to consume the bird (until prevented), it also clearly 'stalked' its prey, as has been reported for free-ranging populations during invertebrate foraging (Soini, 1988; Stevenson and Rylands, 1988). Indeed, a similar observation of stalking, capturing, killing (with a bite to the head) and consuming a bird is reported for a captive *Saguinus* (Schauffelin, 1958 in Snowdon and Soini, 1988). A working hypothesis is that this hunting behavior may be opportunistically extended to birds in the wild. Digby and Barreto (1998) report that free-ranging common marmosets 'seek out and inspect bird nests', and that birds were occasionally observed mobbing marmosets suggesting recognition of a predator threat. Intriguingly, Soini (1988) reports that pygmy marmoset core use areas have fewer birds than surrounding areas of the home range, and that flocking birds are often chased. Soini (1988) suggests this behavior maybe designed to reduce inter-specific feeding competition with birds. This observation suggests there may also be some risk to those that are careless.

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A Northeastern Extension of the Distribution of *Aotus infulatus* in Maranhão, Brazil

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Marcus E. B. Fernandes

Introduction

The night monkeys (*Aotus* Humboldt, 1811) are predominantly Amazonian in their distribution, although they also extend into Central America and south into Paraguay and Argentina (Hershkovitz, 1983). A number of recent studies have adjusted the geographic distributions as indicated by Hershkovitz (1983) (for example, Aquino and Encarnación, 1988; Timm, 1988; Pieckzarca, 1993; Brooks, 1993, in Brooks, 1996; Ford, 1994; Silva Jr. *et al.*, 1995; Rodríguez-Luna *et al.*, 1996). Silva Jr. *et al.* (1995) reported the occurrence of *A. infulatus* Kuhl, 1820 on the islands of Caviana and Marajó,

and north of the Amazon estuary in a small area of southeastern Amapá. According to Hershkovitz (1983), the range of *A. infulatus* is restricted in the east by the Rios Gurupí and Tocantins, and although Silva Jr. *et al.* (1992) and Lopes (1993) recorded its occurrence east of the Rio Gurupí, the range limits as given by Hershkovitz (1983) have been maintained in the recent literature (see, for example, Ford, 1994; Emmons and Feer, 1997; Eisenberg and Redford, 1999). Here we report on a study examining new localities for, and the habitats occupied by, *A. infulatus* in the easternmost part of the range of the genus in the state of Maranhão, confirming its occurrence east as far the Rio Parnaíba.

Material and Methods

A number of expeditions have been carried out since 1989 in order to examine the range limits of *A. infulatus* in the state of Maranhão. Specimens were collected and further evidence was obtained through direct observation (sightings and vocalizations), interviews and from animals kept as pets. The specimens collected were compared with museum specimens at the Museu Paraense Emílio Goeldi (MPEG), Belém, the National Museum of the Federal University of Rio de Janeiro (MNRJ), and the Zoology Museum of the University of São Paulo (MZUSP). All the field specimens collected were deposited in the scientific collection of the MPEG. The localities were plotted on Hershkovitz's map (Hershkovitz, 1983, Fig. 2, p.214) (see Fig. 1).

Results and Discussion

Table 1 summarizes the information obtained in this study, including the localities visited, the habitats in which the specimens were registered, and the nature of each record. The state of Maranhão covers a mosaic of biomes resulting from the transition from Amazonia rain forest to the bush savanna (*Cerrado*) of central Brazil, and the dry thorn scrub and deciduous forest (*Caatinga*) of the northeast. *A. infulatus* was registered in 20 new localities, all east of the Rios Tocantins and Gurupí. These localities are spread through the following five landscapes in Maranhão: Amazonia, Zona dos Cocais (*Orbignya* palm tree forest), coastal areas, *Cerrado*, and the transition zone eastward (between Amazonia, *Cerrado* and *Caatinga* biomes). In Amazonian forest, *A. infulatus* was registered in a few degraded *terra firme* forests mixed with patches of *igapó* (flooded forest). In the Zona dos Cocais records indicated the presence of *A. infulatus* in disturbed forest patches, locally called "*capoeira alta*", as well as in the extensive

Table 1. Field data on the occurrence of *Aotus* and habitat in the states of Maranhão and Piauí, Brazil.

Locality	Landscape	Habitat	Record Type
1. Jurema, Amarante	Amazonia	Secondary forest	Specimen collected; interviews
2. Near to Grajaú	Amazonia	Secondary forest vocalizations, and pets	Direct observation:sightings,
3. Fazenda MAPISA, Buriticupu	Amazonia	Secondary forest and vocalizations	Direct observation: sightings
4. Near to Santa Luzia	Amazonia	Secondary forest vocalizations and pet.	Direct observation:
5. Near to Arame	Amazonia	Secondary forest	Interviews
6. Santa Maria, Alcântara	Coastal area	Mangrove/*Capoeira*/Secondary forest	Interviews
7. Canelatiua, Alcântara	Coastal area	Mangrove/*Capoeira*/Secondary forest interviews	Direct observarion: sightings;
8. São José das Verdades, Bacabal	Zona dos Cocais	*Babaçual-Capoeira*/Secondary forest *Orbignya* sleeping trees	Interviews: local extinction and
9. Near to Lago Verde	Zona dos Cocais	*Babaçual/Capoeira* trees	Interviews: *Orbignya* sleeping
10. Morada Nova,Vitória do Mearim	Zona dos Cocais	*Babaçual*/Secondary forest	Direct observation: vocalizations; interviews: *Orbignya* sleeping trees
11. Pedra Preta, Lago da Pedra	Amazonia	Secondary forest	Specimens collection; interviews
12. Eight localities near to Bacabal (both banks of the Rio Mearim)	Zona dos Cocais	*Babaçual/Capoeira*/Secondary forest	Interviews: local extinction
13. Near by São Luís Gonzaga	Zona dos Cocais	*Babaçual*/Secondary forest	Interviews
14. Near by Coroatá	Zona dos Cocais	*Babaçual/Capoeira* and vocalizations	Direct observation: sightings
15. Nova Guiné, São Mateus	Zona dos Cocais	*Babaçual/Capoeira*	Interviews
16. Lago Verde, right bank of the Rio Mearim, São Mateus	Zona dos Cocais	*Babaçual/Capoeira*/Gallery forest	Interviews: local extinction
17. Palmeiral, Matões	Zona dos Cocais	*Babaçual*/Secondary forest	Direct observation: sightings, vocalizations and sleeping trees
18. São Miguel, Caxias	Transition zone	*Cerradão/Caatinga/Babaçual*	Specimens collected; direct observation: sightings and vocalizations; interviews: *Orbignya* sleeping trees
19. Brejinho, Caxias	Transition zone	*Cerradão/Caatinga/Babaçual*	Interviews
20. Estiva, Alto Parnaíba	Cerrado	*Cerrado*/Gallery forest	Interviews
Localities in the state of Piauí: David Caldas, Novo Nilo, União, and Santa Rita	Transition zone		Not present - Interviews

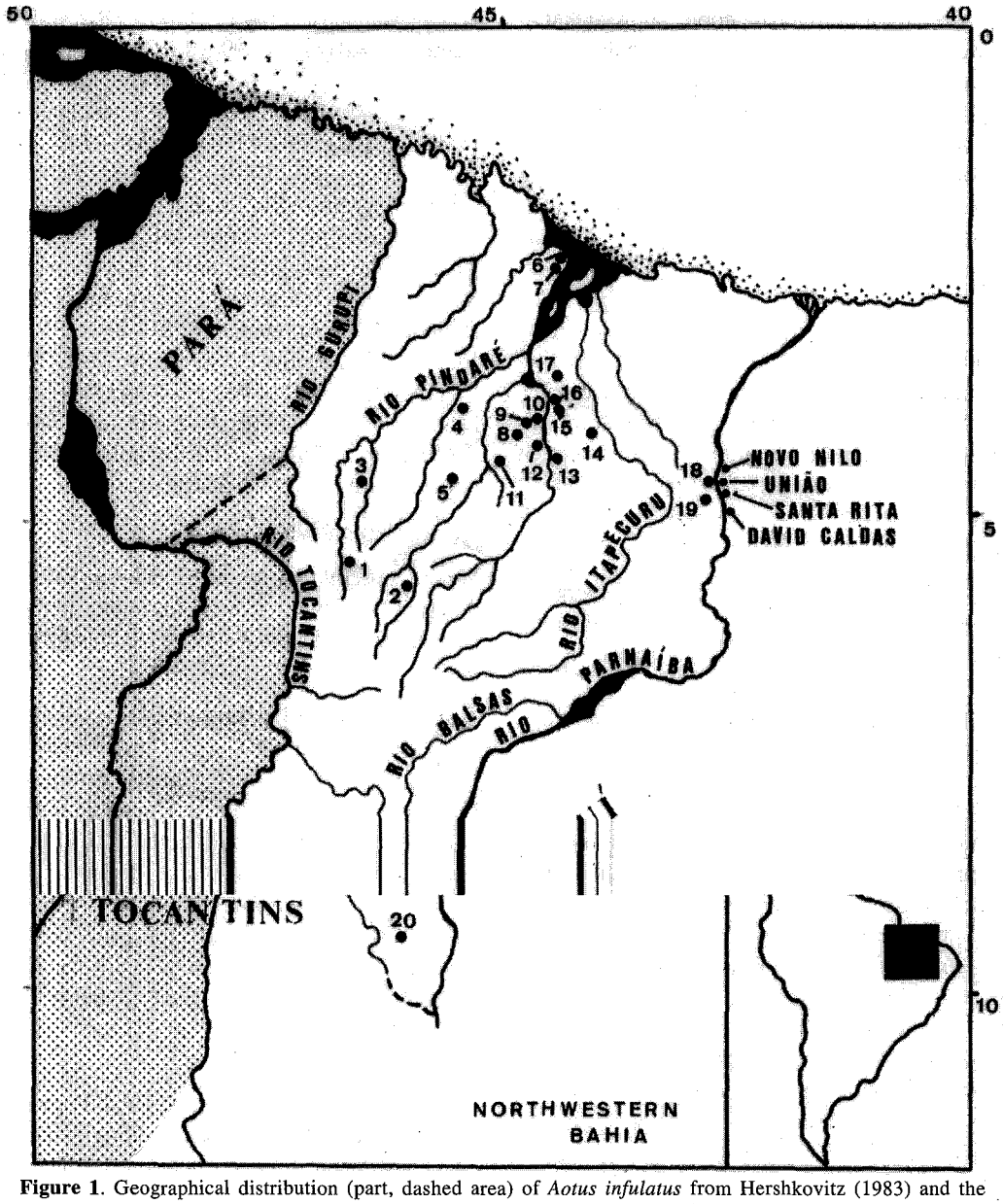

Figure 1. Geographical distribution (part, dashed area) of *Aotus infulatus* from Hershkovitz (1983) and the new localities in the state of Maranhão: 1. Jurema, municipality of Amarante, about 05°28'S, 46°34'W; 2. Near to Grajaú, about 05°49'S, 46°08'W; 3. Fazenda MAPISA, municipality of Buriticupu, about 04°36'S, 46°30'W; 4. Near to Santa Luzia, Rio Zutiua, about 03°53'S, 45°28'W; 5. Near to Arame, about 04°42'S, 45°55'W; 6. Santa Maria, municipality of Alcântara, 02°25'S, 44°39'W; 7. Canelatiua, municipality of Alcântara, 02°28'S, 44°43'W; 8. São José das Verdades, municipality of Bacabal, about 04°57'S, 44°28'W; 9. Near to Lago Verde, about 04°04'S, 44°45'W; 10. Morada Nova, left bank of the Rio Ipixuna-Açu, municipality of Vitória do Mearim, near to 03°28'S, 44°53'W; 11. Pedra Preta, municipality of Lago da Pedra, 04°26'S, 45°00'W; 12. Eight localities on both banks of the Rio Mearim, near to Bacabal, around 04°12'S, 44°47'W; 13. Near to São Luís Gonzaga, right bank of the Rio Mearim, 04°22'S, 44°34'W; 14. Near to Coroatá, 04°08'S, 44°08'W; 15. Nova Guiné, municipality of São Mateus, about 04°01'S, 44°27'W; 16. Lago Verde, right bank of the Rio Mearim, municipality of São Mateus, near to 04°01'S, 44°27'W; 17. Palmeiral, municipality of Matões, about 03°40'S, 44°27'W; 18. São Miguel, left bank of the Rio Parnaíba (opposite to União, State of Piauí), municipality of Caxias, 04°39'S, 43°36'W; 19. Brejinho, near to the left bank of the Rio Parnaíba, municipality of Caxias, 04°49'S, 42°26'W; 20. Estiva, municipality of Alto Parnaíba, 09°28'S, 46°03'W.

areas of *Orbignya* sp. palm trees locally referred to as *babaçual*. These palms are used by night monkeys as sleeping trees. The coastal area is dominated by red mangroves (*Rhizophora* sp.), adjacent to tall secondary growth (*Capoeira alta*). Night monkeys can be found throughout these contiguous areas along the coastline. *Cerrado* is the dominant vegetation in the south of the state. Information collected in the municipality of Alto Parnaíba strongly suggested the occurrence of *A. infulatus* only on the left bank of the river. Finally, there is a transition zone in the east of the state of Maranhão, dominated by mosaics and transitions of *Cerrado* forest (*cerradão*), gallery forest, *babaçual*, and *caatinga*, as well as associations of some local palm trees such as *Orbignya* and *Copernicia*. *A. infulatus* was collected in the *cerradão*, near to a patch of *Orbignya* forest. Direct observations (sightings and vocalizations), to-

gether with information from local people, showed that *A. infulatus* forages in all these environments with the exception of *caatinga*. Local people also emphasized the use of *Orbignya* as sleeping trees. All the information obtained in São Miguel and Brejinho, as well as in four other localities on the right bank of the Rio Parnaíba, state of Piauí (David Caldas, Novo Nilo, União, and Santa Rita), indicated that *A. infulatus* was restricted to the left bank of the river in the state of Maranhão.

Conclusions

The results showed that the geographical distribution of *A. infulatus* extends east to the left bank of the Rio Parnaíba, and hence including all of the state of Maranhão. Although the distribution may not be continuous in this part of Maranhão, the night monkeys were found in many different forest types. The only exceptions were severely degraded areas such as the region nearby the city of Bacabal.

Although the Rio Parnaíba evidently delimits the geographical distribution of *A. infulatus* in the east of its range (and that of the genus), it has features which would indicate that it is not an efficient barrier (see Ayres and Clutton-Brock, 1992). It is a meandering, slow, white-water river, with a high sediment load, and is not a natural barrier for any other primate species. *Callithrix jacchus*, for example, a smaller species than *A. infulatus*, occurs on both banks of the Rio Parnaíba (Silva Jr., unpublished data), and it is reasonable to suppose that enclave populations of *A. infulatus* may occur on the right bank, as has been recorded for other night monkeys by Hershkovitz (1983). Further investigation may also extend the eastern limits of the range of *A. infulatus* toward the northwest of the state of Bahia. This possibility is suggested by a museum specimen (MNRJ-3904), collected by R.M. Gilmore from "north-west Bahia" which has to date been considered to be of mistaken origin. With the range extension described here, the geographical distribution of *A. infulatus* has the largest range of the genus *Aotus*.

Rylands *et al.* (1995) consider *A. infulatus* to be a common species without any risk of extinction. However, there is no information on its biology and ecology from areas outside the Amazon. This study showed that *A. infulatus* uses previously unrecorded environments, such as the meso-habitats described as part of the Zona dos Cocais, coastal area, and the transition zone from eastern Maranhão. Further research is needed to study the ecology of these night monkeys, vital for future conservation programs in a region which has suffered widespread deforestation and degradation of its natural environments.

Specimens Collected and Examined

Specimens collected and material examined at the Museu Paraense Emílio Goeldi (MPEG), Museu Nacional, Universidade Federal do Rio de Janeiro (MNRJ), and Museu de Zoologia da Universidade de São Paulo (MZUSP): *Aotus infulatus*: **AMAPÁ**: Carmo do Macacoari, municipality of Itaubal (MPEG-22522, 22523, 24035); **PARÁ**: Ponta de Pedras, Marajó Island (MPEG-8875, 8876, 8877); Arari Lake, Marajó Island (MPEG-99, 100); Fazenda Santana, Caviana Island, municipality of Chaves (MPEG-23058, 23059, 24130, 24131, 24132); Maiandeua Island, municipality of Maracanã (MNRJ-23102); Nova Timboteua (MNRJ-24840, 24841); Vila Brabo, right bank of Rio Tocantins (MPEG-12177, 12178); Cocal, right bank of Rio Tocantins (MPEG-11851); Timbozal, left bank of Rio Tocantins (MPEG-11852, 11853); Sítio Calandrinho, left bank of the Rio Tocantins (MPEG-8869, 8870); Saúde, left bank of the Rio Tocantins (MPEG-12179); Conceição do Araguaia (MPEG-1321); **MARANHÃO**: Jurema, municipality of Amarante (MPEG-23036); Pedra Preta, municipality of Lago da Pedra (MPEG-23037); São Miguel, right bank of Rio Parnaíba, municipality of Caxias (MPEG-24123, 24124, and field number CZ-1420); **BAHIA**: northwestern Bahia (MNRJ-3904).

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Patrones de Actividad de *Alouatta palliata* en un Fragmento de Selva en Los Tuxtlas, México

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Saúl Juan Solano
Alejandro Estrada
Rosamond Coates-Estrada

En México, la selva húmedo tropical de la región de Los Tuxtlas resguarda la distribución geográfica más septentrional del género *Alouatta* en el Continente Americano representado por la especie *A. palliata* (*v.* Estrada y Coates-Estrada, 1984). Desdichadamente gran parte del hábitat de esta especie ha sido destruido o fragmentado por el hombre como parte del proceso de conversión de la selva a pastizales y, en menor medida, a monocultivos (Estrada y Coates-Estrada, 1996). Nuestro conocimiento sobre el comportamiento y ecología de *Alouatta* bajo condiciones de fragmentación y aislamiento del hábitat en el Neotrópico es aún escaso. Tal información es indispensable para generar modelos de conservación que eviten la desaparición continuada de representantes de las especies de interés.

Los patrones de actividad diurnos de monos aulladores (*Alouatta* spp.) y la relación que éstos guardan con las condiciones de su hábitat ha sido motivo de estudio en diferentes partes del Neotrópico (Serio-Silva, 1992; Bicca-Marques y Calegaro-Marquez, 1994; Stoner, 1996). Los monos aulladores se han caracterizado por presentar patrones de baja actividad, descansando más de la mitad de su tiempo diurno, lo cual se atribuye a la necesidad de procesar grandes cantidades de fibra vegetal como

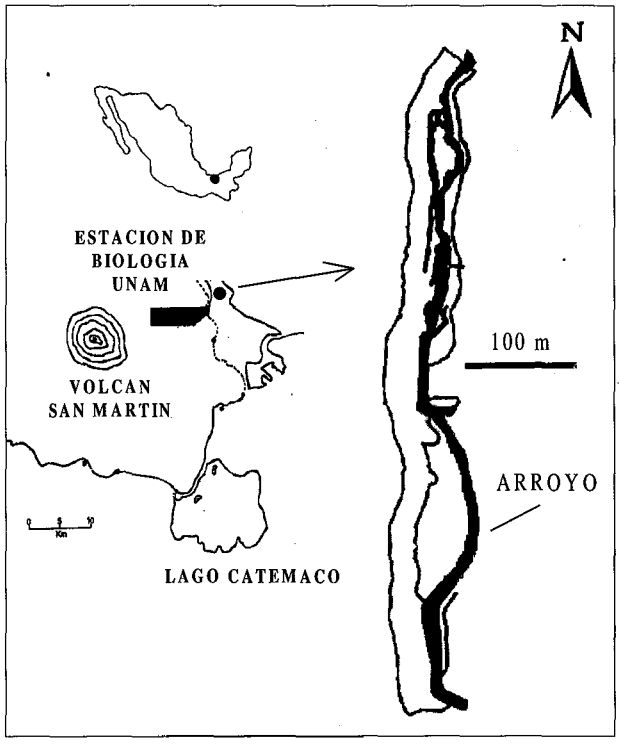

Figura. 1. Ubicación de la zona de estudio y del fragmento habitado por la tropa de monos aulladores. Note la forma alargada y angosta del sitio.

resultado de una dieta rica en hojas (Milton, 1980). Las variaciones en los patrones de actividad de este primate parecen estar relacionados con el grado de dispersión en el tiempo y espacio del recurso alimentario (Crockett y Eisenberg, 1987; Serio-Silva, 1992), con su densidad y con variables abióticas como el clima (Chivers, 1969, Glander, 1979); así como también con la edad y sexo de los aulladores (Bicca-Marques y Calegaro-Marques, 1994). La perturbación antropogénica de los hábitats naturales de este primate también tiene una influencia importante sobre la estrategia de asignación de tiempo y energía a las diferentes actividades vitales (crecimiento, mantenimiento y reproducción), pero hasta el momento existe poca información al respecto. Así, este trabajo presenta información sobre el patrón de actividad general para un

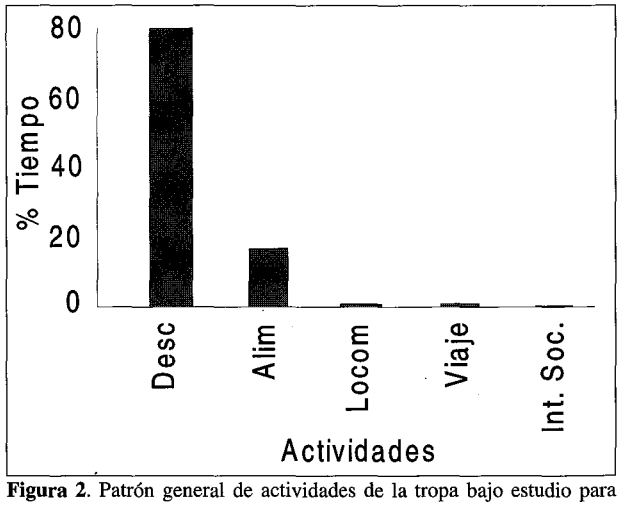

Figura 2. Patrón general de actividades de la tropa bajo estudio para el ciclo anual reportado.