

LONG-TERM EVALUATION OF AN ENVIRONMENTAL EDUCATION  
PROGRAM: ASSESSING THE IMPACTS OF THE GOLDEN LION TAMARIN  
EDUCATION INITIATIVE IN BRAZIL

By

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Abstract of a Thesis Presented to the Graduate School  
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Chair: Susan K. Jacobson  
Major Department: Latin American Studies

The mission of the Golden Lion Tamarin Association (AMLD) in Rio de Janeiro ,  
Brazil, is to sustain a genetically viable population of golden lion tamarins  
(*Leontopithecus rosalia*), an endangered primate species endemic to this region.

Environmental education has been a primary component of the AMLD conservation  
strategy since the launching of the project in 1983.

This study compared results of an evaluative survey conducted in 2001 with  
findings of a 1986 baseline survey. This long-term program evaluation was conducted to  
(1) assess changes in public support, (2) identify strong and weak features of the  
program, and (3) suggest modifications. The study examined 666 surveys, of which 352  
were collected in 2001 in 6 randomly sampled communities and 314 were selected from  
the 1986 database from the same communities.

The study revealed an increase in positive support regarding the tamarin and the  
environment, as well as an increase in the general knowledge about the environment.

However, the composite knowledge scores about the tamarins showed no significant changes in awareness within the period. By analyzing the individual knowledge items, results showed specific gaps regarding the biology and the conservation status of the tamarin. Survey participants did not know the correct habitat for the tamarin nor how many tamarins exist in the wild. Despite specific gaps in knowledge, this analysis also showed an increase in *general* level of knowledge about the tamarin. For instance, there was a greater percentage of people correctly naming it as the golden-lion tamarin and recognizing that it is unique to the region.

Using logistical regressions, the study also identified the socio-demographic groups less knowledgeable about the tamarins. These included people with little formal education and women. In addition, the analysis found that people living in smaller towns had similar knowledge levels about the tamarin as people living in larger towns. This indicates that information about the tamarin has been broadly disseminated and it is not mainly concentrated in the larger towns as it was in 1986.

Results of this study will be used to improve the AMLD program and serve as a model for the evaluation of other environmental education programs in Latin America.

## CHAPTER 1 INTRODUCTION

Five hundred years ago, when the Portuguese arrived in Rio de Janeiro, Brazil, the rainforest covered more than 386,000 square miles along the Atlantic coast. Today, less than 7 percent of the original forest remains, and what is left is threatened by human activities (SOS Mata Atlântica and INPE 1993, WWF 2000). Although deforestation has been severe, the biological importance of the remaining coastal rainforest has been recognized by conservation organizations, including SOS Mata Atlântica, World Wildlife Fund and Conservation International, which consider it a priority ecosystem to conserve (WWF 2002, CI 2002, SOS Mata Atlântica 2000).

Presently, most of the Atlantic coastal forest remains clustered in the hilltops and hillsides along the coast. Residential, agricultural and industrial expansions are the main causes for the fragmentation of the forests in the coastal lowland regions of Brazil (Dean 1995). Although these forests are scattered in a mosaic of fragments, they support a high biodiversity of flora and fauna, including one of the most endangered primates in the world, the golden lion tamarin (*Leontopithecus rosalia*). The Atlantic forest (Mata Atlântica) is one of the most diverse ecosystems in the world. The Botanical Book of Records reports that out of the world's flora, more than 52 percent of tree species, 64 percent of palms and 74 percent of bromeliads are endemic to this type of forest (Botanical Book of Records 1993).

### **Golden-Lion Tamarin Project Background**

In fragments of forest in the state of Rio de Janeiro, lives a bright orange, squirrel-sized monkey, the golden lion tamarin (*Leontopithecus rosalia*). This animal has survived widespread deforestation because of the efforts of the Golden Lion Tamarin Conservation Association, also known by its Brazilian acronym – AMLD (Associação Mico Leão Dourado). The AMLD was established in 1983 with the support of a network of international and national organizations, to protect and sustain the continued increase of the population of wild tamarins and its dwindling habitat. The headquarters of the AMLD is in the Poço das Antas Biological Reserve, located 60 miles northeast of the city of Rio de Janeiro. The Poço das Antas Biological Reserve is a federal sanctuary of 6,213 hectares that protects the wild population of tamarins, as well as other species of local fauna and flora, such as the river otter (*Lutta platensis*), the Broad-snouted spectacled caiman (*Caiman latiróstris*), the monkey pot tree (*Lecythis pison*) and at least 244 species of birds (Dean 1995). In 1998 IBAMA created a second protected area nearby with the purpose of protecting the golden lion tamarin and its habitat, the União Biological Reserve. Other protected areas, known as private reserves of nature protection (RPPNs), have been created through a federal agreement with local land-owners, who agreed to conserve their patches of forests for the reintroduction of captive tamarins to the wild. The total area currently protected for the wild tamarin is more than 16,000 hectares. Throughout this territory, there are about 1,000 wild tamarins, including the populations in the two biological reserves and in the RPPNs. This has been an impressive increase from the 200 individuals reported to exist in the 1970s (AMLD 2000, WWF 2000).

The most common threats to the tamarins are deforestation, hunting inside the protected areas, fires within and around forest fragments, destruction of the forest

understory by cattle, and capture of tamarins for the pet trade (Pádua et al. 2002). Today, the threats continue to be the same, but have subsided due to the presence of conservation efforts and the existence of federal legislation that prohibits the use or removal of natural flora and fauna. These threats are exacerbated by trends in human population growth, landlessness, regional migration and distribution of wealth imbalances. In light of these challenges, the AMLD created an environmental education program that collaborates with surrounding communities to increase local participation in conservation activities by raising local knowledge and developing more positive attitudes and behavior towards the golden lion tamarin and its habitat (AMLD 2000). As research suggests, environmental education efforts can increase pro-environmental behavior and public support for the long-term conservation of habitats (Dietz and Nagagata 1995, Jacobson 1994, Pádua 1994, Monroe and Day 1997).

The golden-lion tamarin education program began in 1983 as one of the first programs in Brazil to sensitize people to the importance of protecting an endangered species and its habitat (Dietz and Nagagata, 1986, 1995, 1997). The environmental education program of the AMLD attracts public attention by using a “flagship” species, the lion tamarin, to preserve biodiversity. Studies on programs for endangered animals suggest that charismatic species attract more people to support conservation initiatives than the general concept of saving ecosystems (Kellert and Berry 1980, Kellert and Westervelt 1983, Westervelt and Llewellyn 1985, Dietz et al. 1994). By protecting the golden lion tamarin, the tamarin education project helps conserve coastal rainforest along with all the other endemic species (Dietz & Nagagata 1994).

Although the scope of the AMLD environmental education work reaches local, national and international audiences, the focus has always been on the local communities neighboring the Poço das Antas Biological Reserve. From the beginning of the program, the target audience selected by the environmental education team has been limited to three municipalities – Silva Jardim, Casimiro de Abreu and Rio das Ostras. The program's target audiences consist of: students and teachers from rural schools, visitors to the educational center, regional landowners, neighboring communities of settlers, and the rural and urban communities at large within these three municipalities. Over the years, AMLD educators have designed a variety of educational approaches in order to encourage locals to participate in conservation, including but not limited to ecological music festivals, plays, parades, school lectures, training courses for teachers, educational field trips, ecological contests, and art exhibits. The AMLD's educational program uses formal, non-formal and informal environmental education approaches to pursue its goals.

Through the formal environmental education approach, the program provides training for elementary school teachers and give presentations at schools during campaigns, special events and when requested. The teacher trainings are composed by a series of workshops covering content information and activities that emphasize the conservation of golden-lion tamarins and their habitat. The program has targeted teachers from elementary schools of local communities surrounding the protected areas where the tamarin lives.

Within the non-formal sector, the program provides information and activities to visitors of the environmental education center and offers support to groups such as, local youth clubs and community associations. The center has a comprehensive exhibit

describing the beginnings of the project and the importance of the tamarin, its habitat and the protected areas. There is also an interpretative trail that provides onsite information and gives a glimpse of the tamarin's habitat. Visitors and school groups walk the trail by themselves or led by one of the program's educators. Frequently, the program takes selected groups of students and tourists to see the tamarin inside one of the protected areas, which include the biological reserve and the RPPNs. The center receives a wide variety of visitors, ranging from school groups to local residents and to national and international tourists. Periodically, the program supports youth and community groups by offering conservation related information, materials and activities as well as logistical support, such as a place for events and/or meetings.

The program also attempts to cover the informal sector of environmental education by providing information to the local TV channels, the radio programs and the local newspapers with the intent to influence the attitudes, values, and knowledge of local communities regarding the golden lion tamarin. Media and fundraising campaigns such as the announcement of the birth of the 1000<sup>th</sup> tamarin and the fundraising for forest corridors campaign are two of the latest activities the program has organized.

The program ensures to maintain ties with government agencies such as the IBAMA (Brazilian Institute of the Environment and Natural Resources), the Forest Police, and the municipal secretariats for education, agriculture and the environment, as well as to relevant community associations and other non-governmental organizations.

### **Environmental Education as a Conservation Strategy**

Environmental education arose from the need to educate citizens about their surroundings in order to prevent and reduce the deterioration of the environment. Influential documents, such as *Caring for the Earth* (IUCN/UNEP/WWF 1991) and

*Agenda 21* (United Nations 1992) have reported that one of the important roles for environmental education is to stimulate social change towards a sustainable society. Environmental education has been regarded as a means of “learning how to manage and improve the relationship between human society and the environment, in an integrated and sustainable manner” (Meadows 1997, p.167). It is also known to have a positive long-term impact on people’s awareness, beliefs, attitudes and knowledge about environmental issues. These elements in turn may influence a consequent change in behavior and adoption of new and more sustainable conducts (Kaiser et al. 1999, Kuhlemeier et al. 1999, Mangas and Martinez 1997, Hines et al. 1986/87).

The practice of environmental education in countries “in development” faces very complex social situations where environmental problems are intimately related to social-economic conflicts. Environmental education programs provide people with opportunities for cognitive and affective gains as well as skills and empowerment to act and behave more sustainably toward nature (Pádua 1997, Iozzi *et al.* 1990.) In this context, the main objective for environmental education in Brazil, as suggested by Sorrentino (1995, p. 15) is “to contribute to the conservation of biodiversity, for individual and collective self-realization and for the political and economic self-management that will promote improvement in the environment and in people’s quality of life.”

Environmental education plays an important role in encouraging us to share our concerns, information and values, which may in turn lead to changes in how a society deals with environmental problems. Environmental education recognizes that it is not enough to understand an issue. People need to be active participants in solving the issue

at hand. The role of environmental education is to help the individual to go through this process of awareness into action (Weilbacher 1991). It is important to note, however, that environmental education does not aim at transferring ideological tendencies. Part of its goal is to provide a rich diversity of options, in which learners can choose the most significant alternatives relating to their own realities. Stapp (1996, p. 112) expresses this thought with the following,

Empowerment happens when education allows the educator and the learner to participate in processes that make them aware of their options and will encourage them to act, thus exercising their roles as citizens.

This process is fundamental since environmental, social and economic problems are increasingly more complex and the abilities of solving them are multifaceted and interdisciplinary (Weilbacher, 1991). In promoting the development of these abilities and new ethical paradigms, environmental education may contribute to a higher respect for life, not only human, but of all living beings.

### **Importance of Evaluating Environmental Education Programs**

Environmental education programs associated with protected areas in Brazil, and in most developing countries, suffer from insufficient funds and pressure from the migration of landless rural populations (Pádua 1994, AMLD 1999). These problems are magnified by the lack of time, money and trained people available to monitor, evaluate and improve existing educational programs. Improvement of any program depends on evaluation. Evaluations are useful for: “measuring the achievement of program objectives, assessing secondary outcomes and unanticipated impacts, identifying strengths and weaknesses in the program, analyzing the program from a cost-benefit perspective, improving program effectiveness, collecting evidence to promote future programs, and sharing experience and lessons learned with similar programs” (Jacobson

1999, p. 267). Evaluations “use scientific methods to measure the implementation and outcomes of programs, for decision-making purposes” (Rutman and Mowbray 1993, p.12). Program evaluation is an important step in the search for factors leading to successful programs because it is a means of improving program effectiveness (Jacobson 1987). In a study of 56 tropical conservation education programs, the only variable that significantly correlated with program success was the inclusion of evaluation (Jacobson and Norris 1998). It has been noted that in the fields of conservation and rural development there is a great need to identify variables associated with program efficacy (Ameyaw 1992, Brandon and Wells 1992).

In environmental education, public support is an essential feature for the success and continuation of a program. Public support is measured through public participation, public satisfaction with the program and positive change in behavior toward the conservation of the environment. Studies have demonstrated the positive correlation between environmental education, public participation and program success rate (Jacobson and McDuff 1997, Hewavitharana 1994, Finsterbusch and Van Wicklin 1987). Research has also demonstrated that evaluation is an important element in correcting the course of environmental education activities (Pádua and Jacobson 1993, Gerakis 1998, Heffernan 1998). One example of an education program that used evaluation results to improve its strategy was the seabird conservation program on the North Shore of the Gulf of St. Lawrence, Canada (Pomerantz 1992). The results of this evaluation strengthened educational strategies aiming to improve the knowledge, attitudes and hunting behaviors of local people in order to reverse population declines of seabirds (Blanchard 1995).

Most evaluations in the environmental education field are conducted within short intervals of time. Evaluation instruments, such as before and after tests, surveys and interviews have been applied to target audiences to assess a one-time visit to a nature exhibit (Heffernan 1998, Chin 1985), a park (Padua and Jacobson, 1993), or a zoo (Marshdoyle et al. 1982, White and Jacobson 1994), or to examine the immediate effect of a one week course (Wood 2001, Bennet and Padalino 1989), a four-to-eight week class (Armstrong and Impara 1991), or a three month long workshop in a zoo (White and Jacobson 1994). These evaluations occurred near the beginning and end of the program activities and seldom looked at long-term impact. Performing evaluations within a short period helps to control for external variables, such as the impacts of historical events and of the media. In executing the evaluation right away, there is higher certainty that the behavior being measured is due to the program or activity. However, it does not assess the long term impact of the activity or program.

Longitudinal studies are designed to permit observations of the same phenomena over an extended period (Babbie 2001). Studies that looked at longer term impacts of environmental education programs were performed by Ryan (1991), Dietz and Nagagata (1995), Paaby and Clark (1995) and Gray (1997), who evaluated programs within one or two years of activities. Fewer attempts have been made to examine the impact of programs after more than two years of activities. Westphal and Halverson (1985/86) and Weber (1995) performed longitudinal evaluations to examine citizen involvement and support for conservation programs within five years of activities. Westphal and Halverson (1985/86) found several attitudinal and behavioral changes resulted from participating in an educational program, the most common of which were: greater

awareness about the topic and more confidence in discussing environmental issues publicly. Weber (1995) used attitudinal surveys and reported that program participants demonstrated increased positive attitudes about the support wildlife tourism provides to park protection even after five years of the onset of the program. Blanchard (1995) performed a longitudinal evaluation within a period of seven years to examine the impact of a seabird conservation program on a local community in the shore of Canada. She reported a sustained improvement in the target audience's knowledge, attitudes and behavior towards seabirds and greater local support for the conservation program. These longitudinal evaluations provide evidence of long-term impact. In the field of education, this is an important finding since educational processes take longer to generate the intended outcomes.

### **Beliefs, Knowledge and Attitudes**

This study evaluates the AMLD program by exploring public beliefs, knowledge and sources of information about the golden lion tamarin and its environment after 18 years of implementation. Questions from the original 1986 survey have been identified as either measuring participants' individual beliefs or levels of knowledge regarding the tamarin and the environment. Beliefs and knowledge are elements embedded in a person's attitude toward a person, place, event, etc. (Kaiser et al 1999, Stutzman and Green 1982, Fishbein and Ajzen 1975). Most behavioral models identify knowledge, beliefs, attitudes and intentions as the major components in the process of generating a specific behavior. In order to understand this study's purpose in measuring beliefs and knowledge levels, this section explores a few of the theoretical models that explain the role of beliefs and knowledge in the construction of attitudes and behavior.

According to Ajzen and Fishbein's Theory of Reasoned Action (Ajzen and Fishbein 1980), understanding the attitudes of people indicates what behaviors they might be likely to perform. This theory describes attitudes as a function of two factors: a person's beliefs about the consequences of their behavior also called the subjective norm factor, and the person's evaluation of those consequences, also referred as the attitude toward behavior factor (Fishbein 1963). Knowledge is not considered a separate component in this model, but it is referred to as a cognitive component that influences the construction of a belief. Thus, a person's attitude is favorable if there is belief or knowledge that performing the behavior will lead to a positive outcome. In contrast, the attitude becomes negative if the person believes or knows that the behavior will generate negative consequences. A favorable attitude engages individuals in a particular behavior, while negative attitudes cause them to avoid certain behaviors. Hence, Ajzen and Fishbein suggest that modifying behavior requires changing a person's underlying beliefs or knowledge about the consequences of specific behaviors. Several studies have used this theory to show that environmental beliefs are related to ecological behavior intentions (Stern and Dietz 1994, Axelrod 1994, Van Liere and Dunlap 1981).

The theory of planned behavior expands the theory of reasoned action by including the impact of behavior that people are unable to control, also known as perceived behavioral control component (Ajzen 1988). This component refers to how easy or difficult it is to perform the behavior based on experiences and possible anticipated obstacles. Thus, for example, when a person believes an animal can be protected through the work of conservation, s/he will contribute to conservation organizations. If a person does not believe that when they put a newspaper in the recycle

bin that it is actually recycled, they are not likely to recycle their newspaper. Fishbein and Manfredo (1992) suggest that to influence attitudes toward a specific behavior, it is necessary to change or reinforce the particular belief and/or their evaluative aspects. They argue that it is possible to use beliefs in developing messages designed to reinforce or change an audience's intentions and that these messages should deal with specific beliefs that underlie the targeted intention.

The model of responsible environmental behavior is another major theory used in explaining the relationships between behavioral components. Hines et al (1986/87) found that the interaction of different types of knowledge together with personality factors determines the intention to act and eventually leads to the desired responsible environmental behavior. Knowledge in this model is more than simply knowing ecological facts. It also includes knowledge of action strategies, action skills, environmentally sensitive attitudes, and exercises to develop self-efficacy. Developing these kinds of knowledge is particularly important in allowing an individual to adapt strategies to situational factors that create changeable conditions. If knowledge is limited to a particular situation, a person may be unable to adapt when changes occur. A study performed by Hsu and Roth (1988) found that knowledge and skills in using action strategies were powerful predictors of responsible environmental behavior. Based on the findings of their study, they concluded that a person is more likely to be environmentally active if s/he has knowledge of action strategies, accepts environmental responsibility and has positive environmental attitudes.

As indicated by the theoretical models described above, belief and knowledge are essential elements in forming attitudes and thus indirectly influencing the development of

a behavior. In the environmental context, Hoban and Clifford (1992) described attitudes by defining them as an expression of beliefs, feelings, deeply rooted values and preferences relative to a person's experience with specific aspects of the natural world. Marcinkowski (1993) showed that positive attitudes provide incentives for individuals to seek more information about environmental issues. McDonough and Lee (1990) have also argued that the increase in levels of knowledge and positive beliefs may be used as indicators of program success. Furthermore, several studies have looked at the relationship between environmental responsible attitudes and levels of knowledge and have found positive and often significant relationship between the two variables (Cano 1998, Kellert 1996, Hartcourt et al 1986, Fialho and Jacobson 1995, Lyons and Breakwell 1994, White 1993, Armstrong and Impara, 1991, Infield 1988, Olson, Bowman and Roth 1984, Taylor and Daniel, 1982).

In conclusion, an individual must first have the relevant knowledge and beliefs in order to have a positive environmental attitude, which ultimately may generate an environmental responsible behavior. Nevertheless, the progression from beliefs and knowledge to informed behavior is not a simple or linear one (Dillon and Gayford 1997). The only conclusion currently established is that the major components of behavior change are knowledge, beliefs, attitudes and behavior. What types of variables interact with each other remains to be determined in future research.

This evaluation measured the long-term changes in beliefs and knowledge regarding the tamarin in order to assess the AMLD environmental education program. Understanding these changes may help to improve program effectiveness and the local levels of support towards the conservation of tamarins and their habitat.

### **Description of the 1986 Evaluation of the AMLD Education Program**

A baseline evaluation was conducted in the initial phases of the program, between 1984 and 1986. Dietz and Nagagata (1995) used a pre/post-test evaluation design by applying a survey in 1984 and a second survey after two years of educational activities. The surveys included questions related to beliefs, knowledge, and information sources regarding the wildlife, forests, and local protected areas. The treatment groups involved students from the local schools and the general adult population in the region. Results from the study indicated an increase in knowledge about the reserve, the golden lion tamarin and the value of forests in both adults and students (Dietz and Nagagata 1995, 1997).

### **Research Objectives and Hypothesis**

The research objectives of this evaluation are to

- (a) Provide accountability of the AMLD environmental education program by assessing public awareness and support generated by the project,
- (b) Improve the AMLD environmental education program delivery by identifying strong and weak features of the program and suggesting modifications.

The research hypothesis of this study is:

The 2001 evaluation of the environmental education program will show (a) an increase of local public awareness and (b) a positive shift in the local support towards the golden lion tamarin compared to results of the 1986 evaluation.

In measuring public knowledge and support resulting from the activities of the AMLD environmental education program, the evaluation answers the question: “Is the program successful?” I compared the results of the 2001 survey to the results of the 1986 survey, concerning changes in knowledge and beliefs of local residents. The evaluation from this accountability perspective is useful in showing the level of support gained or lost in the 15 years since the last evaluation. The second objective of this evaluation has

a managerial context since evaluation results can be used to make better decisions about the design and the delivery of programs (Rutman and Mowbray 1983). In order to make changes to improve a program, managers need to understand how their program is being implemented and how the mechanisms of the activities affect the outcomes (Rutman and Mowbray 1983). By identifying strong and weak environmental education program elements, the managers can generate improvements to the program. This study may assist program managers by providing information to modify activities and techniques of information transfer so that the program can be made more effective.

In addition to quantitatively assessing knowledge, beliefs and information sources of local communities to provide breadth and generalization of results, this evaluation included focus groups to present more in-depth, descriptive context of the study results. Evaluation studies become considerably more powerful when using a combination of quantitative and qualitative methods of assessment (Marcinkowski 1993). Combining a number of data collection instruments improves results by ensuring higher validity and confidence in the findings. Information collected through qualitative and quantitative methods benefits from the strengths of each instrument while minimizing the flaws inherent in single strategies (Cantrell 1993).

The products and impacts of the environmental education strategy of the AMLD have not been assessed since 1986. As the environmental education program has been conducted continuously for 18 years, it offers an excellent opportunity to gather, analyze and compare valuable information to improve the program and disseminate its long term successes and challenges. By conducting a program evaluation of the educational component of the AMLD, this study contributes to our understanding of long-term

impacts of environmental education. This study also may serve as a model for other projects in Brazil to evaluate and improve their environmental education programs.

## CHAPTER 2 DESIGN AND METHODS

Surveys are useful for measuring public attitudes and knowledge. Randomized surveys allow generalizations to be made from a sample to a population. Focus groups are a useful method to explore broad attitudes, motivations and behaviors of audience interest as well as to develop a deeper understanding of a program (Jacobson 1999). Methodological diversity allows the strengths of one technique to compensate for the weaknesses of another. This study used surveys and focus groups to assess the impact of the AMLD environmental education program on the communities surrounding the sites where tamarins live. This study compares results of an evaluative survey conducted in 2001 with findings of a 1986 survey conducted by Dietz and Nagagata (1995).

### **Site Description**

The study site encompasses the area of local activity of the Golden Lion Tamarin Environmental Education Project, located at the Poço das Antas Biological Reserve in the northeast region of the Rio de Janeiro state, Brazil (Figure 1). The AMLD administration and education center are located between the two counties of Silva Jardim and Casimiro de Abreu. A major federal highway (BR 101) provides easy access to the AMLD from the surrounding communities. The two neighboring municipalities accommodate an estimated 44,000 people (IBGE 2000) in rural towns or dispersed on farms or ranches. Local residents currently share this area with 1,000 wild tamarins. The main economic activities in the region relate to agriculture, cattle ranching and commerce (Guia Sócio-econômico dos Municípios do estado do Rio de Janeiro 1993).

Six communities in the counties of Silva Jardim and Casimiro de Abreu were selected for this study's population. The communities were selected based on three criteria: (1) those that participated in the 1986 evaluation which included 24 communities (Dietz and Nagagata 1995), (2) communities that are or have been included in the program's education strategy, according to information from the AMLD annual reports (AMLD 1992, 1993, 1994, 1995, 1996/1997, 1998, 1999, 2000), and (3) communities within 60 kilometers of the reserve's environmental education center. Of the six communities chosen, two are large towns - Casimiro de Abreu and Silva Jardim (with about 14,000 inhabitants each) and four are smaller rural towns – Rio Dourado, Professor Souza, Aldeia Velha and Imbaú, (with about 1,300 inhabitants each). Because a list of 1986 survey participants was not available, a trend study format (Babbie 2001) was used to examine changes within a population over time without having to survey the same exact participants. A database containing information from the 1986 surveys was used to compare with information collected in 2001. The comparison included only data from the six communities selected.

### **Sampling Design**

In order to control for variation in the information collected in 2001, simple random sampling was used to select respondents. A list of customers from the local water company serving the county of Casimiro de Abreu and the 1996 IBGE (Instituto Brasileiro de Geografia e Estatística – Brazilian Institute for Geography and Statistics) regional and sectored census maps for the county of Silva Jardim were used to randomly select the respondents of the survey. For the list of customers from the local water company (SAAE – Sistema de Abastecimento de Água e Esgoto), I used the IBGE's aggregated database (available online) to confirm that most people (96%) in the Casimiro

de Abreu county have water service (IBGE 2002). As I was not able to find a similar list for the communities surveyed in the Silva Jardim county, I relied on the 1996 IBGE's census maps. These maps provided the total number of homes and their locations for each street, which allowed for a random selection of houses. When the selected person was not found at home, the team returned two other times. If after three times the first selected person was not found, the team picked the neighboring house and interviewed the available adult member of the household, again trying three times until someone was found.

In contrast, the 1986 sampling method relied on available subjects. The survey was applied to those who were at home or in the streets at the time researchers visited the communities. This technique is inefficient because it may produce biases, such as not surveying those at work. Although the sampling techniques for both evaluations differ, it was a necessary step to avoid the potential unreliability problems of the 1986 sampling method.

### **Quantitative Methods**

For purposes of performing a comparative analysis using a time series design (Kosecoff and Fink 1982), the questionnaires followed the protocols used in the first program evaluation performed in 1986 (Dietz and Nagagata 1995). We used forty-eight of the original questions and added seven new questions at the end of the survey. These seven questions were added to examine elements of the program included since 1986. The survey instrument was pilot tested (N=6) with available subjects of the chosen communities during June 2001, and revisions were made based on the results. The questions were both open and close-ended, targeting people's belief values (10 questions), knowledge specific to the golden lion tamarin (9 questions), general

knowledge about the local environment (4 questions), sources of information about the tamarin and nature (2 questions), and standard demographic information (8 questions) (Appendix A). Ten questions were later dropped from the analysis due to problems in the design of the question or to difficulties faced during data collection (Appendix A).

A team of three people (two locally hired assistants and the researcher) conducted the surveys in the six communities. The team applied face-to-face questionnaires with adult members 18 years old and older between July and August 2001.

### **Survey Indicators of Belief and Knowledge**

This study surveyed the audience's beliefs, knowledge and sources of information about the golden lion tamarin and local nature. Measures include 10 belief items (Table 1) and 20 knowledge items (Table 2), of which 4 are focused on nature, 9 are specific to the golden lion tamarin, and 7 are related to recent aspects of the program. The 7 questions added to the 2001 survey assessed other relevant information not included in the 1986 survey, such as, people's awareness of the Biological Reserve União and its location, awareness of the AMLD and its purpose, and knowledge about the meaning of forest corridors and ecotourism. These elements of the program were established after 1986. Several survey questions on people's beliefs, knowledge and source of information about the golden lion tamarin were only asked of those who recognized the picture of the animal. The sample size for some items is smaller than the size of the sampled population. Qualitative questions also have smaller sample sizes due to no response answers.

The analysis of belief and knowledge was done in two ways: by using separate empirical indicators of the each concept and by combining the individual questionnaire items into a summary index. In analyzing each belief and knowledge indicator, it is

possible to focus attention on each specific question. By combining several responses into a single index, the goal is to generate a measure that may reflect an individual's overall knowledge of and beliefs about the tamarin. An additional advantage of the summary index is that its value can be used in a regression analysis that permits the introduction of statistical controls.

### **Demographics and Other Relevant Information**

Socio-demographic variables in the surveys include larger/smaller communities, years living in the community, years of education, age and sex. Other information requested included open-ended questions that had respondents identify: benefits provided by the forest and the importance of tamarins to the individual/community.

### **Qualitative Methods**

The qualitative approach used to assess people's perspectives towards the project was the focus group technique. Focus groups are defined as group interviews composed of a homogeneous collection of 7 to 12 individuals who share key characteristics, such as, age, race or occupation (Jacobson 1999). The strengths of the focus group method are that it allows for sharing and stimulating ideas between the participants, as well as it allows for the moderator or other participants to explore people's perceptions about the topic of interest. However, since participants are purposefully selected, it is not possible to extrapolate the results to a broader context. Thus, I used this method primarily to obtain a deeper understanding of local people's beliefs and knowledge about the program elements.

I intended to perform one focus group with each of the six targeted communities; however due to lack of time and resources, I conducted focus groups in only four of the

six communities. Participants of these focus groups shared the characteristic of being a parent of a student from the local elementary schools.

To select participants for each focus group, I randomly selected 20 names out of a list of parents (both mothers and fathers) of students in the public elementary schools of each of the communities. Invitations were sent home with the selected students. Invitations stressed that participation was voluntary, explained the objective of the focus group, emphasized the meeting would not take more than an hour and offered participants a snack and a small gift (a sticker of the AMLD). The meetings took place in a school classroom at an hour the local teachers suggested to be the best. I also performed one pilot test focus group, from which revisions to the questions were made. I tape recorded the conversations and had an assistant take notes. According to recommendations by Morgan (1997), I followed a discussion guide with suggested questions/activities. Open-ended questions were similar to those asked in the survey, but presented in ways to encourage discussion among participants (Appendix for focus group instrument).

This research on human subjects received UF IRB approval, IRB 2001 – 381.

## **Data Analysis**

### **Quantitative Data**

Survey data was directly entered into an SPSS 10.0 software package for statistical analysis. Standard descriptive and inferential statistical procedures were utilized for data analysis (Agresti and Finlay 1997).

Answers related to belief and knowledge measures were converted into dichotomous variables. I used frequency distributions to compare the change in frequency from 1986 to 2001 and chi-square analysis to check for the significance of any existing change. When analyzing trends and examining differences between open-ended

questions or between questions with more than two options for answers, Chi-squared tests were also used to identify significant differences. The Chi-square analysis in these cases was calculated manually using the following formula:

$$X^2 = \frac{\sum (fo - fe)^2}{fe} \quad \begin{array}{l} fo = \text{observed frequency} \\ fe = \text{expected frequency} \end{array}$$

$$= \frac{(\text{row total})(\text{column total})}{\text{total sample size}}$$

Answers for open-ended questions were coded and grouped into categories (Appendix B) in order to facilitate analysis. Significant differences are reported at the alpha level of  $p < 0.05$  and  $p < 0.01$ . Regression analysis was used as an inferential tool to evaluate the relationship in the population from the analysis of sample data.

Regression analysis investigates whether an association exists between two variables and examines the strength and the form of this relationship (Agresti and Finley 1997). Questions related to respondents' level of belief and of knowledge were grouped together into three different indexes. Indexes were built to allow regression analysis techniques to examine the influences of demographic variables on belief and knowledge questions. I used Cronbach's alpha coefficient to describe reliability of belief and knowledge measures for each survey. The Pearson correlation coefficient,  $r$ , was applied to measure the strength of relationships between the dependent variable and the following independent variables; age, gender, education, larger/smaller communities and years living in the county. Standardized  $b$  regression coefficients were used to estimate the relative importance of the dependent variables in their relationship with the independent variables. The regression was done separately for the 1986 and for the 2001 samples.

**Qualitative Data**

I used qualitative data from focus groups to better understand the context of the survey results. The information was later transcribed from the tapes and merged with the notes collected by an assistant. Information was then grouped into categories of beliefs, knowledge and sources of information related to the tamarin and its conservation.

## CHAPTER 3 RESULTS

### **Survey Response**

The comparison of the two surveys included 314 participants from 1986 and 352 participants from 2001, for a total of 666 questionnaires. The 314 participants from 1986 were selected out from a database of 1,021 questionnaires according to the communities selected for this study.

For the surveys conducted in 2001, the non-response rate was zero. Every person contacted agreed to respond to the survey, although on a few occasions the interviewers had to return later due to the participant's lack of immediate time to participate. Nonetheless, two questionnaires (in addition to the total of 352) had to be discarded since observations by the data collector indicated that the participant was unable to focus on the questions due to the presence of small children calling for attention.

### **Socio-demographic Backgrounds**

The mean age of respondents was 38 years old (S.D=16.2) in the 1986 survey, and 41 years old (S.D=16.15) in 2001 (Table 3). In the 1986 survey, 62% of the respondents were female and 38% were male. In 2001, 52 % of the study population was female and 48% was male. Hence, both the age and sex structure of the sample differed.

In 1986, 72% of respondents were from the two largest towns in the county (more than 10,000 inhabitants), Casimiro de Abreu and Silva Jardim, whereas in 2001, the comparable figure was 66%. The proportion of the sample in the smaller towns (less than 2,000 inhabitants) was 28% in 1986 and 34 % in 2001. The number of surveys done

within large communities was similar to the number done within smaller communities; thus, no significant differences between the two datasets in this context were found.

More than half of the people interviewed in both surveys were raised in the region (54% in 1986 and 56% in 2001). Those that migrated reported living in the region a mean number of 14 years for the 1986 survey (S.D.= 13.67) and 17.7 years in 2001 (S.D.= 12.49) (Table 3).

More than three quarters of the people surveyed in both samples attended formal school (87% in 1986 and 92% in 2001). Most people had from one to eight years of school (74% and 69%, respectively for 1986 and 2001). Not surprisingly, fewer people had nine to eleven years of formal education (11% and 20%, respectively) and fewer still had some college education or above (2% and 3%, respectively) (Table 3). IBGE figures confirm that the average number of years of school per person for these regions is between 3.4 to 4.5 years of school (IBGE 2000). Respondent education significantly increased between 1986 and 2001.

## **Beliefs and Knowledge**

### **Beliefs about the Golden-lion Tamarin and its Conservation**

We asked ten questions related to respondents' beliefs about nature (7 questions) and about the golden-lion tamarins (3 questions) (Table 1). When the two surveys are compared, results indicate an increase in positive beliefs toward the conservation of the golden-lion tamarin and its habitat over the fifteen-year period.

More than three quarters of respondents in both surveys believed the GLT was important (83% in 1986 and 90% in 2001), with a significant increase in 2001 (Table 4). An open-ended question asking respondents to specify the importance of the tamarins also showed an increase in a positive belief for their preservation. To facilitate the

analysis of this open-ended question, responses were coded into two main categories of importance: for human needs and for the environment (Appendix B). Results showed a significant increase in responses related to environmental importance (22% in 1986 and 52% in 2001). A large decrease in frequency of responses related to “the animal is important for human needs” occurred from 1986 (77%) to 2001 (47%) (Table 5; Figure 2).

Respondents also indicated a positive belief in their answers to what they would do when encountering a “little monkey” in the woods. When given a choice of answers, such as “take it home”, “sell it”, “kill it”, or “leave it alone”, respondents answering they would not disturb the animal rose from 75% in 1986 to 91% in 2001 (Table 6).

This same type of question was asked about other animals such as a little bird, a paca (*Agouti paca*), a caiman and a snake. Results show a pattern of increase in respondents’ beliefs that wild animals should not be disturbed (Figure 3). Whereas the responses for the paca (27% point increase), the snake (23% point increase) and the caiman (12% point increase) had significant increases, the change was not significant in the case of the bird (Table 6).

Another question related to wild animals also indicated a significant increase in the belief that wild animals were not harmful to human activities. The proportion of the sample who held this belief rose over the fifteen-year period, from 85% in 1986 to 92% in 2001 (Table 4).

Additional questions focused on the perceived benefits that the forest holds for humans. The results showed that most of the respondents in both years seem to agree that forests are beneficial. The proportion of people who held this belief was similar in

both years (Table 4). A subsequent open-ended question asked respondents to specify a benefit provided by the forest. Responses to this question indicated that a large proportion of people in both surveys believe that the benefits forests provide relate to the conservation of nature rather than in providing products and services for human consumption. From 1986 to 2001, this result remained the same, showing a higher frequency of responses (88% in 1986 and 95% in 2001) affirming that forests provide benefits related to conservation (Table 7).

### **Knowledge about the Golden-lion Tamarin and Its Conservation**

Knowledge questions about the golden-lion tamarin and its conservation were restricted to those knowledge areas that had been the focus of the 1986 survey. The survey instrument included thirteen knowledge items, nine of which were specific to the golden-lion tamarin and four pertained to the local environment. Results demonstrated a significant increase in several knowledge questions about the golden lion tamarin.

The frequency of respondents who recognized and correctly named the animal in the picture as the golden-lion tamarin rose significantly from 68% in 1986 to 94% in 2001 (Table 8). In the earlier survey, respondents used 23 different names for the animal. There were also significant increases from 1986 to 2001 in respondents' awareness that tamarins are found in the region and found only in the state of Rio de Janeiro. Knowledge about the correct purpose of the Poço das Antas biological reserve, such as for protection of animals and plants, also increased significantly between 1986 (90%) and 2001 (97%).

Significant decreases in knowledge occurred for two of the survey measures, while no changes were found with respect to two other measures. In 1986, more people (53%) responded correctly to the question related to the social family structure of the

tamarin than in 2001 (33%). A significant decrease occurred in knowledge that tamarin prefer living in small family groups of parents and offspring (average of 6 per group). There was also a decrease of correct answers from 1986 (68%) to 2001 (36%) in the awareness of the total number of golden-lion tamarins existing in the wild. Less people in 2001 answered the correct number of tamarins living in the wild (currently 1,000 tamarins) than in 1986 (500 tamarins). In addition, no significant changes occurred among the frequencies of respondents recognizing the tamarin from a picture (80% in 1986 and 75% in 2001), answering the correct habitat for the tamarin (47% in 1986 and 44% in 2001) or in identifying the correct location for the reserve (90% in 1986 and 97% in 2001) ([Table 8](#)).

### **Knowledge about Environment**

Only one measure showed an increase in knowledge pertaining to the local environment. A significant increase occurred between 1986 and 2001 in respondent's agreement with the existence of a nearby protected area intended to conserve animals and plants. In 1986, 75% of participants agreed with the statement while in 2001 this proportion increased to 86% ([Table 9](#)).

The remaining questions related to other aspects of the environment and to the consequences of human activities. One item was designed to measure the degree to which people knew the names of any endangered species in the area. The other two items referred to deforestation (whether it weakens the soil; and whether it was deemed to be a problem in the area). A comparison of responses in the two surveys showed no significant change in these items ([Table 9](#)).

### **Regression Analysis**

The previous section presented an analysis of beliefs and knowledge using separate empirical indicators of the two concepts. In this section, the objective is to report the results of the regression of the belief and knowledge summary indexes.

There were two objectives in performing these regressions. The first was to examine the variation in the knowledge indexes about the tamarin and local environmental issues between 1986 and 2001. The second reason was to understand the differences in knowledge among the various socio-demographic groups.

### **Reliability Analysis**

Before proceeding with the regression, it was first necessary to assess the internal consistency of the various indexes. The test used to measure inter-item correlation reliability was the Cronbach alpha for reliability analysis. If the Cronbach's coefficient is  $\leq 0.30$ , items do not share a common theme, while coefficients  $\geq 0.80$  strongly indicate a common domain between items (Witter 1978). For the purposes of this research, a Cronbach's alpha of  $\geq 0.30$  was considered reliable.

Three indices were constructed from the survey to examine the beliefs and knowledge pertaining to the tamarin and its conservation. [Table 10](#) shows the reliability values for the three indexes. The index for knowledge about the tamarin and the index for knowledge about nature reported alpha values greater than 0.3, while the reliability value for the index of beliefs about the tamarin were lower than the 0.3 suggested threshold (Witter, 1978). Thus, only the two indexes of knowledge were used for the regression analysis while the index of beliefs was discarded due to its low reliability value.

## **Knowledge Indices**

The total score of each index was used as the dependent variable in a regression analysis. Additional socio-demographic indicators were entered as independent control variables. The latter included: year of survey, education, sex, age, place of residence and years living in the county. The literature on environmental education suggests that socio-demographic variables correlate sometimes with a person's environmental attitudes (Fiallo and Jacobson 1995, Furman 1998, Kellert 1993, Blum 1987, Frost 2000). Moreover, the regression results based on the two surveys may provide substantively important insight into changes over time in the determinants of environmental knowledge.

### **Knowledge index about the golden-lion tamarin**

Overall, knowledge index levels were in the mid range for both samples. On a scale of 1 - 9, the sample mean score for 1986 was 4.63 (S.D.=2.75) and for the 2001 sample was 4.92 (S.D.=2.47) (Table 11). This shows that both in 1986 and 2001 people correctly responded to about half of the knowledge questions. Table 12 presents the *b-coefficient* values for the regressions of the samples of 1986 and 2001. The R-square is 15% in 1986 and is similar fifteen years later - 13%.

Although the regression analysis reports no significant change in knowledge between 1986 and 2001, there are interesting patterns related to demographic variables that can be compared across the years. More specifically, we can use regression analyses to answer a question fundamental to understanding the nature of environmental knowledge. This question concerns the determinants, or covariates, of the knowledge index. In other words, it highlights which of the independent variables has the largest

effect on knowledge once the other socio-demographic controls are entered into the equation.

The literature suggests that a good predictor of environmental knowledge is the amount of formal education that a person has acquired (Arcury 1990, Arcury and Johnson 1987, Lovirich et al. 1986). I converted the education variable into 4 dummy variables, using *no education* as the reference category. The dummy variable technique is useful in this context because it will enable us to see the impact of a given level of education on the knowledge index. Put another way, rather than treat education as a single variable (with a single *b-coefficient*), we can observe the effect of, say, 1-8 years of education and compare it to the effect of 9-11 years of schooling. This flexibility allows us to identify nonlinearities in the data and to compare over time the effects of a particular level of education on the knowledge index.

The results in [Table 12](#) show that knowledge about the tamarin increases as years of schooling increase. Because all of these coefficients are statistically significant, these findings clearly support the premise that education is positively correlated with knowledge about the tamarin. The dummy variable approach permits us to further conclude that the relationship is virtually linear: each increase in the schooling category is associated with an increase of around 1.2 points in the knowledge index. The effects of education are a net of the statistical controls for the other variables in the equation – namely, sex, age, place of residence, and the number of years that individuals have lived in the county. In other words, even after taking all the other variables in consideration, the education variable still performs in similar manner as when analyzed on its own. No

significant changes resulted when calculating the z-scores across the years for each category.

Gender differences were also noted for each sample. Males seem to know more about the golden lion tamarin than females in both the 1986 and 2001 samples. In 1986, the knowledge index was greater by 0.81 for males in respect to females (reference category), while in 2001 it was greater by 1.33 points (Table 12). Comparing across the years in this case reveals that in net of the effects of education and the other controls in the equation, the gender gap continues but did not significantly change.

Further analysis of this knowledge gap was performed to explore possible differences in the ways men and women receive information. An index from 0 to 3 was constructed for mass media sources of information (TV, radio and newspapers), in which 0 referred to no media influences, 1 referred to influences of 1 type of media, 2 referred to 2 types, and 3 referred to 3 types. T-tests and chi-square tests were performed to check for differences in media use by gender. T-tests revealed that for both men and women there was a significant increase in the reported usage of mass media between 1986 and 2001 (Table 13). Further analysis showed that men and women reported similar amounts of media influences in 1986 ( $t=.171$ ,  $df=312$ ,  $p>.05$ ), but in 2001 there was a higher usage of the media by men ( $t=3.26$ ,  $df=350$ ,  $p\leq .001$ ) (Table 13). Chi-square analysis revealed that in 2001 men reported acquiring more information about the tamarin from TV and radio than women (Table 14). No significant differences in mass media usage between genders were found in 1986.

Knowledge also increased for respondents living in larger towns. This occurred even after taking into account the effects of education. For the 1986 sample, knowledge

about the golden lion tamarin in larger towns was significantly higher, increasing 0.68 in respect to smaller towns – the reference category. In the 2001 sample, however, the difference was not statistically significant (Table 12).

Finally, the regression revealed no significant differences between respondents based on age, or by how many years an individual has lived in the county. Although one might expect newcomers to the area to be less informed of environmental issues (and hence a negative coefficient), this was not the case in this study for either year.

### **Knowledge index about the local environment**

Regression analysis results for the knowledge index about environmental issues were generally similar to the knowledge index about the tamarin. Knowledge pertaining to local environmental issues increased as respondent's formal education increased for both samples. Respondent's sex and place of residence also had significant impacts on people's knowledge. For both sampled population, men knew more about these issues than women and residents of larger towns scored higher than residents of smaller towns (Table 15).

The regression for this index, however, also reported a few contrasting results from the previous regression. Knowledge about environmental issues for the 1986 sample was significantly different between those that did not have schooling and those that had 1 to 8 years of formal education. This significance, however, was not present in the results for the 2001 sample. A similar situation occurred in regards to the association between knowledge about nature and the years a person had spent in the county. For the 1986 sample, the longer the respondent had lived in the county, the more s/he would know about nature. In 2001, there were no significant changes in knowledge between those living longer in the area with those living there for shorter periods. The negative

values occurred because the reference for this variable was “0 years”, which represents those people who lived in the area since birth.

No differences were found between respondents based on age for either sample. The variance explained for both 1986 and 2001 samples was 11% ( $R^2= 0.11$ ) (Table 15).

### **Sources of Information about the Golden-lion Tamarin and the Environment**

Two “multiple response” questions were designed to determine how audiences receive environmental information. One question focused on examining where people get information specific to the golden lion tamarin. The other question looked at sources of information about general nature issues. Respondents chose their preferred sources of information from two lists, each presenting 14 different options.

### **Sources of Information about the Golden-lion Tamarin**

Table 16 shows relevant sources of information about the golden-lion tamarin and the changes in frequency within the two specific points in time. Overall, there were increases in the frequency of responses for most of the referred sources.

The source of information with the highest percentage change was that of printed media (newspapers and magazine) with a significant increase in frequency from 16% in 1986 to 64% in 2001. A greater proportion of respondents, however, mentioned television as their main source of environmental information, a response that increased in frequency from 52% in 1986 to 95% in 2001. Radio also increased as a source of information, although not as sharply as the other media. Figure 4 illustrates the increase in responses related to media sources of information between the survey years.

Significant increases occurred for various sources of information related to the environmental education program. The frequency of responses indicating the usage of environmental education materials such as posters and brochures increased from 43% in

1986 to 73% in 2001 (Table 16). People mentioning t-shirts with tamarin pictures as information sources increased in frequency from 29% in 1986 to 69% in 2001.

Affirmative replies related to environmental education activities such as school classes provided by the project also increased considerably from 8% in 1986 to 43% in 2001.

Furthermore, more people in 2001 reported having heard or seen the golden lion tamarin by watching educational movies. Further educational activities that had significant increases in frequency of replies from 1986 to 2001 were: excursions to visit the tamarin and the community meetings organized by the program. Figure 5 illustrates the sources of information related to environmental education that demonstrated significant increases from 1986 to 2001.

Less people reported having received information about the tamarin from a street parade (8% in 1986 to 4% in 2001). This was expected as this event was only done in the initial phase of the program. Annual reports from 1992 to 2000 reported no occurrences of parades. The educational activities that reported a non-significant change were the mobile exhibits and the play about the tamarin.

Sources of information unrelated to the activities of the EE program also reported significant increases in 2001, such as visits to the zoo and talking to other people about the golden lion tamarin. In regards to other people, participants in the 2001 survey, in contrast to those in 1986, responded that adults (5% in 1986 and 75% in 2001), not children, were the ones who most frequently shared information about the tamarin (Table 16).

### **Sources of Information about the Environment**

For sources of information on the environment, television emerged as the source with the highest significant increase – from 36% in 1986 to 89% in 2001 (Table 17).

Smaller significant increases were also reported in 2001 for printed media (newspapers/magazines) and for radio. [Figure 6](#) shows the increase in frequency of response for media sources of information on nature from 1986 to 2001.

Results indicated that environmental education activities have had a positive impact on survey participants as information sources about nature. Educational materials, such as posters and brochures had one of the highest significant frequency changes as a source of information about nature (from 11% to 56% in 2001) ([Table 17](#)). Also, a significantly higher percentage of people in 2001 considered classes in schools (47%), presentations (29%), excursions (5%) and exhibits (9%) as sources of information about nature. A comparison between the years for the various sources of information about nature related to environmental education is displayed in [Figure 7](#). In addition, a higher percentage of people in 2001 reported receiving information from educational movies and from visiting parks.

Other sources of information that had a significant change in frequency were specifically related to talking to certain groups of people. From 1986 to 2001, talking to friends increased in frequency from 31% to 55%, talking to own children increased from 8% to 28%, and talking with program technicians rose from 4% to 12% ([Table 17](#)).

An information source about nature that presented a significant decrease in frequencies between survey years was that of nature observing. Response frequencies decreased from 53% in 1986 to 42% in 2001 ([Table 17](#)).

### **Other Relevant Information**

Questions added to the 2001 questionnaires assessed information about some elements of the program that did not exist in 1986. One of the questions related to the existence, location and purpose of the AMLD. The association was legally created in

1993 as a non-governmental organization to represent the golden-lion tamarin project. Of 352 people questioned, 55% had heard of the name and acronym of the Associação Mico-leão Dourado (AMLD), 50% identified its correct location and 48% gave a correct purpose for the organization (Appendix B). Additionally, respondents were asked if they had visited the education center in the AMLD headquarters. Only 14% of the sample population responded they had visited the education center (Table 18). The analysis of the performance of these respondents in the overall index score indicated that their mean of knowledge about the tamarin was significantly higher than for those people who had not visited the environmental education center (Table 19). Those who had visited the center answered in average 6 (66%) out of 9 of the answers correctly, while those who had never been there answered about half of the questions correctly.

Other questions asked participants about the União Reserve, a federal biological reserve created in 1998 that houses several tamarin families. Of all the survey participants, 33% had heard of this reserve, but only 24% answered its correct location. As expected, most people who claimed to have heard about it lived in towns closer to this reserve, such as Casimiro de Abreu, Prof. Souza and Rio Dourado (Table 20).

Two additional questions asked participants if they had ever heard of the concepts of forest corridor and ecotourism. Most had not heard of either. Only 10% had heard of forest corridor and 23% had heard of ecotourism. Out of those who had heard of these concepts, 51% defined forest corridor correctly and 81% answered the correct definition for ecotourism (Table 18).

### **Focus Group Response**

The purpose of the focus groups in this study was to collect information that would provide a deeper context and explanation of the survey results. Although there

were only three participants in two of the focus groups conducted in the larger communities of Silva Jardim and Casimiro de Abreu, the collected information still contributed to a deeper understanding of local people's awareness and support generated by the environmental education program. Focus group questions are provided in Appendix C. Below, I describe each focus group, and provide selected contributions relevant to this study. I divided the focus group results into two categories: focus groups in smaller towns and focus groups in larger towns.

### **Focus Groups in the Two Smaller Communities**

#### **Rural community of Professor Souza**

This focus group had 12 participants involved. Although more people participated in this than any other focus groups, some participants (5) were not parents of students, but students themselves attending adult classes. The other 7 participants were parents of the local 5<sup>th</sup> grade students who had received invitations to participate. The group included 10 women and 2 men, nine of who had been raised in the region. Three women had been living in town for at least 4 years. Five participants attended school until 7<sup>th</sup> grade, while three finished 8<sup>th</sup> grade and two finished high school. One person had a 3<sup>rd</sup> grade education, another had never attended classes and one person declined to answer. Participants' age ranged from 21 – 45 years old.

During introductions, I asked people to introduce the person sitting at their side as an animal typical of the region. Only five participants used the names of local animals, while the rest named exotics or domestic animals.

When asked to talk about their experience in the forest, everyone responded they had been in the woods before. Two people said they went in to harvest resources such as wood or hearts of palm. Another person talked about how currently there is not much

forest nearby, and all that is left is pasture. A fourth person added that in the past, most destinations she walked to were along wooded paths, but now there are only a few left.

In imagining that the forest from the region had been cut down and the consequences of that, one person began by saying it would change the weather patterns, while another added that pollution would increase and someone else said the supply of water would diminish. A woman spoke of the collapse of a retaining wall due to deforestation which consequently affected the water supply system. She also said that water became scarce because the water company did not build a system adequate to the current population. A woman responded to this by saying that “nobody is to blame” and another woman agreed saying that “the lack of water is everywhere [referring to the water supply system] and the lack of rain is probably due to deforestation.”

There was also some discussion about the theme of federal environmental laws. After introducing the topic, one person agreed with the current laws of environmental protection, while another said that the laws are weak, adding that there should be more vigilance and support, as well as more advertisement on television and more work to raise awareness, beginning with schools. A third person also agreed with the weakness of law enforcement as he shared the story of how he had eaten bush meat in the house of a local forestry policeman.

When asked what they imagine when they see the AMLD logo, most people mentioned they think of the golden lion tamarin, and at least four people said they think about the need for protection of animals and nature. Two other participants talked about the danger of extinction. In the words of one person, the logo “reminds me [that the

animal] is in danger of extinction and it is the symbol of animals that are in the verge of disappearing.”

### **Rural community of Imbaú**

In the rural community of Imbaú, seven participants joined the focus group, although one had to leave in the middle of the session. All participants were parents of the local school's 5<sup>th</sup> grade students. Six were women and one was a man, all of whom were between the ages of 32 and 40 years old. Two participants had formal education up to the 4<sup>th</sup> grade, while three people had completed high school and one person had completed college. All of the participants were raised in the region.

When asked to imagine what would happen if all the local forest was gone, one participant described the following: “water supply would decrease as well as clean air.” Other participants declared that by having the forest around, “there is less trash”, “people are healthier and there is no pollution in the air.” Furthermore, they all agreed that nature smelled better than the burnt oil and smoke common in larger cities.

When they saw the picture of the tamarin (Figure 8) and were asked to relate what they knew about this animal, everyone in this group said they had heard of the tamarin and at least four had seen it in the wild. One person shared her experience of watching a video about the tamarin in the university she attended. She remembered that the message of the video was that “the survival of the golden lion tamarin in the wild helps preserve the forest.” Another participant added that he usually saw people from the project come feed the monkeys in a forest near town.

When I showed the AMLD logo (Figure 9) and asked the group to talk about what they thought when seeing the drawing, most of the participants said it reminded them of the animal itself as well as a call for protection. Three people stated that the logo gives

them the image of family protection, because the “mother is protecting its offspring.” This perception of protection seemed to be translated in the minds of these participants into protection of the species itself. As one participant put it, “it reminds me of preserving the tamarin family.” Another person also mentioned that the image the logo transmits is of “nature, the reserve, and a call for help.”

### **Focus Group in the Two Larger Communities**

#### **Urban community of Casimiro de Abreu**

Four women participated in this discussion; however, only one really contributed. All participants were parents of students in the local elementary school. One of the women brought her toddler, who took most of her attention in the meeting. The other woman was quiet and did not say much, while the fourth woman arrived thirty minutes into the session. They were between the ages of 21 and 40 years old. One woman attended school for only one year, another attended it for five years and a third finished eight years of school. Only one had attended college. Two of the women had not been raised in the region, but had been living there for at least 7 years.

When asked to imagine that all the forest in the region had disappeared, one participant said it would impact people’s lives because, “we need the green, the forests. . . it will get hotter and water will disappear.” The other two agreed and one woman added, “everything is already drying up.”

In talking about the reserve, one woman mentioned that although there is visitation to the education center in the reserve, she does not think many people know about it. She went further in saying that there should be more advertisement for the visitor center. She added, “For people to protect, they have to know about it. It doesn’t help to talk only about protecting the golden-lion tamarin. People protect more if they are

aware and if they can participate. . . . There is a nice gate [for the entrance of the AMLD], but there is no sign advertising the education center.” This same participant also added that she thinks there should always be someone to monitor people’s visits. She said, “When I visited, more than 10 years ago, someone guided me. . . . I was even more interested to know about the tamarin. It is important to orient and raise people’s awareness and allow them access to information.”

In talking about what they imagine when seeing the AMLD logo, one woman said she imagined an area of environmental protection for the golden-lion tamarins as well as a population reproducing freely in their natural habitat. The others nodded in agreement.

#### **Urban community of Silva Jardim**

Three women, all mothers of the school students to whom I had sent invitations, attended this discussion. Two of the women were 44 years of age and the third was 40. Only one had been raised in the region; the other two had been in the region for at least two years. Two of them had a 5<sup>th</sup> grade level education and the other had completed 6<sup>th</sup> grade.

In imagining that all the forest in the region had disappeared, one woman said nothing would happen, while the other two said that the destruction would bring health problems and pollution to the region.

A general theme discussed in this focus group but not in the previous ones, was the law against hunting. All three agreed with the law and one participant added that it was, “right to put hunters in prison.” Another woman mentioned that IBAMA should have more meetings with the general population to help everyone understand what is legal and what is not. She also agreed with the existing laws and added; “animals should be free for the next generations to enjoy them.”

When asked to identify and talk about the golden lion tamarin, all three women recognized the animal and contributed information about its diet and social composition. One woman said tamarins like bananas and another said it also eats fruits in general. All three agreed that it is an animal that prefers to live in a family unit – although they did not specify how many. None of them had ever visited the education center at the reserve nor had ever seen the animal live, but they had seen it on TV. One woman stated, and the other two agreed, that visiting the reserve should be limited because people would destroy it.

In regards to what they imagine when seeing the AMLD logo, one woman mentioned that she thinks of an “oppressed animal that is afraid of people.” Another woman said she thinks “they should be free just as we are free and they have the same privilege to have a family as we, humans do.” They all mentioned seeing the logo on the VW vans of the AMLD program.

### **Limitations of Study**

The limitations to this study include: the sampling method of the 1986 study, the questionnaire instrument, and the longitudinal aspect of this research.

The sampling for surveys with adults in the 1986 evaluation followed a non-probability sampling design of relying on subject availability. This sampling method does not permit any control over the representation of a sample and may create biased results (Babbie 2001). Furthermore, adults interviewed in 1986 were not the same as the ones interviewed in 2001 because there were no records about the previous participants. Surveying the same participants would have generated stronger results since it would be possible to directly measure individual levels of support and knowledge.

Another limitation was to have used the same questionnaire for the 2001 study. This was a necessary condition as questions had to be compared and analyzed for changes in knowledge and beliefs. However, the 1986 questionnaire was designed to evaluate activities occurring in the first two or three years of the program, not within fifteen years of activity. Furthermore, questions should have covered attitudinal and behavioral changes more appropriately, through scales rather than using open-ended questions and just yes/no answers. Furthermore, a few of the questions in the earlier questionnaire were difficult to analyze objectively, such as the qualitative open-ended questions and the nominal types of questions.

The main limitation that affects the internal validity of this design is its longitudinal aspect. The 15 years in between surveys makes it extremely difficult to control for certain external impacts influencing the program's target audience, such as influences of the mass media (TV, radio and newspapers) or of historical events (i.e., the environmental movement) (Fink and Kosecoff 1982). In addition, many educational strategies were developed over those 15 years, modified in the light of further research, baseline evaluation, and the availability of funds. Through this research design, it was impossible to control for confounding variables, such as the Rio Conference of 1992, mass media influences or changes in the strategy of the program.

One extra limitation of this study was that it was conducted with 6 communities surrounding the Biological Reserve Poço das Antas in Rio de Janeiro; thus, it may not reflect the beliefs and knowledge of people from other geographic regions or other socioeconomic mixes.

Table 1. List of survey indicators of belief

Indicators	Statements/ Questions
1986 and 2001 Surveys	1. The golden lion tamarin is an important animal
	2. What is the importance of the golden-lion tamarin? (open-ended question)
Beliefs about the GLT	3. A little monkey should be left undisturbed if found in the woods
and its conservation	4. A bird should be left undisturbed if found in the woods
	5. An alligator should be left undisturbed if found in the woods
	6. A paca should be left undisturbed if found in the woods
	7. A snake should be left undisturbed if found in the woods
	8. Wild animals do not disturb human activities
	9. Forests bring benefits
	10. What is the benefit the forest brings? (open-ended questions)

Table 2. List of survey indicators of knowledge

Indicators	Statements/Questions
<u>1986 and 2001 Surveys</u>	1. Recognition of the picture of the golden-lion tamarin
	2. Identification of its correct name
Knowledge about the golden lion tamarin	3. Awareness that GLTs are found in this county
	4. Awareness that GLTs are only found in this state
	5. Knowledge that GLTs prefer lowland forest habitats
	6. Knowledge that GLTs prefer to live with a mate and offsprings
	7. Knowledge that there are 500 (in 1986) to 1000 (in 2001) tamarins currently living in the wild
	8. Identification of correct location of the Poço das Antas Biological Reserve
	9. Knowledge of correct purpose for the Poço das Antas Biological Reserve
Knowledge about nature	1. Identification of at least one local animal in danger of extinction
	2. Understanding that deforestation disturbs the health of soils and the quantity of available water
	3. Awareness that deforestation is a problem in the region
	4. Knowledge of existence of a federally protected area in the region
<u>2001 Surveys</u>	1. Identification of the AMLD acronym
	2. Knowledge of the location of the AMLD
Knowledge about conservation efforts	3. Knowledge of the purpose of the AMLD
	4. Awareness about the existence of the União reserve
	5. Knowledge of the location of the União reserve
	6. Awareness and understanding of <i>ecotourism</i> concept
	7. Awareness and understanding of <i>forest corridor</i> concept

Table 3. Demographic summary - comparison of selected variables, 1986 - 2001 surveys

		1986 (1)		2001 (2)		Sig. Test	df	Sig
Age	Mean	38.1	S.D.=16.2	41.45	S.D.=16	t= -2.67	664	**
Gender	Male	38%	n=119	52%	n=183	X <sup>2</sup> =13.3	1	**
	Female	62%	n=195	48%	n=169			
Locality								
Larger town	Casimiro de Abreu	22%	n=70	32%	n=113	X <sup>2</sup> =2.6	1	
	Silva Jardim	50%	n=156	34%	n=120			
Smaller town	Aldeia Velha	8%	n=24	9%	n=32			
	Imbau	9%	n=29	9%	n=30			
	Prof. Souza	5%	n=15	7%	n=25			
	Rio Dourado	6%	n=20	9%	n=32			
Years living in the county	born locally	54%	n=170	56%	n=199	X <sup>2</sup> =4.1	3	
	< than 5 years	12%	n=37	8%	n=27			
	between 5 and 15 years	19%	n=60	17%	n=58			
	more than 15 years	15%	n=47	19%	n=68			
Education	none	13%	n=41	8%	n=28	X <sup>2</sup> =13.6	3	**
	1 to 8 years	74%	n=230	69%	n=240			
	9 to 11 years	11%	n=35	20%	n=70			
	some college or above	2%	n=7	3%	n=12			
Total Cases			N=314 <sup>a</sup>	N=352 <sup>a</sup>				

\*\* Significant frequency difference values at the  $\leq .01$  level

<sup>a</sup>Note: Total N for education variable was slightly smaller (313 and 350 respectively); 3 people chose not to respond

Table 4. Selected beliefs about nature and the golden-lion tamarin, 1986 - 2001 surveys

Selected indicators of beliefs	Percent correct					
	(1) 1986	n	(2) 2001	n	(2)-(1)	$X_1^2$
1. The golden lion tamarin is an important animal	83%	187	90%	238	7%	4.5 *
2. Would not disturb monkey if found it in the woods	75%	306	91%	345	16%	27.4 **
3. Wild animals are not harmful to human activities	85%	314	92%	352	7%	6.8 *
4. The forest brings benefits to people	89%	301	87%	351	-2%	0.4

\* Significant frequency difference values at the  $\leq .05$  level.

\*\* Significant frequency difference values at the  $\leq .01$  level

Table 5. Importance given to golden lion tamarins (grouped by topic), 1986 - 2001 surveys

Coded response statements	Percent Correct					
	1986	n	2001	n	(2) - (1)	$X_1^2$
a.human needs	78%	91	48%	79	-30.0%	26.0 **
b.environment	26%	26	52%	90	26.0%	
		N= 117		N= 172		

\*\* Significant frequency difference values at the  $\leq .01$  level

Table 6. Percentage of respondents that say they would not disturb animal if found it in woods

	(1) 1986	n	(2) 2001	n	(2) - (1)	$X_1^2$	
a monkey	75%	306	91%	345	16%	27.4	**
a bird	73%	310	75%	347	2%	0.59	
a snake	36%	274	59%	351	23%	32.9	**
a paca	64%	307	91%	350	27%	72.4	**
a caiman	82%	299	94%	352	12%	24.2	**

\*\* Significant difference values at  $p \leq .01$  level.

Table 7. Forest benefits identified (grouped by topic), 1986 - 2001 surveys.

Coded topic statement	1986	n	2001	n	(2) - (1)	$X_1^2$	
Products/services to humans	12%	30	5%	14	-7%	8.2	**
Nature conservation	88%	220	95%	262	7%		
		N= 256		N= 276			

\* Significant difference values at  $p \leq .01$  level.

Table 8. Selected indicators of specific knowledge about the golden-lion tamarin, 1986 - 2001 surveys

Selected Indicators of Specific Knowledge	Percent correct					
	(1) 1986	n	(2) 2001	n	(2)-(1)	$X_1^2$
1. Identified picture of golden lion tamarin (GLT)	80%	313	75%	351	-5%	2.1
2. Identified correct name of GLT	68%	249	94%	265	26%	55.4 **
3. GLT lives in this region	81%	242	90%	264	9%	8.5 *
4. GLT prefers lowland forest habitat	47%	245	44%	261	-3%	0.5
5. GLT prefers to live with mate and offsprings	53%	250	33%	263	-20%	21.1 **
6. Identification of correct number of GLTs living in the wild	68%	130	36%	206	-32%	32.7 **
7. GLTs are found only in the state of Rio de Janeiro	51%	246	67%	264	16%	13.2 **
8. Correct location of Poco das Antas Biological Reserve	97%	171	97%	288	0%	0.0
9. Correct purpose for the Poco das Antas Biological Reserve	90%	174	97%	254	7%	9.6 *
Extra Q.- Identified the tamarin logo correctly	30%	94	57%	201	27%	49.6 **

\* Significant frequency difference values at the  $\leq .05$  level.

\*\* Significant frequency difference values at the  $\leq .01$  level

Table 9. Selected indicators of general knowledge about environmental issues, 1986 - 2001 surveys

Selected Indicators of General Knowledge	(1) 1986	n	(2) 2001	n	(2)-(1)	$X_1^2$
1. Protected area to conserve animals and plants exists nearby	75%	314	86%	352	11%	12.7 **
2. Correct identification of local animals in danger of extinction	28%	312	32%	350	4%	1.75
3. Deforestation dries out and weakens the soil	94%	218	93%	320	-1%	0.60
4. Deforestation is a current problem in this area	78%	278	78%	338	0%	0.01

\*\* Significant frequency difference values at the  $\leq .01$  level

Table 10. Cronbach alpha values for belief and knowledge about the golden lion tamarin (glt), 1986 -2001 surveys.

	knowledge about glt		knowledge about the environment	
	1986	2001	1986	2001
Means	4.63	4.92	2.11	2.45
SD	2.75	2.47	1.01	0.72
N	311	352	314	352
	$t=-1.4, df=627.7, p=.159$		$t=-4.78, df=560, p<.01$	

Table 11. Means for the index of knowledge about the golden lion tamarin (glt) and nature, 1986 - 2001 surveys.

Indexes	# of items	1986	n	2001	n
belief about the glt	4	0.2	173	0.19	231
knowledge about environment	4	0.45	278	0.31	338
knowledge about the glt	9	0.82	311	0.79	351

Table 12. Index of knowledge specific to the GLT- Individual b-coefficients and variance, 1986 - 2001 surveys

		Year of Study					
		1986			2001		
		Mean	S.D.	B	Mean	S.D.	B
Constant				2.82			3.19
Education	0 years (reference)	2.7	2.2	-	3.5	2.5	-
	1 to 8 years	4.6	2.7	1.28*	5	2.5	1.27*
	9 to 11 years	6.2	2	2.52*	5.5	2	1.91*
	12 years or more	7.4	1.1	3.66*	7	1.3	3.05*
Sex	Female (reference)	4.3	2.8	-	4.3	2.5	-
	Male	5.2	2.5	0.81*	5.5	2.2	1.33*
Age (in years)		38	15.7	-0.000	41.5	2.5	-0.001
Place	Smaller towns (reference)	3.8	2.9	-	4.5	2.5	-
	Larger towns	4.9	2.7	0.68*	5.1	2.4	0.43
Years in county		14.2	13.7	.000	17.7	12.5	0.001
R <sup>2</sup>				0.151			0.127
N				310			351

\* Significant difference values at  $p \leq .05$  level.

Table 13. Means of self-reported use of mass media by gender, 1986 - 2001 surveys

Gender	Year	Mean	SD	n	independent sampled t-test
Men	1986	0.86	0.94	119	$t = -6.6, df = 272, p \leq .001$
	2001	1.6	1	169	
Women	1986	0.84	0.99	195	$t = -3.5, df = 368, p < .001$
	2001	1.2	1	183	

Table 14. Mass media sources of information by gender, 1986 - 2001 surveys

Media	Year	Gender		n	$X_1^2$
		Men	Women		
TV	1986	41%	59%	159	1.21
	2001	54%	47%	252	10.9 *
Newspaper	1986	39%	61%	46	0.019
	2001	52%	48%	168	1.8
Radio	1986	32%	68%	60	1.22
	2001	65%	35%	74	10.6 *

Table 15. Index of knowledge about environmental issues- Individual b-coefficients and variance, 1986 - 2001 Surveys

		Year of Study					
		1986			2001		
		Mean	S.D.	B	Mean	S.D.	B
Constant				1.46			2.24
Education none (reference)		1.4	1	-	2.2	0.8	-
	1 to 8 years	2.1	0.99	0.48*	2.4	0.7	0.16
	9 to 11 years	2.4	0.8	0.94*	2.6	0.6	0.65*
	12 years or more	2.8	7	1.28*	2.8	0.4	0.75*
Sex							
	Female (reference)	1.9	1.1	-	2.3	0.8	-
	Male	2.3	0.78	0.31*	2.6	0.6	0.32*
Age (in years)		38	15.6	.005	41.5	16.1	-.000
Place							
	Small town (reference)	1.9	1.2	-	2.3	0.8	-
	Large town	2.2	0.88	0.28*	2.5	0.6	0.25*
Years in county		14.2	13.7	-.01*	17.7	12.5	-.000
R <sup>2</sup>				0.11			0.11
N				310			351

\* Significant difference values at  $p \leq .05$  level.

Table 16. Sources of information about glt, 1986 - 2001 surveys

Source of Information	Percent Correct		% Pt Change	
	(1) 1986	(2) 2001	(2) - (1)	$X_1^2$
Television	52%	95%	43%	135 **
Radio	19%	28%	9%	5.5 *
Printed media	16%	64%	48%	138 **
Posters	43%	73%	30%	50 **
Educational Movies	11%	34%	23%	43.3 **
Classes	8%	43%	35%	97.3 **
Exhibits	6%	5%	-1%	0.07
Mettings	1%	13%	12%	33.3 **
T-shirts	29%	69%	40%	91.4 **
Street parade	8%	4%	-4%	4 *
Excursion	2%	5%	3%	5.1 *
Play	8%	5%	-3%	2.54
Zoo	8%	21%	13%	16.8 *
People	32%	44%	12%	7.6 *
adult	5%	75%	70%	63.4 **
children	41%	7%	-34%	28.1 **
both	54%	18%	-36%	87.8 **
Total Cases	N=308	N=264		

\* Significant frequency difference values at the  $\leq .05$  level.

\*\* Significant frequency difference values at the  $\leq .01$  level

Note: Due to multiple responses, columns do not sum to 100%

Table 17. Sources of information about the environment, 1986 - 2001 surveys

Source of Information	Percent Correct			$X_1^2$
	(1) 1986	(2) 2001	(2) - (1)	
Television	38%	89%	51%	188 **
Radio	14%	39%	25%	49.8 **
Printed media	19%	62%	43%	126 **
Posters	11%	56%	45%	149 *
Educational Movies	6%	26%	20%	47 **
Classes	31%	47%	16%	16.8 **
Presentations	10%	29%	19%	35.5 **
Exhibits	4%	9%	5%	6.6 *
Excursion	1%	5%	4%	7.8 *
Technicians	4%	12%	8%	14.9 **
Observing nature	53%	42%	-11%	8.2 *
Parks	4%	28%	24%	71.7 **
Own children	8%	28%	20%	45.4 **
Friends	31%	55%	24%	42.4 **
Total Cases	N=314	N=350		

\* Significant frequency difference values at the  $\leq .05$  level.

\*\* Significant frequency difference values at the  $\leq .01$  level.

Note: Due to multiple responses, columns do not sum to 100%

Table 18. Other Relevant Information - responses for 2001 questionnaire only

Abbreviated topic statement	Percentage	n	N
Have heard of Uniao reserve	33%	116	352
Gave correct location of Uniao reserve	24%	82	352
Have heard of AMLD	55%	191	352
Correct location of AMLD	50%	110	352
Correct purpose for AMLD	48%	104	352
Have visited the AMLD education center	14%	48	350
Have heard of forest corridor	10%	35	352
Gave correct definition of forest corridor	51%	19	352
Have heard of ecotourism	23%	82	352
Correct definition of ecotourism	81%	66	352

Table 19. Mean for the index of knowledge between those who visited and those who did not visit the environmental education center, survey 2001

Knowledge of Visitors X Non-visitors		
	visited	not visited
Means	6.12	4.75
SD	2.01	2.5
n	48	301

$t=-4.2, df=71.9, p \leq 0.001$

Table 20. Percentage of people who heard of Reserva Uniao by communities, survey 2001.

Communities	Percentage	n	N
Casimiro de Abreu	43%	50	113
Prof. Souza	10%	12	25
Rio Dourado	19%	22	32
Silva Jardim	18%	21	119
Aldeia Velha	9%	10	32
Imbau	1%	1	30
		N total=	351



Figure 1. Map of the area of occurrence of the golden lion tamarin (Adapted from a drawing by Steve Nash).

\*\* significant difference at  $p \leq .01$  level

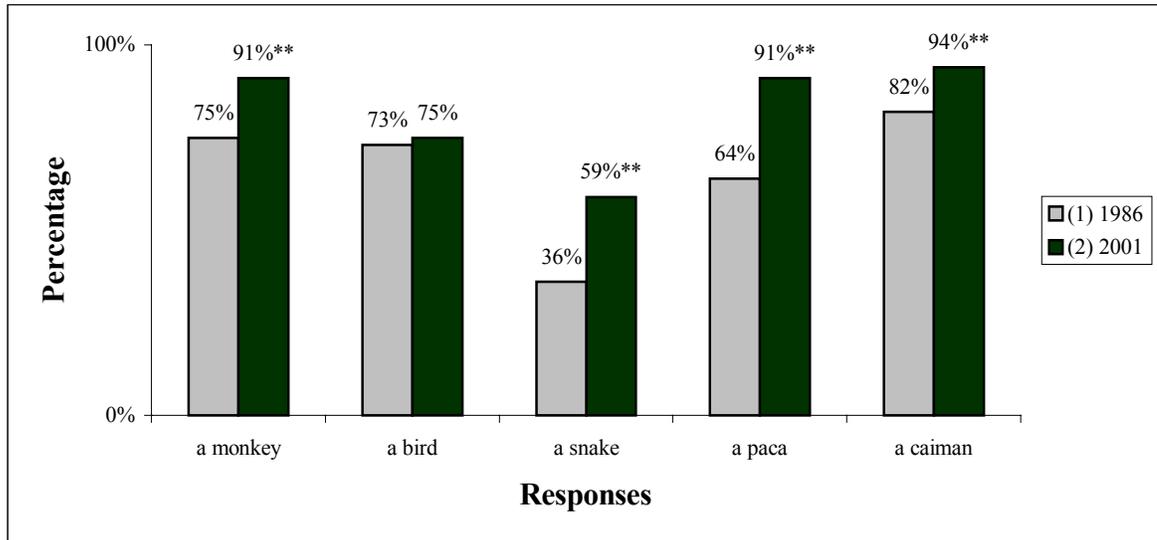


Figure 2. Responses about importance of golden-lion tamarin, 1986 – 2001 surveys

\*\* significant difference at  $p \leq .01$  level

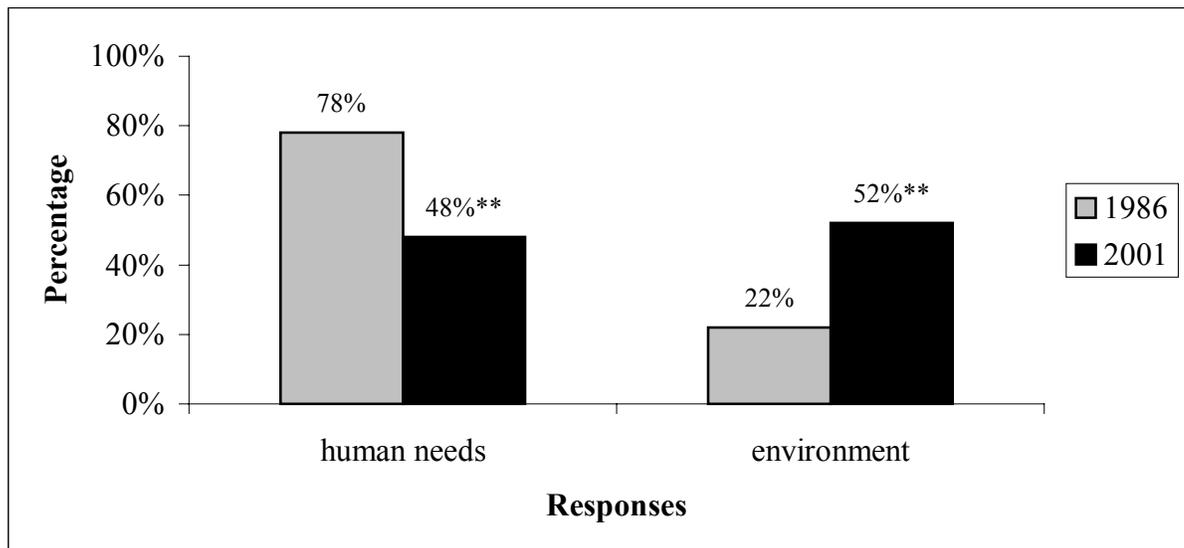


Figure 3. Percentage of respondents saying they would not disturb animal if found in woods.

\* significant difference at  $p \leq .05$  level.

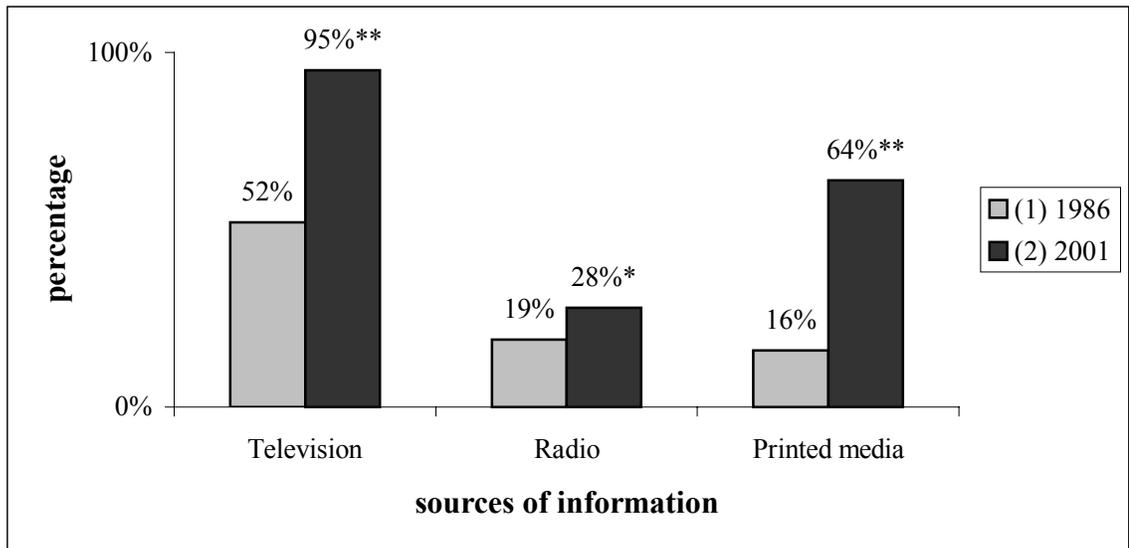


Figure 4. Media sources of information about the golden-lion tamarin, 1986 - 2001 Surveys

\*\* significant difference values at  $p \leq .01$  level

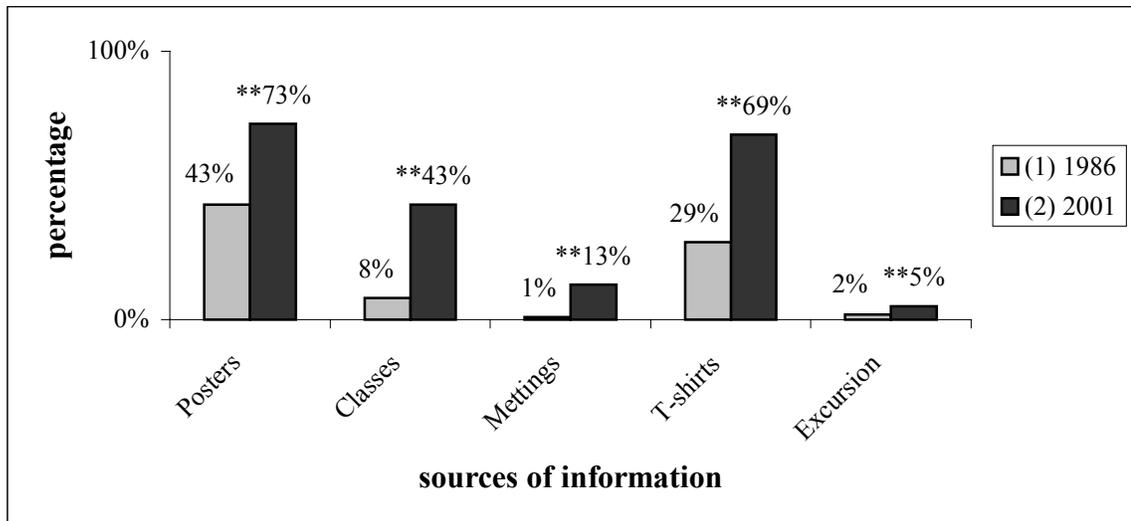


Figure 5. Sources of information related to environmental education, 1986 - 2001 Surveys

\*\* significant difference values at  $p \leq .01$  level

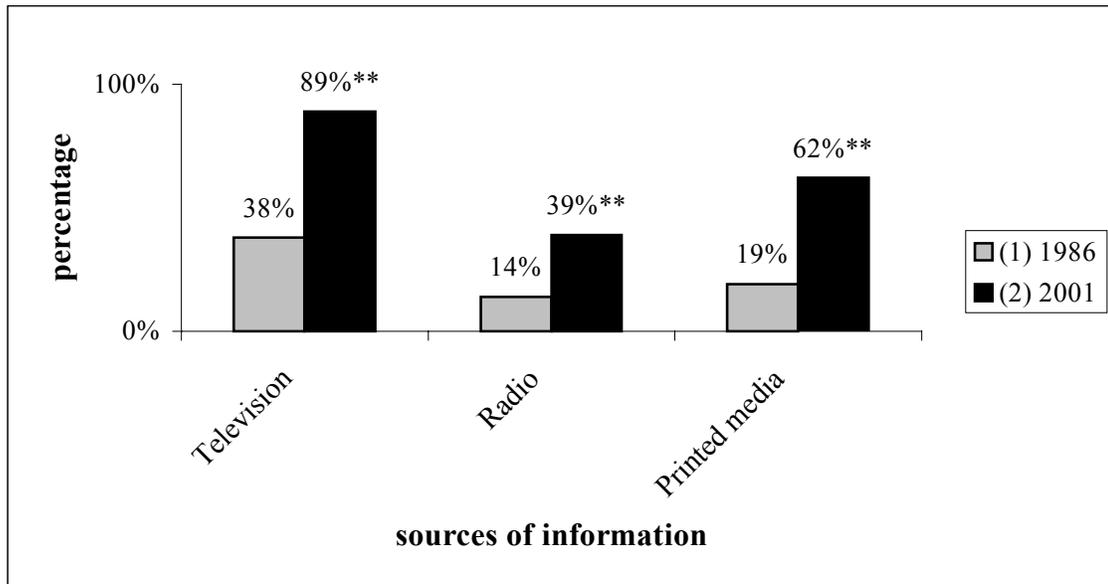


Figure 6. Sources of information about nature related to media, 1986 - 2001 Surveys

\* significant frequency difference values at the  $\leq .05$  level

\*\* significant difference values at  $p \leq .01$  level

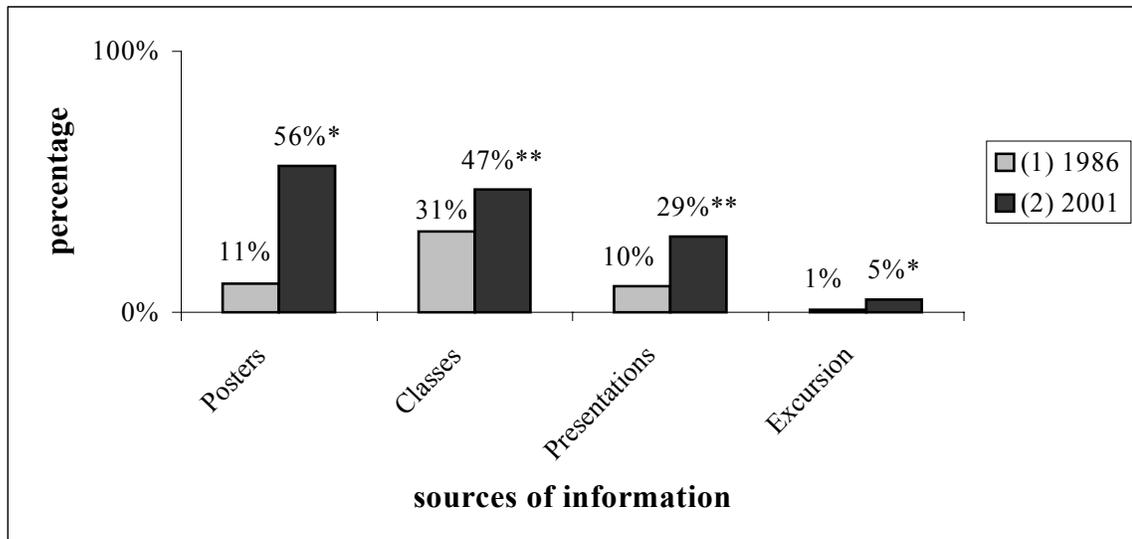


Figure 7. Sources of information about nature related to environmental education, 1986 - 2001 Surveys



Figure 8. Picture of the golden-lion tamarin used in the surveys



Figure 9. AMLD Logo used in the surveys and focus groups

## CHAPTER 4 DISCUSSION

Currently, the population of golden-lion tamarins in the wild is 1,000 animals, a considerable recovery from the 200 thought to exist in the wild in the 1970s (AMLD 2000). Much of this success is due to the conservation strategy coordinated by the Golden-lion Tamarin Association and its national and international partner organizations. Although the program in its entirety has achieved many positive results, there is still much to accomplish. A critical goal of the program is to have enough adequate forests for the tamarin population to reach the naturally sustainable size of 2,000 animals in the wild by the year 2025. As the tamarin population increases, they need more space suitable for their basic needs in order to protect against inbreeding, disease, unpredictable natural disasters and human disturbances. Part of the AMLD's strategy to accomplish this goal is to support an environmental education program to "increase public awareness and involvement in the conservation of golden lion tamarins and their habitat" (AMLD 2000).

This study investigated the long-term impact of the AMLD's environmental education program on the people living near the reserve by determining the level of beliefs and knowledge regarding the golden-lion tamarin and its habitat. The hypothesis of this study was partially confirmed. Results revealed the occurrence of a positive shift in local support towards the conservation of the golden lion tamarin and an increase in knowledge about the environment. On the other hand, levels of knowledge about the tamarin did not increase as expected. Analysis suggested some increase in general

knowledge but no change in overall knowledge about the tamarin. Although it was impossible to determine the causality of these results due to the longitudinal nature of this research and the various external factors that have been at play, the results of this study still provide program accountability and recommendations that may contribute to improve program delivery.

The similarities within socio-demographic characteristics of the sampled population, such as locality of residence and years living in the county, strengthened the comparison between the two datasets. The number of participants from large towns and those from small towns along with the number of years participants were living in the region were similar across datasets. These were important items to control for similarities since differences would have created biases in the results. Although differences in gender and education were found, these were expected. The gender difference between the two datasets was deliberately created in attempts of generating less bias within the 2001 sample population. The education differences were also expected since educational levels of the general population in the area increased throughout these years (IBGE 2000). In general, there were no major significant differences between the sample populations.

I discuss the results of this study by first conferring the support for the AMLD program based on the responses for the individual belief questions. Next, I discuss results of the analysis of individual knowledge items and of the regression analysis between the composite knowledge score and socio-demographic variables. Finally, I discuss the results indicating the impact of the different sources of information on the sample population over time.

### **Support for the Conservation of the Golden-lion Tamarin**

The results of this study revealed significant increases on several indicators of beliefs held by local people regarding the golden-lion tamarin and its habitat. Individual analysis for the indicators of beliefs demonstrated an increase in belief supporting the conservation of the golden-lion tamarin and its habitat. In the 1986 survey, there was no evidence of negative beliefs towards these primates, and as the 2001 results demonstrate, positive beliefs towards the tamarin and its habitat have strengthened. Out of the ten belief indicators used in this study, eight had a positive significant increase and two showed no change. The significant increase in the percentage of most of these indicators suggests a greater local support for conservation of the golden-lion tamarin and its habitat.

Results demonstrated a significant increase in the percentage of people who believe tamarins are important. Of those who indicated they valued the tamarin in 2001, there was an increase in the percentage of people who believed tamarins are valuable for more fundamental reasons like its environmental importance or for the “preservation of nature” rather than for human needs, such as for its “use in tourism” or “for people’s pleasure.” Additionally, among those who identified forest benefits, there was an increase in the 2001 survey, in responses of benefits relating to “nature conservation,” rather than relating the benefits to “products and services to humans.” There was also a significant percentage increase in 2001 of people believing that the tamarin and a few other animals, such as a paca, a caiman and even a snake, should be left undisturbed in their native habitat. Wild animals in general were also perceived to have less impact on human activities in 2001 than in 1986. These results strengthen indications reported by

Dietz et al (1994) of the importance of the golden lion tamarin as a flagship species in conserving other local species and its habitat.

The increase in people's positive perceptions towards the tamarin and its habitat were significant for most of the belief indicators. Focus group results also supported participant's convictions about the importance to protect the surrounding forests in order to maintain a healthy environment for the tamarin, for people and for future generations. These results strengthen earlier indications that tamarins may be effective conservation symbols in raising pride about the habitats where they live (Dietz and Nagagata 1995; Pádua et al. 2002).

### **Knowledge about the Golden-lion Tamarin and the Environment**

The analysis of knowledge about the golden-lion tamarin and its habitat presented mixed results that are discussed below.

#### **Individual Indicators of Knowledge**

The analysis of individual indicators allowed a closer inspection of the kind of information people know today in comparison to what they knew in 1986. Out of thirteen knowledge questions, knowledge increased for 5 of the questions, decreased for 2 and did not change for 7.

The five indicators that reported a significant increase in knowledge between 1986 and 2001, included: (1) the common name of the tamarin; (2) if tamarins are found in the region; (3) the state where tamarins are found; (4) the correct purpose for the Poço das Antas Biological Reserve and (5) if there is a biological reserve in the area. All of these questions relate to a general level of information about the tamarin and its habitat. The only indicator in this category that did not increase in frequency was whether people recognized the tamarin from a picture. About three quarters of the sample population

identified the tamarin from a picture in both 1986 and 2001. Although this is still at a high level of recognition, it was surprising that it did not increase from 1986. For the respondents that identified the tamarin correctly, the positive results indicate a greater general level of knowledge about the tamarin.

Questions that reported a decrease in knowledge included what is the social family structure of the tamarin, and what is the number of tamarins currently living in the wild. These questions required knowledge more specific to the biology and conservation of the tamarin population. Knowing that tamarins live in pairs with a few offspring is an important piece of information that helps people understand the amount of territory needed to sustain a healthy population of tamarins. Regarding the numbers of tamarins in the wild, although a public communications campaign celebrating the birth of the 1000<sup>th</sup> tamarin had been launched two months before the onset of the survey, data showed that only 36% of the respondents knew the correct number of tamarins living in the wild. Being aware of the current number of wild tamarins is essential for involving people in the work to achieve the project's goal of having a sustainable tamarin population in the wild.

Research on public knowledge has usually indicated low scores of knowledge about the environment (Pyrovetsi & Daoutopoulos 1999, Gambro and Switzky 1996, Zimmermann 1996, Holl et al. 1995, Arcury and Christianson 1993, Arcury and Johnson 1987, Buethe 1985, Berroa and Roth 1985, Kellert 1980). Kuhlemeier et.al (1999) has also reported low levels of environmental knowledge in a study of a sample of students from secondary schools in the United States. In general, the current analysis indicated that knowledge about the golden lion tamarin might be increasing in regards to questions

on general information about the tamarin, while decreasing or not changing for more questions on more specific types of information. This indicates that more attention needs to be placed on effectively communicating information specific to tamarin biology and habitat needs.

### **Knowledge Indices**

The analyses of the indices of knowledge demonstrated that people responded correctly to at least half of the questions in both 1986 and 2001 on facts about the tamarin and the local environment. Comparison of the knowledge indices between 1986 and 2001 showed a significant increase in the means for knowledge of environmental issues, but not for the knowledge about the tamarin. The significant change in one index but not in the other was a surprising result. The AMLD environmental education program has been providing information about local environmental issues and about the tamarin and its habitat for the past 18 years, thus it was expected that if one knowledge index increased, the other would increase as well. This result may have occurred due to the impact of external factors, such as the influences of mass media, which may cover more frequently information concerning the local environment than the tamarin specifically. This study could not control for confounding variables such as this.

### **Associations Between Knowledge Indices and Socio-demographic Variables**

The socio-demographic elements of a population are essential indicators of the lifestyles, interests, and receptivity of people; thus, they are important variables in defining, designing and evaluating environmental education programs (Berroa and Roth, 1985). Knowing the differences among groups in environmental support and knowledge can help segment audiences and thereby improve the quality of environmental education programs. Identifying the differences among groups of people can inform the

practitioner about groups' interests and concerns to better target environmental education and to understand any resistance to the program (Arcury and Christianson 1993, Berroa and Roth 1985).

The strength of the relationship between knowledge and the demographic variables was not very strong for either regression (Table 12 and Table 13). The weak strength of both regressions was expected because in the real world the pattern between variables is more disordered and complex than in a controlled environment, which reduces the amount of variance that explains an association (Agresti and Finlay 1997). The  $R^2$  for the knowledge about the tamarin was similarly low for both years 15% in 1986 and 13% fifteen years later (Table 12). A review of studies that similarly used demographic variables showed small values of variance explained in the support of environmental protection ( $R^2 = 15\%$  and  $16\%$ ) (Lowe and Pinhey 1982); in rural-urban differences in environmental concern ( $R^2 = 9\%$  and  $15\%$ ) (Freudenburg & McGinn 1987); sex differences in environmental concern and knowledge ( $R^2 = 3\%$ ,  $5\%$ ,  $7\%$ ,  $16\%$ ) (Arcury et al. 1987), and in the social bases of environmental concern over 17 years ( $R^2 =$  range from  $7\%$  to  $13\%$ ) (Jones and Dunlap 1992).

The regressions showed a few interesting associations between respondent's socio-demographic variables and their level of knowledge about the tamarin and about environmental issues. The strongest association was between education and knowledge, which was virtually linear for both samples and for both indices. Knowledge about the tamarin had a stronger linear relationship with education than knowledge of environmental issues. From the results, we can conclude that education is a statistically significant predictor of both knowledge indices in both years. Thus, the more educated

people are, the more they know about the golden lion tamarin and about local environmental issues.

Education is an important variable to help people understand environmental issues and conservation messages. The more educated the person, the more they will understand information and media messages or the more curious they will be in learning about an issue. In a study of residents of a river basin in Kentucky, Arcury and Christianson (1993) found that the greatest variation in environmental knowledge was due to different levels of education and income. Furthermore, based on the findings of a study of environmentally responsible behavior in secondary school teachers, researchers found that knowledge and skills were powerful predictors of responsible environmental behavior (Hsu and Roth 1988). Education has been found to have positive associations with environmental knowledge in other studies as well (Brothers et al. 1991, Arcury 1990, Caron 1989, Arcury and Johnson 1987, Lovirich et al. 1986). It is easy to understand why people with less education know less about the tamarin, since formal education facilitates learning and motivates people to become better informed.

Another predictor of knowledge was the gender of the respondent. Findings show that even after controlling for other factors, men knew more about the tamarin and the local environment than women in both 1986 and 2001. Sex differences in knowledge may be due to various factors, such as men's tendency of doing more outdoor activities than women (Duda and Young 1993), or that men and women may see and attend to different media. In fact, by examining the influences of the mass media by gender, it was noted that in the 2001 sample, men reported to have higher use of mass media than women. Another possible reason for gender differences in ecological knowledge may be

associated with the time spent and the experiences acquired while fishing, bird watching, or enjoying nature (Tarrant et al.1997, Newhouse 1989). Further research with focus on the gender issue is recommended to explore the possible local causes of why women displayed less knowledge about the tamarin and the local environment.

Several studies have reported gender differences regarding environmental knowledge. Berroa and Roth (1985) showed that females were less knowledgeable than males about the existence of national parks in the Dominican Republic. Arcury et al (1987) also found that males had greater knowledge than females about acid rain. Appleson (1999) reported that women were less knowledgeable about the ecology of a watershed basin in Florida. Likewise, in studies with universities or high-school students, Kibert (2000), Hausbeck et al. (1992), Zimmermann (1996) and Gifford et al (1982/83) reported that male students scored higher in environmental knowledge than females.

Respondent's place of residence was another variable associated with knowledge about the tamarin and about local environmental issues. In the 1986 survey, people living in larger towns had more knowledge about the local environment and about the tamarins than people living in smaller towns. Fifteen years later, however, the variance was only significant for knowledge about the environment. The change in significance for knowledge about the tamarin suggests that there may have been a greater homogenization of information about the tamarin from larger towns to smaller towns over the period. This difference could be due to the program's focus in its earlier years of conducting activities and campaigns in larger towns where the chances of spreading information to a

greater number of people were higher. Currently, the program has been focusing on smaller towns in the surrounding area of the biological reserve (AMLD 2000).

Studies on the impacts of place of residence on environmental knowledge are seldom found in the literature (Arcury and Christianson, 1993). Arcury and Christianson (1993) performed a survey on this issue by measuring the association between environmental knowledge and three different residence groups – urban-metro, urban-nonmetro and rural-nonmetro. They found that the more metropolitan and urban the respondent, the higher their knowledge about the environment. However, when they controlled for other socio-demographic factors, they found that education, income, age and gender accounted for much of the variation in environmental knowledge. Thus, compared to other variables, such as education and income, they concluded that place of residence was not as important in explaining environmental knowledge. This also may be true for this study, since place of residence lost its significance in 2001 and respondents seemed to have become more homogeneous. Because the environmental education program has expanded its activities to a larger area, this homogeneity in knowledge could possibly be a result of the work of the program. Other external factors, such as influences of television programs or the printed media also may be interfering in these results.

Influences of television programs and printed media could also be a factor in explaining why the regression for knowledge about nature reported a loss of significance in knowledge between those living longer in the area with those living there for a shorter period. As the Golden Lion Tamarin Conservation Program has gone from a local initiative to an internationally recognized model program, awareness of its purpose and

objectives has spread across the nation and abroad. Furthermore, television, newspaper and magazine coverage of environmental issues have risen significantly across the world (Hausbeck et al 1992, Ostman & Parker 1987). Thus, residents of areas near or far from the biological reserve may have risen to similar levels of knowledge about environmental issues (Pierce et al 1989).

### **Sources of Information about the Environment and the Golden-lion Tamarin**

This study also determined the changes that occurred in the last fifteen years among the sources of information from which people perceive to gather information about the tamarin and the local environment.

The respondents in 2001 reported having heard about the golden-lion tamarin and about the environment through a greater variety and number of sources than in 1986. There was an increase in the number of reports for the mass media sources (television, radio and printed media), for education materials and activities (posters, classes in school, t-shirts, meetings, excursions, zoos), and from other people (technicians and friends).

Mass media continues to be the most popular source of information about the tamarin and the local environment. Television is still the most mentioned source information and its impact increased since 1986. Research shows that television is often perceived as a source of environmental information for most people (Fortner and Mayer 1991, Brothers et al. 1991, Fortner and Lyon 1985). Television and newspapers have been found to be the most frequently used media on a study done with New York residents (Ostman and Parker 1986/87). A study by Brothers et al (1991) has also showed that a news show broadcast was effective in increasing knowledge levels among its viewers. Another interesting result was that printed media (newspapers and magazines) had the highest percentage change from 1986 to 2001. This suggests an

increase in the influence of the printed media, which may have occurred due to an increase in the coverage of local environmental issues. This positive impact could be the result of a greater global interest on the environment, but could also be due to the local presence of the AMLD. The environmental education program recognizes the power of the media to transmit its environmental message and has been supporting and monitoring articles and programs about the tamarin and its habitat that appear on television, newspapers, magazines or radio (AMLD 2000).

Although mass media sources seem to have had a higher frequency of response, there have also been significant large increases in the frequency of reporting sources related to environmental education activities and materials supported by the program. Posters were the third most mentioned source of information about the tamarin in 2001. Classes in school, meetings, presentations and excursions also had significant increases. This indicates people's awareness of the various activities and materials supported by the program. Another indication of greater awareness about the program's activities is that more than half of the survey participants had heard of the Golden-lion Tamarin Association (AMLD) and knew of its location. During the focus groups, participants recognized the logo of the organization and associated it with the conservation work to protect the tamarin and its habitat. However, less than half of the survey participants gave the correct purpose for the organization. One of the participants of the focus groups stated that there is not enough advertising of the environmental education center in the area or of the opportunities to visit.

More people in 2001 also reported having heard or seen the tamarin by watching educational movies and by visiting parks. However, people seemed to have perceived

these questions differently than expected. Educational movies were understood as any nature program on television, whereas the original intention of the survey was specific to films. Visiting parks was perceived as any park (including zoos and city parks) whereas the researchers meant national and state parks. These misunderstandings may have created higher frequencies of responses for these categories. This reasoning also may explain the discrepancy between the increase of the frequency of responses for visiting parks, and the decrease for observing nature as a source of information about nature.

Less people responded they learned about nature by ‘observing nature’ in 2001. This result may be indicative of the high levels of deforestation and the increase in the urbanization of the local population that has occurred in the region in the past 20 years. Since 1980, the population living in towns has become higher than the population living in farms for both counties (IBGE 2000). Participants in the focus group indicated some of this occurrence when mentioning the disappearance of nearby forested areas due to the increase in urbanization levels.

Another source of information that decreased in frequency of response was the parade, while exhibits and the play underwent no significant changes. The significant decrease that occurred for the parade as a source of information was an expected result. The AMLD annual reports (available since 1992) confirm that between 1992 and 2000, the parade did not occur (AMLD 1992, 1993, 1994, 1995, 1996/97, 1998, 1999, 2000). For the play, the non-significant change was also an expected result since it only occurred 3 times between 1992 and 2000. Regarding the exhibits, they occurred more frequently (between 2 and 6 times a year), but reports state that Casimiro de Abreu and Silva Jardim were the only towns from the ones surveyed where these exhibits occurred. In contrast,

for information about nature, the frequency of responses indicating exhibits as sources of information actually increased.

In general, there is evidence that people currently acquire information about the golden lion tamarin and its habitat from a greater number of sources through the media and through the environmental education program. Studies have suggested that continuity and repetition are two of the key elements identified in the success of educational programs (Dwyer et al. 1993, De Young 1993). The identification of the most successful sources of information should provide the AMLD program with indications of the sources to continue using in future campaigns and activities.

### **Other Relevant Information**

More than half of respondents recognized the AMLD name and knew of its location; however, less than half were able to give the correct purpose for the organization. The AMLD was created in 1992 to manage the golden-lion tamarin project from Brazil; thus, local people in the area might not exactly know the name of the organization managing the project, but are aware of the project itself. Furthermore, this study reported that only 14% of respondents in 2001 had visited the education center, which is housed in the AMLD headquarters. It is possible that if more people had visited the center, there would be a greater awareness about the purpose of the AMLD and knowledge about the golden lion tamarin and its habitat. In fact, the mean for the knowledge score of those who had visited the center was significantly higher than of those who had not visited. In other words, those who had visited the center knew more about the tamarin than those that had never been there. The education center was inaugurated in 1989 as a center to provide information about the golden-lion tamarin and the reserve. Visitation is free and the center's location is easily accessible by car or by

public transportation since it abuts a major federal highway that crosses the region. AMLD annual reports state that the education center exhibit has received more than 25,000 people, while the 2001 survey revealed that only 48 out of the 352 study participants had visited the center. Thus, it seems that most of the visitors are students, travelers or tourists, whereas local residents might have not had the opportunity to visit the center or might have not had their interest triggered.

### **Conclusion**

This study assessed public awareness about relevant environmental issues and levels of support for the AMLD environmental education program from the period of 1986 and 2001. By comparing two sets of data that included respondents' sources of information, beliefs and knowledge about the golden-lion tamarin and its habitat, we have a better understanding of the long term impacts and the strong and weak elements of the environmental education program. This should help strengthen management and improve the environmental education program's contribution to the overall conservation goal of increasing the survival chances for the tamarin population.

Results of this study demonstrate the program was partially successful in achieving its stated goals and objectives of greater citizen awareness and public support. This research provided positive indications of local support towards the conservation of the golden lion tamarin and its habitat. Although the knowledge index score demonstrated no change in knowledge about the tamarin, the analysis of individual questions showed that knowledge is increasing in regards to general information, while decreasing or not changing for content that is more specific. Additionally, people living in smaller towns had similar knowledge levels about the golden lion tamarin as people living in larger towns, in contrast to the 1986 study. Results also showed that education

is a strong and linear predictor of knowledge and that men were more knowledgeable than women in 1986, and continued to be so in 2001.

Environmental education as a conservation strategy is a long term process that aims to have a positive lasting impact on people's environmental responsible behavior. Environmental education "emphasizes attitudes, values, skills, knowledge, motivation, and participation to solve environmental problems" (Braus and Wood 1993, 7). It uses a multitude of techniques such as, consciousness raising, skill building, and action oriented activities in order to improve the relationship between humans and the environment. As an interdisciplinary tool, environmental education draws on various disciplines to address the complex issue of biodiversity conservation. It is a tool along with other tools that helps move humans toward a more balanced approach to quality of life and quality of the environment. As Jacobson (1995, xxiv) expresses, "Although education alone will not solve environmental problems, effective education and communication programs are a prerequisite for better natural resources management, and ultimately for safeguarding the biosphere on which we all depend." Results of this evaluation demonstrated the importance of an environmental education program in creating support for an endangered species and its fragmented habitat. Evaluations are useful in providing insight into the short and long term effects of environmental education programs and thus, in reporting successes and improving the program's contributions to conservation.

With this information, new attempts that benefit from successful aspects of this program and modifications of less effective features can be executed. Future environmental education strategies should be even more successful in encouraging citizen

support and participation in environmental affairs, based on the recommendations that follow.

## CHAPTER 5 RECOMMENDATIONS

*Recommendation 1: Fill the gaps in knowledge about golden lion tamarins and the importance of their rainforest habitat.*

For effective conservation of the tamarin population to take place, it is important to identify the information that reflects a basic understanding of the interrelationships between tamarins and their environment. Research on public knowledge has usually indicated low scores of knowledge about the environment (Arcury and Johnson 1987, Buethe 1985). In this study, frequency distributions of individual knowledge items revealed a lack of knowledge of specific information about the tamarin and there was no increase in the knowledge index from 1986 to 2001.

Only 44% of respondents in 2001 knew that tamarins prefer to live in lowland rainforest, a similar frequency of response as 15 years ago (47%) when the environmental education program began communicating this kind of information in the surrounding areas. Deforestation continues to be the largest threat for the golden lion tamarin population (Padua et al 2002). Being aware of what is the habitat of the golden lion tamarin is a crucial piece of information to help reduce even greater fragmentation of the lowland forests of the region. Respondents to the 2001 survey also lacked knowledge about the numbers of tamarins living in the wild as well as in identifying endangered animals endemic to the area. A public grasp of this kind of information helps create the support needed to strengthen conservation work.

*Recommendation 2: Provide activities or materials targeted to specific audiences.*

Enhanced understanding of the program's audience provides an opportunity for environmental educators to develop focused programs through the selection of more specialized content and media. One of the target audiences of the AMLD program is the group of residents living in the towns surrounding the biological reserve. This study indicated that subsets of the program's target audience, more specifically women and people with lower levels of education, know less about the tamarin and its habitat. The reasons why women are not obtaining information about the tamarin and the environment should be further explored. As research and some of the results have indicated, men and women may attend to different messages, media or activities. Environmental education materials, messages or activities could be developed with a greater focus on women, with more attention to their values and the places they frequent. Newspaper articles and TV programs could be improved with more focus towards women, or informative materials could be distributed to residences in order to reach women working at home. Furthermore, the program could simplify some of the materials and activities in order to reach the less educated audience.

*Recommendation 3: Create opportunities for the local public to have greater participation and involvement in program activities.*

Past research demonstrated that environmental experience is correlated with increased ecological knowledge (Appelson 1999, Kellert 1984, Chaiken 1980) and that local participation in projects has been correlated to overall project success (Jacobson and McDuff 1997, Hewavitharana 1994, Finsterbusch and Van Wicklin 1987). Sociologists agree that durable behavior change requires the use of techniques such as social

commitment, intrinsic behavior and supporting attitudes (Heberlein 1981). Citizen participation in the education program may help create a greater social commitment to an environmentally ethical behavior (O’Riordan 1976, Grieser 2001).

The project appears to have great potential to involve local people in a larger scale, since it has been well established and is popularly known and liked. One way of increasing local participation is to create a volunteer group that could help in the various activities and stages of the program. Volunteers could become a great asset by adding to the human resources capabilities and to the contact networks of the program. Creating partnerships with either the local government or local businesses could offset some of the constraints of having a volunteer group, such as providing transportation and giving logistical back up.

Furthermore, activities that encourage experiences of learning by doing or in which people get information on how to have a positive impact on the environment, such as participating in projects of reforestation, community improvement, or supporting commercialization of legal birds, could help expand levels of awareness and support towards conservation. Research has also showed that promoting thoughtful, informed positive behavior is more successful in changing a behavior than by focusing on stopping negative behavior (Blanchard 1995). Changing a negative to a positive behavior that endures requires the use of techniques such as social commitment, intrinsic behavior and supporting attitudes (Heberlein 1981, De Young 1993). Moreover, becoming involved stimulates the need to know (Carlson 1998) and learning is a social activity. Adults can learn more when they have opportunities to share, discuss and work together (Newstrom and Lengnick-Hall 1991). .

By increasing the frequency of its community outreach with positive behavior activities and of person-to-person and group activities, especially of hands-on experiences, may help improve the environmental education program and its long-term impacts in the region.

*Recommendation 4: Provide greater opportunities for visits to the education center for local community members.*

The educational center was renovated in 2000 and provides an excellent opportunity for increasing awareness of the program's work in the region. In addition to the information provided by the center, there is a nature trail in the back of the center used frequently with school groups to provide them with a glimpse of the tamarin's habitat. This area has been reforested, and tamarin groups can be frequently seen in the area. This provides a chance for directly learning more about these animals and their habitat. Our observations suggest that the education program might not be using these resources to their full potential, since there were a small number of people who reported having visited the center. Results of this study showed that respondents who had visited the center had a significantly greater knowledge about the tamarin than those who had never visited.

The program could target local residents by organizing annual visits to the center and possibly to the inside of the reserve or to another private reserve to see the tamarins. This could become a good opportunity to perform environmental educational activities and to gather further support for conservation. Partnerships with the local and federal government as well as local or national businesses could help provide the needed funding and legal support. Nature centers need to do more than just exhibit ecological principles,

as Monroe (1983) suggested through her work with nature centers: “they need to bridge the gap to the built environment.” Providing opportunities for visitation by the local community might help promote improvement of knowledge and program support.

*Recommendation 5: Conduct periodic monitoring and evaluation*

The environmental education program has not followed a consistent monitoring and evaluation process since 1986. Regularly monitoring educational activities is helpful for assessing the progress of the program. As research has demonstrated, evaluation is an important element in correcting the course of environmental education activities (Pádua & Jacobson 1993, Gerakis 1998, Heffernan 1998). Follow-up assessments of target audiences’ knowledge, beliefs and attitudes are useful measures to improve the program in a consistent manner. Program evaluations are a systematic tool to measure knowledge and attitude changes over longer periods (Weber 1995, Blanchard 1995).

This study demonstrated the need for program evaluation by identifying specific knowledge gaps of the survey participants and by confirming the positive beliefs local people have regarding the tamarin and the environment. In order to improve, the program needs to continually monitor its activities as well as to perform comprehensive evaluations every few years (if possible every 5 years). Additional resources to support monitoring efforts, such as training the environmental education staff in program evaluation, would be well utilized by the program. Future evaluation efforts should consider designing a comprehensive survey that would cover attitudinal and behavioral elements of the target audiences. Presently, evaluations specific to the environmental education center and to the educational activities with the schools are recommended to assess the strengths and weaknesses of these sections of the program.

APPENDIX A  
SURVEY QUESTIONNAIRE

(Present yourself) “My name is \_\_\_\_\_, I am participating in a study that is looking at what people know about their local forests. I will be talking to different people in this community about their knowledge on forests. I will also ask people in the other surrounding communities. I would like to ask some questions about the local forests. Besides asking you about the forests, I would also like to ask a few questions about you, such as: age, education, place of birth, etc. It will take about 20 minutes to ask these questions. Answering these questions will not affect you either for better or for worse. You do not need to answer any questions you do not feel comfortable with or do not wish to answer. You do not need to stop working to answer them. If you prefer, we can come back another time. We will not write down your name, it will be kept private. Do you have any questions? May I begin asking my questions/ May I begin the focus group session? You can always stop me at any time or we can schedule for another day.”

Q 1. Currently, what is the most serious problem in the municipality? (only one problem)

Q 2. Do you think the amount of deforestation that happens in the municipality is currently a problem?

- 1 Yes, it's serious
- 2 Yes, more or less serious
- 3 No, it's not a problem
- 4 Don't know

Q 3. Does the forest bring any benefit to you or to the community?

- 1 Yes
- 2 No
- 3 Don't Know

Q 4. If Yes, Which benefit?

Q 5. Does the forest bring any problems to you or to the community?

- 1 Yes
- 2 No
- 3 Don't Know

Q 6. If Yes, What problem?

Q 7. If you encounter each of these animals in the forest, what would you do?

	Take home	Sell it	Kill and leave	Kill to eat	Leave it alone	Other (specify)
A little bird	1	2	3	4	5	6
A snake	1	2	3	4	5	6
A little monkey	1	2	3	4	5	6
A paca	1	2	3	4	5	6
An alligator	1	2	3	4	5	6

Q 8. Do you know the name of this animal? (Show Tamarin Picture)

1 Yes, it's name is \_\_\_\_\_

2 No, I don't know (Go to question 22)

If Yes,

Q 9. What name do you give it? \_\_\_\_\_

Q 10. Do you know other names for this animal? (specify) \_\_\_\_\_

Q 11. Does this animal live in this municipality?

1 Yes

2 No

3 Don't know

Q 12. Have you seen it ...(mark all that saw or heard, specifying the places)

In the forest

Killed by someone

Caught in a trap

Being cared by someone

On posters or photos (where? \_\_\_\_\_)

On TV

In the zoo

In movies or "slides" (where? \_\_\_\_\_)

In a play (where? \_\_\_\_\_)

In the radio

In the newspaper or magazine?

In classes at school (where? \_\_\_\_\_)

In an exposition (where? \_\_\_\_\_)

In a reunion of some group (where? \_\_\_\_\_)

On t-shirts, buttons, or adhesives (where? \_\_\_\_\_)

On a parade (where? \_\_\_\_\_)

On an excursion (where? \_\_\_\_\_)

Seen someone else talking about the animal  children  adult

Seen or heard being talked in any other conditions? Specify place

Have not seen it in any places

Q 13. (If seen in the forest) How many times have you seen it in the forest?

- 1 One time
- 2 2 to 5 times
- 3 more than 5 times

Q 14. What type of forest does it prefer? (Mark all cited)

- 1 Highlands
- 2 Top of hill
- 3 Side of hill
- 4 Lowlands
- 5 Don't know

Q 15. What does this animal eat? \_\_\_\_\_

Q 16. How does this animal live?

- 1 Alone
- 2 In pairs with young
- 3 In large groups of at least 15 individuals
- 4 I don't know

Q 17. Do you think there are more of these animals in the forests now than there were 10 years ago?

- 1 Yes, there are more
- 2 No, there are less
- 3 No, there are the same number

Q 18. If Yes, or No, there are less, What are the causes? \_\_\_\_\_

Q 19. Does this animal have any importance?

- 1 Yes
- 2 No
- 3 Don't know

Q 20. If Yes, what is its importance?

Q 21. How many individuals of this animal do you think exist in the forests?

- 1 Less than 100
- 2 Around 500
- 3 Around 1000
- 4 Thousands
- 5 Millions
- 6 Don't know

Q 22. The golden-lion-tamarins exist in the forests of which Brazilian states?

**We would like to know your opinion about these sentences**

Q 23. There is a protected area for forest plants and animals near this municipality

1 Yes            2 No            3 Don't know

Q 24. The majority of forest animals are harmful to people

1 Yes            2 No            3 Don't know

Q 25. By law , each landowner must conserve 20% of his or her property in forest. Do you think this is right?

1 Yes            2 No            3 Don't know

Q 26. The hunting and commerce of forest animals are prohibited in Brazil by law.

1 Yes            2 No            3 Don't know

Q 27. Can you say the names of 1 or 2 local animals that are in danger of extinction?

Q 28. Do you know the laws of forest protection (the Forest Code)?

- 1 Know a lot
- 2 Know some
- 3 Only heard of
- 4 Never heard of

Q 29. What happens with the water and the earth after a deforestation?

Q 30. Have you heard of the Biological Reserve Poço das Antas?

- 1 Yes
- 2 No

Q 31. If Yes, Do you know where it is located?

Q 32. Do you know its purpose?

Q 33. Have you heard of the Biological Reserve União?

- 1 Yes
- 2 No

Q 34. If Yes, Where is it located?

Q 35. What is its purpose?

Q 36. Have you heard of the AMLD?

- 1 Yes
- 2 No

Q 37. If Yes, Do you know where it is located?

Q 38. Do you know its purpose?

Q 39. Does the presence of the AMLD bring you or the community any benefit or any problem?

- 1 Brings benefit
- 2 Brings problems
- 3 None of the above
- 4 Don't know

Q 40 Which?

Q 41 Which?

Q 42. Have you seen this drawing? (Show logo)

- 1 Yes
- 2 No

Q 43. If Yes, where did you see it?

Q 44. What does it represent?

Q 45. What you know about the forest and animals that live in the forests, you've learned...

- Observing in the forest
- From parents or relatives
- From the TV
- Reading newspapers and magazines
- From the radio
- Talking with technical people
- Watching presentations and meetings
- Reading posters, brochures
- From classes in school
- Watching a movie (where? \_\_\_\_\_)
- Seeing expositions (where? \_\_\_\_\_)
- Talking to friends
- Talking with your children
- Excursion (where? \_\_\_\_\_)
- Visiting parks and zoos
- Visiting the Educational Center

Q 46. From all of this, how do you think you have learned MORE about nature? (only one answer)

Q 47. Have you ever been interviewed about these subjects before?

- 1 Yes
- 2 No

Q 48. If Yes, when? (year)

We would like to make a few personal questions:

- Q 49. How old are you? (age) \_\_\_\_\_
- Q 50. Did you grow up in this municipality Yes  
No
- Q 51. (If not) How long have you lived in this municipality? (years) \_\_\_\_\_
- Q 52. Did you go to school? Yes  
No
- Q 53. (If yes) What was the last year that you have completed?  
 1<sup>st</sup> term Supletivo? Yes No  
 2<sup>nd</sup> term  
 MOBREAL  
 Technical course  
 College/university or masters/PhD  
 Other
- Q 54. Was any of this study done in the SJ/CA municipality?  
 1 Yes  
 2 No
- Q 55. Sex of respondent:  
 1 Male  
 2 Female
- Q 56. Were there other people present during the interview?  
 1 Yes,  
 2 No

This completes the survey. Thank you very much. If you have any questions regarding the survey, you may contact Dr. Susan Jacobson, Professor at the Department of Wildlife Ecology and Conservation, University of Florida, Gainesville. Her phone number is 352-846-0562.

Any questions or concerns you may have about your rights can be directed to the UFIRB office, Box 112250, University of Florida, Gainesville, FL 32611-2250.

Questions dropped from analysis and explanation.

- Q 1. Currently, what is the most serious problem in the municipality? (only one problem)
- Q 15. What does this animal eat? \_\_\_\_\_
- Q 17. Do you think there are more of these animals in the forests now than there were 10 years ago?  
 Q 18. If Yes, or No, there are less, What are the causes? \_\_\_\_\_
- Q 25. By law, each landowner must conserve 20% of his or her property in forest. Do you think this is right?
- Q 28. Do you know the laws of forest protection (the Forest Code)?

Q 39. Does the presence of the AMLD bring you or the community any benefit or any problem?

Q 40 Which benefit?

Q 41 Which problem?

Q 46. From all of this, how do you think you have learned MORE about nature? (only one answer)

In analyzing these questions, I realized Q 1 was irrelevant to the question asked in this study. Regarding Q 15, answers were numerous combined correct and incorrect information. Furthermore, some answers, were correct, but had not been taught by the program (i.e. bananas). Questions Q17, Q18, Q25, Q28, Q39, Q40, Q41 and Q46 were not well designed for the purposes of this study and generated confusion in the responses.

## APPENDIX B FOCUS GROUP GUIDE

“My name is Christine Archer, I am a student supervised by Dr. Susan Jacobson, a professor at the University of Florida, in the USA. Her address is: Department of Wildlife Ecology and Conservation University of Florida, Gainesville, FL 32611, USA. I am doing a study that is looking at what people know about their local forests. I will also ask people in the other surrounding communities. This discussion should not take more than one hour. Answering these questions will not affect you either for better or for worse. You do not need to talk about any issues you do not feel comfortable with or do not wish to answer. Your name, it will be kept private.

If you have any questions or concerns about your rights, they can be directed to the UFIRB office, PO Box 112250, University of Florida, Gainesville, FL 32611-2250, USA. Do you have any questions? May I begin the focus group session?”

### **Introductory Questions**

1. Tell us your name, age
2. Imagine a friend of yours comes from Bahia to visit you in your hometown. Can anyone describe what you would show to a visitor arriving in the region around your hometown?

### **Attitudes toward nature**

3. What environmental issues should we be concerned about nowadays?
4. What are the main issues related to the environment this community is/should be concerned about?
5. Have any of you had the experience of going inside a forest?  
If Yes, could you describe your experience? Did you feel or saw anything interesting?
6. Imagine all the forest in this area is gone. Can anyone tell us if anything would change?

### **Attitudes toward the golden lion tamarin**

7. Does anybody know the name of this animal? (Show a picture of the golden lion tamarin).
8. What do you know about this animal?  
Do you all agree with that?
9. How did you learn about this animal?
10. Does the animal have any meaning to any of you or to the community you live in?
11. Has any of you seen this animal in the wild? Can you describe that experience?
12. Does anyone think other people would be interested in seeing this animal in the wild?  
Would this bring any benefits or problems to you? To the region?

**Attitudes toward GLT project**

13. Show a picture of the sign indicating the beginning of the Tamarin Biological Reserve. Ask the group to react to the existence of the biological reserve.

14. Do you have any other thoughts/ideas about conserving or not this animal in the wild?

**Summary and Conclusion**

15. Highlights of what the group agree or disagree.

16. Have we missed anything? Any other comments/suggestions?

APPENDIX C  
CODE BOOK

A- Year

1986

2001

B – Municipality

CA – Casimiro de Abreu

SJ – Silva Jardim

C – Rural Community

15 – Aldeia Velha

16 – Imbaú

23 – Professor Souza

25 – Rio Dourado

D – City

01 – Silva Jardim

02 – Casimiro de Abreu

**Q 1. Currently, what is the most serious problem in the municipality? (only one problem)**

99 – Don't know

100- HUMANS CAUSING ENVIRONMENTAL PROBLEMS

01 – deforestation

11 – extinction

26 – people who kill animals; hunters

69 – population growth

101- PROBLEMS CAUSED BY NATURE (also related to influence of humans)

09 – rain

25 – lack of water (rivers with low levels of water)

31 – floodings

34 – (included in 42)

42/34 - insects (warms eating beans) (escargot in the streets) (ants)

56 – mangrove waters (mangroves floods the street)

102- PROBLEMS RELATED TO HEALTH ISSUES

04 – health reception (hospital)(drugstore)(dentist)(medicine)(health station)(lack of...)(health) Lack of clean water (dirty water) (water not treated)

06 – Diseases (malaria)(dengue)

### 103- PROBLEMS RELATED TO SOCIO- ECONOMIC AND DEVELOPMENT ISSUES

- 02 – dam
- 03/37 – roads (bridges)(asphalt)(highways)(paving)(holes on roads)(streets)(dirty streets/ brush)(lack of...street humps)(square)(road passage); (mud) (danger on the asphalt) (dust)
- 05/35/44 – sanitation (pollution) (sewer)(cleaning of rivers de rios, channels)(lack of hygiene)(urban cleaning)
- 07 – government administration (lack of...) (political accomodation)
- 08 – land administration
- 12 – unemployment (lack of work)(maintaining work)
- 13 – inflation
- 14 – electricity (lack of ...) (lightning) (energy rationing)
- 15 – transportation (...public)(... from the road to the city)
- 16/22/54 – education (lack of...) (lack of teacher)(iliteracy)(weak schools) (lack of highschool) (lack of university)
- 17/60 – urbanization (lack of...)
- 18/23 – security (lack of...) (theft) (police) (violence)
- 19 – Lack of communication (lack of phone/ mail)
- 21 – desapropriation of land
- 22 – (included in #16)
- 23 – (included in 18)
- 24 – (included in 42)
- 28 – lack of land to work
- 30 – housing (lack of...)(expensive rent)(house in bad shape)
- 32/41 – weak agriculture
- 35 – (included in 5)
- 37 – (included in 3)
- 40 – (included in 5)
- 44 – (included in 5)
- 54 – (included in 16)
- 36 – commerce (lack of market) (lack of industry)
- 38 – landfill in Juturnaíba
- 41 – (included in 32)
- 43 – lack of assistance to farmers
- 46 – poverty, need
- 47 – lack of area for recreation (lack of gardens in the streets)
- 48 – politics (lack of youth involvement in decision making)
- 50 – TV tower
- 53/55 – meat (lack of...)
- 58 - tourism (noise for tourism)
- 59 – street children
- 60 – (included in 17)
- 62 - drugs
- 63 – lack of fireman
- 64 – lack of money (city debt)

- 67 – lack of dune preservation
- 68 – dirty beaches
- 104- THERE ARE NO MAJOR PROBLEMS
  - 20 – No problems
- 105- OTHER
  - 10 – religion (lack of God, love thy neighbor)
  - 27 – *dangerous cattle that walk around*
  - 29 – movie theatre
  - 33 – hunting prohibition
  - 39 – mechanic
  - 45 – gossip, revenge
  - 49/52 – personal problems (lack of boy/girlfriend) (cut foot) (death)
  - 51 – lack of shame
  - 52 – (included in 49)
  - 57/63/64 – human being (lack of...respect, tranquility, rest)
  - 61 – lack of everything, everything is wrong
  - 63 – (included in 57)
  - 64 – (included in 57)
  - 65 – noise
  - 66 – ignorance

**Q 3. Does the forest bring any benefit to you or to the community?**

- 99 – don't know
- 100- RAW MATERIAL/ PRODUCTS TO HUMANS/SERVICES TO HUMANS
  - 02 – hunting
  - 03 – fruits
  - 04 – wood
  - 05/29 – logs (coal, to cook, to sell)
  - 13 – medicine (medicinal herbs)
  - 15 – heart of palm
  - 16 – to be taken down for agriculture, plantation
  - 19 – food (feeding)
  - 21 – fertile land (land fertilizer)
  - 28 – without the forest, cannot do agriculture
  - 30 – jobs
  - 31 – financial profits
  - 32 – paint
- 101- BENEFITS RELATED TO NATURE CONSERVATION
  - 01 – water (protect waters, rain, potable water, help avoid draught, energy)
  - 06 – avoid pollution (avoid erosion)
  - 07 – pure air
  - 08 – protects soil, soil humidity
  - 09 – protect animals (protect nature)
  - 10/37 – climate stabilizer
  - 11 – shade
  - 12 – beauty

- 14 – birds
- 17 – happiness
- 18/39 – conditions of human life (health)(life) (quality of life) (healthy life)
- 20/24/25 – nature (24 – (included in 20)
- 25 – (included in 20)
- 26 – everybody’s patrimony
- 27 – the forest is important
- 33 – flowers
- 37- (included in 10)
- 39 – (included in 18)
- 34/36 – brings inspiration
- 35 – hope
- 38 – tourism
- 40 – education about preservation
- 41 – to conserve for future generations
- 42 – ecological stability
- 43 – the tamarin
- 44- biodiversity
- 102- OTHER (Selected out in analysis)
  - 23 – recording (animal and plant life)
  - 22 – everything

**Q 9. What name do you give it? \_\_\_\_\_**

**Q 10. Do you know other names for this animal? (specify) \_\_\_\_\_**

99 – não sabe

100- TAMARIN/GOLDEN-LION/GOLDEN TAMARIN

- 01 – mico-leão (mico-dourado)
- 03 – mico
- 10 – mico dourado
- 11 – macaco-leão
- 16 – miquinho
- 25 – mico leão vermelho
- 29 – leão dourado

101- GOLDEN-LION TAMARIN

- 02 – mico-leão-dourado

102- OTHER

- 04 – saui
- 05 – saui vermelho
- 06 – mico-saui
- 07/08 – macaco/ macaquinho
- 09 - macaco asuvio
- 12 – sagui
- 13 – caxinche
- 14 – cachinguelê
- 15 – sagui-vermelho
- 17 – mico-vermelho

- 18 – saui-fogo
- 19 – mico-sagui
- 20 – saim
- 21 – sauá
- 22 – guaxinim
- 23 – macaco saui
- 24 – macaco da noite
- 26 – mico da noite
- 27 – mico sagui
- 28 – macaco da india
- 30 – guigó
- 31 – totó
- 32 – macaquinho vermelho

**Q12 – Where have you seen this animal?**

100- PROJECT ADVERTISEMENT

- 01 – (included in 19)
- 02 – (included in 11)
- 04 – (included in 22)
- 07 – cars and farms
- 12 – church
  - 10 – Mayor office (Forum) (Emater)
  - 11 – bar (barraca) (bares em CA, SJ)
- 13 – IBAMA
- 15 – notebook
  - 19 – commerce; store
- 21 – cars
- 24 – magazine
- 27/32 – health station/hospital
- 32 – (included in 27)
  - 37 – vídeo/ TV
  - 39 – t-shirt, sticker, pin
- 43 – in the road(BR 101)
- 47 – Culture House
- 49 – Dept. Of Education
- 101- ENVIRONMENTAL EDUCATION PROGRAMS
- 06 – RPPN Bom Retiro (Luis Nelson)
- 14 – exposition
- 08 – school
  - 50 – Reserve; Reserve Poço das Antas (Boi Branco); Golden Lion Tamarin Association; Reserve Uniao
- 55 – presentation table
- 102- OTHER PEOPLE
- 05 – with friends
- 26 – with children
- 103- IMMEDIATE REGION

- 03 – (included in 22)
- 09 – Cezário Alvim
  - 17 – Silva Jardim
- 18 – na rua + na escola
- 22/03/04/06 – por aí fora, na rua (na rua em Aldeia Velha)
  - 29 – Imbaú
  - 30 – Bananeiras
  - 31 – Rocha Leão
- 33 – Casimiro de Abreu
- 35 – Barra de São João
- 36 - Aldeia Velha
- 38 – na região
- 42 – Professor Souza
- 46 – Casimiro + Rio das Ostras
  - 51 – Rio Dourado
  - 53 – Rio das Ostras
- 54 – Macaé; Rodovias de Macaé (in LA's data it was repeated thus it was lumped)
  - 56 – Cambucais (sem terras)
- 104- OUTSIDE OF THE REGION
- 23 – zoo
- 25 – Niterói
- 28 – Mariana
- 34/48 – Rio de Janeiro
- 44 – Cabo Frio
- 45 – São Gonçalo
- 48 – (included in 34)
  - 57 - Minas Gerais
  - 58 – Magé
- 105- OTHER
- 16 – at home
- 20 – interview
- 40 – Natura da providencia???
- 41 – army
- 52 – books

**Q12 – Another way (outras)**

- 01 – other people
- 02 – EE program (in the reserve, )
- 03 – advertisement (cars, notebook, brochure...)

**Q 14. What type of forest does it prefer? (Mark all cited)**

- 00 – no answer
- 99 – don't know
- 100- CORRECT
  - 2- hilltop

- 3-hillside
- 4-lowland
- 06 – 1+2
- 07 – 1+3
- 09 – 2 +3
- 101- INCORRECT
- 1- highlands
- 08 – 1+4
- 10 – 2 + 4
- 11 – 3 +4
- 12 – 1,2,3,4
- 13 – 2, 3, 4
- 102- DON'T KNOW
- 5- don't know

**Q 15. What does this animal eat? \_\_\_\_\_**

- 99 – don't know
- 00 – no answer
- 100- CORRECT
- 01 – fruits (wild + domestic) (bananas + fruits)
- 02 – wild fruits
- 03 – fruits + insects
- 06 – bananas
- 12 – insects
- 16 – banana+ wild fruits
- 18 – bananas + insects
- 19 – grasshopper
- 22 – bananas + bugs
- 27 – wild fruits + insects
- 31 – tree frog
- 32 – bananas + wild fruits + bugs
- 37 – wild fruits + bugs
- 42 – guanandi ou guanandirana (red fruit)
- 49 – ingá
- 40 – coconut
- 52 – coquinho, heart of palm, fruits
- 101-INCORRECT
- 4 - leaves
- 05 – domestic fruits
- 7 – home food
- 08 – fruits and baby birds
- 09 – fruits + leaves; + roots
- 10 – bananas + roots
- 11 – bugs
- 13 – fruits + corn
- 14 – fruits + home food

- 15 – bananas, corn, leaves
  - 17 – banana + salt
  - 20 – tree frog + baby snake
  - 21 – bromeliad
  - 23 – bananas + tomatos
  - 24 – orange, leaves, insects
  - 25 - frog
  - 26 – tree frog + warms
  - 28 – insects e small vertebrades (...cobra, perereca, lagarto)
  - 29 – wild fruits and leaves
  - 30 – bugs, fish + leaves
  - 33 – baby bird
  - 34 – crickets e small vertebrades
  - 36 – ants
  - 37 – crickets and caterpillar
  - 38 – bananas, insects, little snakes
  - 39 – fruias + insects + little snakes
  - 41 – meat
  - 43 – baboza
  - 44 – corn, coconut, heart of palm
  - 45 – baby snake
  - 46 – corn
  - 47 – birds and insects
  - 48 – anything it encounters
  - 50 –(included in 28)
  - 51 – fruits, nuts, seeds
  - 52 - bush
  - 53 – insects and plantules
- MISSING VALUE
- 35 – utiliza gravata

**Q 18. If Yes, or No, there are less, What are the causes? \_\_\_\_\_**

99 – don't know

\*\* - nonsense

**100- LESS DUE TO HUMAN ACTIVITY**

01/38 – hunting

02 – deforestation (destruindo habitat) (tem menos mata)(acabaram com as matas)

03 – hunting + deforestation

04/28 – capture (captivity) (comerce)

06/21 – hunting and selling of animals, hunting to sell (comercialization)

05 – fire

07 – deforestation and fire

25 – create or kill

19/26 – destruction

29 – increase of human population

30 – progress

- 37 – imprisonment the animal
- 41 – profit
- 45 – lack of fiscalization
- 48 – little campaign
- 101- LESS DUE TO NATURAL REASONS
  - 08 – dying (disease)
  - 11/15 – extinction
  - 15 – (included in 11)
  - 42 – are peaceful
  - 43 – nature transformation
  - 44 – they do not adapt to any region
  - 49 – predators and captivity destroy
  - 50 – do not procreate
- 102- MORE DUE TO CONSERVATION WORK
  - 09 – in the reserve they are safe (there are an appropriate place for them; protection the reserve gives; environmental protection)
  - 10 – campaign (work done by the reserve) (project alert) (divulgação)
  - 12 – heard more about it now (conscientization) (comprehension)
  - 13/14 – protection/ preservation/ conservation (hunting was prohibited; people do not hunt anymore; it was taken care of; there was no government interest for animals before; protection and explanation; because of the caring; because they are investing in it; preservation work)
  - 20 – reduction of fire
  - 22 – they are taken care
  - 23 – nobody kills
  - 31 – before it was unknown
  - 32 – reintroduction work (bring from other countries; reproduction in captivity)
  - 34 – they want to preserve more
  - 40 – less deforestation
  - 46 – all the forest is transformed in reserve
  - 47 – 1000th tamarin campaign
- 103- MORE DUE TO NATURAL CAUSES
  - 17/18 – reproduction, they procreate
  - 33 – they disappear and appeared again (nao esta mais em extincao)
- 104- OTHER
  - 16 – cannot die off
  - 24 – there are in the zoo

**Q 20. If Yes, what is its importance?**

- 99 – Don't know
- 100- IMPORTANT FOR HUMAN NEEDS
  - 01/24/ 28 – Medicine
  - 02/09/11/19/22/29/31 – Happiness (beauty; distraction; beauty of the forest; decoration; admiration; curiosity; funny; attraction; beauty and helps preserve other animals)

07/43/44 – human survival (good for humans; everything nature gives, we need; to see in nature; recreation; attractive to community)

08 – Food, eat meat

10 – historic

12/27 – pet; pet and eat snakes

14 – future; for children to know in the future; future generations

16 – does not disturb anyone

18 – part of nature and vaccine

20/26/34/35 – it does not exist in other places (unique; patrimony of the region; famous even in the States; one of the richness of Silva Jardim; because it's Brazilian; it's of the Brazilian fauna+)

25 – children learn a lot about them

30 – comerce (para vender)

37 – leather

38 – zoo

40 – scientific research

47 – similar to human being

49 - tourism; ecological tourism

9/11– included in 2

19/22/29/31 – included in 2

#### 101- IMPORTANT FOR NATURE

03/04/05/13 – part of nature

06/42/48 – right to live (life; every animal deserves respect; living being; everything God made is important; the world without animal is not a world)

15/21 – rarity (...in extinction) (to preserve specie)

17/32 – eat some insects; ...and is important for the fauna

23 – cleans forest

33/36 – It's being returned to the forest; thus it must be important; if it wasn't important, the hunting would be not prohibited

39 – indicator specie

41 – fecunds trees (plant propagation)

45 – for one animal scare the other (food chain)

46 – clean environment

#### **Q 22. The golden-lion-tamarins exist in the forests of which Brazilian states?**

##### 100- CORRECT

01 – Rio de Janeiro (na região)

##### 101- INCORRECT

02 – Rio de Janeiro + Mato Grosso

03 – Rio de Janeiro + Amazonas

04 – Amazonas (Manaus)

05 – Amazonas + Rondônia

06 – Brasília

07 – Japão

08 – Rio de Janeiro + São Paulo

09 – Mato Grosso

- 10 – Bahia + Espírito Santo
- 11 – Goiás + Mato Grosso
- 12 – Amazonas + Minas Gerais
- 13 – Pernambuco
- 14 – Minas Gerais
- 15 – Rio de Janeiro + Espírito Santo
- 16 – Rio de Janeiro + Minas Gerais
- 17 – Rio de Janeiro + Bahia
- 18 – Rio Grande do Sul
- 19 – Rio de Janeiro, Mato Grosso, Amazonas
- 20 – Minas Gerais + Mato Grosso
- 21 – Rio de Janeiro, Amazonas + Minas Gerais
- 22 – Amazonia + Mato Grosso
- 23 – Bahia
- 24 – Africa + Manaus
- 25 – Amazonas + Goiás
- 26 – Rio de Janeiro, São Paulo, Minas Gerais
- 27 – Amazonia, Minas Gerais, Goiás, Rio de Janeiro
- 28 – todos
- 29 – Rio e outros estados
- 30 – estados aonde tem a mata Atlântica (including Rio)
- 31 – Pará, Rio, Espírito Santo
- 32 – Rio e Santa Catarina

**Q 27. Can you say the names of 1 or 2 local animals that are in danger of extinction?**

\*- nonsense

00 – no answer

99 – don't know

100 – none

101 – CORRECT

02 – jacú

05 – anta

06 – otter

07 – wild dog

04 – tucano

11 – golden lion tamarin

18 – jaguar

19 – deer

34 - jaguatirica

40 – sloth

49 – barbado monkey

46 - caiman

102- INCORRECT

01 – almost all (the majority)

08 – capibara

10 – cotia

- 17 – wild pig (caietú)
- 43 – parrot
- 21 – paca
- 25 – exotic animals (leão,tigre, urso...)
- 26 – ant eater
- 32 – coati
- 41 - mamute
- 42 – domestic animals
- 35 – lobster
- 44 – macaw
- 09 – rabbit
- 03 – canário da terra (canário)
- 20 – birds
- 12 – skunk
- 27 – azulão-bird
- 13 – wild cat
- 28 – curió (avinhado)
- 14 – mão pelada monkey
- 31 – codorna-bird
- 15 – mico estrela monkey
- 36 – bem te vi- bird
- 16 – hedgehog
- 37– inhambú- bird
- 38 – sabiá da praia- bird
- 39 – tiê sangue- bird
- 45 – trinca-ferro- bird
- 30 – armadillo
- 47 – hummingbird
- 51 – blue macaw; macaw
- 33 – preá - reptile
- 22- lagartos- reptile
- 41 - lobo guará- Brazilian wolf
- 23- frog
- 45 – monkey
- 24 - turtle
- 48 – manatee
- 29 – snake
- 50 – Brazilian anteater

**Q 29. What happens with the water and the earth after a deforestation?**

100- CORRECT

01 – dry up

02 – water dries + land does not produce anything

04 – does not fit for plantation

05 – dries and erosion  
 07 – land slide  
 10 – erosion  
 14 – destroid  
 15 – infertile land  
 20 – dry water + grows bush  
 33 – no life/ dies out  
 34 – not good  
 35 – soil receives much sun and the water changes  
 37 – not stable  
 40 – water changes; land is poor  
 41 – water diminish; destroys soil  
 101- INCORRECT

03 – more water; no production  
 06 – water diminishes + land gives a good product  
 08 – if it's taken cared of, everything is allright  
 09 – dirty water and infertile land  
 11 – polution  
 12 – water poluted and erosion  
 18 – water poluted and dried soil  
 16 – clean water and soil is better

17 – born again  
 19 – open area for production  
 21 – water dries and nothing happens to soil  
 22 – water gets warmer  
 23 – cleans it up  
 24 – provokes an earthquake  
 25 – increases water and soil is better  
 26 – catastrophe  
 27 – flooding  
 28 – land is more humid  
 29 – looses oxygen  
 30 – eliminates microbes from earth  
 31 – soil is massacrated  
 32 – soil dries up + water is dirty  
 36 – lots of bad things  
 38 – in the lowlands, nothing happen; but in hillsides, it slides  
 39 – water diminishes and everything diminishes as well  
 43 – warms up water and weakens soil  
 44 – lots of good things

102- NOTHING

13 – nothing  
 42 – explodes

**Q 31. If Yes, where did you see this drawing?**

## 100- PROJECT ADVERTISEMENT

- 02 – pictures, drawings
  - 03 – car
  - 04 – car of reserve
  - 06 – hat
  - 07 – TV/video
  - 08 – t-shirt
  - 09 – magazine
  - 10 – mayor's office
  - 11 – newspaper
  - 13 – in the police department of Casimiro de Abreu
  - 14 – house of Casimiro de Abreu
  - 15 – car of IBAMA
  - 16 – stickers
  - 17 – in the square; in the street; in the bakery
  - 18 – pin
  - 20 – notebook 37 – notebook
  - 22 – posters
  - 34 – school material
  - 38 – health station (fórum)(hospital)
  - 47 – in the road
  - 48 – security box of IBAMA
  - 49 – bus station of Casimiro
  - 50 – advertisement
  - 59 – Leão Dourado company bus
- 101- ENVIRONMENTAL EDUCATION PROGRAMS

01 – movie (slides)

- 05 – school
- 12 – flyer
- 29 – exposition
- 40 – RPPN Bom Retiro (Luis Nelson)
- 41 – Reserve Poço das Antas (Boi Branco) (Reserve Uniao)
- 54 – party of the city of Casimiro de Abreu
- 55 – (included in 41)
- 58 – farm
- 63- talks

## 102- IMMEDIATE REGION

- 39 – area of Silva Jardim
- 44 – in Aldeia Velha
- 42 – in the region
- 45 – city of Casimiro de Abreu

46 – city of Professor Souza  
 52 – Pavillion of Casimiro de Abreu  
 53 – Cultura house de Casimiro de Abreu  
 57 – Rio Dourado  
 60 – city of Imbau  
 103- OUTSIDE OF REGION

43 – boat in Belém  
 51 – Rio de Janeiro  
 56 - Niteroi  
 61 – Minas Gerais  
 62- zoo  
 104- OTHER

19 – with vida (com o tempo)

21 – books  
 30/36 – at home (friend's house)  
 31 – in the circus  
 33 – now (interview)  
 35- with children  
 36 – (included in 30)

**Q 32. What does it represent?**

100- CORRECT

01 – the golden lion tamarin

02 – tamarin

12/15/18/41 – tamarin + offspring (mother protecting offspring) + preservation

31 – tamarin and nature

8/34- monkey/with offspring

03/09/14 – animal of respect (call for protection; important animal; animal asking for help; asking for support; for caring of animals; conservation; protection; preservation; conscientization.

04/06/10/21 – it is ending; it's in extinction; animals in extinction; symbol for the reduction of extinction

07/11/17/37/38/39 – golden lion tamarin project; symbol of the reserve; work of the reserve; area of preservation of the glt; campaign to preserve the glt; work to avoid with hunting

33 – symbol of organization (...of AMLD) (foundation that protects the environment)

44 – reforestation

23/40 – health in the woods

25 – symbol

26/43 – Silva Jardim (pride of the region; symbol of pride)

27/35 – animal represents everything; life

30/32 – nature (symbol of our nature)

102- INCORRECT

05/16/24/45 – wrong animal (lion; cow; snake; lion and offspring)

08/34 – monkey and offspring

13 – king of forests

19 – vaccination

20 – union of all animals

28 – nothing

22 – recognition of animal (without knowing name)

29/36 – beauty (a beautiful animal)

42 – procreation

**Q 34. From all of this, how do you think you have learned MORE about nature?  
(only one answer)**

100- FROM PROGRAM ACTIVITIES (ADDS + EDUCATION)

6- talking to technicians

7- reading posters+ brochures

8- watching talks and participating in meetings

9- classes in school

10- watching educational movies

11- expositions

14- excursions (to reserve)

16- visiting the Education center (only for 2001)

20 – participando de atividades de preservação

101- FROM THE MEDIA

3- TV

4- newspapers and magazines

5- radio

102- FROM OTHER PEOPLE

2- with parents and family

12- talking to friends

13- talking to sons/daughters

103- OTHER

1- observing in the forest

17 – researching/ reading books

18 – studying

21 – alone

22 – with life (with time, with God)

23 – with everything

15- visiting parks and zoos

**Q 36. If Yes, Where is it located?**

**Q 42. If Yes, Do you know where it is located?**

100- CORRECT ANSWER

01/5 – Poço d' Antas Poço das Antas

02/08/11 – (know exactly where) (exit de AV – se em AV) (entrance de AV – se em CA, RD, PS) (after Rio São João – se em SJ e Imbaú) (BR101 – asphalt) (between SJ e CA)(near the asphalt – se em SJ) (near Juturnaíba) (near the dam)(+ 500km de Ribeirão) (2nd estação indo a SJ) (near Faz. Boi Branco)(limit with CA)(near the river AV) (in the reserve – para 17) (after CA – if in RD ou PS); between SJ, CA, AR

03/12 – Silva Jardim (nearby...)

04 – in an old station

05 – (included in 1)

06 – Poço das Antas – old station

08 – ver 02

10 – near Casimiro

13 – in reserve

15 – in direction of Niterói

101- INCORRECT ANSWER

07 – Casimiro

09 – wrong place

14 – Bicuda

16 – near Bananeira

**Q 37. What is its purpose?**

**Q 43. Do you know its purpose?**

00 – did not respond

99 – don't know

100- CONSERVATION WORK; NATURE PROTECTION

- 01/10/ 23 – to protect animals
- 02/05/08/14/43–conservation (protect animals and plants; protect nature; ecology; conservation; preservation; protect animals and plants in extinction; respect for nature; protect tamarin and other species)
- 04 – to conserve the glt
- 11 – to end with extinction; preserve against extinction
- 15 – work with animals
- 16 – for animals and water
- 17 – create animals and plants
- 20 – protect nature for our well being (to preserve human life; protect animals+give medicine and food; for children to know later; benefits for people; to improve the quality of life)
- 21 – reintroduction and protection
- 22 – avoid deforestation and hunting
- 27 – prevent against future
- 30/35/38 – orient community (orientation; conscientization; clarification; information about conservation; to educate; education for protection)
- 32 – avoid deforestation
- 33 – protect tamarin and other animals
- 34 – study and research
- 35/38 – included in 30
- 38 – included in 35
- 39 – call attention to take care of the Atlantic forest
- 42 – avoid deforestation and protect waters
- 43 – (included in 2)
- 45 – fundraising for conservation work
- 47 – preservation and provides jobs

INCORRECT

101- TO PROVIDE PRODUCTS + SERVICES FOR HUMANS

- 03 – raising tamarin for medicine
- 06 – create animals (procreation; to put animals inside; to increase population of animals)

- 07 – avoid draught
- 09 – value for the municipality (improve municipality) (patrimony of region)(preservation for tourism)
- 12 – prohibit hunting
- 13 – for poverty
- 18 – preserve health; lungs of Rio de Janeiro
- 19 – hunting antas
- 25 – visiting card of Brazil
- 26 – protect antas
- 29 – against destruction
- 28 – vaccination
- 31 – to unify the various reserves

- 36 – provide employment
- 40 – keep an eye and take care
- 41 – association with the reserve
- 46 – administration to take care of tamarin

104- WRONG ANSWER

- 37 – wrong purpose

**Q 39. If Yes, Where is it located?**

100 - CORRECT

- 01 – Rocha Leão/ Rio Dourado
- 02 – Know exactly where (before Macaé e after Casimiro) (in direction to Campos/ to Macaé) (between CA e RO) (muni. CA; after RD)

101 - INCORRECT

- 03 – near Macaé
- 99- Don't know

**Q 48. If yes, what does ecotourism mean?**

100 - CORRECT

- 01 – ecological tourism
- 02 – sustainable ecological tourism (...without depredation) (...for preservation)
- 03 – benefit for municipality
- 06 – preserve nature
- 07 – constructive tourism
- 08 – preservation of rivers and forests to preserve tourism
- 09 – tourism for those that like to study (visit) the woods; to see what nature has; to see animals
- 10 – touristic points
- 12 – conscientization of people and take them to see woods
- 13 – teach tourist what is the environment (guide talks about animals and forest)
- 14 – visit the reserve

101 - INCORRECT

- 04 – several forms of development
- 05 – bring information for tourist to visit Aldeia Velha
- 11 – wrong answer (campaign about animals; presence of people protecting; culture to survive; study of extinction of animals)
- 15 – fundraising

**Q 50. If yes, what does forest corridor mean?**

100 - CORRECT

- 01 – link forest islands (...forest reserves)
- 03 – passage of animals
- 05 – environmental preservation (conserve forests)
- 10 – expandir forest to other areas

101 – INCORRECT

- 02 – for beauty
- 04 – nature protection

- 06 – hold animals
- 07 – for security to go through
- 08 – to run the forest and see the animals
- 09 – to observe

**Q 53. How old are you?**

- 1 – 18 to 29
- 2 – 30 to 39
- 3 – 40 to 49
- 4 – 50 to 59
- 5 – 60 to 69
- 6 – 70 to 100

**Q 55. (If not) How long have you lived in this municipality?**

- 1 – born locally
- 2 – less than 5 yrs
- 3 – between 5 and 15 yrs
- 4 – more than 15 yrs

**Q 57. (If yes) What was the last year that you have completed?**

100- ELEMENTARY SCHOOL INCOMPLETE

- 01- 1
- 02- 2
- 03- 3
- 04- 4
- 05- 5
- 06- 1 grau (nao perguntamos série)

101- ELEMENTARY COMPLETE

- 07- 6
- 08- 7

102- JUNIOR HIGH COMPLETE

- 09- 8

103- HIGH SCHOOL INCOMPLETE

- 10- 1
- 11- 2
- 12- 2 grau (nao perguntamos série)

104- HIGH SCHOOL COMPLETE

- 13- 3

105- TECHNICAL SCHOOL

- 14- Mobral
- 15- Tecnical course
- 16- Teacher proficiency
- 17- Teacher course in high school

106- COLLEGE AND ABOVE

- 18- College/ graduate school

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## BIOGRAPHICAL SKETCH

Christine was 18 years old when she arrived to study in the USA from her native country, Brazil. She attended the American University in Washington, DC, where she earned a B.S. in biology. While still in college, she worked with the National Zoological Park to research animal behavior and species conservation. She became fascinated with improving public support for the conservation of endangered species and ecosystems. In her next job at the World Wildlife Fund, she assisted an environmental education endeavor with Brazilian partner projects as well as prepared materials on flagship species that represented priority regions for conservation. After 8 years in D.C., Christine moved to Philadelphia. She worked for the Philadelphia Zoological Gardens where she contributed in the design and implementation of the Primate Reserve exhibit and its outreach programs. She learned valuable practical skills in working with the zoo's audience as well as gained knowledge in designing activities and lessons. Soon after, she moved to Florida to pursue her master's degree. At completion of this study, Christine was considering a job with a leading conservation organization in New York.