

Title Page

1. CLP project ID & Project title:

001906

**Conservation Status of the Montane Slender Loris in Horton Plains National Park,
Sri Lanka**

2. Host country, site location and the dates in the field:

Sri Lanka, Horton Plains National Park (HPNP) 06/2006 – 05/2007

3. Names of any institutions involved in organising the project or participating

Land Owners Restore Rainforests in Sri Lanka

4. The overall aim summarised in 10–15 words

Identify distribution, population density, abundance and threats to Montane slender loris
in the HPNP

5. Full names of author(s)

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7. Date which the report was completed

10th July 2013

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Acknowledgements

We like to express our thanks to Professor S.W. Kotagama for overall supervision of the project supervision.

We wish to thank BP Conservation Leadership Programme and its staff for technical advice and project support. We thank the Director General of the Department of Wildlife Conservation (DWC) and the Research Committee, Deputy Director of Research, Mr. S. R. B. Dissanayake and Park Warden and his staff at Horton Plains National Park for their support. We thank C. J. Hettiarachchi, G. D. C. Pushpa-Kumara, G. P. Rathnayake, D. R. Vidanapathirana for their assistance during field work. We also wish to thank Members of the Land Owners Restore Rainforests in Sri Lanka (LORRIS), Primates Conservation Society of Sri Lanka (PCSSL), Field Ornithology Group of Sri Lanka (FOGSL) and Nature Exploration and Protection Society (NEPS) for their assistance during the project activities. We also thank staff of “The Trails (Pvt) Ltd” Nuwara Eliya for their kind support. We also thank Lets Travel (Pvt.) Limited for providing field equipment and financial support to fulfil our project activities.

Section 1:

Summary (max 200 words)

The Montane slender loris is a critically endangered primate, endemic to Sri Lanka, and has been observed only in Horton Plains National Park (HPNP). Further it was previously listed as one of the top 25 endangered primate in the world. No one was able to observe clearly or take photographs of this cryptic animal during the last 69 years, and its taxonomic and conservation status was also uncertain. Thus our study was designed to fulfil these gaps in knowledge and raise awareness locally, nationally and internationally for initiate long term conservation programme. The results of our study clearly show that the loris population in HPNP is below 50 and thus its long term survival poses a serious problem. We discovered that its preferred habitat is undisturbed montane evergreen forests, but forest diebacks, over exploitation of firewood and encroachment of exotic plant species have undermined its future survival. Therefore, we conducted several awareness programmes, printed brochures and gave international presentations to create interest for long term conservation of this loris species and it's habitat.

Introduction (max 500 words)

Red slender loris (*Loris tardigradus*) is an endangered primate endemic to the wet zone of Sri Lanka, and includes two subspecies *L. t. tardigradus* and *L. t. nycticeboides*. Both subspecies are listed as endangered (IUCN, 2008). The Montane slender loris (MSL)(*L. t. nycticeboides*) was previously (2004-2008) listed as one of the top 25 endangered primates in the world (Mittermeir *et al.* 2006). Further Sri Lanka together with the Western Ghats in India is listed as a global biodiversity hotspot (Myers *et al.*, 2000). Despite this conservation interest, information on distribution and habitat preferences of MSL was very limited. It was previously recorded only from two specimens collected in 1937 by Tutein-Nolthenius in the Horton Plains region (Hill, 1942), and later by a sighting from eye-shine in 2002 (Nekaris, 2003).No photographs have been taken and no long term studies have been carried out on MSL during last 69 years.

The Horton Plains National Park (IUCN Management Category II) is situated on the highest plateau in Sri Lanka (altitude ranges from 2000-2390m total area is 31km²), and consists of montane evergreen forests and wet patana grasslands that are located on undulating terrain. This park is a tourist attraction and thus faces constant threat of human interference. Furthermore the Department of Wildlife Conservation set up an initial management plan, but did not include small and nocturnal mammals, such as *L. t. nycticeboides*. In addition, there were very few conservation education and awareness programmes in the montane region of Sri Lanka.

Based on the threats faced by the Horton Plains National Park (HPNP), an IUCN CAMP meeting in Coimbatore, India, declared the MSL as Critically Endangered (Nekaris and Jayawardena, 2003). It was therefore vital that in order to save this species from extinction, population surveys and baseline data had to be collected to evaluate the conservation and taxonomic status of this subspecies. In addition, awareness of MSL's Critically Endangered Status had to be raised at the local, national and international level. It is only with such data and effort at raising awareness, that an effective and sustainable long-term conservation program can be initiated.

Key project partners

Department of Wildlife Conservation - Provided research permission to carry out the project and through the Park Warden of HPNP did the field supervision and provided staff for awareness programmes.

Field Ornithology Group of Sri Lanka (FOGSL) – Through Professor S. W. Kotagama, did overall supervision and provided technical support and equipment for the awareness programmes.

Land Owners Restoring Rainforests in Sri Lanka (LORRIS) – provided the trained field staff and logistical support.

Education Department, NuwaraEliya- provided institutional support and helped to identify schools for the awareness workshops.

Nature Exploration and Protection Society (NEPS)- this local organisation provided trainee field staff and also helped to organize the area tour guide training programme.

Project members

Saman Gamage(40years) –

B.Sc. (Agriculture), M.Phil. (Animal Science), currently reading to a PhD at the Department of Zoology, University of Colombo “Revision of taxonomy, distribution, abundance and habitat preference of slender loris (Primate: lorisidae) in Sri Lanka”

Experienced in Ornithology (since 1996) and Primatology (since 2001), And wide range of sampling methods. Also has great deal of experience working with local communities.

Currently working as the principle researcher for the slender loris conservation project, of the Open University of Sri Lanka and Coordinator for the project titled “Re-establishing Ecological Corridors for the Montane slender loris”. And also co-investigator of the project titled “Mitigate Human-Monkey Conflict and Create Safe Havens to Help Conserve Sri Lanka’s Non-Human Primates”, and trained the field staff for nocturnal surveys and community workshops. Coordinated the key project partners to help achieve the final goal.

Wasantha Liyanage(40 years) -

B.Sc. (Agriculture), M.Phil. (Animal Science), PhD (Environmental Engineering)

Experienced in the fields of Ornithology (since 1998) and Primatology (since 2001), and a large range of sampling methods (botanic sampling methods, line transect, point count, Whittaker Nested plot sampling and quadrat sampling). Sound experience in working closely with local communities. Currently working as a Additional District Forest Officer of the Forest Department at NuwaraEliya. Worked as a field researcher and provided technical support to the project’s botanic sampling.

Lilia Bernede(38years) –

MSc (in primate conservation), PhD (behavioural ecology and conservation)

Currently working as a Research Fellow at Griffith University, Brisbane, Australia.

Provided the technical support and advice to the team. Trainer for the project’s behavioral, acoustic, and morphological data collection methods.

Chandima Fernando(37years)-

BSc (Zoology), M.Phil (Ornithology)

Experienced in application of ArcGIS and remote sensing. Currently working as a “Programme Manager” at the Sri Lanka Wildlife Conservation Society.

Provided huge support for community work, field data collection and analysis of remote sensing data.

Samantha Mirando (32years) -

BSc (Agriculture), Post Graduate Diploma in Environmental Management,

Currently working as a manager of a local agricultural farm. Provided great deal of support to collect field data and assisted in conducting nocturnal surveys.

Chaminda Mahanayakage(37 years)-

Higher Diploma in Travel and Tourism, Diploma in Environment Management, currently reading for Masters in Environment Management, University of Colombo. Chamindha is a committee member of the community organization called “Friends of Horton Plains”. Worked as a trainee field assistant and assisted in nocturnal surveys. He is also field officer of the project titled “Mitigating Human-Monkey Conflicts and Creating Safe Havens to Help Conserve Sri Lanka’s Non-Human Primates”.

Vidupa Rathnayaka(26years) -

Passed GCE (Advanced Level), and joined the BP conservation team as an area guide. Worked as a trainee field assistant. Currently working as a naturalist at the Chaya Wild Hotel at Tissamaharama.

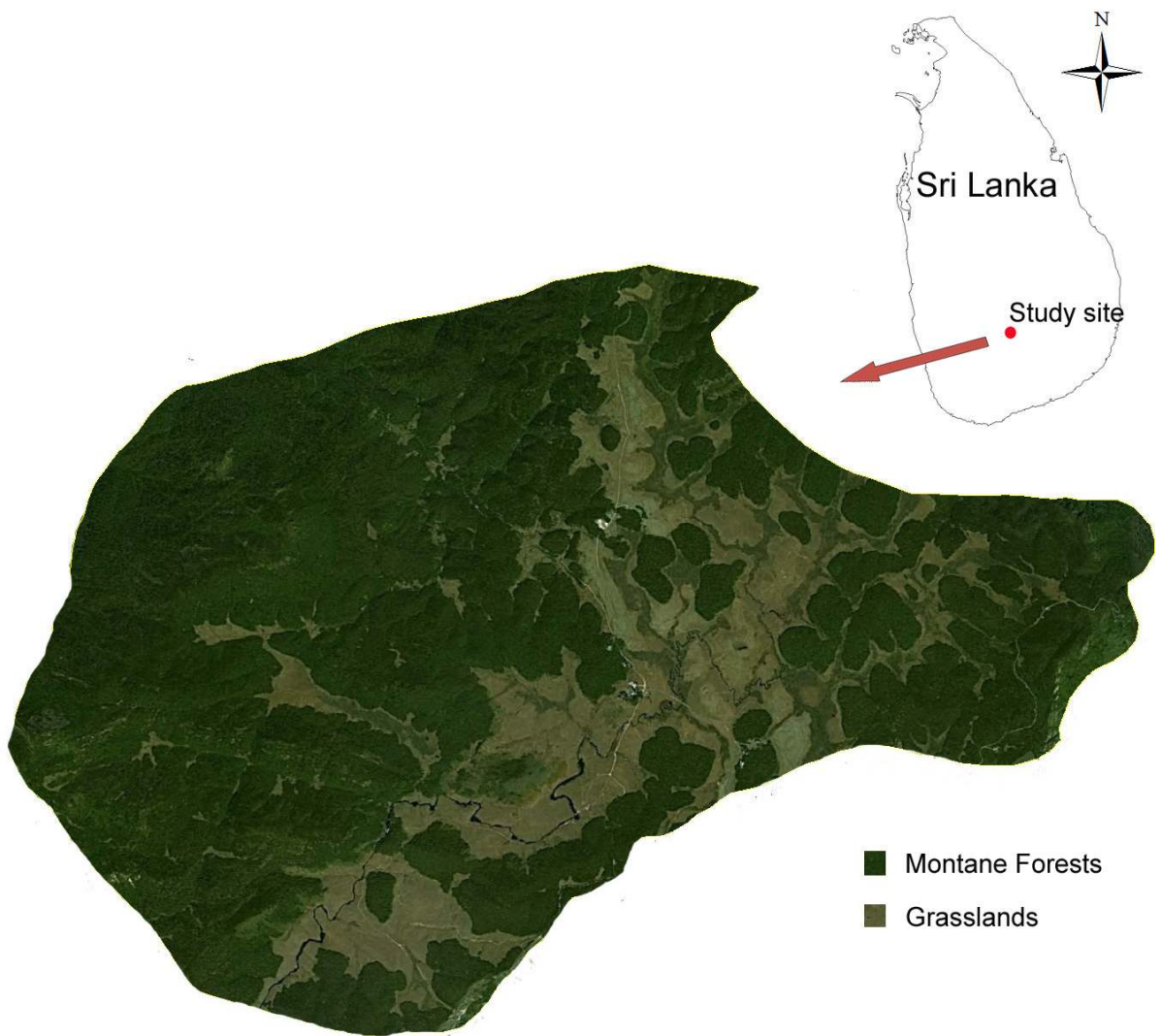


Figure 1: Map of the study site (Horton Plains National Park, Sri Lanka)

Section 2:

Aim and objectives (max 200 words)

The primary aim of this project was to collect baseline data on MSL in the Horton Plains National Park, in order to (i) Evaluate its current conservation and taxonomic status; (ii) Assess its habitat use patterns and preference; and (iii) Educate local communities and raise awareness about this endangered endemic. Therefore, this project had the following objectives

1. Conducting field surveys and local interviews to evaluate MSL's current conservation status.
2. Collecting behavioural, and acoustic information in the field, and morphometric data from live and museum specimens.
3. Assessing MSL's habitat use patterns and preference through microhabitat vegetation surveys and behavioural observations.
4. Assessing resource distribution and availability through insect and vegetation surveys. These surveys also served the purpose of evaluating forest disturbance levels.
5. Assessing potential predator risk through predator density surveys.
6. Promoting the conservation of this species and its habitat and to raise awareness locally, nationally, and internationally, through dissemination of results via publications and presentations.

Methodology (max 500 words)

Objective 1: To evaluate MSL's conservation status, reconnaissance surveys (White & Edwards, 2000) were undertaken using existing roads and paths throughout the national park. Six line transects (2.10, 1.45, 1.25, 1.80, 1.58 and 1.74 km) were then established in areas where MSL was present and each transect was repeated five times during the study period. Each repetition involved two to three trained field researchers, who walked at about 1km per hour, looking for eye shine, and systematically searching for MSL. Upon sighting an individual, perpendicular distance to the transect was measured and the DISTANCE program used later to assess MSL density (Sutherland, 1996). Both reconnaissance and line transects surveys were conducted during 1900-2200 and 0200-0500 hours. Headlamps fitted with red filters were used to minimize disturbance to the animal.

Objective 2: Behavioural data was collected using *adlibitum* sampling and focal animal instantaneous point sampling (Charles-Dominique & Bearder, 1979). Since vocalizations were not heard during the study, the project did not collect acoustic data.

Objective 3: Plotless sampling method was used to collect vegetation data to assess MSL's habitat use patterns and preference. This method has the advantage of being quick and efficient at providing tree densities (Sutherland, 1996). About forty sampling points were chosen randomly within the study site. At each point two sticks were placed perpendicular to each other to demarcate four quadrants. In each quadrant the nearest tree (girth >10cm) from the point and nearest neighbour of the tree (girth >10cm) in the same direction was identified. Then identity of the tree species, distance from the point to the tree, distance between tree and its nearest neighbour, circumference at breast height and the estimated tree height were recorded. Furthermore, the percentage arboreal continuity of each tree was measured using the following scale 0.5-1.5, 1.5-3.5, 3.5-5.0, 5.0-10.0 & >10 meters (Nekaris *et al.* 2005).

In addition microhabitat characteristics of each of these strata, including size, orientation and presence or absence of vines and epiphytes, were recorded. Plant density was calculated using the T-square method (Sutherland, 1996).

The equation used was $D = m^2 / (2.828 \sqrt{X_i \cdot Z_i})$, where D is tree density (trees/ha), m is number of sampling points, X_i is distance from the sampling point (m), and Z_i is distance to the nearest neighbour (m).

Objective 4: Although we were able to conduct vegetation surveys as described above, we did not receive permission to conduct insect study in HPNP.

Objective 5: To evaluate potential slender loris predator population densities we used the same line transects which we established for MSL density surveys.

Objective 6: To promote the conservation of MSL we conducted five workshops, published a booklet to help identify Sri Lanka's slender lorises and presented the project's results at several meetings.

Outputs and Results (max 500 words)

Population data

Data was collected from June 2006 to May 2007 during 156.5km walked during reconnaissance surveys. Additionally 49.6km of line transect surveys were completed along the six predetermined transects. Thus a total of 206.1km was walked during the study period. MSL was observed five times and its density was estimated to be 2.02(0.28-14.44) animals/km². Its abundance was calculated to be 0.024 animal/km.

Habitat availability

The 42 random points that we sampled using the plotless method produced a total of 336 trees (>10cm, CBH) from 16 families and 26 species. Of these, 15 (57.7%) were endemic to Sri Lanka while the remaining 11(42.3%) can be defined as native to Sri Lanka and India (Appendix 1). Average tree height was 6.66 ± 3.41 m (range from 2-18m) and only a few trees were associated with vines (n=14, 4.2%).

The most abundant tree species recorded was *Litsea ovalifolia* (n=33; 9.8%). Other relatively common species included *Calophyllum walkeri* (n=27; 8.0%), *Cinnamomum ovalifolium* (n=26; 7.7%), *Neolitsea fuscata* (n=21; 6.2%) and *Eugenia mabaeoides* (n=20; 5.9%). Furthermore our study recorded 11 exotic species which are gradually encroaching disturbed forests and forest-dieback areas; viz. *Aristeaeklonii*, *Ageratina riparia*, *Cestrum elegans*, *Rubus coronaries*, *Eupatorium riparium*, *Tithonia diversifolia*, *Lantana camara*, *Ulex europaeus*, *Pteridium aquilinum*, *Austroeupatorium inulitolium*, and *Polygonum molle*.

Habitat use and preference

The average height of the trees used by MSL was 8.00 ± 3.16 (range 4 - 12m). Average height from the ground level where MSL were observed was 5.60 ± 2.07 (range 2.5 – 7.0m). MSL showed greater preference for branches (n=4, 80%) followed by trunk (n=1, 20%) and was never observed among vines. Figure 2 shows the available suitable habitat for the MSL, dieback areas and current distribution of MSL in the HPNP.

Assessment of predator pressure

Six possible predators were observed and the *Viverricula indica* had the highest population density (13.55 animals/km²) followed by *Paradoxurus montanus* (5.57), *Prionailurus rubiginosus* (3.02), *Prionailurus viverrinus* (2.01) and *Panthera pardus* (0.75).

Awareness Programmes

1. A two day workshop was conducted for five project staff and five undergraduates from Ruhuna University. It included lectures on primates, slender lorises, montane forests and introduction to line transect and plant sampling methods. After the workshop, a society named “Primates Conservation Society of Sri Lanka” was established(Figure 2).
2. A one--day workshop was conducted for 12 DWC staff at HPNP.
3. A 3-day training workshop was conducted for eight area youths who learned about biodiversity in Sri Lanka and NuwaraEliya. They also identified trails suitable for nature based tour activities (Figure 3).
4. Education and awareness programme at Ohiya Junior School. Total of 108 school children participated (Figure 04)
5. One thousand books were printed for the education workshops and awareness programmes of slender loris and its conservation (Figure 05).
6. Teachers Training: Total of 24 science teachers from NuwaraEliya region participated in the event (Figure 6)



Figure 02: Participant of the primates workshop and the founder members of the “Primate Conservation Society of Sri Lanka”.



Figure 03: Field training for the local youth group



Figure 4: School awareness programmes

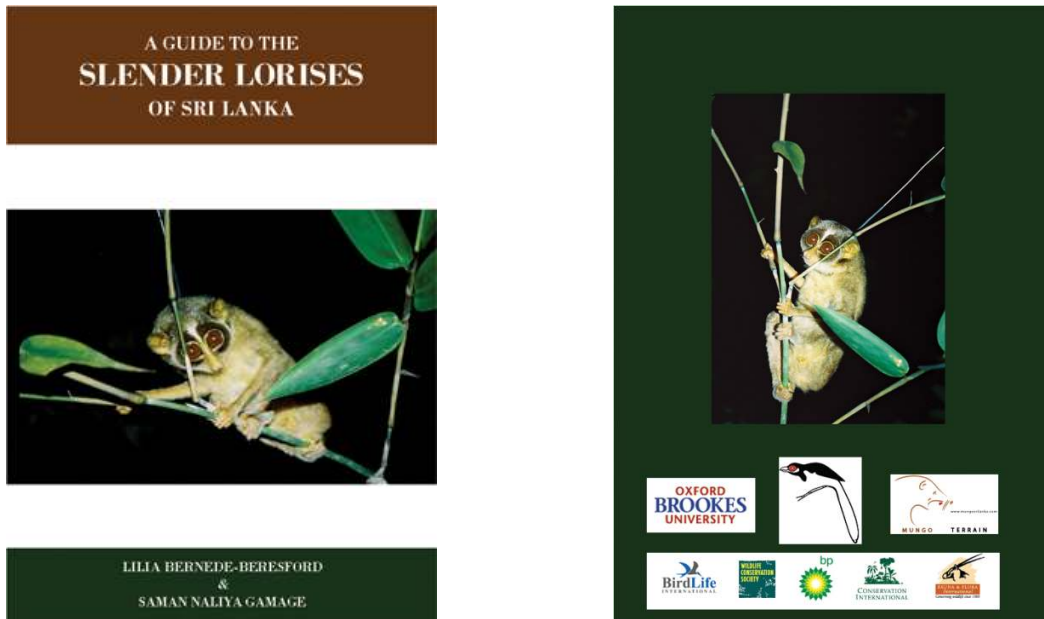


Figure 05: Front and back view of the loris booklet



Figure 6: Participants and trainers of the teacher training programme

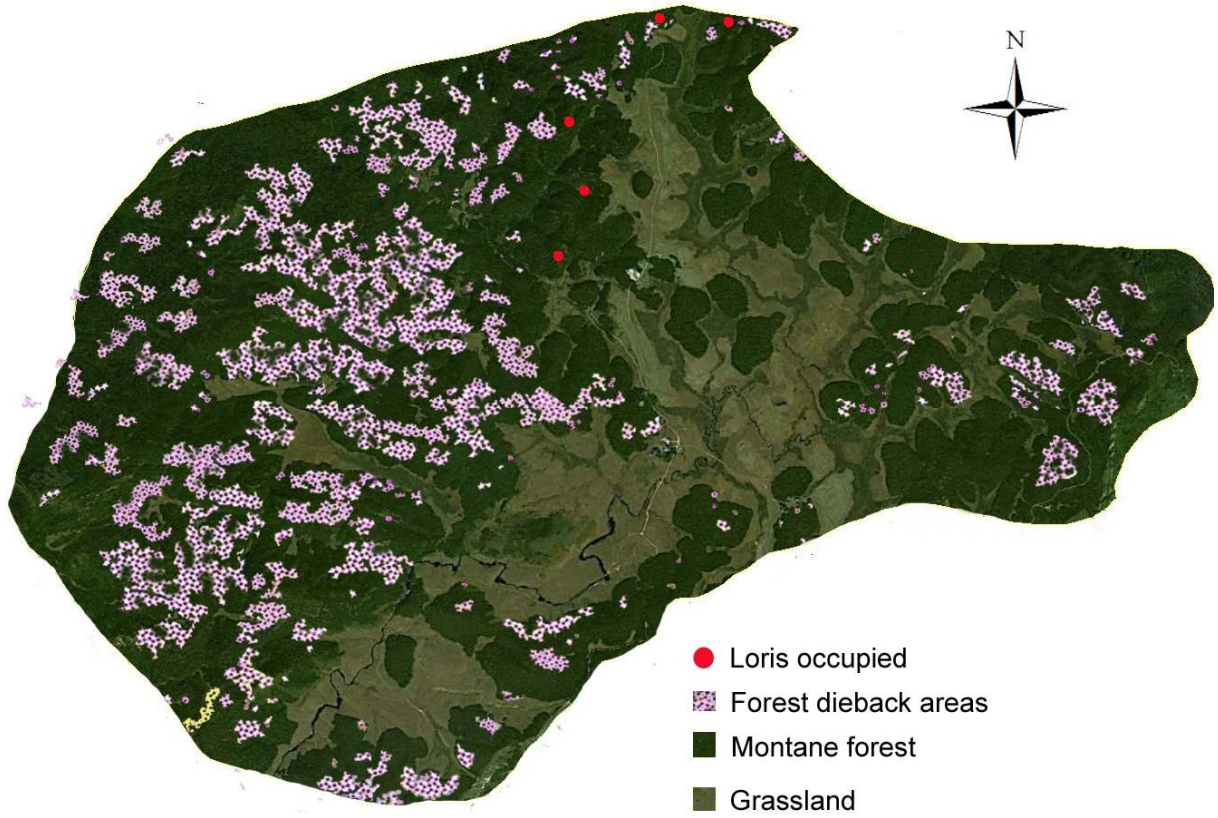


Figure 7: Loris sightings and forest dieback areas of the HPNP

Achievements and Impacts

1. Our project was able to estimate the population density and abundance of MSL in HPNP, which further confirmed that MSL is one of the rarest mammals in Sri Lanka. Thus our results highlighted the need for further studies of MSL in similar montane forest habitats. Therefore, we presented our results to the Zoological Society of London and succeeded in implementing a large scale occupancy monitoring programme [i.e. Conservation Pilot Programme for Red slender loris, (CPPR)] from 2009 to 2011, to confirm range, taxonomy and conservation action plan priorities for *Loris tardigradus* within the fragmented habitat patches of the wet and intermediate ecological zones of Sri Lanka.
2. The field experience and technical training gained by team members during our project was invaluable to the conservation activities in Sri Lanka. For instance, our team members were actively involved in the recently completed CPPR project. In this project the team leader (Saman Gamage) worked as the principal researcher, Chaminda Mahanayakage worked as a research officer and Vidupa Rathnayaka worked as a research assistant.
3. Our awareness and training programmes were able to train local people for nature based tourism activities and build local capacity for future conservation activities. For example the Chaminda Pushpakumara and Vimukthi Sumanasekara who participated in these activities joined the CPPR team as research officers. Two others, Chandima Fernando and Samantha Mirandu, are actively involved in conservation activities through their employment in leading conservation organisations in Sri Lanka. Further several other participants are actively involved in nature based tourism in Sri Lanka (e.g. Gayan Rathnayaka and Ajith Gunasekara).
4. The project was able to launch a new society called “Primate Conservation Society of Sri Lanka” and most of its members are former members of the BP Conservation project. This society is actively involved in conservation activities in Sri Lanka.
5. Finally project was able to raised awareness nationally and internationally for promotes long term conservation of the MSL in Sri Lanka. For example: a. **Nationally**- Saman was facilitate to the National Steering committee for the slender loris conservation project (2008 to 2012) and through this committee we were able to expand the research and conservation activities throughout the montane region; b. **Internationally** – the team was able to make a strong collaboration with Zoological Society of London and implemented a occupancy monitoring programme throughout the wet zone in Sri Lanka (http://www.edgeofexistence.org/mammals/species_info.php?id=22).

Section 3:

Conclusion (max 250 words)

The project was able to provide some base line data on MSL like its low abundance and very small population at HPNP. Further predator pressure is very high and forest dieback and encroachment of exotic plants undermines the future survival of MSL. Therefore, continuous monitoring of MSL is needed in HPNP.

We were unable to evaluate the taxonomic status of MSL because individuals could not be captured. However, based on our sightings we conclude that the external appearance and pelage characteristics are unique to MSL and its habitat is also unique. Given this unique ness we were determined to collect genetic and morphometric data from MSL to evaluate its taxonomic status.

Problems encountered and lessons learnt (max 500 words)

- Which project activities and outcomes went well:
Study of habitat availability, evaluation of predator pressure, training and awareness activities went well.
why?
We used appropriate techniques and well trained staff for these activities. Further all these activities were achievable within a short time period.
- Please detail any problems that the project encountered or deviations from original project plans. Describe how these problems were addressed and what solutions were found to deal with these issues.
 1. Bad weather condition delayed survey activities and increased the number of field visits.
 2. The low frequency of MSL encounters increased the number of reconnaissance walks and repeated surveys along the transects.
 3. The team failed to capture MSL despite increasing our visits to the study site.
 4. We were unable to conduct insect surveys because we did not receive permission from DWC.
- Briefly assess the specific project methodologies and conservation tools used.

Reconnaissance surveys vs. repeated fixed surveys: In reconnaissance surveys we used pre-existing trails and surveyed them once or several times (maximum three times). In the fixed line transect surveys, we demarcated transects in suitable habitats and repeated the surveys five times along each transect. The abundance results were completely different. Abundance from the reconnaissance surveys was (0.013 animals/km) and from the repeated line transects was (0.061 animals/km). Furthermore results of distance sampling technique are also questionable due to small number of observation (n=3).

- Please state important lessons which have been learnt through the course of the project and provide recommendations for future enhancement or modification to the project activities and outcomes.

Most important lesson we learnt from the study was the need to identify proper survey techniques to investigate animals with low detection probability. Results from this study helped us to design the CPPR programme, which was funded by the Zoological Society of London and conducted by the Slender loris conservation programme, of the Open University of Sri Lanka and University of Colombo. In this programme we demarcated 2km transects in the each habitat and repeated the surveys 5 to 9 times along each transect.

In the future (max 200 words)

After the CLP project, funds from People's Trust for Endangered Species (2007-2008) helped us to expand our field surveys and identify new localities where MSL was present.

During the CPPR project we captured a MSL and took the first ever photographs of it (Gamage *et al.* 2010). Furthermore we completed the taxonomic analysis of MSL (DNA and morphometric analysis) and submitted a manuscript for publication. The CPPR study also identified several threats to MSL; forest fragmentation, deforestation for urbanization and agricultural expansion, forest diebacks, and habitat degradation due to firewood collection. These two studies highlighted the importance of taking immediate steps to conserve MSL.

In 2012 we implemented a project titled "Enhancement of natural habitat via bridging the fragmented habitats for survival of critically endangered Montane Slender Loris". Under this programme we have already planted more than 5000 native trees in the montane region and plan to plant 100,000 plants around NuwaraEliya to enhance MSL's natural habitat. Major outcome of this replanting activity will be the establishment of habitat corridors to bridge fragmented habitats and increase the habitat available for MSL. The following BPCP members are actively involved in replanting activities: Saman Gamage, Chaminda Mahanayakage, Chaminda Pushpakumara and Vidupa Rathnayaka.

Section 4

Itemized expenses	Total CLP requested (USD)	Total CLP used (USD)
PHASE I - PROJECT PREPARATION		
Administration		
Communications (telephone/internet/postage)	0.00	0.00
Books and printing journal articles/materials		
Insurance		
Team training (Travell to HPNP + Accomodation + Food)	960.00	598.13
Reconnaissance		
Medical supplies/first aid	0.00	0.00
Equipment		
Scientific/field equipment and supplies (Please detail: binocular 196.26*1	280.00	196.26
Photographic equipment (Please detail: Batteries)		
Camping equipment (Please detail main items:)		
Fuel		
Other (Please detail: 3 head lamps + computor + battries)	1,460.00	1,349.07
PHASE II - IMPLEMENTATION EXPENSES		
Administration		
		0.00
Transportation		
Field vehicle maintenance		
Food & Accommodation for team members (Please detail: Food [(\$4.673 per day/hed * 310)=1448.60] + Accomodation [(\$23.36 per room/room * 63)=1471.96 stipend for local guids (\$9.35 per day * 51) = 476.85	4,320.00	4,320.00
Transportation (Vehicles hiring) \$37.38 per day * 72=2859.81 extra balnce was covered by other source	2,500.00	2,451.54
Customs and port duties		
Workshops		
Outreach/education activities and materials :		
Designing and printing 1000 books (for 1000 books = \$504.67) extra balance was covered by other source	200.00	0.00
Five workshops (\$200*5=1000) extra balance was covered by other sources	600.00	0.00
Other (Please detail:)		
PHASE III - POST-PROJECT EXPENSES		
Administration		
Administration	200.00	0.00
Report production and results dissemination	250.00	0.00
Other (Please detail: Photo & video)	50.00	0.00
Visits museums & botnical gardens (we used other financial source)	200.00	0.00
Contingency	1,000.00	0.00
Total	12,480.00	9,375.00

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Publications -

- Bernede-Beresford, L. & Gamage, S.N. (2006). Field guide to Slender Loris of Sri Lanka. Primate Conservation Society Sri Lanka, No. 610, Wackwella, Galle, Sri Lanka.

Communication -

- Gamage, S. N., D. K. Weerakoon, S. W. Kotagama and Gunawardena, A. (2007). The Distribution, Abundance and Habitat Preferences of Sri Lanka Slender Loris, *Loris tardigradus* (Primates: Lorisidae). *Proceedings of the 21st annual meeting of Society for Conservation Biology*, Nelson Mandela Metropolitan University, Port Elizabeth, South Africa.

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Distribution list

List where copies of the report have been distributed for reference by future project leaders and others, and where the report can be bought (if relevant).

Zoological Society of London, Regent's Park, London, NW1 4RY, United Kingdom.

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