GNUSLETTER

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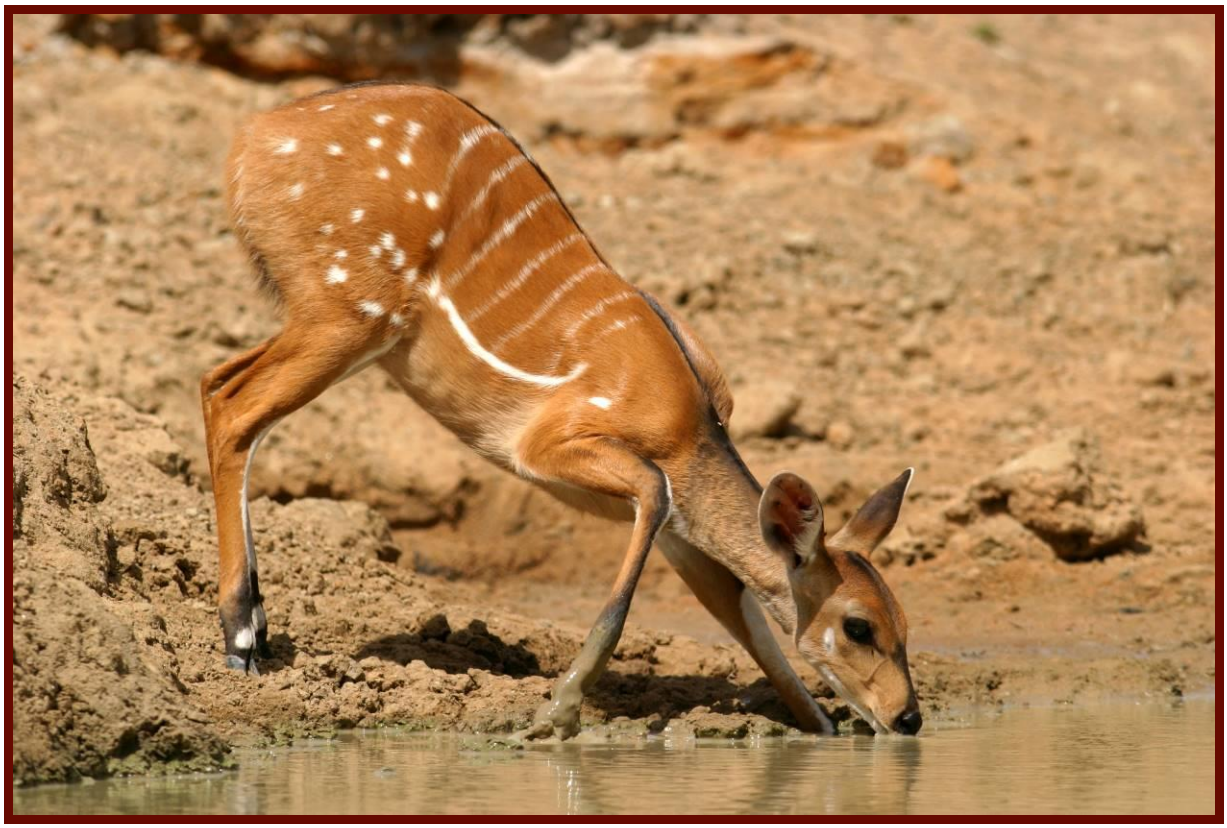
ANTELOPE SPECIALIST GROUP



IUCN Species Survival Commission
Antelope Specialist Group

GNUSLETTER is the biannual newsletter of the IUCN Species Survival Commission Antelope Specialist Group (ASG). First published in 1982 by first ASG Chair Richard D. Estes, the intent of *GNUSLETTER*, then and today, is the dissemination of reports and information regarding antelopes and their conservation.

ASG Members are an important network of individuals and experts working across disciplines throughout Africa, Asia and America. Contributions (original articles, field notes, other material relevant to antelope biology, ecology, and conservation) are welcomed and should be sent to the editor. Today *GNUSLETTER* is published in English in electronic form and distributed widely to members and non-members, and to the IUCN SSC global conservation network. To be added to the distribution list please contact asgpo@marwell.org.uk.

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Cover photo: *Young female bushbuck (*Tragelaphus scriptus*), W National Park and Biosphere Reserve, Niger (© Daniel Cornélis)*

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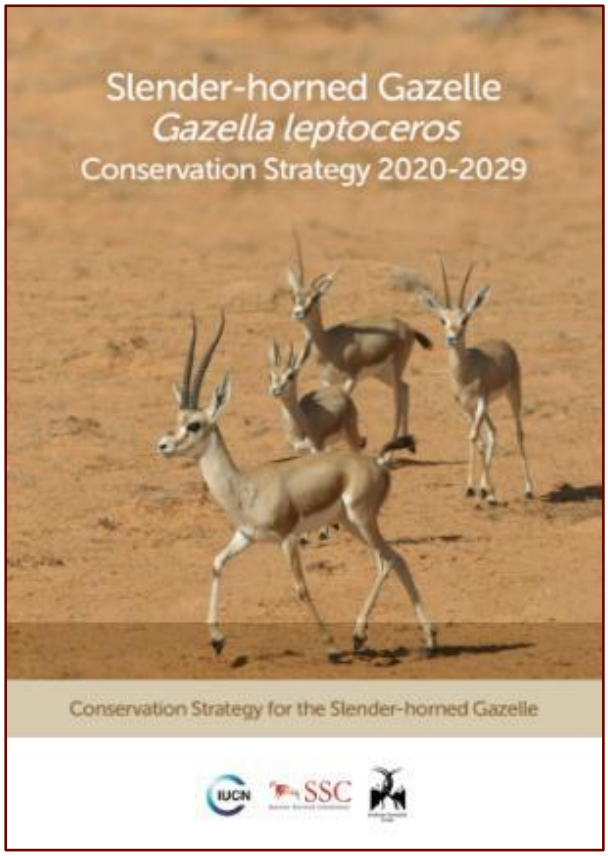
From IUCN and ASG

Gnusletter editorial change

Steve Shurter has decided to step down as editor of *Gnusletter*. Steve took over from the original editor, Dr Dick Estes, in 2007 and has produced every issue since then, with help from Stephanie Rutan and supported by White Oak Conservation, where he is CEO and Executive Director.

ASG is extremely grateful to Steve and his team for their commitment and hard work over the last 14 years. Without them there would have been no *Gnusletter*! We wish Steve all the best in his work at White Oak, and in particular with the important collections of the highly threatened mountain bongo, dama gazelle, and slender-horned gazelle.

Slender-horned gazelle conservation strategy



The slender-horned gazelle (*Gazella leptoceros*) is endemic to the Sahara Desert. Its numbers and range have been greatly reduced and its presence is now confirmed in only 3-4 localities. Since 2016, ASG has coordinated a special session in the margins the annual meetings of the Sahelo-Saharan Interest Group (SSIG). The aim of the sessions was to discuss the species' status and agree priority actions. In view of the precarious situation, it was agreed in May 2019 in Tunis to develop a '*Slender-horned gazelle conservation strategy*' to provide a framework to guide actions needed to conserve and restore populations, both *in situ* and *ex situ*, as well as to aid the development of National Action Plans. The strategy was developed through email consultations with the main stakeholders including government agencies and NGOs. In all, 44 people contributed to the process. The strategy has just published and is available in French and English.

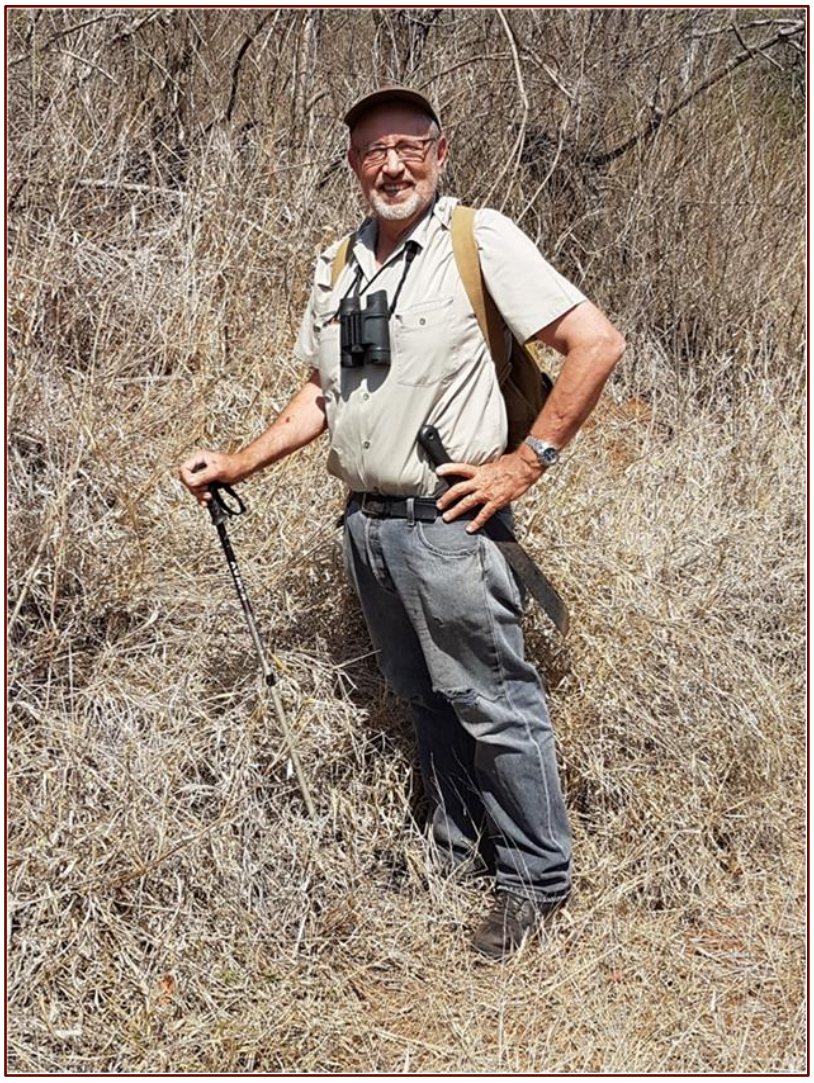
IUCN *Crossroads*

A summary of the critical situation for the addax and the IUCN mission to Niger in January 2020 "*To save the addax antelope, the oil sector and government must work together with conservationists*" has recently been published on IUCN's *Crossroads blog*: https://www.iucn.org/crossroads-blog/202011/save-addax-antelope-oil-sector-and-government-must-work-together-conservationists

In Memoriam: Petri Viljoen

Jeremy Anderson

THE ASG LOSES A LONG-TERM MEMBER: PETRI VILJOEN



For most of us in the Lowveld, the worst part of this year has been the sudden and tragic death of Petri Viljoen in an air crash on the 23rd October. It is a small consolation to know that he was doing something he greatly enjoyed, counting elephants in one of the most magical parts in Africa, the Lower Zambezi valley.

Petri was a born in the Orange Free State and grew up in Bloemfontein. After school he did his National Service – then a B.Sc. Honours at the University of Bloemfontein. He then

joined the Transvaal Division of Nature Conservation as a Mammologist where he worked on a diversity of projects and completed a Masters on oribi behavioral ecology in the Highveld of the eastern Transvaal. He was then moved to work on lions in the Timbavati Nature Reserve adjoining the Kruger National Park and was later offered a position doing research on lions at Savuti in Botswana. This entailed a lot of flying in light aircraft. With his bush-pilot experience from Savuti he then took up a post in Kruger where he undertook the flying for the aerial surveys for ten years and pioneered a real-time data acquisition system using GPS for aerial surveys of wildlife in Kruger National Park (1991-92). This was followed by a two-year interlude in Tanzania, flying surveys on a two-year contract for Frankfurt Zoological Society. He returned to Kruger for a further four years as Senior Scientist.

Then, together with several colleagues, he left Kruger in the dust of the rapid transformation process and built a new career in private consulting. This took him over a number of African countries, and we collaborated on a several projects. The family moved to White River where his wife Zanne took up a teaching post at Uplands College and his daughters, Karina and Janine, excelled academically.

His achievements as a scientist were recognized internationally by him being appointed to the IUCN Antelope Specialist Group and the African Lion Working Group at their inceptions. In the ASG we worked together on bringing the ASG view to solving contentious issues, such as opposing the deliberate crossing of Bontebok with Blesbok and more recently the production of antelope colour morphs such as golden wildebeest and black impala.

He specialised in aerial surveys and undertook these in many of the most remote parts of southern Africa. Not all were without incident and I recall one in Mozambique when a toolbox under his seat luckily intercepted a randomly fired AK47 round heading for his rear.

He was always generous with his time and patient with those that could not understand the intricacies of mysteries such as population modelling. We will always remember him as a true gentleman and someone who was willing to give time help others and always well liked.

His wife Zanne and his two daughters Karina and Nini were the pride of his life and are all achievers in their chosen fields. After his family, flying was one of his great passions and he had over 8,000 hours as a pilot and many more as an observer. So, it is perhaps fitting to remember him in the words of another pilot.

High Flight

"Oh! I have slipped the surly bonds of earth,
And danced the skies on laughter-silvered wings;
Sunward I've climbed, and joined the tumbling mirth
Of sun-split clouds, and done a hundred things
You have not dreamed of. Wheeled and soared and swung
High in the sunlit silence. Hov'ring there
I've chased the shouting wind along, and flung
My eager craft through footless halls of air
Up, up the long, delirious, burning blue
I've topped the wind-swept heights with easy grace
Where never lark or even eagle flew –
And, while with silent lifting mind I've trod
The high untrespassed sanctity of space,
Put out my hand, and touched the face of God."

Research and Reports

Aerial survey of the regional WAP Complex in Benin, Burkina Faso and Niger, April-May 2019

M. Antoninova, A. Gaylard, G. Gibbons., Ch. Moueix, J. Chevillot and J.M. Froment
African Parks in collaboration with:

- *CENAGREF Centre National de Gestion des Réserves de Faune, Benin*
- *OFINAP Office National des Parcs et Réserves, Burkina Faso*
- *DFC/PR Direction de la Faune, de la Chasse et des Parc et Réserves, Niger*

Summary
This report documents an assessment of the abundance and distribution of large mammals and human activity in the regional WAP Complex of contiguous Protected Areas comprising: (i) 3 National Parks (Arly, Pendjari and W), and (ii) 15 Hunting Areas, within 3 countries: Benin, Burkina Faso and Niger (Figure 1). The primary aim of the survey was to count elephant (*Loxodonta africana*) and elephant carcasses, West African savanna buffalo (*Syncerus caffer brachyceros*) and other large herbivores.

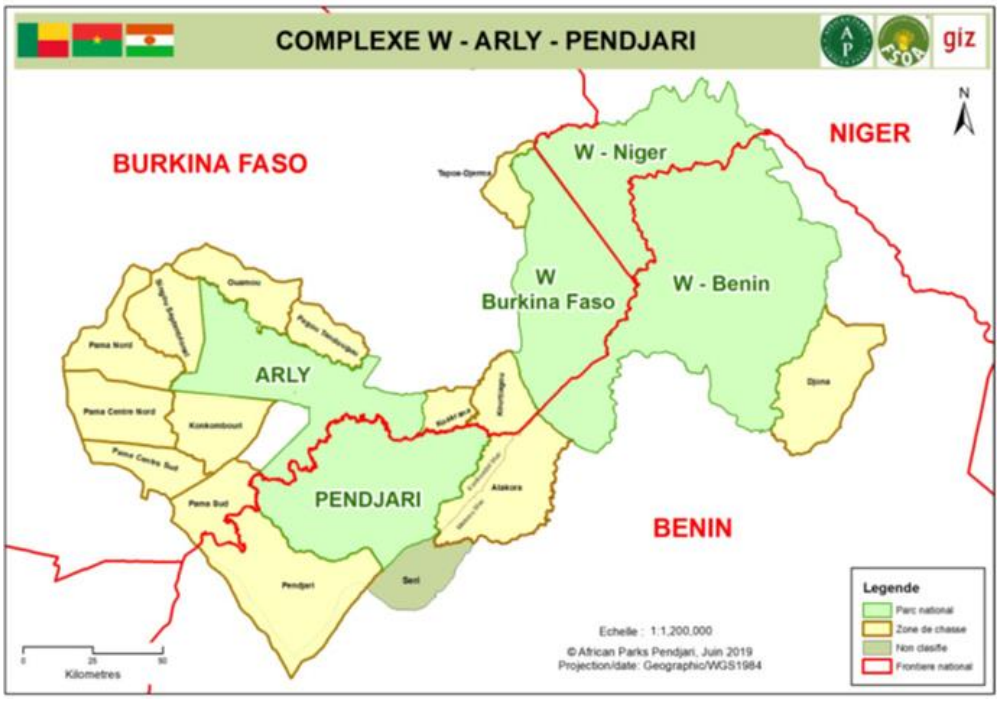


Fig. 1. *Protected Areas of the WAP Complex (© African Parks Pendjari):*

- *National Parks in green*
- *Hunting Areas in yellow*

An aerial total count following standard methodology was conducted between 7 April and 11 May 2019, covering the Benin and Niger parts of the WAP Complex, as well as part of the Arly NP Complex. 65.3% of the entire WAP Complex was surveyed in 2019, in total 17,307km^2. Administrative issues related to the logistical organisation of the survey across the three

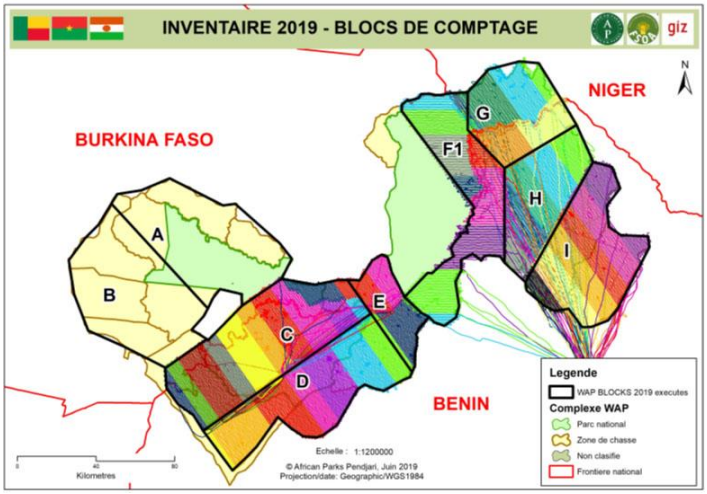


Fig. 2. *Area covered by the aerial census (© African Parks Pendjari)*

countries caused delays and additional flying time, that impede surveying the entire W Complex. Escalating instability in the security of the area compelled African parks to cancel the survey of the majority of the Arly NP Complex and W NP Burkina Faso (Figure 2). It took 51 days (23 P-A + 28 W), with a total of 253 hours of flying (110 P-A +143 W). The total count was conducted at an altitude of 300ft (92m), with 600-m and 700-m transect spacing, using Cessna 182 and Cessna 206 aircrafts.

We counted 3259 elephants within the surveyed zone. The minimum estimates of other wildlife species were as follows: 7263 buffaloes, 4185 Western roan antelopes (*Hippotragus equinus koba*), 275 korrigum (*Damaliscus lunatus korrigum*), 567 Western hartebeest (*Alcelaphus buselaphus major*), 177 defassa waterbucks (*Kobus ellipsiprymnus defassa*), 2803 Buffon's kobs (*Kobus kob kob*) and 553 hippopotamuses (*Hippopotamus amphibius*).

Previous data series do not allow for meaningful comparison or trend analysis. The korrigum, Western hartebeest and defassa waterbuck populations appear low in relation to historical numbers and therefore require appropriate management attention.

Human activity was recorded inside, as well as on the periphery of the surveyed area, with significant encroachment of livestock into the protected areas, as well as continued expansion of agricultural activity on the borders. The number of observations of domestic animals was 1.5 times higher than number of observations of all wild large mammals together.

Population estimates of large mammals in the WAP Complex

The wildlife populations of the Benin and Niger components of the WAP Complex appear to be ecologically viable, but certain species require special attention, in particular, the korrigum (Figure 3 - right) which no longer occurs across most of its former range in Mali, Mauritania, Senegal, or The Gambia, and probably no longer occurs in Nigeria, Togo or western Chad (IUCN SSC Antelope Specialist Group 2017). The korrigum has shown the largest range reduction of any subspecies of the species *Damaliscus lunatus* (Duncan 2013) and although classified as "Endangered" by IUCN, should be considered locally as "Critically endangered". Appropriate research and management practices should be applied to maintain its viable population within WAP Complex, as the population could play a vital role as possible future source for repopulation of West African protected areas. In addition, the defassa waterbuck population is also lower than expected and will require specific management attention. Roan antelopes remain rather abundant (Figure 3 - left) and West African savanna buffaloes are growing (Figures 4 & 6).

Although poaching pressure seems to be largely under control at the moment in Pendjari Complex, elephants will require ongoing protection within the whole WAP, especially in light of the increasing instability and security threats in the sub-region that are likely to increase pressure on elephants (and other species in less protected parts of the WAP Complex). Moreover, and overall, the number of observations of all wild large mammals together (20,762) were 34% less than the number of observations of domestic animals (31,586).

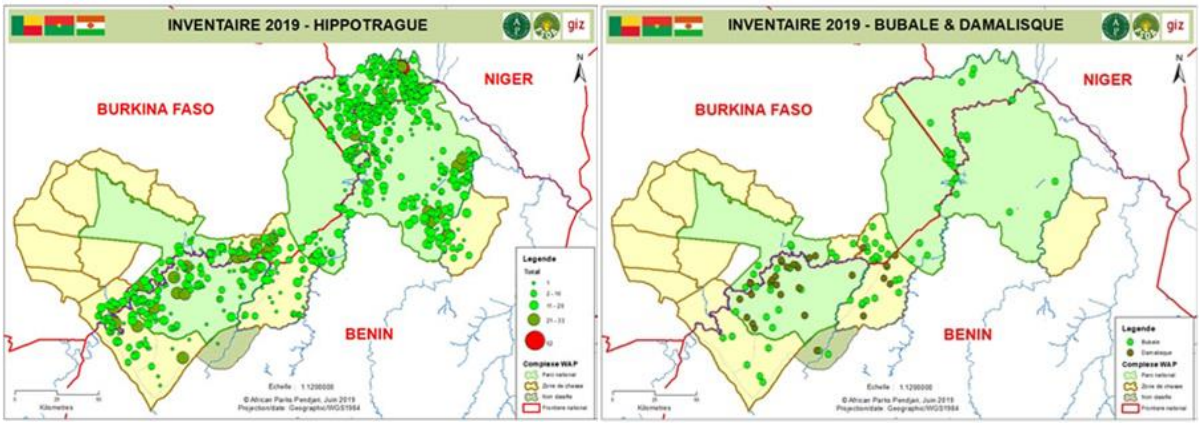


Fig. 3. *Observations in the WAP Complex, aerial survey, 04-05 2019 (© African Parks Pendjari):*
- *Left: Roan antelopes (group size: 1-52)*
- *Right: Korrigum (in dark green) and Western hartebeest (in light green)*

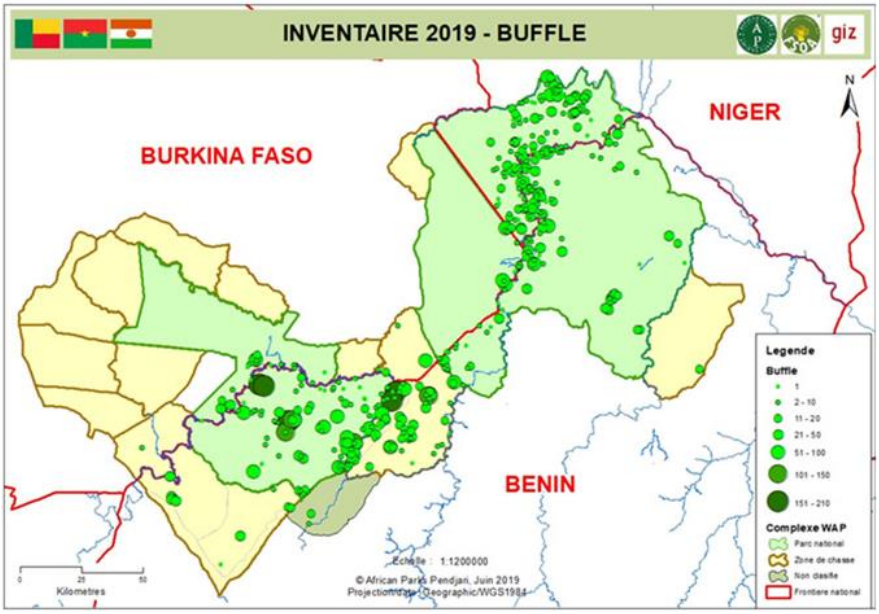


Fig. 4. *Observations of buffalo (group size: 1-210**)** in the WAP Complex during the aerial survey in April-May 2019 (© African Parks Pendjari)*

Illegal human activities and livestock within WAP Complex

Despite the efforts made since 2000 by the State Parties concerned (improvement of the surveillance system and cooperation with local communities, controlled human activities such as tourism and development of non-timber forest products), illegal activities still persist (Figure 5; Table 1).

There is a very strong human demographic pressure on landscape: in Alibori Department, where WAP is located: the population has more than doubled in 20 years (480,000 inhabitants in 2000, now 970,000 in 2020), same for the human density (24.7/km² in 2000, now 50/km² in 2020), while the land surface per person has been divided by 2 (4.04 ha/pers. in 200, now 2.00 ha/pers. in 2020).

The highly active encroachment of agriculture and housing is ongoing and represents a direct threat to the ecological integrity of the WAP Complex. While the cotton cash crop covers

today more than 50% of cultivated fields in Alibori Department, its production has been multiplied by 3.75 over 20 years in this particular Department (80,000 T in 2000, now 300,000 T in 2020). The cotton front is progressing so fast that the WAP buffer zone is simply vanishing in the South and the East. Moreover, about 5% of the WAP Complex are already colonized by cotton fields.

Illegal grazing within the limits of the WAP Complex represents a major threat to wildlife populations, as herders are often involved in poaching and poisoning. In 2015, the aerial census had observed 121,096 heads of livestock in the WAP Complex (Bouché et al. 2015). Today, it is still considered that more than 100,000 heads of cattle rely on WAP rangeland during the late dry season, and that more than 80% of the WAP Complex is used by pastoralists and their livestock. Such large numbers of unregulated cattle will result in overgrazing, habitat and water supply degradation (including wood cutting for feeding cattle with foliage and disturbance of wild large mammals), and potential transmission of diseases to wildlife. This may be already happening and requires thorough monitoring and implementation of management practices on the ground (vaccination, tick control, possibly fencing).

Fishing was banned in the rivers within the National Parks through a tripartite agreement, that brought calm to riverine areas and should allow for the regeneration of terrestrial and aquatic wildlife populations.

Overall, the WAP is already encircled by villages and agricultural fields, a process which is enforcing every day. This encirclement makes a sort of physical barrier which is isolating the ecosystem of the WAP Complex from its surrounding ecosystems.

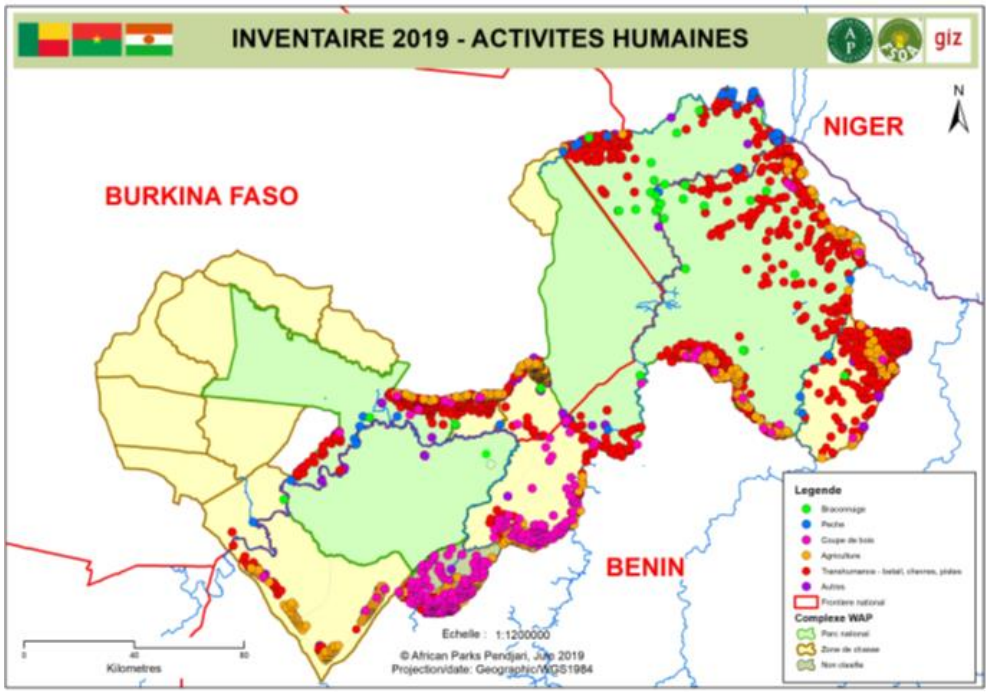


Fig. 5. *Human activities within Protected Areas of the WAP Complex as seen by the aerial survey in April-May 2019 (© African Parks Pendjari)*

The WAP Complex in terms of priority conservation area and the formulation of a rehabilitation strategy

Taking into consideration the wildlife numbers and viability of populations of the main species recorded, we conclude that the Benin and Niger components of the WAP Complex remains a

critical refuge for wildlife in West Africa. However, the WAP Complex is already an isolated natural ecosystem embedded within an agro-pastoral landscape that is itself undergoing economic, social and cultural transformation. The local communities living in WAP proximity (several million people) are still economically dependent on their traditional knowledge and their social and cultural links with their environment. Land and natural resources remain fundamental to their existence. Sixty to 70% of households are farmers, while the remainder are primarily cattle herders. South West of the WAP, the cotton cash crop is a primary source of household income and is continuously expanding. This is accompanied by significant deforestation and soil depletion, pushing farmers to find and occupy 'new land'. North East of the WAP, transhumant livestock and cross-border trade make a major share of the economy. Conflicts over agricultural fields (land conflicts) and grazing rangeland (farmers/pastoralists conflicts) are increasing. The WAP Complex is listed as a UNESCO World Heritage Site, so that a MAB approach should be implemented to accommodate all the driving forces which tend to pull in different directions. Resolving these problems over the next 20 years should therefore be at the centre of the land use planning process, including in the WAP Complex.

This work was financed by:
- African Parks - Pendjari NP Project (National Geographic and Wyss Foundation)
- FSOA - Fondation des Savanes Ouest Africaines GIZ
- German International Collaboration

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Figure 6. *West African savanna buffalo in the WAP Complex, April-May 2019 (© African Parks)*

Four-horned antelope (*Tetracerus quadricornis*) in Dang, Mid-western Nepal: an update on distribution and threats

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Abstract
Four-horned antelope, endemic to Indian subcontinent, is one of the least studied ungulates of Nepal. Data on its presence are available only from four National Parks in the lowlands. Here we present information on confirmed occurrence in Dang district, an area outside protected areas, in Mid-western Nepal (Figure 1). We confirmed the species from five different sites through use of camera traps, sign surveys and secondary data. Hunting of the species was prevalent in most of the recorded localities and was identified as a major threat. Research and conservation programs focusing on connectivity should be prioritized.

Introduction
The four-horned antelope (*Tetracerus quadricornis* de Blainville 1816), also known as "Chausingha" or "Chauka", is a medium-sized, solitary ungulate endemic to the Indian sub-continent (Leslie & Sharma 2009) (Figure 1). It is widely but patchily distributed in dry deciduous forests, and ranges from the Himalayan foothills in Nepal south to the Gangetic flood plains and Deccan Peninsula in India (Sharma *et al.* 2013). It is classified as 'Vulnerable' in the IUCN Red List of threatened species (IUCN SSC Antelope Specialist Group 2017), but as 'Data deficient' in the National Red List (Jnawali *et al.* 2011). FHA was considered to be confined to four Protected Areas (PAs) in Nepal, Bardia National Park (Pokharel 2010; Kunwar *et al.* 2016), Chitwan National Park (Pokharel *et al.* 2015a), Parsa National Park and Banke National Park (Oli *et al.* 2018). However, Khanal *et al.* (2017) provided the first confirmed record of FHA from outside protected areas, in Narayanpur Community forest of Lamahi Municipality in Dang District. We still lack information on its distribution and prevalent threats in areas outside PAs. In this report, we show presence localities of FHA in Dang district, collected through a combination of on-field research and secondary data.

Fig. 1. *A captive subadult four-horned antelope (© Suman Ghimire)*

Study area

Dang district is located in Mid-western Nepal and covers an area of 2,955 km². It consists of two valleys, Dang and Deukhuri. The district is surrounded by forest-covered hills that connect Bardia, Banke, and Chitwan national parks through the Churia forests in the Dovan bottleneck (Khanal 2015). Dand is connected to Banke NP in the west, and to Sohelwa Wildlife Sanctuary in India via an intact forest to the south. *Shorea robusta*, *Dalbergia* and *Acacia* spp. dominate the forest. Degraded forests are found in patches. Barking deer *Muntiacus vaginalis*, spotted deer *Axis axis,* wild boar *Sus scrofa* are some of the other ungulates found here while common leopard *Panthera pardus* and golden jackal *Canis aureus* are the major carnivores. Deukhuri valley is a prime example of a biodiversity-rich landscape in Nepal lying outside the PA system and a study in 2015/16 identified it as important for striped hyena *Hyaena hyaena* (Khanal and Baniya 2018). Dang district comprises of seven rural municipalities (Rapti Rajpur, Gadhawa, Babai, Dangisharan, Banglachuli, Shantinagar), one municipality (Lamahi) and two sub-metropolitan (Tulsipur and Ghorahi) areas.

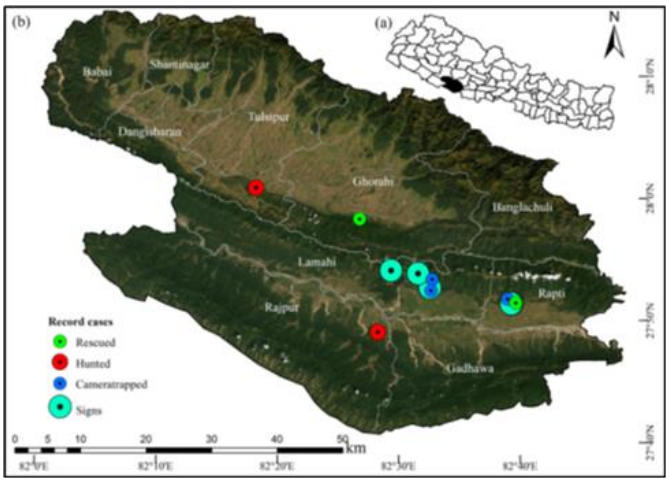

Fig. 2. *Map showing:*
(a) Nepal
(b) Dang district and records of four-horned antelope

Methods

Camera-trapping and sign surveys were the primary methods used for data collection. The study was fundamentally focused on distribution of striped hyena distribution. Camera traps were set up in Deukhuri valley (Lamahi, Rajpur, Rapti and Gadawa). The study area was divided into grids of 5×5 km^2 and only those grids with more than 50% forest cover were selected (Khanal and Baniya 2019). A total of 22 grids were selected for camera-trapping. The camera trap location within each grid cell was selected following sign survey of striped hyena. At each location, a single motion-sensor camera trap was installed 45–60 cm above ground on a game trail, forest road or stream bed, maximizing the possibility of hyena capture. Cameras were active for a minimum of 15 continuous day/nights in each grid cell. All signs encountered during sign survey were recorded along with geographic coordinates and habitat details. The latrines and pellets of FHA found during sign survey were distinguished from others, especially Barking Deer, by comparing them with the observations of Pokharel *et al.* (2015a). Only confirmed pellets were used in preparing the map of FHA distribution. Records from rescue and hunting activities. and evidence collected from forest offices and local informers, were also incorporated.

Results and Discussion

A total of 15,320 images were produced in 520 camera trap nights. Records of FHA presence were made from forested areas of Arjunkhola, Bangau and Narayanpur (Lamahi), Sisahniya and Pipari (Rapti), Bela (Rajpur), Dharapaani (Ghorahi) and Fulbari (Tulsipur) (Figure1). FHA was recorded at three camera trap stations, two from Bangau and Narayanpur (Lamahi) and one from Sisahaniya (Rapti). The two successful camera trap stations of Bangau and Narayanpur

were 1600 m apart and the third station (Sisahaniya) was situated about 10 km away from these two. All three successful camera trap stations were located less than 150 m from seasonal water sources. Furthermore, the area consisted of *Shorea robusta, Dalbergia-Acacia, Legrestomia parviflora* and patches of degraded vegetation. The presence of FHA in these foothill forests differs from the findings of Khan *et al.* (1996) and Pokharel (2010). Sloth bear *Melursus ursinus*, striped hyena, golden jackal, leopard, jungle cat *Felis chaus*, leopard cat *Prionailurus bengalensis*, spotted deer and barking deer were also recorded by the camera traps. In addition to camera trap records, five latrine sites of FHA were confirmed from four different community forests situated in Lamahi and Rapti.

Threats to FHA identified include hunting, attacks by feral dogs and live capture. One individual was found dead with prominent bullet wounds and another subadult was attacked by feral dogs near a forested area in Rajpur. Furthermore, three FHA were observed in captivity, one juvenile in Sishaniya of Rapti and other two subadults in the premises of Dharapani temple, Ghorahi. Interestingly, we found that the local people were well aware of this species. Ambush hunting, particularly at mineral lick sites, was reported in some areas. FHA has been said to avoid human disturbance (Sharma *et al.* 2005) but we recorded it close to human settlement in Dang. The sign abundance, mainly latrine sites, indicated that the area was being used regularly. These sign records in community forests, which are prone to disturbance through collection of fodder, fuelwood, and timber, further weaken the assumption of avoidance of human disturbance. Misidentification of this species as hog deer *Axis porcinus* or barking deer or by forest staff may have led to under-recording its presence. Local knowledge and current presence locations suggest that FHA might have been present here for a long time. Occurrence of subadult FHA provides preliminary evidence that the forested habitats of Dang might be a suitable breeding area for FHA. In protected areas, invasive species and forest fire are identified as major threats to FHA (Pokharel 2012). Outside the PAs, at least in Dang district, hunting and live capture are more noteworthy threats. As FHA was assumed to be confined to protected areas, the presence of captive animals was not known previously. Hunting of different ungulate species for meat is common in Dang. Hunters use snare traps, homemade guns and bullets, and dogs to kill wildlife (Khanal and Baniya 2018). Priority given to flagship species might be one reason that generalist yet endemic species such as FHA (Sharma *et al.* 2005) have been neglected for conservation.

FHA is listed as "Data deficient" (Jnawali *et al.* 2011). However, only a handful of studies have been conducted in Nepal since its assessment (Pokharel 2012, 2015; Pokharel & Storch 2012, Pokharel *et al.* 2015a, 2015b; Kunwar *et al.* 2016, Khanal *et al.* 2017, Oli *et al.* 2018). These studies have been partially useful in improving our understanding of the species in the country. Our study adds further regional insights to the sparse information available for the conservation of FHA, a protected species by law (NPWC Act 1973). This work also underscores the need to survey the Churia Hills landscape and wildlife corridors in lowland Nepal to help understand the true status of FHA. Based on findings of previous studies and the observations in this study, and supplemented by further research, an updated assessment of its national conservation status is needed. Focused conservation programs are also recommended for the species.

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Abundance of the Four-horned Antelope (*Tetracerus quadricornis*) in Gir protected area, India

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Summary
The abundance of the four-horned antelope (*Tetracerus quadricornis*) was estimated using the Distance sampling methodology in Gir Protected Area, the western limit of the distribution of the species. This population is disjunct from the rest of the Indian population, thus according it a higher conservation concern. The study was conducted between December 2017 and June 2018. The individual density was found to be 0.17 ± 0.06 SE, while the group density was 0.07 ± 0.02 SE. The mean group size was 1.8 ± 0.2 SE. The population parameters of Four-Horned antelope from other areas in India are also reported.

Fig 1. *Habitat of the four-horned antelope in Gir Protected Area (© Dhawal Mehta)*

Introduction

The four-horned antelope (*Tetracerus quadricornis*) is a monotypic species of its genus. Approximately 95% of its current global population occurs in India (Rahmani 2001), with the remaining 5% present in Nepal (Shreshta 2001). Though widely distributed, it is nowhere found in high abundance and has always been known as a shy and elusive creature. It inhabits dry deciduous forests and prefers forested areas to open grasslands (Figure 1). From its reported distribution at the end of the 19th century (Blanford 1888), the species has experienced dramatic range reductions with present populations surviving in isolated forested patches. Information on its distribution status in India was gained through a questionnaire surveys and anecdotal reports (Rice 1991, Saxena 1996, Singh 2001). Its current distribution range in India extends

from Uttar Pradesh in the North to Tamilnadu in the South, and Orissa in the East to Gujarat in the West (Sharma and Rahmani 2004). A detailed study on the ecology of the species was undertaken by Sharma (2006); however scant information exists on the species from other areas. It is often included in studies that look at prey base in protected areas and some focused studies have been carried out in selected pockets in India and Nepal. The IUCN Red List designates the species as Vulnerable and states the current population trend as decreasing (IUCN SSC Antelope Specialist Group 2016). Gir forms the westernmost part of the range of the species and the population is disjunct from the peninsular Indian population. Four-horned antelope was part of a multi-species study and assessment of prey base in Gir. The present study was aimed at estimating the abundance and understanding the distribution of the species in Gir Protected Area (Figures 2 & 4).

Fig. 2. *Four-horned antelope in Gir forest (© Dhawal Mehta)*

Study area

The Gir Protected Area is situated from 20º57' to 21º20'N and 70º27' to 71º13'E and lies 40 km from the Arabian Sea coast in the Saurashtra peninsula of Gujarat, India. The Wildlife Sanctuary and National Park (Figure 3) cover an area of 1153 km^2 and 259 km^2, respectively. Besides 470 km^2 of reserve, protected and unclassified forests make a total forested habitat of 1883 km^2 (Singh and Kamboj 1996, Johnsingh *et al.* 1998). Altitudes range from 100 to 648 m. Terrain is undulating, and the central part is hillier than the rest of the park. Drainage is mostly from north to south and the site is intersected by narrow seasonal streams which feed six

perennial rivers. The area experiences four distinct seasons, like the rest of the country. There is a cool dry winter from December to March (average minimum temperature 9^0C) followed by a hot dry season (average maximum temperature 42^0C), which lasts until mid-June. The monsoon breaks in June and continues till September and is followed by a dry post-monsoon season until November.

Rainfall increases from East (850 mm) to West (1000 mm). Gir lies within the Afrotropical realm (Singh and Kamboj 1996) in the 4B Gujarat Rajputana biotic province of Biogeographic Classification of India (Rodgers and Panwar 1988). Gir comprises one of the largest compact tracts of dry deciduous forest (Champion and Seth 1968), classified into three broad classes: Moist Mixed, Thorn forest, and Hill forest which were further divided into eight subtypes (Qureshi and Shah 2004).

Gir PA is inhabited by 37 species of mammals, 38 species of reptiles, over 300 species of birds, over 300 species of insects, and over 600 species of plants. Mammalian large carnivores include Asiatic lion (*Panthera leo leo*) and leopard (*Panthera pardus*) and ungulate species include chital (*Axis axis*), sambar (*Rusa unicolor*), nilgai (*Boselaphus tragocamelus*), four-horned antelope (*Tetracerus quadricornis*), chinkara (*Gazella bennetii*) and wild boar (*Sus scrofa*).

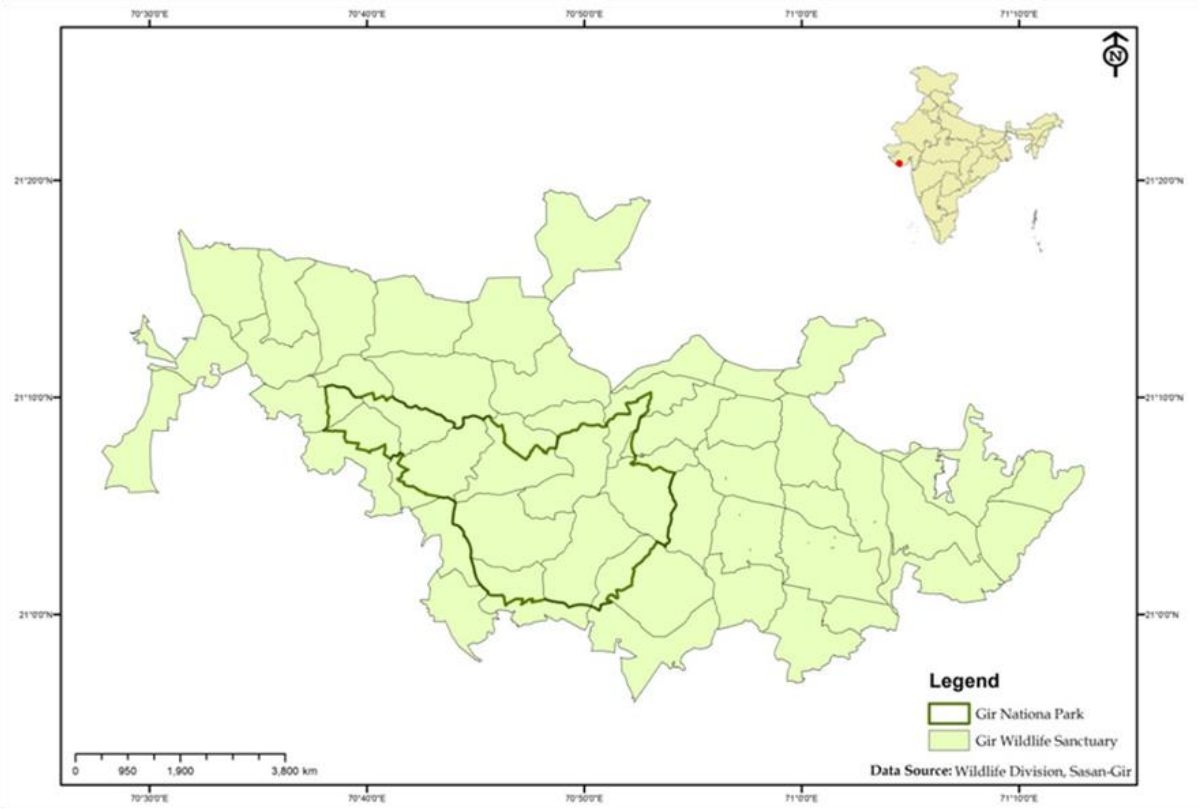

Fig. 3. *Map of the study area: Gir Protected Area*

Methods

Gir has an extensive road network which facilitates vehicle transects. Distance sampling methodology using vehicle transects was carried out from December 2017 to June 2018 to estimate the population of Four-horned Antelope. Data were collected during 06:30-09:30 and 15:00-18:00 by a driver and an observer. In total, 1932.3 km were covered on 54 individual transects which were repeated four times during the study period. Data on group size and the

sighting angle (using a hand-held compass) and sighting distance (using a laser rangefinder) of the detected animal groups were collected while driving at a maximum speed of 20 km/hr. The data were analysed in DISTANCE software (Thomas *et al.* 2010). Whenever possible, individuals were assigned to age-sex categories: adult male, adult female, young.

Results

Four-horned antelopes were recorded on only 10 occasions during the study period. The Uniform Key model with Cosine adjustments of order 1 showed the best fit (AIC=84.117) in the Distance software. The individual density was 0.17 ± 0.06 SE, group density was 0.07 ± 0.02 SE and the mean group size was 1.8 ± 0.2 SE (Table 1). The radial distances of the observed Four-horned Antelopes ranged from 7.0 to 70.7 m with the mean radial distance of 35.08 m ± 6.20 SE. A total of 20 individuals were observed during the study of which 6 were adult males, 10 were adult females, 3 were calves and 1 individual could not be identified. The group size varied from 1 to 3 individuals with the majority seen in group sizes of 2 individuals, comprising 1 male and 1 female. The Adult Female: Adult Male and Adult Female: Young ratios were 1:0.6 and 1:0.3 respectively. The Four-horned Antelopes were recorded in the *Acacia-Lannea-Boswellia* and Scrub vegetation types in areas with moderate to high elevation.

Table 1. *Estimates of density, ESW (effective strip width), encounter rate, average group size with their standard errors of Four-Horned Antelope in Gir Protected Area*

Model Selected	Individual density (SE) (km^{-2})	Group density (SE) (km^{-2})	Effective trip width (SE) (m)	Mean encounter rate (n/L)	Average group size (SE)
Uniform Key with Cosine adjustments of order 1	0.17 (0.06)	0.07 (0.02)	42.81 (7.19)	0.006	1.8 (0.2)

Discussion

Because of the very low sample size, the estimated density of 0.17 animals/km^2 should be regarded as tentative. The DISTANCE software models a detection function, representing the probability of detecting an individual (or group) as a function of distance to the transect line. It allows correcting the number of detected animals for those that are missed and provides an absolute density estimate, provided some key assumptions hold. The sample size during the current study was low in spite of intensive effort, but the detection rates of this species recorded by other researchers in Gir and India have all been very low. The densities in Gir range from 0.2 to 0.42/km^2 (Table 2).

Table 2. *Densities of Four-Horned Antelope in Gir Protected Area*

Density (km^{-2})	SE	Sampling effort (km)	Number of observations	Method	Reference
0.22	na	996	15	Strip-count sampling	Berwick & Jordan 1971
0.42	0.12	3132	66	Road-strip count	Khan *et al.* 1996
0.2	0.1	315	4	Foot transect	Jhala *et al.* 2016
0.17	0.06	1932.3	10	Vehicle transect	This study

These estimates were calculated using different methods and this should be taken into consideration when comparing them. The study concurs with other studies on the species owing to the fact that the densities of the Four-horned Antelope in India are generally low and vary depending on habitat conditions, competition with domestic livestock, predation, and degree of protection (Leslie and Sharma 2009). The densities of the Four-Horned Antelope reported from other sites in India range from 0.02–4.22/km^2 (Table 3).

Table 3. *Densities of Four-Horned Antelope in India*

Study Site	Density (km^{-2})	Sampling effort (km)	Method	Reference
Kanha	2.1	Na	Na	Schaller 1967
Nagarhole	0.8	463.3	Foot transect	Karanth & Sunquist 1992
Bandipur	1.1	475.5	Line transect	Karanth & Nichols 2000
Panna	4.03	532.34	Line transect	Chundawat 2001
Pench (Madhya Pradesh)	0.29	457.5	Foot transect	Biswas & Sankar 2002
Tadoba	0.5	1088	Foot transect	Karanth & Kumar 2005
Melghat	0.5	771.2	Foot transect	Karanth & Kumar 2005
Pench (Maharashtra)	1.1	894	Foot transect	Karanth & Kumar 2005
Mudumalai	0.88	Na	Block count	Baskaran & Desai 1999
Panna	2.22	Na	Foot/vehicle transect	Sharma 2006
Kuno	0.02	760	Foot/ vehicle transect	Khudsar *et al.* 2008
Mudumalai	4.21	299.4	Vehicle transect	Baskaran *et al.* 2009

These estimates were also obtained using different methods, so it is difficult to make comparisons between them, but the low figures reported overall are likely to indicate result from the species' highly elusive nature, and difficulty in detection. As reported during the current study, the Four-horned Antelope prefers to live solitarily or in very small groups (Sharma and Rahmani 2004). The female:male ratio (1:0.6) found during the study and female:young ratio (1:0.3) are similar to those mentioned in earlier studies from forests in the semi-arid zone of the country. Berwick (1974) reported the average female:male ratio to be 1:0.66 and female:young ratio to be 1:0.3 in Gir. Average female:male sex ratio in Panna Tiger reserve was 1:0.69 (Sharma 2006). The Four-horned Antelope was observed in *Acacia-Lannea-Boswellia* and Scrub type of vegetations at moderate to high elevations in Gir which is also consistent with findings of other studies. The Four-horned antelope is known to use hilly terrain, closed canopy, and thick undergrowth for resting and nursing young ones and open or scrub forest for foraging in areas with limited human disturbance and water availability (Sharma *et al.* 2005).

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Fig. 4. *Four-horned antelope in Gir forest (© Dhawal Mehta)*

Sitatunga (*Tragelaphus spekii*) population ecology and habitat use in central Uganda

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https://era.library.ualberta.ca/items/af872d29-c886-4cf4-8be8-30b1bfe282b5

Abstract
Effective wildlife management involves understanding the population status and habitat of the species in question, as well as human interests in management decisions. Human dimensions are complicated - African wildlife topics often spark international interest in addition to local concerns. Most African countries surpass those in the global north in the amount of habitat under protection and funds allocated to conservation. Trophy hunting, while controversial, provides much needed conservation funds and provides incentives for loc communities to conserve wildlife and habitat. Due to the various human interests involved, the African Wildlife Consultative Forum (AWCF) acts to bring stakeholders together to address emerging issues and collaborate on solutions. As an initiative based in Africa, AWCF positions Africans to take the lead in conserving their resources.

Fig. 1. *Male sitatunga in papyrus swamps, Uganda (© Camille Warbington)*

Sitatunga (*Tragelaphus spekii*) is a wetland-dependent antelope species endemic to sub-Saharan Africa. Due to the difficulty of working in papyrus marshes, information about sitatunga populations and habitat use are sparse and often conflicting. Adult male sitatungas are sought by trophy hunters, thereby providing an incentive to conserve wetlands. Nevertheless, wetlands are decreasing in Uganda, spurring concerns of barriers to dispersal.

I used spatial mark-recapture methods and the time in front of the camera (TIFC) method to estimate density of sitatunga in the Mayanja River area of central Uganda. I used 29 camera traps and observation platforms in and around the wetlands, observing openings in the papyrus. I recorded over 900 encounters with sitatunga during the study.

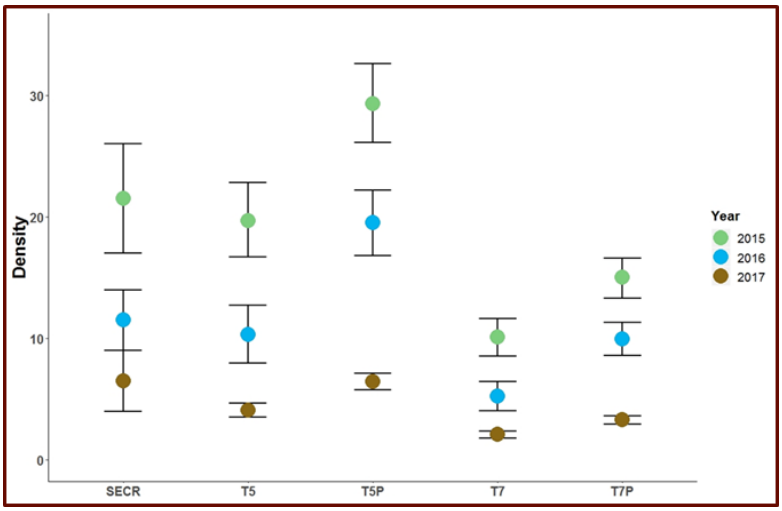

Fig. 2. *Comparison of point estimates and 95% confidence intervals calculated from spatially explicit capture-recapture (SECR) or time in front of the camera (TIFC) models of density of sitatunga in the Mayanja River area of central Uganda. T5 and T7 are the estimates for density using TIFC where the effective detection distance (EDD) is 5 or 7 m respectively and ignoring gaps; T5P and T7P include probabilistically resolved gaps for the listed EDD. Density estimate for SECR is the best model as determined by AIC. Density is animals per km^2 except for SECR which is animals per km of river.*

The analysis shows that sitatunga are heterogeneous in terms of movement, with one group moving 25 times farther than the other group. The estimated population density declines over the three years of the study, from 22 / km of river (95% CI 17 – 26) to 7 / km of river (95% CI 4 – 9). The results also show that TIFC density estimates are comparable to those from spatial capture-recapture methods, reinforcing the estimates of density. Since TIFC does not have the same assumptions that spatial methods do, TIFC will be useful for species that do not conform to spatial mark-recapture model requirements. Population genetics can reveal additional information about the sitatunga population viability and habitat connectivity, so I analyzed DNA samples from adult male sitatunga. Results show that this population is not reproductively isolated, indicating wetland connectivity at a larger scale.

Using camera traps, I analyzed space use of the ungulate assemblage in the study area, which included domestic cattle. I placed cameras in forests, shoreline wetlands, and interior wetlands. I compared the proportion of days with a detection of the species in three habitat types between different hydrologic conditions in the river – high, normal, and low water. Sitatunga are unique in the ungulate community in that they use remote wetlands consistently, regardless of water level. In the forest habitat, all species except sitatunga and warthog show an increase in the proportion of days with a detection over time, regardless of water levels. Even though the intensity of use of forests increases for most species, I expect that dietary and temporal activity differences allow for coexistence in this community, including the novel competitor.

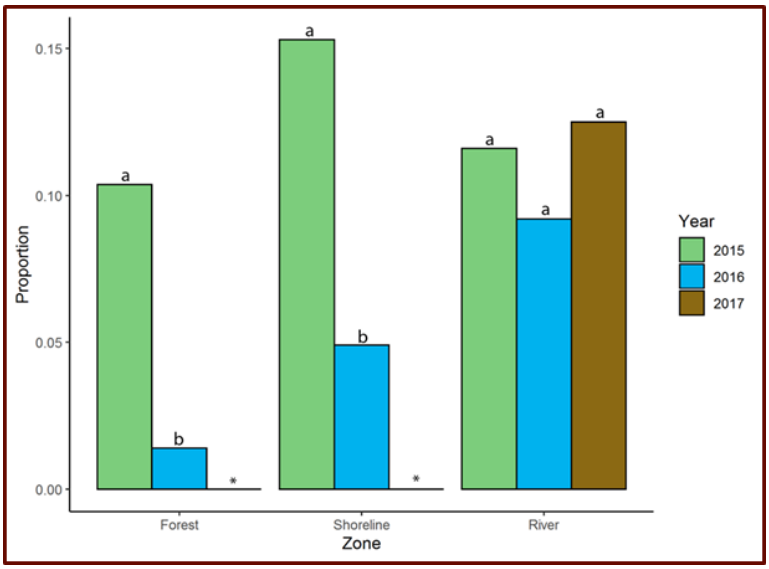

Fig. 3. *Proportion of days with a detection of at least one sitatunga in the three zones for the three hydrologic conditions of the study, 2015 (normal water level), 2016 (high water level), and 2017 (low water level). Different letters indicate significant differences ($p < 0.05$) in proportions for a given year/zone comparison. *: five or fewer detections*

Sitatunga move more than predicted, have high habitat connectivity, and high fidelity to wetland vegetation. Taking these results together, I suggest that this population of sitatunga is not in decline as density results indicate. Instead, sitatunga are relocating activity centers to areas outside my trapping array or to closed papyrus, where I am unable to detect them. Population density and genetic mixing indicate that this population of sitatunga is secure and there is no conservation concern, although clearly wetlands must be conserved to ensure population persistence.

Fig. 4. *Dimorphism in sitatunga: female on the left, male on the right (© Camille Warbington)*

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The social dynamics of the Cape buffalo (*Syncerus caffer caffer*) and the epidemiological implications

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Fig. 1. *Collared buffalo cow in Gonarezhou National park, Zimbabwe (© Daniel Cornélis)*

Abstract

Although the ecology of the Cape buffalo (*Syncerus caffer caffer*) is reasonably well understood, the social dynamics occurring within and among groups are less known, despite the important implications for both buffalo ecology and management, and intra and interspecies disease transmission. This thesis aims to better understand the social behaviour of Cape buffalo across several populations in sub-Saharan Africa using a combination of GPS tracking data and genetic markers. I quantified the dynamics of interactions within and among neighbouring buffalo groups and examined the influence of seasonality and inter-population variance on these dynamics. I also investigated the influence of sex on the dispersal ability, in order to better understand the spread of pathogens among populations. To go further, I examined the impact of intragroup dynamics on a directly transmitted pathogen spread as a model to link the host social organisation and pathogen transmission. This thesis revealed different social dynamics within and among groups, although consistent among the study populations. Results showed

that buffalo formed relatively distinct groups occupying unique and separated home ranges, with minimal overlap, independently on the season. Direct contacts among groups were rare while indirect contacts occurring were more frequent, with serious implications for indirectly transmitted pathogens in the population. These results suggest a behavioural avoidance or a territorial behaviour occurring throughout the year. Females could be more likely to disperse among populations than males. Within groups, individuals formed very unstable dyadic associations. These fission-fusion dynamics varied seasonally, with fission and fusion patterns lasting 1 to 3 days. However, the way individuals interacted with each other within groups only slightly affected the transmission of a directly transmitted pathogen. This study is one of the first to quantify the degree of fission-fusion dynamics and intergroup encounter in Cape buffalo, and to relate these dynamics to variations in environmental conditions across several populations. Therefore, this thesis contributes to the understanding of buffalo social systems and their relation to the environment, a growing issue at the wildlife-livestock interfaces given the economic costs due to pathogen transmission with cattle.

Fig. 2. *Buffalo breeding herd in Kruger national Park, South Africa (© Elodie Wielgus)*

For more information, see: https://onlinelibrary.wiley.com/doi/full/10.1002/ece3.6608

Oryx reintroductions: history revisited

Mark Stanley Price

The recent paper listed in *Gnusletter* 37 (1) about the release of scimitar-horned oryx in Chad (Mertes et al. 2019) (Figure 1) brought back many memories and thoughts about the first releases of Arabian oryx into unfenced desert in Oman, starting in 1982 (Figure 2).

I had the pleasure of being Field Manager for this project, from designing the process and the desert facilities, through releases and then monitoring from 1979 to 1987. The facts below all come from my book published in 1989 (Stanley Price 1989). I should also declare an interest in that I have been a Board member of the Sahara Conservation Fund, the implementing body for the Chad reintroduction, since 2013, which has given me access to the regular reports and research observations coming from the project. On the other hand, I have played no part in the design or implementation of the Chad project.

There are many parallels, similarities, and some differences between the early releases in both Oman and Chad, with insights into how oryx of both species (and probably all oryx species) adapt to and exploit the extreme environments that are their natural habitat. But their specialisations and unique features may not make them a general model for ungulate releases. First some basic facts about early releases in both Chad and Oman:

Fig. 1. *Scimitar-horned oryx in Chad (© Tim Wacher)*

Fig. 2. *Arabian oryx in Oman (© Mark Stanley Price)*

Oman

Herd 1 was released in January 1982; this totaled 10 oryx, including two Oman-born young, which had been in a 100-ha pre-release enclosure for between 10 and 21 months. The oryx were heavily dependent on supplementary feed in the enclosure.

Herd 2, released in April 1984, comprised 11 oryx which had been in this same 100-ha pre-release enclosure for between two and 24 months and included three oryx born in the enclosure. The oryx were heavily dependent on supplementary feed inside, and to lesser extent outside the enclosure until rain fell.

The relatively long periods in the enclosure were based on the prime need to have developed strongly coherent herds before release, with the aim that such individuals would remain together in the face of the opportunity or any temptation to scatter on release: a strategy that was completely successful. Monitoring in Oman of the relatively small number of oryx was based on visual sightings and individual recognition, and a maximum of two short-term VHS radio collars in Herd 1.

Chad

Group 1 of 21 oryx were released in August 2016 after 6 months using adjacent 25 ha enclosures with natural grazing. This was ‘wet season’ with plentiful grazing outside the enclosure.

Group 2 of 14 oryx were released in March 2017 after one month in one of the 25 ha enclosures, in which they were heavily dependent on supplied food and water. This was a ‘dry season’ release.

The paper states that supplementary feed and water were available for any released oryx in the vicinity of the pens or enclosure.

Behaviour on release in Oman

Soon after release the Oman Herd 1 embarked on series of explorations that appeared to be a systematic approach to learning about the new environment (Figure 3). This was probably encouraged by rain falling three weeks after release. From January 1982 to July 1986, Herd 1’s

total range was 1932 km^2 comprising 12 discrete range areas, from between 5 and 61 km from the release site. Movement between range areas was quite evidently in response to rainfall.

Fig. 3. *Arabian oryx in Oman (© Mark Stanley Price)*

After 26 months in the desert Herd 2 had a total range area of only 347 km^2, in only two discrete sub-ranges, with a maximum distance of 16 km from the release site.

This herd responded to rain in June 1986 just as Herd 1 did in 1982, leaving the release area and its food supply. Comparably, the Chadian Group 2 showed a considerable and prompt reduction in its daily visits to feed on the onset of the wet season.

Our interpretation of these observations was these:

1. Oman's Herd 2 established a smaller range on release almost certainly due to the prevailing dry conditions and its dependence on supplementary feed and water close to the release site.
2. Oryx only used supplementary feed when there was no alternative. As soon as fresh grazing appeared after rain, or they moved into an area with grazing, all provided feed was ignored. This would appear to be at least partly the case also with Group 2 in Chad.
3. There was a fundamental difference between Oman Herds 1 and 2, which will also be true of the two groups in Chad. This is the fact that on release Herd 1 saw no other oryx nor found any signs of conspecifics in the release area. Such signs would have been droppings and shed hairs, and shallow scrapes made by oryx to rest in under trees etc. This evidently vacant habitat may have been a motivator for their systematic exploration of their 'empty habitat'.

Herd 2 would have encountered such signs immediately on release and had also seen the occasional oryx from Herd 1 returning to the release site for a short visit. Hence, the Herd 2 oryx knew there were conspecifics in the desert, and that they would meet up with them sometime. This did, indeed, happen on 12–13 June 1984 when Herd 1 returned to the release site after an absence of 22 months. It found Herd 2 adjacent to the enclosure; the herds mingled and the dominant males battled, each defending 'his' interests; the herds then separated into their original combinations, but this was the start of a 6-week period in which the number and composition of groups were very fluid.

Herds 1 and 2 were subject to the same management in the 100-ha enclosure before release. Imported oryx (i.e. those not born in the enclosure) were on average in the enclosure for 16 months (range 11 to 21 months), while the comparable oryx of Herd 2 were enclosed for an average of 12 months (range 2 to 24 months).

So, I would suggest that behaviour on release was not shaped by relatively long confinement but, rather, reflected ecological conditions outside, namely the availability of grazing, and whether the release area was either empty of oryx or showed evidence of the presence of conspecifics. The Chad experience asserts that a short acclimation period is preferable, but I am not convinced of this in view of the importance of ecological conditions in the release area. Further, while this all argues that 'an oryx will be an oryx' when given the chance under free-ranging conditions, one should not dismiss the potential impact of past management regimes: it would be greatly helpful to know if oryx that were bred under captive conditions behave and perform the same as those born and raised under extensive ranch conditions.

Oryx physiology

There are several adaptations known in oryx that are undoubtedly at play in released animals. Captive Arabian oryx on a regime of reduced food and water, to simulate a desert environment, reduced their resting metabolic rate and total evaporative water loss by 16.2 and 25.7% respectively, while maintaining a digestive efficiency of about 70% (Ostrowski et al. 2006). This suggests that the presence of *ad libitum* supplementary food may not be a deterrent for oryx to disperse and explore into areas where the nutritional quality of their diet would be less than if they remained near their feed station.

The second aspect is their ability to undertake long-range movements. The latest research report from Chad relates how a female with calf at heel moved 250 km to the edge of the OROA reserve in August-September 2020 just as the vegetation was responding to fresh rain; the pair then moved the same distance back to the release site over the month or so.

The Chad paper states 'We expected oryx movements after release to represent trade-offs between risky, energetically expensive exploration and resource exploitation.', and the text generalises from other work: 'Yet, exploration decreases the time available for foraging, vigilance, and reproduction (Moehrenschlager and Macdonald 2003; Hamilton et al. 2010; Ryckman et al. 2010), and movements through unfamiliar territory are risky in terms of energetic demands, predation risk, and missed opportunities'.

But, if the animals disperse as a herd, then there is little loss of reproductive opportunity. There is almost no predation risk for oryx in Chad. And more (unspecified) opportunities might be gained than lost by dispersing.

One can explore the energy cost of dispersal. The oryx is a powerful walker, and in Oman we recorded individuals walking 60 km overnight. On the other hand, the oryx is a woeful runner, easily exhausted if chased, which was one of the main reasons for their extirpation.

Information on the daily movement of Serengeti wildebeest (*Connochaetes taurinus*), a species which is both a long-distance walker but can also gallop over fairy short distances, is instructive: for a 92 kg wildebeest, the cost of locomotion was calculated as only 35% of its basal metabolic rate (Pennycuick et al. 1979, Hudson and White 2018). So, long-distance walking is probably not energy-hungry.

Similarly, the cost and risk of moving through unknown, predator-free territory is probably not great. Released oryx in Oman often moved into new country but then returned to the release site directly and purposefully through hitherto unused areas. After a while, it was evident that every oryx knew with great precision its location relative to the release site, and it became a management principle that oryx were never 'lost', even if we did not know where they were.

Some thoughts

The paper by Katherine Mertes and colleagues provoked many welcome memories of reintroducing Arabian oryx into Oman, and it is so heartening to know that this is the first of more papers describing this epically significant reintroduction.

There are differences between the two reintroductions into Oman and Chad. Ecologically, the Oman release area was considerably more arid, with no dependable rainy season. In addition, we were dealing with a very small number of founder animals, and our monitoring was based on observations by rangers, for the technologies for tracking and communication as used in Chad had not been invented. Indeed, all our locations were recorded without the benefit even of GPS.

Further, based on my earlier research experience with efforts to domesticate the fringe-eared oryx (*Oryx beisa callotis*), in Kenya, I was confident the Arabian oryx could be restored to the unenclosed desert if released herds comprised a balanced mix of sexes and ages. The aim was to have established a cohesive dominance hierarchy. This was one reason for a long pre-release period, and the behaviour of the released herds in Oman confirmed this was a valuable management tool.

I argued in 1989 that oryx in general are highly 'reintroducible' because herds with strong dominance hierarchy and cohesion can be formed, and from the fact that they are primarily grazers and are faced in the desert with a small range of mostly palatable grasses; they are a large and robust animal to cope with an extreme environment, to which they show many subtle physiological and behavioural adaptations; these may be latent but are not lost down many generations under diverse management conditions.

The Chad paper is based on more than 230,000 locations provided by smart collars. In contrast, the locations of oryx in Oman were all due to physical sightings and individual identifications. This allowed learning about oryx as individuals and interpreting their behaviour as insights into their perception of the desert and their adaptation to it. Observing long distance moves by single oryx or a group, or a return to the release site for a drink after many months without surface water were all indicators of adaptation and exploitation. This close observation approach soon taught us that the oryx knew what they were doing in the desert: it was us who had to learn from the oryx and trust them.

So, I end with two observations and suggestions. The first is that the Chad project must have a huge volume of on-the-ground sightings of individuals with their locations and movements, behaviour and performance; analysis and description of these would allow a more granular insight into adaptation and resource use. Even if such a focus on individuals suggests a soap opera model, it will be hugely insightful, and of wide public appeal. I hope there will be publications on this.

Second, the success of oryx release and establishment of home ranges depend on the biology and natural history of the species. A scientific approach to reintroduction design is necessary, but also critical is a profound understanding of the species itself: how the first, high-risk releases will perceive and react to empty habitat, and many more challenges. For this reason, I would suggest that we should not generalise from the lessons of a single species to ungulate releases. Given the diversity of sizes, shapes, and ecologies within the range of ungulates, each should merit a species-specific strategy for any reintroduction.

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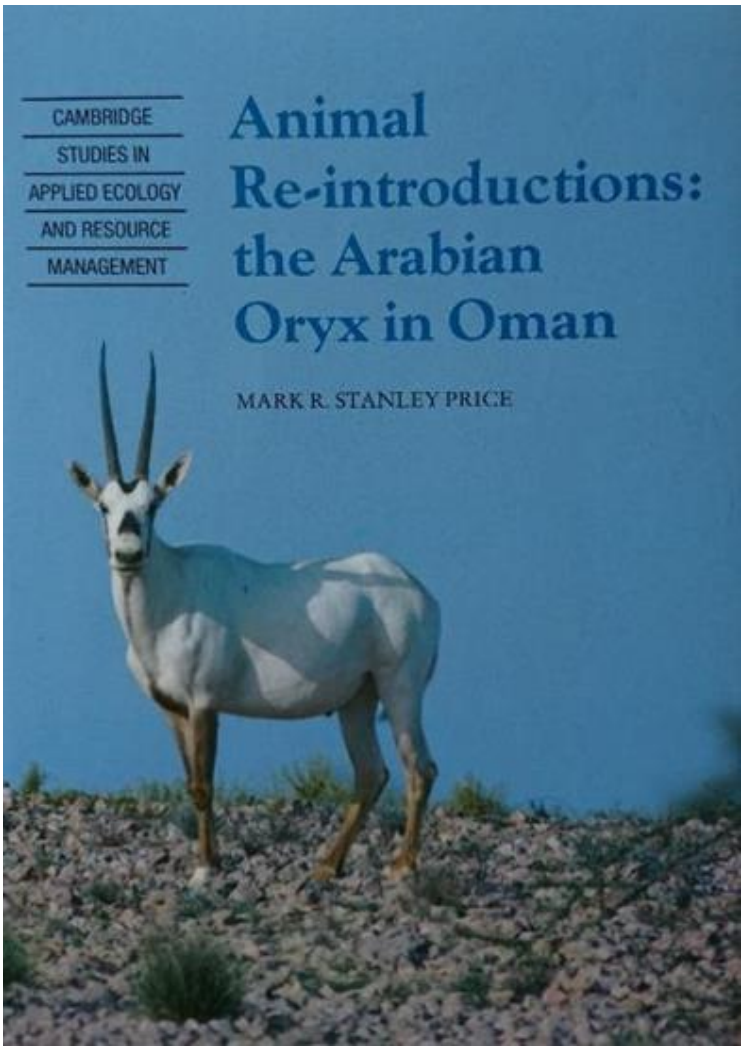

Update on current status of sable antelope classification in the Niassa National Reserve, northern Mozambique

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Introduction

There has been speculation over a number of years whether the subspecies of sable antelope in the Niassa National Reserve in northern Mozambique is *Roosevelt* (*Hippotragus niger roosevelti)* or *Southern* Sable *(H. n. niger)*. This debate stems from the fact that the Niassa sable population is more closely linked to those in southern Tanzania than to populations further to the south in Mozambique. The difference in the physical features between these two subspecies also supports this hypothesis: Roosevelt sable has a smaller body, adult males have smaller horns, and the adult females are often a rustic brown color whereas the Southern sable is a larger animal, with the males carrying larger horns and the females are black in colour. However physical features such as these cannot be used to distinguish between the subspecies since both can exhibit these characteristics. The available data that distinguishes these two subspecies, and the implications for the Niassa Special Reserve in northern Mozambique, are summarised here.

Fig. 1. *Sable antelope (© V. R. Booth)*

Relationship between Sable Antelope subspecies

At least four subspecies of sable antelope have been recognized based on morphological features and mitochondrial DNA sequence data (Ansell 1971; Matthee and Robinson 1999; Pitra et al. 2002; Pitra et al. 2006; Jansen van Vuuren et al. 2010; Rocha 2016; Vaz Pinto 2019). These four subspecies range from Angola in south west Africa (Giant or Angolan sable, *H. n. variani*) to Kenya in north east Africa where the Eastern or Roosevelt sable (*H. n. roosevelti*) ocurrs along the coastal zone that stretches as far south as the Rovuma River in Tanzania. The Southern or Common sable (*H. n. niger*) occurs to the south of the Zambezi River stretching from the Caprivi Strip in north eastern Namibia, through northern Botswana, across north central Zimbabwe, southern Malawi, north eastern South Africa and into central and southern Mozambique. The Zambian or Western sable (*H. n. kirkii*) occurs to the north of the Zambezi

River stretching from western Zambia through northern Malawi and into western Tanzania (Ansell 1971, Ansell and Dowsett (1988), Figure 2). Groves (1983) described a further subspecies, *H. n. anselli*, which is thought to range from eastern Zambia across northern Malawi and into southeastern Tanzania. However, this classification was based on a restricted geographical sampling of few specimens and single morphological characters which undergo extensive individual variation. Until recently, this subspecies was generally not recognised, however, Vaz Pinto (2019) recognised this as a geographically coherent population.

Matthee and Robinson (1999) provide a comprehensive mitochondrial DNA analysis that demonstrates the linkages between the four subspecies of sable. This analysis places the subspecies in two distint groups: one comprising the strictly east African *H. n. roosevelti*, and a second geographically diverse group which includes *H .n. niger* (South Africa, Zimbabwe, Botswana, Mozambique), *H. n. variani* (Angola), and *H.n. kirkii* (Zambia, Malawi, Tanzania). This grouping is further supported by Pitra et. al. (2006) and Jansen van Vuuren et. al. (2010). A fifth genetic group, known as West Tanzanian sable, was recently defined based on its genetic divergence and discrete geographical distribution (Vaz Pinto 2019).

These studies conclude that there is genetic evidence that interbreeding has occurred between *H. n. niger* and *H. n. kirkii (*i.e. Zambia and western Tanzania*),* but there is no evidence of interbreeding between *H. n. kirkii* (western Tanzania) and *H. n.roosevelti* (east African coastal region).

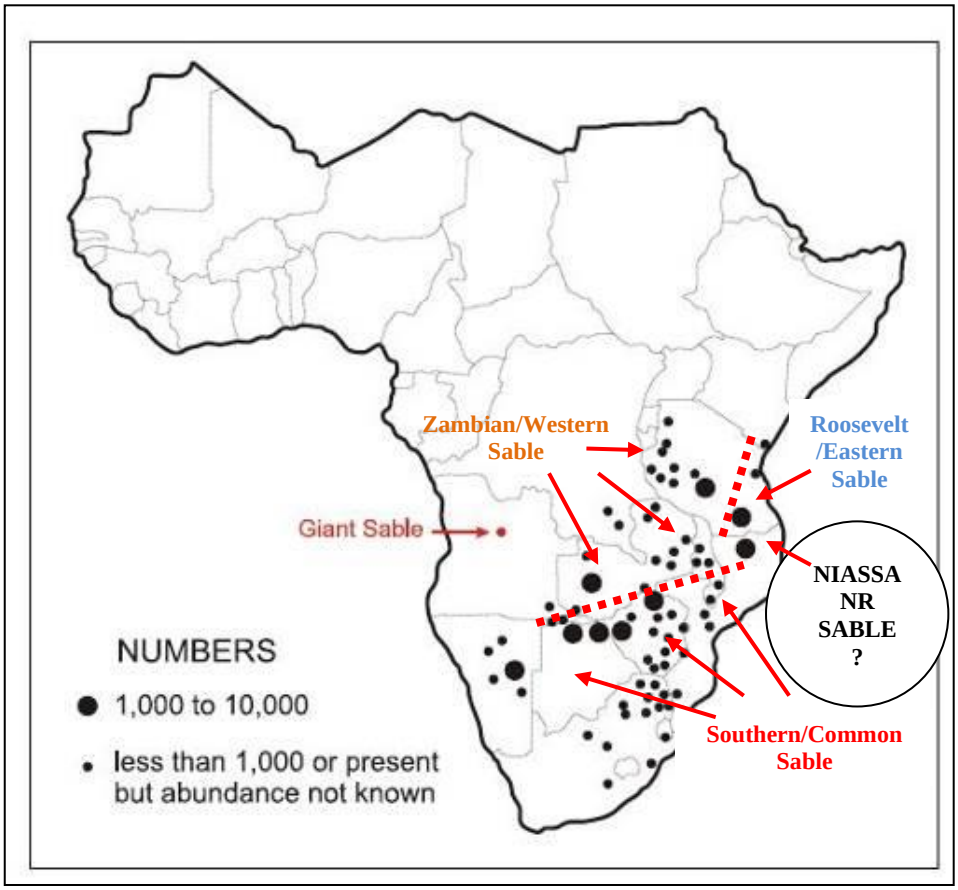

Fig. 2: *Distribution of the four subspecies of sable antelope in Africa (after East 1999)*

Roosevelt vs Western Sable in Tanzania

Roosevelt sable (*H. n. roosevelti*) was thought to be restricted to the Shimba Hills in south eastern Kenya and therefore regarded for some time as an "endangered" subspecies. Historically the Tanzanian sable population was regarded as being *H. n. kirkii*, however there were various schools of thought that believed that the coastal population from Tanga to the Selous Game Reserve and the Kilombero Valley in the west as was in fact *H. n. roosevelti* (see Baldus 2009). If this was the case then *H. n. roosevelti* would not be restricted to the nominate population in the Shimba Hills and therefore could not be regarded as an endangered species (see Baldus, 1998).

In 1998 DNA samples from the Shimba Hills population were collected and compared with samples from the sable antelopes of the Selous and Saadani Game Reserves, Western and Southern Tanzania and Northern Mozambique to determine whether any taxonomic relationship existed. This research was conducted by the staff of the Selous Conservation Programme of Deutsche Gesellschaft fuer Technische Zusammenarbeit (GTZ, the German bilateral development agency) in conjunction with the Tanzania Wildlife Division. GTZ contracted the Berlin based "Institute for Zoo Biology and Wildlife Research" (IZW) to conduct the study led by Prof. R.R. Hofmannn, Prof. C. Pitra and Dr. D. Lieckfeldt.

DNA analysis and comparison of the different samples collected proved that the sable antelopes residing along the eastern coastal region between the Shimba Hills National Park in south eastern Kenya and the western boundary of the Selous Game Reserve as far south as the Rovuma River that formed the Tanzania – Mozambique border belonged to the subspecies *H. n. roosevelti* (Figure 3; Pitra et. al 2002). This research also confirmed that no evidence of hybridisation with the Western and Southern sable types could be found, confirming that *H. n. roosevelti* is an isolated and genetically clearly identifiable subspecies.

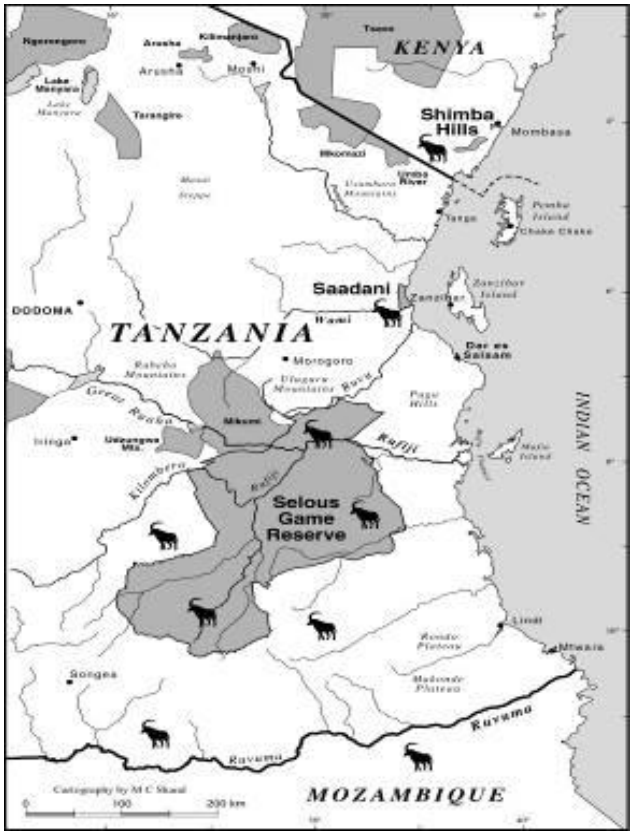

Fig. 3. *Distribution of Roosevelt sable in East Africa (from Baldus 2004)*

The implications of this research were that the eastern coastal population of sable in Tanzania should be recognized as *H. n. roosevelti*. This information was passed on to the Safari Club International (SCI) Trophy Records Committee with the recommendation that all trophies originating from the following areas should be included in the SCI record book as Roosevelt (Baldus, 2004):

1. Selous Game Reserve (Selous GR);
2. Northern buffer zone of Selous GR between Ruvu river and Selous GR;
3. Eastern buffer zone of Selous GR between coast and Selous GR boundary;
4. Southern buffer zone of Selous GR between Ruvuma river (Mozambique boundary) and Selous GR.

The SCI record book now recognised this distribution cautioning that what still remains to be done is to establish its western and southern boundaries through ongoing DNA testing.

Until this is done, the hunting of *H. n. roosevelti* will be limited to the Selous Game Reserve until the western and southern distribution limits are determined (https://huntforever.org/2017/07/10/new-dna-requirement-for-roosevelt-sable-taken-in-mozambique/)

Implication for the Niassa National Reserve, northern Mozambique

Baldus (pers. comm.) collected <5 samples from a very localised area of the Niassa Special Reserve in 1998, but the analysis of these was inconclusive. In 2004/2005 additional skin samples for DNA analysis (*n*=10) were taken from sable on the request of then Reserve Administrator, Baldeu Chande (Colleen Begg, pers. comm.). Rolf Baldus (pers. comm.) confirmed that these samples were analysed and Pitra (Baldus 2009) states that "*South of the Rovuma River in the Niassa Game Reserve the Roosevelt and southern subspecies type are found together indicating that this is the southern boundary where both subspecies occur side by side*".

The majority of these samples were from one area of the Niassa National Reserve (Hunting Block L2) with two samples from outside the Reserve (although Baldeu Chande (pers. comm.) suspects that the coordinates for these samples were incorrect). The location of these samples are shown on the following unpublished map that confirms that they were *H. n. roosevelti* together with a single sample representing an "other" sable, presumed to be the Southern sable, *H. n. niger* (Figure 4, Baldus pers. comm.).

It is unclear why these data were not included in the analysis undertaken by Pitra et. al. (2006) that defines the limits of the nominate *H. niger* and its three genetically differentiated, geographically structured subspecies that are strongly linked through mtDNA lineages.

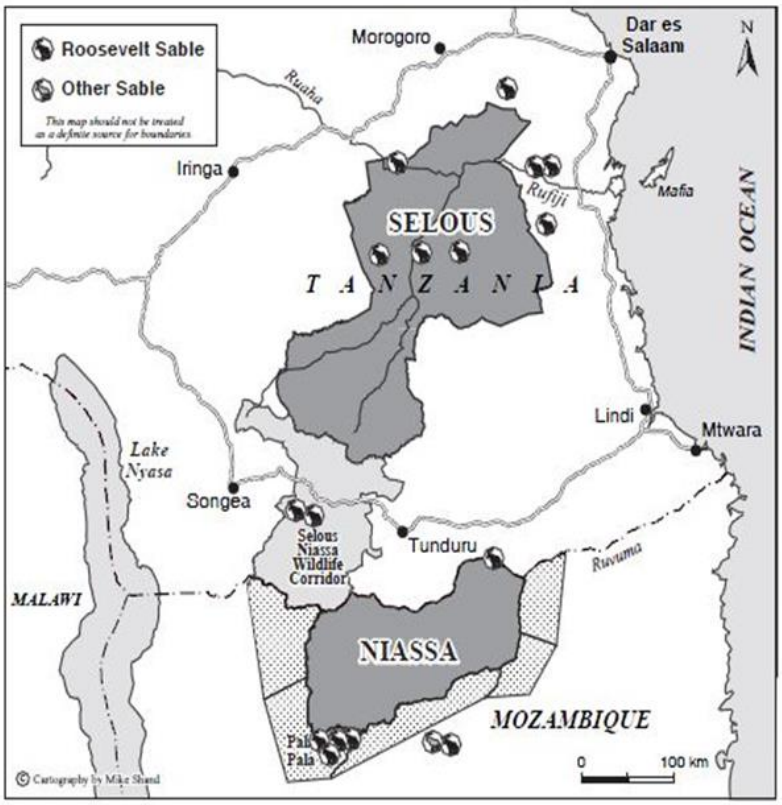

Fig. 4. *The geographical location of* H. n. rooselvelti *samples and one "other" sable sample presumed to be* H. n. niger *in the Niassa National Reserve (Rolf Baldus, unpublished data)*

Are there Roosevelt sable in the Niassa Special Reserve?

The data from the very limited samples analysed thus far strongly suggests that Roosevelt sable does occur in the Niassa Special Reserve, and is likely to extend outside the Reserve to the south. However, the fact that one sample in this analyis suggests that the Southern sable also occurs in the Reserve begs the question whether these two subspecies occur concurrently or whether they merge along an undefined ecological barrier as is the case between the Western sable (*H. n. kirkii*) and Roosevelt sable in western Tanzania.

This issue cannot be resolved by comparing the physical characteristics of the two subspecies as the following photographic evidence shows that it is almost impossible to tell the difference between Roosevelt specimens from north and south of the Rovuma with an example of a Southern sable from Matabeleland in Zimbabwe (Figure 5), nor is there any difference in the trophy quality recorded from sable antelope taken in different areas of the Niassa National Reserve (Figure 6).

There is strong circumstantial evidence that the Niassa Special Reserve sable population is "Roosevelt", however just as there is a transition between the Western (*H. n. kirkii*) and Roosevelt sable in Tanzania, so too could there be a similar transition between the Southern and Roosevelt sable in northern Mozambique.

There have been attempts to verify the genetic status of the "Niassa Reserve" sable. First by a hunting client (Don Mull, email 16/12/2011) in 2008 who submitted two sable trophies to the SCI Records Committee, assuming these to be Roosevelt sable. They were however recorded as Common (or Southern sable). Mr Mull contacted Mr Doug Luger, the SCI Trophy Records Manager, to determine how the Niassa Special Reserve could be included in the recognized range of the Roosevelt sable. Mr Luger indicated that if enough facts were submitted to the Trophy Records Committee then the range might be extended. Mr Mull submitted documents and DNA samples to Mr Luger, but on checking later with Mr Luger's replacement (Mr Mike Rubeni [Sp?]) Mr Mull was informed that that nothing further had been done.

In 2009, Brittany A. Hosmer (from Rock Environmental, LLC, britt@rockenvironmental.com, www.rockenvironmental.com) was requested by SCI to investigate the reports of the Roosevelt sable occurring further south of the Selous Game Reserve with a view to moving the sub-species boundaries for SCI Trophy Records purposes. According to Ms Hosmer, SCI had DNA samples from Roosevelt sable that had been recently killed in the Niassa Special Reserve (presumable those from Mr Mull?). These had been forwarded to Dr. Bill Moritz, (SCI Biologist, Washington, D.C.), however no further news was received from Ms Hosmer or SCI as to whether these were analysed.

Confirmation of the status of the sable population in northern Mozambique has three important implications:

1. It will clarify the status of the subspecies in the region, and if this is shown to be *H. n. roosevelti*, it will extend the range of this subspecies even further and thus improve its conservation status;
2. It will put to rest the debate whether trophies from the Niassa Special Reserve and surrounding region should be classified as Roosevelt sable;
3. The data will further advance our understanding of the genetics and evolutionary biology of this charismatic species.

To achieve this will require that a rigorous sampling programme is introduced across the Niassa Special Reserve, including the surrounding areas to the west as far as Lake Niassa, east to the coast in the Palma District of Cabo Delgado Province and as far south as the Lurio River in Niassa Province. If possible, data from Tete Province in the north west and Zambezi Province in central Mozambique could be used to establish the limits of the Southern sable subspecies.

There are currently moves afoot to conduct an extensive sampling exercise of the Niassa sable population (P. Trevor, WCS, Niassa Special Reserve, *pers comm.*). Until these results are available, it can only be surmised that the Niassa Special Reserve sable population is representative of the *H. n. roosevelti* subspecies.

"Roosevelt" Sable seen on the Rovuma River, Block R3. Niassa National Reserve (© V.R.

Southern Sable seen on Cawston Ranch, Nyamandhlovu District, Matabeleland, Zimbabwe (© V.R. Booth)

Rooseveldt Sable from Kilwa District, southern Tanzania (© Jerome Latrive)

Fig. 5. *Examples of sable antelope from north and south of the Rovuma River compared to an example of a Southern Sable from Zimbabwe*

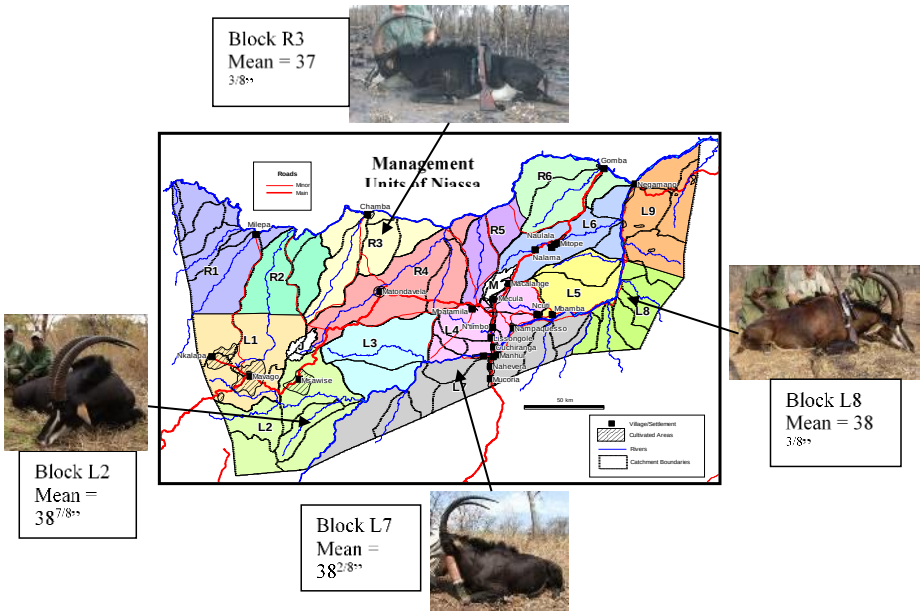

Fig. 6. *Examples of sable antelope trophies from the various management units in the Niassa National Reserve, including the long-term trophy quality as measured by the Rowland Ward methodology (Photos clockwise: courtesy of Johan Calitz Safaris Mozambique (Hunting Block L2), Luambeze Safaris (Hunting Block R3), Kambako Safaris (Hunting Block L8) and Luwire (Hunting Block L7))*

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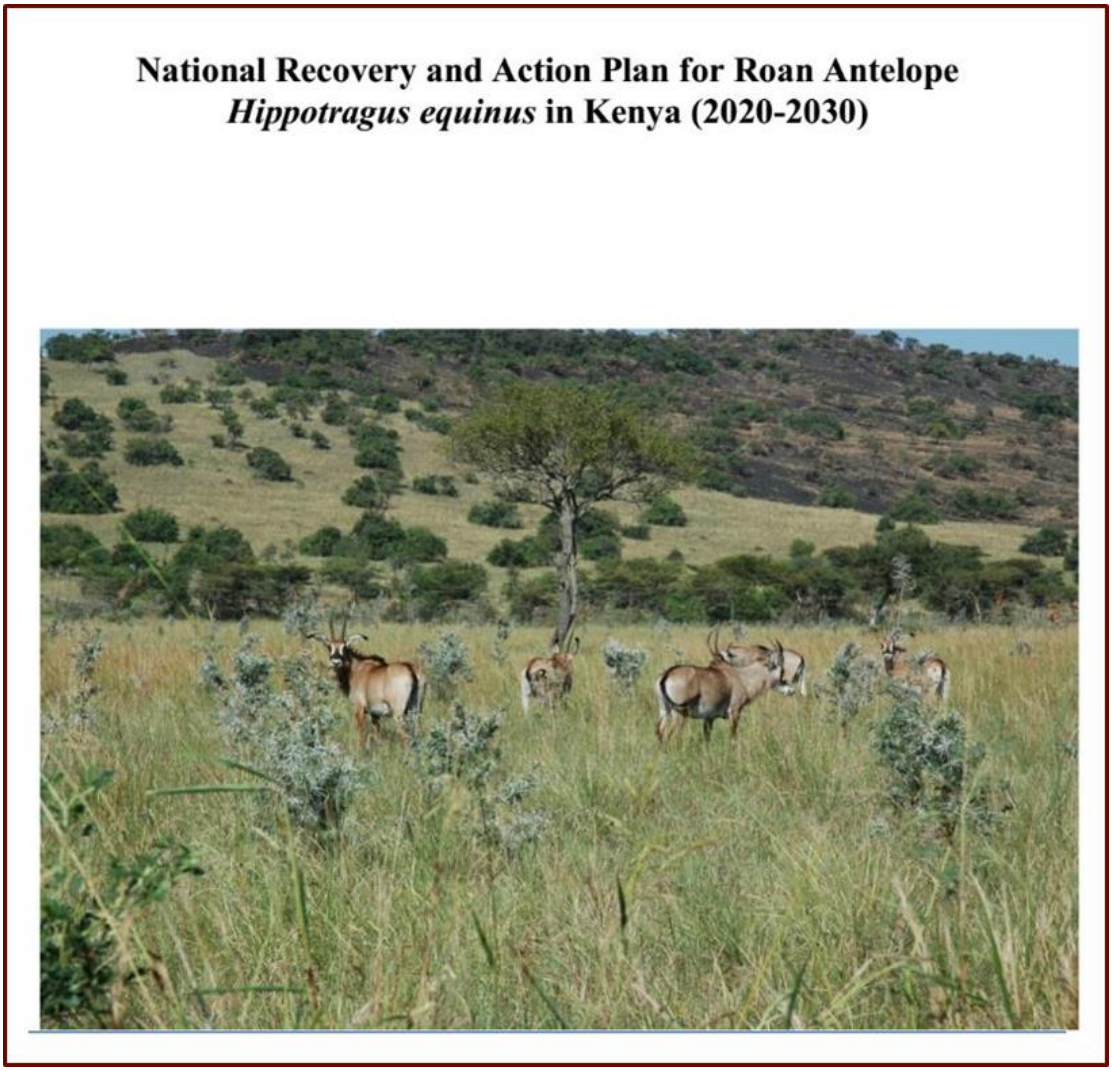
Antelope News

Africa

Roan antelope in Kenya

In March 2020, Kenya Wildlife Service (KWS), in collaboration with partners, launched the *National Recovery and Action Plan for the Roan Antelope Hippotragus equinus in Kenya 2020-2030*. The plan aims to re-establish a viable population of Roan Antelope in Ruma National Park in western Kenya and adjacent areas. The plan identifies threats facing the species and recommends interventions required to address these threats to ensure effective conservation and management of the species. This will be achieved through a set of objectives and activities that will help address security, population and habitat management, community Involvement, education and awareness, and coordination. One of the aims is to increaser the current population of 12 animals to 50 by 2023.

Source: https://www.kws.go.ke/latest-News
https://www.kws.go.ke/content/world-wildlife-day-and-launch-roan-antelope-recovery-plan



Iona National Park, Angola

The Angola Government and non-profit conservation organization African Parks have signed a management agreement for Iona National Park, in partnership with the National Institute of Biodiversity and Conservation Areas (INBAC). Iona NP is one of the largest protected areas in the country, covering 15,200 km^2. It is situated on the Atlantic coast of south-west Angola. It consists of a 150-km long coastal plain, the northern part of the Namib desert, with dunes and gravel plains, mountains in the east, and woodlands, particularly along the Cunene and Curoca rivers. It is regionally important as it forms part of a trans-frontier conservation area (TFCA) with Namibia's Skeleton Coast National Park. The park contains gemsbok (*Oryx gazella*), springbok (*Antidorcas marsupialis*), a few black-faced impala (*Aepyceros melampus petersi*), Damaraland dikdik (*Madoqua kirkii damarensis*), steenbok (*Raphicerus campestris*) and the greater kudu (*Tragelaphus strepsiceros*).
Source:https://www.africanparks.org/angola-government-partners-african-parks-management-iona-national-park

Addax in Niger

Two anti-poaching patrol missions in eastern Niger amounting to 170 person/days were carried out by Noé in collaboration with the Directorate-General of Water and Forests and the departmental directorates of Tesker and N'Gourti. One mission focused on addax monitoring and identified at least three groups of addax, representing 30-40 individuals in an area with abundant pasture after the rains. Unfortunately, the remains of three addax were also found in the Tin Toumma desert, apparently poached 3-4 months earlier by a vehicle probably coming from Libya. A monitoring mission 13-20 October identified several groups of addax, including a newly-born addax sheltering under a bush.
Source: Lettre d'information de Parcs de Noé, Septembre 2020, Octobre 2020. www.noe.fr

First wild-born addax in the reintroduced herd in Chad

The 1st wild-born addax in the reintroduced herd in Chad was born in July 2020, with a 2nd calf born two days later. In late 2019, 15 captive-born addax were flown from UAE to Chad by Environment Agency - Abu Dhabi then released into the Ouadi Rimé-Ouadi Achim Faunal Reserve. The birth of the 2 calves is a sign that the herd is adjusting well to life in the wild. The release of captive-bred addax is part of an agreement with Chad to restore endangered species. In March 2020, a 2nd group of 25 addax was transported to Chad from UAE. They will be released after the rains when conditions are best for the herd to adapt to their new surroundings.
Source: EAD press release, 16 July 2020. www.thenational.ae/uae/environment/calves-born-into-abu-dhabi-addax-herd-in-chad-1.1050228

Dama gazelle born in Chad

The wild-caught pair of Critically Endangered dama gazelle kept at the breeding centre in Ouadi Rimé-Ouadi Achim Game Reserve produced a young on 24 August 2020. The female is one of three brought from the Manga population and male was caught in OAGR (see *Gnusletter* 37#1).
Source: Sahara Conservation Fund e-Bulletin. www.saharanconservation.org

Scimitar-horned oryx numbers increase in Chad

The reintroduced population of scimitar-horned oryx *Oryx dammah* in Ouadi Rimé-Ouadi Achim Game Reserve has increased to 288, following the birth of 33 calves this year.

Source:www.thenational.ae/uae/environment/calves-born-into-abu-dhabi-addax-herd-in-chad-1.1050228

Anthrax in humans, domestic and wild animals, Uganda

Source: The Independent, 24 August 2020
https://www.independent.co.ug/lake-edward-shores-face-anthrax-fears-three-dead/>

La viande de singes, d'antilopes ou de pangolins s'arrache toujours en RDC, malgré les risques de maladie

Alors que de plus en plus d'espèces sont menacées d'extinction du fait de la surchasse et de la déforestation, la demande de viande de brousse ne faiblit pas et le braconnage s'intensifie.
Source : Guillaume Jan, Le Monde Afrique, *11 novembre 2020*
https://www.lemonde.fr/afrique/article/2020/11/11/rdc-de-plus-en-plus-rare-la-viande-de-brousse-s-arrache-toujours-malgre-les-risques-de-maladie_6059355_3212.html

Asia and the Middle East

Tibetan antelopes recover in Hoh Xil

Zonag Lake in the Hoh Xil National Nature Reserve in Qinghai Province, northwest China, is an important site for the Tibetan antelope or chiru *Pantholops hodgsonii* (Figure 1). Every year thousands of females migrate to the lake region to give birth. The population dropped from an estimated 200,000 to 20,000 during the 1980s when they were hunted for their underfur, *shahtoosh*, used to make expensive shawls. To protect Tibetan antelopes, Qinghai set up the Hoh Xil provincial-level nature reserve in 1996, which was upgraded to a state-listed reserve in 1997, covering 45,000km^2. In July 2017, Hoh Xil was inscribed on the World Heritage List. Thanks to systematic anti-poaching measures and a ban on illegal hunting, the Tibetan antelope population has risen to 70,000. According to the reserve management, not a single gunshot has been heard in the reserve since 2009 and it is now free from poachers. There are five protection stations and during the return migration, the rangers may close the road to allow large groups of antelopes to cross.
Source: http://www.xinhuanet.com/english/2020-07/31/c_139254637.htm

Fig. 1. *Tibetan antelope male in Hoh Xil National Nature Reserve (© Bill Bleisch)*

Saiga News 25

The latest issue of *Saiga News* has been published. It contains news updates and articles on: the 2019 aerial survey in Kazakhstan, an update on the population size of Mongolian saiga, using drones on saiga field surveys in Russia, saiga horn trade in Singapore, and the new Lake Elton Biosphere Reserve in Russia. It is available in 6 languages from: *https://www.saigaresourcecentre.com/newsletter/saiga-news-issue-25-winter-20192020*

Arabian oryx reintroduction in UAE

A group of Arabian oryx *Oryx leucoryx* has been released into Houbara Protected Area in the western part of Abu Dhabi by the Environment Agency - Abu Dhabi (EAD) - in coordination with Al Dhafra Municipality. The Houbara PA was established in 2008 and covers 774 km^2. This group is the first of 100 Arabian oryx scheduled for release in stages before the end of the year. The initiative is part of the 'Sheikh Mohamed Bin Zayed Arabian Oryx Reintroduction Programme'. The Arabian oryx population released into the Arabian Oryx Protected Area in southeast Abu Dhabi now numbers more than 800 (Figure 1). Groups of Arabian oryx have also been released in Qasr Al Sarab Protected Area. The UAE hosts more than 10,000 Arabian Oryx, 5,000 of them in the Emirate of Abu Dhabi, which is the largest group of Arabian Oryx in the world. The Programme extends to Oman and Jordan. A project has been initiated under a Memorandum of Understanding between EAD and the Royal Society for the Conservation of Nature to develop a herd of Arabian oryx in the Shaumari Wildlife Reserve, Jordan, where a total of 60 oryx will be released.

Source: Emirates News Agency https://wam.ae/en/details/1395302884269 7 November 2020

Fig. 1. *Arabian oryx in the Arabian Oryx Reserve, Abu Dhabi (© ASG)*

Mountain gazelles under threat in Israel

According to a report in the *Times of Israel*, Mountain gazelles are under serious threat due to several factors - urbanization, poaching, collisions with cars, predation by natural predators and feral dogs, and isolation of habitat patches by roads, railways and fences, including the security barrier between Israel and the Palestinian Authority. According to Israel Nature and Parks Authority, 467 gazelles were found dead or wounded on or next to roads between 2009 and 2017, not including many more animals that were likely to killed on roads but not recorded. Populations of the main natural predators, the wolf (*Canis lupus*) and golden jackal (*Canis*

aureus), are also sustained by human rubbish and agricultural products. Predation of gazelles by wild carnivores is compounded by the presence of tens of thousands of feral dogs that were once culled until animal rights groups objected. The security fence separating the State of Israel from the Palestinian Authority greatly limits the available habitat in this region for gazelles as it runs generally north–south. Gazelle hunting continues, despite strict laws, at an estimated rate of 300–1,300 animals annually, based on information provided by arrested poachers. The animals are shot, chased by off-road vehicles, or trained dogs, caught in stell leg-traps or nooses and spotlighted by poachers using night-vision goggles. Poachers are seldom caught and convicted, and those that are receive small fines and are seldom jailed. In principle, national planning envisages increasing population density in urban areas to leave as much open space as possible. In practice, however, this does not always happen. For example, a plan to build 5,250 residential units, 300 hotel rooms and commercial space on the picturesque Lavan ridge in southwest Jerusalem was approved in 2019, despite being shelved 12 years ago because of public protest. The ridge is home to gazelles and other wildlife and local residents and nature lovers are once again mobilizing to take the decision to appeal. In addition to the Lavan Ridge campaign, residents of the northern Jerusalem neighbourhood of Ramot have been battling the planners for years to protect Mitzpeh Naftoah, another home to mountain gazelles.
Source: https://www.timesofisrael.com/mountain-gazelles-under-serious-threat-urgent-action-needed-study/

America

Texotics

The Texas ranches have long been home to many exotic antelopes and other species. Two recent reports have drawn attention to the scale of these holdings. Thousands of ranches throughout Texas now raise non-native 'hoofstock' or ungulates. State surveys show that there were about 13,000 exotic ungulates in 1963, 72,000 in 1979, 164,000 in 1988. Current estimates are between one and two million animals, belonging to 125–135 species, including many antelopes. The Exotic Wildlife Association has about 5,000 ranchers as members and estimates that the industry brings in $1.3–2 billion in revenue annually. One adult female Cape buffalo or giraffe could sell for $200,000, while a pair could fetch $250,000. Ranches vary widely in size, with the largest up to 3300 km^2 which is bigger than many national parks! The Texas herds of scimitar-horned oryx, addax, and dama gazelle are much higher than the populations remaining in the wild, with several thousand addax and 15-16,000 scimitar-horned oryx. Some of the ranches have contributed animals to the reintroduction programmes for these 2 species in Chad. Other commonly kept antelope include blackbuck (*Antilope cervicapra*), greater kudu (*Tragelaphus tragocamelus*) and nilgai (*Boselaphus tragocamelus*). Nilgai have been present since the 1920s-1930s. Over the years, some animals have escaped and established feral populations. These are now estimated to 30,000 and are found across south Texas all the way to the Rio Grande. The impact on the environment of nilgai – and other feral non-native species – has not been fully assessed. A further negative impact of the 'Texotics' industry is that some ranch owners may kill native predators such as bobcats, coyotes, and mountain lions to protect their herds.
Sources: *https://www.nationalgeographic.com/animals/2020/07/inside-texas-exotic-animal-ranching-industry/ -https://www.texasobserver.org/the-texotics/*

Pronghorns die in 'thrill kill'

A man has been jailed after he ran down six pronghorn with his pickup truck on a road in Lake County, Oregon on April 26, in the latest in a string of poaching "thrill kills" according to Oregon State Police game troopers and the state Department of Fish and Wildlife. The driver told authorities that he did it because he hates pronghorn. Oregon State Police Fish & Wildlife Division troopers discovered the carcasses of five females and one male pronghorn antelope strewn along Fossil Lake Road near Christmas Valley. The buck's horns had been removed and taken as a trophy. One doe was eviscerated with a knife—her unborn fawn removed and placed on its mother's carcass.

Source:https://ktvz.com/news/crime-courts/2020/08/07/christmas-valley-man-jailed-in-poaching-thrill-kill-of-6-pronghorn-antelope/

Epizootic Haemorrhagic Disease suspected in deer and antelope in Montana, USA

Several people [have] reported dead or dying white-tailed deer, along with a few antelope, to [Montana] Fish Wildlife and Parks [FWP] in August 2020. FWP says biologists are still waiting for test results to come back, but early indications suggest patterns and symptoms similar to epizootic hemorrhagic disease (EHD).

Source: Montana Right Now, *21 August 2020*
https://www.montanarightnow.com/great-falls/fish-wildlife-and-parks-looking-for-causes-after-several-white-tailed-deer-were-found-dead/article_188f56fc-e3d5-11ea-9478-dbce6ecf41d5.html

General

Urgent Needs for Global Wildlife Health

Urgent Needs for Global Wildlife Health is a report developed by EcoHealth Alliance scientists and their collaborators to identify major policy gaps and capabilities which are hampering efforts to protect wildlife. The recommendations contained herein are for governments as well as global governing bodies and highlight issues when it comes to conducting rapid investigations during wildlife health emergencies such as massive die-offs or disease outbreaks and assessing the risks to animals and people.

Source: EcoHealth Alliance https://www.ecohealthalliance.org/wildlife-urgent-needs

Guidelines for working with free-ranging wild mammals in the era of the COVID-19 pandemic

The Wildlife Health Specialist Group (WHSG) of the Species Survival Commission (SSC) of the International Union for Conservation of Nature (IUCN) and the World Animal Health Organisation (OIE) have recently released guidelines to minimize the risk of SARS-CoV-2 transmission from people to free-ranging wild mammals. These recommendations are based on 1st principles of biosecurity and hygiene, current knowledge of human-to-animal SARS-CoV-2 transmission, and the precautionary principle.

There is a possibility that SARS-CoV-2 will become endemic in the human population and thus, presents a risk of a potential reverse zoonosis to wildlife as with infectious diseases such as tuberculosis and influenza. There are valid concerns about the health of wild species if infected with the virus and/or a wildlife population becoming a reservoir for SARS-CoV-2.

Any wildlife species/taxa that becomes a reservoir for SARS-CoV-2 could pose a continued public health risk of zoonosis, a risk for the transmission of SARS-CoV-2 to other animal species, and risk negative perceptions resulting in human threats to that species or their populations.

These guidelines provide a framework for people engaged in wildlife work in situ, but hopefully will also be useful more broadly for risk reduction and encouraging professionalism and best practices.

The guidelines, available in English, Spanish and French, are posted at IUCN:
http://www.iucn-whsg.org/COVID-19GuidelinesForWildlifeResearchers

and at OIE:
https://www.oie.int/fileadmin/Home/eng/Our_scientific_expertise/docs/pdf/COV-19/WHSG_and_OIE_COVID-19_Guidelines_Aug2020.pdf

Recently published articles

Africa

Differential response of seven duiker species to human activities in Taï National Park, Côte d'Ivoire

Abdoulaye Diarrassouba, Anthelme Gnagbo, Yao Célestin Kouakou, Geneviève Campbell, Manouhin Roland Tiedoué, Adama Tondossama, Hjalmar S. Kühl, Inza Koné.
African Journal of Ecology 2020 58(1):58-68. https://doi.org/10.1111/aje.12680

Abstract
African rainforest is severely impacted by human activities, ranging from resource collection, selective logging to fragmentation and scale deforestation. Consequently, large mammal communities occurring therein are strongly modified. Here, we present a study conducted in Taï National Park (TNP), which characterises the spatial distribution and differential response of seven duiker species to human activities. Based on extensive survey data recorded between 2005 and 2015, we used a maximum entropy modelling approach for predicting duiker species distribution and a hierarchical clustering approach to identify potential subgroups in the duiker community. The seven duiker species clearly differed in their spatial distribution, with *Cephalophus dorsalis* and *Philantomba maxwellii* being the most common and widely distributed with no clear response towards gradients of impact from human activities. In contrast, *Cephalophus ogilbyi*, *Cephalophus jentinki*, *Cephalophus sylvicultor* and *Cephalophus zebra* showed increasing responses towards anthropogenic impact gradients, with the latter two being particularly sensitive. These duikers are not found in areas of illegal human activities. The restricted distribution of *Cephalophus niger* seems artificial and may indicate species misidentification. The strong spatial signature of human activities in the duiker community of TNP is of concern. Effective park management, including extensive ranger patrols, is vital for ensuring the persistence of this unique duiker community in West Africa.

Bushmeat hunting around Lomami National Park, Democratic Republic of the Congo

Rodrigue Batumile, Gerard Imami, Christian Urom and Aida Cuni-Sanchez
Oryx 2020 1-11. Doi:10.1017/S0030605319001017

Abstract
For most of the Democratic Republic of the Congo quantitative data on bushmeat exploitation are scarce. We conducted focus group discussions on preferred species for household consumption and income generation in 24 villages around Lomami National Park, created in 2016. We also carried out a bushmeat market survey in Kindu, a major town in the study area, to estimate annual sales volumes and retail values. Villagers reported household consumption of mammal species, with the most important being the African brush-tailed porcupine, Peters's duiker, bay duiker and red river hog. The latter three were also the most important for income generation. A greater number of smaller species were consumed at the household level, compared with those traded. A total of 17 mammal and one reptile species were traded in Kindu. Those traded in greater numbers were the African brush-tailed porcupine, blue and bay duiker, red river hog, red-tailed monkey and the sitatunga. We estimated >40,000 carcasses were traded

in Kindu annually, with a retail value of USD 725,000 Several species of conservation concern, such as the bonobo, were mentioned or observed. Few rodents and numerous large animals were traded in Kindu, suggesting resources have not yet been depleted. However, both villagers and urban vendors perceived a decline of many species and reported an increase in the use of firearms and the number of foreign hunters in the area. Among other interventions, we discuss how local communities could be encouraged to help preserve wildlife in the Park's buffer zone.

Saving rodents, losing primates. Why we need tailored bushmeat management strategies

Mona Estrella Bachmann, Martin Reinhardt Nielsen, Heather Cohen, Dagmar Haase, Joseph A. K. Kouassi, Roger Mundry, Hjalmar S. Kuehl
People and Nature 2020. DOI: 10.1002/pan3.10119

Abstract

1. Efforts to curb the unsustainable wildlife trade in tropical forests conceptualize bushmeat as a generic resource, exploited by a homogeneous group. However, bushmeat is composed of miscellaneous species differing in risks of zoonotic disease transmissions, sensitivity to hunting and abundance. If people choose these species for varying reasons, mitigation approaches that neglect specific drivers would likely target abundant species, e.g. rodents. Meanwhile, rare species of greater conservation relevance, like many primates, would be overlooked. Additionally, if reasons vary between user groups, their responsiveness to interventions may differ too.
2. We assessed this possibility for three common strategies to mitigate bushmeat use, which are: development-based—reducing reliance on bushmeat; educational—increasing environmental and school education; and cultural—promoting environmentally friendly habits.
3. We interviewed 348 hunters, 202 traders and 985 consumers of bushmeat around Taï National Park, Côte d'Ivoire, and tested if factors related to the above strategies affected selection for primates, duikers, and rodents.
4. Our analyses revealed that people chose taxa for very different reasons. Users with shared characteristics favoured similar taxa; hunters economically reliant on bushmeat income targeted primates and duikers, while hunters and consumers nutritionally reliant on wildlife protein preferred rodents. Different groups used the same taxa for varying reasons. For example, hunting of primates was associated with economic needs, while their consumption appeared a matter of status. Meanwhile, cultural habits, like religion, specifically affected consumption and taboos inhibited the use of primates; environmental awareness was linked to lower utilization of most taxa within most user groups.
5. Our results demonstrate that educational-, cultural-, and development-based strategies may address different needs and taxa. Consumers may present a key target group, as they rejected rare species for multiple cultural and educational reasons. Notably, the widespread effect of environmental awareness could facilitate large-scale demand-reduction approaches. Nevertheless, there is no one-size-fits-all solution and campaigns need to be tailored to specific taxa and user groups. Ultimately, clear target definitions, prior in-depth research, community-driven solutions and tools from marketing and psychology may help to design novel strategies that encompass the diversity of bushmeat species and its users.

Coexistence between human and wildlife: the nature, causes and mitigations of human wildlife conflict around Bale Mountains National Park, Southeast Ethiopia

Sefi Mekonen
BMC Ecology. 2020 20: Article number 51.
https://bmcecol.biomedcentral.com/articles/10.1186/s12898-020-00319-1

Abstract
Human–wildlife conflict occurs when the needs and behavior of wildlife impact negatively on humans or when humans negatively affect the needs of wildlife. To explore the nature, causes and mitigations of human wildlife conflict, the coexistence between human and wildlife assessment was conducted around Bale Mountains National Park. Data were collected by means of household questionnaires, focus group discussion, interview, field observation and secondary sources. The nature and extent of human wildlife conflict in the study area were profoundly impacted humans, wild animal and the environment through crop damage, habitat disturbance and destruction, livestock predation, and killing of wildlife and human. The major causes of conflict manifested that agricultural expansion (30%), human settlement (24%), overgrazing by livestock (14%), deforestation (18%), illegal grass collection (10%) and poaching (4%). To defend crop raider, farmers have been practiced crop guarding (34%), live fencing (26%), scarecrow (22%), chasing (14%), and smoking (5%). However, fencing (38%), chasing (30%), scarecrow (24%) and guarding (8%) were controlling techniques to defend livestock predator animals. As emphasized in this study, human–wildlife conflicts are negative impacts on both human and wildlife. Accordingly, possible mitigate possibilities for peaceful co-existence between human and wildlife should be create awareness and training to the local communities, identifying clear border between the closure area and the land owned by the residents, formulate rules and regulation for performed local communities, equal benefit sharing of the local communities and reduction of human settlement encroachment into the national park range. Generally, researcher recommended that stakeholders and concerned bodies should be creating awareness to local community for the use of wildlife and human–wildlife conflict mitigation strategies.

Genetic diversity in natural range remnants of the critically endangered hirola antelope (*Beatragus hunteri*)

Michael Jowers, João Queirós, Rui Resende Pinto, Abdullahi H. Ali, Mathew Mutinda, Samer Angelone, Paulo Célio Alves and Raquel Godinho
Zoological Journal of the Linnean Society. 2020

Abstract
The hirola antelope (*Beatragus hunteri*) is considered to be the most endangered antelope in the world. In the *ex situ* translocated population at Tsavo East National Park, calf mortality and the critically low population numbers might suggest low genetic diversity and inbreeding depression. Consequently, a genetic study of the wild population is pivotal to gain an understanding of diversity and differentiation within its range before designing future translocation plans to increase the genetic diversity of the *ex situ* population. For that purpose, we assessed 55 individuals collected across five localities in eastern Kenya, covering its entire natural range. We used the complete mitochondrial DNA control region and microsatellite genotyping to estimate genetic diversity and differentiation across its range. Nuclear genetic diversity was moderate in comparison to other endangered African antelopes, with no signals

of inbreeding. However, the mitochondrial data showed low nucleotide diversity, few haplotypes and low haplotypic differentiation. Overall, the inferred low degree of genetic differentiation and population structure suggests a single population of hirola across the natural range. An overall stable population size was inferred over the recent history of the species, although signals of a recent genetic bottleneck were found. Our results show hope for ongoing conservation management programmes and that there is a future for the hirola in Kenya.

Population density of sitatunga (*Tragelaphus spekii*) in riverine wetland habitats

Camille H. Warbington and Mark S. Boyce
Global Ecology and Conservation. 2020, Volume 24
https://doi.org/10.1016/j.gecco.2020.e01212

Abstract
Estimates of population density of mammals are critical data for effective management. Estimating density is complicated if the species of interest has cryptic markings and occupies dense habitat. Sitatunga (*Tragelaphus spekii*) is such a species, specially adapted to the dense swamps and marshes of sub-Saharan Africa, where traditional population survey techniques have been ineffective. In this study, we used camera traps to estimate density of sitatunga in central Uganda using both spatial capture-recapture methods and time in front of the camera (TIFC). We collected data in three years, 2015e2017. The TIFC model resulted in density estimates similar to the spatial capture-recapture models, without needing information on movement or individual identification. However, spatial capture-recapture models provide an estimate of movement and home range, which is of interest to management. For sitatunga, spatial capture-recapture models revealed higher movement parameters and higher heterogeneity in movement than previously reported. These results illustrate the utility of camera traps for a cryptic species in dense habitats, and provide a potential alternative to spatial capture-recapture methods.

Identifying priority conservation areas in a Saharan environment by highlighting the endangered Cuvier's Gazelle (*Gazella cuvieri*) as a flagship species

F. Javier Herrera-Sánchez, Jose María Gil-Sánchez, Begoña Álvarez, Iinmaculada Cancio, Jesus de Lucas, Ángel Arredondo, Miguel Ángel Díaz-Portero, Javier Rodríguez-Siles, Juan Manuel Sáez, Joaquín Pérez, Emil Mccain, Abdeljebbar Qninba, & Teresa Abáigar.
Scientific Reports. 2020, 10:8241
doi.org/10.1038/s41598-020-65188-6

Abstract
Monitoring populations and designing effective conservation actions for endangered species present significant challenges. An accurate understanding of current distribution, ecological traits and habitat requirements is imperative in formulating conservation strategies. Recent surveys on the southernmost Cuvier's Gazelle (*Gazella cuvieri*) population, an ungulate endemic to north Africa, showcase its importance in terms of numbers and genetic diversity. this population inhabits a remote region in the extreme north-western portion of the Sahara Desert and has not been well studied. Here, we examine the potential distribution of Cuvier's Gazelle and the environmental factors limiting the species in a Saharan environment, by combining broad-scale field survey data and species distribution models. Our objective was to

identify high priority conservation areas in the southernmost known portion of the species' distribution by modelling habitat selection at the landscape scale using a predictive distribution map. our results show that the distribution of Cuvier's Gazelle is strongly related to mountainous areas with heterogeneous terrain and remoteness from large human settlements over other ecological factors that had less impact on the species' presence and distribution. We also provide a quantitative estimate of the potential distribution range of Cuvier's Gazelle in southern Morocco, identifying two well demarcated key areas. the two core areas currently contain enough rugged terrain isolated from human encroachment to support the endangered species in this harsh desert environment. We encourage the implementation of conservation planning for Cuvier's Gazelle as an "umbrella species", which will confer effective protection to higher-quality habitat zones and co-occurring species, leading to sustainable and ecologically responsible development in the region.

Are fission-fusion dynamics consistent among populations? A large-scale study with Cape buffalo (*Syncerus caffer caffer*)

Wielgus E., Cornélis D., de GarineWichatitsky M., et al.
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Abstract
Fission–fusion dynamics allow animals to manage costs and benefits of group living by adjusting group size. The degree of intraspecific variation in fission–fusion dynamics across the geographical range is poorly known. During 2008–2016, 38 adult female Cape buffalo *Syncerus caffer caffer*) were equipped with GPS collars in three populations located in different protected areas (Gonarezhou National Park and Hwange National Park, Zimbabwe; Kruger National Park, South Africa) to investigate the patterns and environmental drivers of fission–fusion dynamics among populations. We estimated home range overlap and fission and fusion events between Cape buffalo dyads. We investigated the temporal dynamics of both events at daily and seasonal scales and examined the influence of habitat and distance to water on event location. Fission– fusion dynamics were generally consistent across populations: fission and fusion periods lasted on average between less than one day and three days. However, we found seasonal differences in the underlying patterns of fission and fusion, which point out the likely influence of resource availability and distribution in time on group dynamics: during the wet season, Cape buffalo split and associated more frequently and were in the same or in a different subgroup for shorter periods. Cape buffalo subgroups were more likely to merge than to split in open areas located near water, but overall vegetation and distance to water were very poor predictors of where fission and fusion events occurred. This study is one of the first to quantify fission–fusion dynamics in a single species across several populations with a common methodology, thus robustly questioning the behavioural flexibility of fission–fusion dynamics among environments.

Asia and the Middle East

Diversification and subspecies patterning of the goitered gazelle (*Gazella subgutturosa*) in Iran

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Abstract
Goitered gazelles, *Gazella subgutturosa*, exist in arid and semiarid regions of Asia from the Middle to the Far East. Although large populations were present over a vast area until recently, a decline of the population as a result of hunting, poaching, and habitat loss led to the IUCN classification of *G. subgutturosa* as "vulnerable." We examined genetic diversity, structure, and phylogeny of *G. subgutturosa* using mitochondrial cytochrome *b* sequences from 18 geographically distant populations in Iran. The median-joining network of cyt *b* haplotypes indicated that three clades of goitered gazelles can be distinguished: a Middle Eastern clade west of the Zagros Mountains (and connected to populations in Turkey and Iraq), a Central Iranian clade (with connection to Azerbaijan), and an Asiatic clade in northeastern Iran (with connection to Turkmenistan, Uzbekistan, and other Asian countries as far as northeastern China and Mongolia). Based on our results, we argue that Iran is the center of diversification of goitered gazelles, due to the presence of large mountain ranges and deserts that lead to the separation of populations. In accordance with previous morphological studies, we identified the Asiatic clade as the subspecies *G. s. yarkandensis*, and the other two clades as the nominate form *G. s. subgutturosa*. The new genetic information for goitered gazelles in Iran provides the basis for future national conservation programs of this species.

The plight of the Endangered mountain gazelle (*Gazella gazella*)

Yoram Yom-tov, Amir Balaban, Ezra Hadad, Gilad Weil and Uri Roll
Oryx 2020, 1-8
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Abstract
The Endangered mountain gazelle *Gazella gazella* was once widespread throughout the Levant. Over the past 100 years its population fluctuated greatly as a result of various anthropogenic threats and disturbances. We review the dynamics of the mountain gazelle throughout this period in Israel, its last remaining stronghold, with c. 5,000 individuals. During the 20th century Israel's human population increased steadily at an annual rate of 2%; the population density is currently 430 persons per km^2 and is forecast to increase further. This presents an array of threats to the mountain gazelle, including habitat change, fragmentation and isolation by roads, railways and fences, poaching, road kills and predation by increasing populations of natural predators and feral dogs, sustained partly by anthropogenic food waste. These threats may act in synergy to amplify their effects. We present an overview of how these factors acted in the past and are currently threatening the survival of this species. We also review the policy and management actions, both implemented and still required, to ensure the persistence of the mountain gazelle. In addition, we analyse connectivity in the landscape, highlighting highly fragmented gazelle populations, and suggest potential interventions. The mountain gazelle exemplifies an ungulate with both great vulnerability to human pressures and a large breeding

potential. As more regions, in Israel and elsewhere, are converted to human dominated landscapes, pressures on wildlife are increasing, and lessons from the mountain gazelle could prove valuable.

Estimating the population size of migrating Tibetan antelopes (*Pantholops hodgsonii*) with unmanned aerial vehicles

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Oryx 2020 - 54(1): 101–109

Abstract
Data on the distribution and population size of the Near Threatened Tibetan antelope (*Pantholops hodgsonii*) are necessary to protect this species. Ground-based count surveys are usually carried out from a long distance to avoid disturbing the sensitive animals, and on calving grounds or along migration routes where they are seasonally concentrated. This can result in underestimation of population sizes if terrain features obstruct the view and high concentrations of animals make estimating numbers difficult. Here we test the efficacy of unmanned aerial vehicles (UAVs) for gathering population data for the Tibetan antelope. We conducted the study south of a known calving ground, at the foot of Sewu Snow Mountain, in the Chang Tang National Nature Reserve, China. The UAV did not appear to disturb the animals and resulted in more accurate counts than ground-based observations. A total of 23,063 Tibetan antelopes were identified in twelve orthoimages derived from c. 4,000 aerial photographs. In the first flight area 7,671 females and 4,353 calves were identified (proportion of calves: 32.6%). In the second flight area 7,989 females and 3,050 calves were identified (proportion of calves: 27.65. Two flights over the same area revealed the direction and speed of moving Tibetan antelope groups. Image resolution, which can be controlled with flight planning, was an important factor in determining the animals' visibility in the photos. We found that UAV-based surveys outperformed ground-based surveys, and that larger UAVs are preferable for this application.

General

Spatiotemporal dynamics of wild herbivore species richness and occupancy across a savannah rangeland: Implications for conservation

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Abstract
Private lands are critical for maintaining biodiversity beyond protected areas. Across Kenyan rangelands, wild herbivores frequently coexist with people and their livestock. Human population and livestock numbers are projected to increase dramatically over the coming decades. Therefore, a better understanding of wildlife-livestock interactions and their consequences for biodiversity conservation on private lands is needed. We used a Bayesian hierarchical, multi-species and multi-year occupancy model on aerial survey data of 15 wild-herbivore species, spanning 15 years (2001–2016) to investigate a) spatiotemporal trends in species occurrence and richness across a mosaic of properties with different land uses in

Laikipia County, central Kenya; and b) the effects of distance to water, vegetation and livestock relative abundance on species occurrence and richness. Although mean herbivore species richness varied little over time, we observed high spatial variation in species occurrence across Laikipia, mainly driven by negative effects of high livestock relative abundance. As expected, 'wildlife friendly' properties had higher herbivore species richness than other areas. However, high variability suggests that some pastoral properties support rich herbivore communities. The area occupied by five species with global conservation concerns, (reticulated giraffe, Grevy's zebra, Beisa Oryx, Defassa waterbuck and gerenuk) and for which Laikipia County is one of the last refuges was <50% across years. We conclude that 'wildlife friendly' properties remain crucial for conservation, although some pastoralist areas offer suitable habitats for wild herbivores. Effective management of stocking rates is critical for maintaining ecosystems able to sustain livestock and wildlife on private lands, ensuring protection for endangered species.

Emerging diseases, livestock expansion and biodiversity loss are positively related at global scale

Serge Morand

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Abstract

Infectious diseases, biodiversity loss and livestock expansion are increasing globally, and examining patterns that link them is important for both public health and conservation. This study is a first attempt to analysis globally these patterns using General additive modelling and Structural equation modelling. A positive association between the number of infectious and parasitic diseases recorded in humans and the total number of animal species between nations was observed. A similar positive association between the number of outbreaks of human infectious diseases, corrected for the number of surveys, and the number of threatened animal species, corrected for the number of animal species, suggests that outbreaks of human infectious diseases are linked with threatened biodiversity. Results of the analyses over the longest period of the dataset (2000–2019) showed a positive correlation between the increasing number of cattle and the number of threatened species, a positive correlation between the increasing number of cattle and the number of outbreaks of human diseases, and a lack of correlation between the number of outbreaks and the number of threatened animal species. As a result, the growing importance of livestock on the planet, while threatening biodiversity, increasingly puts human and animal health at risk. This study calls for further analyses on the consequences of livestock expansion, which depends on several factors that vary by country, namely the growth of human population, changes in diet linked to the westernization of habits, agricultural industrialization and the integration into the world trade, but also the cultural values of livestock.