The Conservation Biology of the Black Lion Tamarin, *Leontopithecus chrysopygus*: First Ten Years' Report

Claudio Valladares-Padua, The Nature Conservancy, 1815 North Lynn Street, Arlington, Virginia 22209, USA, **Suzana M. Padua**, IPÊ - Instituto de Projetos e Pesquisas Ecológicas, Avenida dos Operários 587, 13416-460 Piracicaba, São Paulo, Brazil, and Wildlife Preservation Trust International Inc., 3400 West Girard Avenue, Philadelphia, Pennsylvania 19104-1196, USA, and **Laury Cullen Jr.**, IPÊ - Instituto de Projetos e Pesquisas Ecológicas, Avenida dos Operários 587, 13416-460 Piracicaba, São Paulo, Brazil.

Introduction

The black lion tamarin conservation biology project began ten years ago. The long term research on this species has resulted in information on its genetics, behavior, ecology, demography and habitat characteristics. It has also provided additional benefits such as the protection of forest fragments which belong to private landowners. The involvement of ranch owners in this species' conservation has enhanced the protection of forest fragments within the original range of the black lion tamarin. The protection of remnants of their habitats which are scarce nowadays, enhances the protection not only of this primate, but of all other species found in the same ecosystems.

Other important aspects of the black lion tamarin project have been the training of field professionals and environmental education activities. University students and field assistants, Brazilians and from abroad, are constantly being trained and absorbed in this study or in other field studies, resulting in an effective training program for the conservation of endangered species. Similarly, educational activities are conducted in all research sites as an important part of the species conservation strategy.

The recent phase of the long term conservation management plan for the black lion tamarin resulted from the *Leontopithecus* Population Viability Analysis Workshop, held in 1990 (Seal *et al.*, 1990), which showed that the survival of the black lion tamarin was threatened in the middle to long term. Based on these findings we proposed that the conservation of the species must rely on the effective protection of officially protected areas, privately-owned habitat fragments and captive colonies. These different populations or sub-populations should be integrated in a metapopulation plan which involves translocation, managed dispersal and the continuity of the long term comparative studies underway.

Project Description

Definition of the Problem: In a world increasingly affected by humans, where large tracts of relatively undisturbed habitats are being shredded and fragmented, one of the major challenges for conservation biology is ameliorating the long term consequences of population fragmentation. As indicated above, the black lion tamarin is an extreme example of this habitat fragmentation requiring management for its long term survival (Seal *et al.*, 1990). In the wild, there are around 1000 animals in five confirmed sub-populations; two in protected areas (Morro do Diabo State Park and the Caetetus Ecological Station) and three in privately owned forest fragments (Valladares-Padua and Cullen, in press) (Fig. 1). A Population Viability Analysis carried out

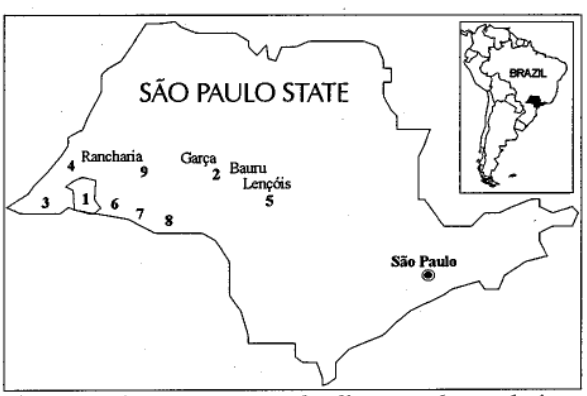

Figure 1. Reserves, recently discovered populations and potential localities for reintroduction or translocation of black lion tamarins. Numbers on the map correspond to the following areas. Reserves: 1. Morro do Diabo State Park, 2. Caetetus State Ecological Station. Areas with recently discovered populations of black lion tamarins: 3. Tucano/ Rosanella Ranch, 4. Ponte Branca Ranch, 5. Rio Claro Ranch. Potential areas for reintroduction/ translocation: 6. Santa Rita Farm, 7. Mosquito Ranch, 8. Vista Bonita Farm, 9. Bartira Farm.

for the black lion tamarin suggested that, if not managed, its survival probability for the next 100 years is very remote even with the most optimistic scenarios for the species.

Previous Information on the Black Lion Tamarin Project: The success of the long term conservation project for *L. chrysopygus* is highly correlated to the amount of knowledge acquired on the species. The Black Lion Tamarin Project has developed one of the largest existing data bases for any neotropical mammal species. It includes information on: 1) distribution and status; 2) genetics; 3) demography in the wild and in captivity; 4) ecology and behavior; 5) captive breeding; 6) habitat restoration; and 7) environmental education.

Current Situation: Presently the Black Lion Tamarin Project is confronting the challenge of designing management plans based on updating the concept of metapopulation (the series of isolated sub-populations of a species) developed by Levins (1969, 1970). To understand the conservation approach we are proposing, it is important to know that when Levins coined the term "metapopulation", what he had in mind was an infinite number of sub or local populations of one species. His main interest was not conservation, but the development of a mathematical model to optimize biological control of crop pests. The idea was to balance local extinction of pest-predators by re-migration from other populations. Thus, in his view, a metapopulation could be regarded as the net result of the establishment, survival, and extinction of local populations.

The approach we are using was developed subsequently, mainly by Gilpin (1987) and Hanski and Gilpin (1991). They proposed an adaptation of Levin's model to conservation biology using a finite number of sub-populations. Their concept identified the minimum viable size of a population as not solely dependent on its size, but also on the patchiness of the existing habitats and on the movement of each individual between habitable patches. The extreme version of their model is the case where discontinuous habitats may result in the total impossibility of natural migration among local populations. These fragmentation processes create small isolated sub-populations enhancing their probability of extinction due to genetic, demographic and environmental forces acting within patches (Soulé, 1980; Ralls and Ballou, 1983). Even if the sub-populations survive, isolation itself might cause differentiation and consequent speciation (Wright, 1977; Franklin, 1980; Otte and Endler, 1989). In the cases where fragmentation precludes natural migration, metapopulation management entails artificially moving animals from one patch to another. Translocation and managed animal migration must also take into consideration previous knowledge about the species so the animals can survive and reproduce in the new area (Foose, 1990).

Since the black lion tamarin is reduced to small fragmented sub-populations (Fig. 1), we believe it is close to the extinction scenario, which can be reversed if we adopt metapopulation management as the central conservation strategy for the species. We have begun to implement this strategy, and in 1995 we intend to complete the following three major steps:

1. A study of potential translocation habitats for the species. Areas with habitat significantly similar to the habitat found in the areas occupied by black lion tamarin subpopulations;

2. A long term monitoring of a series of neighboring groups in one of the black lion tamarins sub-populations;

3. Translocation of one or two of these monitored groups to a protected and uninhabited, pre-selected habitat area.

Methods/Action Plan: To determine the habitat areas appropriate for translocation we are using multivariate analysis to statistically compare potential areas with areas effectively used by the species. The potential areas are the Fazendas Mosquito, Santa Rita and Vista Bonita in the western part of the State of São Paulo and the "palmital" (palm heart plantation) section of the Fazenda Rio Claro. We surveyed these areas in 1991, and found no tamarins. These areas are being compared to those at Morro do Diabo where we conducted a long term study on the ecology and behavior of the tamarins between 1987 and 1990. If the data collected for the habitat of a potential area are not statistically different from those found at Morro do Diabo where the tamarins inhabit, the area will be considered as appropriate for the species and may receive translocated animals.

Together with the translocation, we will develop a long term monitoring of the group to be translocated as well as its neighbors. This will furnish information on habitat selection among lion tamarins. In practical terms, we will be able to analyze how the newly vacant

home range will or will not be occupied by the surrounding individuals or groups of lion tamarins. The resulting data will be very important in a theoretical view point where little is known on habitat selection. However, the most important aspect is the information obtained on minimum and maximum home range sizes and the carrying capacity of a given area which will allow us to calculate the minimum viable habitat for the species.

Personnel Involved: The following professionals are involved in this project, full or part time:

- Claudio Valladares Padua, General Coordinator
- Laury Cullen Jr., Field Coordinator
- Cristiana S. Martins, Field Coordinator
- Carolina Mamede, Local Coordinator at Duraflora
- Evandro L. Gonçalves, Local Coordinator at Morro do Diabo
- Eduardo Ditt, Local Coordinator at Caetetus
- Fabiana Prado, Researcher at Caetetus
- Marilene M. Silva, Researcher at Duraflora
- Jose Maria de Sousa, Field Assistant
- Luiz Homero Gomes, Field Assistant
- José A.G. Garcia, Field Assistant
- José Maria Aragão, Field Assistant
- Suzana M. Padua, Environmental Education Coordinator

There are also a number of trainees and other professionals who have been involved part time with the field work.

The Project's Most Important Results

Black Lion Tamarin Project Continuity: The following activities have been developed in the past ten years, or are being conducted currently:

Already concluded:

a. Preliminary survey of the current distribution of the species;
b. Genetic study of some wild and captive populations;
c. Demographic study of wild and captive populations;
d. Long term study on the ecology and behavior of the species at the Morro do Diabo State Park;
e. Environmental education program at the Morro do Diabo State Park;
f. Survey for new populations in the State of São Paulo;
g. Pre-selection of potential areas for translocation and reintroduction;
h. Census at the Caetetus Ecological Station.

In Progress:

a. Periodic census of the newly discovered sub-populations;
b. Field study on the ecology and behavior of different sub populations;
c. Comparative study on habitats;
d. Pilot project on habitat recovery in Morro do Diabo;
e. Environmental education program for the Caetetus Ecological Station.

To be developed in 1994-1995:

a. A pilot project on translocation;
b. A new survey for wild populations;
c. Field study on the ecology and behavior of different sub-populations.

Training and Environmental Education: One of the most important aspects of this project has been the training of students and field assistants. We have been training people in the field since 1988, when the Morro do Diabo study began. More than 20 people, varying from university students to field assistants, have participated. Environmental education has become a crucial part of the Black Lion Tamarin Project. The Morro do Diabo education program which began in 1989, was receiving in 1991 an average of 1,500 students per month (Padua, 1994). The field staff have begun a similar project at the Duraflora site (Lençois Paulista), with the students living at the Fazenda Rio Claro, one of the research sites. This education program still needs to be structured and evaluated so it can expand and benefit other communities. The idea is to multiply the experience of the Morro do Diabo to the other sites where *L. chrysopygus* is found.

Acknowledgments

We would like to thank the Forestry Institute of the State of São Paulo (IF), the São Paulo Electricity Company (CESP) and the Secretary of the Environment of the State of São Paulo for supporting this program. We are grateful to the communities of Teodoro Sampaio and other towns in the Pontal region which welcomed our conservation initiatives. We also thank individuals and institutions who have supported our work, such as Apenheul - Holland, the Canadian Embassy, in Brazil, Conservation International, the Brazil Science Council (CNPq), Duraflora S.A., Fanwood Foundation, the Fauna and Flora Preservation Society, Fazenda Rosanella, Fazenda Ponte Branca, the Brazilian Institute for the Environment (Ibama), the International Committee for

the Preservation and Management of the Black Lion Tamarins, the Jersey Wildlife Preservation Trust, Lincoln Park Zoo, Whitley Animal Protection Trust, Wildlife Preservation Trust International, World Wildlife Fund - US and the University of Florida, Gainesville.

References

Foose, T.J. 1990. Interactive management of small wild and captive populations. In: Leontopithecus - *Population Viability Analysis Workshop Report*, U.S.Seal, J.D.Ballou and C.Valladares-Padua (eds.), pp.67-77. IUCN/SSC Captive Breeding Specialist Group (CBSG), Apple Valley, Minnesota.

Franklin, I.R. 1980. Evolutionary change in small populations. In: *Conservation Biology: An Evolutionary - Ecological Perspective*, M.E Soulé and B.A Wilcox (eds.), pp.135-149. Sinauer Associates, Sunderland, Massachusetts.

Gilpin, M.E. 1987. Social structure and population vulnerability. In: *Viable Populations for Conservation*, M.E.Soulé (ed.), pp.125-139. Cambridge University Press, Cambridge. pp: 125-139.

Hanski, I. and Gilpin, M. 1991. Metapopulation dynamics: brief history and conceptual domain. *Biol. J. Linn. Soc.*, 42:3-16.

Levins, R. 1969. Some genetic and demographic consequences of environmental heterogeneity for biological control. *Bull. Ent. Soc. Am.*, 15:237-240.

Levins, R. 1970. Extinction. In: *Some Mathematical Questions in Biology, Vol.2*, M. Gerstenhaber (ed.), pp.75-108. American Mathematical Society, Providence, Rhode Island.

Otte, D. and Endler, J.A. 1989. *Speciation and Its Consequences*. Sinauer Associates, Sunderland, Massachusetts.

Padua, S. 1994. Conservation awareness through an environmental education programme in the Atlantic forest of Brazil. *Environmental Conservation*, 21(2): 145-151.

Ralls, K. and J.D. Ballou. 1983. Extinction: Lessons from Zoos. In: *Genetics and Conservation: A Reference for Managing Wild Animals and Plant Populations*, C.M. Schönewald-Cox, S.M. Chambers, B. MacBryde and L.Thomas (eds.), pp.164-184. Benjamin-Cummings, Menlo Park, California.

Seal, U.S., Ballou, J.D. and Valladares-Padua, C. (eds.) 1990. Leontopithecus - *Population Viability Analysis Workshop Report*. IUCN/SSC Captive Breeding Specialist Group (CBSG), Apple Valley, Minnesota.

Soulé, M. E. 1980. Thresholds for survival: maintaining fitness and evolutionary potential. In *Conservation Biology: An Evolutionary-Ecological Perspective.*, M. E. Soulé and B. A. Wilcox (eds.), pp.151-169. Sinauer Associates, Sunderland, Massachusetts.

Valladares-Padua, C. and Cullen Jr., L. In press. Distribution, abundance and minimum viable metapopulation of black lion tamarins *Leontopithecus chrysopygus*. *Dodo, J. Wildl. Preserv. Trusts.*

Wright, S. 1977. *Evolution and Genetics of Populations. Vol. III. Experimental Results and Evolutionary Deductions*. University of Chicago Press, Chicago.