A preliminary assessment of the mammalian fauna of the eastern Bolivian panhandle

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Summary.
Due to the paucity of knowledge of Mammals of the eastern Bolivian panhandle, we: 1) Describe mammalian communities in four macrohabitats of this region (Cerrado, Chiquitano, Forest-Pantanal transition, and Pantanal) focusing on Chiquitano forest; 2) Compare species richness between this region and other regions nearby; 3) Assess the region in terms of its conservation value, as measured by the number of rare species harbored. Most large mammals overlapped all macrohabitats, with the exception of certain specialists of Pantanal or mesic systems (e.g., Tayassu pecari and Blastocerus dichotomus). In contrast, small mammal communities displayed tremendous heterogeneity and turnover among different habitats, with the exception of Proechimys longicaudatus, which was recorded in all four macrohabitats. We recorded new species for Bolivia (Micronycteris sanborni = 3000 km SW range expansion), Dpto. Santa Cruz (Choeroniscus minor = 700 km SE), eastern Bolivia (Marmosops dorothea < 225 km E), and also documented several eastern country records (Phyllostomus discolor ≤ 300 km, Tonatia sylvicola < 250 km, Oecomys mamorae ≤ 150 km). Although Chiquitano forest contained the highest species richness (42 species), the Pantanal harbored the highest number (15) and proportion (42%) of rare species, as well as the highest number of Red-listed species (n = 23, 70%). When comparing this study to other inventoried sites in the region, we found higher proportions of rare species when considering Endangered and Vulnerable species (29%) or all Red-listed taxa (50%), reinforcing that this area of the eastern Bolivian panhandle is extremely important for harboring rare mammals. Additionally, we conclude the eastern Bolivian panhandle is important from a conservation perspective because: 1) New range extensions and some new records for Bolivia or Dpto. Santa Cruz are documented, 2) The majority of the region surveyed contained abundant signs of game animals, suggesting light hunting at best, and 3) Approximately 80% (n = 24, N = 30) of all Red-list candidates were detected.

Resume.
En raison du manque de connaissances sur les Mammifères de l'est de la Bolivie, nous: 1) décrivons les différentes communautés de Mammifères peuplant les différents macrohabitats, en nous concentrant sur la forêt de Chiquitano; 2) comparons la richesse en Mammifères, t. 65, n°4, 2002 : 509-520-
INTRODUCTION

The Cerrado is characterized by a dense, tall, and broadleaf forest with a rich diversity of plant and animal species. However, this biologically diverse ecosystem is under threat from habitat degradation and loss due to deforestation and land conversion for agriculture and other purposes. The Cerrado is one of the most species-rich tropical ecosystems in the world, but it is also one of the most neglected and threatened. The Cerrado is a priority area for conservation efforts due to its unique biodiversity and the threats it faces.

METHODS

Large mammals were sampled by DMB and JMR in late April 1999. Small mammals were identified in all instances in the field. The data obtained from this study were used to assess the conservation status of mammal species in the Cerrado. The data were analyzed to determine the species richness and diversity of mammal communities in the study area.

TABLE 1. Summary of Sampling Methods

<table>
<thead>
<tr>
<th>HABITAT</th>
<th>SITE</th>
<th>COORD.</th>
<th>W (km)</th>
<th>D (km)</th>
<th>H (hr)</th>
<th>S (tn)</th>
<th>T (tn)</th>
<th>M (nn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerrado</td>
<td>Rio Las Conchas</td>
<td>17°33'58.3&quot;S; 59°28'17.1&quot;W</td>
<td>11.5</td>
<td>326</td>
<td>&gt;50</td>
<td>40</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Chiquitano</td>
<td>Estancia Las Conchas</td>
<td>17°35'46.9&quot;S; 59°30'20.5&quot;W</td>
<td>2-3</td>
<td>20</td>
<td>1-2</td>
<td>100</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Pantanal</td>
<td>Estancia Patuju</td>
<td>17°37'04.9&quot;S; 59°32'9.5&quot;W</td>
<td>2-3</td>
<td>2-3</td>
<td>&gt;50</td>
<td>260</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Transitional</td>
<td>Chiquitano</td>
<td>17°47'35.2&quot;S; 55°12'51.1&quot;W</td>
<td>2-3</td>
<td>2-3</td>
<td>&gt;50</td>
<td>320</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Candelaria</td>
<td>Aserradero</td>
<td>17°47'24.1&quot;S; 55°14'22.7&quot;W</td>
<td>2-3</td>
<td>2-3</td>
<td>&gt;50</td>
<td>157</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Santa Elena</td>
<td>Pontons</td>
<td>17°46'12.8&quot;S; 55°13'25.6&quot;W</td>
<td>2-3</td>
<td>2-3</td>
<td>&gt;50</td>
<td>480</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

**KEY WORDS**: Chiquitano, Bolivia, mammals, conservation, rapid assessment
Small mammal voucher specimens were archived at Coleccion Boliviana de Fauna, La Paz, and identified using keys of Anderson (1993, 1997), Aguirre and Patton (1987), and Simmons (1996). Specimens problems during taxonomic designation were taken to the American Museum of Natural History in June 2000 for examination by Guy Musser (Rodentia) and Nancy Simmons (Chiroptera). Tabularized data in Appendix 1 will reveal important information on macrohabitat association and specialization among separate species. The interview data were analyzed using two different methods:

1. Mortality and Jolly-Seber (natural history) population dynamics
2. Rank preference, suggesting that the interview data are directly indicative of abundance in different microhabitats.

We mostly used Rapid Assessment Program (RAP) protocols (Emmons 1993, Taber 1997, Anderson 1997), using:

- 1) All mammals (species richness),
- 2) Bolivian endemic, Endangered, and Vulnerable mammals,
- 3) All Bolivian Red-listed mammals (Tarifa 1996). However, to obtain quantitative data on large mammal abundance implies covering hundreds of kilometers of transects over an extensive period of time (Bocchi 1995, Peres 1997, Brooks 1993). Because our time in the field was limited, we used abundance estimates generated from walked and road transect counts, and interviews of respondents who were the only people living in the area. This information was used to generate data sheets of possible species, based upon region and habitat.

The region we sampled is one of the least known in terms of mammalian inventory in Bolivia, and therefore a master list was compiled prior to entering the field, using: Entrix (1998), Anderson (1997), Emmons and Feer (1997), Schaller (1983), et al. Taber (1997). The results of the test confirmed significance between number of encounters along the transects and sum of rank preferences obtained during interviews (P < 0.01, r = 0.736, n = 11). At the Cerrado site, which commonly fly over bodies of water, species such as Bulldog fishing bat (Noctilio sp.), species such as Mazama franciscana, could not be sampled for comparison.

The interview sample size was 5 (8 individuals). We used Rapid Assessment Program (RAP) protocols (Emmons 1993):

- 1) All mammals (species richness),
- 2) Bolivian endemic, Endangered, and Vulnerable mammals,
- 3) All Bolivian Red-listed mammals (Tarifa 1996).
MAMMALIAN FAUNA OF EASTERN BOLIVIA

Most of the data on large mammals were obtained during more than 50 hr of helicopter flight time (App. 1). The species detected most frequently was Cetrado Forest - a large deer that is extremely stenoecious with regards to habitat association, requiring relatively pristine wetlands. Other species encountered with some degree of frequency include Mazama gouazoubira (App. 1), Ochopeca americana, Dasypus novemcinctus, Dasyprocta punctata, and numerous other species.

We collected eight species of small mammals (one marsupial, three bats and four rodents), with every species collected once except for two species (App. 1). Similar to the situation with Transitional habitat, tracks could not be detected in this relatively swampy habitat, coupled with the exception that actual documented specimen localities between 16-20°S and 58-62°W from Anderson 1997 were used to generate a species list for the eastern Bolivian montane cloud forests.

Emmons (1993) and Tarifa sampled at two localities (~18°30' and ~22°30'), with the exception that actual documented specimen localities between 16-20°S and 58-62°W from Anderson 1997 were used to generate a species list for the eastern Bolivian montane cloud forests. The most species rich macrohabitat is the Chiquitano forest (42), followed by Pantanal (33), Cerrado (22) and Transitional habitat (14) (Table 2). However, caution must be taken to include the overall potential number of hypothetical species that could occur. Development in the immediate area and associated overhunting, considering how close these transects are to the village of San Juan, may warrant more intensive sampling. The number of rare species is highest in Pantanal (L4), followed by Chiquitano forest (11), Cerrado (4) and Transitional habitat (3). When considering all Red-list categories, Pantanal (23) is closely rivaled by Chiquitano forest, followed again by Cerrado (9) and Transitional habitat (4).

The presence of our interviewers, hunters and native people of the region may be a factor that has caused an underestimation of species richness in the study area. Although extremely limited sampling took place in poorly-drained Chiquitano Forest, it is worthy of note that two species of large mammalian game, Tayassu pecari and Euphractus sexcinctus, are the largest two species in the Chiquitano forest, weighing approximately 150 and 28.5 kg, respectively (Robinson and Redford 1991). Similar to the situation in San Juan, all Candelarian interviewed hunters indicated that they have seen and/or hunted Tayassu pecari, Dasyprocta, Silvilagus, Dasypus - and fruit resource abundance (Ramphastos toco) - good water quality and strong avian bioindicators (e.g., Crypturellus undulatus, Formicarius sp.) would support the presence of many other species. The most species rich macrohabitat is the Chiquitano forest (42), followed by Pantanal (33), Cerrado (22) and Transitional habitat (14) (Table 2). However, caution must be taken to include the overall potential number of hypothetical species that could occur. Development in the immediate area and associated overhunting, considering how close these transects are to the village of San Juan, may warrant more intensive sampling. The number of rare species is highest in Pantanal (L4), followed by Chiquitano forest (11), Cerrado (4) and Transitional habitat (3). When considering all Red-list categories, Pantanal (23) is closely rivaled by Chiquitano forest, followed again by Cerrado (9) and Transitional habitat (4).

Four regions were compared with this study to provide an index of regional biodiversity and rarity (Table 2). Emmons (1993) and Tarifa sampled at two localities (~18°30' and ~22°30'). The fact that tracks could not be detected in this relatively swampy habitat, coupled with the exception that actual documented specimen localities between 16-20°S and 58-62°W from Anderson 1997 were used to generate a species list for the eastern Bolivian montane cloud forests, is probably high. A similar situation is likely true with marsupials and rodents, which were taken in low numbers (1-2 individuals) with the exception of Proechimys longicaudatus (App. 1), and habitat was undisturbed in most sites (e.g., Nasua nasua.}

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**Table 2. - Species richness and rarity in this study and other xeric sites in Dpto. Santa Cruz**

Duration would reveal numerous other species present, and at least two new species (Tarifa in prep.).

En. = Endangered, Vu = Vulnerable, R. L. = Red Listed

"from Emmons (1993) and Peres (1997) which also shared 14 Endangered and Vulnerable species.

Moreover, when considering all Red-listed taxa the number of species (24) and proportion (50%) were also higher than other studies, except for Taber et al. (1997) whom also shared 14 Endangered and Vulnerable species.

The data from Taber captured equipment, and to CBF for the use of their dermestary and voucher collections. Special thanks go to ENTRIX, Inc., particularly Bob Honig and John Hu, for providing the baseline map.
### APPENDIX 1. MAMMALIAN INVENTORY

**Tapirs: Status Survey and Conservation.**


Sample Key:

- I = number of signs on walked transects
- r = number of signs on road-driven transects
- h = randomly selected preference by hunters
- s = number collected using small mammal methodologies
- < = seen by interviewees
- > = seen by interviewees more than 3 months ago
- a = number anecdotally observed individuals
- s = number collected using small mammal methodologies

**APPENDIX 2. APPENDIX 1. MAMMALIAN INVENTORY**

<table>
<thead>
<tr>
<th>LATIN NAME</th>
<th>COMMON NAME</th>
<th>FAMILY</th>
<th>ORDER</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Tapirus terrestris</em></td>
<td><em>Tapir</em></td>
<td><em>Perissodactyla</em></td>
<td><em>Mammalia</em></td>
</tr>
</tbody>
</table>

**Status Key:**

- **e** = Endemic
- **E** = Endangered
- **V** = Vulnerable
- **R** = Rare
- **LR** = Lower Risk
- **near threatened**
- **DD** = Data Deficient
- **en** = Endangered, en = possibly Commercially Threatened

**References:**

MAMMALIA

Artiodactyla

Tayassu pecari 3h 4h, <, 2a 25a

Tayassu lajacu It, Ih 3t, 2h, <

Mazama americana 2t, 2h 6t, lr, 5h, <

Mazama gouazoubira 1II, 3h, la 7t, Ih, <, 4a la

Blastocerus dichotomus 15a

Ozoloceros bezoarticus

Rodentia

Scjurus spadiceus 2a a

Oecomys mamorae 2s

Oryzomys nitidus Is

Qrvzomys subilavus Is

Qryzo_mys cf. subflavus? Is

Calgmys callosus Is Is

Galea spixii 2a

Hydrochaerus hydrochaeris la?

Dasyprgcla punctata 4l, 5h 8r, lOh, la

Agouti paca It, llh

Proechimivs longicaudatus Is 4s 2s

Lagomorpha

Silvilagusbrasiliensis It, la It, la