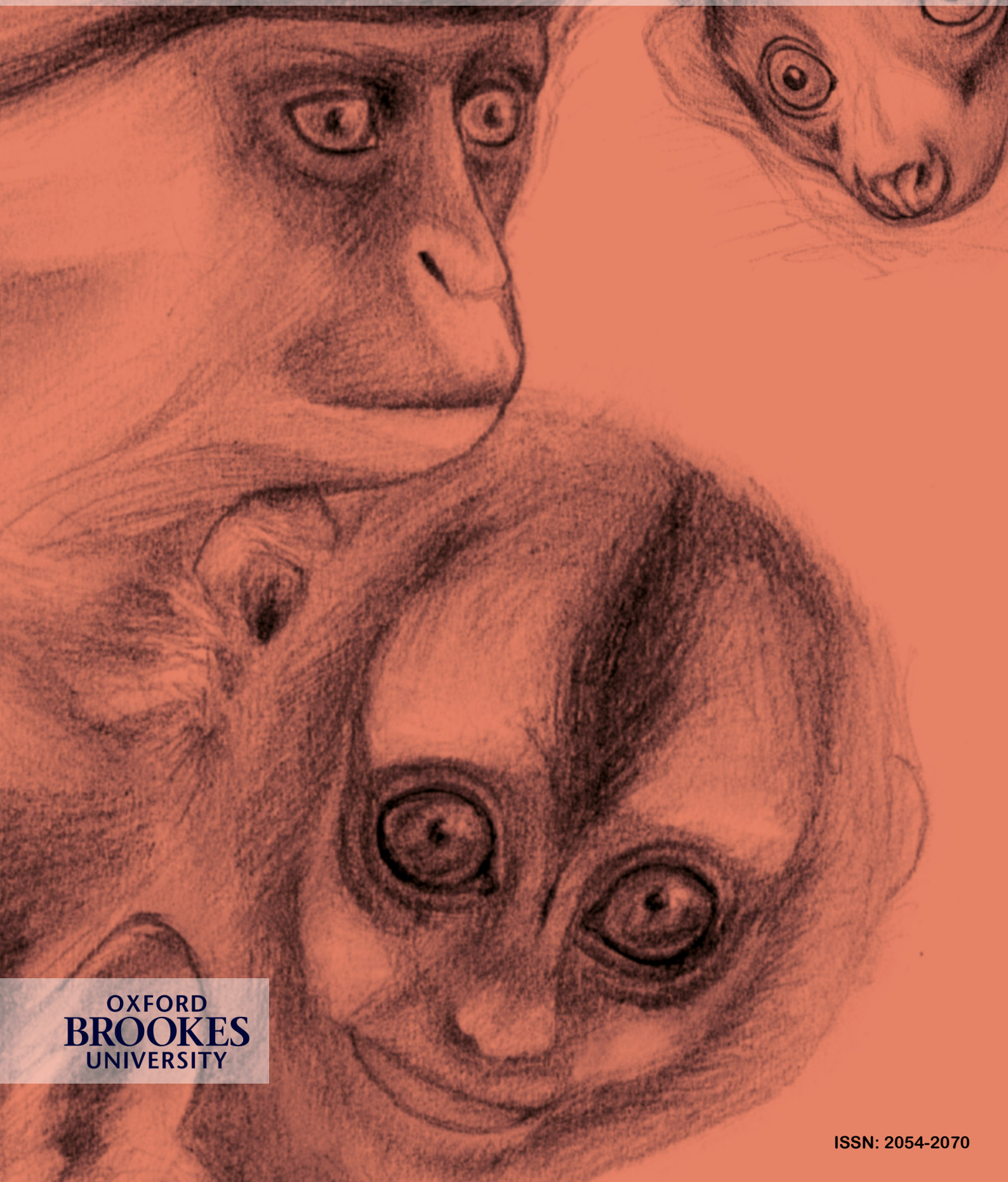
Journal of the MSc in Primate Conservation

Canopy

Volume 15
Issue 2
Spring 2015



OXFORD BROOKES UNIVERSITY

ISSN: 2054-2070

Canopy
Journal of the Primate Conservation
MSc Programme
Oxford Brookes University

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Table of Contents

Letter from the editors

Welcome to the 2015 Spring Edition of Canopy, the in-house journal of the MSc in Primate Conservation at Oxford Brookes University.

Asia has a wide array of different types of non-human primate species, from orang-utans and gibbons to macaques and lorises. There are 119 species with 183 taxa living in 22 countries. Out of the 119 species 113 species have been assessed by the IUCN Primate Specialist group. From this assessment they have listed 17 species as Critically Endangered, 45 as Endangered, and 25 as Vulnerable. One of the main reasons that these primates are listed in those categories is the habitat destruction. This often results in them being displaced, killed, or sold into the pet trade. This has additionally been fuelled by the portrayal of illegally owned primates in the media, especially on social networks.

The articles selected for this issue provide a glimpse of the work being done to help conserve Asian primates. It is essential that we know where these primates are, as well as if and how they are adapting to their changing environment, so that we can educate people about them and their conservation.

We hope that you enjoy this issue of Canopy as it looks at the issues that the Asian primates are facing. Several students of the 14/15 cohort will be studying Asian primates in their habitats, so keep an eye out for these articles in the future Canopy editions.

Cheers,

Editors

Magdalena, Priscillia, Elena, Averee and Nyssa

Letter from the module leader

Welcome to a new edition of Canopy, the journal of the MSc in Primate Conservation at Oxford Brookes University. This issue is dedicated to the conservation of primates in Asia. Asia is home to a wide range of primates from the tiny slender lorises from India and Sri Lanka or the slightly bigger pygmy slow loris from Indochina to the large orangutans from Borneo and Sumatra, and everything in between. The five of families of primates that are found in Asia – Lorisidae, Tarsiidae, Cercopithecoidea, Hylobatidae and Hominidae – represent a bewildering array of variations on the theme of how to be a primate. This diversity in form is mirrored by the diversity of habitats in which Asian primates can be found, from wet mangrove forests on the coast through lowland temperate and tropical forests, to high mountain regions, and increasingly, human-modified or – created habitats.

Asia has also seen a number of highly publicised new primate discoveries: the Myanmar snubnosed monkey, thought to be endemic to Myanmar but now also known to occur across the border into China, or the Kayan slow loris, a new venomous primate from eastern Borneo, comes to mind. In the little explored corners of Asia – of which there are many - as well as the drawers of the natural history museums – of which there are even more- awaits the discovery of still more undescribed species in the years to come.

In this issue we see some of this variation reflected, with articles focussing on the primates from various parts of Asia. All were conducted by MSc students as part of their dissertation project. Primate conservation is as much about dealing with the needs and aspirations of people as it is about the primates per se, and this is also well-reflected in this issue. Two studies from Cambodia, one working on the link between forest use and livelihood and the other on empowering local people through education, and two on the trade in primates in Japan and India, are good examples of the close link (or too close a link) between people and primates. Three studies focused on the distribution and abundances of primates, and these demonstrate how much there is still to learn about what some would considered well-studied taxa. A similar point could be made by the final study that explored the effects of cognitive enrichment in the welfare of captive gibbons – gibbons are kept in large numbers of zoos and rescue centres worldwide but there is plenty of scope of improvement on how to ensure that not only their physical needs are met but also their psychological. Just like we owe it to the wild primates to make sure our actions do not impact them negatively, we owe it to their captive counterparts that ensure that they can live the best live possible life given the circumstances they are in.

Professor Vincent Nijman

Module Leader, MSc Primate Conservation

Forest use, livelihoods and biodiversity: A case study from Phnom Kulen National Park, Cambodia

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Cambodia, along with the rest of Indo-Burma, is thought to be one of the world's greatest biodiversity hotspots (Myers *et al.*, 2000). The forests in Cambodia are vitally important habitats that support eleven primate species (Rawson & Roos, 2008), as well as a variety of other flora and fauna (Onderdonk & Chapman, 1999). Major threats to these forests and other tropical biodiversity are mainly socioeconomic in origin and can include human population growth, corruption and poverty (Sodhi *et al.*, 2004). The population of Cambodia is steadily increasing, with over 80 per cent living in rural locations (NIS, 2008). Increasing population densities are directly correlated to forest loss (Sodhi *et al.*, 2004) and between 30–42% of an impoverished population's income may depend upon natural resource extraction (Hansen & Top, 2006).

The study area, Phnom Kulen National Park (PKNP) (Fig. 1), is one of Cambodia's 23 designated protected areas and was thought to contain four primate species prior to this study, with one other, the Indochinese silvered langur (*Trachypithecus germaini*) possibly being locally extinct. The habitat and geography of PKNP is unique, as it is one of the few remaining semi-evergreen forests within Siem Reap Province and contains globally significant dry dipterocarp forest.

Although PKNP is protected it has not escaped utilisation by locals for natural resource extraction (Smith, 2001). The use of Non Timber Forests Products is a contributing factor adding to the pressures upon the protected areas within Cambodia (Eudley, 2008; Starr *et al.,* 2011).

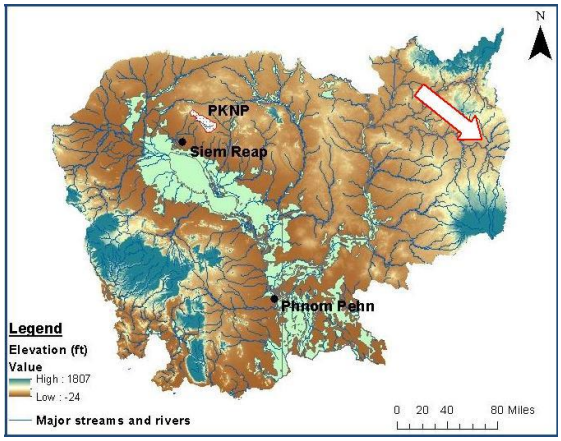

Figure 1: Map of Cambodia showing elevation and main waterways with PKNP and the major cities labelled. Made in ARCmap v.10

There is clear evidence, with concern from both government and non-government organisations, that this is further degrading the quality of the habitat within PKNP. In order to better understand the socio-economic causes of the over utilisation of natural resources within the PKNP, it was necessary to comprehensively assess the current population's livelihood strategies and forest resource use.

The principle investigator worked in conjunction with the Angkor Centre for Conservation of Biodiversity (ACCB) based in Kbal Spean, within the boundaries of PKNP. Data were collected through semi-structured interviews of households[1] (Gillingham & Lee, 1999; Riley, 2006; Marchal & Hill, 2009), comprising 40 main questions, along with loose participant observation methods.

[1] A household is defined as a person or group, either related or unrelated, living together in the same dwelling, acknowledging one household leader and sharing meals.

A mixture of open questions and fixed responses were used to assess the opinions of local villagers (Infield, 1988). The same translator was used for all interviews and permission was sought from the Ministry of Environment in Cambodia prior to commencing the field work.

Figure 2: Local villagers assisting with sampling design

Population samples of villagers were selected using a systematic sampling method (Newing, 2011) designed to prevent spatial autocorrelation occurring. The sample size was predetermined at 20-30 % of each population, or until no new relevant information was discovered, a point known as 'saturation' (Glaser & Strauss, 1967, in Bryman, 2004).

Throughout the planning, data collection and analysis the ethics guidelines of Association of Social Anthropologists of the UK and the Commonwealth were adhered to (ASA, 2011) and the project was approved by the Oxford Brookes University Ethics Committee.

A pilot study (n=6) was conducted with ACCB staff prior to the data collection period (Motzke *et al.,* 2012) and showed that the questions were appropriate and would extract the required information from the participants.

Of the 20 villages in and around PKNP, five villages on Phnom Kulen, the mountain at the centre of the national park, and three in the lowlands were sampled, with a week being allocated to each village (Fig. 2). Data were analysed in SPSS version 19.0 with comparisons being drawn between lowland and mountain households. This was due to the differences between the locations; mountain households were living remotely, either within or on the outskirts of the main PKNP forest, whereas lowland households were surrounded, in general, by agricultural land, with a better infrastructure and access to towns.

In total 226 interviews were conducted in the 8 sample villages. The mean sampling size for the 8 villages was 24.1 % of households. 56.1 % of participants were female and 43.9 % were male. The median age of mountain participants was 42 and for lowland was 40.

Lowland households earned a greater mean annual income than mountain households. Analysis of data showed that crop growing, permanent and non permanent, was the main source of income, with being employed or an entrepreneur the next most common occupation. It is important to note that the income earning relating to natural resource extraction had the second lowest earning potential. This demonstrates that the villagers did not rely heavily upon natural resources as an income source, although they are still extremely important for the households' own consumption. Over 70 % of participants in both locations harvested natural resources at least once a week, making it clear that access to the forest is important. The harvesting of wood, fruit, vegetation and wildlife was significantly more likely to occur in mountain locations, possibly due to mountain participants earning less on average. Over 70 % of lowland households still collected natural resources, proving that although they earn more on average, they continue to utilise the forest. Fish were utilised by both locations and were an important protein source, with honey creating a small but significant contribution to lowland participants' livelihoods. It is therefore important to recognise access to natural resources as a necessity to the population of PKNP.

38 % of participants claimed to hunt and/or trap, with mountain households being more likely to participate than lowland. Villagers did not put hunting and trapping in the same category. It was common that they would state 'no' to hunting, later saying that they regularly trapped. Many villagers were aware that hunting was illegal, but were comfortable to discuss trapping or the use of slingshots by children (pers. obs.) (Fig. 3)

Figure 3: Child with small forest bird; sling shot; small bird. The bird had been shot by the child for food, who had then removed its flight feathers.

The main reason given for trapping was to protect crops. 63 % of participants hunted or trapped around their agricultural land, more frequently during the harvest season. Pig-tailed macaques (*Macaca leonina)* were identified as crop raiders.

Participants who spent time in the forest proved to have a good knowledge of biodiversity in the area. 10 participants regularly saw the Indochinese silvered langur, and when asked for the colour of the offspring as a ground truthing method, most replied 'red', making it likely that they were correct about the species identification. This took the number of primates thought to inhabit PKNP to five.

The most common species hunted were squirrel (the Cambodian striped squirrel *(T. rodolphii)* and variable squirrel *(C. finlaysonii*) (Fig. 4) and rats (*Rattus* spp) rather than the preferred meat species, muntjac (*Muntiacus muntjac)* and wild pig (*Sus scrofa*). Muntjac, which is the most valued wild meat, is the least caught species and the least commonly seen, along with other large mammals.

Figure 4: Variable squirrel (*Callosciurus finlaysonii*) trapped by a villager for own consumption

The income sources of populations living in and around PKNP are varied and multifaceted, giving them the best possible chance of earning enough to survive (Barrett *et al.*, 2001). The reliance on natural resources is not one that increases a householder's income in any substantial way, yet, the harvesting of natural resources is hugely important for own consumption and may prevent households slipping deeper into poverty (Motzke *et al.*, 2012). Therefore, schemes should be put in place to allow the sustainable harvest of natural resources. It is thought that to reduce hunting for wild meat an affordable and sufficient alternative for non-wild fresh protein should be available to a large proportion of the population (Milner-Gulland *et al.*, 2003). It is therefore recommended for both locations that a small scale poultry scheme and livestock husbandry programme is put in place. Households should be trained how to keep poultry and then be provided with a number of vaccinated hens and a cockerel. The birds would provide the household with a sustainable source of protein, in theory reducing the amount of hunting. Households should also be taught how to compost and use their livestock's faeces to create fertiliser. This would increase the quality of the soil, stopping villagers from having to cut forest for more, better quality, agricultural land.

Evidence of the Indochinese silvered langur inhabiting PKNP should be collated to enable adequate protection to be put in place and funding should be applied for to assist with conservation efforts.

A final recommendation is that research is conducted into crop raiding within PKNP. As many traps are placed around chamkars to prevent crop damage by wildlife, research should look into less lethal methods of deterrence, reducing the number of villagers trapping and thereby having a positive effect on biodiversity. This should also reduce the conflict between the human inhabitants of PKNP and its wildlife.

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Distribution of the Javan slow loris (*Nycticebus javanicus*): assessing the presence in East Java, Indonesia

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Primates are amongst the most studied mammal species, but little is known of the Javan slow loris (*Nycticebus javanicus*), a highly threatened nocturnal primate endemic to Java, Indonesia. Unfortunately, many species in greatest need of conservation are the least known. *Nycticebus javanicus* has one of the smallest geographical ranges of all slow loris species and until recently it has also been one of the least studied. Its distribution is highly fragmented due to habitat loss, and it is found in very low densities in primary and secondary forests, but also in disturbed agricultural areas. The known geographic distribution of this highly enigmatic species is restricted to western and central Java (Nekaris & Shekelle, 2008). However, ecological niche modelling by Thorn *et al*. (2009) predicted a potential distribution in the eastern parts of Java as well.

We surveyed areas around East Java using line transects to confirm the presence/absence of the lorises and other nocturnal small mammals in these areas. Modelling by Thorn *et al.* (2009) determined the selection of the survey areas, which included Meru Betiri and Alas Purwo National Parks as well as areas around Ijen Plateau. The study was conducted over a 6 week period between May-July 2013. 40 transects were walked for 76 hours covering 58.3 kilometres. Transects were between 0.1 km and 4.2 km in length, with average transect length of 1.5 km. During the surveys, we encountered five Javan slow lorises, all in Meru Betiri National Park. An overall encounter rate for the slow loris was 0.09/km (n=5).

Other nocturnal small mammal species encountered in various survey areas were: common (or red) giant flying squirrel (*Petaurista petaurista)* (0.10-0.17/km), common palm civet (*Paradoxurus hermaphrodites)* (0.10/km), small-toothed palm civet (*Arctogalidia trivirgata)* (0.12/km), Javan colugo (*Galeopterus variegatus)* (0.05/km) and Javan chevrotain (*Tragulus javanicus)* (0.03/km) (Table 1).

The presence of two diurnal primate species Javan lutung (*Trachypithecus auratus*) and long-tailed macaque (*Macaca fascicularis*) was also recorded. Macaques were present at seven and lutungs at nine different locations.

I did not have enough sightings to estimate the slow loris density in the survey areas, but the low encounter rate suggests low abundance. On the other hand, encounter rates are affected by many variables, including survey effort and detectability. Detectability which means the number of individuals detected per unit of survey effort (distance or time) is considered to be one of major challenges of nocturnal surveys. Small nocturnal mammals are difficult to survey as they are hard to detect, especially in dense tropical rainforests (Duckworth, 1998). Temperature and rainfall influence detectability of most species (Wintle *et al.,* 2005), as does the amount of moonlight and the speed at which transects are walked (Nekaris *et al.,* 2008). Also, identification of species can be problematic when surveying nocturnal small mammals, because the animals are spotted mostly by their eye-shine and patterns of movement. Hunting pressure is thought to lead to torch-shyness and if animals are hidden by vegetation or do not look towards the torch, they can easily be overlooked (Duckworth, 1998).

Short-term surveys can be useful for assessing the presence of species, but estimating abundance or absence requires longer survey

Species/location	Meru Betiri				Alas Purwo			Ijen plateau		
	Bandealit	*Sumber Salak*	*Rajegwesi*	*Sukamade*	*Rowobendo*	*Sadengan*	*Sumurtrong*	*Kawah Ijen*	*Kalisat*	*Sidomulyo*
Javan slow loris	X	X								
Common palm civet	X		X				X			
Small-toothed palm civet			X	X	X		X			
Javan colugo	X									X
Red giant flying squirrel				X					X	
Javan chevrotain				X						
Javan lutung	X	X		X	X	X	X	X	X	
Long-tailed macaque	X	X		X	X	X	X		X	

Table 1: Localities of all species encountered during the surveys.

effort. However, even short-term survey data can be supplemented by collecting information from local people (Anadón *et al.,* 2009). This can be done by conducting interviews as well as visiting local animal markets. I conducted unstructured interviews with people and visited small wildlife markets in the biggest towns in the area. I did not see any slow lorises or other primate species for sale during the visits, but was told that trade in primates does occur. This was supported by the data from the interviews. The interviews produced few data on slow loris presence, but revealed the overall lack of knowledge on nocturnal small mammals and species identification.

The reasons for encountering slow lorises only in one of the recommended survey areas can include survey effort and detectability, but also habitat suitability and the effect of poaching. Further surveys are needed to clarify the status of Javan slow loris and other nocturnal small mammal populations in East Java.

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Effects of cognitive enrichment in gibbons' welfare (Hylobatidae)

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Besides keeping viable populations, animals in captivity can act as an introduction to living wildlife, promoters of environmental literacy, and recruiters for future conservationists (Zimmermann *et al.,* 2007). Thus, animals should be treated as ambassadors and maintained in the highest possible standards so their welfare is not compromised. One approach to reach this goal is enriching the environment where animals are kept, in an attempt to help them cope with the passive environment found in captivity by trying to provide as much stimuli as they would receive in the wild (Young, 2003). This should also include opportunities for animals to exercise their cognitive abilities to solve problems (Carlstead & Shepherdson, 2000), thus the need for cognitive enrichment. As defined by Clark (2011), "Cognitive enrichment is a task (or tasks) whose use engages evolved cognitive skills by providing opportunities to solve problems and control some aspect of the environment, and is correlated to one or more validated measures of well-being". It is important to note that cognitive devices are not the same as food dispensers. They both can pursue the same objective, such as incrementing foraging behaviours or prolonging feeding time, but the key factor to achieve cognitive enrichment is the level of challenge presented to the primate.

This study investigated the effects of two types of enrichments in the behaviour and space use of ten gibbon groups, with representatives from six genera, at Twycross Zoological Park, West Midlands, UK. The study was broken into 4 conditions: baseline, low challenge puzzle feeder (puzzle feeder), higher challenge puzzle feeder (cognitive feeder), and post-enrichment condition. Observations were carried out data between May and July 2013. Each group was observed 60 min per day, four times per condition throughout the four conditions, giving a total observation time of 128 h across all groups. Observations were conducted between 10:00 and 15:00 each day. Time scan sampling methods (Martin & Bateson, 2007) were used to record the behavioural repertoire of the gibbons and their enclosure's position.

The puzzle feeder utilized in this study significantly influenced the amount of time gibbons spent feeding and resting. The cognitive feeder did not reached statistical significance as not all the groups reacted the same to it, yet at least four groups showed an increment in Feeding and a decrease in Resting. As enrichments can have unexpected effects that can be beneficial or detrimental to the animal, the effects on other behaviours were evaluated; in this case, there were no other behavioural consequences. Results obtained in this study show that the enclosure use can be influenced by the enrichments' position as the gibbons spent significantly more time in the part of the enclosure where the enrichment was installed. Thus, the puzzle feeder provided all the groups with behavioural opportunities which allowed them to express control over their environment, hence improving their welfare. In the case of the cognitive feeder, the disparity between the groups could be due to the difference found on the behaviour between groups with young and groups without young and/or the contrast on the effectiveness of the enrichment between young and adult gibbons. For the groups that used the cognitive feeder, there was a trend on both resting and feeding, similar to the one observed in the puzzle feeder condition. Therefore, cognitive enrichment has similar consequences to the animals' welfare as other type of enrichment; it could be more efficient for younger gibbons. However, further

research has to be done to identify the exact interaction of such factors.

Data showed that there are differences in the behaviour depending on the group composition. The groups that had young gibbons (infants and/or juveniles) spent less time resting and more time playing and grooming when compared with the groups composed by just adults. There was also a significant difference in time young and adult gibbons interacted with both enrichments; juveniles spent more time interacting with the devices than adults. If young animals are the ones most in need of cognitive development, have the adequate behavioural repertoire, and are the ones that spend more time with enrichments, they should be specially targeted to receive puzzle and cognitive feeders as they are benefiting the most from access to such enrichments.

Data also showed that there was a significant difference in the time gibbons interacted between the enrichments, being the puzzle the more used. However, in both cases, the time spent engaging with the enrichment remained stable through the four trials; therefore it is concluded that the gibbons did not habituated to either of the enrichments during the study.

Although scarce evidence of these apes' cognitive abilities was found in this study, it appears that motivation is a crucial element that affects their performance. This should be considered in future cognitive evaluations as, for gibbons, not solving the problem may not be due to the lack of cognitive capacities but to the lack of motivation or interest in solving the problem.

It is recommended to use the puzzle feeder in all of Twycross Zoo's gibbon groups, and continue using the cognitive feeders in the groups with young animals. This would lead to more active animals, engaging in the middle/upper sections of the enclosure, which in turn, would enhance the visitor experience. It is also recommended to incorporate activity budgets to the management of captive animals, as they can be a source of valuable information that allows monitoring the behaviour of animals and assisting the planning of enrichment programmes. It is also important in future enrichments, to quantitatively evaluate the effects of the enrichment strategies on a variety of behavioural patterns, and to report the results, either positive or negative, so that those designing enrichment programs can make informed decisions about the value of various enrichment procedures.

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The trade and welfare of slow lorises (*Nycticebus* spp.) as pets in Japan

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The international wildlife trade is one of the principal causes of species endangerment (Broad *et al.,* 2003). A variety of flora and fauna are increasingly being sold through many means including the internet to meet demand for trophies, food, clothing, medicinal purposes, ornamental items, and pets (Broad *et al.,* 2003; IFAW, 2008; Bush *et al.,* 2014). With such demand there are considerable concerns regarding unsustainable trade, population decline, and violation of species welfare (Sollund, 2011; Bush *et al.,* 2014). Despite the presence of legislation, which is often unable to deter illegal activities (Nijman, 2010), the trade in wildlife is worldwide with Southeast Asia in particular supplying demand from the US, the European Union, and Japan (Broad *et al.,* 2003; Nijman, 2010).

Japan is a significant trader of exotic, protected, and threatened wildlife (Ishihara *et al.,* 2010; Reeve, 2014), and is frequently accused of not upholding international wildlife trade legislation (Ishihara *et al.,* 2010). Slow lorises (*Nycticebus* spp.) the internationally protected nocturnal primates endemic to Southeast Asia, have become increasingly popular as pets in Japan since their prevalence on the internet (Nekaris *et al.,* 2013). Despite their protection status, there are continued reports of their smuggling into the country (McGreal, 2007; Nekaris *et al.,* 2013; TRAFFIC, 2013) and the quantity and age of those labelled as captive bred strongly suggest wild collection (Sakamoto, 2007). Nevertheless, the extent of our knowledge on Japan's involvement in slow loris trade is confined to intermittent reports and an examination of their welfare as pets has not been conducted.

This two month study set out to investigate into the extent and nature of the trade and sale of slow lorises in Japan, and gain an insight into their treatment and welfare in private households, with the aim of improving knowledge and aiding their conservation. Using both primary and secondary research methods, I investigated into in-store/online Japanese pet shops, online videos, legal trade data, and confiscation records. Additionally, online video data and the presence/absence of certain welfare conditions in these videos (i.e. housed in unnatural environments, wounds or injury, and human contact) were also recorded. We tested for associations between welfare conditions, and assessed viewer attitudes towards their treatment.

Slow lorises were frequently observed with more than 185 individuals recorded; over a third were seen on sale in pet shops, and nearly two thirds in online videos. Slow lorises were rarely presented with legal trading permits and confiscation records confirmed repeated illegal activity with countries in Southeast Asia as the main contributors. Analysis of welfare revealed four or more conditions were present in over 90% (n=93) of videos. We found no association between welfare conditions which was likely a result of their frequent occurrence. Viewers' attitudes (i.e. expressing positive or negative towards online videos) were only affected when signs of wounds were observed.

The investigations confirm the continued sale of slow lorises in Japan with strong evidence of illegal trade. Informants denoted captive

breeding as their typical method of sourcing slow lorises, yet these animal's captive reproductive rates are particularly low and infant mortality rates are high even in accredited zoos (Fuller *et al.,* 2013; 2014). It is likely that individuals observed in our investigations are victims of illegal trade informants revealed the possibility of obtaining wild slow lorises, certain species that have never been legally imported into Japan were seen on sale, and falsified trading permits were observed. The investigation also provides evidence supporting the unsuitability of slow lorises as pets due to their complex behavioural ecology (Nekaris *et al.,* 2013), highlighting that their welfare is routinely compromised, and people in private households are unable to provide proper care.

In order for Japan to effectively control the trade of slow lorises, more robust legislation and regulation of their trade needs to be implemented, and stronger penalties to perpetrators need be imposed (Shepherd, 2010). Additionally, border control staffs need to be educated on wildlife trade issues and species identification (Natusch & Lyons, 2012). Finally, organisations need to raise public awareness, in part through social media, regarding the reality of the trade and keeping these animals as pets (Sollund, 2011).

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Adaptations in a changing environment: relationship between climate, disturbance and *Nycticebus javanicus* behaviour in Cipaganti, West Java

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Increasingly, wild animals are faced with a multitude of environmental constraints resulting from global climate change and increased anthropogenic activity—the destruction or pollution of an environment caused by human activity. As human populations continue to grow, so does the concurrent increase of agricultural practices. As a result of climate change, agriculturalists are forced to increase in elevation, thus restricting animals to either shift home ranges at higher elevation or overlap with human-populated anthropogenic habitat (Dunbar, 2002). Habitats at various elevations entail diverse ecological conditions and climatic variations, including shifts in temperature, humidity, seasonality, and vegetation (Grow *et al.,* 2013). Additionally, modification for agricultural practices affects the quality of a habitat, restricting the behavior of a species population (Chapman *et al.,* 2003; Gabriel, 2013).

Figure 1: Agroforest at 1,300 meter elevation in Cipaganti, Garut region, West Java, Indonesia.

Endemic to the island of Java and historically found in lowland forest, Javan slow loris (*Nycticebus javanicus*) populations must increasingly adapt to high altitudes, cool temperatures and heavily fragmented forests – a process that is characterizing much of the remaining geographic range (Northeastern India to the Philippines) of seven other slow loris species. Listed on the IUCN Red List as Critically Endangered and included on a list of the "World's Top 25 Most Endangered Primates" (Mittermeier et al., 2008—2010, 2010—2012, 2012—2014) three consecutive times, populations of *N. javanicus* are predominantly found to range within highly disturbed anthropogenic regions.

Located near the east border of the Gunung Papandayan National Park, Cipaganti is an agricultural area comprised of various forest fragments and patches of tree or bamboo interspersed among local owned land (Fig. 1), inhabiting one of the largest known populations of *N. javanicus* (Voskamp *et al.,* 2014).

Working with the Little Fireface Project and the assistance of local field guides, I examined Javan slow lorises (N=6) at three different microhabitats in Cipaganti, West Java to determine the influence(s) of climate and anthropogenic disturbance on their behaviour. As slow lorises travel in social pairs, I followed 3 pairs (one adult male and one adult female), each ranging at different altitudes of 1,000 meters; 1,300 meters; 1,500 meters.

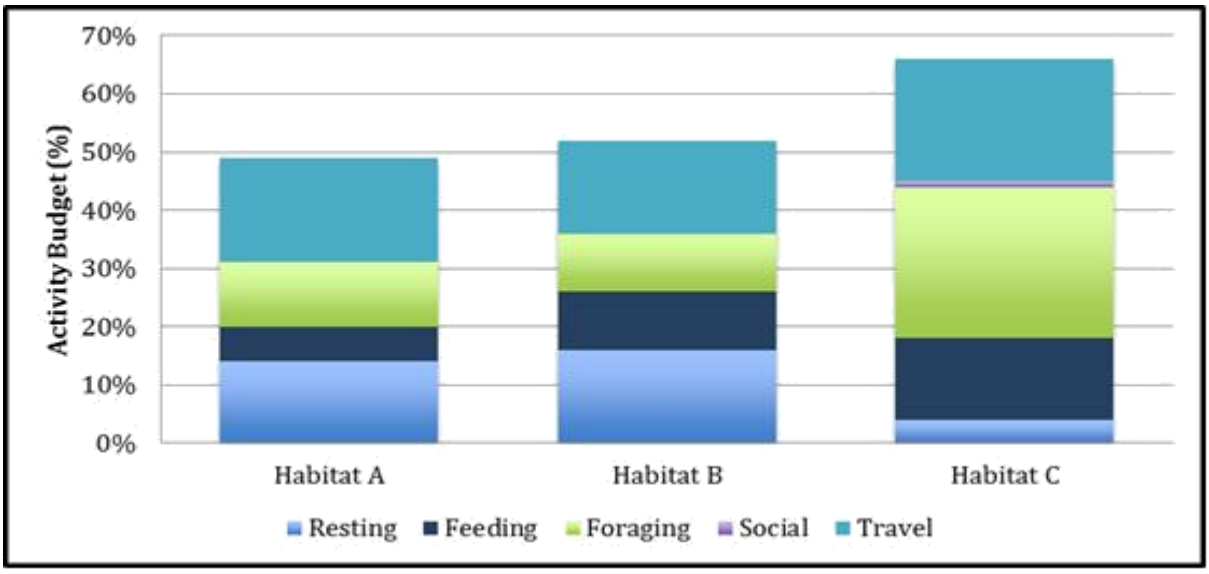

Table 1. Activity budgets of *N. javanicus* pairs ranging in three different microhabitats in Cipaganti, West Java from February 2014 through August 2014. Habitat A: 1,000 meters altitude; Habitat B: 1,300 meters altitude; Habitat C: 1,500 meters altitude

Analyzing their behavior and microhabitat structure for a total of 6 months using SPSS version 21.0, I found loris behavior to vary most in response to levels of humidity and forest connectivity. Loris pairs adjusted their behavior where forest connectivity was limited, largely decreasing travel behaviour. Lorises living at the highest elevation were observed to spend twice as much time foraging and traveling compared to the others (Table 1). This may be due to decreased food availability, as temperature decrease is directly related with increased altitude, and cold temperatures impact vegetation and floral growth (Langvatn, 1996). Lorises (specifically in this region) are known to feed largely on the nectar of flowers (especially Calliandra species). Less nectar in their range would require increased energy spent foraging to acquire proper nutrients and energy to maintain social activities and dispersal.

Knowing the limitations of a species population provides indispensable information applicable in the renditions of conservation policy, management and priority areas. While research on climate change has increased over the past few decades, research has focused more on the ecological impacts, rather than animal species' interactions with essential in the conservation of biodiversity and species existence, understanding a species' adaptive abilities to climate change is equally pertinent in conservation initiatives (Brodie *et al.,* 2013) and should be further examined across primate species.

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Tricks of the trade: the slender loris and other wildlife in supernatural rituals in Bangalore

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"Accidents, enemies, jealousy, sibling rivalry. Politicians with requests for success. Rivalries in work. Teachers who hate each other. Government employees getting promotions over someone else. Spells of attraction."

These are some examples of dilemmas which one interviewee in this study is often asked to fix. The service he provides is black magic and, he tells me, it involves wildlife more often than not. This study was conducted in India's third largest city, Bangalore and its surrounds. It is known as the Silicon Valley of India, yet there is strong evidence that magic rituals and other supernatural practices which harm, kill or adversely affect the welfare of protected wildlife are commonplace in this IT hub.

The purpose of this exploratory study was not to assess the extent of these practices, but to examine the nature of and thinking behind rituals involving the use of wildlife for supernatural purposes in the region. It was initiated through correspondence with a local conservationist who reported that there had been recent incidents where rescued grey slender lorises (*Loris lydekkerianus*) had either been recovered from practitioners or found with ritualistic injuries.

From two original informants, snowball sampling was used to identify and meet with 12 other key informants and stakeholders such as enforcement officials and rescuers, hunters, magic practitioners and their clients. For each, a role-specific semi-structured interview was conducted. Quantitative data were also collected using freelisting and photo I.D. exercises with 34 members of the public.

In total, 53 animals were spoken of as being used and each use was categorised into a mutually exclusive sub-division: religious (e.g. Hindu blood sacrifice), active magic (e.g. to pluck out the eyes of an owl to blind an enemy), traditional medicine (e.g. using

monitor lizard oil as a cure-all), superstition (e.g. hanging a jackal's tail above a door to ward evil) and practical (for consumptive or utilitarian use). Of the 53 recorded, for the purposes of analysis, a shortlist of 17 species was made of all those accruing in 10 or more statements.

In terms of implied threat, based on statements of detrimental practices, the grey slender loris was the leading species with 11% of the total harmful uses spoken of; the Bengal monitor (*Varanus bengalensis*) was the second most mentioned with 9%; followed by the Indian jackal (*Canis aureus indicus*) with 8%. The slender loris was associated, predominantly, with black magic rituals, most often as a live effigy (akin to the popular idea of a 'Voodoo' doll) to be ritually maimed in order to harm the enemy of a client in a similar manner. It is also used in superstitious activities, particularly as an 'oracle' whose silent mouthings are interpreted by a fortune teller. The Bengal monitor statements consisted of significantly more uses in relation to traditional medicine, such as muscle-gaining meat and as curative massage oil. The Indian jackal mentions suggest it is overwhelmingly used for superstitious purposes; specifically the head, teeth, tail and claws are used as talismans and amulets to protect the wearer or owner.

The most mentioned species including both harmful and non-harmful statements was the spectacled cobra (*Naja naja*), a snake with great importance in the core Hindu cannon; yet it had far fewer harmful statements than did the loris, which is not mentioned in any prominent Hindu scriptures. This appeared a possible factor in some other species. A Divine Protection hypothesis was tested, using the Mann-Whitney-U test, to assess whether those species having a positive association with Hindu lore were the subject of fewer harmful statements than those species having no religious significance or only negative associations. This hypothesis was supported, suggesting that those species with no positive religious connection may be at greater risk.

The semi-structured interviews, although lacking in numbers to give robustness, did give compelling and unexpected data pertinent to the trade situation in the study area, with some insights of particular interest. The illegal wildlife trade in Bangalore has become less open within the last 10 years (Ahmed, 2010). From the central, historical trade hub at Russell's Market, now much of the trade occurs through satellite settlements in towns just beyond the city. These settlements are in close proximity to forest patches popular for trapping and hunting and are home to indigenous communities with a tradition in such activities, for example the Jenu Kuruba. Hunting methods are determinedly low-tech involving bamboo bows, wire-snares, glue-pads and poison, with hidden in-place rope bridges and bicycles for transportation. Between settlements demand in areas of low supply can be met by other settlements, creating a mutually beneficial network. Wildlife transport between hubs, even interstate, was said to be facilitated by government buses and perhaps trains; largely due to the lack of baggage scanning.

Rescuers and one journalist gave recent codenames for some of the wildlife currently used: 'Lilliput' for the slender loris; 't-shirt' for the Indian jackal; 'two-wheeler' for owls; 'double-engine' for the red sand boa and 'four-wheeler' for turtles.

Various tricks and scams used in wildlife trade were often mentioned by respondents. A good example is the red sand boa which a number of respondents mentioned was often given erroneous weight by the injection of glucose solutions and the forced ingestion of ball bearings and even liquid mercury prior to sale to inflate the value.

Of particular concern were the number of comments regarding the use of the slender loris in black magic rituals, especially given the paucity of accurate population data within the area and past surveys (Kumara *et al.,* 2009, Das *et al.,* 2011), recording loris habitats which coincide with hunting locations mentioned by informants.

The placing black magic rituals within the sphere of Hinduism by some respondents, including a priest and a magic practitioner, suggests that Hindu spiritual leaders can contribute to the issue by engaging devotees, for instance in raising awareness of tricks employed by wildlife traders and promoting alternatives to animals ritual sacrifice, such as pumpkins, which have already been adopted by many Hindus, particularly those who strictly adhere to the principle of ahimsa (non-violence).

Another issue which may have deep ramifications is the marginalisation felt by the many in the communities to which tribal hunters belong and their subsequent mistrust and resentment of the establishment, which will require sensitivity and applied effort to reconcile.

An ethnographic grasp of local beliefs and practices, generating conservation initiatives sympathetic to these systems, can help inform measures to safeguard species under pressure from human-wildlife conflict.

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Empowering local people through education to conserve Cambodia's primates

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Cambodia is home to 12 primate species of which 11 are threatened with extinction (IUCN, 2013), as deforestation and hunting severely pressure the primates' survival (Loucks *et al.*, 2009; Mittermeier, 2010; IUCN, 2013). Conservation education in which the local community is engaged is vital for long-term conservation (Jacobson, 2006). I therefore carried out a primate conservation education project entitled Tails of Cambodia. My aim was to aid long-term primate conservation by empowering local people living around Kbal Spean and Phnom Kulen national park to conserve Cambodia's primates. My objectives were (1) to increase the knowledge of primate behaviour and conservation issues; (2) to engender a positive attitude towards primates and their conservation; and (3) to provide the skills that help to conserve Cambodian primates.

I carried out the project at Angkor Centre for Conservation of Biodiversity (ACCB), a nature conservation centre located at the protected site Kbal Spean, Cambodia. The project consisted of five units:

• An education program with lectures and activities

• A book containing illustrated stories

• Informal engagement sessions for local children ('miniclubs')

• Local staff training for carrying out the education program and primate observations

• Outreach activities involving websites, reports and marketing of the book

I created the illustrated book at ACCB and printed 700 copies in Siem Reap. I distributed the book to all participants of the education program, miniclub participants and to four libraries of major cities in Cambodia. The miniclubs were implemented together with ACCB's local educators whenever there was time and opportunity to, engaging a total of 307 children. I evaluated the education program, which comprised the major part of the project, by using questionnaires that 129 participants filled out before (pre-test) and after (post-test) the program. I also included a control group of 17 children that received the evaluation test but did not attend the education program. The questionnaires comprised of nine questions that measured knowledge, attitude and skills concerning primate conservation. I compared the post-test with the pre-test to examine whether the objectives were met.

The participants had more positive attitudes and were more confident in their skills regarding primate conservation after the education program compared to before. Their knowledge did not significantly increase, which could have been due to the fact that they already knew a lot about primates: they scored higher on pre-test knowledge than the control group.

Although the education project Tails of Cambodia was a success, I would recommend future conservation education initiatives to (a) improve evaluation methods by devoting studies to the development of psychometrically sound tests, and implement qualitative evaluation methods besides more traditional quantitative ones; (b) empower local communities by developing literacy and providing them access to books about wildlife and the environment; and (c) increase the expertise of conservation education as an scientific discipline by exploring other fields of study, especially social psychology. It is vital that people in Cambodia and in the rest of the

world genuinely care for nature, and education is the means to accomplish this goal.

Figure 1: Indochinese silvered langur *Trachypithecus germaini* at Angkor Centre for Conservation of Biodiversity, Cambodia

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Population density and habitat assessment of Müller's gibbon (*Hylobates muelleri*) in Sungai Wain Protection Forest, East Kalimantan, Indonesia

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Müller's gibbons (*Hylobates muelleri muelleri*) are endemic to the island of Borneo and are the most widely distributed hylobatid on the island, absent only in the southwest (Haimoff, 1985). All gibbons are listed on CITES Appendix I (Geissman, 2007) and they were elevated from Lower Risk/near threatened to Endangered during their last IUCN Red List assessment in 2008. They are so listed because their populations are said to have declined by over 50% in the last 45 years due to the expanding palm oil and logging industries (Geissman, 2007, Cheyne, 2008, Geissman & Nijman, 2008).

To date only one publication provides density estimates for Müller's gibbons endemic to the

	Entire Survey Area	Pristine Forest
Number of Sites	10	5
Total Area (km^2)	30.59	23.60
Number of Groups	68	60
Average Group Density (groups/km^2)	2.87±0.60	3.18±0.57
Average Individuals/km^2	9.55±2.01	11.13±5.27

southern area of East Kalimantan (Nijman & Menken, 2005). Geissman (2003) stressed that, among other priority actions, the completion of status reviews, including population census and monitoring were essential for the protection of gibbons.

The present study sought to assess the group density and habitat of a population of Müller's gibbons residing in Sungai Wain Protection Forest (SWPF), a lowland dipterocarp forest in East Kalimantan, Indonesia.

The quadrangulation survey method was chosen for the present study over line transects due to the unpredictable nature of gibbons in the presence of humans. Line transect survey methods are less reliable for surveying gibbons as they favour the high canopy, may flee quietly, or hide when approached by humans (Brockleman & Ali, 1987; Nijman & Menken, 2005).

Data were collected over 38 survey days from May 20th 2012 to July 16th 2012 from ten different sets of listening posts. Of the ten

sites surveyed, five were located entirely in the pristine forest, four included both pristine and burnt forest, and the remaining site was located entirely in regenerating forest.

The pristine forest of SWPF totals approximately 40km^2 (Fredriksson & Nijman, 2004). Using the individual estimate from the pristine area only (11.13±5.27 individuals/km^2), the population of the intact area can therefore be estimated at 445 individuals belonging to a mated group. Cheyne (2008) postulated that lone males account for approximately 10% of the mated population. Therefore, adding this figure to the estimated population results in a total of 490 gibbons within the pristine forest.

More data need to be collected on *H. m. muelleri* within the regenerating area of SWPF before an accurate population estimate can be made. As only one site was located entirely in the burnt area, extrapolations should be made with caution. Using the density estimate of 0.98 groups/km^2, a value of 3.93 individuals/km^2 was calculated. As the regenerating area is also 40 km^2 (Fredriksson & Nijman, 2004), an overall population estimate of 173 individuals (including lone gibbons) can be made for the burnt area. This would produce a total of 663 gibbons within the pristine and burnt area together. This is likely an underestimation of the true population of SWPF given that Müller's gibbons have been found to sing more often and longer in response to neighbouring groups (Maples *et al.,* 1988).

Habitat data was collected from a total of 99 plots using the speed-plot method. No significant correlations were found between gibbon density and any of the measured vegetation characteristics. This is believed to be due to an unequal distribution of plots, with more data collected from the pristine area compared to the regenerating area. Significant correlations between group density and vegetation characteristics have been found between different forest types rather than within them (Hamard *et al.,* 2010). Therefore it is possible that further data collection between both forest types may elucidate significant results.

Although SWPF is a protected area, the Müller's gibbon population may encounter difficulties in sustaining its population numbers if SWPF experiences another forest fire similar to that following the 1998 El Niño (Fredriksson & Nijman, 2004). Because part of the forest is already regenerating, further damage due to fire may result in forest fragmentation and increased tree mortality, which may reduce the number of food species available (O'Brien *et al.,* 2003).

It is imperative that the ways in which the gibbons use both forest types – pristine and burnt – are understood. This forest will benefit from future monitoring of the gibbon population as it serves as an indicator of how frugivorous primates are able to live in a regenerating forest.

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University Events

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9 Feb	**Dr Andrew Smith** (Anglia Ruskin University)
16 Feb	**Dr Kimberly Hockings** (Oxford Brookes University)
23 Feb	**Jamie Craig** (Cotswold Wildlife Park)
2 March	**Stephanie Poindexter & Kathleen Reinhardt** (Oxford Brookes University)
9 March	**Dr Christoph Schwitzer** (Bristol Zoological Society)
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