2nd International Pangolin Conference (IPC)

Pangolin Conservation, Illegal Trade & Rehabilitation

Skukuza Rest Camp, Kruger National Park

South Africa

12 – 17 September 2021

Cover photograph: Francois Meyer

Welcome Note

Pangolin species globally are now faced with a very real probability of extinction, primarily as a result of unprecedented levels of poaching on natural wild populations. The four Asian species are reaching critically low population levels and the four African species are now experiencing extensive poaching and illicit trade volumes to compensative for the low availability of pangolins in the Asian market. Local harvest and trade has also been found to be completely unsustainable for these mammals with a naturally low population recruitment. However, this group of rare mammals has received increased attention from the scientific community and many aspects of their ecology, biology and physiology are now being investigated.

This conference is an attempt to bring together scientists, animal welfare and animal rights organisations, conservationists and government officials from across global pangolin range states to share their knowledge and expertise gained from their experience and research with regards pangolin ecology, biology, conservation, rehabilitation, cultural use and trade.

We hope that this interactive experience, both virtually and in person by delegates, in this beautiful savanna African setting will forge friendships, collaborative projects and help us to better understand, manage and conserve these illusive, rare and fascinating mammals. We further hope that your stay at Skukuza or your virtual attendance will be a most enjoyable and memorable one.

Ray Jansen
Chairperson of the conference organising committee

Conference proceedings

The opening address will focus on the plight of pangolins Africa and their current conservation status with a focus on South Africa. Ray Jansen will present some of his research findings on this trade and through his students over past five years.
Abstracts of all oral and poster presentations are available in this Booklet.

Presentation information

For those delegates presenting in person, a laptop computer, data projector and overhead screen will be available throughout the Symposium. The presenters are requested to bring their PowerPoint presentations on a USB in order to load it on time before each session. For those delegates presenting remotely, they can please access the webinar via the Zoom Webinar links provided.

Catering

Throughout the duration of the conference, morning and mid-afternoon tea/coffee breaks will be available at the conference venue, while a daily buffet lunch will be served in the Amukelekani Restaurant located in the Skukuza Safari Lodge.

Game drives

Three daily game drives (morning, sunset & night) depart from the front of the main camp reception. These can be booked with the africaMASSIVE staff at the conference centre reception desk.

This conference is hosted by the African Pangolin Working Group; a South African Government approved non-profit organisation dedicated to the conservation of Africa's pangolins.

https://www.pangolin.org.za
https://www.facebook.com/pages/African-Pangolin-Working-Group/513407302073363

Conference programme

DAY 1, 13 SEPTEMBER 2021 PANGOLIN TRADE & TRADITIONAL USE Chair: Alexis Kriel	
09:00 – 09:15	Opening and welcome: Alexis Kriel (Co-Chairperson of the APWG)
09:15 – 10:15	Opening Address *Scales of injustice: Africa's poor, poached pangolins & the impact of the global pandemic* Ray Jansen: Outgoing Chairperson and founder of the African Pangolin Working Group, Member of the IUCN Species Survival Commission Pangolin Specialist Group; Professor at Tshwane University of Technology, South Africa
10:15 – 11:00	Tea
11:00 – 11:30	*The hunting, consumption, and trade of pangolins in sub-Saharan Africa* Daniel J Ingram
11:30 – 12:00	*Business as usual: limited impact of national bans and coronavirus on the sale of pangolins in a major urban bushmeat market in Cameroon* Jessica Harvey-Carroll, Franklin T. Simo, Timm Sonn-Juul, Jean Pierre Tsafack, Serge Aka'a, Francis Nchembi Tarla, Andrew Fowler, Daniel J. Ingram
12:00 – 12:30	*Retrieval, survival and post-release monitoring of Temminck's pangolins (Smutsia temmickii) retrieved out of the illegal wildlife trade in South Africa* Francois Meyer, Lourens Swanepoel[1] & Raymond Jansen
12:30 – 13:00	*Ecology of Temminck's pangolin in north-central Namibia* Kelsey Prediger , Morgan Hauptfleisch, and Monique MacKenzie
13:00 – 14:00	Lunch
14:00 – 14:30	*Developing and testing improved methods for species identification and estimate the number of Indian pangolins (Manus crassicaudata) from scales seized in the illegal trade* Priyan Perera and Hirusha Randimal Algewatta
14:30 – 15:00	*Assessing the feasibility of introducing Temminck's pangolin (Smutsia temminckii), recovered from the illegal wildlife trade, into a private game reserve in Kwa-Zulu Natal, South Africa* Craig Sholto-Douglas, Charli De Vos, Simon Naylor[1] & Ray Jansen
15:00 – 15:30	*Pangolin.Africa – teaming up to save a species* Helena Atkinson & Machel Van Niekerk
15:30 – 16:00	Tea & end of day one

DAY 2, 14 September 2021 PANGOLIN CONSERVATION & REHABILITATION Chair: Nicci Wright	
09:00 – 09:15	Opening and announcements: Nicci Wright
09:15 – 09:45	*Do Malaysians care? A survey of the Malaysian public towards the Sunda pangolin* Chong, J. L. & Gogelawanan, K.
09:45 – 10:15	*Sifting through the bag scales: a multidisciplinary review of pangolin science, patents and public interest* S Heighton and P Gaubert
10:15 – 11:00	Tea
11:00 – 11:30	*Engaging local communities in pangolin conservation in the eastern DRC community-managed forests* PALUKU MBUSA Omer, MITONDO HAMISI Alain
11:30 – 12:00	*Conservation of the globally endangered pangolin and its habitat through research, education and community conservation programs in Sindhupalchowk district, Nepal* Prativa Kaspal
12:00 – 12:30	*Reference intervals for selected haematological and clinical biochemistry measurands in Temminck's pangolin (Smutsia temminckii)* K Lourens, EH Hooijberg, L Meyer
12:30 – 14:00	Lunch
14:00 – 14:30	*Raising five white-bellied pangolin pups in Nigeria* Maria Diekmann, Rare & Endangered Species Trust
14:30 – 15:00	*Ireti: the tale of a Nigerian pangolin* Mark Rume Ofua
15:00 – 15:30	*The rescue, rehabilitation and release of pangolins* Nicci Wright Jessica Jimerson
15:30 – 16:00	Tea & end of day two

DAY 3, 15 SEPTEMBER 2021 PANGOLIN BIOLOGY & ECOLOGY Chair: Ray Jansen	
09:00 – 09:15	Opening and announcements: Ray Jansen
09:15 – 09:45	*Molecular estimation divergence time scale of Indian Pangolin (Manis crassicaudata) found in Sri Lanka from the Indian mainland* H. R. Algewatta, B. G. D. N. K. de Silva, P. K. P. Perera, , L. D. C. Peiris
09:45 – 10:15	*Conservation genetics of pangolins in the Congo Republic* Bernáthová I, Swiacká M, Hulva P, Loubassou C B V & Černá Bolfíková B
10:15 – 11:00	Tea
11:00 – 11:30	*Use of camera trap data to monitor the cryptic Indian pangolins (Manus crassicaudata): A case study from a tropical lowland rainforest in Southwest Sri Lanka* Priyan Perera and Hasitha Karawita
11:30 – 12:00	*Pangolins exhibit behavioural and physiological plasticity in response to fluctuations in climate and food availability in their natural environment* Wendy Panaino, F. Parrini, R. Hetem, L. Meyer, D. Smith, G. van Dyk, and A. Fuller
12:00 – 12:30	*Population genetics of the white-bellied pangolin (Phataginus tricuspis) in the Dahomey Gap (West Africa): challenges for tracing the local trade* Stanislas Zanvo, Sylvestre C.A.M. Djagoun, Fortuné A. Azihou, Bruno Djossa, Komlan Afiademanyo, Ayodedji Olayemi, Clément Agbangla, Brice Sinsin[1], Philippe Gaubert
12:30 – 14:00	Lunch
14:00 – 14:30	*Judiciary and law enforcement education initiatives to combat illegal pangolin trafficking within the Greater Limpopo Transfronteir Conservation Area* Alexis Kriel
14:30 – 15:00	*To thwart pangolin trafficking at international level, there's a dire need to empower local organisations, implicate local communities and ensure an effective local justice system favorable to wildlife* Adams Cassinga
15:00 – 15:30	*Pangolin Crisis Fund* Paul Thomson & Araluen Schunmann
15:30 – 16:00	Tea & end of day three

DAY 4, 16 SEPTEMBER 2021 IUCN SSC PSG WORKSHOP Chair: Matt Shirley and Keri Parker	
09:00 – 12:00	Conservation planning for *Smutsia temminckii* Attendees will be sent a link to join in the workshop closer to the time. Attendance is free of charge.

Oral Presentation Abstracts

Scales of injustice: Africa's poor poached pangolins and the impact of the global pandemic

Ray Jansen
African Pangolin Working Group & Tshwane University of Technology, Pretoria, South Africa

Africa's four pangolin species have been harvested and used in cultural remedies by local communities throughout Africa for as long as resident people can remember. However, the purpose of this harvest has recently changed to accommodate the huge demand for pangolin scales from Asia, in particular, from China. The level of this illegal trade has reached unprecedented levels to the point that Africa's pangolins face a real threat of extinction. The large majority of scales are exported out of West Africa, Nigeria being the epicenter. Within central and west Africa, this trade is in pangolin scales and few to no live animals are traded outside of the bushmeat commodity chain. The opposite is true in southern Africa and in South Africa almost all the trade in pangolins are live animals. In this country, pangolins are retrieved through intelligence driven sting operations, retrieved, hospitalized and then released through an intense post-release monitoring program that ensures release success and adaptation to a wild existence once more. Here, I elaborate on the trade in pangolins in Africa, volumes as well as source and destinations countries as well as on sting operations in South Africa and the facilitated release program and post-release monitoring.

The hunting, consumption, and trade of pangolins in sub-Saharan Africa

Daniel J Ingram
African Forest Ecology Group, Biological and Environmental Sciences, University of Stirling, UK, danieljohningram@gmail.com

The intercontinental trade of African pangolins to Asia is now well-known, yet the way in which people use pangolins within Africa has received less attention. Here, I examine the role that pangolins play in human societies and diets in sub-Saharan Africa. I present data from several studies on the hunting, consumption, use, and trade of pangolins in Africa. The data presented comes from a variety of studies that are based on extensive literature reviews, collating bushmeat datasets and information on seizures, and field surveys. Firstly, I consider the prevalence and frequency of pangolin hunting, outlining the contexts of hunting and methods used to hunt pangolins. Secondly, I present information on the state and availability of pangolins on local bushmeat markets, and examine the contribution of pangolins to diets. Finally, I consider consumptive uses of pangolins other than for food. Across these studies, I show that pangolins are widely consumed across their range, particularly in West and Central Africa, and that pangolins feature in a variety of traditional medicines and cultural activities.

Business as usual: limited impact of national bans and coronavirus on the sale of pangolins in a major urban bushmeat market in Cameroon

Jessica Harvey-Carroll[1,†], Franklin T. Simo[2,†], Timm Sonn-Juul[3], Jean Pierre Tsafack[4], Serge Aka'a[5,6], Francis Nchembi Tarla[5,6], Andrew Fowler[6], Daniel J. Ingram[7*]

[1]School of Psychology and Neuroscience, University of St Andrews, St Andrews, UK
[2]Laboratory of Zoology, Department of Biology and Animal Physiology, University of Yaoundé I, Yaoundé, Cameroon
[3]Section of Biology and Environmental Science, Department of Chemistry and Bioscience, Aalborg University, Fredrik Bajers Vej 7H, 9220 Aalborg, Denmark
[4]Independent Researcher, Yaoundé, Cameroon
[5]Central African Bushmeat Action Group (CABAG), PO Box 16463 Yaoundé, Cameroon
[6]Zoological Society of London – Cameroon, Yaoundé, Cameroon
Biological and Environmental Sciences, University of Stirling, Stirling, FK9 4LA, UK
[†]These authors contributed equally.
**Corresponding author: danieljohningram@gmail.com*

Cameroon, like many other Central African countries, has a long history of bushmeat consumption. Pangolins have been hunted for generations for bushmeat, and in more recent times, their scales have been illegally exported to Asia. Harvesting pangolins has been prohibited in Cameroon since 2017, yet despite this, pangolins are still commonplace on bushmeat markets. During the coronavirus pandemic global attention turned to bushmeat markets, with pangolins first being suspected as the intermediate host of the COVID-19 virus. A continuation of pangolin trade in West and Central Africa has been anecdotally recorded throughout the peak of COVID-19. The dynamics of pangolin sales in Cameroon have yet to be documented.

We present data on the market availability of giant and arboreal pangolins before (2017,2018) and during the COVID-19 pandemic. We found a significant decrease in mean daily counts of arboreal pangolins during the peak of the COVID-19 pandemic, when compared to 2017/2018. No such decrease was found for giant pangolins. Despite the decrease, arboreal pangolins were found consistently in daily surveys. We found no trends in total daily market counts of arboreal pangolins during 2020. We also found no trend when pangolins were separated by state sold (live, fresh or smoked). Due to the continued presence of pangolins throughout 2020, our results likely reflect the belief that bushmeat is safe to eat, as there have been no previous health consequences when bushmeat was eaten during similar epidemics. This is a concerning finding given the rapidly declining CITES listed African pangolin populations.

We documented continuous sales of pangolins following the 2017 protection legislation in a popular, urban bushmeat market. This highlights the importance of pangolins as an income source to Cameroonians. The easily accessible sales suggest law enforcement at a local level is critical to conserve African pangolins.

Ecology of Temminck's pangolin in north-central Namibia

Kelsey Prediger [1], Morgan Hauptfleisch [1], and Monique MacKenzie [2]

[1] Biodiversity Research Centre, Namibia University of Science and Technology, Windhoek, Namibia, kpred3@gmail.com
[2] Centre for Research Into Ecological and Environmental Modelling (CREEM), University of St. Andrews, St. Andrews, Scotland

The Temminck's pangolin is one of the most understudied and poorly understood southern-African mammals and research has demonstrated highly variable results in their ecology, home range size, and behaviour. This study represents the first research in Namibia, focusing on the ecology of Temminck's pangolin in the central shrub savannah habitat of Namibia on a fenced private nature reserve. The study was conducted from September 2018 to March 2020 utilizing VHF telemetry, GPS tracking, and field observations. During the surveyed period it was unusually dry and the annual rainfall for the 2018-2019 rainy season was 218mm – just half of the annual average of 450mm. A total of 46 resident individuals were identified on the 22,000 hectare private reserve and 36 were tagged. Population dynamics were determined to be 36% female, 57% male, and 7% the individual's gender was not determined. Home range and core area were calculated using 95% and 50 % Kernel Density models and CReSS analysis during the growing and non-growing seasons. MCP was analysed for seven individuals which had sufficient data for both seasons. There was no significant difference in home range and core area sizes between the growing and non-growing season, however, male ranges were significantly larger than females, and a polygynous mating system was observed. Based on pitfall surveys and foraging sample collection, study individuals were observed to forage selectively on 6 of the 27 ant and termite species available. During the drought, all individuals lost significant body condition and between July 2019-November 2019, 16 tagged individuals died. For 12 of the 13 individuals (which were able to undergo post-mortem), the primary cause of death was malnutrition with other underlying disease. The findings of this research are very useful in establishing conservation management plans and release protocols for pangolin in Namibia.

Retrieval, survival and post-release monitoring of Temminck's pangolins (*Smutsia temmickii*) retrieved out of the illegal wildlife trade in South Africa

Francois Meyer[1,2], Lourens Swanepoel[1] & Raymond Jansen[2,3]

[1]*Department of Zoology, University of Venda, P/Bag X5050, Thohoyandou, South Africa*
[2]*African Pangolin Working Group https://africanpangolin.org/*

[3]*Department of Environment, Water & Earth Science, Tshwane University of Technology, Pretoria, South Africa*

All species of pangolin are currently considered vulnerable to extinction, with their numbers rapidly declining due to the excessive demand for pangolin scales from the illegal trade. This trade is often highly organised and lucrative, making it extremely problematic to counteract. These factors contribute to pangolins now being regarded as the most illegally trafficked mammals on Earth. Within the trade, pangolins are often kept in dire conditions and in cases where they have been recovered, they rarely survive the ordeal. For those that do survive, many assumptions are made when releasing them back into the wild, with only a few cases where actual monitoring has taken place post-release. This study aims to investigate: the demographics of Temmick's pangolin which has been confiscated from the illicit trade in South Africa, the condition of the animals retrieved, survival between release strategies, and their distribution following release subsequent to veterinary treatment. Study animals were fitted with appropriate tracking equipment and monitored post-release to monitor movement and survival. Living pangolins confiscated in South Africa increased from 8 in 2016 to, 40 in 2018, but declined to 25 in 2019, with confiscations peaking during the cold and dryer seasons of winter and spring. Of the pangolins that were successfully confiscated, 63.2% were adult, 14.7% were sub-adult and 22.1% were juveniles. 68% of these pangolins were found in a compromised state. The soft-release approach has become the preferred method of release in South Africa, and current evidence suggest that it has a positive effect on pangolin survival, but more research is still required. Trade-related stress was the main root of mortalities and a great cause for concern. Sex of animal played no significant role in susceptibility to poaching, or in survival. Post-release monitoring revealed that released pangolins can travel vast distances, and this needs to be taken into consideration when selecting release sites and tracking equipment. Facilitated release procedures have proven to be effective in improving survival probability, but improvements can still be made in all aspects of recovery, treatment and release protocols.

Developing and testing improved methods for species identification and estimate the number of Indian pangolins (*Manus crassicaudata*) from scales seized in the illegal trade

Priyan Perera[1, 2] and Hirusha Randimal Algewatta[1]
[1]*Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka, priyan@sjp.ac.lk*
[2]*IUCN SSC Pangolin Specialist Group, C/o Zoological Society of London, Regent's Park, London, NW1 4RY United Kingdom*

The Indian pangolin (*Manis crassicaudata*) is the only pangolin species recorded in Sri Lanka. Overexploitation of Chinese pangolin (*Manis pentadactyla*) and Sunda pangolin (*Manis javanica*) populations in Asia is believed to have resulted in increased exploitative attention on *M. crassicaudata* in Pakistan, India and possibly Sri Lanka for illicit international trade. Recent confiscations of pangolin scales by Sri Lankan law enforcement authorities and growing incidents of poaching pangolins for illegal trade further hint at the existence of local niche markets for pangolin scales with the possibility of international trade. Lack of awareness and knowledge among ground-level law enforcement officials in identifying pangolin scales and other traded body parts and the absence of robust species-specific methods to estimate the number of animals in confiscated consignments of pangolin scales can be identified as major impediments in effective law enforcement in the Sri Lankan context. Hence, studies focused on describing scale morphology in species identification and developing methods to establish accurate conversion parameters to estimate number of individuals are of priority. This study describes the morphological features of *M. crassicaudata* scales and proposes improved methods to estimate the number of pangolins in the illegal trade to inform law-enforcing authorities. Based on the observations of 25 specimens, an Indian pangolin, on average possess 511 scales. Three morph-types of scales were identified: broad rhombic (n=411), elongated kite shape (n=69), and folded shape scales (n=31). Based on the average frequency and mean dry weight of each scale morph type, the species-specific dry weight of scales for Indian pangolin was 3.6kg, which is approximately 27.5% of full body weight. Accordingly, new and improved methods based on scale morph-type frequencies and dry weight to estimate the number of Indian pangolins from quantities of scales are proposed. Their accuracy was compared with methods currently in practice, and the improved methods found to be more accurate.

Assessing the feasibility of introducing Temminck's pangolin (*Smutsia temminckii*), recovered from the illegal wildlife trade, into a private game reserve in Kwa-Zulu Natal, South Africa

Craig Sholto-Douglas[1], Charli De Vos[1], Simon Naylor[1] & Ray Jansen[2]
[1]Phinda Private Game Reserve, Mun-ya-wana Conservancy, Kwa-Zulu Natal, South Africa
[2]African Pangolin Working Group, Gauteng, South Africa
[1]andBeyond Phinda Private Game Reserve, Hluhluwe, 3960, (035) 562 4500, craig.sholto-douglas@andbeyond.com
[2]African Pangolin Working Group

Since the beginning of June 2019, fourteen Temminck's pangolin (*Smutsia temminckii*), rescued and rehabilitated by the Johannesburg Wildlife Veterinarian Hospital and the African Pangolin Working Group, have been released onto the Mun-ya-wana Conservancy. These are the first pangolins known to inhabit the reserve in over 40 years, following a local extinction driven primarily by hunting and poaching for the illegal international and local traditional trades, and the erection of electric fences. Telemetry and data logger tracking units were deployed on each pangolin before release in order to monitor the post-release health and collect fine-scale movement and behavioural information. Intensive post-release monitoring aimed to assess the feasibility of such reintroductions, and to acquire a better understanding of the ecology of this species for future assessments, including: habitat suitability, territory size, movement and activity patterns, and diet preferences. As of August 2021, four mortalities have been recorded (crocodile, biliary, electric fence, and euthanasia), four have had their tags bitten off by predators and are no longer monitored, and seven are still being monitored. One pup has been born since the inception of the project with another female suspected to have lost her pup shortly after birth. More than 70% of released individuals displayed territoriality and exhibited behaviour suggesting they had settled in their new environment. Since release, the pangolins have had to be retrieved due to proximity to high risk areas on 34 occasions, 110 tags have been deployed, and 28 veterinary consults have been required for sick or injured pangolin.

Pangolin.Africa – teaming up to save a species

Helena Atkinson[1] and Machel van Niekerk[2]
[1]*Pangolin.Africa, Cape Town, South Africa, helena@pangolin.africa*
[2]*Kalahari Wildlife Project, Northern Cape, South Africa, kalahariwildlife1@gmail.com*

Pangolin.Africa was founded in 2018 and is a non-profit organization, dedicated to the conservation of the four African pangolin species. The organization was founded by Pangolin Photo Safaris, who have committed to funding the start-up operational requirements of the NPO. Pangolin.Africa is run by a team of staff with many years of experience in the conservation, tourism and non-profit fields.

We have been working with the tourism industry and pangolin experts to develop pangolin viewing protocol for the tourism industry. The tourism industry has become a major contributor to the conservation sector. As the plight of the pangolin becomes more dire, more and more organizations would like to support and be involved in pangolin conservation. Tourists are often attracted to operators that do work for conservation and they can often be potential funders of that conservation work. Tourism is definitely seen as a valuable contributor to pangolin conservation.

The fact there is a rise in interest in pangolins and in properties offering 'pangolin experiences', having some norms and standards for the industry is crucial. Through this project, we aim to educate the tourism industry and to provide guidelines for pangolin encounters. We have developed a set of tourism industry protocol (guidelines) for pangolin encounters in Africa. This has been a process that took place over 12 months and involved getting data from guides, rangers and trackers and we then got further input from industry conservation experts. We would now like to present to this industry for adoption.

Together with the Kalahari Wildlife Project we form the only registered pangolin rehabilitation facility in the Northern Cape and we support local law enforcement with the rehabilitation of pangolins retrieved from the illegal wildlife trade.

Do Malaysians care? A survey of the Malaysian public towards the Sunda pangolin

Chong, J. L. & Gogelawanan, K.
Faculty of Science & Marine Environment, Universiti Malaysia Terengganu, 21030 Kuala Nerus, Terengganu, Malaysia, julian@umt.edu.my

The Sunda pangolin (*Manis javanica*), which is the only pangolin species found in Malaysia, is critically endangered due to the demand for their scales and meat. The present study was conducted to determine Malaysians' knowledge, awareness and attitude towards the Sunda pangolin. An online survey was employed in this study, with three sections; demographics, knowledge and awareness, and also the attitude of the Malaysian public towards the species. A total of 500 respondents replied, but only 328 were considered based on their ability to correctly recognize the Sunda pangolin. The Mann Whitney and Kruskal Wallis tests were conducted to test significant differences following which a chi square test was used to investigate the association where significance difference was indicated ($P<0.05$). Our results indicate significant differences where higher levels of awareness and knowledge was recorded in males, older respondents, those with higher level of academic attainment, individuals working with the government, and respondents under the M40 socioeconomic group. However association for knowledge and awareness was only recorded with the age, academic attainment, profession sector and socioeconomic status of the respondents. Significance difference was also recorded with divorcees and singles, and those having higher academic attainment having excellent attitude towards the Sunda pangolin, with association was recorded with the respondents' marital status and academic attainment. The majority of the Malaysian public in this study showed poor knowledge (n=218), whereas the majority had a positive attitude (n=311). As such, focused education from a young age has to be nurtured, while social media can play an important role in disseminating knowledge and importance of the Sunda pangolin in the ecosystem to Malaysians.

Sifting through the bag scales: a multidisciplinary review of pangolin science, patents and public interest

S Heighton[1] and P Gaubert[1]

[1] Laboratoire Evolution et Diversité Biologique, UPS/CNRS/IRD, Université Paul Sabatier, 118 route de Narbonne, Bât. 4R1, 31062 Toulouse, France. sean-paul.heighton@univ-tlse3.fr & philippe.gaubert@univ-tlse3.fr

Pangolins have become conservation icons as they continue to be trafficked to extinction as well as being mislabeled as intermediary hosts of the COVID-19 pandemic. Despite their concerning conservation status, pangolins have received little attention in terms of knowledge generation and amalgamation, thus preventing the implementation of scientifically-informed, holistic conservation planning. Considering the benefit of encompassing scientific, social, and economic aspects of conservation issues to produce holistic conservation guidelines, we applied this approach for pangolins. Following a systematic review approach, we extracted pangolin-related publications since 1865 from five research databases (814 publications), as well as data on 5296 patents, online news trends (43,176 articles) and societal interest (Google Trends and Wikipedia Pageviews). Although we detected a significant increase in pangolin-related publications through time, we observed glaring knowledge gaps in contextually important categories including immunology, education, and implications of trade or poaching to pangolin populations. All eight species have literature knowledge gaps, however African species are less represented. Fifteen African range-states have no pangolin literature, while the number of publications with non-range-state lead authors increased from 8% to 42.9% since 2017. Pangolin media output and societal interest have remained low relative to other flagship species, however COVID-19 is shifting these dynamics. Pangolin patent production was linked to Traditional Chinese Medicine, which was seemingly neither driven by science nor traditional pharmacopoeia. This begs the question as to whether other drivers are at stake in the pangolin trade. To help conserve pangolins, we suggest increased effort in health and field-based conservation research, while directing more attention towards Africa. We highlight the importance of maintaining range-author contributions, and of factors that may lead to increased public interest in pangolins. Finally, we highlight possible conservation actions that have not been suggested in current conservation action plans.

Engaging local communities in pangolin conservation in the eastern DRC community-managed forests

PALUKU MBUSA Omer, MITONDO HAMISI Alain
Union of Associations for Gorilla Conservation and Community Development in Eastern DRC (UGADEC), oma.ugadec@gmail.com, Goma, DRC

The forests of the eastern DRC are one of the most important global regions for biodiversity. This region contains rare and threatened species such as the grauer's gorilla (*Gorilla beringei graueri*), pangolins as well as other charismatic fauna. In a biological survey carried out from September to December 2020 in the Tayna Nature Reserve, eastern DRC, out of 196 transects completed, signs of the giant pangolin (*Smutsia gigantea*) were observed in 33 transects; those of the white-bellied pangolin *(Phataginus tricuspis*) in 7 transects, and those of black-bellied pangolin (*Phataginus tetradactyla*) in 2 transects.
Pangolins, in particular, though protected by the Congolese law and confirmed by the IUCN's red list as threatened species, are unfortunately hunted for their meat in the DRC and are one of the most trafficked mammals in Asia and Africa.
In his survey on"the reasons for exploitation of Pangolins by Communities living in and around the Tayna Nature Reserve" undertaken in 2020, David KAMBALE MALIMBO found that the consumption of animal proteins was the main reason for pangolin exploitation. The survey revealed that local people use pangolin derivatives for medicinal and spiritual intents, while a small number of respondents confirmed that people from elsewhere come to source pangolin derivatives in this area. My investigation noticed that the majority of communities involved in the exploitation of endangered species are often unaware of the conservation status of a given species and the legal consequences of their actions. Therefore, UGADEC, a federation of nine Community Based Organizations managing a mosaic of 9 community-managed conservation areas, in the Maiko –Tayna- Kahuzi Biega Landscape, in Eastern DRC, suggests that sensitization compaigns, law enforcement and programmes of education, sustainable protein alternatives and rehabilitation of the captured pangolins should be undertaken to mitigate the threats faced by the pangolin at a landscape level.

Conservation of the globally endangered pangolin and its habitat through research, education and community conservation programs in Sindhupalchowk district, Nepal

Prativa Kaspal
Women for Conservation, prativa.kaspal14@gmail.com

Identifying the dire need for ecological studies on pangolins with greater enforcement of anti-poaching measures through involvement of communities, we carried out activities like transect surveys transect, questionnaire interviews, interaction, conservation education awareness and outreach programs in major pangolin areas along with the production of site specific action plan for the species conservation in the pangolin range areas of Sindhupalchowk district for the first time in Nepal.
After field based surveys in 11 community forests together with, a total of 150 burrows comprising of Fresh (44), New (54) and Old (52) were found. Out of them, 75 burrows with lined scratch marks followed by 9 burrows with footprint marks, 5 burrows with its droppings and 4 burrows with its scale mark at the inner top of the burrow, followed by and 3 burrows with marking of tail movement. The records from the seizure cases on the pangolin scales showed the hunting and poaching were the greatest threats which were further accelerated by profound deep-rooted superstitious beliefs in people, loss of natural habitat, forest fire, and habitat fragmentation by developmental activities and encroachment. One thousand copies of pangolin calendar, educational flexes and banners were prepared and printed out to showcase and distribute among communities during pangolin conservation education programs. A total of 70 local people were interviewed to find out their perception and threat to the species at ground level. To our query regarding the purpose of eating the meat of the species, the highest of 39 respondents took to cure different illness, followed by 19 respondents had eaten in a belief to heal body pain. 50 respondents were interviewed to evaluate the program effectiveness. Conservation challenges for the Community-based Chinese Pangolin Conservation Areas would be the lack of economic resource followed forest fire, lack of regular programs and illicit activities.

Reference intervals for selected haematological and clinical biochemistry measurands in Temminck's pangolin (*Smutsia temminckii*)

K Lourens[1], EH Hooijberg[2&3], L Meyer[1&3]
[1]*Johannesburg Wildlife Veterinary Hospital, South Africa, info@jwvh.org.za*
[2]*Department of Companion Animal Clinical Studies & Centre for Veterinary Wildlife Studies, Faculty of Veterinary Science, University of Pretoria, South Africa*
[3]*Centre for Veterinary Wildlife Studies, Faculty of Veterinary Science, University of Pretoria, South Africa*

An alarming number of pangolins are currently illegally traded for their scales and meat. Many pangolins confiscated from the trade are severely clinically compromised. Unfortunately, little is known about the physiology and normal health of pangolin, making it difficult to identify disease processes and treat them. The purpose of this study was to establish reference intervals (RIs) for haematology and plasma clinical chemistry in the Temminck's pangolin. Blood samples were collected from 27 healthy free-living or rehabilitated pangolins and reference intervals were generated according to international guidelines. Clinical chemistry analysis was performed using the Abaxis VetScan VS2 and haematology was performed using the Abaxis VetScan HM5 analyser. Plasma clinical chemistry RIs were: albumin 26-41 g/L, amylase 316-1014 U/L, ALP 29-153 U/L, ALT 25-307 U/L, bilirubin 1.5-10.8 μmol/L, calcium 1.8-2.5 mmol/L, creatinine 9.7-46.3 μmol/L, glucose 3.8-10.0 mmol/L, potassium 3.6-5.9 mmol/L, phosphate 1.3-2.6 mmol/L, sodium 132-142 mmol/L, total protein 53-84 g/L, and urea 5.6-19.9 mmol/L. Haematology RIs were: WBC 1.8-10.71 $x10^9$/L, RBC 3.88-8.31 $x10^{12}$/L, HGB 73-150 g/L, HCT 26-51%, MCV 55-72 fL, MCH 15.6-21.4 pg, MCHC 242-332 g/L, and RDW 14.3-19.1%. RIs for some measurands were wide, probably due to the small sample size. Nevertheless, these are the first RIs generated for the Temminck's pangolin and the results presented here will allow veterinarians to better determine the health status of pangolin patients, thus enabling them to formulate optimal treatment plans in the hope of increasing patient survival rates of this endangered species.

Raising five white-bellied pangolin pups in Nigeria

Maria Diekmann
Rare & Endangered Species Trust, rest@iway.na

Rarely if ever has there been an opportunity to raise five infant pangolins of any species at the same time under the same conditions. This was done with five White bellied pangolin pups, *Phataginus tricuspis*, in Nigeria and allowed for making strong assumptions on growth, diet and veterinary care as comparison was fairly easy and accurate and took observations out of the "once off chance" realm. I will be sharing data I collected and hypotheses on best practice after much observation and communication with other researchers who have been both successful as well as unsuccessful with pup raising challenges for this species.

Ireti: the tale of a Nigerian pangolin

Mark Rume Ofua
Saintmarks Animal Rescue Foundation, Lagos, Nigeria, saintmark2003@yahoo.com

Nigeria is a home to one of the eight species of the pangolins, the white-bellied pangolin. Nigeria is also widely known as the transit hub for pangolin scales and pangolin trafficking in West Africa. Indeed, the largest seizure of pangolin scales worldwide has been linked to Nigeria. Despite having very good wildlife laws, the lack of political will to enforce same and follow through has left very wide loophole for traffickers and poachers to reign in, bribes make up for the rest.

There is also very limited knowledge about the white bellied pangolin, their feeding habits, their range, physiology, numbers and distribution and thus very little is known about their statue except that the situation is very dire and that serious work needs to be done to bring this to the fore and to work out a plan to save them.

SaintMark's Animal Rescue Foundation rose to the challenge and has worked hard to make sense to this mystery. Having trained with the African Pangolin Working Group (APWG) and with the help of a few friends, we have rescued so many of these white bellied pangolins from the bush meat trade and have specialised in the raising of orphaned pups, which are cruel and sad victims of the bush meat trade as they are just thrown away to die since scale and flesh of the pup is useless.

We have recorded huge success in this line and are currently raising five pups at a single go with two pups close to release into a protected forest.

Here we tell our story with Ireti, a baby rescued from the bush meat table and hand raised to the release stage in a protected forest.

The rescue, rehabilitation and release of pangolins

N. Wright[1] Jessica Jimerson[2]
[1]*African Pangolin Working Group, Johannesburg Wildlife Veterinary Hospital, HSI-Africa, nicci@africanpangolin.org*
[2]*Save Vietnam's Wildlife, Ninh Binh Province, Vietnam*

Pangolins are frequently seized from illegal trade, especially in Africa and Asia. However, rehabilitation of the animals is largely undocumented. This presentation draws on experience in South Africa, where Temminck's pangolin (*Smutsia temminckii*) is often rescued, and Vietnam, where Sunda (*Manis javanica*) and Chinese (*M. pentadactyla*) pangolins are seized with regularity, and discusses the process of rescuing, rehabilitating and releasing pangolins back in to the wild, and associated challenges. The circumstances in which pangolins are rescued in South Africa and Vietnam are starkly different with a single pangolin typically rescued in the former, but more than 200 animals seized at a time in the latter. This presents a number of challenges related to triage and eventual release of the animals back in the wild. The case studies are presented that showcase the rescue, rehabilitation and release process in South Africa and Vietnam.

Molecular estimation divergence time scale of Indian Pangolin (*Manis crassicaudata*) found in Sri Lanka from the Indian mainland

H. R. Algewatta[1], B. G. D. N. K. de Silva[1,2], P. K. P. Perera[3,4], , L. D. C. Peiris[1,2]
[1]*Department of Zoology, Faculty of Applied Sciences, University of Sri Jayewardenepura, Gangodawila, Nugegoda, Sri Lanka*
[2]*Center for Biotechnology, Department of Zoology, Faculty of Applied Sciences, University of Sri Jayewardenepura, Gangodawila, Nugegoda, Sri Lanka.*
[3]*Department of Forestry and Environmental Sciences, Faculty of Faculty of Applied Sciences, University of Sri Jayewardenepura, Gangodawila, Nugegoda, Sri Lanka*
[4] *IUCN SSC Pangolin Specialist Group, C/o Zoological Society of London, Regent's Park, London NW1 4RY, UK.*
Correspondence: hirusharandimal.tmp@sjp.ac.lk

The separation of Sri Lanka from Gondwana and Indian Peninsular in the late Miocene, the new environmental conditions in Sri Lanka provided a diverse topographic, climatic, and biotic stage for the mammals, mostly of Indian-Indochinese origin, to develop unique adaptations. The Indian Pangolin (*Manis crassicaudata*) is native to the Indian subcontinent. Its' population in Sri Lanka is geographically isolated from the mainland population. Therefore, pangolins in Sri Lanka could possess unique morphological adaptations and genetic variation. This study determine the exact molecular divergence period of M. Crassicaudata in Sri Lanka for the first time. We obtained mtDNA sequences from three gene regions (CO1, Cytb, and D-loop) from four blood samples of *M. crassicaudata* specimens from the wet and intermediate climatic zones on the island. The sequence data obtained from each gene region, the phylogenetic programs BEAST v2.2 and Fig Tree were used to infer the estimated divergence times. The sequenced data from *M. Crassicaudata* in India from NCBI. We observed significant genetic differentiation between *M. crassicaudata* of mainland India and Sri Lanka. They were clustered into two well-defined assemblages with an estimated Holocene divergence of 11,500 years ago. The two assemblages showed incomplete geographical partitioning, suggesting allopatric variation.

Conservation genetics of pangolins in the Congo Republic

Bernáthová I[1], Swiacká M[1], Hulva P[2], Loubassou C B V[3] & Černá Bolfíková B[1]
[1]*Faculty of Tropical AgriSciences, Czech University of Life Sciences, Kamýcká 129, 165 00 Praha - Suchdol, e-mail: bernathova@ftz.czu.cz*
[2]*Faculty of Science, Charles University, Albertov 6, 128 00 Praha 2, e-mail: pavel.hulva@natur.cuni.cz*
[3] *Institut National de Recherche Forestière, Brazzavile, Republic of Congo, e-mail: vitoloubassou@gmail.com*

Pangolins are currently considered the world's most illegally trafficked mammals and their numbers continue to decline. Furthermore, there is still a lack of knowledge on their population structure and dynamics. We provide the first population-level molecular study focused on pangolin populations in Odzala-Kokoua National Park in the Congo Republic. We sampled individuals of White-bellied pangolin (*Phataginus tricuspis*) and Giant pangolin (*Smutsia gigantea*) and analysed their mitochondrial (control region) and two nuclear markers (beta-fibrinogen, titin). The mitochondrial haplotype network in *P. tricuspis* indicates differences between sub-populations from western and central Africa which supports cryptic diversity of *P. tricuspis.* We detected population growth in *P. tricuspis* 500 kya. The population expansion started during a period of aridity and it seems that *P. tricuspis* is, to some extent, capable of adaptation to various conditions and is not fixed solely to rainforest habitat. In *S. gigantea*, we detected a slow decline that started around 500 kya, probably also driven by habitat changes. According to genetic distances between the samples from Odzala-Kokoua NP, we estimate the local origin of the pangolins at the trade market. The study provides data on population structure and dynamics of pangolins in the Congo Republic and can be used for better understanding the population biology of pangolins, the local trade dynamics and may contribute to conservation management planning.
The study was supported by IGA grant No. 20213106.

Use of camera trap data to monitor the cryptic Indian pangolins (*Manus crassicaudata*): A case study from a tropical lowland rainforest in Southwest Sri Lanka

Priyan Perera[1, 2] and Hasitha Karawita[1]
[1]*Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka, priyan@sjp.ac.lk*
[2]*IUCN SSC Pangolin Specialist Group, C/o Zoological Society of London, Regent's Park, London, NW1 4RY United Kingdom*

Understanding spatial patterns of abundance and distribution of animal species is central to their monitoring, conservation, and management. However, the abundance estimation is a formidable challenge for animals that are generally inconspicuous. Camera trapping has emerged as a plausible technique in study and monitoring of such cryptic species. Lack of evidence-based data on the occupancy and abundance of the Indian pangolin in different habitats is a major impediments in conservation of the species. We present the results of the first comprehensive study on the habitat occupancy and abundance estimation of Indian pangolins using camera trap data in a tropical lowland rainforest habitat in the southwest of Sri Lanka. Data pertaining to 4480 camara trap nights at 640 locations in the 2000ha-Yagirala Forest Reserve were analyzed. The two main habitat types in the forest; Pine dominated forest (200ha) and natural forest (1800ha) yielded 20 and 35 successful captures. A running mean capture density of 0.1 captures/ha and 0.02 captures/ha was recorded from Pine forest and natural forest respectively.The population density of pangolins in Pine forest and and natural forest was estiated as 0.107 ha^{-1} and 0.029 ha^{-1} respectively by fitting Binomial-Poisson mixture model for a single visit capture data. All photographs of Indian pangolins were recorded between 7.00 pm to 6.00 am, with the highest frequency of photographs captured between 4.00 am and 5.00 am (n=10), followed by 8.00 pm and 9.00 pm (n=08). The implications for long term monitoring and conservation are further discussed.

Pangolins exhibit behavioural and physiological plasticity in response to fluctuations in climate and food availability in their natural environment

W. Panaino[1,2], F. Parrini[2], R. Hetem[1,3], L. Meyer[1,4], D. Smith[5], G. van Dyk[5], and A. Fuller[1]
[1]*Brain Function Research Group, School of Physiology, University of the Witwatersrand, Johannesburg. wpanaino@gmail.com.*
[2]*Centre for African Ecology, School of Animal, Plant and Environmental Sciences, University of the Witwatersrand, Johannesburg.*
[3]*School of Animal, Plant and Environmental Sciences, University of the Witwatersrand, Johannesburg.*
[4]*Department of Paraclinical Sciences and Centre for Veterinary Wildlife Studies, University of Pretoria, Pretoria.*
[5]*Tswalu Kalahari Reserve, Northern Cape*

Increasing air temperatures and greater variability in precipitation occurring with climate change are affecting animals directly by imposing greater heat loads and indirectly by altering resource availability. Temminck's pangolin (*Smutsia temminckii*) is a predominantly nocturnal, myrmecophagous mammal that inhabits parts of Africa, including the already hot and dry Kalahari. Understanding the responses of pangolins to fluctuations in climate and food availability in a hot and arid environment provides an analogue for predicting how pangolins elsewhere will respond to changes in their environment likely to occur with climate change. We investigated the behavioural and physiological responses of six pangolins in the Kalahari for two years in response to fluctuations in climate and food availability. Each pangolin was fitted with a VHF tracking transmitter and an implanted miniature temperature-sensitive data logger, which recorded core body temperature at 5-minute intervals. Pangolins exhibited dietary flexibility during periods of food scarcity, but still experienced low energy intake, particularly during winter when prey was scarce. The low energy intake resulted in lower than normal 24h minimum body temperatures and pangolins emerged from their burrows earlier during the day and shortened their activity period. These adjustments likely offset the metabolic costs of maintaining constant high body temperatures at night. Although the physiological and behavioural plasticity exhibited by the pangolins allowed them to cope with fluctuations in food availability during our study, the extent to which this plasticity will buffer pangolins against future climate change-induced reductions in food availability is unclear.

Population genetics of the white-bellied pangolin (*Phataginus tricuspis*) in the Dahomey Gap (West Africa): challenges for tracing the local trade

Stanislas Zanvo[1,2], Sylvestre C.A.M. Djagoun[1], Fortuné A. Azihou[1], Bruno Djossa[3,*], Komlan Afiademanyo[5], Ayodedji Olayemi[6], Clément Agbangla[4], Brice Sinsin[1], Philippe Gaubert[2]

[1] Laboratory of Applied Ecology, Faculty of Agronomic Sciences, University of Abomey-Calavi, 01 BP 526, Cotonou, Benin, zanvostanislas@yahoo.fr/stanislas.zanvo@univ-tlse3.fr

[2] Laboratoire Evolution et Diversité Biologique (EDB), CNRS/UPS/IRD, Université Toulouse III Paul Sabatier – Bâtiment 4R1, 118 route de Narbonne, 31062 Toulouse cedex 9, France

[3] Laboratoire de Foresterie et de Conservation des Bioressources (LaFCBio), Ecole de Foresterie Tropicale, Université Nationale d'Agriculture, Benin

[4] Laboratoire de Génétique Moléculaire et d'Analyse des Génomes, Faculté des Sciences et Techniques, Université d'Abomey-Calavi, 01BP 526, Cotonou, Bénin

[5] Département de Zoologie et de Biologie Animale, Université de Lomé, BP 1515, Lomé, Togo

[6] Natural History Museum, Obafemi Awolowo University, HO 220005, Ile-Ife, Nigeria

Pangolins have become the flagship species of the wildlife trade. African pangolins are now feeding both local / regional demands and a global trade towards Asia and Europe. Despite this pressing conservation issue, African pangolins still suffer from a lack of baseline data essential for efficient conservation actions. We conducted in the Dahomey Gap (West Africa) a pioneer study on the genetic tracing of the local pangolin trade. We sequenced and genotyped 189 white-bellied pangolins from 18 forests and 12 wildlife markets using a combination of mitochondrial (control region; CR1) and nuclear (microsatellites) markers. Phylogenetic analyses of CR1 revealed the 'endemism' of the pangolin trade, all the traded individuals originating from the Dahomey Gap. Both types of markers showed low levels of genetic diversity and an absence of clear genetic structure among forest island populations in Benin and Togo, with low to moderate levels of differentiation (microsatellites; F_{ST} = 0.022-0.115). Demographic history analyses suggested that white-bellied pangolins experienced a drastic reduction of their effective population size c. 200-500 years ago, placing white-bellied pangolins from the Dahomey Gap under the minimum viable threshold suggested for wild populations. Despite the lack of global geographic structure, we developed a tracing approach based on private allele rarefaction that enabled us to source some specimens from Beninese wildlife markets. Overall, our study provided evidence for (i) genetic erosion in white-bellied pangolins from the Dahomey Gap, (ii) a drastic and recent decrease of their effective population size, and (iii) the multi-sourced origin of pangolins feeding the local trade. Although our microsatellite data allowed discriminating among all individuals, the lack of geographic structure and population differentiation in white-bellied pangolins from the Dahomey Gap remains challenging for trade tracing strategies based on standard genetic markers.

Judiciary and law enforcement education initiatives to combat illegal pangolin trafficking within the Greater Limpopo Transfronteir Conservation Area

Alexis Kriel
Co-chairperson of the African Pangolin Working Group (APWG), alexis@alexiskriel.co.za

South African Police Service (SAPS), and the National Prosecuting Authority (NPA) released a statement in 2019, that Temminck's pangolins (*Smutsia temminckii*) were the species of mammal in South Africa showing the largest increase in illegal poaching and trafficking - above rhino, lion and elephant.
The province with the highest pangolin retrieved from the illegal trade is Limpopo Province, falling within the species natural distribution, bordering Zimbabwe and Mozambique and with the largest population of illegal migrants. An increase in cross-border smuggling of live pangolins has been acknowledged by the NPA due to inadequately policed border posts and a lack of knowledge on pangolins and associated criminal activity.
The APWG engaging with law enforcement has yielded an increase in pangolin-related arrests and improved sentencing from fines of R500 to jail terms being imposed. In May, 2021, because of this concerted effort, a South African citizen, was sentenced to 10 years imprisonment without the option of a fine, for Contravening Sec 57(1) of the National Environmental Management Biodiversity Act 10 of 2004. This set a South African and an African continental precedence but also a global precedence for the highest jail sentence handed to a pangolin poacher.
The APWG has been awarded a grant under a USAID / VukaNow initiative, for conducting custom-designed workshops for combating pangolin-related wildlife crime, with the purpose of facilitating a collaborative effort between law enforcement units and the judiciary.
Evidence-based products will be developed and distributed under the grant, including a comprehensive pangolin-related investigation and prosecution manual for South Africa and Mozambique; a pangolin trade resource kit for frontline law enforcement personnel; and film and electronic versions of the training. The intention is to eventually modify these products for distribution throughout pangolin range states in Africa.

To thwart pangolin trafficking at international level, there's a dire need to empower local organisations, implicate local communities and ensure an effective local justice system favorable to wildlife

Adams Cassinga,
Conserv CONGO, www.conservcongo.org, aminiadams16@hotmail.com, +24 3970440110

The DRC is the only country in Africa with all three species of pangolins in its range *(Smutsia gigantea, Phataginus tricuspis and Phataginus tetradactyla).* For centuries it was taboo to hunt and eat pangolins, in most African cultures, but today it represents not only food for the masses and a delicacy for the upper classes, but also a quick buck for dealers across the globe. To date, the world is still unaware of the major role that the DRC plays in the illegal trade of pangolins – as a source country and a major transiting point – with 80 percent of seizures of scales emanating here. This makes pangolins the most traded animal in the country, after great apes.

In the DRC, pangolins are usually hunted in the forests, using snares and guns; huge cargoes of pangolin scales are consolidated in major cities; with exiting points being in smaller towns, unseen to the untrained eye and then smuggled to CAR, Uganda, South Sudan, Congo Brazzaville and to Asia directly. In recent years, there has been a shift in the way pangolin scales are being shipped abroad and the way they are concealed. Lagos, Kano in Nigeria have become traffickers favorite shipping points after Pointe Noire (Brazzaville) and Matadi (DRC) were uncovered by law enforcement.

There are no pangolin rescue groups or rehabilitation centres and many rescued animals die because of lack of even basic care. Most efforts to conserve pangolins are international and NGO donor incentives with an international approach and without an understanding of local perspectives. There needs to be an atmosphere which is conducive to dialogue with local leaders and chiefs, for supporting them through development projects within their respective communities.

While some advances have been made through Conserv Congo's efforts at dialogue with the Ministry of Justice, for establishing a specialised court for wildlife crime, there continues to be an urgent need to enforce the law protecting wildlife, support investigations at grassroots level and fight for an effective and streamlined judicial system.

Distribution and behaviour of Temminck's pangolin (*Smutsia temminckii*) in relation to electric fences

L Stracquadanio[1], B Tolhurst[1], S Penny[1], N Burnside[1], A Ganswindt[2]
[1] *Ecology, Conservation and Zoonosis Research and Enterprise Group, School of Applied Sciences, University of Brighton, UK, l.stracquadanio@brighton.ac.uk*
[2] *Mammal Research Institute, University of Pretoria, South Africa*

It is currently suggested that electrocutions caused by electric fences are a major threat to Temminck's pangolin (*Smutsia temminckii*) in South Africa. However, the magnitude of the problem and the extent to which variation in fence design affects electrocution risk is unknown, making it difficult to assess the impact for conservation, despite the clear animal welfare implications. The pangolin's bipedal nature means their unprotected abdomens may frequently come in to contact with tripwires at ground level. They then defensively curl into a ball around the wire, often causing injury or death. This research aims to investigate the extent of electrocutions that occur by evaluating pangolin spatial ecology and behaviour in relation to the different fence types within South Africa. This research will aim to answer the following questions: (1) does fence type, perimeter-area ratio, or fence length, influence the probability of a fence crossing attempt, or the size and location of pangolin core areas? (2) Does proximity to fences influence pangolin movement behaviour or proportional habitat use? (3) Do habitat or landscape features (such as water availability or nearby roads) influence the probability of a fence crossing attempt? This study will employ a citizen science questionnaire to estimate the presence of each fence type and evaluate the number of electrocutions occurring within South African properties. This will be distributed to landowners, managers, farmers, and conservationists both online and in-person. Additionally, UHF/VHF tracking of pangolins in the Northern Cape Province will be used to assess pangolin movement behaviour, home ranges and core areas relative to fences. A habitat suitability model and an electrocution risk model for the species will be created. Initial results from these study aspects will be presented. We hope that the research will inform mitigation measures, and potentially involve experimental testing of some of these.

Steps in the right direction: collaboration is key in developing a national framework for pangolin conservation

Kelsey Prediger
Namibian Pangolin Working Group

Pangolins have had little conservation recognition prior to being named the world's most trafficked mammal. Despite this status, over the past 10 years, organized conservation efforts have been slow to progress across much of the African continent with a few exceptions such as the Tikki Hywood Trust in Zimbabwe and the African Pangolin Working Group in South Africa. This is likely due to the complex multi-faceted and trans-disciplinary approaches needed to address the illegal wildlife trade of such an elusive and poorly understood species. There is often poor communication between sectors which is made more difficult because of various backgrounds and views on the subject matter. The Namibian Pangolin Working Group was established to bring all relevant stakeholders together for developing and improving pangolin conservation in the country. Chaired by the Ministry of Environment, Forestry and Tourism, the group includes representation from government sectors, law enforcement entities, local academic institutions, and non-governmental organizations including organizations willing to contribute funding. Collaboration, strong communication, and open minds with a trans-disciplinary approach, has been key factors in taking steps towards coordinated efforts for rescuing pangolins from the illegal wildlife trade and for the drafting of a National Conservation Management Plan for Pangolins. Other African nations should consider adopting a similar model and tailor it to their specific needs to create a strong pangolin conservation programme. Stakeholders from different backgrounds working together is essential for the optimum utilization of limited resources, to avoid duplicating efforts, and to creating lasting positive results.

DELEGATES

Prefix	First Name	Last Name	Email Address	Organisation
Mr.	Hirusha R.	Algewatta	hirusharandimal.tmp@sjp.ac.lk	University of Sri Jayewardenepura
Miss.	Lucy	Archer	lucy.archer@ioz.ac.uk	Zoological Society of London
Dr.	Sally	Armstrong	cobus@versteronline.co.za	Lottoland South Africa
Ms.	Helena	Atkinson	ATKINSON.HELENA@GMAIL.COM	Pangolin.Africa
Ms.	Lauren	Ayres Martinez	L.ayres@globalconservationgorce.org	Global Conservation Force
Dr.	Emily	Bennitt	ebennitt@ub.ac.bw	University of Botswana
Miss.	Iva	Bernáthová	bernathova.iva@gmail.com	Czech University of Life Sciences Prague
Dr.	Ju Lian	Chong	julian@umt.edu.my	Universiti Malaysia Terengganu
Miss.	Victoria	Curr Smith	tori@lilongwewildlife.org	Lilongwe Wildlife Trust
Mr.	Wynand	De Jager	wynanddejager1@gmail.com	Umoya Khulula Wildlife centre
Ms.	Maria	Diekmann	rest@iway.na	Rare and Endangered Species Trust
Mr.	Alain Din	Dipita	adipita1@gmail.com	
Dr.	Philippe	Gaubert	philippe.gaubert@univ-tlse3.fr	Université Paul Sabatier
Dr.	Maja	Gudehus	majagudehus@live.com	
Mrs.	Delecia	Gunn	gunnsigourney@gmail.com	Mpumalanga Tourism and Parks Agency
Mrs.	Jessica	Harvey-carroll	jessharveycarroll@gmail.com	University of St Andrews
Mr.	Luke P.	Haynes	lukehaynes@rocketmail.com	Endangered Wildlife Trust
Mr.	Sean P.	Heighton	sean-paul.heighton@univ-tlse3.fr	Université Paul Sabatier
Dr.	Daniel	Ingram	daniel.ingram@stir.ac.uk	University of Stirling
Mr.	Anthony	Irving	amanda@paintedwolfwines.com	Imageworks Multimedia
Mrs.	Amanda	Irving	amanda@paintedwolfwines.com	African Pangolin Working Group
Prof.	Raymond	Jansen	jansenr@tut.ac.za	African Pangolin Working Group
Mr.	Hasitha	Karawita	hasithakarawita@sjp.ac.lk	University of Sri Jayewardenepura
Mr.	Jules Gosse	Koffi	hossaku@yahoo.fr	
Ms.	Alexis	Kriel	alexis@alexiskriel.co.za	African Pangolin Working Group
Dr.	Karin	Lourens	karinlourens@gmail.com	Johannesburg Wildlife Veterinary Hospital
Dr.	Monique	MacKenzie	Monique.MacKenzie@st-andrews.ac.uk	University of St Andrews
Mr.	Fanie	Masango	faniem464@gmail.com	African Pangolin Working Group
Mr.	Francois	Meyer	kudumeyer@gmail.com	African Pangolin Working Group
Mr.	Adam	Moreno	moreno.151@osu.edu	
Ms.	Anna	Mussi	anna@rhinorevolution.org	Rhino Revolution
Mrs.	Harriet	Nimmo	info@rhinorevolution.org	Rhino Revolution
Miss.	Lauren	Offord	laurenofford@hotmail.com	African Pangolin Working Group
Miss.	Alegria	Olmedo	alegriaoc@gmail.com	University of Oxford
Dr.	Wendy	Panaino	wpanaino@gmail.com	WIts University
Dr.	Priyan	Perera	priyan@sjp.ac.lk	University of Sri Jayewardenepura
Mr.	Adam	Peyman	apeyman@hsi.org	Humane Society International
Ms.	Valery	Phakoago	valeryphakoago@gmail.com	Wits University
Dr.	Darren	Pietersen	darren.thf@gmail.com	Tikki Hywood Foundation
Ms.	Kelsey	Prediger	kpred3@gmail.com	Namibian Pangolin Working Group
Dr.	Anne	Prestel		
Ms.	Betty	Rawheath	brawheath@gmail.com	National Judiciary South Africa
Miss.	Lisa	Scheepers	Tashley_26@hotmail.com	
Mr.	Craig	Sholto-douglas	craig.sholto-douglas@andbeyond.com	Phinda Private Game Reserve
Mr.	Mario	Smuts	mario.smuts@up.ac.za	University of Pretoria
Ms.	Leandra	Stracquadanio	l.stracquadanio@brighton.ac.uk	University of Brighton

Mrs.	Carol	Thompson	pangolincpu@gmail.com	African Pangolin Working Group
Mr.	Glen	Thompson	pangolincpu@gmail.com	African Pangolin Working Group
Mrs.	Machel	Van Niekerk	helena@pangolin.africa	Kalahari Wildlife Project
Mr.	Cobus	Verster	cobus.verster@lottoland.com	Lottoland South Africa
Ms.	Nicci	Wright	nicci.wright50@gmail.com	African Pangolin Working Group
Mr.	Stanislas	Zanvo	zanvostanislas@yahoo.fr	Université Paul Sabatier

NOTES