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 dichotomous*). 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* ≈ 3 000 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 most 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.

Résumé. – 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 macro-habitats, en nous concentrant sur la forêt de Chiquitano ; 2) comparons la richesse en

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espèces entre cette région et les régions voisines ; 3) estimons la valeur de la région en terme de conservation, mesurée par le nombre d'espèces rares présentes. La plupart des espèces de grands mammifères occupent tous les macro-habitats, à l'exception des espèces restreintes au Pantanal ou aux systèmes mésiques (par exemple, *Tayassu pecari* et *Blastocerus dichotomous*). A l'inverse, les communautés de petits mammifères montrent une très grande hétérogénéité et des variations selon les différents habitats à l'exception de *Proechimys longicaudatus*, rencontré dans les quatre macro-habitats. Nous avons trouvé de nouvelles espèces pour la Bolivie (*Micronycteris sanborni*, extension d'environ ≈ 3,000 km vers le sud-ouest de l'aire de répartition), pour le département de Santa Cruz (*Choeroniscus minor,* environ ≈ 700 km) et aussi vers l'est des aires de distribution connues (*Marmosops dorothea* ≈ 225 km). Bien que la forêt de Chiquitano contienne la plus grande richesse en espèces (42 espèces), le Pantanal héberge le plus grand nombre (15) et la plus grande proportion (42 %) d'espèces rares, ainsi que le plus d'espèces menacées (n = 23,70 %). Comparée à d'autres inventaires réalisés dans la région, cette étude montre une plus grande proportion d'espèces rares, que ce soit les espèces en danger ou vulnérables (29 %), ou toutes les espèces menacées (50 %), ce qui confirme que cette partie du plateau est-bolivien est extrêmement importante pour l'hébergement des mammifères rares. De plus nous concluons que le plateau est-bolivien est important pour la conservation parce que : 1) de nouvelles extensions d'aires de répartition et quelques observations d'espèces nouvelles ont été établies pour la Bolivie et pour le département de Santa Cruz, 2) la majorité de la région étudiée contient d'abondantes traces d'espèces gibiers, suggérant une chasse au mieux modérée ; 3) environ 80 % (n = 24, N = 30) de toutes les espèces menacées y ont été détectées.

KEY WORDS : Chiquitano, Bolivia, mammals, conservation, rapid assessment

INTRODUCTION

The 18th – early 19th centuries represented an explosive period of scientific expeditions to document distribution, occurrence and natural history of Neotropical mammals. Consequently, by the middle of the 19th century, South America's mammalian fauna became among the best known, with the exceptions of western Europe and parts of Eurasia (Hershkovitz 1987). However, there are still various parts of South America where the mammalian fauna is at best poorly known (e.g., Emmons and Tarifa 1994). For example, of 1259 collecting localities in Bolivia, fewer than 20 (< 2 %) are in the eastern "panhandle" of Dpto. Santa Cruz (data obtained from Anderson 1997), making this region a priority for mammalian exploration.

In spite of several recent surveys performed in the eastern Bolivian panhandle (Emmons 1993 ; Taber *et al.* 1997), there are still many wide gaps in the inventory of the mammalian fauna of this region. For this reason, we surveyed mammals along a transect spanning four habitats in the eastern Bolivian panhandle.

Our objectives herein specifically are to : 1) Describe mammalian communities in different macrohabitats of the eastern Bolivian panhandle, focusing on Chiquitano forest ; 2) Compare species richness between this region and other regions nearby ; and 3) Assess the region in terms of its conservation value, as measured by the number of rare species harbored.

METHODS

Large mammals were sampled by DMB and JMR in late April 1999. Small mammals were collected by RJV, HA and JMR in late April 1999, and identified in the lab by TT and RJV at Colección Boliviana de Fauna (CBF) ; some species were identified by Guy Musser and Nancy Simmons at the American Museum of Natural History (AMNH) (Table 1).

TABLE 1. – Summary of Sampling Methods
Key : W = walked transects, D = driven transects, I = interviews, H = helicopter overflights, S = small traps (tn = trap-nights), T = tomahawk traps (tn = trap-nights), N = mistnets (nn = net-nights).

HABITAT SITE	COORD.	W (km)	D (km)	I (#)	H (hr)	S (tn)	T (tn)	M (nn)
Cerrado		11.5						
Rio Las Conchas	17°33'58.3"S; 59°28'17.1"W					40		1
Estancia Las Conchas	17°33'58.3"S; 59°28'17.1"W			2		100		
Pozo Mario	17°35'46.9"S; 59°30'20.5"W					260		
Estancia Patuju	17°37'04.9"S; 59°32'9.5"W							2
Chiquitano			326					
San Juan	17°47'35.2"S; 55°12'51.1"W	2-3		20				
Transect 1	17°47'24.1"S; 55°14'22.7"W	2-3						
Transect 2	17°46'12.8"S; 55°13'25.6"W	2-3						
Transect 3	17°45'9.4"S; 55°12'42.6"W	2-3						
Transects 4 and 5	21°00'S; 59°38'35"W	2-3						
Transect 6	17°25'29.6"S; 59°41'27.8"W	2-3						
Transect 7	17°34'3.2"S; 59°48'4.6"W	2-3						
Aserradero Pontons	17°4'36.5"S; 59°34'10.2"W			2		320		2
Transitional					> 50			
Lagunillas	17°4'10.5"S; 59°28'17.1"W					480	9	4
Pantanal					> 50			
Candelaria	16°45'53.7"S; 58°26'21.0"W			16				
Santa Elena	16°41'56.0"S; 59°34'10.2"W			1		157		1

Regional Description

Work was done in four macrohabitats (Cerrado, Chiquitano Forest, Transitional Habitat, and Pantanal), but our work focused predominately in Chiquitano forest – the most sensitive of the macrohabitats studied (Emmons 1993). The Cerrado is characteri-

zed by rocky outcrops and rolling terrain, and a mosaic of palm, savannah and forest that is denser and overall lower than Chiquitano forest. The Chiquitano forest is interesting from a phytogeographic perspective, reaching heights (> 35 m) and stratification rivaling the Amazonian forest to the north, yet the xeric nature is similar to the Chaco to the south ; plant species richness in Chiquitano Forest is among the highest documented for any tropical deciduous forest (Gentry 1995). Similar to the fashion in which Chiquitano forest links Amazonia and the Chaco, transitional habitat links Chiquitano forest and Pantanal ; the forest gradually gives way to interdigitation of several hundred individual marshes ranging from several m^2 to > 1 km^2. The Pantanal is characterized by a relatively homogenous grassy, alluvial, seasonally inundated plain that is punctuated with palm forest.

Field Methods

We mostly used Rapid Assessment Program (RAP) protocols (Emmons 1993 ; Emmons and Tarifa 1994), with slight methodological modifications to help insure scientific rigor. For example, the study took place during the wet season when the Pantanal is inundated and hence roads in that habitat are impassable. However, it was necessary to sample as many habitats as possible to obtain a good representation of the regional mammalian fauna, and therefore sampling methods were slightly modified as needed at each habitat (Caro *et al.* 2001).

Large Mammal Sampling – Large species are an important aspect of this inventory, as these species comprise most of the IUCN and Bolivian Red Lists (IUCN 1996 ; Tarifa 1996). However, to obtain quantitative data on large mammal abundance implies covering hundreds of kilometers of transects over an extensive period of time (Bodmer 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 local residents (especially hunters) ; additionally, anecdotal data were used to augment our species inventories.

Small Mammal Sampling – The methods for sampling small mammals (species ≤ 500 g) included trapping during the night for terrestrial and scansorial mammals (rodents and marsupials) and nocturnal capture of bats using a mist net. Sherman, Victor, Museum Special and Tomahawk traps were used. Traps were set on the ground in pairs in linear transects (trap lines), with a distance of 10 m between traps, for one to three nights in selected microhabitats. Dry oatmeal flakes, vanilla, tuna or sardines, and peanut butter were used as bait. Mist nets were open from 18:30 – 24:00 in different sites. In addition to using nets, bats were captured by hand in areas where local residents reported their presence. Furthermore, it was possible to visually identify some species such as Bulldog fishing bat (*Noctilio sp.*), which commonly fly over open bodies of water.

Lab Methods and Analyses

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), Taber *et al.* (1997), Myers and Wetzel (1983) and Emmons (1993). This list was then used to generate data sheets of possible species, based upon region and habitat.

Small mammal voucher specimens were archived at Colección Boliviana de Fauna (CBF), La Paz, and identified using keys of Anderson (1993, 1997), Aguirre and Anderson (1997), Patton (1987), Musser *et al.* (1998) and Simmons (1996). Specimens were also compared to reference specimens deposited in the CBF. Species posing problems during taxonomic designation were taken to the AMNH in June 2000 for examination by Guy Musser (Rodentia) and Nancy Sinimons (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. For "the game of choice" part of the interview, species were scored by rank (4 points assigned to the most frequently taken species, 3 points to the 2nd, 2 points to the 3rd, and 1 point each for the 4th – 10th) ; these points were summed for each species to provide ranked estimates of abundance at each site. For the "last time a species was seen" part of the interview, if the species was seen less than 3 months ago were considered more common, whereas those seen more than 3 months ago were considered rarer. This information was obtained by comparing the number of interviewees responding more than 3 months versus less than 3 months. Those with equal numbers were indicated as such, straddling the median. The accuracy of these data was tested by comparing the interview results to transect data ("game of choice") or published data ("last time species seen" ; IUCN 1996, Tarifa 1996).

Finally, species richness was assessed by comparing separate sites. Estimates of how "threatened" a given region is in terms of mammalian rarity was assessed by comparing the proportion of Bolivian Red-listed species (Tarifa 1996) relative to all species at each site. Analyses were generated separately for each of the four macrohabitats and several comparative areas (Emmons 1993 ; Taber 1997 ; Anderson 1997), using : 1) all mammals (species richness), 2) Bolivian endemic, Endangered and Vulnerable manimals, and 3) all Bolivian Red-listed mammals (Tarifa 1996).

RESULTS AND DISCUSSION

Accuracy of Interview Data

All hunters indicated they hunt species in the order encountered rather than by preference, suggesting that the interview data are directly indicative of abundance in nature. This was tested with Spearman Rank correlation using the Chiquitano forest data since these data comprised the largest sample. 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, although some consistency was found between transect and interview data (e.g., *Mazama* as an abundant and preferred species), tighter concordance was likely hampered by the small interview sample (n = 2), who were the only people living in the area. The other two habitats (Transitional and Pantanal) were flooded, and therefore transects could not be sampled for comparison.

Similarly, of the species that were reported rare (last seen >3 months ago) during interviews in the Chiquitano and Pantanal, 86 % (n = 6, N = 7) and 93 % (n = 13, N = 14) were red-listed (IUCN 1996, Tarifa 1996), respectively. These results suggest that interview data are consistent and valid.

General Descriptions of Mammalian Communities

Cerrado Forest – The species most frequently encountered by track counts were *Mazama gouazoubira* and *Cerdocyon thous* (App. 1). Other species encountered with some degree of frequency include *Dasypus novemcinctus*, *Dasyprocta punctata* and *M. americana* (App. 1).

Six species of small mammals (one marsupial, two bats and three rodents) were accounted for, with all small mammals represented by a single specimen except for the anecdotal sightings of *Noctilio leporinus* (App. 1). This was perhaps the most valuable site in terms of new findings for small mammals : *Oryzomys cf. subflavus* may warrant a new (sub)species, pending further investigation (G. Musser, pers. obs.), and the specimen of *Micronycteris sanborni* represents the first record for Bolivia (N. Simmons, pers. obs.), with a range extension of approximately 3,000 km to the southwest.

Chiquitano Forest – Although extremely limited sampling took place in poorly-drained Chiquitano Forest, it is worthy of note that two species of large mammalian game, *Tapirus terrestris* and *Tayassu pecari*, were present. Interestingly, these are the largest two species in the Chiquitano forest, weighing approximately 150 and 28.5 kg, respectively (Robinson and Redford 1991).

The remainder of this section focuses upon well-drained Chiquitano Forest. Transects 1 and 2, and the riverine forest by San Juan, although appearing undisturbed in terms of plant composition, were essentially "empty forests" (Redford 1992), with integral habitat and strong avian bioindicators (e.g., *Piaya cayana*, *Galbula ruficauda*, *Celeus lugubris*, *Thamnophilus caerulescens* and *Mymorchilus strigilatus*), yet lacking any signs of large mammals. The absence of large mammals is likely a consequence of development in the immediate area and associated overhunting, considering how close these transects are to the village of San Juan.

Transects 3 – 7 contained an abundance of game species (e.g., *Tapirus*, *Mazama*, *Tayassu*, *Dasyprocta*, *Silvilagus*, *Dasypus* – App. 1), and habitat was undisturbed in most cases. Transect 3 was close to the Rio Tucuvaca crossing, and avian bioindicators of good water quality (*Tigrisoma lineatum*) and fruit resource abundance (*Ramphastos toco*) were present. The presence of large cats along transects 4 and 5 is especially noteworthy, suggesting that the hunting ban in the region of Proyecto Don Mario gold mine (M. Malocsay, pers. comm.) is effective. Transects 6 and 7 appeared to be unmolested forest, as confirmed by the presence of several avian bioindicators with specialized habitat requisites (e.g., *Crypturellus undulatus*, unidentified antshrike, possible *Formicarius sp.*).

Six species of small mammals (one marsupial, three bats and two rodents) were collected (App. 1), with each species being represented by a single specimen, except for *Proechimys longicaudatus* (four specimens). *Choeroniscus minor* represents a new record for Dpto. Santa Cruz with a range extension of approximately 700 km to the southeast, previously known from three localities and three specimens in Dpto. Cochabamba, La Paz and Pando. *Marmosops dorothea*, a Bolivian endemic (Anderson and Tarifa 1996) considerered "Vulnerable" in the IUCN Red Book (IUCN 1996), represents a geographic range extension to the east (≈ 225 km). Additionally, we report *Tonatia sylvicola* (≈ 250 km) as an eastern country record.

Transitional Habitat – Most of our data from the transitional habitat comes from anecdotal sightings and small mammal data in seasonally flooded grassland savanna. The fact that tracks could not be detected in this relatively swampy habitat, coupled with lack of interviews from this region, makes our estimates of this habitat conservative at best. With the exception of *Alouatta caraya*, *Cerdocyon thous* and *Nasua nasua*, most of the data on large mammals were obtained during more than 50 hr of helicopter flight time (App. 1). The species that was detected most frequently was *Blastocerus dichotomous*, a large deer that is extremely stenoecious with regards to habitat association, requiring relatively pristine wetlands.

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). *Phyllostomus discolor* represents a new eastern country record of approximately 300 km, known before only from western Dpto. Santa Cruz ; *Oecomys mamorae* also represents an eastward country record of approximately 150 km.

Pantanal – Similar to the situation with Transitional habitat, tracks could not be easily detected in the Pantanal due to inundated habitat. The habitat specialist *Blastocerus dichotomus* was reported anecdotally along with a few other species (App. 1).

Similar to the situation in San Juan, all Candelarian interviewed hunters indicated they hunt species in the order encountered rather than by preference, suggesting that interview data are directly indicative of species abundance (see statistical test above). The most frequently taken species were *Dasypus novemcinctus*, *Mazama gouazoubira*, both *Tayassu* species, *Euphractus sexcinctus* and *Tolypeutes matacus* (App. 1).

Two species of small mammals were collected (App. 1). As with the other specimen of *Marmosops dorothea*, this represents a geographic range extension of a Bolivian endemic species.

Biodiversity Analyses

Bats could not be compared in the analyses because our sample sizes were too small relative to the overall potential number of hypothetical species that could occur. However, since every species of bat collected was taken only once, Chiropteran biodiversity in the area 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*. Data from Noel Kempff Mercado National Park (Emmons 1998), a nearby region, shows that the number of species recorded increases with longer duration in the field, and therefore we should be able to account for more species over time.

The most species rich macrohabitat is the Chiquitano forest (42), followed by Pantanal (33), Cerrado (22) and Transitional habitat (14) (Table 2). However, caution should be used when interpreting these data, as this result may be a consequence of more intensive sampling. The number of rare species is highest in Pantanal (14), followed by Chiquitano forest (11), Cerrado (4) and Transitional habitat (3). This may again be a consequence of sampling regime. If more intensive sampling had taken place in the Transitional habitat, perhaps more rare species would have been accounted for. When considering all Red-list categories, Pantanal (23) is closely rivaled by Chiquitano (21) 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 (Curuyuqui [18°46'S, 62°14'W] and Perforacion [19°55'S, 62°33'W] in the western part of Dpto. Santa Cruz using similar rapid assessment methods of transect and interview sampling, complemented with small-mammal trapping. The study of Taber *et al.* (1997) was longer-term and covered a broader area (nearly 35,000 km^2) in the Chaco (≈18°30' – 20°00'S, 59°30' – 62°00'W) without intensive effort on small mammal sampling. Actual documented specimen localities between 16-20°S and 58-62°W from Anderson 1997 were used to generate a *bona-fide* species list for the eastern Bolivian

TABLE 2. – Species richness and rarity in this study and other xeric sites in Dpto. Santa Cruz

Caption :
En = Endangered, Vu = Vulnerable, R.L. = Red Listed
^ from Emmons (1993)
* from Taber *et al.* (1997), non-volant fauna only
+ generated using documented specimen localities between 16-20°S and 58-62°W in range maps from Anderson 1997.

THIS STUDY

	Cerrado	Chiquitano	Transitional	Pantanal	All
Total Spp.	22	42	14	33	48
En./Vu. (%)	4 (18%)	11 (26%)	3 (21%)	14 (42%)	14 (29%)
All R.L. (%)	9 (41%)	21 (50%)	4 (28%)	23 (70%)	24 (50%)

COMPARATIVE XERIC SITES IN EASTERN BOLIVIA

	Curuyuqui^ +	Perforacion^	Kaa-Iya NP*	E. Panhandle
Total Spp.	36	32	69	72
En./Vu. (%)	7 (19%)	3 (10%)	14 (20%)	9 (12%)
All R.L. (%)	15 (41%)	9 (28%)	25 (36%)	18 (25%)

panhandle. The data from Taber *et al.* (1997) and Anderson (1997) indicated a higher species richness (69 and 72, respectively) than our study (48), which is not too surprising considering the shorter sampling duration we had available. However, we found more species than Emmons (1993), who recorded 32 and 36 species at two sampled sites. Nonetheless, both the actual number (14) and proportion (29 %) of Endangered and Vulnerable species was higher in this study than any other site, with the exception of Taber *et al.* (1997) whom also shared 14 Endangered and Vulnerable species. Moreover, when considering all Red-listed taxa the number of species (24) and proportion of red-listed species (50 %) were also higher than other studies, except for Taber *et al.* (1997) who found 25 Red-listed species. It is important to realize that no details of data collection were provided in Taber *et al.* (1997), and it is possible that the numbers provided are merely hypothetical. Consequently our study site is likely the most valuable regional area in terms of mammalian rarity.

Conservation Implications

As a consequence of few inventories in the region (Anderson 1997), most (if not all) of the mammals we recorded constituted new site records. Many of the small mammals represent significant records within Bolivia (e.g., *Phyllostomus discolor*, *Tonatia sylvicola*, *Oecomys mamorae*), whereas *Marmosops dorothea* represents an eastward range expansion, and *Choeroniscus minor* represents the first record in eastern Bolivia and only the fourth specimen documented for the country. Trap success was relatively low at 1.5 % (20 individuals in 1326 trap-nights) ; it is likely that longer sampling

duration would reveal numerous other species present, and at least two new species (Tarifa *et al.* in prep.).

Overhunting strongly characterizes habitats that are degraded, often exceeding sustainable game extraction due to high human population density. Examples include transects 1 and 2, where "empty forest" effects (Redford 1995) were observed. However, much of the region surveyed contained abundant signs of game animals. Some of the best bio-indicators for sustainable harvest levels are Tapirs (Brooks *et al.* 1997), primates (Peres 1997 ; Bodmer 1995) and Cracids (Brooks and Strahl 1997) – these are often the first species to disappear due to overhunting, yet their presence was observed with some frequency.

Species such as *Proechimys longicaudatus* were among the most pervasive, being represented at all sites. Interviewees reported some species, such as *Herpailurus* (invariably) and *Eira* (often) as "pests", predating upon domestic chickens, and therefore hunted with some frequency. Nonetheless, these species still persist in the area. However, several other species are quite rare in general. Although some rare species range widely geographically, there are several exceptions that are regionally restricted (cf. Rabinowitz *et al.* 1986) due to endemism and/or small geographic range size or habitat specialization (e.g., *Marmosops dorothea*, *Akodon dayi*, *Chrysocyon*, *Blastocerus* ; Tarifa 1986). Indeed 24 out of 30 possible (80 %) Red-list candidate species (Tarifa 1996) were detected during this study, suggesting the eastern panhandle serves as an important harbor for many rare mammals.

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APPENDIX 1. – MAMMALIAN INVENTORY

Caption :

Sample Key : t = number of signs on walked transects, r = number of signs on road-driven transects, h = ranked preference by hunters, < = seen by interviewees ≤ 3 months, > = seen by interviewees > 3 months ago, a = number anecdotally observed individuals, s = number collected using small mammal methodologies.

Status Key : e = Endemic, E = Endangered, V = Vulnerable, R = Rare, LR = Lower Risk : near threatened, I = Indeterminate, DD = Data Deficient, K = Insufficient Knowledge, CT = Commercially Threatened, (CT) = Possibly Commercially Threatened.

LATIN NAME	Cerrado	Chiquitano	Transitional	Pantanal	IUCN RL	Bol. RL
Marsupialia						
Marmosops dorothea		1s		1s	V	e
Monodelphis domestica	1s		1s			
Xenarthra						
Dasypus novemcinctus	5t	4t, 3h, 1a		1h		
Chaetophractus vellerosus		<		<	DD	K
Euphractus sexcinctus	5h	10h, <		4h, <, 1a	DD	K
Priodontes maximus		>		>	E	V
Tolypeutes matacus	1a?	1a, <		4h, <, 1a	DD	K
Myrmecophaga tridactyla		1t, 11h, >		10h, <	V	V
Tamandua tetradactyla		<		<		
Chiroptera						
Noctilio leporinus	2a					
Micronycteris sanborni	1s					
Phyllostomus discolor			1s			
Tonatia silvicola		1s				
Choeroniscus minor		1s			LR	
Artibeus obscurus		1s	1s			
Sturnira lilium			1s			
Primates						
Callithrix melanura		1t, <, 4a		<, 1a	DD	V
Alouatta caraya		11h, <, 1a	1a	<, 1a	V	V
Aotus azarae		<		<		
Callicebus donacophilus		2a		A		(CT)
Ateles chamek		>				
Cebus apella		11h, <, 2a		<, >		(CT)
Saimiri sciureus		<		A		(CT)
Carnivora						
Cerdocyon thous	8t, 3a	4r, 5a	1a			
Chrysocyon brachyurus				>	V	E
Speothos venaticus		a		a	V	I
Herpailurus yagouaroundi	1t	<		>	DD	I
Leopardus pardalis		>, 1a		10h, >	V	V
Leopardus wiedii	1a	>		>	DD	V
Puma concolor		1t, 9h, >		>	DD	I
Panthera onca		2t, 9h, >, 2a		10h, >	V	V
Lutra longicaudis		<		>	V	V
Eira barbara		<, 1a		>, 1a		
Potos flavus		a				
Nasua nasua		a	8a	a		
Procyon cancrivorus	1t	1t				
Perissodactyla						
Tapirus terrestris	1t, 4h, 1a?	1t, 5h, >, 8a		8h, >	LR	V (CT)

Artiodactyla						
Tayassu pecari	3h	4h, <, 2a	25a	4h, <	V	V (CT)
Tayassu tajacu	1t, 1h	3t, 2h, <, 1a		2h, <	V	V (CT)
Mazama americana	2t, 2h	6t, 1r, 5h, <, 2a		8h, >	DD	CT
Mazama gouazoubira	11t, 3h, 1a	7t, 1h, <, 4a	1a	3h, <	DD	K (CT)
Blastoceros dichotomus			15a	5h, <, >, 2a	LR	V
Ozotoceros bezoarticus				>	V	V
Rodentia						
Sciurus spadiceus	2a	a		a		
Oecomys mamorae			2s			
Oryzomys nitidus			1s			
Oryzomys subflavus	1s					
Oryzomys cf. subflavus?	1s					
Calomys callosus		1s	1s			
Galea spixii	2a					
Hydrochaeris hydrochaeris		1a?				
Dasyprocta punctata	4t, 5h	8r, 10h, 1a				(CT)
Agouti paca		1t, 11h			DD	CT
Proechimys longicaudatus	1s	4s	2s	2s		
Lagomorpha						
Silvilagus brasiliensis	1t, 1a	1t, 1a				