



ZSSA conference 2023

ABSTRACTS

ZSSA 2023 Conference Abstracts

EXTREME ZOOLOGY

Session A

Is wildlife getting by or getting on in our human dominated world?

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Of the Earth's land surface about 75-95% of the ecosystems have been reshaped to some degree by humans, and it has recently been estimated that wild mammals make up just 4% of the entire mammal kingdom. Due to a progressing global human population growth connected with an ever-expanding network of altered landscapes linked to most effective resource utilization, an increasing number of wildlife must coexist with humans in those spaces. Consequently, examining wildlife well-being has been more and more recognised as a crucial component when managing this coexistence. Especially monitoring responses to stressors, defined as a state of perturbed homeostasis, plays an increasingly important role, as stress perceived over a prolonged period is generally regarded as antipathetic to welfare. Quantifying hormones like glucocorticoids or its metabolites is nowadays regarded as a precise and widely accepted approach for examining physiological stress-associated endocrine responses in wildlife roaming in human dominated landscapes.

Findings from a series of studies focussing on urban or transformed land and other anthropogenic factors and their stress-associated endocrine responses in captive and free-roaming primates, mustelids, felids, canids, and other species, will provide detailed insight into the physiological responses of wild mammals to anthropogenic activities and their ability to adapt to human presence or changing environmental conditions. The presented results will thereby clearly underline the importance of monitoring physiological stress-responses, like alterations in glucocorticoid concentrations, as a valuable tool to assist wildlife management and provide a revealing glimpse into the coping mechanisms of wildlife living in a brave new world.

A global review of climate change studies on seabirds and marine mammals

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Biological diversity, in all forms and shapes, are being impacted by climate change. Yet, attributing observed changes in upper trophic level populations to climate change can be challenging, as these are often driven indirectly through lower trophic level changes. To better understand the global footprint of climate change on marine predators, we conducted a global meta-analysis of climate studies on seabirds and marine mammals. Here we firstly report on the primary findings, globally, and in relation to Africa, and then present an overview of knowledge gaps and present a reporting framework for future studies to aid similar future large-scale assessments. We highlight the spatial distribution of climate-predator studies and the temporal requirements for detecting climate change influences in relation to different response variables. Polar regions were well represented in the literature but a concerning low number of studies were conducted around the tropics as well as around the African continent. A disproportionately large number of studies that have demonstrated climate change influences on marine predators arose from the Arctic, where responses were most rapidly detected. Based on available literature, about 19 years is required to detect climate change impacts on marine predators, but this varies by latitude and in relation to response variable. Some of the more pressing needs moving forward is obtaining information on non-breeding and juvenile responses of predators to climate change as existing literature is largely based on breeding adults. There is also a great need for mechanistic rather than correlative approaches in climate change studies. Vulnerability of marine predators to climate change is furthermore largely expressed in relation to sea temperature, with extreme events, including heat waves, needing more attention in the future. Lastly, the interactive effect of climate change and other anthropogenic threats on marine predators is likely significant, yet poorly covered in existing literature.

The road towards effective governance and management of marine protected areas in South Africa: evolving policies, paradigms and processes

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The efficacy of marine protected areas (MPAs) depends on their governance and management. We assess their history in South Africa and recognise four periods. Period 1 (1964–1994) provided initial protection but was based on exclusionary, preservationist policies, was ad hoc in the absence of a national plan, and neglected social considerations. Period 2 (1994–2010) began introducing people-oriented policies, focused on ecosystems rather than species, and was strengthened by formation of a national coordinating body. Although Period 3 (2010–2019) heralded improvements in design, ecosystem representation and stakeholder engagement, fractured governance hindered coordination and management. Period 4 (2019–ongoing) added challenges in managing new offshore MPAs. Using a scoring system, progress in achieving effective MPA governance and management was assessed over these periods for 17 components of governance and management, representing key issues for which changes could be identified throughout.

Fifteen components indicated overall improvements. Legislation and policies, MPA establishment, planning and design, and staff training and skills were the components that showed the most improvement—progress for most other components was weaker. Zero net gains were recorded for enforcement and compliance, and staff complement. We conclude with eight critical needs, flowing mainly from components that fared poorly in the assessment: (1) specify detailed objectives for every MPA; (2) fast-track management plans for new MPAs; (3) improve law enforcement and compliance; (4) enhance participation of adjacent communities and other stakeholders; (5) address MPA-related social impacts and injustices and improve benefit sharing; (6) ensure financial sustainability; (7) strengthen management effectiveness evaluation; (8) improve cooperation between government authorities responsible for MPAs and fisheries.

The Durban Research Action Partnership (D’RAP) – a summary of 10 years of direct and indirect deliverables from a transdisciplinary collaboration

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Transdisciplinary science collaborations are communities of practice created to resolve gaps using research and practice. The Durban Research Action Partnership (D’RAP) is a transdisciplinary collaboration between the University of KwaZulu-Natal (UKZN) and eThekweni Municipality (EM). The partnership has had different research streams since 2011 and several projects in these streams have addressed animals existing and persisting in the transformed urban habitat. Urbanisation is increasing and these types of collaborations can assist with management and policies that affect wildlife. Our aim was to summarise the last 10 years in terms of direct and indirect outputs and assess the impact and changes on policy and management in eThekweni. Information about previous students was used to determine success regarding capacity development; direct deliverables and research outputs such as degrees completed, papers, talks, and conferences were summarised; and the indirect impact of research, like policy, management, and collaborations/networking benefits, were assessed. Many of the postgraduate students who studied under the D’RAP were employed as lecturers or within the environmental sector or continued with further postgraduate studies. Indirect outputs included changes to research implementation by exploring different ideas regarding policy and management. Examples of some of the animal research contributions included the management of human-wildlife conflict, the importance and use of green spaces within the urban mosaic, and an inventory of the species that persist in the urban mosaic landscapes. Many lessons were learned, and practices adapted to make D’RAP successfully achieve its objectives with its 10 years of operation. It is now an anchor point, supporting and facilitating other research programmes and initiatives and creating and connecting a network that benefits from these already established relationships.

Session B

Validation of Enzyme Immunoassays via an Adrenocorticotrophic Stimulation Test for the Non-invasive Quantification of Stress-Related Hormone Metabolites in Naked Mole-Rats

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Small size in mammals usually restricts long-term, frequent monitoring of endocrine function using plasma as a matrix. Thus, non-invasive monitoring of hormone metabolite concentrations in excreta may provide an invaluable approach. Naked mole-rats (*Heterocephalus glaber*, NMR) are small-sized, subterranean mammals with unique characteristics such as extended longevity, cancer resistance and hypoxia tolerance. As such, NMRs are often housed in captivity for biomedical research globally. The current study aimed to examine the suitability of five enzyme-immunoassays (EIAs) for monitoring responses to stressors in the NMR using urine and feces as hormone matrices. A saline control administration, and a synthetic high and low dose of adrenocorticotrophic hormone (ACTH) administration (Synacthen® depot, Nortavis, South Africa (Pty) Ltd), were performed on six male and six female adult NMRs. The results revealed that a 5 α -pregnane-3 β ,11 β ,21-triol-20-one EIA detecting glucocorticoid metabolites (GCMs) with a 5 α -3 β -11 β -diol structure is the most suitable assay for quantifying GCMs in urine samples of males, whereas a 11-oxoetiocholanolone EIA detecting GCMs with a 5 β -3 α -ol-11-one structure appears the most suitable EIA for quantifying GCMs in urine of females. However, only two females showed a response greater than 100% post ACTH administration. A 11-oxoetiocholanolone EIA detecting 11,17 dioxoandrostanes was the most suitable EIA for quantifying GCMs in the feces of both sexes. There were sex-related differences in response to the high and low dose ACTH challenge, with males responding after a saline, low dose ACTH, and high dose ACTH administration, whereas females only showed a significant increase in GCM concentrations after administration of the high dose of ACTH. Therefore, we recommend using feces as a more suitable matrix for non-invasive GCM monitoring for NMRs which can be valuable when investigating housing conditions and other welfare aspects.

Desert-mountain siblings: vicariance in four Southern African bat lineages exemplifies a common biogeographical pattern

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With the uplift and easterly tilting of the southern African escarpment from 23 Ma, a strong west-east gradient in elevation and aridity was established, resulting in deserts and semi-deserts to the west and the high Drakensberg mountains to the east. Superimposed on this gradient, cold-dry periods of approximate 100kya periodicity occurred since the middle Pleistocene (0.9 Ma). Evidence of at least two glaciation periods in the Drakensberg confirm these cycles. Cold periods (with estimated 5C temperature declines) promoted the spread of frost-resistant temperate grasslands and steppes. During warmer cycles these vegetation types were fragmented but persisted on outlying inselbergs to the Drakensberg, providing a mechanism for allopatric speciation of montane temperate species. We tested this hypothesis based on new bat distribution records and molecular and morphological evidence from the Maloti Drakensberg, and from dated phylogenetic trees created using mtDNA cytochrome b sequences with BEAST. We found evidence for incipient speciation during the late Pleistocene and Holocene between mountain and desert siblings within four bat lineages of three different families, exemplifying a common biogeographical pattern in southern Africa plants and animals. In one notable case, horseshoe bats detected from up to 3100m in the Drakensberg and having an echolocation peak frequency of around 80-81 kHz were shown to be almost indistinguishable in their mtDNA sequences from *Rhinolophus damarensis* from the arid Namaqualand of South Africa, but the former is distinctly larger in cranial size than the latter, and importantly, possesses a baculum (penis bone) that is considerably larger (at least twice the length) and different in shape than the latter. Our results suggest that speciation and biological evolution can occur over relative short time frames across fragmented landscapes over steep ecological gradients. This proposed new mountain-endemic bat species will bring to 14 the number of horseshoe bats from South Africa.

Heterozygosity is low where colour polymorphism in wild carnivores prevails

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Colour polymorphism occurs throughout the animal kingdom and has been widely used to investigate evolutionary processes such as balancing selection and genetic drift. Carnivore species are particularly rich in coat colours and patterns, due to their use for camouflage. Colour morphs are typically the result of missense mutations and recessive alleles. However, they may increase in wild populations due to demographic and genetic deterioration. Being at the top of the trophic pyramid, carnivores tend to have low effective population sizes, which make them especially vulnerable to habitat fragmentation and genetic drift. In this study, we compile data on naturally occurring colour morphs within the Carnivora, among which the red leopard (*Panthera pardus*) and black genet (*Genetta maculata*) that occur in South Africa. We found 60 wild colour morphs spread among eight families. Heterozygosity was generally low in areas where colour morphs prevail, which is particularly prominent for large carnivores. Although selective drivers cannot be ruled out completely, the frequency of colour morphs seems to be strongly related to population bottlenecks, which may increase the expression of recessive alleles. For instance, genetic analyses indicated high relatedness in red leopards, supporting the hypothesis that a rare colour morph in the wild has increased its local frequency due to low natal dispersal. Black genets, on the other hand, occur at high population densities, which may mean that selective forces are at play. With an increase in genomic studies, we may gain more insights into the relationship between phenotypic variation in the wild and their underlying causes in small and fragmented populations.

Response of mammalian communities to environmental and landscape variables in Northern KwaZulu-Natal Game Parks, South Africa

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Reinvestigation of mammal assemblages at landscape level are crucial to understanding how natural ecosystem functions or self-regulate over time. We assessed changes in mammalian species richness across Protected Areas (PAs) in Northern KwaZulu-Natal in the Maputaland Conservation Unit, South Africa. Using multi-species occupancy model, we identified abiotic and biotic drivers of mammalian species in PA and contrasted them across two independent survey cycles. We collected data using camera traps during 2013-2014 and 2022-2023 which consisting of 348 camera trap sites covering four PAs (iSimangaliso Wetland Park: Eastern Shores, Western Shores, False Bay, and Tembe Elephant Park) that varied in size, habitat diversity and disturbance levels. We applied the Royle–Nichols multi-session multi-species hierarchical model to estimate species richness and occupancy dynamics of several mammalian species for different PAs while accounting for imperfect detection. Species richness increased with protected area size across both camera trap cycles. Our reinvestigation facilitated comparison and identification of potential drivers affecting mammalian communities across PAs to assist in making wildlife's effective wildlife management decisions.

13 years monkey world through iNkawu Vervet Project

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The iNkawu Vervet Project (IVP) has been studying the behavioural ecology and cognitive behaviour of a population of wild vervet monkeys (*Chlorocebus pygerythrus*) for the past 13 years. During that time, the project has been looking into the evolution of social behaviour using a variety of methods: natural observations, field experiments, Bio-logging (GPS collars) and faecal sample analyses. We are currently following 7 neighbouring groups of habituated vervet monkeys with group size ranging from 21 to 80 individuals (>300 Individuals). The project investigates many aspects of their behaviour: social learning, communication, territory use, sexual reproduction and male mate monopolization, male dispersal and cognition. In this presentation, I will summarize some of the main findings of IVP and describe some of the most recent experiments conducted: comparing cognitive abilities of wild and captive vervet monkeys using touchscreen technology. We found out that while captive monkeys were more likely to interact with the touchscreen, participation in the wild was influenced by sex and age. However, monkeys in the two contexts did not differ in their performance on the simple associative learning task. This study demonstrates that touchscreen technology can be successfully deployed in a population of wild primates. This gives us a starting point to test the animals' cognition under natural conditions that include varying group composition, ongoing activities such as foraging, which are challenging to recreate in captivity. While rates of participation were lower than those found in captivity, reasonable sample size can be achieved, and wild primates can successfully learn touchscreen tasks compare to their captive counterparts. All the work done by this international team offers a lot of knowledge in a wild primate population, which should help to better understand what makes human so unique.

The effect of COVID-19 lockdown restrictions on self-directed behaviour, activity budgets, and spatial use in semi-captive African elephants

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Captive African elephants are continuously exposed to tourism which can contribute to behavioural and physiological stress responses. However, the COVID-19 pandemic led to closures of animal tourism venues and thus a sudden and prolonged absence of tourists. We examined the impact of this unique scenario on 10 semi-captive African elephants maintained at the Knysna Elephant Park, South Africa. We monitored rates of self-directed behaviours (SDBs), before lockdown (i.e high tourist pressure, during lockdown (i.e non-existent tourist pressure) and after lockdown periods (i.e return on tourist pressure). SDBs were recorded as they occurred, along with the number of tourists present during the observation session. General behaviours were recorded to calculate activity budgets as well as the movement patterns and spatial use of the elephants. SDB rates were lower during-lockdown ($p < 0.001$), and higher post-lockdown ($p = 0.033$), indicating a reduction in short-term stress/ anxiety experienced due to the absence of tourists, and that the return of tourists was more stressful than before lockdown implementation. Similarly, both low ($p < 0.001$) and high ($p < 0.001$) numbers of tourists correlated with elevated displays of SDBs, demonstrating that elephants perceived high tourist presence as stressful. Activity budgets revealed a decrease in locomotion ($p < 0.001$), resting ($p < 0.001$), and comfort ($p = 0.005$) during-lockdown and an increase in feeding and time spent out of sight (both $p < 0.001$). Post-lockdown resulted in an increase in locomotion ($p = 0.004$) and feeding behaviours ($p = 0.007$), and a decrease in comfort behaviour ($p < 0.001$) and time spent out of sight ($p = 0.040$). Lastly, elephants travelled less during lockdown ($p < 0.001$) than pre and post. These findings provide further evidence of the stressful effect of tourism, and how human-animal interactions alters the behaviour and the movement patterns of captive animals.

Session C1

Exploring the influence of stakeholder collaboration on the water management of the upper Tugela catchment, South Africa

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Like many countries in the Global South, South Africa lacks collaboration in the management of critical water resources. This places pressure on natural environments that sustain freshwater resources, as well as the communities living in poorly managed areas like the upper Tugela catchment in the KwaZulu-Natal Province. The upper Tugela catchment in the Drakensberg Mountains provides freshwater to the densely populated KwaZulu-Natal and Gauteng provinces and is situated within rural communities that depend on agricultural practices to sustain a living. Although it is assumed that water resources are poorly managed at a local level in this catchment, the nature of current water management in this area has not been characterised to date. To describe water management in the catchment, the study identified and mapped stakeholders that are or should be involved in the management of water resources in the upper Tugela catchment. Snowball and purposive sampling were used to identify stakeholders with a water mandate or influence on water infrastructure, followed by random sampling to obtain an unbiased representation of local community members. 18 stakeholders were identified, consisting of two community representatives, three academic institutions, eight governmental, and two non-governmental organisations. Thereafter, individual interviews were conducted with 16 stakeholders and 60 community members. Interviews consisted of open-ended questions that probed the nature of collaboration between stakeholders. A thematic method was used to analyse the interview data, by assessing strengths, weaknesses, and opportunities in the current management of the catchment. The findings showed poor communication and limited interaction amongst stakeholders, leading to misperceptions and allegations of corruption. Thus, more regular, transparent stakeholder interactions and planning involving all role-players in the water-management ecosystem: local communities, governmental, and non-governmental organisations is encouraged. With co-developed solutions, collaboration should improve, and effective solutions can be found to the water-management crisis in the upper Tugela catchment.

Metazoan parasites of ornamental fishes imported from Sri Lanka and Indonesia

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In South Africa, the majority of ornamental fish are imported from abroad and as a consequence, there is the potential that their ichthyoparasites can invade local aquatic ecosystems. Currently, the legislation does not require that imported fish, destined for the pet industry, be quarantined. In this study, 11 ornamental fish species from nine families i.e. *Trachelyopterus fisheri*, *Metynnis hypsauchen*, *Barbonymus schwanenfeldii*, *Carassius auratus*, *Hypostomus Plecostomus*, *Glossolepis incisos*, *Melanotaenia lacustris*, *Synodontis batensoda*, *Osphronemus goramy*, *Pangasiodon hypophthalmus* and *Poecilia latipinna* were imported from Sri Lanka and Indonesia and examined for parasites within 24 hours of them arriving in South Africa. Fish were sacrificed, dissected and examined for parasites. Parasites observed and collected were preserved using standard methods and their prevalence and mean intensity determined. Of the 10 species examined five were infected, with monogeneans being the most dominant parasites. *Carassius auratus* specimens were infected by *Argulus japonicus*, *Dactylogyrus baueri*, *Dactylogyrus intermedius*, *Gyrodactylus gurleyi* and *Gyrodactylus kobayashii*. *Hypostomus plecostomus* were infected by *Heteropriapulidus heterotylus*. In turn, *M. hypsauchen*, *P. hypophthalmus* and *B. schwanenfeldii* were each infected respectively by a single specimen of *Urocleidoides sinus*, *Thaparocleidus caecus* and *Dactylogyrus lampam*. The prevalence for monogenean parasites varied between 60% for *H. heterotylus* from *H. plecostomus* and 100% for *T. caecus* from *P. hypophthalmus*.

In a separate trial parasite-host interactions were examined over a nine-week period using *G. incisos* as a fish model. On a weekly basis ten specimens of *G. incisos* housed in glass aquaria were randomly selected, sacrificed and examined for parasites. The nematode *Camallanus cotti* and a new monogenean species were collected from the fish examined. Throughout the trial, irregular patterns of increase infestation levels were observed for monogeneans and nematodes. Increases and decreases in infestation levels were linked to changes in water parameters measured. This work was supported by the DSI-NRF (No.101054).

Acoustic activity of bats in deciduous fruit farms of the eastern Free State Province, South Africa

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The intensification of agricultural production systems, landscape simplification and homogenization poses a severe threat to biodiversity and to ecosystem service providers such as bats. The role of bats in agriculture is understudied and relatively unknown in the Free State Province, which is a vitally important agricultural region of South Africa. Furthermore, the trophic link between bats and deciduous fruit crop pests remains largely unknown in South Africa. Three SongMeter SM4 bat detectors (Wildlife Acoustics) were deployed at three fixed sampling points (mid-orchard; orchard edge and nearest water body) on six apple farms for a minimum of three nights during four sampling periods to determine the bat species richness and foraging activity. Detectors were rotated between study sites throughout the 2021-2023 growing seasons to account for spatio-temporal and seasonal variation. The recorded sonograms were analysed in Kaleidoscope Pro (Wildlife Acoustics) to identify the species and foraging guilds (clutter, clutter-edge and open-air) of bats present, and relative activity levels determined by the number of echolocation “passes” and the subset of “feeding buzzes” indicating active foraging of insectivorous bats. In total, more than 65 000 passes were recorded representing a minimum of eight species of bats, with the clutter-edge guild dominating. Preliminary results also indicate higher species diversity and foraging activity at the control site of the water bodies followed by the orchard edges. Surrounding landscape features as well as management practices play a role in shaping the functional composition of bat communities as molecular diet analysis is the next step to determine the pest suppression services provided by bats in this agroecosystem.

The effects of flow alteration by selected weirs on fish assemblages in the Luvuvhu River, Limpopo Province, South Africa.

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Weirs in Luvuvhu River are used for water abstraction, flood control and gauging system, however, their presence cause alteration to water quality and fish assemblages. This study aims to assess ecological consequences of flow regime alteration using fish assemblages in the downstream and upstream weirs sections. A paired samples t-test analysis was applied to determine the significance of environmental factors, habitat quality, trace metals and fish assemblages in six study weirs sites for two years. The results revealed three contrasting environmental conditions associated with fish assemblages and habitat quality: firstly, varying concentrations of trace metals, nutrients and differing water velocities limit the presence and distribution of sensitive fish species in the up- and downstream points; secondly, the change from lotic to lentic system influence structural fish assemblages, showing that not only river alteration by weirs, but agriculture and human-induced activities in the catchment (car washing, laundry and wastes dumping) exert adverse effects on fish assemblages; thirdly, diversity indices showed that lowest diversity matched weirs design, structure and catchment land-use with better fish assemblages recorded in upstream than downstream points. Fish assemblages have significant differences among various velocity-depth class habitats, affecting fish richness, diversity and abundance. Water velocity, temperature, depth, conductivity, pH and dissolved oxygen attributes have shown a significant influence on fish assemblage patterns. Fish surveys in rivers subjected to alteration by weirs and human-induced activities, are critical in detecting pollutants effect, instream flow changes, altered migration and spawning, for the management and conservation of endemic rheophilic fish species.

Identifying conservation units of wild *Oreochromis mossambicus* in Kwazulu-Natal, Mpumalanga, and Limpopo, South Africa

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Oreochromis mossambicus is one of the most important freshwater fish species in the aquaculture industry. They occur naturally in many major river catchments in South Africa, especially in the country's warmer regions (provinces). Despite this, little is known regarding the genetic structure of wild populations. Furthermore, the species is threatened by hybridisation with the introduced *O. niloticus*, and so it has been listed as Vulnerable on the IUCN Red List. Baseline data are essential in determining, conserving, and monitoring important genetic units of *O. mossambicus*. In this study, we assessed genetic structure of *O. mossambicus* across South Africa using a suite of 14 microsatellite loci, focusing on the genetic diversity and fine-scale populations structure of fish from major river catchments in three South African provinces (KwaZulu-Natal, Mpumalanga, and Limpopo). Analyses revealed low genetic diversity within populations, but significant genetic differentiation among populations from different river catchments. The STRUCTURE analyses suggested the presence of 16 geographically correlated genetic clusters, in particular the one population in KwaZulu-Natal (Mtamvuna), three populations in Mpumalanga (Olifants, Loskop Dam and Pieter Vosloo Dam) and four populations in Limpopo (Mapungubjwe, Shingwedzi, Sand River, and Letaba) were highly genetically distinct. We recommend that strict measures be implemented to monitor and conserve the present genetic diversity and differentiation of these populations for their long-term persistence.

An evaluation of present and potential inland fisheries in dams and rivers of KwaZulu-Natal

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Freshwater ecosystems in South Africa provide food and income to subsistence fishers and support vulnerable communities. However, their potential to contribute to subsistence fisheries and the impact of invasive alien species are poorly understood. This study aimed to evaluate the fish communities and subsistence and recreational fisheries in the uMsuduzi River, Henley, and Midmar Dam in KwaZulu-Natal Province, South Africa. Fish community surveys were conducted and catch data from anglers were collected at the study sites using gillnets and fyke nets deployed in summer and winter. We found that KwaZulu-Natal native fish species, such as *Labeobarbus aeneus*, were not found in deep waters during high-flow but in the low-flow season (winter), and that invasive species like *Micropterus salmoides* were found in all seasons. Native yellowfish (*Labeobarbus natalensis*), catfish (*Clarias gariepinus*), largemouth bass (*Micropterus salmoides*), and tilapia (*Oreochromis mossambicus* and *Coptodon zillii*) were among the socio-economically important fish species harvested by subsistence fishers and targeted by recreational anglers in the region. Freshwater fisheries in this region ensure the sustainability of these resources for vulnerable communities. The study findings helped raise awareness about the importance of freshwater fisheries for food security and promote implementing policies and practices that support the sustainable management of these resources. By evaluating fish communities in KwaZulu-Natal and assessing present inland water use policies, the study provides valuable insights into the impact of human activities on freshwater ecosystems. It further supports the development of effective management strategies that promote the resilience of indigenous fish species.

Pollution and biological processes hindering the restoration of a cyprinid population post a fish kill

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Fishes are indicators of freshwater ecosystem health and are used globally to understand the impacts of stressors on water resources. The behavioural ecology of fishes is 10 to 100 times more responsive to environmental change than standard mortality bioassays. Rehabilitation efforts for the cyprinid, the KwaZulu-Natal yellowfish (*Labeobarbus natalensis*), in the uMsunduzi River, Pietermaritzburg, KwaZulu-Natal, South Africa, was the focus following a fish kill in August 2019. Our study aimed to study fish kill management, fish population resilience and river ecological health to contribute to the river's rehabilitation. We conducted quarterly surveys at sites along the uMsunduzi River system to monitor fish population structures, ecological health and overall recovery in 2022 and 2023. Adult *L. natalensis* individuals were collected upstream in unimpacted sites to re-inoculate impacted areas along the uMsunduzi River. Generally, we individually marked fish with pit tags before translocation. We identified any tagged fish during recapture on subsequent surveys. We monitored environmental changes using water quality probes that sent real-time data to a data management system remotely per the locally developed FISHTRAC programme. As part of our restoration efforts, we translocated 118 *L. natalensis* from upstream sites and tributaries to affected areas, with 75 of them with pit tags and 43 without pit tags. We captured and pit-tagged nine *L. natalensis* in a downstream impacted site. Our provisional findings indicate that the fish population structures and overall ecological health of the uMsunduzi River have not improved significantly, except for a downstream site that showed gradual recovery. Action to promote the recovery of the *L. natalensis* will improve the overall health of the Msunduzi River because of their life history traits. This type of rehabilitation aids in filling knowledge gaps in managing large-scale fish deaths, developing practical plans for rehabilitating fish populations, and restoring ecosystem function after catastrophic events.

First insights of a new Urban Vervet Project in KwaZulu-Natal

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While many animal species face major setbacks due to habitat transformations caused by increased urbanisation, vervet monkeys (*Chlorocebus pygerythrus*) are one of a few primate species that effectively acclimatize to anthropogenic environments. Yet little is known about what lies behind their successful adaptation. After the Inkawu Vervet Project have been studying the behaviour of wild vervet monkeys in a savannah environment at Mawana Game Reserve (KZN) for over a decade, a new project was born in November 2022 to investigate the behaviour of their semi-urban counterparts in Simbithi eco-estate in Ballito (KZN). A growing number of studies from multiple species suggest that human altered environments affect animals' cognitive skills. Using a combination of natural observational data (scan, focal and ad libitum), field experiments and citizen data from the residents of Simbithi, this Urban Vervet Project will describe how anthropogenic changes affect vervet monkeys' behaviour and cognitive skills. Here we will present results from two master students: a comparative study on their curiosity level using field experiments based on a previous study conducted in Mawana (Forss et al; 2021), and a descriptive study on human-vervet interactions using both observational data and citizen science from residents living in Simbithi. Findings from our newly established Urban Vervet Project will not only help scientists to examine the influence of urbanisation on primate behaviour and cognitive skills, but it also has the potential to bring implementations for human-wildlife conflicts in South Africa.

Session C2

Comparing DNA yield from fish scales following different extraction protocols

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In the age of extremes, threats like climate change, habitat loss, overfishing and pollution are placing many fish species under great pressure. As fish play a key role in aquatic ecosystem health, it is of the utmost importance to investigate how they might respond to rapidly changing environments. Assessing genetic diversity has therefore become a popular tool in conservation biology since it determines adaptive potential and subsequently fitness of a population or species. Elasmoid scales from teleost fish have been identified as a non-invasive sample type (which are often readily available from fishery archives) from which DNA can be extracted. However, the extraction process can be challenging with different methods yielding different amounts and quality of DNA. Yet few studies focus on the methodological aspects of extraction. Considering the importance of genetic diversity studies, effective use of non-invasive and readily available samples should not be hindered by inadequate methodology that yields small amounts of low-quality DNA or unnecessarily wastes research funds and samples; particularly when studying endangered species. Therefore, this research compared different extraction protocols to find an optimal method for extracting DNA from teleost fish scales. The protocols tested in this study included (1) phenol/chloroform with a TNES-urea digestion buffer, (2) phenol/chloroform with an amniocyte digestion buffer and (3) Qiagen DNeasy Blood and Tissue Kit with variations in incubation times and temperatures of each protocol. While the phenol/chloroform with TNES-urea digestion buffer yielded significantly higher concentrations of DNA compared to the other protocols, all protocols followed in this study yielded sufficient quantities of DNA for further downstream applications. Therefore, while there are multiple viable options when selecting a DNA extraction protocol, each research project's individual needs, requirements and resources need to be carefully considered in order to choose the most effective protocol.

**Intraspecific postcranial histovariability of the broad-snouted caiman *Caiman latirostris*
Daudin, 1802**

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Crocodylia is a clade of neosuquian Crocodyliforms today represented by over twenty species with generally medium body sizes. Modern crocodylians exhibit important physiological plasticity linked to environmental conditions, habitat, feeding, sex, and other intra-population factors. Bone tissue is an important structural component of the skeleton of vertebrates and is involved in the physiology of these animals throughout their development. Thus, a study of the osteohistology provides a reliable source of information to deduce biological information, such as longevity, growth dynamics, body size, metabolism, and sexual and somatic maturation. Although osteohistology studies in Neosuchia are relatively numerous, the diversity of species studied is still lacking. Here, we fill this gap by examining the ontogenetic postcranial histology of the modern South American caiman, *Caiman latirostris*. Our study sample consisted of 12 different sized individuals, from which we prepared calcified transverse thin sections of the forelimb and hindlimb bones of each individual. Our results show ontogenetic variation in the type of bone tissues deposited throughout development, and using the growth marks preserved in the compacta we were able to develop growth curves of these individuals. Furthermore, although some sections revealed the classical lamellar, parallel-fibered, or woven bone matrices, others showed unusual bone tissues. Older specimens exhibited a decrease in bone depositional rates that are evident on the basis of the organization of the collagen fibers and the scarce vascularization. The differences in the bone histology are likely related to plasticity and variability in the growth dynamics of caimans and offer a wide theoretical framework for life history interpretations for this group.

Interacting effects of high air temperature and humidity on the thermoregulatory performance of a large forest bird

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Physiological and behavioural mechanisms utilized by endotherms to maintain sub-lethal body temperatures (T_b) during extreme heat are well-understood, particularly in dry air. Humidity is known to impede important avenues of heat loss, but how air temperature (T_{air}) and humidity interact in more mesic environments to constrain thermoregulatory performance remain poorly understood, particularly among large-bodied species. To disentangle the effects of high T_{air} coupled with increasing humidity on more mesic-associated endotherms, we quantified thermoregulatory performance in a species occupying humid lowlands, the trumpeter hornbill (*Bycanistes bucinator*). We evaluated relationships between T_b , metabolic heat production and evaporative water loss with increasing T_{air} at three humidity levels (6, 13 and 25 g H₂O m⁻³). Maximum rates of evaporative water loss and evaporative cooling efficiency decreased significantly (77.2% and 81.4%, respectively) at 25 g H₂O m⁻³ relative to 6 g H₂O m⁻³. Heat tolerance limits (maximum tolerable T_{air} before the onset of severe hyperthermia) were significantly lower (43.10 ± 1.30 °C) at 25 g H₂O m⁻³ compared to at 6 g H₂O m⁻³ (51.07 ± 1.23 °C). Maximum T_b (T_{bmax} : T_b before loss of coordination) and the slope of T_b (i.e., rate T_b change above the upper critical limit of thermoneutrality) were both significantly higher at 25 g H₂O m⁻³. Our findings reiterate the physiological challenges faced by endotherms in humid environments, where impedance of evaporative cooling results in increased reliance on hyperthermia tolerance and thermally-buffered microsites during extreme heat events. Predicted increases in T_{air} in conjunction with declining cool microrefugia exacerbate these pressures and raise concerns regarding the vulnerability and future persistence of currently common species.

Glucocorticoids as a matrix for avian stress in a changing world

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The world is changing at previously unprecedented rates. These global changes present animals such as birds with new stressors in the environments they inhabit. To mitigate the negative effects of these stressors, we need to understand the physiological responses and constraints associated with these environments to the animals. The use of faecal glucocorticoid metabolites (fGCM) as a biomarker for adrenocortical responses to stressful stimuli provides diverse opportunities for understanding and improving the welfare, health, and reproduction of birds. Using southern pied babblers (*Turdoides bicolor*) as a case study, we looked at the effect of captivity, dominance, and maximum daily air temperatures (T_{max}) on fGCM concentrations. We collected fresh droppings from both free-living and captive birds and quantified fGCM concentrations in these using a previously validated enzyme immunoassay; Tetrahydrocorticosterone. Babblers temporarily held in captivity had substantially higher fGCM concentrations than free-living individuals, indicating that captivity may be a significant stressor for these birds. In free-living individuals, dominant males had the highest fGCM levels, suggesting that being the dominant male of a highly territorial social group is stressful. Additionally, free-living babblers increased fGCM concentrations at T_{max}>38°C, a response that was not apparent in captive babblers at the same temperatures. This suggests that results from captive physiological studies may not be a true reflection of the physiology of wild birds. Our results show that measuring glucocorticoids can be useful in improving our understanding of how birds and other vertebrates respond to stressful environmental perturbations, including but not limited to, the effects of climate change. However, care needs to be taken when interpreting results from captive studies.

Heat tolerance and evaporative cooling capacity in representatives of three orders of non-passerine birds

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Avian heat tolerance and evaporative cooling capacity vary substantially among orders. Still, several non-passerine groups remain in which thermoregulatory performance at high environmental temperatures has not been evaluated. Here, we assessed the physiological responses of representatives of three species of different unstudied orders to air temperature (T_a) above normothermic body temperature (T_b). Using flow-through respirometry at low chamber humidity, we measured T_b , resting metabolic rate (RMR), evaporative water loss (EWL) and evaporative cooling efficiency (ratio of evaporative heat loss to metabolic heat production; EHL/MHP) in Little Swifts (*Apus affinis*, Apodiformes, $n=10$), White-backed Mousebirds (*Colius colius*, Coliiformes, $n=10$) and Acacia Pied Barbets (*Lybius leucomelas*, Piciformes, $n=10$). We predicted that heat tolerance and cooling efficiency would vary among taxa. Since mousebirds used gular flutter during measurements, whereas barbets and swifts did not, we expected mousebirds would defend T_b at a higher T_a and have a greater EHL/MHP. Little swifts and white-backed mousebirds tolerated T_a up to 48°C, with maximum T_b values of 44.7±0.4°C and 44.1±0.6°C, respectively. In contrast, barbets tolerated a maximum T_a of 50°C and maximum T_b of 44.4±0.2°C. Swifts began panting at a lower T_b (41.5±1.7°C) and T_a (39.9±1.8°C) compared to the other species, with barbets panting at the highest T_b (42.1±0.5°C) and T_a (39.9±1.8°C). As predicted, white-backed mousebirds were most efficient at cooling (maximum EHL/MHP=1.64±0.43), and swifts were the least efficient (EHL/MHP=1.39±0.27). The variation in these species' response to environmental temperatures provides insight into how heat tolerance and evaporative cooling capacity vary among non-passerine orders. This increased knowledge can improve biophysical models, enabling us to more accurately determine how species may respond to changing environmental conditions.

Barcoding of rodent populations (Muridae) from the Golden Gate Highlands National Park and the University of the Free State Qwaqwa Campus

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The montane grassland of the Eastern Free State is an area which is under-explored in terms of research and the diversity of rodents in the region is under threat due to urbanisation, continuous fires, overgrazing and global warming. Several rodent species from the family Muridae are said to occur in the region. Most species in this family are morphologically indistinguishable and their taxonomy was mostly reliant on morphological identification. The current study aims to: 1) correctly identify rodents from this family occurring in the Golden Gate Highlands National Park and the University of the Free State. 2) Determine if there are differences in species richness between the Golden Gate Highlands National Park (which is considered wild) and outside the park at the University of the Free State (which is considered urban). Species were delineated using the mitochondrial Cytochrome c oxidase subunit I (COI) gene, which is used in DNA barcoding. The mtDNA analysis revealed five distinct lineages which could be associated with *Rhabdomys dilectus chakae*, *Mus Orangeie*, *Otomys auratus*, *Mastomys coucha* and *Micaelamys namaquensis*. The mtDNA analysis also revealed *Rhabdomys dilectus chakae* species complex. Urban environments have less species richness. The findings of this study will help conservation managers (SAN Parks and DESTEA to improve the accuracy of species records and better management of these species). The study produced new genetic barcodes and locality records of the species in the region. The study also showed the importance of using a second marker like Cytochrome b to confirm COI species ID as most sequences in GenBank were of Cyt b.

**The contribution of inselbergs to the composition and structure of herpetile communities
in an arid grassland landscape**

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Inselbergs are small, isolated rocky outcrops that add environmental heterogeneity to homogeneous landscapes, and so often support fauna and flora that is unique from that of the surrounding area. Hence, inselbergs can be seen as islands that may promote gamma and beta diversity and can even become biodiversity hotspots if dispersal is restricted. However, dispersal limitation may also raise the risk of extinction, lowering local-scale (alpha) diversity. This study aims to determine the conservation value of inselbergs in the arid grassland of central South Africa. We will compare the species composition, diversity, and (stable isotope) niche structure of herpetile communities of inselbergs and surrounding areas, as well as changes in these community properties across inselbergs of different sizes. If inselbergs are indeed biodiversity hotspots in this region, then we expect to find 1) higher levels of alpha diversity on inselbergs than in the surrounding area; 2) a high degree of turnover in species composition, dominance patterns, and niche structure between inselbergs and surrounding areas; and 3) a distinct pattern of structural and functional variation along a gradient of inselberg size. These results will be useful for testing predictions of island biogeography in a fragmented, terrestrial landscape, thereby enhancing our understanding of these systems and providing insights into the degree of conservation effort that needs to be placed on inselbergs.

Session D

Macrophysiology of avian body temperature: a tribute to Barry Lovegrove

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During the 20th Century, most hypotheses about endotherm physiological adaptation to climate focused on metabolic rates rather than body temperature (T_b), mainly because pioneering researchers in the field considered T_b a non-adaptive constant. Barry Lovegrove's work on mammal thermal physiology challenged this paradigm, highlighting the > 10 °C variation in mammalian normothermic body temperature and reconstructing shifts between baso-, meso- and supraendothermy that were key events in mammalian evolution during the Cenozoic. More recently, our work on heat tolerance in birds along a climatic gradient has revealed considerable adaptive variation in avian T_b, with large differences in both maximum (T_{bmax}) and normothermic T_b (T_{bnorm}) among 56 southern African species. Birds inhabiting a warm, humid site on the east coast of southern Africa have comparatively high T_{bmax} (45.60 ± 0.58 °C) and low T_{bnorm} (39.76 ± 0.60 °C) compared to species at cool, montane and hot, arid sites. These differences translate into a significantly greater capacity for hyperthermia (T_{bmax} - T_{bnorm} = 5.84 ± 0.77 °C) among humid lowland birds compared to those occupying montane (4.97 ± 0.99 °C) or arid (4.11 ± 0.84 °C) climates. One particularly unexpected result, in light of the significance of facultative hyperthermia for water conservation, was the significantly lower T_{bmax} of arid-zone birds (44.65 ± 0.60°C) compared to those occupying other sites. This counterintuitive finding raises questions about the physiological costs of hyperthermia, including the expression of heat shock proteins. In addition to climate-correlated variation in T_{bmax}, phylogenetic variation in this trait and evaporative cooling efficiency raise questions about links between hyperthermia tolerance and the capacity heterothermic responses such as torpor, and reveal why passerines, which represent ~60 % of global avian diversity, are particularly vulnerable to heat-related mass mortality during extreme heat waves.

Evolution of avian heat tolerance: the role of atmospheric humidity

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Raised atmospheric water vapour content (i.e., humidity) is known to affect the thermoregulatory performance of endotherms by impeding evaporative cooling capacity. However, little attention has been directed towards understanding how humidity affects the evolution of heat tolerance and thermoregulatory performance, or whether adaptive thermoregulation is evident among endotherms occupying habitats varying in average humidity. We hypothesized that birds from hot, humid habitats have evolved physiological mechanisms to reduce the impact of humidity-impeded evaporative heat dissipation compared to species occupying dryer habitats. To test this hypothesis, we quantified changes in heat tolerance limit (HTL), maximum body temperatures (T_{bmax}) and associated variables in response to humid (19.21 ± 1.20 g H₂O m⁻³) versus dry (1.07 ± 0.84 g H₂O m⁻³) air among 30 southern African bird species occurring at three climatically distinct sites (hot arid, mesic montane and humid lowlands). Making use of a phylogenetically informed comparative framework, we found that raised humidity decreased evaporative water loss (EWL) and resting metabolic rate by 27 - 38% and 21 - 27%, respectively, and did not differ significantly between sites. However, changes in HTL associated with humid air were significantly larger among arid (mean \pm SD = -3.13 ± 1.12 °C) and montane species (-2.44 ± 1.0 °C) compared to lowland species (-1.23 ± 1.34 °C). We also found that, under humid conditions, T_{bmax} among lowland (46.26 ± 0.48 °C) birds was significantly higher than among species at our arid (45.23 ± 0.24 °C) study site. A significant positive relationship for HTL \sim T_{bmax} under humid conditions highlights the functional importance of hyperthermia tolerance for overcoming the humidity-related constraints placed on evaporative cooling and, subsequently, heat tolerance. The macro-physiological patterns we report here, support the concept of a continuum from thermal specialization to thermal generalization among endotherms, with adaptive variation correlated with prevailing climatic conditions.

Public perceptions of African crowned eagles and other raptors in an urban-rural mosaic landscape and its importance for raptor conservation

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The increase in the human population has detrimental effects on natural landscapes through habitat transformations and degradation. Furthermore, with the increase in human population size and the presence of several wildlife species in human-dominated landscapes, interactions which could create good or bad relations are inevitable. For instance, some communities perceive raptor species as a threat to domestic animals, thus creating human-raptor conflict and impacting the species and its management. The overall aim of the study was to investigate the public attitudes and perceptions of African crowned eagles (*Stephanoaetus coronatus*, hereafter crowned eagle) in the urban-rural mosaic landscape of Durban, eThekweni Municipality, KwaZulu-Natal, South Africa. We created a questionnaire survey, mainly conducted face-to-face interviews in rural areas, and sent a link to the online survey to urban communities via neighbourhood watch groups and conservancies. We used generalized linear mixed models to explain better which variables influenced respondents (i) tolerance of crowned eagles, (ii) feelings about crowned eagles, (iii) importance of crowned eagles and (iv) perceiving crowned eagles as a threat to domestic animals. Our results showed that feelings toward crowned eagles, the importance of crowned eagles and spending time in the forest positively influenced tolerance of crowned eagles. Our results further showed that feelings toward crowned eagles and education level negatively influenced whether crowned eagles were perceived as a threat to domestic animals or not. Overall, crowned eagles were 'loved' by community members of eThekweni Municipality. However, we recommend that community members be educated about crowned eagles' ecology through community and school presentations to reduce negative attitudes and perceptions and facilitate raptor persistence in urban-rural mosaic landscapes.

Biological Implications of the osteohistology of modern large flightless birds

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Osteohistology provides valuable information about the life history and overall biology of vertebrates. Such studies are increasingly applied to modern taxa for which life history data is known. Most Neornithes, are considered to have fast, uninterrupted growth dynamics, with skeletal maturity achieved in less than a year. This contrasts with the prolonged growth evident in their nonavian theropod ancestors, as well as among basal, nonornithurine birds. Growth marks are not usually present in the cortices of modern birds, although some closely spaced lines of arrested growth (LAGs) sometimes occur the outer circumferential layer (OCL). Thus, most extant palaeognaths, such as tinamous, cassowaries, emus, rheas, and ostriches, are thought to reach skeletal maturity within a single year. Here, we examined the histology of the ratites (Palaeognathae), *Struthio camelus* (common ostrich), *Rhea americana* (rhea), *Dromaius novaehollandiae* (emu), and *Casuaris casuaris* (cassowary) from the collections of the Museum National d'Histoire Naturelle (MNHN, Paris, France) to assess their osteohistology, growth dynamics, and histovariability of their long bones. Undecalcified thin sections were prepared and were studied under a Zeiss Axio Lab.A1 petrographic microscope. We documented that the limb bones of several of the extant ratites showed annuli/LAGs that interrupt rapid rates of bone deposition that were clearly not part of the OCL. Thus, growth marks appear to be more common than previously reported in ratites and suggests that they required more than a single year to grow up to adult body size. These observations support earlier hypotheses that flexible growth patterns can be present in birds when selection pressures for rapid growth within a single year are absent. Here, we also report on the novel occurrence of osteopathologies in several of the ratite specimens. We propose that the pathologies may have been a consequence of the birds being long lived zoo specimens.

Session E

Extraordinary and ordinary findings: the exploration of the diversity of monogenean parasites of freshwater fishes in South Africa

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Monogenea (Platyhelminthes) is a diverse parasitic group with approximately 5500 species in 750 genera known worldwide. In Africa, 470 species representing 35 genera have been described from fish hosts. Given Africa's high diversity of freshwater fish species (more than 3,000 spp.), one can expect the same for their monogenean parasites. From March 2012 to December 2023, 585 specimens of 23 fish species (seven endemic and 16 native species), representing the Cyprinidae (12 spp.), Cichlidae (4 spp.), Alestidae (3 spp.), Mormyridae (2 spp), Claridae (1 sp.) and Mochokidae (1 sp.) were collected during field surveys at 19 localities from five South African provinces [Limpopo (11), North West (2), Northern Cape (1), KwaZulu-Natal (1) and Western Cape (4)]. Collected hosts were screened for the presence of monogenean parasites and any found were fixed in glycerin-ammonium picrate for morphometric analyses and in ethanol for molecular characterization. A total of 51 monogenean species (MS) representing 13 genera (G) and belonging to three families [Dactylogyridae (MS = 31; G = 8;), Gyrodactylidae (MS = 19; G = 4), and Diplozoidae (MS = 1; G = 1)] were identified. Twenty-six species represent species known to science, seven species of four genera have been described as new to science in the meantime, and additional 18 species from six genera remain yet to be described, with four and 14 species identified from endemic and common hosts, respectively.

The present study showcases the efforts of a decade's worth of intensive scrutiny on the remarkable potential of a highly diverse parasitic group that can contribute to the development of future phylogeographic studies for African fishes. Furthermore, if the past decade could reveal this previously unknown monogenean diversity, the potential for the next decade is promising new discoveries that will substantially contribute to the ecological heritage of South Africa's unique freshwater fish communities harbouring economic and ecologically important fishes and associated parasites in Africa.

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The lesser of two evils: the distribution and invasive potential of non-native fish species in the Mooi River, South Africa

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Recreational angling has a history of species introductions that have caused a great loss of native biodiversity. Despite this, they represent a relatively large economy supporting many people's livelihoods. The Mooi River, South Africa, supports trout fisheries in its upper reach. A weir was constructed to mitigate the loss of a natural barrier, now inundated by a large impoundment. We evaluated the Inchbrakie Weir's efficacy in restricting non-native fish's movement. We evaluated the weir as a fish barrier using fish surveys. We used species distribution modelling to assess the potential for bass to invade the upper reaches should they make their way past the barrier. Our surveys detected three bass species in the study area, including *Micropterus salmoides*, upstream of the fish barrier. *Micropterus dolomieu* was the main concern with the highest invasion potential but was not found upstream of the fish barrier. Distribution modelling showed that suitable habitat was available for all three detected bass species, with *M. salmoides* showing the greatest potential in the upper Mooi River. It concerns the local trout fishery and native fauna persistence. We suggest a structured long-term monitoring plan be set to detect the early invasion of *M. dolomieu* and that a pre-emptive management plan is put in place should the upper Mooi be invaded by *M. dolomieu*.

Small dragons, big surprises: exploring the diversity of blood parasites in *Smaug depressus* (flat dragon lizard) from the Soutpansberg mountain range

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The Soutpansberg mountain range, which is part of the Vhembe Biosphere Reserve, is well-known for its rich biodiversity of over 30 lizard species. However, little is known about the diversity of blood parasites in these reptiles. This is particularly true for *Smaug depressus*, a flat dragon lizard species that is endemic to the Soutpansberg mountain range and surrounding areas in Limpopo, South Africa. Therefore, the objective of this study was to investigate the diversity of blood parasites in *S. depressus* in the eastern part of the mountain range. Blood samples were collected from 20 individuals, and both morphological and molecular analyses were conducted to identify blood parasites. Our results show that *S. depressus* hosts a wide variety of blood parasites, including trypanosomatids, haemosporidians, haemogregarines, haemococcidians, and filarial nematodes. This study provides important baseline data on the diversity of blood parasites in *S. depressus*, and contributes to our understanding of the health and ecology of reptiles in the Soutpansberg mountain range.

Exploring wildlife crossing effectiveness on the N4 Toll Route (TRAC N4), Gauteng Province, South Africa

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Roads have many negative impacts on biodiversity, one of which is a collision between wildlife and vehicles (i.e., roadkill), resulting in not only injury or loss of life to an animal but damage to vehicles and vehicle occupants. Moreover, the barrier effect that roads create can have adverse effects on species' populations. Planning for connectivity in the form of wildlife crossings is key in mitigating negative ecological effects of roads and facilitating species' dispersal ability throughout road-fragmented habitats, as these will save human lives and wildlife diversity. Although numerous underpasses in a form of culverts, viaducts and bridges are part of the structural road planning and design to meet human mobility, and safety needs for storm water drainage, they continue to neglect the needs for connecting wildlife and their habitats. However, to some extent, numerous animals have adapted to using these structures for crossing highways. In this study, we explored the effectiveness of road underpass structures along the TRAC N4 highway, Gauteng, South Africa, for wildlife crossings. The underpasses were monitored continuously using mounted camera traps since December 2022. The preliminary camera trap data showed increasing animal activity and use of the monitored underpasses, with nine mammalian, two reptilian and six bird species recorded using them for crossing the highway. Animal use of the underpass structures for crossing was dependent on the characteristics of the structure (size, shape and adjacent roadside habitat type). This shows that gathering baseline data on wildlife roadkill, animal movement and behavior patterns across roadways could help modify existing road structures accordingly in such that they potentially serve as effective wildlife crossings.

Using DNA barcoding methods to explore Arthropod diversity in a mountainous grassland habitat

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The high levels of biodiversity observed in South Africa are attributed to the immense geographic diversity observed across the landscape. Large parts of the inland mountain ranges of the Eastern Cape Province fall within the grassland biome, known for high levels of floral diversity and endemism. Studies on arthropod diversity in this region are less known. Here I will present results for two insect groups (ants and planthoppers) from an ongoing DNA barcoding project investigating arthropod biodiversity at a sample site in the Winterberg mountains of the Eastern Cape. Both groups are well-known bioindicators of grasslands. Specimens were grouped into morphospecies, and representatives were DNA barcoded at the COI gene. For ants, only a subset of the morphospecies were assessed thus far (101 of 235). The planthoppers were grouped into 17 morphospecies. Sequences were identified to the lowest taxonomic rank using GenBank and BOLD databases. The phylogenetic position of the specimens was further assessed by maximum likelihood (ML). The ant specimens were found to represent 12 genera from two subfamilies (Myrmicinae and Formicinae). Six species-level identifications were made for the ants, with a further 16 possible species present. The hyper-diverse genus *Pheidole* accounted for 54% of the specimens assessed, with two distinct clades observed. The planthopper identifications were less clear, with specimen identifications only possible at family level. The planthopper morphospecies was grouped into three families (Tropiduchidae, Meenoplidae, and Delphacidae) and six possible species. The lack of comprehensive DNA databases does hinder the use of molecular identification in some taxa, as evident from the presented planthopper results. However, other taxa such as ants are well-represented in DNA databases, and genus-level identifications can be made. A closer collaboration between molecular biologists and classical taxonomists is needed to broaden the scope of DNA databases, providing valuable resources for future molecular biomonitoring studies.

Sample design in biodiversity studies matters: a fine-scale study of Lawrence's velvet worm, *Peripatopsis lawrencei* (Onychophora: Peripatopsidae), reveals hidden diversity

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In the present study, by means of fine-scale sampling, the species boundaries in the cape velvet worm *Peripatopsis* lineages will be examined to identify and describe a paraphyletic, cryptic lineage living in sympatry with *P. lawrencei* on the Riviersonderend mountains in the Western Cape, South Africa. This unknown lineage will be compared and contrasted with *P. lawrencei*, through the use of gross morphology and scanning electron microscopy. We expect the two lineages to be morphologically identical but differ in dorsal and ventral papillae. DNA sequence data will be used to place the unknown lineage into a dated phylogeny, and sequences from prior studies will be used to construct a refined phylogenetic tree. The combined sequence topology will be constructed using maximum likelihood and Bayesian inferences, utilising both mitochondrial CO1 and the conserved 18S rRNA markers. Four species delimitation methods will be utilized (ASAP, PTP, GMYC, STACEY) to validate species boundaries, and a divergence time will be conducted on the CO1 dataset. For the second part of the study, a haplotype network will be constructed, and standard diversity values calculated for *Peripatopsis lawrencei*. With this, we can better understand the genetic structuring and colonisation history of this lineage. We predict marked phylogeographic differentiation across the distribution range of the species and marked F_{st} values. The results of this study will allow for a more informed inferences on the urgency of conservation for *Peripatopsis lawrencei* and the unknown novel lineage.

Session F1

Assessing the persistence of Blacksmith and Crowned Lapwings in urban areas of Pietermaritzburg, KwaZulu-Natal

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Urbanisation generally threatens biodiversity. Despite this, many species still persist in urban areas. Those species with broader tolerance generally show improved persistence. Little is documented on ground-nesting birds in urban areas. Lapwings are ground-nesting birds that appear to be persisting in urban landscape mosaics in South Africa. We assessed the persistence of Blacksmith (*Vanellus armatus*) and Crowned Lapwings (*V. coronatus*) in selected metropolitan areas of KwaZulu-Natal. We collected information about their occurrence, habitat use, distribution, and behaviour in urban mosaic landscapes by conducting monthly surveys and observations, and with citizen science feedback. During the breeding season, we determined the influence of anthropogenic activities and different land use on the nesting ecology of lapwings breeding in urban mosaic landscapes. We found that Blacksmith Lapwings' presence in the urban mosaic landscape depended on water availability, temperature, habitat type, resource availability, and grass height. Both lapwing species required short grasslands in urban mosaic landscapes and nested in pairs in open areas. At certain times of the year, they congregated in single species flocks in certain areas of the urban mosaic landscape, particularly open green spaces, for feeding and socialising. Despite all the anthropogenic factors affecting ground nesting birds in urban mosaic landscapes, lapwings show behavioural plasticity to use green spaces for their persistence here.

Passive acoustic monitoring detects new records of globally threatened birds in a high elevation wetland (Free State, South Africa)

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Wetlands act as islands of high biodiversity within the ecological landscape, providing vital ecosystem services to society. Anthropogenic activities are driving wetland degradation, and it has become increasingly rare to find wetlands that do not show signs of biodiversity loss or alteration. The increased loss of biodiversity in wetlands has a negative impact on the local economy and ecosystem services provided by wetlands. We responded to the South African National Biodiversity Assessment (NBA) call to document wetland biodiversity against the backdrop of sustained wetland degradation in Southern Africa. We monitored the soundscape of a high-elevation wetland in Golden Gate Highlands National Park (GGHNP) from June 2019 to December 2020 across 24 localities using a rolling grid layout. We detected 35.9% of the avian species previously recorded from ad-hoc sightings in GGHNP of which 68.1% are wetland obligate species. We contributed an additional 10.2% new species records to the avian diversity of GGHNP, including 24 species that are considered threatened by the International Union for Conservation of Nature. Our remote monitoring technique enabled the first-ever continuous monitoring using remote acoustic equipment for a high-elevation wetland in South Africa, thus contributing to the NBA call.

Comparing how different pitfall distribution patterns affect the capture efficiency of macroinvertebrates within an eastern Free State Sandy Grassland

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Insects are well known to be essential to the environment and have been observed as important role players in everyday ecosystem functions. It is for this reason that we make regular use of them as bioindicators, pollinators, decomposers, and food sources. It has been documented that most ground-dwelling and flying insects are at risk of extinction because they are extremely sensitive to environmental changes such as temperature and humidity variations. Pitfall trapping, a catchment method aimed at sampling ground-dwelling macroinvertebrates, is extensively used in ecological and monitoring studies but, often as a stand-alone capture method, but can be employed in a variety of patterns to increase capture rate and provide a more well-rounded result. However, very few studies have focused on the efficiency of data collected based on pitfall dispersal patterns, and how this may affect the outcome of abundances, species richness, and biodiversity calculations. The most common distribution pattern employed in pitfall trapping is circular, while square, rectangle, straight-line, as well as randomised, are occasionally mentioned in literature. This study aimed to compare how different distribution patterns and designs affected the capture efficiency of invertebrates when using pitfall traps. In total, 2004 macroinvertebrate specimens were captured during the experiment. The square distribution pattern gave the highest abundance, the straight line gave the highest species richness, and the triangle gave the highest diversity. We concluded that it is important to assess as many factors as possible that may contribute to capture efficiency (including pattern arrangement) to understand the possible reasoning behind the observed results. From these results, the triangular pattern arrangement may, in the future, be used more frequently in studies that are based on pitfall trapping sampling, because this pattern provided better evenness when compared to other patterns.

Effects of linear infrastructure on vertebrates in Hluhluwe-iMfolozi Park and Isimangaliso Wetland Park, KwaZulu-Natal, South Africa

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As human development continues to increase, so does the density of road networks and other anthropogenic structures, leading to increased impacts on the natural environment. In KwaZulu-Natal Province, the Zululand area is a biodiversity hotspot, with parks such as Hluhluwe-iMfolozi Park (HiP) and iSimangaliso Wetland Park (ISWP) being vital for biodiversity conservation and ecotourism. These protected areas experience high vehicle traffic, with HiP and ISWP being crossed by major provincial roads. Most studies have focused on the difficulties large mammals face regarding linear infrastructure in these parks but have neglected the smaller vertebrates. As such, small vertebrates have been poorly represented in park management programmes that target reducing wildlife-vehicle collisions (WVCs). This study aimed to identify and compare the species assemblage of vertebrates comprising WVCs, along provincial roads traversing the R618 of HiP, and the R22 central section of ISWP. Repeated 2 h driven surveys were conducted monthly at sunrise and sunset with a total of 1008 survey hours across 504 individual surveys. Data collected for each carcass included identity, global positioning system (GPS) coordinates, photographs, measurements of distances to road shoulder and vegetation, road and habitat characteristics, presence of existing traffic calming and crossing structures, and climatic conditions. The results of this study indicate a need for increased traffic calming and crossing structures along these roads. The data will be further used to inform computational models to determine the ideal locations for implemented measures mitigating WVCs.

Collective movement in meerkats (*Suricata suricatta*): coordination and fitness consequences

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Social species gain benefits from living in groups, such as protection against predators and access to more food patches, but they are at risk of getting diseases and experience foraging competition when resources become scarce. Previous research has found that the position of an individual in the group during foraging can affect their foraging success. For example, individuals at the centre-front or at the edge of a group can have priority access to food patches. Animals located in front of the group may experience increased foraging success but also higher predation risk, whereas those at the centre are protected from predators but have lower foraging success. We investigated whether animals living in an extreme environment, i.e., the Kalahari Desert, optimize their positions within a group to maximize foraging success. Using the obligate social meerkat (*Suricata suricatta*) as a model system, we specifically asked whether dominant individuals tend to occupy the centre-front position, or whether this position is shared equally between all group members. We determined individual foraging success by measuring both morning and lunch weights and used the difference as a proxy for foraging success. In contrast to expectations, we found that dominance rank and spatial position did not affect foraging success in these animals. We discuss the implications of these findings in the context of social foraging on rapidly renewable resources.

Assessment of fish response in the uMngeni River and impoundments, KwaZulu-Natal South Africa

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Fish respond to environmental conditions, so changes in the freshwater system's biological and physicochemical components affect species assemblages. As fish assemblages in freshwater ecosystems are bioindicators of ecosystem health, we assessed these in the uMngeni River, one of the largest rivers in KwaZulu-Natal, South Africa. There are five tributaries of the uMngeni River, four are relatively small (Lions River, Karkloof River, Mpolweni River, and Palmiet River), and a major tributary called the uMsunduzi River. The uMngeni catchment has four dams (Midmar, Albert Falls, Nagle, and Inand) built to supply ~ five million people and industry. We sampled fish communities at shallow river sites in the National River Monitoring Programme (REMP) in the uMngeni, KwaZulu-Natal, from August 2022 to April 2023. We also sampled substrate, cover features, and water quality concurrently. We determined fish response by comparing observed species to reference expected species found in that system, and then scores ranging from natural to severe modifications were obtained. Our results provide an update on ecosystem health using fish communities. The observed freshwater species in the catchment were the same as the expected freshwater fish species, the uppermost sites (wakefields) were dominated by brown trout (*Salmo trutta*) for the whole survey duration while freshwater fish diversity was observed on other sites in the uMngeni. Wakefields sites had physicochemical properties (pH, total dissolved solids, EC, and Salinity) that were lower than those measured on the other surveyed sites. Changes in water quality were observed when moving down the uMngeni River.

Aspects of urban ecology of the rock hyrax (*Procavia capensis*) in the urban mosaic landscapes of KwaZulu-Natal, South Africa

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Abstract Globally, urbanisation significantly alter natural landscape structure and its functionality, affecting both floral and faunal diversity. Nonetheless, some wildlife species thrive and flourish in transformed habitats as they successfully adapt and can exploit urban areas. Most species that persist exhibit phenotypic plasticity in habitat selection, behaviour, movement patterns and population dynamics. The aim of this study was to document the ecology of rock hyrax (*Procavia capensis*) in urban areas, with the aim of assessing the factors that affect their persistence in urban mosaic landscapes of KwaZulu-Natal (KZN), South Africa. The objectives of the study were to investigate the factors determining the occupancy and detection probability of rock hyrax in urban areas of KZN and to understand public perceptions and wildlife conflict issues associated with rock hyrax in urban areas of KZN. The study was conducted in four urban mosaic landscapes of KZN, differing in geographical location, landscape, human density, size, degree of landscape transformation, vegetation type and environmental impacts. Using point counts, presence and absence data of rock hyrax were recorded, and questionnaire surveys were used to understand public perceptions of rock hyrax and human-hyrax conflict interactions. Rock hyrax persistence in urban mosaic landscapes was affected by the quality and availability of green (natural and managed) spaces, food availability, anthropogenic infrastructure, and human-hyrax interactions. Understanding factors that affect the ecology and persistence of rock hyrax in urban mosaic landscapes is important for their conservation in urban mosaic landscapes.

Session F2

Aspects of the urban and rural ecology of Nile monitors (*Varanus niloticus*) in KwaZulu-Natal, South Africa

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Globally, there is unprecedented anthropogenic land use change. Little is known about how reptiles respond to anthropogenic changing land use, especially in Africa. Nile monitors (*Varanus niloticus*) remain poorly understood despite being widespread and heavily exploited. We aimed to determine if Nile monitors are successful exploiters in areas of changing land use and what factors affect their persistence. We caught Nile monitors across a gradient of urbanisation in KwaZulu-Natal (KZN), South Africa, in 2022 and 2023. We obtained morphometrics, body mass, and the capture geographic coordinates for each individual caught. We also inserted a passive integrated transponder (PIT tag) for individual identification. We recorded various habitat parameters at the capture site. We used the data to assess their habitat use, behavioural plasticity, and population dynamics. In addition, we used an online questionnaire to investigate cultural aspects, perceptions, and human/domestic pet interactions with Nile monitors. We have trapped over 80 Nile monitors, mostly in urban mosaic landscapes. They were generally found close to water. They use swimming pools and storm drains in urban areas. We found hunting and selling of Nile monitors occurs in KZN. We documented various myths and folklore about monitors. Urban exploitation and successful management may be key to varanid population persistence with continued changing land use.

Long toes but hopefully not such a long shot

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The endangered long-toed tree frog (*Leptopelis xenodactylus*) is a species that was only discovered in 1963, with little research since. In response to the IUCN recommendation, a study commenced in 2019 to establish a broader knowledge of this species, including a more informed opinion of its distribution and population. This was accomplished by several methods, including a preliminary model which was used to ground truth the possible localities with the highest probabilities of being suitable habitat and containing the species in KwaZulu-Natal South Africa. This resulted in 21 new localities being discovered for the species during the course of the study. The habitat preference for the species was established to be temperate alluvial hummock wetlands in U-shaped valleys at mid-altitudes in southwestern KwaZulu-Natal. A second model was developed, including the information from the new localities, for use in spatial planning. All the known localities were then analysed in relation to the predictions of two downscaled climate change models and a vulnerability framework. Climate change was found to be a potentially significant threat to the species according to one of these models. However, the new localities resulted in an increase of 9 % in the extent of occurrence and 429% in the area of occupancy; indicating that the species might be eligible to be downgraded at the next red-listing.

The State of Aquatic Pollution in Qwaqwa region: Application of microbiotests for toxicity evaluation of river waters

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Water pollution is a global issue, with anthropogenic activities as the primary contributor. South Africa's freshwater systems have come under severe pressure since it is a water-stressed country. Therefore, it is essential to monitor freshwater quality, especially closer to the headwaters in montane areas, as most of the country's water systems begin there. The Free State province has a significant shortage of water quality data and potential pollution threats, especially in the QwaQwa region. The study aimed to assess the water quality of four rivers (Namahadi, Metsi-Matsho, Mpokojwane, and Elands) in Qwaqwa using two model aquatic species from different trophic levels to estimate the ecotoxicological risks of river water samples to the ecosystem. Water was sampled from selected rivers, focusing on the upper, middle, and lower reaches. After that, an acute toxicity test with *Daphnia magna* and a growth inhibition test with *Tetrahymena thermophila* were applied to examine water quality in the laboratory. Our findings show that water samples from most middle and lowest points (Elands River) had significant ecotoxicological effects on both species. However, *T. thermophila* was the most sensitive species compared to *D. magna*. This suggests that some of the water samples were toxic and could cause potential adverse effects on aquatic biota harboring these river systems.

Evaluating fish communities in the uMsunduze mainstream and tributaries in Pietermaritzburg, KwaZulu-Natal

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Multiple anthropogenic activities have significantly impacted freshwater fish communities in KwaZulu-Natal, South Africa. The uMsunduze River in Pietermaritzburg, KwaZulu-Natal, has many anthropogenic stressors, including pollution, habitat modification and impoundments. We compared the fish diversity and abundance between the mainstream uMsunduze River and its tributaries to determine these influences. We surveyed 17 sites between 2022 and 2023 around Pietermaritzburg seasonally and an additional 18 sites ad-hoc using an electroshocker, fyke nets and gill nets. We used the Fish Response Assessment Index (FRAI) to determine the ecological scores at each site and assessed drivers of fish community structures using generalised linear modelling. Our preliminary results found ten fish species out of 48 expected species for the study area, and only 566 individuals across the study area. We found seasonal variation in fish abundances, with fewer individuals in winter (n = 66) and spring (n = 142) than in summer (n = 169) and autumn (n = 189). Two expected species, *Enteromius gurneyii* and *Amphilius natalensis*, are listed as vulnerable. *Enteromius gurneyii* were not caught in the study, and 11 *A. natalensis* were caught during one survey at one ad-hoc site. Some tributaries with low anthropogenic impacts had relatively rich fish species abundance, whereas highly impacted tributaries had no fish, for example, the Baynespruit. We found fish species diversity and abundance were severely altered in the uMsunduze mainstream. Reasons for poor fish community structures can be related to anthropogenic stressors, and management interventions are needed to curb the loss of freshwater biodiversity.

Spatio-temporal distribution of benthic macrofauna of the large fluvially dominated Kei Estuary, South Africa in response to a flood

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The benthic macrofauna communities in estuaries are an important part of the ecosystem. They perform vital functions in these systems such as recycling of nutrients, aiding in the decomposition of organic matter and are a food source for some fish and birds. Physical disturbances as a result of floods and drought are known to be a major determinant of the spatial and temporal dynamics of benthic habitat and associated biotic communities of rivers and estuaries. They alter salinity and sediment properties which, in turn, influences the structure and functioning of benthic communities. Floods may result in reduced benthic diversity and abundance since both burrowing and epibenthic species have the potential of being washed away. The objective of this study was to investigate the effects of a flood on the macrofauna of a fluvially dominated estuary. The Kei estuary was sampled bi-annually from 2016 – 2018, the February 2018 sampling coinciding with a flood event. A total of 38 species were recorded during the sampling period. The amphipod *Grandidierella lutosa* was present in the estuary throughout the sampling period, mainly dominating during the low flow season while the polychaete *Prionospio sexoculata* and an oligochaete belonging to the Naididae dominated during high flow. Densities of *G. lutosa* and *D. ornata* increased substantially after the flood. Maximum densities recorded for *G. lutosa* were 2 461 ind. m⁻² before, 112 ind. m⁻² during and 9 005 ind. m⁻² after, the flood respectively. Similarly, maximum densities recorded for *D. ornata* were 1 323 ind. m⁻² before, 0 ind. m⁻² during and 4 336 ind. m⁻² after, the flood. However, overall, higher species diversity, richness and abundance were observed during the low-flow rather than the high-flow season. Changes in diversity, richness and abundances during and after the flood are consistent with trends observed in similar studies.

The distribution of benthic macroinvertebrates in the wetlands on the Waterberg Mountain Complex, Limpopo Province

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Wetlands cover approximately 3% of the total land area in the Limpopo Basin, with swamps and floodplains being the most common types of wetlands in the region. Almost half of the wetlands identified in the province are in a critical state. This project was conducted in the Waterberg as part of the FBIP project for Waterberg Biodiversity. The Waterberg area has farming activities that take place which include both agriculture and livestock. Various crops are planted in the fertile soil of the Waterberg catchment area and cattle are also farmed extensively in the rich grazing provided by the area. Around the sources of the Waterberg, game farming takes place on a large scale with many privately owned game farms. The mining of tin, chrome and fluorspar also takes place in the area between Mookgopong and Mokopane. Water, sediment and macroinvertebrate samples together with physico-chemical parameters were collected at 12 wetland sites at the beginning of the rainy season in November 2022 coined 'early rains' and just before the end of summer in March 2023 coined 'late rains'. The aim of the study was to assess spatial variation in macroinvertebrate assemblages in relation to water quality of the wetlands of the Waterberg Mountain Complex. Analysis of variance (ANOVA) will be used to determine the differences among the sampled sites of water quality and macroinvertebrate distribution, using Statistica Version 10. A combination of canonical correspondence analysis and univariate analyses will be used to examine the macroinvertebrate assemblage's of different wetland sites of the Waterberg Mountain Complex. The spatial difference in macroinvertebrate abundance will be correlated to changes in water quality to observe the effects of the various water quality constituents to the distribution of macroinvertebrates.

Identifying conservation units of wild *Oreochromis mossambicus* in Kwazulu-Natal, Mpumalanga, and Limpopo, South Africa

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Oreochromis mossambicus is one of the most important freshwater fish species in the aquaculture industry. They occur naturally in many major river catchments in South Africa, especially in the country's warmer regions (provinces). Despite this, little is known regarding the genetic structure of wild populations. Furthermore, the species is threatened by hybridisation with the introduced *O. niloticus*, and so it has been listed as Vulnerable on the IUCN Red List. Baseline data are essential in determining, conserving, and monitoring important genetic units of *O. mossambicus*. In this study, we assessed genetic structure of *O. mossambicus* across South Africa using a suite of 14 microsatellite loci, focusing on the genetic diversity and fine-scale populations structure of fish from major river catchments in three South African provinces (KwaZulu-Natal, Mpumalanga, and Limpopo). Analyses revealed low genetic diversity within populations, but significant genetic differentiation among populations from different river catchments. The STRUCTURE analyses suggested the presence of 16 geographically correlated genetic clusters, in particular the one population in KwaZulu-Natal (Mtamvuna), three populations in Mpumalanga (Olifants, Loskop Dam and Pieter Vosloo Dam) and four populations in Limpopo (Mapungubjwe, Shingwedzi, Sand River, and Letaba) were highly genetically distinct. We recommend that strict measures be implemented to monitor and conserve the present genetic diversity and differentiation of these populations for their long-term persistence.

Session G1

Haemogregarine and haemosporidian diversity of reptiles in KwaZulu-Natal, South Africa

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Haemogregarines and haemosporidians are commonly encountered parasites of erythrocytes or leukocytes and are frequently described from a wide variety of vertebrates including reptiles. However, even with the increase in research on these parasites in the last decade, knowledge on the diversity and systematics of these apicomplexans is still lacking and remains contentious. As such the contribution of further morphologically and molecularly described taxa for use in phylogenetic analyses would be valuable. Hence, the aim of this study was to investigate the diversity of haemogregarines and haemosporidians infecting reptiles from South Africa. Blood and ticks collected from reptiles in KwaZulu-Natal were screened for haemosporidian and haemogregarines parasites using a combined approach. Blood slides were prepared for morphometric data on parasite stages. Screening for haemogregarines and haemosporidians was done by amplifying the 18S rRNA and cyt-b gene regions, respectively. Developmental stages of *Hepatozoon fitzsimonsi* were determined from *Amblyomma* ticks as well as from tissues of a tortoise (*Stigmochelys pardalis*). *Hepatozoon* species were also identified both morphologically and molecularly from the two species of varanids lizards (parasitemia 0.2% and 0.5%, respectively) and one species of elapid snakes (parasitemia of 2% and 4%, respectively). Of the 25 tortoises, two (8.0%) (parasitemia 2–4%) were parasitized by a species of *Haemoproteus* (*Haemocystidium*). Of the 30 snakes, four (13.3%) (parasitemia 12.4%) were found infected with a species comparable to *Haemoproteus mesnili*. As such this study provides the first available molecular data for a species of *Haemocystidium* of tortoises in South Africa. Furthermore, it provides both morphological and molecular data on *Haemocystidium* infecting snakes. Moreover, the present study represents the first morphological and molecular report of *Hepatozoon* within the South African varanids and elapids. This study also highlights the possibility of *H. camari* and *H. ayorbor* being present in South African varanids and snakes, respectively.

**Oral antitrypanosomal effects of Azithromycin on *Trypanosoma congolense* and
*Trypanosoma brucei brucei***

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Host responses to haemoparasites vary depending on type of infecting parasite, the infected cells and the immune status of the host. Reptile immune responses to haemoparasite infections remains to be poorly understood in comparison to mammalian immune responses. This study was aimed at profiling the relationship between haemoparasite infections and the measure of adaptive immune responses, particularly IgY antibody in the Afromontane lizard hosts. A total of 39 lizards were collected from Fika-Patso, Metsimatsho, and Sentinel trail areas in the eastern Free State province whereby n = 11 were from *Pseudocordylus melanotus*, n = 18 from *P. subviridis* and 10 were from *A. atra*. Giemsa-stained blood smears were examined under light microscopy to morphologically identify haemoparasites in blood. Parasites that were identified up to genus level by microscopy included Hepatozoon spp., Plasmodium spp., Sauroplasma spp. and unclassified filarial nematode species. Identification and white blood cell counts were also done using microscopy and observed cells were basophils, azurophils, lymphocytes, monocytes and thrombocytes. PCR was conducted using specific primers to detect Hepatozoon spp., Plasmodium spp. and filarial nematode spp. in blood. A total of 22 samples were positively detected by PCR for targeted cytb and 18S rDNA genes with infection rates of 7.7% for Hepatozoon spp., 23.1% Plasmodium spp. and 25.6% for filarial nematode species from all study sites. ELISA was used for quantitative measurement of IgY in serum samples and the mean IgY levels were relatively higher in *P. melanotus* from Metsimatsho and were lower than the cut-off value in *A. atra* and *P. subviridis* from the three study sites. There was no significant difference at ($p < 0.05$) in levels of IgY between the individual species and between the control samples. This study further showed that there is no correlation between the levels of IgY and parasitaemia of infected sampled lizards.

Assessing the impacts of environmental education on negative perceptions and attitudes towards bats

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Bats are amongst the most important ecosystem service providers in the world. This is in part due to their diversity as they are the second largest group of mammals and their widespread distribution across the world. Despite this, most cultures around the world have negative stereotypes towards bats largely influenced by myths and beliefs about bats stemming from misconceptions about this taxon. This has resulted in the persecution of bats in certain areas especially since the covid 19 outbreak. The study therefore aims to assess the impact of environmental education on enhancing awareness and positive perceptions towards bats and their natural ecosystem services by school learners in Qwaqwa in the eastern Free State. The study is addressing negative stereotypes about bats through informed, interactive, scientific, and public communication in schools with the use of bat awareness classes, posters and engagement in bat research. A BATSS questionnaire tool (Perez et al. 2021) is being used to assess individual attitudes towards bats pre- and post-intervention, targeting for each survey (pre- and post-intervention), 200 learners from two primary and two secondary schools in Phuthaditjhaba. Twelve bat boxes have been erected in the four schools to engage learners in scientific bat research. Initial sampling has revealed high negativity towards bats by learners with 57% believing that bats are dangerous to humans and 60% believing that bats are aggressive. The ongoing sampling is yet to reveal whether environmental education has changed negative perceptions of students towards bats or not.

Session G2

Reproductive ecology of Africa's only known suburban African Woolly-necked Stork (*Ciconia microscelis*) population.

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Across the globe, an increasing number of wildlife species have been found to exploit urban environments with varying degrees of success. The African Woolly-necked Stork (*Ciconia microscelis*) has expanded in KwaZulu-Natal, South Africa, over the past 30 years, and has particularly colonised developed areas. Woolly-necked Storks are now a common resident in suburban residential areas and are routinely fed by homeowners, which is an unprecedented behaviour for the species in Africa. It remains unclear how, demographically, a large, long-lived stork could have expanded so rapidly in a novel environment, and what ecological tradeoffs they may face. Therefore, we initiated a study of population dynamics in developed areas. During the 2022-2023 breeding season, we observed 43 nesting attempts from 37 nests in an urban landscape mosaic in KwaZulu-Natal. Of these nesting attempts, 79% successfully hatched chicks and 58% successfully fledged at least one chick. The mean age at fledging of 71 days was longer than previously reported. This is the first study in Africa on the reproductive ecology of the Woolly-necked Stork to understand how urbanisation influences breeding parameters that could contribute to population expansion.

Microhabitat requirements and occupancy of understory bird forest specialists in Southern Mistbelt Forests of KwaZulu-Natal, South Africa: the use of camera traps

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Monitoring species' habitat selection and microhabitat requirements is vital for conservation and management, though studies on bird species' habitat selection at relatively fine scales are often limited. Camera traps are useful techniques for studying bird communities, particularly elusive species that are challenging to document using trading survey techniques. Here, installed 184 camera traps during the non-breeding and breeding season to study understory forest-specialist birds' habitat requirements in 14 selected Southern Mistbelt Forest patches of KwaZulu-Natal, South Africa. We conducted foliage profile and forest structure surveys and an inventory of tree species richness to characterize forest microhabitat. Over 7182 trap days, we had 615 detections of ten understory forest-specialist bird species, most of which were insectivores. We modelled the occupancy of Lemon Doves *Aplopelia larvata*, Chorister Robin-Chats *Cossypha dichroa*, Crested Guinea-fowls *Guttera pucherani*, and Red-necked Spurfowls *Pternistis afer* to determine microhabitat characteristics that influenced detection probability and occupancy. The main microhabitat characteristics influencing forest-specialist understory birds were tree species richness, leaf litter, and water cover. Forest structural characteristics that influenced occupancy of the selected understory forest-specialists were within 5 m from the forest floor. Microhabitat requirements for the birds were species-specific, with seasonal variations for Lemon Doves. Conservation strategies should maintain undisturbed forest understory to allow for the persistence of understory forest-specialist bird species.

The underground cat: how black-footed cats (*Felis nigripes*) choose and use the burrows of other species

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The black-footed cat (*Felis nigripes*) is Africa's smallest, rarest, and least-studied cat. Endemic to the semi-arid regions of South Africa, Namibia, and Botswana, this nocturnal carnivore seeks refuge from extreme temperatures and predators by sheltering inside burrows by day. However, black-footed cats do not dig their own burrows. Instead they rely upon the digging efforts of other mammal species for suitable den sites. The black-footed cat is more dependent upon burrows than any other felid, yet den usage has never been described for the species. My goal, in addition to describing den usage patterns, was to determine which burrowing species the black-footed cat depends upon for its survival and how this limiting resource may affect their conservation. The entrances of 50 dens, used by five radio-collared female black-footed cats over four weeks, were scanned with LiDAR to measure tunnel width ($M = 15.2 \pm 3.9$ cm) and height ($M = 13.9 \pm 3.6$ cm). Of these, 98% fell within the size range of springhare (*Pedetes capensis*) with the remaining 2% likely to have been springhare burrows enlarged by bat-eared fox (*Otocyon megalotis*) or aardwolf (*Proteles cristata*). The cats each used an average of 11.6 unique den sites over 26 observed days and spent an average of 2.2 consecutive days in a den before selecting a new one. Days-per-den shifted dramatically for mothers when their kittens reached an age of about 44 – 50 days, switching from an average of six days-per-den, to changing dens every day. My results show that black-footed cats are highly reliant upon springhares to provide suitable daytime refugia and maternity dens in southern Namibia. Localized persecution and eradication of springhares on commercial livestock farms may severely limit the reproductive capacity of black-footed cats when suitable replacement burrows are unavailable.

Session H1

The role of mammals on seed dispersal of fleshy-fruited invasive alien plants in the Grassland biome of South Africa

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Fleshy-fruited invasive alien shrubs are an increasing problem in the grasslands of South Africa where they impact vegetation structure and reduce biodiversity. In general, these species are predominantly bird-dispersed in forest systems, therefore, their spread in grassland ecosystems remains understudied including spread by mammals. Mammals facilitate seed movement and may also promote seed germination and seedling establishment. The aim of this study was to determine the role of mammals on seed dispersal of fleshy-fruited invasive alien plants in the grasslands. Eland, baboons, goats, and jackal dung were collected, seeds were removed, identified to species level, and planted in a greenhouse setup. Seeds of the invasive species *Cotoneaster pannosus*, *Pyracantha angustifolia* and *Rosa rubiginosa* (all Rosaceae) were identified from the dung. Germination experiments showed no differences in germination between ingested *P. angustifolia* seed and manually de-pulped controls while there were significant differences in *C. pannosus* seed germination compared to manually de-pulped controls. The ingested had higher germination success than the de-pulped seeds in *C. pannosus*. Overall germination of *R. rubiginosa* seeds from faeces was very low (<2%), similar to controls. Mammals were shown to be important dispersers of invasive fleshy fruiting plants in the grasslands of South Africa, but the effects of ingestion on germination differed between plant species.

Source of introduced populations of *Hemidactylus mabouia* (Moreau de Jonnès, 1818) into the Eastern Cape Province and the potential spread to other South African regions

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Human movements globally have resulted in dispersal and introduction of terrestrial and marine organisms into areas outside of their native range. Species that have been introduced to new habitats can either be alien or invasive alien species. Investigating the source of these introductions is important as it provides baseline information about their biology and evolution. It also allows for better prevention measures for future invasions and for effective conservation strategies. In this study, I investigate the source of the introduced populations of tropical house geckos *Hemidactylus mabouia* in the Eastern Cape Province using two mitochondrial gene regions, ribosomal 16S and NADH dehydrogenase subunit 4 (ND4). We also look at the potential spread of these species using species distribution models (SDMs). The phylogeny showed that the introduced populations into the Eastern Cape were genetically similar to both *H. mabouia* lineages found in Central & Southern Africa. The phylogeny produced two clades from which the majority of the introduced samples were grouped in a clade with samples from Angola, DRC, and Mozambique, and only a few nested within the second clade with the South African native population. Haplotype networks from both genes also showed two clades, matching those found in the phylogeny. The introduced samples were associated with samples from Angola and those from South Africa (native) as these localities had a number of shared haplotypes. SDMs showed less evidence that these individuals could naturally move west down the east coast of South Africa. Our conclusion was that the introductions may be due to multiple avenues like species moving down the east coast or human translocation including trade routes. From this we can conclude that geckos are largely translocated through human movement as they are known for their opportunistic behaviours as they are commensal with humans.

Home invaders: the effects of inter- and intraspecific competition on the population dynamics of cockroaches

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Both intra- and interspecific competition are arguably the most important processes influencing the dynamics and regulation of animal populations. This is because outcomes vary dramatically, from coexistence on the one hand, to exclusion in extreme cases on the other, at species and individual levels. It is difficult to study the effects of competition on populations in the field, due to the simultaneous effects of multiple confounding factors. Short-term experiments in controlled laboratory settings can be, and have been, used to overcome this constraint, provided that the study species has attributes that enable monitoring of rapid demographic responses. Cockroaches (Arthropoda) grow and reproduce rapidly, and thus exhibit multiple short-term population responses such as density-dependent fluctuations and cycles. Moreover, these animals do not undergo major ontogenetic shifts, and so all individuals occupy similar ecological niche space regardless of age, making it theoretically possible to study demographic responses ubiquitously throughout the population. In this study the effect that inter- and intraspecific competition has on the population fluctuations, individual fitness' (using body mass as a proxy), and demographic responses (mortality and fecundity rates) of two species of cockroaches (*Blattella germanica* and *Periplaneta americana*) will be experimentally studied in regulated arenas. Cockroaches will be exposed to varying levels of both intra- and interspecific densities at varying over multiple levels of food supply, and with different resource types. We expect that at high densities, competition will lead to a decrease in growth rate, an effect that will be more pronounced at reduced levels of resource supply.

Session H2

Influence of microhabitat structure on the occupancy of mammalian species within the Southern Mistbelt Forests of KwaZulu-Natal, South Africa

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Afromontane forests of KwaZulu-Natal, South Africa, are highly fragmented, both naturally and anthropogenically, with fragmentation significantly impacting the biodiversity therein. Through occupancy modelling, we investigated microhabitat's influence on the presence of mammalian forest species in the Southern Mistbelt Forests in the Midlands of KwaZulu-Natal in 2020-2021. We deployed 184 camera traps across 14 indigenous forest patches, of varying sizes, across three study areas in the Midlands area. We installed camera traps using a systematic grid placement of 400 m x 400 m, with the camera traps being active for 24 h for at least 21 days. At each camera trap location, habitat structure foliage profiles were recorded in a 20 m radius around the camera trap. Camera trap locations were sampled in the wet (October – April) and dry (May – September) seasons to determine the factors influencing forest mammal presence across both seasons. Bushbuck *Tragelaphus sylvaticus* was the most recorded mammalian species across both seasons, with significant differences in detection instances for bushpig *Potamochoerus larvatus* and Cape porcupine *Hystrix africaeaustralis* between the wet and dry seasons. Mammalian and tree species richness were higher in the larger forest patches, with the protection status of the forests not necessarily resulting in higher mammalian species richness, as overutilisation of forest resources was evident in several forest patches, despite formal protection. Bare ground cover positively influenced the presence of bushbuck and bushpig, with short trees (2 – 5 m) and woody samplings (0 – 2 m) also positively influencing the presence of bushbuck. The microhabitat variables influencing Cape porcupine were quite varied, presumably as they are a generalist species, feeding on whichever resources are available. This study highlighted the factors influencing the presence of several mammalian species, which contributes to the implementation of effective forest conservation management strategies.

Unique carnivores and herbivorous sheep: how patterns of individual niche variation differ across trophic groups

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Individual responses to the effect of inter- and intra-species competition or predation, as well as their fitness and population dynamics, are all influenced by the prevalence of ecologically diverse individuals within populations. The level of ecological individuality has key outcomes for population growth, regulation, and evolutionary diversification. But, what drives variance in individuality is poorly known because of a lack of comparative studies. Here we hypothesized that resource requirement is a key determinant of individuality. Species with smaller intake requirements (carnivores) have more opportunity for diet niche separation to occur at the individual level than species in which each individual needs to consume large amounts of food (herbivores). We aimed to compare the isotopic niche widths and structures between herbivore and carnivore individuals from a xeric (Tswalu Kalahari Reserve) and more mesic (Pendjari Biosphere Reserve) environment. We were able to test the hypothesis that carnivores exhibit intrapopulation niche structure more frequently than herbivores, and whether this was driven by habitat conditions. Cross-sectional data, derived from faeces, were collected for within-population trophic niche variation amongst different mammalian carnivore and herbivore species, based on stable carbon and nitrogen isotope analysis. Analysis of ellipses in isotopic bi-space, as well as a set of community-wide metrics on cross-sectional data, supports the concept that more individual separation occurs in populations of carnivores than in herbivores, even accounting for species-level differences in isotopic niche breadths. These results corroborate the existing evidence that trophic level is a key determinant of the evolution of individual niche variation and, presumably, its role in the regulation of populations.

Diagnosis of gastrointestinal helminths infecting dogs in the Maluti-A-Phofung municipality

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Gastrointestinal helminths are a major cause of mortality and diseases in dogs especially in the tropics and some have been reported to be of zoonotic importance worldwide. In South Africa there is little information on the prevalence of GIT parasites in dogs from resource limited communities. Maluti-A-Phofung municipality is a developing area in the Eastern Free State which has limited access to veterinary services and therefore regular deworming is almost non-existence due to limited knowledge. Therefore, the aim of the study was to identify and calculate the prevalence of clinically relevant intestinal helminths in dogs. Furthermore, to compile a list of gastrointestinal helminths infecting dogs in Maluti-A-Phofung municipality for database purposes. To determine prevalence of GIT helminths faecal samples were collected from dogs around the municipality during the period of September 2021 to November 2021. The diagnostic tool used for helminths was the McMaster technique to determine faecal egg counts. Additionally, faecal cultures were prepared for GI helminths larval identification. A questionnaire was also carried out among dog owners with questions in relation to dog's wellbeing and exposure to deworm. The overall prevalence of gastrointestinal helminth infection in household dogs were respectively higher than faecal samples from Veterinary clinic. Prevalence of parasitic gastrointestinal helminths was higher in young dogs than in adults; and prevalence in parasitic gastrointestinal helminths was higher in female dogs than in male dogs. Due to the high prevalence of zoonotic canine gastrointestinal parasites identified and low levels of awareness of dog owners, there is a need to educate dog owners about the dangers posed by these parasites on public and human health if not controlled.