THE WORLD CONSERVATION UNION (IUCN)
SPECIES SURVIVAL COMMISSION

Volume 24 Number 2, 2005
Published January, 2006

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Antelope Specialist Group

GNUSLETTER

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ASG NEWS

Welcome to the New Editor of the *Gnusletter*

Stephen Shurter, Director of Animal Management, Husbandry and Health at The Wilds in Cumberland, Ohio, responded to my request in the last *Gnusletter* for a volunteer to take over as editor 2007, after I complete the 25th year of my editorship: 1982-2006. His offer is particularly welcome as Steve is Chair for the Antelope and Giraffe Advisory Group of the American Zoo and Aquarium Association. As editor he will be in an ideal position to facilitate communication and cooperation between researchers, managers, and conservationists of wild and captive antelope populations. It is also noteworthy that Steve's experience includes several years of field work in Africa:

He lived in the Democratic Republic of Congo (DRC) from 1987-1991 while working with the okapi conservation project in the Ituri Forest for Gilman International Conservation. In 1990 he participated with the WCS Ituri Forest okapi and duiker study projects, and took part in a survey of Eastern giant eland in Digba Reserve, DRC. In 2004 he participated in the International Przewalski's Gazelle Conservation Workshop held in Xining, China, and is currently working with various organizations to help develop a Western giant eland conservation program in Senegal.

So thank you, Steve, for your willingness to step into the coming breach. He can be reached at sshurter@thewilds.org.

Publication of the Sixth International Wildlife Ranching Symposium

The International Foundation for the Conservation of Wildlife (IGF) is very pleased to announce that the proceedings of the 6th International Wildlife Ranching

Contact: Steve Shurter, AZA Antelope and Giraffe TAG Chair. mail to sshurter@thewilds.org

International Antelope Meeting
Collaboration between the European Association of Zoos and Aquariums (EAZA) and the American Association of Zoos and Aquariums (AZA) Antelope and Giraffe Advisory Groups has continued to grow over the years. On March 29-April 2 2006 a joint meeting of these advisory groups will take place in Hannover, Germany. The intent of this meeting is to foster communication between our respective captive antelope and giraffe program managers, and to further develop mutual support for antelope conservation projects. For information on the meeting please contact: Heiner Engel, Hannover Zoo, engel@zoo-hannover.de

Bongo News Update

Two bongos born in Dec 05 and Jan 06 at RSCF, in same herd. Photo P. Reillo

Summary report on Phase I of the Bongo Repatriation Project
R. D. Estes

The above report of the Bongo SSP fails to mention the fact that 12 of the original 18 bongos repatriated to Kenya in January, 2004 have since died at the Mt. Kenya Game Ranch — now renamed the Mt. Kenya Wildlife Conservancy. Equally disturbing, five of the nine calves born at the facility failed to survive. The SSP report refers to tick-borne disease as one of the health challenges to the naive American animals, but theriolosis definitively accounted for only four of the 12 deaths and occurred during the first few months after arrival. Other identified or suspected causes are indicated in the Animal Inventory reprinted below.

The high mortality rate, indicating husbandry, veterinary and dietary challenges, was of great concern to the veterinary and husbandry teams associated with Phase I who met at White Oak in October. It was agreed that these challenges must be adequately addressed before additional bongo are sent to Kenya. Several courses of action were proposed, some of which are underway. As the principal NGO associated with the project, the RSCF (of which I am a board member), asserts that all the data have to be included and disseminated to the zoo community at large. The repatriated Animal Inventory at the Mt. Kenya Wildlife Conservancy below is a first step.

In addition, a detailed scientific paper discussing the repatriation protocol, along with the veterinary and husbandry problems encountered, is in preparation, and will be presented for publication during 2006. This paper will have group authorship, including U.S. veterinary and program personnel associated with Phase I, and veterinary and epidemiology professionals from Kenya.

A comprehensive account of Phase 1 can be downloaded at the RSCF website (www.rarespecies.org). The funding provided by the Donner Canadian Foundation, the Calgary Zoological Society, UNDP, and UNF, without which the relocation would not have happened, is duly acknowledged, as are the U. S. zoological institutions that donated the bongos, and the Bongo SSP.

Phase II of the project is now well underway, as summarized below by Lyndon Estes, a Research Associate of RSCF, whose full report of his first field season is also available on the RSCF website.

Reintroducing a large herbivore: a remote sensing and modeling approach to determine the mountain bongo's (*Tragelaphus eurycerus isaaci*) past and present critical habitat

A report on the first field season's progress

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October, 2005

Background

The mountain bongo (*Tragelaphus eurycerus isaaci*) is an endangered tragelaphine antelope subspecies endemic to East African montane forests. This animal, now confined to the Aberdare Mountains in Kenya, is the subject of a reintroduction campaign that aims to re-establish a viable wild population on neighboring Mount Kenya.

Demise of Arthur the great bongo bull

Paul Reillo

The Rare Species Conservatory Foundation (RSCF) in Loxahatchee, Florida has been home to several groups of breeding mountain bongo (*Boocercus eurycerus isaaci*) since 1991. Thanks to its lush, subtropical vegetation and ample bongo habitat, the Conservatory has produced some of the largest bulls recorded in the U.S.

Sadly, in February 2005, RSCF lost its biggest bull, Arthur, Global Studbook #699, who was born at the Conservatory in 1993. Known affectionately as "the big guy", Arthur impressed all who saw him, as he was equally massive and agressive — chasing any man or beast that came within 50 meters. Arthur was never ear-tagged, immobilized, or moved from the forest habitat in which he was born. Although never officially weighed, he easily outsized all of his offspring, two of which tipped the scales at more than 850 pounds when they were immobilized for the Bongo Repatriation Program in 2003. Interestingly, at two years of age, both of Arthur's sons were too big to ship to Kenya in January 2004. Conservative estimates put Arthur's weight at 1000 pounds, but several husbandry specialists associated with the bongo project believe he was 1100 pounds or more. His horns measured 1.2 m from tip of the horn to tip of the nose, 0.305 m in circumference, and 0.114 m in diameter at the widest point, and his skull was 0.457 m in length.

Arthur met his end much as he lived his life — violently. He was discovered dead in the forest one morning with one horn snapped clean through, roughly .25 m from the base. His back was drenched in blood, and his chest revealed a single, deep puncture wound that perforated his left lung. We surmise that Arthur was engaged in one of his favorite pastimes— turfing the ground and upending cypress knees in the middle of the night — when he likely snagged a horn on an immovable root mass. Leveraging his full body weight, he managed to break his horn at the thickest point, producing a fountain of blood that sprayed the full length of his back. Since he was observed alive and well the previous evening and found dead at 0700 hours, we guess that he bled profusely for at least four or five hours, and likely grew weak and tired.

The coup de grace must have been inflicted by his 10-year-old brother, Squiggy, Studbook #861, who shared Arthur's 12-acre forest habitat since birth. Squiggy didn't have a scratch on him, so we know the two bulls weren't fighting. Rather, he probably simply seized the opportunity to eliminate the competition — at long last — after which he smoothly and nonchalantly took over the group of four females, which he now guards zealously. At over 900 pounds, Squiggy has assumed the throne as RSCF's biggest bull. Thankfully, he's a lot more relaxed and easy-going than his older brother ever was.

P. S. He sired the two new calves.

Roan X Sable Hybrid Dies At Age 19

R. D. Estes with Ian Whyte

The November 2005 *Africa Geographic* has an article by John Frederick Walker about the giant sable *Hippotragus niger variani* that includes one of the camera-trap photos Pedro Vaz Pinto took in Cangandala NP. Another jpeg taken at night illustrated the account in the last *Gnusletter* — proof, finally, that the celebrated subspecies survived Angola's civil war.

A reader of Walker's article wrote in to say that one of the sable looked a lot like a young roan and he wondered if it could be a hybrid. Certainly not, I replied, but it got me thinking: were there any known hybrids between the two *Hippotragus* spp? From friends in the Evolutionary Genomics Group at Stellenbosch University, I learned that in fact there is one known instance and it occurred in Kruger National Park. It was the subject of a 1995 paper by T. J. Robinson and E. H. Harley: Absence of geographic chromosomal variation in roan and sable antelope and the cytogenetics of a naturally occurring hybrid, published in *Cytogenetics and Cell Genetics* (vol. 71, pp 363-369).

From veteran ASG member Ian Whyte, SAN Parks' Research Manager:

a male of a larger, dominant species, lacking access to females of his own kind, substituting a female of a different but closely related species. Crosses between blue and black wildebeest are a worrisome case in point. I don't know whether hybrids between spiral-horned antelopes (Tragelaphini, inc. kudu, eland, bushbuck, nyala, etc.) are known from wild populations*, but pairings between species kept together in zoos have resulted in lumping all the species (including eland and bongo) in the one genus *Tragelaphus*. At least some of these hybrids are fertile.

*If you know of any, do tell.

Regional genetic structuring of common impala in South and East Africa

E. D. Lorenzen

Introduction

The distribution of a natural population is the product of evolutionary and ecological processes. However, it is difficult to determine whether topographic features such as rivers or mountains, political jurisdictions such as country boundaries, or differences in morphology actually represent natural boundaries in terms of population genetics. It can therefore be useful to confirm whether the subjective classifications are consistent with genetic information, the use of which has greatly increased the potential for understanding population structure across a landscape.

Previous genetic analyses of African bovid species have revealed significant regional differentiation of populations in Southern and East Africa. Kudu, topi, hartebeest, roan and sable antelope all exhibit varying degrees of regional structuring. It has been suggested these previously pan-African species became extinct during the Pleistocene (1.5 million to 10,000 years ago) except in refuges in the south and east. Range expansions during favourable times have subsequently led to the current species distributions. The violent climatic fluctuations characteristic of this period have hence influenced the appearance, geographical expansion and subsequent evolution of the species. This scenario is supported by the similar pattern of spatial variation observed in carnivores and rodents.

One of two recognized subspecies of impala – the common impala – is distributed throughout Southern and East Africa. The intraspecific taxonomy of the subspecies has been subject to disagreements, and up to five subspecies have been listed, albeit with overlapping and ill-defined boundaries. The objectives of this study were to analyze the genetic diversity within the common impala, to assess if there is any spatial genetic structuring of the subspecies across Southern and East Africa, and to use this information to infer the evolutionary history of the subspecies. Two types of genetic markers were used to genotype common impala collected from 14 localities in seven different countries across the species' distribution range.

Evolutionary history

Our data showed significant clustering of the subspecies into two genetically distinct groups; one encompassed all localities in the south, the other comprising the localities sampled in the east. This was interesting, as previous genetic studies had not revealed such a pattern between regions within the common impala. The pattern was only evident from the data produced with the microsatellite markers. These mutate at a very high rate, and we therefore suggest that the split of south and east is of recent origin. This is further supported by the lack of morphological diagnostics of impala from the two regions. [What about the horns? Ed.]

A degree of gene flow was observed between regions, as the geographically intermediate locations of Kafue National Park in Zambia (southern region) and Selous and Burko in Tanzania (eastern region) were found to be genetically admixed. The south/east contrast could reflect distinct evolutionary histories of the two regions. Gene flow would result from secondary contact following range expansion of the refuge populations. This interpretation is supported by the previous bovid studies mentioned above.

From our data, however, it is difficult to tease recurrent processes and history apart. The considerable gene flow between south and east could alternatively reflect the process of isolation-by-distance, whereby genetic similarity between populations decreases with geographic distance. A recent colonization from a large, long-standing and more genetically diverse population in southern Africa towards the east and north could explain the progressive decline in genetic diversity toward the east suggested by our data. A similar pattern has previously been proposed for the wildebeest, whose present distribution range in East Africa is believed to be the result of a more recent expansion from the south.

Samburu population in Kenya distinct

Individuals from Samburu National Reserve in Kenya, the most northern locality within the impala's distribution range, were found to be highly genetically distinct. A bottleneck in the recent history of Samburu would decrease the genetic diversity of the population. Although not statistically supported, circumstantial evidence could indicate such a bottleneck has taken place. During the 1970's and 1980's, the deterioration of Kenya's wildlife sector reached crisis proportions, and wildlife populations across species over the entire country were affected. The impala population in Samburu was seriously affected, but has since stabilized. Another

encompassing Katanga–Chambeshi region, also covering eastern Angola and much of Zambia.

A secure future for the critically endangered Upemba lechwe hinges on reducing adverse human impact and maintaining the integrity of its wetland habitat. Support for protected areas is critical. Maintenance of ecological processes, focused on aquatic systems, is especially important to conserve biodiversity. Recognition of the complex evolutionary history of the region (since the Late Neogene) underpins the scientific foundation for all conservation plans and activities. It prescribes why a regional conservation strategy should encompass the landscape mosaic, structured across neighbouring drainage systems (Lufira, Upper Lualaba and Chambeshi–Luapula rivers). A trans-frontier conservation area will consolidate the protected areas and land use systems of the region in an ecological context.

Key words: Africa, *Kobus anselli*, wetland, endemics, taxonomy, drainage evolution, trans-frontier conservation areas

MALI

Dama Gazelles still survive in Northeastern Mali

François Lamarque, Amewey Ag Sid'ahmed, Stéphane Bouju, Gaoussou Coulibaly, Daouda Maïga, Bourama Niagaté.

The presence of dama gazelles (*Gazella dama dama*) was confirmed by local people in 2003 and 2004 in 8 to 10 places located in the southern part of Tamesna (northeastern Mali). However, no direct observation of dama gazelle could be made during the investigations carried out in the area by the local wildlife service (DNCN).

A terrestrial survey of the two zones assumed to shelter dama gazelles and covering an area of approximately 1,800 km² was first carried out in February 2005 following a systematic sampling pattern.

The presence of dama gazelles in South Tamesna was confirmed by the observation of seven individuals and twelve spoors in the eastern zone and of seven spoors in the western one. According to the first results of the genetic analyses performed by the King Khalid Wildlife Research Centre (Saudi Arabia) on the dung pellets, these dama gazelles would belong to the subspecies *Gazella dama dama.*

However, due to the extremely difficult driving conditions met in both the zones surveyed, it was impossible to reach all the places assumed to shelter dama gazelles. So, a systematic aerial survey of the potential range of dama gazelle in South Tamesna was realized in November 2005. It covered three zones for a total of 6,552 km². This survey allowed us to observe three dama gazelles (a couple and a youngster) in the western zone, almost exactly where spoors were seen in February. On the other hand, no dama gazelles were seen in the eastern zone where direct observations were made during the terrestrial survey. This could be explained by the heavy breeding pressure noted in this area during our survey which coincided with the end of an exceptional rainy season. A camel-back survey should be implemented in June to have a thorough view of the distribution of the dama gazelles throughout the year before gazetting a protected area in Malian South Tamesna to preserve this very highly endangered species.

KENYA

Amboseli Degazetted — What next?

Maasai: Disagreement over Use of National Park

Reprinted from Unrepresented Nations and Peoples Organization

12 Jan 06

Kenya's president on Tuesday flatly rejected demands from outraged environmentalists to reverse the downgrading of a famed national park in the shadow of Mount Kilimanjaro that is home to one of Africa's biggest elephant populations.

President Mwai Kibaki said his decision to change the status of

Amboseli National Park from a "park" to a "reserve" and turn its administration over to the local county council and the Maasai tribal community was "final" and dismissed opponents of the move as "naive".

"We cannot deny the Maasai community this natural resource to please a few individuals," he said in remarks at a drought-stricken Maasai village south of Nairobi where he commissioned a new well, according to a statement from his office.

Politics at the heart of the matter

Kibaki's September 29 presidential decree gives control of Amboseli's substantial gate receipts - about $3.5m last year - and the reserve's management to county officials and the Maasai.

Wildlife conservationists have filed suit to stop the move, saying it will endanger protected animals, including Amboseli's well-known elephants, the pristine nature of the sanctuary and could lead to a drop in tourism revenue. In the lawsuit they claim Kibaki acted unconstitutionally by signing away the park without proper consultation while political foes of the president accused him of trying to win Maasai support for a failed November referendum on a new constitution.

Kibaki did not say what he would do if the court ruled against his decision, but accused opponents of trying to "make political capital out of falsehoods" by spreading lies about the downgrade, which he said would not affect Amboseli, its management or the wildlife that live there.

Management of the park

He said the change "should not lead to its destruction" and noted the government would work with the cash-strapped Ol Kejuado county council on best management practices for Amboseli. Kibaki's decree turned over the 3260-sq. km. park on the Kenyan-Tanzanian border at the foot of Africa's highest peak to the council which had long complained it was being denied the benefits from the natural resource.

Created as a game reserve in 1906, Amboseli – home to wildlife that roam the plains against the stunning backdrop of the snow-capped Kilimanjaro – was once before turned over to local administration in 1948. But that decision was rescinded in 1974 after years of mismanagement and corruption nearly destroyed the ecosystem when it was declared a national park and put under the authority of the KWS.

E. A. Wildlife Society Goes to Court

Wanjiru Macharia
Head: Marketing & Communications
URL: www.eawildlife.org.

8 Dec. 2005
So far: The EAWLS and other organisations have taken the case to the High Court of Kenya. We lodged two separate cases initially. We have made three appearances so far in Court and at present have been granted "stay" Orders - which means that the Olkejuado County Council and the Minister of Tourism and Wildlife cannot execute the gazette notice, which was to allow the County Council to take over the Park.

Both our cases have now been enjoined. KWS has also issued an Affidavit in support of our case. This Affidavit by KWS is very important because it clearly shows that the Gazette Notice was illegal as KWS was not consulted as required by Law (Act 376, section 16).

As a result, Amboseli National Park has not been transferred because of the Court Order. KWS is still solely in charge. If the Park is to be transferred, then the LEGAL PROCESS as stipulated in the Law must be followed. This will ensure that all the steps necessary are followed and that the Maasai can take over and be assisted to manage the Park properly.

Our objection is also supported by the concern that this Council (Kajiado) has no experience in managing a Park and that their main concern is only to get the money collected. They are already getting money from KWS and have never used it to help those Maasai who live near the Park. We have no way of knowing whether this will still be the case even if they do get more money.

This scenario is typical in the Masai Mara, where the people near the Reserve do not get much help from the Council, which collects a lot of money from the Mara. We do not object to the Maasai or any other community managing Parks but this must be done professionally and the people living near the Park get the most benefit – not the Council members.

Once a National Park is converted to a Reserve, there will be less restrictions and like the Mara, there will be more unplanned lodges and hotels being allowed by the Council to make as much money as possible. Amboseli is not like the Mara. The ecosystem is VERY FRAGILE and can become a desert very quickly if proper management is not done. Tourist organizations can also object to the handing over if they care about the future of Amboseli.

TANZANIA

Puku (*Kobus vardoni*) in the Kilombero Valley – threatened?

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Abstract

There have been repeated calls for more active protection of the puku population of the Kilombero Valley, Tanzania. This

population holds c.75% of the world's population of the species and is the only known viable population left in Tanzania. Threats to the puku of the Kilombero Valley are believed to come from high numbers of human settlements and increased grazing along the edge of the Kilombero Valley Game Controlled Area (GCA).

Transects were carried out within the Itete Ward (Ulanga District) in the GCA between 1999 and 2004. The numbers of puku observed in proximity of a tourist-hunting lodge have remained stable for the past five years, whereas those out of the sphere of influence of the lodge have declined by over 90%. The presence of the hunt concessionaires seems to discourage human settlement, habitat conversion, and poaching. If trends identified away from the hunting camp are repeated across the Kilombero Valley, the future for puku is bleak. Consequently, the survival of the puku species is dependent on the conservation of the Kilombero Valley. Therefore, continual monitoring is required to understand and manage any potential decline in this population.

Keywords: Puku (*Kobus vardoni*), Kilombero Valley, Hunting, Conservation

Introduction

There have been repeated calls for the conservation of the puku antelope (*Kobus vardoni*) in the Kilombero Valley, Tanzania (WWF, 1992; East, 1998; Corti *et al.*, 2002; Jenkins *et al.*, 2002; Jenkins *et al.*, 2003; Tanzanian Wildlife Research Institute - TWRI, 2003), yet to date no active conservation has been put in place nationally or internationally. The survival of the puku species is dependant on the protection of the Kilombero Valley population (East, 1998), as this population comprises an estimated 75% of the puku world population (Corti *et al.*, 2002; Jenkins *et al.*, 2003). It is also thought to be the only remaining viable population within Tanzania (Haule, 1997).

Several authors have identified a declining population trend in the valley (WWF, 1992; Tanzanian Wildlife and Conservation Monitoring –TWCM, 1999; Jenkins *et al.*, 2003; TWRI, 2003). The southern section of the valley is designated a Game Controlled Area (GCA), which regulates tourist hunting of large mammals, but does not prevent human activities related to agriculture, fishing, or livestock husbandry (Jenkins *et al.*, 2002). The increasing cattle population in the Kilombero Valley is thought to be responsible for declining puku numbers through direct competition for forage resources (Jenkins *et al.*, 2003; TWRI, 2003).

The Itete Ward of the Ulanga District encompasses an area of the floodplain that includes high human, cattle and puku densities (TWRI, 2003). It is therefore an ideal study area to identify the interactions between them. The people who inhabit Itete Ward believe that there has been a significant reduction in puku in the area since the arrival of livestock farmers from the north in 1997 (Meshack, 2001). Through this study we seek to identify the puku population trends in the Itete Ward and identify possible reasons for any decline.

Methods

The puku population of the Itete Ward was assessed using direct observation point transects (Buckland *et al.*, 1993). A total of 61 fixed-points were positioned at 0.5km intervals along two 10km and two 5km transects. Transects were spaced approximately 3km apart and orientated on a North-South compass bearing. The 10km fixed point transects were situated near Mofu village and the 5km transects near Madabadaba village. Transects at Madabadaba were limited to 5km by a watercourse that could not be traversed. The total area surveyed was 3800 hectares.

The dataset comprises data from yearly large mammal monitoring carried out by Frontier-Tanzania Savannah Research Project in the Ulanga District. The data were collected in a period of time spanning the early and late dry season, i.e. August to September and October to November, between 1999 and 2004. However, no data were collected at Mofu during November 2000, August 2001, and throughout 2002. Direct counts were made from a Bedford Truck (approximately 3m high). Counts were limited to ten minutes from arrival at each fixed-point. The numbers of puku observed from each transect point, along with distance and compass bearing, was recorded. These data were inserted into the computer programme Distance (version 2.5), in order to produce an estimate of population size.

Results

Puku population in the whole Itete Ward

The number of puku in the Itete Ward has not changed significantly between August/September 1999 (6269 puku) and August/September 2004 (5590 puku) (Kruskal Wallis 0.827, $P>0.05$) and between October/November 1999 (920 puku) and October/November 2003 (993 puku) (Kruskal Wallis 0.827, $P>0.05$).

There was a noticeable seasonal decline in puku between August/September and October/November 2001 (Kruskal Wallis 3.857, $P=0.05$). However there was no significant change in numbers between August/September 2003 and October/November 2003 (Kruskal Wallis 0.429, $P>0.05$) (Table 1).

Puku population near Mofu

The population appeared to remain stable in Mofu between August/September 1999 (1858) and August/September 2003 (2494) (Kruskal Wallis 0.429, $P>0.05$) and between October/November 1999 (1694) and October/November 2003 (993) (Kruskal Wallis 0.048, $P>0.05$).

There was no significant change in puku numbers between August/September and October/November in 1999 (Kruskal Wallis 0.429, $P>0.05$) or in 2003 (Kruskal Wallis 2.333, $P>0.05$) (Table 2).

Puku population near Madabadaba

In contrast to Mofu, the population at Madabadaba has declined from 631 in

August/September 1999 to 36 in August/September 2004. This is a significant decline of 94.3% (Kruskal Wallis 4.355, $P<0.05$). Between October/November 1999 and 2004 the population declined significantly (Kruskal Wallis 4.355, $P<0.05$) from 135 to 60 individuals. This represents a decline of 54.8%.

There was no change in puku numbers between August/September 1999 and October/November 1999 (Kruskal Wallis 2.333, $P>0.05$). In 2004 there were significantly more puku present in October/November than in August/September (Kruskal Wallis 5.0, $P<0.05$) (Table 3).

Discussion

Despite the perception of a decline in puku numbers in the Itete Ward as a whole, there has been no significant decline between 1999 and 2004. No significant differences were found in the number of puku between our study periods except a decrease in the Itete Ward as a whole in 2001.

Seasonal movement of puku may be responsible for the perception of decline, since puku are known to concentrate in the centre of the floodplain (TWRI, 2003) in the dry season and on the *miombo* fringes of the floodplain in the wet season (Jenkins *et al.* 2002). Our study periods spanned the early and late dry season and puku probably move off the floodplain just before the rains in January. Seasonal variations in populations make it vital that long-term seasonal data are collected before making assumptions about the conservation need of species. In this instance we do not have enough data to make assumptions about the seasonal movement of puku.

The necessary conditions for interspecific competition are that populations of different species share the same resources, these resources are limited, and the exploitation of these resources negatively affects one or both of the species (Prins, 2000). There is a potential diet overlap between livestock and puku-like species according to Prins (2000), indicating potential competition. In fact, increased numbers of livestock are thought to out-compete puku for good quality grazing (TWRI, 2003), and Puku are believed to avoid areas used by cattle as a result of competition and/or disturbance (Corti *et al.* 2002). However, this assumption is based on data that were affected disproportionately by two data points (see Corti *et al.* 2002 for explanation).

The number of cattle at Mofu has increased from 3980 in 1999 to 9530 in 2004 (Hengeveld *et al. in prep*) with no visible effect on the puku population, which remained stable between 1999 and 2003. This suggests that at present cattle and puku can cohabitate. This can be explained by the fact that at Mofu encroachment is limited by the presence of the safari-hunting lodge and the physical boundary of a river channel; poaching is also discouraged around the hunting lodge by the presence of hunters and Wildlife Division staff. Hunters also manipulate the environment by burning to clear areas of tall grass for hunting. Puku are seen to congregate in these areas.

At Mofu it appears the presence of a safari-hunting lodge has a positive effect on puku populations. However this effect appears to be highly localised. The population at Mofu remains stable whereas that at Madabadaba is in decline despite it being less than 3km away. However, at Madabadaba there has been a decrease of 94.3% between August/September 1999 and August/September 2004, and the October/November population has declined by 54.4% between 1999 and 2004. This trend may be explained by the fact that the human population at Madabadaba is growing at an estimated 2.5% per year (Meshack, 2001). At Mofu encroachment is limited by the presence of the safari-hunting lodge and the physical boundary of a river channel, whereas at Madabadaba each year people move closer to the centre of the floodplain. In 2003 the Frontier-Tanzania camp at Madabadaba was 200m away from the nearest farm (pers. comm., Claire Bracebridge[1]); in 2004 the nearest farm was only 100m away (pers. obs.). Moreover, the hunt concessionaires at Mofu are actively encouraging the movement of people and cattle from the proximity of their safari-hunting lodge to Madabadaba, which is further increasing the population of this area.

Increasing human populations may have direct or indirect effects on the puku population. Hunting is among the direct effects, and it is a consequence of the fact that in the Kilombero Valley bushmeat provides a significant percentage of the average protein intake, because beef is considered of higher value and amongst pastoralists taboo to eat (Haule, 1997). Moreover, puku meat is traditionally served at weddings and funerals and is therefore in demand (Haule, 1997). However, levels of poaching have been reduced by more regular patrols in the area (TWRI, 2003), and the effect of poaching on the puku population remains an important area for future study.

The increased population also means an increased level of encroachment onto the floodplain and the conversion of open grassland areas into rice paddies, thus further reducing the grazing area that is available to puku. The conversion of the natural vegetation into rice paddies in Madabadaba appears to be a likely cause for the decline seen in this area.

In Tanzania, as in many other African countries, tourist hunting is seen as a viable method for the conservation of large mammals (Caro, 1999; Ministry of Natural Resources and Tourism, 1998). Likewise, in the Kilombero Valley GCA the conservation of puku antelope has been largely left in the hands of the hunting companies that run the concessions. However, while the majority of GCAs in Tanzania lie adjacent to national parks, so benefitting from the movement of animals between the two areas (Jenkins *et al.* 2002), the Kilombero Valley GCA shares only a short boundary with the Selous Game Reserve, which is thought to have minimal suitable habitat for puku; as a result it does not act as a refuge (Jenkins *et al.* 2003). Caro

(1999) states that conservation areas that provide for human activities within their boundaries cannot be relied on as a method for conservation of large mammals (Caro, 1999).

Conclusions

The puku population in the Kilombero Valley is isolated and increasing human and cattle numbers on the floodplain are predicted to reduce it significantly through hunting and the conversion of suitable habitat into rice paddies and cattle grazing (East, 1998; Jenkins *et al.*, 2003).

Puku appear to enjoy the protection given by the presence of a safari-hunting lodge at Mofu that limits human encroachment, habitat conversion and poaching. At present there is no evidence of competition between livestock and puku, as the population at Mofu has remained stable despite an increase in cattle numbers. In contrast, the population at Madabadaba has declined, probably as a consequence of increasing poaching, and habitat conversion in the area. Further investigation is needed to ascertain the role played by these human activities in the decline of puku in this area.

Only determined conservation management that discourages human settlement and habitat conversion can halt the decline of puku in the Kilombero Valley. At present hunting concessions provide this management in the area but only have a limited sphere of influence and do not provide adequate conservation to puku. Consequently, a change in status of the Kilombero Valley GCA is highly recommended.

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(Footnote)

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Table 1. Puku abundance in the Itete Ward (inclusive of Mofu and Madabadaba areas) between 1999 and 2004 as estimated by Distance version 2.5.

Year	Months	Density (puku/ha)	Population estimate	Lower confidence limit	Upper Confidence limit
1999	Aug-Sept	1.64	6269	4362	9010
1999	Oct - Nov	0.24	920	696	1216
2000	Aug-Sept	0.47	1806	1158	2817
2000	Oct - Nov	-	-	-	-
2001	Aug-Sept	1.69	6418	4478	10580
2001	Oct - Nov	0.68	2585	1560	4286
2003	Aug-Sept	0.66	2494	1448	4456
2003	Oct - Nov	0.26	993	483	2041
2004	Aug-Sept	1.47	5590	3322	9406

Table 2. Puku Population estimate in the Mofu area of Itete Ward between 1999 and 2004 as estimated by Distance version 2.5.

Year	Months	Density (puku/ha)	Population estimate	Lower confidence limit	Upper Confidence limit
1999	Aug-Sept	0.77	1858	1303	2649
1999	Oct - Nov	0.71	1694	1177	2437
2000	Aug-Sept	0.47	1806	1158	2817
2001	Oct - Nov	0.7	1687	973	2927
2003	Aug-Sept	0.66	2494	1448	4456
2003	Oct - Nov	0.26	993	1448	4456
2004	Aug-Sept	1.47	5590	3322	9406

Table 3. Puku Population estimate in the Madabadaba area of Itete Ward between 1999 and 2004 as estimated by Distance version 2.5.

Year	Months	Density (puku/ha)	Population estimate	Lower confidence limit	Upper Confidence limit
1999	Aug-Sept	0.52	631	166	2401
1999	Oct - Nov	0.11	135	62	293
2001	Oct - Nov	0.65	782	360	1699
2004	Aug-Sept	0.03	36*	-	-
2004	Oct - Nov	0.05	60*	-	-

* Observations were insufficient for Distance version 2.5. Therefore these numbers are an estimate of density calculated by number observed puku divided by surveyed area and multiplied by the total area of Madabadaba

SOUTH AFRICA

Kruger NP Buffalo Census

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[N.B. What is given here are excerpts from a 50-page report, Census Report for Elephants and Buffalo in the Kruger National Park in 2005, which includes umpteen tables and figures for which there is no room in this Gnusletter. Information about buffalo demographics considered to be of particular and general interest has been selected. Ed.]

Introduction

The technique for censusing buffalo has not changed since the initiation of the annual censusing in 1967 (Joubert 1983; Whyte 1996). Helicopters have changed (see Table 1) and the equipment used for photographing the herds has also changed. In 2004, a Canon 10D EOS Digital camera fitted with a Tamron 28-105mm (f/4-5.6) zoom lens was donated by the Honorary Rangers (see Acknowledgements) for use on this census. This camera has proved a resounding success – images are easily downloaded onto a computer, the 6-million pixel images give unprecedented clarity and counting from the computer screen is less taxing than through the dissection microscope. Film and development costs are now also completely avoided. As was the case with elephant, data from all prior censuses were analyzed according to the defined management Regions bordered by the KNP's major rivers (see Figure 1).

Census results

Between 1991 and 1995 the buffalo population of the KNP declined by 52% from 29,359 to 14,123 in response to the devastating droughts of those years (Whyte & Wood 1992; 1993; 1994a; 1994b; 1995; 1996. See also Table 14). In response to the improved habitat conditions (Zambatis 1996) resulting from the higher rainfall experienced over the next two years, the buffalo population finally halted its dramatic decline. Since then it has shown a steady increase except for the year 2002 in which the census result suggested a decline. This was followed by a marginal increase in 2003 (Figure 10 and Table 14). The reasons for this apparent decline were speculated upon in Whyte (2004). The population has now again regained the levels prior to the drought induced declines.

Comparison of the data of the censuses of 2004 and 2005 are given in Table 15. These show that the population has increased by 2573 (9.0%) from 28,489 in 2004 to 31,062 in 2005. Of these, 29,402 (94.7%) were in breeding herds and 1660 (5.3%) were bachelor bulls. There were 4584 calves (14.8%) of less than one year old.

Population structure

The technique used to census buffalo in KNP is probably the most accurate of its kind anywhere in the world, but it does have its shortcomings in terms of data on the structure of the population. It allows for good estimates of the number of bachelor bulls, the number of animals in the breeding herds, and also the number of calves, and the

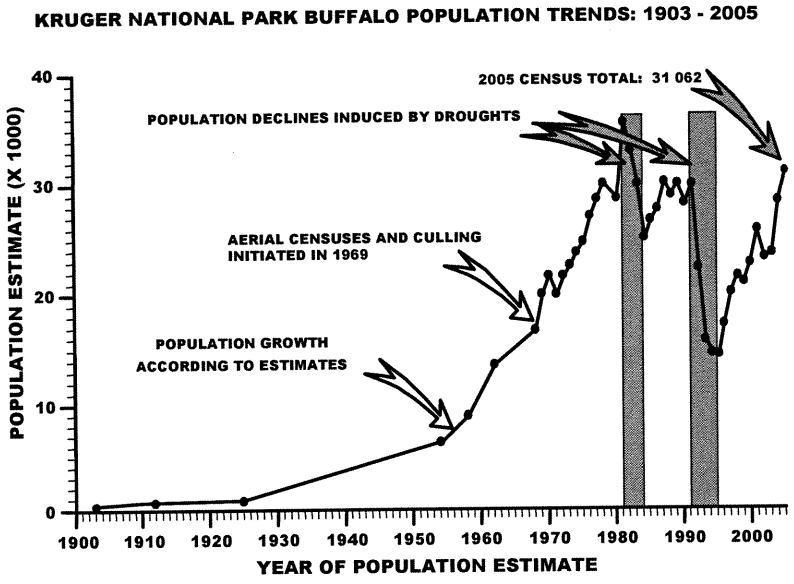


Figure 10: Estimates of the Kruger National Park buffalo population between 1903 and 2005.

relative proportions of these can be calculated with some accuracy. It does not allow a further breakdown of the age structure of the animals in the breeding herds, as the photos are at too coarse a scale to allow recognition of sexes and age classes. Table 17 gives the gross population structure in the Kruger National Park from the respective censuses since 1969.

It is apparent from this table that the proportion of bulls in the population is not consistent from year to year.

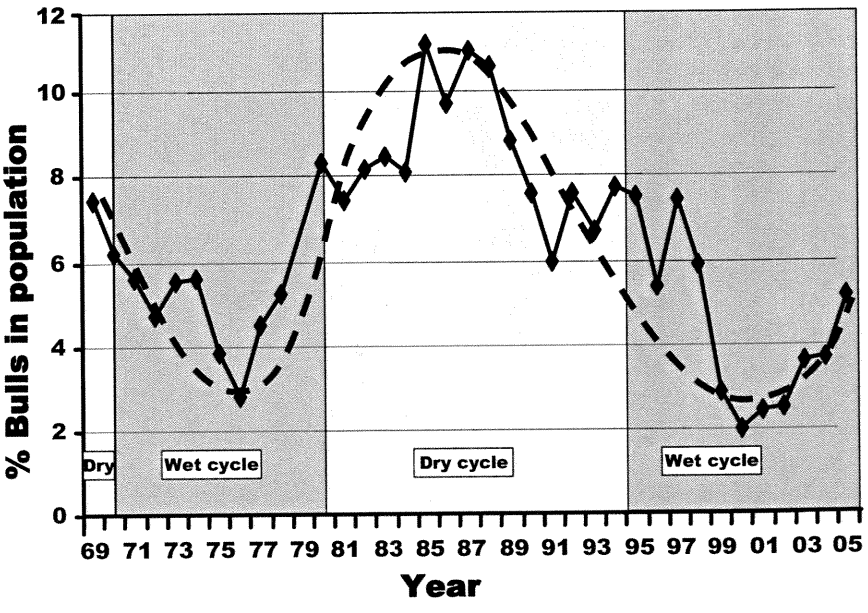
Buffalo bulls

In the 1986 Census Report (Joubert, Hall Martin & Whyte, 1986) Whyte suggested that the proportion of bulls in the population would be found to be cyclical and a decline in this segment of the population over the following years was predicted. This decline occurred as predicted, and the predicted fluctuating trend has continued. It was postulated that during a wet cycle more males than females are born to the buffalo population, and that the opposite would be true during dry cycles. If this was true, then a gradual increase would be expected in the proportion of bachelor bulls once these young bulls achieved maturity and began to move into the bachelor groups.

This phenomenon would go undetected from the census data while the young bulls were still in the breeding herds, but as they joined the bachelor groups at the age of five to six years, a positive trend in the number of bachelors should become evident. There would thus be a five- to six-year time lag after the beginning of the wet cycle before the trend became evident, and would continue for five to six years after the wet period had ended. Conversely, fewer males would be expected to be born during dry cycles but again, only five or six years after the onset of the dry cycles would a negative trend became evident as fewer and fewer young bulls joined bachelor groups. This trend too would continue for five or six years into the subsequent wet cycle.

The data presented in Table 17 and Figure 13 indicate that this is what has been happening up to the present time. While there is a definite trend related to the dry and wet cycles, Visscher, van Aarde & Whyte (2004) looked for evidence which might support a hypothesis suggesting that females were physiologically capable of selecting the sex of their offspring depending on the female's prevailing body condition or other possible environmental correlates, but this could not be demonstrated.

Figure 13: Trends in the proportion of bachelor buffalo bulls recorded in the Kruger National Park population in annual aerial censuses since 1985



Current theory is that the proportion of bulls in bachelor groups and/or in the breeding herds is affected by these climatic cycles through the physical condition of the bulls and that this trend is an artifact of the movement of bulls in and/or out of the herds. Bulls in good physical condition can perhaps compete better for mating opportunities and therefore enter the herds, while bulls in poor condition drop out of herds to regain condition in bachelor groups where competition for resources is less intense than in the large breeding herds.*

The current trend is for an increasing proportion of bulls and this year the bulls showed an increase from 3.7% to 5.3% of the total population (see Whyte (2004) for further detail).

Herd size distribution

The herd size distributions for all censuses since 1969 are given in Figure 14 and Table 18. Mean herd sizes have also been calculated for each respective year, and an average for all years is given. Average herd size over all years was 246.4 (SD = 43.7). The SD is rather low suggesting that there is not much variation from year to year. The major deviation from this mean occurred during extreme drought years. Buffalo herds tend to fragment during droughts, because intra-specific competition for food intensifies in larger herds as the drought progresses. This can be clearly seen in Table 18 and Figure 14 in which the "mirror image" between the number of herds and average herd size can be seen – as herds fragment, herd size goes down but number of herds increases. The current trend resulting from the past few good years has been for fewer herds with a larger average herd size.

Regional Trends in population structure

Bulls

The trends in the bachelor component in all of the respective Regions closely follow those of the population as a whole. Data are only available from 1985 onwards, and these are presented in Table 20 and Figure 15. Declines in all Regions were experienced, culminating in the nadir in 1999/2000, five years after the end of the dry cycle (see discussion related to Table 16 above). In all Regions there have since been good recoveries.

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NAMIBIA

Are black-faced and common impala interbreeding in Etosha National Park, Namibia?

E. D. Lorenzen

The following is a short summary of a research project carried out at the

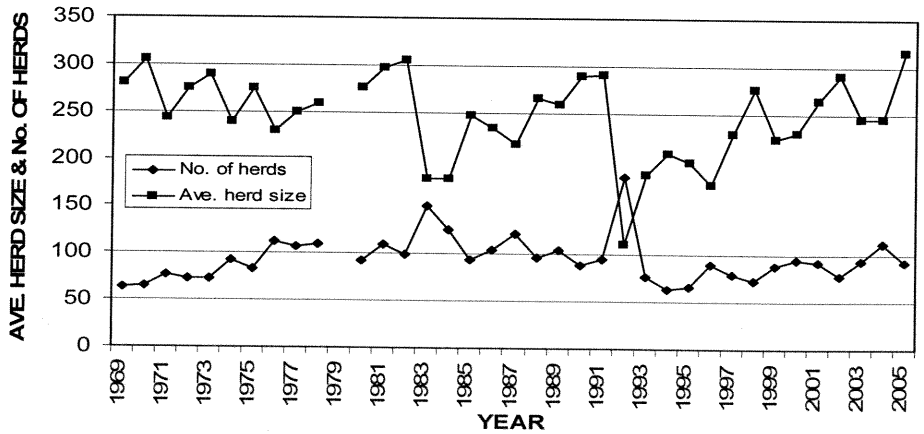

Figure 14: Average buffalo herd sizes and number of herds recorded in respective censuses in the Kruger National Park between 1969 and 2005.

Department of Evolutionary Biology, University of Copenhagen, Denmark in collaboration with the Namibian Ministry of Environment and Tourism. The aim of the study was to determine whether interbreeding occurs between the endemic black-faced impala and the common impala—a subspecies introduced to Namibia during recent decades—in the Etosha National Park, using molecular genetic techniques.

Background

The black-faced impala (*Aepyceros melampus petersi*) is one of two recognized subspecies of impala and has derived its name from its characteristic black nose blaze, which (among other traits) distinguishes it from the common impala (*A. m. melampus).* Historically, it occurred as an isolated population in southwest Africa, more than 900 kms west of the common impala range. Once plentiful, it is now listed as *vulnerable* by the IUCN.

Translocations have played a major role in the recent history of the subspecies in Namibia. To increase the dwindling numbers in the country during the 1960s, black-faced impala were captured near the Angolan border and translocated to the Etosha National Park. This was a great success, and the ~1500 individuals found here essentially provide a pure genetic reservoir of the subspecies for conservation efforts. These could include future translocations of animals to commercial farms or zoos, or reintroductions such as the 1993 augmentation of 16 black-faced impala from Etosha to their natural distribution range in northern Namibia, where only 500 individuals are believed to survive in fragmented populations.

Although translocations can aid the conservation of endangered species, they can also create new threats. Problems following translocation arise when contact between previously geographically separated but closely related groups (such as subspecies) results in interbreeding. If there are no barriers to gene flow, genetic characters can potentially be transferred from one group to another, changing the genetic composition of the native populations and leading to a loss of local adaptation. Interbreeding can lead to the extinction of populations and species, representing a serious threat especially to rare species that come into contact with other, more abundant species. Interbreeding following the translocation of game species has previously been reported between the blesbok and bontebok, and the black and blue wildebeest.

In a bid to further increase numbers of the black-faced impala in Namibia, individuals were sold from Etosha to commercial farms during the 1970s. Simultaneously, common impala, which historically do not occur west of the Caprivi, were introduced to Namibia in the thousands from South Africa. Because of their vast numbers, they are much less costly than black-faced impala. In an effort to afford the black-faced impala further protection, the US Department of Interior banned any import of black-faced hunting trophies to the US in 1980. This paradoxically exacerbated the efforts to increase numbers of black-faced impala: the extra economic cost of purchase along with the US ban now deterred farmers from obtaining, or maintaining, herds of this subspecies.

Farms with both black-faced and common impala have reported mixed herds. Although there has been no direct evidence of hybridization, it is widely believed to occur. At present, five farms bordering Etosha have common impala. As the Etosha fence is not adequately maintained, animals have easy access to and from the park, potentially resulting in interbreeding between subspecies, genetically swamping the vulnerable and endemic black-faced impala. This realization prompted the Namibian Ministry of Environment and Tourism to draft a national management plan to restructure the current management of the subspecies in Etosha. Before implementation, a study of the hybrid status of the Etosha impala was required. As noted in the IUCN *Antelope Specialist Group Report* in 1998, "Prevention of this possibility [interbreeding] and development of methods for identifying and registering pure herds are high priorities in the conservation of the threatened black-faced impala".

The study

Using a set of nuclear genetic markers termed microsatellites; the specific aims of the study were to estimate the levels of genetic differentiation between black-faced and common impala, and to evaluate the degree of interbreeding between subspecies in Etosha NP.

A total of 168 impala samples from nine locations was sampled using a crossbow with biopsy arrows. These were analyzed using eight highly variable microsatellite loci, which produced a unique genotype for each individual, enabling individual recognition of the impala samples. All together, 137 black-faced individuals were analyzed (~8% of the Etosha population). Three populations of common impala were sampled from Chobe (Botswana), Shangani (Zimbabwe) and Samburu (Kenya).

The common impala samples included in the analyses were used to produce a genetic baseline of the common impala subspecies. The genotypes of the black-faced individuals from central Etosha, which were least likely to have been affected by interbreeding with the bordering commons, were used to produce a genetic baseline of the 'pure' black-faced subspecies. This was necessary to estimate the genetic distinctiveness, also termed the level of genetic differentiation, between subspecies. Subsequently, the genetic composition of the remaining black-faced individuals from localities close to the bordering commons were

compared with that of the baselines, to assess the degree of genetic input from each of the subspecies. This was done by calculating the probability of an individual's genotype being derived from one group of origin (i.e. if it was 'pure') or two groups of origin (if the individual was the result of interbreeding).

Outcome

Reflecting their morphological differences, significant genetic differentiation was found between the black-faced and common impala subspecies. Surprisingly, across all analyses carried out on the data, we found no evidence of genetic admixture within Etosha. Park staff maintain they have not witnessed any common impala inside Etosha, although managers on bordering farms claim to have black-faced impala on their land which have escaped from the park.

Impala are socially structured, occurring in small herds. Their social structure involves bachelor herds and harem herds consisting of females and their offspring, accompanied by a territorial male. Solitary black-faced males, but no solitary females, have been observed in Etosha. As the black-faced impala are considerably larger than common impala, solitary common impala males entering the park would be likely to be subordinate to black-faced impala males. Hence they would have difficulty competing for black-faced harems, reducing the risk of hybridization within Etosha. This is consistent with interviews carried out with commercial farmers who have both subspecies on their farms. While there is no concrete evidence of hybridization, farmers claim to have mixed herds. They maintain that black-faced impala males are seen with a harem of common impala females, but common impala males are never observed with a herd of black-faced females. Therefore, the fact that no interbreeding is taking place inside the park does not imply that none is taking place on farms with both subspecies.

Due to logistical constraints in Namibia, we were unable to obtain samples from the five commercial farms bordering Etosha. The genetic composition of the farm populations could be markedly different from that of the Botswana, Zimbabwe and Kenya animals used as reference populations for the common subspecies, and this should be taken into account before concluding whether interbreeding is taking place or not.

The black-faced impala in Etosha is a unique animal of valuable economic potential for Namibia, and managers and parties involved in the conservation of the black-faced impala should not be led to hazardous management decisions, which in turn could compromise the genetic integrity of this vulnerable subspecies. We therefore hope this study generates further interest to initiate sampling of common impala from bordering farms. Genotyping these will aid in a more conclusive study of the interbreeding status of the black-faced impala in Etosha.

Further information

A full report of the study has been published in: Lorenzen & Siegismund (2004). No suggestion of hybridization between the vulnerable Black-faced impala (*Aepyceros melampus petersi*) and the Common impala (*A. m. melampus*) in Etosha NP, Namibia. *Molecular Ecology*, **13**: 3007-3019.

A copy of the manuscript is available from Eline Lorenzen, Department of Evolutionary Biology, Biological Institute, University of Copenhagen, Denmark. Tel: (+45) 3532 1330.
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