Galetti, M., Keuroghlian, A., Hanada, L.& Morato, M.I. 2001. Frugivory and seed dispersal by the lowland tapir (*Tapirus terrestris*) in southeast Brazil. *Biotropica* 33: 723-726.

Henry, O., Feer, F. & Sabatier, D. 2000. Diet of the lowland tapir (*Tapirus terrestris* L.) in French Guiana. *Biotropica* 32:364-368.

Hobbs, N.T. 2003. Challenges and opportunities in integrating ecological knowledge across scales. *For. Ecol. Manage*. 181:223-238.

IUCN 2007. *2007 IUCN Red List of Threatened Species*. www.iucnredlist.org. Downloaded on 28 July 2008.

Kotliar, N.B. & Wiens, J.A. 1990. Multiple scales of patchiness and patch structure: A hierarchical framework for the study of heterogeneity. *Oikos* 59:253-260.

Legendre, L. & Legendre, P. 1998. *Numerical Ecology*. 2nd ed. Elsevier, New York, U.S.A.

Montenegro, O. 2004. *Natural licks as keystone resources for wildlife and people in Amamzonia*. PhD thesis. University of Florida, Gainesville, Florida, U.S.A.

Noss, A.J., Cuéllar, R.L., Barrientos, J., Maffei, L., Cuéllar, E., Arispe, R., Rúmiz, D. & Rivero, K. 2003. A camera trapping and radio telemetry study of lowland tapir (*Tapirus terrestris*) in Bolivian Dry Forests. *Tapir Conservation* 12:24-32.

RAMSAR. 2004. *The Ramsar Convention on Wetlands: The Annotated Ramsar List: Brazil, Ramsar site no. 1270*. www.ramsar.org/profiles_brazil.htm . Downloaded on April 2006.

STATSOFT, INC. 2004. STATISTICA (data analysis software system), version 6. www.statsoft.com.

Wiens, J.A. 2002. Predicting Species Occurrences: Progress, Problems, and Prospects. In: J.M. Scott, P.J. Heglund, M.L. Morrison et al. (Eds.). *Predicting Species Occurrences: Issues of Accuracy and Scale.* Island Press, Washington, DC, U.S.A.

Does Moonlight affect the Use of Natural Licks by Lowland Tapir (*Tapirus terrestris* Linnaeus, 1758) in the Northeastern Brazilian Pantanal?

Igor Pfeifer Coelho[1], Luiz Flamarion B. Oliveira[2], Maria Elaine Oliveira[3]

1 PPG-Ecologia, Departamento de Ecologia, UFRGS, Porto Alegre, Brazil. E-mail: djakare@gmail.com
2 Depto. de Vertebrados, Seção de Mastozoologia, Museu Nacional, UFRJ, Rio de Janeiro, Brazil. E-mail: melfo@terra.com.br
3 PG Ciência Ambiental, Universidade Federal Fluminense, Niterói, Brazil. E-mail: melfolive@terra.com.br

Abstract

We evaluated possible effects of moonlight on frequency of use of three natural licks by lowland tapirs (*Tapirus terrestris*) in the Brazilian Pantanal. Neither lunar phobia nor philia were detected. The frequency of use by tapirs (estimated by camera traps) during different classes of moonlight intensity varied between natural licks, but a similar frequency was observed across all moonlight classes when combining data across all licks. Further studies of activity patterns in lowland tapir in regards to moonlight intensities in other regions of the species' distribution are needed to elucidate if the absence of lunar phobia/philia is a local or a general pattern for the species.

Keywords: *Tapirus terrestris*, activity patterns, lunar, moonlight, Pantanal

Introduction

Species of mammals from diverse groups, such as rodents, rabbits, primates, carnivores, and bats, display nocturnal activity patterns and behaviors related to moonlight intensity. Several studies suggest that lunar phobia is a result of a higher predation risk during moonlit nights (Julien-Laferriere 1997; Leaver 2004; Griffin et al. 2005). Studies looking at the relationships between moonlight and bat behavior suggest lunar phobia as an adaptation to high predation risk by visually oriented predators, like owls and hawks (Meyer et al. 2004) and higher availability of prey (katydids) during dark periods (Lang et al. 2006). Large predators can also present lunar phobia and the mechanism involved in predator-prey relationship remains unclear. For example, in central Brazil the maned wolf (*Chrysocyon brachyurus*) reduces its activity during the full moon, probably as a response to reduced prey (rodents) availability (Sábato et al. 2006).

On the other hand, increased activity during moonlit nights (lunar philia) was found in primates and rodents. Owl monkeys (*Aotus azarai*) in the Argentinean Chaco present greater nocturnal activity as the moonlight increases (Fernadez-Duque 2003). *Tarsius spectrum*, a Sulawesi primate, increases foraging, travel distance and home range size during new moon periods (Gursky 2003). The author points out that a high availability of prey is responsible for lunar philia in this species. Paise & Vieira (2006) show that the rodent *Oxymycterus nasutus* displays increased nocturnal activity with increased night brightness and suggest that brightness levels may facilitate foraging activities or the ability to escape from predators.

Our goal in this study was to evaluate the relationship between moonlight intensity and the frequency of use of natural licks by the lowland tapir (*Tapirus terrestris* Linnaeus 1758) in the northeastern Brazilian Pantanal, looking for evidences of lunar phobia or philia. The lowland tapir is an ungulate of about 250kg, inhabiting dry, rain and gallery forests, chaco, and savannas in South America (Emmons & Feer 1997). Noss et al. (2003) found tapirs in the Bolivian Chaco to be mostly nocturnal. Tapirs feed on fruits, leafs and fibers (Bodmer 1990; Henry et al. 2000) and visit natural licks (lowland areas with wet ground and scarce vegetal covering) to eat soil (geophagy) and/or to drink water (Emmons & Feer 1997; Noss et al. 2003; Montenegro 2004; Coelho 2006). Geophagy by tapirs is probably related to mineral supplementation of their diet (Montenegro 2004) or for the neutralization of toxic substances from plants. Eating soil may be very important for tapirs, especially during reproductive or lactating periods as observed for female African elephants (*Loxodonta africana*; Holdo et al. 2002) or during periods of scarcity of food or great availability of food items rich in secondary compounds as observed for howler monkeys, *Alouatta belzebul* (Souza et al. 2002). In the northeastern Brazilian Pantanal, tapirs show a high frequency of lick use, almost exclusively occurring during the night (Coelho 2006; Figure 1).



Figure 1. Lowland tapirs at a natural lick in SESC-Pantanal Reserve, northeastern Brazilian Pantanal. March 2005.

Material and Method

Our study area was the Natural Private Reserve SESC-Pantanal (16°41' S, 56°16' W), covering 1,070 km^2 in northeastern Brazilian Pantanal. The Reserve presents different forest and savanna vegetation physiognomies. Field surveys were carried out from February to April (flood season) and from July to September (dry season) 2005. We used passive camera traps to investigate the use of eight natural licks by vertebrates in the region (Coelho 2006). We set one camera trap at each lick, positioning the cameras to photograph the areas of highest use (geophagical sites) based on tracks and tooth marks. Each photograph (35mm film, ASA 400) registered date and time. To evaluate a possible relationship between tapir lick use and moonlight, we used all the nocturnal records (after sunset and before sunrise) of the species from the three most visited natural licks (Clementino, Morcegos, and Catraca). A total of 524 nocturnal records were considered for the analysis, 311 from the flood season and 213 from the dry season. We used the percentage of lunar disk illuminated, obtained from the U.S. Naval Observatory website (http://aa.usno.navy.mil/data/docs/RS_OneDay.html), as a measure of night luminosity. Four classes of moonlight intensity were defined (Low: 0-24%, Moderate Low: 25-49%, Moderate High: 50-74%, and High: 75-100%). We calculate the frequency of use as the number of tapir records per sampling time for each class. Data was analyzed for each lick and season separately and for all licks combined. Records before moonrise and after moonset represent zero percent of lunar disk illuminated.

Results

We did not find a relationship between tapir lick use and moon phases. The frequency of use for different classes of moonlight intensity varied between natural licks (Figure 2). At the Clementino lick, higher frequency of visits for both dry and wet seasons were observed at the moderate low class of lunar brightness (Figure 2a). At the Morcegos lick, a higher frequency of use was observed during moderate high moonlight (Figure 2b). Finally, at the Catraca lick, frequencies were highest for the high and low moonlight classes during the dry season and for the moderate low class

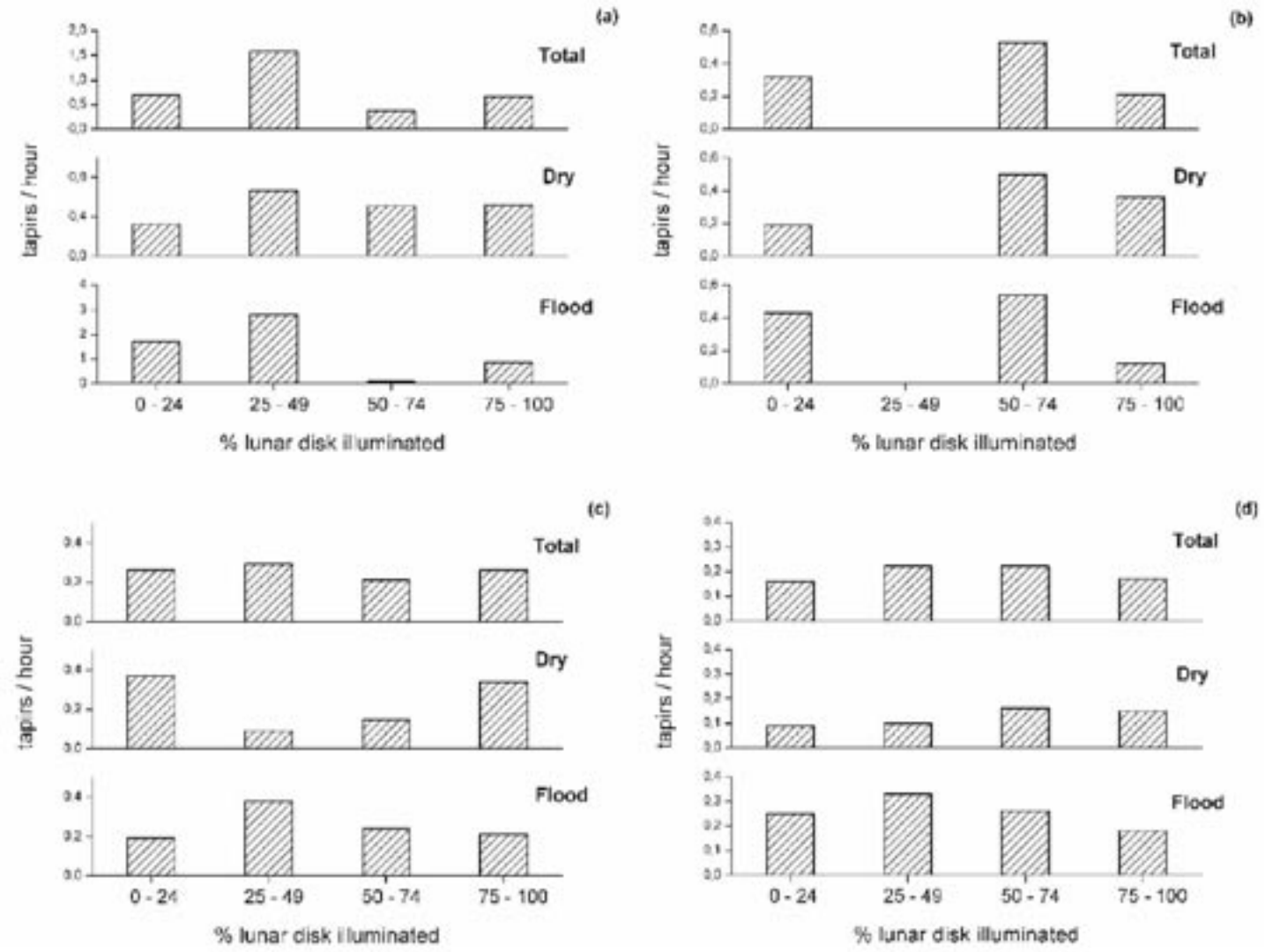

Figure 2. Frequency (visits/hour) of nocturnal visits to natural licks by tapirs for different moonlight intensities during dry and flood seasons in the Brazilian Pantanal:
(a) Clementino lick, (b) Morcegos lick, (c) Catraca lick, and (d) all natural licks.

in the flood period (Figure 2c). We observed a similar frequency for all moonlight classes when combining data for all three natural licks (Figure 2d). Clouds covering the moon could introduce some bias in our results; however, cloudy days are not common in the region, especially during the dry season.

Discussion

Possible lunar philia by tapirs may occur because moonlight facilitates movement and foraging. Local hunters from the Colombian Andes report high activity of mountain tapirs (*Tapirus pinchaque*) during full moon periods (Lizcano & Cavelier 2000). These authors, using camera traps, also found higher nocturnal tapir activity along trails and at a natural lick during the full moon. They suggest that the light could facilitate the movement along trails. However, the authors considered the moon phase at the day of the record regardless of the time (the full moon, for example, may not be visible at some times), which could introduce a certain bias. In the case of this study, luminosity may not be that important for tapir mobility because the reserve is composed of a mosaic of open areas and forests with a flat topography with no apparent difficulty for tapir movement.

Predators frequently visit licks, therefore tapirs might be expected to exhibit some degree of lunar phobia (Coelho 2006). However the local tapir population (estimated at 581 individuals; Cordeiro

2004) might not be under a high predation risk. There are three potential tapir predators in the area: the puma (*Puma concolor*), the jaguar (*Panthera onca*), and humans. Although pumas are abundant in the reserve (Trolle et al. 2007), it is unlikely that they are important tapir predators, with the exception of young or convalescent animals. In addition, a study of puma diet in the reserve failed to observe tapirs among the species' prey (Bachega 2004). Jaguars are more likely to prey on tapirs, however they are not abundant at the reserve when compared to other Pantanal sites (Trolle & Kéry 2005; Soisalo & Cavalcanti 2006). We also have not records of them at the natural licks, though tracks were observed in surrounding areas. Finally, local hunters use natural licks as hunting sites (Farias 2006); however, there has been very little hunting inside the reserve in the past ten years. As such, there is little evidence to suggest lunar phobia in this tapir population. On the other hand, the nutritional and physiological benefits gained from natural licks may outweigh the possible risks of predation.

The high variation in visitation rates among licks for different moonlight intensity classes suggests that the species shows no lunar philia or lunar phobia in the SESC-Pantanal Reserve. Predominance of observations at intermediate classes of moonlight indicates the possibility that tapirs prefer to visit natural licks when there is still sufficient light for movement but predation risk is minimized. However, at this time we do not see a clear pattern to corroborate this hypothesis. Finally, tapir populations at other sites in the Pantanal or other regions that are under higher predation risks may show lunar phobia. An evaluation of activity patterns of lowland tapirs (by radio-telemetry or camera traps) in relation to moonlight intensities for other regions of the tapirs' distribution is needed to elucidate if the absence of lunar phobia/philia is a local or a general pattern for the species.

Acknowledgements

We thank Martin Schossler, Paola Stumpf and Gabriel Hofmann for field assistance, and RPPN SESC-Pantanal park-rangers for logistical support. We thank Leopoldo G. Brandão and Waldir Valutki for providing support for the project. An anonymous reviewer provided valuable comments. This study was financed by SESC-Pantanal and CNPq (483286/2007-9, 310812/2006-2). CAPES provided fellowship to IPC.

References

Bachega, I. 2004. *Ecologia alimentar comparativa de três carnívoros simpátricos (Mammalia: Carnivora) na RPPN do SESC Pantanal, Barão de Melgaço, Mato Grosso*. M.S. dissertation. Programa de Pós-Graduação em Ciências Biológicas, UFMT, Cuiabá, Brazil.

Bodmer, R.E. 1990. Fruit patch size and frugivory in the lowland tapir *Tapirus terrestris*. *Journal of Zoology* 222 (1):121-128.

Coelho, I.P. 2006. *Relações entre barreiros e a fauna de vertebrados no nordeste do Pantanal, Brasil*. M.S. dissertation. Programa de Pós-Graduação em Ecologia, UFRGS. Porto Alegre, Brazil.

Cordeiro, J.L.P. 2004. *Estrutura e heterogeneidade da paisagem de uma Unidade de Conservação no nordeste do Pantanal (RPPN SESC Pantanal), Mato Grosso, Brasil: efeitos sobre a distribuição e densidade de antas (Tapirus terrestris) e de cervos-do-pantanal (Blastocerus dichotomus)*. PhD thesis. Programa de Pós-Graduação em Ecologia, UFRGS. Porto Alegre, Brazil.

Emmons, L.H. & Feer, F. 1997. *Neotropical Rainforest Mammals: A Field Guide*. Second Edition.The University of Chicago Press, Chicago, U.S.A.

Farias, J.K.N.P. 2006. *Sustentabilidade de populações humanas no Mato Grosso: subsídios através do manejo de ungulados silvestres*. M.S. dissertation. PPG em Ciências Ambientais, Instituto de Geociências, UFF, Niterói, Brazil.

Fernandez-Duque, E. 2003. Influences of moonlight, ambient temperature, and food availability on the diurnal and nocturnal activity of owl monkeys (*Aotus azarai*). *Behavioral Ecology and Sociobiology* 54:431-440.

Griffin, P.C., Griffin, S.C., Waroquiers, C., Mills, L.S. 2005. Mortality by the moonlight: predation risk and the snowshoe hare. *Behavioral Ecology* 16 (5):938-944.

Gursky, S. 2003. Lunar Philia in a Nocturnal Primate. *International Journal of Primatology* 24 (2):351-367.

Henry, O., Feer, F., Sabatier, D. 2000. Diet of the lowland tapir (*Tapirus terrestris* L.) in French Guiana. *Biotropica* 32 (2):364-368.

Holdo, R.M., Dudley, J. P., McDowell, L.R. 2002. Geophagy in the African elephant in relation to availability of dietary sodium. *Journal of Mammalogy* 83:652-664.

Julien-Laferriere, D. 1997. The influence of moonlight on activity of woolly opossums (*Caluromys philander*). *Journal of Mammalogy* 78 (1):251-255.

Lang, A.B., Kalko, E.K.V., Römer, H., Bockholdt, C., Dechmann, D.K.N. 2006. Activity levels of bats and katydids in relation to the lunar cycle. *Oecologia* 146: 659-666.

Leaver, L.A. 2004. Effects of food value, predation risk, and pilferage on the caching decisions of *Dipodomys merriami*. *Behavioral Ecology* 15 (5):729-734.

Lizcano, D.J., Cavelier, J. 2000. Daily and seasonal activity of the mountain tapir (*Tapirus pinchaque*) in the Central Andes of Colombia. *Journal of Zoology* 252:429-435.

Meyer, C.F.J., Schwarz, C.J., Fahr, J. 2004. Activity patterns and habitat preferences of insectivorous bats in a West African forest-savanna mosaic. *Journal of Tropical Ecology* 20:397-407.

Montenegro, O. 2004. *Natural licks as keystone resources for wildlife and people in Amamzonia*. PhD thesis. University of Florida, Gainesville, Florida. U.S.A.

Noss, A.J., Cuéllar, R.L, Barrientos, J., Maffei, L., Cuéllar, E., Arispe, R., Rúmiz, D., Rivero, K. 2003. A camera trapping and radio telemetry study of lowland tapir (*Tapirus terrestris*) in Bolivian Dry Forests. *Tapir Conservation* 12 (1):24-32.

Paise, G. & Vieira, E.M. 2006. Daily activity of a neotropical rodent (*Oxymycterus nasutus*): seasonal changes and influence of environmental factors. *Journal of Mammalogy* 87 (4):733-739.

Sábato, M.A.L., Melo, L.F.B., Magni, E.M.V., Young, R.J., Coelho, C.L. 2006. A note on the effect of the full moon on the activity of wild maned wolves, *Chrysocyon brachyurus*. *Behavioral Processes* 73:228-230.

Soisalo, M.K. & Cavalcanti, S.M.C. 2006. Estimating the density of a jaguar population in the Brazilian Pantanal using camera-traps and capture-recapture sampling in combination with GPS radio-telemetry. *Biological Conservation* 129:487-496.

Souza, L.L., Ferrari, S.F., da Costa, M.L., Kern, D.C. 2002. Geophagy as a correlate of folivory in red-handed howler monkeys (*Alouatta belzebul*) from eastern Brazilian Amazonia. *Journal of Chemical Ecology* 28:1613-1621.

Trolle, M & Kéry, M. 2005. Camera-trap study of ocelot and other secretive mammals in the northern Pantanal. *Mammalia* 69:405-412.

Trolle, M., Noss, A.J., Lima, E.S., Dalponte, J.C. 2007. Câmera-trap studies of maned wolf density in the Cerrado and Pantanal of Brazil. *Biodiversity and Conservation* 16:1197-1204.

Aportes a la Historia Natural de la Danta Colombiana (*Tapirus terrestris colombianus)* Compilados en el Norte de los Andes Centrales Colombianos

Andrés Arias Alzate

IUCN/SSC Tapir Specialist Group (TSG), Grupo de Mastozoologia-CTUA, Instituto de Biología, Universidad de Antioquia. Medellín, Colombia.
E mail: andresarias3@yahoo.es

Resumen

Se recopilo información sobre aspectos de historia natural de la danta colombiana (*Tapirus terrestris colombianus*) en las tierras bajas del norte de la Cordillera Central, mediante el monitoreo visual de una hembra subadulta en la vereda La Ceiba (municipio: Remedios, Antioquia, Colombia). Durante el seguimiento se caracterizan tres comportamientos principales: descanso en los refugios, forrajeo y descansos en las fuentes de agua. Además se describen tanto las actividades de cada comportamiento, como los sitios visitados, vocalizaciones y algunos aspectos de su dieta. La información recopilada es importante para promover futuros trabajos sobre historia natural, para así poder soportar mejor planes de conservación, donde la efectiva protección del hábitat natural del tapir, será un importante paso para la protección de esta especie en Colombia.

Palabras calves: *Tapirus terrestris colombianus*, historia natural, comportamiento.

Abstract

Information about some aspects of the Colombian danta (*Tapirus terrestris colombianus*) natural history was compiled in the lowlands of the northern Central Mountain Chain, with the study of a subadult female in La Ceiba locality (municipality of Remedios, Antioquia, Colombia). Three main were characterized: refuge resting, foraging and water resting. Besides, not only the activities of each, but also the places visited, vocalization and some diet aspects are describe. All this information is important to promote more studies about natural history, that support more efficiently the conservation plans, where an effective protection of the tapir`s habitat, will be an important step to protect this specie in Colombia.

Keywords: *Tapirus terrestris colombianus*, natural history, behavior.