

Aspects of the Behavior and Management of the Lowland Tapir (*Tapirus terrestris*) in Captivity in Araxá, Minas Gerais, Brazil

Henrique Ferreira de Ávila¹, D.V.M. Laura Teodoro de Oliveira², Carlos Henrique de Freitas³

- ¹ Biólogo, specialized in animal behavior and its applications - Agronômica Assessoria e Planejamento Ltda. Rua do Ouro, 28 - São Cristóvão, CEP 38.184.052 – Araxá, Minas Gerais, Brasil, E-mail: bio-aax@hotmail.com
- ² D.V.M Researcher of The Conservation Breeding Centre of the Companhia Brasileira de Metalurgia e Mineração - Córrego da Mata, s/nº, CP 08, CEP 38.183-903, Araxá, Minas Gerais, BRAZIL, E-mail: laura@cbmm.com.br
- ³ PhD. Instituto de Ciências da Saúde, Centro Universitário do Planalto de Araxá, Av. Ministro Olavo Drummond, nº 05, São Geraldo, CEP 38.180.084 Araxá, Minas Gerais

Abstract

The purpose of this study was to characterize the behavior of the lowland or Brazilian tapir (*Tapirus terrestris*) and determine the possible correlations between environmental factors and the time when births occur in captivity in this region, in order to obtain useful data for ex situ and in situ management and conservation of the species. The study was carried out in the period February - June 2006 at the Conservation Breeding Centre of Companhia Brasileira de Metalurgia e Mineração (CBMM) in Araxá, Minas Gerais, Brazil. The behaviors of Tapirs were observed in two stages using ad libitum and instantaneous scan sampling techniques totaling 90 hours of behavioral observations. The sample comprised eight specimens among three groups, kept in three different enclosures. Data were also collected on ten tapir births at the Breeding Centre and on historical averages of temperature and rainfall at the site for the period 1987-2006. The observations performed for this study allowed the identification and description of 22 behavioral events expressed for Brazilian tapir in captivity. The behavioral events “chasing”, “biting” and “sniffing genitalia” were performed only by males, apparently relating to sexual interest in females. On the other hand, “Caring parentally” was seen only in females. “Vocalization distress” was also observed only in females, when looking for their young and being chased by males. The “urine marking” was performed only by adult animals, both male and female. All other behavioral events in the repertoire were observed for both males and females. Three different types of vocalizations were observed at high frequencies among the social events and seemed to play an important role for the species in

social interaction. The events were grouped into five behavioral categories with significant difference ($X^2 = 107,06$; $p \leq 0.001$) in their relative frequencies: Rest, 59.35%; Locomotion/Movement 17.76%; Feeding/Maintenance 16.26%; Social Interaction 6.49%; and Agonistic 0.13%. Births are correlated with temperature and ($r_s = 0.57$; $p = 0.05$) not correlated with rainfall ($r_s = -0.11$; $p = 0.72$). The main conclusions were that the individuals studied at the CBMM Conservation Breeding Centre displayed sociable behavior and a varied and frequent vocal communication repertoire. They were mostly observed resting in groups, and performed activities both by day and by night. The reproduction is correlated with the ambient temperature in this region. The type of management followed at CBMM Breeding centre could be seen as a good practice for Brazilian Tapir.

Key words: Brazilian tapir, behavior, management in captivity

Introduction

The Brazilian tapir (*Tapirus terrestris*) is found in transition rainforests and near rivers. Its typical habitat includes areas with 2000-4000 mm annual rainfall, mean temperature of 20°C, and relative humidity of 75% (GOROG, 2001). This species occurs in northern South America, from Colombia to French Guyana, and all the way down to northern Argentina and southern Brazil (Mangini, 2006).

According to The International Union for Conservation of Nature (IUCN), in global terms the status of the Brazilian Tapir is Vulnerable in its

natural habitat as a result of its loss of habitats due to agricultural and cattle breeding expansion in the Caribbean (Mangini, 2007). In the State of Minas Gerais, in Brazil, Tapir is already considered to be at risk of extinction because of the reduction of its habitats (INSTRUÇÃO NORMATIVA COPAM 41/1995).

Tapirs are commonly found in zoos and breeding facilities in their areas of occurrence in the neotropics and Asia, as well as in Europe and Northern America (Mangini, 2006). In captivity, tapirs are relatively easy to maintain and breed, provided those responsible to take care have a good working knowledge of their biology and behavior (Barongi, 1999).

The continued survival of *ex situ* populations will depend on increased scientific knowledge about the management of the species in captivity and increased exchange of information between in-situ researchers and keepers (Medici, 2007).

The purpose of this study was to characterize the behaviors and prepare a behavioral repertoire of the species, as well as verify the possible correlations between environmental factors, such as temperature and rainfall levels, with the time when births occur in captivity in this region, in order to obtain useful data for improvement of *ex situ* and *in situ* management and conservation.

Methodology

The study was carried out at the Conservation Breeding Facility of Companhia Brasileira de Metalurgia e Mineração (CBMM) in Araxá, Minas Gerais, Brazil. The municipality of Araxá lies entirely within the so-called Cerrado biome, in the Macro-Region of the Upper Paranaíba, in the State of Minas Gerais, located at the geographic coordinates of 19°25'53" - 19°50'09" south latitude and 46°44'27" - 47°13'38" west longitude relative to the Greenwich meridian (Rocha; Rosa, 2007). It is within the tropical rainy climate zone, with hot and wet summers and dry winters, characterized by a rainy season, that occurs from October to March and a dry season, from April to September. The mean annual adjusted temperature is 20.1°C, with the mean annual rainfall ranging from 1300 to 1600 mm (Ribeiro; Walter, 1998).

The study was carried out in the period from February to June 2006. The groups were observed in their normal management conditions, without any changes to their diet, enclosures and time of feeding. The sample comprised eight specimens taken from three groups. The specimens were of different ages and some of them had been bred in captivity while the others originated in the wild (Table I).

The three groups were held in enclosures with the following dimensions: group I, 1632 m²; group II,

1200 m²; group III, 3080 m². These enclosures were surrounded by 2-meter high chain-link fences and planted with grasses such as *Brachiaria* (*Brachiaria decumbens*), with a height of about 80 cm, and clumps of elephant grass (*Pennisetum glaucum*), as well as trees such as *Tabebuia alba*, *Mimosa caesalpiniaefolia*, *Schinus molle*, *Bougainvillea glabra*, and *Caesalpinia peltophoroides*, to offer shade for the animals. There were also fruit trees such as avocado (*Persea americana*) and guava (*Psidium guajava*) trees available. In each enclosure food and water containers were placed in a 16 m² covered holding area with a concrete floor. There were no pools or tanks in the enclosures.

The animals were fed every day in the afternoon with a mixture of leaves (from a variety of sources as lettuce, cabbage, broccoli and chard, among others), fruit rind or peel (pineapple, banana, papaya, water melon and melon), vegetables (sweet potato, squash and zucchini), corn, and horse feed (Table II).

The behaviors of Tapirs were observed in two stages. During the first stage of the study (February 21 - March 15, 2006) *ad libitum* observations were performed at random times to describe the relevant behavioral events for the species. Behavioral events or acts were described using the empirical or descriptive method, as described by Del Claro (2004). The sample comprised six animals, from two groups (groups 1 and 2), kept in two different enclosures. The two couples already had a history of reproduction in the CBMM breeding centre. Each group was observed separately one hour a day, at different times each day, in the morning and in the afternoon, totaling 10 hours for group, in this stage. The period also served for the animals to get accustomed to the observer's presence. The observer remained outside of the enclosure at a distance of 3 to 4 meters from the fence. Based on the *ad libitum* observations and a review of the literature on *T. terrestris*, an ethogram was drawn up including a protocol for recording behavioral activities (Cullen et al., 1997). **Appendix I.**

During the second stage (April 4 - June 15, 2006), observations were performed using instantaneous scan sampling techniques. All animals in each group were observed and notes on the behavior of each individual were recorded on the ethogram or protocol for recording behavioral activities (Martin; Bateson, 1993). The sample comprised eight specimens taken from the three groups, 1, 2 and 3, kept in three different enclosures. The third group was formed in the end of March of 2006, when the male nicknamed Burrinho came from another breeding unit for reproduction at CBMM Breeding Centre. Each group was observed separately, at different times in each day. Observations lasted for one hour and took place at 60-second intervals. They were performed two or three

Table I. Identification and origin of specimens maintained at CBMM Conservation Breeding Centre.

Identification	Nickname	Sex	Origin	Age (in June 2006)
Group 1	Sarney	Male	Belo Horizonte Zoo	> 19 years
	Edinha	Female	Belo Horizonte Zoo	14 years 10 months
	Milênio	Male	Born CBMM	5 years 11 months
Group 2	Capadinho	Male	Born CBMM	10 years 9 months
	Filó	Female	Wild	> 4 years
	Monaliza	Female	Born CBMM	2 years 3 months
Group 3	Burrinho	Male	Antapaca Breeding Facility	Unknown
	Jade	Female	Born CBMM	4 years 4 months

times per week for each group, independently, in a total of 23 hours for the group 1, 22 hours for the group 2, and 25 hours for the group 3, totaling 70 hours of behavioral observations in this stage. Fifty-five out of the 70 hours of observations were performed during the day and 15 hours at night. A stopwatch was used to control the observations and intervals. The animals were observed in the enclosures through binoculars. Based on the observations performed during the first stage, they were deemed to be in groups when the distance between them was less than 6 m and alone when the distance was greater than 6 m.

Table II. Diet for an adult tapir specimen at CBMM Conservation Breeding Centre.

Type of Food	Quantity	Frequency
Fruit (including peel or rind)	3.2 kg	Daily
Raw vegetables	1.0 kg	Daily
Raw corn grains	0.8 kg	Daily
Horse feed (maintenance)	0.8 kg	Daily
Leaves	1.3 kg	Daily
Bionate *	15.0 g	Daily
Sugarcane stalks & elephant grass (whole)		Twice a week

* „Bionate GA Reforçado“

(vitamin and mineral supplement produced by Indubrás)

The behavioral records obtained by scan sampling were analyzed in terms of the absolute and relative frequencies of the actions or behavioral events involved. Records were used to prepare a behavioral repertoire for each family and also for all samples, listing all behaviors, their relative and absolute frequency, and total number of events observed in captivity, in accordance with Del-Claro (2004). **Appendix II.** Absolute frequency was measured by noting the number of records of actions or behavioral events by each individual during the sampling period. Relative frequency was measured using the following formula (Cullen, 1997):

$$RF (\%) = \frac{AF \times 100}{TE}$$

where:

- RF = relative frequency
- AF = absolute frequency
- TE = total number of events recorded during sampling period

To verify the probable correlations between births and environmental factors in this region, an analysis was made of the historical mean temperature and rainfall data and historical birth record data for the period from 1987 to 2006. Data were collected by analyzing records on calving by tapirs maintained at the Breeding Centre and on historical averages for temperature and rainfall at the site, for the same period, derived from the files of the CBMM Meteorological Station, located on the company's premises (46°54'58"W; 19°39'33"S; 1,160 m), in the vicinities of the animal enclosures, the same range within which the births took place. Such data were

Table III. Actions or behavioral events performed by six specimens of lowland tapirs in captivity recorded during 20 hours of *ad libitum* observation and on the basis of a review of the literature.

No.	Behavior	Description
1	Bite (B)	Animal bites another.
2	Care parentally (CP)	Female scratches offspring with head or proboscis.
3	Chase (C)	Animal pursues another by running after it. Usually followed by mounting.
4	Copulate (CO)	Male mounts female, followed by penetration of male's genital organ into female's genital organ
5	Drink (D)	Animal drinks from water container.
6	Eat (E)	Animal feeds on grass or food offered by keepers.
7	Excrete (EX)	Animal defecates or urinates, regardless of location in enclosure (physiological only).
8	Expose penis (EP)	Male exposes genital organ and is excited, with or without erection.
9	Lie laterally (LLS or LLG)	Animal lies on side, with one side of body totally in contact with ground and body not resting on forelegs. May be solitary (LLS) or in a group (LLG).
10	Lie on forelegs (LFS or LFG)	Animal lies on its belly, which rests on folded forelegs. May be solitary (LFS) or in a group (LFG).
11	Mount (MO)	Male mounts female by placing both forelegs on female's dorsum, without penetration of male's genital organ into the female's genital organ.
12	Push away (PA)	Animal pushes another away with head or body.
13	Run (RS or RG)	Animal moves relatively fast or gallops. May be solitary (RS) or in a group (RG).
14	Scratch (SC)	Animal scratches itself as self-maintenance action.
15	Sit (SIS or SIG)	Animal sits by resting its weight on folded hind legs while holding forelegs straight. May be solitary (SIS) or in a group (SIG).
16	Sniff (SN)	Animal sniffs another (except genitalia) or sniffs faeces, urine or food.
17	Sniff genitalia (SNG)	Animal sniffs another's genitalia, placing its snout close to or up against other animal's genitalia; may be associated with licking genitalia.
18	Stand still (SSS or SSG)	Animal stands still and is inactive, with all four hooves on ground and legs straight. May be solitary (SSS) or in a group (SSG).
19	Suckle (S)	Infant sucks milk from mother's udder.
20	Urine mark (U)	Animal sprays urine from standing posture, in rapid series of short sharp jets. Usually occurs at specific points of enclosure, evidencing the intention of marking the bounds of this territory.
21	Vocalization click (VCL)*	Two or three clicks emitted in rapid succession
22	Vocalization distress (VDI)*	Similar to long whistle (about 2 seconds).
23	Vocalization squeal (VSQ)	Loud shrill screech or squeal.
24	Walk (WS or WG)	Animal moves around enclosure. May be solitary (WS) or in a group (WG).

* Literature review

Results

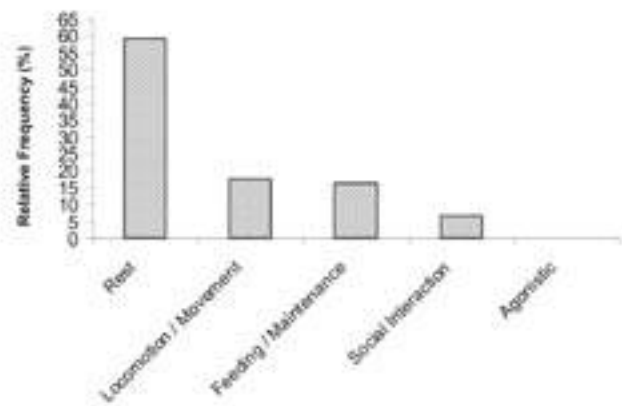


Figure 1. Relative frequencies of behavioral categories for Brazilian Tapir in captivity. This is the result of 70 hours of behavioral observations using scan sampling technique for 8 (eight) Tapir specimens taken from 3 (three) groups among the others at CBMM Breeding facility. This was done from April 4th to June 12th. ($X^2 = 107,06$; $p \leq 0.001$)

grouped by month, the Spearman's rank correlation tests were performed, with significance $p \leq 0.05$. Temperature and rainfall data were converted using the base 10 logarithm for the purpose of displaying the results graphically. The temporal budget equi-distribution in the different behavioral categories were X^2 (chi-square) goodness-of-fit tested for expected equal proportions ($p \leq 0.05$). The statistic program used was BioEstat 4.0 (Ayres, 2005).

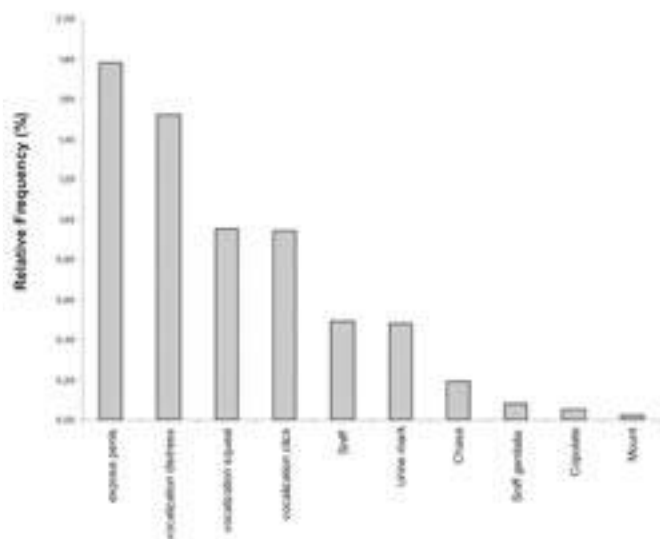


Figure 3. Relative frequencies of behavioral events classified as social interaction among eight lowland tapirs in captivity.

The *ad libitum* observations technique performed at the first stage of the research allowed the identification and description of 22 behavioral acts or events expressed for Brazilian Tapir in captivity, as showed in Table III. Among 22 events, only two types of vocalization were not observed at this stage and was described from literature. However, during the second stage of observations, all types of vocalization could be observed in captivity.

The “urine marking” was performed only by adult animals, both male and female. The behavioral events “chasing”, “biting” and “sniffing genitalia” were performed only by males, apparently relating to sexual interest in females. On the other hand, “Caring parentally” was seen only in females. “Vocalization distress” was also observed only in females, when looking for their young and being chased by males. All other behavioral events in the repertoire were observed for both males and females.

The individuals studied displayed sociable behavior, spending most of the day in groups and were active both by day and by night. Both males and females squealed (VSQ) when the pickup truck approached the enclosures with food and also in response to vocalization by another individual, suggesting that this vocalization was used to convey a warning or alert. Clicking was also observed at feeding times and when couples approached each other in the enclosures, confirming use of this vocalization to identify conspecifics. Another type of vocalization observed in the study was the distress call made by females when chased by males and when separated from their young.

Two mountings were observed during the study, each lasting one minute and including penis exposure but not leading to penetration. They preceded and occurred on the same day as the single act of copulation observed during the period. It occurred on the first day when the animals were placed together in the same enclosure. One of the copulation event was preceded by the male chasing the female for the most part of the day (approximately 10 hours). Whenever the male drew close to the female, he would try to bite her hindquarters. While chasing the female, the male vocalized with recurrent clicks. The female issued distress calls during the chase. When the male finally succeeded in closing on the female, he sniffed her genitalia, exposed his penis and mounted her. Copulation then ensued. Vocalizations became more frequent and intense during approximation and mounting. Copulation occurred on dry ground in the early evening and lasted five minutes. During copulation, the male made recurrent clicks, which became more frequent and intense as copulation proceeded. The female did not vocalize during copulation.

The actions or behavioral events were grouped into five behavioral categories with significant differences ($p \leq 0.05$) in their Relative Frequency (RF): Rest, with a RF of 59.3%; Locomotion/Movement 17.8%; Feeding/Maintenance 16.3%; Social Interaction 6.5%; and Agonistic 0.1%, according to Figure 1. The Rest and Agonistic categories are the ones that deviated the furthest from the expected proportion. There is no significant difference in RF between families.

In the Social Interaction category, the most frequently observed events were “exposing penis”, “vocalization squeal”, “vocalization click” and “vocalization distress”, as showed in Figure 3.

Another analysis of the data showed that the environmental settings most frequently used by the groups were *Brachiaria* grass (44.4%), clumps of elephant grass (21.3%) and tree shade (14.0%), where they remained much of the time refreshing.

An analysis of the history of 10 births that occurred in the period 1987-2006, together with time series for average temperature and rainfall at the CBMM Conservation Breeding Facility, showed that births are correlated with ambient temperatures ($r_s = 0.57$; $p = 0.05$) and not correlated with rainfall ($r_s = -0.11$; $p = 0.72$). Thus, births tend to occur when the average monthly temperature is higher. The relationship between birth occurrences and historical average temperature and rainfall levels at CBMM Conservation Breeding Facility is expressed in Figure 4.

Discussion

The individuals studied at the CBMM Conservation Breeding Centre displayed sociable behavior, were mostly observed while resting in groups, and performed activities both by day and by night. In the wild, tapirs are considered solitary and nocturnal (Barongi, 1999), although females with dependent young, adults with juveniles, or feeding groups are not unusual, showing that the species may live in groups (Medici, 2001). In captivity, while breeding, however, tapirs can be found in groups and may be active during the day (Shoemaker, 2006). Medici (2001) also observed that in some regions, such as Argentina's El Rey National Park, tapirs are typically diurnal, possibly because of the absence of humans. The results showed that this environment and the type of management conducted at CBMM allowed these species to perform behaviors that are similar to the behaviors they may usually have in their natural habitats. The type of management adopted at CBMM breeding centre includes the maintenance of the animals in groups, which are placed in big enclosures planted with grass and trees and with a very good environmental enrichment.

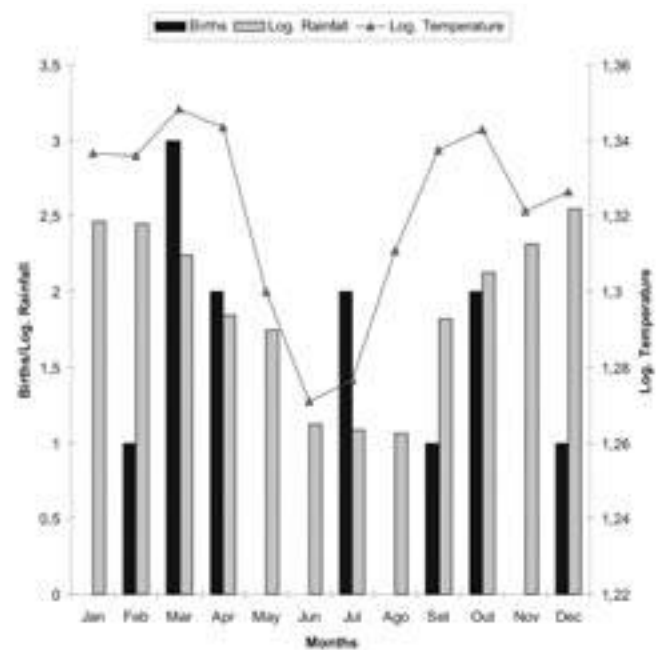


Figure 4. Relationship between 10 birth occurrences and historical averages for temperature and rainfall in the period 1987-2006, at CBMM Conservation Breeding Facility, showing the significant relationship between births and temperature levels. Births are correlated with temperature and ($r_s = 0.57$; $p = 0.05$) not correlated with rainfall ($r_s = -0.11$; $p = 0.72$).

The frequency of agonistic events was very low and the time spent resting was relatively high. According to Barongi (1999), the social behavior of tapirs in captivity is largely dependent on individual animal personalities, past experiences, food availability and size and layout of enclosure. The low degree of aggressiveness observed can be explained by the type of management used in the Breeding Center where consideration is given to the size and composition of the group kept in each enclosure and particular traits of each individual are taken into account when forming the groups. In addition, the enclosures are very large if compared to the minimum size standard recommended for this species while kept in captivity, namely, 18,6 square meters for the outside area (Barongi, 1999), thereby enabling animals to mark out their territories and freely express their behaviors. Also, large amounts of food are available for the animals, including food offered as part of their everyday diet as well as grass, fruits and leaves that naturally occur in the enclosures. In addition, the amount of time spent resting was relatively high, and the frequency of rest events was found to be high during daytime. Tapirs usually rest during daytime and are more active at nighttime

(Emmons; Feer, 1997; Barongi, 1999). In our study, sampling was done mostly (79%) during daytime. Rest frequencies may be different during nighttime, but such conclusion cannot be supported by the small amount of sampling done during the night period (21%).

Vocalizations were found to occur with high frequency among the social events and seemed to play an important role for the species in social interaction. Vocalizations were observed among males prior to copulation; among females while with their young, as part of their parental behavior; and among individuals as alert calls when identifying conspecifics. In nature, tapirs are usually quiet, but may snort and stamp in alarm (EMMONS;FEER,1997). Tapirs communicate using shrill whistling sounds which are associated with urine scent-mark (NOWAK, 1999).

According to Barongi (1999), mounting may occur with or without penetration of the male's genital organ into the female's genital organ. In our study, the mountings observed preceded and occurred on the same day as the single act of copulation observed during the period. The copulation lasted 5 minutes and was preceded by the male chasing the female for most of the day. It was preceded by olfactory, visual and auditory contact between the animals. These findings corroborate the statement in Barongi (1999) that copulation may last from a few to 20 minutes, occurs during estrus, and is preceded by running and chasing, with the possibility of biting.

The event "urine marking" by adults was observed for both females and also for males. They spray urine while standing, in rapid series of short sharp jets. This usually occurs at specific points of the enclosure, evidencing the intention of marking the bounds of their territory. Such finding was somewhat expected for Tapirs, since mammals usually mark out their territories with urine, which may emit scents, or with exudates from various tegumentary glands. In mammals, scent glands are quite developed and most mammals have an acute sense of smell, which plays an import role in their communication and territory defense (ORR, 1986). Thus, with respect to the management of this species in captivity, including how enclosures are designed and groups are managed, it must be taken into account that tapirs are territorial animals.

The environmental settings that were most frequently used by the animals observed in this study were *Brachiaria* grass, with a height of about 80 cm, followed by clumps of elephant grass and tree shade. This can be explained by the fact that tapirs are typically found in forest environments, where animals usually hide from predators and sunlight on the shades of the trees and on clumps of grasses (Barongi, 1999). They are found in rainforest, gallery forest, dry forest, savannah (Chaco), and more open grassy habitats

with water and dense vegetation for refuge (Emmons; Feer, 1997). The result shows the importance of the environmental enrichment of the enclosures for these species.

An analysis of the history of 10 births that occurred in the period 1987-2006, under the same type of management, together with time series for average temperature and rainfall at the CBMM Conservation Breeding Facility, showed that births are correlated with ambient temperatures and not correlated with rainfall levels, and that the highest the ambient temperature is, the higher the number of births will be. According to Shoemaker (2006) the reproductive behavior appears to be not seasonal and varies as a function of the age, experience and reproductive compatibility of each couple. Even though the literature (Nowak, 1999) indicates that births do not follow a seasonal pattern among Brazilian Tapirs, in spite of a tendency for births to occur prior to the commencement of summer rain, a different pattern was observed at the Breeding Center. There were births taking place during the months of February, March and April, which correspond to the end of the summer rain period, and also in July, which is the local dry season. This is an important fact that must be taken into account in respect of the management of tapirs in captivity, since it may be an effective strategy to ensure the reproductive success and preservation of this species.

Conclusions

The main conclusions were that the individuals studied at the CBMM Conservation Breeding Centre displayed sociable behavior and a varied and frequent vocal communication repertoire. For the most part they were observed while resting in groups, and performed activities both by day and by night. The vocal communication repertoire observed was varied and frequent. There are differences in how animals of different gender and age express their behaviors. Their reproduction is correlated with the ambient temperature. The type of management provided at CBMM Breeding centre could be seen as a good practice for Brazilian Tapir in captivity.

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BEHAVIORAL REPERTOIRE FOR LOWLAND TAPIR IN CAPTIVITY							APPENDIX I	
	GROUP							
Behavioral Categories	1		2		3		Total	
Behavioral events	FA	FR	FA	FR	FA	FR	FA	FR
Feeding / Maintenance	657	22,57	455	14,18	390	12,50	1502	16,26
Eat	631	21,68	440	13,72	354	11,35	1425	15,43
Drink	13	0,45	11	0,34	29	0,93	53	0,57
Excrete	6	0,21	1	0,03	5	0,16	12	0,13
Push away	7	0,24	3	0,09	2	0,06	12	0,13
Locomotion / Movement	579	19,89	428	13,34	634	20,33	1641	17,76
walk (single or in group)	560	19,24	414	12,91	597	19,14	1571	17,01
Run (single or in group)	15	0,52	9	0,28	37	1,19	61	0,66
Other	4	0,14	5	0,16	0	0,00	9	0,10
Social Interaction	136	4,67	280	8,73	184	5,90	600	6,49
Sniff	15	0,52	21	0,65	9	0,29	45	0,49
Sniff genitalia	2	0,07	0	0,00	5	0,16	7	0,08
Urine mark	19	0,65	12	0,37	13	0,42	44	0,48
Chase	5	0,17	1	0,03	12	0,38	18	0,19
Expose penis	32	1,10	51	1,59	81	2,60	164	1,78
Mount	0	0,00	0	0,00	2	0,06	2	0,02
Copulate	0	0,00	0	0,00	5	0,16	5	0,05
Vocalization squeal	14	0,48	60	1,87	14	0,45	88	0,95
Vocalization click	13	0,45	90	2,81	37	1,19	140	1,52
Vocalization distress	36	1,24	45	1,40	6	0,19	87	0,94
Agonistic	3	0,10	4	0,12	5	0,16	12	0,13
Push away	2	0,07	3	0,09	0	0,00	5	0,05
Bite	1	0,03	1	0,03	5	0,16	7	0,08
Rest	1536	52,77	2041	63,62	1906	61,11	5483	59,35
Sit (single or in group)	0	0,00	5	0,16	4	12,98	9	0,10
Stand still (single or in group)	366	12,57	491	15,31	405	12,98	1262	13,66
Lie on forelegs (single or in group)	740	25,42	770	24,00	1191	38,19	2701	29,24
lie laterally (single or in group)	430	14,77	775	24,16	306	9,81	1511	16,36
Total of Behavioral Events	2911	100,00	3208	100,00	3119	100,00	9238	100,00
Total of Hours of Observations	23		22		25		70	
FA - absolute frequency	FR - relative frequency							

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PROTOCOL FOR RECORDING BEHAVIORAL ACTIVITIES											APPENDIX II				
CDA - CBMM			Started at: 6:50 PM						Finished at: 7:50 PM						
ambient temperature:															
Animal A: Burro (male)			Animal B: Jade (female)						Enclosure: CDA						
Researcher :Henrique			Date: 25 / 05 / 06						Section: Tapirs						
Behavioral Categories															
	FEEDING / MAINTENANCE			LOCOMOTION / MOVEMENT			REST			SOCIAL INTERACTION			AGONISTIC		
Behavioral Events	eat (E)			walk (W S) or (WG)			Sit (SIS) or (SIG)			care parentally (CP)			bite (B)		
										sniff (SN)					
										sniff genitalia (SNG)					
	drink (D)			run (RS) or (RG)			Stand still (SSS or SSG)			urine mark (U)			push way (PA)		
										suckle (S)					
										chase (C)					
	suckle (S)						lie on forelegs (LFS) or (LFG)			expose penis (EP)					
	excrete (EX)									mount (MO)					
	scratch (SC)						lie laterally (LLS) or (LLG)			copulate (CO)					
										vocalization (VCL-VDI-VSQ)					
MIN	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
1				WS	WS										
2				WS	WS										
3	E						SSS	SSS							
4	E				WS		SSS								
5	E						SSS	SSS							
6							SSS	SSS							
7				WS	WS										
8							SSS	SSS							
9							SSS	SSS							
10							SSS	LFS							
11							SSS	LFS							
12					WS		SSS								
13					WS		SSS								
14	E				WS		SSS								
15							SSS	SSS							
16				WS	WS										
17				WS	WS										
18					WS		SSS								
19				WS				SSS							
20				WS	WS										
21							SSS	SSS							
22							SSS	SSS							
23				WS	WS										
24					WS		SSS								
25	E						SSS	SSS							
26					WS		SSS								
27				WS	WS										

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28				WS	WS										
29				WS	WS										
30				WS	WS										
31				WS	WS										
32				WS				SSS							
33				WS				SSS							
34				WS				SSS							
35				WS	WS										
36				WS	WS										
37				WS	WS					VSQ					
38				WS				SSS							
39				WS	WS										
40		E		WS				SSS							
41				WS	WS										
42				WS	WS		SSS								
43				WS	WS										
44							SSS	SSS							
45				WS	WS										
46				WS				SSS							
47							SSS	SSS							
48				WS	WS										
49							SSS	SSS			VDI				
50				WS	WS					VE	VDI				
51				WS	WS						VDI				
52				WS	WS					VSQ	VDI				
53							SSG	SSG		MO	VDI				
54							SSG	SSG		SNG					
55							SSG	SSG		SNG					
56							SSG	SSG		EP					
57							SSG	SSG		MO					
58							SSG	SSG		CO					
59							SSG	SSG		CO					
60							SSG	SSG		CO					
TOTAL															

observation:

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