1	RL
Glossy-black Thrush *Turdus serranus*	1	L
Buff-throated Saltator *Saltator maximus*	1	RL
Olive Tanager *Chlorothraupis carmioli*	1	RL
Green Honeycreeper *Chlorophanes spiza*	1	RL
Masked Yellowthroat *Geothlypis aequinoctialis*	1	RL
Spectacled Whitestart Myioborus melanocephalus	1	L

Notes on Neting Table.

Sites/Altitudes:

PA = Palmar Alto. 4 sites. elevation given in metres (1200, 1570, 1585 or 1760m)
RSM = Río San Mateo. 900m
L = Limbo. 2020m
RL = Río Leche. 510m
RS = Río Sajta. 305m.

Netters:

KF = Keith Fairclough
AM = Allan Mee
CC = Chris Cutts

Sex/Age:

M = Male
F = Female
Imm = immature
3J = bird in juvenile plumage

Weight: in grammes using a range of pesola balances.

Wing: in mms using graduated steel rules and the `maximum cord' method.

Tarsus: in mms using a Camlab Cambridge superpolyamid caliper gauge. KF used the BTO method of measuring tarsus, i.e., from the notch on the back of the intertarsal joint to the lower edge of the last complete scale before the toes diverge. AM measured from this notch to the pad of the sole. The BTO method consistently measures shorter, so unfortunately measurements between ringers are not directly comparable.

Bill: in mms using caliper gauge. Measured from bill tip to feathers (as opposed to skull). In some species, e.g., flatbills, bill width was measured whilst in other spp., e.g., some tanagers, bill depth was measured.

Head and Bill: in mms using caliper gauge. From bill tip to the rear of the skull.

Body Length: in mms by laying bird on metal rule, measuring from tail tip to bill tip.

NB. Certain measured features within the same species sometimes show a very wide range of measurements. This variation may be real but should in any case be considered with caution. The ringers involved were `rusty' and needed time to ease back into processing (i.e., extra caution with data from early in the project) and lacked experience of measuring certain features, e.g., `head and bill'.

Trapping: All birds were trapped using Japanese or North Ronaldsay nets of varying lengths (30', 40', 60') but mainly the large 60'/18m nets. A maximum of 6 nets were erected at any one time either singly or linked. Poles were cut on site using bamboo or deciduous whips.

Appendix 4. Mammal species recorded from Parque Nacional Carrasco, Cochabamba Department, Bolivia, August 7-October 8 1998.

Species	Elevation (m)	Abundance by site			Comments
		SD	VS	RL	
Bats (*Chiroptera*)					
Bulldog bat *Noctilio sp.*	600	?			fishing near El Palmar
Big brown bat *Vespertilionidae sp.*	1400	R			3 catching insects
Monkeys (*Cebidae*)					
Azara's night monkey *Aotus azarae*	350	R			3 asleep by El Palmar track
Brown capuchin *Cebus apella*	1200-1300	R			2-6 seen
White-bellied spider monkey *Ateles belzebuth chamek*	950			R	4 inc small young
Dogs (*Canidae*)					
Bush dog *Speothos venaticus*	350		R		seen nr Río Sajta
Racoons (*Procyonidae*)					
South American coati *Nasua nasua*	2250	R			one crossed track
Weasels (*Mustilidae*)					
Tayra *Eira barbata*	300-550		R	U	foraging
Neotropical otter *Lontra longicaudis*	450			U	seen & tracks by river
Cats (*Felidae*)					
Jaguarundi *Herpailurus yaguarondi*	1450	R			2 crossed track
Puma *Puma concolor*	400-500			U	tracks and faeces
Jaguar *Panthera onca*	450			R	tracks by Río Leche
Tapirs (*Tapiridae*)					
Brazilian tapir *Tapirus terrestris*	450			U	tracks by Río Leche
Squirrels (*Sciuridae*)					
South Amazon red squirrel *Sciurus spadiceus*	1200-1600	FC			seen number of times
Bolivian squirrel *Sciuris ignitus*	1350-1600	U			alarming
Pacaranas (*Dinomyidae*)					
Pacarana *Dinomys branickii*	1585	R			dead, killed by puma?
Agoutis (*Dasyproctidae*)					
Brown agouti *Dasyprocta variegata*	1200-1450	U		U	on track at SD, seen by river

*Species recorded just outside the PNC boundary.

Key to sites:
Serranía de Callejas (SC), Valle Sajta (VS), Río Leche (RL)

Key to abundance at sites
Fairly common (FC): detected on 50-90% of days
Uncommon (U): detected on 10-50% of days
Rare (R): detected on <10% of days

Appendix 5. Observations of psittacines at a geophagy site in the Valle de la Luna, Río Leche, Cochabamba Department, Bolivia.

Introduction

Geophagy, or soil ingestion, has been reported from a wide range of vertebrate and invertebrate taxa (see refs in Diamond *et al* 1999). Within birds, geophagy has been described from observations of pigeons, cracids, grouse, hornbills and corvids (Prendergast & Boag 1970; Diamond *et al* 1999), but is particularly well known to occur within psittacines (Other refs; Diamond *et al* 1999; Gilardi *et al* 1999). Hypotheses as to the function of geophagy include soil as an aid to digestion, as a buffer against acids, as a mineral supplement, as an aid in the adsorption of dietary toxins, and in gastrointestinal cytoprotection (see Diamond *et al* 1999; Gilardi *et al* 1999). Studies of psittacines and other frugivores so far suggest that geophagy may be most important in the adsorption of toxins produced by plants as a defence against herbivory. Here we report on the presence of an important geophagy site for psittacines near Parque Nacional Carrasco (PNC), Cochabamba Department, Bolivia.

Study site

The geophagy site was located in the Valle de la Luna, on the east side of the Río Leche, 0.5-1km north of the PNC boundary (Fig. 1). The Valle de la Luna (Valley of the Moon) is an extensive, flat, largely unvegetated area at 450m elevation, bounded by the Río Leche (Milk River) to the west, and by steep cliffs and primary forest to the east. The valley floor was composed of accumulated layers of a soft cement-like material, presumably as a result of the run-off of rain from the cliffs. The topography of the cliffs, up to 50m in height, gave the valley an 'amphitheatre' shape. A ridge radiated out from the cliff, bisecting the 'amphitheatre'. The cliffs and ridge were heavily sculpted, forming bizarre and beautiful stalactite-like formations. Although these formations may be largely due to weathering such as the frequent tropical downpours, the presumably long-standing effects of psittacine geophagy may have also been important in shaping the cliffs. Although the geological composition of the cliffs themselves was unknown, the exposed rock on which birds apparently feed was soft and friable. During our brief visit we also witnessed the effects of torrential rain on the valley. Where previously the valley had been completely dry, a number of fast-flowing streams ran from the cliffs to the nearby Río Leche. These streams had the dramatic effect of turning the river white and milky (giving the Río Leche its local name). Upstream of the Valle de la Luna, the Río Leche remained was clear and uncoloured. In the aftermath of such rains and the subsequent subsidence of the Río Leche, many small dead fish were found downstream of the Valle de la Luna. This appeared to be the result of poisoning by toxins in the floodwater run-off from the cliffs. Locals confirmed that such 'poisoning' was a regular occurrence and that the water was not fit for human consumption. This strongly suggests that the Valle de la Luna cliffs are composed of a toxic substance, and therein may lie their attraction to psittacines.

Methods

We recorded birds visiting the site in the Valle de la Luna over nine days, from September 25–October 8, 1998. As psittacines visited the site in the early morning only, observations were confined to this time period. At least two observers were in place by first light before the first birds arrived and, in most cases, remained until all birds had departed from the site. Psittacines were identified to species by a combination of visual observations and vocalisations. Observers were positioned under cover of a small patch of riverine scrub some 200-300m from the main cliffs with a clear view of the geophagy areas. Despite this, not all birds that alighted on the cliffs could be counted accurately because of fissures that hid some birds. Although birds occasionally took flight en masse, it was difficult to get a completely accurate figure as some birds may have been double-counted (birds circled around for some time before re-alighting). The most reliable method therefore was counting all birds as flew in on arrival and again on departure. Birds departing were distinguished from birds that were temporarily 'spooked', as the former flew low and fast directly away from the site out of view while the latter circled for some time before re-alighting. Birds were identified visually on arrival with the aid of 10x50 binoculars and, on the cliff, with x30 telescope. As well as flock number, species and time of arrival and departure, we recorded weather conditions at the beginning and end of the observation period.

Results

Birds began to arrive at the Valle de la Luna site soon after daybreak (earliest 0605hrs). Interestingly, almost all birds observed arriving came from a west or north-west direction. We recorded six species of psittacine feeding at the Valle de la Luna site. Numbers varied widely from day to day (Table 1).

Table 1. Psittacines observed during timed observations at the Valle de la Luna site.

Species	**Numbers of psittacines by date**								
	25/9	**30/9**	**1/10**	**2/10**	**3/10**	**4/10**	**5/10**	**7/10**	**8/10**
Ara ararauna Blue-and-yellow Macaw	4+	nc	7	23	8	8	3	0	5
Ara chloroptera Red-and-green Macaw	0	6*	3	1	0	3	0	2	2
Ara severa Chestnut-fronted Macaw	50+	nc	50+	39	39	42	48	42	108
Aratinga weddellii Dusky-headed Parakeet	350	nc	140	309	407	654	414	358	395
Pionus menstruus Blue-headed Parrot	250+	nc	212	159	277	337	329	222	335
Amazona farinosa Mealy parrot	0	nc	0	0	6	0	0	0	0
Daily totals	650+		412+	531	737	1,044	794	624	845

(*casual observation ; nc = no counts made)

The most common species of macaw was the Chestnut-fronted Macaw *Ara severa* (39-108) while the Dusky-headed Parakeet *Aratinga weddellii* was the most numerous parrot species (140-654) visiting the site. Although the Mealy Parrot *Amazona farinosa* was common in the Rio Leche/Sajta area, the species rarely visited the Valle de la Luna site and was never seen to actively feed on the cliffs. Apart from psittacines, the only other species observed at the geophagy site was Spix's guan *Penelope jacquacu,* although whether this species also 'fed' at the site was not verified.

Discussion

We observed up to, and occasionally over, a thousand psittacines visiting the geophagy site at the Valle de la Luna. Although numbers varied from day to day for most species, the site appears to be in constant and regular use (also per PNC park-guard at the nearby community of Israel). No other geophagy sites were found during a two-month study in PNC (although another apparently similar site to the Valle de la Luna was visible from the Río Leche-Israel track, at a higher elevation and several kilometres away, within PNC). All psittacines recorded visiting the site, apart possibly from *P. menstruus*, were primarily lowland forest species, much of which had been heavily degraded or cleared to the west of the site in recent years. While lowland forest on the east bank of the Río Leche appeared to be largely pristine, forest clearance on the west side of the river had advanced to within 0.5km of the Valle de la Luna by 1998. It is likely that further forest clearance in or near the Valle de la Luna itself would have a detrimental effect on use of the site by psittacines. Macaws in particular use nearby trees before flying down to feed and when disturbed. More importantly, disturbance by humans would have a negative effect on feeding patterns and could result in the abandonment of the site if disturbance levels are high and persistent. Further, the increasing presence of humans and knowledge of the site is likely to result in attempts to trap birds for the parrot trade. This had already taken place at the site in the past (per PNC park-guard) but is likely to be more important as settlers encroach on the site. However, the site is within one kilometre of the PNC boundary. Thus, we strongly recommend that the Valle de la Luna site be incorporated into PNC. This would be possible by relocating the PNC boundary to the east of the Río Leche to include the site. As there were, as yet, no settlers or forest clearance in the immediate area of the Valle de la Luna site to the east of the Río Leche in 1998, this could be done without conflict with local people. Such action would formally protect, at least on paper, an important site for lowland psittacines in eastern Cochabamba Department.

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Appendix 6. Asociaciones de habitat y notas de *Pauxi unicornis* en el Parque Nacional Carrasco, Bolivia.

Mee, A. (1999) Habitat associations and notes on *Pauxi unicornis* in Parque Nacional Carrasco, Bolivia. Cracid Specialist Group Bulletin 9, 15-20.

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Estudiantes de la Universidad de Glasgow (Escocia) y de la colección Boliviana de Fauna llevaron a cabo una expedición al parque Nacional Carrasco (P.N.C, de aquí en adelante), ubicado en el departamento de Cochabamba (Bolivia), desde agosto a octubre de 1998. El P.N.C. mantiene uno de los más grandes y prístinos bosques de Yungas (bosques montanos y sub-montanos) en Bolivia, a la vez que ha sido identificado como un área "clave" para las especies de aves amenazadas a nivel global. El trabajo de campo dentro del P.N.C. se concentró en tres lugares principales: Serranías de Callejas (1200 - 2200 m.s.n.m.), Río San Mateo (750 - 900 m.s.n.m.) e Israel - La leche (350 - 950 m.s.n.m.). Adicionalmente al método de valoración rápida de 10-20 listas de especies, se usaron registros sistemáticos (una combinación de conteos por puntos y bio-acústicos) para estimar densidades y definir asociaciones de hábitat para *P. unicornis*, especie globalmente amenazada.

Al parecer, el P.N.C. mantiene importantes poblaciones de *Pauxi unicornis* y por ello constituye una de las dos únicas áreas formalmente protegidas (junto con el Parque Nacional Amboró) para esta especie. Conocido de solo tres de cuatro áreas en Bolivia y dos en Perú, este Crácido ha sido considerado especie rara/vulnerable por Collar *et al* (1992), sin embargo, desde entonces su estado de amenaza ha sido revisado. Actualmente es identificado como especie amenazada (Collar *et al,*, 1994). Un aspecto interesante es que la "localidad-tipo" para *Pauxi unicornis* es descrita como: "en las colinas sobre Bolívar, cerca a Palmar".. en Cochabamba, cerca o posiblemente en el P.N.C., donde la especie fue descrita en 1937 y dos especímenes fueron colectados a 760 m (Bond y Meyer de Schauensee 1939). Hoy, *Pauxi unicornis* es más conocido del Parque Nacional Amboró, Santa Cruz, donde la especie ha sido localizada y estudiada en los bosques semi-densos de la Yunga, sobre las laderas abruptas a los 700 m (Cox y Clarke 1988). La explosión de machos en leks dispersos durante el inicio de las lluvias en octubre, y censos mediante llamadas de las aves proveyeron un estimado de 40 individuos / Km^2. Resultados más recientes han localizado estos auges repentinos de aves a densidades de 0.2 - 1 / ha. (Cox *et al.*, 1997). *Pauxi unicornis* es también conocido del P.N.C. y casi de manera certera ocurre en áreas fuera del Parque, en el Noreste de Cochabamba.

REGION DE ESTUDIO

El bosque húmedo, conocido como Yungas en el sudeste de Perú, Bolivia y Argentina, es una zona de vegetación característica de las vertientes orientales de los Andes. Mucho del Yunga Boliviano es sobre todo, tierra baja húmeda y bosques montanos perennifolios con una abundancia de musgos y epífitas en altitudes más altas. El bosque de yungas húmedo comprende una zona de transición entre las tierras bajas y los bosques de montaña o bosque enano compuestos de *Podocarpus* y *Polylepis*. Al sur en Chuquisaca, Dpto. Sucre, el bosque de Yungas se confina a una estrecha banda altitudinal entre 1500–2500 m (Schulenberg *et al* 1998). En o cerca de las cimas de los cerros el bosque es más bajo y aun más húmedo (elfin forest) con matorral que marca la transición entre el bosque y el pastizal de páramo en límites altitudinales superiores (Stattersfield *et al* 1998). En la zona del páramo las condiciones climáticas son de nuevo más secas, y los incendios provocados por lugareños en las regiones montañosas queman las colinas en algunas áreas. Éste también es en particular el caso en el norte de Cochabamba y la Cordillera de Mosetenes, donde se localizan pueblos sobre la línea de árboles (S. Herzog com. pers.). Así la integridad de esta zona forestal y su avifauna característica están bajo amenaza en muchas áreas debido a la invasión y degradación humana, aún antes de que especies claves sean descubiertas.

Localizado al este de la ciudad de Cochabamba en la región oeste-central de Bolivia, P.N. C. cubre unas 622,600 ha desde las tierras bajas hasta 4500 m a lo largo de las vertientes orientales de los Andes (Ergueta y Gómez 1997). El parque mantiene extensiones sustanciales de bosque tropical lluvioso y de montaña y en su condición condición representa una área muy importante para las aves amenazadas de Bolivia. Además P.N. C. es una de las dos áreas protegidas de Bolivia que alberga al amenazado *Pauxi unicornis*. La frontera Cochabamba-Dpto St. Cruz forma el límite oriental entre P.N. C. y P.N. Amboro, que juntos forman una extensión importante de los Yungas Bolivianos.

MÉTODOS

Nosotros visitamos los siguientes sitios en la región Valle Sajta-Río Leche del P.N. C.: Comunidad de Israel (20 - 23 septiembre, 300–400 m de altitud) y Río Leche (23 - 26 septiembre y 30 septiembre - 8 octubre, 500 - 900 m). Se estableció un transecto de 2 Km dentro del bosque del P.N. C. El transecto parcialmente siguió las veredas ya establecidas que limitan al parque (500 m), un arroyo seco, así como una vereda nueva hacia el bosque (a 900 m). Nosotros: 1) empleamos listas de especies de valoración rápida en los transectos y límites del parque, 2) hicimos puntos de conteo marcados a intervalos de 200 m a lo largo de la ruta de ambos transectos usado metodología estándar, 3) empleamos "playback" para ayudar en la identificación de especies durante los puntos de conteo y, observaciones casuales así como también "dawn chorus" de 10 min, y 4) colectamos datos ecológicos en las estaciones de conteo en donde *Pauxi* fue localizado.

RESULTADOS

Pauxi unicornis fue registrado en una sola localidad, cerca del Río Leche, en el norte del P.N. C., en la vertiente sur. La altura del dosel fue 15–25 m, con 80% de cobertura del dosel y 5–10% de cobertura en el suelo. Las aves fueron encontradas (escuchadas y/o observadas) en la siguiente proporción: 10/4 a las 09:54 (800 m); 10/5 a las 06:45 (580 m), 08:58 (880 m) y 10:00 (945 m); 10/6 a las 12:30 (955 m); 10/7 a las 11:20 (515 m); y 10/8 a las 08:25 (830 m).

El primer individuo llamando fue escuchado el 4 octubre cerca de la cima del transecto nuevo, 1 km al sur del límite del parque. El bosque en este sitio está compuesto de un gran número de árboles maduros, la mayoría >30 cm DBH. El sotobosque (suelo y sustrato arbustivo) es bastante abierto con una visibilidad de 50 m. Por lo menos se oyeron cuatro individuos diferentes entre 580 - 945 m de altitud el 5 de octubre. Un individuo fue oído y visto brevemente a 830 m de altitud el 8 de octubre. El hábitat en este sitio era bastante similar al sitio anterior con árboles grandes esparcidos (7árboles >1 m DBH dentro de un radio de 25 m) y árboles maduros (34 árboles >30 cm DBH dentro de un radio de 25 m). La frecuencia del "bramido" de los individuos (n = 7) fue, característicamente, 4 bramidos/min (promedio = 14.1 - 15.5 seg. de intervalo entre los bramidos, r = 13 - 18 seg.). Esto es muy similar a la frecuencia registrada en Amboro por Cox *et al* (1997).

DISCUSION

La integridad de los bosques de los Yungas en Bolivia está bajo amenaza debido a la pérdida del hábitat y degradación como consecuencia de las actividades humanas, a pesar del establecimiento de un sistema excelente y creciente de parques nacionales. El extenso clareo de los bosques en las colinas Andinas para cultivar y cosechar coca y cítricos han puesto en peligro a unas 72 especies restringidas a la zona tropical superior (Remsen y Quintela, en Collar *et al.*, 1992). El bosque en la zona endémica de los Yungas (bosque submontano a 500 - 1650 m), en las colinas de los Andes en Bolivia, es más seco que el verdadero bosque de niebla o montano y es más fácil de quemar. Se han reforestado áreas extensas en esta zona, sobre todo en La Paz y Cochabamba. Sin embargo, mucho de Carrasco es todavía inaccesible y difícil de cultivar debido a la falta de acceso, a la pendiente increíble del terreno, y a las altas precipitaciones, probablemente> 10,000 mm/año (S. Herzog, com. pers.). Aparte de los efectos de pérdida y alteración del hábitat, algunos Crácidos y Psitácidos en particular están amenazados por sobrecacería y por captura para el comercio de aves, una actividad extendida a lo largo de gran parte de América del Sur.

Habitat association and notes on the Southern Helmeted Curassow *Pauxi unicornis* in Carrasco National Park, Bolivia.

An expedition to Parque Nacional Carrasco (P.N. C., hereafter), Dpto. Cochabamba, Bolivia, was carried out by students from Glasgow University, Scotland, and Bolivian counterparts from the Coleccion Boliviana de Fauna, from August to October 1998. P.N. C. holds one of the largest pristine tracts of Yungas (montane and sub-montane) forest in Bolivia and has been identified as a Key Area for globally threatened bird species. Within Carrasco fieldwork was concentrated on three main sites, Serrania de Callejas (1200 - 2200 m asl), Rio San Mateo (750 - 900 m asl) and Israel/Rio Leche (350 - 950 m asl). Apart from using Rapid Assessment 10 or 20 species-list methodology, we used systematic recording methods (a combination of point counts and bioacoustics) to estimate densities and define habitat associations for the Southern Helmeted Curassow (*Pauxi unicornis*), a globally threatened species.

It is likely that P.N. C. holds important populations of *P. unicornis* and thus forms one of only two formally protected areas (along with Parque Nacional Amboro) for the species. Known from just three or four areas in Bolivia and two in Peru, this cracid was considered to be vulnerable/rare by Collar et al (1992) but has since had its threatened status reviewed and is now regarded as endangered (Collar et al 1994). Interestingly the type-locality for *P.unicornis* is described as "in the hills above Bolivar, near Palmar " in Cochabamba, near or possibly in P.N. C., where the species was discovered in 1937 and two specimens were taken at 760 m (Bond and Meyer de Schauensee 1939). Today *P. unicornis* is best know from Parque Nacional Amboro, Santa Cruz, where the species has been located and studied in semi-open Yungas forest on steep slopes at 700 m (Cox and Clarke 1988). Males "boom" in dispersed leks at the onset of rains in October and a census of calling birds gave an estimate of 40 birds/sq km. More recent results have located booming birds at densities of 0.2 – 1/ha (Cox et al 1997). *P. unicornis is* also known from P.N. C. and almost certainly occurs in areas outside the park in northeastern Cochabamba.

STUDY REGION

Humid forest, known as Yungas in southeast Peru, Bolivia and Argentina, is a characteristic vegetation zone of the eastern slopes of the Andes. Much of the Bolivian yungas is wet lowland and montane evergreen forest with a profusion of moss and epiphytes especially at higher altitudes. Humid yungas forest comprises a transitional zone between the lowlands and montane or dwarf forest composed of *Podocarpus* and *Polylepis*. To the south in Chuquisaca, Dpto. Sucre, Yungas forest is confined to a narrow elevational band between 1500 – 2500 m (Schulenberg et al 1998). At or near the tops of ridges the forest becomes lower and even wetter (elfin forest) with scrub marking the transition between forest and paramo grassland at upper elevational limits (Stattersfield et al 1998). In the paramo zone the climatic conditions become drier again, and fires set by villagers in the highlands burn increasingly lower downslope in some areas. This is also the case in northern Cochabamba and the Cordillera de Mosetenes in particular, where villages are located above the treeline (S. Herzog pers. comm.). Thus the integrity of this important forest zone and its characteristic avifauna is under threat from human encroachment and degradation in many areas even before key threatened species have been discovered.

Located to the east of Cochabamba city in west-central Bolivia, P.N. C. covers some 622,600 ha from the lowlands to 4500 m along the eastern slopes of the Andes (Ergueta and Gómez 1997). The park holds substantial tracts of montane and lower tropical rainforest and on its present standing is a key area for threatened birds in Bolivia. In addition P.N. C. is one of only two protected areas in Bolivia supporting the endangered Southern Helmeted Curassow (*Pauxi unicornis*). The Cochabamba-St. Cruz

Dpto. border forms the eastern boundary between P.N. C. and P.N. Amboro, both of which together form an important and extensive tract of the Bolivian Yungas.

METHODS

We visited the following sites in Valle Sajta-Rio Leche region of P.N. C.: Comunidad de Israel (20 - 23 September, 300 – 400 m asl) and Rio Leche (23 - 26 September and 30 September - 8 October, 500 - 900 m asl). One 2 km transect was established within the forest inside P.N. C. The transect route partially followed previously cut park boundary line (500 m asl), a dried streambed, as well as a newly cut route into the forest (to 900 m asl). We: 1) employed RAP species-lists on transects and park boundary, 2) made point counts marked at 200 m intervals along the route of both transects using standard methodology, 3) employed bioacoustics with 'playback' to aid in species identification during species-lists, point counts or casual observations as well as a timed 10 min "dawn chorus", and 4) collected ecological data at count stations where curassows were located.

RESULTS

Pauxi unicornis was recorded at a single locality, near the Rio Leche, in the north of P.N. C., on a south-facing slope. The canopy height was 15 – 25 m, with 80% canopy cover and 5 – 10% ground cover. Birds were encountered (heard and/or sighted) on 10/4 at 09:54 (800 m); 10/5 at 06:45 (580 m), 08:58 (880 m) and 10:00 (945 m); 10/6 at 12:30 (955 m); 10/7 at 11:20 (515 m); and 10/8 at 08:25 (830 m).

The first calling individual was heard on the 4 October near the top of the cut transect some 1 km south of the park boundary. Forest at this site is composed of a large number of mature trees with the majority >30 cm DBH. The understorey (ground and shrub layers) is fairly open with a visibility of 50 m. At least four different individuals were heard between 580 - 945 m on 5 October. One individual was heard and seen briefly at 830 m on 8 October. The habitat at this site was largely similar to the previous site with scattered large trees (7 trees >1 m DBH within a 25 m radius) and mature trees (34 trees >30 cm DBH within a 25 m radius). The "booming" frequency of birds (n = 7) was, characteristically, 4 booms/min (mean = 14.1 - 15.5 sec interval between booms, r = 13 - 18 sec). This is very similar to the frequency recorded in Amboro by Cox et al (1997).

DISCUSSION

In spite of the establishment of an excellent and growing system of national parks, the integrity of much of the remaining forest in the Yungas of Bolivia is under threat from habitat loss and degradation due to human activities. Extensive forest clearance in the Andean foothills to cultivate crops such as coca and citrus fruits has endangered some 72 species restricted to the upper tropical zone (Remsen and Quintela, in Collar et al., 1992). Forest in the Yungas endemic zone (sub-montane forest at 500 - 1650 m), in the foothills of the Andes in Bolivia, is drier than true montane or cloud forest and easier to burn. Extensive areas in this zone have been deforested, especially in La Paz and Cochabamba. However, much of Carrasco is as yet inaccessible and difficult to cultivate due to lack of access, the incredible steepness of the terrain, and the very high rainfall, probably > 10,000 mm/yr (S. Herzog, pers. comm.). Apart from the effects of habitat loss and alteration, some cracids and psittacines in particular are threatened by over-hunting as well as trapping for the wild bird trade, a widespread activity throughout large parts of South America.

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Appendix 7. Notes on the Yungas Antwren *Myrmotherula grisea*: a little known Bolivian endemic.

Allan Mee, Dave Pullan and Keith Fairclough.

Myrmotherula grisea, hormiguero endémico de Bolivia, se encuentra en los bosques húmedos en la zona de piedmonte de los Andes del este. Durante el trabajo de campo realizado en el Noreste del dpto. de Cochabamba, registramos una hembra de esta especie en peligro de extinción cerca del Parque Nacional Carrasco. Incluídos en el presente trabajo se presentan los apuntes sobre la ecología y los sonidos de este ave. *M. grisea* parace estar distribuida desigualmente y con una densidad muy baja en todo su rango restringido. Este registro sugiere que posiblemente *M. grisea* ocupe un rango altitudinal mas grande de lo que anteriormente se pensaba.

Introduction

Yungas Antwren *Myrmotherula grisea* is an extremely poorly known antbird of Andean foothill forest. Also called the Ashy Antwren, this threatened species is endemic to Bolivia where it is known only from a handful of observations[2]. Even within its present range, its distribution appears to be patchy. However the relative inaccessibility of much of its forest habitat, combined with the species apparent rarity, has made it a difficult bird to locate.

Distribution

M. grisea is known from some nine localities at 600 - 1,650 m in the dptos. of La Paz (LP), Cochabamba (CO) and Santa Cruz (SC). The type specimen was collected in 1934 at Santa Ana, LP, at 670 m[1] although apparently predated by two specimens from SC taken in 1917[6]. A further two were collected in 1960 and 1961 from "Alto Palmar", CO, at 1100 m and "Santa Rita", SC, at 500 m[6]. Remsen and Parker trapped three birds in tall, humid forest at 1,650 m near Serranía Bellavista, LP, in 1979 and another at 600 m near the Río Beni, LP, in 1981 while Ridgely recorded three birds at 1400 m, N of Caranavi, LP[6]. Parker et al observed two pairs at 650-800 m and a single bird at 1000 m in Parque Nacional Amboro, SC, in 1979[5]. Most recently *M. grisea* has been recorded from Parque Nacional Carrasco (PNC), Prov. Chaparé, CO. Previous records suggest that the species is largely confined to foothill forest in the Bolivian yungas and "does not extend appreciably into the Amazonian lowlands"[6].

Field notes

During fieldwork at PNC[3], we recorded a female *M. grisea* at a site close to the park boundary on 21and 22 September 1998 (see Fig. 1). This site was in forest near the Río Sajta at 345 m, south of Comunidad Israel (17°16'S 64°53'W). AM first heard a bird singing at 1100hrs some 20-30 m from the Río Sajta path. A recording was made of its song and compared with a previous tape of *M. grisea* (made by S. K. Herzog). Its identity was confirmed when we relocated the bird later in the same area.

Playback was also used to see if it elicited a response. Within a few seconds of starting playback the bird responded by flying to within a few m, remaining mostly 6–8 m up in the lower canopy.

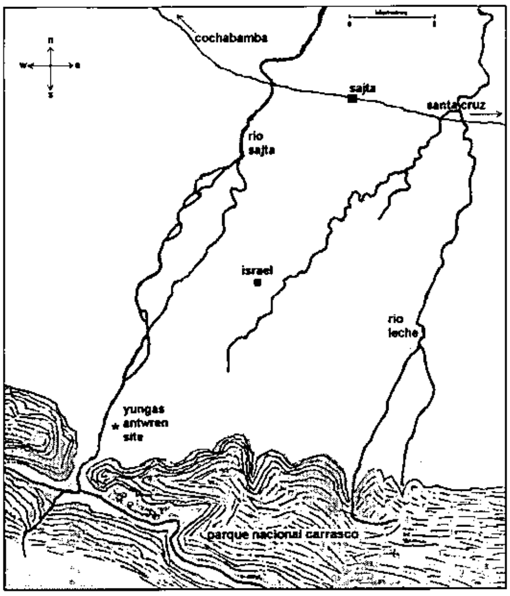

Figure 1. Map showing location of Yungas Antwren *Myrmotherula grisea* site.

M. grisea sang regularly between 1100 and 1300hrs but much less often after this. The bird was extremely active, moving constantly at 6-10 m in the lower - mid canopy, apparently behaving as if territorial and attempting to attract a mate. During the period of observation it was rarely seen to feed.

The following day we relocated what was presumably the same bird at 0715hrs some 100 m south of the original site, where it sang briefly at 5-6 m in the lower canopy. It flew off some distance (>100 m) where it could be heard singing occasionally. Later in the day (1210hrs) the bird was again heard singing intermittently 80-120 m from the Sajta path and was observed 6-10m up in the lower - mid canopy.

Description

Initially *M. grisea* was mostly seen from underneath when its bright rufescent underparts were obvious. It appeared slightly dusky at the sides of the breast while the crown of the head and the mantle were dull brown. The wings and tail were warmer brown and slightly more rufous. There were no wing bars. The bird was palest on the throat and its "face" was paler than the crown with a lighter area around the eye. The bill was grey and relatively long. The legs and feet were lead grey while the former also appeared short. Its tail also appeared shortish although there were no other Myrmotherula antwens at the site for comparison. Parker et al[5] noted that *M. grisea* had a "noticeably longer tail" than the Gray

Antwren *M. menetriesii*. However Ridgely & Tudor[7] state that *M. grisea* overlaps "with the somewhat longer-tailed nominate race" of *M. menetriesii.*

Vocalisations

Parker et al[5] were the first to document the species vocalisations, noting that the calls were similar to *M. menetriesii*. Calls included "an emphatic whit or wheet note, and twittering phrases often given by both sexes simultaneously". The bird we recorded also occasionally interspersed song phrases with a strident wheet call. The song of *M. grisea* is however very different from that of *M. menetriesii*, consisting of a loud, far carrying series of rather "mournful" notes (see Fig 2). The number of syllables per song phrase of the female varied from 3 – 6 (mean 3.9 syllables/phrase). The duration and frequency of song phrases was remarkably consistent (always 9-10 with a mean of 9.8 phrases/min).

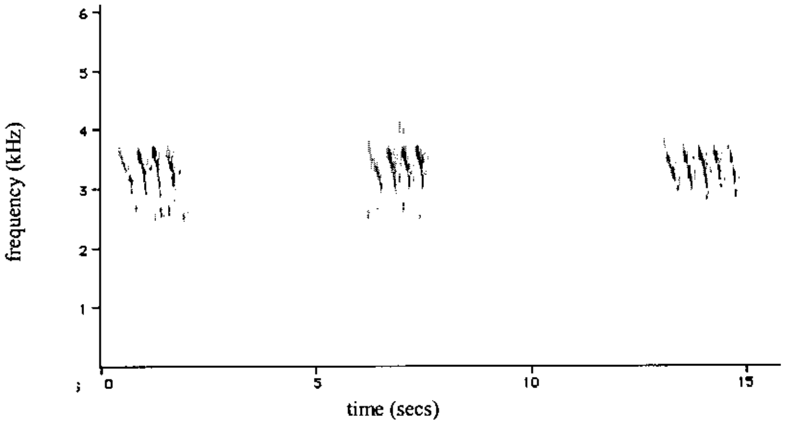

Figure 2. The female song of Yungas Antwren *Myrmotherula grisea.*

Habitat

M. grisea was located in very dense and apparently recently disturbed lowland forest, on flat ground near to the foothills. Forest at this site had a dense ground cover (15-20%) as well as a more open canopy (60-80% cover) indicative of habitat disturbance. There was a total absence of large or mature trees (only 3–5 trees with DBH > 30 cm in a 25 m radius). Mean canopy height was 8–10 m with a few emergent trees to a maximum of 15 m. Much of the site was characterised by dense, almost impenetrable vine tangles.

Ecology

Previous observations indicate that *M. grisea* often forms small mixed-species flocks with other antbirds[156]. However the Río Sajta bird was never seen to associate with other species. Parker et al[5] noted the species dead-leaf searching among vine tangles at PN Amboro. Similarly the high density of vines at the Sajta site may have been an attractive foraging area, at least temporally.

The birds location in degraded lowland forest is intriguing. It has been suggested the species normally occurs above the elevational range of its lowland congeners[5] and previous records suggest an affinity to foothill forest[156]. Despite the low elevation of this record, the site was little more than 1.5 km from steep foothill forest. *M. grisea* may occur over a wider elevational range than previously though where ecological conditions permit, such as in lowland forest near to the foothill zone. Another possibility is that there may be some seasonal migration to lower altitudes.

Conservation

M. grisea is undoubtedly rare and probably occurs at low densities where it does exist. Despite some 7 weeks fieldwork in nearby PNC at elevations of 500-2000 m (including 3 weeks at 500-1000 m at a site 10 km from the Río Sajta site) no other individuals were encountered. However, the potential for under-recording the species is great, at least when it is not vocalising.

The species presence in degraded forest suggests at least some tolerance of man-altered habitats. Given the extent of forest clearance in the Sajta area (we found recently cleared and cultivated land within 0.25 km of the antwren site) it seems likely this forest patch has now disappeared. Human induced pressure is already being felt in nearby PNC where forest in the Río Leche area, east of Israel, had been cleared almost to the park boundary in 1998. This area is also important as a site for the globally threatened Horned Curassow *Pauxi unicornis*[4].

Further survey effort is urgently needed to locate populations of *M. grisea*. Foothill forest in dpto. La Paz must be a priority as none of the sites there from which it has been recorded have any form of protection. Intensive investigation will hopefully reveal more about this elusive endemic.

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Appendix 8. Project budget and sponsors

The Threatened Birds of the Bolivian Yungas 1998 project would have been impossible without the generous sponsorship of the following funding bodies and sponsors:

Funding bodies:

- BP/BirdLife/Fauna & Flora International Conservation Programme
- Carnegie Trust for the Universities of Scotland
- University of Glasgow Court
- Royal Geographical Society
- Albert Reckitt Trust
- Explorers Club of New York
- The Cross Trust
- Cunnningham Initiative awards
- Gilchrist Educational Trust
- Karen Hassen Trust
- Glasgow Natural History Society
- World Pheasant Association
- David Sheperd Conservation Foundation
- Royal Naval Birdwatching Society

Other sponsors:

Aerolineas Argentinas: discounts on flight from UK to Bolivia
British Library National Sound Archive: loan of sound-recording equipment
Royal Navy: loan of tents
Subbuteo Books: discount on field guides

Project donations:

The following were donated to our counterparts in Bolivia, Colección Boliviana de Fauna, at the end of the expedition:

Mist-nets (x2), Birds of South America Vol. 2: Ridgely & Tudor (x1), Checklist of the Birds of Southern South America: de la Peña & Rumboll (x2), Birds of Bolivia 1.0 CD-ROM, binoculars (x1).

Table 1. Threatened Birds of the Bolivian Yungas 1988 project budget.

Final budget

Income	**£**	**Expenditure**	**£**
Funding bodies:		**Pre-expedition:**	
BP Conservation award	3000.00	Insurance	808.85
Carnegie Trust	1000.00	Flights	6344.00
University of Glasgow	1000.00	Administration	286.00
Royal Geographic Society	1000.00	Equipment	928.70
Albert Reckitt Trust	750.00	Books/ maps	345.01
Explorers Club of New York	666.00	Bird sound CDs/Tapes	121.37
Cross Trust	600.00	Medical Supplies	111.45
Cunningham Initiative	500.00	First Aid Courses	167.63
Gilchrist Trust	500.00	RGS workshops	166.63
Karen Hassen Trust	500.00	Insurance equipment	30.21
Glasgow Natural History Society	400.00	GPS Course	21.63
World Pheasant Association	250.00	**Expedition:**	
David Sheperd	150.00	Food	3206.50
Royal Naval Birdwatching Society	100.00	Accommodation	800.00
Other:		Vehicle hire/fuel/repair	2500.00
Raffle	86.49	Internal travel	291.00
GUTCE 98	40.00	Visa extensions	245.00
Individual contributions	6312.00	Guides	150.00
		Departure Taxes	275.00
		Post-expedition:	
		Report	200.00
Total income:	16,854.49	**Total expenditure:**	16948.98

Balance: -£94.49 (cleared by further individual donation)