géneros *Callicebus* y *Cebus*) posiblemente aumentarían esta cifra. Como los limites de distribución lógicamente no coinciden con los límites nacionales, la integración de conocimientos y trabajos a ambos lados de las fronteras es de gran importancia para llenar los vacíos que todavía existen sobre la distribución geográfica. Por ejemplo, la presencia de *Alouatta sara* en Bolivia, en la zona fronteriza con el Perú (Wallace et al. 2010), hace muy probable su presencia en el extremo sur del Perú, pero no existen estudios que lo confirmen. Sólo con la integración de conocimientos y la formación de nexos se puede llenar este y otros vacíos. Además de los primatólogos, el taller de especialistas contó con la participación de guardaparques y profesionales de diferentes áreas naturales protegidas del Perú, gracias a la colaboración del Servicio Nacional de Áreas Naturales Protegidas por el Estado (SERNANP). Esto fue de gran importancia, ya que el personal del SERNANP, por su casi continua presencia en estas áreas, acumula bastante información y conocimientos que de otra manera no llegan a ser divulgados.

Las presentaciones orales (11) y los posters (25) de los estudiantes y científicos jóvenes fueron juzgados por un comité de evaluación. Las cinco mejores presentaciones orales y los ocho mejores posters fueron premiados con los libros "Primate conservation biology" de Guy Cowlishaw y Robin Dunbar y "Field and laboratory methods in primatology" por Joanna Setchell y Deborah Curtis respectivamente, donados por University of Chicago Press y Cambridge University Press. Los autores y títulos de los premiados se encuentran en http://www.monosperu.org/ganadores.html.

En una plenaria hacia el final del simposio, los participantes acordaron por unanimidad la formación de un grupo de primatología dentro de la Sociedad Peruana de Mastozoología. Esperamos que con este grupo las actividades primatológicas en el Perú sigan creciendo, tanto en el número de investigaciones primatológicas como en las acciones de conservación de los primates peruanos que estas promuevan y soporten. El simposio ha sido un primer e importante paso hacia esta dirección.

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Figura 1. Carta del primer día de emisión y estampillas con primates del Perú, emitida el 18 Octubre 2011, en el marco de la inauguración del simposio "Primatología en el Perú"

GOLDEN-HEADED LION TAMARIN RESEARCH IN THE 21ST CENTURY: RECENT ADVANCES AND POTENTIAL AREAS OF FUTURE RESEARCH

On 7 and 8 December 2011, students, researchers, and conservationists with a vested interest in golden-headed lion tamarins (*Leontopithecus chrysomelas;* GHLTs) gathered at the State University of Santa Cruz (UESC; Ilhéus, Bahia, Brazil) for the symposium *`Golden-Headed Lion Tamarin Research in the 21st Century: Recent Advances and Potential Areas of Future Research´* with the aim of sharing recent work and discussing potential future avenues for research. Within the last 5 years, several doctoral dissertations and masters theses were completed that focused on the biology, ecology, and/or conservation of GHLTs in addition to the ongoing work of established scientists who have devoted their professional lives to the study of this

species and the Atlantic Forest. However, language barriers and the fact that many members of the GHLT community are based at institutions throughout the world have complicated widespread access to these results and collaborations among researchers. The primary goals of this symposium were to (1) promote the exchange of existing information, (2) contribute towards a better synchronization of research efforts, and (3) identify important steps for more efficient/collaborative conservation efforts for GHLTs and their habitat. This symposium brought together 30 participants from 12 institutions in Brazil, Belgium and the USA and allowed for the dissemination of information to the global GHLT community, compilation of recent advances in research, and identification of gaps in knowledge of GHLT biology, ecology and conservation, which ultimately fostered discussions on how attendees could collaborate to fill knowledge gaps.

Golden-headed lion tamarins

GHLTs are small arboreal primates threatened by extreme habitat fragmentation and loss of the Atlantic Forest in southern Bahia, Brazil (Pinto and Rylands 1997; IUCN 2012). They are frugi-faunivores that live in small groups (5–7 individuals on average) and maintain home ranges that can be quite large (20–200 ha; Raboy and Dietz 2004; Oliveira et al 2011). In addition to mature and secondary forest, the species uses shade-cocoa plantations known locally as *cabruca* (Raboy et al 2004, Oliveira 2010). The species´ geographic range is characterized by two distinct vegetation types: coastal humid forest in the east, where cocoa production is the predominant agricultural activity, and semi-deciduous mesophytic forest in the west, where cattle ranching is widely practiced (Pinto and Rylands 1997). Because shade-cocoa production in this region utilizes a canopy of native trees, large swaths of forested habitat are still available for GHLTs throughout the east compared to the small, fragmented forest cover interspersed by open cattle ranches in the west. However, forest throughout the species' range was lost at a rate of 13% over the last 20 years, and this deforestation rate is projected to increase as shade cocoa plantations are converted to cattle pastures following declines in cocoa prices and fungal epidemics that devastated the cocoa industry beginning in the early 1990's (Schroth & Harvey, 2007). Additionally, planned changes to Brazil's Forest Act will eliminate enforced protection of certain areas of existing forest (Calmon et al., 2011). Because the majority of native vegetation within the GHLT range is found on private land where extreme pressure for agricultural expansion is highest (Sparovek et al., 2010; Ferreira et al., 2012), a better understanding of the needs of GHLTs and the protection of their habitat is becoming increasingly critical for the survival of this species.

Overview of existing knowledge relevant to the *in situ* conservation of the species

The two-day symposium was structured to allow for a day of research presentations and a day of discussion. Through 16 presentations, participants presented the major results of their recently concluded or ongoing research programs. Topics included ecology and behavior of GHLTs in various habitat types, genetic structure and health of GHLT populations, the impacts of forest fragmentation/connectivity and climate change on the species, and updates on the activities of NGOs and the status of protected areas within the species´ distribution range. Following presentations, participants summarized existing knowledge on *in situ* GHLT biology, ecology and conservation based on past research programs/publications and on the information presented at the symposium (Tables 1 & 2). Additional information (e.g. population surveys, extensive GIS work, population and landscape modelling, genetic sampling, and health assessments) not listed in Table 2 is available at the level of the entire distribution range.

Defining priorities for future research and conservation

Following the summation of existing knowledge, participants worked in break-out groups to identify what they deemed the top five most significant research gaps in GHLT research and knowledge. Working group results were presented and discussed in a plenary session. The topics identified as highest priority research areas included:

1. Ecology, biology, health status, and genetic differentiation of western populations: Demographic and landscape modeling have demonstrated that without protective measures, all western populations are in immediate danger of extinction in the short term (Zeigler, unpubl. data). Despite this urgency, basic scientific information (i.e. ecology, basic biology, genetic differentiation, and health status) needed to develop sound conservation measures is still unavailable for these populations. Such information will improve our understanding of the species´ management needs throughout its range.

2. GHLTs and cabruca *agroforest*: *Cabruca* plantations can range from heavily managed monocultures to highly natural mosaics of cacao trees and endemic tree species, and not all forms are suitable as GHLT habitat. Research focusing on the presence/absence of GHLTs and their comparative demography and ecology along the full spectrum of *cabruca* agroforest is essential to understanding the species´ habitat and management needs and balancing regional socioeconomics with conservation.

3. GHLT dispersal and survival in fragmented landscapes: Very little is known about how GHLTs move and survive in fragmented forest; how often individuals leave forest boundaries and move through non-forest matrix, how far

Table 1. Definitions used to categorize the scope of available knowledge, sample size and duration of available studies on which the assessment in Table 2 is based.

Scope of information	Definition of scope	Sample on which knowledge is based	Duration of study
Homogeneous habitat	Principally composed of relatively continuous mature forest, with only smaller patches of secondary forest.	Maruim-REBIO Una, 17 groups (one study-site)	11 years
Heterogeneous habitat	Composed of a mixture of small and large patches of a wide variety of habitat types. Types of habitats include selectively logged and secondary forest in different stages of regeneration interspersed with abandoned agricultural fields and pastures in the process of regeneration (e.g. cocoa, rubber and jackfruit stands) as well as a mosaic of primary and secondary forest with *cabruca* agroforest.	Piedade-REBIO Una, 5 groups (one study-site); 4 groups in the municipalities of Camacan, Jussari, Una and Arataca	8 years for Piedade-REBIO-Una, 1 year for other groups
Cabruca agroforest	Cacao agroforest where the understory is replaced by cacao trees and around 10% of native canopy trees are left to provide shade for understory. The suitability of *cabruca* for GHLTs varies depending on the diversity and density of shade trees.	3 groups concentrated in the municipality of Ilhéus	4 years and on-going
Semi-deciduous forest	Seasonal forested habitat in the western portion of the species range.	1 fragment, 2 groups	1 year
Restinga	Vegetation adapted to sandy soil; normally distributed along the coast and on soils under marine influence.	Currently no studies	Currently no studies
High altitude forest	Areas of the GHLT range above 400m.	Limited information from survey work across the species' range and from two groups using a mosaic forest that were monitored for a few months in the *cabruca* study	1 season

individuals travel through non-forest matrix, what landscape elements individuals are willing to travel through and which elements act as barriers to dispersal, the probability that dispersing individuals will survive the journey, and whether other characteristics (such as patch occupancy by GHLTs) influence dispersal and settlement. This information is critical for landscape-level conservation planning.

4. A new census of the current GHLT distribution: Given continuing threats across the species' distributional range, the size and locations of populations are likely to still change/decline. Knowing how many individuals/populations exist and where they are located is of vital importance to managing and protecting the species in addition to improving our understanding of population trends and gauging the effectiveness of conservation efforts.

5. GHLT use and behavior in unknown habitat types: Research has thus far focused on GHLTs in primary forest, degraded forest, and *cabruca* agroforest. Little is known regarding if and how GHLTs use other habitat types such as *restinga*, high altitude forest, or other agroforestry systems.

6. Threat impact analysis: Threats to GHLT survival have been identified and include broad processes like forest loss and fragmentation and climate change. Information on the specific nature of these threats and their impacts on GHLT survival, however, is limited. A better understanding of these threats is necessary for protecting GHLT populations from negative impacts.

7. Environmental services provided by GHLTs: GHLTs are hypothesized to have an important role in ecosystem functioning. Research is needed to better understand the importance of the species in maintaining the structure and viability of the Atlantic Forest through, for example, seed dispersal. Since a major part of Brazil's economy relies on Atlantic Forest resources, demonstrating that GHLTs themselves play a critical role in the functionality of the forest may be an alternative approach to securing conservation of the species and its habitat.

8. Environmental education: Research into the perceptions of local people towards GHLTs and conservation in general is important for improving our understanding of their attitudes and offers important information for developing sound, efficient and viable education and outreach programs that involve all relevant stakeholders.

Table 2. Overview of key research topics relevant for the *in-situ* conservation of golden-headed lion tamarins and the current level of available knowledge (both published and unpublished) for those topics. Information is categorized per habitat/landscape or as global knowledge using the following scale: (0) No Information, (1) Little Information (i.e. information based on a single field season and/or on only a few GHLT groups/individuals), (2) Moderate Information, (3) High Amount of Information (i.e. information based on multiple field seasons and GHLT groups/individuals). Asterisks (*) indicate that data have been collected but not yet analyzed.

Category of knowledge	Scope of knowledge					
	Homogeneous	*Heterogeneous*	*Cabruca*	*Semi-deciduous*	*Restinga*	*Altitude*
Mortality	3	2	*	1	0	0
Reproduction	3	2	2	1	0	0
Diet	2	2	2	1	0	0
Activity budget	3	3	2	1	0	0
Tree use	3	3	*	1	0	0
Predation	3*	3	3	0	0	0
Space use	3	3	2	1	0	0
Density	3	2	2	1	0	0
Group size	3	2	2	1	0	1
Home range size	3	2*	2	1	0	0
Health (parasites)	1	1	1	0	0	0
Associations with *C. kuhlii*	3*	2	2	1	0	0
Genetic diversity	3	*	1	1	0	0
Movement within fragments	3	3*	3*	1	0	0
Movement between fragments	0	0	0	0	0	0
Anthropic pressure	1	1	1	2	0	0
Community ecology	2	1	0	0	0	0
Environmental education	3	0	0	0	0	0
Mortality within matrix	0	0	0	0	0	0
Migration/emigration/immigration	2	1	0	0	0	0
Ethnozoology	0	0	0	0	0	0
Environmental quality	2	2	0	1	0	0
Extinction	3	3	*	2	0	0
Extinction rate	3	2	0	0	0	0

The symposium was concluded with a discussion of how we can fill these major research gaps and how communication between researchers and stakeholders can be improved in order to disseminate the results of research and improve the efficiency of conservation efforts of the species.

Conclusion

We considered this meeting a very significant event because it brought together the majority of researchers involved with the *in situ* conservation of GHLTs to discuss research and exchange ideas. The resulting overview of existing knowledge and the list of knowledge gaps can serve as guidelines for the development of future research projects that wish to ultimately contribute to the development of conservation actions for the species. With this information, next steps will include reaching out to stakeholders involved with activities relevant to the conservation of the Atlantic Forest in general and GHLTs in particular. It is important that research results presented during this symposium become available to the wider public, particularly to federal and non-governmental institutions and civil society. The format of the distributed information should allow stakeholders to see how their respective activities might affect GHLTs and the landscape in which they reside while suggesting the kind of alterations that may be required to make those activities more compatible with GHLT conservation.

Ultimately, to maximize the long-term persistence of GHLTs, we need to conserve a functionally connected

landscape that offers adequate resources and allows GHLTs to move and breed successfully within the exceptionally heterogeneous environment of southern Bahia. Partly, this includes a much better understanding of the anthropogenic pressures on GHLTs and their habitat. Of equal importance is the consideration of GHLTs within their broader ecological network and the Atlantic Forest ecosystem. Studying GHLTs as an integral part of the ecological network of which they are a part will improve our understanding of the species' needs as well as its role within the ecosystem, contributing to more efficient conservation actions in the long-term. To get to this point, critical research is still needed at both broader and narrower scales as described in this document. Broadening our focus to the entire Atlantic Forest while continuing to study essential aspects of the species´ biology, is likely the most efficient conservation strategy over the long-term. There is an increasing demand for large-scale projects that focus on regions, their ecological functionality, and the species within those regions. We hope that this document serves as a guideline for how to develop new projects and partnerships that incorporate this demand and contribute to the long-term persistence of GHLTs and the Atlantic Forest.

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Recent Publications

BOOKS

Field and Laboratory Methods in Primatology: A Practical Guide, edited by Joanna M. Setchell & Deborah J. Curtis. 2011. Cambridge University Press. 456 pp. ISBN: 978–052114213. The second edition of this guide to research on wild primates covers the latest advances in the field, including new information on field experiments and measuring behavior. It provides essential advice on the technical and practical aspects of both field and laboratory methods. *Contents:* 1. An ethno primatological approach to interactions between human and non-human primates –Jones-Engel L, Engel GA & Fuentes A; 2. Habituating primates: