Species Action Plan for the Conservation of Raffles' Banded Langur (*Presbytis femoralis femoralis*) in Malaysia and Singapore

Wildlife Reserves Singapore Group

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For further information on the outcomes of this workshop and related progress with Raffles' banded langur conservation, contact Andie (andie.ang@primatewatching.com)

For further information on IUCN SSC CBSG workshops and other CBSG conservation-support tools, go to: www.cbsg.org

Cover photo: An adult Raffles' banded langur in Singapore ©Nick Baker

A contribution of the IUCN SSC Conservation Breeding Specialist Group in partnership with Wildlife Reserves Singapore.

Citation: Ang, A., D'Rozario, V., Jayasri, S.L., Lees, C.M., Li, T.J., Luz, S. 2016. Species Action Plan for the Conservation of Raffles' Banded Langur (*Presbytis femoralis femoralis*) in Malaysia and Singapore. IUCN SSC Conservation Breeding Specialist Group, Apple Valley, MN, USA.

Content

Foreword

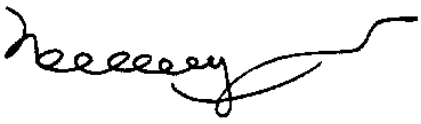
I thank my friend, Dr Andie Ang for inviting me to contribute the foreword to this publication.

A few weeks ago, the World Wildlife Fund (WWF) and the Zoological Society of London published their joint biennial Living Planet Report. The report was truly alarming. It stated that nearly 60 percent of all animals with a back bone have been wiped out since 1970. It also warned that by 2020, only 4 years away, the planet could lose two-thirds of its wildlife population.

It is in this context that we, in Singapore, should do our best to conserve and to save from extinction, our endangered species of flora and fauna.

Eight years ago, I was invited to launch the second edition of the Singapore Red Data Book, on our threatened plants and animals. In the course of my speech, I drew attention to two animals which were associated with Raffles, namely, the cream-coloured giant squirrel and the banded-leaf monkey or Raffles' banded langur. A young scientist in the audience decided to do research on the banded langur. She is none other than Dr Andie Ang.

In August this year, a two-day workshop was held at the Singapore Zoo to develop an action plan for the conservation of the banded langur. The workshop was very successful and was attended by 31 stakeholders, representing 15 organisations from Singapore and Malaysia. It is wonderful that in this Year of the Monkey, a timely collaboration was born, between Malaysia and Singapore, to save the Raffles' banded langur.



Tommy Koh
Patron
Nature Society (Singapore)
UNEP's Champion of the Earth (2006)

Executive Summary

The Raffles' banded langur (*Presbytis femoralis femoralis*) was first reported by Sir Stamford Raffles in Singapore, and it is also found in southern Peninsular Malaysia in Johor and Pahang states. Fewer than 60 Raffles' banded langurs are left in Singapore, while in Malaysia very little is known to form an estimate and they are often confused with other, more common langur species. The 2016 IUCN Red List of Threatened Species lists the subspecies as Endangered, elevated from Vulnerable in the 2008 assessment.

On 1st and 2nd August 2016, 31 stakeholders from 15 organisations met at the Singapore Zoo to plan a future for the Raffles' banded langur in Malaysia and Singapore. The planning workshop was organised and sponsored by the Wildlife Reserves Singapore and facilitated by the IUCN SSC Conservation Breeding Specialist Group. Participants included representatives from the IUCN SSC Primate Specialist Group, Malaysian and Singaporean government agencies, conservation NGOs and universities.

Threats

Loss, fragmentation and degradation of habitat resulting from urban development in Singapore and agricultural conversion in Malaysia have reduced the distribution of the Raffles' banded langur to a number of small, isolated populations across its range. These population fragments have a heightened risk of loss from the effects of genetic deterioration, extreme weather events, disease outbreak and other catastrophic events. Securing a future for the Raffles' banded langur will require targeted action in a number of these areas. At present, however, too little is known about population sizes and composition, distribution, habitat preferences and use, and the degree of population and habitat fragmentation. Further, there is a need to raise awareness both within government and among the wider public, of the existence of Raffles' banded langur, its precarious situation, and the challenges involved in establishing strong inter-country collaboration on species conservation projects. These issues present significant obstacles to securing a future for this threatened primate. To tackle these issues, participants began by constructing a long-term vision and associated conservation goals. They explored in detail the challenges to achieving those goals and used the products of those discussions to set objectives and recommend actions.

Priorities for 2016 – 2018

Habitat priorities:

- In Singapore, reconnect forest fragments by establishing corridors.

Population management and research priorities:

- Clarify taxonomy and systematics.
- Clarify distribution, population size and structure.

Communication and awareness priorities:

- Establish a new Raffles' Banded Langur Working Group.
- Develop targeted education materials for primates in Johor.

50-year Vision

The Raffles' banded langur thrives in intact rainforest, ranging freely in viable, connected populations, widely appreciated and well-understood.

As a valued part of the natural heritage in both Malaysia and Singapore, it exemplifies synergistic conservation collaboration across its range.

Goals

Goal 1: To recover and protect Raffles' banded langur in the wild, ensuring that:

- the rainforest habitat of the taxon is intact, where necessary restored, and safeguarded.
- wild populations are connected where needed.
- genetic and demographic viability are ensured.

Goal 2: To gather key data through ongoing studies, ensuring that:

- its taxonomy and systematics are clarified, and the biology and ecology of the taxon are well understood.
- long-term monitoring and conservation research are in place.

Goal 3: To secure the necessary resources and commitments for long-term conservation of Raffles' banded langur, ensuring that:

- there is strong public awareness and government support.
- cross-country collaboration is strengthened and long-term financial support has been secured.

Next Steps

A Raffles' Banded Langur Working Group (RBL WG) will be formed and chaired by Andie Ang, and will comprise co-chairs and representatives of those organisations key to the future of this langur in both Malaysia and Singapore. A Species Action Plan (SAP) using the outputs of the workshop is produced here and will be used to guide and implement the conservation work for this taxon over the next 10 years and beyond.

The workshop organisers would like to thank, in particular, the following individuals and organisations for their participation and support in the development of the SAP for Raffles' banded langur in Malaysia and Singapore: Wildlife Reserves Singapore Conservation Fund (WRSCF) for funding this workshop and supporting the implementation of this action plan for the next two years, Wildlife Reserves Singapore and its staff for hosting and organising the strategy workshop, Andie Ang for co-organising the workshop and for taking the lead in managing the implementation of the SAP, Lena Chan, Jayasri SL, Li Tian Jiao (National Parks Board Singapore) and Ramesh Boonratana (IUCN SSC Primate Specialist Group) for their support in co-organising this workshop.

1. Status Review and General Overview

The banded langur (*Presbytis femoralis*) is a species of Asian colobine (Cercopithecidae: Colobinae) weighing 6.0-6.5 kg with no sexual dimorphism. It is covered in black fur with a white zone ventrally and white bands on the inside of the thighs. It was first collected and described from Singapore, making Singapore the type locality of the species (Martin 1838).

1.1. Taxonomy and Conservation Status

The banded langur is found in the Malay Peninsula and Sumatra (Groves 2001) and three subspecies are currently recognised: Raffles' banded langur (*Presbytis f. femoralis*) in Johor and Pahang states, Malaysia and in Singapore (Fig. 1); East Sumatran banded langur (*P. f. percura*) in eastern Sumatra; and Robinson's banded langur (*P. f. robinsoni*) in northwest Malay Peninsula, extending north throughout peninsular Thailand and Myanmar (Fig. 2).

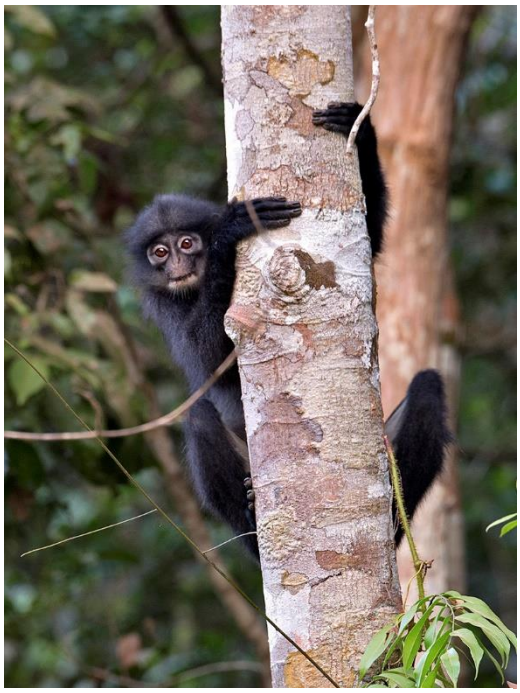


Figure 1. Raffles banded langur (*Presbytis femoralis femoralis*) in Johor. Photo by Nick Baker.

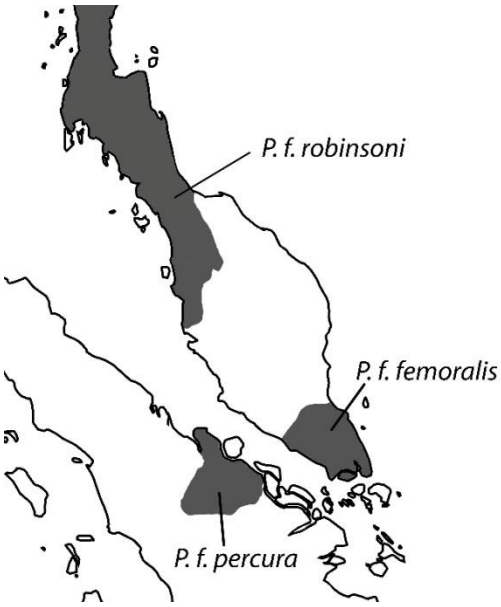


Figure 2. Distribution of three subspecies of banded langurs in the Malay Peninsular and Sumatra. Image by Ang Yuchen.

There had been speculations that the Johor and Singapore populations were different subspecies based on alleged difference in adult pelage colouration (Chasen 1940; Medway 1970; see Lucas et al. 1988), although in some cases specimens from both populations were difficult to separate and may represent individual-level variability (Hüttche 1994). More recently, genetic analyses revealed that populations from Johor (districts of Kluang, Kota Tinggi, Mersing, and Pontian) and Singapore were identical at the mitochondrial 12S rRNA marker and only small differences were observed for cytochrome b (cyt-b) sequences (Ang 2010), hence lending support to the same subspecies status, *P. f. femoralis*, of the two populations.

Furthermore, *P. f. femoralis* from Johor and Singapore may likely be a species of its own. For cyt-b, genetic differences otherwise typical for species were found between *P. f. femoralis*, *P. melalophos* (Sumatra) and *P. comata* (Java) (9.3% to 13.9%) but a 9.5% cyt-b pairwise distance was found between *P. f. femoralis* and *P. f. robinsoni* (Ang 2010). If *P. f. femoralis* is indeed a different species from *P. f. robinsoni* and/or *P. f. percura*, then the Raffles' banded langur in Malaysia and Singapore is an even more threatened taxon than is currently recognised.

In the IUCN Red List of Threatened Species ver. 3.1, *P. femoralis* is classified as Vulnerable (A2cd A3cd A4cd), *P. f. femoralis* as Endangered (A2cd A3cd A4cd), *P. f. percura* as Data Deficient, and *P. f. robinsoni* as Near Threatened. In Singapore, *P. f. femoralis* is critically endangered (Lim et al. 2008). In Malaysia, only a combined assessment for *P. f. femoralis* and *P. f. robinsoni* is available, and they are listed as Least Concern (Department of Wildlife and National Parks Peninsular Malaysia 2010). However, this assessment included *P. siamensis* under *P. femoralis*, resulting in a larger range for *P. femoralis* in Malaysia than should be.

1.2. Population Size and Distribution

The Raffles' banded langur is found in primary, secondary, and swamp rainforests in Malaysia and Singapore (e.g. Lucas et al. 1988). Populations of the Raffles' banded langur are severely fragmented. Its population size in Malaysia is unknown, but assumed to be larger than the Singapore population because of its larger distribution in Malaysia. In Singapore, the population size was estimated to be 40-60 individuals (Ang 2010). Six infants were observed from 2008-2010, with at least one birth season in June-July for three consecutive years (Ang et al. 2010).

In Singapore, the Raffles' banded langur is found only in Central Catchment Nature Reserve (CCNR). It is also known to forage in areas outside the reserve, including Thomson Nature Park, and on rare occasions further east. In Malaysia, it is known to occur in Gunung Panti Forest Reserve (which includes Panti Bird Sanctuary and Panti Recreational Forest), the recreational forests of Gunung Belumut, Gunung Lambak, and Gunung Pulai, but it remains unknown whether it occurs in Gunung Arong Recreational Forest, Pontian Forest Reserve, Endau Rompin National Park, and Gunung Ledang National Park. It was extirpated from Bukit Timah Nature Reserve (BTNR) in Singapore and has not been observed in Tanjung Piai National Park in Malaysia.

1.3. Ecology

The Raffles' banded langur belongs to a group of "leaf-eating monkeys", but this moniker misrepresents the diversity of feeding strategies displayed by this subfamily of colobine primates. Even though colobine primates have morphological adaptations such as large salivary glands (Kay and Davies 1994) and a complex stomach with symbiotic bacteria (Chivers 1994) that enable them to consume large quantities of leafy material, they can exhibit preference toward other plant parts such as fruits and flowers (Fig. 3).

There is only a limited understanding of the feeding ecology of the Raffles' banded langur. In Singapore, a total of 27 food plant species belonging to 24 genera and 20 families were identified through field observations which included leaves of rubber tree (*Hevea brasiliensis*), flowers of tiup-tiup (*Adinandra dumosa*) and fruits of rambutan (*Nephelium lappaceum*) (Ang 2010). Nearly half of the food plant species are locally threatened. An additional 36 food plant species were identified by Srivathsan et al. (2014) using metagenomics and metabarcoding. Unfortunately, there is a lack of ecological studies on the Raffles' banded langur in Malaysia.

Figure 3. An adult Raffles' banded langur feeding on fruit. Photo by Andie Ang.

1.4. Threats

There is an urgent need to clarify the taxonomy of what is considered *P. femoralis* at the species level. At the subspecies level, deforestation and conversion of habitat continue to be major threats to *P. f. femoralis* in Malaysia. It is particularly affected by oil palm plantations, which are expanding very rapidly within its range, resulting in severely fragmented populations. Some of these populations may no longer exist in protected areas, highlighting the need to update knowledge on its current distribution and abundance in Malaysia.

Despite an apparent increase in the number of individuals in the Singapore population of *P. f. femoralis*, the population showed low genetic variability based on seven samples (ca. 20% of population) (Ang et al. 2012; Srivathsan et al. 2016). The after-effects of bottlenecks in the 1970s and 1980s are clearly recognisable which makes the population extremely vulnerable to environmental change (e.g., disease). Within the CCNR, small groups inhabit forest fragments with limited arboreal connectivity. The first recorded roadkill of a juvenile Raffles' banded langur on 17 January 2011 was likely a consequence of its attempt to cross between the forest fragments.

1.5. Conservation and Management

Sustainable development and conservation of wildlife are becoming important goals nested within a larger policy of urban development that is country-specific. The successful conservation of the endangered Raffles' banded langur in Malaysia and Singapore, however, requires a strategy that is not only localised, but also one that goes beyond the boundaries of the countries. The formulation of this Species Action Plan signifies the recognition of the value of cross-border collaboration in addition to maintaining valuable habitats, creating green buffers, and promoting the awareness and conservation of biodiversity.

2. Conservation Strategy and Action Plan for the Raffles' Banded Langur

On 1-2 August 2016, 31 stakeholders from 15 organisations and agencies met at the Singapore Zoo to plan a future for the Raffles' banded langur in Malaysia and Singapore (Fig. 4). The planning workshop was organised and sponsored by the Wildlife Reserves Singapore, and the IUCN SSC Conservation Breeding Specialist Group was engaged to assist with the workshop design and facilitation. Participants included representatives from Malaysian and Singaporean government agencies, the IUCN SSC Primate Specialist Group, conservation NGOs and universities.

Following a welcoming address by Dr Sonja Luz of the Wildlife Reserves Singapore, the workshop opened with a series of scene-setting presentations aimed at bringing participants to a common understanding of the current state of knowledge of Raffles' banded langur, the threats to its persistence and the conservation measures underway for its recovery and protection:

Introduction to Species Action Plans and How They Work – Dr Ramesh Boonratana, Regional Vice-Chair (Asia), IUCN SSC Primate Specialist Group

Introduction to CBSG Conservation Planning Workshops – Caroline Lees, Program Officer, IUCN SSC Conservation Breeding Specialist Group

A Comprehensive and Integrated Conservation Strategy for the Raffles' Banded Langur in Singapore - Dr Lena Chan, Group Director, National Biodiversity Centre, National Parks Board

Everything We Know about the Banded Langur – Andie Ang, IUCN SSC Primate Specialist Group

Preliminary Findings of a Population Viability Assessment for Raffles' Banded Langur – Caroline Lees, Program Officer, IUCN SSC Conservation Breeding Specialist Group

Following the initial presentations, participants were invited to describe one issue or opportunity that they would particularly like to see considered during the workshop. These ideas were captured to ensure no major issues were missed (Appendix III).

Next, participants began work on a Vision in order to build a common focus for deliberations and to define what "effectively conserved" might look like. Themes, ideas and phrases were canvassed from participants to capture a collective view of what the future could hold for Raffles' banded langur under a successful program of recovery and protection. A small group was tasked with using these ideas to draft: i) a Vision Statement and 2) a set of associated, operational Goals, for presentation and review.

With a broad, qualitative sense of how "effectively conserved" might be defined in this case, participants worked to describe in detail the threats, obstacles and issues challenging the sustained recovery and conservation of Raffles' banded langur in Malaysia and Singapore. The results of this exercise are depicted in Figure 2. To ensure discussions remained focused on Raffles' banded langur viability, participants were encouraged to frame their contributions in terms of either: 1) a reduction in vital rates (i.e. more deaths or fewer births in the population); 2) a reduction in carrying capacity for langurs (i.e. reduced habitat or habitat quality) – noting that ultimately this would be expected to

manifest as more deaths or fewer births; or 3) sub-optimal conservation action (i.e. failure to reverse the decline or drive recovery).

The challenges described fell into three main categories: 1) habitat management issues; 2) small population management and research issues; and 3) communication, collaboration and awareness issues. Three discussion groups were formed around these themes:

Discussion Group 1. Habitat Management

- Lena Chan, Sharon Chan, Subash Chandran, Marcus Chua, Li Tian Jiao, Pazil Bin Abdul Patah, Subaraj Rajathurai, Jayasri SL, Belinda Wong

Discussion Group 2. Small Population Management and Research

- Andie Ang, Rajakupal Govindan, Adrian Loo, Abdul Latiff MAB, Rudolf Meier, Robin Ngiam, Amrita Srivathsan, Nicole Tay, Yeo Suay Hwee, Badrul Munir Md Zain

Discussion Group 3. Communication, Collaboration and Awareness

- Vilma D'Rozario, Vina Dharmarajah, Aster Lee, Sivasothi N, Ng Bee Choo, Roopali Raghavan, Sharan Sambhi, Joys Tan, Toh Yuet Hsin

Each working group was asked to take the relevant subset of issues and describe them in detail, noting the way in which they impacted on Raffles' banded langur populations and the reasons why they occurred. Further to this they were asked to consider, for each issue, what the facts were, what was assumed and what needed to be known in order to advance conservation action.

Once issues were clarified, groups developed objectives to address them. These were brought to plenary for discussion and prioritisation. The full list of objectives developed is shown in Table 1. By assigning allocated sticky dots against the objectives they considered 1) most important and 2) most urgent, participants prioritised the list of objectives. Scores are shown in Table 1, with overall priority ranking based on the combined score. Restoring connectivity between populations, protecting habitat and filling key knowledge gaps were afforded the highest priority overall.

Actions were recommended for pursuing each objective. Actions were required to be S.M.A.R.T. (Specific, Measurable, Achievable, Relevant, and Time-bound) and were presented and discussed by the wider group before finalisation.

Finally, participants re-convened to finalise the Vision and Goals, to discuss next steps and to agree an editing team to oversee development of the report.

Figure 4. Participants at the strategy workshop held at the Singapore Zoo on 1-2 August 2016. Photo by Ramesh Boonratana.

2.1. Vision

Our 50-year Vision

The Raffles' banded langur thrives in intact rainforest, ranging freely in viable, connected populations, widely appreciated and well-understood.

As a valued part of the natural heritage in both Malaysia and Singapore, it exemplifies synergistic conservation collaboration across its range.

2.2. Goals

The vision will be realised when we have achieved these goals:

Goal 1: To recover and protect Raffles' banded langur in the wild, ensuring that:

- the rainforest habitat of the taxon is intact, where necessary restored, and safeguarded.
- wild populations are connected where needed.
- genetic and demographic viability are ensured.

Goal 2: To gather key data through ongoing studies, ensuring that:

- its taxonomy and systematics are clarified, and the biology and ecology of the taxon are well understood.
- long-term monitoring and conservation research are in place.

Goal 3: To secure the necessary resources and commitments for long-term conservation of Raffles' banded langur, ensuring that:

- there is strong public awareness and government support.
- cross-country collaboration is strengthened and long-term financial support has been secured.

2.3. Issues

The inter-related issues, obstacles and threats challenging the recovery and conservation of Raffles' banded langur (RBL), are depicted in Figure 5. Descriptions of these factors, their impact on RBL and their underlying causes, are provided below, accompanied by recommended objectives for addressing them.

Habitat Management Issues

Landscape or Habitat Change due to Development

Land use changes resulting from development and agricultural conversion lead to direct and indirect loss of forest habitat for the RBL.

- Ensure core RBL habitats continue to be protected and habitats outside protected areas safeguarded.
- Rehabilitate degraded forest habitats for the RBL.

Fragmentation and Loss of Connectivity

Restricted gene flow in small, isolated populations results in lowered genetic variability and heightened risk of inbreeding. RBLs in fragmented forests are also more vulnerable to demographic and environmental stochasticity, poaching, and increased interaction with humans, which can increase the risk of disease transmission.

- Establish and enhance viable ecological connectivity among RBL habitats (habitat focus).
- Supplement with individuals from other populations, any non-viable RBL populations living in large but isolated forest fragments.

Climate Change (localised microclimate)

Extreme weather events adversely affect RBL habitats and hence their resident populations. Weather events cause changes to habitat in the form of tree falls, erosion, landslides, flooding and wild fires. Habitat changes lead to fragmentation, isolation, and loss of feeding and sleeping sites for RBL.

- Ensure resilience of habitat and establish other appropriate climate change mitigation measures.

Small Population Management and Research Issues

Small Population Size

We know from many studies that small, isolated populations will suffer from inbreeding and genetic erosion over time. Inbreeding can reduce the resilience of populations to disease outbreaks and can lower their fitness by, for example, reducing fertility or increasing mortality. Small isolated populations whether inbred or not, are more susceptible to environmental and demographic stochasticity.

- Increase population size, range and number of populations in Singapore.
- Develop a strategy for restoring gene flow between Malaysia and Singapore.

- Ensure connectivity between isolated/fragmented populations (population focus).

Knowledge Gaps

We know that there are gaps in knowledge in the areas of taxonomy and systematics, ecology, behaviour, and distribution which constrain our ability to take effective action to conserve the RBL. These gaps are due to the lack of resources and support for this neglected and difficult to study taxon.

- Resolve taxonomy and systematics.
- Ensure long-term financial support and multi-stakeholder commitments to common research and conservation goals.
- Carry out long-term monitoring and biological data collection.

Human-langur Conflict

Encroachment into langur habitats and other forms of human disturbance (e.g. food provisioning) can result in langur intrusions into human settlements. This reinforces negative public perceptions of monkeys in general. We know that macaques that intrude into human settlements may be killed and we assume that this could be extended to langurs, especially when local human populations tend to perceive all monkey species as one and the same, in terms of them being a nuisance.

- Reduce habitat encroachment.
- Prevent RBL from entering human settlements.

Communication, Collaboration and Awareness Issues

Poor Collaboration

A silo mentality, differing organisational priorities and the absence of a successful precedent for collaborative conservation action within and between Malaysia and Singapore, hinders interagency and intergovernmental cooperation towards the conservation of RBL.

- Create a platform for intergovernmental cooperation to address a unique conservation opportunity.
- Build on existing personal relationships to establish an interagency platform for participation and prioritisation of the RBL.

Lack of Targeted Education and Outreach Programs

Direct human impacts such as hunting, poaching and human-wildlife conflict have an unknown but potentially damaging impact on the RBL. Such impacts could be mitigated by conservation education and outreach programs informed by an understanding of the cultural and livelihood practices of local and indigenous communities in Malaysia as well as by existing laws protecting the species.

- Provide an education and outreach program on the unique identity of the RBL and the urgent need to conserve it: a) to raise the profile and increase awareness of the RBL and b) to increase ability to distinguish local primate species and increase tolerance towards them.

Lack of Awareness of RBL and Effective Communication

The lack of effective communication on the RBL from knowledge base to agencies and policy makers has led to insufficient evidence-based policy making and on-ground action to prevent habitat fragmentation and degradation, and loss of connectivity.

- Use results of further studies of RBL to create awareness and guide policies, particularly in Peninsular Malaysia.
- Communication from existing knowledge base to help agencies and policymakers to develop a plan to connect forest fragments and to preserve, protect and gazette areas.
- Identification of all stakeholders who play and can play a role in effective conservation of RBL, as well as providing a platform for sharing information and customising the message to motivate individual stakeholders.

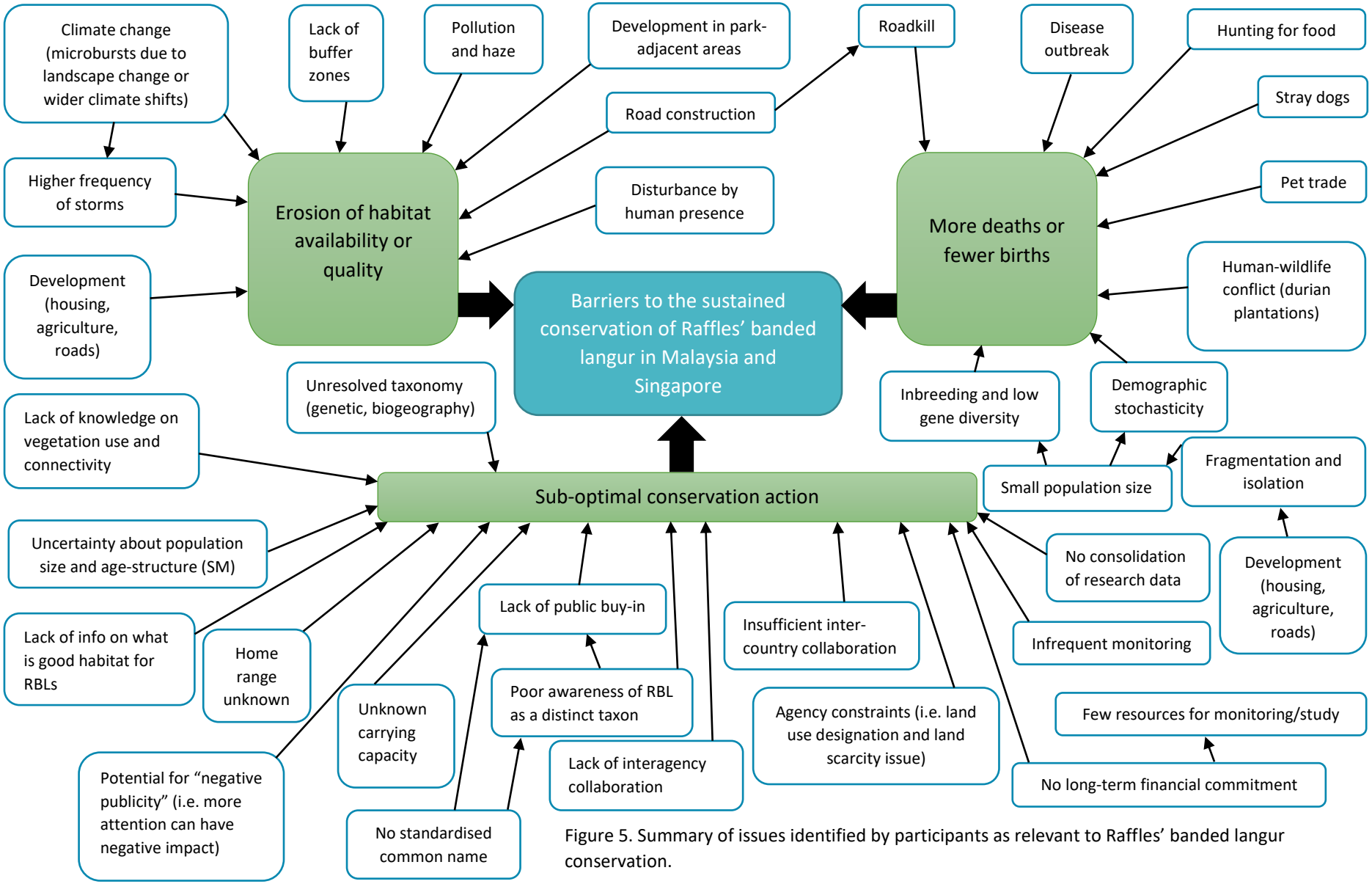


Figure 5. Summary of issues identified by participants as relevant to Raffles' banded langur conservation.

Table 1. Prioritisation by workshop participants, of the all issue-based objectives, based on what was considered to be a) most important and b) most urgent in the recovery and conservation of RBL (scores indicate number of participant votes).

Objectives	Importance	Urgency	Total	Overall rank
Restoring Connectivity Establish and enhance viable ecological connectivity among Raffles' banded langur (RBL) habitats (i.e. forest connectivity). Supplement with individuals from other populations, any non-viable RBL populations living in large but isolated fragments of forest. Ensure connectivity between isolated/fragmented populations (i.e. through facilitated movements).	10	19	29	1
Protecting Habitat Ensure core RBL habitats continue to be protected and habitats outside protected areas safeguarded.	19	8	27	2
Knowledge Gaps Resolve taxonomy and systematics.	4	17	21	3
Carry out surveys, biological data collection and long-term monitoring (Malaysia and Singapore).	2	14	16	4
Communication and Collaboration To create a platform for intergovernmental cooperation to address a unique conservation opportunity. Build on existing personal relationships to establish an interagency platform for participation and prioritization of the RBL.	6	7	13	5
Provide an education and outreach program on the unique identity of the RBL and the urgent need to conserve it.	4	8	12	6
Facilitating Planning and Action Communication from existing knowledge base to help agencies and policymakers to develop a plan to connect forest fragments and to preserve, protect and gazette areas.	6	2	8	7
Identification of all stakeholders who play and can play a role in effective conservation of RBL, as well as providing a platform for sharing information and customising the messaging to motivate individual stakeholders.	5	3	8	7
Ensure long term financial support and multi-stakeholder commitments in common research and conservation goals.	8	0	8	7
Use results from further studies of the RBL to create awareness and guide policies, particularly in Malaysia.	5	2	7	10
Build on existing personal relationships to establish an interagency platform for participation and prioritisation of the RBL.	1	0	1	16
Small Population Management Increase population size, range and number of populations.	3	3	6	11
Develop a strategy for restoring gene flow between Malaysia and Singapore.	4	1	5	12
Habitat Restoration Rehabilitate degraded forest habitats for the RBL.	1	3	4	13
Reduce habitat encroachment.	0	3	3	14
Prevent RBL from entering human settlements.	2	1	3	14
Climate Change Adaptation Ensure resilience of habitat and establish other appropriate mitigation measures for climate change impacts.	0	0	0	16

2.4. Actions

Recommended actions for achieving the objectives are described here, housed under the goals they are directed towards.

Goal 1: To recover and protect Raffles' banded langur in the wild, ensuring that:
• the rainforest habitat of the taxon is intact, where necessary restored, and safeguarded. • wild populations are connected where needed. • genetic and demographic viability are ensured.

Objective 1. Ensure core RBL habitats continue to be protected and habitats outside protected areas safeguarded

Action 1.1 Communicate importance of RBL habitats in protected and non-protected areas to decision makers and general public
Responsibility: Andie Ang, JGIS, MNSJ, NParks, NSS, NUS, PERHILITAN, UKM, UTHM, and WRS
Timeline: Malaysia and Singapore - ongoing
Measurables: Meetings and media reports
Collaborators/Partners: JGIS, MNSJ, NParks, NSS, PERHILITAN, WRS, private land owners, developers, other government agencies, and the public
Resources: Malaysia and Singapore – to be determined

Action 1.2 Work towards safeguarding unprotected RBL habitats
Responsibility: Andie Ang, JGIS, MNSJ, NParks, NSS, NUS, PERHILITAN, UKM, UTHM, and WRS
Timeline: Malaysia and Singapore - ongoing
Measurables: Number of buffer areas and corridors established
Potential Collaborators/Partners: JGIS, MNSJ, NParks, NSS, PERHILITAN, WRS, private land owners, developers, and other government agencies
Resources: To be determined

Objective 2. Rehabilitate degraded forest habitats for RBL

Action 2.1. Planting of degraded areas with RBL food plants and plants used as sleeping sites, and ensuring arboreal connectivity
Responsibility: NParks and PERHILITAN
Timeline: Malaysia - 5 years; Singapore - 3 years
Measurables: Number of trees planted, areas rehabilitated, tracking of planted trees and assessment of tree health
Potential Collaborators/Partners: JGIS, MNSJ, NParks, NSS, PERHILITAN, WRS, private land owners, developers, other government agencies, and volunteers
Resources: To be determined

Objective 3. Establish and enhance viable ecological connectivity among RBL habitats (habitat focus)

Action 3.1 Determine RBL distribution and population in Malaysia and Singapore, and identify habitat status (size, location, protected area/non-protected area, and long-term land use changes)

Responsibility: Andie Ang, MNSJ, NParks, NSS, NUS, PERHILITAN, UKM, and UTHM
Timeline: Malaysia - 3 years beginning from 2017; Singapore - 1 year beginning from 2017
Measurables: Distribution maps, population demographics, and habitat classification map
Potential Collaborators/Partners: Andie Ang, MINDEF, MNSJ, NParks, NSS, NUS, PERHILITAN, SLA, UKM, URA, UTHM, WRS, and volunteers
Resources: Malaysia - Team of 3, RM 250K/year; Singapore - Team of 3, SGD 250K/year

Action 3.2 Identify and plan connectivity (natural and man-made) among RBL habitats
Responsibility: Andie Ang, MNSJ, NParks, NSS, NUS, PERHILITAN, UKM, and UTHM
Timeline: Malaysia - 2 years after initial study; Singapore - 2 years after initial study
Measurables: Connectivity plan, maps and models
Potential Collaborators/Partners: Andie Ang, MINDEF, NParks, NUS, PERHILITAN, SLA, UKM, URA, UTHM, and external agencies to do modeling
Resources: Malaysia - 1 researcher, RM 50K/year; Singapore: - 1 researcher, SGD 50K/year

Action 3.3 Network with stakeholders to secure habitat connectivity
Responsibility: NParks and PERHILITAN
Timeline: Malaysia and Singapore - 1st phase 5 years, thereafter ongoing
Measurables: Meetings, workshops, agreements, MOUs, and exhibitions
Potential Collaborators/Partners: MINDEF, MNSJ, NParks, NSS, PERHILITAN, SLA, URA, private land owners, developers, and other government agencies
Resources: Malaysia - relevant representatives, RM 50K/year; Singapore - relevant representatives, SGD 50K/year

Action 3.4 Establish, enhance, monitor and maintain habitat connectivity
Responsibility: Establish, enhance and maintain (NParks and PERHILITAN); Monitor (Andie Ang, MNSJ, NSS, NUS, UKM, UTHM)
Timeline: Malaysia - 5 years, Singapore - 3 years (Establish and enhance"); Malaysia and Singapore - ongoing ("Monitor and maintain")
Measurables: Natural corridors, plantings and buffer zones ("Establish and enhance"); Sighting reports monitoring reports, tree-trimming at langur-crossing areas prevented ("Monitor and maintain")
Potential Collaborators/Partners: Andie Ang, MNSJ, NParks, NSS, NUS, PERHILITAN, UKM, UTHM, WRS, private land owners, developers, other government agencies, and volunteers
Resources: To be determined

Objective 4. Ensure resilience of habitat and establish other appropriate mitigation measures for climate change impacts

Action 4.1 Explore the expected impact of climate change on the forests of Malaysia and Singapore, especially in areas inhabited by RBLs
Responsibility: Andie Ang, NParks, NUS, PERHILITAN, UKM, and UTHM
Timeline: January 2017-ongoing
Measurables: Expected impact of climate change identified and quantified
Potential Collaborators/Partners: JGIS, MNSJ, NParks, NSS, NUS, PERHILITAN, UKM, UTHM, and WRS
Resources: To be determined

Action 4.2 Take appropriate actions as revealed from Action 3.1.1 (above)

Responsibility: Andie Ang, NParks, NUS, PERHILITAN, UKM, and UTHM
Timeline: January 2017-ongoing
Measurables: Climate change impacts are minimised
Potential Collaborators/Partners: JGIS, MNSJ, NParks, NSS, NUS, PERHILITAN, UKM, UTHM, and WRS
Resources: To be determined

Objective 5. Ensure connectivity between isolated/fragmented populations (population focus)

Action 5.1 Identify places where there is a need for facilitated movement (due to loss of connectivity, lack of canopy cover, obstructions, roads, water bodies etc.) in Malaysia and Singapore
Responsibility: Andie Ang, UKM, and UTHM
Timeline: January 2017 to mid-2018
Measurables: Documented crossing points and potential crossing points for RBLs; identification of plant species near crossing points
Potential Collaborators/Partners: FRIM, JGIS, LTA, MINDEF, MNSJ, NParks, NSS, NUS, PERHILITAN, PTNJ, PUB, SLA, UKM, URA, UTHM, WRS, and volunteers
Resources: Malaysia - To be determined; Singapore - WRSCF (till mid-2018)

Action 5.2 Recommend and test out canopy bridges (in Singapore first)
Responsibility: Andie Ang and JGIS
Timeline: Singapore - permits and proposal by early 2017, identify people who do monitoring and start monitoring before building; construction of first rope bridge by mid-2017, monitoring till mid-2018, further actions based on success
Measurables: Trial run in Singapore first in order to evaluate success/failure and ways to improve canopy bridge designs before applying it in potential places in Malaysia (e.g. Mersing); camera trap photos of RBL (and other animals) usage
Potential Collaborators/Partners: JGIS, MINDEF, NParks, NSS, PERHILITAN, UKM, UTHM, WRS, and volunteers
Resources: Malaysia - potential funds from WRS; Singapore - JGIS (could give up to SGD 5K + manpower), also possibly from NParks, and WRS

Objective 6. Supplement with individuals from other populations, any non-viable RBL populations living in large but isolated forest fragments

Action 6.1 Determine if there are isolated RBL groups (including lone individuals) within Malaysia and Singapore that are not viable (i.e. very small group sizes or completely cut off from other groups)
Responsibility: Andie Ang
Timeline: 2017 and ongoing
Measurables: Location(s), number(s), and demographics of isolated RBLs; measurements of distance from nearest group; obstacles to habitat connectivity identified
Potential Collaborators/Partners: MNSJ, NParks, NSS, PERHILITAN, and WRS
Resources: WRSCF

Action 6.2 Translocate isolated RBL individuals/groups into other populations (within Malaysia and Singapore) when impossible to connect the habitats
Responsibility: NParks, PERHILITAN, and WRS
Timeline: Depending on outputs from Action 2.2.1 above.

Measurables: Successful integration of isolated RBLs into resident groups
Potential Collaborators/Partners: AVA, Ng Soon Chye (NTU), NParks, NUS, PERHILITAN, and WRS
Resources: To be determined

Objective 7. Increase population size, range and number of populations in Singapore

Action 7.1 Characterise RBL ecology, home range sizes, sleeping sites, and habitat requirements
Responsibility: Andie Ang and NParks
Timeline: January 2017-ongoing
Measurables: Data on food species; home range of different groups; locations of sleeping sites
Potential Collaborators/Partners: JGIS, NParks, NSS, NUS, WRS and volunteers
Resources: WRSCF (till mid-2018)

Action 7.2 Determine effective population size (male:female)
Responsibility: Andie Ang and NParks
Timeline: January 2017-ongoing
Measurables: Population size; demographic data (e.g. number of males, number of females, and age ranges)
Potential Collaborators/Partners: JGIS, NParks, NSS, NUS, WRS and volunteers
Resources: WRSCF (till mid-2018)

Action 7.3 Understand carrying capacity in suitable habitats
Responsibility: Andie Ang and NParks
Timeline: January 2017-ongoing
Measurables: Suitable habitats in Singapore identified; estimated number of RBL groups/group sizes that each habitat can hold
Potential Collaborators/Partners: JGIS, NParks, NSS, and NUS
Resources: To be determined

Action 7.4 Using the information gathered from 4.1.1-3, propose for discussion and agreement, population size targets for RBL in Singapore, in association with a strategy for restoring gene-flow with Malaysia, which will provide for long-term viability
Responsibility: NParks, NUS, RBL WG, and WRS
Timeline: July 2018
Measurables: Population size targets of RBL conveyed to relevant authorities in Singapore
Potential Collaborators/Partners: JGIS, NParks, NSS, NUS, and WRS
Resources: To be determined

Action 7.5 Use the information gathered through 4.1.1-3, to refine the management measures supporting Objectives 1.1, 1.2 and 2.1 to work towards achieving and sustaining the agreed population targets for RBLs in Singapore.
Responsibility: NParks, NUS, RBL WG, and WRS
Timeline: July 2018-ongoing
Measurables: Population growth, increase in range and number of groups
Potential Collaborators/Partners: JGIS, NParks, NSS, NUS, and WRS
Resources: To be determined

Objective 8. Develop a strategy for restoring gene flow between Malaysia and Singapore

Action 8.1 Study population genetics of RBLs in Malaysia and Singapore
Responsibility: Andie Ang, NUS, UKM, UTHM and WRS
Timeline: January 2017-July 2018
Measurables: DNA (from fecal samples) obtained from Malaysia and Singapore, and indices on genetic diversity and gene flow measured such as using F_{st} (fixation index), G_{st} (gene differentiation), and SNP (single-nucleotide polymorphism)
Potential Collaborators/Partners: AVA, NParks, NUS, UKM, and UTHM
Resources: SGD 300K

Action 8.2 Determine if there are rescued RBLs or RBLs already in captivity in Malaysia that could potentially be translocated to supplement the gene pool in Singapore
Responsibility: Andie Ang
Timeline: 2017 and ongoing
Measurables: Location(s) and number(s) of RBLs in captivity in Malaysia
Potential Collaborators/Partners: AVA, MNSJ, NEA, NParks, NSS, PERHILITAN, and WRS
Resources: WRSCF (till mid-2018)

Action 8.3 Develop protocols for captive care, semen collection, translocation, and reintroduction
Responsibility: NParks, PERHILITAN, and WRS
Timeline: End 2016-2017
Measurables: Protocol developed for semen collection and transfer, translocation, *ex-situ* care, and reintroduction (refer to IPS protocol)
Potential Collaborators/Partners: AVA, Ng Soon Chye, NParks, PERHILITAN, and WRS
Resources: To be determined; potential funding from WRS

Action 8.4 Translocate rescued, captive, or wild RBL individuals from Johor into Singapore if RBL population in Singapore is determined to be unusually homozygous
Responsibility: NParks, PERHILITAN, and WRS
Timeline: Depending on assessment of inbreeding in RBL population in Singapore
Measurables: Successful integration of RBLs from Johor into the population in Singapore
Potential Collaborators/Partners: AVA, Ng Soon Chye, NParks, NUS, PERHILITAN, and WRS
Resources: To be determined

Objective 9. Reduce habitat encroachment

Action 9.1 Determine why encroachment happens in each place
Responsibility: RBL WG, NParks, and PERHILITAN
Timeline: January 2017-ongoing
Measurables: Causes of encroachment (e.g. housing development, plantation, etc.) identified
Potential Collaborators/Partners: LTA, MINDEF, NParks, PERHILITAN, SLA, URA, and WRS
Resources: WRSCF (till mid-2018)

Action 9.2 Approach stakeholders who control the land and discuss alternative solutions
Responsibility: Andie Ang, Abdul Latiff (UTHM), NParks, and Badrul Zain (UKM)
Timeline: January 2017-ongoing
Measurables: RBL WG engaged before potential development/habitat conversion occurs

Potential Collaborators/Partners: NParks, PERHILITAN, URA, WRS, and agroforesters
Resources: To be determined

Objective 10. Prevent RBL from entering human settlements

Action 10.1 Determine if RBL is entering human settlements
Responsibility: Andie Ang, Abdul Latiff (UTHM), and Badrul Zain (UKM)
Timeline: Ongoing
Measurables: Identified primate species that enter human settlements
Potential Collaborators/Partners: NParks, PTNJ, UKM, UTHM, and social scientists/anthropologists
Resources: To be determined

Action 10.2 Improve the habitats of RBL by planting more diet plants
Responsibility: FRIM, NParks, PERHILITAN, and PTNJ
Timeline: Ongoing
Measurables: Number of food plant species planted within RBL habitats
Potential Collaborators/Partners: JGIS, FRIM, NParks, NSS, NUS, PERHILITAN, PTNJ, UKM, UTHM, and WRS
Resources: To be determined

Action 10.3 Understand motives of RBL intrusions (if RBL is entering human settlements)
Responsibility: Andie Ang, Abdul Latiff (UTHM), and Badrul Zain (UKM)
Timeline: Depending on assessment of Action 6.2.1. (above)
Measurables: Solutions to prevent RBL from entering human settlements and to prevent RBL/human conflict
Potential Collaborators/Partners: JGIS, FRIM, NParks, NSS, NUS, PERHILITAN, PTNJ, UKM, UTHM, and WRS
Resources: To be determined

Goal 2: To gather key data through ongoing studies, ensuring that:
• its taxonomy and systematics are clarified, and the biology and ecology of the taxon are well understood. • long-term monitoring and conservation research are in place.

Objective 11. Resolve taxonomy and systematics

Action 11.1 Sample populations of all subspecies, request available genetic data from other researchers and institutions and analyse the genetic data to determine subspecies or species status
Responsibility: Andie Ang, Amrita Srivathsan (NUS), Badrul Zain (UKM), and Abdul Latiff (UTHM)
Timeline: Getting permits and obtaining data - from now to mid-2017; Analyse data – end-2017
Measurables: An evidence-based determination on whether RBL should be managed as a subspecies or as a species
Potential Collaborators/Partners: Zoological Museum of Bogor, NParks, NUS, PERHILITAN, Christian Roos (German Primate Center), Smithsonian, Jatna Supriatna (University of Indonesia), UKM, and UTHM
Resources: To be determined

Objective 12. Ensure long-term financial support and multi-stakeholder commitments to common research and conservation goals

Action 12.1. Disseminate Action Plan document to all agencies and identify key stakeholders and their commitments
Responsibility: Andie Ang, JGIS, NParks, NSS, NUS, PERHILITAN, UTHM, and WRS
Timeline: Malaysia - Communicate and endorsement by mid-2017; Singapore - Communicate and endorsement by end 2016
Measurables: External funding secured, meetings, and key partners confirmed (possibly through MOU)
Potential Collaborators/Partners: AVA, Forestry Department of Malaysia, FRIM, IUCN, J-Biotech, JGIS, Johor State Forestry Department, KPT, LKCNHM, LTA, MINDEF, MNSJ, NEA, NIE, NParks, NSS, NTU, NUS, PERHILITAN, PTNJ, PUB, SLA, UKM, UPEN Johor, URA, UTHM, WCS, and WRS
Resources: Malaysia - RM 100K for first 2 years, RM 50K for next 5 years; Singapore - SGD 200K for first 2 years (WRSCF), SGD 50K for next 5 years. Potential sources of funding from CI, IUCN, MbZ, MOE, NParks, and WCS

Objective 13. Carry out long-term monitoring and biological data collection

Action 13.1. Identify individuals who are willing to do the field surveys, and carry out the surveys
Responsibility: Andie Ang, JGIS, MNSJ, NParks, NSS, NUS, PERHILITAN, UKM, UTHM, and WRS
Timeline: Preliminary findings (presence/absence data) by mid-2017. Malaysia - Gunung Lambak (by Andie Ang, 13-15 August 2016, completed); Sungai Sedili (by Andie Ang and MNSJ, 19-22 September 2016, completed); Gunung Ledang (by Abdul Latiff and UTHM, September 2016, completed); Tanjung Piai and Endau-Rompin (by Abdul Latiff and UTHM); Yong Peng (by Abdul Latiff and UTHM); Pontian (by Abdult Latiff, before February 2017); Gunung Arong (by NSS, 2017); Jemaluang (by NSS and MNSJ, 2017). Singapore – Immediate. Long-term monitoring – recreational forests of Gunung Panti and Gunung Lambak, Malaysia (by Andie Ang, January-December 2017); Singapore (by Andie Ang, January 2017-June 2018)
Measurables: Population demographic data and changes, distribution, and threats
Potential Collaborators/Partners: FRIM, JGIS, MNSJ, NParks, NSS, NUS, PERHILITAN, UKM, UTHM, WRS, and volunteers
Resources: WRSCF (2 years from August 2016); resources needed for per diem for volunteers

Goal 3: To secure the necessary resources and commitments for long-term conservation of Raffles' banded langur, ensuring that:
• there is strong public awareness and government support. • cross-country collaboration is strengthened and long-term financial support has been secured.

Objective 14. Create a platform for intergovernmental cooperation to address a unique conservation opportunity

Action 14.1 Identify relevant government authorities from Malaysia and Singapore and get advice on MOU processes
Responsibility: Malaysia - PERHILITAN to liaise with all relevant authorities/stakeholders; Singapore - NParks to liaise with Prof. Tommy Koh and MFA
Timeline: Begin August 12th (following the launch of RBL conservation strategy). Give one month for a preliminary response (by end September 2016 latest)
Measurables: Details of stakeholders who have responded positively for the partnership
Potential Collaborators/Partners: Malaysia - Forestry Department of Malaysia (Federal), Johor State Forestry Department (State), Ministry of Foreign Affairs (Federal), MNSJ, PERHILITAN (Federal), PTNJ, UPEN Johor (State); Singapore - AVA, JGIS, MFA, MND, NParks, and NSS
Resources: Minimal (emails, phone calls, and meetings)

Action 14.2 Malaysia and Singapore to check with relevant authorities to discuss, draft and negotiate the signing of an MOU
Responsibility: NParks and PERHILITAN
Timeline: 3-6 months (end Sept 2016 to April 2017). Preferably by "Year of the Monkey"
Measurables: Signing of MOU/MOC. MOC may be easier to get their parties on board. Media coverage in Malaysia and Singapore to raise public awareness
Collaborators/Partners: Media agencies; JGIS (statement to media on this); MNSJ and NSS can also make a statement; possibly with royal patronage
Resources: Personnel from PERHILITAN and NParks to commit time to take this forward

Objective 15. Build on existing personal relationships to establish an interagency platform for participation and prioritisation of the RBL

Action 15.1. Identify relevant government agencies within Malaysia and Singapore
Responsibility: Malaysia - PERHILITAN; Singapore - NParks
Timeline: Begin August 12th (following the launch of RBL conservation strategy). Give one month for a preliminary response (by end September 2016 latest)
Measurables: Details of stakeholders who have responded positively for the partnership
Potential Collaborators/Partners: MND, MNSJ, NParks, and PERHILITAN
Resources: Minimal (emails, phone calls, and meetings)

Objective 16. Provide an education and outreach program on the unique identity of the RBL and the urgent need to conserve it: a) to raise the profile and increase awareness of the RBL and b) to increase ability to distinguish local primate species and increase tolerance towards them

Action 16.1 Create a Working Group with relevant stakeholders to develop education and outreach efforts for the RBL
Responsibility: Andie Ang, JGIS, MNSJ, NParks, NSS, NUS, PERHILITAN, and WRS
Timeline: To form by September 2016 that will meet once every 2 months
Measurables: Implementation of the communication actions as listed in the strategy (creating database; developing message; publishing identification brochure for Malaysia; actively communicating on developments).

Potential Collaborators/Partners: JAKOA (Department of Orang Asli Development/Jabatan Kemajuan Orang Asli); local communities, MNSJ has contact with Nature Lovers Clubs in schools (Malaysia); MOE (Singapore)
Resources: Meetings/organisational logistics and planning (incidental costs)

Action 16.2 Create a database that compiles resources on the RBL so as to develop education and outreach materials
Responsibility: Andie Ang
Timeline: Immediate
Measurables: Public access to information on RBL
Potential Collaborators/Partners: RBL WG
Resources: Creation of a website/online portal (negligible cost): to be managed by Andie Ang

Action 16.3 Develop a message on the identity of the RBL and on the urgent need to conserve the species
Responsibility: RBL WG
Timeline: Begin September 2016 (ongoing)
Measurables: Periodic delivery of communication resources
Potential Collaborators/Partners: RBL WG and other stakeholders
*Resources***:** Funds for hiring designer/editor to create communications materials, including the brochure. Tentative budget: SGD 10K. To apply for funds from sponsors such as Garden City Fund (for outreach materials and to reach schools) and Lee Foundation

Action 16.4 Publish an identification brochure for primates in Johor
Responsibility: MNSJ, PERHILITAN, UTHM, and UKM,
Timeline: Complete in November 2016
Measurables: Completed brochure
Potential Collaborators/Partners: JGIS, Nick Baker and NSS
Resources: RM 10,000

Action 16.5 Active communication to target audience (in Malaysia and Singapore) of the message developed about RBL
Responsibility: All workshop participants and RBL WG
Timeline: January 2017-ongoing
Measurables: Within the target audience, an increase in the number of people who know about the RBL and an increase in how much they know
Potential Collaborators/Partners: All workshop participants and RBL WG
Resources: Funds from various sources (such as the Garden City Fund)

Objective 17. Communication from existing knowledge base to agencies and policymakers to develop a plan to connect forest fragments and other actions (e.g. preserving and protecting gazetted areas)

Action 17.1 Organise and conduct two preliminary seminars (in Malaysia and Singapore) and continuous engagement with relevant authorities
Responsibility: MNSJ, NParks, and UHTM
Timeline: January 2017 onwards

Measurables: A list of key agencies/corporations with an indication of who we have reached out to and communicated with
Potential Collaborators/Partners: Information from Habitat Working Group on parties responsible for land use change, who will then be targets for communication in the seminars
Resources: Budget from WRSCF to fund Andie Ang to manage this

Objective 18. Use results from further study of RBL to create awareness and guide policies, particularly in Peninsular Malaysia

Action 18.1 Update the Red List status of RBL for Malaysia
Responsibility: PERHILITAN
Timeline: Pending results from further study of RBL in Malaysia
Measurables: Updated Red List disseminated to stakeholders and relevant authorities
Potential Collaborators/Partners: Andie Ang, MNSJ, UKM, and UTHM
Resources: To be determined

Objective 19. Identification of all stakeholders who play and can play a role in effective conservation of RBL, as well as providing a platform for sharing information and customising the message to motivate individual stakeholders

Action 19.1 Identification of all stakeholders who play and can play a role in effective conservation of RBL, as well as providing a platform for sharing information and customising the message to motivate individual stakeholders
Responsibility: RBL WG
Timeline: Immediate. Within one month from 12th August 2016
Measurables: Directory of stakeholders (relevant contacts)
Potential Collaborators/Partners: Andie Ang, JGIS, MNSJ, NParks, NSS, NUS, PERHILITAN, UKM, UTHM, and WRS
Resources: Minimal

2.5. Implementation and Immediate Priorities

The responsible agencies for Raffles' banded langur conservation in Malaysia and Singapore are, respectively, Department of Wildlife and National Parks Peninsular Malaysia (PERHILITAN) and National Parks Board Singapore. These agencies, who were partners in the development of this strategy and action plan, will be key to plan implementation, providing not only on-ground support but also helping to shepherd priority activities through the appropriate government processes. However, it is recognised that these agencies alone cannot achieve what is needed; collaboration with conservation NGOs, *ex-situ* experts, universities, the public, and other contributors will be essential. To coordinate these partnerships, drive implementation, maintain communication amongst collaborators, and to track and report on the completion of action and progress towards goals, a coordinator (Andie Ang) has been engaged, funded through the Wildlife Reserves Singapore. To support this work, it was agreed that a Raffles' Banded Langur Working Group (RBL WG) would be established, chaired by Andie Ang with Malaysian and Singaporean co-chairs. The RBL WG will also comprise of representatives from the partnering institutions.

Priorities for the RBL WG for the first two years (2016-2018) will be as follows:

Habitat priorities:

- Protect RBL habitats and connect forest fragments (Actions 1.1-1.2 and 3.1)

Population management and research priorities:

- Clarify taxonomy and systematics (Action 11.1)
- Clarify distribution, population size and structure (Actions 7.1-7.3 and 13.1)
- In Singapore, restore connectivity between fragmented/isolated populations (Actions 5.1-5.2)

Communication and awareness priorities:

- Establish a new Raffles' Banded Langur Working Group (agreed in final plenary)
- Cement cross-country and interagency collaboration within and between Malaysia and Singapore (Actions 14.1-14.2, 15.1 and 19.1)
- Develop targeted education materials for primates in Johor (Actions 16.1-16.5)

The Conservation Strategy for the Raffles' Banded Langur was launched officially on 12 August 2016 at the Singapore Botanical Gardens by Professor Tommy Koh (Ambassador-at-Large at the Ministry of Foreign Affairs Singapore). The launch was hosted by the National Parks Board Singapore and the Conservation Strategy was reported in the Straits Times <Ray of Hope for Monkey Species near Extinction>

3. References

Ang A. 2010. Banded leaf monkeys in Singapore: preliminary data on taxonomy, feeding ecology, reproduction, and population size. M.Sc. thesis, National University of Singapore: 112pp.

Ang A., Ismail M.R.B. and Meier R. 2010. Reproduction and infant pelage colouration of the banded leaf monkey in Singapore. Raffles Bulletin of Zoology 58(2): 411-415.

Ang A., Srivathsan A., Md.-Zain B.M., Ismail M.R.B. and Meier R. 2012. Low genetic variability in the recovering urban banded leaf monkey population of Singapore. Raffles Bulletin of Zoology 60(2): 589-594.

Chasen F.N. 1940. A handlist of Malayan mammals. Bulletin of the Raffles Museum 15: 1-209.

Chivers D.J. 1994. Functional anatomy of the gastrointestinal tract. In: Davies A.G. and Oates J.F. (eds.), Colobine monkeys: their ecology, behaviour, and evolution. Cambridge University Press, Cambridge, UK: 205-227.

Department of Wildlife and National Parks Peninsular Malaysia 2010. Red list of mammals for Peninsular Malaysia. DWNP: 159pp.

Groves C.P. 2001. Primate taxonomy. Smithsonian Institution Press, Washington and London: 350pp.

Hüttche C. 1994. The ecology, taxonomy and conservation of the banded leaf monkey (*Presbytis femoralis femoralis*) in Singapore. Diploma thesis, Free University of Berlin.

Kay R.N.B. and Davies A.G. 1994. Digestive physiology. In: Davies A.G. and Oates J.F. (eds.), Colobine monkeys: their ecology, behaviour, and evolution. Cambridge University Press, Cambridge, UK: 229-249.

Lim K.K.P., Subaraj R., Yeo S.H., Lim N., Lane D. and Lee B.Y.H. 2008. Mammals. In: Davison G.W.H., Ng P.K.L. and Ho H.C. (eds.), The Singapore red data book: threatened plants and animals of Singapore, second edition. Nature Society Singapore: 198pp.

Lucas P.W., Hails C.J. and Corlett R.T. 1988. Status of the banded langur in Singapore. Primate Conservation 9: 136-138.

Martin W. 1838. Natural history of man and monkeys. Charlesworth's Magazine of Natural History 2: 436.

Medway L. 1970. The monkeys of Sundaland: ecology and systematics of the cercopithecids of a humid equatorial environment. In: Napier J.R. and Napier P.H. (eds.), Old World monkeys: evolution, systematics and behaviour. Academic Press, New York: 513-553.

Srivathsan A., Ang A., Vogler A.P. and Meier R. 2016. Fecal metagenomics for the simultaneous assessment of diet, parasites, and population genetics of an understudied primate. Frontiers in Zoology 13: 17.

Appendix I: Acronyms and Abbreviations

AVA – Agri-Food and Veterinary Authority of Singapore
CBSG – Conservation Breeding Specialist Group (of the IUCN SSC)
CI – Conservation International
FRIM – Forestry Research Institute of Malaysia
IPS – International Primatological Society
IUCN – International Union for the Conservation of Nature
J-Biotech – Johor Biotechnology and Biodiversity Corporation
JGIS – Jane Goodall Institute (Singapore)
KPT – Kementerian Pendidikan Tinggi (Ministry of Higher Education Malaysia)
LKCNHM – Lee Kong Chian Natural History Museum
LTA – Land Transport Authority (Singapore)
MbZ – Mohamed bin Zayed Species Conservation Fund
MFA – Ministry of Foreign Affairs (Singapore)
MINDEF – Ministry of Defence (Singapore)
MND – Ministry of National Development (Singapore)
MOC – Memorandum of Collaboration
MOE – Ministry of Education (Singapore)
MOU – Memorandum of Understanding
MPH – Mandai Parks Holdings
NEA – National Environment Agency (Singapore)
NIE – National Institute of Education (Singapore)
NParks – National Parks Board (Singapore)
NSS – Nature Society (Singapore)
NTU – Nanyang Technological University (Singapore)
NUS – National University of Singapore
PERHILITAN – Department of Wildlife and National Parks Peninsular Malaysia
PTNJ – Perbadanan Taman Negara Johor (Johor National Parks Corporation)
PUB – Public Utilities Board (Singapore)
RBL WG – Raffles' Banded Langur Working Group
SSC – Species Survival Commission (of the IUCN)
SLA – Singapore Land Authority
UKM – Universiti Kebangsaan Malaysia (National University of Malaysia)
UPEN – Unit Perancang Ekonomi Negeri (Economic Planning Unit)
URA – Urban Redevelopment Authority (Singapore)
UTHM – Universiti Tun Hussein Onn Malaysia (Tun Hussein Onn University of Malaysia)
WCS – Wildlife Conservation Society
WRS – Wildlife Reserves Singapore
WRSCF – Wildlife Reserve Singapore Conservation Fund

Appendix II: Workshop Participants

Table of workshop participants, affiliation and email address (if they are OK with that)

Name	Affiliation	Email Address
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Appendix III: Day 1 – Challenges and Opportunities

The following list includes the challenges and opportunities raised by workshop participants at the beginning of the workshop, which they hoped to see addressed.

1. Singapore and Malaysia working together.
2. Governments and researchers working together.
3. Understanding how research can help conservation.
4. Consider the role of protected areas.
5. Consider the role of genetics and research.
6. Pull together all relevant stakeholders, disciplines and resources.
7. Standardize a name for the taxon.
8. Understand population trends across the entire range.
9. Understand how to best manage areas.
10. Involve the public through citizen science.
11. How can the wider community contribute?
12. How can undergraduates contribute?
13. Be mindful not to over-manage.
14. Consider an *ex-situ* group.
15. Make this happen – it's been too long!
16. Connectivity.
17. Research and forest restoration ecology.
18. We need less disturbance.
19. This is urgent - do this rapidly.
20. Restore the species to its former range.
21. Connectivity is very important.
22. We are here to learn as much as we can about conservation of this species.
23. We would like to see how we can assist with permits.
24. Create more awareness.
25. We need clarity of taxonomy.
26. How can Malaysia contribute?
27. How can genetic work contribute?
28. One plan approach linking *ex-situ* and *in-situ*
29. Goal should be an implementable plan.
30. Set an example on how Singapore and Malaysia can work together