Ecology and Behaviour of Golden-Headed Lion Tamarin (*Leontopithecus chrysomelas*) in a Mesophytic Forest in Southern Bahia, Brazil.

Final Report

Carlos Eduardo Guidorizzi – IESB (Institute of Socio-Environmental Studies of Southern Bahia)

INTRODUCTION

The Golden-headed lion tamarin (GHLD) (Figure 1) is endemic to the southern Bahia region. Due to habitat fragmentation and its originally restricted distribution *L. chrysomelas* is considered a species threatened of extinction, in the category of "Endangered", according to the IUCN criteria and the Brazilian List of Threatened Species (MMA, 2005; IUCN, 2007).

The Atlantic Forest of southern Bahia has high diversity and endemism rates for plants and animals (Fonseca *et al*., 2002). Primates are a good example of such diversity: the region is an endemism center for the Order (Kinzey, 1982) and it is in southern Bahia that can be found the most diversified primate community in the whole Atlantic Forest, with the six genera of the biome originally occurring (Rylands, 1996) – *Callithrix*, *Leontopithecus*, *Callicebus*, *Cebus*, *Alouatta* e *Brachyteles*.

Two different vegetation type are found within the occurrence area of *L. chrysomelas* (Rylands *et al*., 2002; Pinto 1994): *Wet Forest*, with no distinct dry period and characterized by over 1000 mm of rainfall annually, high trees, and many epiphytes; and the *Mesophytic Forest* characterized by c. 1000 mm of rainfall annually and a distinct dry period (Gouvêa *et al*, 1976; Vinha *et al*., 1976) (Figure 2).

The western area of occupancy of *L chrysomelas* is characterized by a high seasonality in rainfall, trees are smaller and loose their leaves during the driest period, which lasts about 5 months, from May until September. On the other hand, the eastern part of the species distribution doesn't show a distinct dry period. Besides these climatic and vegetational differences, there are also socio-economic dissimilarities. In the Mesophytic region, cattle ranching is the main economic activity, and forest fragments are small and isolated by large areas of pasture. In the east, forest fragments are larger and there is certain connectivity due to the cacao (*Theobroma cacao*) plantations, known as *cabruca*. In this agro-forest system, cacao is planted in the under storey of the forest (Alger and Caldas, 1996).

More than half of the species distribution is in the Mesophytic Forest region, but most of the populations are found in the Wet forest region (Pinto, 1994). Remaining populations in the west are found in numerous small and highly isolated forest fragments (Pinto e Rylands, 1997).

Habitat destruction and fragmentation lead to a low genetic variability, due to the isolation of small populations (Ralls *et al*., 1986). Besides, it increases the chance of negative effects such as hunting, incidence of diseases, predation pressure and stochastic events (Laurence e Cochrane, 2001). Fragmentation also affects habitat quality, by modifying floristic composition, distribution and density of plant species (Menon e Poirier, 1996). Food availability, vegetation structure, floristic composition and predation pressure are environmental characteristics that affects some aspects of the species ecology and behaviour, such as home range and use of space, diet and activity patterns (Oates, 1987).

Ecological and behavioural differences, caused by habitat differences, in distinct populations of the same primate species has been reported for several species. For *Leontopithecus*, differences have been reported for different species and even for different population of the same species (Kierulff at al., 2002).

Only two studies on the ecology and behaviour of *L. chrysomelas* were held in areas of Wet Forest, near to the coast, at the Lemos Maia Experimental Station (Rylands, 1982; Rylands, 1989) and a long-term study has been conducted at the Una Biological Reserve (Dietz *et al*., 1994; Raboy, 2002; Raboy and Dietz, 2004; Raboy *at al*. 2004; Hankerson *et al*., 2006).

Given floristic, structure and seasonal differences between the Mesophytic and Wet Forest, and also differences in the anthropogenic pressures, it is expected that populations of *L. chrysomelas* inhabiting these habitats show differences in their ecology and behaviour.

The main objective of this study is to understand the ecology and behaviour of GHLT in a Mesophytic Forest and verify how differences in the habitat affect species ecology and behaviour by comparing results with researches conducted in Wet Forest.

A better understanding of the ecological end behavioural variation of a species inhabiting different habitats allows us to know which environmental conditions affect the species, and it is essential to design management and conservation practices for the species survival (Primack e Rodrigues, 2001; Valladares-Padua *et al*., 2002). Understanding how the species cope in degraded habitat also contribute to the understanding of what would be the minimal conditions allowing survival of the population in short term and guide conservation decisions for the preservation and enhancement of the forest fragment (Wong e Sicotte, 2007).

A Brief View on the Ecology of the Golden-Headed Lion Tamarin

The species is frugivorous-faunivorous, fruits are the principal component of its diet, and the forage for animal preys (insects and small vertebrates, such as lizards and frogs) generally occurs in epiphyte bromeliads. Exudates of *Parkia pendula* are eaten in low proportions from holes gnawed by *Callithrix kuhli*, a sympatric Callithrichid, and also from cracks in the branches where the gum flows spontaneously. Flowers and nectar are also consumed, mainly from *Symphonia globulifera* trees (Raboy, 2002). Tree holes are used as sleeping sites (Coimbra-Filho, 1978) and the species uses mature and secondary forest in different degrees of degradation, although mature forest are necessary, mostly for the presence of sleeping sites and bromeliads. The home range varies between 40 ha (Rylands, 1982) and 123, 4 ha (Raboy, 2002) and females give birth to twins.

METHODS

Study Site

During the first months we visited several semidecidual forest fragments within the distribution area of *L. chrysomelas*, to choose the best place for the study. It was not an easy task, since the access to the fragments were often difficult due to bad

conditions of the dirty roads or even to the absence of roads to get to the fragments. Moreover, some farm owners did not allow us to conduct the study on their properties. In July/2005 we chose the place for the study and since than the work with the tamarins began.

The study was conducted in Barro Branco Farm, Itororó (Figure 3 and 4). The area has about 450ha of semidecidual forest isolated by pasture and it has suffered intensive selective logging in the past (Figure 5). This situation is representative of most of the fragments on the region of semidecidual forest.

Subjects

Five groups of lion tamarins were identified in the area and, at the beginning, we tried to capture two of them to put radio-collars. We captured the group using the same methods of previous studies (Kierulff, 2000; Raboy, 2002). The capture was necessary to fit radio transmitters, for sex identification and to dye the animals for individual identification in the field. They were baited with bananas in a tomahawk trap on a platform. Unfortunately, the capture did not succeed. Apparently, lion tamarins in this place were not attracted by bananas or any other fruit; and other animals, such as coatis (*Nasua nasua*) and tayras (*Eira barbara*), are abundant and eat all the fruits before the tamarins can get to them. So we decided to follow one group without radio transmitter.

In November/2005 we started to follow a group of golden-headed lion tamarins, with four adult individuals. After a period of habituation with the researcher, which lasted approximately one month, data collection started in January/2006, and this group (MAN) was monitored from **January/2006 until August/2006**.

In August/2006 we tried another capture. At this time we had a field assistant, who baited the groups with bananas and watched the traps more closely, so other animals could not eat the bananas. This time we did succeed, and two groups were captured (MAN and another one, GRA). At the time of capture, group MAN had only two individuals, both males, and one radio transmitter was fitted in one of them. Group GRA was composed by four adults, two males and two females. Two radio transmitters were fitted in two individuals of the group. After the capture, we intensified the monitoring of group GRA, and group MAN was followed only occasionally, since it was composed by only two males. The group GRA was monitored from **August/2006 until September/2007**, a total of fourteen months. The procedures for capturing and handling the animals (Figure 6 and 7) were previously approved by the International Committee for the Conservation and Management of Lion Tamarins (ICCM) and by the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA).

Data Collection

The methodology is the same as used on studies with golden-headed lion tamarin in Wet Forest, so comparison can be more accurate. Data on activities were collected using scans sampling (Altmann, 1974). The activity of each individual of the group was registered at 20 minutes interval. The following behavioural categories were used:

1. *Traveling*
2. *Stationary/Rest*
3. *Eating/Foraging for plant parts*
4. *Eating insects*
5. *Foraging for insects*
6. *Socializing*
7. *Others*

Position of the group is also registered every 20 minutes, using GPS. On each scan sampling, the activity of each individual and the height are recorded. All fruiting trees visited by the group were marked.

RESULTS

Groups Composition and Observation Hours

Group MAN

In the beginning of the research, in January/2006, the group was composed by four adult individuals. In 10/02/06 one female gave birth to twins, but they disappeared two weeks later, and cause of death is unknown. One of the adults disappeared in 16/02/06 and another in 28/06/06. So, at this time the group was with only two individuals, both males. It is hard to know if the adult individuals died or left the group, but it is improbable that both left the group. In May/2007 a female joined the group and in June/2007 the male who carried the radio transmitter were found dead, possibly attacked by a predator, since the carcass was not found, only the radio transmitter and some fur. We believe the predator was an eagle. After that, we lost contact with the group.

The group was observed for 169.5 hours, between January/2006 and August/2007. There were only 5 complete days of observation, which contributed for 56.5 hours. Data on group MAN were used to calculate home range and to describe their diet.

Group GRA

In August/2006, when we first captured the group, it was composed of four adult individuals, two males and two females. Twins were born in 22/09/06 (from female 2). In 26/10/06 female 1 also gave birth to twins. One of the infants from the first birth disappeared in 02/11/07. In February/2002 female 2 gave birth again to twins, one of them disappeared in May/2007. Female 2 were not seen in the group two weeks after that. She was not carrying radio transmitter, so it is hard to know if she died or left the group, but it is not likely that she had left the group, since she gave birth less then 3 months earlier. The other infant born in February disappeared in September/2007. Thus the group composition varied from 4 to 9 during the period of the study.

This was the main study group and data on this group were used to calculate home range, time budgets and to describe the diet. The group was followed systematically for 2 to 6 days per month, for 14 months. There were 682.79 hours of observation, in 64 complete days, and a total of 12.310 individual records. Table

1 shows the number of hours, days and records of group GRA on each month of observation.

Table 1. Days, hours and registers on each day of observation of group GRA.

	Hours of observation	Complete days	Group Records	Individuals Records	Valid individual Records *	Out of sight Records	% of Valid Records
Aug/06	23.75	2	55	220	163	57	74.1
Sep/06	62.66	6	189	756	543	213	71.8
Oct/06	44.55	4	134	536	437	99	81.5
Nov/06	25.78	2	66	264	219	45	82.9
Dec/06	22.18	2	67	268	200	68	74.6
Jan/07	45.31	4	137	959	712	247	74.2
Feb/07	73.9	6	196	1372	1048	324	76.4
Mar/07	65.03	6	196	1372	1156	216	84.3
Apr/07	54.3	5	156	1092	854	238	78.3
May/07	60.36	6	171	1464	1190	274	81.3
Jun/07	57.28	6	172	1204	1033	171	85.8
Jul/07	45.18	5	135	952	761	191	79.9
Aug/07	55.08	5	141	987	793	194	80.3
Sep/07	**47.43**	**5**	**144**	**864**	**724**	**140**	**83.8**
TOTAL	**682.79**	**64**	**1959**	**12310**	**9833**	**2477**	**79.9**

*** Not considering "out of sight" records.**

Seasonality

Figure 8 shows the mean of monthly precipitation in the region during the period from 1974 until 1978 (CEPLAC, 1981). Mean annual rainfall in this period was 1132mm, and dry season occur during the winter (from May to September).

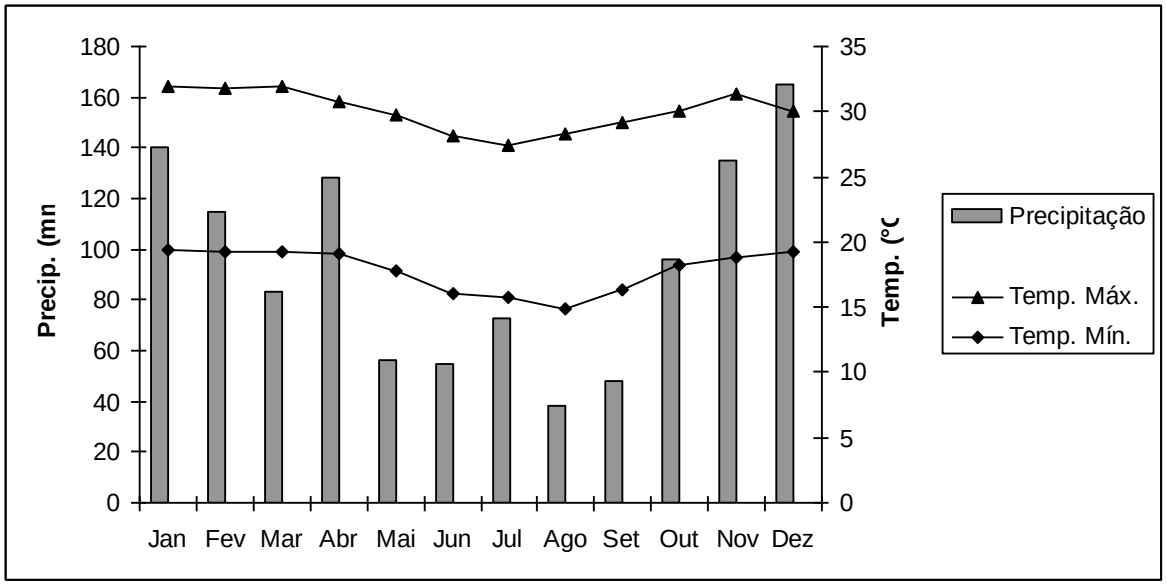

Figure 8. Mean rain fall and temperature in the study area. Data from 1974 till 1978.

Data on rain fall was collected during the study period showed a similar pattern (Figure 9).

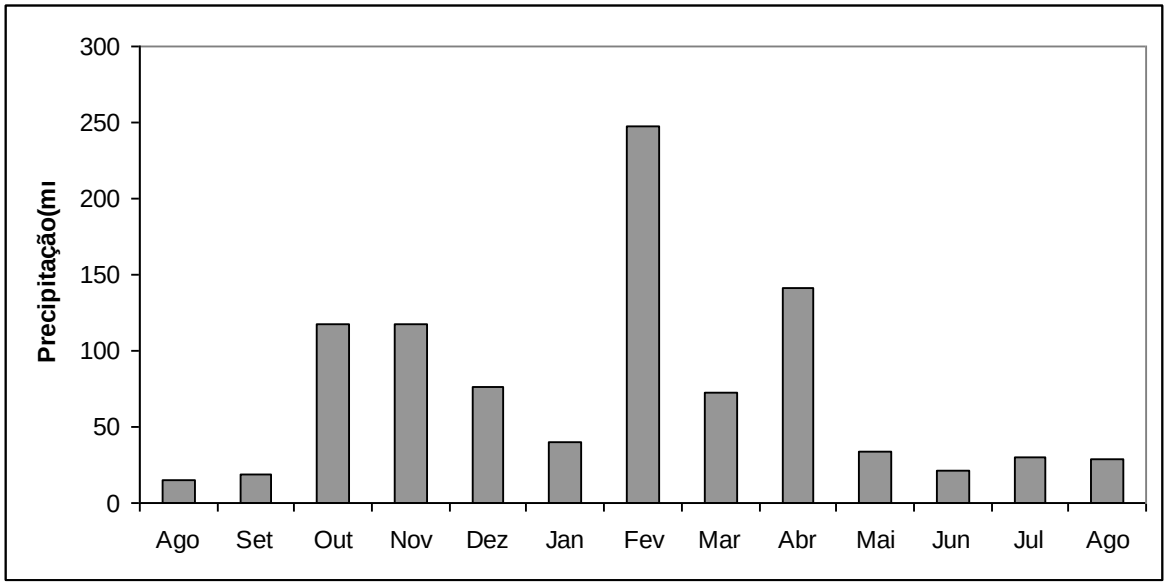

Figure 9. Rain fall during the study period, from August/2006 till August/2007.

Activity Patterns and Diet

Foraging for insects, traveling and stationary had similar proportion in the total time budgets of the group GRA, with 25% each. The fourth most common activity was eating fruits, with 14% of the time. Socializing occupied 7% of the time and eating insects and exudates 1% each, same time dedicated to "other" activities (Figure 10,11 and 12).

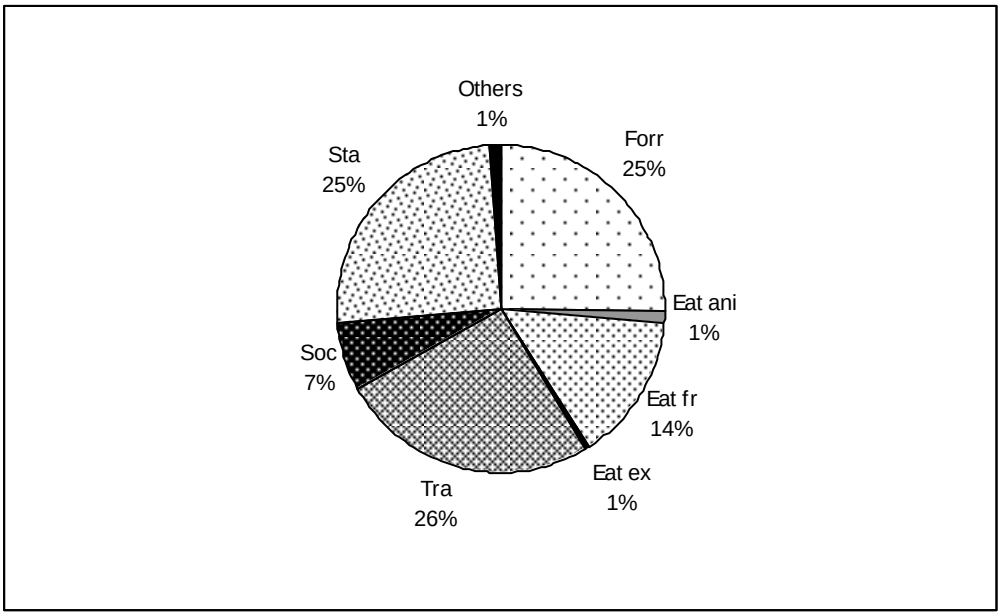

Figure 10. Activity pattern of the group GRA, from August/2006 till September/2007. Sta: Stationary; Soc: socializing: Tra: Traveling; Eat ex: Eating exsudates; Eat fr: Eating fruit; Eat ani: Eating animal; Forr: Forraging for insects.

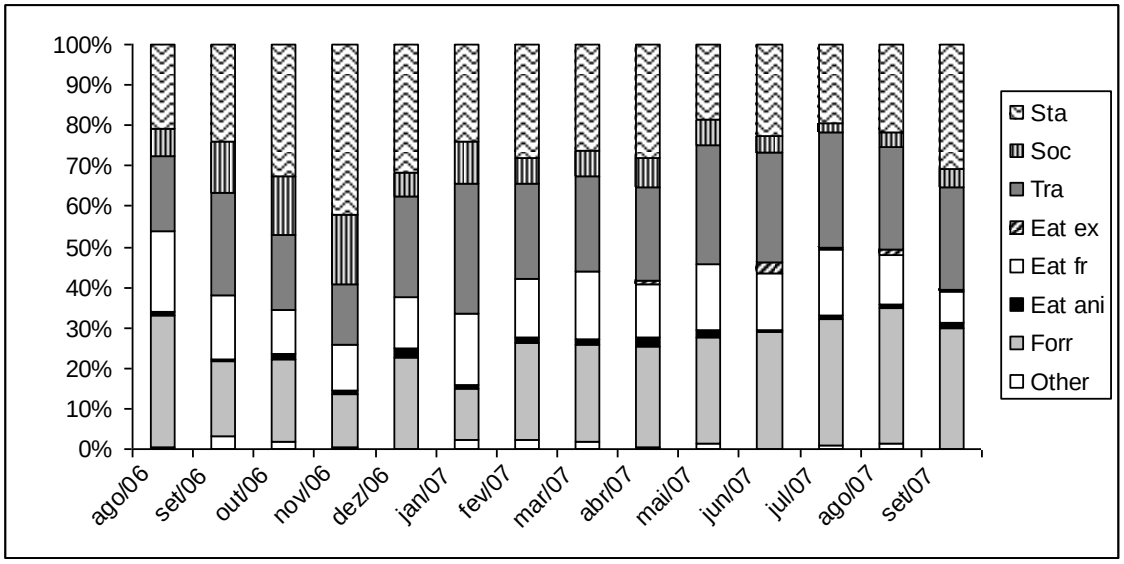

Figure 11. Activity pattern of the main study group, GRA, on each month of observation. Sta: Stationary; Soc: socializing: Tra: Traveling; Eat ex: Eating exsudates; Eat fr: Eating fruit; Eat ani: Eating animal; Forr: Forraging for insects.

The golden-headed lion tamarin in the Mesophytic forest eats mainly ripe fruits, insects and small vertebrates, such as frogs and lizards. Among the invertebrates, adult insects of the Orders Orthoptera, Blattaria, and larvae of the Orders Coleoptera and Lepidoptera were eaten more commonly. They also ate, less frequently, termites, spiders, snails, and centipede. Eating exudates were not common, and observed only in the dry season, in April and from June to September (Figure 11).

Summing the time dedicated to feeding, 64% were eating or foraging for animal prey, 35% eating fruits and only 1% of the feeding time was dedicated for exudates (Figure 13). The tamarins didn't use flowers, nectar or fungus on their diet.

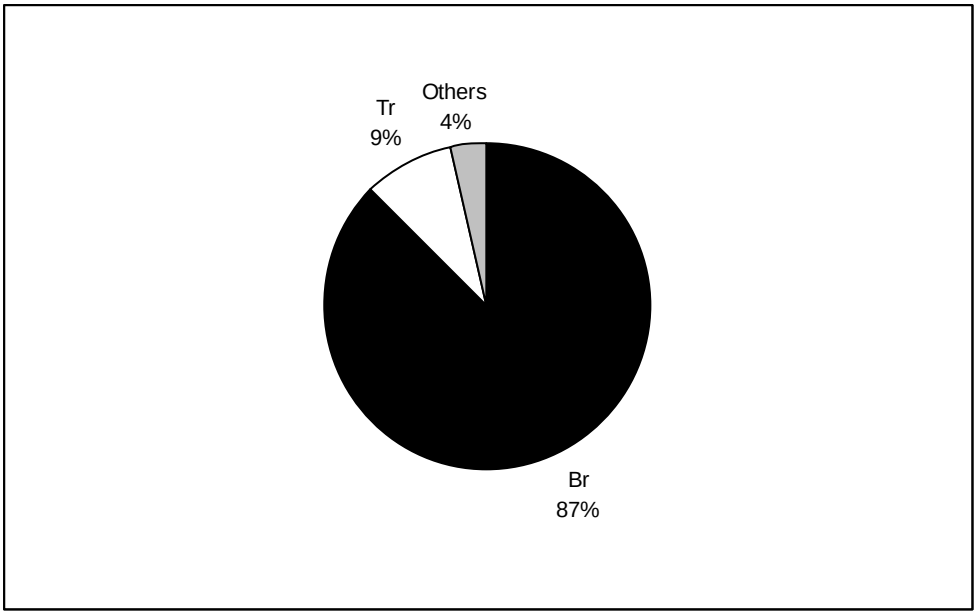

Figura 13. Total of the time dedicated to feeding. Eat ex: Eating exudates; Eat fr: Eating fruits; Eat/Forr ani: Eating and Forraging for animal prey.

Plant species that had their fruits eaten were not identified, so it is still not possible to list the plant species eaten by golden-headed lion tamarins in the fragment, but bromeliads of the genus *Aechmea* were among the fruits more often eaten, and it is possible to evaluate the relative importance of bromeliads fruits on the species diet. Species were not identified, but at least three species of *Aechmea* had the fruits eaten. If only records of "eating fruit" are analyzed, 49.7% were fruits from bromeliads, the rest (51.3%) been all the other kind of fruit.

From 553 marked fruit trees, 231 (41,8%) were bromeliads (Figure 14). Evaluating the number of visits in each plant for eating fruits, 478 (52,4%) were in bromeliads, of a total of 913 visits recorded. These values show that some bromeliads had their fruits eaten several times.

Most of the foraging for animal prey occurred in bromeliads or in dry leaves from bromeliads (87%), while tree trunks (including tree holes and tree barks) represented 9% of the foraging registers. Other microhabitats used for foraging were palm leaves, epiphytes other than bromeliads and the floor, and were used in only 4% of the registers (Figure 15).

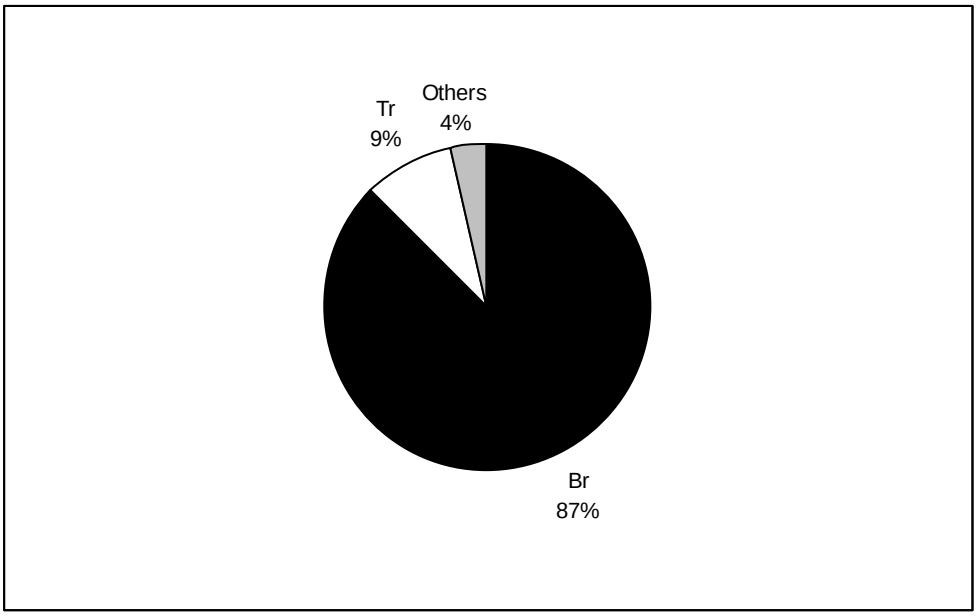

Figura 15. Proportion of microhabitats used for foraging for animal prey. Br: Bromeliads, including dry leaves from bromeliads; Te: Tree trunk, including tree holes and tree barks; Others include palm leaves, epiphytes other than bromeliads and the floor.

Home Range, Daily Movements and Sleeping Sites

The home range was 81,04 ha for group GRA and 70 ha for group MAN, obtained by the Minimum Convex Polygon, (MCP), in which the most external points are linked to form the polygon. Due to the irregular shape of the fragment, the polygon encloses pasture areas, which obviously are not used by the tamarins. Excluding these areas, the forest area used by group GRA was 71.38 ha and by group MAN 67 ha (Figure 16). Daily movement of group GRA was 1.342,02 ± 296,01 m (max.

1.871,71 m e min. 688,17 m). During the study period, the main group used 34 sleeping sites, all of them tree holes (Figure 17).

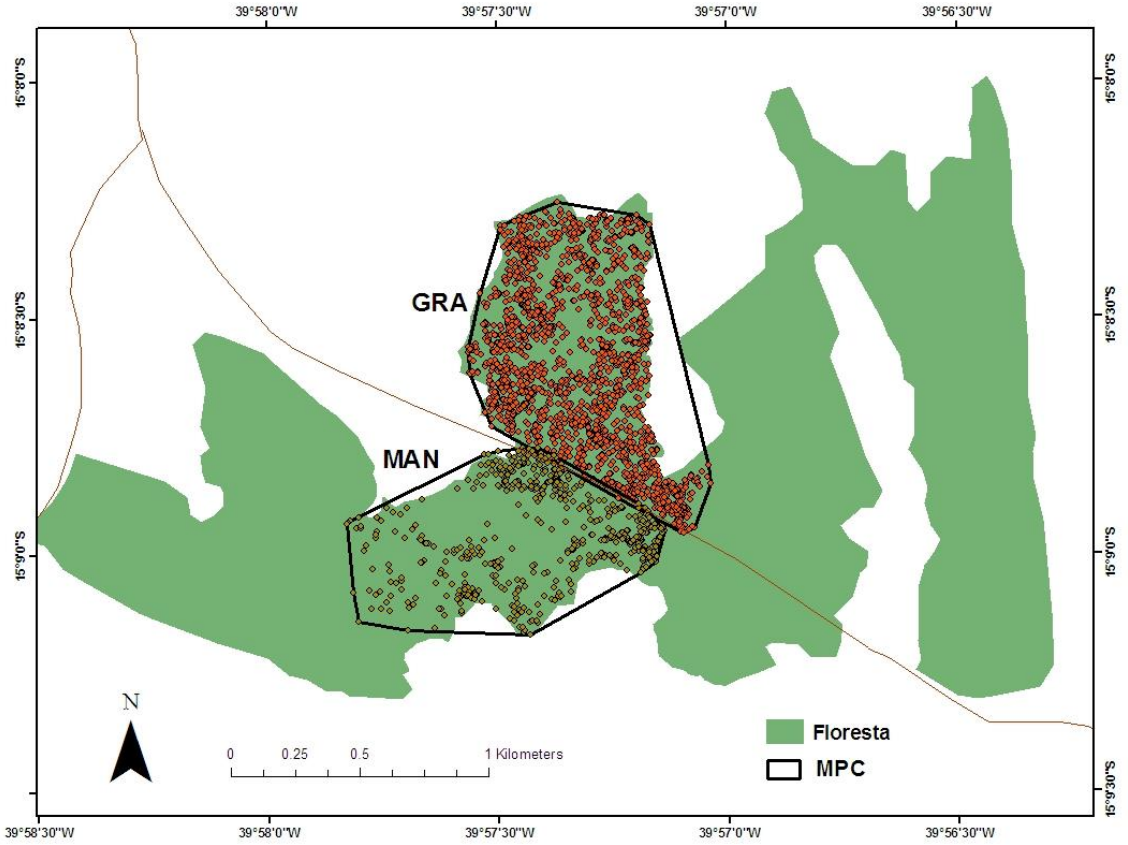

Figure 16. Home range using the Minimum Polygon Comvex (MPC) method.

Activity Period

The mean activity period of the group was 10,28 (± 0,87) hours (N = 59 days). The minimum was 8,53 hours, in June, and the maximum was 12,01 hours, in January. (Table 2).

Table 2. Activity period of the main study group, GRA, from August/2006 until September/2007.

Activity	Time (hours)
Exit of sleeping tree (min. e max.)	5:01(Nov/2006) – 6:51 (Aug/2006)
Entry in sleeping tree (min. e max.)	14:45 (Jun/2007) – 17:38 (Jan/2006)
Maximum Activity Time (hours)	12,01
Minimum Activity Time (hours)	8,53
Mean Activity Time (hours)	10,28

DISCUSSION

In general, lion tamarins in the Mesophytic forest fragment showed a diet with items similar to observed for other *Leontopithecus* populations, including the studies with *L. chrysomelas* (Rylands, 1989; Raboy, 2004). They ate fruits, insects, small vertebrates and exudates, but some items used by other populations of

Leontopithecus, such as nectar, flower and fungus, were not used. Flowers of *Symphonia globulifera* were an important item on the diet of *L. chrysomelas* at Lemos Maia Experimental Station, reaching 20% of plant food records (Rylands, 1989). In the semidecidual forest fragment this plant species is not present.

Exudates were eaten during the dry season, from April until September, when fruit availability was apparently low. Even so, the proportion of exudates on the diet was very low, only 1% of feeding records, showing that the decrease on fruit availability was not intense. Other populations of lion tamarins complement their diet with exudates during the period of food scarcity (Kierulff *et al*., 2002). Rylands (1989) found that exudates make 11% of plant items consumed on one of the three months of observation. For *L. chrysopygus*, a species that inhabits semidecidual forest, exudates are even more important. During dry season, when food supply is low, it corresponded to 55% of all the feeding records (Passos, 1999).

Bromeliad fruits were available throughout the year and lion tamarins consumed it on every month of observation. Actually, there was not one single day of observation in which they weren't seen eaten these fruits and more than half of all plants visited for fruit eating were bromeliads. This value is probably underestimated, since, in many occasions, it was not possible to know what the group was doing in the bromeliad, because of the lack of vision. It is likely that they were eating fruits in many of these occasions. So, the importance of bromeliads on the golden headed lion tamarins diet is even greater than the observed.

Bromeliads are also the most used microhabitas for foraging for animal prey, as observed on Wet Forest (Rylands, 1989; Raboy and Dietz 2004), confirming the importance of this resource for different populations of *L. chrysomelas*. In the studied group, the importance of bromeliads or their dry leaves were even greater: 86% of all foraging records. Rylands (1989) found 50% and Raboy and Dietz (2004), 76,5%. Thus, data reveal the relevance of bromeliads for lion tamarins in the Mesophytic forest, as fruit fount and as foraging site.

The studied group spent more time foraging for animal prey than previous studies with the species had shown (Table 3). It is likely that it happens due to differences in fruit availability on these three different sites. On Mesophytic forest, fruit availability is probably lower than on Wet Forest, so animals spend more time searching for animals.

Table 3. Comparison of activity pattern of three studies with *Leontopithecus chrysomelas*.

	This Study	**Rylands (1989)**	**Raboy (2002)**
Traveling	26%	43%	33%
Stationary	32%	20%	33%
Eating plant	15%	24%	12%
Eating/Foraging animal	26%	13%	20%
Others	1%	-	2%

Rylands (1989) studing one group inhabiting Wet Forest, found a home range of 40 ha and Raboy (2002), in Una Biological Reserve, found a mean home range of 124 ha, for three groups. The first study had only three months of duration though.

In Mesophytic Forest, the fragmented landscape may play a role on the home range of the studied group and the irregular shape of the forest limits its size. The north, east and west boundaries of the home range border pasture areas. Thus, the home range could not be extended to these sides. On the south boundary, there is the dirty road, which makes a gap of approximately 10 meters between the canopies of trees on each side of the road. The road acted as a barrier for the home range, although, potentially, lion tamarins are able to cross the road on the floor, as observed for three times. On the other side of the road there were two groups of golden-headed lion tamarin. If the forest was continuous, the home range could be larger, although still limited by the presence of other groups. Thus, given the irregular shape of the forest fragment and the presence of other lion tamarins groups, the value obtained by MPC method shows the real area used by the group.

Raboy (2002) found a higher daily movement (1753m). Given that the home range of the group in Mesophytic forest is smaller, it was expected that the daily movement was also shorter, since it is positively related to home range (Oates, 1987).

CONCLUSIONS AND RECOMENDATIONS FOR THE CONSERVATION OF GOLDEN HEADED LION TAMARIN, WITH EMPHASIS ON POPULATIONS INHABITING SEMIDECIDUAL FOREST

1. Items of the diet of golden-headed lion tamarins in Mesophytic Forest, which included fruits, insects, small vertebrates and exudates, are similar to other studied populations of *Leontopithecus*, including the population of *L. chrysomelas* in Una Biological Reserve.
2. The studied group in Mesophytic forest showed a greater proportion of time dedicated to eating and searching for animal prey than previous studies had shown in Una Biological Reserve, what may indicate that fruit availability in Mesophytic forest is lower than in Wet Forest.
3. Bromeliads are essential resource for *L. chrysomelas* inhabiting Mesophytic Forest, for being the most frequently used microhabitat for foraging for animal prey and for its fruit as well, which are among the most consumed and are eaten every month.
4. There is no rigorous decrease on food availability for golden-headed lion tamarins in Mesophytic Forest, but, during the dry season, lion tamarins complement their diet with exudates and feed on a small number of tree fruit species besides bromeliads.
5. Golden-headed lion tamarins are well adapted to local ecological conditions, highlighting their great ecological flexibility, greater than what had been shown until now.
6. A group of *L. chrysomelas* is able to survive in an area of 70ha. This value should be used as the minimum value in population assessment for Mesophytic Forest.

Although hunting still occurs in the region, forest devastation is the main threat to lion tamarins and other species. Besides *L. chrysomelas*, other three primate species co-exists in the fragments of the region: the yellow-breasted capuchin monkey (*Cebus xanthosternos*), the masked titi (*Callicebus melanochir*) and the commom marmoset (*Callithrix kuhlii*). *C. xanthosternos* is "critically endangered" and *C. melanochir* is "vulnerable", according to IUCN Red List of Threatened Species. The presence of these species shows the importance of conserving the forest fragments in the Mesophytic forest region.

Fragmentation of forest leads to isolation of small population, which may result in diminished genetic variability of the species, by increasing endogamy and preventing new individuals to entry the populations with new genetic input. In long term, it may result in local extinction. Neotropical Primates are especially vulnerable to fragmentation process, since they highly rely on forestry habitats, and have a limit ability to cross open areas to get to another forest patch.

The study area is highly fragmented and the matrix is formed by pasture areas, but different fragments still harbor groups of golden-headed lion tamarins and other primates. Many of these fragments are separated by old pasture, with initial secondary vegetation. An effort should be made to connect these fragments with corridors, allowing the movement of animals across fragments. Plant species used by lion tamarins, both as fruit resource or as sleeping site, could be used to create these corridors, enhancing the chances that lion tamarins uses the corridors as bridges between fragments. All plants used by the animals were collected, and the species identification is in progress right now. Soon we will be able to list all plant species that are important for the lion tamarins in the fragment.

Results showed that bromeliads are important resources for lion tamarins in the Mesophytic Forest region. Although it is not possible to say that bromeliads are key resource for lion tamarins, it is undeniable that bromeliads play an important role on their ecology, mostly during the dry season, when few fruits were eaten other than bromeliads. Conservation actions in the region should take it into account. Although management actions such as reintroduction or translocation are still not recommended for the species, as pointed out in the last PHVA for *Leontopithecus* (Holst *et al*., 2006), the presence of enough bromeliads in the area must be evaluated if such actions become necessary. There are no protected populations of GHLT inhabiting Mesophytic Forest and, when choosing possible areas to be protected, the presence of bromeliads should also be evaluated.

Another issue is the conservation of the fragments. The shapes of those fragments are often too irregular, enhancing the edge proportion. Edge effects are known to alter forest characteristics, both biotic and abiotic. Although lion tamarins use edge forests very often, edge effect can be amplified over time, impoverishing the fragment as a hole. It can represent a difficulty in protecting those fragments over a long time, but some actions could reduce the impoverishing of the fragment.

In the studied fragment, not all its boundary is enclosed within fences, allowing the cattle to enter the fragment. The stock go inside the fragment searching for young leaves and plant buds, preventing these plants to grow and altering the natural

regeneration process of the forest, mostly near the edges. Enclosuring all the fragment within wire fences would avoid the cattle to go inside, and the regeneration process would accelerate.

Although not as common as it used to be in a recent past, logging still exists in the region, mostly to get wood to fix fences and stables and to be used as fire wood. This activity also contributes to impoverish the forest. Farm owners are the decision makers about the fate of the fragments within their properties and, as could be observed, sometimes there is a total lack of knowledge about the endangered species that occur in their own forest, and even about the importance of protecting the remaining forest. Actually, there is an absence of any kind of conservation actions in the whole region. Environmental education programs focusing on farm owners should have priority, trying to change their negative behaviours towards the forest.

As pointed out, there is no protected area in the region. The implementation of Private Reserves is the most feasible strategy to create protected areas for golden-headed lion tamarins in the region. Private Reserves (in Portuguese RPPN – Reserva Particular do Patrimônio Natural) are private areas recognized by the Brazilian government as a conservation unity. No profitable activity is allowed in Private Reserve, only research and educational activities. The creation of such Reserve, though, depends on the forest owner will. Again, an education program should also focus the propagation of information concerning the importance of Private Reserves.

Future research in the area should focus:

1. Monitoring other groups in the fragment can help understanding the movement dynamic across neighboring fragments and immigration/emigration patterns in a fragmented landscape. This information is necessary for a proper management of the population in that region.
2. Detailed studies focusing the feeding behavior of golden headed lion tamarins on bromeliads could give a better view of the relationship between lion tamarins and bromeliads, and on which degree they are linked.
3. Genetic studies, assessing the genetic variability of the population inhabiting the forest fragments and comparing their genetics with the population from Rebio-Una, are essential to a better comprehension of the genetic structure of the species and to evaluate the potential of populations living in small fragments to act as a genetic diversity reservoir.
4. There is a lack of fauna studies in the Mesophytic Forest region. Faunal inventories on the fragments could reveal the presence of rare and endemic species, what could enhance the visibility of the region, favoring other conservation actions in the region.

Initial budget of the project

Rate of exchange (2004)	**£ 1**	**US$ 1,80**	**R$ 5,57**
1 Radio-receptor	**£ 560**	**US$ 1.000**	**R$ 3.120**
2 radio-transmitters	**£ 280**	**US$ 500**	**R$ 1.560**
Field Assistant	**£ 1.300**	**US$ 2.340**	**R$ 7.240**
Field Material	**£ 350**	**US$ 630**	**R$ 1.950**
Office Material	**£ 200**	**US$ 360**	**R$ 1.115**
Travel / Spends (fuel, food, car maintenance)	**£ 2.000**	**US$ 3.600**	**R$ 11.140**
TOTAL	**£ 4.690**	**US$ 8.430**	**R$ 26.125**

Budget for 18 months
Total received at the time we get the money: **£ 4.690 = R$ 23.367,76**

Expenditure: February 2005 - January 2006

Fuel	R$ 2.904,47
Spendings (food, field material)	R$ 1.599,53
Car maintenance	R$ 3.685,23
Administrative tax (IESB - 10%)	R$ 2.336,76
TOTAL	**R$ 10.525,99**

Obs: Radio receptor and radio-transmitters were bought with another source of money that could be used exclusively for that purpose (Primate Action Fund). Still left in January/2006: R$ 12.868,61

Expenditure: February 2006 – September/2007

A field assistant was hired in May/2006.

Fuel	R$ 2.904,01
Spendings (food, field material)	R$ 1.265,35
Car maintenance	R$ 2.039,25
Field assistant	R$ 6.660
TOTAL	**R$ 12.868,61**

LITERATURE CITED

ALGER, K.; CALDAS, M. Cacau na Bahia: decadência e ameaça à Mata Atlântica. **Ciência Hoje.** Vol. 20, 1996, p. 28-35.

CEPLAC. Centro de Pesquisas do cacao**. Resumos dos dados climatológicos. Posto: Fazenda Cabana da Ponte. Município: Itororó-BA. Período: 1973/1978**. 1981

COIMBRA-FILHO, A.F. Natural Shelter of *Leontopithecus rosalia* and Some Ecological Implications. In **Biology and Conservation of the Callitrichdae**. D.G. Kleiman (ed). Smithsonian Institution. 1978, p. 79-89.

DIETZ, J.; SOUZA, S.N.F.; SILVA, J.R.O. Population structure and territory size in golden-headed lion tamarins, *Leontopithecus chrysomelas*. **Neotropical Primates**. Vol. 2 (suppl), 1994, pgs. 21-23.

FONSECA, G.A.B., *et al*. **Abordagens Ecológicas e Instrumentos Econômicos para o Estabelecimento do Corredor do Descobrimento: uma Estratégia para Reverter a Fragmentação Florestal da mata atlântica no Sul da Bahia.** Instituto de Estudos Sócio Ambientais do Sul da Bahia (IESB), Consevation International do Brasil, PROBIO/MMA, Universidade Federal de Minas Gerais, Núcleo de Estudos e Pesquisas Ambientais da UNICAMP, Departamento de Desenvolvimento Florestal do Estado da Bahia, Brasília. Relatório técnico não publicado. 2002.

GOUVÊA, J.B.S., MATTOS, L.A. a HORI, M.. Fitogeografia In: **Diagnóstico Socioeconômico da Região Cacaueira, vol 7: Recursos Florestais**. Comissão Executiva do Plano da Lavoura Cacaueira (CEPLAC) e Instituto Interamericano de Ciências Agrícolas – OEA. Ilhéus, Bahia, Brasil. 1976.

HANKERSON, S.J; DIETZ, J.; RABOY, B.E. Associations between golden-headed lion tamarins and the bird community in the Atlantic Forest of southern Bahia. **International Journal of Primatology**. Vol. 27 (2), 2006, pgs. 487-495.

HOLST, B.; MEDICE, O.J.; MARINHO-FILHO, O.J.; KLEIMAN, D.; LEUS, K.,; PISSINATTI, A., VIVEKANDA, G..; BALLOU, J.D.; TRAYLOR-HOLZER, K.; RABOY, B.; VLEESCHOUWER, K.; MONTENEGRO, M.M. (eds.). **Lion Tamarin population and habitat viability assessment workshop 2005, final report**. IUCN/SSC Conservation Breeding Specialist Group, Apple Valley, MN, USA. 2006.

IUCN. **2007 IUCN Red List of Threatened Species**. Disponível em http://www.iucnredlist.org Acessado em 10 set. 2007.

KIERULFF, M.C.M; RABOY, B.E.; PROCÓPIO DE OLIVEIRA, P.; MILLER, K.; PASSOS, F.; PRADO, F. Behavioral Ecology of Lion Tamarins. In: **Lion Tamarins Biology and Conservation** D.G. Kleiman and A.B. Rylands (eds.). 2002, pgs. 157-187.

KINZEY, W.G. Distribution of primates and forest refuges**.** In: **Biological Diversification in the Tropics**. G. T. Prance, Editors. New York: Columbia University Press. 1982, Pgs. 455-482.

LAURENCE, W.F.; COCHRANE, M.A. Synergystic effects in fragmented landscapes. **Conservation Biology**. Vol. 15, 2001, pgs. 1488-1489.

MENON, S.; POIRIER, F.E. Lion-tailed macaques (Macaca silenus) in a disturbed forest fragment: activity patterns and time budget. **International Journal of Primatology**. Vol. 17, 1996, pgs. 969-985.

MMA – MINISTÉRIO DO MEIO AMBIENTE. **Lista Nacional das Espécies da Fauna Brasileira Ameaçadas de Extinção.** Disponível em www.mma.gov.br/port/sbf/fauna/index, acesso em 14 set. 2007.

OATES, J.F. Food distribution and primate behaviour. In: **Primates Societies**. B.B. Smuts D.L. Cheney R.M. Seyfarth R.W. Wrangham T.T. Struhsaker, (Ed). University of Chicago Press., Chicago. 1987, Pgs. 197-209

PASSOS, F.C. Dieta de um Grupo de Mico-Leão-Preto, *Leontopithecus chrysopygus* (Mammalia, Callitrichidae), na Estação Ecológica dos Caetetus, São Paulo. **Revista Brasileira de Zoologia**. Vol. 16, 1999, pgs. 269-278.

PINTO, L.P. de S.. **Distribuição Geográfica, População e Estado de Conservação do Mico-Leão-da-Cara-Dourada, *Leontopithecus chrysomelas* (Callitrichidae, Primates).** Dissertação de mestrado, Universidade Federal de Minas Gerais, Belo Horizonte, Minas Gerais. 1994.

PINTO, L.P. de S. and RYLANDS, A.B.. Geographic distribution of the golden-headed lion tamarim, *Leontopithecus chrysomelas*: Implications for its management and conservation. **Folia Primatologica**. Vol. 68, 1997, pgs. 161-180.

PRIMACK, R.B.; RODRIGUES, E. **Biologia da Conservação**. Londrina. 2005. 325p.

RABOY, B.E.. **The Ecology and Behavior of Wild Golden-Headed-Lion-Tamarins (*Leontopithecus crysomelas*).** Tese (doutorado), University o Maryland. 2002, 160p.

RABOY, B.E. and DIETZ, J.M.. Diet, foraging, and use of space in wild golden-headed lion tamarins **American Journal of Primatology**. Vol. 63(1), 2004, Pgs. 1-15.

RABOY, B.E., CHRISTMAN, M.C., DIETZ, J.M. The use of degraded and shade cocoa forests by endangered golden-headed lion tamarins *Leontopithecus chrysomelas* **Oryx**. Vol. 38(1), 2004, Pgs. 75-83.

RALLS, K.; HARVEY, P.H.; LYLES, A.M. Inbreeding in natural populations of birds and mammals. In: **Conservation Biology: the science of scarcity and diversity**. Soulé, M.E. (Ed.). Sinauer, Sunderland, 1986, pgs. 35-56.

RYLANS, A.B. **The Behaviour and Ecology of three Species of Marmosets and tamarins (Callitrichidae, Primates) in Brazil**. Tese de Doutorado, University of Cambridge, UK. 1982.

RYLANDS, A.B. Sympatric brazilian callitrhchids: the black tufted-ear marmoset, *Callithrix kuhli*, and the golden-headed lion tamarin, *Leontopithecus chrysomelas*. **Journal of Human evolution**. Vol 18, 1989, 679-695.

RYLANS, A.B. Habitat and the evolution of social and reproductive behavior in Callitrichidae. **American Journal of Primatology**. Vol. 38(1)., 1996, Pgs: 5-18.

RYLANDS, A.B., KIERULFF, M.C.M. e PINTO, L.P.de S. Distribution and status of lion tamarins. In D.G. Kleiman and A.B. Rylands (eds.), **Lion Tamarins Biology and Conservation**, 2002, Pgs. 42-70.

VINHA, S.G. da, RAMOS, T.J.S. e HORI, M. Inventário Florestal. In: **Diagnóstico Socioeconômico da Região Cacaueira, vol 7: Recursos Florestais**. Comissão Executiva do Plano da Lavoura Cacaueira e Instituto Interamericano de Ciências Agrícolas – OEA. Ilhéus, Bahia, Brasil. 1976.

THOMAS, W.; CARVALHO, A.M.; HERRERA-MACBRYDE, H. Centers of plant diversity. SA12: Atlantic Moist Forest of Southern Bahia. 2003. Disponível em www.nmnh.si.edu/botany/projects/cpd/sa/sa12.htm. acessado em 14 de setembro de 2007.

VALLADARES-PÁDUA, C.B.; BALLOU, J.D.; MARTINS, C.S.; CULLEN, L.JR. Metapopulation management for the conservation of black lion tamarins. In D.G. Kleiman and A.B. Rylands (eds.), **Lion Tamarins Biology and Conservation**, 2002, Pgs. 301-314.

WONG, N.P.; SICOTTE, P. Activity budgets and ranging patterns of Colobus vellerosus in forest fragments in Central Ghana. **Folia Primatologica**. Vol. 78, 2007, pgs. 245-254.