

## Unexpected mammalian records in the state of Maranhão Ocorrências inusitadas de mamíferos no estado do Maranhão

Tadeu Gomes de Oliveira<sup>I</sup>  
Rafael Gomes Gerude<sup>II</sup>  
José de Sousa e Silva Júnior<sup>III</sup>

**Abstract:** Evidence about unexpected occurrences of mammals in the state of Maranhão are presented in order to emphasize the transitional aspect of the state. An analysis was made of the geographic distribution area of eleven species of mammals that originally did not include the State and/or did not describe the habitats where the species were found. Results showed the influence of several biomes in the composition of the local mammalian fauna, confirming the State as a transitional area among morphoclimatic domains. There were expansions in the geographic distribution of some species, as well as the record of new habitats and *taxa* for Maranhão.

**Keywords:** Mammals. Maranhão. Transitionality. Biogeography.

**Resumo:** Evidências são apresentadas sobre ocorrências não usuais de mamíferos no Maranhão, objetivando averiguar o caráter transicional deste estado. Analisou-se a área de distribuição geográfica de onze espécies de mamíferos que não incluíam o Maranhão e/ou não descreviam os habitats onde as espécies foram registradas. O estudo revelou a influência de diversos biomas sobre a mastofauna maranhense, mostrando o estado como uma área transicional entre estes. Observou-se expansão na área de distribuição geográfica de algumas espécies, além do registro de novos habitats e táxons para o Maranhão.

**Palavras-chave:** Mamíferos. Maranhão. Transicionalidade. Biogeografia.

---

<sup>I</sup> Instituto Pró-Carnívoros e Universidade Estadual do Maranhão. Departamento de Biologia. São Luís, Maranhão, Brasil (tadeu4@yahoo.com).

<sup>II</sup> Núcleo de Pesquisas em Ecologia e Conservação da Biodiversidade do Maranhão. São Luís, Maranhão, Brasil (rafaelgerude@hotmail.com).

<sup>III</sup> Museu Paraense Emílio Goeldi. Coordenação de Zoologia. Belém, Pará, Brasil (cazuza@museu-goeldi.br).



## INTRODUCTION

The state of Maranhão is geographically located in an area under the influence of three major morphoclimatic domains, the Amazonian in the north, the Caatinga in the northeast and the Cerrado in central Brazil (Ab'saber, 1977). Consequently, the state presents, to a lesser or greater extent, characteristics of all these areas. The vegetation cover, with 14 types (IBGE, 1993), reflects this transitionality between the super-humid and the semi-arid. This, ultimately, would lead to a great biological diversity. Unfortunately, local plant and animal species diversity is poorly known, due to lack of surveys (Oliveira, 1996). This fact, associated with a considerably high level of environmental degradation, is responsible for altering the original biota before it is known. Landsat data showed that about 68% of original cover within Legal Amazon in the state is already altered or lost (Fearnside, 1995). The Cerrado area is also under significant pressure due to its agricultural potential, and special governmental incentives.

Recent surveys being conducted in several areas of the state have shown the presence of several species of mammals in areas and/or habitats from which they were previously unknown. This paper aims to compile data about these unexpected occurrences of mammals in Maranhão, assessing its transitional aspect and importance in mammalian biogeography.

## MATERIAL AND METHODS

Data presented include only the unexpected occurrences, by which we mean species presence in habitats and/or areas outside their known distribution area. Species records came from field surveys being conducted in Amazonian and savanna (Cerrado) areas in the state of Maranhão (Oliveira, 1993; Oliveira *et al.*, 2001). Small mammals were trapped by capture-recapture techniques (from 1997 to the present date; >6,000 trap/nights), whereas larger species were recorded by means of direct (visualization) or indirect (skin, skull, other remains) observations. Small mammal species identification was

confirmed comparing the voucher specimens collected of each species with those of museum specimens from the collections of Museu de Zoologia da Universidade de São Paulo and Museu Paraense Emílio Goeldi. Collected specimens were deposited at the Mammal Collection of Universidade Estadual do Maranhão. Additionally, data were supplemented with records from the literature and interviews with knowledgeable locals. Information from interviews was used only if they were considered undisputedly correct (after morphological and ecological descriptions of the species, as well as its identification on colored plates). All species listed were either collected (small mammals) or seen (larger species).

## RESULTS AND DISCUSSION

Until now, 11 unusual species of mammals were recorded in Maranhão state, most of which from the orders Rodentia and Didelphimorphia (Table 1). Of these, four are exclusively Amazonian, whereas the other three are mostly associated with this biome, although they can also be found in other ecosystems.

*Chironectes minimus* (water opossum; *mucura-d'água*): this species has a poorly known geographic distribution that does not include Maranhão. In Brazil *C. minimus* is known for some areas of the Amazon Basin (the Amazon River mouth, including all Amapá state and the lower Tocantins River, and central area, between the Amazon, Madeira and Tapajós Rivers) and the southeast, as well as the southern region (Emmons; Feer, 1997; Eisenberg; Redford, 1999). In Maranhão, it is here recorded for the first time, for the region located between the Pindaré and Zutiua Rivers (Fazenda Mapisa and nearby Santa Luzia) and the area of the Indian Reserves of Alto Turiçu and Caru (Figure 1). This considerably expands the species' distribution area. Observations were made in black water lakes and clear water streams in pristine/lightly disturbed forest with hilly topography, the kind of area from which most records of this animal come.

*Gracilinanus agilis* (agile gracile mouse opossum; *catita*): this medium-sized mouse opossum is known to occur mostly in the dryer parts of Brazil. Habitat association is with the mesic areas of the Cerrado biome, that is, gallery forests, but would also include evergreen forests (Emmons; Feer, 1997; Eisenberg; Redford, 1999). In Maranhão, five specimens (two males, three females) were trapped in a heavily logged Amazonian forest near the border with

Table 1. Unexpected mammalian records in the state of Maranhão. (continues)

TAXA	LOCALITY	COORDINATES	HABITAT	OBSERVATION	SOURCE
<b>DIDELPHIMORPHIA</b>					
Didelphidae					
<i>Chironectes minimus</i>	PIN Ximborendá PIN Awa Fazenda MAPISA, Buriticupu	02°40'S 46°01'W 03°45'S 46°09'W 04°36'S 46°30'W	Pristine/lightly disturbed Amazonian forest	First records	This paper (all remaining records)
<i>Gracilinanus agilis</i>	São Pedro da Água Branca	05°03'S 48°21'W	Heavily logged Amazonian forest	First record and new habitat	This paper
<i>Metachirus nudicaudatus</i>	PIN Guajá PIN Awa Fazenda Mapisa, Buriticupu	03°07'S 46°04'W 03°45'S 46°09'W 04°36'S 46°30'W	Pristine/lightly disturbed Amazonian forest	First records	This paper (all remaining records)
<i>Monodelphis umbristriata</i>	Vila Nova dos Martírios  PIN Awa	05°10'S 48°04'W  03°45'S 46°01'W	Highly disturbed riverine/ secondary Amazonian forest Pristine/lightly disturbed Amazonian rainforest	First records	This paper (all remaining records)
<b>CINGULATA</b>					
Dasypodidae					
<i>Dasypus kappleri</i>	PIN Guajá PIN Awa Santa Luzia Arame Buriticupu Grajaú Fazenda MAPISA, Buriticupu	03°07'S 46°04'W 03°45'S 46°09'W 03°53'S 45°28'W 04°42'S 45°55'W 04°14'S 46°32'W 05°49'S 46°08'W 04°36'S 46°30'W	Pristine/lightly disturbed lowland Amazonian forest	First records	This paper (all remaining records)
<i>Tolypeutes tricinctus</i>	Mirador State Park São Miguel	06°25'S 45°20'W 04°39'S 43°36'W	Savanna ( <i>cerrado, sensu stricto</i> ) <i>Cerradão</i> (forest savanna)/ carnaubal	New habitat	Oliveira (1995) This paper
<b>CARNIVORA</b>					
Mephitidae					
<i>Conepatus semistriatus</i>	Buriticupu Forest Reserve  São Luís Gonzaga Lago do Junco Peritoró Left bank of the Itapecuru River, nearby Codó	04°17'S 46°23'W  04°23'S 44°39'W 04°33'S 44°55'W 04°23'S 44°20'W 04°27'S 43°53'W	Disturbed areas and the border of pristine Amazonian rainforest/ agricultural fields Babassu palm forest/low scrub Gallery forest/ <i>cerradão</i>	New habitat	Oliveira (1996)  This paper (all remaining records)



Table 1. Unexpected mammalian records in the state of Maranhão. (finished)

TAXA	LOCALITY	COORDINATES	HABITAT	OBSERVATION	SOURCE
CARNIVORA					
Mephitidae					
<i>Conepatus semistriatus</i>	BR-316, between Caxias and Timon	04°58'S 43°10'W	<i>Cerradão</i> /babassu palm forest	New habitat	This paper (all remaining records)
	BR-316, nearby Timon	05°05'S 42°50'W			
	Pio XII	03°52'S 45°17'W	Babassu palm forest/low scrub		
	Lago da Pedra	04°33'S 45°07'W	Babassu palm forest/secondary forest		
	Bambu River	04°12'S 44°50'W	Babassu palm forest/low scrub		
	Alto Alegre	04°06'S 44°57'W			
	Piratinga	04°12'S 44°35'W	Babassu palm forest/gallery forest		
	Fazenda Lagoa Nova	04°04'S 44°58'W	Babassu palm forest/secondary forest		
	São José das Verdades	04°57'S 44°28'W	Babassu palm forest/ low scrub		
	Peritoró	04°23'S 44°20'W			
São Miguel	04°39'S 43°36'W	Savanna ( <i>cerrado</i> , <i>sensu stricto</i> )/carnaubal palm grove (of the Caatinga domain)			
Brejinho	04°47'S 42°50'W	<i>Cerradão</i> /babassu palm forest			
Nearby Caxias	04°51'S 43°21'W	<i>Cerradão</i>			
RODENTIA					
Erethizontidae					
<i>Coendou koopmani</i>	PIN Tiracambu	03°52'S 46°12'W	Pristine/lightly disturbed	First records and new habitat	This paper (all remaining records)
	Pindaré	03°38'S 45°29'W	Amazonian forest		
	PIN Awa	03°45'S 46°09'W			
	Bom Jardim	04°44'S 44°21'W			
	Santa Luzia	03°53'S 45°28'W	Babassu palm forest/tall scrub/secondary forest		
PIN Pindaré	03°38'S 45°29'W				
Caviidae					
<i>Kerodon ruprestris</i>	Mirador State Park	06°25'S 45°20'W	Savanna	New habitat	Oliveira (1993)
	Benedito Leite	07°13'S 44°33'W	<i>Cerradão</i>		
	Boa Esperança	06°39'S 43°41'W	<i>Cerradão</i>		
	São Miguel	04°39'S 43°36'W	<i>Cerradão</i> /carnaubal palm grove (of the Caatinga domain)		
Echimyidae					
<i>Dactylopsys dactylinus</i>	Buriticipu	03°00'S 45°00'W	Amazonian terra-firme lightly,	New records and habitat	Silva Jr; Nunes (2000)
	Grajaú	05°49'S 46°08'W	moderately or highly disturbed		
	Lago da Pedra	04°19'S 45°08'W	forests		
	Lago Verde (São Mateus)	04°01'S 44°27'W			
	Palmeiral (Matões)	03°40'S 44°27'W	Babassu palm forest/secondary forest		
	Fazenda Lagoa Nova	04°04'S 44°58'W			
	São José das Verdades	04°57'S 44°28'W			
	Nearby Lago Verde city	04°04'S 44°45'W			
<i>Echimyus chrysurus</i>	Vargem Grande	03°30'S 43°55'W	Savanna/gallery forest	New habitat	Oliveira; Mesquita (1998)
	PIN Awá	03°45'S 46°09'W	Pristine/lightly disturbed Amazonian rainforest		
	Estiva River, Bacabal	04°12'S 44°47'W	Babassu palm forest/low scrub		



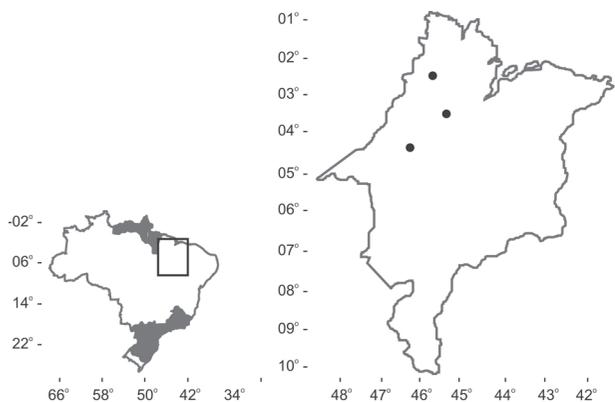


Figure 1. Known geographic range, as proposed by Emmons and Feer (1997), and new records of *Chironectes minimus* in the state of Maranhão.

the state of Pará (Figure 2). For this area, Eisenberg and Redford (1999) considered only *Gracilinanus emiliae*, which, in fact, shows some similarities with *G. agilis* in coloration, but different body size and proportions. Measurements of specimens conform to those of the latter and are clearly different from those of the first. Costa and Patton (2006) reviewing Brazilian marsupial diversity, and its geographic and systematic limits, mention only three species for Brazil, *Gracilinanus microtarsus* of the Atlantic forest, *G. emiliae* for Eastern Amazonia, near Belém, and *G. agilis* of Northeastern Brazil. Thus, this record does not only considerably expand the distribution area of *G. agilis*, but also registers it for eastern Amazonian forests.

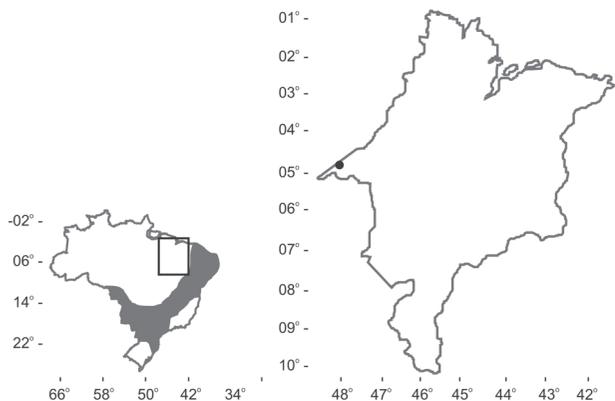


Figure 2. Known geographic range, as proposed by Emmons and Feer (1997), and new records of *Gracilinanus agilis* in the state of Maranhão.

*Metachirus nudicaudatus* (brown four-eyed opossum; *mucura-de-quatro-olhos*): the distribution area of this species in Brazil includes the Amazon Basin, Mato Grosso, Goiás, and from the coast of Bahia to northern Paraná (Cabrera, 1957; Emmons; Feer, 1997). There is no specific work dealing with the species' biogeography. The most carefully done maps available do not usually include the state of Maranhão, or do so only marginally (Emmons; Feer, 1997; Eisenberg; Redford, 1999). Therefore, this is the first record of this species in Maranhão (Table 1, Figure 3). Five females were trapped in lowland Amazonian rainforest. One in pristine/lightly disturbed forest with little undergrowth, a kind of habitat that the species seems to favor (Emmons; Feer, 1997), and four in heavily logged forest of the Gurupi area. Another individual, a male, was trapped in the border of a pristine/lightly disturbed forest in the Fazenda Mapisa. The presence of *M. nudicaudatus* in Maranhão could be expected, as it has been trapped in other relatively nearby areas of Eastern Amazon in Pará - Tucuruí and Capim Rivers in Paragominas (Eisenberg; Redford, 1999; Oliveira unpubl. data). The traditional exclusion of Maranhão from distribution maps reflects the lack of data both for the species and for the state.

*Monodelphis umbristriata* (= *M. americana*) (three-striped short-tailed opossum; *catita*): there is no agreement regarding the taxonomy and geographic distribution of this species. Gardner (1993) considered *M. americana* the species with three dorsal stripes found around Belém, Pará and adjacent areas. Conversely, Gomes (1991) assigns this area of Northern Brazil to *M. umbristriata*, whereas *M. americana* would be the species that would range from João Pessoa, Paraíba to southeastern Minas Gerais and São Paulo states and northern Paraná. This means that the former is the Amazonian form, whereas the latter is the Atlantic forest species. According to Gomes (1991) and Pine (1976), *M. umbristriata* is also found in Goiás (Veadeiros, Brasília) and southwest Minas Gerais (Passos). On the other hand, Gardner (1993) and Emmons and Feer (1997) assigned these populations to *M. rubida*, which, in their scheme, is synonymous with *M. umbristriata*,

with the exclusion of the Belém area population (Eisenberg; Redford, 1999). According to the description presented in Gomes (1991) the specimens from Maranhão would belong to *M. umbristriata*. In this state records are from areas of pristine/ lightly disturbed Amazonian rainforest of the Gurupi river area, and for a considerably disturbed riverine/secondary forest near Imperatriz (Figure 4), which suggests the species' resilience to disturbances. These areas are about 160 and 350 km away in a straight line to the nearest collecting localities in Pará (Gomes, 1991). In this way, these first records for Maranhão not only significantly expand the species' geographic distribution, but also mention new habitats used.

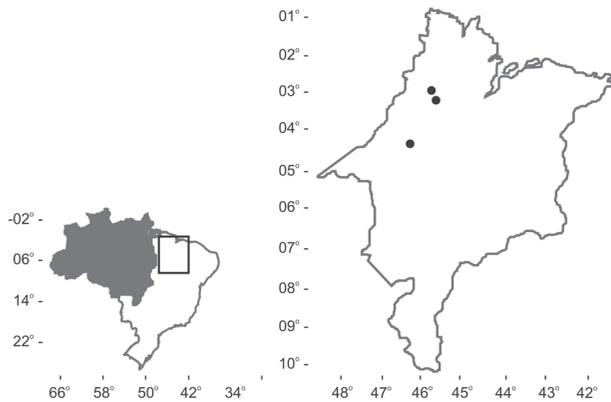


Figure 3. Known geographic range, as proposed by Emmons and Feer (1997), and new records of *Metachirus nudicaudatus* in the state of Maranhão.

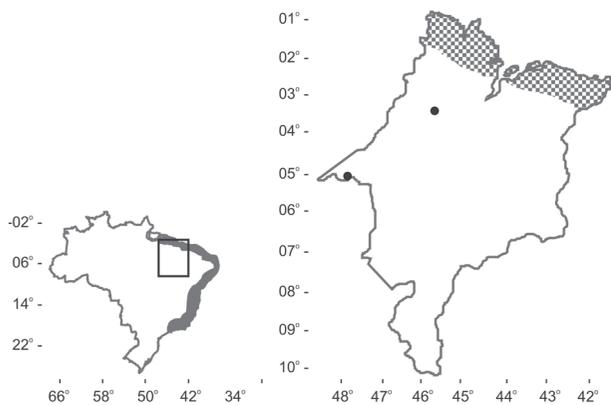


Figure 4. Geographic range, as proposed by Emmons and Feer (1997), and new records of *Monodelphis umbristriata* (= *M. americana*) in the state of Maranhão.

*Dasypus kappleri* (greater long-nosed armadillo; *tatu-quinze-quilos*): although Eisenberg and Redford's (1999) generic map included western Maranhão in the species range, Wetzel (1985) was not sure about its presence as known collecting localities were far from the state, whereas Emmons and Feer (1997) considered the Belém area as the eastern most limit for this armadillo. In Maranhão we know of three specimens captured by Ka'apor and Awá-Guajá indians for the Gurupi lowland rainforest area of western Maranhão. Four individuals hunted by local inhabitants (one nearby Santa Luzia, two in Buriticupu, and another in Arame) were reported as coming from pristine/lightly disturbed forest. Three individuals were observed in the same forest type, one nearby Grajaú and two in Fazenda Mapisa (Figure 5). These are the first records for this species in the state.

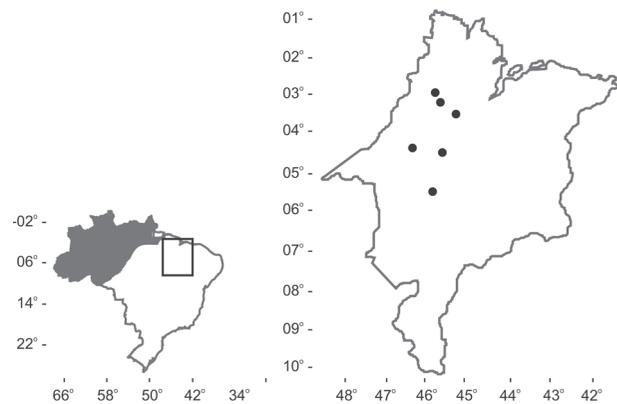


Figure 5. New geographic range, as proposed by Emmons and Feer (1997), and new records of *Dasypus kappleri* in the state of Maranhão.

*Tolypeutes tricinctus* (three-banded armadillo; *tatu-bola*): this armadillo, recently rediscovered by scientists (Santos *et al.*, 1994) was originally described as endemic to the Caatinga biome (Fonseca *et al.*, 1994). However, recent records have reported it for areas of deciduous forest in Bahia and savannas (cerrado, *sensu stricto*) in Maranhão (Table 1, Figure 6), close to areas of semiarid thorny scrub of the Caatinga domain, which the species seems to favor (Silva; Oren, 1993; Fonseca *et al.*, 1994; Oliveira, 1995, 1996). An animal was observed in São

Miguel, in the northeastern part of the State. There, transitional vegetation predominates, with a mosaic of savanna, babassu palm forest and semiarid thorny scrub. The animal was sighted in an area of *cerradão* (forest savanna). The occurrence of the three-banded armadillo in Maranhão reflects the state's transitionality. In Maranhão, its status was considered as critically endangered or even possibly extinct (Oliveira, 1997).

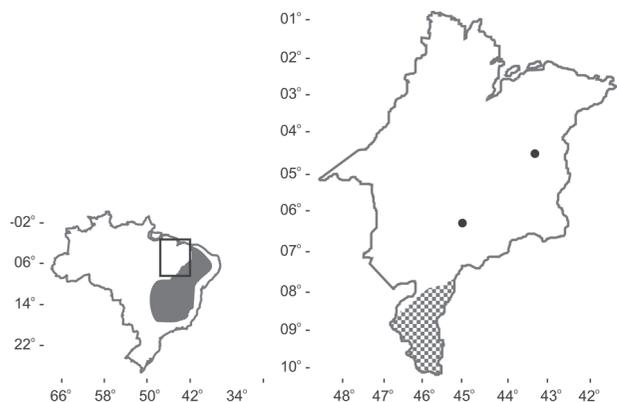


Figure 6. Known habitat, as proposed by Wetzel (1985), and new records of *Tolypeutes tricinctus* in the state of Maranhão.

*Conepatus semistriatus* (hog-nosed skunk; *gambá*): this skunk is more characteristic, in South America, of open and dry areas and borders of forests. The species is not considered to occur in the Amazon region. However, Oliveira (1996, [20?]) recorded it for disturbed areas and the border of pristine Amazonian rainforest in western Maranhão (Figure 7). Additional records were made for babassu palm forest/secondary forests. We speculate that (a) the species always occurred in the area, but due to lack of studies and surveys its presence has never been properly recorded, or (b) due the degradation of the pristine forest, proper conditions for its establishment in the region were created, and thus it expanded its geographic distribution area.

*Coendou koopmani* (black dwarf porcupine; *cuandu-preto*): this is a recently described species of small porcupine with a darkened coloration. Its known distribution consists of a narrow strip along the southern margin of the Amazon River from above its confluence with the Madeira River (Island of

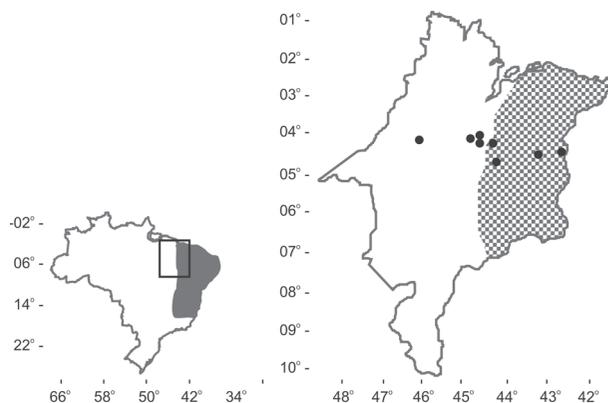


Figure 7. Known habitat, as proposed by Emmons and Feer (1997), and new records of *Conepatus semistriatus* in the state of Maranhão.

Tayaúna) until Marajó Island and the Belém region, in Pará (Handley; Pine, 1992). Reports of Ka'apor, Guajajara and Awá-Guajá Indians indicated the species' presence in the Indian Reservations of Alto Turiaçu, Caru and Pindaré. Additionally, local residents have reported it for Bom Jardim and Santa Luzia (Figure 8). According to the informants this would be a species of porcupine with little hair and totally dark, which agrees exactly with description of the main characteristics of *C. koopmani*. This species is distinctly different and smaller than *C. prehensilis*, the other species it is sympatric with. These records would expand the eastern limit of the black dwarf porcupine's distribution with at least 250 km. There are no data about the species' biology, except that it occurs in lowland *terra-firme* Amazonian rainforest (Emmons; Feer, 1997), the type of vegetation it is

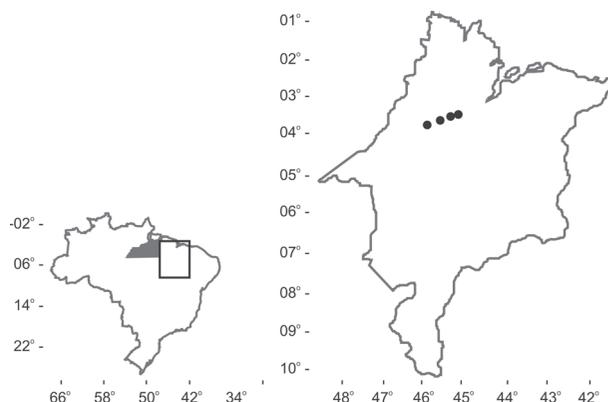


Figure 8. Known geographic range, as proposed by Emmons and Feer (1997), and new records of *Coendou koopmani* in the state of Maranhão.

reported from in Maranhão. In this state it is found in both pristine/lightly disturbed as well as in considerably disturbed areas with babassu palm forests (Table 1). The latter would consist a new habitat for this porcupine.

*Kerodon rupestris* (rock cavy; *mocó*): the geographic distribution of this rodent goes from eastern Piauí and remaining states of the Brazilian northeast (except Maranhão) to northeastern Minas Gerais (Cabrera, 1957; Nowak, 1991). The rock cavy is considered endemic to the Caatinga domain (Willig; Mares, 1989). According to Oliveira (1993), the species' occurrence has been recorded in the savannas (*cerrado, sensu stricto*) of central-west Maranhão, thus expanding its distribution and habitat. New observations indicated the presence of *K. rupestris* in four new localities along the Parnaíba River, two on the left bank (Maranhão) and two on the right bank (Piauí). All observations were made in rocky environments. Reports of locals also confirmed the preference of the species for this habitat type. Inhabitants of São Miguel also mentioned the presence of *K. rupestris* in the region of the middle/lower Parnaíba River, although this remains to be confirmed. This animal is hunted for food in all these localities. Figure 9 shows all records of *K. rupestris* in this region.

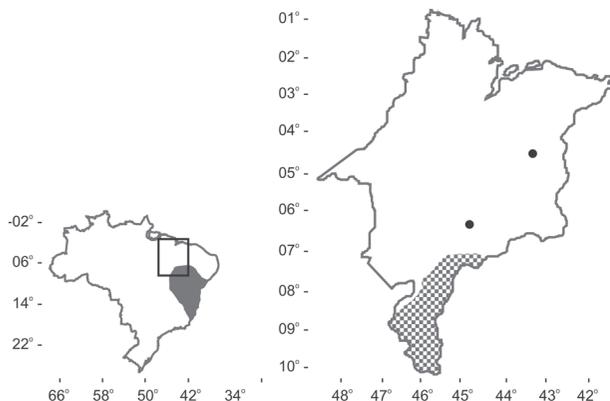


Figure 9. Known distribution, as proposed by Mares and Ojeda (1982), and new records of *Kerodon rupestris* in the state of Maranhão.

*Dactylomys dactylinus* (Amazon bamboo rat; *rato-toró*; *rato-do-bambu*): the distribution of this Echimyidae is confusing. Some authors restrict it to the western portion of the Brazilian Amazon and adjacent areas in Colombia,

Peru and Ecuador (Eisenberg; Redford, 1999), while others also include a narrow strip along the southern margin of the Amazon River and the area around Belém, Pará (Emmons; Feer, 1997). In any event, this bamboo rat is most commonly associated with the western Amazonian faunal assemblage. In Maranhão specimens were collected in Buriticupu, Grajaú, Lago da Pedra, Lago Verde of São Mateus municipality and Palmeiral (Silva Jr.; Nunes, 2000). New records indicated the presence of bamboo rats in the localities of São José das Verdades, Fazenda Lagoa Nova and the nearby city of Lago Verde (Figure 10). Habitats included Amazonian terra-firme lightly, moderately or highly disturbed forests associated or not with babassu palm forests (Table 1). These habitats are different from those of bamboo patches and dense riverine vegetation, typically described for the species (Emmons, 1981; Silva Jr.; Nunes, 2000). Taking into account the distribution presented by Emmons and Feer (1997), the collecting localities were at least 500 km apart, besides being in previously unrecorded habitat types (Silva Jr.; Nunes, 2000), as was also observed for *Echimyis chrysurus* (Oliveira; Mesquita, 1998).

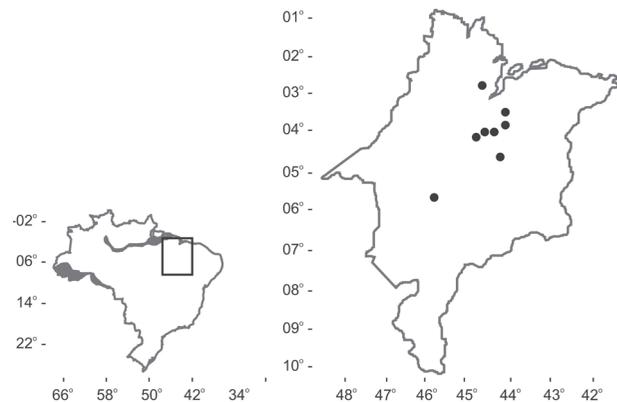


Figure 10. Known geographic range of and habitat, as proposed by Emmons and Feer (1997), and new records of *Dactylomys dactylinus* in the state of Maranhão.

*Echimyis chrysurus* (white-faced tree rat; *rato-estrela*): originally described for the Guianas and Amazon Basin east of the Negro and Xingu Rivers (Cabrera, 1957; Emmons ; Feer, 1997; Eisenberg; Redford, 1999), this arboreal rodent has been captured in an ecological tension area, whose

vegetation is a mix of deciduous forest and savanna (IBGE, 1993), with the physiognomy of the latter (Oliveira; Mesquita, 1998), besides pristine/lightly disturbed Amazonian rainforest as well as considerably disturbed forest associated with babassu palm grooves, besides typical Amazonian forests of the Gurupi area (Table 1, Figure 11). Its presence in the riverine forests of northeastern Maranhão, not only expands the distribution of the white-faced tree rat (about 500 km), but also records it for new habitat, because it was previously considered to be restricted to multistratal mature Amazonian rainforest (Emmons; Feer, 1997; Oliveira; Mesquita, 1998; Eisenberg; Redford, 1999). This is an evidence of the ecotone status of the state of Maranhão.

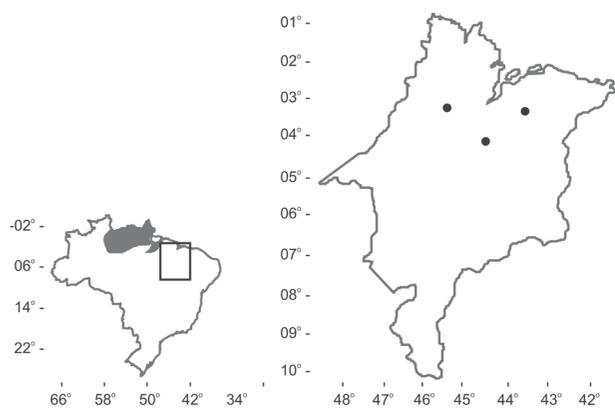


Figure 11. Known distribution, as proposed by Emmons and Feer (1997), and new records of *Echimys chrysurus* in the state of Maranhão.

Data presented expanded the distribution area for five species (45,4%) inside their own biome, while the remaining six species (54,5%) not only expanded their geographic area, but were also recorded for new habitats. These findings suggest that the state of Maranhão is indeed a transitional area where the Amazonian domain assemblage gives way to that of the dry savannas (Cerrado), with an additional influence of the semiarid thorny scrub of the Caatinga. Similar results attesting the transitionality of the state were observed for the assemblages of birds, Euglossini bees and phlebotome flies in Maranhão (Hellmayr, 1929; Oren, 1988; Rebêlo, 1995; Rebêlo; Silva, 1999; Rebêlo; Oliveira, 2000; Rebêlo *et al.*, 2000; Silva Jr., unpub. data). The

number of unexpected species of mammals will certainly rise, as more areas are properly sampled.

## CONCLUSIONS

Results showed that Maranhão presented characteristics of an ecotone state, representing a key area for a better understanding of the biogeography of Neotropical mammals, especially Amazonian; the use of mammals to verify the transitionality proved efficient; the majority of the lack of information regarding the biogeography of mammals in Brazil and, especially, in Maranhão is a result of lack of studies/surveys in this area, which makes the State less diverse and the group less known. This idea is congruent with the discussions by Vivo (1996) and Silva Jr. (1998) about this issue; and Maranhão does not have a faunal assemblage typical of a single biome, but is rather a mix of ecosystems, which would increase its biodiversity, and thus make the State very important for biological conservation, despite its high levels of habitat degradation.

## REFERENCES

- AB'SABER, A. N. Os domínios morfoclimáticos na América do Sul. *Geomorfologia*, v. 52, p. 1-21, 1977.
- CABRERA, A. Catálogo de los mamíferos de América del Sur. *Rev. Mus. Argent. Cien. Nat. Bernardino Rivadavia*, v. 4: 307-732, 1957.
- COSTA, L. P.; PATTON, J. L. Diversidade e limites geográficos e sistemáticos de marsupiais brasileiros. In: CÁCERES, N. C.; MONTEIRO-FILHO, E. L. A. (Eds.). *Os marsupiais do Brasil: biologia, ecologia, evolução*. Campo Grande: UFMS, 2006. 364 p., p. 321-341.
- EMMONS, L. H. Morphological, ecological, and behavioral adaptations for arboreal browsing in *Dactylopsilus dactylopsilus* (Rodentia, Echimyidae). *Journal of Mammalogy*, v. 62, n. 1, p. 183-189, 1981.
- EMMONS, L. H.; FEER, F. *Neotropical rainforest mammals: a field guide*. 2. ed. Chicago: University of Chicago, 1997. 281 p.
- EISENBERG, J. F.; REDFORD, K. H. *Mammals of the Neotropics. The Central Neotropics: Ecuador, Peru, Bolívia, Brazil*. Chicago: University of Chicago, 1999. v. 3.
- FEARNSIDE, P. M. Quem desmata a Amazônia: os pobres ou os ricos? *Ci. Hoje*, São Paulo, v. 19, n. 113, p. 2-33, 1995.

- FONSECA, G. A. B. da; RYLANDS, A. B.; COSTA, C. M. R. *et al.* **Livro vermelho dos mamíferos brasileiros ameaçados de extinção**. Belo Horizonte: Fundação Biodiversitas, 1994. 459 p.
- GARDNER, A. L. Didelphimorphia. In: WILSON, D. E., REEDER, D. M. (Ed.). **Mammal species of the world**. Washington, D. C.: Smithsonian Institution, 1993. p. 15-23.
- GOMES, N. F. **Revisão sistemática do gênero *Monodelphis* (Didelphidae: Marsupialia)**. 1991. Dissertação (Mestrado) - Instituto de Biociências, Universidade de São Paulo, 1991.
- HANDLEY, C.O., Jr.; PINE, R. A new species of prehensile-tailed porcupine genus *Coendou* Lacépède from Brazil. **Mammalia**, v. 56, n. 2, p. 238-244, 1992.
- HELLMAYR, C. E. A contribution to the ornithology of northeastern Brazil. **Field Mus. Nat. Hist., Zool. ser.**, v. 12, n. 18, p. 235-501, 1929.
- IBGE. Fundação Instituto Brasileiro de Geografia e Estatística. **Mapa de vegetação do Brasil**. Rio de Janeiro, 1993.
- MARES, M. A.; OJEDA, R. A. Patterns of diversity and adaptation in South American hystricognath rodents. In: MARES, M. A.; GENOWAYS, H. H. (Ed.). **Mammalian biology in South America**. Linesville: University of Pittsburgh, 1982. 539 p, p 393-432, v. 6.
- NOWAK, R. M. **Walker's mammals of the world**. 5. ed. Baltimore: Johns Hopkins, 1991. 1629 p, v. 2.
- OLIVEIRA, T. G. de. no prelo. **Carnívoros do Brasil**. São Paulo, CENAP-IBAMA/Associação Pró-Carnívoros.
- OLIVEIRA, T. G. de. Status dos mamíferos no Estado do Maranhão: uma proposta de classificação. **Pesq. Foco**, São Luís, v. 5, 6, p. 63-80, 1997.
- OLIVEIRA, T. G. de. Zoogeografia da fauna de mamíferos terrestres de grande porte do Maranhão. **Pesq. Foco**, São Luís, v. 4, n. 4, p. 71-81, 1996.
- OLIVEIRA, T. G. de. The Brazilian three-banded armadillo *Tolypeutes tricinctus* in Maranhão. **Edentata**, n. 2, p. 18-19, 1995.
- OLIVEIRA, T. G. de. Observações preliminares sobre a fauna de mamíferos do Parque Estadual de Mirador, Maranhão. **Cad. Pesq.**, n. 9, p. 7-14, 1993.
- OLIVEIRA, T. G. de, GERUDE, R. G.; DIAS, P. A. Composição de espécies e uso de vertebrados terrestres em áreas indígenas da Amazônia maranhense. In: **DIAGNÓSTICO Sócio-Econômico e Geoambiental das Terras Indígenas Pindaré, Caru, Alto Turiaçu e Awa-Guaja: avaliação dos recursos bióticos das indígenas do Maranhão**. Santa Inês: Companhia Vale do Rio Doce, Gerência de Desenvolvimento Regional de Santa Inês, 2001.
- OLIVEIRA, T. G. de ; MESQUITA, E. R. L. Notes on the distribution of the white-faced tree rat, *Echimys chrysurus* (Rodentia, Echimyidae) in northeastern Brazil. **Mammalia**, v. 62, n. 2, p. 305-306, 1998.
- OREN, D. C. Uma reserva biológica para o Maranhão. **Ci. Hoje**, v. 8, p. 36-45, 1988.
- PINE, R. H. *Monodelphis umbristriata* (A. de Miranda - Ribeiro) is a distinct species of opossum. **J. Mammal.**, v. 57, p. 785-787, 1976.
- REBÊLO, J. M. M. Espécies de Anthophoridae (Hymenoptera, Apoidea) e sua associação com flores numa área restrita da Ilha de São Luís-MA. **Bol. Mus. Para. Emílio Goeldi**, v. 11, n. 2, p. 445-466, 1995.
- REBÊLO, J. M. M.; OLIVEIRA, S. T. de. Flebotomíneos (Diptera, Psychodidae) de lagoas, município de Buriticupu, Amazônia maranhense, I - riqueza e abundância relativa das espécies em área de colonização recente. **Rev. Soc. Bras. Med. Trop.**, v. 3, n. 1, p. 11-19, 2000.
- REBÊLO, J. M. M.; OLIVEIRA, S. T.; BARROS, V. L. L. Flebotomíneos da Amazônia maranhense IV: riqueza e abundância relativa das espécies em área de colonização antiga. **Entomologia y Vectores**, v. 7, p. 61-72, 2000.
- REBÊLO, J. M. M.; SILVA, F. S. Distribuição das abelhas Euglossini (Hymenoptera, Apidae) no estado do Maranhão, Brasil. **Anais da Sociedade Entomológica do Brasil**, v. 28, n. 3, p. 389-401, 1999.
- SANTOS, I. B., FONSECA, G. A. B., RIGUEIRA, S. ; MACHADO, R. B. The rediscovery of the Brazilian three-banded armadillo and notes on its conservation status. **Edentata**, n. 1, p. 11-15, 1994.
- SILVA Jr., J. S.; NUNES, A. P. An extension of the geographical distribution of *Dactylopsax dactylinus* Desmarest, 1822 (Rodentia, Echimyidae). **Bol. Mus. Para. Emílio Goeldi, ser. Zool.**, Belém, v. 16, n. 1, m p. 65-73, 2000.
- SILVA Jr., J. S. Problemas de amostragem no desenvolvimento da sistemática e biogeografia de primatas neotropicais. **Neotropical Primates**, v. 6, n. 1, p. 21-22, 1998.
- SILVA, J. M. C.; OREN, D. C. Observations on the habitat and distribution of the Brazilian three-banded armadillo *Tolypeutes tricinctus*, a threatened Caatinga endemic. **Mammalia**, n. 57, 149-152, 1993.
- VIVO, M. de. How many species of mammals are there in Brazil? In: BICUDO, C. E.; MENEZES, N. A. (Eds.). Biodiversity in Brazil: a first approach. Workshop Methods for the assesment of Biodiversity in Plants and Animals. **Proceedings...** Campos do Jordão, 1996. p. 313-321.
- WETZEL, R. M. Taxonomy and distribution of armadillos, Dasypodidae. In: MONTGOMERY, G. G. (Ed.). **The evolution and ecology of armadillos, sloths, and vermilinguas**. Washington, D.C.: Smithsonian Institution, 1985. 451 p., p 23-46.
- WILLIG, M. R.; MARES, M. A. Mammals from Caatinga: an updated list and summary of recent research. **Rev. Brasil. Biol.**, v. 42, p. 361-367, 1989.

Recebido: 27/02/2003  
Aprovado: 14/05/2007

