

# **Bats** without Borders, Durban Natural Science Museum and BCA

are delighted to welcome you to the

#AfriPopo2022



## **AfriPopo Student Symposium**



DURBAN  
NATURAL SCIENCE  
MUSEUM

A museum about  
the earth, its history  
and life on earth,  
both past and present.



## Conference sponsors

#AfriPopo2022

We would like to thank our generous sponsors for kindly supporting this important symposium, and the first of its kind.

Wildlife Acoustics and WildTeam have generously donated the student presentation prizes. Wildlife Acoustics has also donated an additional raffle prize that anyone attending the conference can win! We would also like to acknowledge Andrew Jackson who kindly designed our fantastic logo – thank you for the pro bono time you gave to support this symposium!



## Student committee

The vision for this conference, is to provide a friendly and supportive opportunity for students and early career professionals to network and share their research findings – and a great opportunity to connect people working on bats across Africa! We wanted this event to be organised by students for students! We are very grateful to our [#AfriPopo2022 team](#) for their time, energy and dedication!

- Ana Gledis da Conceição (Mozambique)
- Alexandra Howard (South Africa)
- Sospeter Kibiwot (Kenya)
- Monday Veli Mdluli (Eswatini | South Africa)
- Bismark Opoku (Ghana | Germany)
- Helen Taylor-Boyd (Zambia | UK)

## Day 1 - Symposium Programme

#AfriPopo2022

Saturday 25<sup>th</sup> June 2022

*Times below are southern African time*

08H30	Zoom event opens – come along and network and register
<b>Chair: Bismark Opuko</b> <i>Moderator: Alexandra Howard</i>	
09H00	Welcome and announcements
09H10	<b>Dr Rachael Cooper-Bohannon</b> An overview of the weekend symposium and an introduction to Bats without Borders – vision, mission, challenges and opportunities
09H30	<b>Early career keynote speaker – David Wechuli</b> Variation in echolocation pulse source level and detection distances of bat assemblages across sites
<b>BAT DIVERSITY</b>	
10H00	<b>Josphat Etabo</b> Bat activity and species richness along a gradient of human disturbance at Lake Naivasha Area
10H20	<b>Laura Torrent</b> A taxonomic review of Equatorial Guinea bat species to root an urgent Bat Conservation Policy
10H40	BREAK – tea/coffee
<b>Chair: Helen Taylor-Boyd</b> <i>Moderator: Alexandra Howard</i>	
11H00	<b>Monday Veli Mdluli</b> Quantifying the effects of climate change and anthropogenic changes on bat communities in Afromontane grasslands
11H20	<b>Yoba Alenga</b> Bat sonotype as a novel insight into the Congo Basin Rainforest dynamic
<b>THREATS - DEFORESTATION / CLIMATE CHANGE</b>	
11H40	<b>Sospeter Kibiwot</b> Effects of forest degradation on bats at south and north Nandi Forest, Western Kenya
12H00	<b>Patrick Jules Atagana</b> Impact of the habitat type and climate change on the bats' community (Mammalia: Chiroptera) of the Dja Biosphere Reserve (South, Cameroon)

<b>Chair: Alexandra Howard</b> <i>Moderator: Helen Taylor-Boyd</i>	
<b>GENETIC AND MORPHOLOGICAL DIVERSITY</b>	
12H20	<b>Bismark Opoku</b> Cryptic diversity in West African Noack's round-leaf bat <i>Hipposideros aff. Ruber</i>
12H40	<b>Ana Gledis da Conceição</b> The relationship between the morphology of the vestibular system and echolocation parameters of bats of Gorongosa National Park, Sofala, Mozambique
13H00	LUNCH
13H40	Networking event – breakout rooms!
<b>WORKSHOP SESSIONS</b>	
13H50	<b>Workshop 1 – African bat taxonomy and diversity</b> Dr Leigh Richards, Durban Natural Science Museum <i>Moderator: Veli Mdluli</i>
15H00	BREAK – tea/coffee
15H10	<b>Workshop 2 – An introduction to sound and call analysis</b> Paul Howden-Leach, Wildlife Acoustics <i>Moderator: Sospeter Kibiwot</i>
16H20	Wrap-up
16H25	End of Day 1

### Keynote speaker

#### Variation in Echolocation Pulse Source Level and Detection Distances of Bat Assemblages Across Sites

David B Wechuli<sup>1</sup>, David S Jacobs<sup>1</sup> and Marc Holderied<sup>2</sup>

<sup>1</sup> Department of Biological Sciences, University of Cape Town, Cape Town-RSA

<sup>2</sup> School of Biological Sciences, University of Bristol, Bristol, UK

Echolocation pulses used by bats comprise several parameters and one of them is the source level. This is a vital parameter as it can directly impact the distance at which bats perceive targets in their environment and, most importantly, distances at which they detect prey. Different habitats present different challenges for echolocation systems, and so the quality and content of information derived from echolocation pulses reflects these environmental challenges. As such, echolocation pulses within or between species may vary from one habitat to the next due to variable selection pressure, resulting in local adaptation. Habitat is, therefore, a key component in shaping the evolution of echolocation. The Acoustic Adaptation Hypothesis (AAH) proposes that acoustic properties of the environment influence sound propagation and therefore the evolution of echolocation pulses. Here, we used multiple microphone arrays to measure the source levels of echolocation pulses of 14 bat species in several bat assemblages across sites in six biomes in South Africa. Contrary to the AAH, our results revealed that bats in the same assemblage used different echolocation pulse source levels, frequencies and duration resulting in different detection distances, which differ among bat assemblages occupying different sites. Furthermore, detection distance was species-specific and remained similar within species between assemblages; suggesting that species is a better predictor of detection distances compared to habitat as indicated by *Miniopterus natalensis* across all seven sites.

## BAT DIVERSITY

### **Bat activity and species richness along a gradient of human disturbance at Lake Naivasha area.**

Josphat Etabo<sup>1</sup>, Paul Webala, John Githaiga and James Ireri Kanya.

<sup>1</sup>*University of Nairobi*

The management and maintenance of populations of wildlife requires an understanding of how individuals and groups use their habitat. In Kenya, about a quarter of the country's mammal species are bats. Although reviews or checklists exist, and some previous studies have been carried out on Kenyan bats, numerous gaps still exist especially on bat responses to anthropogenic activities that lead to loss and fragmentation of their habitats. Lake Naivasha ecosystem is one of the protected and recognized Ramsar sites of both economic and ecological importance in Kenya. As a wetland of ecological importance, the Lake is considered a vital and fragile habitat for endangered flora and fauna occupying the area. However, the lake basin is under serious threats from a wide range of rapidly intensifying pressure exacerbated by reduction of Lake water Levels, deforestation, increased soil erosion and siltation of feeder Rivers, encroachment, transformation of riverine buffer zones in the catchment areas, poor waste management and Infestation by invasive species. All these conflicting pressures on the basins natural resources, has a direct impact on diversity and abundance of bats dependent on the basin. Specifically, nothing is known about the bats that may occur around the Lake ecosystem and their responses to the ongoing habitat encroachment, degradation, and pollution. This study investigated bat activity and species richness along a gradient of human disturbance at Lake Naivasha. A total of 216 mist netting hours resulted into capture of 5 bat species namely: *Scotophilus andrewreborii*, *Rhinolophus eloquens*, *Chaerephon pumilus*, *Epomophorus wahlbergii* and *Eptesicus hottentotus* across the three study areas. Three bat detectors were used with results yet to be analyzed. The outcome of this research will help in the formulation of policies, management plans and key decisions to ensure the long-term maintenance and survival of viable populations of bats utilizing these altered habitats.

### **A taxonomic review of Equatorial Guinea bat species to root an urgent bat conservation policy.**

Laura Torrent<sup>1</sup>, Diogo F. Ferreira, Joxerra Aihartzza, Inazio Garin, Esther Abeme, Ngueme Alene, Miguel Angel Fuentes, Luke L. Powell, Javier Juste.

<sup>1</sup>*BiBio, Natural Sciences Museum of Granollers - CiBIO - Doñana Biological Station.*

Equatorial Guinea, Central Africa, is in one of the most important Africa's hotspots of biodiversity. However, the most recent bat research published is dating from the 1990s and focused only on the insular species. Meanwhile the continental region has received no attention in scientific publications since the 1970s, with the description of 22 bat species. Almost three decades later, we did three expeditions since 2018 to specifically survey the bat fauna of the continental region. Furthermore, we reviewed an extensive museum collection

from the region, compiled before the twenty-first century, and stored at the Doñana Biological Station (EBD-CSIC) in Spain. We combined traditional taxonomy, based on morphological characters, with molecular analysis to provide the first checklist of all bat species from the continental region of Equatorial Guinea. For the identification of museum specimens, we measured external and craniodental traits. From biopsy samples we extracted and amplified mitochondrial gene Cytb, and the sequences were compared with homologous sequences available in GenBank to confirm cryptic species. In total, we confirmed the presence of 54 bat species for the continental region of Equatorial Guinea. Out of them, 31 are new records for the country. By improving the knowledge of bats species and its distribution in Equatorial Guinea, we can lay the foundations for local authorities to direct their efforts for the protection of its fauna and reinforce forest conservation.

### **Quantifying the effects of climate change and anthropogenic disturbance on bat communities in Afromontane grassland ecosystem.**

Monday Veli Mdluli<sup>1</sup>, Ara Monadjem, Emile Bredenhand and Peter Taylor.

<sup>1</sup>*University of the Free State, Afromontane Research Unit*

The Drakensberg Afromontane grasslands, like most grasslands in the world, are threatened by unprecedented habitat loss and degradation through anthropogenic changes such as urbanization, livestock overgrazing and climate change despite the important ecosystem services that they provide. This is quite unfortunate as this area is known to harbour rare and endemic bat species. This study aims to ascertain the influence of climate change on bat activity, community structure, species richness distribution and bat diet along an elevational and land use gradient in the Drakensberg Afromontane Grasslands. Acoustic sampling is being conducted over a range of elevations ranging from 1800m to 3000m in the Maloti Drakensberg in Witsieshoek and Golden Gate Highlands National Park in the Free State province of South Africa. For the land use gradient aspect, acoustic and physical capture (mist netting and harp trapping) bat sampling is being conducted in a least disturbed (nature reserve), moderately disturbed (community conservation area), and most disturbed area (town of Phuthaditjhaba). An educational and citizen science project has been initiated at four schools in Phuthaditjhaba to promote awareness of bat conservation and to involve learners in collecting data for the project from erected bat houses and from bat detectors. Sampling so far has shown high bat activity at low elevations and in least disturbed areas. Assessment of school students' attitudes towards bats has been found to be mostly negative with more than 60% of students being afraid of bats believing that they are dangerous to humans and aggressive.

## THREATS – DEFORESTATION / CLIMATE CHANGE

### **Effects of forest degradation on bats at south and north Nandi Forests, Western Kenya.**

Sospeter Kibiwot<sup>1</sup>, Paul Webala and Johnstone Kimanzi.

<sup>1</sup>*University of Eldoret, Kenya*

Habitat loss and degradation are major threats to biodiversity, especially in tropical rainforests, where both biodiversity and deforestation rates are high. However, too little is known about the effects of such perturbations on bats in Africa, although they have received considerable attention in the Neotropics. Using captures and acoustic sampling, this study investigated effects of habitat degradation on bat assemblages, based on captures at matrix, edge and interior locations in two forests of South (18,000 ha) and North (10,500 ha) Nandi, western Kenya, presenting a spectrum of human-use regimes. Tree density and intensity of human use (cut tree stumps, charcoal kilns, footpaths) were used as predictors of bat abundance and species richness. A Total of 5322-m mist net effort, over 400 hours' echolocation calls, and 2016 harp hours resulted in the capture of 6003 bats representing 24 species from 8 families. Species abundance increased progressively from interior (17 species) to edge (15 species) and matrix (10 species) habitats (frugivores, forest-interior insectivores, forest-edge insectivores, and open-space insectivores). Frugivores were frequently captured at the matrices and edges, but a few in the interior of the two forests while the forest-interior insectivores and narrow-space foragers predominated in the interiors of the forest. Forest specialists showed positive associations with forest variables (canopy cover and tree density), whereas frugivores responded positively to the human-use indicators. On these bases, specialist species appear to be especially vulnerable to forest fragmentation.

### **Impact of the habitat type and climate change on the bats' community (Mammalia: Chiroptera) of the Dja Biosphere Reserve (South Cameroon).**

Patrick Jules Atagna<sup>1</sup>

<sup>1</sup>*University of Maroua, Cameroon*

The Dja Biosphere, located midway between the administrative regions of Eastern and Southern Cameroon is the most protected area of Cameroon. This site faces several anthropogenic pressures especially poaching, mining and logging and deforestation which lead to the fragmentation of the primary forest. This study has determined how the bats' community structure in four different habitats which present different degradation levels are impacted. The study compared the specific structure of the bats regarding habitats and seasons and thus we built species distribution models using occurrence records, climate data (Worldclim), and Maximum entropy (MaxEnt) modelling technique to predict the most abundant species distribution at the 2030 and 2050 horizon. With 10 Japanese mist nets per sites, bats were sampled during 160 nights in four different habitats during the four seasons occurring in the Dja Biosphere Reserve. In sum, 549 bats belonging to 4 families, 16 genres and 25 species were captured. The primary forest was the most richness habitat with 19



species, followed by the cocoa plantation (15 species), human habitats (11 species) and the secondary forest (eight species). Regarding the seasons, the big dry season was the richest (20 species), followed by the small rainy season (13 species); the small dry season (11 species) and the big rainy season (10 species). However, there was no significant difference observed in the species richness variation regarding the habitats ( $P = 0.058$ ) and seasons ( $P = 0.214$ ). Contrary to the specific richness, abundance significantly varied in terms of habitats ( $P = 0.014$ ) and seasons ( $P = 0.04$ ). The structure of the diversity of the bats in the primary forest differed from the three other habitats which were perturbed. No difference was however observed in the seasons. Meanwhile, a combination of the two habitat variables and seasons significantly affect the bat diversity. *Megaloglossus woermanni* was the most abundant specie (117 individuals). Climate change may affect the distribution of bats in the 2030 and 2050 horizon with considerable effects on *Casinycteris argynis*, *Hipposideros cf. caffer* and *Pipistrellus nanulus* which will see their distribution areas almost disappear in 2050. Despite the conversion of primary forest into various disturbed habitats (plantations, mining and logging), the Dja Biosphere Reserve has great potential in chiropterofauna.

### **Bat sonotype as a novel insight into the Congo Basin Rainforest dynamic.**

Yoba Alenga<sup>1</sup>

<sup>1</sup>*Congolese Youth Biodiversity Network*

Tropical forest ecosystems are undergoing an exponential regression of their surface areas with subsequent habitat loss and fragmentation. The effects of such disturbances on bats are quite significant, even leading to a decline in populations. In order to ensure the maintenance of bat populations, it is thus important to preserve their habitats. This involves highlighting preferential habitats but also factors related to their foraging sites.

We have combined acoustic surveys and capture-mark-recapture methods to study relationships between bats and their preferred habitats and also to identify functional role of bats captured or recorded in their habitat. A total of 42 bats were captured, belonging to 13 species, including 5 species of frugivorous bats and 8 insectivorous bats.

The frugivorous bats - namely the species *Scotonycteris bergmansi*, *Casinycteris arginnis*, *Myonycteris torquata* and *Epomops franqueti* - were associated with dispersal of 16 plant species in the Yangambi Man and Biosphere Reserve (*Aidia micrantha*, *Allanblackia floribunda*, *Anonidium mannii*, *Barteria nigritana*, *Canarium schweinfurthii*, *Coelocaryon preussi*, *Dacryodes edulis*, *Mammea africana*, *Maranthes glabra*, *Microdesmis yanfungana*, *Musanga cecropioides*, *Pycnanthus angolensis*, *Staudtia gabonensis*, *Strombosia grandifolia*, *Strombosiopsis tetrandra* and *Panda oleosa*) while the species *Megaloglossus woermanni* ensures the pollination of the species *Maranthes glabra*.

Acoustic monitoring revealed the presence of 11 sonotypes namely of the following species : *Chaerephon pumilus*, *Macronycteris gigas*, *Macronycteris vittatus*, *Doryrhina cyclops*, *Rhinolophus fumigatus*, *Neoromicia nana/Scotophilus dinganii*, *Pipistrellus nanulus*, *Pipistrellus rueppellii*, *Nycteris arge*, *Myotis bocagii* and *Glauconycteris superba*.

The type of habitat (primary forest) significantly increases the foraging activity of bats. A medium to high density of the understorey and a medium opening of the canopy have a significant influence on bat activity and call structure. The complementarity of acoustic monitoring and capture is crucial to understand the mechanisms governing aggregation of bats assemblages in order to assess their activity and the ecosystem services they provide.

## GENETIC AND MORPHOLOGICAL DIVERSITY

### **Cryptic diversity in West African Noack's round-Leaf bat *Hipposideros aff. ruber*.**

Bismark Opoku<sup>1,3</sup>, Peter Vallo<sup>1,2</sup>, Petr Benda<sup>4,5</sup>, Daniel Korley Attuquayefio<sup>3</sup>, Samuel Kingsley Oppong<sup>6</sup>, Marco Tschapka<sup>1</sup>.

<sup>1</sup>*Institute of Evolutionary Ecology and Conservation Genomics, Ulm University, Ulm, Germany;* <sup>2</sup> *Institute of Vertebrate Biology, Czech Academy of Sciences, Brno;* <sup>3</sup>*Department of Animal Biology and Conservation Science, University of Ghana, Legon, Accra, Ghana;* <sup>4</sup>*Department of Zoology, National Museum (Natural History), Praha;* <sup>5</sup>*Department of Zoology, Faculty of Science, Charles University, Praha;* <sup>6</sup>*Department of Wildlife and Range Movement, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.*

The taxonomic and phylogenetic histories of African bats remain poorly resolved due to the high incidence of cryptic species groups. *Hipposideros aff. ruber*, a West African cryptic form belonging to the *H. caffer* species complex is one of such cryptic groups. Interestingly, specimens belonging to one of the established mitochondrial lineages, D, show further divergent lineages. Specimens from the Sudanian savanna of Senegal and Benin and the forest zone of Liberia, Côte d'Ivoire and Ghana have revealed four sub-lineages. Yet the taxonomic significance of these lineages has not been assessed due to inconclusive morphological analyses based on a limited number of specimens. Using an extended data set including 65 new specimens from the savanna and forest zones of Ghana, we revised the genetic and skull morphology of *H. aff. ruber*. Sequences of mitochondrial cytochrome b gene separated the savanna populations, lineages D1 and D2 from the forest population, lineage D3. The genetic divergence between the savanna D1 and D2, and the forest D3 reached 6 %. Linear and Geometric morphometric analysis of skull dimensions among the three lineages showed certain size and shape trends. While the former analysis showed trends in the relative length of the rostrum, the latter revealed shape changes in the zygomatic arch, nasal inflation and the prae-maxilla. The forest lineage D3 showed a slightly wider zygomatic arch, a more abrupt nasal inflation and a higher position of the most anterior point of the prae-maxilla when compared to D1 and D2. Lineage D3 may therefore represent another cryptic species within *H. caffer* complex but its reproductive isolation from the savanna *H. aff. ruber*, is yet to be investigated.

## **The relationship between the morphology of the vestibular system and echolocation parameters of bats of Gorongosa National Park, Sofala, Mozambique.**

Ana Gledis da Conceição<sup>1</sup>, Ara Monadjem and Piotr Naskrecki.

<sup>1</sup>*Gorongosa National Park, Department of Biological Sciences, University of Eswatini, Museum of Comparative Zoology, Harvard University & E.O. Wilson Biodiversity Laboratory Gorongosa National Park, Mozambique*

Bats play an important role as seed dispersers, pollinators, pest control agents, and are suitable indicator species for habitat disturbance. However, identifying bats to species can be difficult for certain groups. Traditionally, bats have been identified based on morphometric features, such as the size and shape of the cranium, teeth, and baculum. More recently researchers have been incorporating genetic and acoustic characters, allowing the identification of bats through integrative taxonomy. I investigated the relationship between the bony elements of the vestibular systems and selected echolocation parameters in 38 bat species from Gorongosa National Park, central Mozambique: Vespertilioniformes (*Vespertilionidae* – 15 spp., *Miniopteridae* – 3 spp., *Molossidae* -3 spp., *Nycteridae* – 3 spp., and *Emballonuridae* – 1 sp.) and Pteropodiformes (*Rhinolophidae* – 6 spp., *Pteropodidae* – 3 spp., *Hipposideridae* – 2 spp, and *Rhinonycteridae* – 1 sp.) The vestibular system was photographed and processed with a focus-stacking technique that used a combination of software by Helicon Soft Ltd. Pteropodiformes have a greater proportion in the number of cochlear coils than the suborder Vespertilioniformes that has a lower number. The PCA results demonstrate an association between the parameters of bat echolocation calls and the structure of their vestibular organs, with species that emit lower frequency calls having larger but less complex vestibular organs than those emitting higher frequency calls.

A study has never been done relating the morphology of the vestibular system and echolocation parameters in Southern and Central Africa bats. The present study demonstrated this relationship found differences in the shape of the vestibular system among species of bats, therefore, it is suggested that the study be used as a new method for identifying bats in addition to the existing methods. It is recommended that the study be replicated between species using more individuals of the same species, combined with computed tomography (CT) methods and histological investigations, therefore, the standardization of photographs should be more effective to obtain more informative and accurate results.

## SATURDAY WORKSHOP SESSIONS

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**African bat taxonomy and diversity** - Dr Leigh Richards, Durban Natural Science Museum

This workshop will give an overview of the taxonomy and diversity of African bats with a focus on new technologies, novel methods and current taxonomic resources available to students and researchers.

**An introduction to sound and call analysis** - Paul Howden-Leach, Wildlife Acoustics

This workshop covers the basic properties of ultrasonic sound, and how bats use these sounds to navigate and feed. We then take a detailed look into how bat detectors work, the different types that are available, and their technical evolution over the decades to what we have today. Finally, we will look at some measurements and parameters which are commonly used in identifying bats from their calls. These parameters are a fixed standard in identification of species but will also need to be recorded when documenting new species.

## DAY 2 - Symposium Programme

#AfriPopo2022

Sunday 26<sup>th</sup> June 2022

Times below are southern African time

08H30	Zoom event opens – come along and network
<b>Chair: Sospeter Kibiwot</b> <i>Moderator: Alexandra Howard</i>	
09H00	Announcements
<b>CITIZEN SCIENCE</b>	
09H05	<b>Josephine Ambaisi</b> <i>Eidolon helvum</i> Conservation through Enhanced Citizen Science in Schools in Vihiga County, Kenya
<b>HUMAN-BAT INTERACTIONS</b>	
09H10	<b>Reilly Jackson</b> Building Roost Selection by Synanthropic Bats in Rural Southeastern Kenya
<b>ROOSTING ECOLOGY</b>	
09H30	<b>Damilare Ayokunle</b> Understanding fruit bat movement pattern, leveraging on radio telemetry and data analytics
<b>ECTOPARASITES</b>	
09H50	<b>Noel Gabiliga Thiombiano</b> Inventory of bat ( <i>Scotophilus leucogaster</i> ) ectoparasites of savannah area in Burkina Faso
10H10	BREAK – tea/coffee
10H30	Network event – breakout rooms!
<b>Chair: Veli Mdluli</b> <i>Moderator: Bismark Opuko</i>	
<b>ECOSYSTEM SERVICES</b>	
10H40	<b>Diogo F. Ferreira</b> Bats (and birds) enhance yields in Afrotropical cacao agroforests only under high shade
11H00	<b>Helen Taylor-Boyd</b> Bats in commercial agricultural landscapes: Zambia as a case study
11H20	<b>Alexandra Howard</b> Ecosystem services of bats on apple farms in the eastern Free State Province of South Africa

<b>WORKSHOP SESSIONS</b>	
11H40	<b>Workshop 3 – An introduction to managing conservation projects</b> Dr Adam Barlow, WildTeam <i>Moderator: Veli Mdluli</i>
13H00	LUNCH
13H40	<b>Workshop 4 – Panel discussion on career pathways</b> Daniel Phiri (BirdWatch Zambia), Kate MacEwan (Western Ecosystems Technology, USA) and Professor Peter Taylor (University of the Free State, South Africa) <i>Moderator: Sospeter Kibiwot</i>
<b>CLOSING SESSION</b>	
	<b>Chair: Sospeter Kibiwot</b> <i>Moderator: Helen Taylor-Boyd</i>
14H50	<b>Keynote speaker – Professor Peter Taylor</b> To split or not to split: Species concepts, integrative taxonomy & discovery of small mammals in Africa
15H50	Prize giving, online team photo and closing remarks
16H00	End of the FIRST AfriPopo Student Symposium
16H00	Additional networking opportunity for those who would like to stay on!

## Presentation abstracts

# AfriPopo2022

### CITIZEN SCIENCE

#### **POSTER: *Eidolon helvum* conservation through enhanced Citizen Science in schools in Vihiga County, Kenya.**

Josephine Ambaisi<sup>1</sup>, Paul Webala and Evarastus Obura

<sup>1</sup>University of Eldoret, Kenya

Straw colored fruit bats (*Eidolon helvum*) are severely threatened by a combination of factors including habitat loss, negative perceptions and myths surrounding them, which leads to decrease in their numbers in Western circuit. There's little information about *E. helvum* because it is an understudied species in Kenya. Guided by the strategic objectives: Enhance awareness among local schools as community educators on ecological roles of bats and their contribution to ecosystems, thus helping to demystify long standing harmful local myths and traditions regarding the bats, Improve capacity of local schools to monitor *E. helvum* and their habitat to pilot establishment of a long-term community-based monitoring protocol to enhance local understanding on ecosystem use/changes vis-a-vis species distribution and to Increase local schools' virtual interaction and sharing of important information/data from periodic monitoring activities to prompt local and support global action for the *E. helvum* conservation: Key activities included; Mapping schools, training School Club leaders, school outreach, learning field trips, initiating a School's bat monitoring protocol and virtual learning platform (Bats counts), recruiting and training monitoring scouts and development of a digital platform. We set up school bat clubs in 2 schools (Maseno Boys and Mbale High Schools) near the *Eidolon helvum* roost sites (Mbale A, Mbale B, Maseno Kefri and Ilwanda roost sites) where we piloted our project, organized workshops in schools whereby we disseminated information about bats to 37 students and we also trained them on how to collect data, analyze and report the findings regarding bats. Having set up school clubs to help us monitor our species of interest we set up a community-based straw-colored fruit bats platform whereby we monitored the dynamics of bats over time. We identified and trained 8 community monitoring scouts (per roost site) who together with the students helped us in generating monthly basic data for a period of 12 months with the bat population fluctuating from as low as 10 to as high as 27945 bats. We set up a digital communication hub that connected and promoted networking in schools hence information exchange about bats amongst students. Additionally, we formulated an action plan for the conservation of *E. helvum*. Citizen science in schools helped in enlightening the communities living around the bats roosting sites on the importance of conserving these species.

## HUMAN-BAT INTERACTIONS

### **Building roost selection by synanthropic bats in rural southeastern Kenya.**

Reilly T. Jackson<sup>1</sup>, Paul Webala<sup>2</sup>, Joseph Ogola<sup>3</sup>, and Kristian M. Forbes<sup>1</sup>.

<sup>1</sup>*Department of Biological Sciences, University of Arkansas, Fayetteville;* <sup>2</sup> *Department of Forestry and Wildlife Management, Maasai Mara University, Narok, Kenya;* <sup>3</sup>*Department of Medical Microbiology, University of Nairobi, Nairobi, Kenya.*

With increasing rates of urbanization, wildlife must adapt to living near humans. Bats are successful urban inhabitants, often occupying human structures actively used by humans and their domestic animals. This cohabitation of bats and humans creates opportunities for exposure to bats and their viruses, a necessary first step in spillover and zoonotic disease emergence. Understanding how bats select human buildings for roosts is currently limited and warrants research attention given the zoonotic disease risk many species of bats pose. We surveyed 179 buildings in southeastern Kenya in 2021 to understand building selection parameters employed by synanthropic bats. We identified and surveyed 59 buildings occupied by eight species of bats as well as 120 nearby unoccupied (control) buildings. Preliminary results show that bats selected older, taller buildings that had higher internal humidity, more entry points, and less human disturbance compared to controls ( $P \leq 0.0003$ ). We found that light, wall material, and the number of entry points affect building temperature and humidity, and that wall material and building height varied with building age. Future work will include more data collection and fine-tuning analytical methods to determine factors important in selection of building roosts for individual species. With shifts in Kenyan housing trends from older, mud-walled structures to multi-level cement buildings possessing an attic, newer buildings may be especially susceptible to colonization by bats, potentially increasing opportunities for human-bat contact. As this trend continues, humans may be inadvertently increasing their opportunities of exposure to bats, which may have future human health ramifications.



## ROOSTING ECOLOGY

### **Understanding fruit bat movement pattern, leveraging on radio telemetry and data analytics.**

Damilare Ayokunle<sup>1</sup>, Oluwatosin Atobatele

<sup>1</sup>*Bowen University, Nigeria*

A large population of straw-colored fruit bats, *Eidolon helvum* (Kerr, 1792), has been observed to roost on trees at the Iwo Campus of Bowen University since 2005. This frugivorous and volant bat has a panmictic distribution through much of sub-Saharan Africa; they are the only mammal capable of true flight. They also exhibit a highly gregarious social structure, long life span, low fecundity and are monoestrous. The global conservation status of *E. helvum* is “Near Threatened” (since 2008), because of a significant decline in their population mostly due to anthropogenic activities. There has been relatively little research into the movement pattern and roost choice of the fruit bats in Africa. The bat population roosts during the day on Bowen University campus and migrates to forage at dusk. The location (Bowen University campus) seems to serve as a protected site from significant hunting pressure. Adult male and female fruit bats were tagged with GPS tags to measure and record the movement pattern which was logged to a local and cloud database for data analysis. The capturing, handling, and tagging of bats was carried out as humanely as possible while adhering strictly to Standard Operating Procedures for bat study. The study was able to create the roosting pattern of the straw-colored fruit bats on the Iwo campus of Bowen University, map out roosting locations and analyzed their movement patterns which were not specific as they all go to different foraging locations, and also generate a dataset which can be used predictive analytics (Roosting Partitioning). The study highlights that the movement pattern of *Eidolon* bats can be successfully observed with the use of GPS loggers. Information is lacking as regards factors leading to the different choice of foraging locations of bats within the same sampled area.

## ECTOPARASITES

### **Inventory of bat (*Scotophilus leucogaster*) ectoparasites of savannaha area in Burkina Faso**

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*Scotophilus leucogaster* is one of the most widespread insectivorous bats species in Burkina Faso. Despite its key role in the balance of the ecosystem, this species could be a host to a

large number of ectoparasites, which can act as vectors for zoonotic agents. For this reason, we investigated on ectoparasites of *S. leucogaster* in savannah area of Burkina Faso. A total of 102 *S. leucogaster* were captured, using mist nets, in five different areas of Burkina Faso from August to November 2018. Ectoparasites were collected through hand picking and also by swabbing with cotton well soaked in 70% ethanol. The results revealed that 24.5% of the bats were infested with ectoparasites. Four (04) species of parasites were determined (tick: *Argas vespertilionis*, mites: *Cimex* sp, acarian: *Spinturnix* sp and *Macronyssus* sp), belonging to four (04) families and three (03) orders. The most abundant ectoparasites species were *Argas* sp. The results also showed that adult male bats harbored high numbers of ectoparasites than female bats. Comparing the prevalence according to areas, we found that, the highest proportion of individuals infested was recorded at Bobo-Dioulasso. These results show that bats are hosts of several parasites and this parasitofauna could be responsible for public health problems.

## ECOSYSTEM SERVICES

### **Bats (and birds) enhance yields in Afrotropical cacao agroforests only under high shade.**

Diogo F. Ferreira<sup>1</sup>, Crinan Jarrett, Alain Christel Wandji, Patrick Jules Atagana, Hugo Rebelo, Bea Maas and Luke L. Powell

<sup>1</sup>*CIBIO-InBIO, University of Porto*

Sub-Saharan Africa is one of the most biodiverse regions on earth and one of the largest producers of cocoa, producing about 68.4% of the world's chocolate. Cocoa pests and diseases can cause losses of 761 million dollars annually. However, no studies from Africa have quantified the role of flying vertebrates as pest suppressors in cacao plantations. We used an exclusion experiment to prevent access of bats and birds to cacao trees for 12 months and quantified how their absence affected arthropod communities, herbivory, and cacao crop yield. Overall, important pests such as Mealybugs and other hemipterans were more abundant in enclosures (9 and 1.6 times increase, respectively), despite potential multitrophic interactions with simultaneously increasing predatory arthropods such as spiders and mantis. Under heavy shade (90%), cacao trees with vertebrate enclosures had 3.9 times fewer flowers and 3.2 times fewer large pods than control trees, corresponding to losses on average of \$478 ha<sup>-1</sup>y<sup>-1</sup>. Under low shade cover (10%) however, the opposite pattern was evident: enclosures trees had 5.2 times more flowers and 3.7 times more large pods than control trees, corresponding to savings on average of \$796 ha<sup>-1</sup>y<sup>-1</sup>. We demonstrate that the enormous potential of African flying vertebrates as pest suppressors in cacao plantations is dependent on the different local shade tree managements. Our findings encourage African policymakers and farmers to adopt more high shade cocoa agroforestry systems to maximize the pest suppression services provided by bats and birds within these plantations.

## **Bats in commercial agricultural landscapes: Zambia as a case study.**

Helen Taylor-Boyd<sup>1,2</sup>, Fuentes-Montemayor, E.<sup>1,2</sup> and Park, K.J.<sup>1,2</sup>

<sup>1</sup>*University of Stirling*, <sup>2</sup>*Bats without Borders*

Human population growth is increasing pressure on our natural resources and habitats. Crop production in particular results in large scale land clearance and is known to be one of the largest drivers of habitat loss; however these landscapes can also result in conditions favourable to particular species assemblages. The study of species assemblages can tell us about the potential effects of anthropogenic activity on ecosystem functions. Bats can be used as indicators in this regard, with a wide diversity of species co-existing in a variety of niches, with different levels of resilience to human disturbance. Studies worldwide provide evidence for a provision of ecosystem services insectivorous bats, with some demonstrating that they can reduce insect pest populations significantly. For Africa, insect pest control services by bats and the effects of agriculture on biodiversity have been largely understudied. My PhD research focuses on how bats use agricultural landscapes so as to better understand effects of agriculture on bat diversity and ecology, but also investigate the potential provision of insect pest control services by bats in an Afrotropic environment. Acoustic and trapping methods were used to record bat species assemblages and activity levels on 30 farms in Zambia during cropping seasons. Insect traps were used to assess food availability and droppings were collected for dietary analysis by molecular techniques to screen for known crop pests in diets. Insectivorous bat activity was recorded over crop fields and crop pests were found to be present in bat diet. Detailed analysis is currently underway and up to date findings will be presented. A general overview of Zambian bat distributions, acoustics and morphology will also be included.

## **Ecosystem services of bats on apple farms in the eastern Free State Province of South Africa.**

Alexandra Howard<sup>1</sup>, Ara Monadjem, Wanda Markotter and Peter Taylor.

<sup>1</sup>*Fromontane Research Unit, Dept of Zoology & Entomology, University of the Free State*

The aim of this research project is to assess and demonstrate to local communities the benefits of bat ecosystem services in agricultural landscapes in the Free State Province of South Africa. There are potentially financial benefits for farmers from the ecosystem services of bats such as reduced crop damage due to insect pests, decreased use and costs of pesticides and increased fruit yield through the pest control provided by foraging insectivorous bats. Despite the intensive bio-control and integrated pest management efforts in South Africa, the role of bats as a bio-control agent has not been investigated as serious economic pests are known to be predated upon by insectivorous bats. Previously established techniques such as molecular diet analysis by metabarcoding, economic yield calculations by avoided cost modelling, and standardised questionnaires to assess public perceptions will be used in this novel study area and agroecosystem of deciduous fruit farms in the Fouriesberg-Harrismith area of the eastern Free State. Preliminary results from the acoustic monitoring in the middle and edge of orchards compared to control water sites will be presented as well as the early results from the bat boxes erected at all study sites.

## SUNDAY WORKSHOP SESSION & PANEL DISCUSSION

### **An introduction to managing conservation projects - Dr Adam Barlow (WildTeam)**

In this session you will get an overview of the skills, processes, and technology you need to effectively manage a conservation project from start to finish. You will gain an understanding of key concepts that are essential for planning, managing, and reporting on any type of conservation work. These concepts are from the Wildlife Conservation Professional Series of best practices, which have been used to train over 1,600 conservationists working for 424 organisations around the globe, including SCB, TNC, WCS, and WWF.

WildTeam run a range of courses to develop conservation leadership skills, for more information visit: <https://www.wildteam.org.uk/>

### **Panel discussion on career pathways**

Daniel Phiri (BirdWatch Zambia), Kate MacEwan (Western Ecosystems Technology, USA) and Professor Peter Taylor (University of the Free State, South Africa)

## CLOSING SESSION

### **Keynote speaker**

### **To split or not to split: Species concepts, integrative taxonomy & discovery of small mammals in Africa**

Dr Iroro Tanshi<sup>1,2,3</sup>

<sup>1</sup>*Department of Animal and Environmental Biology, University of Benin, Benin City, NGA;*

<sup>2</sup>*Department of Biology, University of Washington, Seattle, USA;* <sup>3</sup>*Small Mammal Conservation Organization, Benin City, NGA;* <sup>4</sup>*Department of Biological Sciences, Texas Tech University, Lubbock, USA*

P. J. Taylor<sup>1</sup>

<sup>1</sup> *Zoology & Entomology Department, Afromontane Research Unit, University of the Free State, QwaQwa Campus*

During the current extinction crisis, the age-old "species debate" (splitters versus lumpers) continues to impact on the IUCN Redlist "triage" process with different IUCN specialist groups adopting widely varying species concepts, leading to very different conservation outcomes and priorities for different biota. Species splitting may occur either due to genuine speciation or "taxonomic inflation" where subspecies (or cryptic species) are raised

to species status due to a particular philosophy. The latter is considered bad practice while the former may present an inconvenient truth for conservation, burdening already scarce resources. Lack of dialogue between taxonomists and conservationists exacerbates the problem. For example, in a 2017 Nature paper, Garnett and Christides considered that "taxonomic anarchy" hampered conservation efforts and that species lists should be mediated by an international committee of the IUBS. A recent review of African small mammal taxonomy documented increases of 13% (rodents) and 18% (bats) over the past three decades in the number of recognized species of Afro-Malagasy rodents and bats. Referring to case studies, predominantly from montane habitats, the study showed that these increases are a genuine reflection of speciation in cryptic species complexes and suggested a four-criterion approach to delimiting species accurately. Moreover, some of these cryptic Afromontane small mammal species are subject to increased extinction risks due to small population size and anthropogenic changes (habitat degradation and climate change). These changes were captured accurately in a recent national Mammal Red List of South Africa, Lesotho and Swaziland, as well as by ongoing international IUCN Redlisting efforts for small mammals, both highlighting the plight of Afromontane habitats and range-restricted endemic small mammals and indicating that taxonomists and conservationists can work together to assess the Red List status (and conservation recommendations) of cryptic species based on robust taxonomic revisions.