BOLIVIA 2009

EXPEDITION REPORT

-GLASGOW UNIVERSITY EXPLORATION SOCIETY-

COMPILED AND EDITED BY IAIN DICKSON AND JOANNE KINGSBURY

CONTACT: IAIN DICKSON, 1 PATHFOOT DRIVE, BRIDGE OF ALLAN, STIRLING, FK9 4SD

University of Glasgow

CONSERVACION DE AVES EN BOLIVIA

ARMONIA

Foreword

It is with great pleasure that we present to you the report for the 2009 University of Glasgow expedition to Bolivia. This document details the scientific studies and methodologies carried out by the expedition as well as listing expedition finances, logistics and personnel.
The aim of the expedition was to conduct a rapid assessment of the Avian, Mammalian and herpetological fauna of a newly created reserve in the Beni region of Bolivia, paying particular attention to the critically endangered Blue-throated Macaw as well as any species listed by the IUCN as being under threat. There have been very few scientific expeditions to this region of Bolivia and the expedition gathered much information over its 5 week duration which will help further our understanding of this unique habitat, including documenting the existence of several species of conservation importance. We were also able to help conduct the first icthyological and botanical surveys of the area.

During the expedition we worked closely with Association Armonia (Birdlife Bolivia) and with the local people of Beni. It is hoped that the links forged during the expedition will help continue to promote conservation throughout the region.

Contents

Acknowledgements

Firstly, the expedition would like to thank all of those sponsors who supported and made the Bolivia 2009 expedition possible. It is only through the financial support of these organisations that the exploration society is able to organise expeditions and provide those undergraduate students with interests in natural history with valuable and enjoyable experiences. The expedition therefore greatfully acknowledges the support of the University of Glasgow Court, Carnegie Trust, Thriplow Charitable Trust, Lindeth Charitable Trust, Glasgow Natural History Society, Gilchrist Educational Trust and the Albert Rekkit Charitable Trust.

Funds were also raised through various activities such as bag-packing, selling hotdogs, band nights and bucket rattling on Sauchiehall street. Sincere thanks are extended to those who contributed to the success of all these activities. In particular the team would like to thank Somerfield in Knightswood, all the bands and DJs who played for free and all the hungry people who bought a hot dog outside the QMU.

The team received much help from our scientific counterparts whose advice was invaluable throughout the expedition. Gratitude is particularly expressed to Dr Ross Macleod Gustavo Sanchez Avilla, Erica, Miriam and Chene from the Noel Kempff Mercado Museum of Natural History in Santa Cruz, Aruro Munoz, Zorro, Mauricio Herrera, Douglas Bruckner, Bennett Hennessey and all the staff at Associacion Armonia without whose constant support the expedition could not have taken place. We would also like to thank Prof Rodger Downie and Dr Stewart white for offering advice and writing us countless references.

The expedition would especially like to express its thanks to all the people of Beni who showed us such wonderful hospitality during our stay and making the whole experience unforgettable.

2.0 Introduction

2.1 Dates

10/07/2009 – 24/08/2009

2.2 Location

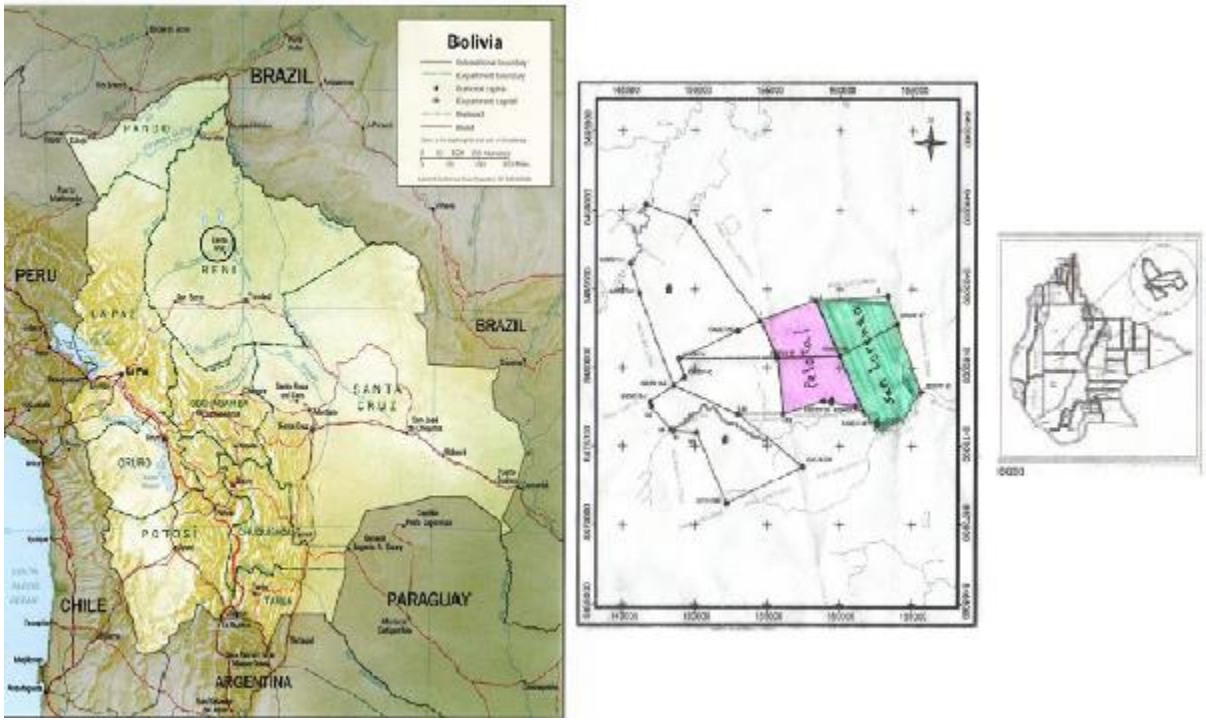

Figure 1: *Location of research within Bolivia and map of reserve*

The expedition took place at the Barba Azul Reserve which is located at geographic coordinates 13 44 17 S, 66 04 33 W, in the Beni Department of Northern Bolivia.

2.3 Aims and Objectives

The aim of the GU Bolivia Expedition 2009 was to conduct the first biological survey of the newly established Barba Azul Reserve, located in the poorly surveyed Beni region of Bolivia. Due to conditions on the ground we were unable to complete some of the aims initially listed in the expedition proposal, namely that we were unable to conduct an ecological study of the Rio Beni Titi monkey due to is absence from the reserve and similarly we were unable to collect any data on the Beni Grackle, Beni Greenlet or Beni Softail as we did not detect these species during our stay, as a result of this we adapted our fieldwork to include the first icthyological survey of the reserve. The objectives therefore were:

- Carry out an ornithological inventory of the reserve to establish the area's avian biodiversity and create a species list for the reserve to provide a baseline for future research and for the benefit of future ecotourism to the area.

- Assess the mammalian diversity of the area by conducting a baseline inventory of mammal species present, using camera traps line transects and roving records.

- Document the presence and distribution of any species listed as under threat by IUCN, in particular the distribution of the Vulnerable Cock-tailed tyrant and the Black-masked Finch.

- Assess the herpetological importance of the reserve by performing night transects and aural surveys on the reserve's water bodies.

- Work with a local botanist to make a preliminary study of the plant biodiversity of the area and assess the botanical importance of the reserve.

- Assist local biologists in performing of the first icthyological survey of the reserve.

2.4 Background

Bolivia is considered to be one of the most bio-diverse countries in the world. It contains around 14% of the world's bird species, all in an area equivalent to 0.75% of earth's terrestrial surface (Stattersfield *et al*. 1998). The country is similarly rich in other taxa and its conservation is of critical importance to maintaining the earth's biological richness. Bolivia is also home to an extraordinary range of habitats spanning from the high altitudes of the Andes to the lowland savannahs and Amazon basin.

The GU Bolivia expedition 2009 consisted of a team of 7 students from the University of Glasgow (UK) who worked alongside biologists (1 British and 5 Bolivian) from the University of Glasgow and Association Armonia, an avian conservation NGO based in Santa Cruz, Bolivia. During the expedition we conducted a rapid assessment of the avian, mammalian, herpetological, icthyological and botanical populations of the Barba Azul reserve in the Beni region of Bolivia's Northern lowlands.

The expedition worked closely with Association Armonia (Birdlife Bolivia) and staff from the Noell Kempff Mercado Museumof Natural History in Santa Cruz.

Attention was initially drawn to the area that would become the Reserva Barba Azul by Armonia's ongoing Blue-Throated Macaw conservation programme which identified the area as holding one of the largest remaining populations of this critically endangered species. As most of the remaining populations of this species exist in small fragments scattered over a wide geographical area the area was identified as the best location to site a reserve dedicated to the preservation of the Blue-Throated Macaw.

The Barba Azul reserve is located in the centre of the Llanos de Moxos, a huge area of lowland Bolivia consisting of gallery forest, raised forest islands and seasonally inundated savannah which, during the wet season, flood to form the third largest wetland in South America. The Llanos de Moxos lie at the meeting point of three of South America's great ecosystems, the Amazon rainforest to the north and west, the Cerrado grasslands to the east and the thorny scrub of the Chaco to the south, as a result of this location the floral and faunal composition of Beni is a unique mix of all three of these habitats along with species that are found nowhere else on the planet, a prime example being the endemic Blue-throated macaw.

Due to is remote location and poor transport infrastructure very few studies have been done in the Beni region, especially when compared to similar areas in other countries, such as the Pantanal in Brazil. As a result of this very little baseline data is known about the floral and faunal composition of the Beni region. Prior to the expedition the scientists at Armonia had compiled an avian species list for the reserve and documented the presence of some of the larger vertebrates, however little was known about the abundance and distribution of these species and less still was known about the composition of the mammalian, herpetological, icthyological and botanical populations of the reserve. The GU Bolivia expedition 2009 therefore represents the first systematic biological survey of the Barba Azul reserve.

2.5 Logistics

Fundraising

All members of the expedition worked extremely hard throughout the year to raise the money needed to make the expedition a success. At the start of the year the expedition members wrote letters to several organizations and trusts asking for financial support, we were extremely grateful to receive positive replies from several of these bodies with the resulting financial contributions providing a large proportion of the expedition budget. In addition to this each expedition member provided a personal contribution of £750 pulling in a total of £5250

The remaining proportion of the budget was raised by the expedition members themselves through a multitude of fundraising activities including bag packing, band nights, bucket rattling and selling hot dogs and soup on cold winter nights outside the QM Student Union. Through all these activities along with donations and personal contributions the expedition managed to raise a budget of £15,100. We would like to express our thanks again to everyone who helped make these events a success and to acknowledge the hard work of all the expedition members throughout the year.

Timetable

The expedition spent the months before departure assembling the necessary equipment before, via various routes, arriving in Santa Cruz at the beginning of July. Due to conditions on the ground, namely the annual floodwaters not receding sufficiently, the start of the

expedition had to be delayed by several days, this time was spent in Santa Cruz meeting up with our Bolivian counterparts and obtaining the remaining equipment we would need for the duration of our stay. Finally the expedition left Santa Cruz on the 15th of July and headed north to Trinidad, the capital of Beni department. After an overnight stay in Armonia's offices the expedition headed north via pick up to the town of Santa Ana de Yacuma, here the considerably dustier expedition members spent a final night in civilisation before flying by light aircraft to a ranch adjacent to our destination, here the expedition got its first taste of life in the savannah with the local mosquitoes making the greatest impression. From here the expedition then travelled the remaining few miles either on foot or on horseback finally arriving at the research area on the 19th of July.

After making camp the expedition immediately began the fieldwork with camera traps being set and transects earmarked and mapped for the Bird and Mammal surveys. For the next two weeks the expedition focused on surveying the avian, mammalian, icthyological and botanical populations of the reserve, typically three teams of two would walk a transect in each of the three habitats (savannah, cerrado and forest) recording all avian and mammalian activity while one person each worked with the ichthyology and botany teams led by staff from the Noel Kempff Mercado Natural History Museum in Santa Cruz. After two weeks the personnel from the museum left and effort for the icthyological and botanical fieldwork switched to herpetology, with the herpetology team being led by Arturo Munoz who joined the expedition in its third week. This pattern of work continued for another two weeks with the expedition collecting a total of 32 days worth of data. After this the expedition reluctantly broke camp on the 22nd of August and were taken by road to Trinidad via Santa Ana, here the final few days were spent processing the data gathered in the field.

2.6 Safety

All members of the expedition were covered with travel insurance for the duration of the expedition. Prior to the expedition leaving, a risk assessment was completed and everyone was made aware of the risks of the rainforest environment.

All members took anti-malarias as we were at risk, be it low, of malaria. We had with us a comprehensive medical kit and 2 members attended a first aid course in case of any accidents whilst in the field. A contingency plan was also drawn up in case of an emergency and the need to evacuate someone from the field; the expedition also took a satellite phone to retain contact with the outside world.

2.7 Personnel

Glasgow team:

Iain Dickson (21) 4th year Zoology student:

The adventurer of the lot, fearless and bare skinned in the face of mosquitoes. Always looked at the positives, even in light of certain doom.

Joanne Kingsbury (26) 2nd year Zoology student:

The most organised member of the expedition, Jo's tent was the only one that could be considered liveable after the first week. Enthusiastic about pretty much everything we did, an expert on the finer points of life.

Dieter Turk (22) 4th year Politics student

Expedition photographer and pun master kept us all amused with his witty banter, a demon on the chess board but never get this man to erect your tent.

Carly Hough (22) 2nd year Zoology student

The quiet one of the expedition, saw everything, if there was only one Blue-throated macaw left in the world it would be sitting on Carly's head, the only girl to tame the fox.

Alan Whyte (24) 3rd year Zoology student

The realist of the bunch, nicknamed Grandpa due to his cheery and outgoing demeanour, particularly in the mornings. Useful as a lightning conductor on savannah transects and a maestro at locationg ticks.

Iona McLachlan (21) 4th year Zoology student

The only one whose spirits remained totally positive during the whole expedition and who could be counted on to laugh at just about any situation that happened, head babysitter

Grant Reekie (21) 3rd year Zoology student

The most proactive of the group, his inventions ranged from the successful (bow and arrow) to the not so successful (bow and arrow). A human mosquito magnet

Scientific counterparts:

Ross Macleod (41) Project Advisor

A veteran of many previous expeditions to Bolivia, Ross guided us across Bolivia as well as providing scientific advice and technical support, all of which were invaluable to the expedition

Gustavo Sanchez Avilla (30) Bolivian Ornithologist

Gustavo, provided a wealth of knowledge about the avian life of the reserve. A genius in the camp kitchen, amongst his many other talents he can also list his wolf/cow impersonation and keeping us entertained by singing about the river.

Arturo Munoz (29) Bolivian Herpetologist

Despite being disappointed by the scarcity of Herp life on the reserve Arturo provided us with training in a number of important areas, most notably how to catch a Caiman with your bare hands.

2.8 Financial Report

The projected cost of the expedition plus a 10% contingency was £ 16,560. The Personal contributions were set at £ 750 each, providing a total of £ 5250 and leaving £ 11,310 to be raised through fundraising.

Projected Costs

£	
Flights: London – Santa Cruz	5950
Administration Costs	250
Training Courses	510
Equipment	2700
Insurance	1000
Food	1120
Accommodation	675
Transport	1000
Wages	1300
Post-expedition	550
Contingency (10%)	1505
Total 16560	

Expedition Income

£	
Personal Contributions	5250
Grant: University of Glasgow	1300
Grant: Carnegie Trust	2000
Grant: Glasgow Natural History Society	800
Grant: Thriplow Charitable Trust	800
Grant: Gilchrist Educational Trust	1000
Grant: Albert Rekkit Charitable Trust	750
Grant: Conservation Leadership Programme	400
Fundraising Activities	2800
Total 15 100	

Expedition Expenditure

£	
Flights	5800
Food	1600
Wages	2600
Accommodation	500
Transport (inc internal flights)	675
Medical kit (inc first aid course)	275
Equipment	2600
Post-Expedition Costs	650
Total	**14700**
Balance surplus:	**400**

After contingency we expected a budget shortfall of around £1460 however we ended up with a budget surplus of £400, which suggests our estimation of the budget based on previous expeditions to Bolivia was fairly accurate. The way we spent the money differed from our estimations in that we were able to save money on training courses, insurance and on local transport while wages were higher than expected as the expedition chose to recruit an ichthyologist for part of the expedition. The surplus money will be used to contribute towards the follow up expedition which is planned for summer 2010.

3.0 Bird report

Iain Dickson and Grant Reekie

3.1 Introduction and background

With five endemic bird areas, four secondary areas (Stattersfield et al. 1998) and 137 locally endemic species (Stotz et al. 1996) Bolivia is one of the most bio-diverse countries for avian life in the world. It is estimated to contain 1,398 species (Hennessey et al. 2003), which equates to around 14% of all bird species (Wege and Long 1995). However, many species are vulnerable to disturbances and habitat destruction and Bolivia contains 61 restricted range species (Stattersfield et al. 1998) and a total of 31 species listed as threatened (IUCN 2007).

Figure 3.1: *The Blue-throated Macaw (Ara gluacogularis)*

Only two ecosystems can be considered truly endemic to Bolivia, the Andean dry valleys and the Beni Savannah. Unfortunately the Beni remains entirely unprotected and is currently

coming under much strain from high impact cattle ranching as well as habitat destruction due to annual burning of the savannah by landowners.

The Beni Savannah covers an area of 126,000 km2 located in the lowlands of the southwest Amazon basin and is considered an endangered ecosystem by The Nature Conservancy. The savannah consists of a mosaic of seasonally flooded grasslands interspersed with raised forest islands and extensive gallery forest along the rivers. Numerous bird species have been documented in the Beni, with a total 509 having been recorded so far (Beck, Moraes 1997). The Beni region is however extremely understudied and very little is known about the abundance, distribution or composition of the avian communities found there.

The Bolivia 2009 expedition was tasked with documenting the avian population of the reserve Barba Azul, a former ranch recently purchased and currently being converted into a reserve by Association Armonia (Birdlife Bolivia) who facilitated the purchase of the reserve in order to establish an area for the protection of the Blue-throated Macaw (*Ara gluacogularis*), a critically endangered species (ICUN 2009). In addition to documenting the presence and abundance of the Blue-throated Macaw the expedition also aimed to assess the abundance of several other species listed as being under threat, most notably the Cock-tailed tyrant (Alectrurus tricolor) and the Black- masked Finch (*Coryphaspiza melanotis*), which were both predicted to occur locally as well as to assess the importance of the area for conservation.

3.2 Study area

The study was conducted within the Barba Azul reserve in the centre of the Beni region in Bolivia (13 44 17 S, 66 04 33 W). The study area consisted of a mosaic of seasonally flooded savannah which floods for between 4-6 months of the year, cerrado (dry savannah with scattered trees and forest thickets), raised forest islands and riparian habitat. This composition of habitat is typical of this region of the Beni and the diversity of vegetation meant we expected to find a wide range of species there. The reserve itself constitutes 35 square kilometres of former ranch land and as grazing animals had only recently removed from the land the effects of heavy grazing could still be seen, however it is hoped that removal of these animals will facilitate a regeneration of the ecosystem.

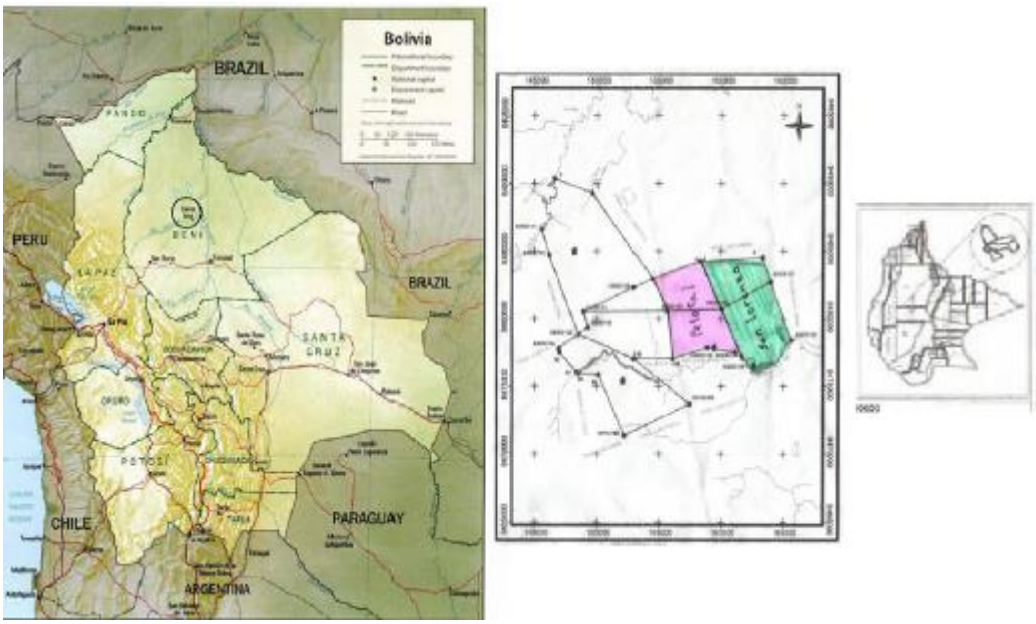

Figure 3.2: *Location of reserve within Bolivia and a map of the reserve itself*

3.3 Methods

Line transects

5 mornings per week, typically between the hours of 06.00 and 10.00 3 groups of two observers walked 1.5 hr line transects of approx 3-5km, one for each of the main habitat types (forest, cerrado, savannah). Transects were located on the main existing paths through the forest and cerrado areas as these were relatively small areas and at times impassable outside of trails. There were 4 main transects in the savannah, one on either side and two running through the middle in an attempt to cover as much of the reserve as possible with these savannah transects being completed in a rotational order. Each bird sighting during these transects was identified if possible using binoculars of 10x magnification, if identification was not immediately possible a description of the individual was noted and where possible photos were taken for later identification. Information was also recorded about the number and composition of groups, the perpendicular distance from transect and the behaviour of individuals observed during sightings. Data about distance from transect was then used to calculate species density.

Figure 3.3: *Student at work on transect*

In place of transects, one morning each week was devoted to a Blue-throated Macaw survey. Each survey lasted 1.5 hrs, and observations were taken every 5 minutes during this time to record the number of Macaws visible, number of Blue-throated Macaws, the actions and behaviours of the Blue-throated Macaws and the number of juveniles present. The Blue-throated Macaw survey was undertaken at 3 locations simultaneously; roosting trees near camp, halfway through the main forest island and at the far end of this forest island, near the reserve boundary. Figure 3.4 (shown below) is a diagrammatic representation of the locations of the Blue-throated Macaw survey trees within the southern part of the reserve.

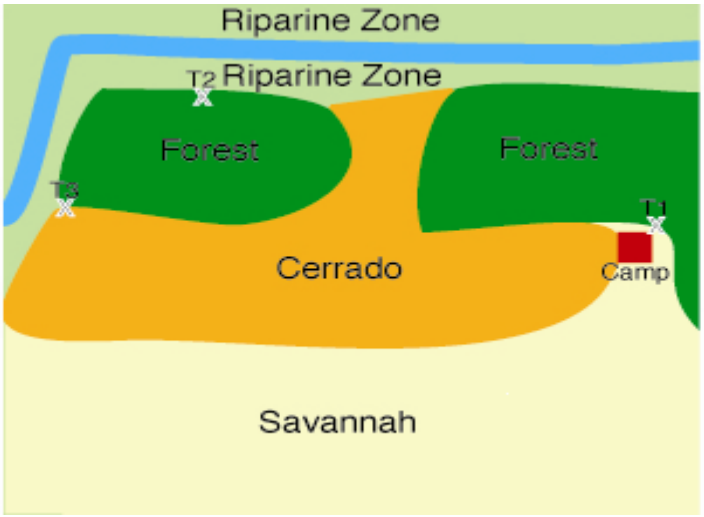

Figure 3.4: *Diagram showing locations of Blue-throated Macaw survey trees (T1, T2 & T3).*

Other fieldwork and data analysis

Attempts were also made to capture and identify nightjars in the savannah, and to mist net in the forest, but these had very limited success.

Analysis of bird densities and abundances was carried out using the Distance 6.0 software (Thomas *et. al*, 2009). The program extrapolates densities of species by calculating a probability of detection curve fitted to data on the perpendicular distances of objects from line transects. This is based on the idea that objects (in this case birds) are less likely to be detected the further away from the transect they are (Thomas *et. al*, 2009). Models are calculated and compared and one is chosen based on having the minimum akaike information criteria (AIC). The software then uses this model and the resulting detection curve to estimate the density of a species within the area sampled, then extrapolates this for the entire region. An estimate of abundance is then calculated using the resulting regional density estimate, given with a 95% confidence interval.

3.4 Results

The number of species we observed and indentified varied across the habitat types. In total 140 species were detected during the expedition of these 85 species were recorded in the cerrado, 81 in the savannah and 57 in the forest. The savannah contained the most species with a conservation status above least concern, with 1 critically endangered species (the Blue-throated Macaw) (IUCN 2009, Birdlife International 2009), 2 vulnerable species (Black-masked Finch and Cock-tailed Tyrant) (IUCN 2009, Birdlife International 2009) and 3 near threatened species (Dark-throated Seedeater, Greater Rhea and Orinoco Goose) (IUCN 2009, Birdlife International, 2009). The Cerrado had similar results, but no Rhea, Black-masked Finch or Cock-tailed Tyrant were recorded. The only species with an IUCN status above near threatened in the forest was the Blue-throated Macaw. Full species lists for each habitat type with the conservation status of each species are included in the appendices.

All savannah transects were designed to provide information for distance sampling, and in most cases observations were recorded with perpendicular distance data. The birds chosen for distance sampling were the Black-masked finch (*Coryphaspiza melanotis*), Cock-tailed tyrant (*Alectrurus tricolor*), and Wedge-tailed grass finch (*Emberizoides herbicola*). Black-masked finch and Cock-tailed tyrant were selected for their conservation importance, and Wedge-tailed grass finch because it is an indicator of grassland ecosystem health (Stotz *et. al.,* 1996). The detection curves which Distance 6.0 fitted to the observations are included below, as are the calculated figures for density and abundance of each species.

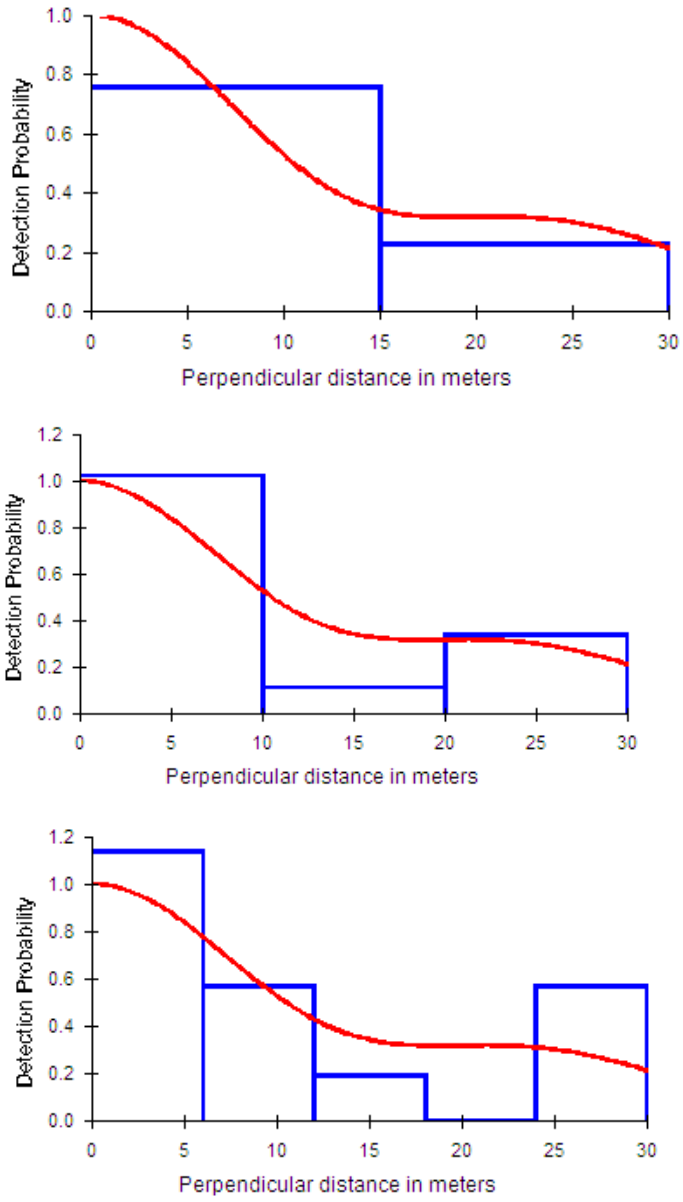

Figure 3.5: *Detection probability curves fitted to Black-masked Finch Coryphaspiza melanotis data. Model is based on 13 observations and uses a half-normal key with 2 cosine adjustments of order, with convergence achieved by 19 function evaluations. The AICc value was 90.08. The point estimate of density was 1.45 per hectare, with a standard error of 0.95. This led to an abundance estimate of 4,358 individuals in the savannah region, with a standard error of 2867.1. Thus, with 95% confidence intervals (95% C.I.), the estimate for density is 0.28 - 7.33/hectare, and the abundance estimate for the region is 863 – 22,003.*

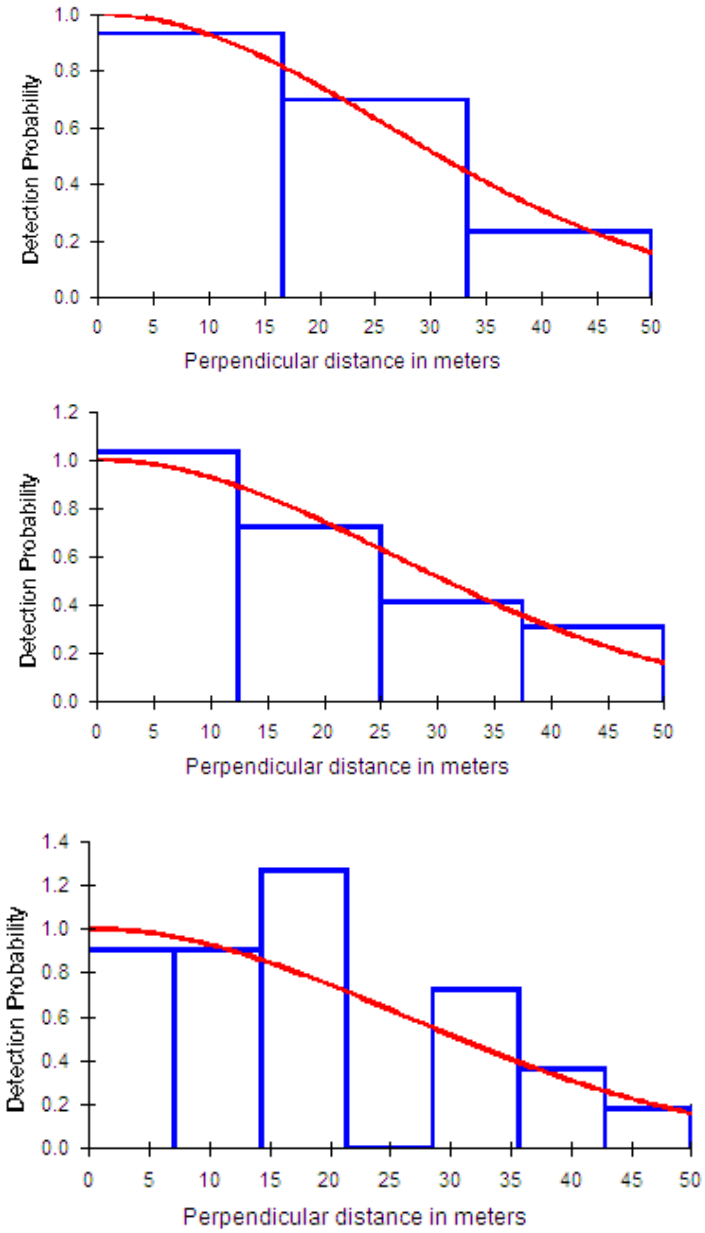

Figure 3.6: *Detection probability curves fitted to wedge tailed grass finch Emberizoides herbicola data.Model is based on 24 observations and uses a half-normal key, with convergence achieved by 19 function evaluations. The AICc value was 184.73. The point estimate of density was 1.04 per hectare, with a standard error of 0.73. This led to an abundance estimate of 3,130 individuals in the savannah region, with a standard error of 2200. With 95% C.I.'s included, density estimate = 0.16 – 6.74/hectare, and the abundance estimate = 484 – 20,247.*

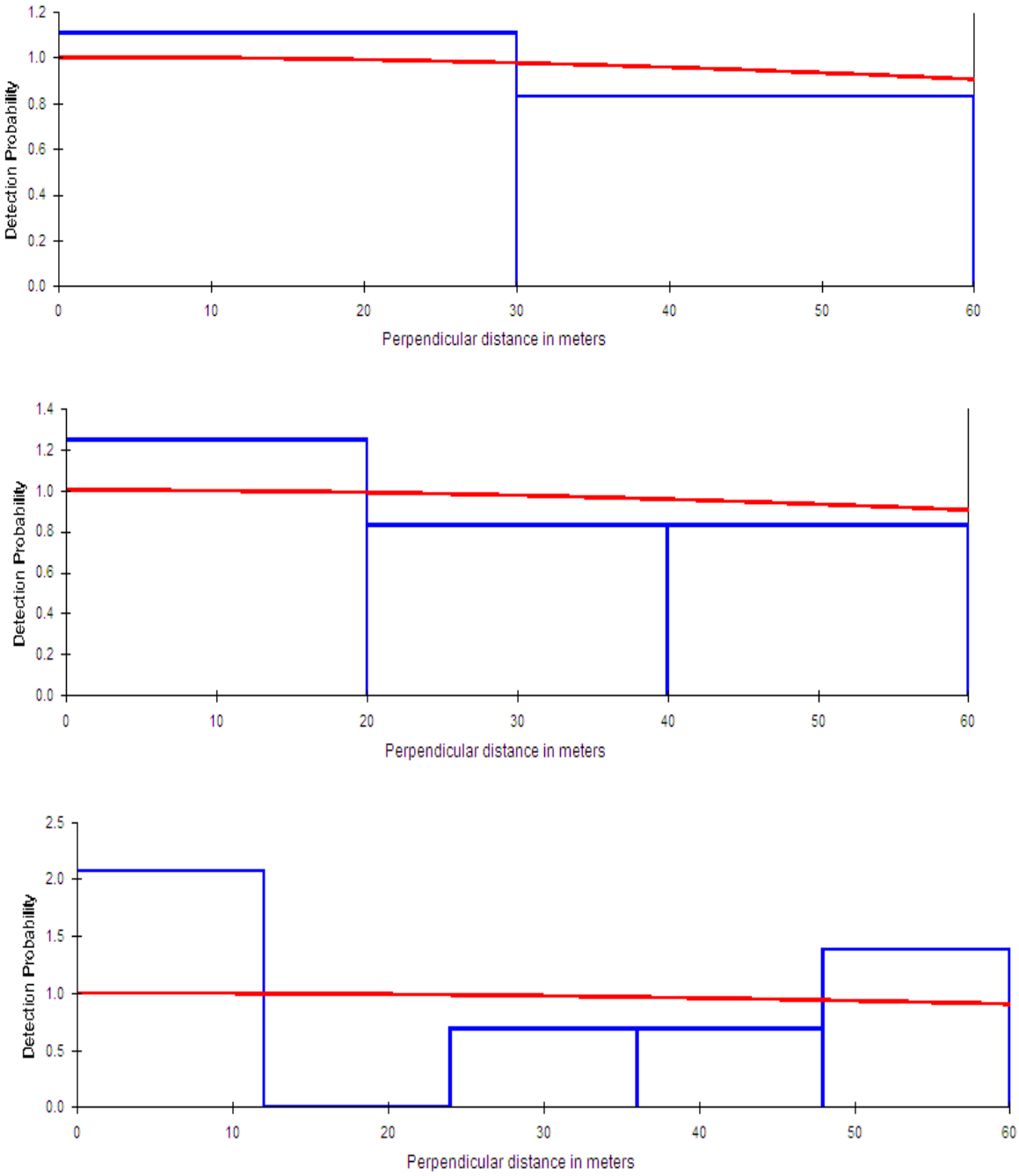

Figure 3.7: *Detection curves fitted to Cock-tailed tyrant Alectrurus tricolor data. Model is based on 14 observations and uses a half-normal key, with convergence achieved by 20 function evaluations. The AICc value was 116.93. The point estimate of density was 0.45 per hectare, with a standard error of 0.12. This led to an abundance estimate of 1,358 individuals in the savannah region, with a standard error of 367.53. With 95% C.I.'s included density estimate = 0.25 – 0.80/hectare, and the abundancy estimate = 768 – 2,402.*

Blue-throated Macaw survey:
In a total of 18 surveys (some data missing: total number = 24), 9 successfully recorded Blue-throated Macaws. 3 of these surveys included observations of juveniles, with a total of 5 juveniles observed. The highest number of individuals observed simultaneously in one location was 15, at 11.30am on the 25/08/09 at the tree furthest away from the camp. The second highest was 12, observed at approx. 07.45am on the 8/8/09 at the middle survey tree. Additionally outside the surveys a group of 25 individuals was observed on */9/09

Indicator species:
Bird species lists for the savannah and cerrado were compared to the "campo grasslands" and "low, seasonally flooded grasslands" indicator species databases in Stotz *et al.* (1996) as the reserve grassland ecosystem matched elements of the descriptions of both of these habitat types. To ensure our species list was only compared against species found in Bolivia, lists in Stotz *et al.* were checked against "Lista anotatado de las aves de Bolivia" (Hennessy *et al.,* 2003*).* All further discussion of 'the databases' refers to this cross-referenced version.
For "low, seasonally flooded grasslands", our species list contained 9 out of 16 species in the database, a total of 56.2%. For "campo grasslands" our species list contained 9 out of 17 species in the database, a total of 52.9%. The compared lists can be found in the appendices.

3.5 Discussion:

Conservation importance and recommendations

The data gathered from the expedition indicates that the reserve contains a total of 6 species that can be considered of special important for global conservation. The critically endangered Blue-throated Macaw *(Ara gluacogularis),* despite numbering only a few hundred individuals in the wild seems to be comparatively abundant within the reserve area. It was observed in all habitats relatively frequently (See species list in appendices). There were observations of large groups and observations of juveniles with parents, suggesting that Blue-throated macaws may be breeding in the wider area. In addition, populations of the vulnerable cock-tailed tyrant (*Alectrurus tricolor)* and black-masked finch *(Coryphaspiza melanotis)* were recorded in the savannah region of the reserve, both these species were observed at fairly high densities and were recorded on all 4 savannah transects indicating their presence across the savannah portion of the reserve. The expedition also documented sizeable populations of the Dark-throated seedeater (*Sporophila ruficollis*) in the savannah, Greater Rhea (*Rhea Americana*) in the savannah and forest and the Orinoco goose (*Neochen jubata*) which was recorded in the savannah and in the cerrado, all these species are listed as near-threatened by the ICUN.

In itself the presence of the critically endangered Blue-throated Macaw in such numbers identifies the reserve as an area of immense conservation importance. In addition the observation of sizeable populations of 5 other species of conservation concern merely highlights the importance of establishing this area as a site for conservation. Of the 6 threatened species 3 of them (Greater Rhea, Blue-throated Macaw, Cock-tailed tyrant) were

seen to be displaying some form of reproductive behaviour, (Nesting, presence of juveniles, and courtship display) which also indicates that conservation of this area could have a positive impact on the population recovery of these species. The large numbers of indicator species detected further highlights the importance of the reserve for conserving a unique savannah ecosystem and despite the recent grazing pressure the savannah habitat appears to be in relatively good condition. Almost no part of the Beni savannah ecoregion is currently protected and as the Bolivian government has ruled out the creation of any new national parks further conservation efforts in the region are likely to take the form of small, private reserves such as the Barba Azul reserve, it is therefore crucial that we document the populations sustained by the reserve as it may serve to form a blueprint for similar reserve established in the region.

As the Barba Azul reserve is located on land thought to represent typical Beni savannah habitat is would be interesting to find out whether other similar areas of the Beni contain similar densities of the species that are of conservation concern (with the exception of the Blue-throated Macaw which is known to be very sparsely distributed).

The reserve was located on former ranch land and the area still showed signs of disturbance, most notably the effects of grazing pressure and the effects of the annual burning by ranch owners. As all livestock have now been removed it will be interesting to see to what extent the avian community changes as the area's natural vegetation recovers.

Comparatively few species were identified in the forest habitat, this may be due to a lack of species relating to the small size of the forest island studied however it may also be that many cryptic species remained undetected due to the greater volume of vegetation cover. It is therefore recommended that any future expedition to the area involves a more intensive programme of mist netting, possibly in conjunction with sound recording as both these methods have been shown to be effective at detecting more cryptic avian species (Karr 1981, Parker 1991)

3.6 References

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3.7 Appendixes

Appendix 1: Species detected in the Barba Azul Reserve, the habitats in which they were detected and their conservation or indicator species status

Latin name	Common name	Focal species	Indicator species	Conservation status	Habitat
Chloroceryle amazona	Amazon Kingfisher	0		7	C
Mycteria americana	American Woodstork	0		7	s,c
Falco femoralis	Aplomado Falcon	0	CG	7	s,c
Porzana albicollis	Ash-throated Crake	0	SFG	7	s,c
Phimosus infuscatus	Bare-faced Ibis	0		7	s,c
Xolmis dominicanus	Black and White Monjita	0		3	s,c
Coragyps atratus	Black Vulture	0		7	c,f
Pheucticus aureoventris	Black-backed Grosbeak	0		7	S
Oryzoborus atrirostris	Black-billed Seedfinch	0		7	C
Busarellus nigricollis	Black-collared Hawk	0		7	F
Coryphaspiza melanotis	Black-masked Finch	1	CG	3	S
Himantopus mexicanus	Black-necked Stilt	0		7	S
Ara ararauna	Blue and Yellow Macaw	0		7	s,c,f
Ara glaucogularis	Blue-throated Macaw	1		1	s,c,f
Forpus xanthopterygi	Blue-winged Parrotlet	0		7	F
Amazonetta braziliensis	Brazilian Teal	0		7	S
Progne tapera	Brown-chested Martin	0		7	s,c
Thyrothorus leucotis	Buff-breasted Wren	0		7	s
Theristicus caudatus	Buff-necked Ibis	0		7	s
Xiphorhynchus	Buff-throated	0		7	s,c,f

gultas	Woodcreeper				
Colaptes campestris	Campo flicker	0		7	c, s
Bubulcus ibis	Cattle Egret	0		7	s,c
Machetornis rixosa	Cattle Tyrant	0		7	s,c
Mimus saturninus	Chalk-browed Mockingbird	0		7	s,c
Gnorimopsar chopi	Chopi Blackbird	0		7	s,c,f
Alectrurus tricolor	Cock-tailed Tyrant	1	CG	3	s
Ardea cocoi	Cocoi Heron	0		7	s,c
Turdus amaurochalinus	Creamy-bellied Thrush	0		7	s,f
Psarocolis decumanus	Crested oropendola	0		7	c,f
Campephilus melanoleucos	Crimson-crested Woodpecker	0		7	c,f
Sporophila ruficollis	Dark-throated Seedeater	1	SFG	6	s,c
Veniliornis frontalis	Dot-fronted Woodpecker	0		7	f
Attila bolivianus	Dull-capped Attila	0		7	c
Icterus cayanensis	Epaulet Oriole	0		7	c
Tyrannus savana	Fork-tailed Flycatcher	0		7	s
Cnemotriccus fuscatus	Fuscous Flycatcher	0		7	c
Hylochoris chrysura	Gilded Hummingbird	0		7	c
Chlorostilbon aureoventris	Glittering-bellied Emerald	0		7	s
Ara auricollis	Golden-collared Macaw	0		7	f
Piculus chrysochloros	Golden-green Woodpecker	0		7	f
Ammodramus humerulis	Grassland Sparrow	0		7	s,c
Sicalis luteola	Grassland Yellow Finch	0		7	s,c
Leptotila rufaxilla	Gray-fronted dove	0		7	c,f
Saltator coerulescens	Grayish Saltator	0		7	c,f
Aramides cajanea	Gray-necked Woodrail	0		7	c
Ardea alba	Great Egret	0		7	s,c
Pitangus sulphuratus	Great Kiskadee	0		7	s,c,f
Crotophaga major	Greater Ani	0		7	c,s
Rhea americana	Greater Rhea	1	CG	6	S,f

Phacellodomas ruber	Greater Thornbird	0		7	f
Mesembrinibis cayennensis	Green Ibis	0		7	f,s
Guira guira	Guira Cuckoo	0		7	s,f
Opistocomus hoatzin	Hoatzin	0		7	s
Chondrohierax uncinatus	Hook-billed Kite	0		7	c
Trogolytes aedon	House Wren	0		7	s
Jabiru jabiru	Jabiru	0		7	s
Sarcoramphus papa	King Vulture	0		7	f
Phactusa simlex	Large-billed Tern	0		7	c
Pitangus lictor	Lesser Kiskadee	0		7	c
Cathartes burrovianus	Lesser Yellow-headed Vulture	0		7	f,c
Dryocopus lineatus	Lineated Woodpecker	0		7	f
Veniliornis passerinus	Little Woodpecker	0		7	f
Uropelia campestris	Long-tailed Ground Dove	0	SFG, CG	7	s,c,f
Circus buffoni	Long-winged Harrier	0	SFG	7	s
Polioptila domicola	Masked Gnatcatcher	0		7	c
Cairina moaschata	Muscovy Duck	0		7	c, s
Lepidocolaptes angustiros	Narrow-billed Woodcreeper	0		7	c,f
Phalocrocorax brasilianus	Neotropical Cormorant	0		7	c
Falco deiroleucus	Orange-breasted Falcon	0		7	c
Neochen jubata	Orinoco Goose	1		6	s,c
Turdus leucomelas	Pale-breasted Thrush	0		7	s,c,f
Patagioenas cayannensis	Pale-vented Pigeon	0		7	c
Thraupis palmurium	Palm Tanager	0		7	f
Aratinga aurea	Peach-fronted Parakeet	0	SFG	7	c
Columbina picui	Picui Ground Dove	0		7	s,c,f
Columbina minuta	Plain-breasted Ground Dove	0		7	c
Theristicus caerulescens	Plumbeous Ibis	0		7	s,f
Cyanaocorax cyanomelas	Purplish Jay	0		7	c,f

Paroaria gularis	Red-capped Cardinal	0		7	s,f
Paroaria coronata	Red-crested Cardinal	0		7	s,c
Rhynchotus rufescens	Red-winged Tinamou	0		7	s,c
Ajaia ajaja	Roseate Spoonbill	0		7	s,c
Columbina talpacoti	Ruddy Ground Dove	0		7	s,c,f
Tigrisoma lineatum	Rufescent Tiger-heron	0		7	s
Pseudoseisura unirufa	Rufous Cachalote	0		7	s,c,f
Farnarious rufus	Rufous Hornero	0		7	c
Furnarious rufus	Rufous Hornero	0		7	f
Cyclarhis gujanensis	Rufous-browed Peppershrike	0		7	c,f
Laterallus melangphais	Rufous-sided Crake	0		7	s
Sicalis flaveola	Saffron Finch	0		7	s,c
Buteogallus meridionalis	Savannah Hawk	0		7	s, c
Thraupis sayaca	Sayaca Tanager	0		7	c,f
Hydropsalis torquata	Scissor-tailed Nightjar	0		7	c,f
Cistothoris platensis	Sedge Wren	0		7	f
Molothrus bonariensis	Shiny Cowbird	0		7	s,c
Myiarchus ferox	Short-crested Flycatcher	0		7	f
Buteo bachyurus	Short-tailed Hawk	0		7	s
Crotophaga ani	Smooth-billed Ani	0		7	c,f
Rostrhamus sociabilis	Snail Kite	0		7	c
Egretta thula	Snowy Egret	0		7	f
Myiozetes similis	Social Flycatcher	0		7	s,c
Cacicus solitarius	Solitary Cacique	0		7	c, f
Gallinago paraguieae	South American Snipe	0		7	s
Caracara plancus	Southern Caracara	0		7	s,c,f
Vanellus chilensis	Southern Lapwing	0		7	c,s
Chauna torquata	Southern screamer	0		7	s,c
Hymenos perspicallatus	Spectacled Tyrant	0		7	s
Dendroplex picus	Straight-billed Woodcreeper	0		7	f
Myiodynastes maculatus	Streaked Flycatcher	0		7	s
Sporophila	Tawny-bellied	0	SFG, CG	7	s

hypoxantha	Seedeater				
Ramphastos toco	Toco Toucan	0	SFG	7	f,c
Tyrannus melancholicus	Tropical Kingbird	0		7	s,c,f
Icterus icterus	Troupial	0		7	c,f
Cathartes aura	Turkey Vulture	0		7	s,c,f
Agelasticus cyanopus	Unicoloured Blackbird	0		7	s
Chrysosomus cyanopus	Unicoloured Blackbird	0		7	c
Pyrocephalus rubinus	Vermillion Flycatcher	0		7	s,c
Jacana jacana	Wattled Jacana	0		7	s
Emberizoides herbicola	Wedge-tailed Grass Finch	0	CG	7	s
Syrigma sibilatrix	Whistling Heron	0	SFG	7	s,c
Melanerpes candidus	White Woodpecker	0		7	f
Sturnell supercilliaris	White-browed Blackbird	0		7	s,c
Aratinga leucopthalma	White-eyed Parakeet	0		7	c,f
Dendrocygna viduata	White-faced Whistling Duck	0		7	s
Muscisaxicola albifrons	White-fronted Ground Tyrant	0		7	s
Arundinicola leucocephala	White-headed Marsh Tyrant	0		7	c
Xolmis velata	White-rumped Monjita	0		7	s
Polytmus guinumbi	White-tailed Goldenthroat	0	SFG, CG	7	c
Buteo albicadatus	White-tailed Hawk	0		7	c
Leptotila verreauxi	White-tipped Dove	0		7	s,c,f
Picumnus albosquamatus	White-wedged Piculet	0		7	f
Tolmomyias sulphurescens	Yellow Olive Flycatcher	0		7	f
Elaenia flavogaster	Yellow-bellied Eleania	0		7	s
Ammodramus aurifrons	Yellow-browed Sparrow	0		7	s
Satraapa icterophrys	Yellow-browed Tyrant	0		7	c,f
Brotogeris chiriri	Yellow-chevroned Parakeet	0		7	f
Certhiaxis cinnamomeus	Yellow-chinned Spinetail	0		7	f

Milvago chimachima	Yellow-headed Caracara	0		7	s,c,f
Anthus lutescens	Yellowish Pippit	0		7	s
Melanerpes favifrons	Yellow-tufted Woodpecker	0		7	C
Totals	140		14		

Indicator species: SFG = Seasonally flooded grasslands (Stolz et al, 1996), CG = Campo grasslands (Stolz et al, 1996). Conservation status key: 1= Critically Endangered, 2=Endangered, 3=Vulnerable, 4=Threatened, 5=Conservation Dependant, 6=Near Threatened, 7=Least Concern. Habitat: C=Cerrado, F=Forest, S-Savannah.

Appendix 2: Indicator species comparison

Low, seasonally flooded grasslands

Species	**Common name**	**Observed?**	
Syrigma sibilatrix	Whistling heron	Y	**Total=16**
Circus buffoni	Long winged harrier	Y	**Y=9**
Porzana albicollis	Ash throated crake	Y	**N=7**
Gallinago undulata	Giant snipe	N	**%Y=56.2**
Uropelia campestris	Long-tailed ground dove	Y	
Aratinga aurea	Peach fronted Parakeet	Y	
Chordeilles pusillus	Least nighthawk	N	
Caprimulgus maculicaudus	Spot-tailed nightjar	N	
Polytmus guainumbi	White tailed goldenthroat	Y	
Ramphastas toco	Toco toucan	Y	
Synallaxis hypospodia	Cinerous breasted spinetail	N	
Polystiticus pectoralis	Bearded tachuri	N	
Gubernetes yetapa	Streamer tailed tyrant	N	
Sporophila hypoxantha	Tawny bellied seedeater	Y	
Sporophila plumbea	Plumbeous seedeater	N	
Sporophila ruficolis	Dark throated seedeater	Y	
Campo Grasslands			
Species	**Common name**	**Observed?**	
Rhea americana	Greater Rhea	Y	**Total=17**
Falco femoralis	Aplomado falcon	Y	**Y=9**
Micropygia schombergkii	Ocellated crake	N	**N=8**
Uropelia campestris	Long-tailed ground dove	Y	**%Y=52.9**
Polytmus gauinumbi	White tailed goldenthroat	Y	
Melanopareia torquata	Collared crescent chest	N	
Caulicovora caudacata	Sharp tailed tyrant	N	
Polystiticus pectoralis	Bearded tachuri	N	
Euscarthmus rufomarginatus	Rufous sided pygmy tyrant	N	

Alectrurus tricolor	Cock tailed tyrant	Y
Alopochelidon fucata	Tawny headed swallow	N
Sicalis citrina	Stripe tailed yellow finch	N
Emberizoides herbicola	Wedge tailed grass finch	Y
Sporophila hypoxantha	Tawny bellied seedeater	Y
Sporophila ruficolis	Dark throated seedeater	Y
Coryphaspiza melanotis	Black masked finch	Y
Cypsnagra hirundinacea	White rumped tanager	N

4. Mammal report

Joanne Kingsbury and Grant Reekie

4.1 Introduction and background

Figure 4.1: *Southern Tamandua (Tamandua tetradactyl) this individual made an unexpected trip into our camp one evening.*

Only two ecosystems can be considered truly endemic to Bolivia, the Andean dry valleys and the Beni Savannah. Unfortunately the Beni remains entirely unprotected and is currently coming under much strain from high impact cattle ranching as well as habitat destruction due to annual burning of the savannah by landowners.

The Beni Savannah covers an area of 126,000 km2 located in the lowlands of the southwest Amazon basin and is considered an endangered ecosystem by The Nature Conservancy. The savannah consists of a mosaic of seasonally flooded grasslands interspersed with raised forest

islands and extensive gallery forest along the rivers. The Beni Savannahs have been found to harbour significant mammalian diversity, with over one hundred and forty six species recorded so far (Beck Moraes 1997). The area shares many species with the Amazon rainforest further north and several with the Gran Chaco grasslands to the west. The Beni region is however extremely understudied and very little is known about the abundance, distribution or composition of the mammalian communities found there.

The Bolivia 2009 expedition was tasked with documenting the mammalian populations of the Reserva Barba Azul, a former ranch recently purchased and currently being converted into a reserve by Associacion Armonia (Birdlife Bolivia) who facilitated the purchase of the reserve in order to establish an area for the protection of the Blue-throated Macaw (Ara gluacogularis), a critically endangered species (ICUN 2009). In addition to documenting the presence and abundance of the Blue-throated Macaw the expedition also aimed to assess the reserves mammalian biodiversity.

4.2 Study Site

The study was conducted within the Barba Azul reserve in the centre of the Beni region in Bolivia (13 44 17 S, 66 04 33 W). The study area consisted of a mosaic of seasonally flooded savannah which floods for between 4-6 months of the year, cerrado (dry savannah with scattered trees and forest thickets), raised forest islands and riparian habitat. This composition of habitat is typical of this region of the Beni and the diversity of vegetation meant we expected to find a wide range of species there. The reserve itself constitutes 35 square kilometres of former ranch land, as grazing animals had only recently removed from the land the effects of heavy grazing could still be seen, however it is hoped that removal of these animals will facilitate a regeneration of the natural ecosystem. (Figure 4.2)

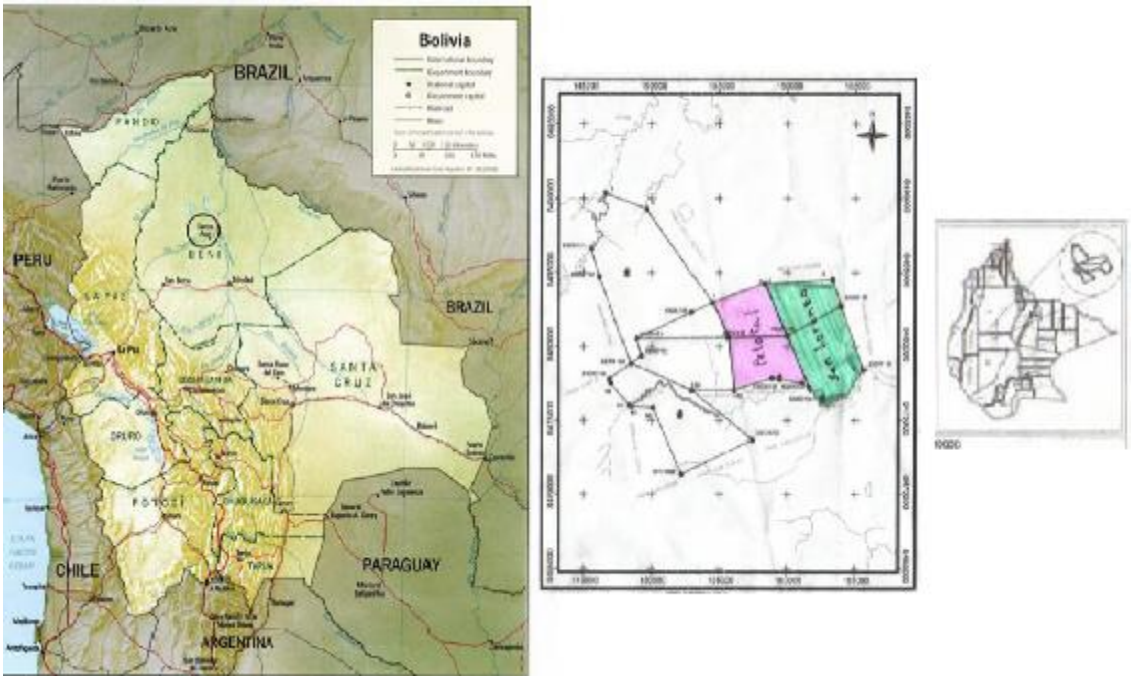

Figure 4.2: *Location of reserve within Bolivia and a map of the reserve itself*

4.3 Methods

Daytime Line Transects

Morning line transects were conducted in conjunction with avian transects (see figure 2.2). Three transects were walked each morning in each of the three habitats; savannah, cerrado and forest. These ranged in length from 3-5km and took around 2-2.5 hours to walk depending on vegetation. Transects were conducted over the whole duration of the expedition, 5 days per week, for a total of 28 days, from the 23rd July to the 20th August. On two days we were unable to conduct line transects due to unexpected cold/wet weather conditions resulting from a weather phenomenon known locally as “El Sur”. This drives exceptionally freezing winds over the Beni from southern Patagonia.

Four savannah transects were used, each of these began at the edge of the cerrado habitat immediately beside the main forest island and ran out across the plain. In an attempt to maximize the area under investigation, one transect was located at either side of the reserve with the other two running through the centre. These transects were completed in a rotational order.

Through the forest and cerrrado habitats, transects were located pre-existent main paths as these were relatively small areas and at times impassable outside of trails. Forest transects included areas with smaller trees, more vascular plants and dense undergrowth. In addition there were also sections of open Motaku forest interspersed with vines. Cerrado transects included areas of thick dense bush and more open sections where trees were widely spaced and termite mounds abundant.

Generalist species usually occur throughout the area, but it was also important to include all habitats to ensure that any specialist species confined to only a few vegetation types (Voss and Emmons 1996) were included in the survey.

The transects were walked daily by teams of 2 people at a speed of approximately 1.5km/h. In the teams, one person would primarily record the bird species data while the second person would record the mammalian species data. To keep disturbance to a minimum each individual walked as silently as possible. Transects were commenced at around dawn (~06:00hrs), a period when diurnal mammals are becoming active, and generally terminated by 1100hrs when the midday heat causes most mammals to rest. Observers worked with different individuals throughout the study period and also worked on all six of the transects so that any differences in identification abilities did not produce bias in survey results from different parts of the study area.

If a mammal was detected, either visually or by sound, the following information was recorded: date, time, species, number of individuals and habitat. GPS locations were also taken and recorded where possible. The start time of the transect was also noted as well as; the time of termination, the transect number and the names of the observers who were carrying out the transect.

Night Line Transects

In addition to the daily transects several transects were also carried out at night to detect purely nocturnal mammals such as opossums, puma and others that might be more active at this time (Emmons 1997). The same transects were walked at night as during the day and data recorded as before. Only one transect was walked on any one night and transects and were rotated between the three habitats (savannah, cerrado and forest). Transects commenced between 2000hrs and 2100hrs (around two hours after dark) and terminated before midnight. Each observer carried a strong flashlight that was illuminated intermittently and swept around the area around for signs of mammal activity. The torches were not permanently switched on, firstly, to reduce any disturbance that they could cause and, secondly, to prolong the life of the batteries. The nature of the conditions, i.e. the absence of constant light, increased the importance of listening for movement through the forest to compensate for the visual impairment, as not all of the forest was simultaneously illuminated. Silent pauses were taken at intervals along transects (around one pause every twenty minutes) to prevent the sound of the observer's own footsteps from interfering with any potential noises produced by mammals. As a result the average speed for walking the night transects was slightly slower than that for during the day.

Camera Traps:

Camera trapping was used as an aid to detect the more elusive mammals, such as the jaguar (*Panthera onca*) maned wolf (*Chrysocyon brachyurus*) and puma (*Puma concolor)* (Emmons

1997). Eight camera trap stations were used in total, three in the savannah habitat, two in the cerrado and three in the main forest island. Stations within the same habitat were spread out to cover as much of the habitat as possible. Camera traps were in use from 23rd July until the 20th August, collecting 28 days worth of data. Camera trap stations were positioned near sites where mammal activity was evident or alternatively in areas where it was expected. These sites were chosen on the following basis:

1. Tracks present nearby: where tracks were abundant, fresh or belonging to a species of interest, cameras were deployed nearby.

2. Trails: many mammals prefer to walk along trails, large carnivores such as *Panthera onca*, *Puma concolor* and *Leopardus pardalis*, specifically tend to use man-made trails (Emmons 1997). Cameras were deployed in areas where dense vegetation "bottlenecked" pathways or where many trails converged in one place.

3. Presence of a resource: where trails lead to water or where areas otherwise appeared ideal for drinking or feeding, cameras were positioned nearby.

In the savannah habitat, two camera stations were positioned along trails cut by animals, grasses on each side of the trail ranged from knee-length to waist-length. A further station was positioned on an isolated tree which was suspected as a territorial marking post due to the strong musky odour present around the site.

In the cerrado, one camera station was positioned on a trail leading out from the forest which had dense vegetation either side. The other cerrado station was positioned at a site where numerous trails converged, all exhibiting tracks of giant anteater and one with suspected maned wolf tracks.

In the forest, one camera station was positioned along a man made trail, bordered on one side by thin vegetation and on the other by a wire fence, this was nearby a site where maned wolf were heard calling. The second forest camera station was positioned near the outskirts of the island on a site where many trails converged, some of which lead to water. Puma tracks had also been sighted nearby. The third and last forest camera station was positioned in open Motaku forest near a tree suspected to as being used by mammals as a scratching post.

At each station, the two camera traps were positioned 5-10m apart by securing them to adjacent trees or, in open areas, to posts erected by ourselves. These were angled towards a central point that was 1m off the line joining the 2 traps (Figure 4.3). If the cameras directly faced each other, problems could have occurred due to mutual interference between the camera flashes (Karanth 2004). Vegetation and undergrowth that was in the camera's field of view was removed, to prevent it from obstructing the visual image of a mammal as it passed across the detection path. Photographs were automatically taken when the built in sensor detected motion. The cameras were mounted so that the sensor was at a height of 45cm,

enabling efficient capture of large and medium sized mammals (Karanth 2004). Once set up the cameras were purposefully set off to ensure that they worked properly. Each camera set was numbered so as photos would be identifiable to a specific habitat during analysis.

Camera traps are most effective when disturbance around them is minimized, thus once set, they were avoided for the duration of the study except when maintenance checks were necessary.

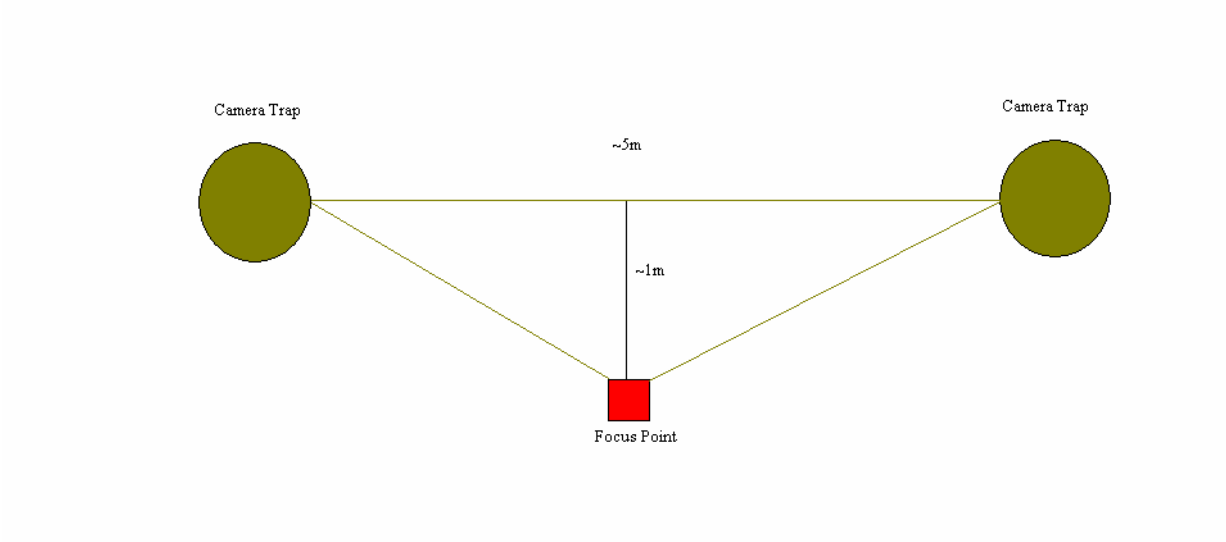

Figure 4.3: *Showing the positioning of each camera trap at each station*

If the cameras directly faced each other, problems could have occurred due to mutual interference between the camera flashes (Karanth 2004). Vegetation and undergrowth that was in the camera's field of view was removed, to prevent it from obstructing the visual image of a mammal as it passed across the detection path. Photographs were taken automatically when the built in sensor detected motion.

Cameras were constantly active from the time that they were set up until they were dismounted and collected. To prevent a large number of pictures of the same individual from being captured a 30-second delay was enforced on every camera. If a mammal passed through the detection zone and triggered the sensor then the sensor would be switched off for 30 seconds and no photographs would be taken. The batteries and sensors were checked on each camera every 7 days and replaced if necessary.

Tracks:

Whilst walking the ground was constantly scrutinized for tracks, the best locations being riverbanks and wet trails where the substrate was suitably wet to allow preservation of complete prints. Where tracks were found, they were photographed and tracings were made on acetate using a marker pen. The habitat in which the tracks were found was also recorded. Emmons (1997) was used to identify the tracks to species level.

4.4 Results and Discussion

From direct observations alone, we were able to detect the presence of a total of 20 terrestrial and arboreal, medium to large sized mammal species on the reserve (Table 4.1). All of these were observed by direct visual encounter with the exception of the maned wolf, ocelot and jaguarundi. Of these, 11 were observed along transects and a further 7 observed via random encounters.

In total, images of 12 different species were caught on camera traps, some of these multiple times. In addition, the tracks of 10 species were observed along transects.

Species	Common	Detection method	Habitat	Conservation status
Alouatta caraya	Black Howler Monkey	D, T, C, A	S (tracks), F	7
Dasyprocta variegate	Brown Agouti	D, T, C	F	7
Hydrocaeris hydrocaeris	Capybara	D, T, C	F	7
Pecari tajacu	Collared Peccary	D, T, C	F	7
Myrmecophaga tridactyla	Giant Anteater	D, T, C	S, C, F	6
Panthera onca	Jaguar	D	F	6
Dasypus novemcinctu	Nine-Banded long-nosed Armadillo	D, C	F C	7
Ozotoceros bezoarticus	Pampas Deer	D, C	S	6
Puma concolor	Puma	D, T, A	F, S (Aural), C (Aural)	7
Tamandua tetradactyla	Southern Tamandua	D, C	F, C	7
Euphractus sexcinctus	Yellow Armadillo	D, C	F, C, S	7
Procyon cancrivorus	Crab-eating raccoon	D, T, C	F, S (tracks)	7
Cerdocyon thous	Crab-eating fox	D, T, P	F,C,S(tracks)	7
Marmosa murina	Linnaeus's mouse opossum	D	F	7
Chrysocyon brachyurus	Maned wolf	C, A	F, S	6
Didelphis albiventris	White-eared Opossum	D, C	F	7
Nasua nasua	South American Coati	D	F,	7
Cebus apella	Brown Capuchin Monkey	D	F	7
Leopardus pardalis	Ocelot	T	F, S	7
Puma yagouaroundi	Jaguarundi	T	F, S	7

Table 4.1: *Mammalian species list for the Barba Azul Reserve with detection method (D=Direct visual encounter, T=Tracks, C=Camera Trap, A=Aural), Habitat observed in*

(S=Savannah, F=Forest, C=Cerrado) and Conservation Status (7=Least Concern, 6=Near Threatened).

For these reasons, direct visual encounters were the most successful surveying method for detecting species richness in our study period. Direct observations also detected 4 species that were not detected by any other method. Direct encounters along transects are necessary for detecting arboreal species such as monkeys that don't often leave tracks, as they rarely descend from the trees. However, we did manage to capture one camera trap image of a male howler monkey on the ground as it crossed an area of cerrado between two closely adjacent forest islands (Figure 4.7). In addition, howler monkey tracks were discovered along a wet path far out into the savannah, suggesting dispersal of this species over relatively large distances between forest islands.

There was also one direct sighting of 2 jaguars, believed to be mother and offspring. Anecdotal evidence of the presence of these individuals and other lone jaguars in the area came from surrounding ranches. Ranch owners claimed that the number of jaguars they encounter increases significantly during the calving season when small newborn livestock are sometimes killed by the cats. In some cases there were also claims of shooting jaguars in the past, substantiated by skins, skulls and other trophies.

Two of the species that were observed were not found within the limits of the reserve, the brown capuchin monkey, *Cebus apella,* and the South American coati, *Nasua nasua.* These were observed instead, in the forest islands of Pelotal Ranch, to the west of the reserve, an area being considered by Armonia for the reserves expansion.

The camera traps were extremely successful in some locations, and less so in others. Those in the forest worked well, frequently capturing images of a diverse range of. In the cerrado, images were fewer and diversity of species less. The savannah traps seemed the least successful. However, we propose that this was due to their positioning rather than a lack of species as a large diversity of tracks were found along trails in other areas of the reserve – specifically one trail running along the reserves eastern border and another running centrally through the savannah in a north westerly direction from base camp. mammals (Table 4.1 and Figures 4.4-4.10)

There was one species detected by the camera traps that was otherwise only detected via vocalizations, the maned wolf (Figure 4.9). This is a rare and vulnerable species (IUCN Red list 2009) which is of great conservation importance. Although the photograph does not contain the head, the coloration, fur length, black socks and height indicate its identity. Evidence for the presence of this species on the reserve is backed up by frequent aural reports and sound recordings. Maned Wolf howls were distinctive and frequently heard around the savannah and occasionally in the cerrado and forest areas. Aural howls were

most often observed to be heard from around 11pm until 2am and just before dawn (around 4am until 5am). Despite various attempts to gain a visual sighting of this species, including overnight camp hides in the savannah and walks at the times when they were suspected (from vocalizations) to be most active, our efforts to gain a direct sighting or photograph remained unrewarded.

Some of the animals recorded on camera traps have quite distinctive markings or coloration, and as such can be identified and used to give a minimum number of individuals of a species in the area (Karanth, 1995; Carbone *et. al,* 2001). In the case of the near threatened giant anteater (*Myrmecophaga tridactyla*), it would appear that there are at least 2 individuals in the area. Justification of this conclusion using the camera trap photographs is included (Figure. 4.10). This method of identification could be useful to future research in order to assess the minimum number of individuals using the reserve.

Tracks were found in all areas of the reserve. These seemed most abundant along damp trails in the savannah habitat and near the banks of the Rio Omi. Tracks were also found in the forest and cerrado particularly in dusty areas where soils were loose. Track surveys picked up the presence of two species that were not detected in any other way, the ocelot *(Leopardus pardalis)* and the jaguarundi *(Puma yagouaroundi)* (Figure 4.12 and 4.13). Puma *(Puma concolor)* tracks were also frequently observed (Figure 4.11). It would seem that perhaps track surveys are that best method of detection for the more elusive cat species of the reserve.

Figure 4.4: *Southern Tamandua (Tamandua tetradactyl)*

Figure 4.5: *Collared Peccary (Pecari tajacu)*

Figure 4.6: *Capybara (Hydrocaeris hydrocaeris)*

Figure 4.7: *Black Howler Monkey (Alouatta caraya)*

Figure 4.8: *Crab Eating Racoon (Procyon cancrivorus)*

Figure 4.9: *Maned Wolf (Chrysocyon brachyurus)*

Figure 4.10: *Anteater Identification. The Anteater in frames 1 through 4 has some sort of bald patch, perhaps an injury, on the neck (circled in red where visible). The Anteaters in the bottom 2 frames lack this mark, and also appear to have darker coloration in general. Finally, frame 6 shows that this specimen's forelimb markings are different from those in frame 1 – 4. Unfortunately, it is difficult to distinguish if the anteaters in frames 5 and 6 are different without seeing these markings. I would conclude that this gives evidence of at least 2 Giant Anteaters in the area.*

Figure 4.11: *Puma (Puma concolor) Tracks With Pen For Scale*

Figure 4.12: *Jaguarundi (Puma yagouaroundi) Tracks With Pen For Scale*

Figure 4.13: *Ocelot (Leopardus pardalis) Tracks With Pen For Scale*

4.5 References

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5. Herpetology report

Researchers: Arturo Muñoz, Ineke Plaetinck.

5.1 Introduction

Bolivia is characterized by great biological diversity due to the presence of a large variety of ecosystems and ecoregions. Unfortunately the knowledge of this diversity is very superficial. Including areas where almost nothing is known about their diversity and much less about the community structure of vertebrates. If we talk about amphibians and reptiles the situation is even worse, particularly in reptiles where in many cases there is only one record per species in the country.

Currently more than 254 known species of amphibians and 304 reptiles have been found in Bolivia with 60 species of amphibians and 29 species of reptiles being endemic to the country. (Aguayo 2009; Cortez, 2009), of these species in Bolivia a large percentage are in the lowland area of the country, of which the study area is part. The presence of different habitats, flooded savannas, closed forest, Forest Island and gallery forest patches makes the potential of this area to accommodate a large number of species is high.

Amphibians are organisms that depend on water or humidity, so it's no surprise that the greatest concentration of species is to be found in the Neotropics, particularly in the Amazon and Atlantic forest of Brazil. In Bolivia, the highest concentration of amphibians is found in the rainforests of the Amazon and other lowland ecoregions (containing between 35-45% of all amphibians in the country) and the Yungas, which contains about 32% of the Country's amphibians (Köhler, 2000).

The objective of herpetological work during our stay in the Barba Azul reserve was to conduct a rapid assessment of community RAP amphibian and reptile habitat Island forests, hills and savannah of the area and assess their importance for global and national conservation.

5.2 Methods

Default temporary transects were conducted using the method VES (Visual Encountrer Survey), as well as inventory methods in the short term (Heyer et al. 1994). This search was done to two meters on either side of the main shaft at each different habitats, looking in areas where there was a high probability of finding individuals.

A portion of primary data, biological data were taken from the species found were also collected recordings of songs with a minidisc Shrap MTMD90 and a unidirectional microphone Hammer 10 RMZ and tissue samples.

Weather conditions such as rain, fog, wind, were recorded before and after sampling.

To estimate the percentage of the community of amphibians reported during the inventory Jacknife1 estimator was used to calculate the total species richness in the study area with Estimates501 Program (Colwell and Codington 1994).

For the analysis of the relative abundance following equation was used:

$$Ii = ni / no\ min\ i$$

$$\%\ Ii = Ii * 100 / S\ Ii$$

Where:

ni = number of individuals observed the species in the area

No min i = number of minutes of sampling in the area

It uses the values of this index in proportion to the standardization and graphical representation of the relative abundance of each species in the area. This index allows for better control of sampling effort used in each sample, a more effective way than that based on the frequency of occurrence of a species in a given sample (Lizana *et al.* 1988).

3.3 Effort

2 people per day on an island of forest, savanna and closed making 100 visual transects in each macro habitat during the day and night.

5.3 Results

We found a total of 15 species of amphibians belonging to three families: Bufonidae (2), Hylidae (6) and Leptodactylidae 7. We expect to find many more species that were not found due to the unfavourable time for this group of vertebrates, it is our recommendation to make further surveys possibly during the rainy season when conditions are more favourable for these species.

Of the species found no have any significance for conservation or endemism, because the species found are recorded in a large area of the lowlands of Bolivia, Brazil, Peru.

Very few reptiles were found, representing only ten species belonging to seven families as shown in Table 2. We would expect to find many more species in the area, which is why it is necessary to continue work on this type of habitat. Regarding species conservation more research on the abundance and distribution of *Melanosuchus niger* would be interesting as is a CITES species,

Table 1: Amphibian species list for the reserve (Evidence, V = Visual, A = Audio, G = Audio Recording F = Filming or photography, C = Collect. H '= relative abundance)

Order	Family	Species	Evidence	Abundance(%)
	Bufonidae	*Rhinella granulosa*	F, V	2
		Rhinella Schneideri	V,A	4
		Dedropsophus leucophyllatus	VFA	7
		Dedropsophus nanus	V,F,A	10
	Hylidae Hylidae	*Hypsiboas geographicus*	A	2
		Hypsiboas punctatus	V,F,A	12
Anura		*Sphaenorynchus lacteus*	A	2
		Trachycephalus venulosus	V	2
		Adenomera diptyx	A,V	14
		Leptodactylus podicipinus	V,F,A	15
		Leptodactylus fuscus	V	8
	Leptodactylidae Leptodactylidae	*Leptodactylus leptodactyloides*	V	10
		Physalaemus albonotatus	V	2
		Leptodactylus cf. didymus	V	2
		Leptodactylys chaquensis macrosternum	V,F	8

Table 2. Reptile species list for the reserve (Evidence, V = Visual, and F = Filming or photography, C = Collect. H '= relative abundance)

Order	Family	Species	Evidence
Crocodylia	*Alligatoridae*	*Caiman yacare*	V,F
		Melanosuchus niger	V
Squamata-sauria	*Polychrotidae*	*Anolis cf nittens*	V
	Scincidae	*Mabuya sp.*	V
	Teiidae	*Ameiva ameiva*	V,F
Squamata-ophidia	*Boidae*	*Eunectes*	V
	Colubridae	*Leptodeira annulata*	V,F
		Hidrodinastes gigas	V,F
	Viperidae	*Botrhops cf.matogrosensis*	V,F
		Crotalus durissus	V

Here are some pictures of some of the species we found:

Figure 5.1: *Caiman yacare*

Figure 5.2: *Hypsiboas punctatus*

Figure 4.3: *Leptodactylus chaquensis macrosternum*

Figure 4.4: *Leptodeira annulata*

5. Icthyology and Botanical study

During biological surveys much attention is often paid to documenting the Avian, Mammalian and Herpetological fauna of an area while much less effort is put in to documenting the other communities of a research area. During the course of our stay the expedition helped to carry out an inventory of the ichthyological and botanical populations of the Barba Azul reserve. In this we were assisted by local experts recruited by Armonia and based at the Noel Kempff Mercado Museum of Natural History in Santa Cruz. These surveys represent the first of their kind to this area of Bolivia and are some of the first scientific studies in these respective fields to have ever looked at the Beni ecosystem. The findings of these studies will therefore greatly enhance the understanding how this unique ecosystem operates.

5.1 Icthyology fieldwork

The expedition assisted in the undertaking of the first Icthyological assessment of the Barba Azul reserve. The programme of research mainly involved working alongside specialists from the Museum of Natural History in Santa Cruz to collect samples from the water bodies of the reserve. Samples were taken through a combination of cast netting, drag netting and line fishing with the samples themselves being preserved in formaldehyde for later identification. The majority of sampling took place in the Rio Omi which flows through the reserve and floods annually to cover over half the reserve area. Sampling took place during the morning and evening with a different area being sampled each day. The samples taken during the expedition were taken to the Museum of Natural History in Santa Cruz where they are currently undergoing identification.

5.2 Botanical fieldwork

The Botanical fieldwork involved working alongside a Botanist from the Museum of Natural History in Santa Cruz to collect samples and conduct transects throughout the reserve in what represents the first assessment of its kind in the research area. The fieldwork centred on cataloguing the differing types of vegetation between the three main habitats in the reserve (savannah, cerrado, forest). As the reserve was formerly the site of a cattle ranch some of the vegetation still showed signs of disturbance, most notably those relating to grazing pressure and the annual burning of the savannah by ranch owners. As all livestock have now been removed from the area the results of this year's botanical survey will be used as the benchmark for future surveys which hope to document the restoration of the area's natural vegetation structure.

The results of both these surveys are currently still being processed by staff at the Noel Kempff Mercado Museum of natural History in Santa Cruz, the results of which will be made available to all interested parties as soon as possible

Figure 5.1: *Student and scientist collecting icthyological specimens for identification*