

PSGB Winter Meeting 2022



7th-8th
December
2022

tz
Twycross Zoo
IN THE HEART OF CONSERVATION



Primate Society
of Great Britain

PSGB Winter Meeting

Twycross Zoo – East Midland Zoological Society is proud to host the Primate Society of Great Britain's Winter Meeting on 7th-8th December 2022, the first in-person meeting of the Society since 2019.

As a conservation charity and zoo, our vision is to educate and inspire people to care about and therefore save the other species with which we share our planet. We aim to make a significant contribution to the welfare and conservation of animals, especially primates.

Twycross Zoo is a specialist in primate care and the only place in the UK where visitors can see all four great apes – gorilla, orangutan, chimpanzee and bonobo, alongside a diverse range of primate species.

Primates have been at the heart of Twycross Zoo's most recent developments, including a multi-species gibbon complex in 2016 and the £3.5million 'Chimpanzee Eden' in 2018. Next year, to coincide with the Zoo's 60th Anniversary, we will break ground on the **National Science and Conservation Centre**. This purpose-built centre will support conservationists and scientists around the world with a facility for both research and teaching, and will include the development of a world class orangutan exhibit.


Registered delegates of the Meeting will have free access to the Zoo for the duration of the conference, and are invited to join a guided tour of the primate collection after lunch on 8th December. Please register your interest on the sign-up sheet provided at the reception desk at your earliest opportunity so we can ensure everyone is able to participate.

The presentations will be in the Windows on the Wild conference room in the Himalaya building, while the posters will be exhibited in The View Restaurant next to the conference room.

SCAN ME TO VIEW MAP



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 Department for Levelling Up,
Housing & Communities



NSCC
National Science and
Conservation Centre
at Twycross Zoo

Hinckley & Bosworth
Borough Council

The National Science and Conservation Centre (NSCC) is a 'centre of excellence' for biodiversity conservation at Twycross Zoo, supported by the UK government's Levelling Up Fund and Hinckley and Bosworth Borough Council.

Twycross Zoo – East Midland Zoological Society (EMZS) Ltd., successfully secured nearly £19m grant funding from the government's Levelling Up Fund (LUF) in October 2021.

The LUF and EMZS investments enable the establishment of the NSCC as a mini higher education campus, adjacent to the zoo, housing a 200 seater lecture theatre, 2 biological labs, 3 classrooms and 15 ensuite accommodation rooms.

As a "centre of excellence" for biodiversity conservation the NSCC's strategic aim is to deliver a world class purpose built centre to host researchers, conservationists and scientists alongside delivering education programmes and tourism growth for the region.

The three pillars of the NSCC are education, research and community engagement. We aim to work across these three areas to support biodiversity conservation and deliver the conservationists of the future.

The NSCC team are interested in engaging with and exploring mutually beneficial partnership opportunities with universities, NGOs/INGOs, business and stakeholders to co-develop and deliver research and educational programmes, utilising the expertise, knowledge, and specialist facilities at Twycross Zoo and in the newly built NSCC.

Let's talk to work together and advance biodiversity conservation!

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Supported by:



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Reaching us

Twycross Zoo is located on the A444, which can be accessed via the A5 and the M42 junction 11. Just follow the brown attraction signs.
For satellite navigation use post code: CV9 3PX

Free parking is available on site, and your vehicle will be accessible at all times.

There is no public transport to the Zoo but there are several taxi companies in the nearby town of Atherstone including:

- Atherstone Taxis: 01827 712427/01827 712428, enquiries@atherstonetaxis.co.uk
<https://taxiatherstone.co.uk/>
- Triple A Taxis: 01827 713637, info@tripleataxis.co.uk
<http://tripleataxis.co.uk/book-a-taxi/>

On arrival please come to our Himalaya entrance building where the registration desk will be situated.

Sustainability at Twycross Zoo

We strive to employ environmentally friendly and sustainable practices as much as possible in the Zoo, hence we made this booklet available in an electronic format only. Please download it onto your devices so that you can refer to it throughout the Meeting.

We will provide all registered delegates with a name badge that will also enable you to visit the Zoo free of charge during the conference. Please return these badges to staff at the end of the Meeting so that they can be used again.

Please also remember to bring your reusable water bottles.

All food provided at the conference is 100% vegetarian, a vegan option will be available.

Recordings and social media posts

As part of our aim to make this Meeting as inclusive as possible, the presentations will be streamed live to allow access for researchers in range countries. The recordings will be available after the conference upon request, and thus the filming of the presentations is not permitted. As always, please refrain from using flash photography, and take photographs and use them with due consideration.

We encourage delegates to use the hashtag and Twitter handles provided below when posting about the Meeting.

FAO speakers – we suggest you highlight at the beginning of your talk or on your slides if you would prefer people not to take photos or post about your presentation.

#PSGB22

Twycross Zoo: @TwycrossZoo

Primate Society of Great Britain: @PrimateSociety

A special thank you to everybody who contributed to the organization of this event.

PSGB Winter Meeting

Schedule

Day 1: Wednesday 7th December

10:00 – 10:30	Registration & refreshments
10:30 – 10:50	David Meek, Interim CEO, Twycross Zoo: Welcome & Introduction Stuart Semple, President, PSGB: Welcome & Opening Remarks
Session 1 – Chair: Lisa Gillespie	
10:50 – 11:30	Plenary speaker: Josep Call: From Chrysippus's dog to modern primate studies of inferential reasoning
11:30 – 11:45	Q&A
11:45 – 12:05	Jake Brooker: Prefeeding affiliative contact facilitates cofeeding tolerance in sanctuary-living bonobos and chimpanzees
12:05 – 12:25	Giulia Ciminelli: Automatic detection of enrichments usage in rhesus monkeys
12:30 – 13:30	Lunch & AGM
Session 2 – Chair: Andrea Dempsey	
13:30 – 13.50	Victoria Gerhke: Mikajy Natiara: 10 Years of Native Conservation Efforts in Northwestern Madagascar
13.50-14.10	Phillipa Dobbs & Rachel Jarvis: Ape Heart Project – Ten years of research to understand ape heart disease
14.10-14.30	Andrea Molyneaux: Primates and Ecotourism in Bukit Lawang, North Sumatra - a Provider's Perspective
14:30 – 15:30	Speed presentations: Rebecca Smith, Emily Boucker, Sara Fontani, Marta Todó Llorens, Emily Johnson, Elliot Howard-Spink, Ashley Pearson, Georgia Sandars, Guillermina Hernández-Cruz, Stephanie Kordon
15.30-15.50	Coffee
Session 3 – Chair: Josep Call	
15.50-16.10	Susan Cheyne: The Power of Gibbon Song: Going Beyond the Research to Inform Conservation Actions
16.10-16.30	Joseph Mine: Vocal signals facilitate cooperative hunting in wild chimpanzees
16:30-16.50	Siân Waters: Barbary Macaques in the Rif Mountains of Morocco: Good News and Bad
16:50 – 17:00	Stuart Semple: Closing Remarks
17:00 – 18:00	Drinks reception & poster presentations
18:30 – 20:30	Pizza & pasta evening

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Schedule

Day 2: Thursday 8th December

09:00 – 09:20	Coffee on arrival
09:20 – 09:30	Welcome back
Session 4 – Chair: Rebecca Biddle	
09:30 – 10:10	Plenary speaker: Grainne McCabe: Conserving the lesser-known primates: conservation action planning to save <i>Cercocebus</i> and <i>Mandrillus</i> monkeys
10:10 – 10:25	Q&A
10:25 – 10:30	Napier Medal Presentation by Stuart Semple, PSGB President
10:30 – 10:50	Napier Medal Winner: Ennes Silva Felipe: Bald-headed uakari taxonomy and conservation, Brazil
10:50 – 11:00	Q&A
11:00 – 11:15	Paul Walker, Wildtracks: Primate Rehabilitation and Release in Belize – a Model for Successful Reintroductions
11:15 – 11:35	Coffee
Session 5 – Chair: Richard Sands	
11:35 – 11:55	Lauren Lansdowne: Genetic Analysis of the EAZA Gibbon Conservation Breeding Programmes
11:55 – 12:15	Andrea Dempsey: One Plan Approach to Primate Conservation in Ghana
12:15 – 12:45	Panel discussion: Siân Waters, Susan Cheyne, Stuart Semple, Grainne McCabe: Post-Pandemic Primatology - How Covid changed/will change how we approach the study and conservation of primates
12:45 – 13:00	Stuart Semple: Summary and Closing Remarks
13:00 – 14:00	Break
14:00 – 15:30	Optional Tour of Twycross Primate Collection

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Plenary Speakers



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Professor Josep Call - From Chrysippus's dog to modern primate studies of inferential reasoning
University of St Andrews, UK

Cognition is a constructive process. Our minds are constantly piecing together disparate and incomplete bits of information to make sense of the world. Inferential reasoning, i.e., reorganizing and combining bits of information with current or past experiences to create novel solutions, is one of the components involved in this constructive process. Since Chrysippus's time, scholars have wondered about whether nonhuman animals are capable of making inferences, and if so, whether they are grounded on logical reasoning. Much of the empirical effort in comparative cognition has been devoted to distinguishing inferential from non-inferential processes based on associative or low-level general attentional processes. In this talk, I will present a series of object search studies to investigate the nature and temporal dimension of primate inferences. First, I will explore whether the nature of primate inferences is probabilistic or deterministic. In other words, do primates only consider single or multiple possibilities, or do they also conceive necessities. Second, I will explore the temporal dimension of inferential reasoning in primates. In particular, are primates equally capable of making inferences about events that have already occurred compared to those that have yet to occur?

Dr Grainne McCabe - Conserving the lesser-known primates: conservation action planning to save *Cercocebus* and *Mandrillus* monkeys
Bristol Zoological Society, UK

Cercocebus and *Mandrillus* spp. live in 12 sub-Saharan African countries, ranging from Senegal in the west to the Tana River Delta in the east. They are characterised by a suite of morphological adaptations to feeding on hard seeds and nuts that are foraged from the forest floor, making them key seed dispersers. According to the IUCN Red List, all 10 taxa (nine species, one divided into two subspecies) have decreasing population trends. Further, nine out of the 10 taxa are threatened with extinction - specifically, one is Critically Endangered, six are Endangered, two are Vulnerable, and one is Least Concern. As large-bodied monkeys, these taxa are highly threatened by the wild meat trade, as well as habitat fragmentation and loss. The decreasing populations of *Cercocebus* and *Mandrillus* spp., combined with the increasing threats to their survival and the significant dearth of detailed ecological, biological and behavioural knowledge of most taxa, underscore the need to bring awareness to these monkey species. The lack of awareness of these taxa among public audiences has compounded the problem, with limited research, attention and conservation focus to date. Thus, the rationale of the *Cercocebus* and *Mandrillus* spp. Conservation Action Plan is to prevent a silent extinction of these key ecosystem engineers. In this talk, I will discuss the origins of this plan, the process and challenges faced in its development and the next steps. The goal of the Plan is to provide clear recommendations for impactful actions for these species collectively, within their range countries, as well as at the species or subspecies level, to ensure targeted conservation actions that would halt the decline of these monkeys who play a critical role in the maintenance of the forest ecosystem of West, Central and East Africa.

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PSGB Medal Winner



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Napier Memorial Medal

The Napier Memorial Medal is offered every two years to a new primatologist to provide encouragement through the public recognition of their work.

Felipe Ennes Silva - Bald-headed uakari taxonomy and conservation, Brazil

Université libre de Bruxelles, Belgium

The Amazon Rainforest is home to one of the greatest primate diversity in the world, with 149 species and subspecies being recognised in 17 genera. Although harbouring this great diversity, information on the phylogenetic relationship, geographic distribution, and conservation status are still missing for many of these taxa. Bald-headed uakaris, genus *Cacajao*, are one such case. Until recently, they are classified as one species and four subspecies based on the patterns of pelage colouration. During my PhD research, I used a genome-wide reduced representation (ddRADseq) to investigate the phylogenetic relationship of bald-headed uakaris and to estimate their divergence time. I visited zoological collections in Brazil, the USA, and Europe to examine the Museum's specimens and I collected new field data on their geographic distribution in the Brazilian Amazonia. Based on this dataset, I proposed a new taxonomic arrangement for the bald-headed uakaris as follows: *Cacajao calvus* (I. Geoffroy, 1847), *C. rubicundus* (I. Geoffroy and Deville, 1848), *C. ucayalii* (Thomas, 1928), *C. novaesi* (Hershkovitz, 1987), and I described the white uakaris from the Tarauacá River as new species, *C. amuna* (Silva et al. 2022). *Cacajao novaesi* and *C. amuna* have the most restricted geographic distribution occurring on opposite banks of the Tarauacá River. The other three bald uakaris species have a disjunct distribution. In Brazil, the disjunct distribution is a result of the landscape changes caused by the intense tectonism and sedimentological activity in western Amazonia. Climate change and deforestation will have different impacts on the habitat of bald uakaris in future scenarios, with the southern species being more affected. Hunting is a threat identified for *C. ucayalii* and *C. novaesi*, but not for the other species. I discuss the priorities for future research on bald-headed uakaris in a scenario of political and economic uncertainties in Brazil.

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PHOTO: Victoria Gehrke

PSGB Conservation Cause 2022



Mikajy Natiora

Mikajy Natiora is from the local malagasy dialect in the Sofia region and means **Protect Nature: Protect Biodiversity**

Mikajy Natiora works to **protect Madagascar's endemic biodiversity** by combining ecological research and local community involvement in the region surrounding the Sahamalaza Iles Radama National Park and Sofia region, in northwest Madagascar.

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Presentations



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Prefeeding affiliative contact facilitates cofeeding tolerance in sanctuary-living bonobos and chimpanzees

Jake S. Brooker¹, Edwin J. C. van Leeuwen², Stephanie Kordon¹, Zoë Goldsborough^{3,4}, Christine E. Webb⁵, Frans B. M. de Waal⁶, Zanna Clay¹

¹Durham University, UK; ²University Utrecht, The Netherlands; ³Max Planck of Animal Behavior, Germany; ⁴University of Konstanz, Germany; ⁵Harvard University, USA; ⁶Emory University, USA

A key contributor towards the collective temperaments of social organisms is social tolerance—the propensity to gather in close proximity to conspecifics without aggression. Humans can be characterized as a tolerant species, broadly, however levels can vary from person to person and culture to culture. Similarly, some great ape communities have also been observed to vary significantly in degrees of social tolerance. Specifically, variation in cofeeding tolerance among our closest living relatives, bonobos (*Pan paniscus*) and chimpanzees (*Pan troglodytes*), is greater at the group-level than the species-level, despite apparent differences in aggressivity and dominance style. There are indications that varying social composition can lead to differences in group cofeeding tolerance, however the proximate drivers towards increased social tolerance in our closest living relatives remain relatively opaque. Bonobos and chimpanzees are known to use reassuring body contact during periods of social tension, such as intergroup encounters and competitive feeding contexts, but also to reconcile and console following social conflict. Here, using a cofeeding paradigm to assess social tolerance across five sanctuary-living *Pan* groups consisting of N = 116 individuals, we show that increased engagement in affiliative body contact prior to competitive feeding increases one's likelihood of access to the food resource. Both the number of affiliative contact partners and absolute number of affiliative contacts were associated with increased presence within the cofeeding zone. These trends were found for all groups and were strongest in the two most socially tolerant groups and one intolerant chimpanzee group. We conclude that, despite clear species differences in aggressivity and dominance style, reassuring body contact may facilitate increased cofeeding tolerance on a proximate level, for both tolerant and despotic *Pan* groups.

Automatic detection of enrichments usage in rhesus monkeys

Giulia Ciminelli¹, Claire Witham², Melissa Bateson¹

¹Newcastle University, UK; ²MRC Harwell, UK

Environmental enrichment for animals can improve physical and psychological well-being, decreasing abnormal behaviours and promoting species-typical activities. All facilities housing captive animals need to develop plans for environmental enrichment that maximise the benefit to animals whilst considering factors such as cost, practicality, and safety. Traditionally, care staff monitor the use of the enrichment through direct observation. In practice this takes both time and training, and it is usually only carried on for a short period of time (mainly on the first few days after the introduction of the enrichment). We implemented and validated an automated technology that monitors how group-housed rhesus macaques interact with different items of structural enrichment during the entire time it is present in the room. In this study, we focussed on enrichment items that are partially mobile and that would move when a macaque interacted with them, allowing us to use the movement of the enrichment item as a proxy measurement for use. We recorded videos of enclosures (housing groups of 8-20 macaques at the Centre for Macaques) and trained an object detection that can track the same enrichment item throughout more than 10 different macaque enclosures. The main advantage of tracking the enrichment instead of the animals themselves is that the enrichment is generally rigid in shape and often brightly coloured. This means that it takes relatively few labelled frames to train a highly accurate model to track the enrichment, saving time in both labelling the frames and training the model. This model allows us to calculate how much the enrichment is being used permitting us to compare enrichment use across different groups (including breeding vs juvenile groups).

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Mikajy Natiora: 10 Years of Native Conservation Efforts in Northwestern Madagascar

Victoria Gerhke

Mikajy Natiora, Madagascar

Mikajy Natiora is a Madagascar-based conservation non-profit association, created in 2013 by Malagasy biologists. The founders of the association are composed of multidisciplinary biologists working to protect the country's endemic fauna and flora. Mikajy Natiora uses a multi-pronged, community-based approach to conservation through research, education and outreach, reforestation, community engagement and alternative livelihoods. Mikajy Natiora's study site is Andilambologno forest, adjacent to Sahamalaza Iles-Radama National Park, in the north-western part of Madagascar, and the surrounding communities. We employ and train local people as Forest Rangers to safeguard their forests for wildlife and the community alike, develop and support sustainable farming methods, engage the younger generations in learning about ecology, science and cultures. The Forest Rangers help us closely monitor local lemur populations and changes to the forests in order to better plan conservation management. We are currently in the process of building a research station that will double as a community and education center for local kids and organic farming methods, as well as a tree nursery. Mikajy Natiora is a locally based wildlife and nature conservation organization, created by local citizens for the local citizens, and we are so thankful for the support from the international community to help protect our lemurs and people.

Ape Heart Project – Ten years of research to understand ape heart disease

Phillipa Dobbs¹, Rachel Jarvis^{1,2}

¹Twycross Zoo, UK; ²University of Nottingham, UK

The Ape Heart Project was established by Sharon Redrobe OBE in 2012 as a joint collaboration between Twycross Zoo and University of Nottingham to lead research into heart disease in Great Apes. This project is an EAZA Great Ape Taxon Advisory Group endorsed initiative and has involved many European institutions over the last ten years. It has been shown that heart disease is a significant cause of death in zoo-housed great apes and this has had a significant impact on the European and US populations.

Over the last ten years research has been focused on refining how to diagnose heart disease in Great apes post mortem with almost 100 ape hearts examined. The project offers full cardiac examination including histopathology to all European zoos including a full written report. Various patterns of disease have been identified and some novel pathologies.

The project has more recently been working on identifying clinical applications to diagnose heart disease ante mortem. This includes cardiac ultrasound, ECG's and measurement of cardiac biomarkers under anaesthesia. Twycross Zoo is leading the way in the UK in collecting this data from all apes both under anaesthesia and now conscious using positive reinforcement training. If heart disease can be diagnosed and/or monitored using training rather than anaesthesia this will be really useful for current and future populations.

Current research involves investigating if vitamin D deficiency is a risk factor for heart disease. A European wide study was conducted on vitamin D levels in Chimpanzees which showed interesting results. This has now been expanded to other species of Great Apes to see if similar patterns are seen. Cardiac biomarkers are also being analysed validated to help with diagnosis.

In the last ten years the Ape Heart Project has generated over 20 publications and is growing stronger by the year.

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Primates and Ecotourism in Bukit Lawang, North Sumatra - a Provider's Perspective

Andrea Molyneux

Green Hill, Indonesia/Oxford Brookes University, UK

Despite a high level of primate diversity, wildlife tourism in Sumatra is focused on orangutans at Bukit Lawang. The small amount of published work on primate tourism in Sumatra has been done from the perspective of the primates with other literature examining issues such as flagship species, deforestation and primate crop raiding. Ecotourism is often mentioned in such literature and actions for providers given as potential solutions but rarely is any practical advice given to providers of tourism services. No literature exists from the perspectives of those working in the industry providing primate tourism services. For the first time this chapter provides a unique perspective on tourism from the point of view of a business, Green Hill, which has been providing conservation-focused tourism services in Bukit Lawang, North Sumatra, for 13 years. It provides an overview of Green Hill, its practices and philosophy and uses data from 5 years of jungle trekking services to demonstrate success in marketing a more naturalistic and sustainable approach to trekking focused on the community and environment in a remote area with no rehabilitated orangutans and thus no guaranteed sightings. The work of Green Hill has had a positive impact on primate conservation and has relevance for other areas in Indonesia and beyond. We suggest that for primate tourism to be effective, primates should not be the sole focus of a tourism program and tourism, be it "eco" or otherwise, should not be seen as a panacea by researchers. If primate tourism is to succeed community-level local providers must be collaborated with on an equal footing. It is essential to understand the area, the culture, the political history, the people, and the primates. It is also crucial to understand the tourism market, the target audiences, and how to market services and manage expectations appropriately.

The Power of Gibbon Song: Going Beyond the Research to Inform Conservation Actions

Susan M. Cheyne^{1,2}, Carolyn Thompson^{1,3,4}, Alizeé Martin¹, Abdulaziz K⁵, Helene Birot¹, Eka Cahyaningrum⁵, Joana Aragay¹, Petricia Andini Hutasoit⁵ and Jito Sugardjito⁶

¹ Borneo Nature Foundation International, UK; ² Oxford Brookes University, UK; ³ University College London, UK; ⁴ Zoological Society of London, UK; ⁵ Yayasan Borneo Nature Foundation, Indonesia; ⁶ Universitas Nasional, Indonesia

Gibbons (*Hylobatidae*) are small arboreal apes known for their stereotyped songs, which are often the subject of detailed studies regarding their evolution, responses to changing environments, involvement in social behaviour, and used to design efficient vocalisation-based survey techniques to monitor populations. We present a case study of how Borneo Nature Foundation, a non-governmental organisation based in Indonesia, is holistically working to use the songs of Bornean white-bearded gibbons (*Hylobates albibarbis*) to inform conservation actions and education efforts. We showcase how a field of study, namely primate acoustics, is an untapped resource to engage with local communities and can be developed into educational tools in the form of storytelling, mobile apps and games, to highlight the plight of threatened species and how to conserve them. The conservation research and the face-to-face education and outreach through the apps and games are continuing and the work of BNF is expanding to reach more children in Central Kalimantan and to evaluate the impact of these educational tools. Finally, all these data need to be shared to highlight the importance of public outreach for science communication including online sessions, magazines, social media, children's clubs, school visits, public events etc.

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Vocal signals facilitate cooperative hunting in wild chimpanzees

Joseph G Mine^{1,2}, Katie E Slocombe³, Erik P Willems⁴, Ian C Gilby⁵, Miranda Yu⁶, Melissa Emery Thompson⁷, Martin N Muller⁷, Richard W Wrangham⁸, Simon W Townsend^{1,2,9*†}, Zarin P Machanda^{6†}

¹Department of Comparative Language Science, University of Zurich, Switzerland; ²Center for the Interdisciplinary Study of Language Evolution, University of Zurich, Switzerland; ³University of York, UK; ⁴Department of Anthropology, University of Zurich, Switzerland; ⁵Arizona State University, USA; ⁶Tufts University, USA; ⁷University of New Mexico, USA; ⁸Harvard University, USA; ⁹University of Warwick, UK

Cooperation and communication likely co-evolved in humans. However, the evolutionary roots of this interdependence remain unclear. We address this issue by investigating the role of vocal signals in facilitating a group cooperative behavior in an ape species: hunting in wild chimpanzees. First, we show that bark vocalizations produced before hunt initiation are reliable signals of behavioral motivation, with barkers being most likely to participate in the hunt. Next, we find that barks are associated with greater hunter recruitment and more effective hunting, with shorter latencies to hunting initiation and prey capture. Our results indicate that the co-evolutionary relationship between vocal communication and group-level cooperation is not unique to humans in the ape lineage, and is likely to have been present in our last common ancestor with chimpanzees.

Barbary Macaques in the Rif Mountains of Morocco: Good News and Bad

Siân Waters, Ahmed El Harrad, Mohamed Chetuan, Ahmed Chetuan & Lucy Radford
Barbary Macaque Awareness & Conservation, UK & Morocco

The Endangered Barbary macaque (*Macaca sylvanus*) is endemic to Morocco and Algeria. The species occurs in three mountainous areas of Morocco including the Rif Mountain range in the far north of the country. The authors began a long-term community conservation project in 2009. Part of our work involves conducting population surveys of this region. We conducted an extensive survey of potential macaque habitat in the Rif over two years in 2016-2018. We found that, while some populations are still very isolated and small, there is a thriving and currently contiguous population inhabiting the diverse, but connected, habitats situated in the mountain chains and connecting canyons in the eastern Rif and a larger, contiguous population of ~4,000 macaques in Bouhachem mixed oak forest. However, the Rifian forests are very susceptible to wild fire. In 2020 and 2022, wild fires spread through large parts of Bouhachem forest. The most recent fire in July 2002 burned over 7,500 ha of forest, destroyed five villages and killed many macaques as well as other wildlife and villagers' livestock. Here we present current information about the status of the macaque population in Bouhachem and discuss how we are working with the communities to reduce the risk and effects of wild fire on people and Barbary macaques in the future.

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Primate Rehabilitation and Release in Belize – a Model for Successful Reintroductions

Paul Walker

Wildtracks, Belize

Belize has two globally endangered primates – the Yucatan black howler monkey (*Alouatta pigra*), a regional endemic, and the Central American spider monkey (*Ateles geoffroyi*). Traditionally, primate rehabilitation has been viewed as being a purely welfare action. The Wildtracks Primate Rehabilitation Programme demonstrates that effectively planned rehabilitation can be used for delivering significant conservation gains, both for at-risk species and for strengthening ecosystem resilience. In Belize, a national zero tolerance policy for captive primates has resulted in a 95% decrease in the illegal trade in primates (pre-Covid). Strong partnerships ensure that all primates confiscated by the Forest Department or surrendered from the illegal pet trade are rehabilitated by Wildtracks and released in a highly effective endangered species reintroduction programme – with significant investment of time and resources in post-release monitoring, achieving a 95% post-release survival rate and rapid population growth.

Genetic Analysis of the EAZA Gibbon Conservation Breeding Programmes

Lauren Lansdowne¹, Kazunari Matsudaira², Kristiana Brink¹, Katie Dripps¹, Vivienne Li¹, Ed Hollox¹, Richard Badge¹

¹University of Leicester, UK; ²University of Tokyo, Japan

Estimations of genetic diversity and inbreeding within captive populations are calculated from studbook data. These are based on the assumption of unrelated founders, which may be erroneous, resulting in inaccurate appraisal of the population. We developed a panel of 12 microsatellite loci to investigate the genetic status of the gibbons held by the European Association of Zoos and Aquaria (EAZA), and to compare these data with independent samples held at the University of Tokyo, Japan. The panel has successfully generated profiles on all species of gibbon so far tested (11 species across three genera). From the EAZA collection we generated full (12 locus) profiles for 64 individuals, and partial profiles for a further 39. From the Tokyo collection 51 full profiles were generated. Deviation from Hardy-Weinberg equilibrium was detected for the *Symphalangus syndactylus* EAZA population ($n=27$, $p<0.01$), but no others. Loss of alleles across generations was observed for all EAZA populations, and loss of heterozygosity was observed for all EAZA populations except *Nomascus leucogenys* ($n=7$). Comparison between the EAZA and Tokyo collections revealed unique alleles for all species in both sets of samples, indicating a greater quantity of genetic diversity is present in wild populations, which is not fully represented in captivity. In addition, our data indicate the presence of species-specific alleles in some *Hylobates* species, which may of utility for species and hybrid identification. These data should be interpreted with care, as they do not represent profiles for all individuals in the EAZA collection. Nevertheless, our results demonstrate the advantage of direct genetic testing to obtain quantitative data, with which to assess breeding populations. These tools will assist conservation breeding programmes by providing robust information on the genetic health of populations, guiding decisions on future breeding of groups and individuals.

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One Plan Approach to Primate Conservation in Ghana

Andrea Dempsey

West African Primate Conservation Action, Ghana

The West African Primate Conservation Action is a local NGO working in Ghana and Cote d'Ivoire. We are missioned to safeguard the future of threatened primates using the One Plan Approach, ensuring inclusivity, sustainability and effectiveness. WAPCA works to achieve this through four key pillars; **discover** – primate surveys to find or monitor primate populations, **protect** – using community based initiatives to protect the forest and its inhabitants, **reinforce** – ex-situ breeding is crucial element of conservation and a possible reintroduction population in the future and **connect** – conservation education to connect people with nature using a multi-disciplinary approach. WAPCA is an advocate for local conservation and the promotion of local primatology in range countries, it demonstrates the need to approach conservation at a holistic level – recognising the needs of the people as much as the primates and highlights the important role that progressive zoos play in conservation. WAPCA focuses on the white-naped mangabey, *Cercocebus lunulatus*, Roloway monkey, *Cercopithecus roloway*, black and white-thighed colobus, *Colobus vellerosus* and Miss Waldrons' Colobus, *Procolobus waldroni*.

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Speed Presentations



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The challenges of primate research and conservation in Paraguay

Rebecca L. Smith¹, Jorge Damián Ayala Santacruz¹ and Paul Smith^{1,2}

¹ Fundación Para La Tierra, Paraguay; ² FAUNA Paraguay, Paraguay

The primate fauna of Paraguay consists of just five species (*Sapajus cay*, *Alouatta caraya*, *Aotus azarae*, *Plecturocebus pallescens* and *Mico melanurus*) and has been largely overlooked by the international primatological community. Paraguay currently has the second highest deforestation rate in Latin America and the threats facing Paraguayan primates are as severe as anywhere else on the continent. Primate conservation in Paraguay is complicated by the complete absence of a homegrown primatological research community and the country lacks the solid biological research foundation required for the development of robust management strategies. Only one university degree in biology is available in the country (with the Universidad Nacional de Asunción), and opportunities for postgraduate education in biological sciences require studying abroad, whilst the limited number of career opportunities upon graduation mean that those receiving such training frequently prefer to pursue their career elsewhere rather than return to the country to practice. No higher education courses in primatology are currently available in Paraguay at all. Fundación Para La Tierra (PLT) is a Paraguayan conservation and education NGO (80086144-2), founded in 2010. PLT focuses on conservation of Paraguay's natural habitats through scientific research, community engagement and education, and runs Paraguay's only long-term primatology research projects: the "Hooded Capuchin Project" conserving *Sapajus cay* in what little remains of the Upper Paraná Atlantic Forest and the "Urban Howler Monkey Project" researching the behavioural ecology of *Alouatta caraya* inhabiting the city of Pilar. The PLT primate projects adopt a multi-faceted approach: long-term scientific research, training and supporting people with an interest in primates, supervision of national and international students and environmental education in schools. We conclude that partnerships between local and international academic and conservation institutions in a strategic plan to develop primatology are essential for the development of the science in Paraguay.

Population Viability Analysis of Douc Langurs (*Pygathrix* spp.) in Việt Nam

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Douc langurs (*Pygathrix* spp.) range in Vietnam, Cambodia, and PDR Laos, and all three recognized species are currently listed as Critically Endangered by the IUCN Red List, due to habitat loss, fragmentation, and increased levels of poaching created by the demand for their use in traditional medicines. Sub-populations in Vietnam rarely exceed 1000 individuals and despite reducing populations, there is a dearth of research on extinction risk analysis to understand how these threats directly affect their survival. We ran a population viability analysis (PVA) using VORTEX and modelled scenarios of increasing rates of deforestation and poaching to reflect the two biggest threats to red-shanked douc langur (*Pygathrix nemaeus*), black-shanked douc langur (*P. nigripes*) and grey-shanked douc langur (*P. cinerea*), within nine different sites in Vietnam. Our findings suggest that populations modelled were predicted to decline by at least 62% within the next 50 years. Loss of habitat and poaching have different effects on douc populations depending on the habitat size and the starting population, and isolated populations of fewer than 100 individuals would not be able to maintain healthy levels of genetic diversity. The PVA we ran also highlights some gaps in knowledge of the life history and reproductive behaviours of wild douc langurs, population numbers in non-protected areas, and the details of the illegal trade. Further research is required to produce more accurate population viability analyses and to understand the drivers and enabling factors behind illegal trade in order to implement more effective protection for douc langurs.

PSGB Winter Meeting

Anogenital scent-marking signals reproductive status in zoo-housed female Alaotran lemurs – Towards successful captive breeding practices for endangered primates

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The Alaotran gentle lemur (*Hapalemur alaotrensis*) is one of the 25 most endangered primates in the world and shows low success rate in captive breeding programmes. It is therefore vital to further understand its reproductive biology.

Foremost, we conducted the first detailed chemical analysis of anogenital odour secretions in female gentle lemurs to identify the chemical signature conveying information about female fertility. We studied a breeding female in a captive group (n=5) hosted at Jersey Zoo, Channel Islands. We collected behavioural data (n=318 hours) using all occurrences of some behaviours and ad libitum sampling methods, and faecal (n=54) and vaginal odour (n=35) samples via positive reinforcement training. We measured sex hormone levels using enzyme immunoassay technique and investigated the volatile component of odour signals using solid-phase microextraction and gas chromatography-mass spectrometry. We then used these findings to design a new scent enrichment and evaluate its effects on mating behaviour and well-being, via behavioural observations (n=385 hours), faecal endocrinology (n=140) and gut microbiota (n=140) analysis, in three non-breeding pairs (n=6) at Jersey, Birmingham (UK) and Mulhouse (France) zoos.

We found a significant positive correlation between periods and rates of female anogenital scent-marking whereby female performed anogenital scent-marking more frequently during the breeding period, suggesting that anogenital scent-marking may signal the reproductive status of captive female gentle lemurs. The volatile chemical profile changed over the study, with four compounds (2-Heptanone, 3-Heptanone, 3-Octanone, 4-Methyl 3-Hexanone) distinguishing the fertile window during the breeding period.

We will also present our findings on male sexual behaviours as well as behavioural and physiological indicators of stress in both male and female gentle lemurs. We will then discuss how this study might entail impact on management and husbandry practices adopted by European zoos.

PSGB Winter Meeting

Immigrant male infanticide and mother-infant cannibalism in Peters' Angolan colobus (*Colobus angolensis palliatus*)

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Infanticide among primates is well known though the reasons for its occurrence have not been substantiated across the taxa. This is partially because of the rarity of the event and, therefore, the unlikelihood that it is witnessed. Among the colobine monkeys, there are suspected and witnessed reports of infanticide in African and Asian species. Given that infanticide appears common in this subfamily, it is unsurprising that infanticide events are known from Peters' Angolan colobus (*Colobus angolensis palliatus*) in Diani, Kenya, because the groups residing in the suburban town are well habituated. However, we report an unusual infanticide event that included cannibalism. Mother-infant cannibalism has been reported in other primate species, including cercopithecids such as vervet monkeys and Tonkean macaques, although never in a colobine species. The event was witnessed on the 24th of November 2021 during an 18-month weaning behaviour study of three troops of *C. a. palliatus*. The occurrence was well documented from before the initial attack until after the infant's death. In addition, a post-mortem exam was performed, and the infanticide and cannibalism injuries were noted. Furthermore, the group's behaviour in response to the event was documented.

We describe the stages of the event and then review the eight hypotheses proposed to explain infanticide (sexual selection, social pathology, cannibalism or exploitation, resource competition, parental manipulation, eliminate genes of current sexual rivals, eliminate genes of future sexual rivals and by-product of adaptive aggression) and discuss those that best describe our witnessed event. This report adds to the scanty body of literature on primate infanticides and cannibalism providing detailed information to make sense of this dramatic life history event in some species.

Do non-human primate mothers show behavioural changes associated with human grief after the death of their infant?

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All living animals eventually die. It is generally accepted that all humans grieve the death of close social partners. However, there is currently little empirical research into how animals respond to death, including our close relatives, the non-human primates (hereafter primates). We aim to fill this gap by determining if primate mothers display a behavioural change after the death of their infant. This is the first study to collect prospective quantitative data on the responses of bereaved primates. Behavioural observations were carried out on eleven bereaved rhesus macaque mothers, each with two matched non-bereaved controls (one with an infant and one without) (n=33) from the Cayo Santiago field site. This data was then analysed using generalised linear mixed models to determine the presence of a relationship between bereavement and four behaviours associated with human grief (loss of appetite, lethargy, increased stress, and social withdrawal). We found that bereaved mothers spent significantly less time resting and significantly more time feeding than the non-bereaved controls. No significant difference was found in time spent grooming and time spent carrying out stress-related displacement behaviours. Consequently, a behavioural change was seen in response to bereavement, but it was not analogous to behaviours commonly associated with grief in humans. This research hopes to advance the field of comparative thanatology by providing a basis for future studies in this area.

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Hierarchical syntactic structures in chimpanzee action during a natural tool-use task

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Hierarchical sequencing underlies many human behaviours that are unique in their complexity, including language, music, and technology. Despite this prevalence, the origins of the cognitive machinery which supports hierarchical sequential action remain unknown. Several studies have recently speculated that hierarchical sequencing in tool manufacture and use may have evolved prior to or after the divergence of hominins from non-human animals, paving the way for its co-option in other behavioural domains. Hierarchical structuring may then have emerged in other behaviours (e.g., language) later in human evolution, either through exaptation of relevant cognitive substrates, or as an independent, parallel transition. As such, non-human primates - particularly apes - offer an important comparative reference point to investigate the evolution of hierarchical cognition. Here, we examined the latent structure of action sequences used by eight wild West-African chimpanzees during natural nut-cracking behaviours at an outdoor laboratory in Bossou, Guinea. Using models of mutual information (MI) decay, we assessed whether chimpanzees relied on Markovian, hierarchical, or composite strategies to sequence actions during nut-cracking.

For seven individuals, MI decay was best approximated by a model that encompassed exponential and power-law decay dynamics, reflecting Markovian structuring on shorter timescales, and hierarchical structuring at longer timescales. For one individual, MI decay was best approximated by a power-law decay model, reflecting hierarchical structuring of elements at all temporal scales. Our findings therefore demonstrate the use of hierarchical sequencing in tool use by a non-human primate, with likely homologous origins with human tool behaviours. We explore the implications of our results alongside the limited hierarchical complexity of non-human primate vocal communication, and in light of hypotheses predicting the evolution of hierarchical syntax in language through action.

Does Food based enrichment help reduce agonistic behaviours within a group of zoo-housed De Brazza's monkeys (*Cercopithecus neglectus*)

Ashley Pearson

Twycross Zoo/University of Edinburgh, UK

The study conducted at Twycross Zoo hypothesised that food-based enrichment will have a significant reduction on negative/agonistic behaviours within a group of De Brazza's monkeys. The study tested three enrichment devices (Puzzle Feeders, KONG's™ and Hol-ee Rollers) on a group of zoo-housed De Brazza's monkeys (Group formation 1:5:0), observing the effect they had on aggression levels, while considering three main objectives: whether the enrichment can reduce agonistic behaviours, if it was successful was there a reduction in the efficacy with repeated exposure, and whether one device was more effective than others. Observations were taken 30 minutes prior to enrichment and 30 minutes post enrichment. The enrichment reduced the levels of aggression in the group by up to 25% and on specific individuals it had an effect of up to 75% reduction. There was variation in the efficacy between the enrichment devices; puzzle feeders were the most effective. However Hol-ee Rollers had a consistent reduction in aggressive behaviours compared to KONG's™ and Puzzle Feeders, both of which saw at least one instance of increasing aggression. Both Puzzle Feeders and Hol-ee Rollers were statistically significant with a confidence level at 95% (<0.05), KONG's™ could not be classified as significant unless the confidence level was set at 90% (0.1). These results conclude that enrichment can reduce aggression levels in De Brazza's monkeys and are significant for the captive management of the species. When introducing new individuals to groups levels of aggression and stress can spike. The provision of food-based enrichment can alleviate aggression levels, which could result in the reduction of injuries or the success of a breeding programme.

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Positive Behavioural Contagion in Chimpanzees

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Behavioural contagion - the onset of a species-typical behaviour soon after witnessing it in a conspecific - forms the foundation of behavioural synchrony and cohesive group living in social animals. Although past research has mostly focused on negative emotions or neutral contexts, the sharing of positive emotions in particular may be key for social affiliation. To address this research gap, we investigated the contagion of two positive interactive behaviours, grooming and play, in chimpanzees. We predicted that individuals would be more likely to perform these behaviours after observing them, and that those more likely to 'catch' these behaviours would be more socially integrated. We collected naturalistic observations of 47 sanctuary-living chimpanzees at Chimfunshi Wildlife Orphanage in Zambia, taking 5-min focal follows of chimpanzees after they had observed grooming and play, and pairing these with matched controls. We explored whether contagion is moderated by age, sex and social closeness, and how individual differences in contagion predict social integration. Results reveal the first evidence for grooming and play contagion in chimpanzees. In this sample, grooming contagion appeared to be influenced by a social closeness bias, whilst play contagion was more pronounced in younger individuals. These findings emphasise that contagion is not restricted to negative or self-directed behaviours, and that considering the behavioural context is crucial when determining predictors of contagious behaviour. Studying what influences this foundational social process, and its significance for social integration, deepens our understanding of the underpinnings of affective state matching, social bonding and group dynamics.

Individual differences in sociability predict neutrophil-to-lymphocyte ratios in rescued capuchin monkeys (*Sapajus libidinosus*)

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The relationship between primate personality and health has gained much interest in the last decades. Neutrophil-to-lymphocyte ratios (NLR) measure the activity of the immune system and have been used to investigate the effects of chronic stress and its relationship with personality. We aimed to investigate the association between personality and NLR of 13 trafficked capuchin monkeys (*Sapajus libidinosus*) housed in a wildlife rescue centre in Brazil. We predicted that more sociable and less neurotic and stereotypic individuals would have lower NLR when compared to less sociable and more neurotic and stereotypic monkeys. We obtained blood samples in a routine health assessment and calculated the NLR for each individual. We used a set of seven behavioural tests and the Hominoid Personality Questionnaire (HPQ) to assess the personality of the monkeys and validated them using behavioural observations. We found acceptable levels of inter-rater reliability ($p < 0.05$) in 43/54 items of the HPQ and acceptable levels of consistency between trials in 18/24 variables measured in the behavioural tests. We reduced these variables into dimensions using Principal Component Analysis and obtained four HPQ-components (Openness, Neuroticism, Assertiveness, and Sociability) and five behavioural tests-components (stereotypic, creative, risk-averse, sociable to humans, and aggressive). We found a strong correlation between NLR and sociability ($r = -0.638$, $p = 0.019$) and a moderate correlation between NLR and sociability to humans ($r = -0.540$, $p = 0.057$). We used multiple regression analysis with backward elimination and found that sociability significantly predicted NLR $F(3,9) = 7.564$, $p = 0.019$, $R^2 = 0.407$. These findings suggest that more sociable individuals may be less chronically stressed when compared to less sociable individuals. Further research is needed to understand the association of personality with chronic stress in capuchin monkeys and its implication for capuchin conservation and well-being, using other physiological indicators where possible.

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Social and empathic competence in sanctuary housed bonobos - A longitudinal approach

Stephanie Kordon¹, Christine Webb², Frans BM de Waal³, Zanna Clay¹

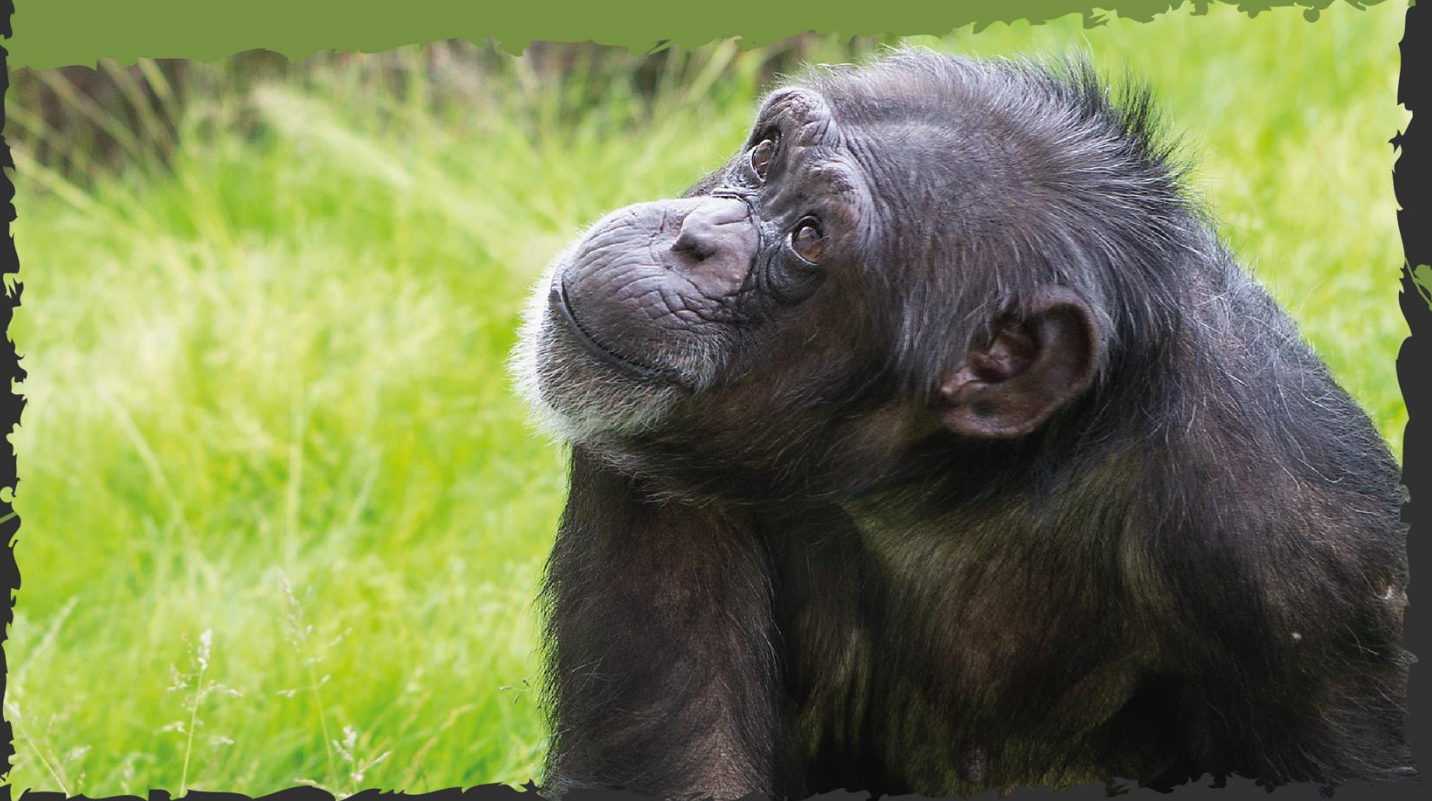
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Early maternal loss can have life-long effects on sociability and empathic tendencies in apes. Juvenile, orphaned bonobos in a sanctuary in DR Congo were found to show striking deficiencies in their social and empathic competences as compared to their mother-reared peers. However, little is known on their subsequent development across the lifespan and whether these impairments to their social functioning continue into adolescence and adulthood. The present study aims to investigate whether their social competence and empathic tendencies change across age and whether this interacts with early life rearing environment (i.e. mother-reared or orphaned) and sex. Observations on semi-wild housed bonobos (*Pan paniscus*) at Lola ya Bonobo sanctuary in D.R. Congo were conducted at several time points across 10 years. The sanctuary houses orphaned bonobos, usually rescued as infants as well as mother-reared individuals which provides a unique opportunity to investigate the impact of rearing backgrounds in a developmental context (N = 74 individuals). Preliminary results showed that females increase their social affiliative tendencies with age while males show a decrease with age. Mother-reared bonobos showed a decrease in consolation tendency with age, which was more pronounced in females than males. Orphaned bonobos showed more consistent consolation tendencies across age however, females showed a slight developmental decline as well. This reveals that mother-reared and female orphans are more in line with previous findings on apes showing a developmental decline in consolation tendency. As expected in a male-philopatric social system of bonobos, orphaned males, lacking maternal support appear to face continuous deficiencies in their social and empathic tendencies. Further analysis will provide insights into individual social strategies. The present study may provide valuable insight into predictors of healthy social functioning of rehabilitated orphaned bonobos and provide useful information for the sanctuary to maximise the likelihood of successful rehabilitation efforts.

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Poster Presentations



PSGB Winter Meeting

Assessment of the host preferences of *Culex pipiens* mosquitoes at two UK zoos

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Culex pipiens mosquitoes are a widespread and highly abundant species of mosquito in the UK, and are vectors for West Nile Virus (WNV) and Usutu virus (USUV). Studies have identified circulation of these viruses in European zoos, and WNV exposure has been demonstrated in primates. These viruses are spreading across Europe and knowledge of mosquito biting preferences can aid understanding of at-risk animals. The study objectives were to understand whether primates were at risk of exposure. We hypothesised that *Cx pipiens* would preferentially bite birds, however little is understood about opportunistic biting of *Cx pipiens*. Mosquito traps were set at Twycross Zoo (TZ) and Chester Zoo (CZ) at various animal enclosures during summer, 2021. Bloodfed *Cx pipiens* were identified, and abdomens were removed for DNA extraction. Sella scale grade was performed to categorise DNA degradation. Following DNA extraction, the cytochrome oxidase 1 gene of vertebrate DNA was amplified using a nested-PCR. Products were sequenced and a Basic Local Alignment Search Tool search was conducted to identify vertebrate DNA. From field collections in 2021, 1.8% and 2.8% of the total collections were blood-fed *Cx pipiens*, with the mean Sella scale for DNA degradation being 5.6 and 4.5 at TZ and CZ, respectively. The most common vertebrate DNA that was sequenced was the Eurasian Blackbird, followed by the Yellowhammer and the House Sparrow. *Cx pipiens* was demonstrated to have fed from a captive Northern Bald Ibis and one *Cx pipiens* has been shown to feed from a human. Here, we have demonstrated the largely ornithophilic nature of *Cx pipiens* and the ability for this mosquito species to bite native and captive avian species as well as people. These results may suggest that *Cx pipiens* can bite other mammals including primates and further bloodmeal analysis should be carried out to gain further insight.

Emotional communication in bonobos (*Pan paniscus*) as indicator of captive welfare

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There is lots of literature available about bad welfare, but there is little which identifies good welfare. This study explored the link between animal welfare and emotional responses to social behaviour in a fission-fusion group of 13 captive bonobos at Twycross Zoo. Social behaviours included socio-sex, grooming, play and aggression including yawn contagion as a basal form of empathy. Null hypothesis one was that there would be difference between bonobo behaviours regardless of the captive environment, whether they had access outside. Null hypothesis two was that social behaviours were not predicted by one another or contributed to an animal's welfare. The final null hypothesis was that yawn contagion in bonobos was not linked to an emotional response between kinship and/or strength of social bonds. The project included scan sampling the two groups every 10 minutes. Yawn trains were also identified. Results showed a large variety of behaviours exhibited during the scan sampling, with no statistical difference between having/not having access outside. Accepting the null hypothesis. Focal sampling showed grooming rates and sex rates were predicted by play rates. Individual aggression was predicted by age of the recipient. Social sex was predicted by age of the recipient (younger individuals had higher rates) and sex of the recipient (females had higher rates). Play rates were predicted by age of actor and age of the recipient (younger individuals had higher play rates). Grooming was not predicted by either sex/age of the recipient or sex/age of the actor. These results rejected the null hypothesis. Yawn contagion showed a relationship with grooming rates, those closely bonded exhibited yawn contagion. Rejecting the null hypothesis. Kinship did not show a link with yawn contagion. Overall welfare of the two groups was considered good due to the frequency of behaviours. To further improve welfare, increasing/changing enrichment schemes were suggested.

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Identifying biases in tufted capuchin associative learning: Are patterns in line with non-primate species?

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Previous research with non-primate species has focused on examining the effects that social stimuli can have on rates of learning associative rules. Hopewell et al (2010) identified that grey squirrels show a feature-negative effect for social sources of information, in that they more readily learn to avoid the social stimulus and seek rewards in alternative locations. Characteristically 'social' species like bumblebees have shown enhanced learning rates due to the presence of a social stimulus over a comparable non-social one (Averages-Weber, Lachlan, & Chittka 2017). We sought to test for these contrasting effects in tufted capuchins, to see whether the presence of social or non-social stimuli could have positive or negative effects on learning rates for differing associative rules. Subjects were 32 tufted capuchins housed at the 'Living Links to Human Evolution Research Centre' at Edinburgh Zoo. The variables "Information Source" (social or non-social) and "Associative Rule" (rewarding cue or non-rewarding cue) were assigned in a 2x2 factorial design, as between-subjects conditions.

We predicted that the number of test trials required to reach criterion performance will be different for individuals reinforced to use a social cue identifying which of two stimuli is associated with a reward, compared with those reinforced to use a non-social cue identifying which of the two is associated with a reward. Results of a GLMM where individual effects were controlled for showed no main effect for Information Source, and no main effect for Associative Rule. There was no significant interaction. These results are in stark contrast to results of previous studies, where apparent biases for (in the bumblebees' case) or against (in the squirrels' case) social sources of information led to varying success in those species' learning of associative rules. When researching primate species, the benefits of social sources of information should not be presumed.

Discerning the 'Synanthrope': Ranging patterns, habitat selection and roost characteristics of the Rhesus macaque (*Macaca mulatta*) in a mosaic landscape in northern India

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The *Macaca mulatta* in India, inhabits a wide range of natural and anthropogenic landscapes, living in close association with humans. Increased instances of human-macaque conflict have been reported from northern India lately. Ranging patterns in synanthropic macaques is influenced by habitat preference, which may indicate possible conflict scenarios in human-altered habitats. Two socially distinct Rhesus troops, designated A and B, with 56 and 64 individuals respectively, were studied in the 16 sq. km study area comprising fragmented forest patches and anthropogenic structures on the outskirts of Dehradun city. One adult female from each troop was collared with a GPS logger taking fixes at 15-minute intervals. Coordinates were obtained for the birth (April-June) and pre-breeding (July-August) season in 2022. Overall home range (95%) and core range (50%) of A were 26.15ha and 4.53ha; and B were 46.84ha and 7.82ha, kernel density least squares cross validation (LSCV). Daily travel distances were significantly different for individuals ($p < 0.05$). Daily displacement showed no significant difference individually or seasonally. Design III habitat selection ratios were calculated using habitat class areas from 100% minimum convex polygon as available and 95% kernel LSCV as utilized. Selection ratios were high for human-modified habitat classes. Mean nocturnal roost revisits as a measure of site fidelity were 6.27 ± 0.32 ($n=118$) for A and 5.03 ± 0.37 ($n=92$) for B. Small home ranges with high selection ratios for roads and human habitation suggest higher resource availability for the troops through provisioning and garbage dumps. Mean daily travel distances were ~8.6 times of mean daily displacements indicating intensive usage. Roost revisits were high and within the core range, concentrated along edge habitats. High revisits and extended residence at localized sites may perpetuate heightened perceived agonistic interactions in humans. Understanding these patterns shall allow for informed management practices alleviating conflict, facilitating long-term human-macaque coexistence.

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Novel insight into the strongylid nematodes of South-East and East Asian primates

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With non-human primates (NHPs) one of the most endangered mammalian taxa, there is ongoing need to better understand their conservation threats. One such threat is the risk of disease, with various bacterial, viral and parasitic infections previously reported to have damaging consequences for NHP hosts. Habitat fragmentation and disturbance may shift disease epidemiology and exacerbate negative implications of infection. Strongylid nematodes are particularly prevalent amongst NHPs, with 100% prevalence reported in some populations. While strongylid infections are typically asymptomatic in NHPs, clinical manifestation has been reported in both captivity and the wild. Current knowledge of NHP strongylid infections remains limited, restricted by strongylids typically occurring as mixed infections of multiple genera, which are indistinguishable through traditional microscopic approaches. We applied modern molecular techniques for insight into the genetic diversity of strongylid infections in South-East and East Asian NHPs. We hypothesised strongylid nematodes occur in mixed communities of multiple taxa, dominated by *Oesophagostomum*, matching previous findings based on single-specimen genetics. We applied metabarcoding, utilizing the Illumina MiSeq platform, to 90 samples from five species of wild NHPs, occurring in Malaysian Borneo or Japan: *Pongo pygmaeus* (14), *Trachypithecus cristatus* (5), *Nasalis larvatus* (4), *Macaca nemestrina* (2), *Macaca fascicularis* (17) and *Macaca fuscata* (48). Surprisingly, we found almost all haplotypes were assigned to a single strongylid species: *Oesophagostomum aculeatum*. Four unidentified haplotypes, unique to a single host species, suggests potential of multiple genera infections in some hosts. Obtained results indicate that strongylid communities of Asian NHPs may be less species-rich than those in African NHPs, where multi-genera communities are reported. These findings provide an exciting first insight, however, further sampling is required to better capture the true genetic diversity of strongylid communities in Asian NHPs. Such knowledge can contribute baseline data to assist with ongoing monitoring of health threats to wild NHPs.

PSGB Winter Meeting

Juvenile bonobo (*Pan paniscus*) proximity and reliance to their mother in captivity

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Wild ape juveniles rely on their mother to facilitate social and ecological knowledge which requires them to be in close proximity whilst their role in a zoo setting has been less explored. We investigated whether captive juvenile bonobos (*Pan paniscus*) spent more time at a distance greater than 5 metres from their mother and whether they were less reliant on her due to the predictability of a captive environment compared to that of the wild. Research was conducted at Twycross Zoo with a sample size of three juveniles, two males and one female. Using continuous focal sampling on each subject between 2 and 4 times each day over 18 days, time was recorded for duration each bonobo was less than and greater than 5 metres from its mother, contact time with its mother and time taken to return after an agonistic interaction. Overall amount of time was also recorded for behaviour, which was split into grooming, resting, play, eating and other. Data collected was combined for analysis for each variable. Results for distance returned significant results, showing there is a possible link that less reliance is needed in a captive environment. Results for time spent on each behaviour returned varied results with particular interest in grooming as most time was spent on this behaviour, compared to previous studies conducted in the wild where those results showed it was one of the least seen behaviours. This study has allowed a starting point when looking at reliance a juvenile bonobo has with their mother in captivity, however further studies should be undertaken to help future management of the species in zoos.

Chimpanzees demonstrate intraspecific variation in dominance style and are not more despotic than bonobos

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Variation is the cornerstone of evolutionary theory, yet variation in animal social behaviour is more often examined between species than within species. Moreover, measures of social constructs are rarely verified by examining their covariation patterns. Dominance style (the strictness with which dominance is enforced, ranging from 'despotic' to 'tolerant') is a fundamental component of social relationships in many animal species, but how it is best measured and how it varies within species is poorly understood. Bonobos are traditionally viewed as more tolerant than chimpanzees though some recent experimental data has challenged this assumption. However, the dominance style of *Pan* has never been empirically examined using verified dominance style measures. Using observational data from ten groups of chimpanzees and bonobos (one wild, four captive, in each species), we assessed the co-variation of seven social measures both within and between species. Using principal components analyses, we identified candidate measures of dominance style and developed a behavioural index in each species. We found no evidence that chimpanzees and bonobos differed in dominance style at a species level. Rather, we found considerable intra-species variation in dominance style in chimpanzees, and found greater tolerance for same-sex partners in male chimpanzees than females. In contrast, the bonobo groups exhibited low intra-species variation in dominance style. Our results contradict the narrative that bonobos are more tolerant than chimpanzees, and instead highlight striking behavioural flexibility in chimpanzee dominance style.

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Hand injecting troop of bonobos for the Influenza vaccination

Jen Bridges

Twycross Zoo, UK

Twycross Zoo, UK, is the only zoo in the UK to house the 4 great ape species. Due to their close genetic relationship, bonobos are susceptible to many of the same diseases as humans, including the influenza virus. Influenza can have serious consequences and in 2021/22 during the zoos influenza vaccination programme the keepers undertook extensive training from the veterinary team to administer the vaccine to 11 bonobos successfully vaccinating them by hand injection via positive reinforcement training.

The Zoo has received a BIAZA Bronze Award for excellence in 'Animal Husbandry, Care and Breeding' in recognition of the highly-skilled animal and veterinary teams' work to improve the health and welfare of its bonobo group.

Open wound management of a Chimpanzee

Jen Bridges

Twycross Zoo, UK

In 2019 at Twycross Zoo, UK, a 32-year-old male chimp sustained a large avulsion wound measuring 15cmx15cm after a fight. Emergency surgery was performed to clean and close the wound up. The troop of chimps picked at the stitches therefore it was managed as an open wound. The chimp was trained via positive reinforcement daily to allow treatment with daily saline flushing, applying topical treatments (prontosan, hydrogel, collagen particles, and barrier spray), debridement and class 4 laser therapy. The chimp was trained to allow the laser therapy for a duration of 4 minutes per treatment. Successfully managing this wound has allowed for no further anaesthetic or surgery. Each session and treatment provided was on the chimpanzee's terms using positive reinforcement training with a food reward so he presented his leg multiple times daily to be assessed and managed. The wound healed fully within 6 months.

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Effect of maternal style on infant tantrum behaviour in chacma baboons (*Papio ursinus*)

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Tantrums are common in many primate species and have been described as a manifestation of mother-offspring conflict. In the human literature, tantrums have been examined in the context of both parent-offspring conflict (POC) and attachment theory while in nonhuman primates, tantrums have been described primarily from a POC perspective. In order to test contrasting predictions of the effect of maternal style on infant behaviour generated by the two different frameworks of attachment theory and POC, we investigated how tantrum behaviour varies according to maternal style, using four years of demographic and behavioural data from wild chacma baboons (*Papio ursinus*) at Tsaobis Baboon Project in Namibia. We used principal component analysis (PCA) on behavioural data from 64 mother-infant (aged 0-18 months) pairs and found that maternal behaviour varied along two axes: protectiveness and rejection. We used the corresponding PCA scores to determine maternal style. We then tested the hypotheses that: according to POC, infants of more rejecting mothers would throw more tantrums to elicit more investment; and, according to attachment theory, infants of more rejecting mothers would be less likely to throw tantrums due to the relatively low maternal responsiveness. We analysed tantrum behaviour using a generalised linear mixed model (GLMM) and found four potential factors influencing tantrum occurrence: maternal protectiveness, maternal rejection, sex of the infant, and mother's parity. Infants with more rejecting mothers had more tantrums, and infants whose mothers were more protective had fewer tantrums. Variation in protectiveness was the most significant predictor for tantrum occurrence. Our results are in line with predictions based on POC theory rather than those of attachment theory. A looser definition of attachment than that used in the human literature is likely to be more productive in the context of nonhuman primates and can be used to form predictions under a POC framework.

Application of Holistic Assessment & Evaluation in Treating the Traumatic Injuries of a Zoo-Housed Chimpanzee (*Pan troglodytes*) within a Multi-Male/Multi-Female Community Socially-Managed Under the Ethos of Restricted Intervention

Lloyd Antrobus

Twycross Zoo, UK

Intragroup aggression and the treatment of resulting injuries remains a critical aspect of progressive chimpanzee (*Pan troglodytes*) welfare and social management. In September 2022, *Jambo*, a 40-year-old male chimpanzee at Twycross Zoo sustained a significant traumatic injury to the sole and dorsum of the right foot, likely acquired as a result of intragroup aggression. Triggered by a cycling female, an increase in intragroup aggression was observed prior to the injury. While allowing hierarchical disputes to unfold by limiting human interference may lead to injury, facilitating such agency and natural sociality within multi-male/multi-female communities is widely considered to improve overall physical, psychological, and social welfare. Within the ethos of restricted intervention strategies of social management, holistic multi-stakeholder assessments and evaluations concluded that despite the severity of the injury, surgical intervention, at that time, was not the right course of action. Holistic assessments and evaluations outlined: severe pre-existing cardiac disease placing *Jambo* at high-risk for complications under general anaesthetic; social consequences of brief removal of the dominant male at a critical social juncture; *Jambo's* positive behavioural response to an intensive programme of positive reinforcement training required to capture and shape new behaviours that allow for the application of topical treatment; behavioural responses indicating that the injury and course of treatment were not compromising the social welfare of either *Jambo* or the wider community; positive behavioural and healing response to previous treatment of more minor wounds; and that despite minor limitations to his mobility, *Jambo* continued to exhibit normal behavioural markers and social responsibilities of a dominant male chimpanzee. While there is undoubtedly no uniform approach to treating the wounds of zoo-housed chimpanzees, continuous holistic assessment and evaluation resulted in wound recovery without compromising the sociality, agency, and physical welfare of both *Jambo* and the wider community of chimpanzees at Twycross Zoo.

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Left versus Right: Lateralized Behaviour in Captive Javan Gibbons, *Hylobates moloch*

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This study investigated handedness in captive Javan gibbons, *Hylobates moloch*. Field studies have suggested that, contrary to humans and most great apes who are right-handed at the population level, Hylobatids may be left-handed at the population level, but not enough research has been done on this group to allow for a clearer picture of handedness and findings from wild and captive populations are somewhat conflicting. Hand preferences have been suggested to occur because of posture. The Postural Origins (PO) Theory postulates that terrestrial primates are more likely to be right-handed in contrast to arboreal primates are more likely to be left-handed due to the right-hand being used for balance demands. Thus gibbons, as highly arboreal primates, are predicted to be left-handed. In this study, conducted at Howlett's Wild Animal Park, UK, I focused on captive gibbon handedness during a range of natural behaviours: leading limb, feeding, bracing, self-scratch, and resting arm cross, to see if the data was in line with the predictions from the PO theory that gibbons have a left-hand bias at the population level. I also tested for sex differences in handedness of the individual behaviours, for differences between adults versus juveniles for the individual behaviours, and for evidence of task specialisation. I found the gibbons had a left-hand bias at the population level as well as a significant left-hand bias in their leading limb. There was no task specialization in relation to handedness, and no difference in handedness across age groups, but sex did influence hand preference when comparing all the tasks together. Males showed more of a bias towards the left hand than females.

The Effect of Zoo Construction Noise on Great Ape Behaviour and Welfare

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It is commonly accepted that anthropogenic noise can have negative effects on wildlife (e.g., impaired communication, altered mating behaviours). In contrast to those living in the wild, animals in captivity cannot withdraw as easily from acoustic stressors. Long-term stress can have detrimental consequences on physical and mental health and thus it is important to monitor sources of noise to assess potential welfare impacts. Within the zoo context, the impacts of building work have been little studied. Construction related to both new facilities and the renovation of existing ones produces potentially negative stimuli, but it remains uncertain which are the most salient and what their effects may be. In this study, we are investigating the impacts of construction on one troop (N=5) of Western lowland gorillas (*Gorilla gorilla gorilla*) and one troop (N=5) of Sumatran orangutans (*Pongo abelii*) housed at the Durrell Wildlife Conservation Trust, Jersey, Channel Islands; and one troop (N=6) of Western lowland gorillas and one troop (N=14) of common chimpanzees (*Pan troglodytes*) housed at Twycross Zoo. Both zoos are constructing new buildings located relatively close to the animals' enclosures. During the initial construction phases, we are assessing the sound- and vibrosapes emerging from the construction work. Simultaneously, the animals' responses are closely monitored through behavioural observations and hormonal analyses (faecal cortisol). The ape species in this project function as models to understand salient aspects of construction noise on primate welfare. The knowledge produced will enable the development and realisation of effective mitigation measures to preserve welfare during construction work.

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The hooded capuchin monkey is Vulnerable in Paraguay and at least Near Threatened globally according to Red List Criteria

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Habitat loss and fragmentation, particularly because of agrarian and urban expansions, are threatening biodiversity worldwide. Paraguay is predicted to lose all its primary moist forests by 2028. The most endangered habitat in Paraguay is the Upper Paraná Atlantic Forest (BAAPA) that has been decimated by industrial agriculture in the last 60 years. The hooded capuchin is the best-known Paraguayan primate and the only species mostly restricted to BAAPA fragments. Here we used local knowledge (local defined as people living permanently in Paraguay, including the first author) about the known presence of the species in habitat fragment to assess whether species presence was associated with forest cover in fragments. We found that the presence of hooded capuchins required predominance of forest cover with the monkey being 80% likely to be present for 56% cover, and 90% for 70% cover. We then assessed how forest cover changed through the *Sapajus cay* range and for *S. cay*'s predicted range in Paraguay using Global ForestWatch forest cover prediction for 2000 to 2019. The capuchin has lost 23% of highly suitable habitat across its whole range and 58% in Paraguay. Suitable habitat for hooded capuchin monkeys is therefore decreasing across the full extent of the species. In Paraguay, the remaining habitat is being fragmented and degraded and distance between fragments is increasing. As the situation in Paraguay is critical, we recommend that the capuchin be classified as Vulnerable at a national level under criterion B1, b(i), b(ii) and b(iii). Predictions across the species range warrant at least a classification of Near Threatened for the species.

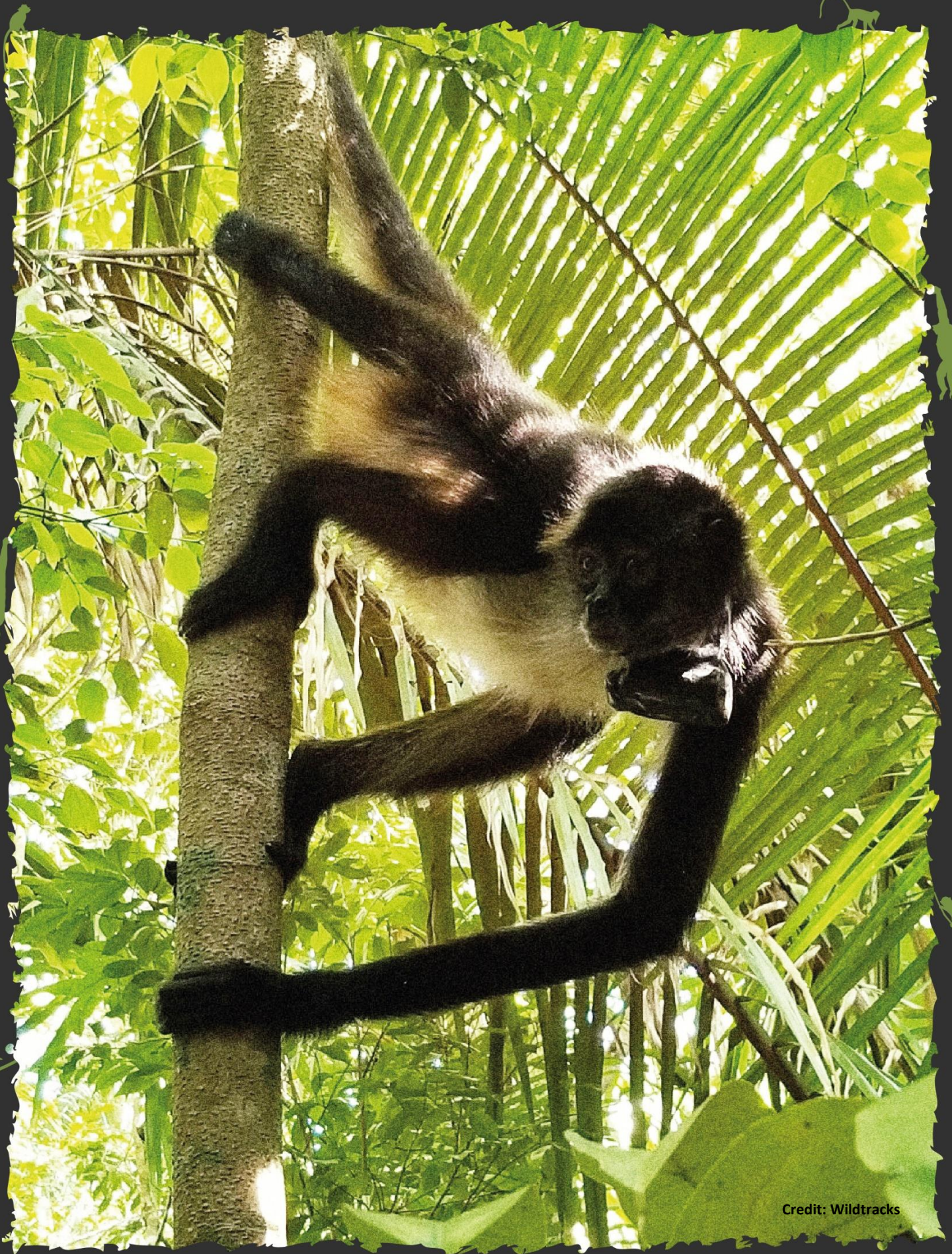
Wildlife bridges to reduce electrocutions and other road-related fatalities for mantled howler monkeys (*Alouatta palliata*) in Costa Rica

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Roads and other linear clearings pose a major restriction to wildlife movement, including arboreal primates. The principal cause of this problem is urban and rural development projects, which increases forest fragmentation and forces arboreal wildlife to cross roads on the ground or on electrical wires. Costa Rican officials have reported high rates of death by electrocution for the Vulnerable mantled howler monkeys (*Alouatta palliata*) making such crossings. To address this issue, we were granted funding from the PSGB Conservation Grant in 2021 to build canopy bridges in high fatality areas in the Nicoya Peninsula. Working with partners from the Costa Rican national electricity and telecommunications agency who safely installed the bridges, we were able to put up five bridges and to monitor four of these with camera traps. Further internal funding from the University of South Wales in 2022 allowed us to expand the project, and we currently have 9 arial bridges in place, 5 with camera traps installed. The bridges have a vertical ladder design; the lower rope is of a wide diameter (25mm) and the upper rope is a narrower one which the animal can use for balancing with their tail. Each bridge and camera pair costs approximately £300 excluding labour. This is an ongoing, small scale conservation project, so while we have videos and sightings of monkeys using the bridges, we do not yet have firm results on whether they have reduced road-related fatalities in the area. However, the PSGB conference offers an excellent opportunity to speak to colleagues working on arial bridges elsewhere in the world, to discuss how the animals move on the bridges and ways to improve their design, and to share best practices for wildlife bridge projects.

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Credit: Wildtracks

