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Address
Canopy c/o Vincent Nijman
Faculty of Humanities and Social Sciences
Oxford Brookes University
Oxford
OX3 0BP
UK

Website
MSc Primate Conservation:
http://www.brookes.ac.uk/primates

Front Cover
Crowned lemurs in Ankarana Reserve, Madagascar ©Susan Lawrance

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Letter from the Editors

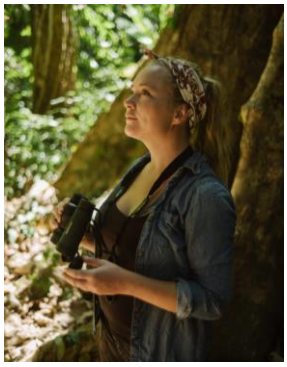
Welcome to the Winter 2020 edition of Canopy. The adventure with our official in-house journal started in 2002, and after 18 years of published issues, interest in primate conservation and the enthusiasm of our MSc students continues to grow, with many topics still a central feature of international research. However, this year has been a strange one; the COVID-19 pandemic has had a global impact and continues to change our lives. In terms of our MSc course, we now have a blended approach to teaching, with online learning and face to face classes taking place concurrently. We thank our course team for their tireless commitment to ensuring that, as students, we continue to have an excellent learning experience. We are lucky in some respects as we have more online material accessible to us than ever before: video lectures and Zoom seminars have made it possible to learn flexibly and from a distance, and online conferences have offered opportunities for extracurricular learning and networking that would have previously been largely inaccessible.

However, one of the biggest impacts that the pandemic has had on the global scientific community is that it is currently preventing most field-based activities, and as such we are currently unable to study many primates up close and personal in their natural range. We applaud our outgoing 2020 MSc Primate Conservation cohort for showing exemplary levels of adaptability, with many of them moving to desk-based dissertations on short notice and producing some excellent research that contributes to important conservation work. All of this must have seemed extremely daunting, as many aspects of primate conservation are difficult to investigate without direct observations in the field, but at a time when communities and wildlife need our effort more than ever before, our MSc students continue to produce amazing research that will contribute significantly to a brighter future. Our role is to keep scientific research alive and to study species and ecosystems in order to contribute to their conservation for many years to come.

In this issue, we present wide-ranging studies from previous MSc students, covering topics from the development of the first ever microsatellite loci for the pygmy slow loris to the use of social media in communicating primate encounters. We also provide a summary of all primate genera covered in Canopy articles since 2012, looking at popular species, those that have been less studied, and leaving you to fill the gap in 2021 with those not featured at all! We think that this is a crucial moment to share knowledge and to keep scientific research alive.

We hope you enjoy this issue of Canopy. Thank you to all the researchers who have contributed to this edition, to the MSc course team for their dedication to our learning, and to you for reading this issue and helping us to keep primate conservation at the forefront of global environmental priorities.

The editors.



Letter from the Lecturer

Back in the autumn of 2007 I was one of the incoming Primate Conservation MSc students. I remember my first year at Oxford Brookes University as hard work, so much fun and overall life changing. We were 30 students from all over the world and many of my classmates have gone on to do incredible careers in primatology, and elsewhere. I also remember being grateful for how welcoming the community of alumni was and this is something that keeps impressing me to this day. One of my favourite aspects of the Oxford Brookes University's Primate Conservation degree is this great, warm and very global support network that are our alumni group. Wherever you go in the world there is someone who has done the degree and you are instantly connected.

I have now worked for the Primate Conservation MSc (and now also MRes!) for 10 years, as Lab Technician, Associate Lecturer and now lastly as a Lecturer and I love my job (so much I ended up doing a PhD here while I was at it). To be involved with all these amazing students coming through each year with such knowledge, passion and drive feels like a real honour. We have now had over 500 students coming through out MSc and MRes degrees and they have conducted research for their final projects in almost 60 countries, doing anything from applied fieldwork, museum studies to captive research and desk based studies. This Canopy issue looks back at some of this alumni research, and what species they have focused on.

We always tell our students that networking is very important, but to not forget that some of the most amazing future primatologists and conservationists are most probably among them in their own cohort (it is very much the case for me!). As we are celebrating our 20 year anniversary as a degree we have dedicated our Monday evening seminar series (also affectionately known as Monkey Mondays) to have an all alumni line up. It has been lovely this semester to reconnect with alumni from all over the world and see what they are up to now. The silver lining of online meetings becoming the norm lately is that we can broadcast these talks online for anyone to see, and invite alumni from wherever in the world they are currently located. So far we have had talks from the forests of Central African Republic, from a sloth rescue centre in Costa Rica and from a village in Sumatra, among others. Come join us when we start up the online seminar series again on the 25th January 2021, and you can see our previous Monkey Monday talks on our MSc Facebook page (https://www.facebook.com/PrimConsOBU/videos). On our Facebook page you can also see our blog series #AlumniFriday and read even more about where our alumni are and what they are doing nowadays.

Magdalena Svensson, Lecturer in Primate Conservation

Developing the first-ever microsatellite loci for the pygmy slow loris (*Nycticebus pygmaeus*)

Giang T.H Cao
Cohort 2016-2017
giang.cth.93@gmail.com

Slow lorises (*Nycticebus* spp.) are small nocturnal primates found in South and Southeast Asia. In addition to increasingly fragmented habitat, the survival of all *Nycticebus* species has been seriously compromised following their sudden rise to fame through social media as "cute pets"- an issue that has only exacerbated illegal poaching of wild populations (Osterberg & Nekaris, 2015). They also occur in medicine trade and as photo props (Schulze & Groves, 2004). Despite requiring urgent conservation management, little is known about *Nycticebus* population genetics, where no effective tools have been generated to assess comprehensively population viability of the species. Microsatellites, also known as Simple Sequence Repeats, which are special repetitive DNA sequences in the genome, are considered one of the most effective molecular tools in population studies. This project characterises the first-ever species-specific microsatellite markers for slow lorises by utilizing Illumina paired-end next generation sequencing (NGS) technology. NGS is regarded as a powerful, low-cost and rapid technique to assist population genetic studies of any non-model species, which can help overcome the lack of prior genomic data and limitations of traditional methods for developing microsatellite markers (Abdelkrim *et al.,* 2009; Santana *et al*., 2009). Potential microsatellite markers were identified from Illumina next generation sequencing data of pygmy slow loris (*N. pygmaeus*) using Galaxy pipeline procedure (Griffiths *et al*., 2016, Fig. 1). This open-source and web-based workflow is an integrated package of several programs that are designed to directly identify microsatellite loci and their flanking regions for primer binding sites from raw Illumina paired-end reads.

A set of 12 noninvasive *N. pygmaeus* samples, including tissues and hairs, were collected from specimens of the National Museum of Scotland. Genomic DNAs were extracted using Qiagen DNeasy blood and tissue kit with minor modifications to the manufacturer's protocol depending on sample types to increase DNA yield from low quality DNA samples (Cao *et al.,* 2016). To locate microsatellite loci, a paired-end library of genomic DNA was made with the Nextera®DNA Preparation Kit using 50 ng of DNA following the manufacturer's protocol and sequenced on the Illumina MiSeq. The library construction and sequencing were carried out by the Genetics Core Facility at the University of Salford. Read lengths used were 2 x 250bp.

Table 1. Characteristics of genotyped *N. pygmaeus* microsatellite loci

Locus	Primer sequences (5'–3')	Repeat motif	T_a (°C)	Size range (bp)	N_A	N_I
Nyg1	F: AGCAGAAGGCCAAACAGAGG R: ACCACTGCACTCGGTCTTCG	ATTTT(30)	67.8	354-365	3	6/6
Nyg3	F: CACTCTCACTCTCGGACCCC R: CTTAAGCCTTCTCCTCCGGG	AGCCC(30)	66	321	1	6/6
Nyg4	F: TGGTGATTGAGTGGATGTTGG R: TGCCTTGTCCTTGTGTGTGC	ATCT(56)	67.5	403-415	4	6/6
Nyg5	F: CTTCCATGCTCCTCACTGCC R: ATGCAAGTCACAGTGCCCC	AAAG(24)	66.3	437-441	2	5/6
Nyg6	F: GAGGCAAGGTTGAGACCAGG R: GCCTCTCTGGGACATCATCC	TCTG(24)	66	333-353	3	4/6
Nyg7	F: AGAGGGAACCAAGGTAGGGC R: CCCCAAGGAGGAGATGACC	TTCC(40)	65.8	317-344	5	5/6
Nyg8	F: ACCCCAATCTGGTCCTACCC R: GTTTAAGTGGGCCAGCAAGG	TTCC(24)	65.6	410-458	4	6/6
Nyg9	F: GCCAGTCTGATATTGCCTGC R: TGTGAAATTCTCTGTGCCCC	TTCC(68)	65	303-323	5	5/6
Nyg11	F: AGAAGTGCTGCCATGACTGG R: GGAAGTACCAAGATAGAGGAAGGG	AAAC(24)	63.9	395-403	3	6/6
Nyg12	F: GAGCCAGAGGAGGAAATAAAAGG R: CCAATCTAAAGCATGGGACACC	AAAT(28)	66.3	374	1	6/6
Nyg13	F: GAATCTCCTTTTCTGAAGACCTGG R: AGGGCATTGGTTCTCTCTTCC	AAAG(100)	65.5	208-249	7	5/6
Nyg15	F: AGGGGAAGTGGGGTAAGAGG R: CCACCTCCTTGCTTTCATCC	AAAG(76)	65.8	335-359	6	5/6
Nyg16	F: AAAGGCAAGAGGGAGAAAAGG R: GGGCATTGCAGAGAGATCC	TTCC(24)	64.8	314-318	2	5/6
Nyg17	F: CCACACTCTAGCCTGGGTGG R: CATTGAATCAAGGGGATGGC	AAAT(24)	66.3	400-453	3	3/6
Nyg18	F: TTCATAAGAGCTCTGTGGCAGG R: TCCTCTGTGGAAACTTGGAGG	TTCC(24)	65.4	264-272	2	6/6
Nyg20	F: CTGGGAATTCCTTGAGGGC R: CACCAGTCCATCTTTGCATCC	ATGG(24)	66.7	283	1	6/6
Nyg21	F: GTAAAGACTCATTCCCCGCC R: TGAATTAGCAGGAAAAGGGGC	ATGG(24)	66	307	1	2/6
Nyg22	F: CAGACCCCTCCACAATGACC R: CTGGTCTTCTGGTTCATAATCTGG	AAAT(24)	64.6	360-424	3	5/6
Nyg23	F: CGCCATTAATGTTTCTCAGGC R: AGGGCTTTGGAGCTGTTACC	ATCT(68)	64.3	384-404	5	5/6
Nyg24	F: TGGCATTCGTACTCCTCTGG R: CGCATACACAATCCTCTGCC	ATCT(48)	65.5	397-409	4	6/6
Nyg25	F: TTCTTTCTGGCCAGTTCTGC R: AACCCAGAGGGATGGAAAGG	TTC(18)	66.2	271-274	2	6/6

Notes: Ta: optimal annealing temperature; NA: number of alleles found; NI: number of individuals genotyped.

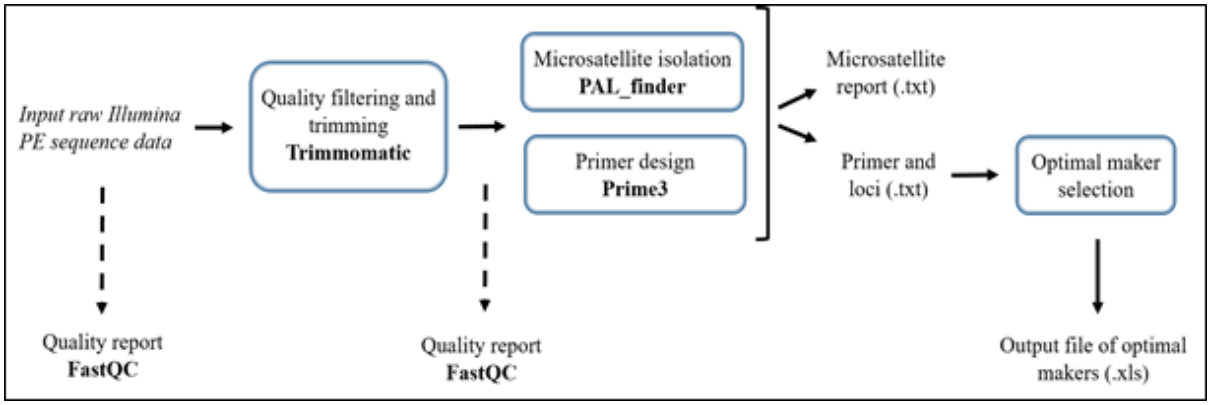


Figure 1. Galaxy pipeline processes for microsatellite identification from Illumina next generation sequencing data (Griffiths *et al.,* 2016)

Through Galaxy pipeline, a total number of 440 loci was obtained for *N. pygmaeus*. 30 markers containing 6 tri-, 21 tetra-, 3 penta-nucleotides were selected to verify successful amplification and variation using 6 individuals. Each forward primer was tagged with one of three universal tails that are Blacket C (5'-CAGGACCAGGCTACCGTG -3'), M13modA (5'-TAGGAGTGCAGCAAGCAT -3') and M13modB (5'- CACTGCTTAGAGCGATGC -3') (Blacket *et al.,* 2012; Culley *et al.,* 2013). Fluorescent dyes including FAM, Cy5 and TAMRA were attached with complementary Blacket C, M13modA and M13modB tails, respectively. PCRs were performed using the Type-itMicrosatellite PCR Kit in 5 µl reactions (2.5 µl of mastermix, 1.5 µl of water, 0.5 µM of primer mix and 0.5 µl of DNA or higher depending on the concentration of DNA in the obtained extraction solution). The following PCR conditions were used: initial denaturation at 95°C for 5 min; with 28 cycles at 95°C for 30s, 61°C for 90s, 72°C for 30s; and the final extension at 60°C for 30 min. Of the 30 initial loci, 26 were successfully amplified and visualised on agarose gel electrophoresis. Capillary electrophoresis was performed using ABI 3730 DNA Analyzer for fragment length analysis with the GenescanTM 500 LIZ® size standard. Allele peaks were then determined using Peak Scanner software v1.0 (Applied Biosystems, 2006).

Fragment length analysis of PCR products by capillary electrophoresis yielded 21 scorable markers. Of these, 17 loci showed significant polymorphism with 2 – 7 alleles per locus. A total of 67 alleles were scored from 21 loci (Table 1).

As no previous work has been carried out on this threatened species, the results from this project have many important implications for the conservation of slow lorises. My novel 17 polymorphic loci will hence provide a promising tool for directly assessing relatedness between slow loris individuals, benefit understandings of social organisation which are still hindered in this cryptic species, and further a range of conservation studies such as individual identification, investigation

of population genetics, population connectivity, structure and genetic diversity as well as aid in the implementation of both in-situ and ex-situ management for the species. The results also suggest a better sampling on the species to fully characterise the obtained markers.

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Costs and benefits of methodologies used to determine blue monkey (*Cercopithecus mitis*) presence in naturally fragmented forest patches of Nyika National Park, Malawi

Eleanor Darbey
Cohort 2016-2017
elliedarbey@gmail.com

Population surveys remain at the core of all conservation management plans: if the quantity and distribution of a species is unknown, it is not possible to implement and monitor the efficacy of different approaches (Rylands *et al.,* 2008). The applications of primate surveys include, but are not limited to: (i) providing a baseline density or quantity; (ii) comparing the importance of different habitats; and (iii) assessing variation in populations from previous censuses over time (Plumptre & Cox, 2006). Consistency of methods in independent surveys is important for comparability. The most accurate method for estimating densities is through distance sampling from line transects, however this may not be appropriate for all situations (Rylands *et al.,* 2008). Data on abundance and distribution through determining presence/absence, provides valuable

information on primates restricted to forest islands, population statuses, carrying capacities, and novel findings in unknown areas (Chiarello & de Melo, 2001).

Here, I present preliminary results on the presence and distribution of blue monkeys (*Cercopithecus mitis*, Fig. 1), in a previously unstudied area. Research on *C. mitis* throughout Africa is not lacking, however the data this study provides on *C. mitis* is novel in Malawi, as it is the first survey of diurnal primate abundance in Nyika National Park (NNP). The most appropriate method for surveying primates should be decided on a case-by-case basis, and herein lay the greatest challenge of this study.

Figure 1. Blue monkey (*C. mitis*) seen in forest patch of Nyika National Park, Malawi.

NNP encompasses the Nyika Plateau, a large mountain island rising from 580 to 2607m above sea level, on the border of Zambia, in the North of Malawi (Chitaukali *et al*., 2001). The study site was comprised of a 2,500ha matrix of rolling grassland, interspersed with small isolated Afromontane forest patches (6 – 100ha, Fig. 2).

Straight line transects provide the opportunity for distance sampling, a method which yields the most information when counting primates (Buckland *et al.,* 1993). This method is favoured in continuous forest, where either transects are already established, or there is enough time to do so. Additionally, distance sampling requires a minimum of 40 – 50 sightings in order to analyse the data using DISTANCE software (Thomas *et al.,* 2010); these values were not obtainable during this study. Undergrowth in NNP forest patches was dense, and the patches have been naturally fragmented by grassland for at least 11,500 years according to pollen cores (Meadows & Linder, 1993). Consequently, cutting transects following line transect methods would have been inefficient, and decreased and degraded these forest patches (Keane *et al.,* 2012). There is a relatively prominent poacher presence in NNP (NNP scouts, Pers. Comm.), confirmed during this study, and creating transects could have exacerbated the accessibility of forest patches to poachers, possibly endangering *C. mitis* and other species (Walsh & White, 1999).

Determining occupancy of forest patches using presence/absence surveys was therefore most suited to this site due to practical limitations. By surveying nearly all patches greater than 6ha only twice, we adopted a maximum-area method rather than maximum effort in a small area, enabling us to gain a clearer understanding of *C. mitis*

distribution. I used reconnaissance surveys, moving through the forest in a predetermined direction, following a path of least resistance along natural structures (e.g. rivers and game trails, Walsh & White, 1999). Though this method removes an element of scientific accuracy and repeatability, it overcomes the inefficiency of cutting line transects. We walked quietly and slowly (1-2km per hour) through forests to detect *C. mitis* presence, stopping every 50m to listen (Salmona *et al.,* 2014). When *C. mitis* were encountered, GPS location, and information regarding observed and estimated individuals was recorded. To assess the influence of patch characteristics on *C. mitis,* parameters of their spatial geometry, internal vegetation structure, and signs of poaching were measured.

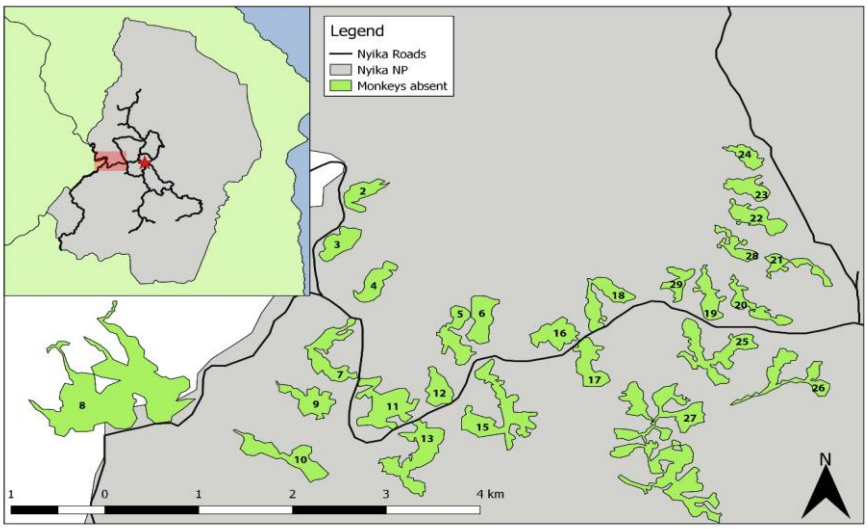

Figure 2. Study site of forest patches surveyed in Nyika National Park (top left),

In just 22 days, from May to July 2017, we were able to cover over 100km of recce surveys in 27 forest patches. Groups of *C. mitis* were encountered on ten occasions during this time. Lone males, male bachelor groups, and single male, multi-female groups were observed. The male group observed was composed of three individuals, and the mixed groups ranged from 10 to 20 ($\bar{x}$ = 12.83 ± 1.50, N=6) individuals seen. Assessing the composition of age-sex class within groups was problematic as it was not possible to see and classify all individuals. In the largest patch (100ha), three groups were encountered: two during the first survey and one during the second. We can be confident in this record because the first two were engaged in intergroup aggression when detected, and subsequently travelled in opposing directions. The third group was the bachelor male group therefore distinguishable from the previous two. We believe the rest of the groups are distinct from each other due to the distance between occupied patches and independence

of sightings. Analysis of habitat parameters revealed that neither patch geometry nor internal vegetation composition greatly influenced the presence of *C. mitis* in a patch.

Primate surveys provide a method of obtaining abundance and distribution data. This study was a case where density estimations from line transects were not possible, and presence/absence surveys offered a suitable and feasible alternative (Keane *et al.,* 2012). We found that *C. mitis* were present in the Afromontane forest patches surveyed in NNP. Very little contemporary research has been conducted on primates in Malawi, and this was the first survey offering novel information on *C. mitis* distribution here. Not only does this provide NNP with basic distribution data for conserving this population, it also creates a starting point for future research to build and expand upon.

A vital part of any research is the recognition of the limitations of the method, and thus the reliability of results. Recce surveys should be used with caution and only applied to a situation such as this where straight line transects were not appropriate. The potential for error in this method lies in the importance of repeats (Walsh & White, 1999). I was unable to use sophisticated statistical tools (PRESENCE software) to analyse the occupancy of *C. mitis* in these patches due to the small number of repeats (MacKenzie, 2005). However, recce surveys are simple to teach, and once records of the tracks taken through the forests are shared with NNP scouts, the aim is for these surveys to be repeated in the future. The amount of ground covered in such a short survey time period truly demonstrated the efficiency of this method for evaluating primate presence.

To improve the scope of presence/absence surveys, it is important they are combined with additional factors such as patch shape, vegetation composition, and the presence of human interference. Though in this study these parameters were not found to influence primate presence, other research finds patch shape and irregularity affect internal forest structure and thus available resources (Hill & Curran, 2003). The validity of results in each study relies on determining the most appropriate method, and must be thoroughly considered before initiating research. Preliminary studies such as this should not be overlooked in conservation, as they provide a platform for developing robust methods, and the potential for long-term research to continue in the future.

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Flexible activity patterns in a primarily diurnal primate; (*Ateles geoffroyi*), in an anthropogenic habitat

Nicki Guisneuf
Cohort 2018-2019
nickiguisneuf@gmail.com

Due to habitat loss and fragmentation caused by human population growth, over 60% of nonhuman primates worldwide are threatened with extinction (Estrada *et al.*, 2017). This has increased proximity with humans, and primates' ability to adapt to this increasingly anthropogenic habitat is crucial to their survival (Wong & Candolin, 2015). Primates have been shown to respond by adjusting their diet, grouping patterns, social organisation and activity (McLennan *et al*., 2017).

Binary categories of being either diurnal or nocturnal tend to be given to animals, although more recently some are also classed at cathemeral or crepuscular (Nichols & Alexander, 2018). Even so, these fixed categories underestimate the flexibility in activity patterns and the ability to shift and be active at times outside of the assumed activity periods. The aim of this study was to investigate nocturnal activity in Endangered Geoffroyi's spider monkeys (*Ateles geoffroyi*). I collected data from 16 May to 16 July 2019 in Los Arboles Tulum, Yucatan Peninsula, Mexico. The main objective was to determine whether the spider monkeys were active at night and to identify which parts of the night they were most active.

Los Arboles, Tulum is a 400ha area, 14km from the city of Tulum. This area of forest is converted into separate lots on which houses

are being built. There are strict development rules and building can only cover up to 5% of each lot. Currently, 32 houses have been built and 98% of the area remains forested. Each day, the monkeys travel outside of the limits of the study area at some point, but always return to sleep. I conducted observations from the roof of one of the residential houses, which is next to one of the most frequently used spider monkey sleep sites. The spider monkeys are habituated to humans, both observers and residents but choose to sleep close to houses and areas of increased anthropogenic activity.

I conducted half night observations, from sunset to 01:00 or 01:00 to sunrise. I used auditory group sampling (Pruetz, 2018) to record the activity of the monkeys at night, based on the sound of them moving in the trees. If I was able to see the exact activity, this was recorded. These were recorded as durations, with a start and end time. I also recorded the number and type of vocalisations when they occurred. These were recorded as count data. I also recorded any other noises audible in the forest, including anthropogenic noise and sounds from other animals.

I calculated the total duration of activity for each observation night, along with the mean duration and the range. I did this both for the total number of vocalisations and for the total duration of activity. Duration activity totals were the sum of activity related sound, locomotion, social play and grooming. I also calculated the total duration of activity, according to each hour throughout the night to determine the peak times of activity.

I collected a total of 30 half night observations, each between five hours and nine minutes and five hours and 41 minutes in length. Results show that the monkeys were consistently active during the night, with low levels of activity during every hour of the night, across all observations (Table 1). The average duration of activity for each observation was 19 minutes and 12 seconds. The shortest duration was 21 seconds and the longest was one hour, three minutes and 20 seconds.

Figure 1 shows the total activity for each hour of the night and Figure 2 shows the total number of vocalisations, also according to time of night. It is clear that the majority of activity took place in the earliest part of the night, in the hours proceeding sunset as there are high peaks for both activity and vocalisations. Activity for the rest of the night was consistent but low, with a smaller peak just before sunrise.

The present study provides novel evidence that spider monkeys are consistently active during the night, rather than being fixed to diurnal activity, as is often assumed in diurnal species.

Table 1: Totals and averages of duration of overall activity and total number of vocalisations, for each observation night of the spider monkeys in the Yucatan peninsula, Mexico, between 16 May and 16 July 2019.

	n	Total	Mean	St Dev	Range
Overall activity (time)	30	5:13:53	00:19:12	883.31	3779
Number of vocalisations	30	1350	45	43.52	171

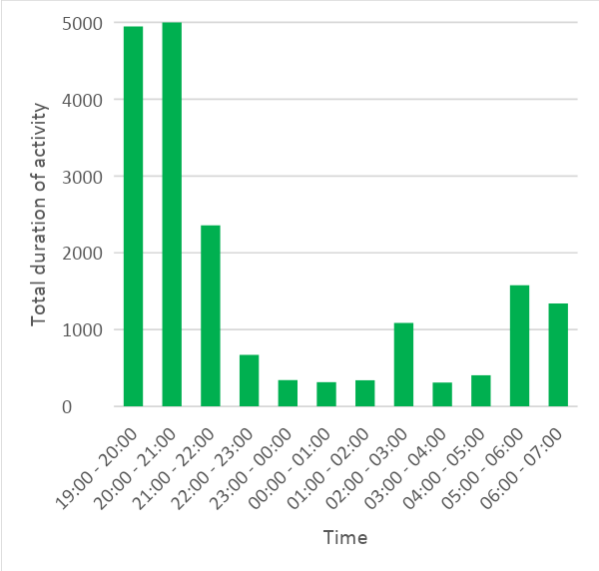

Figure 1: Graph showing the total duration of activity across all 30 nocturnal observations of the spider monkeys, according to time of night.

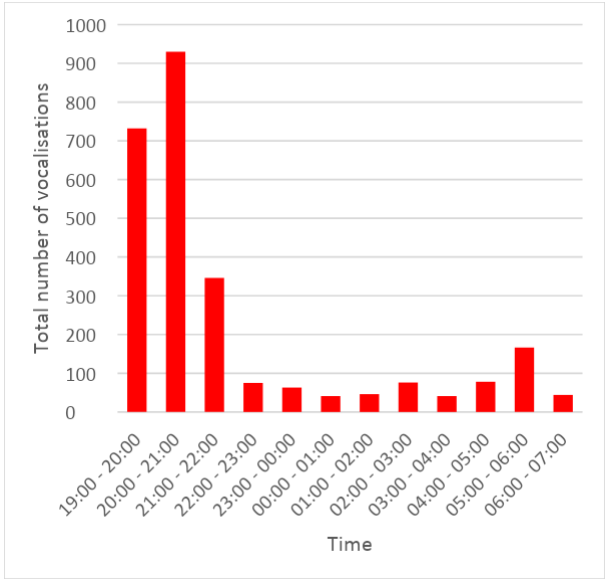

Figure 2: Graph showing the total number of vocalisations across all 30 nocturnal observations of the spider monkeys, according to time of night.

Due to the methods, records of activity are likely to be an underestimate as activity with no associated noise would not have been recorded. Although I would argue that spider monkeys should still be considered primarily diurnal because nocturnal activity was low, in accordance with previous research (Muñoz-Delgado *et al.,* 2018), activity patterns have a degree of flexibility. The spider monkeys were more active during periods of twilight than the rest of the night, with peaks in activity during these times.

Studies of other primates including, rhesus macaques (*Macaca mulatta*), snub-nosed monkeys (*Rhinopithecus brelichi*) and chimpanzees (*Pan troglodytes*) found similar patterns, with the onset and end of activity being highly correlated with sunrise and sunset (Vessey, 1973; Tan *et al.,* 2013; Pruetz, 2018). A peak in activity after nightfall was also observed in chimpanzees (Pruetz, 2018). A study of captive chimpanzees concluded that waking during the night and moving around their enclosures is common (Videan,

2006). Other primates also commonly increase their calling rates at dusk (Zamma, 2018). For example, barbary macaques (*Macaca sylvanus*) vocalise more as they prepare for sleep, sometimes as late as 23:00 (Hammerschmidt, et al*.,* 1994). A small dawn peak was observed in this study, consistent with other primates such as orangutans (*Pongo abelii*; Ross & Geissmann, 2009) and Guatemalan black howler monkeys (*Alouatta pigra*; van Belle*, et al.,* 2013). In conclusion, activity patterns in diurnal primates are not as fixed as often assumed and this study provides evidence that spider monkeys frequently engage in activity and vocalisations during the night.

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Lemurs on YouTube: Public perception on lemurs in different contexts (pet, wild and captivity), and implications for conservation

Kirsten Abbott
Cohort 2017-2018
ka_abbott@yahoo.com

Social media websites such as YouTube have increased in popularity (Nekaris *et al.,* 2013), and are becoming more recognised as a tool for scientific research (Dylewski *et al*., 2017). Conservation concerns have also been identified from the videos such as views of poor animal welfare associated with the illegal pet trade (Reuter & Schaefer, 2016). Overexploitation of wild populations for the pet trade has contributed to a decrease in species numbers and has become a serious conservation concern (Reuter *et al.,* 2016). Audience information such as opinions are freely accessible on sites such as YouTube in the form of comments, view counts, likes and dislikes attached to a video. Social media sites allow the public, including traders, to share content (videos, images etc) of animals that are for the most part uncensored and has been linked to an increase in trade demand (Nekaris *et al*., 2016).

Endemic to Madagascar, lemurs are the most threatened of mammal groups (LaFleur *et al.,* 2016), consisting of five families which are listed on the highest classification of CITES (Convention on the International Trade in Endangered Species); Appendix I (CITES, 2017). An estimated 28,000 lemurs were sold into the pet trade between 2010 and 2013 (LaFleur *et al.,* 2016). My aim was to research indicators of public perceptions (comments, total views, likes and dislikes) from YouTube videos that involve lemurs in a pet, domestic captive and wild context.

On YouTube, my search terms were; 'lemur pet', 'lemur zoo' and 'lemur wild'. I chose the word 'zoo' rather than 'captivity' because of a higher number of search hits. The results page was sorted by high-to-low view count for the probability there would be more comments to analyse. The highest viewed video that was uploaded between 2012-2017 and suited the category used. I uploaded the comments to Nvivo 11 using the Ncapture extension, and manually grouped by topic. Comments in a non-English language were not included, nor subjects unrelated to the video topic. If there was more than one viewpoint in a comment, I counted them as separate views. I did not include replies to the comments as it was the same users who were arguing the same viewpoints. Assumptions were made analysing the data. For example, users saying 'I like lemurs' under the pet video were assumed to be for the pet trade but people saying this in the 'for the wild' video were assumed to be against. All data were correct on 12th October 2017.

The total number of searches for 'lemur pet' was 372,000, for 'lemur wild' it was 96,800

and for ‘lemur zoo’ 114,000. The total number of views, likes and dislikes for each video type can be seen in Fig. 1. The pet video had a higher percentage (proportional to the total video views) of likes and dislikes than the zoo or wild context. The zoo video had fewer dislikes than the other two.

The wild setting video had more total views than either of the pet or zoo setting videos. Seventy-five comments were established in the pet lemur videos.

A total of 49/75 (65%) were in favour of lemurs as pets and 26/75 (35%) were against it. The categories for and against having lemurs as pets can be seen in Table 1. For the wild lemur video 39 views were established into five categories (Table 2), although there were no comments wanting to own a lemur or involving the pet trade. There were only two comments relevant to this study for the zoo video, one criticising the zoo for only having one individual of one species (*Varecia variegata*) and a customer asking if they can touch the lemurs in the new exhibit.

Concerning conservation, the search term ‘lemur pet’ resulted in the most video results suggesting there are more search tags for a pet than zoo or wild. All three of the videos likes and dislikes were very low, below 0.4%, when compared as percentages of the total views. To participate in interacting with YouTube functions requires an account to sign in. This simple step may deter the user from interacting and combined with the low numbers in relation to total views, it may not be the best indicator of public perceptions of a topic. To view a video, however, a person does not have to login.

The pet video had the highest percentage of likes but also the highest percentage of dislikes (out of the three videos) showing the extent of controversy of owning a pet lemur. The most common view across all the comments were wanting to own a lemur themselves. The second was expressing that the lemur was cute. These were also found commonly (top three) in social media comments for slow loris pet videos (Nekaris *et al.,* 2013). The pet setting video was the only video where users asked how to attain one for themselves. This could further contribute to the pet trade. Eight comments also mentioned knowing someone who [owned a lemur] or owning a lemur themselves which shows that this may be a more common issue and that pet owners watch other owners videos.

There were more overall views for the documentary than the zoo or pet video, but this may be because it is a longer video or people have prior knowledge of the franchise. The second highest number of comments were related to fictional characters based on lemur species, commonly known as ‘King Julian’ or ‘Zamboomafoo’.

A portrayal of a species in the media affects how people perceive wildlife. For example, there was a rise in trade of owls in Indonesia

linked to their portrayal in the 'Harry Potter' films (Nijman & Nekaris, 2017). There were no comments regarding the pet trade in the wild or zoo-based lemur videos evidencing the influence personal pet videos have on the public. Future studies should avoid documentaries and focus on comparing videos uploaded by the public to minimise bias. However, this is difficult to manage as some users may already have a higher following affecting the number of comments, likes or dislikes [their video] may receive [rather than being] based on lemur perceptions. The popularity of this documentary could be linked to the increase of adults watching educational videos on the internet from 22% in 2007 to 38% in 2010 (Waters & Jones, 2011). The zoo setting video had the least amount of total views and comments (both total and proportionate to view count), suggesting more effort should be allocated to social media marketing and uploading educational videos, as other non-profit organisations have been shown to do successfully (Waters & Jones, 2011).

YouTube could act as a facilitator of communication between the scientific community and the public (Nelson & Fijn, 2013) since it has more than a billion users globally (Dylewski *et al.,* 2017) and is an interactive medium where the uploader can engage with the audience (Waters & Jones, 2011). For example, none of the comments in any of the three background contexts mentioned scientific nomenclature, even common names were sparsely used, and people just referred to the animals as 'lemurs'. More communication strategies should involve educating people about the different species and connecting the public community with the scientific community. Further studies on a larger sample of videos of each type and identifying the location of video settings would be beneficial. Initiatives are needed with social media organisations to make a stand against illegal lemur pet videos to assist the conservation of the species.

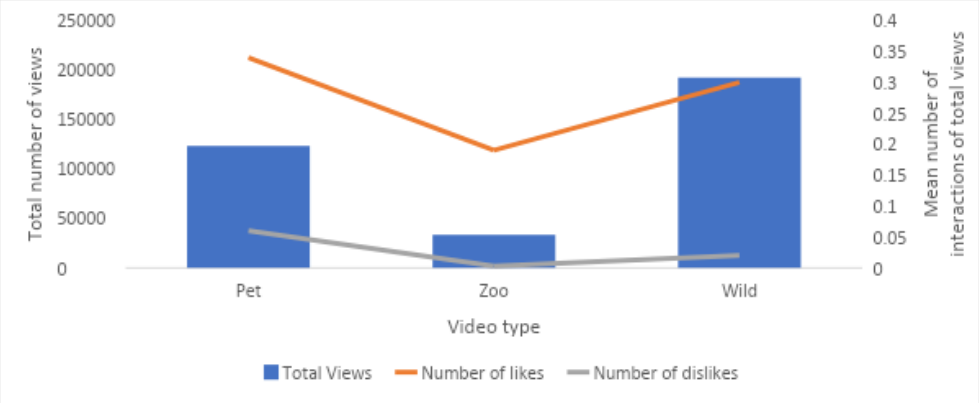

Figure 1: Total number of views and likes and dislikes (mean of the videos total views) from three YouTube videos of lemurs in a pet, zoo and wild context.

Table 1: YouTube video comments from a domestic pet lemur video, categorised into views and reasonings for and against keeping lemurs as pets, number of comments (for or against) and combined percentage for and against.

Comment categories	Number of comments	% of total comments
For		
Expressing wish to own one	11	15
Lemurs look cute	9	12
Lemurs are safer in private ownership than in the wild	4	5
Knowledge of own/another lemur owned as a pet	8	11
Practicalities about how to attain one	7	9
Husbandry about keeping a pet lemur	8	11
Other (statements with no reasoning behind viewpoint)	2	3
Against		
Lemurs belong in the wild	4	5
It is illegal to own a lemur as a pet	3	4
It is immoral to own a lemur as a pet	7	9
Lemurs are endangered	6	8
Lemurs suffer as pets	1	1
Other (statements with no reasoning behind viewpoint)	5	7

Table 2. YouTube video comments put into categories based on lemurs in the wild.

Comment Categories	Number of comments	% of total comments
Liking lemurs	18	46
Other animal species than lemurs	5	13
Expressed gaining knowledge from the video	2	5
Mentioning Malagasy language	1	2
Referencing fictional characters	12	32

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Featured primates in articles written for Canopy 2012-2020

Today around 65% of living primate species distributed in 91 countries across the Neotropics, mainland Africa, Madagascar, South Asia and Southeast Asia are threatened with extinction. A total of 75% have declining populations as a result of deforestation and habitat loss (Estrada, 2020). Whilst reviewing past issues of Canopy, it struck us that it would be interesting to look at the primates that had been featured in articles submitted to Canopy over the past 8 years. We wanted to highlight the 'popular' primates as study subjects and those less studied. By their omission, we also invite future students to 'fill the gaps' by looking at not yet studied primates in the hope that their research will contribute to much needed conservation effort to save endangered species. We assessed 38 articles and listed the genus, species and frequency of occurrence. If there was an article relating to a generic group such as 'Lemurs' this was also noted. The results were interesting and hopefully provide opportunities for MSc students to study primates that have not yet been featured.

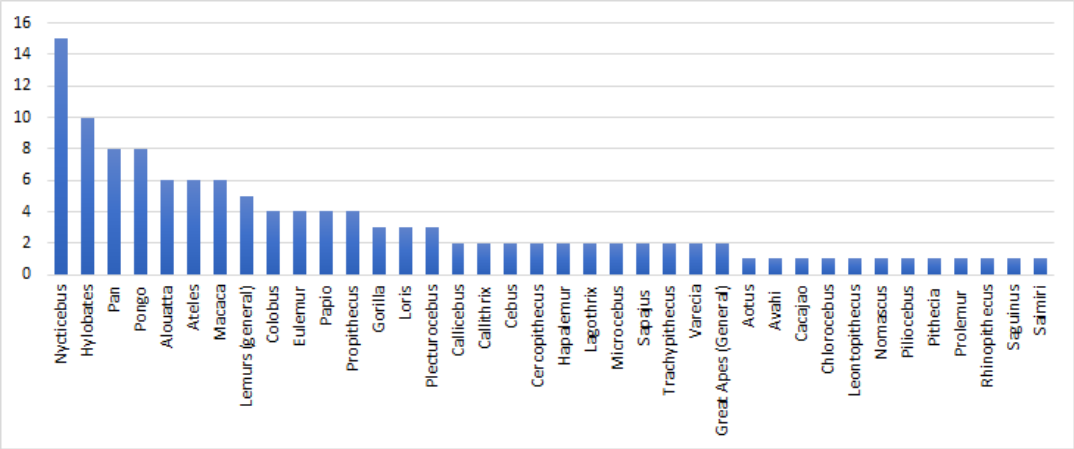

Figure 1. Frequency of primate genus featured in Canopy articles between 2012-2020

Perhaps, unsurprisingly, the most studied primates are those where the MSc Primate Conservation course team has provided active research opportunities over the years: *Nycticebus, Hylobates*, *Pongo, Eulemur, Propethicus, Hapalemur, Microcebus*. But *Pan troglodytes* (chimpanzee) and *Pan paniscus* (bonobo), *Alouatta* ssp. (howler monkey), *Ateles* ssp. (spider monkey) and *Macaca* ssp. (macaques) have also been popular study subjects. Just over 33% of featured primates included lesser known species, particularly from the Neotropics, such as *Aotus jorge hernandez* (Hernandez-camacho night monkey), *Cacajao ayresi* (Ayres black uacari), *Pithecia chrysocephala* (golden-faced sakis) or *Rhinopithecus avunculus* (Tonkin snub-nosed monkey) from northern Vietnam.

Of the primates studied, 65% of the species mentioned are threatened with extinction (IUCN, 2020). The rest are currently listed as of Least Concern and one is Data Deficient (*Aotus jorge hernandez*).

Recent research into conservation impact has shown that entire primate families are omitted from evidence-based research: Tarsiidae and Aotidae for example. It was also found that a large proportion of published research focused on large-bodied primates and Old World monkeys, particularly the great apes (Junker *et al.,* 2020). The conclusion was that evidence-based information is lacking to effectively protect and manage many vulnerable primate species.

There are 76 genera of primates (Cotton *et al.*, 2016) with 36 covered in Canopy articles over the last eight years. A total of 79 different species have been covered and given that there are 398 primate species in total (Junker *et al.,* 2020) there is still plenty of scope for an Oxford Brookes MSc student to do research on a previously unstudied species.

S Lawrance

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Increased human-wildlife interactions intensify disease transmission between humans and non-human primates

Lex Kernan
Cohort: 2019-2020
lexlexakernan@gmail.com

Primate conservation combines multiple disciplines to address the rapid decline of primate biodiversity and habitat, while upholding human well-being and sustainability for future generations (Estrada *et al.,* 2017). Challenges primates face include but are not limited to: habitat loss through deforestation, hunting, culling, crop foraging, the pet trade, and disease. Projected in 2017, 60% of all primates were threatened with extinction while 75% overall were experiencing population decline (Reid, 2020). Diseases are a major contributor to both non-human primate and human health, especially with the recent outbreaks of Ebola Virus Disease (Leendertz *et al*., 2017), the Zika virus (Baud *et al.,* 2017), long-standing cases of malaria (Ameri, 2010), and the 2019 novel Coronavirus pandemic (Gillespie & Leendertz, 2020). While many human vaccines have been created, disease transmission remains a constant fight (Calvignac-Spencer *et al.,* 2012). Disease transmission is a cause for concern because of the increased contact between humans and non-human primates in recent decades via sanctuaries and rehabilitation centres, population growth, and tourism (Narat *et al.,* 2017; Nunn & Gillespie, 2016).

Due to governmental bureaucracy, advanced mutating diseases, and limited knowledge, disease can spread through developing countries with a devastating number of casualties (Narat *et al.,* 2017). While treatments may work in small quantities and education can help preventively, in more recent decades the severity of the situation has increased (Hughes, 2019). As our closest genetic relatives, apes are susceptible to both non-human and human related diseases, impacting conservation, primate

health, and the livelihoods of human populations (Pedersen & Davies, 2009).

Ecotourism is a way to provide an alternative livelihood for human populations while protecting primates (Riley, 2015). Marginalized groups are economically, socially, politically, and psychologically impacted positively by the opportunities ecotourism offers (Mwesigwa & Mubangizi, 2016). In turn, local peoples are motivated to value, protect, and conserve the environment. Therefore, providing the awareness and education needed to implement biodiversity conservation strategies for non-human primates.

While many factors relate to primate health and global extinction, disease is linked to biodiversity (Nunn *et al.,* 2016). Through four concepts described by Nunn and Gillespie (2016), the diversity of primates contributes to the diseases circulating in the population and vise-versa. These circumstances have a dramatic effect on global public health. Escalations of disease in primate countries cause detrimental impacts on human well-being and environmental stability (Calvignac-Spencer *et al.,* 2012).

A disease results in an agent causing negative effects to the structure or function of an organism (Foster & Slonczewski, 2017). Limiting death requires both the scientific knowledge of the disease (i.e. characteristics, replication, environment, transmission) and the understanding of risk to the susceptible population (i.e. reservoir of disease, route of transmission, consequences of exposure, susceptibility, and likelihood of spread). Disease transmission whether zoonotic (from animal to human) or anthropozoonotic (from human to animal) can entail viruses, parasites, and bacteria (Walsh et al., 2007).

The health risks associated with ecotourism pose an immediate threat to park personnel, tourists, and wildlife (Calvignac-Spencer *et al.,* 2012; Hanes *et al.,* 2018). Ebola Virus caused a 95% population decline in mountain gorillas and dramatically reduced human populations (Lappan *et al.,* 2020). Diseases within primate countries including Rift Valley Fever, malaria, MERS, SARS, HIV, Marburg, and COVID-19 cause devastating effects on future generation viability (Gillespie & Leendertz, 2020). Coxsackie B3 virus have shown probable transmission between humans and chimpanzees causing respiratory illness (Nielsen *et al.,* 2012). Thereby, interactions between humans while handling or living in close proximity to non-human primates could result in a transfer of a number of diseases.

Identifying the threats of disease transmission and contributing recommendations for the future of ecotourism, One Health Initiatives, and global health; research must continue in order to advance management strategies and policies to limit disease transmission between humans and non-human primates. It is imperative not only to identify the diseases, but also the methodology by which to study

the implications of the disease, the mechanisms to monitor it, and the focus for future research of the disease (Devaux *et al.,* 2019). Any contact between humans and wildlife can create an opportunity for transmission. To better conservation, health and healthcare needs to be available to all humans and disease research must span across species. Due to the multiple levels within governments, mutating diseases, and limited knowledge of infectious disease, there will remain a constant battle to prevent, understand, and contain outbreaks as the world continues to globalize. For the sake of primate well-being, the progression of studies in infectious disease, and the proper attention to altering public perceptions, it will be necessary to collaborate across disciplines and reach out to the general public. In order to properly and actively protect and conserve primates in the wild and in captive populations and to thereby reduce extinction rates, a multifaceted approach must be achieved.

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Social Network Analysis; a tool for Primate Conservation

Becky Easter
Cohort 2019-2020
beckyeaster1@googlemail.com

Social Network Analysis (SNA) has revolutionised the understanding of social behaviour and sociality. The powerful combination of common mathematical language and diagrammatic mapping enables researchers to describe and quantify patterns of social relationships. The additional ability to explore the implications of sociality and social structure from multiple perspectives makes the technique invaluable and relevant. Evolving from simple description of social structure, SNA has become a leading tool to assess and evaluate strength, stability, and significance of social behaviour. Application of the network approach to animal behaviour and behavioural ecology is not new; however, in recent times the network approach has become increasingly popular (Makagon *et al.,* 2012). Spanning taxonomic orders and genera, SNA demonstrates a unique flexibility for analysis of social animal behaviour. Despite widespread use and application, non-human primates dominate social animal network research. Consequently, much of what is already known about social relationships - the dynamics, and benefits of sociality – is as a result of studies on primates (Sick *et al.,* 2014). Primates are ideal subjects for SNA (McCowan *et al.,* 2016). First and foremost, a propensity for social behaviour and group living make primates, as an order, attractive to social scientists. Facilitated by large, evolved brains, primates possess sophisticated cognitive skills which enable them to form, and track, differentiated social relationships and maintain groups (Silk, 2007). Moreover, primates have also been shown to modify these relationships in response to both social and environmental pressures. Outside of purely social factors, primates are additionally appealing due to well-defined social systems, variability between species and completely observable life histories (McCowan *et al.,* 2016). At present two of the largest threats to species of conservation concern, including 60% of primates, are climate change and human activity (Estrada *et al.,* 2017). While these threats are both established and acknowledged, the detrimental effects are often not recognised or anticipated in a population until the damage is already significant, and yet it is at this point conservation efforts generally begin. SNA may be a novel solution for primate conservation; though an established tool, there has been little conservation-specific focus for its application. Here the existing applications of SNA are discussed, with view to evaluate implications for conservation efforts.

SNA as a framework is characterised by the creation and construction of visual maps of

connection (sociograms) (Scott & Stokman, 2015) and the catalogue of established terms used to describe and quantify them (network metrics, Kurvers *et al.,* 2014). Separately, the two elements are valuable as standalone diagnostic tools. For example, early use of simple sociograms revealed the unique social structuring of Hamadryas baboons, diagrammatic visualisation of social data indicated the pattern whereby males were central to groups of females. Similarly, network metrics are able to reveal patterns otherwise obscured in simple matrix form. Network metrics are used to identify an individuals' role in a social network through quantifying its relative influence and position. Thus, some individuals are more important than others (Lusseau and Newman, 2004). SNA is bifocal; the analysis can be either individual- or network-level (Bandyopadhyay *et al*., 2011). Traditionally the network approach has focused on the individual, i.e. the positioning and influence of any given individual in the network and is a result of historical focus on the dyadic relationship (Sueur *et al.,* 2011). The implications and consequences of social network position are known; for example, an individuals' social position has implications for susceptibility to disease as well as access to resources and information (Blaszczyk, 2018). Central individuals are more susceptible to disease as their position in the network facilitates greater exposure to pathogens whilst more peripheral or less connected individuals, while still at risk, experience a reduced risk. Likewise, central individuals are likely better informed than peripheral individuals (Romano *et al.,* 2020). More recently, there has been a greater focus on the dynamic nature of social networks and thus implications or resilience of position through time; whereby dynamicity is the result of relationship change or modification in response to internal or external factors (Davis *et al.,* 2018). From the individual perspective, positions are shown to be both consistent and heritable (Blaszczyk, 2018). Identifying and understanding an individuals' role and influence has management, and therefore conservation, implications. Conservation protocols involving targeted removal, strategic vaccination and intentional relocation are dependent on identifying key individuals; individuals which may not be immediately obvious without analysis of social behaviour. Particularly, in light of the recent novel coronavirus pandemic, targeted vaccinations may prove vital in the preservation of high risk or vulnerable species (Rushmore *et al.,* 2014). Targeting central individuals or 'social' brokers (individuals which connect groups) may reduce or halt disease transmission across the network, thus preventing spread.

In comparison, network-level analysis is rare, albeit a growing trend. The network structure of a group has implications beyond the individual, i.e. the development and or

persistence of culture (Cantor & Whitehead, 2013), behaviour, and cooperation (Brent, 2015). Moreover, the network structure has substantial implications for social group stability and vulnerability. How a network responds to external pressures is indicative of social resilience (Snijders *et al*., 2017). SNA has the potential to predict instability, though this is dependent on extensive social monitoring and data collection. In this instance, previous fragmentation or fission events are likely to be important (Larson *et al.,* 2018). The ability to analyse the network prior to and post fragmentation would likely provide information needed to predict future events or learn indicators of similar events. Conservation of vulnerable primates is likely to benefit from the analysis of species of lesser conservation concern, especially those within similar areas, facing similar threats. Whilst this has not yet been analysed, there is definite scope and need for future research.

An area in which SNA is likely to benefit is the strategic relocation animals for conservation (Letty *et al*., 2007, hereafter translocation). As yet, translocations do not yield a success rate consistent enough to encourage consistent use. An established, but expensive tool strategic translocations offer opportunities to restock and reintroduce individuals/groups of vulnerable species in their extant range. Network analysis may offer insight into reasons for translocation failure or even, translocation success. Prior to, during, and after relocation, network analysis could provide indicators of network health and social group stability. Translocations of individuals would benefit from a baseline knowledge of the resident or focal group/population, encompassing the assessment of integration success as well as the impact of an incoming individual. The translocation of entire social groups is often necessary, in areas that cannot support them or in rehabilitation for release situations. Social networks are known to change with new environment (Dufour *et al.,* 2011), the impacts of which though are likely to be group, population specific. SNA, again prior to and post- translocation, are could give better insight into the adaptive value of sociality in this case. SNA is not without its challenges, or indeed panacea for primate conservation. SNA offers the opportunity to enhance existing protocols and inform new ones using knowledge of social structure and social responsiveness to change. Network analysis is costly; time consuming and data hungry SNA is not a quick fix. Large amounts of time are needed both to collect sufficient amount of data to ensure inferences are robust and representative. Oftentimes it is not feasible to conduct long term studies; labour and cost intensive, and frequently difficult. Thus, it could be suggested that similar studies of captive populations may be an advantage, especially for endangered species. Research to this effect should be carried out with

caution, and under the assumption captive populations will react differently owing to the captive environment. As a pilot or initial investigation, there may be some useful insights which could better inform wild management. Similarly, there is opportunity for wild populations to inform the management of captive populations.

To conclude, SNA has a place in primate conservation. An established yet underused tool, SNA has potential to inform conservation planning and management if challenges are considered at onset. Beginning SNA earlier, social data collection and then analysis, is advantageous and recommended for vulnerable species. Avenues of future research involve captive populations as proxies for vulnerable wild populations, and success of SNA inference on conservation planning.

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Using Instagram hashtags to determine areas of high human-primate interaction

Holly Torres
Cohort 2017-2018
holly.torres02@gmail.com

Ecotourism, or tourism to natural areas containing wildlife for the benefit of economy and conservation (Sutherland, 2000), is a growing industry (MacMillan & McInnes, 2004). Wildlife is typically the focal point behind ecotourism as people seek exotic experiences with animals whilst benefiting conservation (MaCcoll & Tribe, 2017).

It is important to look into the practices of ecotourism sites to ensure the conservation message is still being represented, since the consequences of humans interacting with wildlife can be dangerous to species and individuals (Sutherland, 2009; Pleguezuelos *et al.,* 2016; Muehlenbein, 2017). Ecotourism can lead to the spread of deadly pathogens between humans and wildlife (especially primates) (Muehlenbein, 2017), destroy habitats (Sutherland, 2009), promote unnatural behaviours of wildlife as a result of human dependence (Kinnaird & O'Brien, 1996), and lead to habitat loss (Isaacs, 2000). Ecotourism experiences can be documented in pictures and made public when posted to personal social media profiles such as Instagram (Lu *et al.,* 2016). Tourists have been found to utilise social media as a research tool for planning activities (Terttunen, 2017).

In this study I aimed to uncover the areas of the world where ecotourism efforts need to be improved to follow the expectations of conservation. Since primates occur in popular ecotourism sites I chose to focus on these species. The present study utilised Instagram as a tool to identify ecotourism locations and to determine if different search terms predicted if a post contained evidence of a human-primate interaction.

I explored the hashtags, a '#' symbol followed by a keyword or phrase that creates a link to a feed of content other users have posted (Tsur & Rappoport, 2012), #monkeys and #primates by searching in Instagram. In this study I analysed 200 posts (including pictures and videos); 100 posts for each hashtag. I recorded: presence of at least one human; location (Tang *et al.,* 2015); and species for each post. I recorded a post as having a human present if a human was anywhere in the image, a human voice was heard (for videos), and if the primate was manipulating a human's personal item. I chose posts only in the 'Most Recent' section of each Instagram search page, recording information on every chronological post that contained a living primate. All posts I observed had some indication of a location such as a direct location tag or hashtag.

I gathered data over a period of two weeks recording information on ≤30 posts for each

hashtag in one sitting. I recorded during random days of the week and times of the day to prevent any posting bias. I used R Version 3.1.3 (R Core Team, 2015) to run χ^2 tests of independence to analyse the data.

I found that when searching Instagram using '#monkeys' there was a significantly greater proportion of posts that would contain humans in the vicinity of primates than searches that used #primates (χ^2=8.1254, df=1, p<0.001, Fig. 1). The location (continent) did not significantly determine whether the posts would have humans in them (χ^2=8.7613, df=5, p=0.119), but the results were still noteworthy. In Asia the ratio of posts that were without humans to those with humans was about 2:1 compared to the ratio of approximately 6:1 in North America indicating a larger proportion of people posting in Asia interacting with primates.

The location, however, did significantly affect the proportion of posts per hashtag (χ^2=72.7874, df=5, p<0.001, Fig. 2). In Asia the proportion of #monkeys to #primates posts was approximately 4:1 while in Africa (1:7) and North America (1:6) the pattern was reversed.

These findings indicated a clear difference in how primates are being advertised between these areas of the world.

Since tourists build their travel expectations through social media (Terttunen, 2017) it is important to change the expectation of interacting with primates so that we can reduce the amount of human-primate interactions generated by ecotourism. To do so it is important to further investigate the origin of these #monkeys posts, specifically where they come from, why this terminology was used, and how it affects the behaviour of future visitors if they actually are more likely to interact with primates after seeing other human's interactions.

Asia and Europe produced the most results of posts using #monkeys, I looked into the distribution of posts across countries. Of the 73 posts Asia generated in this study, Indonesia produced the most with 30.1% and India followed with 23.3%. In Indonesia all but 2 posts using #monkeys were located on the island of Bali. According to TripAdvisor the 4th most popular thing to do in Bali is visit the Sacred Monkey Forest Sanctuary. There, long-tailed macaques (*Macaca fascicularis*) roam around temples and a forest environment while tourist walk around the grounds free to interact with whatever wildlife is around. In Europe, the UK produced the most posts using '#monkeys' with 100% of the posts coming from Gibraltar. According to TripAdvisor the top thing to do when visiting Gibraltar is to visit the Rock of Gibraltar, which is the habitat of hundreds of barbary macaques (*M. sylvanus*). Tourists walk up and down the rock or mountain visiting various other attractions whilst being surrounded by macaques.

Macaques range from Southern Europe to Southeast Asia and tend to be found in areas with high human populations (Fuentes *et al.,* 2007). Visits to these areas gives humans the perfect opportunity to take and post pictures of their primate interactions, making these important locations for new conservation education programs that discourage this behaviour. By establishing conservation programs for tourists in areas such as Bali and Gibraltar about the risks of human influence previously described we can decrease the demand for human-primate interactions and better promote conservation.

This study had a few limitations. Since all of the data were gathered using social media the accuracy of the information that the individual users included in their posts such as location was questionable. Social media, however, has been used in tourism research for information on tourist demographics (Levin *et al*., 2015), flow (Chua *et al*., 2016), and desires (Hausmann *et al.,* 2017) with Instagram being one of the world's most popular mediums (Sheldon & Bryant, 2016). Also, the results of this study were not a sample of all posts by tourists including primates, it only represented those that were made public and included the relevant tags. For the purposes of this study, however, I was interested in posts that were available to the general public via the #monkeys and #primates hashtags and location tags since those posts are available to the public.

Further research is needed between the dynamics of terminology and its implications for primate conservation. Specifically, the significance of the terms 'monkey' and 'primate' to people across the world. According to this study there was a connection between the choice of these two words and the presence of humans. Further research should look into how ecotourism locations label or discuss their primate attractions in order to give more insight of how visitors end up using this terminology. Those findings could then be applied to previously identified conservation target areas and education programs. Simply keeping tourists informed on the effects of their behaviours and potential consequences of posting to social media could aid conservation efforts around the world.

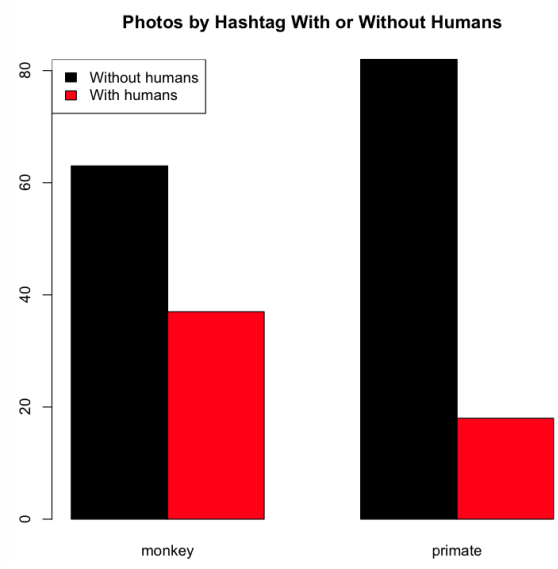

Figure 1. Bar graph of number of total Instagram posts with or without humans for #monkeys and #primates. (χ^2=8.1254, df=1, p<0.014)

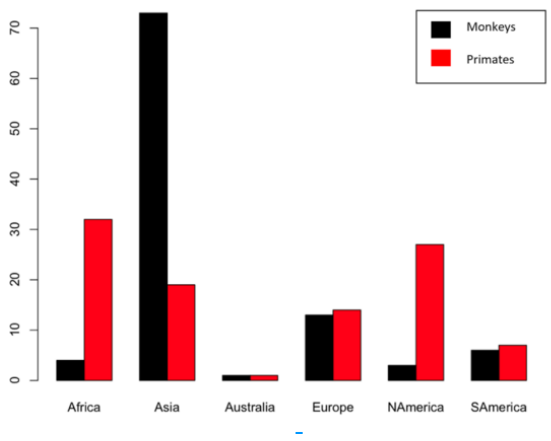

Figure 2. Bar graph of the total number of Instagram posts using #monkeys and #primates across each continent. (χ^2=72.7874, df = 5, p< 0.001).

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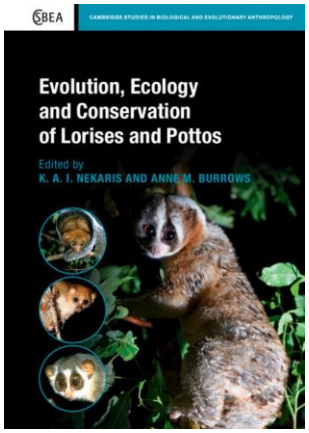
Book Review: Nekaris KAI & Burrows AM (eds.) 2020. Evolution, Ecology and Conservation of Lorises and Pottos. Cambridge University Press, Cambridge.

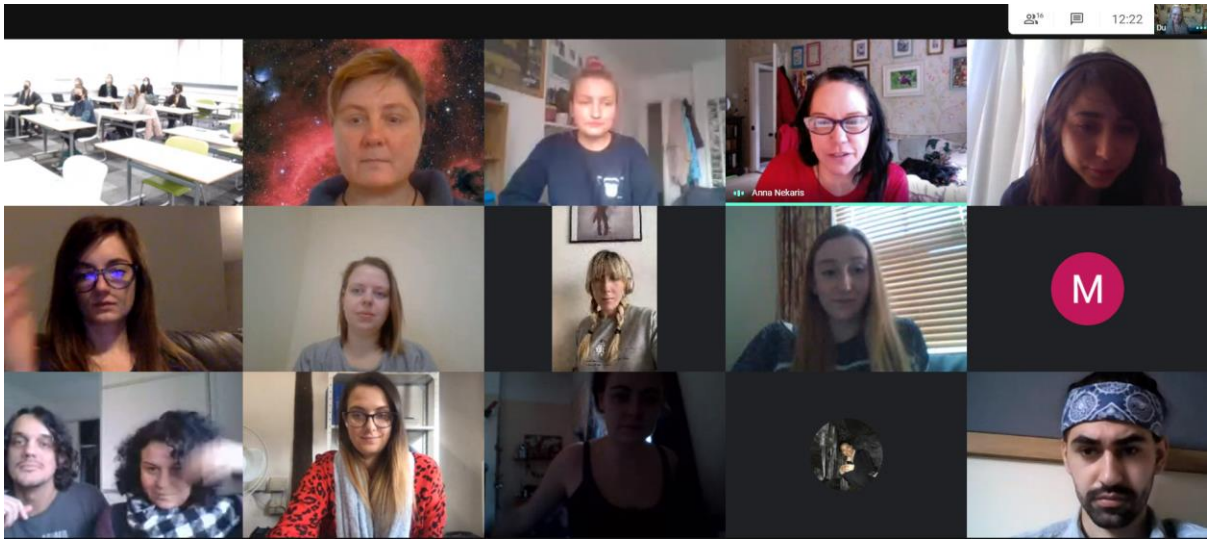


Edited by Professors K.A. I. Nekaris and Anne M. Burrows, this book provides a comprehensive synthesis of our present knowledge of the lorises of Asia (genera *Loris, Nycticebus*) and pottos and angwantibos of Africa (genera *Perodicticus, Arctocebus*). Divided into three sections devoted to the topics of evolution, ecology and conservation, the book includes chapters by researchers in both the lab and the field working to bridge the gaps in our knowledge of this fascinating and chronically-understudied group, including many alumni of the MSc in Primate Conservation and members of the Nocturnal Primate Research Group at Oxford Brookes University. These chapters are thoroughly researched, and take the form of either a metanalytic review or an experimental or observation-based report. As researchers interested in systematics and genetics, the first section was a personal highlight; this covers the history of the group, their taxonomy and status within the fossil record, and even has a chapter discussing the advances in molecular study of loris taxa that have taken place over recent years, an exciting area that still requires much research.

We also found the chapter on social organisation of lorisiformes very illuminating. Historically lorises have been described as solitary, but as we learn more about these animals, research is suggesting that they have complex social organisations which is explored in this chapter. This knowledge provides important considerations for lorises held in captivity, both in zoos and rescue centres.

In addition to physical and evolutionary approaches to the study of the Lorisidae, Parts II and III are focused on their ecology and captive management, and research, trade and conservation respectively, making it an extremely useful practical resource for professionals working in zoos, sanctuaries, rescue centres, fieldwork, and in conservation education and outreach with lorises and pottos. As students undertaking research projects on slow lorises, the chapter on the use of accelerometers was insightful to learn one less invasive method that others have used successfully to record slow lorises. The style of the book is clear and easy to read, and multiple pictures and illustrations are included. As the first book to cover the Lorisidae in such detail, this title is a must read, and a valuable resource for researchers and students interested in working with this fascinating and elusive group of nocturnal primates.

A. R. Watkins & P. Bwye



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