

A Call for Sahelo-Saharan Invertebrate Surveys for Understanding and Conserving Ecosystem Services and Food Webs

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Invertebrates are keystone species in most environments around the world as providers of essential ecosystem services, such as food, decomposition and nutrient recycling, seed dispersal and pollination. The long-term conservation of ecosystems requires a better knowledge of the role invertebrates play in habitat integrity. It is estimated that 90% of angiosperms evolved for insect pollination with bees being the most important pollinator in most ecosystems. Because of their association with flowering plants bees provide keystone pollination services for the production of seeds, fruits and nuts for which many vertebrates from foxes to antelopes to birds to tortoises rely upon for their survival, as well as for the long-term propagation and survival of the forage plants themselves. Even plants like grasses that do not require pollinators benefit from the seed dispersal activities of species of ants. Additionally, a major component of the diet of many birds and mammals is the diverse invertebrate community of beetles, grasshoppers, and other species within the region.

In order to better understand and conserve many species and their habitats there is a need for a more complete understanding of the diversity of life within an area. With examples of known and potential relationships between invertebrates and plants and vertebrates, with examples from the Termit and Tin Touma and other areas this presentation will be a call for additional invertebrate survey work within the Sahelo-Saharan region to better understand the plant-invertebrate-vertebrate and invertebrate-vertebrate relationships that currently exist, are potentially at risk, and also need to be conserved.

Key words: Invertebrates, Pollinators, Bees, Ants, Ecosystem Services

Mortality of scimitar-horned oryx (*Oryx dammah*) at ZSL Whipsnade zoo; 1987-2011

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Sixty scimitar-horned oryx died or were euthanased at ZSL Whipsnade zoo between 1987 and 2011. All, except two males which were euthanased as surplus animals, were examined post mortem. These comprised two foetuses, 15 neonates (0-10 days old), 12 juveniles (11 days to 11 months) and 29 adults (one year and above).

The foetuses were aborted, but no cause could be established. One neonate was markedly underweight and was potentially a late abortion. Three neonates were newborn and hadn't yet breathed. In one case there were traumatic lesions compatible with dystocia, but it was not possible to say whether the other two were stillborn or died during parturition. Six of the neonates died within 48 hours of birth and had failed to suck adequately, if at all. In two cases in 1987 recent very wet weather was the main cause, while in the others low birth weights, exposure and poor mothering were possibly involved. One calf was being assist-fed whilst attempts were made to re-integrate it with the mother, but it died of aspiration pneumonia. Three older neonates also showed poor growth and weight-gain, with one calf affected by the same period of wet weather in 1987. Two neonates died of bacterial infections (listeriosis and an umbilical infection).

The majority (nine of 12) of the juveniles died of bacterial infections, often involving multiple abdominal organs, especially the intestines and associated with micro-abscessation. Yersiniosis (infection with *Yersinia pseudotuberculosis*) was suspected in many cases, but the bacterium was only cultured in two. *Escherichia coli* in pure or predominant growth was isolated from four others. One 2-month-old calf was suspected to have pneumonia and was euthanased, a 5-month-old was euthanased after fracturing its lumbar spine during a catch-up, and no cause of death could be established in the final calf.

Similar multi-centric bacterial infections were found in three 2 and 3-year-old oryx, again with a suspicion of yersiniosis and/or colibacillosis. Three young adults in poor condition were thought to have copper deficiency and parasitic gastroenteritis, whilst older animals euthanased due to poor condition were found to have a variety of conditions, including missing or infected teeth, kidney failure, bronchopneumonia, splenitis, chronic arthritis, granulomatous infection and neoplasia. Trauma was the cause of death or euthanasia in seven cases, but there was evidence of trauma in many others, often where herd members had been attacking weak or old individuals. Other conditions noted during post mortem examinations included hoof lesions and solar necrosis/abscessation, inter-digital gland impaction, adrenal enlargement, abdominal tapeworm cysts, thickened heart valves, fat necrosis and haemorrhage and abomasitis.

A review of the causes of death of calves born in the breeding seasons of 1990-2 (21 calves born, 16 dying before 1 year of age) focused attention on the importance of nutrition of the pregnant and lactating females, copper deficiency and parasitic gastroenteritis in the herd, and the difficulty of ensuring that young calves were adequately treated with anthelmintics. In the subsequent two breeding seasons only one of 15 calves died before reaching the age of one year.

Key words:

Preliminary genetic characterization of north-western African populations of Dorcas gazelle

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North African gazelles represent excellent models to understand factors determining genetic structure in wide-range vertebrates that have undergone strong population declines. However, there is lack of quantitative knowledge on distribution of suitable habitats, ecological niche parameters, range regression, genetic structure, and barriers in the landscape for gene flow. This work aims at determining genetic diversity in Dorcas gazelle (*Gazella dorcas*) in its north-western African range, comprising Morocco and Mauritania. Both invasive and non-invasive molecular methods were used to sequence two fragments of mitochondrial DNA on different managed populations (wild, semi-captive and captive). Genetic diversity at both mtDNA markers showed a clear dichotomy within *G. dorcas* populations. The wild populations (Morocco and Mauritania) and the captive population maintained in Almeria (Spain) exhibited higher levels of genetic diversity, than all captive and semi-captive populations across this north-western range. These data should be taken into consideration in order to better implement a conservation action plan for the species in their natural area of distribution.

Key Words:

Distribution, suitable areas and conservation status of mountain-restricted biodiversity in Mauritania

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Specialist species and/or peripheral populations in range limits may be particularly vulnerable to isolation, especially in areas with extreme climatic conditions such as deserts. Relict populations of distinct biogeographic origin can be found alongside with endemic mountain-restricted species in Sahara-Sahelian mountains. In the mountains of Mauritania, the Afro-tropical *Papio papio* (IUCN: NT) co-exist with the endemic *Felovia vae* (DD) and *Agama boulengeri* (NE), in presumably isolated populations restricted to suitable patches. Determining population fragmentation levels together with the extent of occurrence and area of occupancy are necessary for conservation status assessments. In order to assess these parameters, this study identifies environmental factors related to species presence and quantifies suitable areas of occurrence for the three species and evaluates the conservation status of *F. vae* and *A. boulengeri*. High-resolution data were combined with environmental factors to derive ecological niche-based models of species occurrence. Ecological models identified distance to gueltas as the factor most related with the range of the three species, and distance to bare areas and rocky deserts for *F. vae* and *A. boulengeri*. Suitable areas for the three species within Mauritania are limited to mountains and these are mostly isolated and fragmented. Still, both *F. vae* and *A. boulengeri* were categorised as Least Concern. Data gathered and results obtained in this study provide information about the distribution of the target species in Mauritanian mountains and therefore, increase the current knowledge about local biodiversity. The results of the study further suggest the need to establish protected areas in Mauritanian mountains.

Key Words:

Elephant conservation in Mali through community empowerment

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How do you conserve elephants in over a vast area (40,000km²) suffering from poverty and resource degradation? South of the bend in the Niger River an internationally important population of around 550 “desert elephants” makes an astonishing migration. The presentation will outline the experience so far of The Wild Foundation’s long-term Mali Elephant Project, whose aim is to conserve this elephant population, while restoring degraded ecosystems and their biodiversity, and improving the livelihoods of the local population. Spatial analyses, using remote sensing, GIS and GPS collars, have provided an understanding of how their unique migration has enabled the elephants to survive a harsh Sahelian environment where others on similar latitudes have died out. These studies also identified the chief threats and priority areas for action, as it became clear that the fates of the ecosystem, its population and the elephants were inter-twined. A combination of socio-ecological studies and collaborative approaches to engage the communities along the migration route has resulted in (often surprising) ways to enable human-elephant co-existence. One key element is to combat the current anarchic use of natural resources by multiple ethnicities and interests, by bringing local communities together to devise management systems (including enforcement) that all agree to, to restore ecosystem resilience, increase resource availability for local livelihoods, generate income, and accommodate elephant needs. In this way elephants become an integral part of natural resource management through the generation of long-term capacity at all levels of decision-making. Results have so far exceeded expectations.

Keywords: Human-elephant conflict mitigation, biodiversity conservation, resilience enhancement, sustainable natural resource management, collaborative approach, livelihoods.

Conservation news from the Sahara: update on results of SCF Pan Sahara Wildlife Survey in Niger, Chad and Tunisia, 2011'

Tim Wachter

Zoological Society of London

The Pan Sahara Wildlife Survey, conducted by the Sahara Conservation Fund and funded by HH Sheikh Mohammed bin Zayed Al Nahyan, Abu Dhabi, has worked with government agencies in Niger, Chad and Tunisia to complete 10 field surveys designed to collect integrated data on wildlife status and human land use practice in a series of sites believed to be of high priority for wildlife conservation. This presentation summarises key results, including comparison of wildlife and livestock numbers in the Ouadi Rime Ouadi Achim Game Reserve, updates on threatened antelope species such as slender-horned, dama gazelle and dorcass, and the latest estimates of large bustard densities in sahelian grassland habitats. Practical conservation steps arising from some of these points are discussed and will be expanded in a separate presentations.

Key Words:

A strategy for the conservation of cheetah and wild dogs across the Sahelo-Sahara region

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Addresses.....

Cheetah and wild dog are the widest ranging large carnivores in Africa. With home ranges that can exceed 1000km², these species need massive areas for their survival. Even the best protected areas harbour densities of cheetah and wild dog less than 10% that of lions and their survival requires a new approach to conservation. This has led to the development of a range-wide conservation process for cheetah and wild dogs. The two species were combined because they have similar conservation needs, and to increase leverage. The process has the ambitious aim of securing the survival of both species across their range in Africa, by engaging support at all levels, from local communities to governments, and establishing capacity for sustainable conservation. Regional conservation strategies have been established for eastern and southern Africa, and in January 2012 workshops were held in Parc W, Niger, to develop a strategy for north, west and central Africa and a national conservation action plan for Niger. The regional strategy forms a framework for the conservation of cheetah and wild dog in this Sahelo-Sahara region. The subspecies of cheetah occurring in the region is critically endangered, while there may be as few as 300 wild dogs left. Here we describe the conclusions of these workshops, outline the current state of conservation for both species.

Key Words:

Influence of Sahara-Sahelian mountains in herpetofauna diversification

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The Sahara desert is not homogeneous, either geographically, environmentally or biologically. Among the features that mostly introduce heterogeneity on the Sahara are the mountains. Mountains generate different (micro-)climates, preserve water and present exposed rock and different soil types from that of the surrounding areas, due to reduced eolian deposition and erosion. This is reflected in the local biodiversity, comprising many relict populations and endemisms. Humid-arid cycles are known to have occurred during at least the last seven million years on Sahara. This caused a series of range shifts, colonization and isolation events that shaped the present day Saharan biodiversity. Water dependency, dispersal capacity, and life history affect a species' ability to deal with climatic changes. Having Mauritania as the primary study area, examples of contrasting dispersal and diversification patterns of five vertebrate groups will be presented: Agama, Amietophrynus, Hoplobatrachus, Ptyodactylus and Crocodylus. Preliminary phylogenetic and phylogeographic analysis have shown surprising structure and high genetic diversity in Agama and Hoplobatrachus whereas the other three groups have lower degree of diversification. Saharan mountains seem to have acted along the climatic phases both as corridors and islands for reptiles, whereas topographical variation seems to produce less impact on amphibians. Results obtained so far give basis for investigation of evolution of herpetofauna in the Sahara-Sahel region and for testing the role of climatic shifts in shaping contemporary diversity. The observed biodiversity richness also calls for the consideration of these mountains in future conservation plans, and for biodiversity assessments in other Sahara-Sahelian mountain systems.

Key Words:

Dorcas gazelle and livestock use of trees according to size in a hyper-arid landscape

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Abstract

We examined the relationship between Dorcas gazelle and livestock use of trees according to size. Our data suggest that Dorcas gazelle use of trees differs according to species and size. Larger Acacia trees are used for territorial purposes whereas smaller trees may be visited within the course of grazing. Our data show that tree size also determines potential food availability. On shorter trees, gazelles can graze on leafy vegetation at a range of heights between ground level until the top of the tree. In contrast, leafy vegetation on taller trees is available at heights that are often too high for gazelles to reach. However, larger trees provide another food source for gazelles not found on shorter trees such as seed pods, which were only found on larger *A. radiana* trees. There was no significant difference between the size of the other tree species that were used and not used by gazelles. Goats, camels, and donkeys were typically associated with only larger trees, regardless of species. Dorcas gazelle conservation will require maintaining viable Acacia populations that are characterized by recruitment and a variation of tree sizes and ages.

Age determination and its applications towards Nubian ibex conservation

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Age estimation and knowledge about a population's age structure is important for population modeling, which incorporates age dependent survival and mortality rates. Age determination is possible for many ungulates by counting horn growth rings. However this method needs to be validated for each species. The object of this study was to test if Nubian ibex in South Sinai, Egypt can be aged by counting growth rings from poached animals and to utilize age specific mortality data to create a survivorship curve. The preliminary results suggest that males are easier to age than females. Females were more difficult to age because the growth rings are not pronounced and too close together as a result of females having shorter horns. Males are easier to age because their horns are longer, which makes it easier to identify growth rings due to the greater separation between them. Male Nubian ibex in South Sinai appear to have low survivorship, with approximately less than fifty percent of males surviving past the age of three. The survivorship curve suggests that the population of Nubian ibex in South Sinai is not regulated by density dependent effects. Natural predators of Nubian ibex in South Sinai are extinct and therefore poaching represents the largest source of mortality. This ongoing study will also discuss poaching trends of Nubian ibex, reasons behind poaching, and possible solutions.

Identifying the current and future distribution of ungulates in Egypt under different scenarios of climate change

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Abstract

Numerous studies indicate that Egypt will be threatened by future climate change. Identifying the contemporary, as well as predicting the future potential distribution, of Egypt's ungulates is crucial for implementing an effective conservation plan. Species distribution models provide a powerful tool for identifying the potential current distribution range and future distribution in response to climate change. The objectives of this study were to model the potential current distribution and future shifts in distribution in response to climate change of four desert ungulates, Dorcas gazelle, Barbary sheep, Nubian ibex, and slender horned gazelle. In addition, we also tested if Egypt's protected areas potentially serve as a potential refuge against climate change. Maxent software, maximum entropy algorithm, was adopted to develop the prediction of distribution ranges using the presence data points with a set of climatic and non-climatic variables. According the model, the distribution ranges of each the Barbary sheep and Nubian ibex potentially cover approximately 6% of Egypt's total area. It is predicted that Barbary sheep distribution will decline by 98 % as a result of climate change, whereas Nubian ibex was predicted to be resilient to climate change. The distribution of Dorcas gazelle and Slender-horned gazelle were predicted to potentially occur in approximately 30% of Egypt's total area. The model predicted that the slender-horned gazelle will be threatened by climate change which will result in a potential distribution decline of 75%. The Dorcas gazelle was not predicted to be threatened by climate change and potentially will increase its distribution in response to climate change. Our model showed that the distribution of Egypt's protected areas network served as potentially important refuges from climate change.

La restauration des antilopes sahélo-sahariennes au Ferlo : la création de la réserve de biosphère du Ferlo comme alternative de conservation.

Babacar Ngor Youm

Résumé :

Le Sénégal, dans sa politique de conservation, a entrepris depuis les indépendances des opérations de repeuplement pour la restauration de la faune disparue. Cette politique a abouti à la création de deux réserves de faune (Guembeul et Ferlo) pour recevoir les trois Antilopes sahélo-sahariennes dont la présence a été décrite dans le pays.

D'une superficie de 487 000 ha, la Réserve de Faune du Ferlo Nord (RFFN) a accueilli depuis 2003 la gazelle damma, l'oryx algazelle et la gazelle dorcas dans un enclos de 600 ha. La réussite de ces opérations de réintroduction a permis un accroissement des effectifs et doit aboutir à long terme à la mise en liberté totale des animaux. Toutefois, compte tenu de la situation qui prévaut actuellement dans la zone du Ferlo, caractérisée par une forte occupation humaine irrégulière de pasteurs sédentaires et transhumants occasionnant l'implantation de nombreux ouvrages hydrauliques et des besoins d'expansion des communes de Matam et de Ranérou en particulier, l'option de transformer les deux réserves de faune du Ferlo nord et sud en une réserve de biosphère a été prise. L'objectif est d'adapter cette nouvelle situation au besoin de conservation de la faune. Cependant la mise en place et la gestion de la réserve de biosphère en perspective peut connaître des difficultés et susciter des interrogations en rapport avec les exigences écologiques des espèces et de l'environnement socio-économique du milieu. La réserve de biosphère du Ferlo peut néanmoins être un atout pour la conservation de la faune au regard des potentialités de la zone.

Mots clés : RFFN, ASS, réintroduction, Réserve de Biosphère,

Addax conservation in the wild: status update in Niger

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¹ Sahara Conservation Fund

The addax (*Addax nasomaculatus*) is an impressive 100kg+ spiral-horned antelope, symbolic of the remote Saharan interior. As one of the largest wild mammals of the Sahara it is an excellent indicator of ecosystem health. It is able to survive without drinking water, exploiting sparse, ephemeral vegetation of the sand seas and sandy plains. Formerly found in great numbers over immense arid areas, its population has crashed to a few hundred individuals in isolated pockets since the advent of modern weapons and transport. The species is now listed as Critically Endangered on the IUCN Red Data List of Threatened Species.

The last viable addax population in the wild has found a refuge in the desert of Tin Toumma located in the eastern zone of Niger. This population has been studied since 2006 by the team of the sahelo-saharan antelope project. A specific methodology based on transects within the current distribution area has been implemented to monitor the nucleus of the addax population. The team has carried out aerial and road surveys to estimate the population and to analyze the distribution according to ecological and human factors. Within the area the distribution pattern of addax was based on the variability of good pastures according to seasonal rainfall with shade trees (*Acacia raddiana* and *Maerua crassifolia* at the massif, relict *Salvadora persica* in the dunes) also providing important resources in season. Since 2009 oil exploitation has completely changed the known distribution pattern. We will present the main results of the monitoring carried out during the last 3 years and we will highlight the new challenges for the species conservation.

Earth Observation: overseen potential for habitat assessment and species reintroduction.

Freemantle, T.P. Wachter, T. Newby, J. & Pettorelli, N. (in review);

Abstract

Under the IUCN reintroduction guidelines, habitat evaluation is considered an essential step for assessing the potential of an area to support a viable reintroduced population of a given species. Remote Sensing techniques can support such investigations, by greatly enhancing the temporal and spatial coverage of habitat assessments. To demonstrate this, our study makes use of freely-available earth observation data to evaluate the suitability of the Ouadi Rimé-Ouadi Achim Game Reserve in central Chad (OROAGR), for the reintroduction of the Scimitar-horned Oryx. The reserve was the last stronghold of the species within its historic range, prior to their extinction in the wild in the 1980s. Long term trends in climatic variables and net primary production (NPP), and current and potential levels of anthropogenic impacts on the ecosystem were assessed. Results show that since the 1980's there has been a steady increase in average annual precipitation and satellite-derived estimates of NPP. Spatial downscaling of the average trend in NPP showed that the north of the protected area exhibited a drying trend, while the south was associated with intense greening. As a result, the boundary between ecosystem types is currently narrowing. Human induced impacts in the region were reported to be relatively low, and analysis confirmed that climate is the main driver of trends in NPP in this protected area. These results suggest that OROAGR is a favourable site for oryx reintroduction, and provides key information for the implementation and the future management of the reintroduced population.

Keywords: remote sensing, Oryx, reintroduction, NDVI